Lake County Department of Utilities

Sanitary & Storm Sewers
Inflow & Infiltration Investigation
Lake County Department of Utilities

Village of Fairport Harbor

June 2017

BURGESS & NIPLE
Engineers ■ Architects ■ Planners

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*Printed copies of the Investigation Document include hard copies of Appendices A-C.

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LIST OF ACRONYMS

ADWF	Average Dry Weather Flow
AVE.	Avenue
B&N	Burgess & Niple
BLVD.	Boulevard
CCTV	Closed-Circuit Television
CIPP	Cured-in-Place Pipe
CMP	Corrugated Metal Pipe
FM	Flow Meter
FT	Feet
GIS	Geographic Information System
GPM	Gallons Per Minute
GPD	Gallons Per Day
GPS	Global Positioning System
GWI	Ground Water Infiltration
IN.	Inch
HR	Hour
I/I	Inflow and Infiltration
LCDU	Lake County Department of Utilities
LCSMD	Lake County Storm Water Management Department
MH	Manhole
NASSCO	National Association of Sewer Service Companies
NO.	Number
O&M	Operation and Maintenance
OEPA	Ohio Environmental Protection Agency
PACP	Pipeline Association and Certification Program
RD.	Road
SAS	Sanitary sewer
SSO	Sanitary Sewer Overflow
ST	Street
STS	Storm sewer
USEPA	United States Environmental Protection Agency
VCP	Vitrified clay pipe

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1.0 EXECUTIVE SUMMARY

I/I BACKGROUND

In the Fall of 2015, the Lake County Department of Utilities (LCDU) entered into an agreement with Burgess & Niple (B&N) to perform an Inflow & Infiltration (I/I) Investigation in the Village of Fairport Harbor (Village) in response to concerns over water-related issues in conjunction with wet weather events. This investigation is a continuation of LCDU efforts to assist with improvements within the Village. Since 1986, LCDU has completed 15 projects in the Village totaling approximately $4.5 five million dollars. The terms inflow and infiltration refer to excess water that is able to enter sanitary sewer systems, and therefore uses up available capacity of the sanitary sewers and their ability to convey flow away from collection points, which can contribute to wet weather related issues. The purpose of the investigation is to make determinations as to the probable causes of these issues and make recommendations on potential actions to address the identified causes.

An "Integrated Planning" approach was used to separately investigate, and arrive at final determinations and recommendations for both the sanitary sewer system (public sewer mains and private laterals) and the storm sewer system (public sewer mains). This approach, which is endorsed by both the Federal and Ohio EPA, provides guidance on multiple aspects related to the overall goals of the 1972 U.S. Clean Water Act (CWA). One of the key points is recommending that sanitary (wastewater) and stormwater systems should be analyzed separately, but addressed in conjunction with one another. This approach will make the most efficient use of resources and funds to maintain and improve said systems as required to ensure public well-being and water quality. The same general concept can be applied in discussing the separate ownership (public vs. private) that is attached to the sanitary sewer mains (public) and service laterals (private), and storm sewer mains (public). The separate responsibility associated with ownership is consistent with LCDU Rules and Regulations.

Three major components comprise the Village's sanitary (wastewater) and storm water systems. These components are the public sanitary sewers, private sanitary sewer laterals, and the public storm sewers, which include catch basins. Public sanitary sewers are typically located in the public right-of-way (R/W) or in easement areas where the County can access them. Often these sewer pipes are referred to as sanitary "mains" or "trunk" sewers. The sanitary sewer system is designed to carry wastewater from plumbing fixtures to a centralized facility (GLK wastewater plant) to be treated (cleaned) and then discharged according to OEPA standards. The public sanitary sewers are maintained and cleaned by LCDU. The public sanitary sewer collection system in the Village consists of approximately 57,200 feet of underground sewers which range in size from 6-inch to 18-inch. The sanitary sewers located in the north side of the Village generally flow west via gravity to the Fourth St. Pump Station, located on Fourth St. between High St. and Water St., which then pumps to the Glyco II Pump Station. The sanitary sewers

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from the south side of the Village also generally flow west via gravity to the Glyco II Pump Station. The Glyco II Pump Station then pumps the flow through an 18-inch force main underneath the Grand River, through the Village of Grand River, and then to the west side of SR 44 where it transitions to a gravity sewer and flows to the GLK Wastewater Treatment Plant. The private sanitary sewer laterals are the household wastewater pipes that carry flow via gravity from private plumbing fixtures to the public sanitary sewer main. The total length of private sanitary lateral pipe in the Village is estimated to be approximately 69,000 feet, with an average length from structure to sanitary main of approximately 50 feet each. The sanitary sewer lateral is the responsibility of the private property owner to clean and maintain. The limits of responsibility for the private property owner are from the beginning of the pipe inside the private structure until the connection to the tee or wye, which is in-line with the public sanitary sewer main.

The public storm sewers are storm water pipes designed to convey rainwater to water bodies such as rivers, streams, or lakes. The responsibility of cleaning and maintaining the public storm sewers is that of the Village. The stormwater collection system in the Village consists primarily of approximately 329 catch basins connected to approximately 35,700 feet of underground storm sewer mains which range in size from 8-inch to 48-inch. These sewers typically flow via gravity to the west or north, discharging to either the Grand River or Lake Erie. In general, private residential properties in the Village typically do not have private storm laterals connected to the public storm sewers.

The Village is a “Member Community” of the Lake County Storm Water Management Department (LCSMD) and therefore, upon request, is eligible for assistance for maintenance and improvement of their stormwater collection system. Annually, the Village contributes approximately $109,000 ($3.50 per month per parcel) as a “Member Community”. Conservatively, approximately 75% of the annual contribution is available for maintenance and improvements. These funds can be utilized annually or accumulated over time for use on a large improvement. The funds can also be utilized for annual debt service on a project , which is capped at 50% of the annual contribution amount.

Based upon initial meetings and discussions with the Village’s Mayor and Flood Committee, it was established that it is the Village’s opinion that the majority of underground foundation (footer) drains for structures on private property are cross-connected to the property’s private sanitary lateral. This opinion is based upon past historical discussions and observations between Village officials and residents where this type of cross connection was confirmed during repairs and inspections of private sanitary service laterals. Such a cross connection for multiple structures would allow substantial amounts of stormwater to enter (inflow) into the public sanitary sewers during rain events which would in turn use up the available capacity designed for smaller typical sanitary flows, and therefore cause the public sanitary sewers to surcharge and “back-up” into yards and basements. The public sewer collection system in the Village was originally constructed and installed as a combined sewer system (a

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single pipe conveying both wastewater and storm water simulataneously) in the early 1900s, with the wastewater treatment plant being constructed in the 1950s. As part of the effort to "separate" the public collection system, downspouts were disconnected with a splashblock program in the 1990s and 2000s, but foundation drains were not addressed. This is siginificant in that it only takes a small number of homes, which have either or both foundation drains and downspouts connected to the sanitary service lateral, to exceed the capacity (340 gpm) of a typical residential 8-inch sanitary sewer pipe. Just 17 residential homes, each contributing approximately 18 gpm, can overwhelm an 8-inch sewer pipe in short period of time. In summary, it is the Village's opinion that inflow from the cross connections of private foundation drains to private sanitary laterals is one of the primary contributing factors to wet weather related issues experienced by Village residents. It also was discussed that the following factors are thought to be potential contributors to I/I in the Village: roots and structural deficiencies in private sanitary laterals; improperly plugged and abandoned downspout piping; and lack of cleaning and maintenance for the public storm sewers which had led to reduced capacity.

In lieu of performing a Village-wide investigation, a small pilot area was selected for performing detailed I/I investigation methods. The selected pilot area is essentially the northeast quadrant of the Village, having the following limits: Second Street, East Street, Fifth Street, Vine Street. The pilot area was selected based upon criteria as discussed in Section 2.6 of this report. The goal is that the results of the pilot area testing can be extrapolated or assumed to be typical for the rest of the Village.

I/I INVESTIGATION

Prior to beginning the I/I investigation, the project team of LCDU and B&N met several times with the Village's Mayor and Flood Committee to discuss the past history of wet weather related issues in the Village. These meetings and discussions resulted in the approach and steps outlined below:

- Review existing records and mapping
- Review previous investigations and flow monitoring
- Survey questionnaire to Village property owners with LCDU sanitary accounts
    - Public meeting with residents to discuss the survey results and investigation
- Field observation of existing storm sewer outfalls
- Field observation during wet weather events

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- Pilot area testing
  - Second Street, East Street, Fifth Street, Vine Street
    - Review of public sanitary and storm sewer CCTV inspections
    - Visual inspection of sanitary and storm sewer manholes, and storm catch basins
    - Private Source Dye Testing - aids in identifying sanitary service laterals that are directly connected to foundation drains, downspouts, or have other deficiencies that allow I/I to enter the public sanitary sewer system

1.1 I/I FINDINGS AND DETERMINATIONS

The sanitary sewer system appears to be experiencing I/I due to multiple factors. The condition of the public sanitary sewer system itself, within the pilot area, is contributing to the entry of some I/I due to leaking joints and structural deficiencies identified in this investigation. Based on observations of encrustations and some active infiltration at joints, it is clear that water is entering through joints in the sanitary sewer, which is not uncommon for a public sewer system of this age. Specifically, 15 public sanitary sewer point improvements, five point repairs and 10 CIPP lining segments, have been identified in the pilot area, which are acting as pathways for I/I into the public sanitary sewer system (Appendix A, Exhibit 5). CIPP lining would include grouting the private lateral connection point to the public sewer main.

The private sanitary service laterals within the pilot area are likely contributing a significant amount of I/I based upon the results of the private source dye testing which was performed on 10 properties. Overall, eight of the 10 properties had positive hits for dyed water entering the private sanitary lateral via one or both of either deficiencies at the joints such as roots, encrustations, and separated joints, or confirmed cross connections to foundation drains (Table 6.1). The presence of tree roots is not surprising given the age of the Village and the presence of mature trees in many yards. The observed flows entering the private sanitary laterals were estimated to be in the range of 1-3 gpm at the pipe joints and 5-8 gpm at the foundation drain cross connection. For the sake of further discussion, it can be assumed that the total observed I/I flow into these private sanitary laterals is 8 gpm. Assuming that a typical 8-inch diameter public sanitary sewer at minimum slope can carry 340 gpm before surcharging, a manhole-to-manhole segment of that public sewer would typically have at least 12 residents connected that would be contributing a total of 96 gpm into the public sanitary sewer. This is significant in that 96 gpm is approximately 30% of the total capacity of the public sanitary sewer. Also, the flows discussed herein are the result of a rainfall simulation on a small isolated area on each property with a duration of typically 10-20 minutes, and does not take into account flows from roof top areas. During an actual rain event, which would be over the entire property and typically last much longer than 20 minutes, the I/I flows that would be realized would be significantly greater than what was observed in the private source

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dye testing. It is not unreasonable to assume that that during an actual wet weather event, 50% or more of the capacity of the public sanitary sewer could be used up by I/I entering via the private sanitary laterals. This investigation does not quantify the amount of typical average daily sanitary flow and infiltration at the joints in the public sanitary sewer, which also uses up the available capacity.

In summary, the private sanitary service laterals are likely a primary contributing factor for wet weather related issues due to the I/I that they are likely conveying, as demonstrated by the private source dye testing results. Specifically the existence of cross connections from the foundation drains to the private sanitary sewer is of greatest concern as it presents the utmost potential for collecting and conveying large inflow volumes into the public sanitary sewers. While this determination cannot be factually quantified or verified for all properties, it can be assumed to be typical for most properties given the past historical knowledge of cross connections, past smoke testing results, and the wide-spread distribution of wet weather related issues across the Village. It is estimated that there is approximately 69,000 feet of private sanitary service lateral pipe in the Village, which presents a significant potential for contributing and conveying I/I.

The poor structural and operational condition of the public storm sewer system, both within and outside the pilot area, suggests that the sewers are unable to quickly and efficiently convey stormwater flow during wet weather events, and are therefore a primary contributing factor to both flooding issues and I/I in the sanitary sewers. Both the public storm sewers and catch basin laterals have structural deficiencies and leaks, which were confirmed via CCTV inspection and past smoke testing. A few of the larger trunk sewer segments, such as those running through the High School and “The Gully” are in critical condition and should be addressed as soon as possible to avoid the possibility of collapse and complete failure. Specifically, 20 public storm sewer improvements, which are a combination of point repairs and CIPP lining, have been identified (Appendix A, Exhibit 6). Private storm drain pipes are also a concern. As previously discussed, the private source dye testing confirms that foundation drains are cross connected to the private sanitary laterals, the condition of which is likely typical for the majority of Village properties. Additionally, a few properties within the pilot area appeared to allow dyed water to enter the private sanitary laterals via below-grade downspout connections. While these connections had been previously disconnected at grade, the process by which they were plugged and abandoned appears to have not been carried out in a sufficient manner, or has deteriorated and needs to be addressed again.

The severity and expediency in which I/I has been observed is likely significantly increased due to the lack of cleaning and maintenance of the public storm sewer system, including catch basins. The decreased capacity due to sediment and debris accumulation and the structurally deficient condition of these items contribute to saturating the ground and surrounding soil, which inhibits the ability of both to function properly and efficiently, thus introducing more water, which can migrate down into the

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sanitary sewer. The reduced capacity of the public storm sewers decreases the amount of flow that can be conveyed away, thus creating a surcharged (pressure) flow condition in the storm sewer, which pushes water into the surrounding soil, thus decreasing the amount of water that can be absorbed by the ground. Surcharged storm sewers also can backup water into catch basins, decreasing their ability to convey surface water from the roadway and properties.

In summary, while the condition of the public sanitary sewer is contributing to the entry of some I/I, the majority of the I/I entering the public sanitary sewer is due to the existing poor structural condition and lack of cleaning and maintenance of the public storm sewer system, and also the cross connection of private foundation drains into private sanitary service laterals.

1.2 I/I REDUCTION RECOMMENDATIONS

There are multiple recommendations, from both the structural and operational/maintenance standpoint, for working towards reducing I/I into the public sanitary sewers and maintaining the maximum stormwater conveyance capacity in the public storm sewers. The following summarizes the recommendations in order of priority:

1. Repair structural pipe defects in both the public sanitary and public storm sewers (Appendix A, Exhibits 5 & 6). Fifteen improvements have been identified in the public sanitary sewers and 20 improvements have been identified in the public storm sewers. Performing these repairs will reduce the amount of water that is able to pass between pipes and the surrounding soil. It also closes holes where soil and backfill material is able to wash into pipes, and in the process create the potential for sinkholes. It eliminates the chance of a pipe defect becoming a complete pipe collapse, which might not be realized until a large wet weather event occurs. It should be noted that these repairs reflect the review of 48% (4,100 of 8,600 feet) of the public sanitary sewers and 37% (1,700 of 4,700 feet) of the public storm sewers within the pilot area. As part of the investigation, an additional 3,100 feet of storm sewer located outside the pilot area was televised as identified by LCSMD.

   Special consideration should be given to performing the improvements to some of the larger public storm trunk sewers, such as those running through the High School property and the area known as "The Gully." Certain segments of these sewers are in critical condition and at a high risk to quickly and completely collapse in the near future.

2. Create a Village program and corresponding ordinance(s), in coordination with LCDU, to have all private properties with LCDU sanitary accounts undergo private source dye testing to certify the existence of any cross connections between the private sanitary lateral and any private storm drain piping. The program and ordinance(s) will require any verified cross connections to be removed within a specified time period. The existing "*Codified Ordinances of Fairport Harbor, Chapter 915,*

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Storm Water Control" has a fair amount of applicable language and therefore provides a good starting point for embarking on such a program.

3. Proceed with scheduling and completing the cleaning and inspection of the remainder (30,900 feet) of the public storm sewer system (Appendix A, Exhibit 6), including catch basin laterals. Contractor costs to clean and CCTV inspect the remaining public storm sewer pipes, which are anticipated to contain a fair amount of sediment and debris, can be estimated at $5.00 to $6.00 per foot. Once the storm sewer system is completely cleaned and inspected, the following benefits should be realized:

    a. A complete and accurate GIS map, with corresponding attribute data, of the system can be completed which will lead to a better understanding of how the system operates and improve the efficiency of future maintenance and inspections. The current GIS map which was created by the LCSMD gives a good representation of the overall system; however, it is lacking attribute data such as pipe size and material. The existing GIS map will likely undergo some revisions pending the findings realized by completing an inspection and verification of the entire system.
    b. Previously unknown defects will be identified and repaired which are contributing to I/I.
    c. Cleaning of sediment and debris will restore previously unavailable capacity to the storm sewers, which will increase their capacity to move larger volumes of storm water more quickly away from collection and problem areas than was previously capable.
    d. The cost for future cleaning and inspection will be able to be performed more efficiently and should result in lower costs at $3.00 to $4.00 per foot.

4. Develop a Village program for the regular cleaning, maintenance, and inspection of the storm sewer system, including catch basins. Eventually, an acceptable cycle for the program will be able to be determined. For example, storm sewers may only need to be addressed every 5 years, and addressing catch basins could be an annual event. The Village should consider coordinating such efforts with LCSMD. LCDU has specific staff and equipment dedicated to the annual cleaning and inspection of public sanitary sewers as time and resources allows. Sewers and areas that have a history of past operational issues are typically given preference, along with current hot spots. Typically LCDU is able to clean and inspect approximately seven miles annually.

5. Consideration should be given to conducting post construction flow monitoring to verify the effectiveness of I/I driven improvements. Once Recommendations 1 and 2 are completed, install flow meters in the primary sanitary trunk sewers in order to collect post-sewer improvements flow. These flows could be compared to flows in the 2008 Metcalf & Eddy (M&E) flow monitoring report or to more recent flow monitoring performed prior to the improvements. The cost to rent a flow meter and rain gauge is approximately $1,000 per month. A flow monitoring period of 4 months, starting in April, should be anticipated.

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6. Explore developing a public outreach program, in coordination with LCDU and LCSMD, to educate property owners on the importance of having their private sanitary service lateral inspected, and cleaned as needed, on a regular basis. This action could assist in decreasing I/I and the frequency and severity of sewage back-ups.

7. Should the completion of the previous steps not result in a desirable reduction of I/I, consideration should be given to explore the possibility of performing cured-in-place-pipe (CIPP) lining of the entire existing public sanitary sewer system, including sealing service lateral connection points. This option could include sealing of the lateral connection points via grouting or a cured-in-place product, and the interior lining of the manholes. This rehabilitation would minimize the amount of I/I that is able to enter the sanitary sewer. However, lining the sanitary sewers, without addressing the storm sewers, will likely compound the existing issues of the poorly functioning public storm sewer system as the I/I that was entering the sanitary sewer will now migrate in greater magnitude and speed along existing pathways and into previously unaffected areas, thus creating new issues and magnifying existing issues. CIPP lining could be added to LCDU's long-term Capital Improvements Plan.

The total estimated costs to perform the improvements in Recommendation 1 for the public sanitary sewer and public storm sewer system, are $320,000 and $633,000, respectively. Seeing as these improvements are from the pilot area, which accounts for approximately one quarter of the Village, the cost of these improvements could be extrapolated over the entire Village, the result of which is $1,128,000 and $2,532,000, respectively, for the public sanitary sewer and public storm sewer system. It should be noted that the current construction cost estimate to replace the entire public sanitary sewer and public storm sewer systems are approximately $10,051,000 and $7,556,000 respectively. Please see Appendix B for cost estimates.

It should be noted that the Village of Fairport Harbor has been active in undertaking projects to improve their storm sewer collections and minimize the impacts of wet weather events.

- 2016 Community Development Block Grant (CDBG) funds. The Village secured $75,000 for sanitary sewer lateral replacement, disconnecting storm cross-connections to sanitary laterals, and installation of storm sump pumps. This funding was able to be utilized by four qualifying property owners.

- 2016 Independence Street drainage improvements. This project ran from Vine Street to Plum Street and included improvements for curb drains and connections to the existing storm sewer on Plum.

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- 2016 NS Railroad Property Drainage Improvements. This project improved the collection and conveyance of stormwater in the area running parallel to and between East St. and the railroad, from New Fourth Street to York Place , and included a new improved storm sewer outlet pipe.

- 2017 Third Street Improvements. The Village secured $600,000 in Ohio Public Works Commission (OPWC) funding for this project which is scheduled to begin construction in 2017, and will run from Plum Steet to East Street. The improvements will include the replacement of the existing storm sewer and water main, the replacement or rehabilitation the existing sanitary sewer, and new road pavement. LCDU is covering the cost for the sanitary sewer.

- Storm sewer cleaning and inspection. The Village continues to coordinate with the LCSMD to clean and inspect storm sewers in select areas.

Taking steps to first maximize the capability and efficiency to convey stormwater away from areas of concern, such as completing repairs and keeping public storm sewer pipes clean, will typically be more effective in addressing I/I and associated wet weather issues, than by first looking to minimize the entry of I/I, such as with CIPP lining, as the conveyance of stormwater away from affected areas is not improved. In this example, the pathway into the sanitary sewer has been greatly decreased via CIPP lining, therefore forcing more water to migrate in greater quantity and speed to the public storm sewer system and up private sanitary laterals. This discussion is not to suggest that one system is more critical than the other, but instead to reinforce that both systems have specific deficiencies which can affect each other and therefore both must have their respective issues addressed in order to realize a significant decrease in I/I. This determination helps reinforce the concept of Integrated Planning in that both the sanitary and storm sewer systems should be addressed separately, albeit in unison, as addressing only one with the assumption that it will result in a similar degree of positive outcomes for both systems will likely result in minimal success in realizing the desired outcome of fewer and less severe water related issues for the Village of Fairport Harbor.

Please review the full I/I Investigation document and Appendices for all data and graphical exhibit representations of items discussed herein.

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2.0 INTRODUCTION AND PURPOSE

In response to concerns over flooding issues in conjunction with rain events, the Lake County Department of Utilities (LCDU) has completed an Inflow and Infiltration (I/I) Investigation in the Village of Fairport Harbor (Village). The terms inflow and infiltration refer to excess water that is able to enter sewer systems, and therefore uses the capacity of the sewers and their ability to convey flow away from collection points as designed. Excessive I/I can be caused by multiple factors, and can often be a contributor to flood-related issues. The type of flooding reported in the Village is located in roadways, yards, and basements of private property. The purpose of this study is to make determinations as to the probable causes of these flooding issues and make recommendations on potential actions to address the identified causes. The goal is to arrive at a consensus to minimize and reduce I/I which should then decrease basement flooding, improve the available capacity of the sanitary collection system, and reduce operating costs at the downstream pump stations. In addition to LCDU, both the Village of Fairport Harbor, and Lake County Stormwater Management Department (LCSMD) were parties to the investigation.

The approach that is the common theme throughout this investigation, is that of "Integrated Planning." This approach, which is endorsed by both the Federal and Ohio EPA, provides guidance on multiple aspects related to the overall goals of the 1972 U.S. Clean Water Act (CWA). One of the key points is recommending that sanitary (wastewater) and stormwater systems should be analyzed separately but addressed in conjunction with one another. This will make the most efficient use of resources and funds to maintain and improve said systems as required to ensure public well-being and water quality. The same general concept can be applied in discussing the separate ownership (public vs. private) that is attached to the sanitary sewer mains (public) and service laterals (private), and storm sewer mains (public). The separate responsibility associated with ownership is consistent with LCDU Rules and Regulations.

"Integrated planning will assist municipalities on their critical paths to achieving the human health and water quality objectives of the Clean Water Act by identifying efficiencies in implementing requirements that arise from distinct wastewater and stormwater programs, including how to best prioritize capital investments" – EPA June 5, 2012 Memorandum (Integrated Municipal Stormwater and Wastewater Planning Approach Framework)

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2.1 BACKGROUND

In the Fall of 2015 LCDU entered into an agreement with Burgess & Niple (B&N) to perform an I/I Investigation in the Village of Fairport Harbor. Three major components comprise the Village's sanitary (wastewater) and stormwater systems. These components are the public sanitary sewers, private sanitary sewer laterals, and the public storm sewers, which include catch basins. Public sanitary sewers are typically located in the public right-of-way (R/W) or in easement areas where the County can access them. Often these sewer pipes are referred to as sanitary "mains" or "trunk" sewers. The gray colored pipes in Figure 2.1 reflect sanitary sewer mains.

The sanitary sewer system is designed to carry wastewater from plumbing fixtures to a centralized facility to be treated (cleaned) and then discharged according to OEPA standards. The public sanitary sewers are maintained and cleaned by LCDU. The sanitary collection system in the Village consists of underground sanitary sewers which range in size from 6-inch to 18-inch. The sewers located in the north side of the Village generally flow west via gravity to the Fourth St. Pump Station located on Fourth St. between High St. and Water St. During dry weather flow, the station pumps the collected sanitary flow through a 12-inch force main that transitions to a gravity main through the Village to the Glyco II Pump Station located near the intersection of High St. and Mariner Dr. During wet weather events, the Fourth St. Pump Station is able to collect excess flow and pump it through a 16-inch force main to a surge holding tank located at the Glyco II Pump Station site. The sanitary sewers from the south side of the Village also generally flow west via gravity to the Glyco II Pump Station. The Glyco II Pump Station then pumps the flow through an 18-inch force main underneath the Grand River to the River Rd. Pump Station located in the Village of Grand River. The private sanitary sewer laterals are the household wastewater pipes that carry flow via gravity from private plumbing fixtures to the public sanitary sewer main. The service laterals depicted in Figure 2.1 are the yellow pipes. The sanitary sewer lateral is the responsibility of the private property owner to clean and maintain. The limits of responsibility for the private property owner are from the beginning of the pipe inside the private structure until the connection to the tee or wye, which is in-line with the public sanitary sewer main.

The public storm sewers are sewer pipes designed to convey rainwater to water bodies such as rivers, streams, or lakes. The responsibility of cleaning and maintaining the public storm sewers is that of the Village. The Village is a "Member Community" of LCSMD and therefore, upon request, is eligible for assistance for maintenance and improvement of their stormwater system. The stormwater collection system in the Village consists primarily of catch basins connected to underground storm sewers which range in size from 8-inch to 48-inch. Streets without storm sewer piping typically rely on the curbs of the street to convey the stormwater to catch basins located along the streets. These entities typically flow via gravity to the west, discharging to the Grand River. Figure 2.2 shows the difference between the sanitary sewer mains (tan) and the storm sewer mains (blue).

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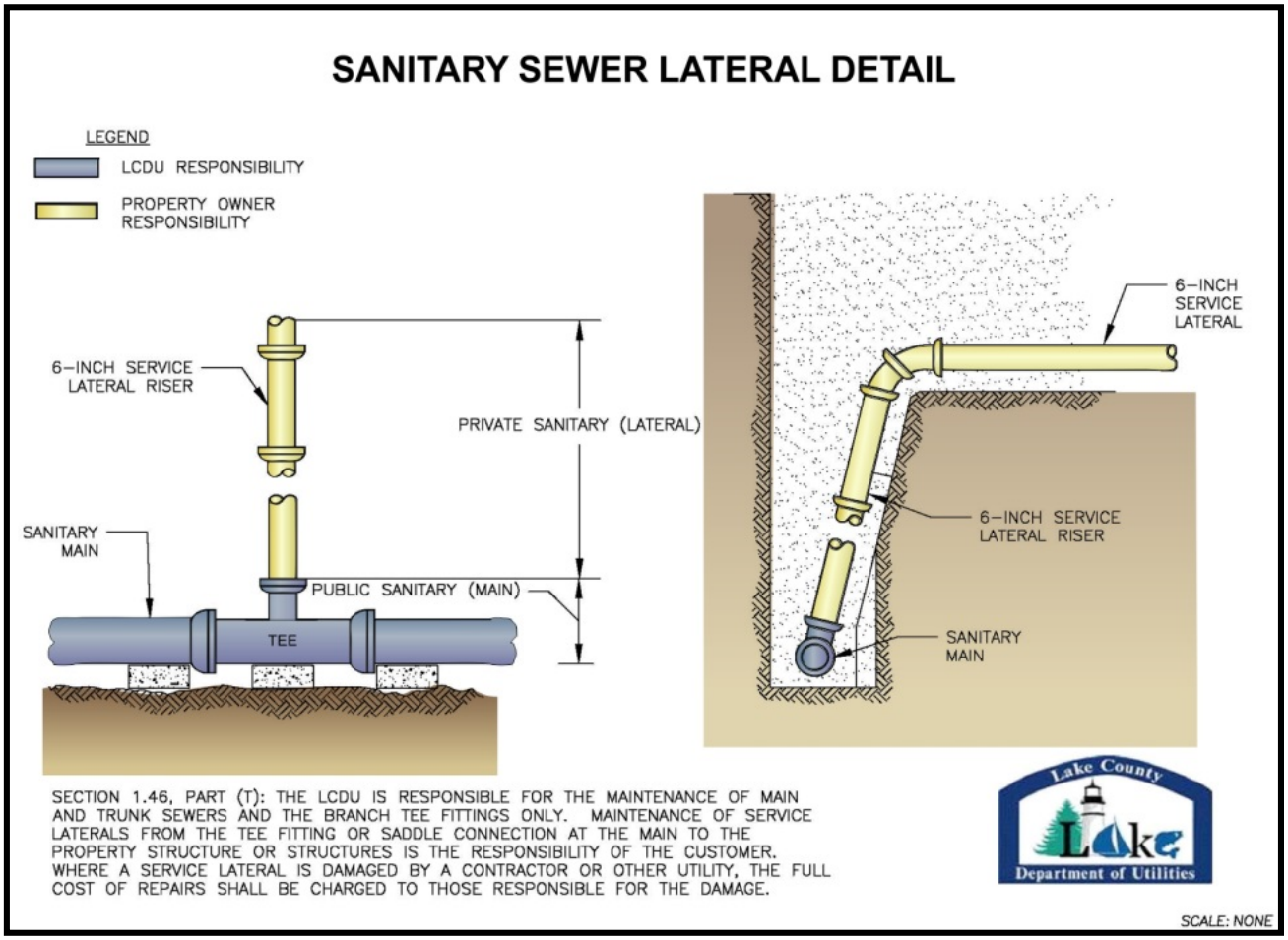

Figure 2.1
LCDU Sanitary Sewer Lateral Detail

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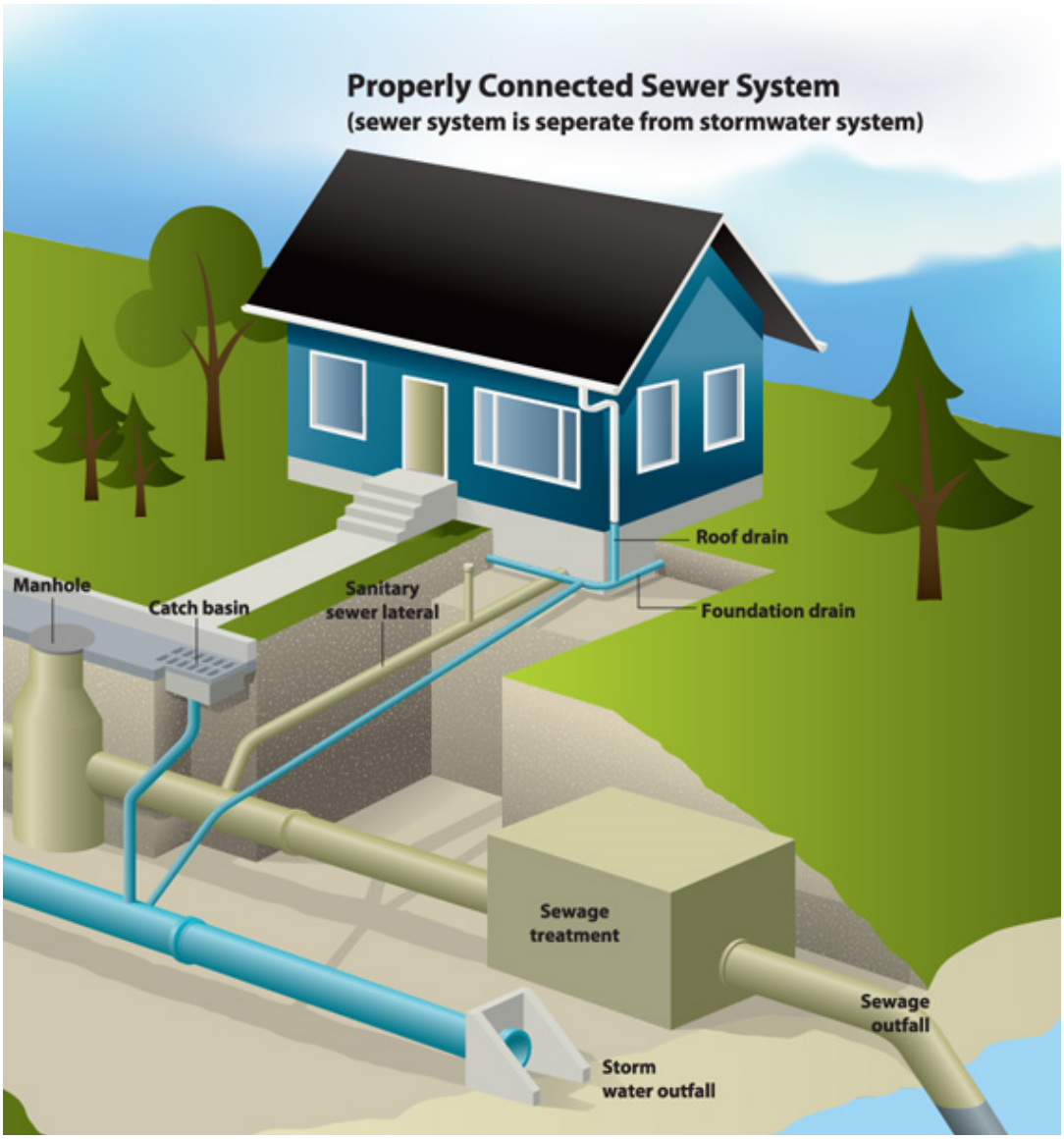

Figure 2.2
Sanitary and Storm Sewers

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Now that the function and purpose of each sewer pipe is known, we can understand how I/I can affect a sanitary sewer. I/I is any unwanted storm or ground water that is finding its way into the sanitary sewer system. Therefore, it is undesirable for sanitary and storm sewers to be interconnected. Common sources of I/I are direct and indirect cross connections from storm sewers to sanitary sewers, improper sump pump or foundation drain connections, broken sanitary sewer laterals, leaking pipe joints, root intrusion into laterals, leaky sanitary sewer manholes, and cracked or broken sanitary sewer mains. Sanitary sewer systems are designed to handle specific capacities of wastewater; when I/I enters the system it can cause the sanitary sewer to surcharge, backing up into basements and yards or overflowing from sanitary manholes. Figure 2.3 pictured below shows possible I/I pathways where water may be entering into the sanitary sewer system.

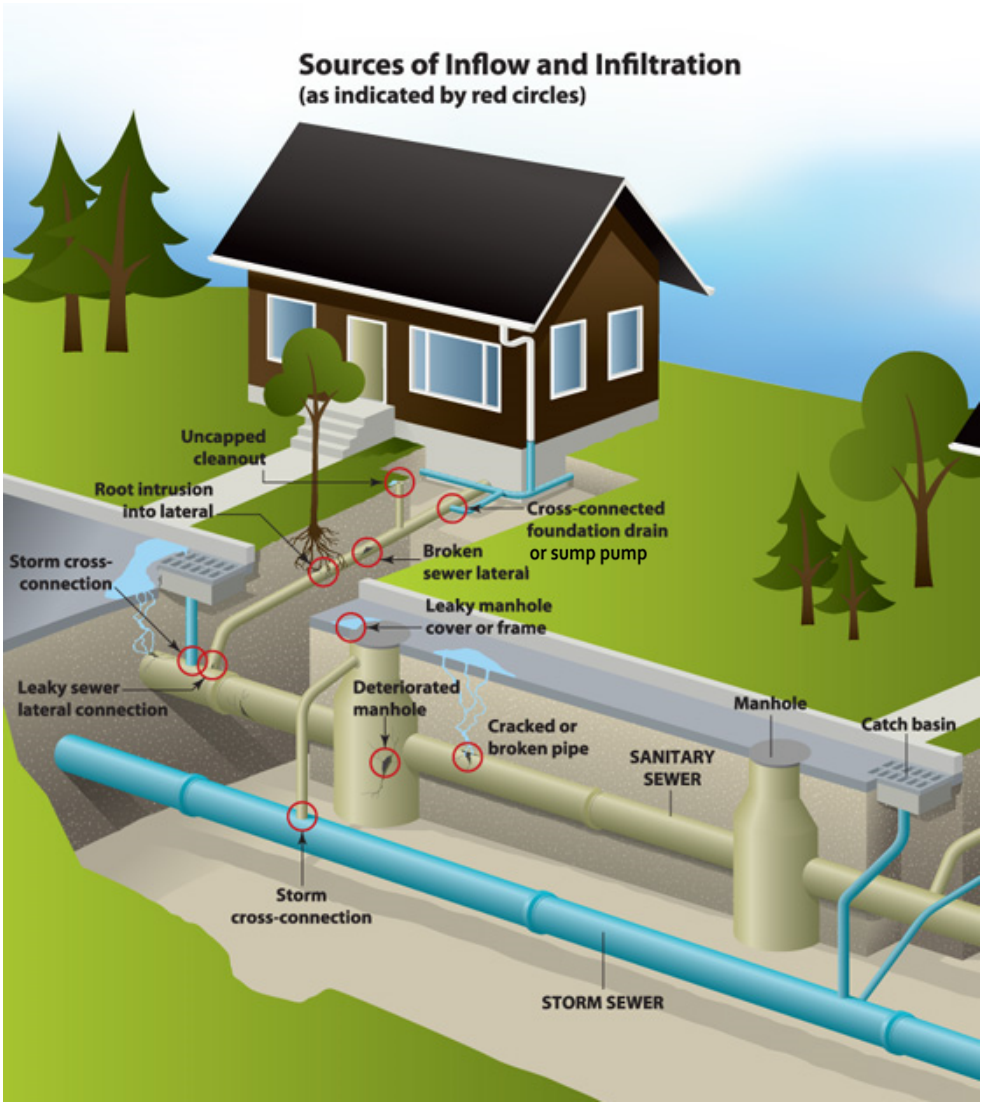

Figure 2.3 – Sources of Inflow and Infiltration

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2.2 RECORDS

LCDU provided sewer complaint records dating back to 2008 and provided Closed Circuit TV (CCTV) inspection reports and videos of the public sanitary sewers in the Village. This data was imported into a Geographic Information System (GIS) exhibit to determine if there were any trends of concentrated areas of flood-related issues. The data graphically showed that the complaints were Village-wide with some of the more concentrated areas of complaints located along East St., from Second St. to Fifth St., and along Vine St. from South St. to King St. (Appendix A, Exhibit 1).

2.3 MAPPING

LCDU provided GIS mapping of the Village's public sanitary sewer collection system. The mapping was updated as part of the I/I study to reflect new sanitary sewer information that was found during the field investigations and televising. New sanitary manholes and sewer segments were reported to LCDU and incorporated into the GIS system.

LCSMD had previously obtained GPS locations of all storm catch basins and storm manholes (see photos below) in the Village and imported them into GIS. Using this information, a storm sewer map was generated for the entire system. However, not all catch basin information was known at the time the map was created thus leaving some gaps in terms of connectivity.

Fairport Harbor Storm Catch Basin and Storm Manhole

As part of the I/I investigation B&N crews opened every catch basin and storm manhole inside the pilot area that was accessible to observe size, material, and direction of flow of the storm sewer pipes. Once this data was collected, the overall public storm sewer map was updated for the Village showing all

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known sewer pipes, manholes, catch basins, and direction of flow (Appendix A, Exhibit 6). B&N coordinated with LCSMD to create a unique asset ID naming convention assigned to each stormwater GIS asset (pipes, manholes, catch basins). The updated map can be used going forward as a tool to for planning and scheduling future maintenance, inspection, and repairs of the public storm sewer system.

2.4 FLOW MONITORING & RAIN EVENTS

Since flow monitoring was previously conducted in 2008 by Metcalf & Eddy (M&E) as part of a SAS evaluation for LCDU, no additional flow monitoring was performed as part of this investigation. B&N was able to use this previous flow monitoring data and apply it to this investigation. The flow monitoring period was from April 23, 2008 through July 15, 2008. During that time period, M&E utilized 10 flow monitors and two rain gauges across the entire Village to study how the sanitary sewer system reacts to storm events. A total of 19 rain events with rainfall depths ranging from 0.12-inches to 2.03-inches were documented. Three of the 19 rain events had depths of one inch or greater.

Exhibit 3 in Appendix A shows the location of the flow meters and which sanitary sewer flows were captured by each meter. Below the map of the Village, a table shows the ranking of the metered areas by the highest peaking ratio. The peaking ratio is calculated by dividing the peak I/I reading from the meter during a wet weather event by the average flow reading during normal dry weather conditions. The highest and second highest peaking factors calculated were located near the Northeast quadrant of the Village.

During two rain events, B&N crews were in the Village to observe field conditions of manholes, catch basins, and roads to document where excessive storm water was observed. B&N documented and observed the conditions with photos and notes (Section 4.1).

2.5 SURVEY QUESTIONNAIRE

One of the first steps in conducting the I/I Investigation was to provide information to, and get feedback from, residents in the Village. A letter and questionnaire were mailed to each active LCDU sanitary sewer account in the Village in October 2015 (Appendix C). Approximately 1,400 questionnaires were mailed out and 341 (25%) were received back. The questionnaire asked residents to provide information on the frequency, location, and type of wet weather related issues they had experienced. Of the 341 responses, 245 (72%) residents indicated experiencing wet weather related issues. This information was plotted on a map (Appendix A, Exhibit 2) to see if there was a pattern or any concentrated areas. The questionnaire responses showed one area of concentrated flooding in the northeast section of the Village. This was an important piece of information used in determining a pilot area for this investigation. Another important section of the questionnaire was to see how many

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residents would be interested in having their private sanitary sewer lateral inspected, cleaned, and dye tested as part of the private source investigation. Of the 341 responses, 198 (58%) residents indicated that they would be willing to participate in the testing. Inside the pilot area, a total of 36 residents were willing to participate in the testing. After reviewing the questionnaire data and making phone calls to the residents willing to participate followed by on-site interviews, 10 properties were chosen within the pilot area to conduct the private source dye testing.

2.6 PILOT AREA DETERMINATION

Due to the size of the Village, it was decided to select a small "pilot area" for the I/I Investigation. The following criteria was used to pick the pilot area:

- Questionnaires – Once the questionnaires were returned from the residents, the information was recorded into an Excel data sheet and the data was linked to GIS and a map was created to show the quantity, proximity, and concentrations of wet weather related issues (Appendix A, Exhibit 2).

- Flow Monitoring – The flow monitoring data that was collected in 2008 was used to determine which areas of the Village were typically experiencing the most I/I during wet weather events. For the entire Village, the two highest I/I tributary areas and the fifth highest I/I tributary area are located in the northeast quadrant of the Village.

- Sewer Configuration – The area selected should include both sanitary and storm sewers, as well as multiple collection/tributary basins for each.

- Smoke Testing – Previous smoke testing was performed by LCDU in the northern and southwest portions of the Village in 2010.

- Discussions with LCDU and Fairport Harbor Flood Committee – Through multiple meetings and discussions with both LCDU and Fairport's Flood Committee, a general idea of where consistent wet weather related issues occurred was determined.

After analyzing all the data from the items listed above, it was determined that the northeast quadrant of the Village would be a good location for the pilot area. The pilot area consists of the area bounded by Second St., East St., Fifth St., and Vine St. The area is shown in Figure 2.4.

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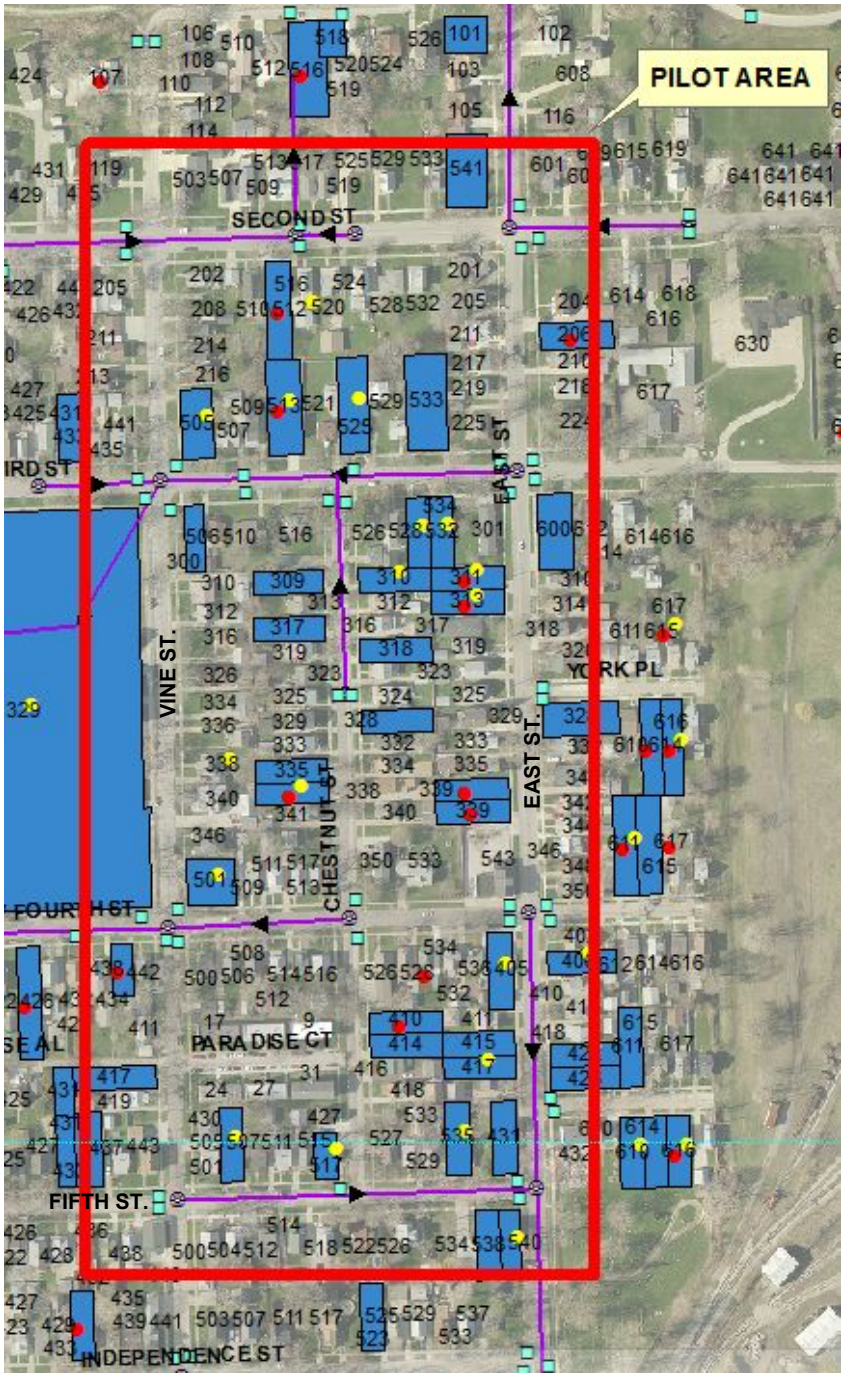

Pilot Area Location
Figure 2.4

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2.7 PROPERTY RESEARCH

As part of the investigation, B&N utilized information on the Lake County Auditor's website to research the approximate year of construction for existing homes within the pilot area. The average year of construction for the pilot area is as follows:

- East St. - 1929
- Vine St. – 1933
- Chestnut St. – 1920
- Second St. – 1915
- Third St. – 1926
- New Fourth St. – 1935
- Fifth St. – 1914

The average year of construction for the 10 houses that were dye tested as part of the private source dye testing (not including one house that was built in the early 1990's) was 1936. The average year of construction for houses that were found to have foundation drains cross-connected to sanitary laterals was 1938. The intent is to be able to correlate the approximate year of construction to typical plumbing configurations and connections that have been predominately found to exist.

2.8 SEWER CLEANING & INSPECTION

In preparation for the I/I investigation, LCDU had their in-house cleaning and CCTV inspection crews clean and televise the sanitary sewers located inside of the pilot area. For the storm sewers, LCSMD worked with B&N to target crucial storm pipes that were located both inside and outside the pilot area to clean and inspect. Ciro's Sewer Cleaning was hired by LCSMD to complete this work.

2.9 I/I EVALUATION

The following field tests were selected from the standard "tool box" for the I/I investigations:

- Smoke Testing – Previously performed by LCDU within and around the pilot area in September 2010. This test aids in identifying I/I pathways between the sanitary and storm sewers.

- Private Source Dye Testing – Performed by B&N within the pilot area in October 2016. This test aids in identifying private sanitary service laterals that may have direct cross connections to storm sewer piping such as foundation drains and roof drain downspouts, or other deficiencies that allow I/I to enter through various pathways.

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3.0 SMOKE TESTING RESULTS

Smoke testing was conducted by LCDU in September of 2010 within and around the pilot area. During the testing, smoke was found in storm catch basins, downspouts, around house foundations, from the ground in the middle of front yards, and house clean outs. See Table 3.1 for smoke location descriptions.

Smoke testing is performed by introducing a non-hazardous, non-toxic smoke into the sanitary sewer main, via manholes. When the testing is performed on a "tight" system without deficiencies and cross connections to the storm system, the smoke should run through the main sewer in the road, to the sanitary lateral, and then make its way through the house plumbing and exit through the vent stack at the top of the house.

The presence of smoke in the storm catch basins suggests that I/I is likely occurring at a significant level. It first suggests that there are well defined, open I/I pathways in the ground between the sanitary sewer system and the storm sewer system. Second it suggests that the sanitary sewers and catch basin connection pipes may have structural deficiencies and leaky or disconnected pipe joints. The joint deficiencies would allow the smoke to escape the sanitary sewer and find its way into the storm sewers and catch basins. During a rain event, the opposite would happen where the storm water finds its way out of the leaky storm sewers and catch basins and seeps down into the leaky sanitary sewer joints allowing excess water to enter into the sanitary sewer.

The presence of smoke along house foundations suggests that the foundation (footer) drains located around the basement of the house are likely cross connected to the private sanitary lateral. During the smoke testing performed by LCDU in and around the pilot area, 13 houses had positive hits for smoke appearing around the foundation.

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Table 3.1 - Village of Fairport Harbor Smoke Testing Results		
No.	**Location**	**Object With Smoke**
1	418 Second St.	Downspouts
2	420 Second St.	Foundation
3	422 Second St.	Catch Basin
4	440 Second St.	Catch Basin
5	501 Second St.	Catch Basin
6	619 Second St.	Catch Basin
7	405 Third St.	Foundation
8	525 Third St.	Foundation
9	510 Third St.	Catch Basin
10	516 Third St.	Catch Basin
11	617 Third St.	Foundation
12	Prospect	Downspouts
13	Prospect	Foundation
14	Prospect	Middle of Yard
15	218 East St.	Middle of Yard, Foundation
16	224 East St.	Middle of Yard, Foundation
17	318 East St.	Downspouts, Foundation
18	323 East St.	Downspouts, Foundation
19	333 East St.	Cleanout
20	335 East St.	Foundation
21	340 East St.	Middle of Yard
22	516 York St.	Middle of Yard
23	520 York St.	Middle of Yard
24	310 Chestnut St.	Middle of Yard
25	318 Chestnut St.	Cleanout
26	322 Chestnut St.	Middle of Yard
27	324 Chestnut St.	Catch Basin
28	325 Chestnut St.	Catch Basin, Foundation
29	335 Chestnut St.	Middle of Yard
30	312 Vine St.	Downspouts
31	326 Vine St.	Foundation
32	334 Vine St.	Downspouts
33	336 Vine St.	Foundation

= Property With Smoke Around Foundation

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4.0 PUBLIC STORM SYSTEM INVESTIGATION

The Village public storm sewer system consists of approximately 90 manholes, 329 catch basins, and 35,700 feet of storm sewer, including lateral pipes connecting the catch basins to the public storm sewer mains. For this investigation, the following field observations were documented.

4.1 RAIN EVENT FIELD OBSERVATIONS

B&N was onsite to observe and document two significant wet weather events. The first event took place on October 21, 2016 and registered 0.76 inches of rain. The second event took place on January 12, 2017 and was a combination of 0.91 inches of rain with melting snow.

During and after rain events, B&N crews noticed that standing water was present on most streets in the pilot area. These areas typically exhibited a combination of the following observations which are likely contributing to I/I:

- Drainage deficiencies on roadways. Standing water was still in the streets hours after a rain event.
- Catch basins were clogged with debris and leaves, not allowing water to efficiently enter into the storm sewer collection system.
- Catch basins draining at a slow rate indicating that the cross connection pipes between catch basins or from catch basins to the storm mains, or the storm mains themselves need to be cleaned of sediment and debris.

The following pictures document typical observations during rain events.

Roadway Drainage Deficiency
Second St.
January 12, 2017

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Roadway Drainage Deficiency
Vine St. and Third St.
January 12, 2017

Roadway Drainage Deficiency
Chestnut St.
January 12, 2017

Clogged Catch Basin
East St.
January 12, 2017

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Clogged Catch Basin
Fifth St. at East St.
January 12, 2017

During the rain events B&N opened both sanitary and storm manholes to observe the flows in the pipes during wet weather. The storm manholes showed normal flowing conditions with gradual flow and no signs of surcharging. After opening several sanitary manholes it was evident that storm water was finding its way into the sanitary system causing a significant increase in flow. The picture below shows large amounts of clear water moving through the sanitary system. These areas were observed to have high I/I related flows in the public sanitary sewers:

- Third St. and East St. – I/I from the south pipe
- Third St. and Vine St. – I/I from north and east pipe
- Fifth St. and Chestnut St. – I/I from north pipe

Sanitary Manhole at Third St. and Vine St.
During Wet Weather Flow

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4.2 STORM MANHOLE AND STORM CATCH BASIN INSPECTIONS

Located inside the pilot area are approximately 12 storm sewer manholes and 41 storm catch basins. In order to get a better understanding of the connectivity of the system, these structures were inspected from the surface by B&N field crews. Besides confirming connectivity, inspecting these structures allows for other benefits. One benefit is to examine the structural condition of each structure. Making sure the structures are performing as designed is an important aspect of the I/I investigation process. If the structures are in poor condition, it could allow for heavy infiltration into the system. The second benefit is to visually observe how the current system is functioning. Many times one can see if the pipe segment entering or exiting the manhole or catch basin is clean or full of sediment and debris.

The storm manholes in the pilot area are constructed from precast concrete or brick. There are several instances where a storm grate was used as a lid for the manhole verses a standard solid manhole cover. All manholes inspected were generally in "good" condition with no major structural deficiencies. Inspections were completed when the ground was saturated to see if there was any infiltration entering the system. During the inspections there was little to no I/I observed entering the storm sewer manholes.

The catch basins in the pilot area are mainly constructed out of brick and mortar. The majority of catch basins are rectangular in shape and are located at the four corners of an intersection. The overall condition of the catch basins can be rated "fair" to "good." The biggest concern with most of the catch basins is the cracking and loss of mortar between the bricks. This is causing a handful of catch basins to exhibit loose brick on the interior walls. This is a concern as there is a potential for possible collapses of the structure and also provides pathways for infiltration. The catch basin on the south side of York St. near East St. was rated "poor." The catch basin is approximately 2 feet deep and has several bricks that are loose and look ready to fall into the structure. A structural rehab of this catch basin is recommended.

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Catch Basin Located on York St.
Loose Bricks and Full of Debris

Catch Basin Located on Second St.
Clogged With Debris, Water Backed Up

4.3 STORM OUTFALL MANHOLE INSPECTIONS

As part of the I/I investigation, the most downstream storm sewer manholes on the outfall pipes conveying flow to the Grand River were visually inspected from the top of the manhole. These inspections occurred during August of 2016. Due to the time of the inspections, the weather had been fairly dry and the river water elevation was observed to be average. Table 4.1 below includes the data that was observed. Four out of the five manholes were field located and inspected; the fifth manhole was unable to be located and is likely buried under pavement in Water St. near the railroad tracks.

Three out of the four manholes inspected had water from the Grand River "backing-up" into the pipe resulting in standing water being observed in the manholes. One manhole had 10 inches of standing water at the bottom and another manhole had river water pushing its way up into two other connecting pipes. One manhole had heavy amounts of debris located in all three connecting pipes. The debris mostly consisted of drift wood from the river.

While observed conditions of standing water are not uncommon in existing storm sewer outfalls and fluctuate based on the level of water at the discharge point, the presence of water in the pipe ultimately decreases the capacity in the pipe and also allows for deposits of sediment and debris to accumulate in the pipe. The end result of an outfall under these conditions is that the ability of the pipe to efficiently convey stormwater out of the collection system is decreased.

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Table 4.1 - Village of Fairport Harbor Storm Manhole Outfall Inspections									
No.	Location	Asset ID	Manhole Depth	Manhole Material	Total Connections	Overall Condition Assessment of Manhole	Infiltration Visible	Surcharged River Water in Manhole	Comments
1	Located in grass at NW corner of Water St. and Third St.	100056	7'-10"	Precast Concrete	4	Excellent	None	Yes; 6"	Manhole in excellent condition, no debris observed.
2	Located in grass off of Water St. across from Lyondell concrete accesse drive.	100127	6'-10"	Precast Concrete	3	Excellent	None	No	Manhole in excellent condition, heavy wood debris in manhole. 10" pipe to west completely filled with debris.
3	Located in grass off of Water St. across from Lyondell between power pole and flag pole.	100128	9'-2"	Precast Concrete	4	Excellent	None	Yes; 10"	Manhole in excellent condition, no debris observed, river water surcharging back up outlet pipe and flowing into other pipes.
4	Unable to Locate	100081	N/A	N/A	N/A	N/A	N/A	N/A	Manhole is buried, need to CCTV sewer and field locate.
5	Located in grass off of Water St., north of High St. intersection and west of railroad tracks.	100098	10'-6"	Precast Concrete	2	Good	None	Yes; 12"	Manhole with square grated cover on top.

Storm Manhole Asset ID 100056
Standing Water in Invert

Storm Manhole Asset ID 100127
Large Amounts of Wood Debris

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Storm Manhole ID 100128
Standing Water Invert

Storm Manhole ID 100098
Standing Water Invert

4.4 STORM WATER CONVEYANCE

Not every street in the Village has a stormwater drainage system consisting of catch basins and underground sewer piping. Many of the streets rely on a curb system to carry the stormwater along the sides of the street to a point where it can enter a catch basin that is connected to a storm sewer. The following streets within the pilot area have a curb system that directs the stormwater to catch basins, typically at intersections:

- Third St. (east of East St.)
- York St., New Fourth St. (east of East St.)
- Joughin St.
- Chestnut St. between New Fourth St. and Fifth St.
- Half of Chestnut St. between Third St. and New Fourth St.
- Vine St.

The only street in the pilot area that does not have any curbs or any apparent form of stormwater conveyance is Paradise Ct., which is located between Vine St. and Chestnut St. Pictured below are examples of streets within the pilot area:

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Paradise Ct.
No Curb For Stormwater Conveyance

New Fourth St.
Typical Curb System (east of East St.)

New Fourth St.
Typical Curb System (west of East St.)

Chestnut St.
Typical Curb and Catch Basin Collection System

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5.0 SEWER CLEANING & INSPECTION

As part of the I/I investigation it was decided to perform television inspection of both the public sanitary sewers and public storm sewers located within the pilot area to get an understanding of the current conditions of the sewers. The pilot area contains 8,600 feet of sanitary sewer and 4,700 feet of storm sewer. Fairport Harbor as a whole has an estimated 57,200 feet of public sanitary sewer and an estimated 35,700 feet of public storm sewer. It also is estimated that there is 69,000 feet of private sanitary sewer lateral pipe in the Village, 14,500 feet of which is within the pilot area.

Only 4,100 feet of the public sanitary sewer out of the 8,600 feet (48%) was able to be televised by LCDU in the pilot area mainly due to hard mineral deposits protruding at joints and intruding laterals which would not allow the camera unit to pass. The public storm sewer segments were divided into three categories for televising: High Priority, Second High Priority, and Low Priority. The LCSMD was tasked with inspecting these sewers, via a contractor, as funding was available. The storm trunk sewer that is primarily located outside the pilot area, running along Third St., through the Harding School property, and discharging to the Grand River was designated a High Priority and therefore included as part of the inspection, as was the storm sewer on New Fourth St. Ultimately the LCSMD was able to televise 4,800 feet of public storm sewer located both inside (1,700 feet) and outside (3,100 feet) the pilot area, including the High and Second High Priority segments (Appendix A, Exhibit 6). The additional 3,100 feet of storm sewer located outside the pilot area was identified by LCSMD.

5.1 SANITARY SEWER OBSERVATIONS

Once the cleaning and televising of the public sanitary sewers was completed, all inspection logs and videos were reviewed by PACP-certified B&N personnel to observe and summarize the condition of the pipes. The gravity sanitary sewer system consists primarily of 8-inch vitrified clay pipe (VCP). Sediment and debris in the sanitary sewer were minimal. The most common defects noted was hard mineral deposits (encrustations) at pipe joints and intruding laterals. Encrustations are typically an indication that groundwater has been seeping in at the pipe joints. In some cases, the encrustations were large enough to block the CCTV camera from passing through. LCDU was able to remove some of the smaller encrustations with a root-cutting tool. While televising was taking place on Third St. between Vine St. and Chestnut St. it was observed that large amounts of clear water were gushing into the sanitary sewer at the pipe joints. The televising was completed during fairly dry weather which indicates that there may be a water main break or a substantial groundwater conveyance nearby. The Village was notified of these concerns. While reviewing historical CCTV data from the pilot area, it was observed that on a rainy day multiple houses on Third St. showed clear water consistently entering the sanitary sewer system via the sanitary sewer laterals.

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This indicates that either the sanitary laterals have structural defects causing infiltration or that they have cross connections from foundation drains, sump pumps, or connected downspouts. Please see photos below for examples of these defects.

SAS - York St. - Double Intruding Lateral

SAS - Joughin St. – Mineral Deposits at Joints

SAS - Third St. – Heavy Infiltration

SAS - East St. – Intruding Lateral

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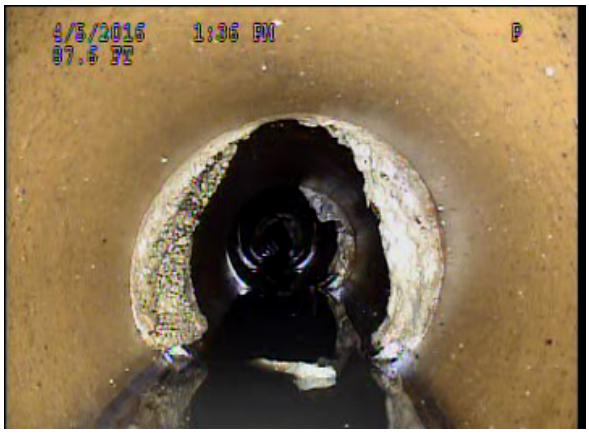
SAS - East St. – Intruding Lateral



SAS - New Fourth St. – Mineral Deposits at Joints

Structural defects also were noted, which included cracks, fractured/broken pipe, offset joints, and holes in the pipe. Six of these defects can be considered significant in that they exhibit substantial structural defects and are likely allowing water to enter the sewer and therefore are recommended to be repaired. Five of these six defects are continuous over the majority of the individual sewer segments and therefore should be CIPP-lined. Five additional segments with lesser continuous defects were flagged to be annually monitored to determine if the defects are becoming worse. All five of these segments would also be candidates for CIPP lining. Four sanitary laterals within the pilot area were found to be damaged and disconnected or offset at the connection point to the public sewer main, and therefore require repair for reconnection. There were also a few laterals which appeared to be fully or partially blocked with debris and waste material. The repair locations are spread throughout the entire pilot area. Table 5.1 summarizes the recommended repairs and Appendix A, Exhibit 5, shows their locations. Please see photos below for examples of these defects.

SAS - East St. – Multiple Fractures

SAS - Fifth St. – Hole, Multiple Fractures

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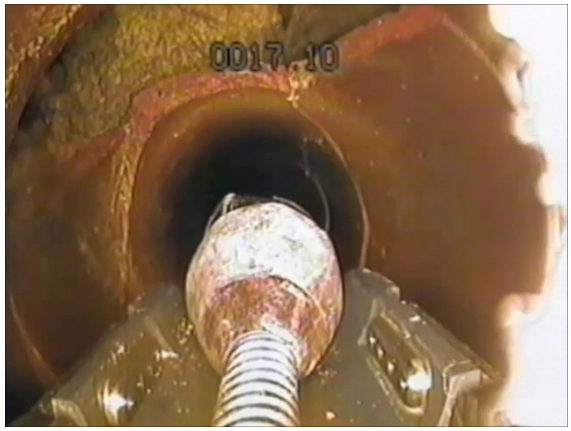

SAS - East St.
Large Hole at Crow; Soil Visible

SAS - Chestnut St. – Multiple Fractures

SAS - Second St. – Broken Tee Connection

SAS - Second St. – Broken Tee Connection

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SAS - Second St. – Lateral with Heavy Debris

SAS - Second St. – Lateral with Heavy Debris

Table 5.1 - Village of Fairport Harbor Sanitary Sewer Repairs

Repair No.	Location	GIS Object ID	Diameter (in)	Pipe Material	Pipe Defect	Repair Type	Full Length CCTV	Distance From MH (ft)	Length of Repair (ft)	Located Near Storm Sewer or Ditch*
1	East St.	11557	8	VCP	Large Hole - Soil Visible	Point Repair	No	17' Upstream of MH 6699	5	Yes
2	East St.	11549	8	VCP	Fractures - Multiple	CIPP Line	Yes		205	No
3	Third	11573	8	VCP	Gushers at Multiple Joints - Possible Watermain Break	CIPP Line	Yes		283	Yes
4	New Fourth	13635	8	VCP	Fractures - Multiple	CIPP Line	No		265	No
5	Chestnut	11578	8	VCP	Broken Tee Connection, Fractures, Cracks	CIPP Line	Yes		262	No
6	Vine	11634	8	VCP	Fractures - Multiple, Broken Pipe	CIPP Line	No		300	No
7	East St.	13637	8	VCP	Cracks, Small Hole	Monitor - CIPP Line	Yes		141	Yes
8	Second St.	11559	8	VCP	Cracks, Fractures	Monitor - CIPP Line	Yes		236	No
9	Second St.	11580	8	VCP	Cracks, Minor Broken Pipe	Monitor - CIPP Line	Yes		255	No
10	Fifth St.	13638	8	VCP	Fractures, Infiltration	Monitor - CIPP Line	No		317	Yes
11	Fifth St.	11588	8	VCP	Fractures, Infiltration	Monitor - CIPP Line	No		301	Yes
12	Second St.	11580	8	VCP	Broken Tee Connection	Point Repair		5' Downstream of MH 6708	5	No
13	Second St.	11558	8	VCP	Broken Tee Connection	Point Repair		46' Upstream of MH 6694	5	No
14	Fifth St.	11588	8	VCP	Broken Tee Connection	Point Repair	No	69' Downstream of MH 5329	5	No
15	Fifth St.	11588	8	VCP	Broken Tee Connection	Point Repair	No	110' Downstream of MH 5329	5	No

* Denotes point repair within 8-feet of storm sewer
** See Appendix B for construction cost estimates for these repairs

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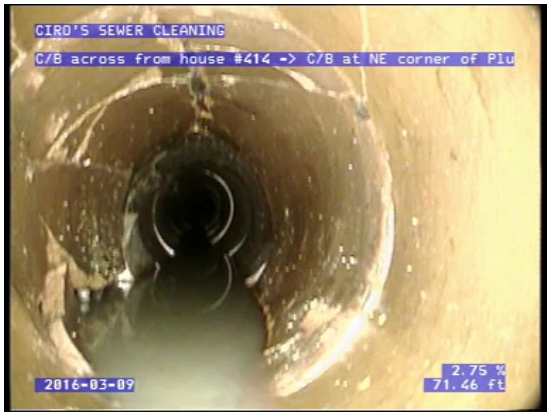
Overall, the condition of the sanitary sewer system can be characterized to be in "Fair" to "Good" condition. The pipes are very clean and do not appear to have any conditions which would significantly decrease the capacity and prohibit the conveyance of sanitary flows. While there are 15 improvements recommended, 10 are recommended to be CIPP lined and therefore could be addressed quickly and efficiently at reasonable construction costs with little to no excavation and inconveniences to residents and traffic (Appendix A, Exhibit 5). Once all repairs are addressed, the structural condition of the sanitary sewer system could be characterized as "Good."

5.2 STORM SEWER OBSERVATIONS

Once the cleaning and televising of the public storm sewers was completed, all inspection logs and videos were reviewed by PACP-certified B&N personnel to observe and summarize the condition of the pipes. The main trunk sewers of the storm system consist primarily of 18-inch VCP pipe and 24-inch reinforced concrete pipe (RCP), with some 48-inch RCP for some outfall piping runs. Catch basin laterals and other connection pipes are comprised of multiple pipe materials such as VCP, RCP, CMP (corrugated metal pipe), and a variety of plastic pipes. The majority of the storm sewers contained minimal sediment and debris levels.

The storm sewer on New Fourth St., which consists of both 8-inch and 10-inch pipe, was televised from east of Plum St. heading west and ending at Eagle St. (approximately 1,300 ft.) Along this run, numerous defects were recorded including utilities bored through the storm pipe, roots, cracks, fractures, holes, and broken pipe (see example photos below). One defect discovered on the 10-inch pipe appears to show a previous repair made with an 8-inch piece of pipe. Using a smaller pipe in the middle of a sewer segment could cause bottle-necking in the sewer and cause the water to back up quicker than typical during significant wet weather events. A list of storm sewer defects can be seen in Table 5.2. The defects are shown on the storm sewer map in Appendix A, Exhibit 6.

STS - New Fourth St. – Hole in Crown; Soil Visible



STS - New Fourth St. – Fractures/Broken Pipe

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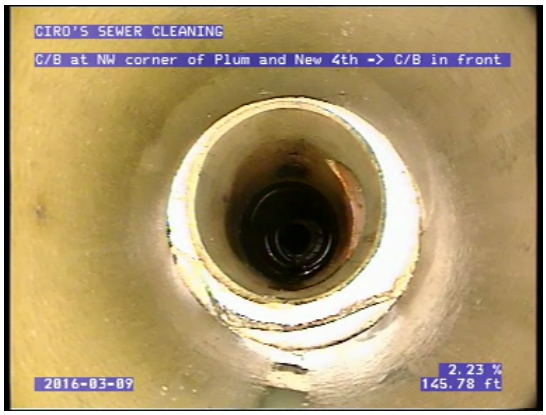
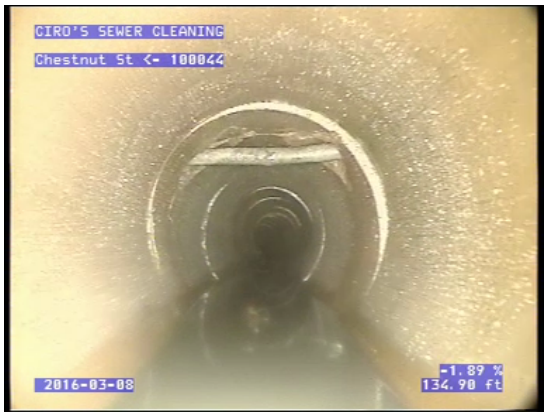


STS - New Fourth St. – Repair with Smaller Pipe

STS - New Fourth St. – Large Hole; Soil Visible

STS - New Fourth St. – Roots



STS - New Fourth St. – Utility Through Crown of Storm Sewer

The primary storm trunk sewer in the pilot area, which consists of pipe ranging from 8-inch to 24-inch, starts at the intersection of Third St. and East St., runs west along Third St., cuts through the Harding School football field, then continues west through "The Gully," transitioning to a 3 ft. by 3 ft. stone box culvert crossing High St., and finally makes its way through the LyondellBasell property and discharges to the Grand River. This total length of pipe is approximately 3,000 feet. Along this entire run, numerous defects were recorded including roots, cracks, fractures, holes, deformed pipe, broken pipe, and missing pipe (see photos below). Many of the instances of cracked, fractured, and deformed pipe were continuous over the majority of individual sewer segments. On New Fourth St., there was another instance where it appears that incorrect diameter pipe, smaller than existing, was used for a previous point repair. This again can be a concern for bottle-necking and causing back-ups.

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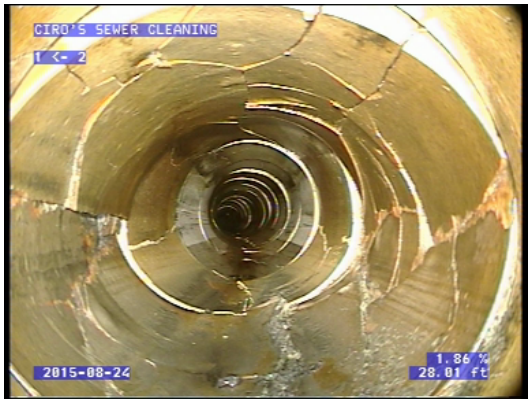
STS - Plum St. – CMP Deformed; Hole in Pipe

STS - Harding School- Fractured, Deformed Pipe



STS - "The Gully" – Multiple Fractures,

STS - Third St. – Utility Bored Through Storm Sewer

STS - Harding School – Repair with Smaller Pipe

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One public storm sewer segment that had significant debris levels restricting flow is the stone box culvert that crosses High St. which was found to be approximately two-thirds full of sediment and debris. The culvert is attached to the downstream end of the 24-inch trunk sewer that runs from Third St. and through the Harding School property. This box culvert is approximately 3 feet wide by 3 feet tall. The sewer inspection contractor spent several days cleaning out debris from the box culvert. The restored capacity of the culvert will allow it to convey stormwater much more efficiently.

STS - High St. – Box Culvert Before Cleaning

STS - High St. – Box Culvert After Cleaning

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Another storm sewer, a 10-inch VCP sewer, starts at the intersection of New Fourth St. and East St. and heads south down East St. to the Grand River. As part of this investigation, only the first segment of this trunk sewer which was located inside the pilot area was televised. During televising, one large hole in the invert of the pipe was discovered that needs to be repaired. After talking to residents that live nearby, they have stated that during heavy rain events, this particular storm sewer backs up and causes the storm water to push back through the catch basins located at the intersection of New Fourth St. and East St. Photos below show broken pipe from both the upstream and downstream position.

STS - East St. – Broken Pipe Looking Downstream

STS - East St. – Broken Pipe Looking Upstream

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Table 5.2 - Village of Fairport Harbor Storm Sewer Repairs

Repair No.	Location	Asset ID	Diameter (in)	Pipe Material	Pipe Defect	Repair Type	Full Length CCTV	Distance From MH (ft)	Length of Repair (ft)	Located Near Sanitary Sewer*
1	East St.	100058:100059	10	VCP	Broken	Point Repair	Yes	272' Downstream MH 100058	5	No
2	New Fourth St.	UNK:100044	8	VCP	Utility Bored Through Main, Cut Roots, Locate/Raise US MH	Point Repair	No	137' Upstream of MH 100044	5	Yes
3	New Fourth St.	300424:300427	8	VCP	Fractures and Cracks	CIPP Line	Yes		140	Yes
4	New Fourth St.	300427:300428	8	VCP	Fractures, Cracks, Hole	CIPP Line	Yes		130	No
5	New Fourth St.	300428:300430	10	VCP	Fractures, Cracks, Hole	CIPP Line	Yes		170	No
6	New Fourth St.	300431:300433	10	CPP/VCP	Fractures, Cracks, Incorrect Pipe Size Used For Repair	Point Repair and CIPP Line	Yes	8' Upstream of CB 300433	5, 160	No
7	New Fourth St.	300433:300435	10	VCP	Hole	CIPP Line	Yes		190	No
8	New Fourth St.	300435:300436	10	VCP	Hole, Broken Pipe	Replacement	No		50	No
9	Third St.	100033:100117	10	VCP	Hole, Utility Bored Through Main	Point Repair and CIPP Line	Yes	416' Downstream of MH 100033	5, 400	No
10	Third St.	100117:100037	18	VCP	Fractures at Invert and Crown. Possible Utility Bored in Line	Monitor - CIPP Line	Yes		260	No
11	Easement - Harding School Football Field	100137:100131	18	VCP	Fractures	CIPP Line	Yes		70	No
12	Easement - Harding School Football Field	100131:100042	18	VCP	Fractures, Bend, Size Change	New MH, CIPP Line	Yes		360	No
13	Easement - Harding School Football Field	100042:300445	18	VCP	Deformed Pipe, Ready to Collapse	Replacement	Yes		160	No
14	Plum St.	300444:300445	18-24	CMP	Missing Pipe, Deformed	Replacement	No		70	Yes
15	Gully	100051:100052	24	VCP	Fractures, Slight Deform	CIPP Line	Yes		330	Yes
16	Gully	UNK:100052	15	VCP	Fractures, Slight Deform	New MH, CIPP Line	Yes		70	No
17	Lyondellbasell	100124:100125	24	VCP	Fractures	Monitor - CIPP Line	Yes		310	Yes
18	Lyondellbasell	100125:100126	24	VCP	Need to CCTV and Confirm Information	CIPP Line While on Lyondell Property	No		40	No
19	Lyondellbasell	100126:100128	24	VCP	Need to CCTV and Confirm Information	CIPP Line While on Lyondell Property	No		150	No
20	York St.	300485		Brick	Missing/Loose Bricks in Catch Basin	Rehab Catch Basin				No

* Denotes point repair within 8-feet of sanitary sewer

Overall, the condition of the public storm sewers that were televised for this investigation can be characterized as "poor." There are 20 total improvements recommended (Table 5.2). The high number of segments with structural defects, 15, that need to be repaired is significant and if not addressed soon can lead to pipe failures which can have negative impacts to nearby areas and properties. There are four additional segments with lesser continuous defects that have been flagged to be annually monitored to determine if the defects are becoming worse. All four of these segments also would be candidates for CIPP lining. For pipe repairs called out as replacement, pipe bursting installation could be considered as an alternate installation method that would minimize excavations and disruptions.

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For the CIPP lining repairs recommended on New Fourth St. and for the trunk sewer running from Third St. to High, it should be noted that there are a few mid-segment pipe size transitions and a bend that will make CIPP lining difficult, and would therefore likely require the installation of new manholes for access at said locations and the replacement of short pipe runs to provide access and consistent pipe diameters prior to lining.

Another option for addressing the storm trunk sewer from Third St. to Eagle St. would be to abandon the existing sewer and install a new sewer along Third St. from Vine St. to Eagle St., and then connect to the existing storm sewer manhole at Eagle St. This option may require the rehabilitation or upsizing of the existing sewer along Eagle St., from Third St. to the existing manhole north of Fourth St. Additional field investigation, sewer televising, and surveying would be required in order to fully explore and confirm the feasibility of this option.

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6.0 PRIVATE SOURCE I/I INVESTIGATIONS

In order to optimize identification and quantification of I/I sources from private properties, it was important to establish target homes or areas within the pilot area that would appear to be the most probable candidates for contributing substantial I/I into sanitary sewers. Developing a list of target homes or areas to be further investigated and tested was accomplished through a systematic review of data acquired from the following sources:

- A comprehensive review of historical records.
- Issuance of Survey Questionnaires to each property owner within the investigation area and thorough review and tabulation of the responses received.
- Phone interviews with property owners
- On-site interviews with property owner and visual inspections
- Field observations during I/I testing.

6.1 SELECTION OF PRIVATE PROPERTIES TO BE TESTED

As stated previously in Section 2.5, 36 residents inside the pilot area were willing to have their plumbing inspected to see if the private I/I test could be conducted on their property. Both phone and on-site interviews of residents who indicated they would be willing to participate in the testing were conducted by one of the private I/I testing team members. Each interview began by reiterating the purpose of the investigation followed by a brief summary of the field activities that had been undertaken to-date. Completed Survey Questionnaires (Appendix D) were taken to the interviews to help discuss the areas of the property that were identified as possible contributors of I/I into the sanitary sewer system. The Questionnaire also provided the interviewer with background information and insight into the resident/property owner's wet weather related issues.

For the private I/I sewer lateral testing to be completed, it was desirable to have the cleanout located on the lateral to be accessible for push-camera insertion. If the clean-out was not accessible or did not exist, a floor drain, with no trap, could be accessed to enter into the lateral. After completing the plumbing inspections and interviewing the residents, 10 properties were chosen on which the private I/I testing could be completed. Other properties were eliminated due to the presence of backflow preventers in the lateral, traps in floor drains, and owners deciding not to participate despite initially agreeing to do so.

Before the commencement of inspection and testing operations, a signed Property Access Permission Form was obtained from the homeowner. Once obtained, a systematic inspection of the structure was completed. Information, as applicable, pertaining to the basement, vent stack, cleanout, floor drains,

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sump pumps, downspout locations and conditions, roof gutter condition, foundation drains, exterior clean-out location and condition, and area drainage were recorded on field forms specific to this phase of the project. Any observed plumbing issues along with basement storage issues were noted.

At the conclusion of the interview and inspection, a time was scheduled with the resident/property owner to perform the on-site testing. Additional telephone numbers or contact information was requested at this time. Each interview was concluded by thanking the occupant for their time and for their participation relating to this project.

6.2 PRIVATE PROPERTY DETECTION TECHNIQUES

During the interview process, attempts were made to schedule testing of properties while the resident/property owner was present to allow interior access. This would allow crews to check for any test water entering the basement and ensure that items in the basement would not be damaged by the foundation testing procedure. It also allowed the observer to record any dye entering the basement floor drains. The following is a list of the private inspection procedures:

- Downspout Rainfall Simulation and Dye Testing
- Foundation and Area Drain Rainfall Simulation and Dye Testing
- Sanitary Lateral Rainfall Simulation and Dye Testing
- Main Sewer Closed Circuit Television (CCTV)
- Lateral Push Camera in sanitary lateral
- Field Data Documentation including digital photographs and hand sketches

6.2.1 Types of Dye and Testing Equipment

Water that was utilized during the testing for the large sewer cleaning trucks was purchased from City of Painesville Water Department. For areas that were hard to reach, such as around house foundations, garden hoses from the residents' houses were sometimes used with their permission. Rainfall simulation utilized portable water storage tanks with water pumps, fluorescent dye, closed-circuit television equipment, and a push camera. Fluorescent dyes were typically used to enhance visible detection of test water used in rainfall simulation. These dyes are safe to handle, visible in low concentrations, are non-staining, inert to solids and debris in sewers, and biodegradable.

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Testing of Downspout

Dye Used in Testing

6.2.2 Downspout Rainfall Simulation and Dye Testing

Properly designed roof gutters and downspouts collect rain water that falls onto roofs and directs this rain water away from the structure through a storm lateral that either outlets at a curb or to the ground away from the structure's foundation. In the Village, a few downspouts were found to be connected underground and discharging to the street or sidewalk, while others were found discharging onto splash blocks or directly onto the ground.

Improperly sloped or maintained gutters that are sagging or clogged can cause storm water to overtop and spill directly into window wells or onto the ground along the side of the structure. Disconnected downspouts that allow collected rain water to splash onto the ground are another high potential source of I/I when combined with poorly graded yards that are either flat or are sloped toward the structure. Structures that exhibit a clogged or sagging gutter, disconnected downspouts, downspouts that discharge onto the ground, or clogged storm laterals can allow storm water to migrate through the ground to the foundation drain and ultimately to the sanitary lateral and sanitary sewer system.

The downspout rainfall simulation was performed following notification of the resident/property owner along with procurement of the Property Access Permission Form. Before testing proceeded, the resident was asked to postpone the use of water for the duration of the testing. The application of simulated rainfall varied per property up to a maximum of 1 hour. A garden hose was placed in each downspout on the structure. Care was taken not to damage existing gutter and downspout systems. Any resulting damage incurred was to be repaired to prior existing conditions by the rainfall simulation subcontractor. The time when testing water was applied to the downspouts was recorded. Dye was then added to each downspout following a determination that testing would not stain siding.

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Prior to starting the downspout rainfall simulation, a CCTV camera was positioned in the public sanitary sewer main at the sanitary lateral tie-in location, and a separate push camera was placed in the private sanitary sewer lateral to observe and quantify any dyed water that might appear flowing from the lateral. If after 20 minutes of elapsed time and no dyed water was observed at the discharge of the sanitary lateral, B&N's field representative made a determination as to whether the downspout rainfall simulation testing should be extended for another 20-minute period. This decision was based upon specific field observations and past experience. If no dyed water was observed at the sanitary lateral after the second 20-minute period, B&N's field representative again made a determination as to whether to terminate the downspout rainfall simulation testing or whether to extend the testing for another 20-minute period. If no dyed water was observed during the third 20-minute period, the downspout rainfall simulation testing was terminated at that property.

Lateral Cleaning (typical)

Lateral Inspection & Recording (typical)

If dyed water appeared flowing from the lateral, the time of observance was recorded along with an estimate of flow rate in gallons per minute (gpm). Crews then proceeded to clean the lateral, if needed, using high pressure jetting to facilitate lateral inspection. Several "passes" were typically completed prior to inspection of the lateral. A recording was made of each lateral CCTV on DVD format and a paper report prepared. A recording also was made of the main line sewer segment. The testing apparatus, including the CCTV and the push camera, was then moved to the next property on the list. This same overall procedure was generally followed for foundation and area drain dye testing.

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6.2.3 Foundation and Area Drain Rainfall Simulation and Dye Testing

Foundation and area drains, such as lower back door stoops, lower level garage/driveway drains, or yard drains can also be significant sources of I/I. These drains can be directly connected to the sanitary lateral or to a storm lateral that is not functioning properly. Dyed water was applied to these areas once the downspout rainfall simulation testing was completed. During the dye testing, the field crew looked for all possible outlet locations for the destination of this dyed water. The same overall testing procedure utilized for downspout dye testing was followed.

6.2.4 Sanitary Lateral Rainfall Simulation and Dye Testing

During the private source rainfall simulation testing process, field personnel marked the surface area above the approximate location of the sanitary lateral between the structure and the main line sewer. The area above the lateral was then tested by discharging dyed water onto the ground (pictured right). This testing allowed the investigation team to determine if surface water was infiltrating into the private sanitary lateral through pipe joints or other structural deficiencies in the lateral pipe. The sanitary sewer was either located in the street right-of-way or in easement areas. It was therefore necessary to observe the area between the structure and the sanitary sewer, above the sanitary lateral, usually in the grassy area in front or to the rear of the structure. The area above the lateral is commonly depressed running the length of the lateral from the house to the sanitary sewer, which will pond during wet-weather events. Water was equally dispersed over the ground at the point above the lateral in grassy areas. Low points in the surface over the lateral may indicate that a leak below ground is causing erosion and allowing rainwater to migrate (infiltrate) into the lateral. During testing, a CCTV camera was positioned in the public sanitary sewer main at the sanitary lateral tie-in location, and a separate push camera was placed in the private sanitary sewer lateral to observe and quantify any dyed water that might appear flowing into the lateral.

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6.2.5 Main Sewer Closed Circuit Television (CCTV)

Prior to any rainfall simulation testing, a closed-circuit television camera was positioned in the main sanitary sewer at the connection point of the sanitary lateral of the structure being tested. The inspection recorded the footage of the subject sewer tap relative to a manhole. The CCTV operator was stationed in the CCTV control vehicle as the testing of each property was being performed. Pertinent information such as the street address, time, date, and purpose of the inspection was recorded. No pre-cleaning of the main sewer lines was performed as part of the private property inspection unless it was needed to reach the sanitary lateral location. During the rainfall simulation testing, when dyed water was observed at the discharge of the lateral by the CCTV operator, the increased flow in the lateral was recorded, and an estimate of flow rate was then assigned to the property.

6.2.6 Lateral Push Camera

During the private source dye testing, a lateral push camera (pictured below) was inserted into an interior or exterior cleanout. The purpose of the lateral push camera was to specifically identify, locate, and quantify sources of I/I into the private sanitary lateral. Each sanitary lateral was cleaned, if needed, immediately prior to inspection using pressurized water. The push camera was used to perform an inspection of the lateral, giving special attention to the location of leak(s) and defects. Care was taken to avoid spilling water and other fluids inside the homes.

Sewer Lateral Push Camera System

The B&N field inspector was present during the entire rainfall simulation testing to monitor the results of the lateral push camera and to answer any questions that the resident may have about the testing procedure.

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6.2.7 Field Data Documentation

Proper documentation is essential for a private I/I investigation. An experienced inspector was present during all tests. This inspector completed a daily report of all properties tested and their physical characteristics to supplement the information collected by the contractor. For instances where dyed water did not immediately show up in the sanitary lateral, the inspector had the expertise to determine if a property has a high potential to produce a leak and the authority to instruct the contractor to continue testing up to 1 hour in these cases. All testing results were documented using hard copy and electronic files that contained all pertinent information about the structure being tested. Test results included a video file from the CCTV on DVD, a video file from the lateral push camera, written observation form, and hand sketch of the property. Photos and videos containing deficiencies found were reviewed to evaluate results and to determine the best method of rehabilitation.

6.3 PRIVATE I/I INVESTIGATION RESULTS

The on-site testing of the 10 private properties was performed from October 3, 2016 through October 7, 2016. A property tested "positive" if dyed water was observed entering the main sanitary sewer from the property's lateral during rain event simulation and dye testing. The locations of the properties that were tested and the test results are shown in Appendix A, Exhibit 4.

Of the 10 properties tested, eight (80%) tested positive for I/I. Six of the properties tested positive for inflow from foundation drains that were confirmed via video to be connected to the sanitary lateral. Five properties tested positive for infiltration which were typically due to deficiencies at the joints in the sanitary lateral pipe. Table 6.1 includes a summary of the private properties tested and the corresponding results. Dye testing field forms and CCTV inspection information pertaining to all properties tested are contained in Appendix E.

In addition to the 10 properties selected for testing, B&N contacted the 47 residents in the Village who indicated on their questionnaire that they have previously had their sanitary lateral televised and inspected in the past. These residents indicated that they had been given the inspection results in the form of a VHS tape. The original goal was to be able to view these tapes in order to get a better idea of the overall condition of sanitary laterals in the Village and if they had cross connections with foundation drains or other types of storm sewers. Unfortunately, none of the 47 residents were ever able to locate their tapes and pass them along for review. During conversations with the residents about the lateral televising it was clear that a majority of people had their laterals inspected and cleaned to remove tree roots in order to restore flow capacity. Several residents stated that the inspection indicated that their sanitary lateral was in poor condition and needed to be replaced.

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Table 6.1 - Fairport Harbor Private Testing Hit Summary

Address	Date	Downspouts Discharge		Sump Pump	Sump Discharge	Foundation Drain Verified Connection to Sanitary Lateral	I/I Testing At Foundation Wall (Footer Drains)			I/I Testing Over Ground Top of Sanitary Lateral			Sanitary Lateral Conditions									Comments
		Splash block	Other				I/I Hit	Time to Infiltration	I/I Rate (gpm)*	I/I Hit	Time to Infiltration	I/I Rate (gpm)*	Broken Lateral Pipe	Cracked Lateral Pipe	Offset Joint	Deposits	Medium roots	Heavy Roots	I/I Dripper	I/I Runner	I/I Gusher	
405 East St.	10/3/2016	Yes	-	Yes	Hose out window	Yes	Yes	5 Min; 20 Min.	5-8	No	-	0				X						Not traditional sump pump, resident has pump sitting on floor in corner of basement to use when floods. Inflow present through foundation drains into sanitary lateral. Dyed water in lateral from south side of house was observed after 5 minutes, dyed water in lateral was also observed from north side of house after 20 minutes.
517 Fifth St.	10/3/2016	No	Drain Pipe to Sidewalk	Yes	Sidewalk	Yes	Yes	14 Min	5-8	No	-	0				X		X				Not traditional sump pump, resident has pump sitting on floor in corner of basement to use when floods. Inflow present through foundation drains into sanitary lateral.
600 Third St.	10/4/2016	Yes	-	Yes	Yard	Yes	Yes	10 Min	5-8	Yes	10 Min	1-3			X	X				X	X	Dyed water was entering sanitary lateral through drain in basement floor. Water was introduced through void up against foundation and was then traveling down under the basement slab and up through a crack in floor into drain. I/I through drain and through lateral joints.
532 New Fourth St.	10/4/2016	Yes	-	No	-	No	No	-	0	Yes	12 Min	1-3		X		X					X	Heavy infiltration at two joints under basement slab in sanitary lateral. Lateral has trap located in tree lawn. Grade 3 fracture at crown of sanitary lateral, 16' from sanitary main.
501 New Fourth St.	10/5/2016	No	Drain Pipe to Sidewalk	No	-	Yes	Yes	50 Min	2-5	Yes	50 Min	1-3							X			Appears downspouts previously connected to foundation drains, they have been disconnected. Dyed water was introduced at location of abandoned downspout near foundation of house. Dyed water was observed in sanitary lateral from foundation drains.
513 Third St.	10/5/2016	No	Drain Pipe to Sidewalk	Yes	Tree Lawn	No	No	-	0	No	-	0			X							Footer drains connected to sump pump and discharge on grade near sidewalk. Downspouts connected underground and discharge to sidewalk as well. No I/I observed.
533 Third St.	10/6/2016	Yes	-	No	-	Yes	No	-	0	Yes	20 Min	1-3				X	X					Basement walls are in poor condition. Within 5 minutes of introducing dyed water, it began pouring in through basement walls and traveling to floor drain. Resident states he is getting walls fixed in Spring. Tee connection to sanitary lateral exist, however looks to be clogged and filled with roots. Downspouts used to be connected, tested abandoned connection and was able to get dyed water into sanitary lateral.
301 East St.	10/6/2016	Yes	-	Yes	Yard	Yes	No	-	0	No	-	0				X		X				Basement of house was previously "waterproofed" earlier in 2016. New foundation drains were put in and run to newly installed sump pump that discharges outside on grade. Old foundation drains are most likely still present below grade, although water introduced at corners of house did not produce I/I in sanitary lateral.
225 East St.	10/7/2016	Yes	-	No	-	Yes	Yes	13 Mins	5-8	No	-	0					X					Tested foundation near window-well that had stone around it. Dye was entering sanitary lateral through 12:00 connection after 13 minutes. Inflow through foundation drains into sanitary lateral confirmed.
414 Chestnut St.	10/7/2016	Yes	-	Yes	Underground in Sanitary Lateral Trench	Yes	Yes	20 Mins	5-8	Yes	10 Min	1-3			X						X	Sump pump located outside of house up against foundation. Water was introduced into sump to trace discharge point under the ground. After 20 minutes dyed water was entering sanitary lateral where the lateral has a material change and a separated joint. Assumed that sump pump discharge pipe is leaking and is in same trench or nearby the sanitary lateral. Heavy infiltration at this transition.

*Estimated ranges of I/I flow

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6.4 PRIVATE I/I SUMMARY

The results of the private I/I investigation indicate that the primary cause of inflow into the public sanitary sewer is likely foundation drains that are cross connected to the private sanitary lateral.

Six of the 10 properties had positive hits for dyed water making its way through the ground around the foundation, into the foundation drains, and then into the sanitary lateral pipe via direct connection. The foundation drains were typically connected to the sanitary lateral just outside the basement wall with a cross-tee type connection at both 3 o'clock and 9 o'clock (Appendix A, Sketch 1). Another example of a foundation drain connection configuration was from a single tee connection located at the 12 o'clock position on the sanitary lateral. Upon introducing the water for the rainfall simulation, times varied for water entering the laterals with the quickest time of entry being 5 minutes and the longest time being 50 minutes. Four of these six properties had water entering the sanitary laterals in less than 15 minutes. The rate of flow observed entering the sanitary laterals from the foundation drains was estimated to be in the range of 5-8 gallons per minute. This extremely fast time for inflow being documented suggests that the existing ground strata is comprised of old, well established pathways which convey rain water quickly below grade. Such findings are not unusual given the age of the structures on previously disturbed sites and the presence of construction features such as window wells, plugged downspouts, and gravel landscaping around foundations, all of which typically magnify the conveyance of storm water below grade.

Five of the 10 properties tested positive for infiltration into the sanitary lateral which was typically due to deficiencies at the joints in the lateral pipe. The primary deficiencies observed at the joints was in the form of root intrusion and joint separation. Four of the 10 houses showed moderate to heavy roots at multiple joints throughout the lateral. The rate of flow observed entering the sanitary laterals at joints was estimated to be in the range of 1-3 gallons per minute.

Another source of inflow into sanitary laterals that was observed was at abandoned downspouts where they had been disconnected at grade. It was concluded two houses (501 New Fourth St. and 533 Third St.) were to have had their downspouts previously connected. One property had the disconnected pipe cut and filled with cracked concrete at grade. The other property was thought to have an individual connection to the sanitary lateral, separate from the foundation drain connections. Water and dye was introduced at the corners of the homes where the abandoned downspout pipes went below grade. At both properties, dyed water was able to make its way through the abandoned downspout connection and into the sanitary lateral. During testing, no active downspout connections discharging below grade were observed.

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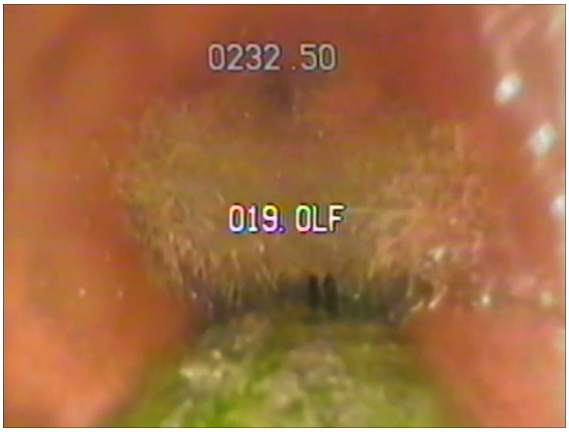
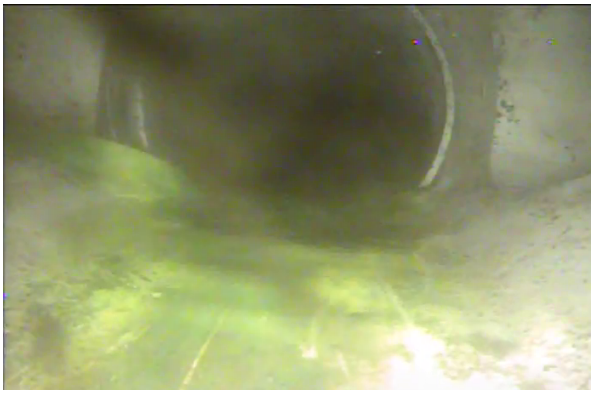
During the dye testing and CCTV inspection of the laterals, it was observed that none of the properties had a clean-out located outside the house. Exterior clean-outs are typically located in the yard and are utilized to access the sanitary lateral for regular cleaning and inspection. During this investigation there were several sanitary laterals that needed to be cleaned due to deposits in the line or tree roots at the pipe joints. While there was access via clean-outs in the basement, it was decided with the property owners to not clean from inside the basement as it would likely result in water coming back into the basement which was undesirable.

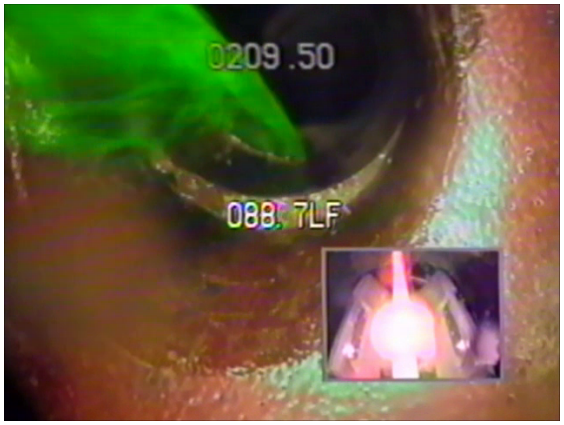


517 Fifth St. – Large Root Ball
(Camera in SAS Lateral Looking Towards House)

533 Third St. – Medium Root Ball
(Camera in SAS Lateral Looking Towards House)



600 Third St. – 3:00 and 9:00 Tee Connection on Lateral With Dyed Water Entering
(Camera in SAS Lateral Looking Towards Sanitary Main)



225 East St. – Connection 12:00 on Lateral With Dye Water Entering
(Camera in SAS Lateral Looking Towards House, Tilted up to 12:00 Position)

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Appendix A

Exhibits

EXHIBIT 1 - VILLAGE OF FAIRPORT HARBOR
LCDU SEWER COMPLAINT RECORDS
JANUARY 2008-APRIL 2014

N
W E
S

- = SEWER BACKUP
- = MULTIPLE SEWER COMPLAINTS
- = SINK HOLE
- = ODOR

LCDU - FAIRPORT HARBOR - SEWER I/I INVESTIGATION

0 65 130 260 390 Feet

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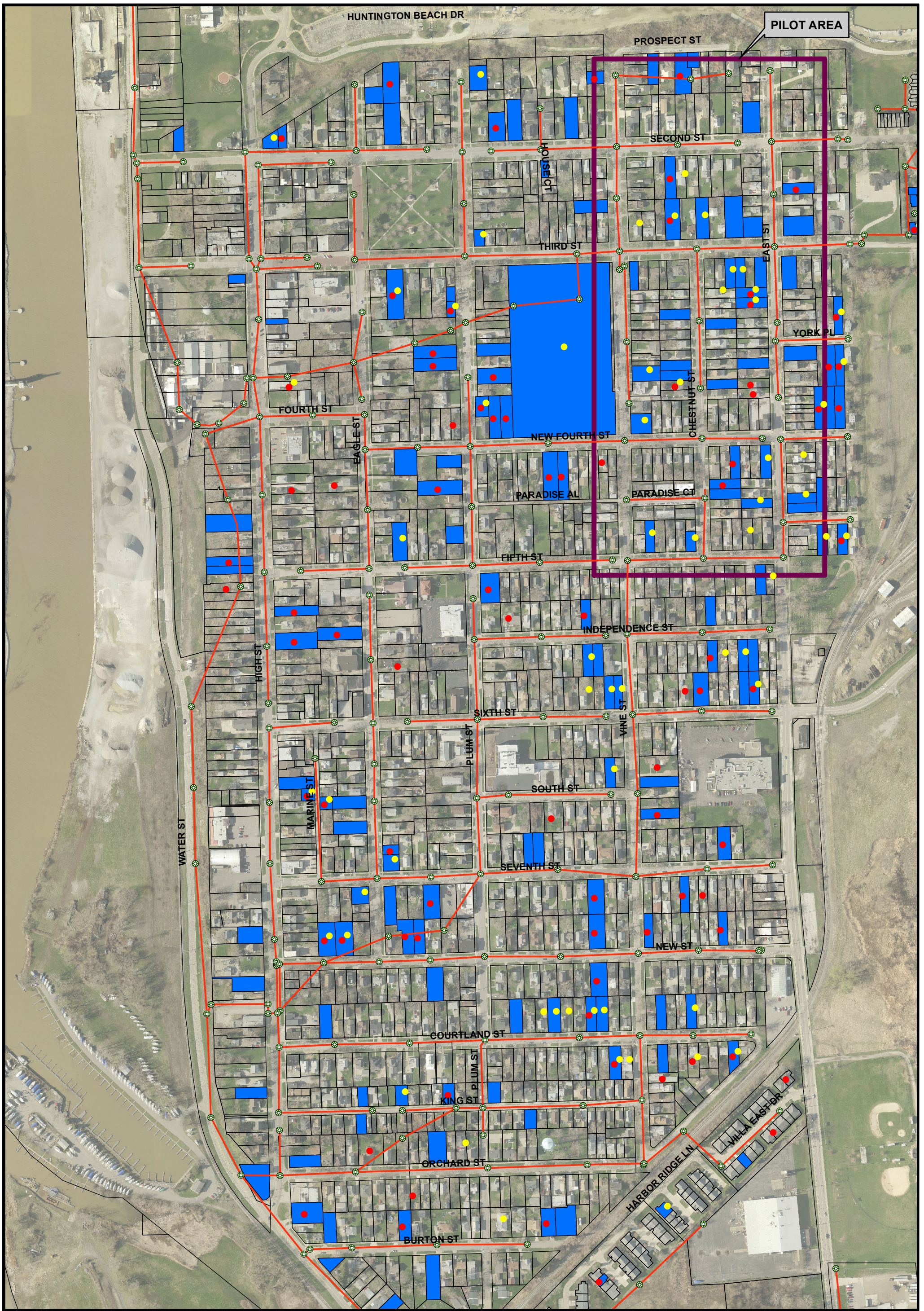


EXHIBIT 2 - VILLAGE OF FAIRPORT HARBOR
LCDU QUESTIONNAIRE RESULTS

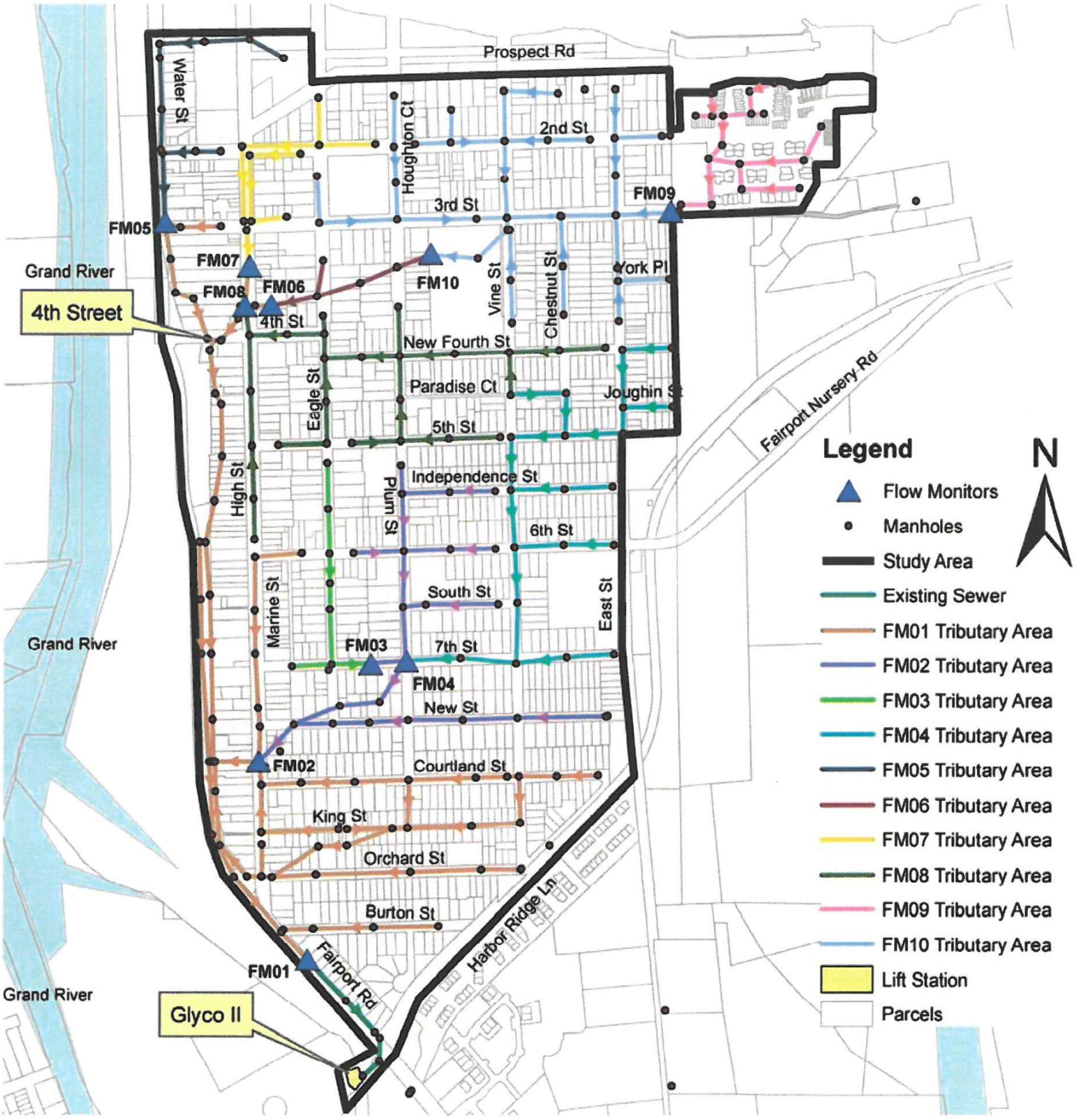
N W E S

- SANITARY MANHOLE
- SANITARY SEWER PIPE
- PILOT AREA
- YARD FLOODING
- STREET FLOODING
- BASEMENT FLOODING

LCDU - FAIRPORT HARBOR - I/I INVESTIGATION

0 100 200 400 600 Feet

BURGESS & NIPLE



Rank	Individual Flow Monitor	Calculated Individual Peak I/I (gpd)	Individual Basin Ave. DWF (gpd)	Peaking Factor
1	FM08	1,693,286	45,210	37.5
2	FM10	2,022,603	78,078	25.9
3	FM06	1,053,230	67,103	15.7
4	FM07	605,190	41,094	14.7
5	FM04	880,238	62,457	14.1
6	FM02	612,929	58,169	10.5
7	FM03	325,611	32,134	10.1
8	FM09	121,111	12,540	9.7
9	FM01	1,425,794	308,503	4.6
10	FM05	178,833	68,731	2.6

EXHIBIT 3 - VILLAGE OF FAIRPORT HARBOR
FLOW METER LOCATIONS AND RESULTS
(2008 M&E SANITARY SEWER EVALUATION)

LCDU - FAIRPORT HARBOR - SEWER I/I INVESTIGATION

BURGESS & NIPLE

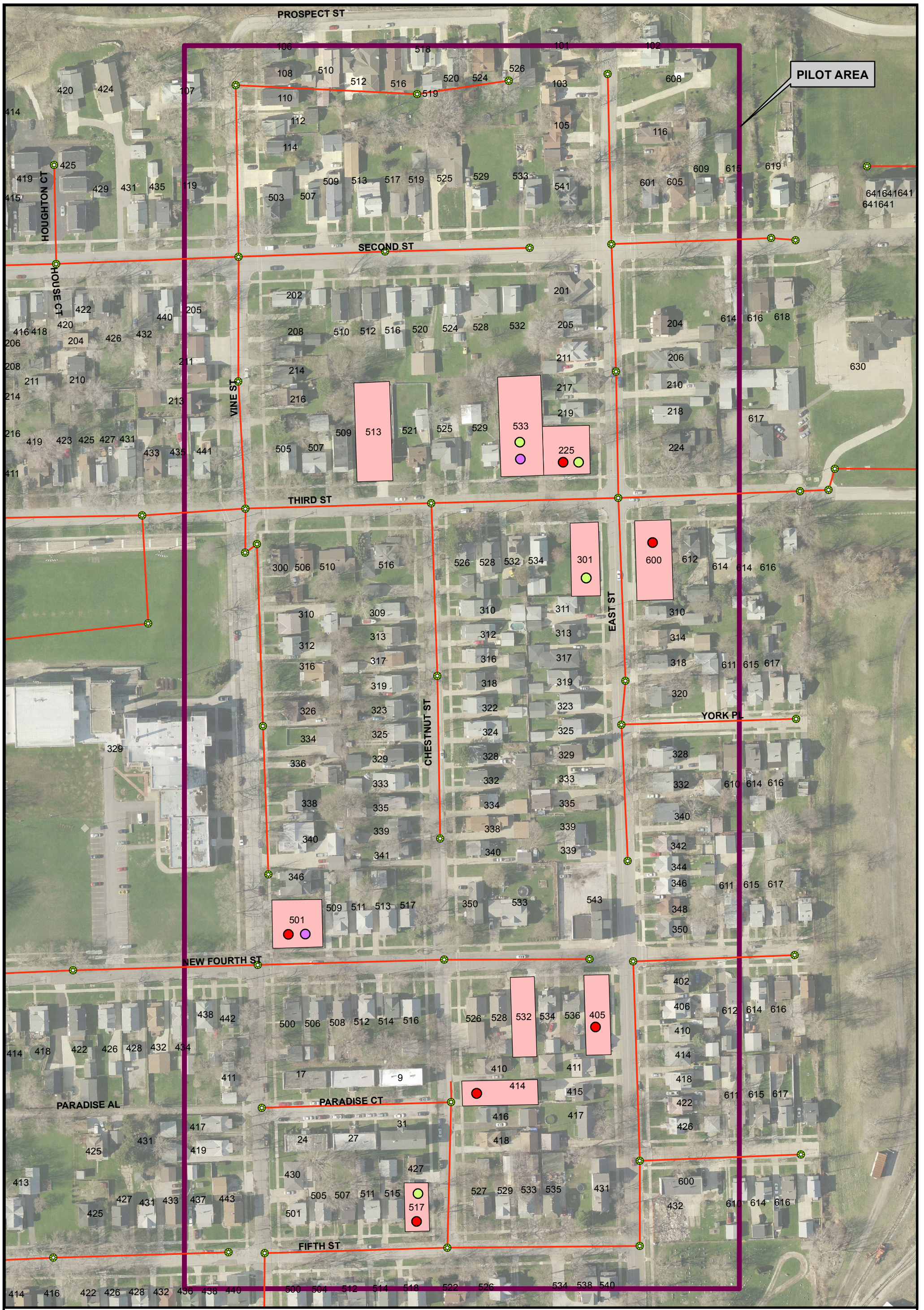


EXHIBIT 4 - VILLAGE OF FAIRPORT HARBOR
PRIVATE SANITARY LATERAL
TESTING LOCATIONS AND RESULTS

- PRIVATE I/I TESTING CONDUCTED
- TREE ROOTS DETECTED
- INFLOW FROM FOUNDATION DRAINS DETECTED
- INFLOW FROM ABANDONED DOWNSPOUTS DETECTED
- PILOT AREA

LCDU - FAIRPORT HARBOR - I/I INVESTIGATION

0 40 80 160 240 Feet

BURGESS & NIPLE

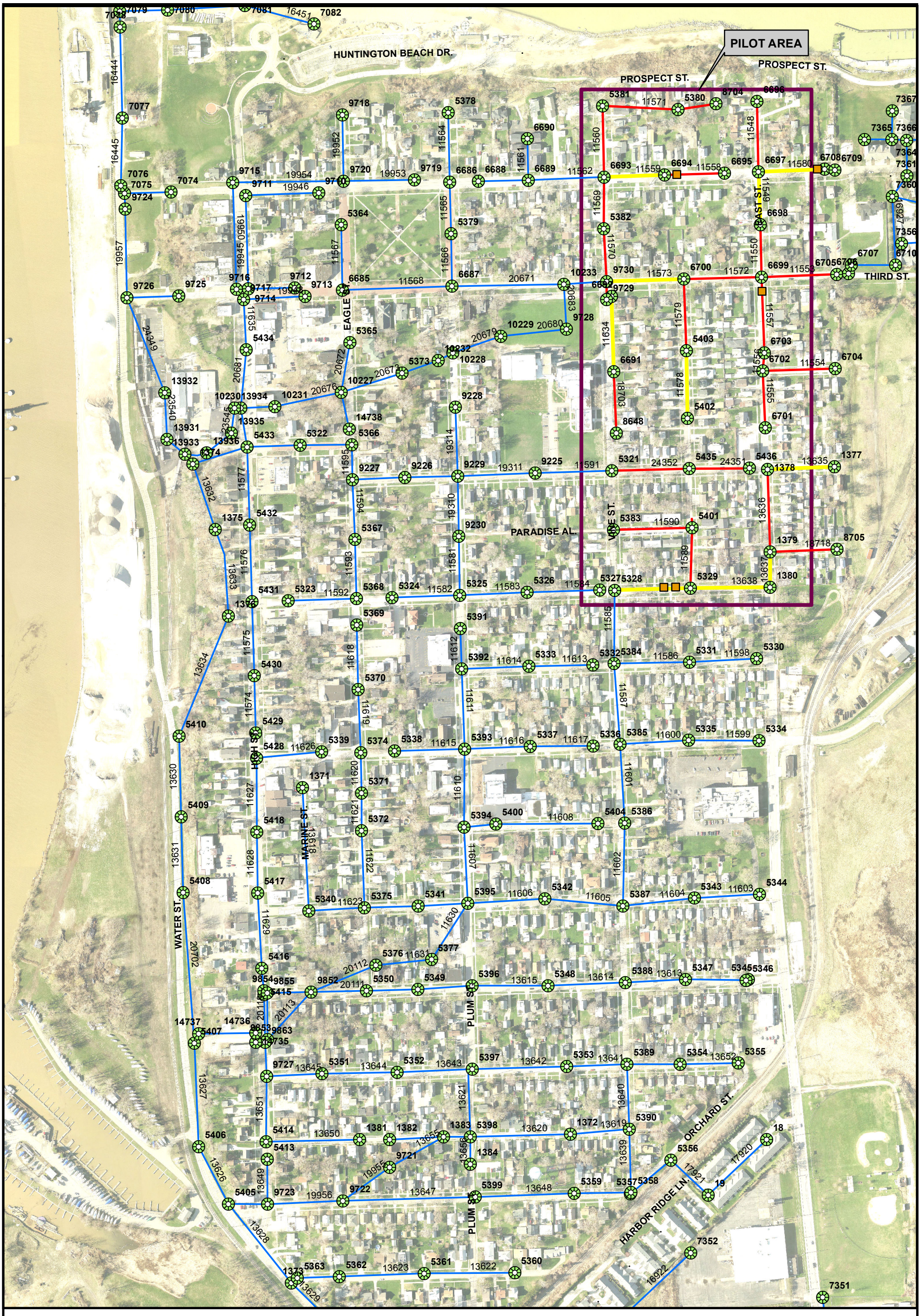


EXHIBIT 5 - VILLAGE OF FAIRPORT HARBOR
SANITARY SEWER SYSTEM
RECOMMENDED REPAIRS

SANITARY MANHOLE
SANITARY SEWER REVIEWED
SANITARY SEWER OUTSIDE PILOT AREA
SANITARY SEWER LINING RECOMMENDED

LCDU - FAIRPORT HARBOR - SEWER I/I INVESTIGATION

PILOT AREA
SANITARY SEWER POINT REPAIR

0 70 140 280 420 Feet

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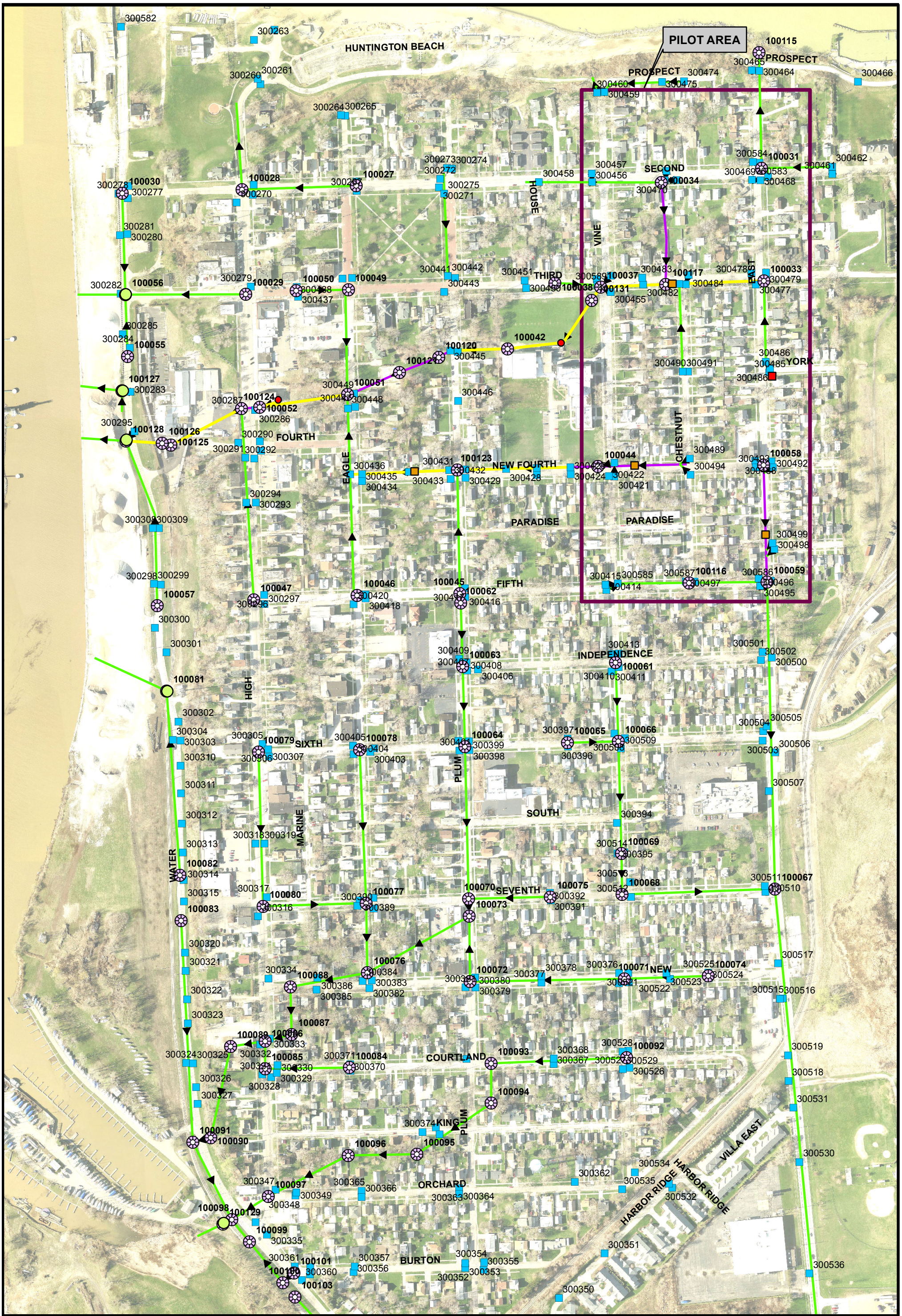
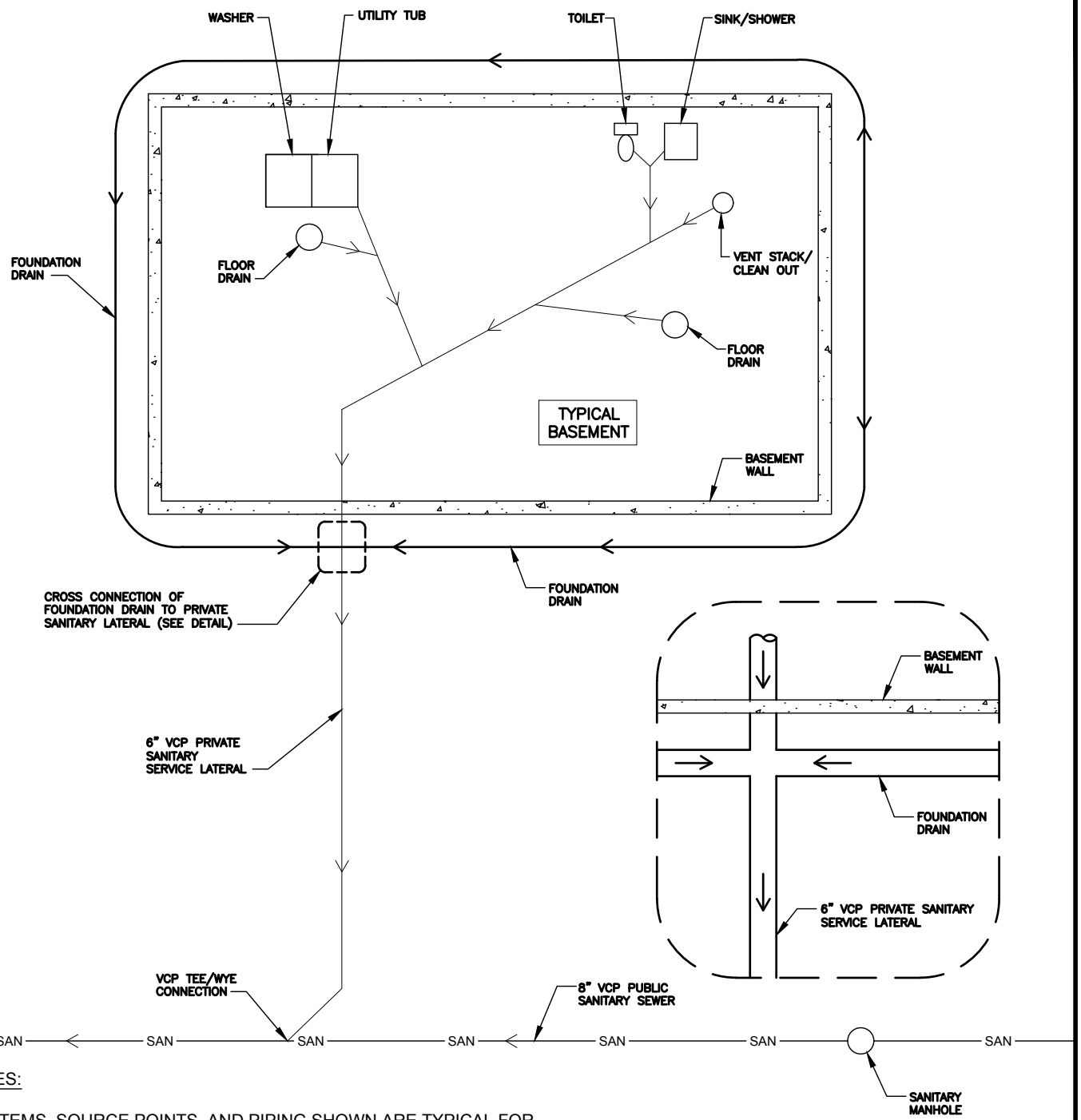

PILOT AREA
HUNTINGTON BEACH
PROSPECT
SECOND
THIRD
FOURTH
FIFTH
SIXTH
NEW FOURTH
HOUSE
VINE
EAST
CHESTNUT
PARADISE
EAGLE
HIGH
WATER
MARINE
PLUM
INDEPENDENCE
SOUTH
YORK
NEW
COURTLAND
KING
ORCHARD
BURTON
HARBOR RIDGE
VILLA EAST
EXHIBIT 6 - VILLAGE OF FAIRPORT HARBOR
STORM SEWER SYSTEM
RECOMMENDED REPAIRS
PILOT AREA
STORM MANHOLE, STORM CATCH BASIN
STORM SEWER REVIEWED AS PART OF INVESTIGATION
STORM SEWER OUTSIDE STUDY AREA
STORM SEWER LINING OR REPLACEMENT
STORM SEWER POINT REPAIR
CATCH BASIN REHAB
OUTFALL MANHOLE
NEW MANHOLE
LCDU - FAIRPORT HARBOR - SEWER I/I INVESTIGATION
0 105 210 420 630
Feet
BURGESS & NIPLE



NOTES:

1. ITEMS, SOURCE POINTS, AND PIPING SHOWN ARE TYPICAL FOR BASEMENTS OBSERVED. ACTUAL CONDITIONS AND CONFIGURATIONS WILL VARY FROM HOUSE TO HOUSE.
2. THE ONLY CLEAN-OUTS OBSERVED WERE LOCATED ON VENT STACKS. NO OUTSIDE CLEAN-OUTS WERE DETECTED DURING PRIVATE SANITARY LATERAL INSPECTION.
3. TYPICAL DOWNSPOUTS DISCHARGED TO SPLASH BLOCKS OR PIPED TO SIDEWALK/TREE LAWN. DURING TESTING TWO HOUSES WERE IDENTIFIED AS HAVING DOWNSPOUTS PREVIOUSLY TIED INTO THE PRIVATE SANITARY LATERAL.

SKETCH 1
TYP. BASEMENT PLUMBING

VILLAGE OF FAIRPORT HARBOR
LCDU – SEWER I/I INVESTIGATION

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Appendix B

Construction Cost Estimates for Recommendations

LAKE COUNTY DEPARTMENT OF UTILITIES

I/I INVESTIGATION - VILLAGE OF FAIRPORT HARBOR

BURGESS & NIPLE
Engineers ■ Architects ■ Planners

30-May-17

SANITARY SEWER (SAS) IMPROVEMENTS

PRELIMINARY CONSTRUCTION COST ESTIMATE

NO.	DESCRIPTION	AMOUNT
1	SAS Point Repairs (Total)	$ 320,000
TOTAL PRELIMINARY CONSTRUCTION COST - SAS IMPROVEMENTS		**$ 320,000**

*Estimate to replace entire public sanitary sewer system is approximately $10,049,000.00

STORM SEWER (STS) IMPROVEMENTS

PRELIMINARY CONSTRUCTION COST ESTIMATE

NO.	DESCRIPTION	AMOUNT
1	STS Point Repairs (Total)	$ 633,000
TOTAL PRELIMINARY CONSTRUCTION COST - STS IMPROVEMENTS		**$ 633,000**

*Estimate to replace entire public storm sewer system is approximately $7,381,000.00 (This estimate does not include installing new storm sewers on roads that do not currently have existing storm sewers).

LAKE COUNTY DEPARTMENT OF UTILITIES
I/I INVESTIGATION - VILLAGE OF FAIRPORT HARBOR

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SANITARY SEWER (SAS) IMPROVEMENTS
PRELIMINARY CONSTRUCTION COST ESTIMATE **30-May-17**

NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
East St. Near Third St. (Hole, Soil Visible)					
1	8-Inch VCP Sanitary Sewer	10	LF	$ 600	$ 6,000
2	Backfill Material	9	CY	$ 50	$ 500
3	Asphalt Pavement Replacement	6	SY	$ 200	$ 1,200
					$ 7,700
East St., Third St., New Fourth St., Chestnut St., Vine St., Second St., Fifth St. (Holes, Fractures, Cracks)					
4	8-Inch CIPP Liner	2600	LF	$ 45	$ 117,000
5	Service Lateral Reinstatement	80	EA	$ 200	$ 16,000
6	Service Lateral Connection Grouting	80	EA	$ 500	$ 40,000
7	Manhole Lining	170	LF	$ 450	$ 76,500
					$ 249,500
Second St. Repair 1 (Broken Tee Connection)					
8	8"x6" VCP Sanitary Sewer Tee Connection (Including Spool Pieces)	1	EA	$ 7,000	$ 7,000
9	Backfill material	5	CY	$ 50	$ 300
10	Asphalt Pavement Material	5	SY	$ 200	$ 1,000
					$ 8,300
Second St. Repair 2 (Broken Tee Connection)					
11	8"x6" VCP Sanitary Sewer Tee Connection (Including Spool Pieces)	1	EA	$ 7,000	$ 7,000
12	Backfill material	5	CY	$ 50	$ 300
13	Asphalt Pavement Material	5	SY	$ 200	$ 1,000
					$ 8,300
Fifth St. Repair 1 (Broken Tee Connection)					
14	8"x6" VCP Sanitary Sewer Tee Connection (Including Spool Pieces)	1	EA	$ 7,000	$ 7,000
15	Backfill material	5	CY	$ 50	$ 300
16	Asphalt Pavement Material	5	SY	$ 200	$ 1,000
					$ 8,300
Fifth St. Repair 2 (Broken Tee Connection)					
17	8"x6" VCP Sanitary Sewer Tee Connection (Including Spool Pieces)	1	EA	$ 7,000	$ 7,000
18	Backfill material	5	CY	$ 50	$ 300
19	Asphalt Pavement Material	5	SY	$ 200	$ 1,000
					$ 8,300
PRELIMINARY CONSTRUCTION COST - SAS POINT REPAIRS					**$ 290,400**
	CONTINGENCY	**1**	**10%**	**$ 29,000**	**$ 29,000**
PRELIMINARY CONSTRUCTION COST - SAS POINT REPAIRS					**$ 320,000**

*Estimated costs reflect each improvement as an individual project and mobilization

LAKE COUNTY DEPARTMENT OF UTILITIES
I/I INVESTIGATION - VILLAGE OF FAIRPORT HARBOR

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STORM SEWER (STS) IMPROVEMENTS **30-May-17**
PRELIMINARY CONSTRUCTION COST ESTIMATE

NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
East St. (Broken Pipe)					
1	10-Inch VCP Storm Sewer	5	LF	$ 1,500	$ 7,500
2	Backfill Material	5	CY	$ 50	$ 300
3	Asphalt Pavement Replacement	6	SY	$ 200	$ 1,200
					$ 9,000
New Fourth St. (Intruding Pipe, Buried Manhole)					
4	Raise Existing Manhole To Grade	1	EA	$ 3,000	$ 3,000
5	8-Inch VCP Storm Sewer	5	LF	$ 1,000	$ 5,000
6	Backfill Material	6	CY	$ 50	$ 300
7	Asphalt Pavement Replacement	7	SY	$ 200	$ 1,400
					$ 9,700
New Fourth St. (Replace Incorrect Size Tee Connection)					
8	10-Inch VCP Storm Sewer	5	LF	$ 800	$ 7,000
9	10-Inch x 6-Inch Tee Connection	1	EA	$ 1,000	$ 1,000
10	Backfill Material	5	CY	$ 50	$ 300
11	Asphalt Pavement Replacement	5	SY	$ 200	$ 1,000
					$ 9,300
New Fourth St. (Broken Pipe)					
12	10-Inch VCP Storm Sewer	50	LF	$ 800	$ 40,000
13	Backfill Material	44	CY	$ 50	$ 2,300
14	Asphalt Pavement Replacement	28	SY	$ 200	$ 5,600
					$ 47,900
New Fourth St. Lining (Holes, Fractures, Cracks)					
15	10-Inch CIPP Liner	800	LF	$ 50	$ 40,000
16	Service Lateral Reinstatement	5	EA	$ 200	$ 1,000
17	Service Lateral Connection Sealing	5	EA	$ 2,500	$ 12,500
18	Manhole Lining	70	LF	$ 450	$ 31,500
					$ 85,000
Third St. (Intruding Pipe)					
19	10-Inch VCP Storm Sewer	5	LF	$ 1,500	$ 7,500
20	Backfill Material	5	CY	$ 50	$ 300
21	Asphalt Pavement Replacement	5	SY	$ 200	$ 1,000
					$ 8,800
Easement - High School (Deformed Pipe)					
22	18-Inch VCP Storm Sewer	155	LF	$ 400	$ 62,000
23	Backfill Material	138	CY	$ 50	$ 6,900
24	Grading and Seeding	1	LS	$ 500	$ 500
					$ 69,400
Plum St. (Deformed Pipe)					
25	24-Inch CMP Storm Sewer	70	LF	$ 700	$ 49,000
26	Backfill Material	62	CY	$ 50	$ 3,200
27	Asphalt Pavement Replacement	39	SY	$ 200	$ 7,800
					$ 60,000
Third St. Lining (Hole, Fractures)					
28	10-Inch CIPP Liner	400	LF	$ 50	$ 20,000
29	Service Lateral Reinstatement	4	EA	$ 250	$ 1,000
30	Service Lateral Connection Grouting	4	EA	$ 500	$ 2,000
31	Manhole Lining	20	LF	$ 450	$ 9,000
					$ 32,000
Third St./Easement Through High School Lining (Hole, Fractures)					
32	18-Inch CIPP Liner	800	LF	$ 85	$ 68,000
33	Service Lateral Reinstatement	4	EA	$ 250	$ 1,000
34	Service Lateral Connection Grouting	4	EA	$ 500	$ 2,000
35	Manhole Lining	36	LF	$ 450	$ 16,200
36	New Precast Manhole	1	EA	$ 5,000	$ 5,000
					$ 92,200
Gully From Eagle St. Through Lyondell Property (Fractures, Slight Deformity)					
37	24-Inch CIPP Liner	815	LF	$ 120	$ 97,800
38	Service Lateral Reinstatement	4	EA	$ 250	$ 1,000
39	Service Lateral Connection Grouting	4	EA	$ 500	$ 2,000
40	Manhole Lining	72	LF	$ 450	$ 32,400
					$ 133,200
Gully From Building to Manhole 100052 (Fractures)					
41	15-Inch CIPP Liner	70	LF	$ 75	$ 5,300
42	Manhole Lining	10	LF	$ 450	$ 4,500
43	New Precast Manhole	1	EA	$ 5,000	$ 5,000
					$ 14,800
York St. - Rehab Catch Basin					
44	Rehab Existing Catch Basin	1	EA	$ 3,000	$ 3,000
					$ 3,000
SUBTOTAL PRELIMINARY CONSTRUCTION COST - STS POINT REPAIRS					**$ 575,000**
	CONTINGENCY	**1**	**10%**	**$ 57,500**	**$ 58,000**
TOTAL PRELIMINARY CONSTRUCTION COST - STS POINT REPAIRS					**$ 633,000**

*Estimated costs reflect each improvement as an individual project and mobilization

LAKE COUNTY DEPARTMENT OF UTILITIES
I/I INVESTIGATION - VILLAGE OF FAIRPORT HARBOR
STORM SEWER (STS) IMPROVEMENTS

BURGESS & NIPLE
Engineers ■ Architects ■ Planners

STS CLEANING & INSPECTION **30-May-17**
PRELIMINARY CONSTRUCTION COST ESTIMATE

NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
1	Mobilization	1	LS	$ 5,000	$ 5,000
Cleaning & Inspection of Remaining STS*					
2	Cleaning and CCTV Inspection of Storm Sewer Pipes and Catch Basin Laterals	30,900	LF	$ 6	$ 185,400
	SUBTOTAL PRELIMINARY CONSTRUCTION COST - STS CLEANING & INSPECTION				**$ 191,000**
	CONTINGENCY	**1**	**10%**	**$ 18,500**	**$ 19,000**
	TOTAL PRELIMINARY CONSTRUCTION COST - STS CLEANING & INSPECTION				**$ 210,000**

*Total storm sewer system pipe is estimated at 35,700 ft. For this investigation, LCSMD had 4,800 feet within and tributary to the pilot area cleaned and inspected

LAKE COUNTY DEPARTMENT OF UTILITIES
I/I INVESTIGATION - VILLAGE OF FAIRPORT HARBOR
SANITARY SEWER (SAS) AND STORM SEWER (STS)
REPLACEMENT OF ENTIRE PUBLIC SYSTEMS
PRELIMINARY CONSTRUCTION COST ESTIMATE

BURGESS & NIPLE
Engineers ■ Architects ■ Planners

30-May-17

NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Sanitary Sewer Quantity					
1	6-Inch VCP Sewer	898	LF	$ 60	$ 54,000
2	8-Inch VCP Sewer	38,706	LF	$ 65	$ 2,516,000
3	10-Inch VCP Sewer	3,093	LF	$ 70	$ 217,000
4	12-Inch VCP Sewer	6,217	LF	$ 80	$ 498,000
5	15-Inch VCP Sewer	251	LF	$ 100	$ 26,000
7	18-Inch VCP Sewer	8,035	LF	$ 150	$ 1,206,000
8	Sanitary Manholes	172	EA	$ 7,000	$ 1,204,000
9	Backfill	53,000	CY	$ 35	$ 1,855,000
10	Pavement Replacement & Restoration	33,000	SY	$ 75	$ 2,475,000
					$ 10,051,000
Storm Sewer Quantity					
1	6-Inch PVC Sewer	5,000	LF	$ 40	$ 200,000
2	8-Inch PVC Sewer	5,000	LF	$ 45	$ 225,000
3	10-Inch PVC Sewer	6,000	LF	$ 60	$ 360,000
4	12-Inch RCP Sewer	7,700	LF	$ 120	$ 924,000
5	18-Inch RCP Sewer	6,000	LF	$ 140	$ 840,000
6	24-Inch RCP Sewer	5,000	LF	$ 175	$ 875,000
7	48-Inch RCP Sewer	1,000	LF	$ 350	$ 350,000
8	Storm Manholes	89	EA	$ 4,000	$ 356,000
9	Storm Catch Basins	330	EA	$ 2,200	$ 726,000
10	Backfill	30,000	CY	$ 35	$ 1,050,000
11	Pavement Replacement & Restoration	22,000	SY	$ 75	$ 1,650,000
					$ 7,556,000
	SUBTOTAL PRELIMINARY SANITARY AND STORM SEWER COST				**$ 17,607,000**
	CONTINGENCY		10%	$ 1,760,700	**$ 1,761,000**
	TOTAL PRELIMINARY SANITARY AND STORM COST				**$ 19,400,000**

*Quantities for storm sewer are estimated as exact quantities are unknown.

*Pavement replacement estimated for all sewers; manholes; catch basins

Lake County Department of Utilities
105 Main Street, 3rd Floor
Painesville, Ohio 44077-0490
Phone (440) 350-2652
Fax (440) 350-5784
www.lakecountyohio.org

Appendix C

Property Owner Correspondence

Lake County Sewer Separation Program

Your Sewer Improvement Connection

Lake County Department of Utilities
105 Main Street, 3rd Floor
Painesville, Ohio 44077-0490
Phone (440) 350-2652
Fax (440) 350-5784
www.lakecountyohio.org

February 9, 2015

Re: Village of Fairport Harbor Sewer Inflow & Infiltration Investigation

Dear Resident:

You are invited to attend a **public meeting at 6:00 pm, February 23, at the Village Senior Center**, located at 1380 East Street. This meeting is being conducted on behalf of the Lake County Department of Utilities (LCDU), Lake County Stormwater Management Department (LCSMD), and the Village of Fairport Harbor.

The meeting will discuss the following items:

- Review of the sewer systems in the Village
- What is Inflow & Infiltration?
- Recent and upcoming work
- Results of October 2015 survey questionnaire
- 2016 Inflow & Infiltration Investigation

The LCDU, LCSMD, and the Village remain committed to working together to address issues which affect the residents of the Village. We look forward to you attending and participating in the meeting on February 23.

Sincerely,

Richard L. Martin
Executive Director
Lake County Department of Utilities

Tim Manross
Mayor
Village of Fairport Harbor

Timothy A. Miller
Director
Lake County Stormwater Management Department

Lake County Sewer Separation Program

Your Sewer Improvement Connection

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October 19, 2015

Re: Village of Fairport Harbor Sewer Inflow & Infiltration Investigation

Dear Resident:

An investigation of the three individual sewer systems (1-2-3) in the Village will soon begin. The investigation will use an "Integrated Approach" and will be a joint effort between the Lake County Department of Utilities (LCDU), Lake County Stormwater Management Department (LCSMD), and the Village. ***The objective of this investigation will be to determine potential future actions and improvements to minimize inflow and infiltration (I&I) into the public sanitary sewer system and improve the efficiency of the public storm sewers.*** The 1-2-3 investigation will consist of:

1. Public sanitary sewers (LCDU responsibility & maintenance)
2. Private sanitary service laterals (property owner responsibility & maintenance)
3. Public storm sewers (Village responsibility & maintenance)

Enclosed is a questionnaire that will help identify areas of concern. Please fill out this survey and return it in the enclosed self-addressed stamped envelope.

Burgess & Niple, Inc. (B&N), a local engineering firm located in Painesville, will be assisting the County with this investigation. If you have any questions, please call Rob Hrusovsky Jr., project engineer (B&N), at (440) 354-9700 or e-mail him at robert.hrusovsky@burgessniple.com.

The LCDU, LCSMD and the Village remain committed to working together to address issues which affect the residents of the Village. Thank you for taking a few moments to complete and return the enclosed survey. This information is vital in assisting us to continue investigating the issues in the Village.

Sincerely,

Daniel P. Troy
President
Lake County Commissioner

Tim Manross
Mayor
Village of Fairport Harbor

Lake County Department of Utilities
105 Main Street, 3rd Floor
Painesville, OH 44077-0490
Phone: (440) 350-2652
Fax: (440) 350-5784

SURVEY QUESTIONNAIRE

PLEASE RETURN BY NOV. 6

The Lake County Department of Utilities (LCDU), Lake County Stormwater Management Department (LCSMD) and the Village of Fairport Harbor are conducting an area-wide investigation of the stormwater and sanitary sewer systems within the Village. In order to better serve you, it is important that we are made aware of stormwater and sanitary sewer problems your property may be experiencing. Please take a moment to fill out this survey and return it in the enclosed self-addressed stamped envelope. Thank you for your cooperation.

Name *(optional)*:_____

PROPERTY ADDRESS: _____
IMPORTANT

1. How long have you been located at this address? (years)

_____

2. Do you have:

☐ Basement ☐ Split level ☐ Crawl Space ☐ Slab

☐ A yard that slopes away from the building?
☐ A yard that slopes toward the building?
☐ A depressed trench or low area in the yard?
☐ Large established trees near the building?

3. Do you experience any type of flooding in/on your property?
Check all that apply.

☐ Basement ☐ Front Yard ☐ Back Yard ☐ Street

☐ Drive ☐ Other ☐ None

*Comment: _____

4. If basement flooding occurs, what is the usual depth of the water (inches)? _____

5. If flooding occurs on your street:

How long does the water stand (hours)? _____
Was there standing water in your yard?
☐ Yes ☐ No

If yes, ☐ Front Yard ☐ Back Yard ☐ Both
If yes, ☐ During average rain ☐ During heavy rain

6. How does unwanted water enter your basement?
Check all that apply.
☐ Basement floor drains
☐ From drains in window wells
☐ From basement walls
☐ From perimeter of basement floor
☐ From sump overflowing
☐ Don't know
☐ Other _____

7. How many times have you had water in your basement?
List dates if known.
☐ In the past 5 years _____
☐ In the past 7 years _____
☐ Never

CONTINUED ON BACK

8. Describe water in basement. *Check all that apply.*
☐ Clear ☐ Muddy ☐ Murky (gray or black)
☐ Odor ☐ No Odor ☐ Not applicable

9. What kind of special equipment do you have to take care of or prevent basement flooding? *Check all that apply.*
☐ Sump pump
☐ Back-up valve / Backflow preventer
☐ Standpipe
☐ Other _____
☐ None

10. If you have experienced flooding, when does it occur?
☐ During an average rain event
☐ Only during a heavy rain event
☐ Immediately after a rain event
☐ The rain event is not a factor
☐ Have not noticed
Cause if other than rain: _____

11. If a sump pump is used, when and how often does it run?
Check all that apply.
☐ Runs periodically during dry weather
☐ Runs often during dry weather
☐ Runs as soon as rain begins
☐ Runs continually during rain
☐ Rains continually after rain stops
☐ Stops running when rain stops
☐ Not applicable

12. Where does the discharge from your sump pump flow?
☐ To curb outlet
☐ To storm sewer
☐ To sanitary sewer
☐ Onto ground in front yard
☐ Onto ground in back yard
☐ Don't know
☐ Other _____
☐ Not applicable / do not have sump pump

13. What is the total number of roof downspouts you have? _____
Number of downspouts connected into the ground _____
☐ Discharges to curb outlet
☐ Discharges to ditch
☐ Do not know where it discharges to
☐ Storm sewer
☐ Sanitary service lateral
Number of downspouts that splash onto ground _____

14. Have you ever had your private sanitary service lateral inspected (televised) from within your property structure? (This is your private sanitary sewer pipe running from your house, connecting to the public sanitary sewer.)
☐ Yes ☐ No
If yes, what was determined from the inspection?
_____

15. Do you know if any of the following are connected to your sanitary service lateral?
☐ Yes, downspouts
☐ Yes, sump pump
☐ Yes, basement drain (washtubs/laundry/toilet/shower)
☐ None

16. In your opinion, yard and street flooding is caused by:
Check all that apply.
☐ Street grade problems
☐ Yard grade problems
☐ Not enough storm sewers
☐ Storm sewers too small
☐ Sanitary sewers too small
☐ Other _____
☐ Aging infrastructure
☐ Blocked catch basin
☐ Blocked curb inlet
☐ Blocked storm sewer
☐ No flooding problem
Comment: _____

17. What best describes the storm water drainage on your street?
☐ No storm sewers
☐ Roadside ditches
☐ Catch basins with storm sewer pipes
☐ Curb with gutter leading to catch basin

18. Would you be willing to be contacted for a more detailed discussion of your drainage issues?
☐ YES ☐ NO

If yes, best time to call: _____
Telephone number: _____
Email Address: _____

19. Would you be willing to participate in having your plumbing inspected and private sanitary service lateral cleaned and inspected (free of charge)?
☐ YES ☐ NO

If yes, best time to call: _____
Telephone number: _____

20. If you have any photos (or any other documentation) of the flooding that occurs on your property or street please attach a copy of them with a date the flooding occurred. You may also email them to robert.hrusovsky@burgessniple.com. Any information is greatly appreciated and will help with the investigation.

COMMENTS: _____

Please return your completed questionnaire by Nov. 6

Thank you for your participation in this survey.

Lake County Department of Utilities
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Appendix D

Completed Survey Questionnaires

***electronic files (DVD)**

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Appendix E

Private I/I Inspection Videos and Logs

***electronic files (DVD)**

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Appendix F

Sanitary and Storm Sewer Inspection Videos and Logs

***electronic files (DVD)**

Lake County
Sewer Separation
Program

Your Sewer Improvement Connection

BURGESS & NIPLE
Engineers ■ Architects ■ Planners

burgessniple.com