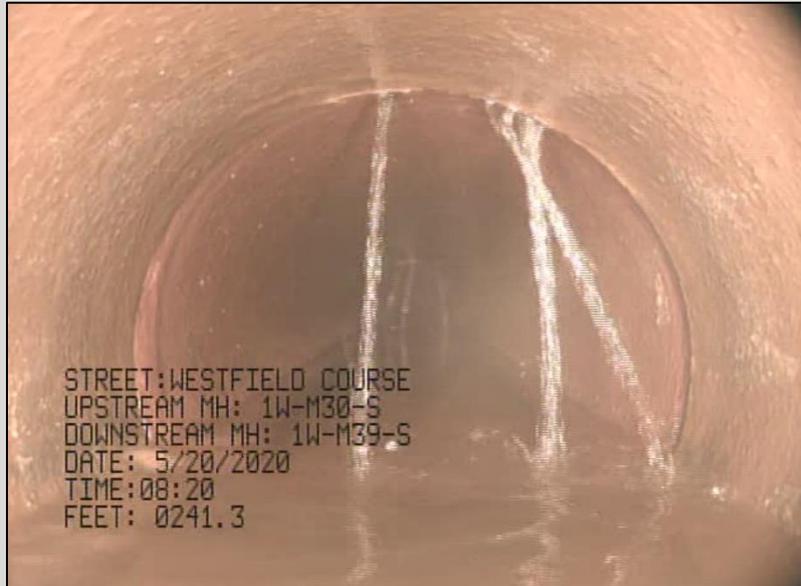


# Sanitary Sewer Evaluation: Geneva East Basin

City of Geneva



August 31<sup>st</sup>, 2020

Prepared For  
The City of Geneva



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## 1 Executive Summary

Deuchler Engineering Corporation (Deuchler) was hired by the City of Geneva (City) to develop a program to evaluate and recommend necessary modifications, if any, for surcharging and sanitary sewer overflows (SSOs) often requiring pumping by the Owner during wet weather events at six known locations where the City bypass pumps during heavy rain events. The City is in the process of investigating the tributary areas to each of these locations to reduce SSOs in accordance with their NPDES permit. Geneva East is one of those locations. From January 2019 through June 2020, Deuchler had installed flow meters in 8 sanitary basins across the City at 32 different locations. With SSO's occurring throughout the City, flow monitoring will provide the data needed to prioritize the rehabilitation of the system and locate the hydraulic bottlenecks in need of modification.

The initial flow monitoring data shows high peak flows and high volumes of I/I entering the basin upstream of 2V-M04 (877 Manchester Course). Additionally, observed downstream control is not allowing the pipe to operate at full capacity.

The force main discharge from the lift station on Parker Ct into 1V-M24 (634 Westfield) creates a hydraulic disturbance that temporarily holds the upstream flow back. Recommendations for this location, such as pump downsizing and/or force main realignment will depend upon the results of the complete flow study currently underway. If no downsizing and/or force main realignment takes place, it is recommended to re-design the entry path of the force main discharge into 1V-M24. This will reduce the hydraulic impact of the flow entering from the force main.

The distressed VCP and Ductile Iron segments will be best served with mainline joint chemical grout to help eliminate inflow and infiltration. The segments with significant root intrusion are recommended for CIPP lining to ensure the roots are eliminated. Grouting and lining recommendations can be found on Exhibit 4 and Exhibit 5.

With modest peak flows entering from 2W-M53 (1006 Manchester), the sewers in Chesapeake Way Area are not called out for rehabilitation. The PVC pipes are in good condition, and did not show signs of I/I. Additionally, the PVC sewers upstream of 2V-M04 (877 Manchester) have been left out of the cost estimate as well.

All service connections tied with these lines are recommended for grout as well. With the nature of infiltration on the mainline as well as the high quantity in the basin, grouting is recommended for 30 feet from the main line up the service pipe. This recommended work is located on private property (per City Code). All work on private property will require permission and hold harmless agreements.

The manhole defects identified are recommended for repair. These repairs will further the life span of these structures, as well as eliminate sources of I/I.

The televising shows approximately 21 services on Westfield with a flat slope, holding water even during dry weather conditions. Deuchler recommends each resident that is shown with the flat sloped service or that has experienced backups in the past to construct an overhead sewer or other backflow prevention measures to mitigate the lack of cover and slope from the main line sewer. Including the residents that have experienced backups, the amount of recommended overhead sewer systems is 27. The homes with observed flat services are shown on Exhibit 3. Overhead sewer installation costs vary significantly, from \$6,000 to \$15,000, depending on the home.

Deuchler is recommending building sump pump inspections for the Geneva East as well. Building sump pump inspections will help identify any directly connected sump pumps or other improper plumbing that causes excess flow to enter the sanitary system.

Table 1-1 shows the rough cost estimate for the rehabilitation outlined in this report.

Table 1-1

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	COST
1	Pre-construction cleaning and televising	22,000	LF	\$3.50	\$77,000.00
2	Lateral Cleaning and Televising	325	EACH	\$300.00	\$97,500.00
3	T-liner Installation (5-foot shorty, 8" x 6")	3	EACH	\$3,000.00	\$9,000.00
4	Cured-in-Place Pipelining (8")	3,500	LF	\$30.00	\$105,000.00
5	Lateral Reinstatements	82	EACH	\$100.00	\$8,200.00
6	Air Test Mainline Joint (8")	3,000	EACH	\$60.00	\$180,000.00
7	Air Test Mainline Joint (12")	100	EACH	\$80.00	\$8,000.00
8	Grout Mainline Joint (8")	2,200	EACH	\$15.00	\$33,000.00
9	Grout Mainline Joint (12")	75	EACH	\$30.00	\$2,250.00
10	Air Test Service Connection (30-foot)	320	EACH	\$3,000.00	\$960,000.00
11	Grout Service Connection (30-foot)	220	EACH	\$500.00	\$110,000.00
12	In Pavement Chimney Rehab	7	EACH	\$2,400.00	\$16,800.00
13	Off Pavement Chimney Rehab	33	EACH	\$1,900.00	\$62,700.00
14	Internal Chimney Sealing	34	EACH	\$600.00	\$20,400.00
15	Lid Replacement	6	EACH	\$250.00	\$1,500.00
16	Furnish New Lid and Frame	3	EACH	\$300.00	\$900.00
17	Reset Existing Frame	6	EACH	\$2,000.00	\$12,000.00
18	Plug Abandoned Pipe	1	EACH	\$900.00	\$900.00
19	Grout Bottom 18"	8	EACH	\$200.00	\$1,600.00
20	Grout Entire Manhole	5	EACH	\$800.00	\$4,000.00
21	Replace Bench and Trough	4	EACH	\$2,600.00	\$10,400.00
22	Cementitious Coat	7	EACH	\$2,600.00	\$18,200.00
23	Overhead Sewer System	27	EACH	\$15,000.00	\$405,000.00
ESTIMATED COST:					\$2,144,350

This cost basis and style of recommendations are similar for the other areas of town already inspected.

## 2 Introduction

Deuchler Engineering Corporation (Deuchler) was hired by the City of Geneva (City) to develop a program to evaluate and recommend necessary modifications, if any, for surcharging and sanitary sewer overflows (SSOs) often requiring pumping by the Owner during wet weather events at six known locations where the City bypass pumps during heavy rain events. The City is in the process of investigating the tributary areas to each of these locations to reduce SSOs in accordance with their NPDES permit. Geneva East is one of those locations. From January 2019 through June 2020, Deuchler had installed flow meters in 8 sanitary basins across the City at 32 different locations. With SSO's occurring throughout the City, flow monitoring will provide the data needed to prioritize the rehabilitation of the system and locate the hydraulic bottlenecks in need of modification.

Over the last 10 years, the City of Geneva has experienced sewer overflows, specifically basement backups, in the Geneva East area. The Geneva East area is bounded by East Side Drive to the west, Division Street to the north, Manchester Course and Chesapeake Way to the south, and Kirk Road to the east. Figure 2-1 shows an overall area map with street labels.

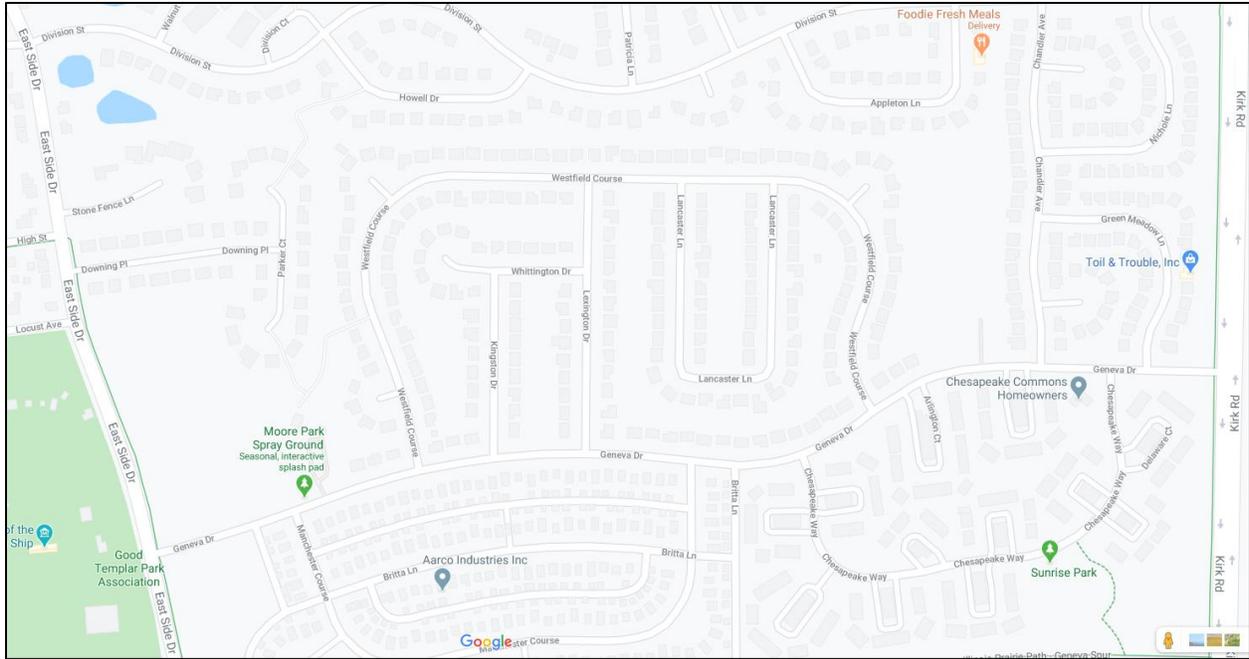


Figure 2-1

The City has often needed to pump the sanitary sewer at 2V-M06 (892 Manchester Course) into the storm system to relieve flow and prevent basements from backing up. The SSO's have been centralized along Westfield Course and Geneva Drive. Figure 2-2 shows the location of 2V-M06.

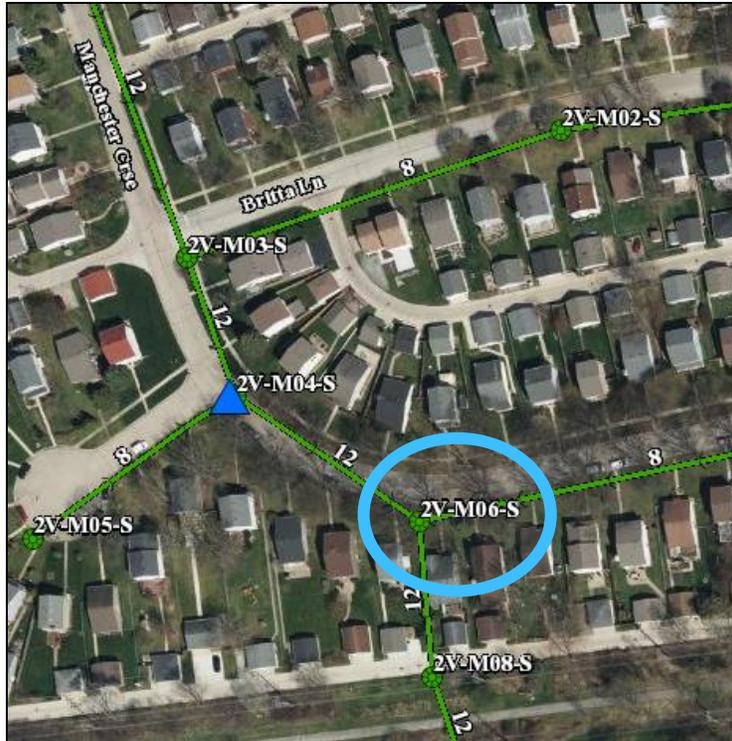


Figure 2-2

The SSO's are the result of storm water Inflow and Infiltration (I/I) entering the sanitary sewer system. When it rains, the runoff will find the sanitary sewer through direct and indirect connections. According to the EPA, Inflow is defined as "Water other than sanitary flow that enters a sewer system from sources which include, but are not limited to, roof leaders, cellar drains, yard drains, area drains, drains from wet areas, cross connections between storm sewers and sanitary sewers, catch basins, cooling towers, stormwater, surface runoff (including leaking manhole covers), street wash-water, or drainage. Inflow does not include, and is distinguished from infiltration. Inflow is generally measured during wet weather." Infiltration is defined as "groundwater that infiltrates a sewer system through defective pipes, pipe joints, connections, or manholes. Infiltration does not include, and is distinguished from inflow. Infiltration is generally measured during seasonally high ground water conditions, during a dry period." Figure 2-3 provides a visual aid for the concept of Inflow and Infiltration (I/I).

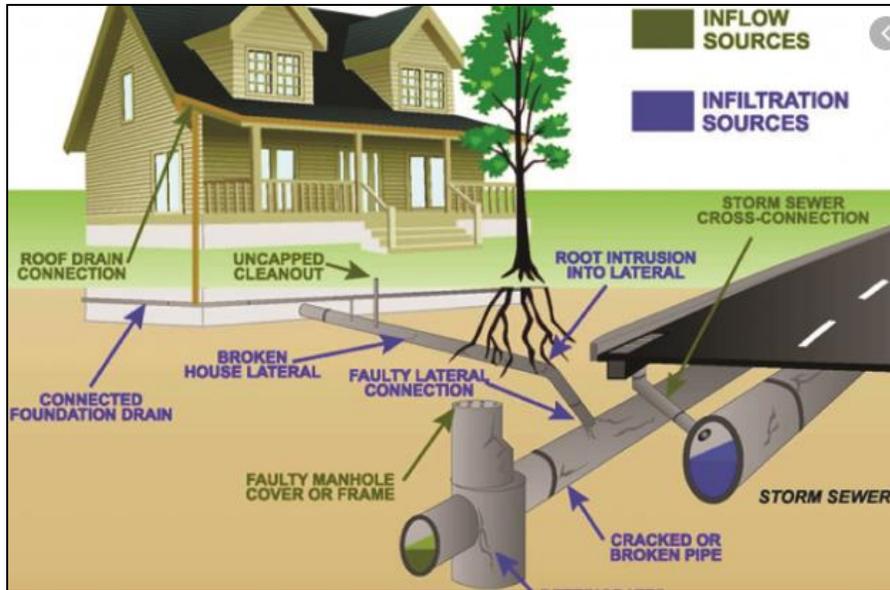


Figure 2-3 (Trenchless Technology Magazine)

Most recently, the sewer system experienced flow backups during the rain events from May 14, 2020 through May 19, 2020. This series of storms produced 6.95 inches of rain over 120 hours (5 days). Using ISWS Bulletin-75 recurrence intervals, this storm constitutes a 7-year, 5-day event. This means a 5 day storm period bringing 6.95 inches of rain occurs every 7 years, or a 14% chance of occurring in any given year.

High peak flows and downstream hydraulic restrictions caused the sewers to surcharge and overflow. A brief summary of the initial findings can be found in Section 2 of this report.

The City of Geneva contracted with SewerTech LLC to clean and televise the sewers in the Geneva East area, upstream of manhole 2V-M06. The televising was conducted in May and June of 2020. Deuchler Engineering reviewed the sewer televising in order to provide recommendations for rehabilitating the collection system and reducing the potential for I/I to enter the system. Additionally, Deuchler performed manhole inspections at each structure upstream of 2V-M06 in order to provide complete public sector analysis for removing I/I.

### 3 Flow Monitoring Summary

#### 3.1 Meter Locations

The first three flow meters were installed in the Geneva East Area in December of 2019. These meters were located at the following manholes:

- 2V-M04
- 2V-M21
- 2W-M53

After the storm events of May 14-18, SSO's were reported along Westfield Course. By request of the City to accelerate the investigation in this area, Deuchler installed four additional flow meters at the following locations:

- 3W-M24
- 4V-M24
- 1W-M45
- 1W-M15

All of the flow meter locations are shown on Exhibit 1.

#### 3.2 Flow Data Analysis

The meter at 2W-M53 was removed in May of 2020. This site was not showing high peak flows and was ruled out as a significant I/I contributor. On May 14, the meter at 2W-M53 reported a peak flow of just 0.39 million gallons per day (MGD). For comparison, 2V-M04 recorded a peak of 1.15 MGD. This meter was relocated to the higher priority locations within Geneva East.

“Downstream Control” is a term commonly used in flow monitoring. This term refers to a restriction of flow shown at a flow monitoring site. Figure 3-1 shows the downstream control seen at 2V-M04 (877 Manchester). Downstream control limits the flow capacity of the pipe and backs up the sewers upstream of it. In this case, the pipe has a theoretical full-pipe capacity of approximately 1.8 MGD, but is only able to pass 0.9 MGD. Once the flow reaches 0.9 MGD, a restriction downstream does not allow any more flow to pass through. When more than 0.9 MGD of flow enters from the upstream sections, the water elevation rises and the flow begins to back up. This is seen in the chart as well, with elevations reaching nearly 70 inches above the invert (bottom) of the pipe.

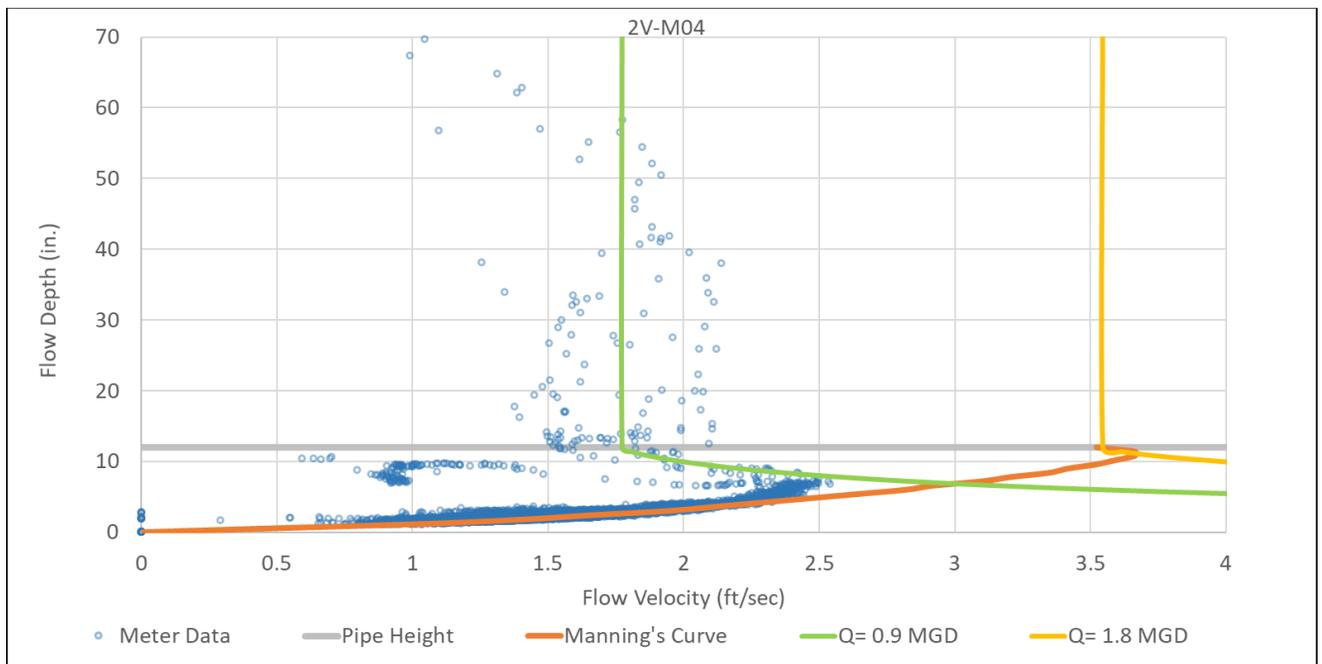


Figure 3-1

With the downstream control seen at 2V-M04, the need to add flow meters further downstream became apparent. A meter was installed at 3W-M24 (behind 27 Ridge Ln) on May 15<sup>th</sup> just in time to record the flows for the remainder of the wet weather event. This data still showed downstream control, which led to the installation of 4V-M24. The analysis at 4V-M24 is ongoing due to the lack of rain since the meter was installed.

Even with the downstream control serving to dampen peak flows, 2V-M04 still showed a peaking factor of 19 times the average dry weather flow of July.

- Average Dry Weather Flow (July): 0.06
- Peak Flow during May Rains: 1.15 MGD
- Peaking Factor:  $1.15/0.06 = 19.2$

Sanitary sewers are typically designed to carry peak flows of 100 gallons per person per day, which accounts for standard levels of I/I. Larger peak flows are not accounted for in capacity analysis and will overwhelm the system.

With no high-intensity storms since installation, there is not enough data to produce a full flow monitoring report yet. The preliminary high volumes of I/I entering 2V-M04 show a need for rehabilitation of upstream sewers, however. Additionally, the downstream control will be further studied with more flow data.

### 3.3 Force Main In 1V-M24 (634 Westfield)

A manhole inspection of 1V-M24 (634 Westfield) revealed that the force main from the lift station at the south end of Parker Ct discharges directly onto the flow path. This flow discharge creates a hydraulic disturbance and creates “downstream control” in the sewers upstream of it. When the level upstream in the wet well of the pump station reaches a certain level, the station will turn “on” and pump 165 gallons per minute. When the level has subsided to a predetermined design point, the pumps will shut “off”. This flow converted to Million Gallons per Day is equal to 0.24 MGD. The dry weather flows recorded to date for 1W-M15 show a daily peak of 0.04 MGD flowing through this manhole. This discharge, six times larger than the established flow, crashing down at a high velocity contributes to a reduced capacity in upstream sewers for the duration of pumping.



Figure 3-2

Figure 3-2 shows the discharge creating surcharge and turbulence in 1V-M24.

The lift station on Parker Ct is monitored via pump run times. City personnel conduct weekly checks to retrieve the run times. In the two weeks leading up to the rain events of May 14<sup>th</sup> -18<sup>th</sup>, the station averaged a run time of about a half hour each day. From May 14<sup>th</sup> to May 22<sup>nd</sup>, the station ran approximately an hour and a half each day. Table 3-1 shows the pump run time data for the spring of 2020.

Table 3-1

<b>Geneva East Lift Station</b>						
<i>Monitoring Period 2020</i>		<b>Pump Run Hours Per Day</b>				
		No 1	No 2	Total		
27-Mar	3-Apr	0.39	0.39	0.78		
3-Apr	8-Apr	0.26	0.28	0.54		
8-Apr	16-Apr	0.24	0.30	0.54		
16-Apr	24-Apr	0.27	0.40	0.67		
24-Apr	2-May	0.41	0.39	0.8		
2-May	8-May	0.28	0.35	0.63		
8-May	14-May	0.25	0.28	0.53		
14-May	22-May	0.49	0.83	1.32		
22-May	1-Jun	0.32	0.28	0.6		
1-Jun	8-Jun	0.17	0.20	0.37		

The 165 gallon per minute value is with one pump running. The station holds two pumps, and both have the ability to run during high flow events. It cannot be confirmed if both pumps ran during the May storm event.

The hydraulics of 1V-M24 should be considered for re-design. The flow path of the force main can be improved to limit the downstream control on Westfield. Typically, this can be achieved by installing a new manhole to introduce the flow from the force main with less turbulence.

The need to reroute the force main will be contingent upon the wet weather flow data for the upstream meter located at 1W-M15. During dry weather, the surcharging appears to be localized at the force main discharge point and does not appear on the upstream flow data. Additionally, with low run times and only serving 35 homes, downsizing the pump capacity at the lift station would help limit the hydraulic disturbance in 1V-M24.

The downstream meter at 2V-M04 shows flow spikes once a day during the first half of July. These flow spikes can reach up to 0.15 MGD over the previous data points, nearly the flow of the pump station with one pump running. Figure 3-3 shows the data from July 1<sup>st</sup>, 2020 through July 15<sup>th</sup>, 2020.

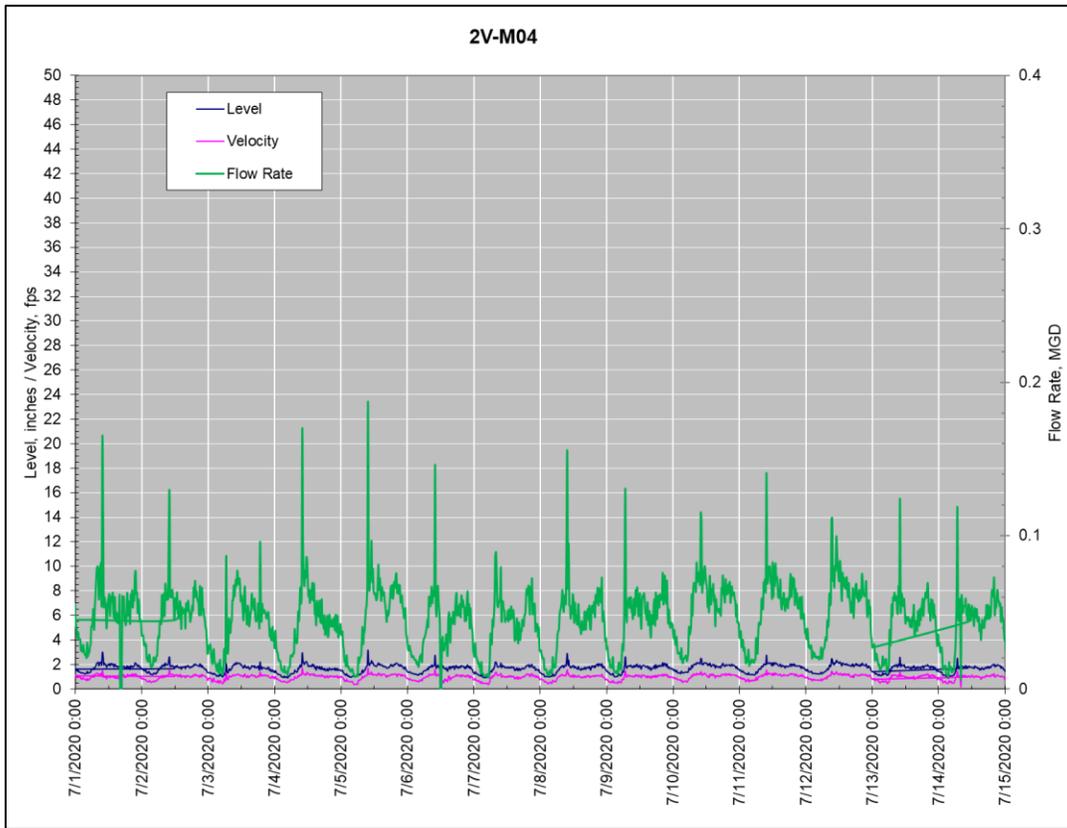


Figure 3-3

With higher dry weather flows in the late winter / early spring, the peaks are not as pronounced. Figure 3-4 shows the flow from February 15<sup>th</sup>, 2020 through March 1<sup>st</sup>, 2020. With larger dry flows established from upstream of 1V-M24, the force main discharge does not show up as clearly. The extent of surcharge in 1V-M24 will be greater with these higher dry weather flows, however, and will need to be analyzed in the next wet season and major storm event.

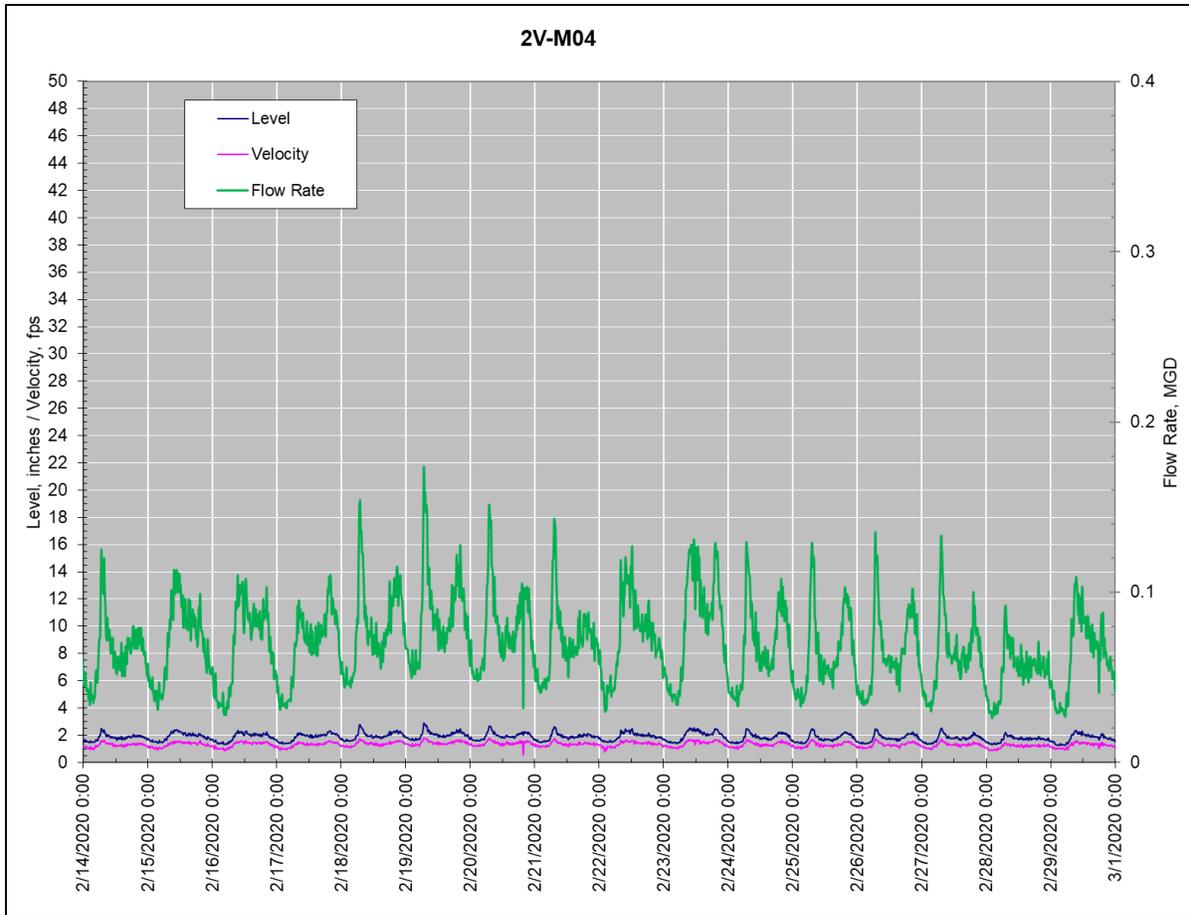


Figure 3-4

With backups still occurring downstream of the station, this suggests the force of the discharge creating a downstream control effect is not the only problem present.

## 4 Sewer Televising

### 4.1 Overview

TV Review is a critical component for rehabilitating a sanitary sewer system. Sewer televising has the following goals:

- Condition assessment. Is rehabilitation required? If yes, how urgently is it required.
- Identify connections from storm sewers
- Identify “dead” connections to empty lots or fields.
- Inventory of private service connections. Perform a condition assessment of the connection regarding structural integrity and I/I evidence.
- Identification of cost-effective repairs.
- Identification of maintenance issues such as grease and debris that can potentially cause pipes to plug leading to backups.

An important element of sewer televising and review is understanding the coding language. Staff performing the review have previously been Pipe Assessment Certification Program (PACP) certified. PACP codes are used to create a standard process for comparing pipe conditions across the country.

## 4.2 Dig Repair

One recommended dig repair was identified during the TV review. The repair is located on 1X-M20 to 1W-M36. A large bulge in the liner is obstructing flow. If not removed, the bulge can potentially lead to backups upstream. Figure 4-1 shows the bulge in this section. Exhibit 4 shows the overall location of the bulge. This repair was made the week of August 24, 2020.

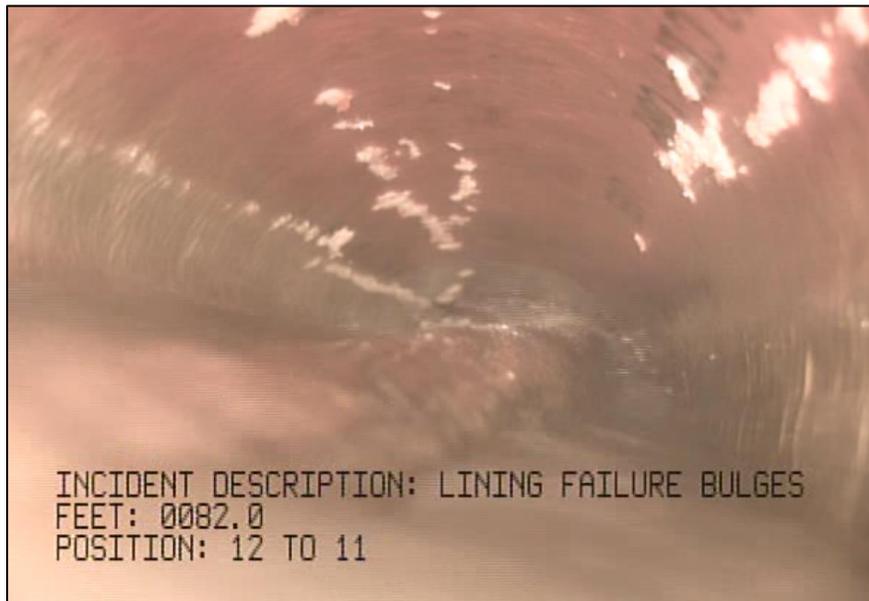


Figure 4-1

### 4.3 Sewer Main Line Defects

The structural condition of the mainline is assessed during TV review. On a scale of 0-5, 5 being the worst condition, each pipe segment is assigned a Cured In Place Pipe (CIPP) lining priority. CIPP is the most common rehabilitation for small diameter sewers in need of structural rehabilitation. The rating is derived from the quantity and severity of defects found.

In the Geneva East basin, the highest assigned rating was a 3. This was assigned 15 times. A 3 rating falls into the category of medium lining priority. In this case, each of the sewers was Vitrified Clay Pipe (VCP) and showed signs of deterioration. Some segments were labeled as medium priority that had severe root intrusion that standard grout would not be able to remediate.

Roots will often enter pipelines at the joints. Roots seek the moisture and nutrients present in sanitary sewers. When roots are found in sewers, they will often continue to grow and become a large obstruction restricting flow. Additionally, the space in the joints that allows roots to penetrate is also a source of I/I. Segments with a significant amount of roots are recommended to be lined with CIPP. Figure 4-2 shows root intrusion at a VCP joint.

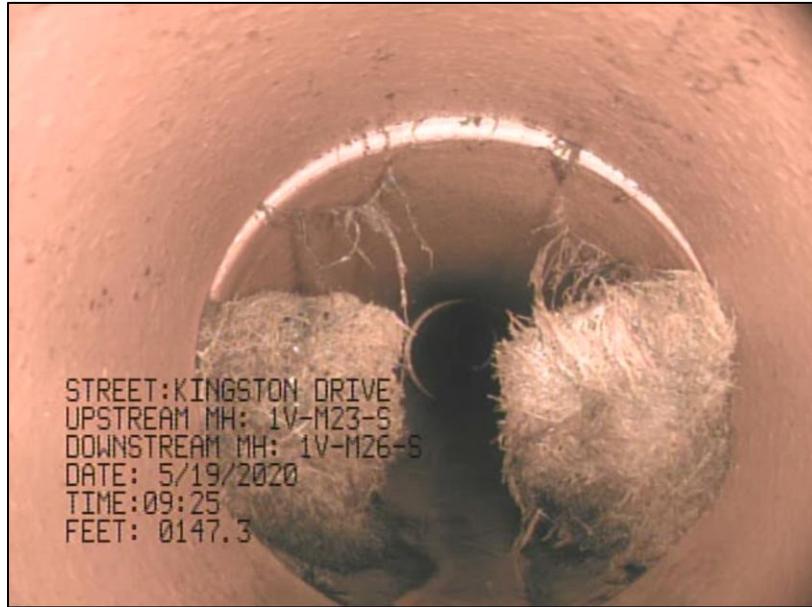


Figure 4-2

Many pipes are in good structural condition, but show active infiltration or signs of past infiltration. Segment 1W-M30 to 1W-M39 was televised on 5-20-2020, a few days after the heavy rains. This segment showed active I/I at nearly every joint. Figure 4-3 shows a few of the leaking joints.

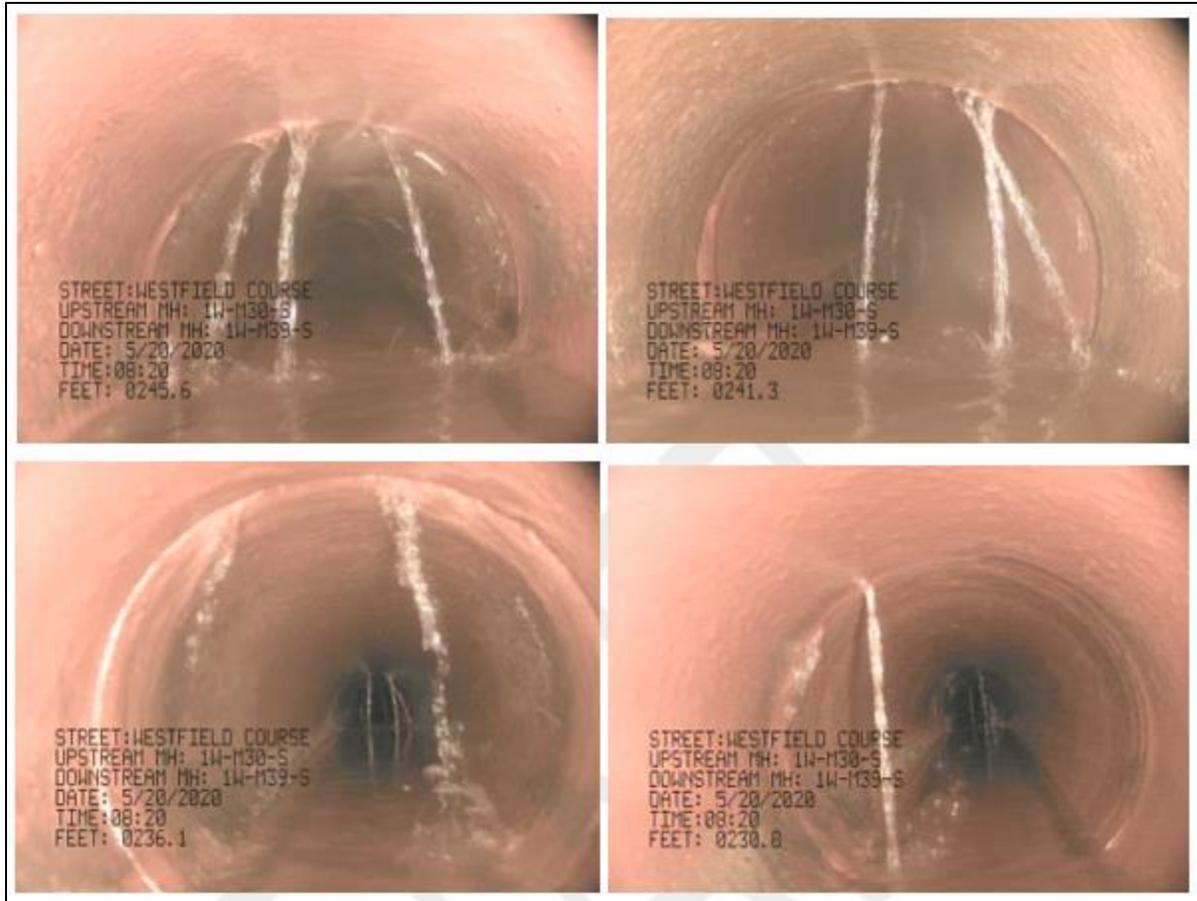


Figure 4-3

Figure 4-4 shows a strong stream of infiltration into 1V-M27 to 1V-M29.



Figure 4-4

Mineral deposits will often form where a pipe has previously leaked. Deposits were not common in the VCP sewers in the area, they were more prevalent in the Ductile Iron segments. Figure 4-5 shows some light deposits forming at a main line joint.

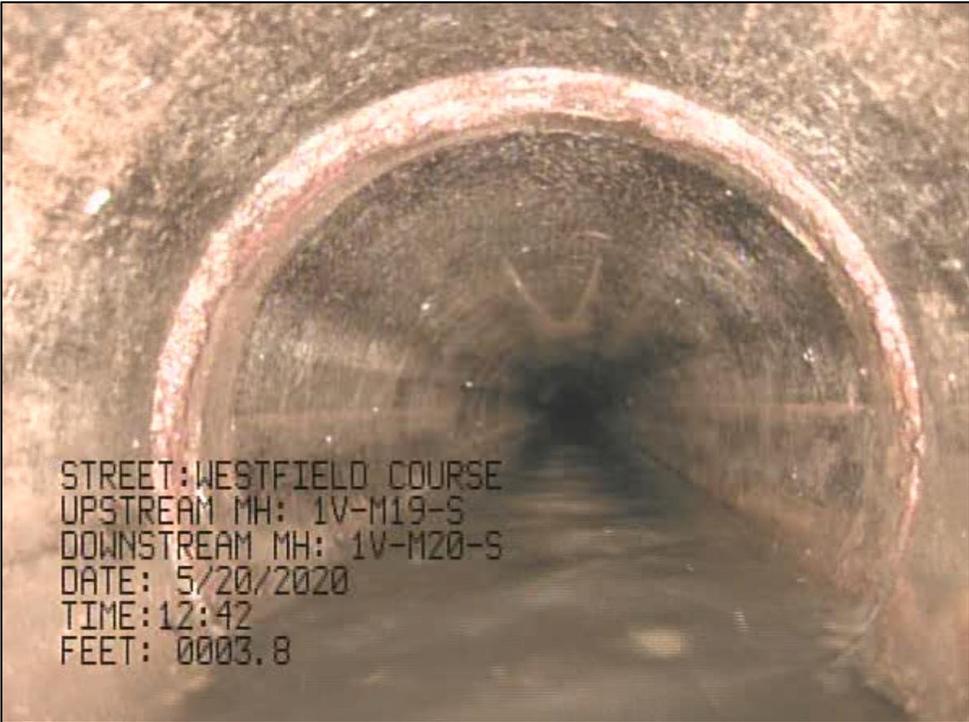


Figure 4-5

Absence/peeling of joint seal material is another sign of infiltration that might not be actively leaking during inspection. Figure 4-6 shows a joint with peeling seal material.

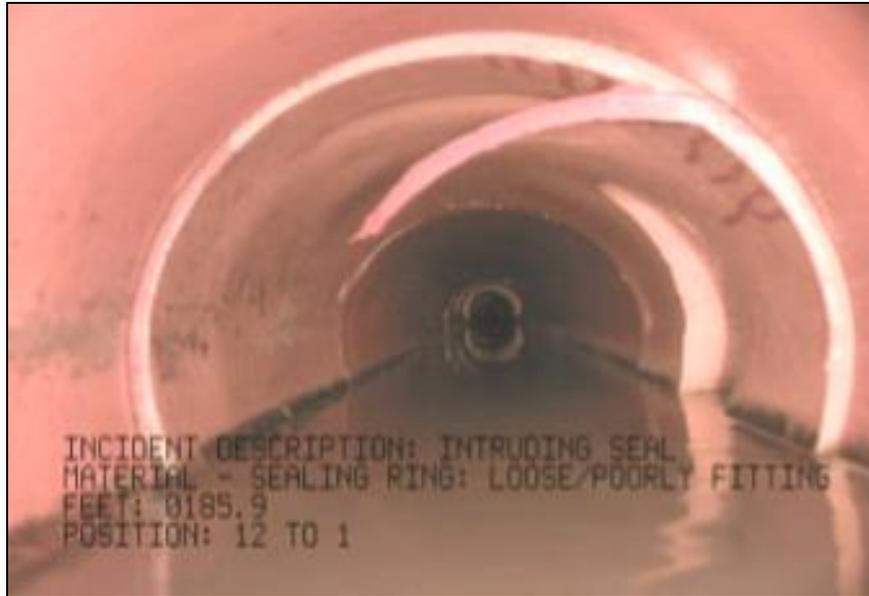


Figure 4-6

The material of each pipe often tells a story for the condition of the sewers and potential rehabilitation needed. Exhibit 2 shows each pipe material for the segments within the study area color-coded. Table 4-1 shows the total footage for each pipe material upstream of 2V-M06. Four segments that have multiple pipe materials were not included in the table.

Table 4-4-1

<b>Pipe Type</b>	<b>Upstream of 2V-M04 (feet)</b>
PVC	15,100
VCP	8,000
Ductile Iron	3,600
CIPP	600

In this study area, the active infiltration is concentrated in the VCP sewers. Roots are present in many of the VCP sewers as well.

The Ductile Iron sewers show signs of infiltration at the joints, but not much active infiltration.

In general, the PVC sewers were in the best condition in the study area. This is confirmed with the flow meter data at 2W-M53 (1006 Manchester) as a majority of the upstream sewers are PVC. The 8,500 feet of PVC sewers upstream of 2W-M53 are not recommended for air testing and grouting at this time.

## 4.4 Sewer Main Line Rehabilitation

For these pipes, air testing and chemical grout is the preferred rehabilitation method. Chemical grout is a more cost-effective alternative to CIPP, so it is a cost-effective rehabilitation method where the pipe does not have observed structural deficiencies. The chemical grout is used to seal a leaking system.

In order to provide cost-effective, yet comprehensive infiltration removal, each joint in a pipe segment will be air tested before grouted. The air test will tell the operator if there is a leak at the joint when the pressure on his air test drops. If the pressure on his test drops, grout will be applied to the joint. If the pressure holds, that means the joint is airtight and the operator will move to the next joint.

Although infiltration may be spotted at only a few joints, it is important to test all joints. If a leak is sealed up, the water will move to the next joint that is not properly sealed, which might not have been leaking at the time of inspection.

The segments with root intrusion are recommended to be lined. Over time, the roots can grow back and penetrate chemical grout. A CIPP liner will ensure that roots are kept out of the main line.

With a large amount of I/I entering the basin, Deuchler is recommending air testing and grouting of each mainline joint that is not scheduled for lining. The life expectancy of grout is typically 15 years, and the life expectancy of CIPP is roughly 50 years.

Exhibit 4 and Exhibit 5 show the lining and grouting recommendations for the study area.

## 4.5 Service Lateral Defects

The next critical component of I/I removal in sanitary systems is addressing the service connections and laterals. Similar to the main line sewer, service laterals have joints that will often deteriorate over time and allow roots and infiltration to seep in. Figure 4-7 shows the different categories of inflow and infiltration locations on a service lateral and on private property.

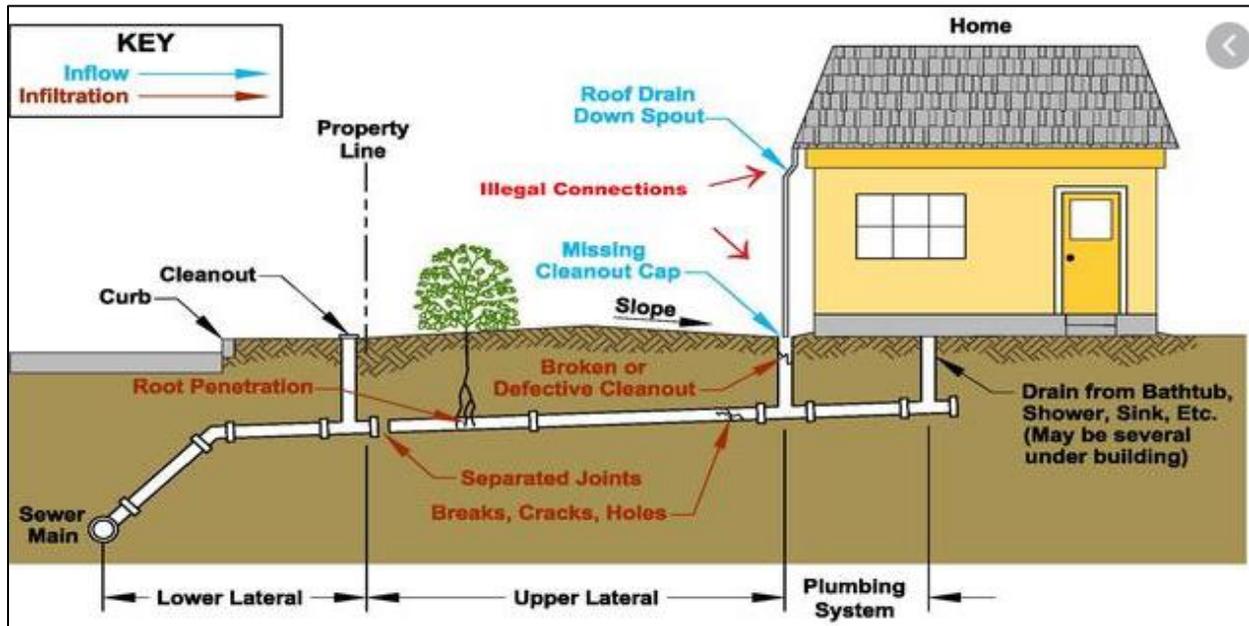


Figure 4-7 (via [Sonomawater.org/lateral](http://Sonomawater.org/lateral))

The connection point for the service at the main line is a location where infiltration is more prevalent. Figure 4-8 shows a leak at a connection point.

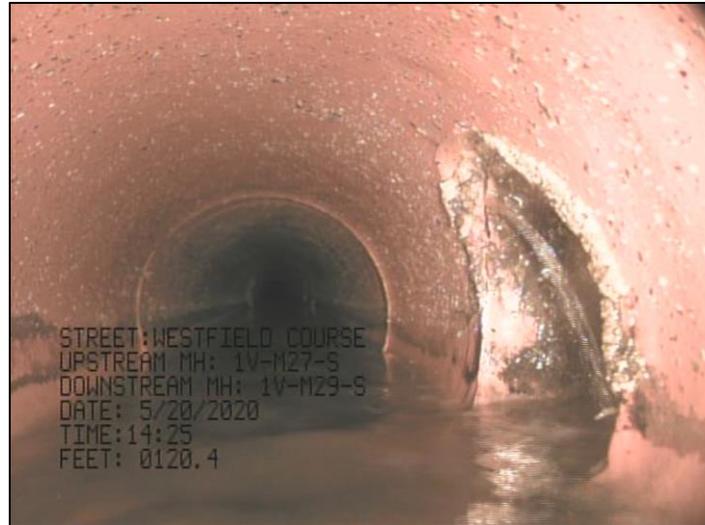


Figure 4-8

All service connections, in addition to the service lateral, are recommended for chemical grout. This recommendation holds for all pipes recommended for CIPP and main line chemical grout. This recommended work is located on private property (per City Code). All work on private property will require permission and hold harmless agreements.

Along Westfield Course, many service connections appear to show a flat slope back to the homes. With relatively shallow sewers on Westfield (approximately 6-9 feet deep), the service connections do not appear to have significant cover from the main line. In turn, any surcharge seen in the sewer main will surcharge the service connections with low slopes. Figure 4-9 shows a service between 1V-M20 and 1V-M24, carrying half a pipe of flow at the time of inspection. Typically, service connections with proper slopes will not hold stagnant water, and only have water present when it is flowing to the main line. Figure 4-10 shows a cross section sketch of this relationship.

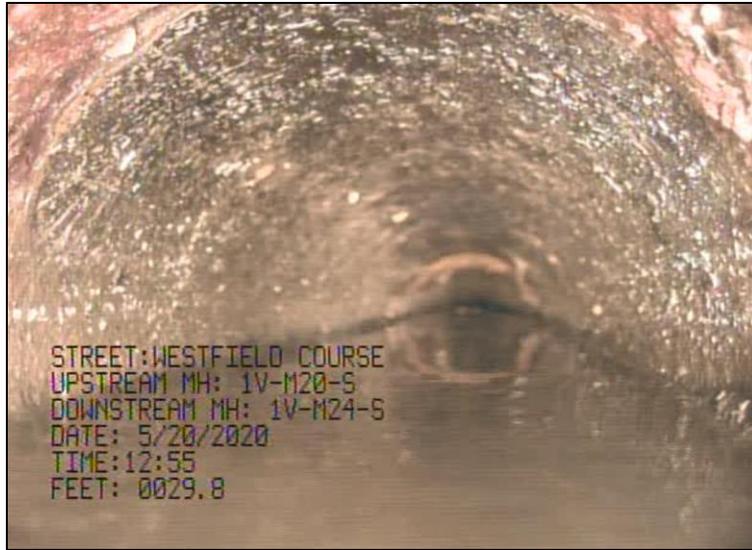


Figure 4-9

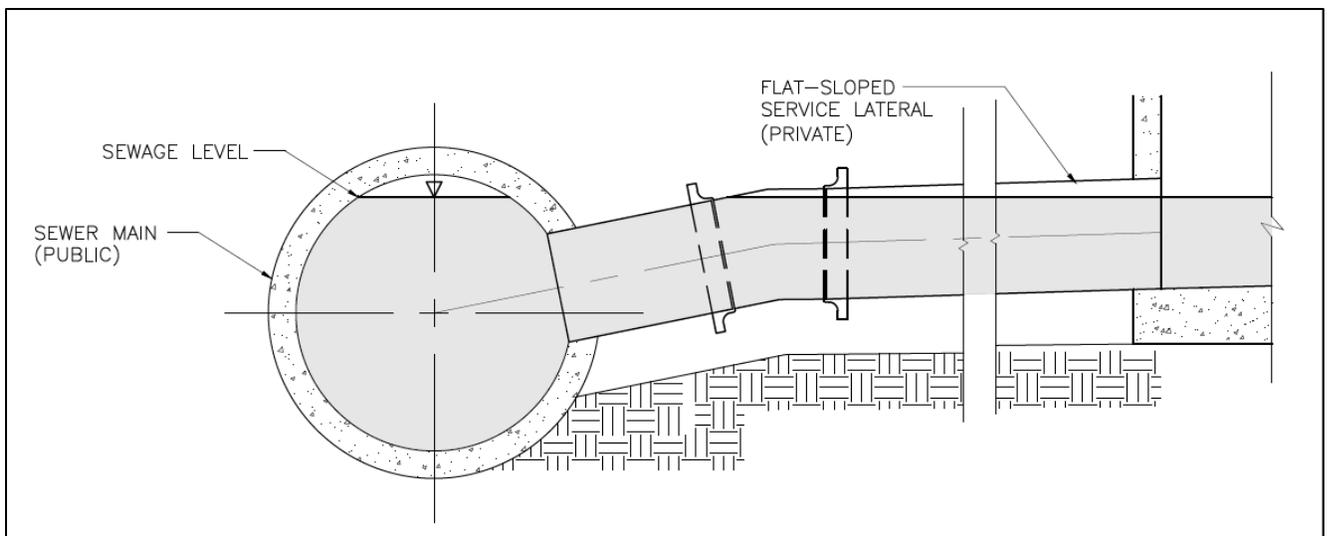


Figure 4-10

Exhibit 3 shows the service laterals along Westfield that appear flat with surcharge during the TV inspections.

Deuchler is recommending all homes that have experienced wet weather SSO's and/or are shown to have flat-sloped services install an overhead system to protect their homes. Overhead sewer systems are a common way of dealing with this issue. Overhead sewer

systems effectively raise the lowest point of plumbing above a potential elevation for overflow. Any connections in a basement will be rerouted and pumped out of the house. Figure 4-11 shows a diagram for an overhead sewer system. In total, 27 services are recommended for overhead sewer.

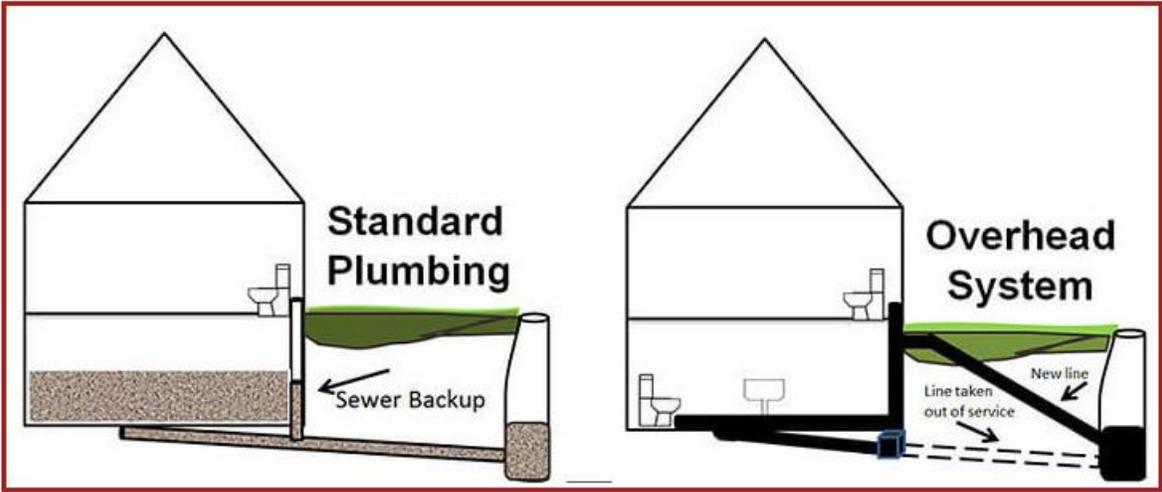


Figure 4-11

The City sent out a homeowner survey in 2020. Appendix A shares the findings from this survey, which includes the homes that have already converted to overhead sewer.

## 5 Manhole Inspections

### 5.1 Overview

Manhole inspections were performed in Geneva East from May 2020 to July 2020. These inspections were performed to identify structural defects and locate sources of inflow and infiltration (I/I). All elements of the manhole, visible from the top, were inspected.

The following items were focal points of the field inspection:

- Location
- Active leaks or signs of leaks
- Prone to flooding, ponding, or sheeting
- Proper cover seal
- Frame & chimney seals/offset/gaps
- Cone section holes/roots/seals
- Wall holes/roots/seals
- Pipe seal condition
- Bench and trough construction

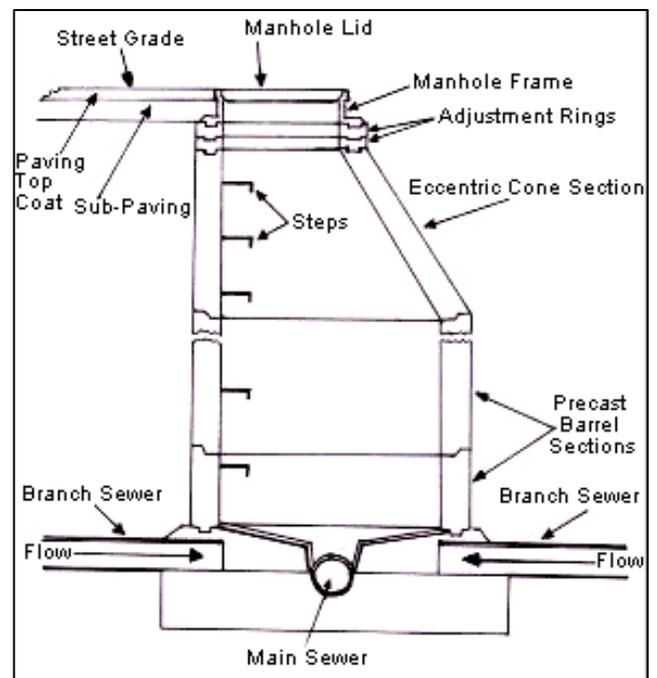


Figure 5-1 (LouisvilleMSD.org)

Figure 5-1 shows the various parts of a sanitary manhole. The adjustment is a term used to describe the concrete rings used to match the wall and cone sections with the frame. The chimney refers to the adjustment rings and the frame.

## 5.2 Defects and Rehabilitation Methods

For each manhole, a specific rehabilitation method(s) was called out on an as-needed basis. Each of the repair methods are described below.

- Structures that are recommended for chimney rehabilitation had either a severe offset, fractures, roots, or evidence of significant I/I. The repair calls for new concrete rings and a proper external seal in order to keep I/I from entering the manhole. Figure 5-2 shows 1V-M37, a good example of chimney deterioration with root intrusion.



Figure 5-2

If located in a low-lying area, these defects allow a significant amount of I/I to enter the manhole. In roadways, these defects allow base material to wash into the manhole and cause cracks at the surface of the road. This is typically the most common repair item for a manhole inspection project.

- In structures that are not as severe, an internal chimney seal has been recommended. Additionally, manholes that are in sidewalks or driveways where a dig repair would be difficult and intrusive to residents have been recommended for internal seals.
- Manholes that had a broken/missing gasket are recommended for a lid replacement. In low lying areas where sheeting or ponding is present, this repair is an effective way to eliminate I/I.
- Corroded frames were identified for replacement. Over time, hydrogen sulfide can eat away at the frames and weaken their structural integrity. Additionally, the replacement will provide a stronger seal for the lid to the frame with a new gasket. This can eliminate a large amount of I/I in low lying areas.
- Offset frames, with no other defects to the chimney, are included under the “Reset Existing Frame” item.
- Plugging abandoned pipes are an easy way to remove large quantities of I/I from potentially entering the system. This will reduce any unnecessary storm water that enters from branches of the system that are no longer in use.
- Grouting is an industry-standard method of sealing cracks and holes that show signs of leaking inside manholes. Similar to pipelines, this method of rehabilitation focuses on removing I/I and does not structurally repair the manhole. The callouts for grouting are broken down based on the type of defect. In some cases, the infiltration is isolated to the bottom of the structure. In others, the entire manhole could benefit from grouting. Figure 5-3 shows staining and void space in 1V-M28 at the pipe entering from the north. Grout will seal the voids and prevent infiltration from entering the manhole.



Figure 5-3

- Pipe seals, where pipes enter a manhole, is another common location of I/I entering the system. Figure 5-4 shows an example of Westfield Course. Injecting chemical grout at the bottom of a manhole can shore up the pipe seals in a manhole.



Figure 5-4

- Bench and trough defects can have a significant impact on the hydraulics of a sewer system. In manholes where the trough acts as a sump, significant head loss occurs which reduces the capacity of the system during wet weather events. In this case, a replacement bench and trough is recommended. Figure 5-5 shows the non-existent bench and trough in 2W-M12. Additionally, debris will settle out and pile up in the manhole. If enough debris settles out, the sewer has potential to plug and prevent flow from passing through.



Figure 5-5

- For brick/block (occasionally precast) manholes that show signs of I/I and are also in need of a structural lift, a cementitious coating is recommended. This repair method will seal up the often-porous nature of brick/block structures and provide a layer of structural support. This repair item is also recommended for root intrusion. Figure 5-6 shows root intrusion into 1V-M28, which will require a cementitious coat.



Figure 5-6

Exhibit 6 shows the repair methods called out for each structure. The total number of each defect and corresponding repair item are shown in Table 5-1. The corresponding rehabilitation code referenced in Exhibit 6 for each item is included in the table as well.

Table 5-5-1

Rehab Type	Number of Defects	Rehab Code
In Pavement Chimney Rehab	7	A
Off Pavement Chimney Rehab	33	B
Internal Chimney Sealing	34	C
Lid Replacement	6	D
Furnish New Lid and Frame	3	E
Reset Existing Frame	6	F
Plug Abandoned Pipe	1	K
Grout Bottom 18"	8	L
Grout Entire Manhole	5	N
Replace Bench and Trough	4	R
Cementitious Coat	7	U

## **6 Smoke Testing**

Smoke Testing is being conducted in the Geneva East area starting August 31st, 2020. Smoke testing is conducted in order to locate private sector defects that allow I/I to enter the system. Typically downspouts, cleanout caps, area drains are the main inflow sources. Service laterals and defective cleanouts are additional locations that can show further evidence of infiltration. Smoke testing can also reveal any major public storm sewer connections as well.

The results of this study will be updated into this report upon completion.

## 7 Conclusions

The initial flow monitoring data shows high peak flows and high volumes of I/I entering the basin upstream of 2V-M04 (877 Manchester Course). Additionally, observed downstream control is not allowing the pipe to operate at full capacity.

The force main discharge into 1V-M24 has a significant impact on the flow hydraulics of the main line sewer at this location.

A large bulge in a CIPP liner was discovered on 1X-M20 to 1W-M36.

The VCP sewers showed significant active infiltration and signs of past infiltration. The Ductile Iron sewers show signs of past infiltration as well. Additionally, a few segments of VCP were troubled with severe root intrusion.

Service connections and service laterals showed signs of I/I and the need for rehabilitation as well.

Additional private sector flow can be identified through other methods of inspection such as building sump pump inspections.

## 8 Recommendations and Cost Estimate

The force main discharge into 1V-M24 creates a hydraulic disturbance that temporarily holds the upstream flow back. Recommendations for this location, such as pump downsizing and/or force main realignment will depend upon the results of the complete flow study currently underway. If no downsizing and/or force main realignment takes place, it is recommended to re-design the entry path of the force main discharge into 1V-M24. This will reduce the hydraulic impact of the flow entering from the force main.

The distressed VCP and Ductile Iron segments will be best served with mainline joint chemical grout. The segments with significant root intrusion are recommended for CIPP lining to ensure the roots are eliminated.

All service connections tied with these lines are recommended for grout as well. With the nature of infiltration on the mainline as well as the high quantity in the basin, grouting is recommended for 30 feet from the main line up the service pipe. This recommended work is located on private property (per City Code). All work on private property will require permission and hold harmless agreements.

With modest peak flows entering from 2W-M53, the sewers in Chesapeake Way Area are not called out for rehabilitation. The PVC pipes are in good condition, and did not show signs of I/I. Additionally, the PVC sewers upstream of 2V-M04 have been left out of the cost estimate as well.

The manhole defects identified are recommended for repair. These repairs will further the life span of these structures, as well as eliminate sources of I/I.

The televising shows approximately 21 services on Westfield with a flat slope, holding water even during dry weather conditions. Deuchler recommends each resident that is shown with the flat sloped service or that has experienced backups in the past to construct an overhead sewer or other backflow prevention measures to mitigate the lack of cover

and slope from the main line sewer. Including the residents that have experienced backups, the amount of recommended overhead sewer systems is 27. The homes with observed flat services are shown on Exhibit 3. Overhead sewer installation costs vary significantly, from \$6,000 to \$15,000, depending on the home.

Deuchler is recommending building sump pump inspections for the Geneva East as well. Building sump pump inspections will help identify any directly connected sump pumps or other improper plumbing that causes excess flow to enter the sanitary system. The budgetary cost for building inspections is \$140 per home. This works out to about \$76,000 for the homes upstream of 2V-M04. This cost reflects a two person crew (male and female) for the protection and comfort of the residents, inspectors, and City.

Table 8-1 shows the rough cost estimate for the rehabilitation outlined in this report.

Table 8-1

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	COST
1	Pre-construction cleaning and televising	22,000	LF	\$3.50	\$77,000.00
2	Lateral Cleaning and Televising	325	EACH	\$300.00	\$97,500.00
3	T-liner Installation (5-foot shorty, 8" x 6")	3	EACH	\$3,000.00	\$9,000.00
4	Cured-in-Place Pipelining (8")	3,500	LF	\$30.00	\$105,000.00
5	Lateral Reinstatements	82	EACH	\$100.00	\$8,200.00
6	Air Test Mainline Joint (8")	3,000	EACH	\$60.00	\$180,000.00
7	Air Test Mainline Joint (12")	100	EACH	\$80.00	\$8,000.00
8	Grout Mainline Joint (8")	2,200	EACH	\$15.00	\$33,000.00
9	Grout Mainline Joint (12")	75	EACH	\$30.00	\$2,250.00
10	Air Test Service Connection (30-foot)	320	EACH	\$3,000.00	\$960,000.00
11	Grout Service Connection (30-foot)	220	EACH	\$500.00	\$110,000.00
12	In Pavement Chimney Rehab	7	EACH	\$2,400.00	\$16,800.00
13	Off Pavement Chimney Rehab	33	EACH	\$1,900.00	\$62,700.00
14	Internal Chimney Sealing	34	EACH	\$600.00	\$20,400.00
15	Lid Replacement	6	EACH	\$250.00	\$1,500.00
16	Furnish New Lid and Frame	3	EACH	\$300.00	\$900.00
17	Reset Existing Frame	6	EACH	\$2,000.00	\$12,000.00
18	Plug Abandoned Pipe	1	EACH	\$900.00	\$900.00
19	Grout Bottom 18"	8	EACH	\$200.00	\$1,600.00
20	Grout Entire Manhole	5	EACH	\$800.00	\$4,000.00
21	Replace Bench and Trough	4	EACH	\$2,600.00	\$10,400.00
22	Cementitious Coat	7	EACH	\$2,600.00	\$18,200.00
23	Overhead Sewer System	27	EACH	\$15,000.00	\$405,000.00
ESTIMATED COST:					\$2,144,350

This cost basis and style of recommendations are similar for the other areas of town already inspected.



**DEUCHLER**

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# Appendix A

## Resident Survey

Resident Address	Did a sewer backup occur on 5/17/2020	Have you experienced a sewer backup	If yes, how many times and approx. date?	Did you report the sewer backup	Was your home built with an OH Sewer?	As a result, Did you install any type of device (No, Yes, Standpipe, Check Valve, OH Sewer)	Approx cost of said device	Are you aware of our grant?	If yes, did you utilize it?	If no, was there a reason?
840	Manchester Course	No	No	N/A	Yes					
925	Britta Lane	No	No	N/A	N/A	N/A				N/A
804	Manchester Course	Yes	Yes	2 Previous	Previous Owner did	No	Yes	\$2,650	Yes	Yes
1001	Britta Lane	No	No	N/A	N/A	No	N/A		No	
538	Westfield Course	No	No			No	No		Yes	
569	Westfield Course	No	No			No			No	
600	Westfield Course	No	Yes		Yes	No	Modified Overhead		Yes	Denied
634	Westfield Course	No	Yes	4 Previous Owner 2015	Yes	No			Yes	No
637	Westfield Course	No	Yes	2008	Yes	No	Standpipe		Yes	No
644	Westfield Course	No	Yes	2008 or 2009	Yes	No	Overhead Sewer		Yes	Yes Previous Owner
647	Westfield Course	No	Yes	2008	No	No	Standpipe		Yes	No
664	Westfield Course	Yes	Yes	2008	2008 yes 2020 no	No	Standpipe		Yes	No
885	Geneva Drive	No	No			No	No			
889	Geneva Drive	Yes	?			No				
909	Geneva Drive	Yes	Yes	2-3 Times	Yes	No	No		Yes	No
647	Westfield Course	Yes	Yes		No	No	Standpipe			
718	Westfield Course	No	No							
549	Westfield Course	No	No			No	No			
558	Westfield Course									
578	Westfield Course	Yes	Yes			No	No			
579	Westfield Course	No	No			No				
1003	Manchester Course	No	No			Unsure	No		No	No
887	Britta Lane	No	No			Yes	No		Yes	
829	Manchester Course	No	No			No	No		No	
883	Britta Lane	No	No				No			
1012	Manchester Course	Yes	No		No	Unsure	No		No	Would like information on Grant
921	Britta Lane	No	No			No	No		No	
896	Manchester Course	No	No			No			Yes	
875	Britta Lane	Yes	Yes	6 times since 1997	No		Standpipe	\$400	No	
1012	Britta Lane	No	No						No	Would Like Info
1026	Manchester Course	No	No			No			No	
1028	Manchester Course	No	No			No	No		No	
1123	Geneva Drive	No	No		No	No			No	
766	Westfield Course	No	No		No	Thinks so			No	
1018	Geneva Drive	No	No		No	No	No		No	Asked if she needed an overhead system
1010	Geneva Drive	No	No		No	No	No			
892	Geneva Drive	No	No		No	Yes			Yes	
1093	Geneva Drive	No	Yes	See Survey	No	No	No		No	No
1147	Westfield Course	No	No		No	No			Yes	No
1143	Geneva Drive	No	No		No	No			No	
947	Westfield Course	No	No		Yes					
936	Manchester Course	No	Yes	2016	Yes	No	Overhead system	\$3,150	Yes	Yes
800	Manchester Course	Yes	Yes	See Survey	Only in 2020	No	No			
1129	Westfield Course	No	No		Yes	No	No		No	
1031	Westfield Course	No	No		Yes	No	No		No	
984	Manchester Course	No	Yes							
908	Geneva Drive	No	No			No			No	
1019	Britta Lane	No	No		Unsure				No	
888	Manchester Course	No	Yes	once 2009	maybe	No	standpipe; check-valve	\$ 50.00	no	didn't know
948	Manchester Course	Yes	Yes	May-15	No	No	No		Yes	No
755	Lancaster Lane	No	No		No	No			No	Grant not enough
872	Manchester Ct.	Yes	Yes	Several	Yes	No	No		Yes	No
538	Lexington Drive	No	No			No			No	Too expensive





**Legend**

**Sanitary Sewer MATERIAL**

- CIPP
- DIP
- DIP-VCP
- PVC
- PVC-VCP
- VCP

**Exhibit 2: Pipe Materials**







**Legend**

- ⊗ Dig Repair - 1XM20-1WM36
- Segments Recommended to be Lined

**Exhibit 4: Segments Recommended to be Lined**





**Exhibit 6: Segments Recommended to be Grouted**





**Exhibit 6: Manhole Rehabilitation Recommendations**

