Capacity, Management, Operation and Maintenance Program Development

Program Summary

Prepared for

City of Cleveland Heights Sewer Department
February 1, 2018

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Glossary

Basin: A portion of the Sanitary Sewer System that is a distinct wastewater collection area as designated by Cleveland Heights.

BMP: Best Management Practice.

Building/Private Property Backup:

A wastewater release or backup occurring into a building or private property that is caused by blockages, flow conditions, or malfunctions within the Sanitary Sewer System. Building/Private Property Backup does not include wastewater backups resulting from (i) flow conditions caused by overland flooding or (ii) blockages, flow conditions, or malfunctions of a Private Sewer Service Line.

Calendar Year:

A period starting on January 1 and ending on December 31.

CCDPW: Cuyahoga County Department of Public Works.

CIP: Capital Improvement Plan.

CIS: Customer Information Systems

City or City of Cleveland Heights:

The City of Cleveland Heights, Ohio.

CCTV: Closed circuit television.

Common Trench Separate Manholes:

The storm sewer is aligned less than a foot above but offset to the right or left of the sanitary sewer. There are two separate manholes to access the storm and sanitary sewers.

CMMS: Computerized Maintenance Management Systems.

CMOM: Capacity, Management, Operation and Maintenance Program.

Cross Connection:

Any connection, whether by pipe or any other means, including by the absence of a sufficient barrier, between any part of the Sanitary Sewer System and any part of the Municipal Separate Storm Sewer System that allows flow between the two systems.

Date of Lodging:

The date on which this Decree is lodged with the United States District Court for the Northern District of Ohio.

Day: A calendar day unless expressly stated to be a business day. In computing any period of time under this Consent Decree, where the last day would fall on a Saturday, Sunday, or federal holiday, the period shall run until the close of business of the next business day.

Deliverable:

Any written document required to be submitted by Cleveland Heights to EPA under this Consent Decree, other than reports required under Section VII of the Consent Decree.

Dividing Wall Sewers:

The storm sewer is aligned less than a foot above but offset to the right or left of the sanitary sewer. A common manhole was constructed to access the storm and sanitary sewer. In the manhole, a weir wall is typically constructed perpendicular to the flow path.

EPA: The United States Environmental Protection Agency and any of its successor departments or agencies.

FSE: Food Service Establishments.

FOG: Fats, oils, and grease.

FOG Control Device:

Any grease trap, FOG interceptor, or other mechanism or device, which attaches to, or is applied to a FOG Generator's wastewater plumbing fixtures and lines, the purpose of which is to collect, contain, or remove FOG from the waste stream of a FOG Generator prior to discharge into the Sanitary Sewer System.

FOG Generator:

Any non-residential food service establishment or food preparation or processing establishment that discharges FOG into the Sanitary Sewer System.

General Permit:

The Authorization for Small Municipal Storm Sewer Systems to Discharge Storm Water Under the National Pollutant Discharge Elimination System Permit OHQ00003 issued by the State of Ohio on September 11, 2014 covering the Municipal Separate Storm Sewer System and any predecessor state permits for the MS4, and any subsequent general permits issued by the State and applicable to the MS4.

GIS: Geographic Information Systems.

Infiltration/Inflow or I/I:

The total quantity of water from Infiltration and Inflow without distinguishing the source.

Known SSOs:

The list of SSOs currently identified by Cleveland Heights and listed in Appendix A and any other SSO locations discovered by the City.

LACP: Lateral Assessment and Certification Program.

MACP: Manhole Assessment and Certification Program.

MGD: Million gallons per day.

MOM: Management, Operations and Maintenance Program.

NASSCO: National Association of Sewer Service Companies.

NEORSD: The Northeast Ohio Regional Sewer District.

NEORSD System:

The wastewater collection and transmission system owned and/or operated by NEORSD and designed to collect and convey municipal sewage (domestic, commercial, and industrial) to NEORSD's wastewater treatment plants.

Ohio EPA or OEPA:

The Ohio Environmental Protection Agency and any successor departments or agencies of the State of Ohio.

ORC: Ohio Revised Code

Over-under Sewers:

A separate sewer system in which the sanitary and storm sewers are installed in a common trench, one above the other; share common manholes; and are separated by a removable plate that is intended to allow access to the lower sewer.

PACP: Pipeline Assessment and Certification Program.

PM: Preventative Maintenance.

PPE: Personal Protective Equipment.

Private Sewer Service Line:

A portion of a sewer system, not owned by Cleveland Heights, used to convey wastewater from a property parcel or a building to the Sanitary Sewer System.

Recreation Season:

The period between May 1 and October 31 in a given calendar year.

RTMP: Real Time Monitoring Plan.

Sanitary Sewer Overflow or SSO:

Any discharge, overflow, spill, diversion, or release of wastewater, regardless of volume, from, or caused by, conditions in the Sanitary Sewer System and shall include:

- discharges to waters of the United States or waters of the State from the Sanitary Sewer System;
- any release of wastewater from the Sanitary Sewer System to public or private property that does not reach waters of the United States or waters of the State, including Building/Private Property Backups; and
- any release of wastewater from the Sanitary Sewer System that enters the Municipal Separate Storm Sewer System.
- "Sanitary Sewer System" shall mean the portion of the sewer system owned and/or operated by the City that is designed to convey sewage, and not stormwater, from residences, commercial buildings, industrial plants, and institutions to the NEORSD System.

Sewer Segment:

The continuous run of gravity sewer line pipe extending from one manhole to the next manhole.

Sewer System:

The sewer system owned and/or operated by Cleveland Heights that is designed to convey sewage and stormwater, including both the Sanitary Sewer System and the Municipal Separate Storm Sewer System.

SMP: System Modeling Plan.

SOP: Standard Operating Procedures.

SORP: Sewer Overflow Response Plan.

SCMP: System Characterization Monitoring Plan.

SSD: Sanitary Sewer Discharge.

Structural SSO, or Known SSO:

The Cleveland Heights sewer system includes 39 known SSO structures that are monitored for wet weather activation using tethered wooden blocks and/or periodic electronic real-time monitoring equipment. Known SSOs will be controlled per the part 2 Consent Decree to be developed in response to the Integrated Overflow Control Master Plan due June 1, 2021.

WWTP: Wastewater Treatment Plant.

Year: A period running from a given date to the same date the following year (e.g., from January 18, 2018 to January 18, 2019).

Section 1 - CMOM Framework

1.1 Background

On July 19, 2017, a final Consent Decree was lodged between the United States Environmental Protection Agency (USEPA), the State of Ohio and the City of Cleveland Heights. The Consent Decree includes various required actions under Section V. Compliance Requirements. Section C. Paragraph 21 requires development of a written CMOM Program. Paragraphs 21 and 22 require the City to provide the USEPA with a schedule to:

- *By December 1, 2017, Cleveland Heights shall submit for EPA review and approval a written Capacity, Management, Operation, and Maintenance Program ("CMOM Program") that satisfies the requirements of Appendix B.*
- *Cleveland Heights shall implement the CMOM Program upon approval of the program by EPA, unless otherwise directed by EPA.*

CMOM Elements

The acronym CMOM stands for:

- Capacity
- Management
- Operation
- Maintenance

The USEPA developed the CMOM Guidance in the early 2000's to support the implementation of the proposed Sanitary Sewer Overflow (SSO) Rule. The goal of the proposed SSO Rule was to clarify the CWA requirements for proper operation and maintenance of sanitary collection systems and emphasize the duty of the owner to mitigate SSOs.

Four General Standards were defined as the goals of any CMOM Program:

- Properly manage, operate and maintain all parts of its sewer collection system, at all times.
- Provide adequate capacity to convey base and peak design flows for all parts of the sewer system.
- Take all feasible steps to cease sanitary sewer overflows and mitigate the impacts of such overflows on waters of the state, the environment and public health.
- Provide notification to the public and other directly affected parties of any incidents of overflows from the sewerage system.

1.2 CMOM Approach

Development of the individual CMOM Programs was an interactive process including document review, numerous meetings, functional workgroups, and field observations within Cleveland Heights. The Cleveland Heights CMOM Program is written in accordance with *"Guide for Evaluating CMOM Programs at Sanitary Sewer Collection Systems" EPA 205-B-05-002, January 2005* and additional specific requirements required by EPA in Appendix B of the Consent Decree. The CMOM Program comprises 16 CMOM sub-programs, organized into the following categories:

1. Emergency Response programs (2 programs)
2. System Evaluation and Capacity Assurance programs (3 programs)

3. Engineering Design and Construction programs (1 program)
4. Operation and Maintenance programs (4 programs)
5. Support programs (6 programs)

Each sub-program is defined in more detail in Sections 2 through 6. For each of the sub-programs in the CMOM Program, the following general information has been developed and documented, as appropriate:

1. Program Definition and Purpose: A clear description of why the program exists.
2. Goals and Performance Measures: Defined goals and measures of progress toward goal attainment and program success. Not all programs have a specific performance measure while others have multiple measures.
3. Program Description/Components: A formally recognized set of tasks/efforts and mechanisms to execute work.
4. Training: Program-specific skill development and instruction for employees.
5. Information Management: Documentation to collect, maintain and use data to achieve the program goals.
6. Resource Management: Resources allocated and managed to achieve program goals.
7. Process for Continuous Improvement: Established procedures and schedule to periodically evaluate program performance and identify improvement opportunities.
8. Implementation Plan: Certain programs require further development. An implementation plan has been identified for those programs with specific activities that are deemed necessary to promote regulatory compliance.

Additionally, there is a Program Evaluations section (Section 7) which summarizes performance measures, areas for improvement and identified activities for implementation. This section forms the basis for reporting CMOM Program implementation status. The estimated timeframe goals in the CMOM Program are dependent on the USEPA CMOM approval date.

1.3 City of Cleveland Heights Public Works Mission Statement

The City of Cleveland Heights Sewer Department is part of the City's Public Works Department.

The department is responsible for maintenance and repair of city streets, public ground and parks; cleaning, repairing, maintaining and inspecting all sanitary and storm sewers, drains, culverts and watercourses; ice and snow removal, maintenance of public buildings; and the collection and disposal of solid waste and recyclables.

The City of Cleveland Heights Public Works Department has the following mission: "Public Works is committed to providing a superior level of public service to the residents of Cleveland Heights and maintaining the City's infrastructure in an efficient and cost-effective manner."

1.4 City of Cleveland Heights CMOM Program Goals

In accordance with the Consent Decree, the CMOM Program includes specific goals as outlined in Table 1-1 on the following page, with specific CMOM references to achieve the goal. Table 1-1 is included as a convenience to the compliance reviewer. In addition, Cleveland Heights has identified areas for improvement and areas for continued success and growth. The CMOM Program describes and formalizes all the identified goals. Generally, the high-level goals of the CMOM Program include:

- Manage, operate and maintain the collection system effectively and efficiently.

- Investigate suspected capacity constrained areas of the collection system and develop programs to address those constraints.
- Proactively minimize sewer overflows.
- Protect public health and the environment.
- Stop/reduce and mitigate the impacts of reportable SSOs in the portion of the wastewater collection system over which Cleveland Heights has operational control.
- Comply with the Cleveland Heights Consent Decree, Docket No. 90-5-1-1-10457 administered by the USEPA, Region 5.

Table 1-1 CMOM Program Goals Specific to Consent Decree

Consent Decree Appendix B Reference	Goal	CMOM Section Reference
Section B	Training Program for technical and skills training for appropriate categories of the City's Employees	Section 6.2 - Training
Section C	Adopt a Sewer Overflow Response Plan (SORP)	Section 2.1 – Sewer Overflow Response Plan
Section D	SSO Reporting Plan	Section 2.1 – Sewer Overflow Response Plan
Section E	Sanitary sewer cleaning program including routine and high frequency cleaning	Section 5.1 – Gravity System Maintenance
Section F	Sewer system inspection program including internal and manhole inspections	Section 5.1 – Gravity System Maintenance
Section G	Fats, oils and grease control program	Section 6.6 - Fats, Oils and Grease
Section H	Root control program	Section 5.1.3.3 – Root Control Program
Section I	Information Management System	Section 6.3 – Information Management
Section J	Plan and schedule for developing Standard Operating Procedures (SOPs)	Section 5 – Operations and Maintenance Programs
Section K	Private sewer service line defect remediation Program	Section 6.5 – Legal Support
Section L	Staffing Plan	Section 1.6 – City of Cleveland Heights Organizational Structure

1.5 Service Area Description

1.5.1 Collection System

The City of Cleveland Heights sewer system is a satellite collection system that is tributary to the Northeast Ohio Regional Sewer District (NEORSD, District) system. Cleveland Heights sewage flows are tributary to the NEORSD Heights-Hilltop Interceptor (HHI) and Doan Valley Interceptor systems, and are treated at the District's Easterly Wastewater Treatment Plant (WWTP) on Lake Erie.

Table 1-2 provides general system information about the City of Cleveland Heights' Sewer Collection System. A map of the sewer collection service area is presented in Figure 1-1.

Table 1-2 City of Cleveland Heights Sewer System Information	
Number of Pump Stations	2
Combined Sewer (miles)	1.4
Overflow (SSO/CSO) (miles)	5.3
Total Length of Gravity Sanitary (miles)	127
Total Length of Force Main (miles)	0.03
Service Area (square miles)	8.1
Population Served	46,000

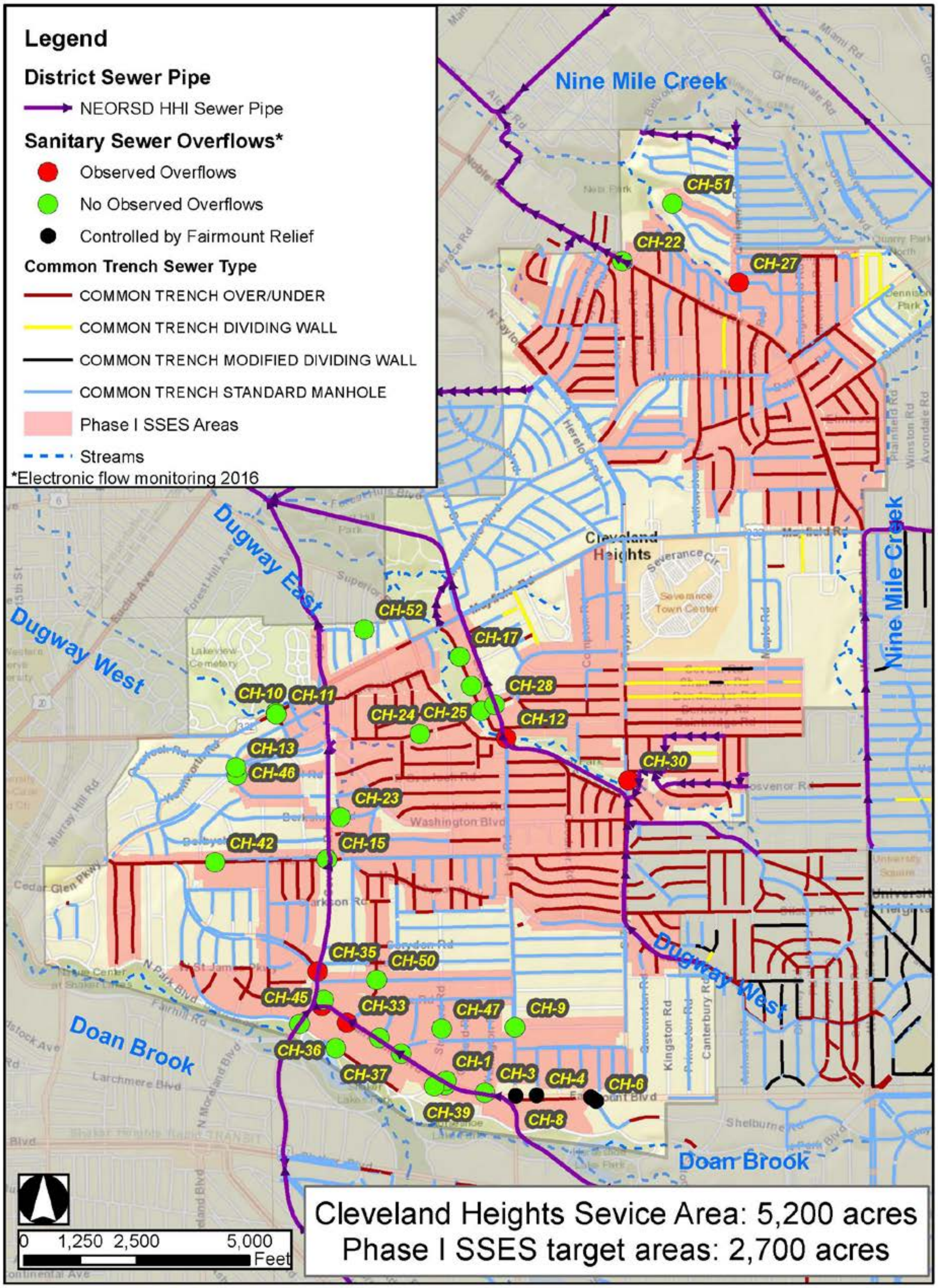

Figure 1-1 City of Cleveland Heights Sewer Collection System Service Area

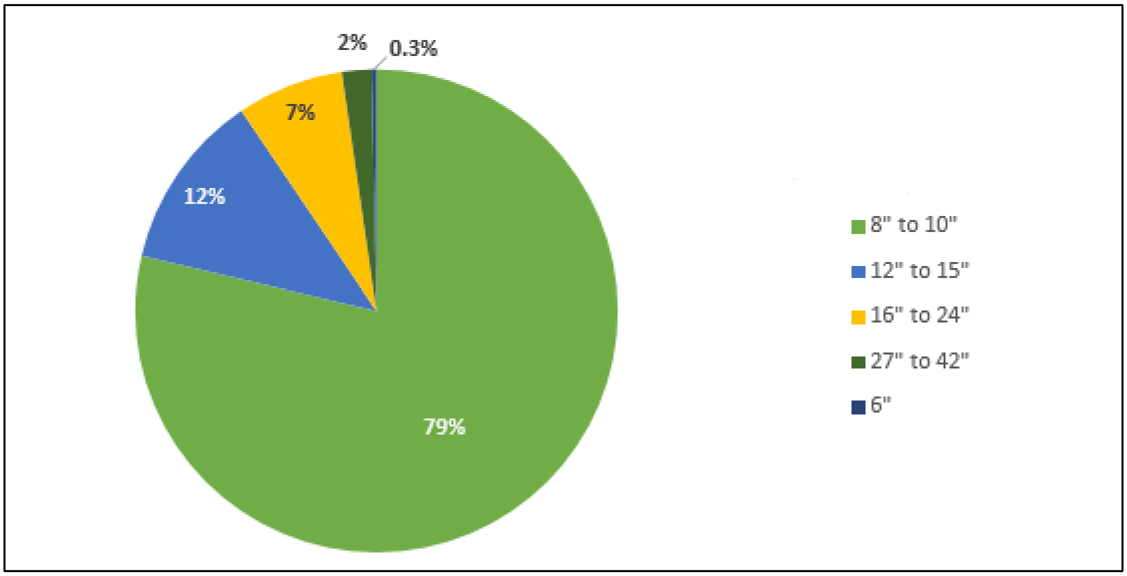

Figure 1-2 City of Cleveland Heights Gravity Sewer Diameters

The Cleveland Heights gravity sewer system ranges in size from 6 to 42 inches in diameter. **Figure 1-2** shows a breakdown of pipe size and percentage of each size.

The gravity sewer system can be broken down into two distinct trench types: separate trench and common trench. In separate trench systems, the sanitary sewer and storm sewer were constructed in separate trenches. Common trench sewers were constructed in three distinct configurations:

1) **Over/Under Sewers:** The storm sewer is aligned approximately two feet above (storm drain crown to sanitary invert) and in line with the sanitary sewer. A common manhole was constructed to access both storm and sanitary sewers. A removable invert plate (also documented as boiler plate) was placed at the manhole to provide access to the sanitary sewer. **Figure 1-3** shows a schematic of an over/under sewer. Over time, invert plates have been unseated, damaged or lost. The movement of the invert plate can contribute significant stormwater inflow during wet weather.

2) **Dividing Wall Sewers:** The storm sewer is aligned less than a foot above and offset laterally from the sanitary sewer. A common manhole was constructed to access the storm and sanitary sewers. In the manhole, a weir wall was typically constructed perpendicular to the flow path. **Figure 1-4** shows a schematic of a dividing wall sewer.

3) **Common Trench Standard Sewers:** The storm sewer is aligned less than a foot above and offset laterally from the sanitary sewer. There are two separate manholes to access the storm and sanitary sewers. **Figure 1-5** shows a schematic of a common trench standard sewer. Though there is no direct hydraulic connection, there is an increased potential for storm exfiltration entering the sanitary sewer through RDII due to the common trench configuration of the sewers.

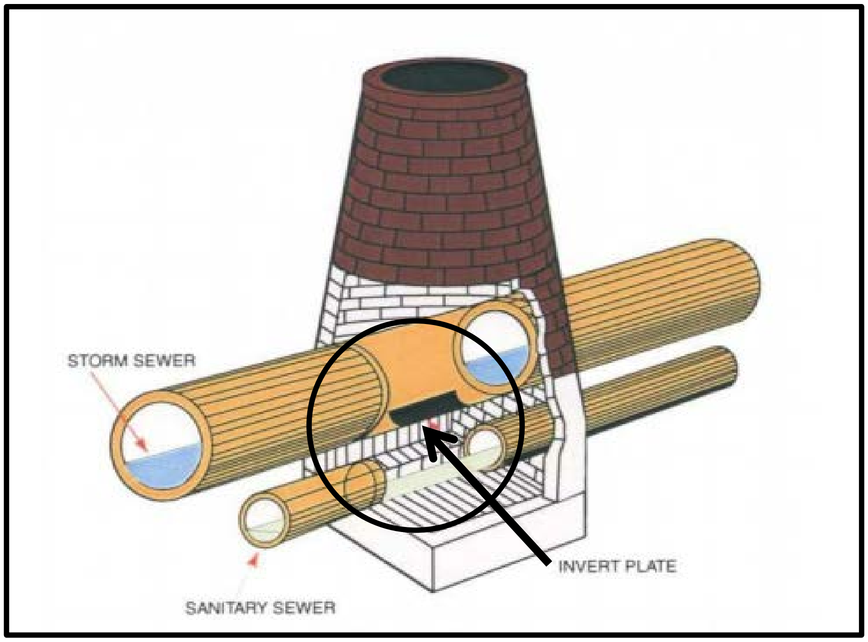

Figure 1-3 Common Trench Over-Under (Invert Plate) Sewer

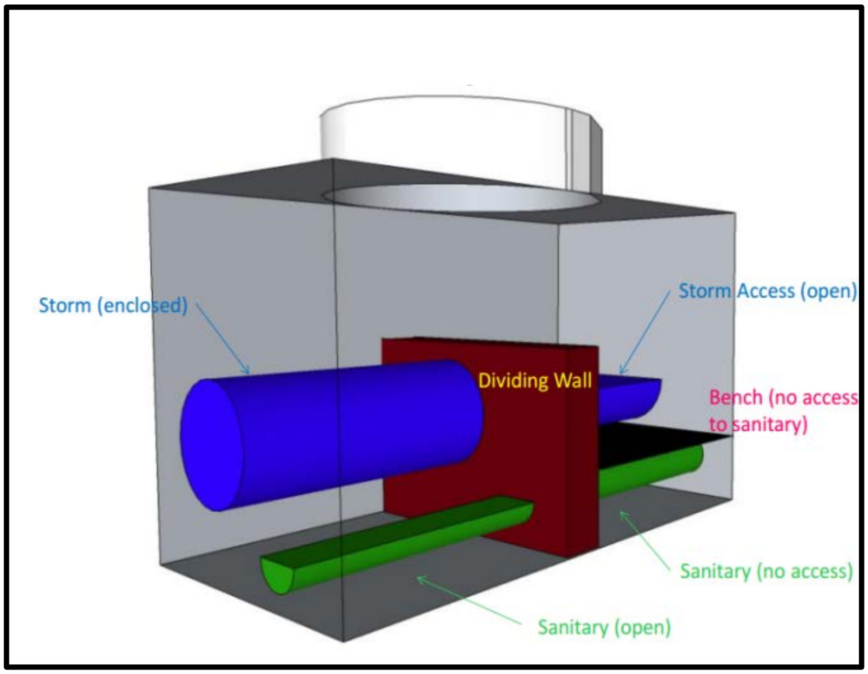

Figure 1-4 Common Trench Dividing Wall Sewer

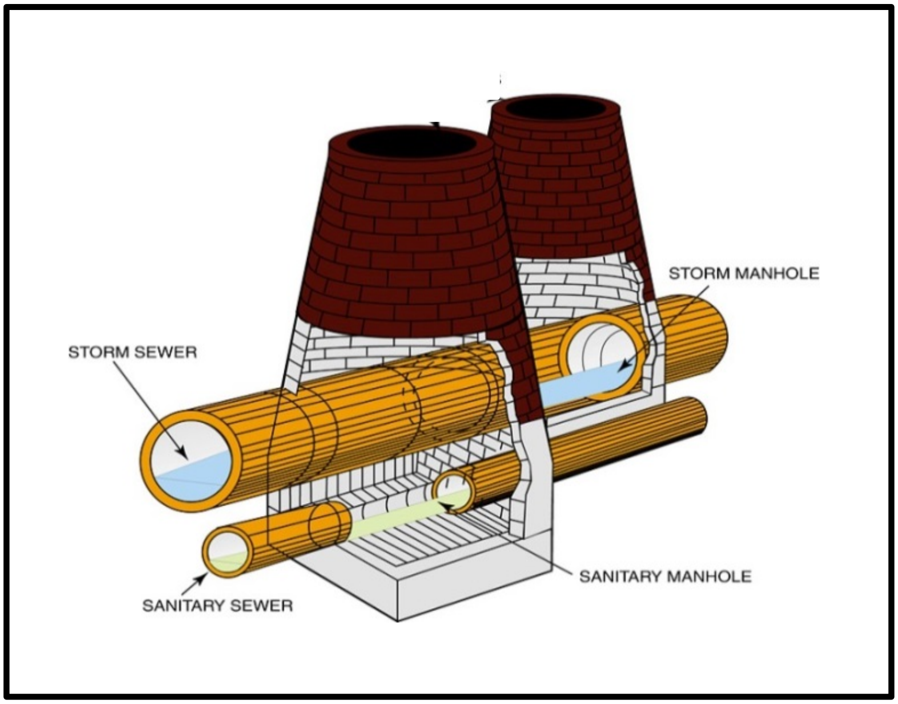

Figure 1-5 Common Trench Standard Sewer

Approximate quantities of each sewer configuration are shown in **Figure 1-6**.

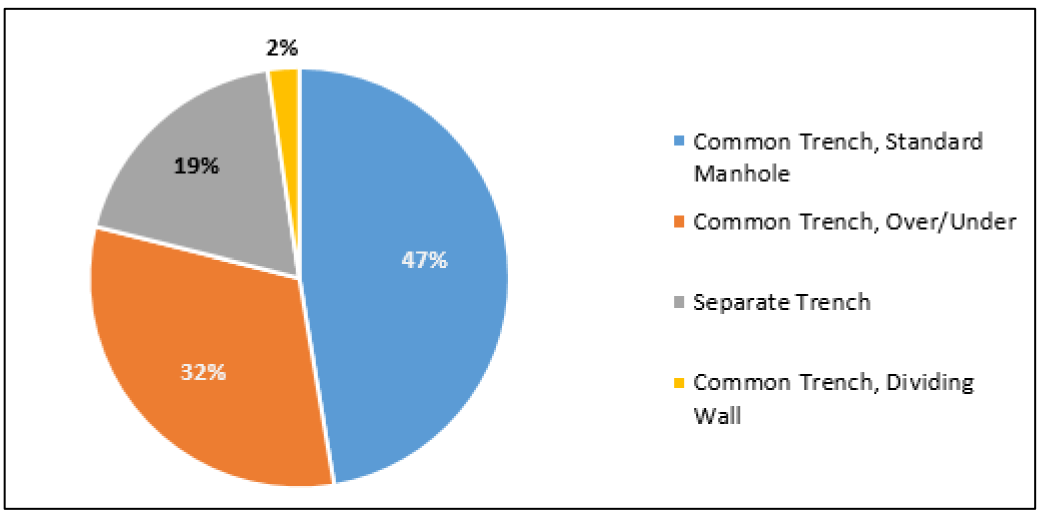

Figure 1-6 Cleveland Heights Gravity Sanitary Sewer Trench/Manhole Configuration

The City is fully developed with customers connected to the sewer system. Future expansion/ extension of the sewer system is unlikely. Land use in Cleveland Heights according to Cuyahoga County zoning assessed in March 2017 is shown in **Figure 1-7**.

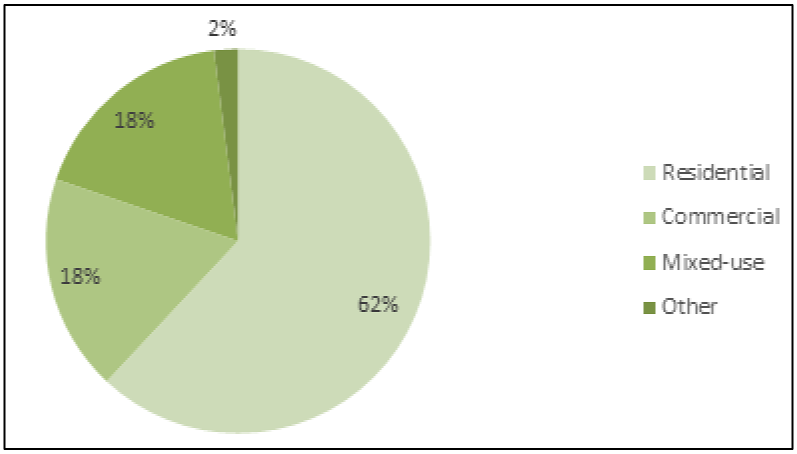

Figure 1-7 Cleveland Heights Land Use

1.6 City of Cleveland Heights Organizational Structure

The Sewer Department is maintained within the Utilities Division under the Public Works Department. A citywide organizational chart is shown in **Figure 1-8** to display other departments that may have responsibility in the CMOM program.

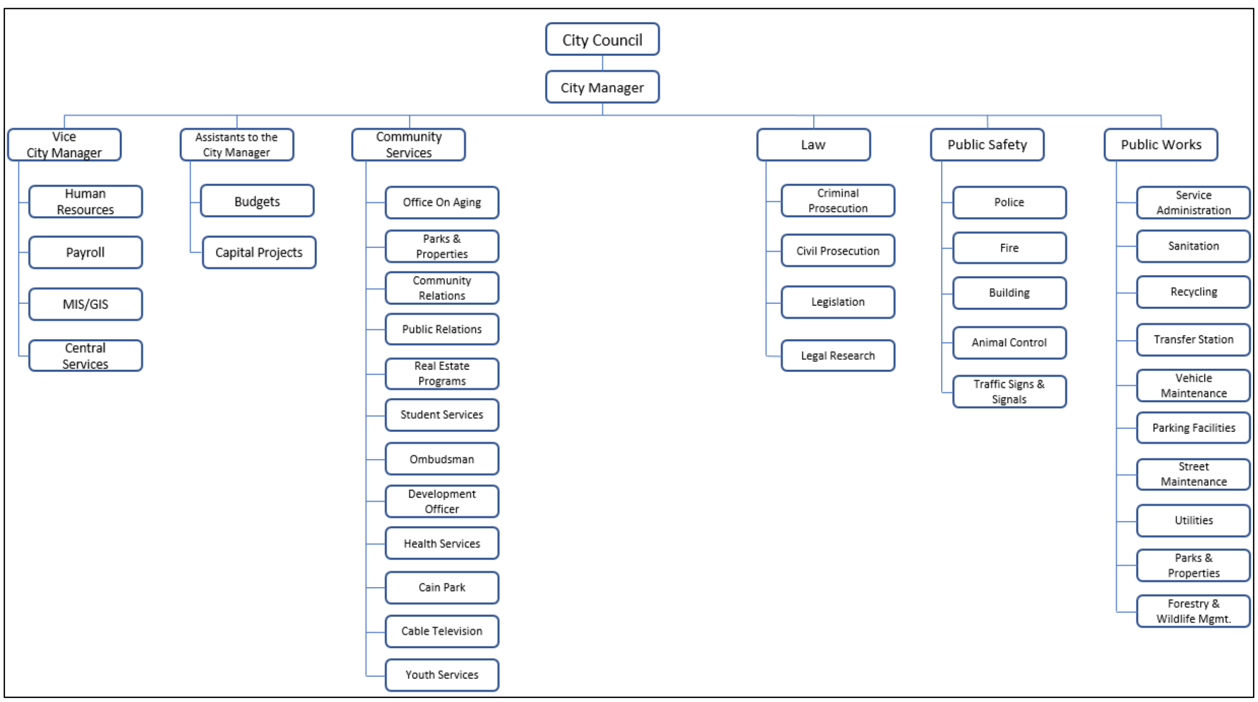

Figure 1-8 Cleveland Heights Citywide Organizational Chart

The Cleveland Heights Collection System is managed, operated and maintained by 10 full time positions within the Utilities Division, under Public Works. These positions include management, administrative support, and operations and maintenance staff for the collection system.

The Utilities Division is overseen by the Commissioner of Utilities and reports to the Public Works Director. Generally, policy decisions originate within the department and are presented to the City Manager.

The Utilities Division focuses on sewer only. Until 2016, the Division was also responsible for the drinking water system, but responsibility for the water distribution system has been transferred to the Cleveland Water Department. Cleveland Heights is no longer responsible for water starting in 2018. A large part of the transition is moving former Water Department employees into new roles in the Sewer Department. This transition allows the Sewer Department to achieve staffing levels consistent with expected workloads to achieve compliance with the Consent Decree requirements.

A Staffing Plan reflecting the transition of Water Department employees into the Sewer Department is shown in Figure 1-9 on the following page. This transition was nearly complete at the end of 2017 with all former water employees identified for their new positions within the Sewer Department and all but one functioning in those positions.

Operation of the Sewer Department is led by the Commissioner of Utilities who maintains oversight of capital planning, budgets and staffing. The Sewer Supervisor is primarily responsible for sanitary sewer system maintenance, which includes pipe cleaning, pipe repairs, pipe inspections and maintaining the two pump stations. Outside service providers, including Cuyahoga County Public Works Department, provide on-call support to Sewer Department staff to perform cleaning and CCTV services.

Staff members assigned to the operation and maintenance of sanitary sewers are cross trained on the various types of responsibilities associated with the collection system. This provides Cleveland Heights Sewer Department with the flexibility to utilize staff where they are most needed, especially in response to after-hours emergencies.

Utilities Administration performs a variety of support activities in conjunction with the Commissioner of Utilities, including receipt of calls from the residents to report sewer problems or requests for service. The business operations for Utilities Administration also includes accounting, payroll, secretarial and customer relations.

An Engineering Consultant prepares plans and reviews plans submitted by architects, engineering firms, contractors and developers.

A Cleveland Heights Sewer Department organizational chart, shown in Figure 1-9, identifies the budgeted positions within the department. The chart shows the lines of communication related to the management, operations and maintenance of the sanitary sewer system. Job descriptions for each title are maintained and updated as needed by the Commissioner of Utilities.

CMOM Program staff are defined in each CMOM sub-program. The Commissioner of Utilities is the CMOM Program Leader, and is responsible for tracking performance measures, meeting reporting requirements under the Consent Decree and overseeing the reporting of overflow events to the proper authorities.

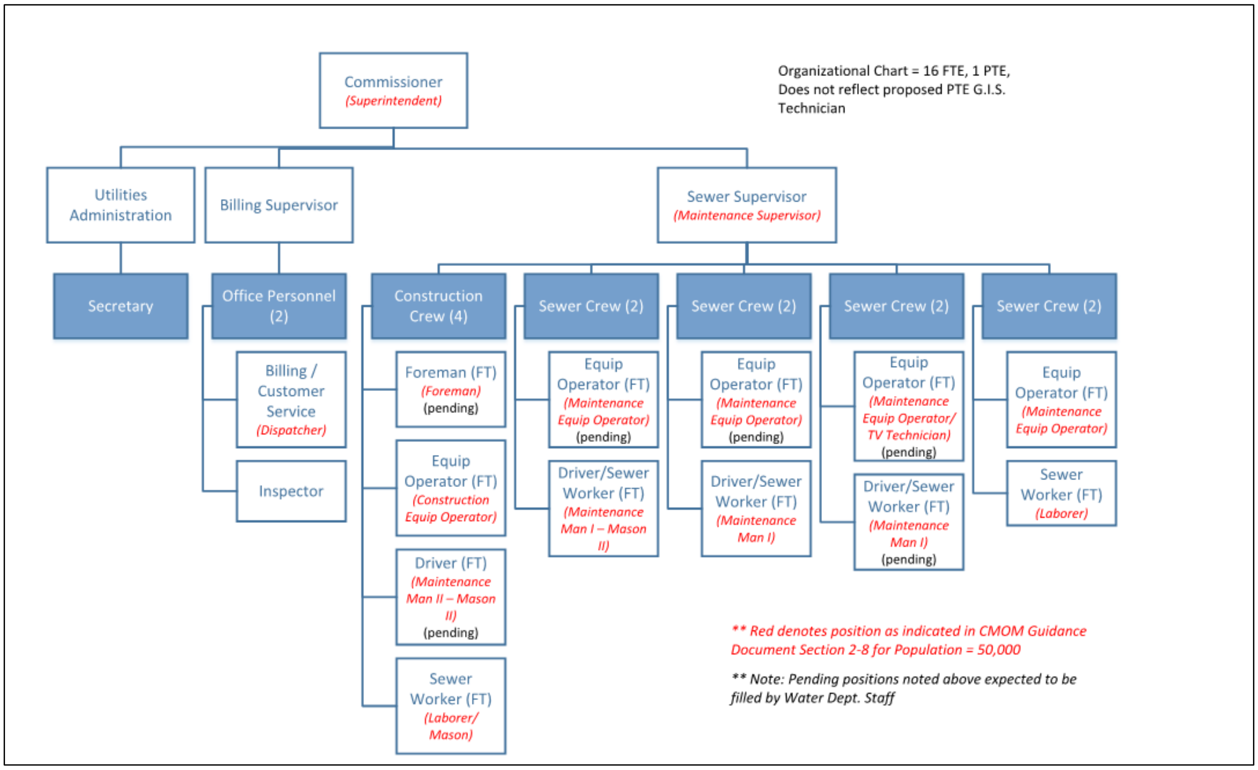

Figure 1-9 Cleveland Heights 2018 Sewer Department Organizational Chart

Section 2 - Emergency Response

The following CMOM Programs are related to Emergency Response:

1. Sewer Overflow Response Plan
2. Contingency Planning

2.1 Sewer Overflow Response Plan

2.1.1 Program Definition and Purpose

Rapid response to basement flooding and SSOs to grade (also termed *non-structural SSOs*, not including wet weather SSOs at known SSO structures) will help minimize negative impacts to public health, water quality, the environment, and private property. The Sewer Overflow Response Plan (SORP) is designed to ensure that appropriate crews are immediately dispatched to all reported SSOs to stop the overflow as quickly as possible; to minimize the effects of the overflow on public health and the environment; to minimize the impact of the overflow on collection system operations; and to report the overflow to the appropriate regulatory agencies, and to the public when warranted.

2.1.2 Goals and Performance Measures

The primary goals of the SORP are to protect public health and the environment, satisfy regulatory agencies, and consistently employ procedures for avoiding SSOs and managing overflows if they occur.

Additional goals of the SORP include:

- Protect collection system personnel.
- Protect the collection system and all appurtenances.
- Protect private and public property beyond the collection facilities.

Table 2-1 presents performance measures associated with the SORP.

Table 2-1 Sewer Overflow Response Plan - Performance Measures				
Measure Number	Measure Name	Description	Calculation	Target Value
2.1.2.1	Number of SSOs	Track number of SSOs by failure type	Number of SSO events per year	Trend
2.1.2.2	SSO Release Reporting	Report spills discharged to the waters of the State to Ohio EPA and USEPA	(Number of notifications completed within 24 hours / Total Number of reports per year) * 100%	100%
2.1.2.3	SSO Release Report Follow-up	Provide 5-day follow-up report for non-structural SSOs	(Number of 5-day follow-up reports submitted on time / Total Number of reports per year) * 100%	100%
2.1.2.4	SSO Response Training	Ensure all personnel whose duties require SSO response, reporting, and recordkeeping are properly trained	Number of employees trained / Number of employees involved	Trend

2.1.3 Program Description and Components

The Cleveland Heights SORP was approved by the USEPA on May 30, 2017. It identifies measures to mitigate the impacts of an SSO and to protect public health and the environment. It also contains processes to meet the goal shown in Table 2-2. The SORP is included in Appendix A of this document.

2.1.4 Training

Formal training will be provided to all CMOM program staff members, including those receiving calls, responding to reports and notifying staff who are responsible for reporting to the proper authorities.

New employees and employees reassigned to the Sewer Department will be trained on the current plan. Refresher training will be conducted on an as-needed basis, and if there are major revisions to the procedures in the plan. Training sessions and attendees will be documented and tracked as a performance measure.

2.1.5 Information Management

The information generated from a non-structural SSO event is documented and filed in an SSO Follow-up Report that is sent to the Ohio EPA and USEPA. All SSO reports and photographs taken are filed on the Sewer Department computers. Monthly SSO reports shall provide information on the occurrence of SSOs and the impacts of SSOs on receiving waters in the Cleveland Heights service area including SSO identification and location, activation time, duration, estimated volume, name of waterbody and public areas potentially affected.

As part of GIS implementation, the City will document steps to populate GIS with SSO structures, activation events and additional SSO information.

2.1.6 Resource Management

The SORP provides detailed information on available resources for SSO event management and response.

2.1.7 Process for Continuous Improvement

The SORP document will be reviewed every two years, and after significant non-structural overflow events. A debrief after each major response event will identify any issues with implementing the SORP so that updates can be made. The Commissioner of Utilities is responsible for conducting the evaluation and developing revisions.

2.1.8 Implementation Plan

Table 2-2 Sewer Overflow Response Plan - Implementation Plan

Reference Number	Program Milestone	Description	Time Frame
2.1.8.1	Add SSOs to GIS	Populate GIS with SSO locations, activations and additional SSO information	1 year

2.2 Contingency Planning

2.2.1 Program Definition and Purpose

Cuyahoga County has prepared a county-wide Emergency Operations Plan to implement emergency procedures in response to certain situations when it is known there is a potential problem in the area or a severe weather event is forecasted. Cleveland Heights' crews and private contractors are available 24 hours a day, seven days a week to respond to Emergency Operations. Equipment, such as emergency generators to maintain pump station operation during a power interruption and a backup portable pump, is available in the event of an emergency.

2.2.2 Goals and Performance Measures

The goal of the Contingency Planning program is to ensure rapid and consistent response and emergency operations in the event of abnormal conditions.

Due to the varying circumstances encountered during emergency situations, performance measures are not appropriate for contingency response activities. Depending on the severity of the event, Cleveland Heights may review the event to account for unforeseen circumstances, and identify lessons learned and recommendations to promote continuous improvement.

2.2.3 Program Description and Components

Cleveland Heights prepares for emergencies of varying size and impact. Emergency response plans are characterized in Table 2-3. There are also descriptions of the various types of response plans in this section. The SORP was described in Section 2.1.

Table 2-3 Emergency Response Planning

Emergency Category	Response Plan
SSO	Sewer Overflow Response Plan (SORP)
Major County-wide emergency or natural disaster	Cuyahoga County Emergency Operations Plan
Public Notification	Public Notification Plan (available through Community Relations Department)

2.2.4 Training

Training for emergency response is performed for applicable staff as necessary.

2.2.5 Information Management

Cleveland Heights maintains the latest versions of emergency preparedness documentation digitally. Copies are filed at the Sewer Supervisor's office and the Sewer Department Garage at 2863 Noble Road.

2.2.6 Resource Management

The City's overall lead for the Contingency Planning program is the Public Works Director. All Sewer Department staff members may be available for response to emergency situations based on their unique responsibilities.

2.2.7 Process for Continuous Improvement

After a serious sewer system emergency event, Cleveland Heights Sewer Department evaluates the response and the results of the crews' activities. This helps to improve procedures, assess the vulnerability of the Cleveland Heights collection system and identify any plans which need adjustment or development.

2.2.8 Implementation Plan

None identified.

Section 3 - Integrated Overflow Control Master Plan

The Integrated Overflow Control Master Plan (IOCMP) is a requirement of the Partial Consent Decree that will summarize remedial measures recommended to provide adequate capacity and control SSOs. Activities required for development of the IOCMP will provide input into other CMOM programs. For example, sewers inspected as part of the IOCMP Sewer System Evaluation Survey (SSES) will be recorded with sewer inspections conducted for other reasons (such as maintenance) each year to document the yearly total.

Developing the IOCMP will provide baseline information to manage the system going forward. The following sections summarize points of coordination between the CMOM and IOCMP development activities, including the following:

1. Sewer System Evaluation Survey
2. Monitoring
3. System Modeling and Capacity Assessment

3.1 Sewer System Evaluation Survey

3.1.1 Definition and Purpose

The SSES Work Plan required by the Consent Decree is due December 4, 2017. This section summarizes key components of the Work Plan. The City expects to begin the SSES effort in 2018 to meet the deadlines of the Consent Decree.

The Cleveland Heights SSES will be conducted in two phases. Phase 1 will include investigations in at least half of the service area, including all known SSOs and known problem areas, and will provide the primary information for development of the IOCMP. Figure 1-1 shows the proposed Phase 1 SSES areas in pink shading. The Phase 2 SSES will complete investigations in the remainder of the system, and will be used to update the IOCMP as needed prior to submittal. The purpose of the SSES is to confirm sanitary sewer configuration including trench type, identify sewer basins with excessive I/I, quantify sources of I/I, identify SSOs and cross connections, assess sewer condition and provide input to the system hydraulic model. The SSES is complementary to the system maintenance programs that are being developed and implemented under this CMOM Program.

The SSES will use standard procedures including adherence to NASSCO Standards for sewer condition assessment. The SSES includes inspections of all sanitary sewer manholes to identify currently unidentified cross-connections between the sanitary and storm systems. Potential cross connections will be confirmed using techniques such as dye water testing, lamping and CCTV inspection.

3.1.2 Goals and Performance Measures

The goal of the SSES is to identify system problems and potential cost-effective solutions for sewer system issues contributing to SSOs. No ongoing performance measures have been identified for this program under the CMOM.

3.1.3 Description and Components

The SSES includes inspection and assessment of gravity sewer segments using CCTV and other inspection techniques to identify pipe structural degradation, illicit discharges, cross connections, and non-stormwater discharges into the storm system. The system assessments are also used to update pipeline asset attribute data, such as depth/elevation, materials and diameter.

The City reviews existing data concerning SSOs, building/private property backups, sewage flows and sanitary sewer system attributes while planning inspections. The purpose of this review is to select appropriate inspection technologies and identify gaps in existing information.

The following activities may be used to locate individual sources of I/I, assess physical condition and confirm system connectivity:

- Visual inspections of pipes and manholes
- Flow monitoring to isolate sources of I/I, including the use of micro monitors
- Smoke testing
- Dye testing
- CCTV inspection to identify sewers in need of repair, rehabilitation, or replacement
- Building inspections

3.1.4 Training

SSES activities will be conducted by City staff and supported by outside firms with specialized expertise. The City requires all CCTV inspections to be completed by individuals who are certified by NASSCO.

3.1.5 Information Management

The SSES Work Plan will summarize a data management approach to organize, analyze, and report data that will be collected and used for development of the IOCMP. Industry standard quality control/quality assurance methods will be used to promote accuracy and reliability of the data collected.

3.1.6 Resource Management

City crews will be supported by Cuyahoga County Department of Public Works staff and outside firms as needed. These support crews will also report to the Commissioner of Utilities.

3.1.7 Process for Continuous Improvement

None identified.

3.1.8 Implementation Plan

The SSES Work Plan required by the Consent Decree is due December 4, 2017. The City expects to begin the SSES effort in 2018 to meet the deadlines of the Consent Decree.

3.2 Monitoring

3.2.1 Definition and Purpose

The Monitoring Program, as detailed in the Consent Decree, has three main components: rainfall monitoring, real-time SSO monitoring and system characterization monitoring. The Monitoring Program will characterize SSO activity, alert Cleveland Heights staff to ongoing overflow events and support refinement and expansion of the system model and development of the IOCMP.

The City submitted a Real Time Monitoring Plan (RTMP), dated May 30, 2017. The purpose of the RT monitoring is to track activations of the 10 most active known SSOs in Cleveland Heights for a period of three months annually. The RTMP was approved by EPA for implementation by Cleveland Heights. A System Characterization Monitoring Plan (SCMP) is due to EPA on March 2, 2018. The SCMP will identify rain gauge and model calibration meter locations. Cleveland Heights expects to implement System Characterization Monitoring in 2018 to comply with deadlines in the Consent Decree.

3.2.2 Goals and Performance Measures

The goal of the Monitoring Program is to measure system performance during dry and wet weather events to track SSO activity and provide flow and rainfall data for model update and calibration. Rainfall data is being collected using the NEORSD rain gauge network and radar rainfall provider to quantify rainfall associated with wet weather flows. No on-going performance measures have been identified for this program. Data quality requirements are listed in the flow monitoring plans, as necessary.

3.2.3 Description and Components

The Cleveland Heights Monitoring Program consists of monitoring rainfall, SSO activity, and dry and wet weather sanitary sewer flow monitoring to satisfy the requirements of the Consent Decree. Existing flow data, including data recorded by NEORSD, will also be used to supplement information collected by Cleveland Heights.

In addition to the periodic real time monitoring, the City is monitoring the activation of known SSOs using tethered blocks. This method determines whether an SSO has activated by placing a movable wooden block at or near an overflow and then checking the location of the block after a rain event. The City checks the overflows monitored by tethered blocks after each rain event greater than 0.25 inches or monthly if no rainfall is recorded.

The RTMP required by the Consent Decree describes the City's periodic use of digital, continuously-recording, real-time telemetered flow monitors at 10 known SSOs believed to be the most active.

The SCMP will provide requirements for monitoring site selection, equipment selection and installation, calibration, maintenance, and data quality assurance checks to optimize monitoring accuracy. The flow monitoring and rainfall data will be used to characterize the wet weather response (I/I) in basins throughout the sanitary sewer system.

The SCMP will summarize:

- Type and location of rain gauges
- Locations for flow meters and remote level sensing devices
- Periods of monitoring at each location
- The minimum number of wet weather events to be monitored and the intended characteristics of those events (total rainfall, peak intensity, etc.)
- A protocol for re-evaluating the placement of flow meters and remote flow detection devices determined to be producing unacceptable data
- A data review (QA) and management plan
- How any monitoring performed by NEORSD that the City anticipates using and the City's own monitoring efforts comply with the requirements of the Consent Decree and are in accordance with acceptable industry practice

- How the combination of the monitoring carried out by NEORSD and the City will adequately support the SSES, System Model development and calibration, capacity evaluation, and ultimately the development of an effective IOCMP
- How the City's flow monitoring shall allow adequate characterization of the stormwater flows in the portions of its collection system that include over/under sewers

3.2.4 Training

Flow monitoring is being conducted by outside flow monitoring contractors with specialized expertise. The City trains crews performing tethered block monitoring to check and observe the sites and properly fill out the tracking form.

3.2.5 Information Management

The City will use software recommended in the SCMP or by the flow monitoring vendor to access the flow data. Data storage will be via database in a location to be determined. The City will provide data summaries from its monitoring on the City website for public viewing. Locations and approximate frequencies of SSOs will also be posted for public review.

3.2.6 Resource Management

Sewer Department staff provide tethered block monitoring as part of their regular duties.

3.2.7 Process for Continuous Improvement

None Identified.

3.2.8 Implementation Plan

The SCMP required by the Consent Decree is due to EPA on March 2, 2018. The City expects to implement the monitoring in 2018 to meet the deadlines of the Consent Decree.

3.3 Collection System Model and Capacity Assessment

3.3.1 Definition and Purpose

The Collection System Model will update and calibrate an existing hydraulic model to simulate system performance and identify capacity deficiencies by establishing a relationship between rainfall and wet-weather flow rates in the sanitary sewer system. A System Modeling Plan (SMP) is due to EPA on March 30, 2018. The calibrated System Model is due by April 1, 2019.

Cleveland Heights expects to implement Collection System Modeling in 2018 and 2019 to comply with deadlines in the Consent Decree.

3.3.2 Goals and Performance Measures

The goal of the Collection System Modeling Program is to establish the relationship between rainfall and the wet-weather flow rate in the sanitary sewer system, and apply that relationship to identify those elements of the sanitary sewer system that are predicted to experience surcharging or SSOs during various rainfall events.

3.3.3 Description and Components

The existing collection system model has been developed by NEORSD using the InfoWorks ICM model. This model will be updated and expanded to support development of the IOCMP. The City will use best available information to accurately reflect current conditions regarding pipe sizes and slopes; hydraulic flow control device properties; and other system attributes. SSES investigations will also support model update and added detail to support analysis and recommendation of necessary system improvements.

The model will be calibrated to the extent possible. Due to the unique configuration of the sewers and the degree of cross filtration, calibration of the model will be more difficult than a typical separate sewer system. Calibration will be achieved through information gathered by the Monitoring Program.

3.3.3.1 Capacity Evaluation

The City will use its System Model to determine whether the modeled portions of its sewer system are adequately sized to transport (1) peak current dry-weather flows, (2) anticipated future dry-weather flows based on a 20-year population projection, and (3) peak wet-weather flows during the rainfall events listed in the SMP. Given that the lack of capacity in the storm or sanitary sewer may affect the operation of the other, the City will consider inadequacies in storm sewer capacity in its evaluation. The capacity evaluation will provide areas of restricted capacity in the sewer system for potential remediation in the IOCMP.

3.3.4 Training

Modeling activities will be conducted by the City's engineering consultant.

3.3.5 Information Management

Hydraulic model files will be maintained the City's engineering consultant.

3.3.6 Resource Management

City staff will be responsible to support necessary field activities, and to review results and deliverables associated with monitoring and modeling

3.3.7 Process for Continuous Improvement

None Identified.

3.3.8 Implementation Plan

The SMP required by the Consent Decree is due to EPA on March 30, 2018. The City will develop the updated Collection System Model in 2018 and 2019 to meet the deadlines of the Consent Decree.

Section 4 - Engineering Design and Construction Standards

The following CMOM Program is related to Engineering Design and Construction Standards.

4.1 Design and Construction Standards

4.1.1 Program Definition and Purpose

The purpose of the Engineering Design and Construction program is to provide consistency and ensure the quality of the design and construction of the sanitary sewer system components.

The City of Cleveland Heights ensures that new or improved infrastructure is designed in accordance with applicable standards, codes, and guidelines, and is inspected and built to standard construction specifications. Updated construction Information is provided to the public via the city website and the Public Relations Department for notification of major projects that cause significant disruption to the public. The Sewer Department distributes door hangers on streets in which maintenance work is being conducted.

4.1.2 Goals and Performance Measures

Table 4-1 Engineering Design and Construction Standards - Performance Measures

Measure Number	Measure Name	Description		Target Value
4.1.2.1	CIP Implementation	Complete identified replacement and rehabilitation projects to abate the likelihood of failures in the system	Number of CIP or Infrastructure Replacement projects completed which address specific SSO abatement plans	Trend

4.1.3 Program Description and Components

The Engineering Design and Construction program is guided by documentation made available by the Cuyahoga County Sanitary Engineer (CCSE) to provide conformity to the design and review of wastewater utility improvements. Documentation includes design standards, standard details, construction specifications and the approved product lists. This documentation is published as part of the Cuyahoga County Drawings and Standards, and references *UNIFORM STANDARDS FOR SEWERAGE IMPROVEMENTS, December 1998, City of Cleveland, Northeast Ohio Regional Sewer District, Cuyahoga County Sanitary Engineering Division, Municipal Engineers Association of Northeast Ohio, and Ohio EPA Northeast District Office.*

Drawings & Standards - Cuyahoga County Department of Public Works.

4.1.3.1 Proper Design

Design standards are in place to define the general design components and record keeping requirements necessary to provide design and construction services in Cleveland Heights. Standard details and design criteria are used to ensure uniform design and construction of critical infrastructure. The local sewer permitting program requires that all wastewater collection system extensions meet the minimum design requirements in accordance with the County's Standards. In addition, Cleveland Heights' consulting engineer participates in the design review process.

4.1.3.2 Permit Approval and Inspection

When construction activities are under way, a member of the Streets Division is assigned as resident project representative to observe the installation, rehabilitation or replacement of mainline sewers within the public right-of-way. For projects designed by a consulting engineer, a resident project representative approved by the City is provided by the consultant. Private sewers and lateral work is observed and approved by a City-approved inspector (excluding indoor plumbing). Notification of these activities is achieved through the application for a sewer connection permit prior to any work. Permit approval and inspection includes the following components:

- Designers and Installers must use acceptable materials, standards, standard drawings and Special Provisions for installation of the sanitary sewer as provided in the Cuyahoga County Drawings and Standards.
- A Cleveland Heights representative reviews all plans for new construction to ensure they meet the requirements of the Cuyahoga County Standards. A street opening permit will be issued after approval.
- The Standards Section 5 – CONSTRUCTION: Section 5.211 – Inspection and Testing, lists the sanitary sewer testing requirements for installation of new sewers. The tests may include, but are not limited to, the following:
  - Testing for deflection of gravity sewers
  - Testing for leakage of gravity sewers
  - Pressure and leakage testing for force mains
- Project inspection is completed by Cleveland Heights or approved Representatives per the Standards. Cleveland Heights employs a competent resident project representative to observe the construction of the project and checks for conformance with the approved contract, drawings and specifications.

4.1.3.3 Capital Improvement Program

The Public Works Department has prepared a prioritized list of projects annually for the Capital Improvement Plan (CIP). The CIP was last updated in 2003. An implementation plan (Section 4.1.8) for continuing to update the CIP includes reviewing all information gathered during the previous year including failure records, finalized studies (such as PACP reports), operational needs identified by staff, etc. The CIP is incorporated into the Public Works budget which is approved by the City Manager.

4.1.4 Training

Cleveland Heights hires staff qualified by education, certification and experience for positions relevant to sewer construction. The City hires trained consultants for assistance in design and oversight to assist with projects and inspection. In-house personnel receive on-the-job training as needed. Refer to Section 6.2 for more information.

4.1.5 Information Management

As-built record information is stored at the Sewer Department and is available for review by field staff. Where discrepancies are encountered between the record information and actual field conditions, the system maps are updated with the correct information.

4.1.6 Resource Management

Engineering consultant firms and contractors are used extensively for design of capital projects and to perform construction administration work under the direction of the Commissioner of Utilities.

4.1.7 Process for Continuous Improvement

The Sewer Department will continue to review plans for new development and meet with the affected parties to ensure design, permitting and construction meet the goals of the City of Cleveland Heights.

4.1.8 Implementation Plan

Table 4-2 Engineering Design and Construction Standards - Implementation Plan

Reference Number	Program Milestone	Description	Time Frame
4.1.8.1	Capital Planning Enhancement	Update CIP which was last updated in 2003 and evaluate on an annual basis based on findings from IOCMP and subsequent SSES activities.	3 years

Section 5 - Operations and Maintenance Programs

The following CMOM Programs are related to Operations and Maintenance programs:

1. Gravity Sewer Maintenance
2. Pump Station and Force Main Maintenance
3. Equipment, Parts and Tools Management
4. Ohio Utilities Protection Service (OUPS)

5.1 Gravity Sewer Maintenance

5.1.1 Program Definition and Purpose

Cleveland Heights' system consists primarily of gravity sewers to collect and transmit flow from customers to the NEORSD interceptor system tributary to the Easterly WWTP. Cleveland Heights owns and operates the gravity sewers that discharge into the NEORSD interceptors.

Operation of these gravity systems includes routine maintenance and cleaning, assessing the condition of the system, and performing corrective maintenance when required to maintain adequate system performance.

The purpose of the gravity system maintenance program is to clean the gravity pipes and conduct inspections and repairs on pipes and manholes by various methods to prevent SSOs, reduce Infiltration/Inflow (I/I) and ensure sustainability of the collection system infrastructure.

5.1.2 Goals and Performance Measures

The goals of the gravity system maintenance program are to:

- Provide reliable, continuous service and maintain compliance with federal and state regulations.
- Remove obstructions from the sanitary sewer that may hinder flow.
- Identify defects that contribute substantial I/I to the sanitary sewer system.
- Identify defects that may lead to SSOs.
- Identify and address areas that may require increased maintenance attention.
- Maintain the gravity system to minimize adverse impacts to the residents and environment.
- Preserve the useful life of the gravity system.

Table 5-1 presents performance measures related to the gravity system.

Table 5-1 Gravity System Maintenance - Performance Measures				
Measure Number	Measure Name	Description	Calculation	Target Value
5.1.2.1*	Gravity Sewer Cleaning	Obstructions in Gravity Sewer systems can contribute to SSOs. The systematic cleaning of the system removes debris and accumulations of solids, reducing potential for SSOs. This measure monitors performance of gravity sewer cleaning to remove debris.	At least 25 miles of gravity main sewer cleaned per calendar year	100%
5.1.2.2*	Gravity System Inspections	Internal inspection of the Gravity System provides useful information to assess the condition of the lines allowing proactive measures to be taken to reduce infiltration and identify conditions that may lead to failure. This measure monitors total inspection in a 10-year cycle.	Inspect entire sanitary system on a 10-year cycle	100%
5.1.2.3*	Gravity System Inspections	Internal inspection of high risk assets is important to maintain the life expectancy of the collection system. Cleveland Heights will investigate all PACP and MACP condition scores of 3 or greater on a 5-year basis.	Inspect pipes and manholes graded 3 or worse on a 5-year cycle	100%
5.1.2.4*	System Issues determined to be caused by roots	The annual number of system issues related to roots provides an indication and trend of progress being made to reduce these occurrences.	Number of system issues related to roots per year	Trend

**Measure to be tracked once maintenance practices are implemented according to Table 5-2. Related activities performed under the SSES Program will be tracked with these performance measures.*

5.1.3 Program Description and Components

Cleveland Heights owns approximately 127 miles of gravity sewer pipeline. Gravity sewer operation and maintenance generally consists of cleaning, inspection, repairs, and right-of-way/easement coordination activities. The sanitary sewer cleaning programs and sewer system inspection programs that support these activities are listed below.

5.1.3.1 Routine Cleaning Program

Cleveland Heights has a Routine Cleaning Program that includes scheduled cleaning of the sanitary sewers to help prevent SSOs. The cleaning helps remove fats, oils and grease (FOG), debris, roots and other obstructions from the sanitary sewers. Cleveland Heights prioritizes cleaning based on current operational conditions. The descending order of priorities are generally customer complaints and overflow related; hot spot areas; and proactive cleaning. Cleveland Heights completes proactive gravity sewer cleaning as resources are available. The Sewer Supervisor sets the day-to-day priorities.

As part of the CMOM implementation plan, a standard operating procedure (SOP) for sewer line and manhole cleaning and routine maintenance will be developed. The SOP will describe the staff, equipment, and procedures that will be used to identify sewer segments with significant FOG, debris, roots and other obstructions in the sanitary sewers through sewer cleaning activities, CCTV inspection, and SSO response activities. The SOP will also provide for tracking of the nature and amount of material removed during sewer line and manhole cleaning.

5.1.3.2 High Frequency Cleaning Program

The Sewer Supervisor leads a High Frequency Cleaning Program that maintains a list of “hot spots” for increased cleaning and/or inspections. The list includes locations of known recurring issues, nature of the previous issue and the appropriate action (i.e., check, flush, root cut, grease control).

As of July 2017, there are 29 locations on the High Frequency Cleaning Program. The list is updated periodically as new issues arise and projects are completed to address the root cause of maintenance issues. The current hot spot list and associated maps can be found in Appendix B of this report. Hot spots are currently all inspected and addressed twice annually or as determined by the Sewer Supervisor. Hot spot areas may be prioritized by the Sewer Supervisor if needed to optimize the High Frequency Cleaning Program.

5.1.3.3 Root Control Program

Cleveland Heights currently has a few areas with repeated root intrusion issues that may cause or contribute to blockages and/or SSOs in the sewer system. These areas are included in the high frequency cleaning program and are checked twice a year and maintained as needed with mechanical root cutting measures until the issue is resolved by sewer replacement or lining.

As part of the CMOM implementation plan, a standard operating procedure (SOP) for root control maintenance has been developed. The SOP describes the staff, equipment, and procedures used to identify sewer segments with significant root intrusion through sewer cleaning activities, CCTV inspection, and SSO response activities along with measures to prevent the reoccurrence of root growth. The root control maintenance SOP can be found in Appendix C of this report. Chemical root control is currently prohibited in Cleveland Heights.

5.1.3.4 Gravity Sewer Inspection

Cleveland Heights will be performing routine CCTV inspection of the gravity collection system. CCTV inspection is a non-destructive, proactive approach to evaluate the pipeline infrastructure and manholes and is used with cleaning to assess the condition of the pipeline interior. A CCTV inspection may be used to:

- Inspect pipeline and manhole condition and to determine the location of problem areas such as pipe or joint separations, drops, ruptures, obstructions, grease accumulation, deterioration, pipe misalignment, and root intrusions.
- Locate infiltration and inflow sources.
- Look for damage to sewers caused by excavation and construction.
- Search for unrecorded connections, such as illegal or unauthorized connections.
- Evaluate effectiveness of pipeline repairs, replacement, and/or rehabilitation within the sewer system.
- Assess pipeline condition for new installations before the warranty period ends.

CCTV information is recorded using National Association of Sewer Service Companies (NASSCO) Pipeline Assessment & Certification Program (PACP) and Manhole Assessment & Certification Program (MACP) standards. The PACP and MACP defect coding provides a level of consistency and is the industry standard.

Previously, a majority of the CCTV inspection has been completed by Cuyahoga County Department of Public Works (CCDPW) under a shared services agreement or by private contractors. Cleveland Heights is procuring a CCTV equipment truck for use by trained Cleveland Heights crews. The new CCTV truck will be equipped with a mobile data connection allowing access to historic permit applications, record drawings and other historical information. Inspection activities are prioritized based on current operational conditions. The priorities are generally customer complaints and overflow-related issues, sink holes and agency coordination and proactive inspection. The Cleveland Heights CCTV crew will also complete a significant portion of the proposed SSES system inspection. The Sewer Supervisor sets the day-to-day priorities.

5.1.3.5 Corrective Maintenance

Repairs to the gravity collection system are identified through customer interaction, agency coordination and CCTV activities. The Sewer Supervisor provides the Utilities Commissioner with repair-related information. Cleveland Heights staff will complete low complexity repairs. These types of repairs would typically include depths 8 feet or less and lengths limited to one to two pipe sections. More complex repairs are completed by an outside contractor. Repairs are inspected with CCTV after completion. For corrective maintenance associated with an SSO, the procedures in the Sewer Overflow Response Plan are followed, as necessary.

5.1.3.6 Right-of-way and Easements

Cleveland Heights is responsible for including adjustment of manhole and cleanout castings during implementation of paving contracts. The Cleveland Heights Sewer Department will periodically perform a cursory inspection to ensure that the castings are properly set and that no foreign material has been introduced into the sanitary sewer. While some manholes within the system are paved over, contract requirements and proactive location and raising of previously paved over manholes is continuously reducing the number of inaccessible manholes.

Cleveland Heights also maintains a limited number of easements performing maintenance for access on an as needed seasonally basis. Pump station driveways and access roads are plowed in the winter as needed.

5.1.4 Training

Training for personnel responsible for gravity collection system operation and maintenance is provided on-the-job and by equipment vendors. All staff are cross trained on each aspect of the gravity maintenance activities to allow for flexibility of crew assignments.

To prepare for in-house CCTV inspection, crews have started receiving NASSCO PACP and MACP training. Currently there are five NASSCO PACP and MACP trained Sewer Department staff members with the intention of having at least seven trained staff members at all times. The Sewer Supervisor and Utilities Commissioner are also NASSCO certified. County staff and private contractors are trained for PACP and MACP inspections.

5.1.5 Information Management

Information related to gravity system maintenance is maintained in the following ways:

- Work orders are currently generated on paper forms and stored as a hard copy in the Sewer Supervisor's office. Information recorded for each work order includes:
    - condition/cause of problem
    - location
    - work description
    - staff, equipment, resources onsite
    - time
    - materials used
    - follow up work required
- CCTV equipment uses software for recording inspection information. The software is PACP compliant.
- The CCTV information is stored on a digital video disc (DVD) after each inspection and filed in the Sewer Supervisor's office.

The new Information Management software (Lucity) has been installed and will increasingly be used to support system maintenance in the following ways:

- Work orders will be generated electronically and stored at specific points in the GIS.
- CCTV inspections will be directly uploaded to the IMS and tracked using GIS.
- System updates to the collection system will be completed in GIS.
- Costs will be tracked for sewer maintenance work.

Record drawings are available for the Cleveland Heights gravity collection system to help locate pipelines and manholes. All manholes have been assigned unique identifiers. CCTV information is tied to specific assets using the unique identifiers. The unique identifiers will also be used in the Information Management System (IMS) that is being implemented.

5.1.6 Resource Management

The Sewer Supervisor currently oversees six Sewer Department staff who perform day-to-day gravity collection system activities and respond to emergencies in the collection system. As of June 2017, all job position descriptions have been updated. By January 2018, there will be 12 Sewer Department staff after transition from the previous Cleveland Heights Water Department is complete.

5.1.7 Process for Continuous Improvement

As mentioned in previous sections, Cleveland Heights is implementing several existing improvement initiatives. These include developing SOPs for sewer and manhole cleaning, developing an SOP for root control, updating job position descriptions, providing NASSCO PACP and MACP training to additional sewer maintenance staff to perform CCTV inspections, updating system maps and implementing an Information Management System.

5.1.8 Implementation Plan

Table 5-2 Gravity System Maintenance - Implementation Plan

Reference Number	Program Milestone	Description	Time Frame
5.1.8.1	Gravity Sewer Maintenance	Develop an SOP for sewer line and manhole cleaning and routine maintenance.	1 year
5.1.8.2	Gravity Sewer Maintenance	Cleveland Heights is acquiring a CCTV truck and will certify operators to allow for in-house CCTV capabilities.	1-2 years
5.1.8.3	Gravity Sewer Maintenance	Use Lucity to track maintenance costs associated with sewer assets.	2 years

5.2 Pump Station and Force Main Maintenance

5.2.1 Program Definition and Purpose

Cleveland Heights operates and maintains two pump stations and less than one mile of force main. The Pump Station and Force Main Maintenance program provides proactive operation and maintenance to promote reliability and minimize pump station down time in the event of a failure. Special knowledge of electrical, mechanical, physical and hydraulic systems is required to successfully implement the program. The program documentation addresses maintenance, routine operations and emergency operations for pump stations and force mains.

5.2.2 Goals and Performance Measures

The goals of the Pump Station and Force Main Maintenance program are to:

- Promote continuous, reliable operation of Cleveland Heights pump stations.
- Maintain compliance with state and federal regulations.
- Preserve asset useful life.
- Inspect and maintain pump stations in accordance with sound maintenance principles.
- Minimize down time in the event of a pump station failure.
- Proactively minimize sewer overflows.

Specific performance measures related to implementation of the program are listed in Table 5-3.

Table 5-3 Pump Station and Force Main Maintenance - Performance Measures

Measure Number	Measure Name	Description	Calculation	Target Value
5.2.2.1*	Pump Station Routine Inspections	Monthly routine inspection of each of its pump stations to identify potential issues.	(Number of routine pump station inspections monthly / Total number of pump stations) * 100%	100%
5.2.2.2*	Pump Station Comprehensive Inspections	Biannual comprehensive inspections of each of its pump stations to identify potential issues.	(Number of comprehensive pump station inspections biannually / Total number of pump stations) * 100%	100%

**Measure to be tracked once maintenance practices are implemented according to Table 5-4.*

5.2.3 Program Description and Components

The two Cleveland Heights pump stations are located on Woodview Road and at Forest Hills Park. The Woodview Pump Station services an area of approximately 20 households and the pumps were refurbished in 2007. The Forest Hills Park Pump Station is only used seasonally since it services the public park area. The Forest Hills Park electrical system was replaced in 2016. There have been no recurrent operational issues at the pump stations even during wet weather events.

5.2.4 Routine Operations

Generally, pump stations and force mains are designed to operate automatically using wet well level settings to turn pumps on and off. Other features include automatically alternating pump starts ensuring even wear/regular exercising of each pump.

The pump stations have alarm systems with alarms including, but not limited to, pump failure, high and low level, and power failure. The alarms are automatically transmitted via telemetry to the Sewer Supervisor’s cellular phone. There are presently no remote-control capabilities for either station.

As a proactive operational measure, pump stations are visited monthly by qualified Sewer Maintenance personnel. The purpose of these inspections is to:

- Check for and address grease accumulations in the wet well.
- Maintain station and site cleanliness.
- Perform pump operational and visual check.

- Identify any abnormal conditions.

A checklist has been developed and will be used during monthly pump station site visits.

More comprehensive pump station inspections are completed twice a year by an outside contractor. These operational inspections are accomplished in accordance with a checklist which includes equipment testing and visual inspections. Any issues noted during the operational inspections are documented and provided to the Sewer Supervisor for use and record keeping. The issues are then documented in a work order and assigned a priority by the Sewer Supervisor. Work orders are assigned to an outside contractor for most repairs and equipment servicing.

As part of the CMOM implementation plan, standard operating procedures (SOPs) for pump station general inspections and pump station operational procedures will be developed. The SOPs will describe the staff, equipment, and procedures that will be used to identify pump station or force main concerns.

All monthly visit checklists and bi-annual inspection reports are filed in the Sewer Supervisors office. These documents will be incorporated into the IMS system during the implementation of the software operations.

5.2.5 Emergency Operations

To maintain continuous operability, pump stations are designed with redundant critical pumping equipment in accordance with 10 State Standards. A North Star portable generator, as shown in **Figure 5-1**, is available to power a pump station if there is a power failure.

Figure 5-1 North Star Portable Generator

If there is a power failure at the Forest Hills Park Pump Station, the restrooms served by this pump station will be shut down for the duration of the outage.

During emergency operations, the Sewer Supervisor receives a pump station alarm call and will contact the two on call Sewer Maintenance personnel to investigate the problem and determine a solution. During a call associated with a localized power failure, Sewer Maintenance personnel are responsible for portable generator deployment to restore pump station operation and for reporting any necessary repairs to the Sewer Supervisor immediately, so he can contact the outside contractor to address the issue.

Generally, Sewer Maintenance crews will investigate any possible overflows that may have occurred outside of the immediate pump station area. Sewer Maintenance crews would respond to force main failures. The goal for response time for emergency operations is 45 minutes.

5.2.6 Maintenance

All mechanical, electrical and physical maintenance for pump stations is contracted to an outside contractor. Typical activities include maintenance for pump station equipment according to manufacturer's instructions and pump/motor overhaul as necessary.

If the contractor finds any issues during cleaning or inspection, the Cleveland Heights Sewer Supervisor is informed within 24 hours.

5.2.7 Training

Training for personnel responsible for pump station and force main operation and maintenance is provided on-the-job and by equipment vendors.

5.2.8 Information Management

Information related to pump stations and force mains is maintained in the following ways:

- Work orders are currently generated on paper forms and stored in hard copy.
- Pump station inspections, both monthly and bi-annual, are documented on a standardized hard copy report.
- Manufacturer's equipment manuals are available at the Sewer Supervisor's office.

5.2.9 Resource Management

The Sewer Supervisor is the main contact with the outside contractor for all maintenance work performed on the Cleveland Heights pump stations. The outside contractor responds to pump station maintenance related emergencies and performs major pump overhauls and deep force main repairs.

5.2.10 Process for Continuous Improvement

Cleveland Heights is developing SOPs for pump station and force main inspections. All pump station checks and inspection documentation will be incorporated into the IMS.

5.2.11 Implementation Plan

As mentioned in previous sections, Cleveland Heights is implementing routine inspections on pump stations and force mains.

Table 5-4 Pump Station and Force Main Maintenance - Implementation Plan

Reference Number	Program Milestone	Description	Time Frame
5.2.8.1	Pump Station Operational Inspections	Develop an SOP for pump station general inspections.	1-2 years
5.2.8.2	Pump Station Operational Inspections	Develop an SOP for pump station operational procedures.	1-2 years

5.3 Equipment, Parts and Tools Management

5.3.1 Program Definition and Purpose

The City of Cleveland Heights maintains a wide variety of equipment, parts and tools necessary to support the operations and maintenance of the sanitary sewer system. The equipment, parts and tools are managed by the Sewer Supervisor.

5.3.2 Goals and Performance Measures

The goals of the Equipment and Tools Management program are to:

- Provide reliable equipment, replacement parts and tools for collection system operation and maintenance.
- Maintain equipment and tools to prolong useful life.

There are no performance measures associated with Equipment and Tools Management.

5.3.3 Program Description and Components

The Sewer Department Garage houses most of the tools and spare parts used to maintain the collection system. There is a garage bay area for vehicles, the portable pump and emergency generator. Cleveland Heights maintains an inventory of critical replacement parts for the collection system at the Sewer Department Garage. Cleveland Heights also has a Gorman Rupp 3-inch portable pump, as shown in **Figure 5-2**, which can handle up to 2-inch solids.

Figure 5-2 Cleveland Heights Portable Sewage Pump

Cleveland Heights maintains an inventory of critical replacement parts for the collection system at the Sewer Department Garage including:

- Pipe – PVC
- Fittings – PVC
- Ferncos
- Couplings
- Manhole lids and castings

Cleveland Heights only keeps pipe and fittings up to 12 inches in diameter. If a larger diameter pipe or fitting is needed, there are two local pipe supply companies that have up to 24-inch-diameter pipe and 15-inch fittings in local inventory and can order larger parts with approximately a one-week lead time. The two local pipe suppliers are:

Green Builders 527 South Green Road South Euclid, OH 44121 216-291-9800	HD Supply 23880 Broadway Avenue Bedford, OH 44146 440-439-4040

A sewer maintenance spare parts inventory was documented by Cleveland Heights and submitted to EPA in September 2017. A copy of that inventory review can be found in Appendix D of this document.

5.3.4 Training

Training for personnel responsible for maintaining equipment and tools is provided on-the-job and by equipment vendors.

5.3.5 Information Management

A spreadsheet is used to monitor and track available spare parts and tools. As work orders are reviewed and prioritized, parts needs are assessed and checked against available inventory. If additional parts or materials are needed, they are procured prior to assignment to the crew. The spreadsheet of inventory as of June 2017 is shown in Figure 5-3. This spreadsheet is updated as inventory is consumed or added.

SEWER INVENTORY	6/15/2017

FERNCOS	
1	10" C TO P
0	8" C TO P
0	6" C TO P
4	6" P TO P
2	4" C TO P

PVC PIPE	
12'	12"
4'	10"
8'	8"
40'	6"
40'	4"

PVC PIECES	
1	12" 45
1	10 X10X8 TEE
1	8" TEE
2	8" Y
1	8" 90
1	8" TEE
1	8 " 45
1	6" TO 4"
1	6" Y
1	6X6X2 Y
5	6" 90
6	6" 22
5	6" 45

BRICKS	100
MORTAR	30
CEMENT	12
WATER PLUG	1

DYE	
2	RED TABLETS
10	RED POWDER
0	GREEN LIQUID
PAINT - CANS	
60	GREEN
3	PINK
11	WHITE

CASTINGS AND LIDS/GRATES		
2	1710	SOLID
1	1710	GRATE
1	7030	GRATE

SEWER MACHINES		3
CUTTERS	1"	30
	2"	14
	3"	24
	4"	12
	6"	30
BELTS		3
LEADERS		8
PORTABLE PUMP		1
PORTABLE GENERATOR		1
SEWER JET		1
CABLE 50'X.66		6
CAMERAS		2
LADDER		1
TRIPOD		1
SHOVELS		
SPADES		3
SHORT SHOVELS		2

Figure 5-3 Spare Parts and Tools Inventory June 2017

Cleveland Heights will use the anticipated information management system to supplement inventory management and may consider use for vehicle maintenance.

5.3.6 Resource Management

The Sewer Supervisor oversees the Equipment, Parts and Tools Maintenance program. The Sewer Supervisor is located at the Sewer Garage, 2863 Noble Road.

5.3.7 Process for Continuous Improvement

Parts are generally replaced in the inventory as they are used. The inventory is reviewed and updated at least quarterly by the Sewer Supervisor. The Vehicle Maintenance Department and the Sewer Supervisor evaluate vehicles annually for recurring maintenance issues, obsolescence, and symptoms that equipment has reached the end of its useful life. Reviewing the vehicles results in timely replacements and increased fleet reliability.

5.3.8 Implementation Plan

None Identified.

5.4 Ohio Utilities Protection Service (OUPS)

5.4.1 Program Definition and Purpose

Cleveland Heights participates in the Ohio Utilities Protection Service (OUPS) program to prevent damage to its underground assets by locating and marking underground lines prior to construction or other excavations that may occur.

5.4.2 Goals and Performance Measures

Table 5-5 Ohio Utilities Protection Service - Performance Measures

Measure Number	Measure Name	Description	Calculation	Target Value
5.4.2.1	OUPS Marking	Properly marking underground utility lines promotes public safety and system reliability. This measure monitors Cleveland Heights asset damage from mismarks.	Number of sewer asset utility strikes with mismark by Cleveland Heights	0

5.4.3 Program Description and Components

As a utility owner, Cleveland Heights is required by the State of Ohio to participate in the state-wide OUPS program. The Ohio Public Utilities Commission is responsible for enforcement of the OUPS program.

Anyone preparing to excavate is required by law to call OUPS to have all underground utilities located and marked before digging. OUPS coordinates the calls and notifies all utilities of the planned excavation area. Cleveland Heights is required to mark tickets, if necessary, within 48 hours. More detailed information on the requirements and regulations of the OUPS program can be found in the OUPS Excavator Manual.

Tickets first come into the City's Utilities Department via fax/paper, not via phone calls, from OUPS. All sewer tickets are assigned accordingly to a marking crew, which consists of internally-trained workers from the Sewer Department to locate their pipes. Sewer Department staff follow best practices in the OUPS Excavator Manual for utility marking. The marking crew uses record drawings and line of sight to provide the location of the underground utility.

Typical daily summertime ticket volume for Cleveland Heights varies and can be sporadic. Larger volumes occur when other utilities (e.g. gas) will be performing wide-scale work in a subdivision. Usually the ticket volumes are still manageable, but if needed, additional sewer or Public Works personnel can assist in marking the utilities.

5.4.4 Training

On-the-job training, OUPS meetings and workshops are provided for technicians who perform this work.

5.4.5 Information Management

All OUPS tickets are received via fax/paper in the Cleveland Heights customer service department. Hard copies are filed in Cleveland Heights Utilities Division.

5.4.6 Resource Management

The Utilities Division is responsible for implementing the Cleveland Heights OUPS program.

5.4.7 Process for Continuous Improvement

None Identified.

5.4.8 Implementation Plan

None identified.

Section 6 - Support Programs

The following CMOM Programs are related to Support programs:

1. Safety
2. Training
3. Information Management
4. Customer Service
5. Legal Support
6. Fats, Oils and Grease (FOG)

6.1 Safety

6.1.1 Program Definition and Purpose

The Commissioner of Utilities is responsible for the Sewer Department Safety program. Sewer-specific safety training is done by an outside vendor; however, all Sewer Maintenance personnel are trained on a regular basis.

6.1.2 Goals and Performance Measures

The goals of Cleveland Heights safety training are to:

- Eliminate or reduce accidents, personal injuries, and property damage.
- Ensure a safe place to work for all employees.
- Provide education and safety training to all employees.
- Provide appropriate personal protection equipment (PPE) to ensure safety and health in job duties.

There are no performance measures associated with the safety training reported under the CMOM Program.

6.1.3 Resource Management

Safety training is the responsibility of the Commissioner of Utilities. The acting foreman for each crew is responsible for safety on the job and for communicating/reporting any safety concerns to the Sewer Supervisor.

6.1.4 Program Description and Components

Safety training is an ongoing requirement for Cleveland Heights employees. Regular training is provided to safely perform all types of activities, especially the hazards that are inherent in the day-to-day requirements of maintenance staff. Safety training is typically conducted for staff members bi-annually or as required by their specific job responsibilities.

The Cleveland Heights Safety program topics include, but are not limited to:

- Confined Space Entry
- Blood Borne Pathogens
- Personal Protective Equipment
- Defensive Driving
- First Aid

- Traffic Safety
- Heat-related and Cold-related Illnesses
- Trenching and Excavation

The safety program is reviewed annually, and additional safety topics will be added if identified as needed by the Sewer Department. Specific training programs may be reviewed and enhanced if an incident occurs in which additional training may prevent or better educate staff to avert similar incidents in the future.

6.1.4.1 Personal Protective Equipment

Cleveland Heights is committed to creating the safest and healthiest environment possible for its employees. Cleveland Heights provides all employees with job-specific personal protective equipment (PPE) upon initial hire and replaces equipment on an as-needed basis using the Safety Equipment Form.

The Sewer Supervisor will provide the replacement PPE and the employee will sign the Safety Equipment form that confirms that they have all their proper PPE. The signed form is given to the Commissioner of Utilities and is kept on file. An example copy of the signed Safety Equipment form is included in Appendix E.

6.1.4.2 Outside Contractors

Cleveland Heights requires all outside contractors to have safety programs in place. Contractors are responsible for implementing their safety programs in accordance with all local, state and national rules and regulations.

6.1.5 Training

New hires receive a safety summary manual that contains information related to safety training. Additionally, job-specific training is provided in a wide range of topics listed in Section 6.1.4.

6.1.6 Information Management

While not reported under CMOM, the Sewer Department tracks recordable and non-recordable incidents, near-miss accidents, and vehicle accidents per OSHA reporting requirements. These records are kept in the Sewer Supervisor’s office. Training related to safety is tracked and hardcopies are filed in the Sewer Supervisor’s office.

6.1.7 Process for Continuous Improvement

The Sewer Department has safety posters in the sewer garage for relevant topics including confined space entry. These posters contain a safety-related message. The Department uses the posters to perform training within their work centers.

6.1.8 Implementation Plan

None identified.

6.2 Training

6.2.1 Program Definition and Purpose

Employee training programs and educational assistance benefits are essential to the operation and maintenance of the sewer system. Cleveland Heights maintains training requirements to ensure safe and effective operation and maintenance of the collection system. Because of the importance of consistency in the sewer system inspection program, MACP and PACP certification training has been identified as essential to the employees performing these inspections.

6.2.2 Goals and Performance Measures

The goal of Cleveland Heights' Training program is to train all employees to perform job duties safely and effectively and provide training opportunities for career enhancement.

Table 6-1 Training - Performance Measures

Measure Number	Measure Name	Description	Calculation	Target Value
6.2.2.1	NASSCO MACP and PACP Training	Employees need to be recertified every three years on NASSCO MACP and PACP.	Number of employees with current NASSCO certification.	At least 7

6.2.3 Program Description and Components

Training specific to individual CMOM Programs is described in the CMOM Program documentation sections. This section describes technical and skills training specifically for system inspection and response to SSOs. All employees involved in system inspection will have received PACP and MACP training and certification. As part of the Sewer Overflow Response Plan (SORP) employees that may respond to an SSO will be trained in response procedures. As part of the IMS implementation employees will be trained on data collection, information management, data reporting and recordkeeping. During new employee orientation, employees are provided with a handbook on policies and procedures, and review of Cleveland Heights' fundamental mission, goals and policies. Subsequent training is based on individual needs, position requirements and advancement goals.

6.2.3.1 Safety Training

Safety training is an ongoing requirement for Cleveland Heights employees. Regular training is provided to safely perform all types of activities, including confined space entry, trenching and shoring, traffic control, electrical maintenance, and pump station operations and maintenance. Details of the Safety Training can be found in Section 6.1.

Cleveland Heights safety training is provided through:

- Outside vendors
- Manufacturer training
- On-the-job training

6.2.3.2 Management Training

Cleveland Heights partners with instructors from consultants to provide management training to Cleveland Heights managers and supervisors. Training topics include employee management, conflict resolution, management tools, human resources, teamwork and communication.

6.2.3.3 Skills Training

Cleveland Heights provides skills training for computer use including familiarity and basic functions of Microsoft Word, Excel and Outlook. IMS implementation training with Lucity will include data collection, information management, reporting and record keeping using the software.

6.2.3.4 Technical Training

Most technical training provided to employees is through on-the-job training. On-the-job training is provided to new field Sewer Maintenance staff. Employee training completion and comprehension is assessed as part of annual employee performance evaluations. Additionally, the City has developed and will be developing SOPs for procedures required for specific inspection and maintenance activities. Equipment or program-specific training is provided by equipment vendors or industry associations.

6.2.3.5 College Tuition Reimbursement

To provide an incentive for employees to earn college credit, Cleveland Heights reimburses tuition fees to qualified employees who attend college to earn a degree needed to meet job requirements or prepare for advancement. Cleveland Heights reimburses employees for each course they successfully complete.

6.2.4 Training

Staff members who administer Training Programs are provided on-the-job training for specific job responsibilities.

6.2.5 Information Management

Employees' training records are currently maintained as part of employee performance evaluations. As part of the Lucity installation, systems are being created which include training tracking and notification of upcoming training needs. Tracking information will include;

- Date of training,
- Topics covered,
- Name(s) and affiliation of the instructor,
- Names of employees who received training.

This information will be included in Cleveland Heights Consent Decree Annual Reporting.

6.2.6 Resource Management

Instructors come from both within the organization and from other organizations or outside consultants. Content is delivered through a variety of methods, including lectures, discussions and on-the-job. The Utilities Commissioner oversees the Training program for the Sewer Department.

6.2.7 Process for Continuous Improvement

Cleveland Heights periodically reviews and revises the Training program as necessary. For example, responsiveness to a dry weather SSO may be evaluated and any deficiencies noted in the response would be incorporated into the next SSO response training session. Failure of staff to keep training up to date for example, in MACP and PACP certification, could result in being taken off inspection crews until the required training is completed.

6.2.8 Implementation Plan

Table 6-2 Training - Implementation Plan			
Reference Number	Program Milestone	Description	Time Frame
6.2.8.1	Training Activity Documentation	Formally track activity proficiencies for each staff member to assure they are adequately trained to operate the collection system.	2 years

6.3 Information Management

6.3.1 Program Definition and Purpose

Cleveland Heights uses a variety of information management tools to support management, operations and maintenance activities by providing for the storage, retrieval and analysis of data related to its assets and their condition, and work performed to maintain them.

6.3.2 Goals and Performance Measures

The Information Management program will develop and implement sustainable, useful, up-to-date and accurate systems and related business processes to increase the efficiency of Cleveland Heights' CMOM Program. An Information Management System Development Plan has been created to streamline conversion to Lucity as Cleveland Heights' primary Information Management System. This plan is included as Appendix F of this CMOM document, and is scheduled to be implemented by December 1, 2018 as noted in Table 6.3.

6.3.3 Program Description and Components

Cleveland Heights Sewer Department currently uses a variety of information management systems for data about personnel, assets, customer service, project tracking, etc. The CMOM Information Management program focuses on asset management and work management information.

6.3.3.1 Geographic Information System

A fundamental function of the Information Management program is the development and maintenance of a Geographic Information System (GIS). The GIS provides a spatial representation (map) of the system assets, including pipes, manholes, and pump stations, as well as other features under the responsibility of the Cleveland Heights Sewer Department. Asset attributes are accessible through a map interface. Updates to the maps and addition of new assets are overseen by the Management Information Services (MIS) Department. Many GIS modifications will be identified and updated in real time in the field during the SSES and CMOM follow-up work. The GIS Analyst in the MIS Department will verify the updates and make monthly revisions to the GIS. There are various GIS tools available to Cleveland Heights personnel as described below.

Northeast Ohio Regional Sewer District ArcGIS Online (AGOL)

NEORSD operates an online GIS to maintain the District's and local communities' assets and pipes. It also is a repository for inspection and maintenance data from studies and other sources. The District allows the local communities access to the mapping and the Cleveland Heights Sewer Department has login capabilities. Cleveland Heights can then upload information contained in the District's AGOL system into their local GIS platform. A screenshot of AGOL is shown in **Figure 6-1** on the following page.

Internal ArcGIS Server

The City has purchased and installed a local ArcGIS Server and Desktop Software from Esri. The City will be working with NEORSD to get all their data layers uploaded to the new local system. The transfer of information is nearly complete.

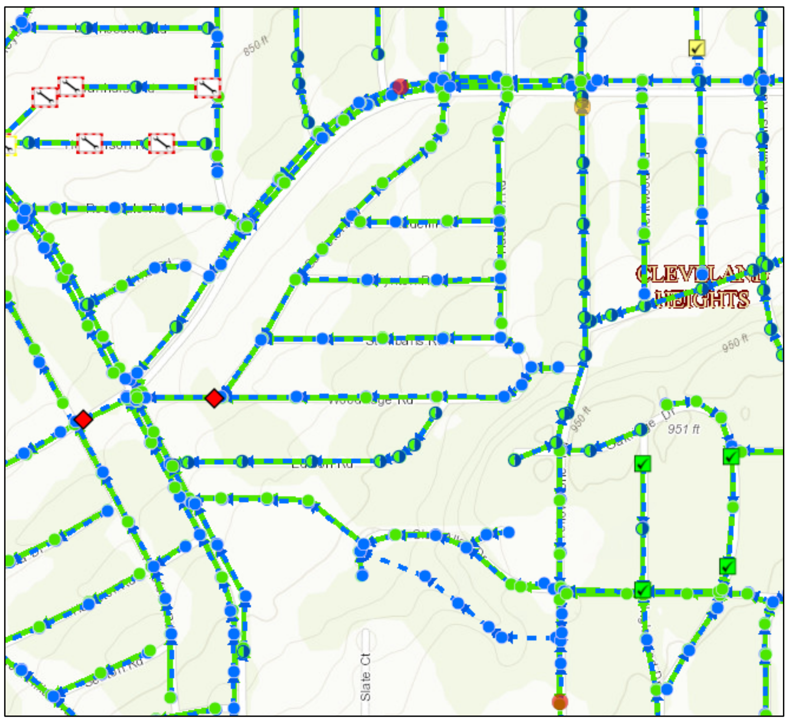

Figure 6-1 Screenshot of AGOL Map

6.3.3.2 Work Management – Lucity Software

Cleveland Heights has selected, procured, and installed Lucity for its Computerized Maintenance Management System (CMMS). Lucity's GIS-centric approach supports maintenance and daily operations, allowing Cleveland Heights to organize, manage, and maintain asset information and related work history using a map interface. Asset information collected includes:

- Location, size, material and configuration of all collection system assets,
- Date of installation, if known,
- Condition of the assets,
- History of any field investigation done on the asset,

- Maintenance history.

Various tools allow users to visualize scheduled work, ongoing activities, recurring maintenance problems, and historical information. Initial implementation for sewer assets is ongoing. Once data is input into the system, it will remain indefinitely, and will be updated as new information becomes available. Additional information on the Lucity install can be found in the IMS Development Plan in Appendix F.

New World Software

While implementation of Lucity is ongoing, Cleveland Heights continues to use Tyler Technologies New World Software to schedule appointments, track complaints and work orders, and view customer history and work orders related to sewer and service lead cleaning. As the new software package is enabled, the information stored in New World will be transferred to Lucity. Use of New World software will be phased out once Lucity is fully functional.

6.3.4 Training

Once Lucity is fully implemented, several employees will be trained by a Lucity representative on the software package. Lucity will also provide on-the-job training so that additional employees will have a working knowledge of the software.

6.3.5 Information Management

Currently, NEORSD’s AGOL GIS system serves as a master asset registry that will be carried over into the new in-house GIS system. Work performed on assets (e.g., CCTV with push camera) is recorded referencing the nearest address. After implementation, Lucity will track all work orders related to the asset IDs imported from the NEORSD GIS. Condition information will continue to be captured by Cleveland Heights staff, obtained through subcontractors and through past and present NEORSD studies, which will be aggregated into a central repository on Cleveland Heights’ network with the intent of populating the GIS.

6.3.6 Resource Management

The GIS Analyst is primarily responsible for the implementation of the Information Management program and supporting the Sewer Department.

6.3.7 Process for Continuous Improvement

Development of an Information Management system is a continuous improvement process to refine asset attributes based on observations in the field, the discovery of previously unmapped assets, etc. Updates and revisions will be continuously forwarded to the GIS Analyst to maintain the various information management systems.

6.3.8 Implementation Plan

Table 6-3 Information Management - Implementation Plan			
Reference Number	Program Milestone	Description	Time Frame
6.3.8.1	IMS Software	Implement Information Management System.	by December 1, 2018
6.3.8.2	Computerized Work Management	Advance data collection by implementing computerized work order tracking for CMOM preventive maintenance work orders.	3 years

6.4 Customer Service

6.4.1 Program Definition and Purpose

The Customer Service program manages customer service calls, public and media interaction and outreach activities.

6.4.2 Goals and Performance Measures

The goals of the Customer Service program include:

- Perform work activities in a manner that is in the best interest of the organization and the customers it serves.
- Maintain good customer relations by being courteous, helpful and conveying confidence during interactions with customers.
- Promote public understanding and engagement with the functions and mission of the City of Cleveland Heights.

6.4.3 Program Description and Components

The Customer Service program manages customer service calls, public and media interaction and outreach activities.

6.4.3.1 Customer Service Calls

During normal business hours, Utilities Administration staff at the Utilities Division initially receive customer calls pertaining to sanitary sewer issues. Pertinent information is obtained from the customer to complete a Sewer Maintenance Inquiry Form using the New World Software. An example of the front page of the form is shown in Figure 6-2. For sewer maintenance orders, status code D is used on the form. New forms will be developed in the new software.

```
City of Cleveland Heights                                                UT0865S2
12/13/16                           WATER BILLING
                           Account Master File Maintenance
                                                             CHANGE
Account#:                       Status Code: ___A Active
Name....:
Address.:
Mail Code/Addr.:                                           Carrier Route: ____

                                        ***********************************
                                        *       Available Options:        *
                                        * 1. General Billing Information *
Home Phone #...:                        * 2. Meter Information            *
Work Phone #...: ___________            * 3. Other Charge Information     *
Customer Type..: ___R Residentia        * 4. User Defined Account Tables *
Service Type...: _WSL Wat,Sew,Lf        * 5. User Defined Account Dates   *
Rental.........: N                      ***********************************
Life Support...: N                      * A. Inactive Information         *
Number of Units: ___10_                 * B. Payment Plan Information     *
Date Moved In..: ________               * C. SRSUC Information            *
Identification Num.: ________________   * D. Sewer Maintance Orders       *
Property Number....: ________________
Major Owner...:                         Option...: _
 F3=Exit              F23=Account Narrative          F24=Tenant Narrative
```

Figure 6-2 Sewer Maintenance Inquiry Form

An appointment is scheduled if requested, or, if the problem needs immediate attention, the crew members on call that day are dispatched to investigate the issue. The customer will be informed of the results by the crew members on site or by telephone, if necessary.

For calls after normal business hours, phone calls are forwarded to the non-emergency police number, and then forwarded to the Sewer Supervisor. If necessary, the on-call crew is dispatched to investigate the issue.

The Sewer Maintenance Inquiry Form facilitates collection of customer information including: name, location, date/time, and problem description. The form also has a section for investigation results. Follow-up information from the inquiry is reported back from the responding crew after the maintenance visit and is input into the system directly. The standard data includes whether there was water in the customer's basement, the cause of sewer issue if known, operational condition of the mainline, homeowner follow up required and time completed. Forms for past house calls are available and can be accessed by the crew performing the maintenance request.

6.4.3.2 Cleveland Heights Website

The City of Cleveland Heights maintains a public website that includes information produced by the Public Works Division and Utilities Division. The website serves as the first interaction with the Utilities Division for many customers. Designed to be useful for new and existing customers, the website includes a department description, Consent Decree description, a link for questions relating to the Consent Decree or other general inquiries, department contacts, Sewer System dos and don'ts, and a link to report sewer problems via email. The website will be providing monthly reports and SSO activation information as required in the Consent Decree.

6.4.3.3 Media Communication

Media communication is handled by the Community Relations Department within Cleveland Heights.

6.4.4 Training

Utilities Administration staff receive on-the-job training. Training is conducted in shifts so that there are always personnel available to take calls.

6.4.5 Information Management

The Utilities Administration staff uses New World software to manage customer account information including service calls, ongoing issues, etc. All calls to the Public Utilities Division are tracked with dated description entries for continuity between customer service representatives.

6.4.6 Resource Management

Utilities Administration/Billing is located at City Hall, 40 Severance Circle, and has four staff members.

The Management Information Services Director oversees the City website and Utilities Division webpage. A small team of Management Information Services Department personnel can update website content.

6.4.7 Process for Continuous Improvement

Staff review operations and content periodically to assess if the program can be improved.

6.4.8 Implementation Plan

Table 6-4 Customer Service - Implementation Plan			
Reference Number	Program Milestone	Description	Time Frame
6.4.8.1	Sewer Problem Tracking in New IMS Software	The new IMS software will have improved tracking software for resident sewer calls. Incorporate current tracking systems into the new software.	1-2 years
6.4.8.2	Webpage updates	Include monthly reports and SSO reports to the website once IOCMP and SSES activities have commenced and provide updated public education materials for increased public awareness.	1-2 years

6.5 Legal Support

6.5.1 Program Definition and Purpose

The purpose of the Legal Support program is to provide appropriate legal authority to support the management, operations and maintenance of the City's sanitary collection system. The City, through its codified ordinances and the Ohio Revised Code (ORC), has legal authority to ensure compliance with the Uniform Standards for Construction of Sewerage Improvements.

The City has adopted the Uniform Rules, Regulations, and Standards for the Design and Construction of Sewerage Improvements, dated May 11, 1978. As part of the CMOM Implementation, the City will adopt the 1998 version and subsequent updates of the Uniform Standards for Construction of Sewerage Improvements.

6.5.2 Goals and Performance Measures

The goals of Cleveland Heights' Legal Support program are to provide legal authority to:

- Generally, ensure compliance with the Uniform Standards for Construction of Sewerage Improvements.
- Control infiltration and connections from inflow sources.
- Require sewers and connections be properly designed and constructed.
- Ensure proper installation, testing and inspection of new and rehabilitated sewers (such as new or rehabilitated collector sewers and/or new or rehabilitated service laterals).
- Implement the general and specific prohibition of the national pretreatment program.

6.5.3 Program Description and Components

Under the ORC (shown below), the director of public service (e.g. City Manager for Cleveland Heights) may implement bylaws and regulations to enforce the standards in the Uniform Standards for Construction of Sewerage Improvements, December 1998 *(once adopted).*

Ohio Revised Code 729.51 Bylaws and regulations.

> The director of public service and the board of trustees of public affairs may make such bylaws and regulations as are necessary for the safe, economical, and efficient management and protection of the sewerage system and sewage pumping, treatment, and disposal works mentioned in Section 729.49 of the Revised Code, and for the construction and use of house sewers and their connections to the

> sewerage system. Such bylaws and regulations shall have the same effect as ordinances, when not repugnant thereto, or to the constitution or laws of the state.
>
> Effective Date: 10-01-1953.

Cleveland Heights previously adopted 1978 Uniform Standards as shown below. This ordinance will be updated to the December 1998 version as part of CMOM Program implementation.

Cleveland Heights Codified Ordinances 911.04 CONSTRUCTION OF SEWERAGE IMPROVEMENTS.

> The City hereby approves and adopts the Uniform Rules, Regulations, and Standards for the Design and Construction of Sewerage Improvements, dated May 11, 1978, as formulated by the Committee on Uniform Standards. A copy of such Uniform Rules, Regulations and Standards is on file in the Office of the Clerk of Council.
>
> (Ord. 112-1978. Passed 10-2-78.)

The Uniform Standards for Construction of Sewerage Improvements, December 1998, provides requirements which support the goals of the Legal Support Program. The document is attached as **Appendix G**. For example, Part 3 documents standards for properly designing and installing new sewers including lateral connections. Additional excerpts related to Fats, Oils and Grease (FOG) and inflow are shown below.

Part 4.2B prohibits grease (FOG) discharges which interfere with sewer operation:

> No person shall discharge or cause to be discharged any solid or viscous substances in quantities or of such size capable of causing obstruction to the flow in sewers, or other interference with the proper operation of the sewage works such as, but not limited to: ashes, cinders, sand, mud, structural materials, straw, shavings, metal, glass, sludge, feathers, grease and fats, tar, plastics, wood, unground garbage, whole blood, paunch manure, hair and fleshings, entrails, and paper dishes, cups, milk containers, chemical residues, paint residues, lime slurry or cannery waste bulk, etc. (either whole or ground by garbage grinders).

Part 5.203B prohibits sources of inflow:

> No storm water which accumulates in excavated basement areas is to be discharged into the sanitary sewerage system. Roof drains, foundation drains or any other clean water connections to the sanitary sewer system are prohibited.

6.5.4 Training

As programs related to private property I/I and FOG enforcement are developed and implemented, City staff will be trained on implementation procedures.

6.5.5 Information Management

Programs related to private property enforcement will have information management systems established during implementation.

6.5.6 Resource Management

The City has attorneys on staff who assist with legal issues.

6.5.7 Process for Continuous Improvement

None Identified.

6.5.8 Implementation Plan

Table 6-5 Legal Support - Implementation Plan			
Reference Number	Program Milestone	Description	Time Frame
6.5.8.1	Adopt Uniform Standards for Construction of Sewerage Improvements	Cleveland Heights will adopt the latest version of the Uniform Standards for Construction of Sewerage Improvements into its codified ordinance to take advantage of language clarifying prohibited discharges into the sewer system.	1 year

6.6 Fats, Oils and Grease

6.6.1 Program Definition and Purpose

The buildup of fats, oils and grease (FOG) in gravity sewers and pump station wet wells can significantly contribute to obstructions in the sanitary sewer. The purpose of the FOG program is to protect human health and the environment by minimizing the FOG entering the sanitary sewer system and mitigating the impacts of FOG that does enter the system.

6.6.2 Goals and Performance Measures

The goals of the FOG program are to:

- Preserve sewer capacity.
- Reduce potential of blockages in the system.
- Reduce FOG-related SSOs and the related risk to public health and the environment.
- Reduce the need for High Frequency Cleaning.
- Reduce utility maintenance costs associated with responding to grease-related SSOs and blockages.
- Enforce prohibitions of FOG discharge to reduce likelihood of recurrence.

Performance measures for the FOG program are shown in Table 6-6.

Table 6-6 Fats, Oils and Grease - Performance Measures				
Measure Number	Measure Name	Description	Calculation	Target Value
6.6.2.2	System Issues determined to be caused by FOG	The annual number of system issues related to FOG provides an indication and trend of progress being made to reduce these occurrences.	Number of system SSOs and known blockages related to FOG per year	Trend

6.6.3 Program Description and Components

The FOG program actively works to reduce the recurrence of FOG issues in the collection system. An Interim FOG and Root Problem Analysis completed by Cleveland Heights in August 2017, provides an introductory discussion of Cleveland Heights FOG problem areas and monitoring procedures. This report can be found in Appendix H of this CMOM. There are regulations in place as part of Section 4 of the Uniform Standards for Sewerage Improvements, referenced in Cleveland Heights' Sewer Regulations. The Sewer Department, the Building Department and the Cuyahoga County Board of

Health (CCBOH) implement the FOG program including the activities summarized below. The summaries contain references to the Uniform Standards for Sewerage Improvements which are subject to regular updates.

Inspections

The Cleveland Heights Building Department inspects grease traps and plumbing for new installations. The CCBOH conducts inspections of FOG haulers and food service establishments (FSEs). These inspections use a standard form for consistency. Inspections are typically annual or biannual depending on defined levels of risk. Levels of Risk defined by CCBOH that establish a tiered compliance inspection frequency can be found in **Appendix I**. Inspection records are maintained on the CCBOH website at http://healthspace.com/clients/ohio/cuyahoga/cuyahoga_web_live.nsf. Locations of FOG haulers and FSEs will be imported into the Sewer Departments GIS as part of the FOG Generator Compliance Plan implementation.

Permitting

The Cleveland Heights Building Department can use the permitting process for new FSEs to ensure compliance with the Uniform Standards. This process includes issuing permits to FSEs with associated requirements for grease interceptor installation and maintenance.

Best Management Practices

Cleveland Heights is developing best management practice (BMP) educational material for distribution in problem areas and for new connections. Additionally, during house calls with excessive grease noted in the lateral, sewer crews notify the customer of the problems caused by flushing grease and other potential obstructive objects into sewers and drains.

System Maintenance

The Sewer Department maintains a list of "hot spots" for increased cleaning and/or inspections. The list includes locations of known previous issues, nature of the previous issue and the appropriate maintenance action (I.e., check, flush, grease control). The current list of hot spots and maps associated with these areas are shown in **Appendix H**.

6.6.4 Training

Sewer Department personnel receive on-the-job training for specific duties, including educating private residents during house calls, and SOPs will be developed for addressing FOG in the collection system.

6.6.5 Information Management

All FSE inspection reports are kept on file with the Building Department or CCBOH webpage. Inspections of the FSEs are added to the FSE file on the CCBOH webpage to maintain a historic record of performance for each FSE. Sewer Department personnel have access to FOG generators inspections through the CCBOH website and will eventually have access through the City's GIS as part of the FOG Generator Compliance Plan implementation.

6.6.6 Resource Management

The CCBOH and Building Department provides monitoring, permitting and reporting for the FOG program. The Sewer Department addresses manifested FOG issues in the collection system and communicates the findings back to the CCBOH for follow-up inspection and potential enforcement action.

6.6.7 Process for Continuous Improvement

As IOCMP and SSES field inspections and activities progress, the Sewer Department will assess the need for a formal FOG control program. The Consent Decree suggests potential topics to be covered if a program is deemed necessary. The high frequency cleaning location list will be optimized depending on field findings.

6.6.8 Implementation Plan

The implementation measures mentioned in Table 6-7 are subject to field findings and the assessment of a need for a formal FOG control program. FOG program elements will be phased into implementation as needed based on results of the Cleveland Heights Sewer System Evaluation Survey (SSES) and CMOM activities.

Table 6-7 Fats, Oils and Grease - Implementation Plan

Reference Number	Program Milestone	Description	Time Frame
6.6.8.1	FOG Generator Compliance	A progressive compliance assistance program for generators, GIS update, guide identifying applicable city ordinances and regulations, establish performance indicators, disposal manifest system, staffing to implement FOG Program, and establish a FOG enforcement program	10 years
6.6.8.2	FOG Control	Track and ID sources of all FOG-related SSOs and blockages, Public education program, establish standards for design and construction of FOG control devices	IOCMP Commencement - 10 years

Section 7 - Program Evaluations

7.1 Audits and Performance Measures of CMOM Program

7.1.1 CMOM Program Audits

Performance evaluations of Cleveland Heights' CMOM Program will occur at intervals of approximately three years to evaluate changes and/or deficiencies in the CMOM Program and define steps to respond to program modifications. Revisions, as appropriate, will be made as results of the audit and evaluation or as other circumstances dictate.

Audits will include evaluation of each CMOM Program element for consistency with current practices and evaluation of progress on improvement initiatives. Changes in processes, procedures or documentation will be updated, as appropriate, in the CMOM Program based on the findings of these audits.

7.1.2 Summary of Performance Measures

As part of CMOM implementation, Cleveland Heights will track performance measures to allow for the on-going evaluation of operations, maintenance and system performance criteria. The system performance data will be reviewed in conjunction with the program element performance measures identified in this document. When analyzed together, this relevant information will allow diagnosis of any areas that need adjustment, additional resources or increased emphasis. Cleveland Heights has established a goal to develop the systems necessary to track the performance measures in the CMOM Program within one year of CMOM Program approval.

Although the CMOM document will be reviewed and updated on a three-year basis, the overall system performance and status of improvement initiatives will be evaluated in an annual assessment and on an on-going basis.

Table 7-1 lists the performance measures that have been identified and will be reviewed over the next three-year period. The annual assessment complements ongoing internal audit of system data and provides an opportunity to reflect on the current year's performance data to compare results with the previous year's performance data to determine if there are any trends which may identify the need for program adjustments. Cleveland Heights may adjust the measures and targets as necessary to best track the goals of the CMOM Program.

Table 7-1 City of Cleveland Heights Performance Measures				
Performance Measure Number	Performance Measure Name	Description	Calculation	Target Value
2.1.2.1	Number of SSOs	Track number of SSOs by failure type.	Number of SSO events per year	Trend
2.1.2.2	SSO Release Reporting	Report spills discharged to the waters of the State to Ohio EPA and USEPA.	(Number of notifications completed within 24 hours / Total number of reports per year) * 100%	100%
2.1.2.3	SSO Release Report Follow-up	Provide 5-day follow-up report for non-structural SSOs.	(Number of 5-day follow-up reports submitted on time / Total number of reports per year) * 100%	100%
2.1.2.4	SSO Response Training	Ensure all personnel whose duties require SSO response, reporting, and recordkeeping are properly trained.	(Number of employees trained annually / Number of employees involved) * 100%	95%
4.1.2.1	CIP Implementation	Complete identified replacement and rehabilitation projects to abate the likelihood of failures in the system.	Number of CIP or Infrastructure Replacement projects completed which address specific SSO abatement plans	Trend
5.1.2.1*	Gravity Sewer Cleaning	Obstructions in Gravity Sewer systems can contribute to SSOs. The systematic cleaning of the system removes debris and accumulations of solids resulting in reduced potential for SSOs. This measure monitors performance of gravity sewer cleaning to remove debris.	At least 25 miles of gravity main cleaned per calendar year	100%
5.1.2.2*	Gravity System Inspections	Internal inspection of the Gravity System provides useful information to assess the condition of the lines allowing proactive measures to be taken to reduce infiltration and identify conditions that may lead to failure. This measure monitors total inspection in a 10-year cycle.	Inspect entire sanitary system on a 10-year cycle	100%
5.1.2.3*	Gravity System Inspections	Internal inspection of high risk assets is important to maintain the life expectancy of the collection system. Cleveland Heights will investigate all PACP and MACP condition scores of 3 or greater on a 5-year basis.	Inspect pipes and manholes graded 3 or worse on a 5-year cycle	100%
5.1.2.4*	System Issues determined to be caused by roots	The annual number of system issues related to roots provides an indication and trend of progress being made to reduce these occurrences.	Number of system issues related to roots per year	Trend
5.2.2.1*	Pump Station Routine Inspections	Monthly routine inspection of each of its pump stations to identify potential issues.	(Number of routine pump station inspections monthly / Total number of pump stations) * 100%	100%
5.2.2.2*	Pump Station Comprehensive Inspections	Biannual comprehensive inspections at each of its pump stations to identify potential issues.	(Number of comprehensive pump station inspections biannually / Total number of pump stations) * 100%	100%
5.4.2.1	OUPS Marking	Properly marking underground utility lines promotes public safety and system	Number of sewer asset utility strikes with mismark by Cleveland	0

Table 7-1 City of Cleveland Heights Performance Measures				
Performance Measure Number	Performance Measure Name	Description	Calculation	Target Value
		reliability. This measure monitors Cleveland Heights asset damage from mismarks.	Heights	
6.2.2.1	NASSCO MACP and PACP Training	Employees need to be recertified every three years on NASSCO MACP and PACP.	Number of employees with current NASSCO certification.	At least 7
6.6.2.2	System Issues determined to be caused by FOG	The annual number of system issues related to FOG provides an indication and trend of progress being made to reduce these occurrences.	Number of system SSOs and "near miss blockages" related to FOG per year	Trend

**These measures will be tracked after implementation of the preventive maintenance procedures described in Table 7-2.*

7.2 Implementation Plan

7.2.1 Implementation Plan

Cleveland Heights is committed to continuous improvement in the CMOM Program. This section summarizes the implementation plan and improvement initiatives defined in each CMOM Program area previously discussed in this plan where the City will focus attention to enhance existing programs. As part of the continuous improvement process, the City will revisit these improvement areas to assess progress, adjust actions, identify new areas of improvement, move areas completed off the implementation list, and make other adjustments as necessary to reflect circumstances at the time of the evaluation. The implementation plan for each program area is summarized in Table 7-2.

Table 7-2 Implementation Plan				
Section Reference	Program Area	Program Milestone	Description	Time Frame
2.1.8.1	Add SSOs to GIS	Populate GIS with SSO locations and additional SSO activation	To improve tracking of SSO structures and SSO events, new GIS mapping will be updated with this information.	1 year
4.1.8.1	Design and Construction Standards	Capital Planning Enhancement	Update CIP which was last updated in 2003 and evaluate on an annual basis based on findings from IOCMP and subsequent SSES activities.	3 years
5.1.8.1	Gravity System Maintenance	Gravity Sewer Maintenance	Develop an SOP for sewer line and manhole cleaning and routine maintenance.	1 year
5.1.8.2	Gravity System Maintenance	Gravity Sewer Maintenance	Cleveland Heights intends to acquire a CCTV truck and get operators trained to allow for in-house CCTV capabilities.	1-2 years
5.1.8.3	Gravity System Maintenance	Gravity Sewer Maintenance	Use Lucity to track maintenance costs associated with sewer assets.	2 years
5.2.8.1	Pump Station and Force Main Maintenance	Pump Station Operational Inspections	Develop an SOP for pump station general inspections.	1-2 years
5.2.8.2	Pump Station and Force Main Maintenance	Pump Station Operational Inspections	Develop an SOP for pump station operational procedures.	1-2 years
6.2.8.1	Training	Training Activity Documentation	Formally track activity proficiencies for each staff member to assure they are adequately trained to operate the collection system.	2 years
6.3.8.1	Information Systems	IMS Software	Lucity software has been installed. Complete Information Management System Development Plan.	by December 1, 2018
6.3.8.2	Information Systems	Computerized Work Management	Advance data collection by implementing computerized work order tracking for CMOM preventive maintenance work orders.	3 years
6.4.8.1	Customer Service	Sewer Problem Tracking in New IMS Software	The new IMS software will have improved tracking software for resident sewer calls. Incorporate current tracking systems into the new software.	1-2 years

Table 7-2 Implementation Plan				
Section Reference	Program Area	Program Milestone	Description	Time Frame
6.4.8.2	Customer Service	Webpage updates	Include monthly reports and SSO reports to the website once IOCMP and SSES activities have commenced and provide updated public education materials for increased public awareness.	1-2 years
6.5.8.1	Legal Authority	Adopt Uniform Standards for Construction of Sewerage Improvements	Cleveland Heights will adopt the latest version of the Uniform Standards for Construction of Sewerage Improvements into its codified ordinance to take advantage of language clarifying prohibited discharges into the sewer system.	1 year
6.6.8.1	Fats, Oils, and Grease	FOG Generator Compliance	A progressive compliance assistance program for generators, GIS update, guide identifying applicable city ordinances and regulations, establish performance indicators, disposal manifest system, staffing to implement FOG Program, and establish a FOG enforcement program	Phased in over 10 years based on SSES and CMOM
6.6.8.2	Fats, Oils, and Grease	FOG Control	Track and ID sources of all FOG-related SSOs and blockages, Public education program, establish standards for design and construction of FOG control devices	IOCMP Commencement -10 years

Appendix A: Sewer Overflow Response Plan

Appendix B: High Frequency Cleaning List

Appendix C: Root Control Maintenance SOP

Appendix D: Sewer Maintenance Spare Parts Inventory

Appendix E: Safety Equipment Form

Appendix F: Information Management System Development Plan

Appendix G: Uniform Standards for Sewerage Improvements

Appendix H: Interim FOG and Root Intrusion Problem Analysis

Appendix I: Levels of Risk for Inspection Frequency

City of Cleveland Heights

Sewer Overflow Response Plan (SORP)
Final

Prepared For

Revised

May 30, 2017

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APPENDICES

1.0 General

The City of Cleveland Heights Sewer Overflow Response Plan (SORP) is designed to ensure that every report of a sewage overflow to surface land or water or building backup is immediately dispatched to the appropriate City Sewer Maintenance personnel for response. Staff will confirm the event details and work to minimize the effects of the overflow with respect to public health and surface water quality. The SORP includes provisions to ensure that notification and reporting is made to the appropriate local, state and federal authorities. For purposes of this SORP, "confirmed sewage spill" is also referred to as "sewer overflow," "overflow," or "SSO," and is defined as those overflows from the sanitary sewer system that reach surface land or water, or that backup from the sanitary sewer system through a lateral to a building basement.

The effective date of this plan is May 30, 2017.

1.1 Objectives

The primary objectives of the SORP are to protect public health and the environment, satisfy regulatory agencies, and consistently employ procedures for avoiding SSOs and managing overflows if they occur. **Appendix A** summarizes measures to help avoid SSOs.

Additional objectives of the SORP are as follows:

- Protect collection system personnel
- Protect the collection system and all appurtenances
- Protect private and public property beyond the collection facilities

1.2 Organization of Plan

The key elements of the SORP are addressed individually as

follows: Section 1 - General

Section 2 – Procedure for Overflow Response

Section 3 – Public Advisory Procedure

Section 4 – Regulatory Agency Notification Procedure

Section 5 – Maintenance of SORP

1.3 SSO Structures

The Cleveland Heights system has several manhole structures with overflow pipes intended to relieve the sanitary sewer during large rain events. A list of these SSO structures and locations is provided in **Appendix B**. All piped, or known SSO structures have been inspected per the National Association of Sewer Service Companies (NASSCO) Manhole Assessment Certification Program (MACP) standards during the Northeast Ohio Regional Sewer District (NEORSD) Heights Hilltop Local Sewer System Evaluation Study (LSSES) project. These inspections are on record in the Utilities Division.

Activations at these known SSO locations are currently monitored by tethered block at the overflow pipe. Within 24 hours after a rain event over 0.25 inches, the blocks are checked by Sewer Maintenance Personnel to see if they have been displaced. This period may vary based on other unplanned staff priorities and/or afterhours timing of rainfall. A Sanitary Sewer Overflow Monitoring Field Form is completed for each SSO visited that records the date, time, inspector's name, if the overflow activated and estimated gallons of overflow. An example of the form can be found in **Appendix C** of this report. The inspection reports are sent to USEPA Region 5 and Ohio EPA on a monthly basis. If a rain event of 0.25 inches does not occur within a month, the tethered blocks are checked to make sure they are in place, are not stuck to the weir surface, and that there hasn't been evidence of a dry weather overflow. If a dry weather overflow is observed at the time of the tethered block check, or is otherwise detected, overflow response measures described in this document and summarized below will be initiated.

- Inspect piping at manhole for blockage of sanitary sewer outlet. Remove any blockage.
- Inspect next manhole downstream.
  - If flowing normally, clean and inspect sewer reach downstream of surcharged manhole per section 2.3 and Appendix D.
  - If surcharged, check downstream manholes to isolate location and cause of surcharge.
- Address blockage or collapse as per Section 2.3. and Appendix D

Any future modifications to the monitoring methods of designed SSOs will be updated in this document.

2.0 Procedure for Overflow Response

The Overflow Response Procedure presents a strategy for the City of Cleveland Heights and the Sewer Maintenance Supervisor to mobilize labor, materials, tools and equipment to correct or repair conditions that may cause or contribute to an unpermitted discharge to surface land or water, or back up through a service lateral into a building. **Appendix D** contains Emergency Procedures for responding to common causes of SSOs.

2.1 Receipt of Information Regarding Sanitary Sewer Overflows

An overflow may be reported by the public or detected by City employees or others. The City of Cleveland Heights is responsible to act based on phone calls or reports of possible sewage overflow from the collection system, and to provide immediate response.

Telephone calls from the public reporting possible sewer overflows are directed to the City Public Utilities Division at 216-291-5995, where phone hours are 8:30 AM to 5:00 PM, or via email through the Public Utilities Division web page at: http://www.clevelandheights.com/index.aspx?page=570, which is checked daily. After hours phone calls are directed by message to call the Cleveland Heights Police Department. A list of public offices to which reports of SSOs may be directed is provided below.

Contact Name	Telephone Number
City Switchboard	216-291-4444
Cleveland Heights Fire Department	216-291-2885
Cleveland Heights Police Department	216-291-4987

Appendix E provides a Sewer Overflow Response Flow Chart that summarizes key steps in the response process.

The Public Utilities Division obtains all information available relevant to the overflow using a standard phone contact form including the following:

- Time and date call was received
- Nearest address and/or cross streets of the specific location of potential overflow
- Description of problem

- Caller's name and phone number
- Any other relevant information that will enable sewer maintenance personnel to quickly locate, assess and stop the overflow

The Public Utilities Division dispatches sewer maintenance personnel to confirm the overflow. Until verified, the reported incident will be referred to as a "possible spill."

A sewer overflow report will be completed by the Supervisor within 24 hours of the responding crew's confirmation of an overflow. A copy of the sanitary sewer overflow response form is shown in **Appendix F**. See Section 4 of this report for more information regarding reporting requirements.

2.2 Dispatch of Sewer Maintenance Personnel to Site of Sewer Overflow

Failure of any element of the collection system that threatens to cause or causes an SSO or basement backup must trigger an immediate response to isolate and correct the problem. Personnel and equipment must be available to respond to any SSO location. Additional maintenance personnel shall be "on call" in the event extra manpower is needed. On call staff are required to respond to the Sewer Maintenance Garage within 45 minutes of receiving a call off work hours.

2.2.1 Dispatching Maintenance Personnel

When the City of Cleveland Heights receives notification of a potential sewer overflow, the Public Utilities Division dispatches sewer maintenance personnel with appropriate resources as required. Coordination of response to the overflow is directed by either the Commissioner of Utilities or the Sewer Maintenance Supervisor.

2.2.2 Sewer Maintenance Personnel Instructions

Dispatch sewer maintenance personnel by telephone or radio. Assign appropriate personnel, supplies and equipment needed based on location type and spill reported. Typical supplies and equipment to be available on call response trucks include the following:

- Manhole hook
- Sandbags
- Absorbent pads

- Bleach mixture
- Shovel
- Push camera (normally stored in maintenance building for protection and security, and picked up for overflow response)
- Flashlight
- Gas Detector
- Personal Protective Equipment
- Traffic cones or other traffic control

All dispatched personnel should proceed immediately to the site of the SSO. Report any delays or conflicts in assignments to the Commissioner of Utilities or the Sewer Maintenance Supervisor immediately for resolution. Sewer maintenance personnel report their findings, including possible damage to private and public property, to the Commissioner of Utilities or the Sewer Maintenance Supervisor immediately upon making their investigation.

2.2.3 Additional Resources

The Commissioner of Utilities or the Sewer Maintenance Supervisor receives and responds to requests for additional personnel, material, supplies, and equipment to support sewer maintenance personnel working at the site of a sewer overflow. Additional staff support may include personnel in the City's Streets Division, Parks Division, Properties Division, the Cuyahoga County Sanitary Engineer's Office, and private contractors. Additional equipment may include sewer jet, backhoe, dump truck, containment devices, traffic control, bypass pumping equipment and other vehicles.

2.2.4 Preliminary Assessment of Damage to Private and Public Property

The City maintenance personnel shall use professional discretion to achieve the goals of this SORP. The City maintenance personnel shall not enter private property for purposes of assessing damage unless authorized by the Commissioner of Utilities or Supervisor and the building owner. The City maintenance personnel shall document any damage, if possible, by still photographs and/or video footage of the sewer overflow impacted area to thoroughly capture the nature and extent of impacts. Maintenance personnel will also take proper precautions inside of private property similar to routine sewer calls and try to work at exterior cleanouts rather than inside the basement.

2.2.5 Field Supervision and Inspection

- The Sewer Maintenance Supervisor visits the site of the sewer overflow to ensure that provisions of this Overflow Response Plan and other directives are met.
- The Commissioner of Utilities or Sewer Maintenance Supervisor verbally notifies appropriate regulatory agencies and submits the overflow report to them within the specified time.

2.2.6 Coordination with Hazardous Material Response

- Upon arrival at the scene of a sewer overflow, should a suspicious substance (e.g., oil sheen, foamy residue) be found on the ground surface, or should a suspicious odor (e.g. gasoline) not common to the sewer system be detected, the sewer maintenance crew shall immediately secure the area to make it inaccessible by the public and contact the Sewer Maintenance Supervisor for guidance before taking further action. Staff should use precaution around unknown or ignitable liquids/vapors and keep any source of open flame a safe distance from the spill area.
- The Supervisor shall contact the Fire Department via 911 and provide them with the appropriate information and location. The NEORSD online GIS system, printed sewer maps, and future Cleveland Heights GIS will be available to trace likely flow paths for spills entering the storm and/or sanitary sewer systems.
- Sewer maintenance personnel shall not perform any additional activities until directed by the Fire Department.
- If a hazardous material response team is needed, one of the following HAZMAT companies should be contacted by the Commissioner of Utilities or the Supervisor:

ENVIRO SERVE 4600 Brookpark Road Cleveland, OH 44134 216-642-1311	AKE 503 Broadway Bedford, OH 44146 440-232-0042	Chagrin/Southeast Hazardous Team 5595 Harper Road Solon, OH 44139 440-337-1491

- Upon arrival of the hazardous material response team, the sewer maintenance personnel shall take direction from the team lead. Cleanup and containment will proceed by the sewer maintenance personnel only when the HAZMAT authority determines it is safe and hazardous threats have been mitigated.

2.3 Overflow Correction, Containment, and Clean-up

This Section describes specific actions to be performed by the City sewer maintenance personnel during an SSO. The objectives of these actions are to:

- Protect public health, the environment and property from sewage overflows and restore the surrounding area back to normal as soon as possible.
- Establish perimeters and containment zones with appropriate traffic controls, vehicles or barriers to limit access to the discharge by the public.
- Promptly notify the public and regulatory agency with preliminary overflow information and potential impacts.
- Contain the sewer overflow to the maximum extent practicable, using barriers or natural topography (e.g., hills, berms).
- Limit the travel of the overflow and prevent the discharge of sewage into surface waters.

Cleveland Heights can typically respond adequately with its own personnel and equipment. The Sewer Department has the skills and experience to respond rapidly in the most appropriate manner. An important issue in emergency response is to ensure that the temporary actions necessary to divert flows and repair the problem do not produce problems elsewhere in the system.

Circumstances may arise when the City requires the support of a private sewer repair contractor. Typical examples include large diameter pipes buried at depths requiring sheet piling and dewatering with excavation or open cut sewer rehabilitation operations that may exceed one day to complete. If the need for a private sewer repair contractor arises, contact will be made by the Utilities Commissioner or Sewer Maintenance Supervisor. Available private sewer contractors that have been utilized in Cleveland Heights include:

Fabrizi Trucking	Terrace Construction	Monte Construction
90 Columbia Road	3965 Pearl Road	9290 Amberwood Drive
Valley City, OH 44280	Cleveland, OH 44109	Kirtland, OH 44094
440-234-1284	216-739-3170	440-256-4424

The City has an understanding with these Contractors that response to a sewer emergency will be made as expeditiously as possible.

2.3.1 Responsibilities of City Sewer Maintenance Personnel Upon Arrival

The first personnel who arrive at the site of a sewer overflow must protect the health and safety of the public by mitigating the impact of the overflow to the maximum extent practicable. If the overflow is not the City's responsibility, but there is imminent threat to public health, public or private property, or to the Waters of the State, then the responsible party is contacted and assumes responsibility.

Upon arrival at an SSO, the City sewer maintenance personnel perform the following:

- Determine if feasible the cause of the overflow, e.g. sewer line blockage, pump station mechanical or electrical failure, sewer line break, etc.
- Take immediate steps to stop the overflow, e.g. relieve pipeline blockage, manually operate pump station controls, repairs pipe, etc. Extraordinary steps may be considered where overflows from private property threaten public health and safety (e.g., an overflow running off private property into the public right-of-way)
- Request additional personnel, materials, supplies, or equipment that will expedite and minimize the impact of the overflow, if needed
- Contact Fire and Police Department for assistance with limiting access by the public or traffic control, if required

2.3.2 Initial Measures for Containment

The following measures must be initiated to contain the overflowing sewage and recover, where feasible, sewage that has already been discharged, minimizing impact to public health and/or the environment:

- Determine the immediate discharge point of the overflow, e.g. storm drain, street curb gutter, body of water, stream, etc.
- Contain or isolate the overflow using sand bags and/or other standard materials and equipment.
- Take immediate steps to contain the overflow, e.g., block or bag storm drains, recover sewage using vacuum truck, divert into downstream sanitary sewer manhole, etc.
- City sewer vehicles are equipped with containment booms to control the spread of surface spills. They have absorbent pads and granules to soak up contaminated liquids. They are also equipped with proper personal protective equipment (PPE) to

allow direct contact with a contaminated area.

2.3.3 Additional Measures Under Potentially Prolonged Overflow Conditions

In the event of a prolonged sewer line blockage or a sewer line collapse, bypass pumping may be required. The City owns and operates a small trash pump for localized bypass pumping of small flows. Because the City currently cannot sustain prolonged bypass pumping, a private contractor is often retained. The private contractor will be contacted by the Director of Public Works, Utilities Commissioner or the Sewer Maintenance Supervisor, all of whom can authorize services from private contractors up to a cost of $50,000 under authority of the City Manager. Efforts that exceed $50,000 need approval from City Council. Contact information for the preferred contractor is below.

AAA Advanced Plumbing & Drain
7277 Bessemer Avenue
Cleveland, OH 44127
216-341-2900

2.3.4 SSO Flow Estimation Methods

Part of the overflow response is to estimate the volume of flow being discharged. There are several methods for volume estimation and two are discussed in more detail in this document. Additional information on estimating sewer overflow volumes can be found in **Appendix G**, Guidelines for Estimating Overflow Volume from the City of West Sacramento, CA.

Method 1 – best method to use during small overflows and dry weather conditions.

1. Sketch the shape of the spill that is contained.
2. Measure the length and width in feet, then multiply the two values to determine the area.
3. Measure the depth in several locations in feet and multiply by area to get volume in cubic feet.
4. Multiply the volume by 7.5 gallons/ft^3 to convert into gallons: gallons of spill = volume x 7.5 gallons/ft^3

Method 2 – best method to use in larger overflows.

1. Determine the estimated duration in total elapsed time from when the overflow started until it stops in minutes.
2. Estimate the rate at which the overflow is flowing, usually expressed in gallons

per minute (gpm).

3. Multiply the two values together to get total gallons of overflow in gallons.

2.3.5 Clean-up

Clean sewer overflow sites thoroughly after an overflow to eliminate all readily identified residue (e.g., sewage solids, papers, rags, plastics, and rubber products) as follows.

- Where practical, thoroughly flush the area and clean up any sewage or wash-down water. Solids and debris are to be flushed, swept, raked, picked up, and transported for proper disposal. Liquid waste should be removed using a vactor truck, or directed to a sanitary sewer.
- Secure the overflow area to prevent contact by members of the public until the site has been thoroughly cleaned.
- Where appropriate, disinfect and deodorize the overflow site. Prevent discharge of overflow or cleaning water to storm sewers or open channel drains.
- Where sewage has resulted in ponding, pump the pond dry and dispose of the residue in the sewage pit at the sewer maintenance garage. Contaminated water removed from the site will be discharged to a sanitary sewer.
- If a ponded area contains sewage that cannot be pumped dry, it may be treated with a bleach solution consisting of a cup of bleach per gallon of water. If sewage has discharged into a storm drain or directly into body of water, or has the potential to discharge into a body of water that may contain fish or other aquatic life, do not use bleach.
- If sewage has discharged into a storm drain, use containment measures such as sand bags to reduce the discharge, flush the storm drain and recover flush water using a vactor truck or portable pump.

2.4 Training

The Public Utilities Division shall provide training on implementation of the SORP on a periodic basis for Sewer Department Personnel. New staff who may be involved with SSO response will be trained on this plan as part of their orientation. The training shall include review of prior incidents and discussion of appropriate responses when action is required. Training should also be conducted for any new equipment acquired by the Sewer Department. Training session attendance shall be documented and kept with this SORP.

2.5 Backflow of Sewage from Public Sewers onto Private Property

Sewer maintenance personnel will respond to sewer backups reported by residents. Crews have proper equipment including sewer snakes and root cutters to help clear private laterals and alleviate backflow of sewage into basements. This service is paid for by the resident separate from their sewer bill and requires an appointment.

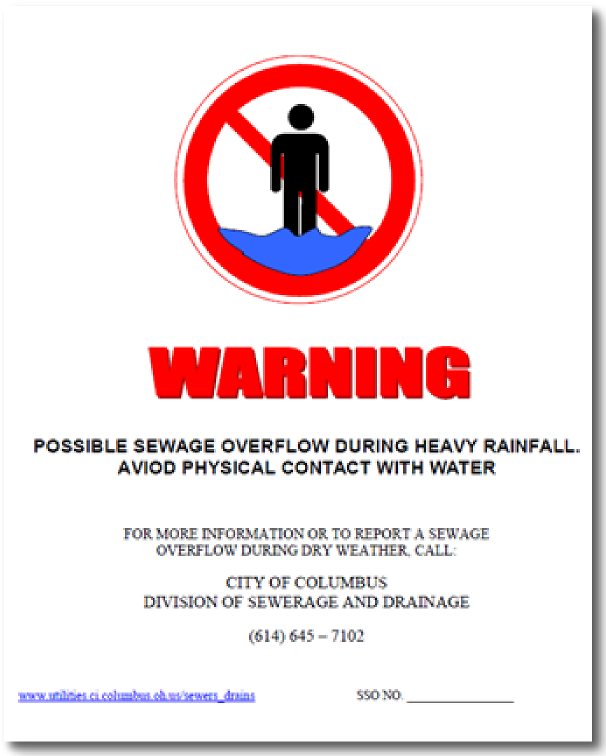
However, if the City determines that a problem in the public sewer is causing the basement backup, City personnel will use protocols discussed in this document to remedy the issue and mitigate the private property backup.

3.0 Public Advisory Procedure

This Section describes the actions the City will take to limit public access to areas potentially impacted by SSOs. The City has an agreement with the Cuyahoga County Board of Health to assist with notification procedures and public education.

3.1 Signage

The City has primary responsibility for determining when to post notices of polluted surface water bodies or ground surfaces that result from uncontrolled wastewater discharges from its collection system. The postings provide a warning of potential public health risks due to sewage contamination. Signage SSO discharge locations is being considered, and will be procured as part of the CMOM program development. Examples of long-term signage, and temporary signage for use at emergency overflow locations are shown in the following figures.



Example Long-term SSO Notification

Example Temporary SSO Notification

3.2 Website

The City's Utilities/Water/Sewer home web page provides information to the public regarding known SSO discharge locations, as well as monthly overflow reports. Notices of emergency SSOs will also be posted to the website by the Commissioner of Utilities or Sewer Maintenance Supervisor within 24 hours of becoming aware of the SSO.

4.0 Regulatory Agency Notification Plan

Wet weather overflows at known SSO locations are reported monthly as discussed in Section 1.3. Dry weather SSOs at any location, and wet weather SSOs occurring at locations other than known SSO structure locations will be reported as follows. The Commissioner of Public Utilities (or their designee) is responsible for proper reporting of SSOs. The Commissioner, within 24 hours of the sewer overflow confirmation, provides summary information by phone or email to the Ohio EPA, and USEPA Region 5, and NEORSD, including SSO location, date and time, duration, estimated volume and location of discharge to surface waters, if any. Contact information for notifications is listed later in this section. Final SSO information is provided through a 5-Day Follow-Up Report and submitted to the Ohio EPA and USEPA. The following link is used to report to the Ohio EPA.

http://www.epa.ohio.gov/dsw/permits/technical_assistance.aspx#152108575-sanitary-sewer-overflows-ssos

The 5-Day Follow-Up Report form can be found in **Appendix H** of this plan. Information on SSOs will also be provided in monthly and annual reports as required in the Consent Decree section entitled *Reporting Requirements*.

Notification shall be given to the following agencies as appropriate:

Cleveland Heights Fire Department	216-291-2673
Cuyahoga County Local Emergency	216-771-1365
Cuyahoga County Board of Health	216-201-2000
Northeast Ohio Regional Sewer District	216-881-6600
Ohio EPA	330-963-1145 or 800-282-9378
USEPA Region 5	800-621-8431
National Response Center	800-424-8802

Discovery of new overflow structures or modification of existing structural overflows requires notification to the NEORSD Community Discharge Permit Program Manager at the number in the table above.

5.0 Maintenance of SORP

The SORP will be reviewed every two years, or after a significant overflow event. SORP amendments will allow the City to address changes to procedures, contact information and regulatory requirements, for example.

During the SORP review, any overflows that have occurred since the last review shall be discussed to determine whether the actions dictated by the plan were adequate to remediate the situation, and may be revised as appropriate.

Appendix A – Measures to Avoid Sewer Overflow

Measures to Avoid Sewer Overflows

A. Proper Collection System Maintenance and Operations Program

- Routine cleaning, according to the CMOM program, of pipes (FOG, root deposits)
- Maintaining and addressing high frequency cleaning list
- Sealing or maintenance of deteriorating sewers
- Remediation of poor/substandard construction (short term)
- Sewer replacement or rehabilitation program (long term)
- Proper maintenance and operations of pump stations
- Inspection/service of main lines and private laterals

B. New Sewer System Construction/Rehabilitation

- Use the latest technology and standards in constructing new sewer system improvements
- Perform proper construction inspection/quality assurance procedures

C. Elimination of Constructed and/or Chronic SSOs

- Cleveland Heights will complete sewer system evaluation survey (SSES) activities including televising and manhole inspections. The City will also complete flow monitoring and modeling, a capacity analysis and Overflow Control Master Plan to detail proposed projects to control SSOs and basement flooding in Cleveland Heights. The master plan is scheduled to be completed in 2021, and would be followed by capital improvements to control overflows.

Appendix B – List of Known SSO Structures

Appendix B - List of Known SSO Structures in Cleveland Heights as of May, 2017

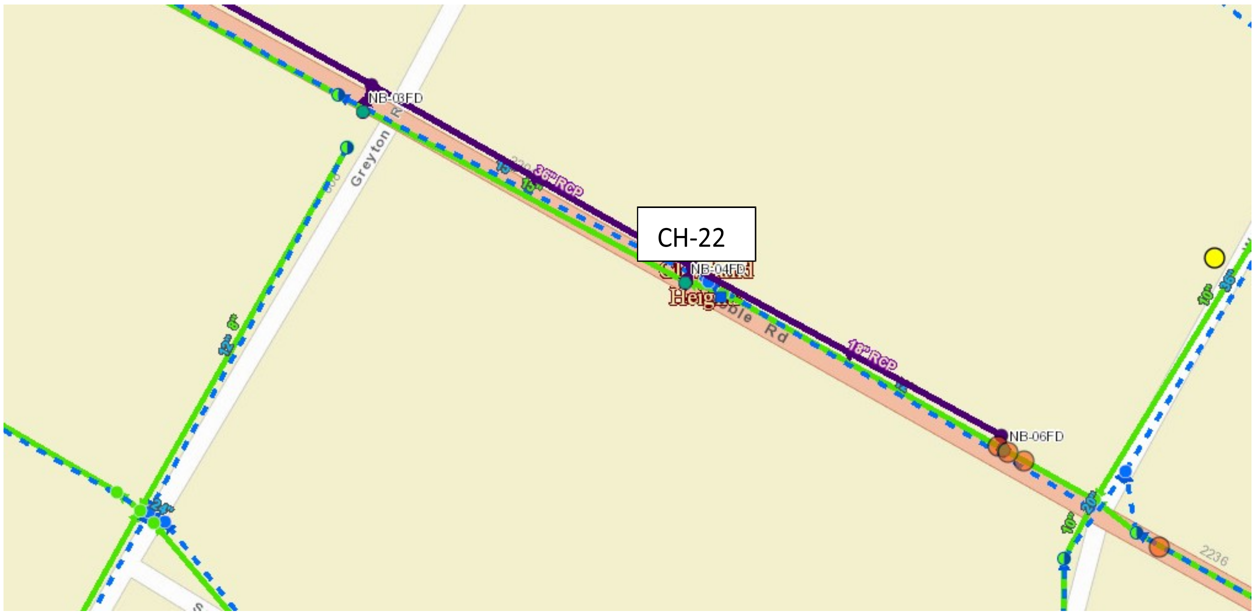
Count	SSO Name	Location
1	CH-1	Fairmount at North Woodland (3041)
2	CH-2	Fairmount at South Woodland (3026)
3	CH-3	Fairmount at Wellington (North Side)
4	CH-4	Fairmount at Dartmoor (North Side)
5	CH-5	Fairmount at Shelbourne
6	CH-6	Fairmount at Shelbourne
7	CH-7	Fairmount at Shelbourne (North Side)
8	CH-8	Fairmount at Lee (North Side)
9	CH-9	Bradford at Lee
10	CH-10	Hampshire Lane at Mayfield (North Vault)
11	CH-11	Hampshire Lane at Mayfield (South Vault)
12	CH-12	Lee at Superior
13	CH-13	Hampshire Lane at Euclid Heights
14	CH-14	Derbyshire at Euclid Heights
15	CH-15	Coventry at Cedar
16	CH-17	1685 Cumberland
17	CH-22	2225 Noble Road
18	CH-23	2828 Derbyshire
19	CH-24	3003 Euclid Heights
20	CH-25	Cumberland at Somerton
21	CH-26	Euclid Heights at Cumberland
22	CH-27	Quilliams - North of Randolph
23	CH-28	Euclid Heights at Lee
24	CH-30	Taylor Road North of Superior
25	CH-32	Fairmount at Arlington
26	CH-33	Fairmount at Fairfax
27	CH-35	Coventry and Fairmount
28	CH-36	North Park and Coventry
29	CH-37	Fairfax at North Park (Northwest Corner)
30	CH-38	Fairmount at Marlboro
31	CH-39	3012 North Woodland
32	CH-42	12537 Cedar
33	CH-45	2764 Fairmount (In Island)
34	CH-46	Edgehill at Euclid Heights
35	CH-47	2528 Stratford
36	CH-49	2765 Fairmount (East of Church)
37	CH-50	Scarborough Road at Lamberton
38	CH-51	Langton at Atherstone
39	CH-52	Eddington north of Avondale

Appendix C – Example of SSO Monitoring Field Form

Appendix C - Sanitary Sewer Overflow Monitoring Field Form

OVERFLOW # 22

ADDRESS: 2225 Noble Road



DATE OF INSPECTION ________________________________

TIME OF INSPECTION _________________________________

DID OVERFLOW ACTIVATE? ____________________________

IF YES, ESTIMATE GALLONS_____________________________

RETURN TO SITE IF ACTIVATED TO DETERMINE TIME IT STOPPED ACTIVATING

____

INSPECTORS

__________________________________ __________________________________

Appendix D – Emergency Procedures for Response to Common Types of SSOs

Emergency response procedures for the following failure modes are described in this document.

- Sewer Blockage or Back up into Basement
- Overflowing Sewer Manhole Resulting from Surcharged Trunk Sewer (No backup into building)
- Sewer Main Break/Collapse
- Wastewater Pump Station Alarms General Response Actions

Sewer Blockage or Back up into Basement

- Dispatch the crew immediately to the complainant address with details. Crew notifies complainant/property owner(s) when they are on site to resolve the issue.
- If the flow is questionable (not reasonable for the given service area) go to the upstream manhole to visually compare flows.
- If the flow from both manholes is reasonable for the area, notify property owners that the problem is in their service lateral and that the Sewer Department can relieve the blockage for a fee or to contact a plumber or sewer service contractor to relieve the blockage.
    - If the property owner requests the City to clean the sewer lateral, the following procedure is followed:
        - Check to make sure the City has proper access via a clean-out or test tee *(Note: The City does not use a stack access).* If there is not proper access, the property owner is directed to contact a private plumber.
    - Locate access, run sewer machine and advise property owner/rep. of the City's findings, i.e., roots, paper towels, grease, etc.)
- If the downstream manhole is full and there is a potential for overflow,
    - Request additional manpower and equipment as needed (e.g. excavating crew, bypass pumping equipment, etc.)
    - If the overflow has potential to reach a storm sewer system, block inlets
    - Set up pump out equipment and hoses from the upstream manhole to the nearest flowing manhole below the blockage.

- Continue checking manholes downstream until a dry manhole is found indicating a blockage upstream.
- Clean line with sewer jetter. Install the proper size sand trap in the downstream invert of the manhole before clearing the blockage to capture the debris.
- Use the necessary equipment to relieve the blockage by jet flushing
- Remove the debris from the manhole and observe it to try to determine the cause of the blockage.
- Notify supervisor and describe the blockage. The supervisor will notify the proper authorities and agencies.
- Cordon off the area if ponding occurs on the street or easement (public or private).
- Collect as much of the sewage as possible, estimating volume recovered.
- Disinfect according to policy and notify surrounding homes (notify appropriate officials, as needed).
- Schedule a television inspection.
- Complete a report indicating the time of the call, a description of the problem, repair work done, personnel present and equipment used. Include estimate of spill and volume recovered.

Notes:

1. When available, use collected debris to try to determine the cause of the blockage. Confirm removal of all debris from the manhole.
2. Record the water damage to all items in the basement. Record all actions taken (from start to finish) in log/record book, including equipment and personnel that were utilized.

Overflowing Sewer Manhole Resulting from Surcharged Trunk Sewer
(No backup into building)

- Dispatch the crew immediately to the problem location.
- Go to the location of the overflowing manhole to assess the immediate danger to public health or the environment.

- If the wastewater is in the streets/roads (public or private), use sand bags to contain the wastewater to minimize any impact to public health or the environment.
- Sandbag nearby catch basin inlets or paved leak-offs to prevent the wastewater from entering the drainage system and causing potential contamination to the receiving waters.
- Determine the location of the blockage by inspecting the downstream manholes until a dry manhole is found.
    - Request additional manpower and equipment as needed (e.g. excavating crew, bypass pumping equipment, etc.) or to help with evaluating options for pumping around the blockage.
    - Contact private contractor to set up pump out equipment and hoses from the upstream manhole to the nearest flowing manhole below the blockage.
- Install the proper size sand trap in the downstream invert of the manhole before clearing the blockage to capture the debris. Remove the debris from the manhole and assess it to try to determine the cause of the blockage.
- Use the necessary equipment to relieve the blockage by jet flushing.
- If it is imminent that the wastewater will be released into wetlands, receiving waters or a drinking water supply watershed, contact the supervisor who will call in extra crews and coordinate emergency equipment. The supervisor will also notify the proper authorities and agencies, including the fire department, to set up flotation booms across streams, brooks, etc., if necessary.
- Gather and remove sewage related debris and organic matter from the affected area.
- Cordon off the area if ponding occurs.
- Collect as much of the sewage as possible, estimating the volume recovered.
- Disinfect according to policy and notify surrounding homes (notify appropriate officials, as needed).
- If the wastewater jeopardizes a playground or park, cordon off the entire area. Close the park to the public until the issue has been remedied to the satisfaction of the local and state boards of health and the local park superintendent.
- Complete a report indicating the time of the call, description of the problem, repair work done, personnel present and equipment used, estimated volume of spill and volume recovered.

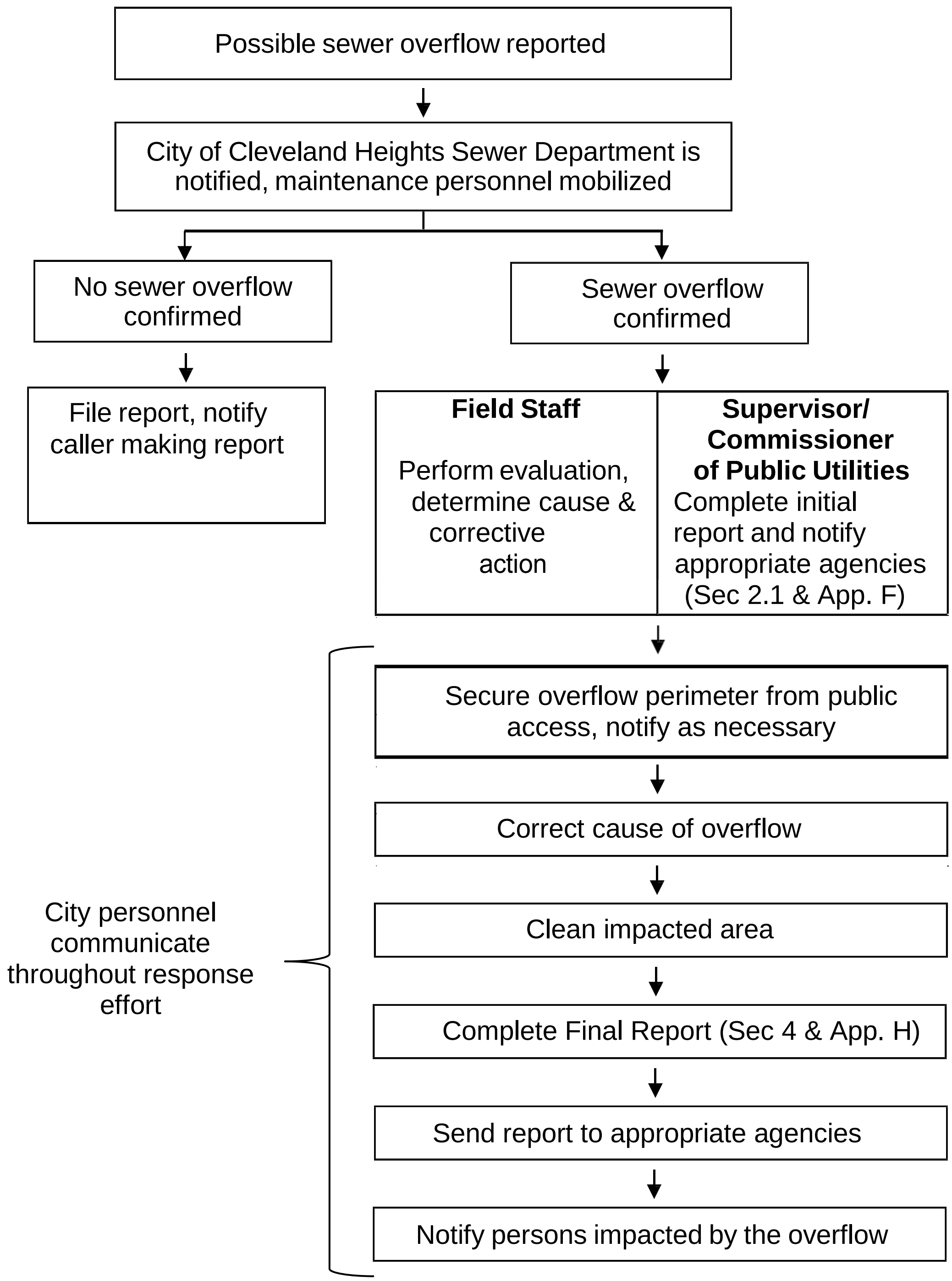
Sewer Main Break/Collapse

- Dispatch a crew to the location of the break/collapse immediately while referring to the sewer maps for location of sewers (private lands flow patterns, manholes, etc.) to determine which critical facilities are in the area.
- Crew sets up signs, barricades, and/or barrels for traffic control and public safety, rerouting traffic as necessary and deploying traffic control measures, such as police or flag person, as needed.
- If it is a main line break, the Commissioner shall notify the appropriate authorities and city officials immediately.
- Request additional manpower and equipment as needed based on initial damage assessment (e.g. excavating crew, private contractor, etc.)
- Pumping around the break from the upstream manhole to the downstream manhole may be required. If necessary, contact a private contractor with pumping equipment. If not necessary, prepare for repairs while the pipe is flowing.
- Call in additional crews to set up flotation booms across streams, install sandbags, etc., as necessary. Unless special conditions exist, **pumping around the failed sewer main is a priority** before containing the overflow.
- Gather and remove sewage related debris and organic matter from the affected area.
- If the wastewater is in the streets/roads (public or private), use sand bags to contain the wastewater to minimize any impact to public health or the environment.
- Sandbag nearby catch basin inlets or paved leak-offs to prevent the wastewater from entering the drainage system and causing potential contamination to the receiving waters.
- Cordon off the area if ponding occurs.
- Collect as much of the sewage as possible, disinfect and notify surrounding homes (Commissioner notifies appropriate officials, as needed).
- If the wastewater jeopardizes a playground or park, cordon off the entire area. Close the park to the public until the issue has been remedied to the satisfaction of the local and state boards of health and the local park superintendent.
- Determine the location of the break/collapse and make any necessary repairs by cutting out damaged pipe and replacing with a section of PVC pipe.

- Upon confirmation of adequacy of the repair by an Inspector, backfill the excavation (if necessary) and restore surface conditions to match existing conditions.
- To restore the sewer line to full capacity, the crew should remove any debris that may have entered and accumulated in the sewer line downstream and upstream from the break/collapse. The crew should clean the sewer line as described below.
- Install the proper size sand trap in the downstream invert of the downstream manhole to trap any debris which may have accumulated in the sewer line.
- Using a high velocity jet-flushing vehicle, begin flushing from the downstream manhole against the flow to the upstream manhole.
- Repeat this procedure for several upstream and downstream pipe reaches.
- The crew leader should thoroughly document the nature and extent of the impacts including the use of photographs and video footage where possible.
- Make out a report indicating the time of the call, a description of the problem, the repair work done, personnel present and equipment used.
- If sewage overflowed the collection system, file Ohio EPA Overflow Notification Log and Overflow Report Form.

Appendix E – Sewer Overflow Response Flow Chart

Sewer Overflow Response Flow Chart



Appendix F – Sanitary Sewer Overflow Response Form

Sanitary Sewer Overflow Response Form

DATE________________________TIME________________________ am/pm

Caller Name____

NAME AND ADDRESS ____

OVERFLOW LOCATION____

TYPE OF STRUCTURE: MANHOLE ___ PUMP STATION____FORCE MAIN___ LATERAL___ OTHER____
explain:____

CAUSE OF OVERFLOW:______________________ ESTIMATED VOLUME:___________________________

IS PROBLEM THE CITY'S RESPONSIBILITY: YES______ NO _______

IF NO, LIST RESPONSIBLE PARTY: PROPERTY OWNER ___ PRIVATE SEWER ___ OTHER _______________

HAS SPILL ENTERED WATERS OF THE STATE, ENTERED A RESIDENCE OR COULD ENDANGER HUMAN HEALTH : YES_____NO_______ ADDRESS or RECEIVING WATER _______________________________

HAS AFFECTED PUBLIC BEEN NOTIFIED: YES_____NO_______ NOT NEEDED_______

SUPERVISOR NOTIFIED: DATE__________TIME_______ am/pm SUPERVISOR NAME:_____________

OHIO EPA (800-282-9378) SPILL HOTLINE NOTIFIED: YES_____ NO _____ TIME__________ am/pm

OHIO EPA NOTIFICATION # _________________________ CITY CONTACT: _________________________

SIGNS POSTED? YES ____ NO _____ PICTURES TAKEN? YES____#__________ No ___

CORRECTIVE ACTIONS AND ADDITIONAL COMMENTS:
____
____
____
____
____

Appendix G – Guidelines for Estimating Overflow Volume

Reference Sheet for Estimating Sewer Flow Rate from Overflowing Sewer Maintenance Holes

All estimates are calculated in gallons per minute (gpm)


5 gpm


25 gpm


50 gpm


100 gpm


150 gpm


200 gpm


225 gpm


250 gpm


275 gpm

All photos were taken during a demonstration using metered water from a hydrant in cooperation with the City of San Diego's Water Department.

SSO Flow Estimation Tables

TABLE 1
ESTIMATED SSO FLOW OUT OF MH WITH COVER IN PLACE

24" COVER

Height of spout above M/H rim **H** in inches	SSO FLOW **Q** in gpm	SSO FLOW **Q** in MGD	Min. Sewer size in which these flows are possible
1/4	1	0.001	
1/2	3	0.004	
3/4	6	0.008	
1	9	0.013	
1 1/4	12	0.018	
1 1/2	16	0.024	
1 3/4	21	0.030	
2	25	0.037	
2 1/4	31	0.045	
2 1/2	38	0.054	
2 3/4	45	0.065	
3	54	0.077	
3 1/4	64	0.092	
3 1/2	75	0.107	
3 3/4	87	0.125	
4	100	0.145	
4 1/4	115	0.166	
4 1/2	131	0.189	
4 3/4	148	0.214	
5	166	0.240	
5 1/4	185	0.266	
5 1/2	204	0.294	
5 3/4	224	0.322	6"
6	244	0.352	
6 1/4	265	0.382	
6 1/2	286	0.412	
6 3/4	308	0.444	
7	331	0.476	
7 1/4	354	0.509	
7 1/2	377	0.543	
7 3/4	401	0.578	8"
8	426	0.613	
8 1/4	451	0.649	
8 1/2	476	0.686	
8 3/4	502	0.723	
9	529	0.761	

36" COVER

Height of spout above M/H rim **H** in inches	SSO FLOW **Q** in gpm	SSO FLOW **Q** in MGD	Min. Sewer size in which these flows are possible
1/4	1	0.002	
1/2	4	0.006	
3/4	8	0.012	
1	13	0.019	
1 1/4	18	0.026	
1 1/2	24	0.035	
1 3/4	31	0.044	
2	37	0.054	
2 1/4	45	0.065	
2 1/2	55	0.079	
2 3/4	66	0.095	
3	78	0.113	
3 1/4	93	0.134	
3 1/2	109	0.157	
3 3/4	127	0.183	
4	147	0.211	
4 1/4	169	0.243	
4 1/2	192	0.276	
4 3/4	217	0.312	6"
5	243	0.350	
5 1/4	270	0.389	
5 1/2	299	0.430	
5 3/4	327	0.471	
6	357	0.514	
6 1/4	387	0.558	8"
6 1/2	419	0.603	
6 3/4	451	0.649	
7	483	0.696	
7 1/4	517	0.744	
7 1/2	551	0.794	
7 3/4	587	0.845	10"
8	622	0.896	
8 1/4	659	0.949	
8 1/2	697	1.003	
8 3/4	734	1.057	
9	773	1.113	

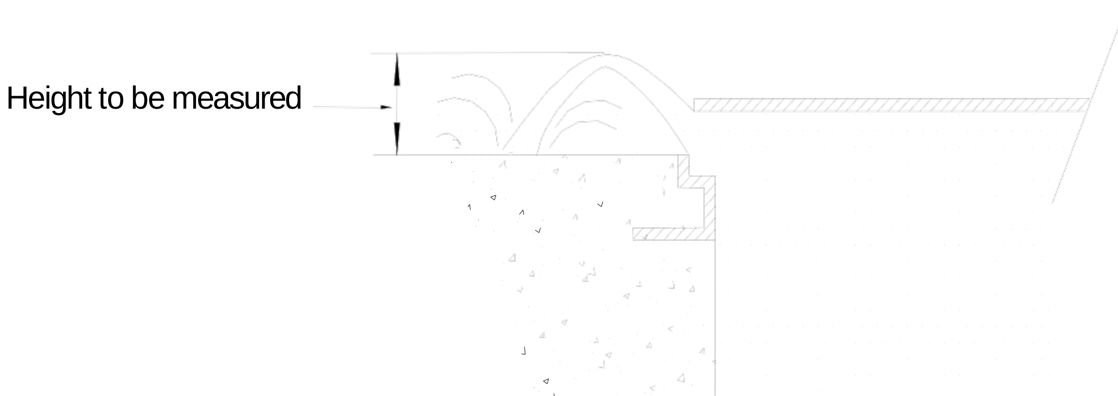
Disclaimer:
This sanitary sewer overflow table was developed by Ed Euyen, Civil Engineer, P.E. No. 33955, California, for County Sanitation District 1. This table is provided as an example. Other Agencies may want to develop their own estimating tables.

The formula used to develop Table 1 measures the maximum height of the water coming out of the maintenance hole above the rim. The formula was taken from hydraulics and its application by A.H. Gibson (Constable & Co. Limited).

Example Overflow Estimation:

The maintenance hole cover is unseated and slightly elevated on a 24” casting. The maximum height of the discharge above the rim is 5 ¼ inches. According to Table 1, these conditions would yield an SSO of 185 gallons per minute.

FLOW OUT OF MH WITH COVER IN PLACE



This sanitary sewer overflow drawing was developed by Debbie Myers, Principal Engineering Technician, for Ed Euyen, Civil Engineer, P.E. No. 33955, California, of County Sanitation District 1.

TABLE 2

ESTIMATED SSO FLOW OUT OF MH WITH COVER REMOVED

24" FRAME

Water Height above M/H frame **H** in inches	S S O FLOW **Q** in gpm	in MGD	Min. Sewer size in which these flows are possible
1/8	28	0.04	
1/4	62	0.09	
3/8	111	0.16	
1/2	160	0.23	
5/8	215	0.31	6"
3/4	354	0.51	8"
7/8	569	0.82	10"
1	799	1.15	12"
1 1/8	1,035	1.49	
1 1/4	1,340	1.93	15"
1 3/8	1,660	2.39	
1 1/2	1,986	2.86	
1 5/8	2,396	3.45	18"
1 3/4	2,799	4.03	
1 7/8	3,132	4.51	
2	3,444	4.96	21"
2 1/8	3,750	5.4	
2 1/4	3,986	5.74	
2 3/8	4,215	6.07	
2 1/2	4,437	6.39	
2 5/8	4,569	6.58	24"
2 3/4	4,687	6.75	
2 7/8	4,799	6.91	
3	4,910	7.07	

36" FRAME

Water Height above M/H frame **H** in inches	S S O FLOW **Q** in gpm	in MGD	Min. Sewer size in which these flows are possible
1/8	49	0.07	
1/4	111	0.16	
3/8	187	0.27	6"
1/2	271	0.39	
5/8	361	0.52	8"
3/4	458	0.66	
7/8	556	0.8	10"
1	660	0.95	12"
1 1/8	1,035	1.49	
1 1/4	1,486	2.14	15"
1 3/8	1,951	2.81	
1 1/2	2,424	3.49	18"
1 5/8	2,903	4.18	
1 3/4	3,382	4.87	
1 7/8	3,917	5.64	21"
2	4,458	6.42	
2 1/8	5,000	7.2	24"
2 1/4	5,556	8	
2 3/8	6,118	8.81	
2 1/2	6,764	9.74	
2 5/8	7,403	10.66	
2 3/4	7,972	11.48	30"
2 7/8	8,521	12.27	
3	9,062	13.05	
3 1/8	9,604	13.83	
3 1/4	10,139	14.6	
3 3/8	10,625	15.3	36"
3 1/2	11,097	15.98	
3 5/8	11,569	16.66	
3 3/4	12,035	17.33	
3 7/8	12,486	17.98	
4	12,861	18.52	
4 1/8	13,076	18.83	
4 1/4	13,285	19.13	
4 3/8	13,486	19.42	

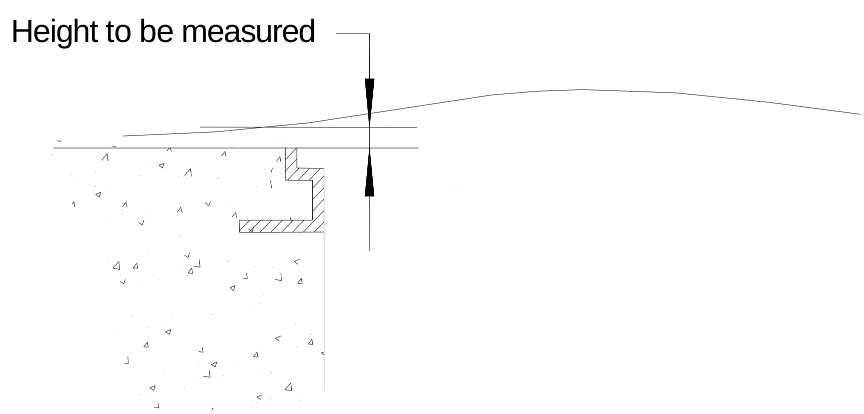
Disclaimer:
This sanitary sewer overflow table was developed by Ed Euyen, Civil Engineer, P.E. No. 33955, California, for County Sanitation District 1. This table is provided as an example. Other Agencies may want to develop their own estimating tables.

The formula used to develop Table 2 for estimating SSO's out of maintenance holes without covers is based on discharge over curved weir -- bell mouth spillways for 2" to 12" diameter pipes. The formula was taken from hydraulics and its application by A.H. Gibson (Constable & Co. Limited).

Example Overflow Estimation:

The maintenance hole cover is off and the flow coming out of a 36" frame maintenance hole at one-inch (1") height will be approximately 660 gallons per minute.

2.3 FLOW OUT OF MH WITH COVER REMOVED (TABLE 2)



This sanitary sewer overflow drawing was developed by Debbie Myers, Principal Engineering Technician, for Ed Euyen, Civil Engineer, P.E. No. 33955, California, of County Sanitation District 1.

TABLE 3

ESTIMATED SSO FLOW OUT OF MH PICK HOLE

Height of spout above M/H cover **H** in inches	SSO FLOW **Q** in gpm	Height of spout above M/H cover **H** in inches	SSO FLOW **Q** in gpm
1/8	1.0	5 1/8	6.2
1/4	1.4	5 1/4	6.3
3/8	1.7	5 3/8	6.3
1/2	1.9	5 1/2	6.4
5/8	2.2	5 5/8	6.5
3/4	2.4	5 3/4	6.6
7/8	2.6	5 7/8	6.6
1	2.7	6	6.7
1 1/8	2.9	6 1/8	6.8
1 1/4	3.1	6 1/4	6.8
1 3/8	3.2	6 3/8	6.9
1 1/2	3.4	6 1/2	7.0
1 5/8	3.5	6 5/8	7.0
1 3/4	3.6	6 3/4	7.1
1 7/8	3.7	6 7/8	7.2
2	3.9	7	7.2
2 1/8	4.0	7 1/8	7.3
2 1/4	4.1	7 1/4	7.4
2 3/8	4.2	7 3/8	7.4
2 1/2	4.3	7 1/2	7.5
2 5/8	4.4	7 5/8	7.6
2 3/4	4.5	7 3/4	7.6
2 7/8	4.6	7 7/8	7.7
3	4.7	8	7.7
3 1/8	4.8	8 1/8	7.8
3 1/4	4.9	8 1/4	7.9
3 3/8	5.0	8 3/8	7.9
3 1/2	5.1	8 1/2	8.0
3 5/8	5.2	8 5/8	8.0
3 3/4	5.3	8 3/4	8.1
3 7/8	5.4	8 7/8	8.1
4	5.5	9	8.2
4 1/8	5.6	9 1/8	8.3
4 1/4	5.6	9 1/4	8.3
4 3/8	5.7	9 3/8	8.4
4 1/2	5.8	9 1/2	8.4
4 5/8	5.9	9 5/8	8.5
4 3/4	6.0	9 3/4	8.5
4 7/8	6.0	9 7/8	8.6
5	6.1	10	8.7

Unrestrained M/H cover will start to lift

Note: This chart is based on a 7/8-inch diameter pick hole

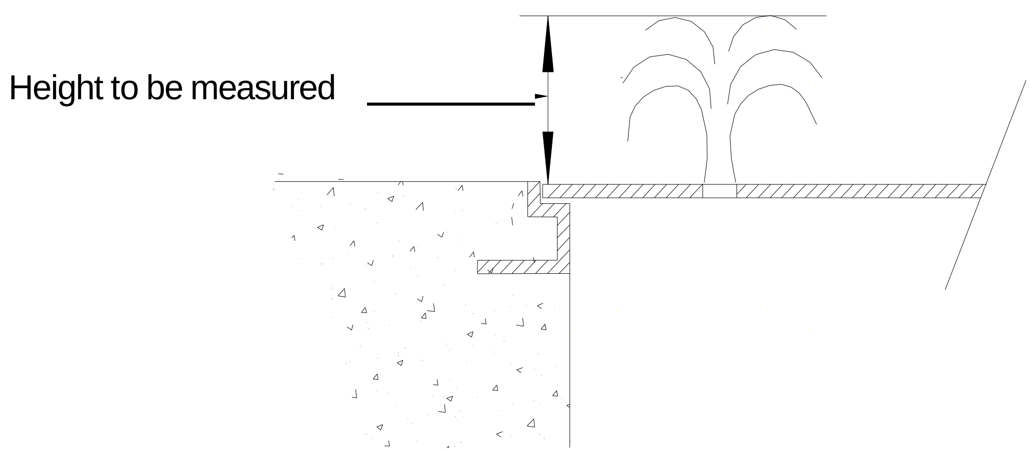
Disclaimer: This sanitary sewer overflow table was developed by Ed Euyen, Civil Engineer, P.E. No. 33955, California, for County Sanitation District 1. This table is provided as an example. Other Agencies may want to develop their own estimating tables.

The formula used to develop Table 3 is Q=CcVA, where Q is equal to the quantity of the flow in gallons per minute, Cc is equal to the coefficient of contraction (.63), V is equal to the velocity of the overflow, and A is equal to the area of the pick hole.[2] If all units are in feet, the quantity will be calculated in cubic feet per second, which when multiplied by 448.8 will give the answer in gallons per minute. (One cubic foot per second is equal to 448.8 gallons per minute, hence this conversion method).

Example Overflow Estimation:

The maintenance hole cover is in place and the height of water coming out of the pick hole seven-eighths of an inch in diameter (7/8") is 3 inches (3"). This will produce an SSO flow of approximately 4.7 gallons per minute.

FLOW OUT OF VENT OR PICK HOLE (TABLE 3)



This sanitary sewer overflow drawing was developed by Debbie Myers, Principal Engineering Technician, for Ed Euyen, Civil Engineer, P.E. No. 33955, California, of County Sanitation District 1.

[2] Velocity for the purposes of this formula is calculated by using the formula h = v squared / 2G, where h is equal to the height of the overflow, v is equal to velocity, and G is equal to the acceleration of gravity.

Appendix H – Sewer Overflow 5-Day Follow up Report

OhioEPA

State of Ohio Environmental Protection Agency

Ohio EPA Form 4237
Issued 08/04

Sanitary Sewer Overflow 5-Day Follow Up Report

Report Submitted by:	
Date	
Facility Name	
Ohio NPDES Permit No.	
Period Covered by Report	
Contact Person Name	
Contact PersonTitle	
Mailing Address	
City, State, Zip	
County	
Telephone No.	
E-mail Address	

Signature required at end of form

Overflow Information	
Event start date and time – if multiple locations, include information for each	
Event end date and time	
Location(s) the SSO – include unique ID number if one exists	
Destination(s) of overflow	☐ Basement or building ☐ Ground ☐ Storm sewer to receiving water ☐ Directly to receiving water
Specific receiving water(s) (if applicable)	
Estimated volume (million gallons) – if multiple locations, include volume for each	
Sewer system component(s) from which release occurred	☐ Manhole ☐ Constructed overflow ☐ Pipe crack ☐ Pump station ☐ Other (explain)
Cause(s) of overflow	☐ Extreme weather ☐ Equipment failure ☐ Power failure ☐ Debris in line ☐ Roots ☐ Grease ☐ Other blockages ☐ Line deterioration ☐ Vandalism ☐ Other (explain)

EPA 4237 (08/04) Page 1 of 2

Click to clear all entered information (on both pages of this form) CLEAR

Steps taken or planned to eliminate and/or reduce the overflow – include schedule of major milestones	
Steps taken or planned to prevent reoccurrence of the overflow(s) – include schedule of major milestones	
Steps taken or planned to mitigate the impact(s) of the overflow(s) – include schedule of major milestones	
Additional information (attach additional pages, maps, etc. as needed)	

I CERTIFY THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION IN THIS REPORT AND ALL ATTACHMENTS. I BELIEVE THAT THE INFORMATION IS TRUE, ACCURATE, AND COMPLETE.

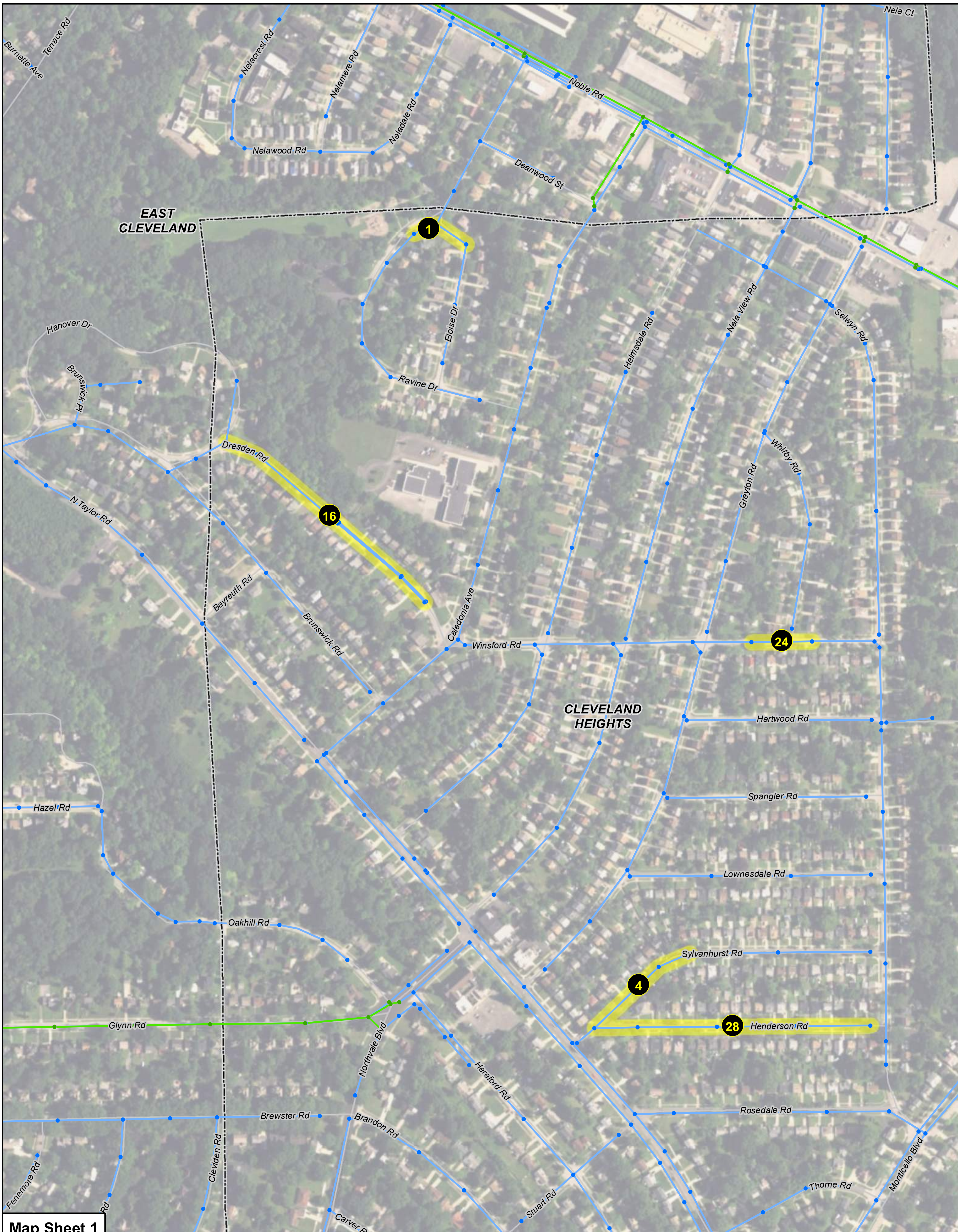
Signature

Date

Title

EPA 4237 (08/04)

Page 2 of 2



Map Sheet 1

Legend

- Community Border
- District_Manhole
- Local_Manhole
- District_Pump_Station
- Local_Pump_Station
- District Gravity Main
- District Pressure Main
- Local Gravity Main
- Local Pressure Main
- HFC Locations

N

Map Key	High Frequency Cleaning Locations	Length (LF)	Identified From	Cause
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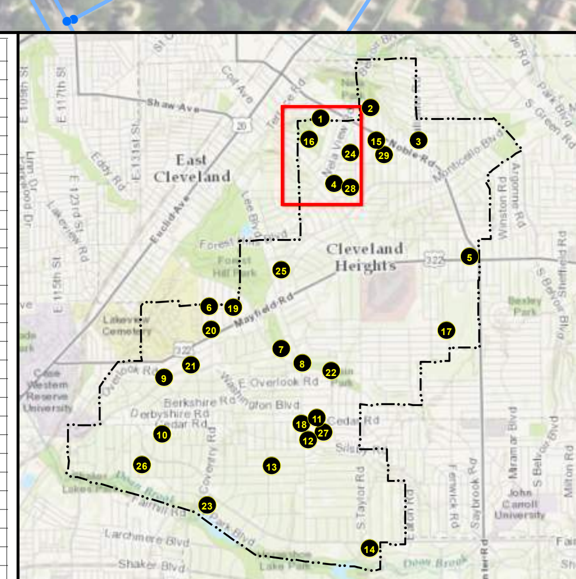
24	3390 Winsford Road	250	Cleaning Reports	Residential Grease
25	Bolton Road & Monticello Blvd	220	Cleaning Reports	Residential Grease
26	2520 - 2334 Ardleigh Drive	460	Cleaning Reports	Residential Grease
27	3244 Cedarbrook Road	200	Cleaning Reports	Residential Grease
28	Henderson Road	1,000	Identified during HHI LSSES	Roots
29	Pembrook Road	1,700	Identified during HHI LSSES	Roots



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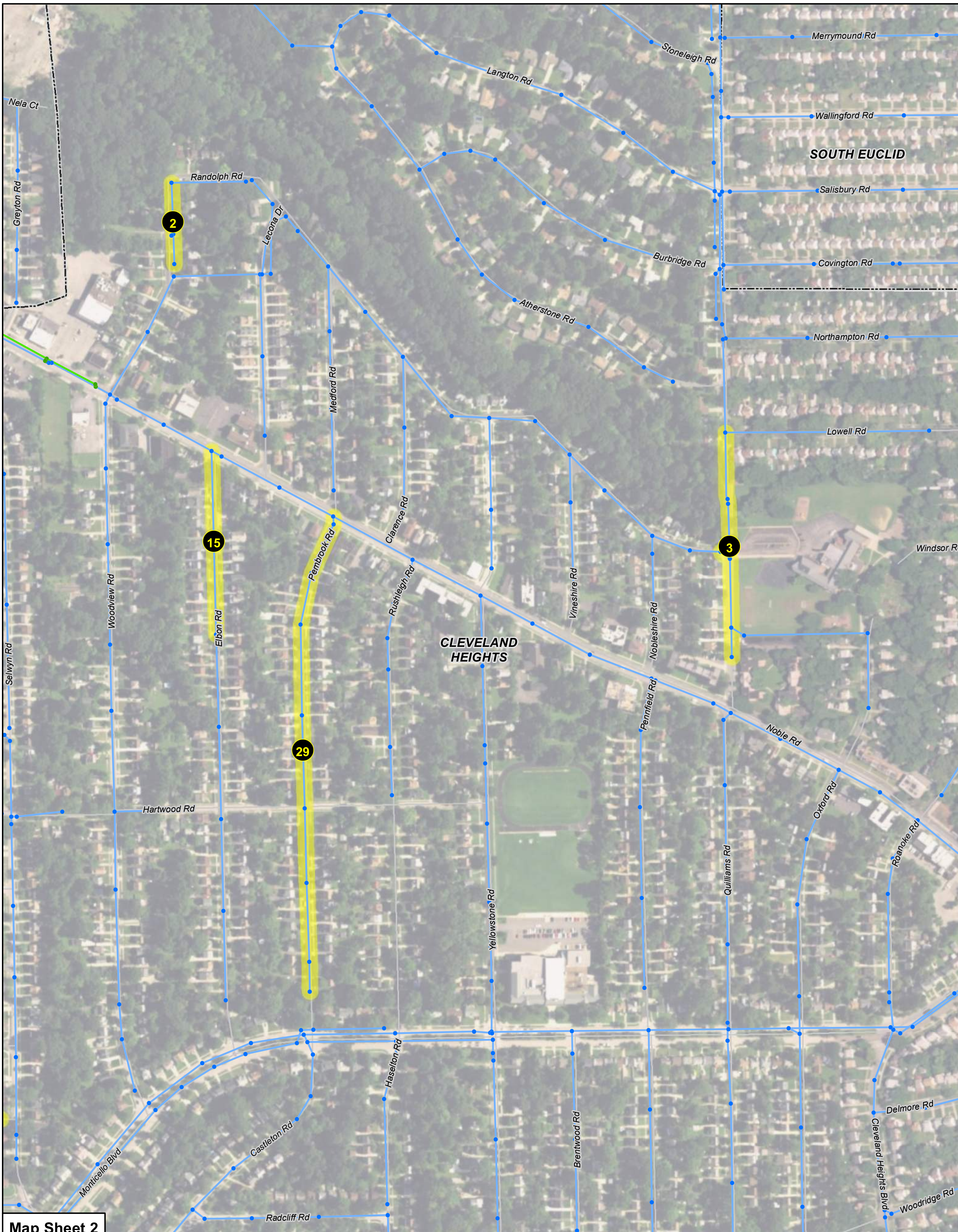

Map Sheet 2

Legend

- Community Border
- District_Manhole
- Local_Manhole
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- Local_Pump_Station
- District Gravity Main
- District Pressure Main
- Local Gravity Main
- Local Pressure Main
- HFC Locations

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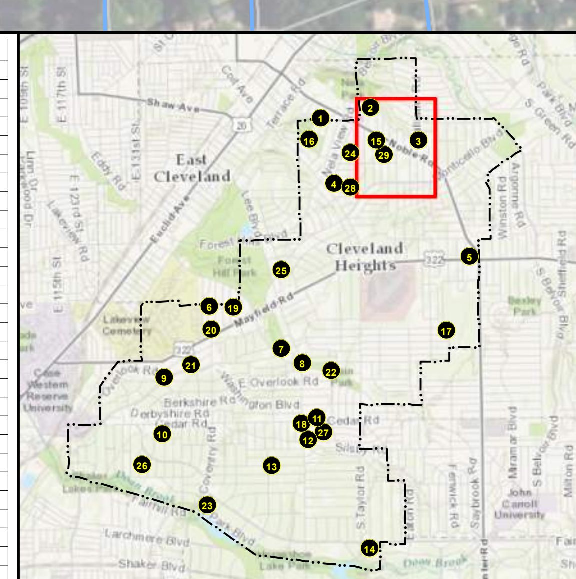

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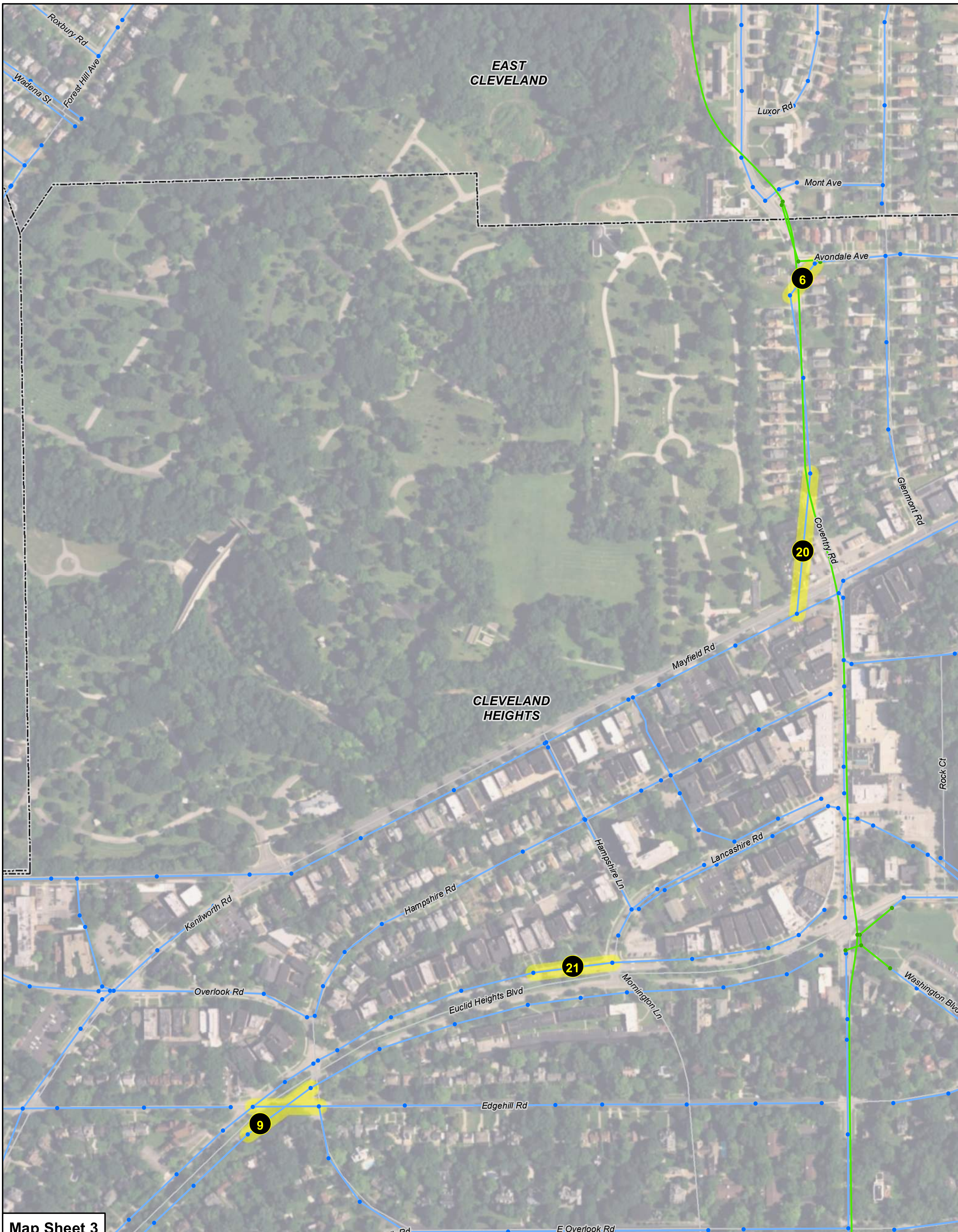

Map Sheet 3

Legend

- Community Border
- District_Manhole
- Local_Manhole
- District_Pump_Station
- Local_Pump_Station
- District Gravity Main
- District Pressure Main
- Local Gravity Main
- Local Pressure Main
- 1 HFC Locations

N

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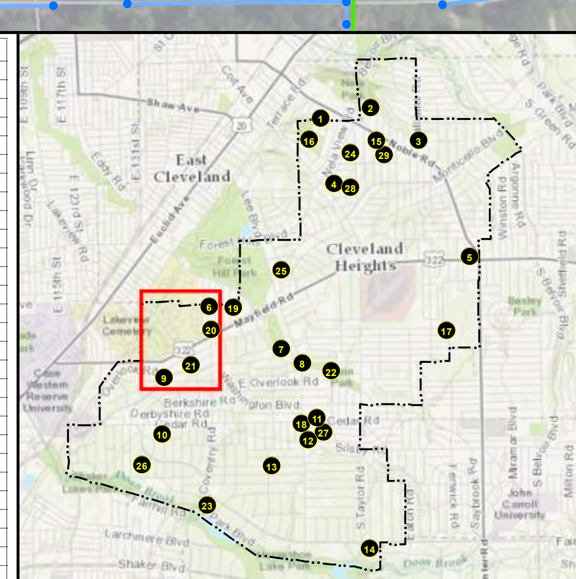

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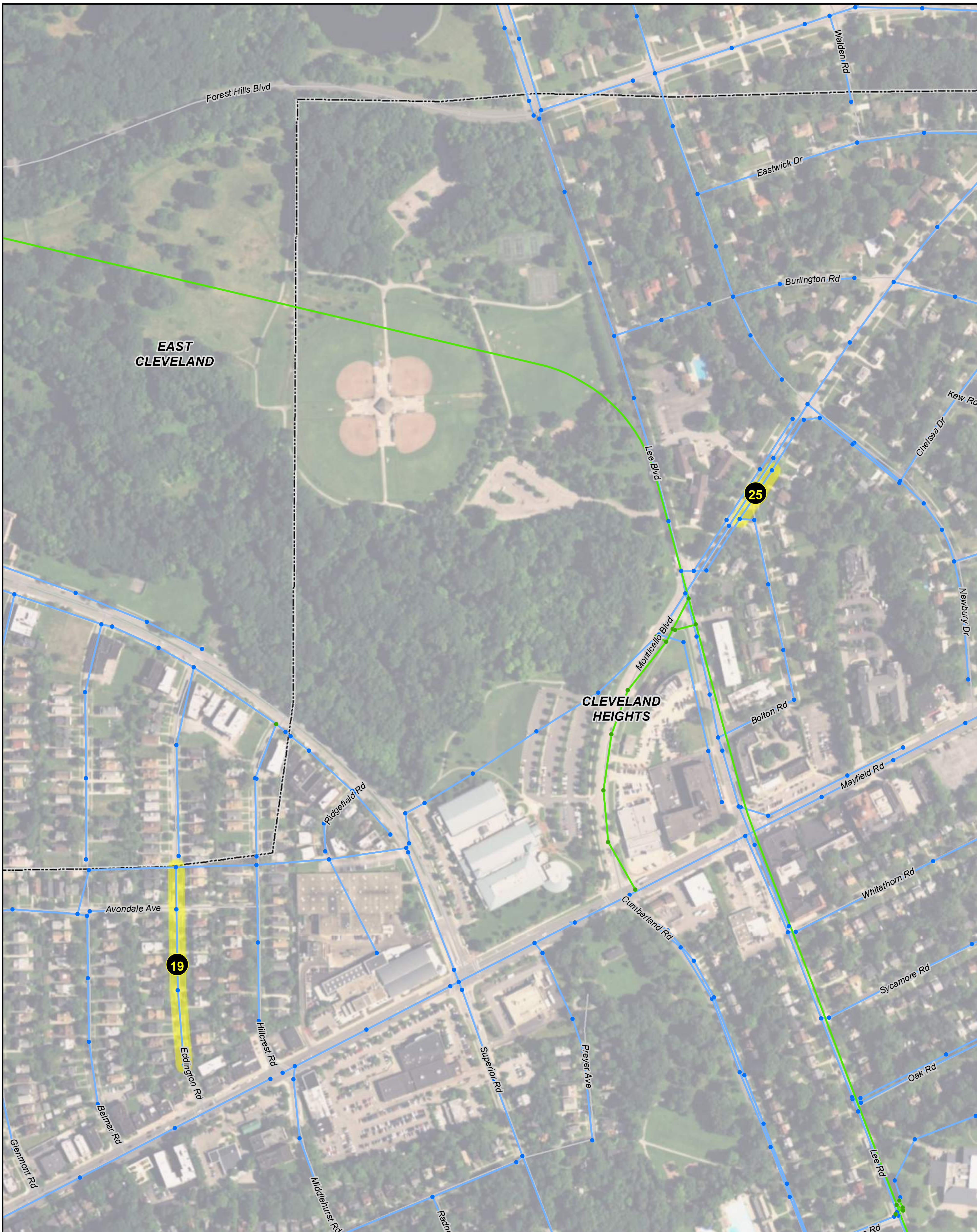

Map Sheet 4

Legend

- Community Border
- District_Manhole
- Local_Manhole
- District_Pump_Station
- Local_Pump_Station
- District Gravity Main
- District Pressure Main
- Local Gravity Main
- Local Pressure Main
- 1 HFC Locations

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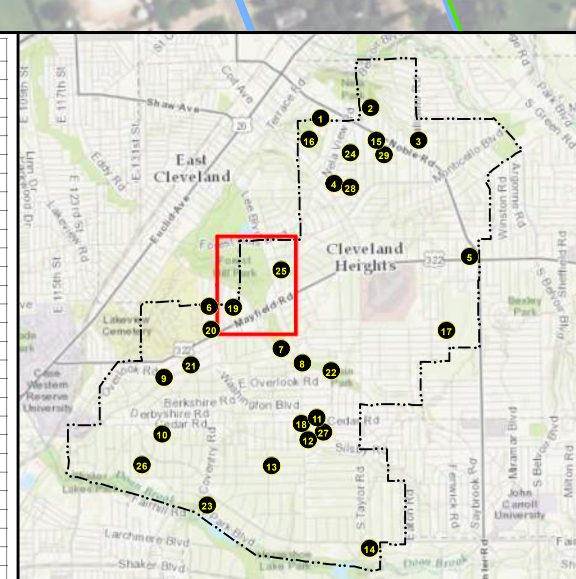

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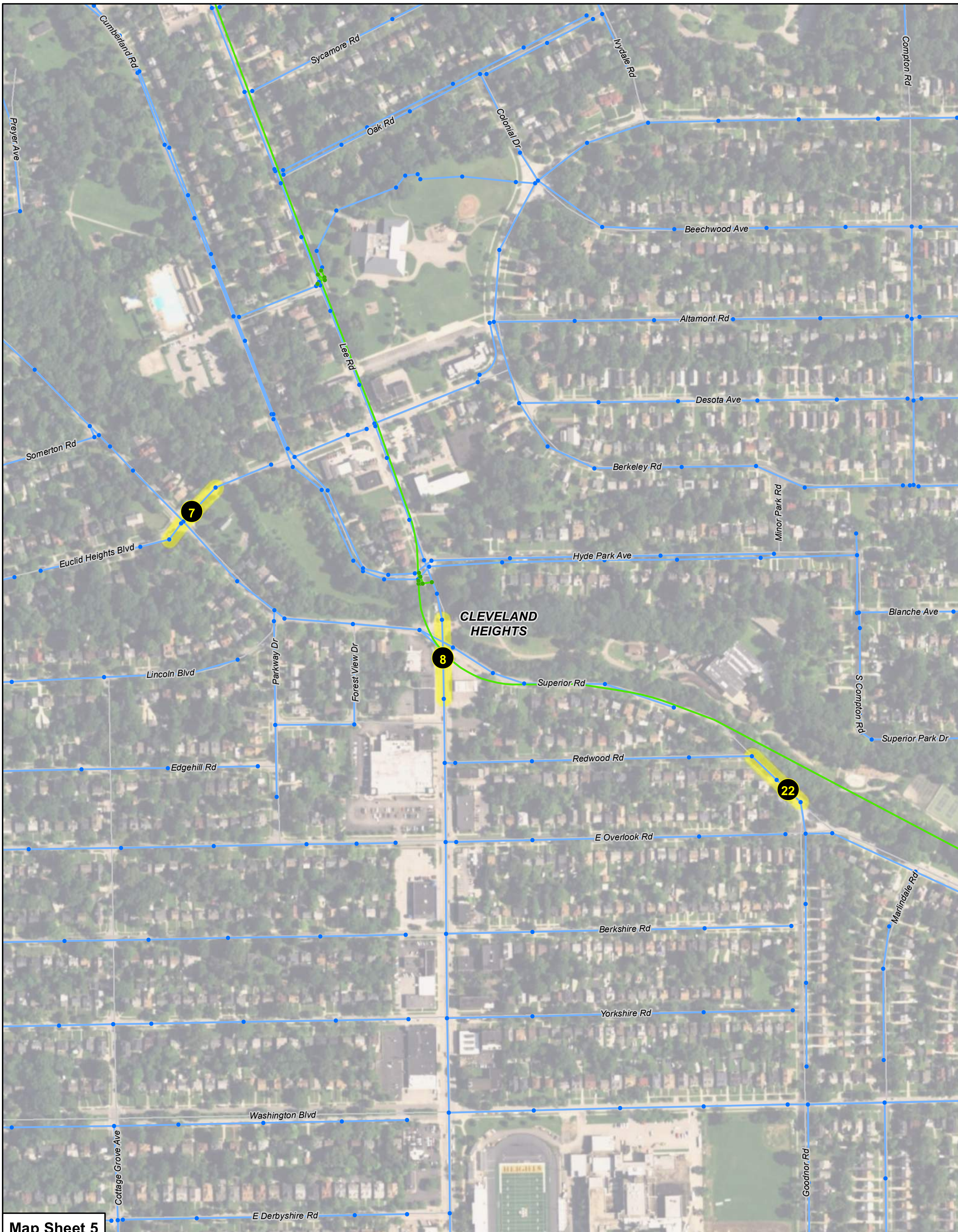

Map Sheet 5

Legend

- Community Border
- District_Manhole
- Local_Manhole
- District_Pump_Station
- Local_Pump_Station
- District Gravity Main
- District Pressure Main
- Local Gravity Main
- Local Pressure Main
- 1 HFC Locations

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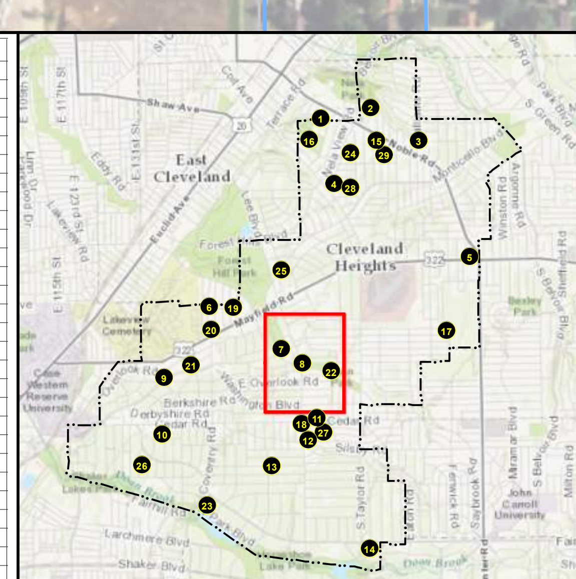

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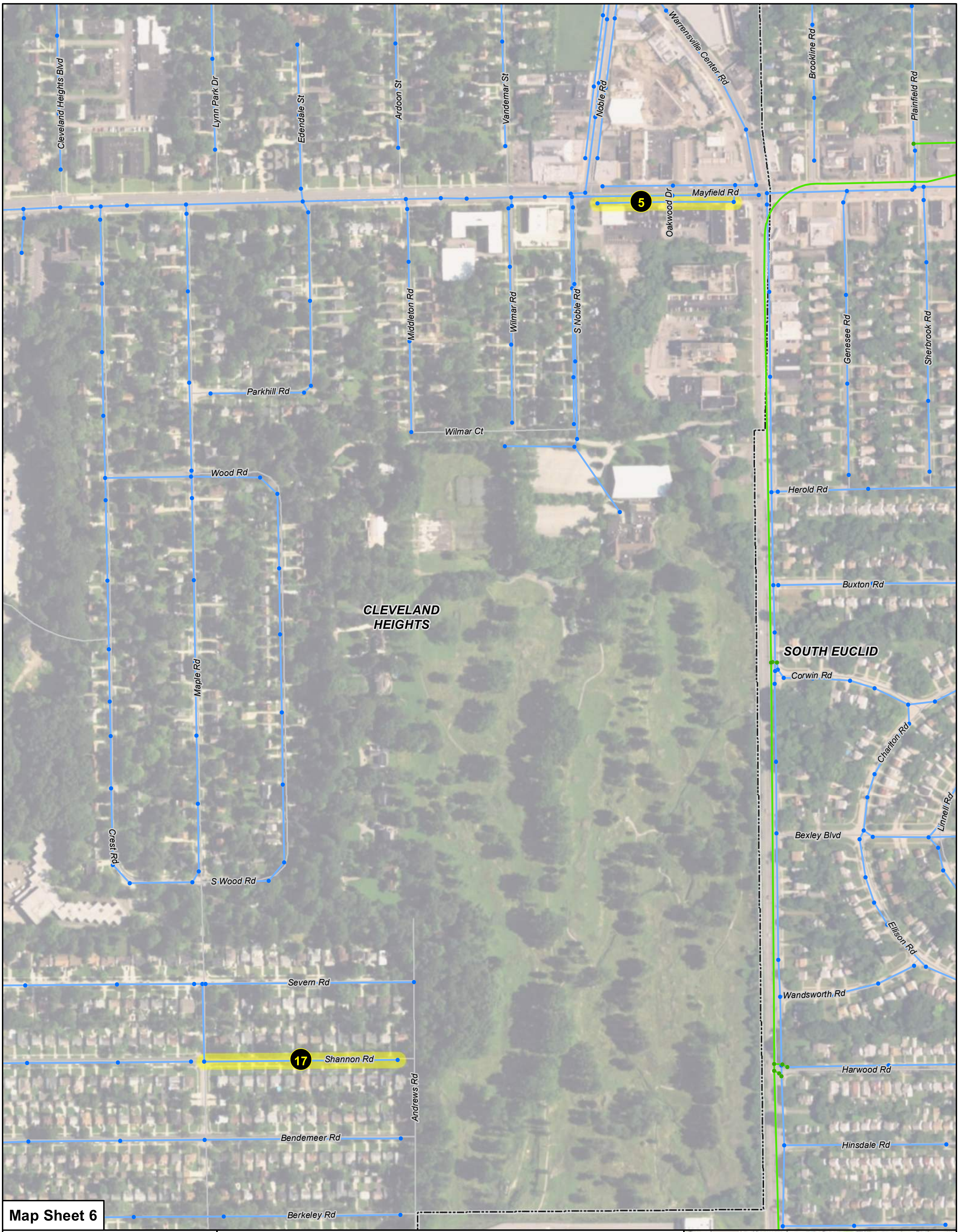

Map Sheet 6

Legend

- Community Border
- District_Manhole
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- District_Pump_Station
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- District Gravity Main
- District Pressure Main
- Local Gravity Main
- Local Pressure Main
- HFC Locations

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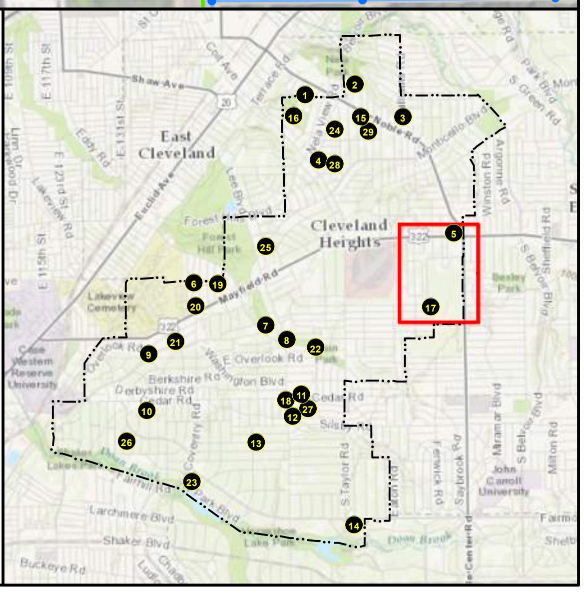

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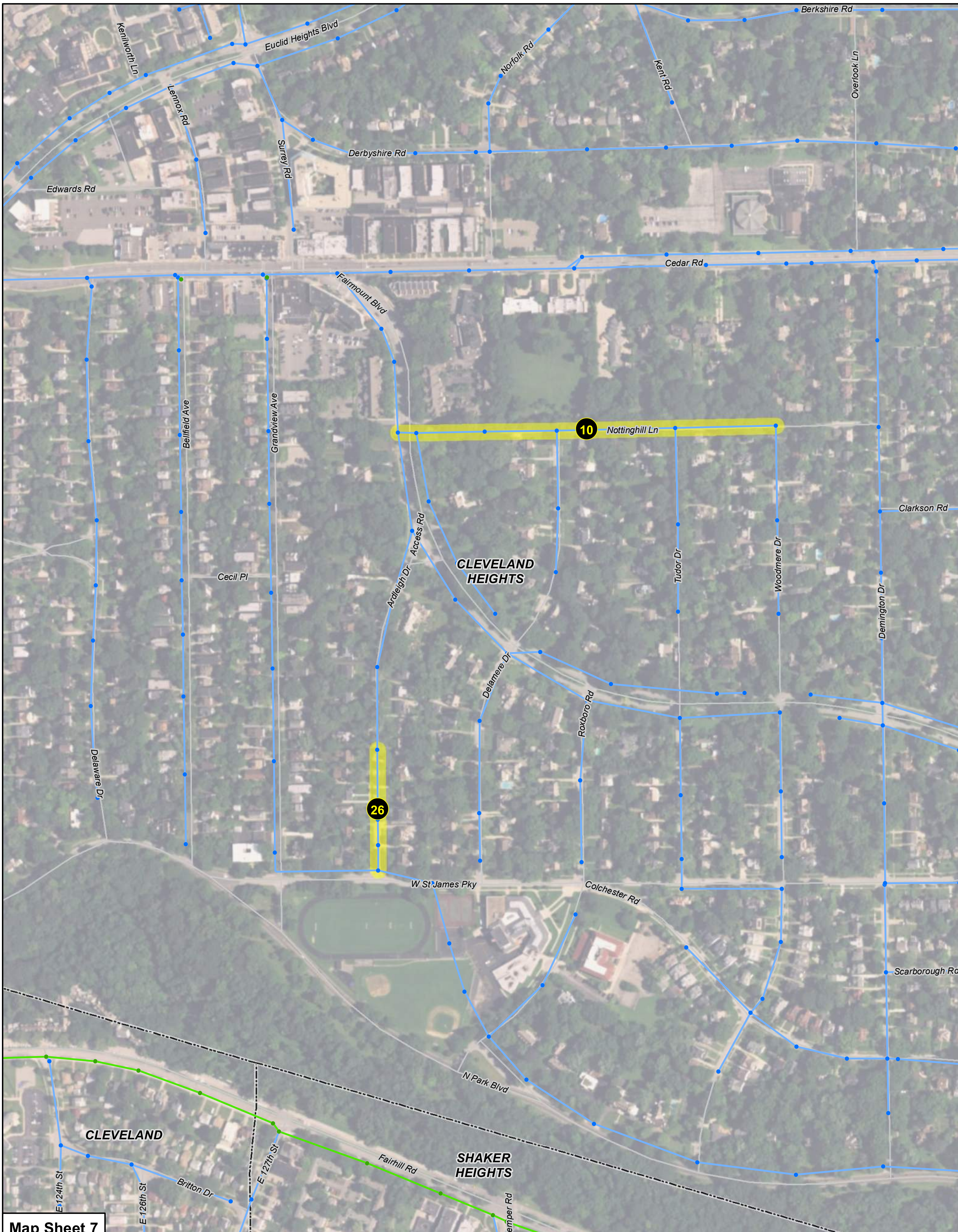

Map Sheet 7

Legend

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- District Gravity Main
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- Local Gravity Main
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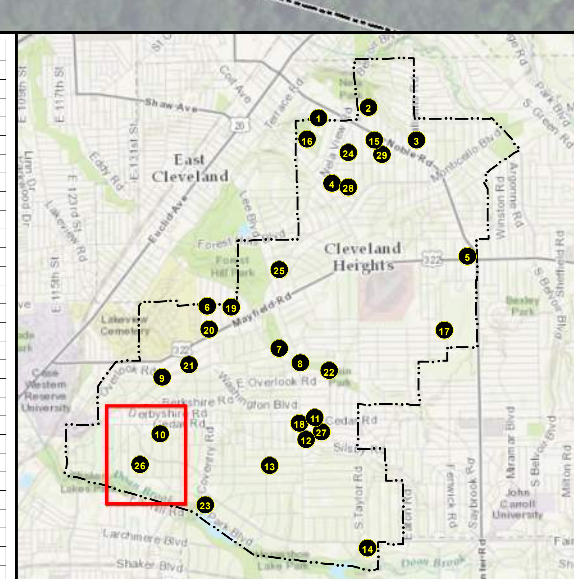

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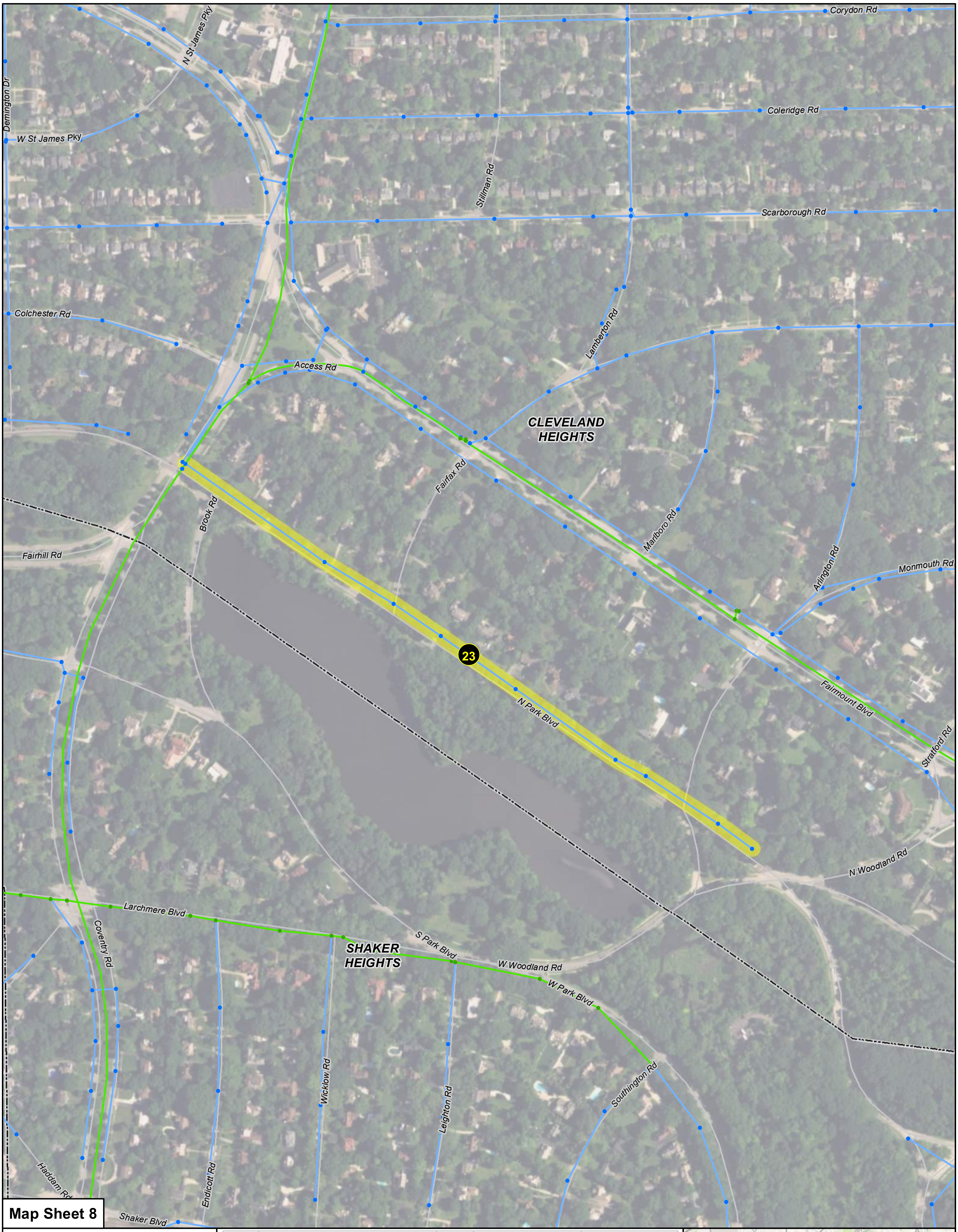

Map Sheet 8

Legend

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- Local_Pump_Station
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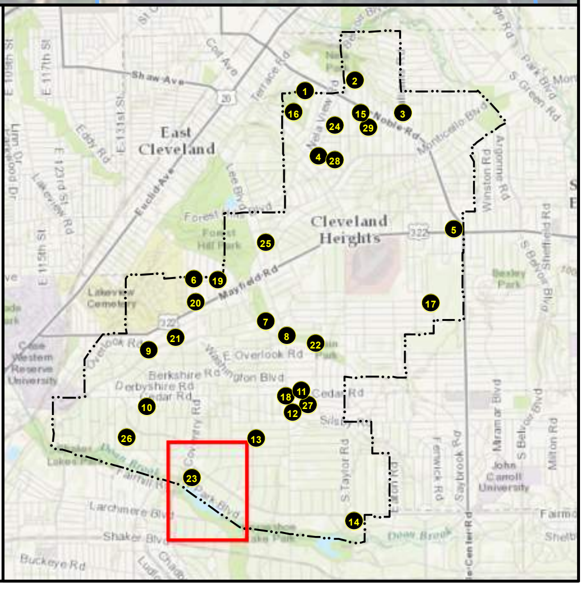
19	Eddington Road	730	2007 Sewer Cleaning Report	Residential Grease
20	1714 Coventry Road	540	2008 Sewer Cleaning Report	Residential Grease
21	2684 Euclid Heights Blvd	570	2009 Sewer Cleaning Report	Residential Grease
22	Superior between Redwood and Goodnor	250	2009 Sewer Cleaning Report	Residential Grease
23	North Park btw Coventry and Arlington	2,800		Roots
24	3390 Winsford Road	250	Cleaning Reports	Residential Grease
25	Bolton Road & Monticello Blvd	220	Cleaning Reports	Residential Grease
26	2520 - 2334 Ardleigh Drive	460	Cleaning Reports	Residential Grease
27	3244 Cedarbrook Road	200	Cleaning Reports	Residential Grease
28	Henderson Road	1,000	Identified during HHI LSSES	Roots
29	Pembrook Road	1,700	Identified during HHI LSSES	Roots



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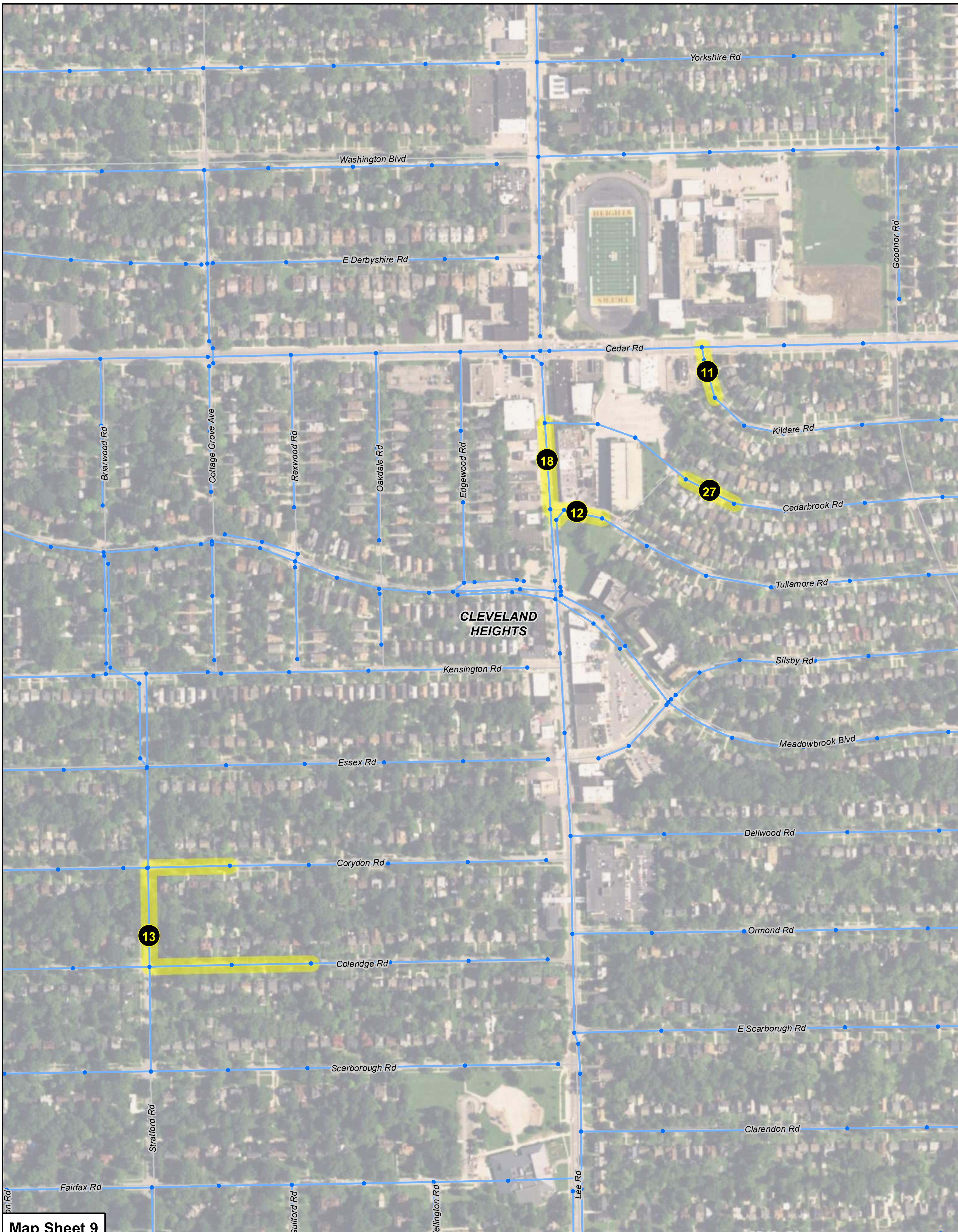

Map Sheet 9

Legend

- Community Border
- District_Manhole
- Local_Manhole
- District_Pump_Station
- Local_Pump_Station
- District Gravity Main
- District Pressure Main
- Local Gravity Main
- Local Pressure Main
- HFC Locations

Map Key	High Frequency Cleaning Locations	Length (LF)	Identified From	Cause
1	Eloise in north section	450	From CMOM March 2016	Residential Grease
2	Randolph intersecting Woodview	200	From CMOM March 2016	Pump Station
3	Quilliams (from Noble to Lowell)	850	From CMOM March 2016	Residential Grease
4	Sylvanhurst at Henderson	460	From CMOM March 2016	Residential Grease
5	Mayfield (south side) from Noble to Warrensville Center	510	From CMOM March 2016	Commercial Grease
6	Coventry at Avondale	200	From CMOM March 2016	Residential Grease
7	Superior and Euclid Heights Blvd	200	From CMOM March 2016	Residential Grease
8	Superior and Lee	200	From CMOM March 2016	Residential Grease
9	Euclid Heights at Edgehill	600	From CMOM March 2016	Residential Grease
10	Nottinghill Lane	1,400	From CMOM March 2016	Residential Grease
11	Kildare (lower)	200	From CMOM March 2016	Residential Grease
12	Tullamore	200	From CMOM March 2016	Residential Grease
13	Coleridge - Stratford - Corydon	1,200	From CMOM March 2016	Roots
14	North Park Lane (Shelburne to City Line)	900	From CMOM March 2016	Residential Grease and Roots
15	943 Elbon to Noble	400	2007 Sewer Cleaning Report	Residential Grease
16	Dresdon Road	1000		Residential Grease
17	Shannon at Maple	750	2007 Sewer Cleaning Report	Residential Grease
18	2195 Lee Road	330	2007 Sewer Cleaning Report	Commercial Grease
19	Eddington Road	730	2007 Sewer Cleaning Report	Residential Grease
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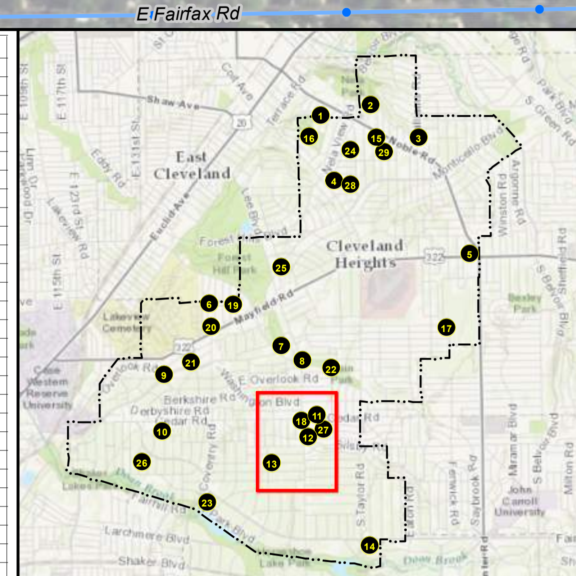

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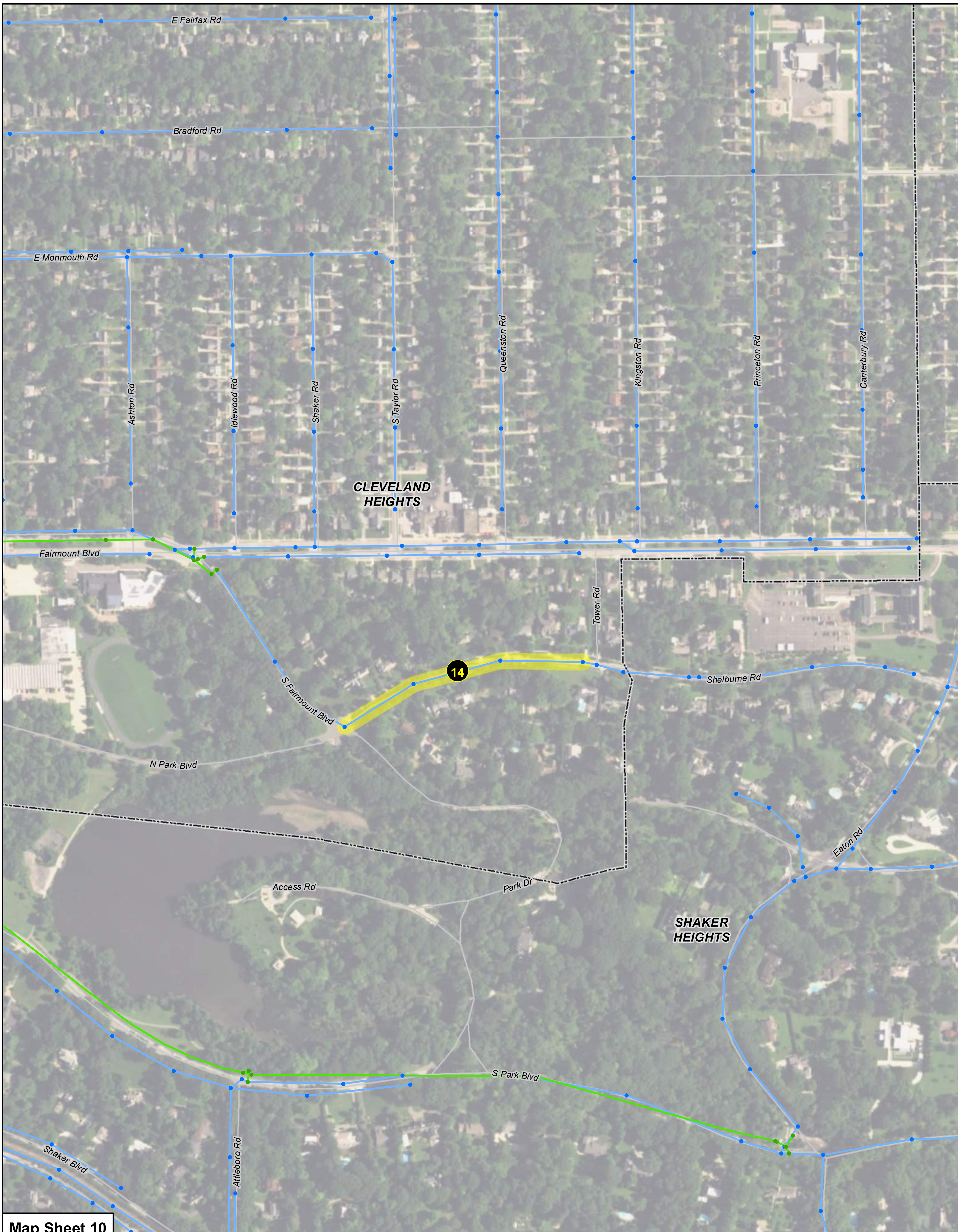

Map Sheet 10

Legend

- Community Border
- District_Manhole
- Local_Manhole
- District_Pump_Station
- Local_Pump_Station
- District Gravity Main
- District Pressure Main
- Local Gravity Main
- Local Pressure Main
- 1 HFC Locations

N

Map Key	High Frequency Cleaning Locations	Length (LF)	Identified From	Cause
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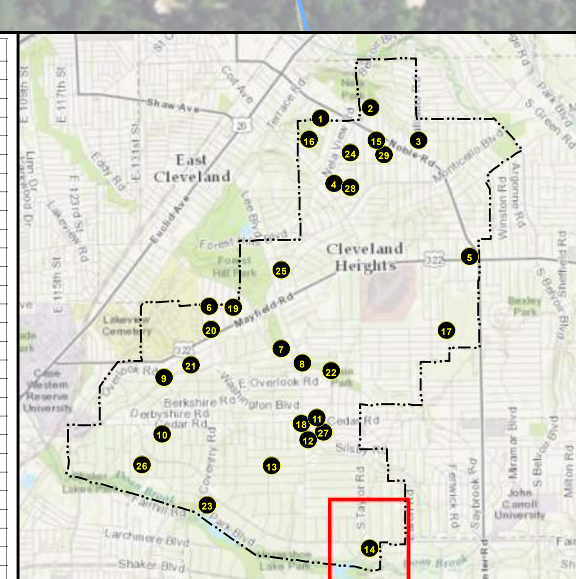

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SEWER MAINTENANCE
STANDARD OPERATING PROCEDURE (SOP)

CLEVELAND HEIGHTS

Administrative Support ☐ Field Operations ☒

Area: Sewer Maintenance **SOP No.:** SM-01

Title: Root Control Maintenance

Status: Draft ☒ Final ☐ **Original Date:** 07/11/17 **Revision Date:** ______

Reviewers: ______

Author: Wade Trim / Brown and Caldwell **Revision Number:** 0

INTRODUCTION / PURPOSE:

The purpose of this procedure is to provide instructions on how to remove blockages in the sanitary sewer due to root intrusion using a jet root saw. This will minimize root intrusion into the sanitary sewer within the collection system.

GENERAL FREQUENCY:

All known root hotspots will be inspected at least twice a year.

RESOURCES:

Crew
1 – Equipment Operator
1 – Utility Person
2 – Traffic Control (as needed)

MATERIALS:

Water

EQUIPMENT:

1 – Mongoose Jetter Truck
1 – Debris Basket
1 – Back-up truck with overhead arrow for traffic control (as needed)
PPE (gloves, hardhat, safety glasses, rain gear, rubber boots, hearing protection)
Laptop, charger and Sewer Cleaning Log

GENERAL WORK METHOD:

1. Sewer Maintenance Supervisor identifies area to be inspected by studying the video inspection data.
2. Clean pipe if accumulated sediment/roots are 20% or more of the pipe. (Refer to Gravity Sewer Line Cleaning and Routine Maintenance SOP)
3. Supervisor prepares work schedule and dispatches staff.
4. Place traffic control signs and safety devices as required at jobsite.
5. Use proper PPE.
6. Operator and laborer work together to remove manhole lid and position equipment.
7. Choose the appropriate nozzle for the root cutting to be performed.

8. Hydro jet with root cutter the line as needed to clean out debris, roots, etc.
9. During the jetting operations, capture any material with the appropriately size debris basket. Do not allow significant debris to travel downstream in the pipe which could result in another blockage.
10. While root cutting a sanitary sewer main use a higher pressure between about 1500-1800 psi dependent on the density of the roots that are being cut. Monitoring of cutting progression is through the vibration of the hose. When the hose is vibrating, it is cutting. When the hose is static, the head is stuck and not rotating the saw blade head.
11. Observe the conditions in the working manhole to identify if water is backing up into the manhole, to note the color of the flow during pull back and attempt to identify the type of material being flushed back to the manhole.
12. If additional resources are needed, such as heavy cleaning, contact Supervisor, for mobilization of Cuyahoga County Public Works or private contractor.
13. Collect large debris during cleaning or screening.
14. Remove equipment, including debris basket.
15. Spray out structure.
16. If additional cleaning of the structure is needed, staff cleans all areas within structure so that base of manhole is exposed. Remove debris from sanitary manhole. Clean all surfaces, walls, brick, concrete, inlet and outlet.
17. Inspect condition of inlet, outfall, and brick/concrete structure.
18. Replace and secure lid to avoid noise from traffic driving over it.
19. Clean up jobsite, tools and truck.
20. Remove traffic control signs and safety devices as required at jobsite.
21. Make notes about any further work that is needed.
22. Decant debris in appropriate location.
23. Accurately report mains and manholes cleaned in computer and on Sewer Cleaning Log.

Cleveland Heights

Sewer Maintenance Spare Parts Inventory

Final

February 14, 2018

WADETRIM TEAM

1.0 Introduction

This document reviews the current sewer maintenance spare parts inventory, , identified deficits in the inventory, and proposed actions to address the identified deficits. This inventory is required under the Interim Management, Operations and Maintenance (MOM) Measures in Appendix B (A.4.e.) of the Consent Decree between Cleveland Heights and the USEPA.

The summary is based on a review of available sewer maintenance information from Sewer Department staff including the Sewer Supervisor. Relevant information and spare parts needs for the past three years were referenced for this inventory. Older information was also considered if there was a history of reoccurring issues that required specific spare parts for resolution. It was determined that there were no instances of a prolonged problem or SSO in the collection system in which a spare part, length of pipe or appurtenance was needed and not available. Therefore, there are no identified deficits in the City's spare parts inventory.

2.0 Program Description and Components

The Sewer Department Garage houses most of the tools and spare parts used to maintain the collection system. There is a garage bay area for vehicles, the portable pump and emergency generator. Cleveland Heights maintains an inventory of critical replacement parts for the collection system at the Sewer Department Garage. Critical replacement parts kept in inventory include:

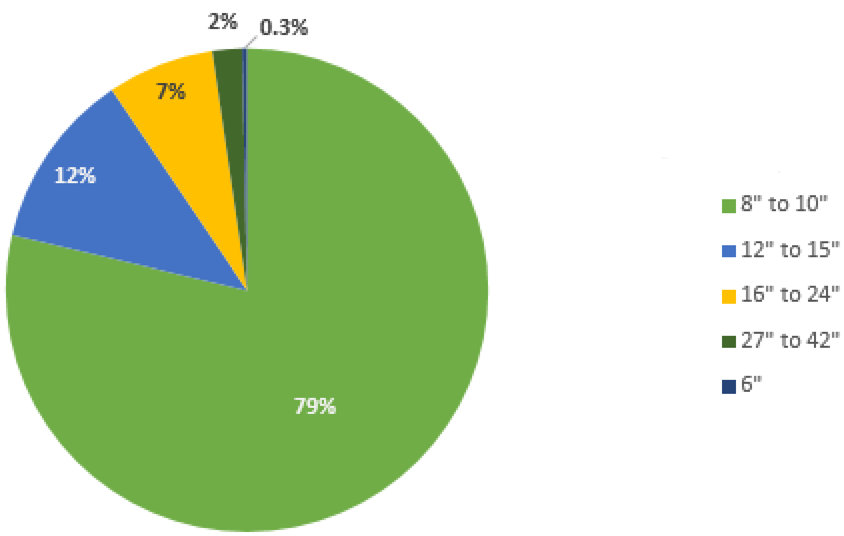
- Pipe – PVC
- Fittings - PVC
- Couplings
- Manhole lids, castings
- Concrete, mortar and sealants

A current inventory of all spare parts and tools available is shown in **Attachment A** of this document. This spreadsheet will be reviewed and updated periodically if additional parts or materials are needed in the City's inventory.

Pipe and Fittings

Cleveland Heights collection system includes sewer pipe of various sizes ranging from 8 inches to 42 inches. **Figure 1** shows a breakdown of sewer main sizes in the collections system.

Figure 1. City of Cleveland Heights Gravity Sewer Diameters.



Most of the City's sewer laterals are 4 or 6 inches in diameter. Cleveland Heights keeps in-house pipe and fittings up to 12 inches in diameter, which comprises 80% of the collection system and all service laterals. If a length of pipe or fitting larger than 12 inches in diameter is needed, there are two local pipe supply companies that have, in stock for immediate pickup, up to 24 inch diameter pipe, which accounts for 97.7% of the collection system, and up to 15 inch fittings, which accounts for 91% of the collection system. The suppliers also have the ability to order larger parts with approximately a one-week lead time. The current local pipe suppliers are:

Green Builders	HD Supply
527 South Green Road	23880 Broadway Avenue
South Euclid, Ohio 44121	Bedford, Ohio 44146
216-291-9800	440-439-4040

The Utilities Commissioner and the Sewer Supervisor have authorization to make purchases up to $50,000 for spare parts, piping and fittings or emergency repairs.

Bypass Pumping/Emergency Pump Station Operation

In the event of a prolonged sewer line blockage or a sewer line collapse, bypass pumping may be required. The City owns and operates a Gorman Rupp 3-inch portable pump for localized bypass pumping of small flows. A specification sheet for the pump can be found in **Attachment B** of this report. Because the City is not equipped to sustain prolonged bypass pumping, a private contractor is retained for instances in which long term bypass maybe needed. Contact information for the preferred contractor is below.

AAA Advanced Plumbing & Drain
7277 Bessemer Avenue
Cleveland, OH 44127
216-341-2900

The City has a North Star 5500 PPG series portable generator in the event of a pump station power failure. A private company is contracted to perform semiannual inspections of the pump stations. No spare parts for the pump stations are kept on-site. If specific parts are needed they are ordered by the private contractor who also performs the maintenance or repair.

3.0 Future Considerations

Cleveland Heights will continue to maintain a critical spare parts inventory and will incorporate the inventory spreadsheet into the upcomig IMS system. As IOCMP and SSES activities ramp up, inventories of spare parts may be adjusted to incorporate pipe and appurtenances if critical repairs are frequently required and material shortage becomes an issue.

Attachment A – Spare Parts Inventory, June 15, 2017

SEWER INVENTORY 6/15/2017

FERNCOS	
1	10" C TO P
0	8" C TO P
0	6" C TO P
4	6" P TO P
2	4" C TO P

PVC PIPE	
12'	12"
4'	10"
8'	8"
40'	6"
40'	4"

PVC PIECES	
1	12" 45
1	10 X10X8 TEE
1	8" TEE
2	8" Y
1	8" 90
1	8" TEE
1	8 " 45
1	6" TO 4"
1	6" Y
1	6X6X2 Y
5	6" 90
6	6" 22
5	6" 45

BRICKS	100
MORTAR	30
CEMENT	12
WATER PLUG	1

DYE	
2	RED TABLETS
10	RED POWDER
0	GREEN LIQUID
PAINT - CANS	
60	GREEN
3	PINK
11	WHITE

CASTINGS AND LIDS/GRATES	
2	1710 SOLID
1	1710 GRATE
1	7030 GRATE

SEWER MACHINES		3
CUTTERS	1"	30
	2"	14
	3"	24
	4"	12
	6"	30
BELTS		3
LEADERS		8
PORTABLE PUMP		1
PORTABLE GENERATOR		1
SEWER JET		1
CABLE 50'X.66		6
CAMERAS		2
LADDER		1
TRIPOD		1
SHOVELS		
SPADES		3
SHORT SHOVELS		2

Attachment B – Portable Pump Specifications

A C E G

GORMAN-RUPP PUMPS

Gasoline Engine Driven

Self Priming Centrifugal Pump

Model 13D-GX240

Size 3” x 3”

CERTIFIED PERFORMANCE
CONTRACTORS PUMP BUREAU
cpb
The manufacturer of this pump certifies that it was manufactured in accordance with the standards of the Contractors Pump Bureau.

18MTC

Total Head		Capacity Of Pump In U.S. Gallons Per Minute (GPM) At Continuous Performance				
P.S.I.	Feet					
38.6	89	90	90	90	90	90
34.7	80	100	140	150	150	150
30.3	70	138	182	205	205	205
26.0	60	162	210	242	258	258
21.7	50	176	228	266	292	302
17.3	40	180	238	282	315	335
13.0	30	182	246	292	328	356
8.7	20	185	250	300	338	370
Suction Lift		25’	20’	15’	10’	5’

PUMP SPECIFICATIONS

Size: 3” x 3” (76 mm x 76 mm) NPT - Female.
Casing: Aluminum Alloy 356-T6 W/Gray Iron 30 Cutwater Insert. Maximum Operating Pressure 66 psi (455 kPa).*
Semi-Open Type, Two Vane Impeller: Ductile Iron 65-45-12. Handles 1 1/2” (38,1 mm) Diameter Spherical Solids.
Replaceable Wear Plate: Carbon Steel 1026.
Removable Cover Plate: Aluminum Alloy 356-T6; 4 lbs. (1.8 kg.).
Intermediate Bracket: Aluminum Alloy 356-T6.
Seal: Double, Grease-Lubricated with Spring-Loaded Grease Cup. Sintered Bronze Stationary Seal Seats. Steel Rotating Faces. Neoprene Packing Rings. Maximum Temperature of Liquid Pumped, 110°F (43°C). Maximum Suction Pressure 10 psi (69 kPa).*
Seal Liner: Copper Alloy C26000.
Flap Valve: Buna-N W/Nylon Reinforcing; Steel and Brass.
Suction Flange: Aluminum Alloy 356-T6.
Gaskets: Cork W/Nitrile Binder (NC710).
O-Ring: Buna-N.
Hardware: Standard Plated Steel.
Roll Cage with Rubber Feet.
90° Ductile Iron Discharge Elbow.
Strainer.

Optional Equipment: Wheel Kit with 2.75” x 10” (70 mm x 254 mm) Semi-Pneumatic Tires.

**Consult Factory for Applications Exceeding Maximum Pressure and/or Temperature Indicated.*

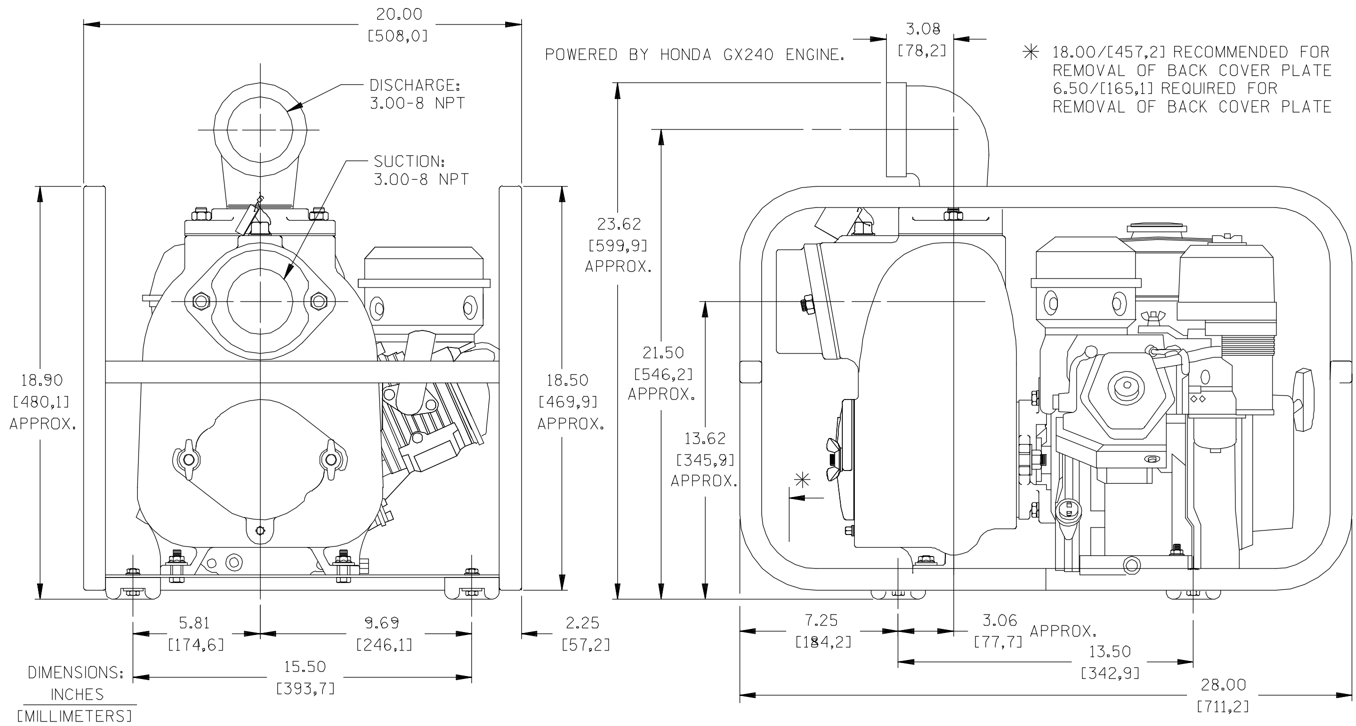
WARNING!
Do not use in explosive atmosphere or for pumping volatile flammable liquids.

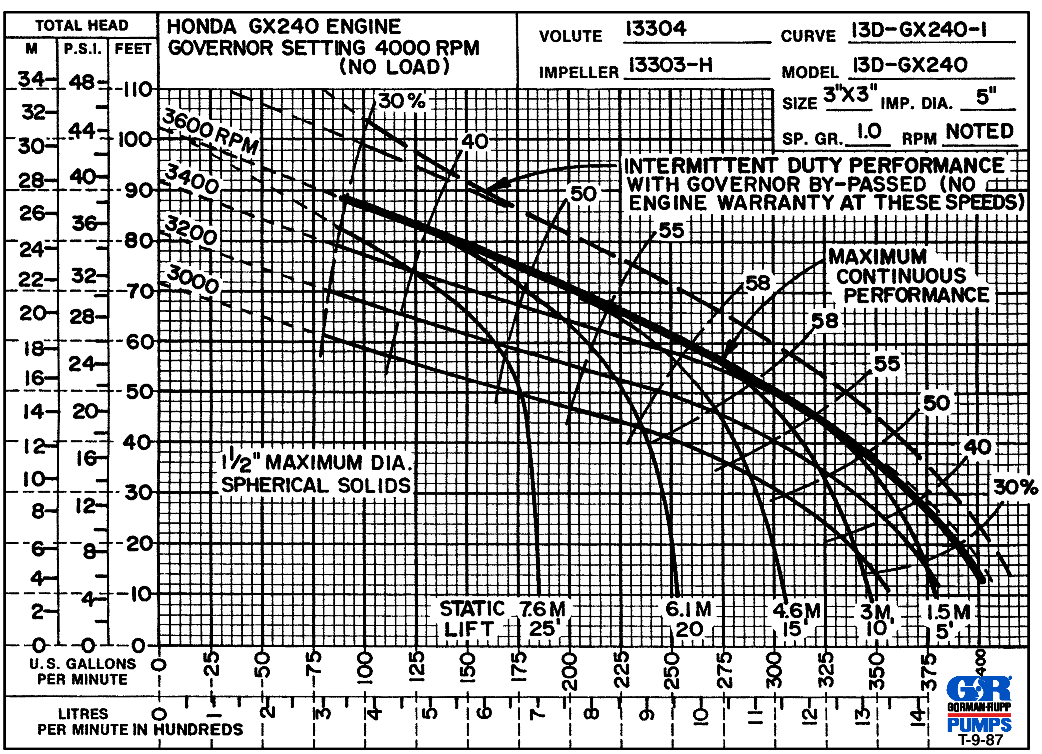
ENGINE SPECIFICATIONS

Model: Honda GX240.
Type: Single Cylinder, Four Cycle, Air Cooled, Overhead Valve, Gasoline Engine.
Displacement: 14.8 Cu. In. (242 cc).
Carburetor: Horizontal Type.
Cylinder: Aluminum Alloy W/Cast Iron Liner.
Governor: Mechanical.
Lubrication: Splash System.
Air Cleaner: Dry Type, Dual Element.
Oil Reservoir: 37 U.S. Oz. (1,1 Liters).
Fuel Tank: 1.6 U.S. Gallons (6,1 Liters).
Full Load Operating Time: 2.7 Hours.
Starter: Rope Rewind.
Ignition System: Transistorized Magneto.
Standard Features: Muffler W/Guard. Rotary Stop Switch. Manual Throttle Control with Top Speed Limit. Manual Choke. “Oil Alert™” Low Oil Shut Down.

HONDA PUBLISHED PERFORMANCE:
Maximum Continuous B.H.P. 6.8 (5,1 kW) @ 3600 RPM
Maximum Dynamic B.H.P. 8.0 (6,0 kW) @ 3600 RPM

Specification Data	APPROXIMATE DIMENSIONS and WEIGHTS	NET WEIGHT: 126 LBS. (57 KG.) SHIPPING WEIGHT: 136 LBS. (62 KG.) EXPORT CRATE: 6.3 CU. FT. (0,19 CU. M.) WHEEL KIT ADD 25 LBS. (11,3 KG.); SHIPPING CRATE (SEPARATE) 3 CU. FT. (0,1 CU. M.)
SECTION 45, PAGE 552		





THE GORMAN-RUPP COMPANY • MANSFIELD, OHIO

GORMAN-RUPP OF CANADA LIMITED • ST. THOMAS, ONTARIO, CANADA

Specifications Subject to Change Without Notice

Printed in U.S.A.

SAFETY EQUIPMENT

EACH EMPLOYEE OF THE WATER AND SEWER DEPTMENT IS ISSUED THE FOLLOWING SAFTEY EQUIPMENT TO BE USED DAILY WHILE PERFORMING THEIR ASSIGNMENTS. THE RESULT OF NOT HAVING THE PROPER EQUIPMENT ON COULD RESULT IN DISCIPLINE. THIS IS FOR YOUR PROTECTION SO YOU CAN BE SAFE.

1. HARD HAT ✓
2. GLOVES
3. SAFTEY VEST
4. EYE PROTECTION ✓
5. EAR PROTECTION ✓
6. BOOTS
7. TRAFFIC CONES ______

I HAVE RECEIVED THE FOLLOWING SAFTEY GEAR AND UNDERSTAND THAT I WILL WEAR MY EQUIPMENT EVERYDAY BECAUSE IT IS PART OF MY JOB AND IT IS FOR MY SAFETY. I ALSO UNDERSTAND THE CONSEQUENCES OF NOT WEARING MY SAFTEY EQUIPMENT.

Joe Coelbo 1-19-17

EMPLOYEES NAME DATE

1-19-17

SUPERVISORS NAME DATE

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William Owens   Will Owens   1-17-17

EMPLOYEES NAME   DATE

[signature]   1-17-17

SUPERVISORS NAME   DATE

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Dwane Clagget   Dwane Claggett   1-18-17
EMPLOYEES NAME   DATE

1-18-17
SUPERVISORS NAME   DATE

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Bob Maughton 1-18-17

EMPLOYEES NAME DATE

1-18-17

SUPERVISORS NAME DATE

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Joe Cardarella 1/18/17

EMPLOYEES NAME DATE

1-18-17

SUPERVISORS NAME DATE

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Tony Palmisano

Tony Palmisano 1-18-17

EMPLOYEES NAME DATE

1-18-17

SUPERVISORS NAME DATE

SAFETY EQUIPMENT

EACH EMPLOYEE OF THE WATER AND SEWER DEPTMENT IS ISSUED THE FOLLOWING SAFTEY EQUIPMENT TO BE USED DAILY WHILE PERFORMING THEIR ASSIGNMENTS. THE RESULT OF NOT HAVING THE PROPER EQUIPMENT ON COULD RESULT IN DISCIPLINE. THIS IS FOR YOUR PROTECTION SO YOU CAN BE SAFE.

1. HARD HAT ✓
2. GLOVES ✓
3. SAFTEY VEST
4. EYE PROTECTION ✓
5. EAR PROTECTION has
6. BOOTS has
7. TRAFFIC CONES will use tall cones

I HAVE RECEIVED THE FOLLOWING SAFTEY GEAR AND UNDERSTAND THAT I WILL WEAR MY EQUIPMENT EVERYDAY BECAUSE IT IS PART OF MY JOB AND IT IS FOR MY SAFETY. I ALSO UNDERSTAND THE CONSEQUENCES OF NOT WEARING MY SAFTEY EQUIPMENT.

[signature] Dee Jones 1-18-17

EMPLOYEES NAME DATE

[signature] 1-18-17

SUPERVISORS NAME DATE

SAFETY EQUIPMENT

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7. TRAFFIC CONES 0

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David Eathridge DAVID EATHRIDGE 1-18-17

EMPLOYEES NAME DATE

1-18-17

SUPERVISORS NAME DATE

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[signature] Bill Carrig 1-17-17

EMPLOYEES NAME DATE

[signature] 1-17-17

SUPERVISORS NAME DATE

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Angelo Manco 1-17-17

EMPLOYEES NAME DATE

1-17-17

SUPERVISORS NAME DATE

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Jeff Jackson 1-17-17

EMPLOYEES NAME DATE

1-17-17

SUPERVISORS NAME DATE

Cleveland Heights

Information Management System Development Plan

Draft

February 14, 2018

WADETRIM TEAM

1.0 Introduction

This Information Management System Development Plan (IMS Plan) summarizes Cleveland Heights proposed approach for updating the Sewer Department's IMS as required under the Capacity, Management, Operations and Maintenance (CMOM) Measures in Appendix B (Section I) of the Consent Decree between Cleveland Heights and the USEPA.

2.0 Implementation Plan

This IMS Plan will be implemented by December 1, 2018. The IMS will be consistent with requirements in the Consent Decree including:

- A Program capable of maintaining data on the sanitary sewer system assets and sanitary sewer overflows (SSOs) including maintenance records, specific SSO data developed in the SSO Reporting Plan and a Geographical Information System (GIS) for tracking spatial tools.

Implementation progress of the IMS Plan includes the following:

2.1 Staffing – COMPLETE

The City has hired a GIS Analyst to maintain asset information in IMS/GIS. Administration of the IMS will be performed by the City's Management Information Services (MIS) Department.

2.2 System Selection – COMPLETE

Lucity has been selected as the IMS software for Cleveland Heights. This software will help Cleveland Heights manage assets, create a work order system, organize preventative maintenance practices and create an overall repository of information on the City's collection system.

2.3 Procurement – COMPLETE

Agreement signed with Lucity Inc. for Lucity software.

2.4 Installation – Ongoing

The City has completed installation of Esri GIS desktop software that will be used to maintain the collection system asset information in an Esri geodatabase. The City has also completed installation of Lucity server software on the City system. The City's Management Information Services (MIS) Department and Sewer Department will be working with Lucity representatives on next steps including installing and testing the mobile server which will allow for mobile data collection.

2.5 Configuration/Testing – Ongoing

The City and Lucity representatives have been meeting regularly to complete installation and configuration on Cleveland Heights' system. The City's MIS Department and Sewer Department will be working with Lucity representatives to:

- Review and develop templates for work orders and data collection
- Configure the Esri GIS for use within Lucity
- Configure Lucity for specific City workflows
- Configure and develop Lucity report templates

2.6 Data Development

GIS

The City obtained GIS mapping of the collection system and stormwater system assets from NEORSD and is currently comparing the data to record drawings to identify areas needing additional field investigation to resolve uncertainties in the asset inventory.

All sewer system assets in the GIS have unique asset IDs assigned to them. These IDs will be referenced in the IMS and in future field inspection datasets.

SSES Data

The City will obtain a copy of field investigation datasets for City assets from NEORSD including inspections done during the District's Heights Hilltop LSSES project. These SSES datasets will be stored on the Cleveland Heights local server. This will allow for Cleveland Heights Sewer Department to have access to manhole and SSO inspections, CCTV pipe inspections, and dye and smoke testing results that were performed during the Heights Hilltop project. This information will be included in the Phase 1 SSES required under the Consent Decree.

2.7 Data Loading

Loading asset information into Lucity is being performed by Cleveland Heights staff as part of the initial configuration in conjunction with Lucity professional services.

2.8 Training

City staff will undergo training with Lucity representatives to include the following topics:

- installation and maintenance
- security
- configuration
- document management
- data integration
- reporting
- importing and exporting of data

Separate training sessions for smaller groups will focus on work and asset management. The sessions will lead into the start of field investigations required for the SSES program, and will allow for real time field data collection and work order generation from the SSES activities.

3.0 Updating Asset Data in the IMS

After initial configuration is complete, the City will implement ongoing maintenance procedures to keep the asset inventory information up to date. The primary tasks to be performed by the City's GIS Analyst on an ongoing basis will include:

- Incorporation of new construction and asset rehabilitation/renewal information into the GIS and IMS using record drawings as they are received.
- Coordination with NEORSD to synchronize GIS updates between the City's geodatabase and NEORSD's enterprise geodatabase on a regular basis.
- Updating the GIS asset inventory from field inspection datasets to reflect SSES findings and existing system conditions.

4.0 Updating Work History Data in IMS

The City will also use Lucity Mobile software on mobile devices in the field to record work performed on assets via work orders. Field inspection work collected in external software packages (e.g., CCTV observations gathered using NASSCO PACP-compliant software on inspection contractor's truck computers), will be imported into Lucity for centralized information management.

UNIFORM STANDARDS FOR SEWERAGE IMPROVEMENTS

December 1998

City of Cleveland
Northeast Ohio Regional Sewer District
Cuyahoga County Sanitary Engineering Division
Municipal Engineers Association of Northeast
Ohio EPA Northeast District Office

standards

UNIFORM STANDARDS
FOR
SEWERAGE
IMPROVEMENTS

CITY OF CLEVELAND

NORTHEAST OHIO REGIONAL SEWER DISTRICT

CUYAHOGA COUNTY SANITARY ENGINEERING DIVISION

MUNICIPAL ENGINEERS ASSOCIATION OF NORTHEAST OHIO

OHIO EPA NORTHEAST DISTRICT OFFICE

We, the regular members of the Committee on Uniform Standards for Sewerage Improvements, have prepared these Standards and recommend their adoption and use by all governmental entities, agencies, and consulting engineers in Cuyahoga County.

Richard G. Hunsinger, P.E., P.S., Chair	Chief Engineer **Cuyahoga County Sanitary Engineering Division** 6100 W. Canal Road Valley View, Ohio 44125
John A. Fazio, P.E.	**Northeast Ohio Regional Sewer District** 3826 Euclid Avenue Cleveland, Ohio 44115
Jeffrey J. Filarski, P.E.	**Municipal Engineers Association of NE Ohio**
Stephen Hovancsek, P.E., P.S.	**Municipal Engineers Association of NE Ohio**
John Januska, P.E.	**Ohio EPA Northeast District Office** 2110 East Aurora Road Twinsburg, Ohio 44087
Frederick N. Tufts, P.E.	**Municipal Engineers Association of NE Ohio**
Stephen N. Toth, E.I.T., S.I.T.	**Division of Water Pollution Control** City of Cleveland 12302 Kirby Cleveland, Ohio 44108

NON-VOTING MEMBERS

Ruth Langsner, P.E.	Sanitary Engineer **Cuyahoga County Sanitary Engineering Division** 6100 W. Canal Road Valley View, Ohio 44125
Leonard Zavarella	**Cuyahoga County Sanitary Engineering Division** 6100 W. Canal Road Valley View, Ohio 44125
Rachid F. Zoghaib, P.E.	**Division of Water Pollution Control** City of Cleveland 12302 Kirby Cleveland, Ohio 44108

GENERAL OUTLINE OF THE RULES, REGULATIONS, AND STANDARDS FOR INSTALLATION OF SEWERAGE IMPROVEMENTS

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PART 5 - STANDARD SPECIFICATIONS

PART 6 - STANDARD DESIGN AND CALCULATION FORMS

PART 1 - GENERAL INFORMATION

1.1 PURPOSE

These Standards are intended for use as a guide in the design and construction of sewerage facilities. These Standards are minimum requirements for design and construction of sewerage and storm water facilities in Cuyahoga County. Adherence to the Standards does not guarantee proper design and/or construction. Designers must use engineering judgement in the application of these Standards and are ultimately responsible for a design which will result in satisfactory performance of all structures and systems.

Adherence to the Standards does not guarantee compliance with Federal, State and Municipal regulations, laws or ordinances. In cases where the Standards conflict with Federal, State, and/or Municipal standards, regulations, laws or ordinances, whichever is more restrictive, shall apply.

1.2 DEFINITIONS

Definition of terms and their use in the Standards are in accordance with the GLOSSARY - WATER AND WASTEWATER CONTROL ENGINEERING, published by APHA, ASCE, AWWA and WEF, formerly WPCF. The units of expression used are in accordance with those recommended in Manual of Practice Number 6, Units of Expression for Wastewater Treatment, published by the WEF, formerly WPCF, Water Pollution Control Federation. Reference to Standards or Specifications shall mean the latest version available.

1.3 AUTHORITY

Approvals pursuant to these Standards shall be obtained from those agencies exercising jurisdiction or responsibility for any or all of the following functions:

1. Construction, inspection, operation and maintenance of the storm or drainage system;
2. Construction, inspection, operation and maintenance of the sanitary wastewater collection system;

3. Construction, inspection, operation and maintenance of storm or wastewater pumping stations;
4. Construction, inspection, operation and maintenance of the storm or wastewater treatment facilities.

It should be recognized that approvals may be required by more than one local, county, regional and/or special purpose agency.

A list of authorized agencies and municipalities which can be contacted for information or required approvals is provided on page 1-3. This list serves as a guide in identifying agencies with potential review, approval or permit authority.

Ohio Environmental Protection Agency (OEPA), Cuyahoga County Sanitary Engineering Division (CCSED), Northeast Ohio Regional Sewer District (NEORSD) where applicable, and the municipality's approval is required on all sanitary sewers, combined sewers, wastewater pumping stations, wastewater treatment plants, and wastewater sludge handling and disposal facilities.

Additional approval requirements will be identified by any responsible agency upon receipt of plans and/or specifications for review.

AGENCIES EXERCISING JURISDICTION OR RESPONSIBILITY FOR REVIEW AND/OR APPROVAL

Incorporated Municipalities

Cuyahoga County Sanitary Engineering Division
6100 W. Canal Road
Valley View, Ohio 44125

TELEPHONE: (216) 443-8213

Northeast Ohio Regional Sewer District
3826 Euclid Avenue
Cleveland, Ohio 44115

TELEPHONE: (216) 881-6600

Ohio Environmental Protection Agency
Northeast Ohio District Office
2110 East Aurora Road
Twinsburg, Ohio 44087

TELEPHONE: (330) 425-9171

PART 2 - PERMIT REQUIREMENTS

2.1 PROCEDURE

a. No unauthorized person shall uncover, make any connections with or opening into, use, alter or disturb any public sewer or appurtenance thereof without first obtaining a written permit from all appropriate authorities.

b. The permit will be issued when the plans and specifications have been approved by the appropriate authorities.

c. Approval of plans and specifications for storm and/or sanitary sewers within the public right-of-way by the responsible agencies will serve as authority to construct those facilities. Permits for storm or sanitary service connections are required for all facilities or structures desiring use of a public sewer. The issuing authorities for the permits are listed on Page 1-3 of these Specifications.

d. Obtaining the required plan approvals and service connection permits from the Cuyahoga County Sanitary Engineering Division does not relieve a contractor from the responsibility to obtain local permits and/or utility company approvals.

2.2 PERMIT APPLICATIONS

Service Connection Permit forms may be obtained from the issuing municipal authority and/or the Cuyahoga County Sanitary Engineering Division.

PART 3 - STANDARDS FOR SEWERAGE FACILITIES

3.1 - ENGINEERING

3.101 Preparation of Drawings, Specifications, and Designer's Reports

A. General Information

B. Designer's Reports

3.102 Plans of Sewerage Facilities

A. General Information

B. Detailed Plans

3.103 Plans of Sewers

A. General Information

B. Boring Location Plans

C. Detailed Plans and Profiles

D. Special Detail Drawings

3.104 Plans of Sewage Pumping Stations

A. Location Plan

B. Detailed Plans

3.105 Plans of Sewage Treatment Plants

A. Location Plan

B. General Layout

C. Detailed Plan

3.106 Specifications

A. General Information

B. Construction Requirements

3.107 Revisions to Approved Plans

3.108 Operation During Construction

3.101 PREPARATION OF DRAWINGS, SPECIFICATIONS AND DESIGNER'S REPORT

A. General Information

All drawings, specifications, and designer's reports submitted for approval shall be prepared by or under the supervision of a Registered Professional Engineer legally licensed to practice in Ohio. The front cover or fly leaf of each set of such drawings, of each copy of the designer's reports and of the specifications submitted, shall bear the imprint of the seal of the Registered Engineer by or under whom it was prepared. In addition, each drawing submitted shall bear an imprint or a legible facsimile of such seal.

B. Designer's Reports

The purpose of the report is to record in form for convenient and permanent reference the controlling assumptions made and factors used in the functional design of the sewerage works as a whole and of each of the component units. Data on structural, mechanical, and electrical designs may be excluded except to the extent that reference to such elements are necessary in checking the functional operation. Copies of a report consisting of the appropriate required information shall be submitted to the approving agency.

3.102 PLANS OF SEWERAGE FACILITIES

A. General Information

All plans for sewerage facilities shall bear a suitable title sheet showing the name of the municipality, sewer district, or institution, and show the scale in feet, a graphical scale, original lot number and tract, the north point, date and the name of the engineer and imprint of the registration seal; these plans shall be clear and legible.

All plans shall be drawn to a scale which will permit all necessary information to be plainly shown. To facilitate the microfilming of all approved plans, the maximum plan size shall be no larger than 24 inches by 36 inches. Datum used shall be USGS only.

B. Detailed Plans

Detailed plans shall consist of plan views, elevations, sections and supplementary views which, together with the specifications and general layouts, provide the working information for the contract and construction of the works. Dimensions and relative elevations of structures, the location and outline of form of equipment, location and size of piping, water levels, ground elevations, and any other pertinent data shall be included. All plans shall include complete general notes and applicable standard sewer details pertaining to the project.

3.103 PLANS OF SEWERS

A. General Information

A comprehensive plan of the existing and/or proposed sewers shall be submitted for projects involving new sewer systems or substantial additions to existing systems. This plan shall show the following:

1. Topography and Elevations

   Existing or proposed streets and all streams, water courses, or water surfaces shall be clearly shown.

2. Contour Lines

   General contour lines of not more than two (2) feet intervals shall be included.

3. Streams

   The direction of flow in all streams, and high and low water elevations of all water surfaces at sewer outlets and overflows shall be shown. Where necessary, cross sections may be required.

4. Boundaries

   The boundary lines of the municipality or township and the sewer district or area to be sewered by project shall be shown.

5. Sewers

   The plan shall show the location, size, slope and direction of flow of all existing and proposed sanitary, storm, and combined sewers associated with the proposed project.

6. Location of any Wetlands or Flood Plains.

B. Boring Location Plans

Boring location plan and cross section (with boring log sheets) shall be supplied when required by the reviewing agency for major sewer projects.

C. Detailed Plans and Profiles

Detailed plans and profiles must be submitted for sewer construction projects. Projects should have a horizontal scale of not more than fifty (50) feet to the inch. Profiles shall have an appropriate vertical scale of not more than ten (10) feet to the inch. Plans and profile shall show:

1. Location of streets.

2. Existing and proposed ground surface, elevations, size, material and type of pipe, length between manholes, invert and surface elevation at each manhole, and grade of sewer between each two (2) adjacent manholes as well as the size and elevations of the sewer into which the flow of the sewer under consideration is to discharge. All manholes shall be numbered and stationed on the plan and correspondingly numbered on the profile.

3. Where there is any question of the sewer being sufficiently deep to serve any existing or proposed building, the elevation and location of the basement floor shall be plotted on the profile and plan of the sewer which is to serve the building in question. The engineer shall state that all sewers are sufficiently deep to serve existing adjacent basements and future normal depth basements except where otherwise noted on the plans.

4. Locations of all special features such as inverted siphons, concrete encasements, elevated sewers, etc.

5. All known existing structures and vegetation both above and below ground which might interfere with the proposed construction, particularly water mains, gas mains, underground utilities, etc.

D. Special Detailed Drawings

Special detailed drawings, made to a scale to clearly show the nature of the design, shall be furnished to show the following particulars:

1. All stream crossings and sewer outlets, with elevations of the stream bed and extreme high and low water levels.
2. Details of all special sewer joints and cross-sections.
3. Details of all sewer appurtenances such as, but not limited to, manholes, catch basins, inlets, inspection chambers, inverted siphons, regulators, head-walls and elevated sewers.

3.104 PLANS OF SEWAGE PUMPING STATIONS

A. Location Plan

A plan shall be submitted for projects involving construction or modification of pumping stations. This plan shall show the following:

1. The location and extent of the tributary area.
2. Any municipal or township boundaries within the tributary area.
3. The location of the pumping station and force main and gravity sewers.
4. Location and capacity of existing outlet sewer or treatment facility.
5. The general topography using a maximum contour interval of ten (10) feet and pertinent elevations.
6. Location of any wetlands or flood plain.

B. Detailed Plans

Detailed plans shall be submitted showing the following, where applicable:

1. A topographic map of the property to be used. Contour intervals shall be not more than two (2) feet.
2. Existing pumping station.
3. Proposed pumping station, including provision for installation of future pumps or ejectors, standby power, telemetry equipment and removal of pumps.
4. Elevation of high water at the site, and maximum elevation of sewage in the collection system upon occasion of power failure.
5. Test borings and ground water elevations.

3.105 PLANS OF SEWAGE TREATMENT PLANTS

A. Location Plan

A plan shall be submitted showing the sewage treatment plant in relation to the remainder of the system. A USGS Topographic Map (7.5 minute series where available) shall be included to indicate its location with relation to streams and the point of discharge of treated effluent.

B. General Layout

Layouts of the proposed sewage treatment plant shall be submitted showing:

1. Topography of the site.
2. Size and location of plant structures.
3. Schematic flow diagram showing the flow through various plant units.
4. Piping, including any arrangements for bypassing individuals units.
5. Materials handled and direction of flow through pipes shall be shown.
6. Hydraulic profiles showing the flow of sewage, supernatant and sludge, including hydraulic and energy gradients.
7. Test borings and ground water elevations.
8. Location of existing streams, ditches, etc.

C. Detailed Plans

Detailed plans shall show the following:

1. Location, dimensions and elevations of all existing and proposed plant facilities.
2. Elevations of high and low water level of the body of water to which the plant effluent is to be discharged.
3. Type, size, pertinent features, and manufacturer's rated capacity of all pumps, blowers, motors and other mechanical devices.
4. Type, size, slope, material of all piping and open conduits.
5. Adequate description of any features not otherwise covered by specifications.

3.106 SPECIFICATIONS

A. General Information

Complete technical specifications for the material and construction of sewers, sewage pumping stations, sewage treatment plants, and all appurtenances, shall accompany the detailed plans.

The specifications shall include, but not be limited to, all construction information not shown on the drawings which is necessary to inform the builder in detail of the construction requirements as follows:

B. Construction Requirements

1. Quality of materials, workmanship, fabrication, and the type, size, strength, operating characteristics, requirements and rating of all mechanical and electrical equipment.
2. Allowable infiltration.
3. Valves, piping and jointing of pipe.
4. Wiring.
5. Meters.
6. Laboratory fixtures and equipment.
7. Operating tools.
8. Construction materials.
9. Special filter materials such as stone, sand or gravel.
10. Miscellaneous appurtenances.
11. Chemicals when used.
12. Instructions for testing materials and equipment as necessary to meet design standards.
13. Operating tests for the complete works and component units.
14. Requirement for instructions, warranties and Operation and Maintenance manuals.
15. Traffic control.
16. Permit requirements.

3.107 <u>REVISIONS TO APPROVED PLANS</u>

The facilities shall be constructed under supervision of a professional engineer in accordance with the approved plans, reports, and specifications. Any deviations from approved plans or specifications affecting capacity, flow or operation of units shall be approved in writing before such changes are made. Plans or specifications so revised should therefore be submitted well in advance of any construction work which will be affected by such changes to permit sufficient time for review and approval. "As Built" plans, prepared by the design engineer, clearly showing any alterations shall be placed on file with the responsible agency at the completion of the work.

3.108 <u>OPERATION DURING CONSTRUCTION</u>

Specifications shall contain a program or require a plan for keeping existing sewers, pumping stations and/or treatment plant units in operation during construction of the improvements.

3.2 - DESIGN OF SANITARY SEWERS

3.206 Layout of Sewers

A. General Information

B. Curved Sewers

C. Lateral Connections

D. Test Tee

E. Manholes Frames and Castings

F. Depth of Sanitary Sewers

G. Velocities

3.207 Organization of Computations

3.201 INVESTIGATIONS AND SURVEYS

A. General Information

Sanitary sewers shall be designed for conveyance in a separate gravity system at such depths that all structures within the tributary area may be served at full basement depths so that the estimated ultimate tributary population and area is served. Type II cement must be utilized for the fabrication of concrete sanitary sewer pipe.

B. Information Required

Each project shall be identified by name, municipality within which it is to be constructed, original lot number and tract. A general description of the project shall be provided. The description shall indicate the approximate site size, zoning, probable upstream tributary area of future system expansion and any special factors to be considered in the system design.

C. Investigations

Information on all existing conditions shall be listed. The designer shall list the capacity and capacity available of the receiving sewer and the sewage treatment facility which will ultimately accept the predicted hydraulic load. Consideration shall be given to potential overall development of tributary area, how such future development will affect the design of the project under consideration, and any existing on site facilities that will be eliminated, incorporated within or modified by the proposed project. Special analysis shall be required for known areas with high inflow and infiltration.

D. Special Projects

Variation from a separate gravity sanitary sewerage system or from the normal depth required to serve the entire tributary area shall be considered a special project. Special projects shall require that the approving governmental agency review and approve the variation in concept prior to final design. Variations shall include shallow depth, materials of construction, methods of construction, pressure sewer systems, quantity of sewage generated, alternative collection systems and other variations not included in the Specifications.

E. **MANHOLE ACCESS**

When designing new sewers, the engineer will insure that access for service vehicles is provided to at least every other manhole along the alignment of the sewer line. If difficulty in insuring access is encountered, the design engineer will bring the potential problem to the attention of the reviewing authority prior to finalizing the design.

If a road is constructed for the access, it shall be a minimum of 15 feet wide with an aggregate rock or cinder base of 8 inches minimum thickness.

3.202 QUANTITY OF SANITARY SEWAGE

A. General Information

Sanitary sewers shall be designed for peak flow plus infiltration allowance basis. See Table 3.2 RATIO OF AVERAGE TO PEAK FLOWS.

B. Design Basis

1. Ultimate Population Density is based on existing zoning.
2. Sewage Flow Guide (OEPA) Table 3.1.
3. For undeveloped commercial property, use fifteen hundred (1,500) gallons per acre per day average daily flow.

SEWAGE FLOW GUIDE
TABLE 3.1

PLACE		ESTIMATED SEWAGE FLOW GALLONS PER DAY
Apartments and Condominiums		250 one bedroom 300 two bedroom 350 three bedroom
Assembly Halls	Note a	2 per seat
Beauty Shop, Styling Salon		200 per basin
Bowling Alleys (no food service)	Note a	75 per lane
Churches (small)	Note a	3-5 per sanctuary seat
Churches (large with kitchen)	Note b	5-7 per sanctuary seat
Country Clubs		50 per member
Dance Halls	Note a	2 per person
Doctors/Dentists		75 per doctor 20 per employee 10 per patient
Drive-In Theaters		5 per car space
Factories (no showers)		25 per employee
Factories (with showers)		35 per employee
Food Service Operations Ordinary Restaurant (not 24-hour) 24-Hour Restaurant Banquet Rooms Restaurant Along Freeway Tavern (very little food service) Curb Service (drive-in) Vending Machine Restaurants	 Note c Note c Note c Note c Note c Note c	 35 per seat at 400 ppm BOD_5 50 per seat at 400 ppm BOD_5 5 per seat at 400 ppm BOD_5 100 per seat at 400 ppm BOD_5 35 per seat at 400 ppm BOD_5 50 per car space at 400 ppm BOD_5 100 per seat at 200 ppm BOD_5
Homes in Subdivision		400 per dwelling
Hospitals (no resident personnel)	Note b	300 per bed
Institutions (residents)	Note b	100 per person
Laundries (coin-operated)	Note e	400 per standard size machine
Laundry wastes require special consideration		Consult district office
Marinas (restrooms and showers only)		15 per boat mooring/slip/dock
Migrant Labor Camps	Note g	50 per person
Mobile Home Parks		300 per mobile home space
Motels		100 per unit

PLACE		ESTIMATED SEWAGE FLOW GALLONS PER DAY
Nursing and Rest Homes	Note b	200 per patient at 300 ppm BOD_5 100 per resident employee 50 per non-resident employee
Office Buildings		20 per employee
Recreational Vehicle Dumping Stations		Consult district office
Recreational Vehicle Parks and Camps		See DWPC Policy 2.07
Retail Store		20 per employee
Schools - Elementary - High and Junior High	Note b Note b	15 per pupil 20 per pupil
Service Stations	Note d	1000 first bay or pump island 500 additional bay or pump island
Shopping Centers (No food service or laundries)	Note f	0.2 per sq. ft. of floor space
Swimming Pool (average) With hot water shower		3-5 per swimmer (design load) 5-7 per swimmer (design load)
Vacation Cottages		50 per person
Veterinarians and Animal Hospitals	Note h Note h	10 per run 10 per cage 20 per employee
Youth and Recreation Camps	Note b	50 per person

Note a - Food Service waste not included.

Note b - Food Service waste included but without garbage grinders.

Note c - Aeration tanks for these require 48 hour detention period. Garbage grinders not permitted.

Note d - Truck parking areas will require consideration for treatment of runoff at large truck stops.

Note e - Laundry (coin operated); Temperatures may be critical if not diluted with other sewage. Laundry flow shall not be more than 20 percent of the additional bay or pump island flow of a treatment plant. Commercial laundries will not be permitted for treatment plants designed for less than 30,000 gpd.

Note f - Add laundries or other high flow or high strength uses.

Note g - 20 gpd if vault latrine is used for toilet wastes.

Note h - Assumes manual removal of solids, food, droppings, etc. prior to hosing.

RATIO OF AVERAGE TO PEAK FLOWS
TABLE 3.2

AVER. 24 HOUR FLOW IN M.G.D.	CONVERSION FACTOR	PEAK FLOW IN M.G.D.
0.1	3.70	0.37
0.2	3.66	0.73
0.3	3.63	1.09
0.4	3.59	1.44
0.5	3.55	1.78
0.6	3.52	2.11
0.7	3.48	2.44
0.8	3.45	2.76
0.9	3.42	3.08
1.0	3.38	3.38
1.5	3.23	4.85
2.0	3.09	6.18
2.5	2.97	7.43
3.0	2.86	8.56
3.5	2.76	9.66
4.0	2.66	10.64
4.5	2.58	11.61
5.0	2.51	12.55
5.5	2.44	13.42
6.0	2.38	14.28
6.5	2.32	15.08
7.0	2.27	15.89
7.5	2.23	16.73
8.0	2.19	17.52
8.5	2.15	18.28
9.0	2.11	18.99
9.5	2.08	19.76
10.0	2.06	20.60
11.0	2.00	22.00

For flows in excess of eleven (11) mgd, a conversion factor of 2.00 shall be used.

C. <u>Infiltration</u>

For new systems, allowance shall be 375 gallons per acre day for the upstream tributary acreage.

D. Additional Design Factors

These include additional requirements such as maximum sewage or waste flow from industrial plants, pumping requirements, and other situations that may exist but are not included in these Standards.

3.203 DESIGN CRITERIA FOR SANITARY SEWERS

In general, all sewers shall be designed using the following criteria, with variations from such to create a special project.

A. Energy Concept

The energy concept of hydraulic design shall be used on all projects, with the energy line occurring above the free water surface by an amount equal to the velocity head of $h_f = V^2 / 2g$.

B. Flow Formulas

Mannings Formula $V = \frac{1.486}{n}(R)^{2/3}(S)^{1/2}$ where S is slope in feet per foot; R is hydraulic radius; and n is roughness coefficient. The roughness coefficient shall be n = 0.015 for sizes up to and including 27 inches; n = 0.013 for sizes including 30 inches through 84 inches and n = 0.011 for 90 inches or larger. Mannings Formula and Tables are provided in Table 3.3. The quantity of flow, Q = AV, where A is the cross sectional area of the conduit developed by the nominal conduit diameter is included in the Table. Where other than circular pipe is proposed, the actual cross-sectional area developed may be used. The formula for the Hydraulic Radius is R = A/p where p is the wetted perimeter developed by the nominal pipe diameter and/or the actual wetted perimeter developed may be used.

TABLE 3.3

C. Mannings Formula Flow Tables

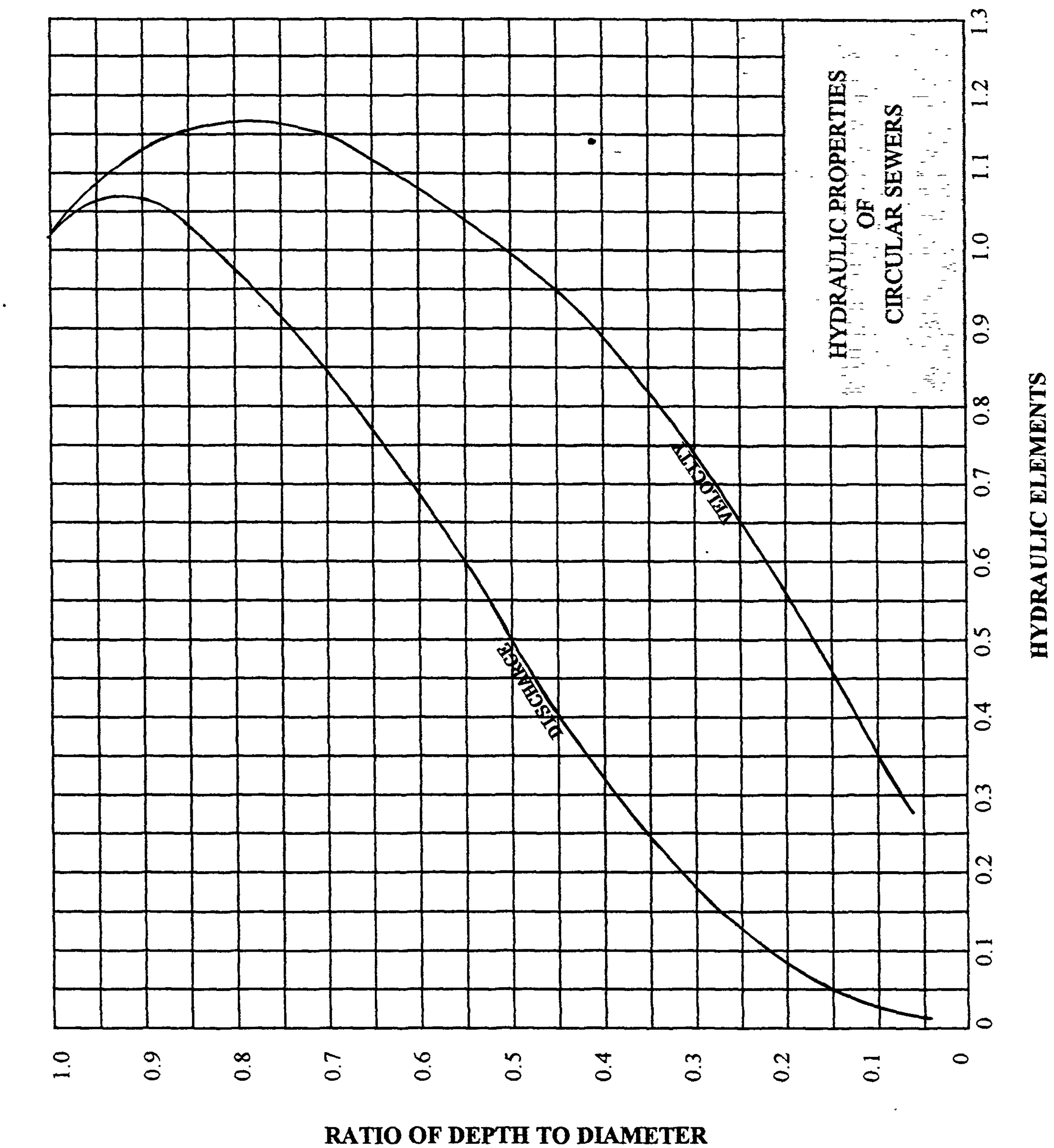
$$Q = AV \qquad V = \frac{1.486}{n} (R)^{2/3} (S)^{1/2}$$

	DIAMETER (IN)	CAP. @ 1% (cfs)	AREA (ft.^{2})	CAP. @ 1% (MGD)
n=0.015	5	0.321	0.139	0.207
	6	0.485	0.196	0.313
	8	1.061	0.349	0.686
	10	1.906	0.545	1.232
	12	3.087	0.785	1.995
	15	5.567	1.227	3.598
	16	6.604	1.389	4.266
	18	9.105	1.767	5.827
	21	13.730	2.405	8.870
	24	19.610	3.142	12.670
	27	26.750	3.977	17.290
n=0.013	30	40.790	4.909	26.370
	33	53.030	5.940	34.280
	36	66.670	7.069	43.090
	39	82.410	8.296	53.260
	42	100.200	9.621	64.760
	48	143.600	12.570	92.840
	54	196.000	15.900	126.700
	60	260.400	19.640	168.300
	66	334.800	23.760	216.400
	72	423.400	28.270	273.700
	78	523.100	33.180	338.100
	84	638.800	38.490	412.900
n=0.011	90	906.000	44.180	585.600
	96	1077.700	50.270	696.500
	102	1264.900	56.750	817.500
	108	1475.600	63.620	953.700
	120	1954.400	78.540	1263.200
	132	2520.200	95.030	1628.800
	144	3177.900	113.100	2053.900

TO FIND CAPACITY AT ANY SLOPE
MULTIPLY; CAPACITY LISTED @ 1% BY $(S)^{1/2}$ in %.

D. Hydraulic Properties of Circular Sewers

The hydraulic properties for partially full circular sections of pipe may be derived from the following graph:



E. Minimum Size

The minimum nominal size of all sanitary sewers, excluding lateral connections, shall be eight inches (8") in diameter.

3.204 SEWER MATERIALS

A. General Information

All piping materials, manholes, and appurtenances furnished for public sanitary sewers shall comply with the latest applicable national standards, such as the American Society for Testing and Materials (ASTM), American National Standards Institute (ANSI), American Water Works Association (AWWA), or other representative standards organizations. Some products are specified with more than one applicable reference standard for such items as testing, installation, or supplementary material specifications.

B. Types of Sewer Pipe

Product description, materials testing, field testing and installation techniques shall be governed by the documents cited below unless otherwise specified.

1. Vitrified Clay Sewer Pipe, ASTM C-700 ES, may be used up to 15 inches in diameter.
2. Acrylonitrile-Butadiene-Styrene (ABS) or Polyvinyl Chloride (PVC) Composite Sewer Pipe ASTM D-2680 may be used up to 15 inches in diameter.
3. Acrylonitrile-Butadiene-Styrene (ABS) Solid Wall Sewer Pipe ASTM D-2751, may be used up to 12 inches in diameter.
4. Polyvinyl Chloride (PVC) Sewer Pipe and Fittings conforming to ASTM D-3034, SDR-35, SDR-23.5, SDR-26, ASTM F-949 up to 36 inches in diameter, ASTM F-794 up to 48 inches in diameter, ASTM F-679 up to 30 inches in diameter, ASTM F-789 up to 18 inches in diameter.
5. Reinforced Concrete Pipe ASTM C-76 or C-507 may be used for 12 inches in diameter or larger.
6. Reinforced plastic mortar sewer pipe ASTM D-3262.
7. Cast Iron Pipe ANSI A-21.6, (AWWA C-106) may be used for special projects approved by the municipal engineer and other appropriate agencies.
8. Ductile Iron Pipe, ANSI A-21.51, Class 52, (AWWA C-151).

For depths greater than 13 feet, when thermoplastic piping or PVC composite sewer pipe is used, it is recommended that minimum pipe stiffness of 115 PSI or SDR-26 be utilized. All plastic pipe for sanitary sewers and fittings shall have a minimum pipe stiffness of 46 PSI. In addition to the above for plastic pipes, the 5 percent diametric, in place deflection limits on the average inside diameter shall be adhered to. All sewer pipe within a manhole to manhole increment shall be one type and class. In the case of lateral connections, proper watertight transition connections of differing materials may be permitted. Lateral connections to building sites shall be a minimum of six (6) inches in diameter. Only wye branch fittings will be accepted for service connections for sewers up to and including 21" diameter. For sewers 24 inches and larger, tee connections are permitted. Deflection test is required on all plastic pipe with a pipe stiffness less than 200 PSI. Air testing required for all sanitary sewers.

C. <u>Sanitary Sewer Joints</u>

All sanitary sewers shall be installed with premium water tight joints of the bell and spigot type to insure maximum durability, flexibility, strength and water-tightness. All sewer materials listed above provide for joint water-tightness tests in their specifications. All sanitary sewer joints in the public right-of-way shall conform to ASTM C-425 for Clay pipe, ASTM C-361 for concrete pipe, ASTM D-3212 for plastic pipe, AWWA C-111 for Cast iron pipe, AWWA C-111 for Ductile Iron Pipe.

Joints for PVC pipe shall be of shall be elastomeric O-ring. Solvent cement joints for pipes six (6) inches or under is acceptable. All ABS joints shall be of the O-ring or the solvent cement type. If the joint is of the solvent cement type, it shall be installed per ASTM D-2235 and the manufacturer's recommendations. Additionally, all exposed ends of the ABS composite pipe shall be fully sealed with solvent cement. Elastomeric qualities of joint gaskets or O-rings shall meet ASTM F-477. Solvent cement for PVC piping and fittings shall conform to ASTM D-2564. Welded joints shall be air tested 24 hours after installation.

3.205 FORCE MAINS

A. General Information

All materials for the force main shall comply with the latest applicable national organizations standards such as Section 3.204A. Minimum cover of four (4) feet shall be used on force mains. All force mains crossing a stream shall have 6 inches of concrete (3000 PSI) encasement.

B. Material

The force main material shall be polyvinyl chloride (PVC) pipe SDR-26 ASTM D 2241, Push-on-Joints ASTM D-3139; SDR-21 ASTM D-2241, Push-on-Joints ASTM D-3139; AWWA C-900 series; Class 150 meeting requirements of DR-18 with rubber gaskets or O-Rings conforming to the requirements of ASTM D-3139; Push on Joints or Mechanical Joints Ductile Iron Pipe ANSI A21.51 Class 52 (AWWA C-151); Cast Iron Pipe ANSI A 21.6, (AWWA C-106). Other materials which are rated as pressure piping by national standards organizations such as ASTM, AWWA or ANSI are acceptable.

C. Fittings

For force mains 4" or larger, only ductile iron and gray iron (special projects) fittings are allowed. ANSI/AWWA A21.53/C-153 fittings shall be cast from ductile iron grade 70-50-05 or gray iron (special projects) with minimum tensile strength of 25,000 PSI in accordance with ANSI/AWWA A21.10/C-110. Fittings and accessories shall be mechanical joints in accordance with ANSI/AWWA A21.10/C-110 and ANSI/AWWA A21.11/C-111, with the exception of the manufacturer's proprietary design dimensions and weights. The wall thickness of ductile iron fittings shall be the equivalent of ductile iron Class 54. The working pressure rating shall be 350 PSI for ductile iron fittings and 250 PSI for gray iron fittings. Fittings shall have a bituminous outside coating in accordance with ANSI/AWWA A21.10/C-110. Fittings shall be cement lined and seal coated with bituminous material in accordance with ANSI/AWWA A21.4/C-104.

D. Thrust Blocks

All thrust blocks can be either 4,000 PSI concrete or of the pipe restrain type such as the ones manufactured by Uni-flange, such as melalugs, or retaining glands. The concrete blocking must have its entire face bearing against undisturbed soil. Blocking design shall be based on combined working pressures plus water hammer of 240 PSI minimum and bearing capacity values of 1,000 psf for sand and gravel; 3,000 psf, shale; 5,000 psf, rock. No welding of bends will be permitted on the force main. Pipe bedding and trench details shall conform to the contract drawings.

3.206 <u>LAYOUT OF SEWERS</u>

A. <u>General Information</u>

In general, the layout of the sewerage systems shall be such that the storm and sanitary sewers shall be on opposite sides of the roadways and within the tree lawn areas where practical. Where opposite side construction is not practical, every effort shall be made to separate the storm and sanitary sewers by six (6) feet barrel to barrel. Both the storm and sanitary sewers shall be constructed using a premium jointed conduit throughout.

For sewers size 36 inches in diameter and less, manholes shall be spaced at not over 400 feet. For sewers 42 inches through 60 inches in diameter and larger, manholes shall be spaced at not over 600 feet. In sewer sizes larger than 60 inches in diameter, manhole spacing up to 1,000 feet will be considered. Tunnels shall be considered special projects. Manholes shall be placed at the end of all sewer runs which are 100 feet or more in length, and at any change of line, grade or size of sewer. A full size clean-out may be provided in lieu of a manhole at the end of sewer runs less than 150 feet.

All sewers (storm and sanitary) crossing a creek shall have six (6) inches of concrete (3000 PSI) encasement. All pipes (storm and sanitary) shall be encased in six (6) inches of concrete (3000 PSI) if ground cover is less that three (3) feet. Variations to be approved by appropriate agencies.

B. <u>Curved Sewers</u>

In general, all sanitary sewers shall be constructed to straight lines and grades. Curved sanitary sewers less than 36 inches in diameter shall be considered a special project. Sanitary sewers over 36 inches may be laid in horizontal curves as long as the joint deflection is limited to a

degree within that allowable joint deflection under the specification for the premium type joint used. Sewers curved vertically or in combination with horizontal curves shall be considered a special project.

C. Lateral Connections

Lateral connections to building sites shall be a minimum of six inches (6") in diameter and constructed of Vitrified Clay ASTM C-700 ES, Cast Iron ANSI A-21.6 (Class 22), Ductile Iron ANSI A-21.51 (Class 52), ABS Solid Wall D-2751 (SDR35), ABS Composite ASTM D-2680, Polyvinyl Chloride (PVC) ASTM F-679, ASTM F-789, ASTM F-794, ASTM F-949, ASTM D-3034 (SDR35) Pipe. For new works, when flexible pipe is utilized, all lateral connections to the main public sanitary sewer (up to, and inlcuding 21 inch in size) shall be made through use of manufactured fittings. Neatly cored holes with core bore seals and special fittings as recommended by the Manufacturer Trade Association of the flexible piping material involved is acceptable for repair works, or for sewer larger than 21 inch in size. In no case will the connections for other than six (6) inch lateral connections exceed 2/5 the diameter of the main sewer. Lateral connections shall be installed utilizing a laser or grade bar devices.

D. Test-Tee

Each lateral connection to building sites shall have a test-tee of full size constructed one foot outside of the right-of-way line or public easement line where such are encountered (Sheet 14/27). Test-tee caps shall be cast or Ductile iron. Plastic caps with metallic element imbedded are acceptable in non-paved areas (Sheet 15/27).

E. Manholes Frames and Castings

Standard manholes frames and castings are as indicated in the General Notes, Sheets 2/27 and 3/27. Manholes in residential and non-residential areas which may be subject to flooding shall have solid lid castings and, where such conditions occur in excess of 1,000 feet of sewer, special non-flooding venting shall be provided.

F. Depth of Sanitary Sewers

In general, the top of the pipe of sanitary sewers shall be at least 10 feet below the average finished grade at the building line in residential districts and 12 feet below the building line elevation in all other areas. Conduits shallower than this requirement shall be considered a special project.

G. Velocities

All sewers shall be designed and constructed to give mean velocities, when flowing full, of not less than 2.0 feet per second. The following are the minimum slopes which should be provided; however, slopes greater than these are desirable, with maximum velocity of 15.0 feet per second. Velocities greater or less shall be considered special projects.

SEWER SIZE (INCH)	MIN. SLOPE IN %
6	1.00
8	0.44
10	0.33
12	0.26
15	0.20
16	0.18
18	0.15
21	0.12
24	0.10
27	0.09
30	0.058
33	0.050
36	0.046

3.207 ORGANIZATION OF COMPUTATIONS

The Standard Computation Sheet, contained in Part 6, shall be filled out for each project and submitted to the approving governmental agency, along with a sewerage design map of such scale as to reasonably relate both on and off site areas incorporated within the design.

3.3 - DESIGN OF STORM SEWERS

3.304 Water Management and Sediment Control

3.305 Detention/Retention Basins

3.306 Culverts

3.307 Headwalls

3.308 Organization of Computations

3.301 DESIGN OF STORM SEWERS

A. General Information

These guidelines apply to storm sewers in the public right-of-way. Storm sewers on private property fall under the jurisdiction of the municipal engineer where work is being performed. Storm drainage shall be designed for conveyance in a separate gravity system at such depths that all structures within the tributary area may be served to full foundation footer drain depths and no violations of a natural drainage area are generated.

B. Investigations and Surveys

1. Information Required

   Each project shall be identified by name, municipality within which it is to be constructed and original lot number and tract. A general description of the project shall be included indicating approximate project size, zoning, general description of discharge points, off site tributary area drainage area maps, and any special factors to be considered in the design.

2. Investigations

   Information on all existing conditions shall be listed. This information shall include capacity of receiving sewers or downstream culverts and the ability of receiving waterways to provide an adequate outlet with respect to both depth and capacity in vicinity of storm outlet. Special analysis will be required for known flooding areas.

C. Special Projects

Variation from a separate gravity storm sewerage system of normal depth shall be considered a special project. The approving governmental agency shall review and approve the proposed variation in concept prior to final design. Variations requiring review and approval will include shallow depth, materials of construction, methods of construction, controlled discharge systems, combination conduit-overland flow system, and others.

3.302 DESIGN CRITERIA FOR STORM SEWERS

A. General Information

In general, all sewers shall be designed using the following criteria. Variation from such would constitute special projects.

B. Design Storm Frequency

Residential	5 Year Frequency
Multifamily	10 Year Frequency
Schools	10 Year Frequency
Industrial/Commercial	10 Year Frequency
Major Urban Business Area	25 Year Frequency

Additional Minimum Criteria

Flow between	0 cfs - 150 cfs	5 Year Frequency
Flow between	150 cfs - 500 cfs	10 Year Frequency
Flow between	500 cfs - 1500 cfs	25 Year Frequency
Flow between	1500 cfs - and over	50 Year Frequency

C. Rainfall Intensity - Duration

5 - Year Storm	i = 1.50 Inches/Hr.
10 - Year Storm	i = 1.80 Inches/Hr.
25 - Year Storm	i = 2.00 Inches/Hr.
50 - Year Storm	i = 2.25 Inches/Hr.
100 - Year Storm	i = 2.50 Inches/Hr.

D. Runoff Coefficient

Zoning	Lot Area (ft^2)	c =
Residential	0 - 5000	0.7
	5,000 - 10,000	0.6
	10,000 - 25,000	0.5
	25,000 - and over	0.4

Multifamily and Schools	0.75
Industrial/Commercial	0.90
Shopping Centers	0.90
Major Urban	0.90
Business Area	0.90

The above runoff coefficients assume typical ground cover and average slope.

E. Concentration Times

1. Residential Areas.

   The concentration times to the critical inlet varies between 12 and 20 minutes with 15 minutes to be used as the average case based upon full development of the land.

2. Industrial - Multifamily - School Areas.

   The concentration time to the critical inlet varies between 10 and 15 minutes with 12.5 minutes to be used as the average case based upon full development of the land.

3. Major Urban Business Areas and Shopping Centers.

   The concentration time to the critical inlet varies between 5 and 12 minutes with 10 minutes used as the average case based upon full development of the land.

F. Standard Rainfall Intensity-Duration Tables

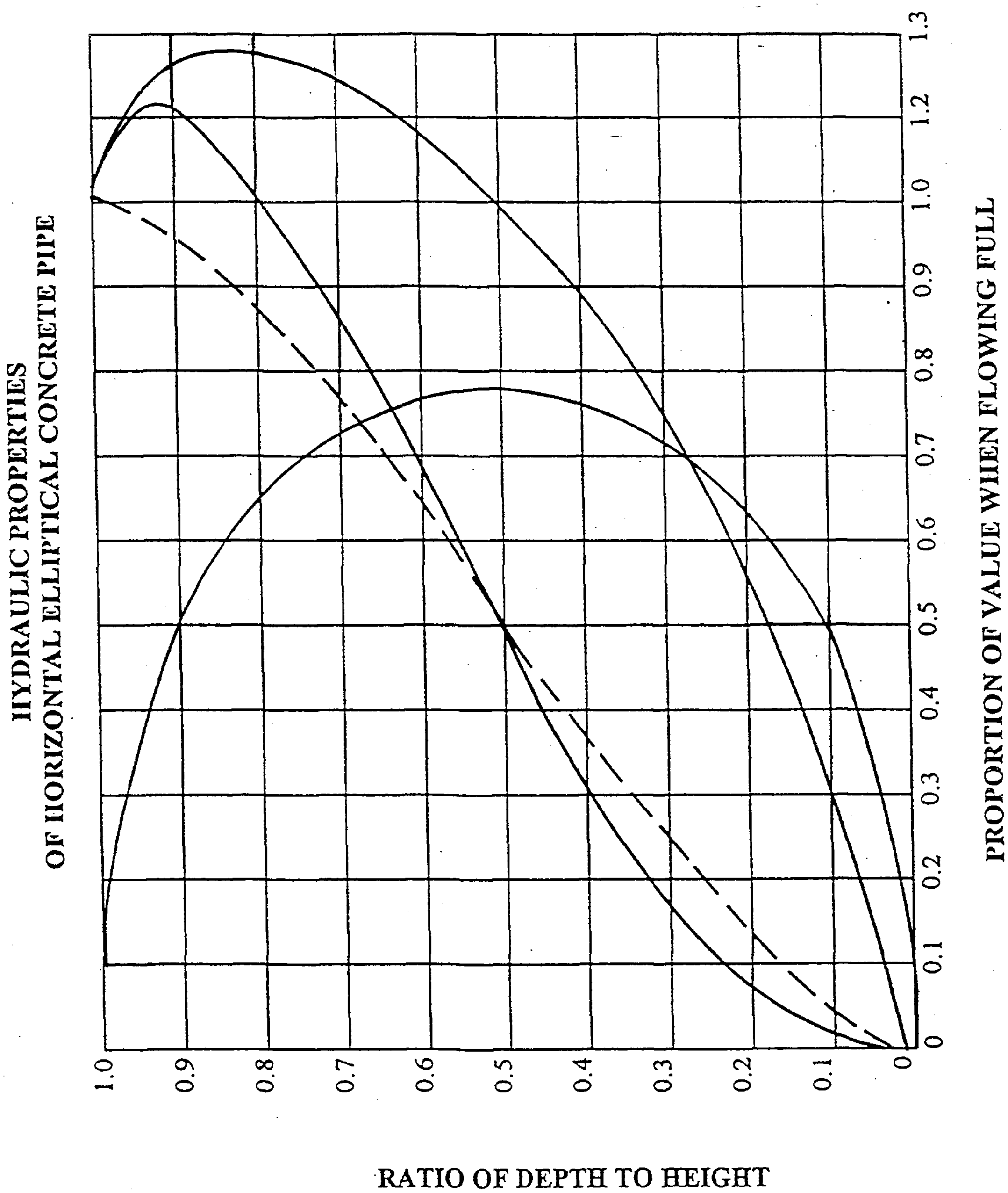
The Standard Rainfall Intensity-Duration Tables shall be used to determine the rainfall intensity occurring at the time of concentration to the inlet under consideration.

STANDARD RAINFALL INTENSITY-DURATION TABLES

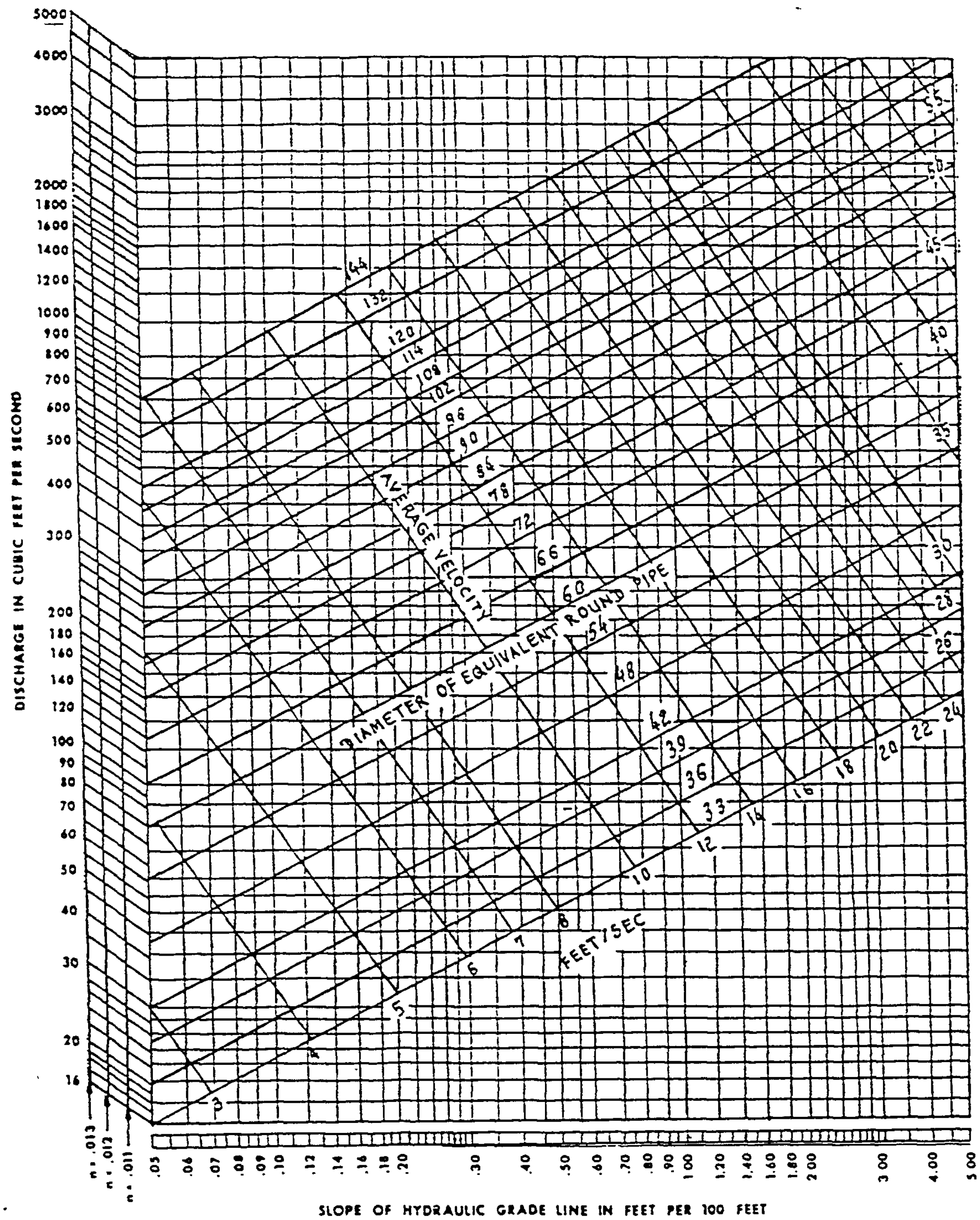
Rainfall Intensity in Inches Per Hour

Time of Concentration In Minutes	5 Yr. 1.50"/Hr.	10 Yr. Design 1.80"/Hr.	25 Yr. Storm 2.00"/Hr.	50 Yr. Frequency 2.25"/Hr.	100 Yr. 2.50"/Hr.
10	4.30	4.95	5.20	5.75	6.15
11	4.14	4.78	5.04	5.58	5.98
12	4.00	4.63	4.89	5.41	5.81
13	3.87	4.48	4.74	5.26	5.65
14	3.74	4.34	4.61	5.11	5.51
15	3.62	4.21	4.48	4.98	5.37
16	3.51	4.09	4.36	4.85	5.23
17	3.41	3.98	4.25	4.72	5.11
18	3.31	3.87	4.14	4.60	4.99
19	3.22	3.76	4.04	4.49	4.87
20	3.13	3.67	3.94	4.39	4.76
21	3.05	3.57	3.85	4.28	4.65
22	2.97	3.49	3.76	4.19	4.55
23	2.89	3.40	3.67	4.09	4.46
24	2.82	3.32	3.59	4.01	4.37
25	2.76	3.25	3.51	3.92	4.28
26	2.69	3.17	3.44	3.84	4.19
27	2.63	3.10	3.37	3.76	4.11
28	2.57	3.04	3.30	3.69	4.03
29	2.52	2.97	3.23	3.61	3.96
30	2.46	2.91	3.17	3.54	3.88
35	2.22	2.64	2.89	3.23	3.28
40	2.03	2.41	2.65	2.97	3.28
45	1.86	2.22	2.45	2.75	3.04
50	1.72	2.06	2.28	2.56	2.84
55	1.60	1.92	2.13	2.40	2.66
60	1.50	1.80	2.00	2.25	2.50
70	1.33	1.60	1.78	2.01	2.23
80	1.19	1.43	1.60	1.81	2.02
90	1.08	1.30	1.46	1.65	1.84
100	0.99	1.19	1.34	1.51	1.70
110	0.91	1.10	1.24	1.40	1.57
120	0.84	1.02	1.15	1.30	1.46

G-HYDRAULIC PROPERTIES
OF HORIZONTAL ELLIPTICAL CONCRETE PIPE



H. HORIZONTAL ELLIPTICAL
REINFORCED CONCRETE PIPE
FLOWING FULL



I. Flow Formulas

1. Quantity of Runoff by Rational Method.

   a. Areas up to 500 Acres

   Q = CIA in cubic feet per second where A is the area to be drained in acres, C is the runoff coefficient for the area under consideration and I is the rainfall intensity derived from the Standard Rainfall Intensity-Duration Tables for the concentration time to the inlet under consideration.

   b. Areas Greater Than 500 Acres

   Ohio Department of Natural Resources Bulletin No. 45 with urbanization correction in accordance with the following table shall be used as a guideline for computing runoff quantities.

URBANIZATION MULTIPLYING FACTOR

PERCENT URBANIZATION	10 YEAR STORM	25 YEAR STORM	50 YEAR STORM	100 YEAR STORM
10	1.25	1.25	1.25	1.25
20	1.39	1.36	1.34	1.33
30	1.52	1.47	1.44	1.42
40	1.67	1.58	1.53	1.50
50	1.81	1.69	1.63	1.58
60	1.94	1.81	1.72	1.67
70	2.08	1.92	1.82	1.75
80	2.22	2.03	1.91	1.83
90	2.36	2.14	2.01	1.92
100	2.50	2.25	2.10	2.00

2. Manning's Formula

   $V = \frac{1.486}{n} (R)^{2/3} (S)^{1/2}$ where S is slope in feet per foot; R is hydraulic radius; and n is the roughness coefficient. The roughness coefficient shall be n = 0.015 for sizes up to and including 27 inches; n = 0.013 for sizes including 30 inches through 84 inches and n = 0.011 for 90 inches and larger. Graphs for the Manning Formula are provided in Table 3.3. This Table is based on Quantity of flow Q = Av where A is the cross-sectional area of the conduit developed by the nominal conduit diameter. Where other than circular pipe is proposed, the actual cross-sectional area developed may be used.

3. Hydraulic Radius

   The formula for the hydraulic radius is R = A/p where p is wetted perimeter developed by the nominal pipe diameter. Where other than circular pipe is proposed, the actual wetted perimeter developed may be used.

3.303 LAYOUT OF SEWERS

A. General Information

The layout of the storm system shall place the storm and sanitary sewers on opposite sides of roadways and within the tree lawn areas where practical. Where opposite side construction is not practical, every effort shall be made to separate the storm and sanitary sewers by six feet (6') barrel to barrel. Vertical and horizontal alignment of storm sewers shall be in general conformance with Section 3.206. Manhole spacing shall be also as described in Section 3.206. Catch basins shall be used prior to the connection of inlets into the main storm sewer system. Consideration shall be given to installing traps or other methods to control the release of floatable debris into the sewer system.

B. Minimum Size

The minimum size of all storm sewers, excluding connections and yard drains, shall be 12 inches in diameter. The minimum yard drain size shall be 8" in diameter.

C. Types of Conduits

In addition to conduits recommended for sanitary sewers, the following conduits may be utilized for public storm sewers:

1. Reinforced Concrete Arch Culvert ASTM C-507
2. Reinforced Concrete Elliptical Pipe ASTM C-597
3. Reinforced Concrete Box Culvert ASTM C-789
4. Reinforced Concrete Box Culvert ASTM C-850

5. Uncased bored sewer conduit under 14 inches shall be Ductile Iron Pipe ANSI A-21.51 Class 2. Pipe over 14 inches through 24 inches shall be Ductile Iron Culvert Pipe ANSI A-716, and pipe 30 inches and over may be Ductile Iron Culvert Pipe ANSI A-716 or Reinforced Concrete Pipe ASTM C-76.

6. Polyvinyl Chloride (PVC) ASTM F-794, AASHTO M-304-91. Pipe cell classification must be stamped on pipe. When required by the engineer, certification of long term properties of design shall be provided.

   Pipe shall be installed in accordance with Uniform Standard Sewer Details. Only wye branch fittings will be accepted for service connections for sewers up to and including 21" diameter. For sewers 24 inches and larger, tee connections are permitted.

   Deflection test is required on all plastic pipe with a pipe stiffness less than 200 PSI. Air testing is not required for storm sewers.

   For projects, where such pipe is applicable and approved by the municipal engineer, aluminized steel Type II pipe, 46 PSI minimum pipe stiffness conforming to ASTM A-819 and AASHTO M-274 is acceptable for installation where soils pH are in the range of 5-9. In cases where aluminized or galvanized pipe is encased in concrete, the pipe shall be coated with a bituminous substance. Sections of pipe which fits into a concrete manhole or concrete headwall shall also be coated.

   All storm sewer pipes between manholes increments shall be one type and class of pipe. In case of lateral connections, transition connections of different materials may be permitted.

D. <u>Lateral Connections</u>

Lateral connections to building sites shall be a minimum of six inches (6") in diameter and of the materials listed above.

E. Storm Sewer Joints

Storm sewers in the right-of-way, easements, private property under pavement, driveways and sidewalks, and any other storm sewer tributary to public storm sewers shall have premium joints conforming to ASTM D-3212 for plastic pipes, ASTM C-425 for clay pipes, ASTM C-443 for concrete pipes, ASTM A-798 for aluminized steel pipes (where pipe is approved by municipal engineer). Exceptions may be allowed upon approval of the Municipal Engineer where work is being performed.

F. Depths of Sewers

In general, the storm sewer crown shall be at least 8 1/2 feet below the finished grade at the building line in residential districts and 10 1/2 feet below the finished grade at the building line in all other areas, measured to the crown of the conduit. Conduits shallower than this requirement shall be considered as a special project.

G. Velocities

Storm sewers should have a minimum flowing full velocity of three feet (3') per second and a maximum velocity of 15 feet per second.

H. Open Channel and Culvert Design

Open channels shall be designed using the energy concept and Mannings Formula using care in selection of the proper roughness coefficient "n". The following are suggested "n" factors for several typical open channel materials:

n = 0.014 for concrete lined

n = 0.017 for smooth rock bottoms with rock or concrete sides

n = 0.023 for well constructed waterways in firm earth.

Other channel materials may be considered as special projects. Other suitable "n" factors and velocities can be obtained from the Bureau of Public Roads Publication, Hydraulic Engineering Circular No. 5.

I. Concrete Anchorage

Unless otherwise specified, concrete anchorage will be utilized when sewer slopes fall within the following limits:

20% to 35% slope-anchorage shall be 36 feet center to center (maximum)

35% to 50% slope-anchorage shall be 24 feet center to center (maximum)

over 50% slope-anchorage shall be 16 feet center to center (maximum)

Concrete anchorage will be installed on the down side of each bell.

3.304 WATER MANAGEMENT AND SEDIMENT CONTROL

In order to prevent flooding of other land and stream channel erosion and to protect water resources from degradation resulting from accelerated storm water flows caused by construction activities, the owner, or the owner's representative shall be responsible for developing an erosion and sediment control plan. This plan shall meet the standards and specifications in the current edition of "Rain Water and Land Development" prepared by the Natural Resource Conservation Services, Ohio Environmental Protection Agency.

This requirement applies to development of one (1) acre or more. The Erosion and Sediment Control Plan shall be submitted to and approved by the city/village/township engineer prior to any earth disturbing activity for the development area.

The city/village/township engineer may submit the plan to the Cuyahoga County Soil and Water Conservation District for their review and comments prior to approval. Development disturbing five (5) or more acres or part of a larger common plan of development must have a National Pollutant Discharge Elimination System (NPDES) permit from Ohio Environmental Protection Agency.

3.305 DETENTION/RETENTION BASINS

In general, storage basins are considered to be special projects with the design criteria to be that of the local city/village/township ordinances and as recommended by the Cuyahoga County Soil and Water Conservation District Model Ordinance.

Maximum storm water discharge from any project may be established by the responsible agency for the purpose of minimizing downstream flooding, erosion control or protection of downstream structures.

3.306 CULVERTS

Culverts under all roads with minimum traffic volumes of 2000 vehicles per day shall be designed for a 25 year storm flow with headwater of one (1) foot below the edge of the roadway. Consideration shall be given to the headwater elevation with respect to adjacent buildings.

3.307 HEADWALLS

The design engineer shall consider the earth pressure and surcharge pressures exerted behind the headwall during design. The headwalls shall be designed to resist overturning.

In areas with steep backslopes, the use of an ODOT HW-3 headwall shall be considered. In areas with gradual backslopes, an ODOT HW-1 or HW-4 headwall shall be considered. Outlet channel protection, consisting of dumped rock limestone and sized per ODOT requirements shall be placed in areas with erodible soils. A filter fabric shall be used below the limestone.

3.308 ORGANIZATION OF COMPUTATIONS

The Standard Computation Sheet contained in Part 6, shall be filled out for each project and submitted to the approving governmental agency along with a drainage design map of such scale as to reasonably relate both on and off site areas incorporated within the design.

Any special treatment, such as stilling basins, energy dissipator, downstream channel improvements, erosion control or other treatment shall be taken into consideration by the design engineer.

3.4 DESIGN OF WASTEWATER AND STORM WATER PUMPING STATIONS

The design engineer shall refer to the latest revision of the Ten State Standards for the design of wastewater and storm water pumping stations.

3.5 WASTEWATER TREATMENT PLANTS

The design engineer shall refer to the latest revisions of the Ten State Standards for the design of wastewater treatment plants for plants over 100,000 GPD, for plants under 100,000 GPD use OEPA Guidelines.

PART 4 - SEWER USE REGULATIONS

4.1 General Limitations

4.2 Discharge Quality Standards

A. Toxic Materials

B. Solids or Viscous Materials

C. Other Harmful Wastes

4.3 Owner's Responsibilities

4.1 GENERAL LIMITATIONS

It shall be unlawful to discharge to any natural outlet within the area under the jurisdiction of the responsible agency, any sewage, industrial waste or other polluted waters, except where suitable treatment has been provided in accordance with the provisions of these Regulations.

No person shall discharge or cause to be discharged any sewage, industrial waste or other polluted waters to any sanitary sewer or wastewater treatment plant, except where suitable treatment has been provided in accordance with these Regulations. In addition, discharges tributary to treatment plants or trunk sewers operated by the Northeast Ohio Regional Sewer District shall conform to the Northeast Ohio Regional Sewer District Sewer Use Code.

Industries which fall under the Federal Pretreatment Regulations shall meet the applicable discharge limits of those regulations.

No person shall discharge or cause to be discharged any storm water, surface water, groundwater, swimming pool water (except backwash), or unpolluted industrial process waters to any sanitary sewer.

Storm water and all other unpolluted drainage shall be discharged to such sewers as are specifically designed as combined sewers or storm sewers, or to a natural outlet approved by the responsible agency. Industrial cooling water or unpolluted process waters may be discharged, on approval of the responsible agency, to a storm sewer or natural outlet.

4.2 DISCHARGE QUALITY STANDARDS

A. Toxic Materials

No person shall discharge or cause to be discharged any of the following described wastes or waters to any public sewers: any gasoline, benzene, naphtha, fuel oil, or other flammable or explosive liquid, solid or gas; any waste stream with a closed cup flash point of less than 140°F as measured by test method 40CFR261.21. Additionally, any waters or wastes containing toxic solids, liquids, or gases in sufficient quantity either single or by interaction with other wastes which may constitute a hazard to humans or animals or create any hazard in the receiving waters or any materials which may cause an upset, interference, inhibition, or pass through of the wastewater treatment plant or sewerage system.

B. Solids or Viscous Materials

No person shall discharge or cause to be discharged any solid or viscous substances in quantities or of such size capable of causing obstruction to the flow in sewers, or other interference with the proper operation of the sewage works such as, but not limited to: ashes, cinders, sand, mud, structural materials, straw, shavings, metal, glass, sludge, feathers, grease and fats, tar, plastics, wood, unground garbage, whole blood, paunch manure, hair and fleshings, entrails, and paper dishes, cups, milk containers, chemical residues, paint residues, lime slurry or cannery waste bulk, etc. (either whole or ground by garbage grinders).

C. Other Harmful Wastes

No person shall discharge or cause to be discharged the following described substances, materials, waters, or wastes if it appears, in the opinion of the responsible agency, that such wastes can harm either the sewers, sewer system or equipment, sewage treatment process or equipment, or have an adverse effect on the receiving stream, or can otherwise endanger life, limb, public property, or constitute a nuisance. In forming their opinion as to the acceptability of these wastes, the responsible agency will give consideration to such factors as the quantities of subject wastes in relation to flows and velocities in the sewers, materials or construction of the sewers, nature of the sewage treatment process, capacity of the sewage treatment plant, and other pertinent factors. The substances prohibited are:

1. Any liquid or vapor having a temperature higher than one hundred forty degrees (140°) F., sixty degrees (60°) C.

2. Any water or waste containing fats, wax, grease, or oils, petroleum base, whether emulsified or not, in excess of eighty (80) mg/1 or one hundred (100) mg/1 containing substances which may solidify or become viscous at temperatures between thirty-two (32°) and one hundred forty (140°) degrees F. or zero degrees (0°) C. and sixty degrees (60°) C.

3. Any garbage that has not been properly shredded. The installation and operation of any garbage grinder equipped with a motor of three-fourth (3/4) horsepower or greater shall be subject to the review and approval of the responsible agency.

4. Cyanide in excess of two (2) milligrams per liter for amenable cynide and ten (10) milligrams per liter of total cyanide. Both stated figures shall be regulated at the discretion of the responsible agency, using such data as it is provided by the laboratory of the responsible agency.

5. Any radioactive wastes or isotopes of such a concentration that may exceed the limits established by the applicable State or Federal Regulations, or would cause an upset, interference, inhibition, or pass through at the treatment works.

6. Any water or wastes, acid or alkaline in reaction, and having corrosive properties capable of causing damage or hazard to structures, equipment or personnel. Any waters or wastes having a pH lower than 5.0 Standard Units (S.U.) Any waters or wastes having a pH higher than 10.5 Standard Units (S.U.). Free acids and alkalis of such waste must be neutralized at all times.

7. Materials which exert or cause:
   a) Unusual concentrations of inert suspended solids (such as, but not limited to, fuller's earth, lime slurries, and lime residue) or of inert dissolved solids (such as, but not limited to, sodium chloride, calcium chloride and sodium sulfate), from ion

exchange softeners.

b) Excessive discoloration (such as, but not limited to, dye wastes and vegetable tanning solutions).

c) Discharge rate and servicing not to exceed the hydraulic capacity of the sewer, unusual volume of flow, or concentration of wastes constituting "slugs" as defined herein.

8. Any waters or wastes which contain the substances or possess characteristics which may be injurious to the sewers or which may be hazardous and which in the judgement of the responsible agency may have a deleterious effect upon the sewage works, processes, equipment, or receiving waters, or which otherwise might create a hazard to life or constitute a public nuisance.

4.3 OWNER'S RESPONSIBILITIES

Where preliminary treatment of flow-equalizing facilities are provided for any waters or wastes, they shall be maintained continuously in a satisfactory and effective operation by the owner at his expense.

Any wastes prohibited by these Regulations which are discharged to the sewer system shall be brought to the attention of the responsible agency at the time it occurs. For failure to report discharges at the time they occur, a fine shall be levied for each occurrence. The amount of the fine shall be determined by appropriated agency(s).

It shall be understood that the above shall in no way relieve any individual, company or industry of any liabilities for damage to any facilities, which damage can be shown to have been caused by the wastes discharged by said individual, company or industry. All measurements, tests and analysis of the characteristics of waters and wastes to which reference is made in these Regulations shall be determined in accordance with latest edition of "Standard Methods for the Examination of Water and Wastewater", published by the American Public Health Association; or Ohio Department of Health, Division of Laboratories, or the Robert A. Taft Sanitary Engineering Center, United Sates Department of Interior, or ASTM, whichever method is applicable. Any measurements, tests, or analyses not covered in the tests must be described. No statement contained in these Regulation's shall preclude other agencies from initiating additional enforcement action such as levying of additional fines and/or criminal prosecution and/or removal of sewer service.

Where such facilities are provided for the treatment, pretreatment, control or neutralization of waters or wastes, they shall be maintained continuously in a satisfactory and effective operation by the owner at his expense and shall be subject to periodic inspection by the responsible agency. The owner shall maintain operating records and shall submit to the responsible agency, in a form prescribed by the responsible agency, a monthly summary report of the character of the influent and effluent to show the performance of the treatment facilities as determined.

An approval by the responsible agency of facilities does not, in any way, guarantee that these facilities will function in the manner described by a person or company; nor shall it relieve a person or company of the responsibility of revamping, enlarging or otherwise modifying such facilities to accomplish the intended purpose.

No statement contained in these Regulations shall be construed as preventing any special agreement or arrangement between the responsible agency and any person whereby an industrial waste of unusual strength or character may be accepted by the responsible agency for treatment.

PART 5 - STANDARD SPECIFICATIONS

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E. Polyvinyl Chloride (PVC) Pipe

F. PVC Composite Wall Pipe

G. Fiberglass Reinforced Plastic Mortar Pipe

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PART 5 STANDARD SPECIFICATIONS

5.1 - MATERIALS

5.101 GENERAL INFORMATION

Unless otherwise specified, all materials used in the work under these Regulations shall conform to the requirements of the latest revision of the applicable specifications of the American Society for Testing and Materials (ASTM), and shall be tested in accordance with the latest specifications or methods of testing that have been adopted, revised or proposed for such materials. It is further understood and agreed that wherever reference is made to the specifications and/or methods of testing adopted by the American Society for Testing and Materials, American Concrete Institute, American National Standards Institute, American Water Works Association, American Welding Society, Ohio Department of Transportation, American Association of State Highway and Transportation Officials, City of Cleveland Water Department, or other organization or department, it shall refer to the standards of that society or organization, bearing the latest date.

On private work outside of the public right-of-way and in easements, when conflicts arise on the type of materials to be specified for usage in a project, the responsibility will be with the municipal engineer.

5.102 INSPECTION

No material shall be used in the work until it has been inspected and approved on the site of the work. When required by the responsible agency, any or all materials entering into the construction of any work under this contract shall be tested by a reputable local testing laboratory. Such inspection shall not relieve the contractor of any obligations in this respect, and any defective material or workmanship shall be at all times liable to rejection when discovered, until the final completion and adjustment of the contract.

5.103 MILL, FACTORY AND FIELD TESTING MATERIALS

All materials to be incorporated in the work of this contract shall be tested or inspected in accordance with the following schedule. Sampling, testing and inspection shall be made in accordance with the latest applicable ASTM standards.

A. Laboratory Testing

The following materials shall be inspected and tested at the expense of the responsible agency, by a local bureau, laboratory or other agency selected by the engineer, and the contractor shall furnish all such samples of materials as may be required, and such materials shall be approved before permission is given to incorporate same in the work. It is the responsibility of the contractor to arrange for laboratory testing and the cost of such samples shall be included in the unit prices bid for the various items of work. The requirements for each item to be tested shall be as follows:

1. Cement
   a) Containers shall bear the name of the manufacturer.
   b) The testing laboratories shall provide certificates of test of samples for 7 day and 28 day compressive strength, soundness, time of setting and fineness, for each carload shipped.

2. Sand
   a) Color test for organic matter.
   b) Decantation test for silt.
   c) Sieve analysis.

3. Brick
   a) Shale sewer brick shall be tested for the requirements of Section 5.119A of these Specifications.
   b) Concrete sewer brick shall be tested according to Section 5.119B of these Specifications.

4. Concrete Masonry Units
   a) Compressive Strength Test.
   b) Absorption Test.

5. Stone
   a) Sieve Analysis and Visual Inspection.
   b) Abrasion.
   c) Absorption.

6. Concrete (Concrete test not required for small projects such as house or building connections.)

   For each separate pour:
   a) Slump Test.
   b) Three compression (cylinder) tests made at two different times.

7. Sanitary and Storm Sewer Pipe

   Furnish one pipe section for each diameter of a given strength class for each 2,000 feet or fraction thereof to be supplied on each individual project.
   a) Clay, Plain Concrete and Reinforced Concrete Pipe - 3 Edge Bearing Test
      1) Clay pipe strength as required by ASTM C-700ES.
      2) Plain concrete pipe strength as required by C-14.
      3) Reinforced concrete strength as required by C-76.

      Test loading for reinforced concrete pipe shall be increased to a magnitude of 115% of that which the pipe must support without developing a 0.01 inch crack as defined in ASTM Specification C-497, "Determining Physical Properties of Concrete Pipe or Tile." If a 0.01 inch crack has not been developed by this increased loading, the crushing load shall be removed, the test terminated and the test section plus all the pipe it represents shall be considered to have passed the 3 Edge Bearing Test requirements. Should a 0.01 inch crack develop in the pipe surface at or prior to the attainment of the 115% load, the pipe shall be tested to ultimate strength.

   b) Concrete Pipe

      When concrete pipe manufactured at a plant that has been previously approved by a responsible agency has once been tested and approved for a specific size and design in accordance with the above procedure, any responsible agency may accept similar concrete pipe on the basis of one of the following:

1. Plant certification that the pipe and joints meet the project specifications.
2. Accepting results of the three edge bearing tests previously completed.
3. Core sampling. Such cores can be used to verify wall thickness, steel areas, absorption and concrete compressive strength.

c) Flexible Pipe - Strength, flattening, stiffness and deflection in accordance with ASTM D-2412.

   1) ABS Solid Wall Pipe as required by ASTM D-2751, (SDR35) to acceptance values given therein.
   2) ABS and PVC Composite Wall Pipe as required by ASTM D-2680 to acceptance values given therein.
   3) Polyvinyl Chloride Pipe (PVC) - All polyvinyl chloride pipe shall conform to the requirements specified in the latest Standard Specifications for Polyvinyl Chloride Pipes, ASTM Designation D-3034; ASTM D-2241, ASTM D-3139, ASTM F-949, ASTM F-794, ASTM F-679, ASTM F-789, AASHTO M-304. All pipes and fittings shall be marked or stenciled with the appropriate classification.

d) Aluminized steel type 2 pipe (where acceptable) per ASTM A-760 Type 2, ASTM A-819, AASHTO M-274.

e) Reinforced plastic mortar pipe as requied by ASTM D-3262.

f) Acceptance Tests for Iron Pipe.

   1) Ductile Iron Pipe tensile and impact tested as required in ANSI A 21.51 to acceptance values listed therein.
   2) Cast-Iron pipe modules of rupture and secant modules of elasticity tested as required in ANSI A 21.6 or A 21.8 to accepted values listed therein.

8. Welding

   Shop and field tests shall be made on the work of welding operations according to the American Welding Society's "Standard Qualification Procedure".

9. Miscellaneous

   All other material and testing procedures which the responsible agency may determine to be necessary.

B. Certified Mill Tests

Certificates of tests at mill by manufacturer shall be furnished for the following materials:

1. Cast Iron Pipe, Fittings and other Castings:

   Furnish certificates of tests by foundry under ANSI, AWWA, or Federal Specifications. Make, weight, and year to be stenciled or cast on all pipe, fittings and castings.

2. Structural Steel, Reinforcing Steel and Genuine Ductile Iron and Corrugated Metal:

   Furnish certified mill tests of steels and ductile irons.

3. All other material which the responsible agency may determine to be necessary.

C. Visual Inspection

All material and all equipment shall be subject to visual inspection and acceptance or rejection after delivery to the site of the work. All rejected materials shall immediately be removed from the site. All pipes shall be stamped bearing manufacture's name, date, type of pipe (class if concrete), and applicable ASTM and/or AASHTO numbers.

5.104 CLAY PIPE

All clay sewer pipe shall conform to the requirements stipulated in the "Standard Specifications for Clay Sewer Pipe", ASTM Designation C-700 ES, as may be specifically identified on the plans or further specified. All clay pipe service laterals shall conform to ASTM Designation C-700 ES.

5.105 CONCRETE PIPE (Circular and Elliptical)

A. Non-reinforced Concrete

All non-reinforced concrete sewer pipe furnished under these Specifications shall conform to all the requirements of Class 3 pipe in "Concrete Sewer, Storm Drain, and Culvert Pipe", ASTM Designation C-14. Sanitary sewer pipes shall be manufactured utilizing Type II cement only.

B. Reinforced Circular Concrete

All reinforced circular concrete sewer pipe furnished under these Specifications shall conform to all the requirements of "Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe", ASTM Designation C-76. Where designs for a given size and strength class of pipe are provided for under the provisions of the ODOT Specifications, such designs shall be permitted subject to the testing requirements of Section 5.103 as it applies to circular reinforced concrete pipe. Sanitary sewer pipes shall be manufactured utilizing Type II cement only.

C. Reinforced Elliptical Concrete

All reinforced elliptical concrete sewer pipe furnished under these Specifications shall conform to all the requirements of "Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe", ASTM Designation C-507. Where designs for a given size and strength class of pipe are provided for under provisions of the ODOT Specifications, such designs shall be permitted subject to the test requirements of Section 5.103 as it applies to reinforced elliptical concrete pipe.

5.106 CAST IRON PIPE

A. Form and Conditions

All cast iron pipe and special castings shall be of superior quality of iron, tough and even grain, free from cracks, sand, holes or defects of any nature. Cast iron pipe shown on the plans and bid blanks as Thickness Class "22", cement lined, shall conform to the "Specifications for Cast Iron Pipe, for Water and Other Liquids". ANSI A-21.6 or A-21.8. Every length of pipe delivered to the site shall have been previously tested and withstood the minimum hydraulic pressure required by the specifications under which it is furnished. All cast iron pipe and special castings used in pipe extensions must be numbered and inspected, said inspection to be made by an inspector from the responsible agency.

B. Weight of Special Castings

No special castings shall be accepted, the weight of which shall be less than American Water Works Association, Class "D", standard weight, by more than ten percent (10%).

C. Application of Coating

All pipe and special castings shall be thoroughly cleaned and, except for cement-mortar lined pipe, shall be coated inside and outside with an approved asphaltum or other approved impervious preparation in accordance with ANSI A-21.4 applied at a temperature of 300°F. Pipe shall be handled in such a manner that a minimum amount of damage to the coating will result. All cast iron pipe or fittings, the coating of which has been damaged in shipping or handling, shall have the damaged portion well cleaned and coated as above specified before being placed in the work. The contractor shall thoroughly coat all exposed parts of nuts and bolts, as above specified, after the pipe has been placed and before backfilling has been placed. All field coating shall be furnished by the contractor and approved by the responsible agency. All cement-mortar lining for cast iron and ductile iron pipe and fittings shall be installed in conformance with ANSI A-21.4.

5.107 DUCTILE IRON PIPE

A. Form and Conditions

All ductile iron pipe and special castings shall be of superior quality of iron, tough and even grain, free from cracks, sand, holes or defects of any nature.

Ductile iron pipe shown on the plans and bid blanks as cement lined Thickness Class "52" shall conform to the Specifications for Ductile Iron Pipe, for Water and Other Liquids, ANSI A-21.51. Every length of pipe delivered to the site shall have been previously tested and withstood the minimum hydraulic pressure required by the specifications under which it is furnished. All ductile iron pipe and special castings used in pipe extensions must be numbered and inspected, said inspection to be made by an inspector from the responsible agency.

B. Application of Coating

All pipe and special castings shall be thoroughly cleaned, and except for cement-mortar lined pipe, shall be coated inside and outside with an approved asphaltum or other approved impervious preparation applied at a temperature of 300°F. Pipe shall be handled in such a manner that a minimum amount of damage to the coating will result. All ductile iron pipe or fittings, the coating of which has been damaged in shipping or handling, shall have the damaged portion well cleaned and recoated as above specified before being placed in the work. The contractor shall thoroughly coat all exposed parts of nuts and bolts, as above specified, after the pipe has been placed and before backfilling has been placed. All field coating shall be furnished and applied by the contractor and approved by the responsible agency.

5.108 ALUMINIZED STEEL PIPE

Where installation is applicable and accepted, aluminized steel Type 2 pipe shall conform to ASTM A-760 and ASTM A-819, AASHTO M-274 for materials, ASTM A-796 for design, and ASTM A-798 for installation.

5.109 CORRUGATED METAL PIPE

Where installation is applicable and accepted, all corrugated metal pipe shall be galvanized and shall conform to the requirements of the latest specifications for corrugated metal pipe adopted in the ODOT Specifications. The thickness of the base metal shall be shown on the plans. When specified or called for on the plans, a bituminous paved invert and/or bituminous coating or a smooth bituminous lining applied centrifugally shall be applied to the pipe after fabrication. Corrugated metal pipe is to be used only in special projects upon approval of the Municipal Engineer and other appropriate agencies.

5.110 ACRYLONITRILE-BUTADIENE-STYPENE (ABS) SOLID WALL PIPE

All ABS solid wall pipe shall conform to the requirements specified in the latest Standard Specifications for ABS Solid Wall Pipe and Fittings, ASTM Designation D-2751. All pipe and fittings shall be marked or stenciled with the appropriate classification.

5.111 ACRYLONITRILE (ABS) AND POLYVINYL CHLORIDE (PVC) COMPOSITE WALL PIPE

All ABS composite pipe shall conform to the requirements specified in the latest Standard Specifications for ABS and PVC Composite Sewer Piping, ASTM Designation D-2680. Exposed ends of all pipe and fittings shall be sealed with a thick application of solvent cement. All pipe and fittings shall be marked or stenciled with the appropriate classification.

5.112 POLYVINYL CHLORIDE PIPE (PVC)

All polyvinyl chloride pipe shall conform to the requirements specified in the latest Standard Specifications for Polyvinyl Chloride Pipes, ASTM Designation D-3034; ASTM D-2241, ASTM D-3139, ASTM F-949, ASTM F-794, ASTM F-679, ASTM F-789, AASHTO M-304. All pipes and fittings shall be marked or stenciled with the appropriate classification.

5.113 FIBERGLASS REINFORCED PLASTIC MORTAR PIPE

All reinforced plastic mortar pipe shall conform to the requirements specified in the latest Standard Specifications of ASTM D-3262.

5.114 JOINTING MATERIALS

Joint materials for all classifications of pipe shall be the same between any consecutive manholes.

A. For Clay Pipe

Clay pipe for sanitary sewers and storm sewers installations shall be provided with compression joints meeting all performance requirements of ASTM Standard C-425.

B. For Concrete Pipe

1. Sanitary and Storm Sewers

   Concrete pipe joints for sanitary sewers shall conform to the requirements of ASTM C-361 as it pertains to the use of a confined gasket. For storm sewer, ASTM C-443 is acceptable. All joints shall consist of confined approved gaskets placed in grooves in the spigots of the pipe such that the gaskets will be enclosed on all sides when the pipe is laid and the joints are completed.

All elliptical reinforced concrete pipe for sanitary and storm sewers shall have Butyl rubber type joints unless otherwise specified.

C. <u>Acrylonitrile-Butadiene-Styrene (ABS) Solid Wall Pipe</u>

All ABS Solid Wall Pipe joints shall be of the "0" ring or Solvent Cement type per ASTM 2680.

D. <u>Acrylonitrile-Butadiene-Styrene (ABS) Composite Wall Pipe</u>

All ABS Composite Wall Pipe Joints shall be of the "0" ring or Solvent Cement type per ASTM 2680, if the joint is of the solvent type, it shall be installed per ASTM D-2235 and the manufacturer's recommendations. Additionally, all exposed ends of the ABS Composite Pipe shall be fully sealed with a thick application of solvent cement.

E. <u>For Polyvinyl Chloride (PVC) Pipe</u>

PVC pipe joints shall be integral with the body of the pipe, belled as illustrated in ASTM D-3034 and shall utilize "0" ring gaskets meeting requirements of ASTM D-3212. Gaskets shall conform to ASTM F-477.

F. <u>For Polyvinyl Chloride Composite (PVC) Wall Pipe</u>

All PVC Composite Wall Pipe Joints shall be of the "0" ring or solvent cement type per ASTM D-2680. If the joint is of the solvent cement type, it shall be installed per ASTM D-3564 and the manufacturer's recommendations. Additionally, all exposed ends of the PVC Composite Pipe shall be fully sealed with a thick application of solvent cement.

G. <u>Fiberglass Reinforced Plastic Mortar Pipe</u>

Coupling joints shall meet the requirements os ASTM D-4161.

H. <u>Cast Iron and Ductile Pipe</u>

Joints shall be rubber slip joints, comparable to the following: "Tyton" Joint, as manufactured by the U.S. Pipe and Foundry Company; "Pastite" Joint, as manufactured by American Iron Pipe or "Bell-Tite", as manufactured by James B. Clow and Sons, Inc.

I. Aluminized Steel Pipe (where applicable and approved)

Joints for aluminized steel pipe shall conform to the requirements of ASTM A-798 specifications.

5.115 CASTINGS

Castings for manholes, inlets and catch basins furnished under these Specifications shall conform in design to the standard plans on file in the office of the responsible agency Engineer. All casting shall be true to pattern and free from cracks, gas holes, flaws and excessive shrinkage. Surfaces shall be free from burnt-on sand and shall be reasonably smooth. Runners, fins, risers and other cast-on pieces shall be removed.

Cast iron manhole and catch basin frames, covers and for any other purpose under these Specifications, except as otherwise provided, shall conform to all the requirements of Class No. 30 for Gray Iron Castings of the ASTM Designation A-48.

All castings shall be commercially machineable and, in the case of manholes and catch basins, the frame and cover shall, if necessary, be so machined that it will be impossible to rock the cover after it has been seated in the proper position in the frame.

5.116 MANHOLE STEPS

A. General Information

All steps shall be minimum of 12 inches in width with safety side lugs to prevent slipping and shall conform to the latest OSHA requirements.

B. Ductile Iron Steps

They shall be true to pattern and surfaces shall be free from cracks, flaws, fins, and burnt-on sand, and shall be reasonably smooth. They shall be coated with an approved asphaltum or other impervious preparation. The ductile iron shall conform to all of the requirements of Grade 65-45-12, ASTM Designation A-536.

C. Plastic-Steel Manhole Steps

The plastic used shall be a Co-Polymer Polypropylene and shall conform to the requirements of ASTM D-4101-95. The steel shall conform to ASTM A-496, D-20 or ASTM A615 Grade 60. The steel shall be epoxy-coated per ASTM A-934 or be galvanized. All steps shall conform to ASTM C-478-94 paragraph 13 with safety side legs to prevent slipping and shall conform to the latest OSHA requirements.

5.117 CONCRETE AND MASONRY

A. Precast Manholes

All precast concrete manhole sections furnished under these Specifications shall conform to all the requirements of 'Precast Reinforced Concrete Manhole Sections", ASTM Designation C-478. All joints shall also be sealed externally with a trowelable mastic compound such as Fabertite, Kent Seal or equal. Precast manhole "tee" sections where used on sewers 48 inches in diameter and larger shall conform in design to the Uniform Standard Sewer Details of the responsible agency.

Approved water-stop gaskets shall be utilized when plastic pipe connections are made into a masonry or precast structure.

B. Portland Cement

All cement used in the work shall be of an approved brand and shall meet the requirements of the following ASTM Designation:

Standard Portland Cement	**C-150 Type I**
*** Standard Portland Cement w/air entraining admixture:**	**C-150 Type I**
High Early Strength Portland Cement	**C-150 Type III**
*** High Early Strength Portland Cement w/air entraining admixture:**	**C-150 Type III**

*** Air entraining admixture shall conform to AASHO, M-154 added at mixer.**

Cement for job-mixed concrete shall be furnished in unbroken 94 pound bags marked with the brand of the manufacturer, showing no signs of damage from moisture such as the formation of cakes or lumps, or of damage of any other character.

C. Water

All water required in the execution of the contract must be provided by the Contractor. It shall be free form organic matter, acids and strong alkalis and shall be of potable quality. Water may be obtained from fire hydrants of the municipality wherever available, after obtaining a permit for such services. Cost of water shall be included in the unit prices bid for the various items of work unless otherwise designated by the responsible agency.

D. Fine Aggregates

The fine aggregates shall consist of natural or manufactured sand composed of clean, strong, hard, durable, uncoated particles of stone. It shall be well graded from coarse to fine and shall be free from lumps of clay, shale, loam, soft and flaky particles, and all organic matter. The sand shall conform to the following grading:

SIEVE NO. (U.S. STANDARD SIEVE SERIES)	TOTAL PERCENT BY WEIGHT PASSING
3/8"	100
No. 4	95-100
No. 8	70-95
No. 16	45-80
No. 30	25-60
No. 50	10-30
No. 100	1-10
No. 200	0-4

In the event that the sand does not pass the minimum requirements for the No. 50 and/or the No. 100 sieves, the deficiency may be corrected by the addition of approved fine inorganic material.

The amount of such material to be added shall be determined by a laboratory designated by the responsible agency engineer.

The gradation of the sand from any one source shall be reasonably uniform and not subject to extreme variations within the above specified limits. Sand from any one source exhibiting a variation in fineness modules of more than 0.20 may be rejected.

In addition to the grading requirements, the fine aggregate shall pass the color test for organic matter, soundness test and the compressive tests of cement sand mortar, all as per the latest ASTM specifications.

E. Mortar Sand

With the exception of grading, the specifications for the fine aggregate shall govern. Grading shall be as follows:

SIEVE NO. (U.S. STANDARD SIEVE SERIES)	TOTAL PERCENT BY WEIGHT PASSING
No. 4	100
No. 8	90-100
No. 50	15-40
No. 100	0-10
No. 200	0-5

F. Coarse Aggregates

The coarse aggregate shall consist of clean, strong, hard, durable, uncoated particles of crushed limestone, or crushed granite. It shall be reasonably uniform in density and free from an excess of thin, elongated or laminated pieces and also free from organic material.

Recycled concrete on public right-of-way projects is not allowed. It can be used on private property with the approval of the municipal engineer.

The amounts of deleterious substances contained in the aggregate shall not exceed the following limits:

	Percent by Weight
Dust (Passing No. 200 Sieve)	1.0
Shale	1.0
Coal	1.0
Clay Lumps	0.25
Soft Fragments	3.0
Miscellaneous Substances such as Chert Alkali, Friable Laminated Pieces	1.0

If the material passing the No. 200 sieve consists of the dust of fracture, and is free from shale or clay particles, the allowable amount may be increased to 1.5%.

The coarse aggregate shall conform to the appropriate AASHTO M-43 grading.

Light weight aggregates will not be permitted and all coarse aggregates shall weigh at least 65 pounds per cubic foot.

All coarse aggregates shall meet the ASTM specifications in regard to soundness and abrasion losses.

5.118 BRICK

A. Shale Sewer Brick

All sewer brick shall be made from shale sewer brick and shall be smooth, sound, hard, tough, and thoroughly vitrified. They shall be true in form with straight sharp edges and flat surfaces, and shall be uniform in quality, cross section and dimensions. Shale sewer brick furnished or used under these Specifications shall comply with all the requirements for Grade S.S., ASTM C-32 so far as the same may apply and are not in conflict with these Specifications.

Sewer brick shall be one or more of the following designated sizes:

DEPTH	WIDTH	LENGTH
1 1/2"	4"	8 1/2"
3"	4"	8 1/2"
3 1/2"	4"	8 1/2"

Not more than two percent (2%) of the brick shall vary more than one-eighth inch (1/8") in depth or width, or one-quarter inch (1/4") in length from the specified dimensions.

Lugged brick, cored brick or brick having recessed or openings extending through or partially through the body of the brick in any direction will not be accepted under these Specifications.

All shale brick furnished or used under these Specifications shall comply with the following physical test requirements:

ABSORPTION LIMIT (5 Hour Boiling)

Mean of five (5) tests ---------------Not to exceed 6%

Individual Maximum--------------------Not to exceed 9%

Minimum Compressive Strength (lbs. per sq. inch)

Mean of five (5) tests----8000

Individual Minimum--------6000

B. Concrete Brick

Brick used in storm sewers, catch basins, inlet basins, storm manholes and storm junction chambers may be concrete sewer brick conforming to ASTM Designation C-55, Type I, Grade S-1.

5.119 REINFORCING STEEL

Reinforcing steel shall conform to the "Standard Specifications for Billet Steel or Rail Steel Reinforcement Bars" of the American Society for Testing and Materials, ASTM A-615 or ASTM A-616. Bars shall be round as indicated on the drawings, and shall be of the deformed type. Bars shall be of new stock and free from scale, rust, oil, paint or coating of any kind, except epoxy coatings as specifically called for. Deformations shall conform to ASTM Designation A-305. Welded wire fabric shall conform to the latest ASTM Specification A-185.

5.120 STRUCTURAL STEEL

All structural steel shall meet the requirements of the "Standard Specifications for Steel Bridges and Buildings", ASTM Designation A-36.

5.121 STEEL ELECTRODES

Steel electrodes shall conform to all requirements of the latest "Standard Specifications of Steel Electrodes", ASTM Designation A-233.

5.122 LUMBER

Lumber for sheeting, sheet piling, forms, bracing or bridging must be of good quality and of sizes and strength suitable for protecting the work and workers from danger, and for securing the best possible condition for construction. Any material deemed unsuitable or unsafe by the responsible agency must be removed at once from the work.

A. Grillage

Lumber for grillage under the foundation of the sewer shall be of oak, southern yellow pine or douglas fir. Other species must be approved by the engineer. The material for grillage shall conform to the following specifications and grades:

1. **Oak:** 1700# f grade for wales and bridge plank grade for flooring based on the specifications by the National Hardwood Lumber Association.

2. **Southern Yellow Pine:** Structural square edge and sound longleaf P. & T. or dense structural square edge and sound shortleaf P. & T. grades for wales, and No. 1 structural longleaf J. & P. or dense No. 1 structural shortleaf J. & P. grades for flooring based on the specifications by the Southern Pine Association.

3. **Douglas Fir:** Select structural B. & S. or dense construction B. & S. grades for wales, and select structural J. & P. or dense construction J. & P. grades for flooring based on

the specifications by the West Coast Lumberman's Association.

B. Timber Piles

Piles shall be of red oak, white oak, cypress, southern yellow pine or douglas fir. Other species must be approved by the responsible agency engineer. All piles shall be sound, solid and contain no unsound knots. Sound knots will be permitted provided they do not exceed one-third (1/3) of the minimum diameter of the pile at that particular section and are not over four inches (4") in diameter. Any defects or combination of defects, which would be more injurious than the maximum allowable, will not be permitted. Piles shall have a uniform taper and be free from short kinks. A reasonable amount of ground swell will be permitted but shall not extend more than three feet (3') from the butt or be considered in measuring diameters.

5.2 - CONSTRUCTION

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B. Replacing, Moving and Repairing of Existing Structures

C. Removal of Existing Sewers and Appurtenances

D. Restoration of Pavement, Curbing, Concrete Gutters, Driveways, Sidewalks, Retaining Walls, Headwalls, Piers and Abutments

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PART 5.2 CONSTRUCTION

5.201 SITE WORK

A. Maintaining Sewage Flow

The contractor shall be required to bypass and maintain the flow in all existing live sanitary and storm sewers during construction and the method employed shall be approved by the responsible agency. The full cost of bypassing and maintaining sewage flow shall be included in the prices bid for other items of work and no additional compensation will be allowed therefore.

B. Replacing, Moving and Repairing of Existing Structures

The contractor shall be responsible for the replacement, movement or repair and maintenance of all sewers, drains, catch basins, manholes, culverts, water lines, steam lines, air or gas lines, wire conduit(s) and any other appurtenances or structures encountered in the performance of said work, together in conjunction with all house connections whether or not they are shown on the plans.

Written permission from the owner must be obtained prior to initiating any construction on privately owned lines, equipment or appurtenances.

The contractor shall have the responsibility to replace, move or repair and maintain all pipes for water, steam, air or gas, and all wire conduit(s), and all other structures encountered in the work and repair of all damage done to any of the said structures through acts or negligence and shall keep them in repair during the life of this contract.

The contractor shall, in all cases, restore all existing utilities and structures to the full satisfaction of the responsible agency engineer.

The full cost of replacing, moving or repairing all damage done to any of the said structures encountered in excavation, including continuously along the trench, shall be included in the unit prices bid for other items of work and no additional compensation will be allowed therefore, whether or not shown on the plans.

C. Removal of Existing Sewers and Appurtenances

Where required to clear the new construction, or when shown on the plans, existing sewers, manholes, catch basins and other appurtenances shall be removed by the contractor. All abandoned sewers, when required by the municipal engineer, shall be filled with sand or flowable materials such as durofill and bulkheaded with brick masonry bulkheads at all points where they are cut. Manholes shall be demolished five (5) feet below grade and filled with suitable materials approved by the engineer. Any materials removed in the progress of the work which are deemed to be salvageable, shall be removed to storage points designated by the engineer and shall remain the property of the responsible agency. The contractor shall use reasonable care in removing such items to prevent breakage and shall include the entire cost of sandfilling, bulkheading and removal of existing sewers and appurtenances in the unit prices bid for sewers in place.

D. Restoration of Pavement, Curbing, Concrete Gutters, Driveways, Sidewalks, Retaining Walls, Headwalls, Piers and Abutments

All pavements, road surfaces, curbing, concrete gutters, driveways, driveway culvert pipes, sidewalks, retaining walls, piers, headwalls, abutments, fencing and mailboxes removed or damaged during the course of the work shall be replaced by the contractor. All such items shall be replaced in the same manner, and be at least of equal quality and dimensions as existed before the commencement of the work. All such replacement shall be performed as soon as practicable. The full cost of such work shall be included in the unit prices bid for sewers in place. All replacement work done on County, Municipal or State roads shall be approved by the appropriate agency or agencies.

E. Removal of Trees

Only those trees which are directly in the line of excavation, or those which are designated for removal by the responsible agency, shall be removed to a depth of six (6) inches below the finished grade. The entire cost of removing all sizes of trees shall be included in the prices bid for other items of work and no additional compensation will be allowed therefore, unless otherwise specified.

F. Dust Control

The contractor shall keep the entire construction site reasonably clean and clear of excessive dust. The contractor shall immediately control the dust or apply dust control chemicals in the affected area to the full satisfaction of the responsible agency.

The full cost of this work shall be included in the unit prices bid for other items of work, and no additional compensation will be allowed therefore.

5.202 EXCAVATING

A. Test Pits

The contractor shall dig such exploratory test pits as necessary, in advance of excavation operations, to determine the exact location of subsurface pipe lines, conduits and structures which are likely to be encountered, and shall make acceptable provision for their protection, support and maintenance in operation. The cost of such work shall be included in the unit prices bid for sewers in place.

B. Alignment and Grade

Alignment and grade shall be established by means of grade bars or a laser beam.

1. Laser Beam

   The contractor shall furnish all material and labor to establish line and grade of the generated laser beam from the benchmarks and control points indicated on the plans. The end of laterals and all "Y" branches shall be staked and maximum place of hubs shall be fifty (50) feet. All manholes and inlet basins shall be set to grade by the contractor. The final inspection approval and acceptance of the sewer system shall be contingent upon the final adjustment of the castings. At final grade, the surface of the ground shall slope away from the manhole covers. The laser shall be securely anchored and checked at least twice daily to insure that OSHA Regulations are met. Strict adherence to the manufacturer's operation procedure shall be observed. Only qualified and trained employees may be assigned to install, adjust, or operate laser equipment, and proof of qualifications of the equipment operator must be available at all times. Areas in which lasers are used, must be posted with standard laser warning placards and the laser beam shall be turned off when not needed.

During rain, snow, dust, excessive heat or fog, the operation of laser systems shall be prohibited if beam scatter occurs.

All horizontal and vertical control required for the complete layout and performance of the work under this Contract shall be done by the contractor at the contractor's expense, and any approvals by the responsible agency of the contractor's methods will not relieve the contractor of responsibility.

2. Open Cut

   All sewers in open cut shall be laid and maintained to the required lines and grades.

   Unless otherwise specified, the responsible agency shall establish all base lines for the location of the principal component parts of the work together with a suitable number of benchmarks adjacent to the work. Based upon the information provided, the contractor shall employ and retain a Registered Surveyor to develop and make all detail surveys necessary for construction, including slope stake, cut stakes, batter boards, stakes for pile locations and other working points, lines and elevations. The contractor shall have the responsibility to carefully preserve benchmarks, reference points and stakes, and in case of the destruction thereof, the contractor shall be charged with the expense and damage resulting therefrom and shall be responsible for any mistakes that may be caused by the loss or disturbance of such benchmarks, reference points and stakes. The contractor shall notify the responsible agency at least 72 hours prior to starting survey work to establish line and grade.

3. Tunnel

   In tunnel construction, the contractor shall furnish all labor and equipment required to transfer line and grade from the benchmarks and control points at ground level indicated on the plans into the tunnel section at each shaft. The method employed by the contractor shall be approved by the responsible agency. The control of vertical and horizontal alignment in the tunnel sections shall be accomplished by the use of a laser beam instrument, unless another method is approved in writing by the engineer.

Prior to submitting the estimate for payment, the contractor shall submit for review by the engineer a plan and profile of all work performed during the preceding month. The plan and profile shall indicate thereon the survey indication of adherence to the design alignment and grade, as well as conformity to the requirements of these Specifications. The survey notes and drawings to be submitted shall be certified and stamped by a Registered Surveyor, licensed to practice in the State of Ohio. The surveyor shall be a specialist in tunnel work.

C. <u>Excavation and Preparation of Trench</u>

1. General

Unless otherwise provided, all excavation shall be unclassified and shall include the removal and disposal of all material encountered in excavation, including pavement surface, pavement base and other materials. It shall also include the placing and removal of the sheeting and bracing, and removing water encountered. All excavated materials shall be stored in convenient piles near the construction work sites or removed from the site unless otherwise specified.

All excavation under existing or future pavements, driveways or sidewalks shall be backfilled with approved premium backfill. On roadways, premium backfill shall extend to four (4') feet beyond edge of pavement.

2. Width

The maximum width of unsheeted trench shall not exceed 12 inches on each side of the pipe for pipe diameters or spans of 24 inches or less, and not exceed 15 inches on each side of the pipe for diameters or spans greater than 24 inches and less than 72 inches, and not exceed 24 inches on each side of the pipe for pipe diameters or spans 72 inches and larger. The minimum width of unsheeted trench shall be at least nine (9) inches wider on each side than the outside diameter of pipe at the spring line.

3. Bedding

Type I. All pipe shall have a bedding of AASHTO M-43 No. 57, 6, 67, 68, 7, 78 or 8 aggregate extending the width of the trench excavation with depth in conformance with the construction drawings. When Type I bedding is used, the cost of all bedding, as described above, shall be included in the price bid for the various pipe items unless otherwise shown.

Type II. Where shown on the drawings, pipe shall be bedded in a monolithic cradle of plain concrete having a minimum thickness below the bottom of the pipe of one-fourth (1/4) the vertical inside pipe diameter or rise but not less than six (6) inches extending up the sides for a height equal to one-fourth (1/4) the vertical outside diameter or rise. The cradle shall have a width at least equal to that of the excavated trench. 3000 psi concrete mix shall be used for the above bedding purposes. Care shall be taken so that the concrete strength does not exceed 3000 psi, unless a positive method of breaking bond between the pipe and the concrete is provided for.

When sewer is not crossing a creek or any other body of water and the top of the pipe has less than three (3) feet of cover, it is recommended that the pipe be encased on both sides and top with minimum six (6) inches of 3,000# concrete. The pipe shall be bedded as specified in the drawings. The encasement of sewers shall be the decision of the design engineer.

All space within the width of the trench excavation, inside or outside the authorized limits, shall be filled between the elevation limits with the same material as specified for the type of bedding to be used and as shown on the applicable standard drawings.

When Type II bedding or capping of pipe is used, the cost of all bedding, as described above, shall be included in the price bid for the various pipe items.

4. Pipe Cover

Only coarse aggregate shall be used for filling above the pipe bedding along the sides of the sewer and to a height of 12 inches over the top of the sewers. For concrete, ductile and iron pipes, the minimum cover shall be to the spring line of the pipe. The pipe cover material shall be brought up evenly on both sides of the sewers and shall be thoroughly compacted by tamping or ramming. Care shall be taken to spade the aggregate under the pipe haunch below the spring line.

5. Concrete Anchorage

Concrete anchorages will be used when sewer slopes fall within the following limits, unless otherwise specified:

20% to 35% slope - anchorage 36 feet center to center (maximum)

35% to 50% slope - anchorage 24 feet center to center (maximum)

Over 50% slope - anchorage 16 feet center to center (maximum).

The cost of concrete anchorage shall be included in the contract unit price for the sewer complete in place and no additional compensation will be allowed therefore.

D. Blasting

Blasting will not be permitted under and near buildings, bridges, railroad tracks and underground structures and utilities. Elsewhere, blasting will be permitted, but only upon the written approval of the responsible agency and of the municipality in which work is being done. The contractor shall use all possible precautions against accidents or damage due to explosions or in the use or storage of explosives, and the contractor shall assume all risk and responsibility therefore and promptly settle all claims occasioned thereby thus saving the responsible agency harmless from any claims resulting from such actions. A licensed person in the use of explosives shall be employed to supervise the drilling and blasting operations.

The engineer shall fix the time during which the blasting operations may be carried on. Explosives shall be used, handled and stored as prescribed by the laws and regulations of OSHA, the State of Ohio and legal municipality. All explosives shall be kept in a safe place, at a sufficient distance from the work, so that in case of accident, no damage will occur to any part of the work or adjacent property.

Explosives shall be so stored and secured that they are not accessible to unauthorized persons. Blasting shall be conducted so as not to endanger persons or property and, whenever required, the blast shall be covered with mats or otherwise satisfactorily confined. The contractor shall be held responsible for and shall make good, any damage caused by blasting or accidental discharge. Blasting in tunnel sections and elsewhere, when permitted, shall be done in accordance with the provision of all applicable Local, State and Federal Laws.

E. Tunnel

All excavation shall be open cut from the surface and no tunneling will be allowed except when written permission has been previously obtained from the engineer or it is specifically called for on the contract documents. In case tunnelling is permitted under pavements, or specifically called for on the plans, the work shall be done in accordance with the supplemental specifications. The contractor must take out the necessary permits and make the necessary deposits for the proper replacing of pavement support or the breaking down and repairing of the pavement.

F. Sewers Within Jacked or Bored Casing Pipe

At the locations shown on the plans, the sewer pipe shall be installed in a steel casing pipe with track for sewer pipe as per details shown on the contract plans. Material, equipment and construction procedures shall comply with the contract documents and shall be in accordance with the supplemental specifications. Carrier pipe shall be blocked top and bottom to prevent floating.

G. Jacked, Bored or Tunneled Service Connections

At the locations shown on the contract documents, the sewer pipe shall be jacked into a bored hole as herein specified. A sufficiently large boring pit shall be excavated to allow for proper alignment of the drilling equipment and to allow the pipe to be pushed through the drilled hole. The alignment of pipe will not be allowed to vary more than two (2) feet at the upstream end of the house connections from a line drawn at right angles from the sanitary sewer at the wye or riser. The lateral connections shall be laid on a grade of not less than one percent (1%) but not more than three percent (3%), and the invert of the upstream end of the pipe shall be not less than nine (9) feet below the elevation of the center line of the street for residential areas and

12 feet for commercial and industrial areas. The upstream end of the pipe shall be fitted with a stopper painted yellow for sanitary (natural color for storm) and an increaser and adapter, if necessary.

In cases where local ordinances or governmental agencies prohibit the cutting of pavements, and the subsurface consists of rock or other hard material that does not lend itself to boring, the sewer shall, upon the order of the engineer, be installed by tunneling under the pavement.

H. <u>Bracing and Sheeting or Excavation</u>

All trench and excavation bracing and sheeting shall be in conformance with the latest available OSHA Requirements.

I. <u>Drainage</u>

The contractor shall, when ordered by the engineer, construct tight bulkheads across trench and provide pumps suitable for the removal of any water which may be encountered or which may accumulate in the trenches. Unless otherwise provided for in the contract documents, drainage water will not be permitted to flood the trench or flow through the sewer.

1. Drainage of Trenches and Underdrains

   The sewer trench shall be kept free from storm, surface, and subsoil water or sewage. No joints shall be made under water. If necessary, the contractor shall install an underdrain embedded on all sides in crushed stone, as shown on the plans or standard construction details. This work shall be done only upon the written order of the responsible agency and it will paid for at the unit price bid for underdrains, unless otherwise specified.

2. Existing Water Courses

   In open water courses, ditches or drains and drain pipes encountered during the progress of work, the contractor shall provide for protection and securing of a continuous flow in such courses or drains and shall repair any damage that may be done by reason of them. Unless otherwise specified, the full cost of such shall be included in other items of work and no additional compensation will be provided therefore.

J. Paved Surfaces

The contractor shall remove all pavements, road surfaces, curbing, driveways, and sidewalks within the lines of excavation. The contractor shall clean saw cut the pavement and base without undue shattering. All concrete curbing, driveways or sidewalks within the lines of excavation shall be broken up and removed by the contractor. All such work shall be done in accordance with the rules and regulations of the municipality in which the work is done.

The use of pneumatic or hydraulic backhoe boom mounted pavement breakers or weights dropped on pavement for breaking will not be allowed except by written permission of the responsible agency. The full cost of such work shall be included in the unit prices bid for sewers in place, unless otherwise specified.

K. Excavation by Machine or by Hand

The use of excavation machinery will be permitted, except in places where hand excavation is called for in the contract documents. The full cost of such work shall be included in the unit prices bid for sewers in place, unless otherwise specified.

L. Barricades, Guards and Safety Provisions

Temporary traffic control devices and facilities shall be furnished, erected and maintained in accordance with the latest edition of the Manual on Uniform Traffic Control Devices for Streets and Highways prepared by the National Joint Committee on Uniform Traffic Control Devices. The work shall be conducted so that the least interference with traffic will result. Suitable steel plate bridges of a minimum of 0.75" thickness and recessed and anchored shall be provided over open trenches in pavements and driveways. The full cost of such shall be included in the unit prices bid for sewers in place, unless otherwise specified.

5.203 PIPE INSTALLATION

A. General Information

All pipe for use in sanitary or storm sewers shall conform to the specifications for pipe in Sections 5.104, 5.105, 5.106, 5.107, 5.108, 5.109, 5.110, 5.111, 5.112, 5.113.

Only one (1) type and strength of pipe shall be used between any two (2) consecutive manholes, unless otherwise shown on the contract drawings and specifications.

Where ASTM, ANSI or other national organizations have published recommended practices for installation, such recommendations shall be followed. Clay pipe shall be installed in full compliance with ASTM C12, "Standard Recommended Practice for Installing Vitrified Clay Pipe." Concrete pipe, as specified by the American Concrete Pipe Association, Design Data - 40. Plastic pipe, ABS Solid Wall pipe, ABS Composite Wall pipe and PVC pipe, shall be installed in full compliance with ASTM D2321, "Standard Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe". Reinforced plastic mortar pipe shall be installed per ASTM D-3839. All pipe shall be installed as shown in the Uniform Standard Sewer Detail Drawings.

B. Construction

After the trench has been excavated and the pipe bedded as specified in Section 5.202-C-3, the pipe shall be laid to the line and grade as specified. All joints shall be made as hereinafter specified. In no case shall material, except bedding material, be placed under the bell of the pipe to secure proper grade.

Previous to being lowered into the trench, each pipe shall be carefully inspected and those not meeting the specified requirements shall be rejected, clearly marked and immediately removed from the site of the work. Satisfactory means shall be used to hold the pipe in line while the pipe is being jointed, and due precautions shall be taken to insure that the spigot end of the pipe being laid is pushed to the proper depth into the bell of the proceeding pipe.

All sanitary and storm sewer connections shall be a minimum of six (6") inches I.D. and installed at a minimum of 1% grade. Variations to be approved by proper agencies.

Pipe shall be laid with the socket end upstream.

No pipe shall be laid within ten (10) feet of the machine excavating the trench nor within 40 feet of any place where blasting is being done. In no case shall more than 200 feet of trench be opened in advance of the pipe laying operations.

In sanitary sewer construction, no drainage shall run through the newly laid pipe. All sewers shall be tightly sealed at open ends at the completion of each day's work and no drainage water shall be permitted to flow through the sewer.

No storm water which accumulates in excavated basement areas is to be discharged into the sanitary sewerage system. Roof drains, foundation drains or any other clean water connections to the sanitary sewer system are prohibited.

All trenches and excavations shall, in general, be backfilled as soon as possible after the pipe is laid and jointed. Pipe cover zone shall be compacted to engineer's specifications. Where concrete encasement or cradle is used, pipe shall not be backfilled for at least 24 hours after placing concrete except that pipe may be covered to a depth of, not to exceed, 16 inches over the top of the pipe. The method employed in depositing the backfill shall be such as to prevent damage to the sewer or other structures.

5.204 PIPE JOINTS

A. General Information

The pipes shall be very carefully stored and handled to prevent any damage and no pipes shall be connected if the jointing rings have been deformed or damaged from any cause. Unless otherwise specified by the engineer, directed or indicated on the plans, the following types of joints shall be used.

B. Joints for Clay Pipe

The joints for clay pipe shall conform to the provisions of Section 5.114 of these Standards.

When jointing pipe using a compression type joint, a lubricant as furnished or recommended by the pipe manufacturer, shall be applied in the manner prescribed by the pipe manufacturer. No jute or other caulking will be permitted. The spigot shall then be entered into the socket and the pipe shoved home in an approved manner to fully complete the particular type of joint which is being used. The socket and spigot shall be free of any foreign matter which may prevent proper jointing of the pipe. When laying the pipe in concrete bedding, care shall be exercised to prevent the joint materials from coming in contact with the fresh concrete until after the joint has been completed.

C. Joints for Concrete Pipe

The joints for concrete pipe shall conform to the provisions of Section 5.114 of these Specifications.

When jointing pipe using a compression type joint, a lubricant as furnished or recommended by the pipe manufacturer shall be applied in the manner prescribed by the pipe manufacturer. No jute or other caulking will be permitted. The spigot shall then be entered into the socket and the pipe shoved home in an approved manner to fully complete the particular type of joint which is being used. The socket and spigot shall be free of any foreign matter which may prevent proper jointing of the pipe. When laying the pipe in concrete, care shall be exercised to prevent the gasket from coming in contact with the fresh concrete until after the joint has been completed.

D. Joints for Acrylonitrile-Butadiene-Styrene (ABS) Solid Wall Pipe

The joints for ABS Solid Wall Pipe shall conform to the provisions of Sections 5.114.

When jointing pipe for lateral sewers, ABS solvent cement joints shall be installed in accordance with ASTM D-2235. Pipe shall be cleaned of dust or moisture. Remove grease and oil with an approved cleaning solvent. Brush cement solvent uniformly on mating surfaces of inner socket and outer pipe. Insert the pipe immediately after applying cement, using a slight twisting motion, and hold in position for a few seconds to prevent the pipe from backing out. Avoid rough handling for one (1) hour. For more complete instructions and cautionary notes, refer to Appendix A of ASTM D-2235.

E. Joints for Acrylonitrile-Butadiene-Styrene (ABS) Composite Wall Pipe

The joints for ABS Composite Wall Pipe shall conform to the provisions of Section 5.114.

When jointing pipe using the required 0-ring compression type joint, a lubricant recommended by the gasket manufacturer shall be used. The gasket shall be lubricated by drawing it through lubricant held in the hand of the worker, thus coating the entire surface of the gasket allowing free rotation as the spigot is pushed into the socket. The socket and spigot shall be free of any foreign matter such as twigs, sand particles, or other material that might prevent closure of the joint.

F. Joints for Polyvinyl Chloride (PVC) Pipe

The joints for PVC pipe shall conform to the provisions of Section 5.114. When jointing pipe using the required 0-ring compression type joint, a lubricant recommended by the gasket manufacturer shall be used. The socket and spigot shall be free of any foreign matter such as twigs, sand particles, or other material that might prevent closure of the joint. Lubricant shall be applied to the bevel of the spigot end and approximately mid-way back to the insertion line. Do not apply lubricant inside the bell.

G. Joints for Polyvinyl Chloride Composite (PVC) Wall Pipe

Joints for PVC Composite wall pipe to conform to the provisions of Section 5.114.

H. Joints for Fiberglass Reinforced Plastic Mortar Pipe

Joints for fiberglass reinforced plastic mortar pipe shall conform to the provision of Section 5.114.

I. Joints for Cast and Ductile Iron Pipe

Joints for Cast and Ductile Iron Pipe shall conform to the provision of Section 5.114. The socket and spigot shall be free of any foreign matter. The gasket shall be thoroughly lubricated allowing free rotation as the spigot is pushed into the socket.

1. Rubber Slip Joints

   All cast iron and ductile pipe, shall be laid with rubber slip joints, comparable to one (1) of the following:

   "Tyton" joint, as manufactured by the U.S. Pipe and Foundry Company.

   "Fastite" joint, as manufactured by the American Cast Iron Pipe Company.

   "Bell-Tite" joint, as manufactured by James B. Clow & Sons, Inc.

2. Bolted Joints

   Where specified or called for on the plans, bolted or special type mechanical joints shall be used for cast iron, ductile iron or steel pipe. Such joints shall be made in a manner satisfactory to the responsible agency and in accordance with the manufacturer's instructions.

3. Lead Joints

   Lead joints shall be used only in special repair projects with written approval of the municipal engineer and appropriate agencies.

J. Joints for Aluminized Steel Pipe (where applicable and accepted)

Joints for aluminized steel pipe shall conform to the provision of 5.114.

5.205 BACKFILLING

A. Extent of Backfill

The backfill includes all backfilling, ramming, puddling or rolling as required, the regrading of adjacent disturbed areas, the replacing of drains and other surface and subsurface structures, the placing and maintaining of temporary sidewalks and driveways, furnishing of suitable backfill material and all appurtenant work incidental thereto.

B. Backfill Material

If approved by the responsible agency, material excavated from the trench shall be suitable for backfill. The contractor shall secure suitable material from other sources if required. The backfill material shall be brought up evenly and must be placed in 12 inch horizontal layers or to the specified depth with minimum 95% compaction or as required by the engineer, by methods satisfactory to the responsible agency. Puddling may be allowed except in heavy clay soils or during freezing weather. In general, the additional water shall be limited to achieving optimum moisture content for tamping procedures.

No backfilling shall be made during freezing weather except by written permission of the responsible agency, and no fill shall be made when the material already in the trench is frozen, nor shall frozen material be used in backfilling.

C. Premium Backfill

At all places where pavement, driveways, concrete gutters, and sidewalks are removed in the sewer construction and/or proposed in new construction, all backfilling of the sewer trench shall be made with limestone screenings or coarse aggregate as specified on the plans.

It is the contractor's responsibility that the pipe bedding and cover is in accordance with the "Typical Trench Details" Sheet No. 11/27 of the **Uniform Standard Sewer Details**.

D. Additional Premium Backfill

Where ordered by the responsible agency, sections of the trench, other than those specified above or called for on the plans, shall also be backfilled with premium material. All such additional backfilling ordered by the responsible agency will be paid for at the contract unit price bid for "Additional Premium Backfill Material" unless otherwise specified.

It is the contractor's responsibility that the pipe bedding and cover is in accordance with the "Typical Trench Details" Sheet No. 11/27 of **Uniform Standard Sewer Details**.

5.206 DISPOSAL OF SURPLUS EXCAVATED MATERIAL

All surplus excavated material shall be removed and disposed of by the contractor. The cost of this work shall be included in the contract unit price bid for sewers and no additional compensation will be allowed, therefore, unless otherwise specified.

5.207 BRANCH CONNECTIONS AND RISERS

Branches, "Y"s or "T"s of the size specified, shall be installed at the locations shown on the plans and shall be standard fittings. Openings at the outer ends of the branches shall be closed and sealed with approved stoppers. When required on account on depth of the sewer, branches shall be built up vertically with riser pipes to a point nine (9) feet below the top of the building line ground elevation as shown on the drawings, using bends whenever necessary. Branch connections and risers shall be included in the contract unit price unless otherwise specified. All pipe joints shall be carefully made and shall conform to the requirements in these Specifications of the type of pipe used.

5.208 LATERAL CONNECTIONS

Sewer service street connections shall be constructed as shown on the plans and shall be laid in accordance with Section 5.203 from the lateral sewer or risers to a point designated on the plans.

All street connections shall be closed and sealed at the outer end with approved premium stoppers.

All lateral connections crossing under existing pavements shall be constructed of cast iron or ductile iron and be installed by boring and pushing the ductile iron pipe through the excavated hole unless written permission is granted by the responsible agency to use the open trench method.

5.209 MANHOLES

All manholes shall be built in accordance with the plans and Uniform Standard Sewer Details. Plastic manholes are not allowed. Sanitary manholes shall be constructed of precast concrete manhole sections conforming to Section 5.118. Storm manholes shall be constructed of either precast concrete manhole sections conforming to Section 5.118, or concrete brick conforming to Section 5.119 B, or shale sewer brick conforming to Section 5.119 A.

All brick used in manhole construction shall be laid in full mortar beds with no mortar joint appearing on the inner surface of the manhole exceeding three-eighths inches (3/8) thick.

When sewer brick is used for manhole construction, they shall be laid in 1 to 2 Portland Cement mortar with bricks arranged radially as headers, forming a wall nine inches (9) thick. In deep manholes, the wall shall be 13 inches below a point 12 feet from the surface to a maximum depth of 28 feet.

Two ring brick arches shall be incorporated in the manhole masonry walls around all sewer pipes passing through the walls. The entire outer surface of sewer brick manholes shall be plastered with a smooth coating of 1 to 2 Portland Cement mortar at least one-half inch (1/2) in thickness. The top of the walls of manholes shall be properly leveled off with mortar so as to form a flat surface upon which the cast iron manhole cover ring is to rest and the manhole shall be carried to proper height above sewer. In precast manholes, provisions shall be made for a minimum of four inches (4) and a maximum of 12 inches of grade rings or brick (brick acceptable in storm sewer manholes) between the uppermost precast section and the bottom of the cast iron manhole cover ring. All manhole lift holes shall be sealed water tight with a non shrink grout or an expanding portland cement mixture such as Octoplug or equal. Sanitary sewer manholes shall have a three inch (3) minimum vertical distance from the bottom of the casting to the top of the conical section for the installation of chimney seals. The contractor shall furnish and set in mortar, upon the top of each manhole, a cast iron manhole ring and cover, ventilated or solid as specified. Where the pipe passes through the outside face of manhole walls, there shall be a pipe joint such that slight flexing or motion can take place in the plane of the wall face without shearing the sewer pipe.

Manhole steps, as specified in Section 5.117, shall be built into each manhole in accordance with the Uniform Standard Details and shall be continued downward along the interior side of the manhole spaced not less than 12 inches apart nor more than 16 inches apart. Landing platforms shall be installed in manholes that are over 28 feet deep to the invert with a maximum vertical spacing of 20 feet. All sanitary covers in streets, residential areas and areas subject to inundation shall be solid with the notation on the covers, "SAN SEWER". All other areas, except for trunk sewers, solid covers may be used. Watertight manhole covers are to be used wherever the manhole tops may be flooded by street runoff or high water. Locked manhole covers may be desirable in isolated easement locations or where vandalism may be a problem.

New sanitary sewer manholes shall be equipped with chimney seals. Chimney seals can either be installed internally or externally. If internal, the seal shall remain flexible throughout 25 year design life, allowing repeated vertical movement of the frame of not less than two (2) inches and/or repeated horizontal movement of not less than ½". The rubber portion of the seal shall have a minimum thickness of 3/16" and be made from a high quality rubber compound conforming to the applicable requirements of ASTM C-923 with a minimum 1500 psi tensile strength, a maximum 18% compression set and a hardness (durometer) of 48± 5. The bands shall be formed from 16 gauge stainless steel conforming to ASTM A-240, type 304 and shall have a positive locking mechanism. Any screws, bolts or nuts used for this mechanism shall be stainless steel, conforming to ASTM F-593 and 594, Type 304.

If external seals are used, cement mortar shall be used in the joint between the manhole frame and grade rings. This joint shall be ¾" thick. Butyl rubber caulk, conforming to AASHTO M198 Type B may be applied to the lower sealing surface of the sleeve to fill any minor irregularities in the masonry surface.

The material utilized for external seals shall be of the same quality as the material utilized for internal seals.

Chimney seals to be installed per manufacturer's specifications.

All costs for furnishing and installing the seal shall be included in the unit price bid for sanitary manholes.

A. <u>Drop Manholes</u>

Where shown on the plans, drop manholes shall be built in accordance with the **<u>Uniform Standard Sewer Details</u>**. The drop pipe shall be one-half of the main sewer diameter, eight (8) inch minimum and a 24 inch maximum diameter and shall be encased in reinforced concrete to the dimensions shown on the Standard Details. The cost of the drop and such encasement shall be included in the contract unit price for the drop manhole, complete, in place, unless otherwise specified.

B. Inlets and Catch Basins

Inlets and catch basins shall be built in accordance with plans and the **Uniform Standard Sewer Details**. Precast polymer concrete trench drain types, rated for H-20 loading, complying with ASTM C-579 for polymer concrete and ASTM A-536-84 for ductule iron frame and grate is acceptable upon approval from municipal engineer where work is being performed.

C. Bulkheads

The contractor shall construct masonry bulkheads in all existing sewers which are cut and abandoned, in all stub sewers in new sewer construction, at all locations shown on the plans and at all other locations where so directed by the responsible agency. They shall be built nine inches (9) thick, unless otherwise specified, and with a one-half inch (1/2) coating of 1 to 2 cement mortar. The cost of constructing bulkheads shall be included in the contract price bid for various sewer items and no additional compensation will be allowed, therefore, unless otherwise specified.

5.210 CONCRETE AND MASONRY

A. Frost and Dampness Protection of Masonry

All masonry work shall be carried on under dry conditions and be properly protected form cold weather and dampness. Such work shall be protected from frost to the extent and equivalent to what is required for concrete as specified under Section 5.210-D-6 of these Specifications.

All material and all work in progress shall be adequately covered during periods of precipitation. The cost of frost and dampness protection of masonry shall be included in the contract price bid for various sewer items and no additional compensation will be allowed, therefore, unless otherwise specified.

B. Mortar

Mortar shall be composed of one (1) part, portland cement, two (2) parts mortar sand by volume. Mortar sand shall conform to Section 5.121 of these Specifications. All mortar shall be mixed in tight boxes or mixers furnished by the contractor. In mixing the mortar, the contractor shall accurately measure the sand and cement. Shovel measurements will not be permitted. In no case shall mortar be used that has once begun to set; retempering will not be allowed. No lime or other admixtures of any description shall be used unless so specified or permitted by the responsible agency.

C. Concrete

1. General Information

   Concrete shall consist of a mixture of Portland Cement, fine aggregates, coarse aggregates and water, proportioned and mixed as provided in these Specifications and constructed as shown on the plans. In proportioning concrete materials, one (1) sack of cement shall be considered as being one (1) cubic foot volume and 94 pounds weight. Total maximum water shall be considered as that including added water and surface water in the aggregates. Cement shall be weighed on a balance scale separate from those used to weigh the other ingredients. Aggregates shall be measured by weight. Batch weights shall be based on surface dried materials and shall be corrected to take into account the weight of surface water contained in the aggregate. Water shall be measured by volume or weight.

2. Unit Stresses

   All structural concrete, both plain and reinforced, shall develop a minimum ultimate compressive stress of 4000 psi at 28 days. Unless otherwise noted on plans, all concrete shall be taken to be 4000 psi. Admixtures shall not be used unless approved by the responsible agency.

   Concrete for bedding, encasement of pipe and general fill purposes shall have a minimum concrete mix strength of 3000 psi at 28 days. Admixtures shall not be used unless approved by the responsible agency.

3. Portions of Aggregates

   Before starting any concrete work, the contractor shall inform the engineer as to the source of the aggregates. A testing laboratory will then test representative samples of coarse and fine aggregates and establish the weights of each aggregate to be used in the concrete mixes.

The responsible agency may change the relative proportions of fine and coarse aggregate, at any time during construction, to conform to variations in the character of the material used, at the same time maintaining the water-cement ratio and the specified slumps.

4. Quality Control

It is the intent of these Specifications that all concrete construction shall be monitored by a testing laboratory approved by the responsible agency. This includes the testing of materials, establishment of batch weights, inspection and testing, per the latest ASTM Specifications.

ASSUMED STRENGTH OF CONCRETE MIXTURES

Water Content U.S. Gal., per 94 lb. Sack of Cement	**Assumed Compressive Strength at 28 Days, Lb. per sq. Inch**
7 1/4	2500
6 1/2	3000
5 3/4	3500
5	4000

NOTE: In interpreting this table, surface water contained in the aggregate must be included as part of the mixture water in computing the water content.

In all cases, the materials used in concrete shall conform to their respective sections of these Specifications.

No concrete exposed to the action of freezing weather shall have a water content exceeding six (6) gallons per sack of cement.

5. Storage of Materials

The contractor shall provide suitable means of storing and protecting the cement against dampness. Different grades or brands of cement shall be stored separately. Sacks of cement, which for any reason have become partially set, or which contain lumps or caked cement, shall not be used.

Each size and type of aggregate shall be stored separately and kept in such a manner as to avoid the inclusion of all foreign matter. Aggregates containing lumps of frozen or partially cemented material shall not be used in the concrete.

Coarse aggregates shall be stored in such a manner as to avoid segregation of particles and to maintain a reasonably uniform moisture content.

6. Consistency of Concrete

The proportions of aggregate to cement shall be such as to produce concrete that can be worked readily into the corners and angles of the forms and around the reinforcement without excessive spading and without segregation or accumulation of water on the surface. In no case shall concrete be placed which shows a slump outside the following limits:

	SLUMP IN INCHES	
TYPE OF CONSTRUCTION	**Maximum**	**Minimum**
Reinforced Footings and Headwalls	4	2
Reinforced Beams, Columns, Slabs & Walls	5	3
Pipe Cradling, Encasement & Fill	5	3

7. Water-Cement Ratio

Inasmuch as the strength of concrete is a function of water-cement ratio, it is imperative that this ratio, as established by the testing laboratory approved by the responsible agency, not be exceeded under any circumstances.

In the event that the given water-cement ratio does not produce the proper consistency and workability of the concrete mixes, the testing laboratory will change the relative proportions of the aggregates with the written approval and permission of the responsible agency. Free moisture held by the aggregates must be included in determining the water-cement ratio.

8. Tests on Concrete

   a. During the progress of the work, compression test specimens shall be made and cured in accordance with the "Standard Method of Making and Curing Concrete Compression and Flexure Test Specimens in the Field", ASTM Designation C-31. Not less than three (3) specimens shall be made for each test, nor less than one (1) test for each 250 cu. yd. of concrete of each class. Specimens shall be cured under laboratory conditions except that when there is a possibility of the surrounding air temperature falling below 40°F. Additional specimens may be required to be cured under job conditions unless otherwise specified.

   b. Specimens shall be tested in accordance with the "Standard Method of Test for Compressive Strength of Molded Concrete Cylinders", ASTM Designation C-39.

   c. The standard age of test shall be 28 days. Seven day (7) tests shall be made to provide the relationship between the 7 and 28 day strengths of the concrete as established by test for the materials and proportions used.

   d. All concrete that does not meet the specified strength requirements as indicated by compression test cylinders, shall be retested by taking cores from the completed structures and testing them. If the concrete fails to meet the minimum strength requirements on this second test, the responsible agency shall order its removal in writing. Any such removal and replacement shall be done at the contractor's expense.

D. <u>Mixing and Placing Concrete</u>

1. Preparation of Equipment and Place of Deposit

   a. Before placing concrete, all equipment for mixing and transporting the concrete shall be cleaned, all debris and ice shall be removed from the places to be occupied by the concrete, forms shall be thoroughly wetted (except in freezing weather) or oiled, and masonry filler units that will be in contact with concrete shall be well drenched (except in freezing weather), and the reinforcement shall be thoroughly cleaned of ice and other coatings.

b. Water shall be removed from place of deposit before concrete is placed unless otherwise permitted by the responsible agency.

2. Mixing of Concrete

   a. The concrete shall be mixed until there is a uniform distribution of the materials and shall be discharged completely before the mixer is recharged.

   b. For job-mixed concrete, the mixer shall be rotated at a speed recommended by the manufacturer and mixing shall be continued for at least one (1) minute after all materials are in the mixer.

   c. Ready-mixed concrete shall be mixed and delivered in accordance with the requirements set forth in the "Standard Specifications for Ready-Mixed Concrete", ASTM Designation C-94.

   d. Mixing concrete by hand will not be permitted except when approved by the responsible agency.

3. Conveying

   a. Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent the separation or loss of the materials.

   b. Equipment for chuting, pumping and pneumatically conveying concrete shall be of such size and design as to insure a practically continuous flow of concrete at the delivery end without separation of the materials.

4. Depositing

   a. Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. The concreting shall be carried on at such a rate that the concrete is at all times plastic and flows readily into the space between the bars. No concrete that has partially hardened or been contaminated by foreign material shall be deposited on the work, nor shall retempered concrete be used.

   b. When concreting is once started, it shall be carried on as a continuous operation until the placing of the panel or section is completed. The top surface shall be generally level.

      When construction joints are necessary, they shall be made in accordance with Section 5.210-E-7.

   c. All concrete shall be thoroughly compacted by suitable means during the operation of placing and shall be thoroughly worked around reinforcement and embedded fixtures and into the corners of the forms.

5. Curing

   Provision shall be made for maintaining concrete in a moist condition for at least seven (7) days after the placement of the concrete, except for high-early-strength concretes, moist curing shall be provided for at least the first 72 hours. Any fast set concrete shall be kept in a moist condition for at least four (4) hours.

6. Cold Weather Requirements

   a. Adequate equipment shall be provided for heating the concrete materials and protecting the concrete when the atmosphere temperature is 40°F or less. No frozen materials containing ice shall be used.

   b. All concrete materials and all reinforcement, forms, fillers and ground with which the concrete is to come in contact, shall be free from frost. Whenever the temperature of the surrounding air is below 40°F, all concrete in the forms shall have temperatures of between 50°F and 80°F, and adequate means shall be provided for maintaining a temperature of not less than 50°F for five (5) days, except, when high-early-strength concrete is used, the temperature shall be maintained at not less than 50°F for 72 hours or for as much more time as is necessary to insure proper curing of the concrete. The housing, covering or other protection used in connection with curing shall remain in place and intact at least 24 hours after the artificial heating is discontinued. No dependence shall be placed on salt or other chemicals for the prevention of freezing. No concrete exposed to the action of freezing weather shall have a water content exceeding six (6) gallons per sack of cement.

E. Concrete Forms and Construction Details

1. Design of Forms

   Forms shall conform to the shape, lines and dimensions of the members as called for on the plans, and shall be substantial and sufficiently tight to prevent leakage of mortar. They shall be properly braced or tied together so as to maintain position and shape.

2. Removal of Forms

   Forms shall be removed in such a manner as to insure the complete safety of the structure. Where the structure as a whole is supported on shoring, the removable floor forms, beams and girder sides, column and similar vertical forms may be removed after 72 hours or with written approval from the responsible agency, providing the concrete is sufficiently hard not to be injured thereby. In no case shall the supporting forms or shoring be removed until the members have acquired sufficient strength to support safely their weight and the load thereon.

3. Cleaning and Bending Reinforcement

   Steel reinforcement, at the time concrete is placed, shall be free from rust, scale or other coatings that will destroy or reduce the bond. All bending shall be done in accordance with current ACI requirements. Steel reinforcement to be epoxy coated if required by the engineer.

4. Placing Reinforcement

   Steel reinforcement shall be accurately placed in accordance with the plans and shall be adequately secured in position by concrete or metal chairs and spacers.

5. Splices and Offsets in Reinforcement

   a. In slabs, beams and girders, splices of reinforcement at points of maximum stress shall be avoided. Splices shall provide sufficient lap to transfer the stress between bars by bond and shear.

   b. Where changes in the cross section of a column occur, the longitudinal bars shall be offset in a region where lateral support is afforded. Where offset, the slope of the inclined portion shall not be more than one (1) to six (6), and in case of tied columns, the ties shall be spaced not more than three inches (3) on center for a distance of one foot (1) below the below the actual point of offset.

6. Concrete Protection for Reinforcement

   a. The steel reinforcement shall be protected by the thickness of concrete indicated on the plans. Where not otherwise shown, the thickness of concrete over the reinforcement shall be as follows: Where concrete is deposited against the ground without the use of forms, not less than three inches (3). Where concrete is exposed to the weather, or exposed to the ground but placed in forms, not less than two inches (2) for bars more than five-eighths inch (5/8) in diameter and one and one-half inches (1½) for bars five-eighths inch (5/8) or less in diameter. In slabs and walls not exposed to the ground or to the weather, not less than three-fourths inch (3/4). In beams, girders, and columns not exposed to the ground or to the weather, not less than one and one-half inches (1½). In all cases, the thickness of concrete over the reinforcement shall be at least equal to the diameter of round bars.

   b. Exposed reinforcement bars intended for bonding with future extensions shall be protected from corrosion by concrete or other adequate covering.

7. Construction Joints

   Joints not indicated on the plans shall be so made and located as to least impair the strength of the structure. Where a joint is to be made, the surface of the concrete shall be thoroughly cleaned and all debris removed. In addition, vertical joints shall be thoroughly wetted and slushed with a coat of neat cement grout immediately before the placing of new concrete.

5.211 INSPECTION AND TESTING

A. Service Markings

Whenever a stone or concrete sidewalk or curb exists, service connections shall be indicated by witness signs cut into the sidewalk or curb. Each riser, slant or "Y" connection, left plugged at the sewer, shall be evidenced by a triangle and each sewer curb connection, plugged at the curb, shall be evidenced by an arrow.

B. Line Acceptance Tests for Sewers

1. All sanitary sewers 24 inches in diameter and under shall be tested for leakage in the following manner:

   After completing a reasonable section of sewer and the manholes have been completed, the contractor shall furnish all equipment, material and personnel to conduct a "line acceptance" test using low pressure air. The equipment to be used shall have prior approval and the test shall be conducted under the supervision of the responsible agency. The line acceptance test shall be conducted after backfilling has been completed.

   All wyes, tees or end of lateral stubs shall be suitably capped to withstand the internal test pressures. Such caps shall be a type which is easily removable for future lateral connections or extensions.

After a manhole-to-manhole section of the line has been cleaned, it shall be plugged at each manhole with pneumatic plugs inflated to 35 psig internal pressure. The design of the plugs shall be such that they will hold against the line test pressure without requiring external blocking or bracing. External blocking or bracing may be used for extra protection. Each pneumatic plug shall have a sealing length equal to or greater than the diameter of the pipe in which it is to be used so that effective sealing will always take place around any nodule or lump that may be on the inner surface of the pipe. Before actual line testing starts, the pneumatic plugs shall pass the following qualifying test in the presence of the responsible agency: one (1) length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked; air shall be introduced into the pipe until the pipe pressure reaches 15 psig. The pneumatic plugs being checked shall hold against this pressure without bracing being needed and without movement of the plugs out of the pipe. All pneumatic plugs shall pass the aforementioned qualifications before being used to test the actual installation.

One (1) pneumatic plug used in this testing procedure shall have two (2) factory equipped hose connections in addition to that hose connection used only for the inflation of the pneumatic plug. One (1) of the additional hose connections shall be used for continuously reading the air pressure rise in the sealed line. The second additional hose connection shall be used only for introducing low pressure air into the sealed line.

There shall be a minimum three inch (3) diameter, 0-36 psig gauge supplied for reading the internal pressure of the line being tested.

Calibrations from the 0-10 psig range shall be in tenths of pounds and this 0-10 portion shall cover 90% of the complete dial range.

Low pressure air shall be introduced into the sealed line until the internal pressure reaches 4.0 psig greater than the average back pressure of any ground water pressure that may be over the pipe. At least two (2) minutes shall be allowed for the air pressure to stabilize. After the stabilization period, the hose for introducing low pressure air into the sealed line shall be disconnected from the air source in such a manner as to retain the pressure in the sealed line. The starting pressure shall not exceed 9.0 psi.

The portion of line being tested shall be accepted if the portion under test does not lose air at a rate greater than 0.003 cfm per square foot of internal pipe surface when tested at an average pressure of 3.0 psig greater than any pressure exerted by ground water that may be over the pipe at the time of the test.

The previous requirement shall be accomplished by performing the test as follows: The time required in minutes for the pressure to decrease from 3.5 to 2.5 psig greater than the average back pressure of any ground water that may be over the pipe shall not be less than the time shown for the given diameter in the following table:

Pipe Diameter in Inches	**Minutes**
8	4.0
10	5.0
12	5.5
15	7.5
18	8.5
21	10.0
24	12.5

Where high ground water is known to exist, the height in feet of ground water above the invert of the sewer shall be divided by 2.3 to establish the pounds of pressure that will be added to the internal air pressure used for the line acceptance test in determining the time in minutes for the air pressure to decrease 1.0 psig.

If the installation fails to meet the requirements of this test, the contractor shall determine at his own expense the source of leakage. The contractor shall repair or replace all defective materials and/or workership and then re-test the installation for compliance with these Specifications for the line acceptance test.

For specific reference on these tests, refer to ASTM C-924 for Concrete Pipe, ASTM F-1417 for Plastic Pipe, ASTM C-828 for Clay Pipe.

Air testing shall be performed by a certified independent agency.

2. Deflection Test

All plastic pipe (sanitary and storm) having a pipe stiffness less than 200 psi shall be tested for proper installation by means of deflection attainment. Deflection testing is not required for plastic pipe with a pipe stiffness of 200 psi or greater. In addition to material tests, construction compaction and leakage tests required elsewhere in these Standards, the contractor is required to install the pipe in such a manner that the diametric deflection shall not exceed five percent (5%). To attain this requirement, the backfill materials surrounding the pipe shall be compacted to the required Standard Densities called out in ASTM D-2321. The sectors requiring compaction shall include the bed and side fill material, as well as the material placed above the pipe for a distance of 12 inches.

Deflection tests shall be performed no sooner than 60 days following completion of backfill. Final deflection tests shall be performed by the responsible agency of an accredited, independent testing laboratory that shall submit verification records of results and dates tested. Maximum ring deflection of the pipe under load shall be limited to five percent (5%) of the base inside diameter listed in ASTM D-2751 for ABS Solid Wall Pipe and ASTM-D 2680 for ABS Composite Wall Pipe. For Polyvinyl Chloride (PVC) Pipe use Base Inside Diameter as per ASTM D-3034, ASTM F-679, F-789, F-794, F-949 and AASTHO M-304, Fiberglass Reinforced Plastic Mortar Pipe, ASTM D-3262.

All pipe failing to maintain the five percent (5%) maximum deflection diameter or larger listed for the applicable type of pipe shall be considered to have been improperly installed and shall be relaid or replaced by the contractor at no cost to the responsible agency.

Deflection testing shall be accomplished by using an electronic deflectometer which produces a continuous record of diameter readings or by pulling a go, no-go gage through the pipe. Go, no-go gages may be mandrels, spheres, pin-sleds, or other device approved by the responsible agency prior to testing.

3. Weir - Test

   Weir test shall be performed on all sanitary sewers in pipe sizes 27 inches in diameter and larger as specified herein. The maximum permissible leakage shall be 100 gallons/per inch of diameter/per mile/per day when field tested by actual infiltration conditions. Where low ground water conditions exist, exfiltration tests shall be used.

4. All sewers storm and sanitary 48" in diameter or larger constructed under these Standards shall be subjected to visual inspection. Sewers in sizes smaller than 48" in diameter shall be internally TV inspected. Costs will be paid for by the contractor unless otherwise provided for in the specifications. The responsible agency shall retain ownership of all inspection records. Following any repairs and/or cleaning, the lines shall be resubmitted to the low pressure air "Line Acceptance" test prior to photographic or television inspection. The municipal engineer may require air test or weir test on storm sewers.

   Whenever sewer work is adjacent to a water main, test of the main may be required upon completion of the sewer work along each section of water main between line valves to determine if any leakage has been caused by the contractor's operations.

   In case leakage is shown by the test, the contractor shall be responsible for any repairs. After completion of the contract, a final test of the entire main shall be made and approved by the responsible water authority.

C. <u>Leakage Tests for Force Mains</u>

1. Methodology

   All pipes, valves, fittings, etc., shall be laid in such a manner as to assure that all joints are watertight. After the pipe is laid and before backfill is placed around the joints, such lengths of the force main, as determined by the responsible agency, shall be tested under a hydrostatic pressure of 75 pounds per square inch above the maximum pump head, but, in no case, shall such force mains be tested at less than 100 pounds per square inch. The test shall be conducted under the direction of the responsible agency or the agency's appointed agent. The contractor may obtain water for testing by observing the rules and regulations enforced in the municipality or township in which the work is being done. The contractor shall furnish pressure gauges, suitable pump or pumps, pipes, test heads, and all appliances, labor, fuel, and other appurtenances necessary to make the test.

The test pressure shall be maintained for a length of time determined by the responsible agency to allow for a thorough examination of joints and elimination of leaks if any should be discovered. Minimum time duration without pressure drop shall be one (1) hour. The pipe lines shall be made absolutely tight under the test pressure.

After the test has been completed, the contractor shall drain all pipes and surrounding areas. The contractor shall open all valves, air cocks, bypasses, and drains in the section of the installation tested immediately after the test to prevent damage to the force main and appurtenances due to freezing weather.

2. Alternate Method

The force main shall be tested under the same hydrostatic pressure as above. The test pressure shall be maintained for a period of two (2) hours by pumping additional water into the main, if necessary. The quantity of water thus pumped into the main multiplied by 12 shall be taken as the leakage per 24 hours.

The permitted leakage shall not exceed a rate of 75 gallons per 24 hours, per mile of pipe, per inch of nominal diameter.

In using this method of testing, the contractor may backfill the pipe except at joints immediately following the laying and before the actual test has been made. In case the leakage is in excess of the permissible 75 gallons/mile/inch of diameter/day, the contractor shall locate and repair the leak. The contractor shall furnish suitable means for determining the quantity of water lost by leakage during the test.

The method of testing any force mains shall be approved by the responsible agency. Additional testing and/or different test conditions may be specified in the contract specifications or contract drawings. All testing and repairs shall be included in the unit price bid for sewers and force mains in place and no additional compensation will be provided, therefore, unless otherwise specified.

5.212 FABRICATION AND ERECTION OF STEEL

A. Structural Steel

In general, the fabrication of steel and the erection thereof shall be in accordance with the latest "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" and the "Code of Standard Practice for Steel Buildings and Bridges" of the American Institute of Steel Construction.

In the event that work is done on land under the jurisdiction of railroads, highway departments or other similar agencies, the specifications will be subject to the approval of such agencies.

B. Reinforcing Steel

Fabrication and erection of reinforcing steel shall conform to the current edition of the "Specifications for Placing Reinforcement" and the "Code of Standard Practice" of the Concrete Reinforcing Steel Institute.

5.213 WELDING

Welding of iron and steel shall be done by operators who have been previously qualified by tests as prescribed in the American Welding Society's "Standard Qualification Procedure" to perform the type of work required. All equipment shall be of a type which will produce proper current so that the operator may produce satisfactory welds. The welding machine shall be 200-400 ampere, 25-40 volt capacity.

Electrodes shall be of classification numbers E-6011, E-6012, E-6013, or E-6020, and shall be suitable for positions and other conditions of intended use in accordance with the instructions with each container.

Field welding shall be done by direct current.

The technique of welding employed, the appearance and quality of welds made, and the methods of correcting defective work, shall conform to the current edition of Welding Society "Code for Arc Welding in Building Construction", Section 4, Workmanship.

Surfaces to be welded shall be free from loose scale, rust, grease, paint and other foreign material, except that mill scale which withstands vigorous wire brushing may remain. A light film of linseed oil may likewise be disregarded, joint surfaces shall be free from fins and tears.

No welding shall be done when the base metal temperature is lower than 0°F. At temperatures between 32°F and 0°F, the surface of all areas within three inches (3) of a point where a weld is started shall be heated until they are too hot to touch before welding is started.

Finished members shall be true to line and free from twists, bends and open joints.

5.214 MISCELLANEOUS

A. Clean-up, Repairs, Seeding and Sodding

1. Clean-up

   As the work progresses, the contractor shall keep the site reasonably free of debris, discarded materials and equipment. He shall maintain streets in a safe and convenient condition for travel as well as providing vehicular access to the abutting properties. Upon completion of the work, the contractor shall remove all surplus excavated materials, tools, equipment and temporary buildings from the site and restore all pavements, road surfaces, curbing, gutters, driveways, driveway culvert pipes, sidewalks, retaining walls, guard rails, utility and service lines, mail boxes, and other items affected by the construction operations. All such work shall be of a quality and dimensions approved by the responsible agency, including all disturbed driveway culvert pipes which shall be replaced with new pipe in a minimum of 14 gauge and 12 inch diameter or as shown on the plans.

The contractor shall perform such replacements as soon as practicable after completion of the sewer and shall save the responsible agency free and harmless from all suits for damages to persons or property arising from or caused by this construction.

Before final acceptance for the work, the contractor shall, as directed by the responsible agency, clear the sewers of any mortar, dirt of other refuse that may have been left or accumulated in the sewers. All manholes, inlets, catch basins and other structures shall be cleared of all forms, scaffolding, bulkheads, centering, surplus mortar, rubbish or dirt and left in a clean and proper condition.

2. Seeding and Sodding

The contractor shall restore to original grade and seed and/or sod all lawn and grass areas disturbed by construction. All areas adjacent to residences shall be sodded. Areas in easements away from residences shall be seeded. The contractor, at his/her option and with prior approval of the responsible agency, may substitute sod for the areas specified for seed, all at no change in contract price.

a. Material

1. Sod shall be 100% Marion Blue grass, strongly rooted and free of pernicious weeds and bent grasses. It shall be mowed to a height not to exceed two inches (2) before cutting and lifting and shall be of uniform thickness; not over one and one-half inches (1½) or less than one inch (1) of soil. Sod shall be delivered within 24 hours after being cut and shall be installed within 36 hours after cutting.

2. Grass seed shall be vendor-mixed and delivered to the site in sealed bags and guaranteed by the dealer. Mix shall be as follows:

   35% - Kentucky Bluegrass

   55% - Creeping Red Fescue

   5% - Red Top

   5% - White Dutch Clover

b. Method of Installation

1. Sodding

   The subgrade material shall be loosened and mixed to a depth of two (2) to four (4) inches. All sticks, stone over two (2) inches and rubbish shall be removed and the whole area compacted so that it will be parallel to the finished grade. A commercial fertilizer formula 10-6-4 shall be applied to the upper two (2) inches of soil at the rate of ten (10) pounds per 1000 square feet and thoroughly raked in.

   Sod shall be laid so that no voids occur and shall be tamped and rolled. Screened topsoil shall be brushed or raked over the area to be sodded and the sod shall be thoroughly watered. The complete surface should be true to finished grades.

   Sod on slopes steeper than two to one (2:1) shall be held in place by six (6) inch long wooden pins driven flush with the top of the sod at two (2) foot intervals or by other methods approved by the responsible agency.

2. Seeding

   Before any seed is sown, the ground shall be raked until surface is smooth, friable and of uniform fine texture, then lightly compacted. Area shall have a minimum 6" of top soil. Low spots shall be brought up to finished grade. A 10-6-4 formula commercial fertilizer shall be evenly applied at the rate of 15 pounds per 1000 square feet. Seed shall be applied evenly at a rate of four (4) pounds per 100 square feet with a mechanical spreader, lightly raked, then watered with a fine spray.

c. Maintenance

All seeded and sodded areas shall be protected and maintained by watering, mowing and replanting until an even dense growth is started. Dead sod or non-growing seeded areas shall be repaired at the direction of the responsible agency engineer. The full cost of all clean-up, repairs, seeding, sodding, reseeding and resodding shall be included in the unit prices bid for other items or work, unless otherwise specified.

d. Replacement of Trees and Shrubs

The contractor shall be responsible for replacing trees, shrubbery and sprinkler systems damaged during and all appurtenant work incidental thereto, unless otherwise provided in the plans and specifications. The full cost of this shall be included in the unit prices for sewers in place.

B. <u>Measurement for Payment</u>

1. General

The contract price per unit of storm sewer, sanitary sewer, manholes, catch basins, inlets, curb connections and other items, is for the work complete in place as shown on the plans and specifications regardless of the character of the material encountered in the excavation or contingencies of any other nature, unless otherwise specified. Unit and lump sum prices for such work complete in place shall include the furnishing of all labor, materials, tools and equipment necessary for its proper performance, unless otherwise specified. All costs such as excavation, backfill, relocation, repair or replacement of existing structures, sheeting and bracing of excavations, clean-up and repairs and all other operations required in the construction shall be included in the contract unit or lump sum prices, and no additional compensation will be allowed thereof unless otherwise specified.

It is the intent of these Specifications that the cost of the work which does not have pay items provided for, shall be included in the contract unit or lump sum prices for items shown on the bid blanks.

2. Sewers

The number of linear feet of sewers to be paid for under their respective items, shall be the actual number of lineal feet of each class and size, measured continuously along the center line of the sewer through manholes, "T"s and "Y" branches.

Such payment shall include the furnishing, laying, connecting and testing of the sewer; the excavation, sheeting, concrete encasement or cradling of the pipe, backfilling, including premium backfill; the replacement of all structures and pavements and the furnishing of all labor, materials, tools and equipment to complete the work as specified in the contract document or ordered by the responsible agency. Such payment shall include all items of expense except such items as are stated in the specifications to have separate payments.

When a sewer begins or ends at a manhole, measurement shall be made to the center of the manhole. At all points where sewers change size, the measurement for each size shall be made to the center of the manhole where the change is made.

3. Manholes

The number of manholes of each type to be paid for under their respective items shall be the actual number of manholes of each type installed in the work, including excavation, backfill, masonry, stubs, cast iron and ductile iron frames, covers, steps, pipe drops, concrete, chimney seals, and all other required appurtenances.

4. Catch Basins and Inlets

The number of catch basins and inlets to be paid for at the respective contract prices shall be the actual number of each installed in the work, including excavation, backfill, masonry or reinforced concrete, cast iron and ductile iron frames, grates steps, traps, stubs and all other required appurtenances.

5. Y-Branches, "T's, Y-Connections and Slants

The number of branches, connections of each type and size to be paid for under their respective items shall be the actual number of such connections installed in the work. When Y-branches, "T"s, or slants require extensions to clear the sides of the concrete bedding and encasement, but no risers are necessary, the cost of such extensions shall be included in the price bid for each Y-branch, "T" or slant. There will be no deduction for these specials from the length of pipe they are connected to.

6. Risers

   The number of lineal feet of pipe riser to be paid for at the contract price, shall be the actual number of lineal feet of each size of vertical risers furnished, laid and connected, measured from the bell end of the branch or slant at the sewer, along the center line of the riser pipe, including any intermediate bends. The cost of concrete or masonry encasements and excavation and backfill shall be included in the contract unit price per lineal foot of riser.

7. Lateral Connections

   Clay, cast iron, ABS solid wall, ABS composite wall, Polyvinyl Chloride (PVC), and ductile iron pipe lateral connections will be paid for at their respective contract unit prices per lineal foot of each size of connections or risers to the end of the lateral connections installed from the branch connections or risers to the end of the lateral connection, regardless or kind of pipe or excavation procedure used, unless otherwise specified.

   The prices bid shall include furnishing, laying and connecting pipe; the excavation by boring and/or tunneling or jacking for the cast iron and ductile iron and open cut for clay or plastic pipe, concrete encasement where specified, sheeting, backfilling, replacement of all structures, utilities and paved surfaces and the furnishing of all labor, materials tools and equipment to complete the work as shown on the contract documents or ordered by the responsible agency. Lateral connections shown on the plans and details to be installed as six (6) inch clay pipe, six inch (6) ductile iron pipe, ABS solid wall pipe, ABS composite pipe, and PVC all of which will be paid for at the same contract unit price bid per lineal foot of lateral connection pipe whether installed by the open cut, boring, jacking or tunneling methods. Bends, increasers, and adapters will be included in the contract unit price bid.

Any additional cost of installing the lateral connections above their respective contract unit prices bid per lineal foot of each size shall be included in the contract price bid for various sewer items and no additional compensation will be allowed therefore.

8. Catch Basin and Inlet Connections

   The number of lineal feet of each class and size of catch basin or inlet pipe connections to be paid for at the contract unit price shall be the actual number or lineal feet of such pipe connections installed, measured from the center of the manhole to the center of catch basin or inlet, including concrete cradling or bedding for all catch basins and inlet connection pipe.

   The contract unit price shall include all costs as described under other parts of Section 5.214 B of these Specifications including the cost of concrete cradling or bedding for all catch basins and inlet connections pipe.

9. Sheeting Ordered Left in Place

   The amount of sheeting in thousand feet board measure to be paid for at the contract unit price, shall be the amount actually left in place by the contractor upon written order of the responsible agency. In no case will capping, bracing or sheeting used in tunnel construction be paid for as sheeting.

10. Timber Grillage

    The amount of timber grillage in thousand feet board measure to be paid for at the contract unit price, shall be the amount actually installed in trench by the contractor upon written order of the responsible agency. The contract unit price shall include all cost of furnishing, treating and placing of such timber grillage. In no case will capping, bracing or sheeting used in tunnel construction be paid for as grillage.

11. Tile Underdrain

    The number of lineal feet of tile underdrain to be paid for at the contract unit price, shall be the number of lineal feet of such underdrain actually installed in the work upon written order of the responsible agency. The cost of additional excavation, furnishing and placing of stone screening and tile shall be included in the contract unit price.

12. Additional Excavation

    The number of cubic yards of additional excavation to be paid for at the contract unit price shall be the amount of additional excavation required by reason of increase in depths of the excavation, over and above that shown on the plans or excavation made necessary that is not shown in the contract documents.

    The number of cubic yards of excavation to be paid for at the contract unit price shall be established by computing the actual volume of material unless otherwise specified.

13. Additional Premium Backfill

    The number of cubic yards of additional premium backfill to be paid for at the contract prices shall be the actual amount of the respective materials installed in the work upon written order of the responsible agency, over and above that called for in the contract documents.

14. Additional Structural Concrete

    The number of cubic yards of additional concrete to be paid for at the contract unit prices for plain and reinforced concrete respectively shall be the actual number of cubic yards installed in the work upon written order of the responsible agency, over and above that called for in the contract documents.

    The contract unit price shall include all cost of furnishing and placing of concrete and the form work. Reinforced concrete shall include the cost of steel in place.

15. Additional Concrete Bedding, Cradling or Fill

    The number of cubic yards of additional concrete bedding, cradling or fill to be paid for at the contract unit price shall be the actual number of cubic yards of such concrete installed in the work upon written order of the responsible agency, exclusive of quantities which are specified to be paid for under other items of the work. The contract unit price shall include all cost of furnishing and placing of such concrete.

16. Sewers in Tunnel Construction

The number of lineal feet of sewers in tunnel construction to be paid for under their respective items shall be the actual number of lineal feet of each class and size, measured continuously along the center line of the sewer to the inside face of manholes, in shafts at the invert but not through them, and to the end of the tunnel construction wherever it is terminated.

Such payment shall include the proper construction of sewers in tunnel, including excavation, its disposal, sheeting, bracing and lining of the tunnel excavation, cement grouting, crane rails or channels, sewer pipe, concrete backfill, plain or reinforced, or encasements, connecting and testing of the sewer, the replacement of all structures and pavements and the furnishing of all labor, materials, tools and equipment to complete the work, as shown in the contract documents or ordered in writing by the responsible agency. Such payment shall include all items of expense except such items as are stated in the contract documents to have separate payments.

When sewer in tunnel construction ends at a manhole in a shaft, measurement shall be made to the nearest inside face of the wall of the manhole at the invert. At all points where sewers in tunnel construction change size, the measurement for each size shall be made to the nearest inside face of the wall of the manhole where the change is made.

17. Manholes in Shaft Construction

The number of manholes constructed in shafts of each type to be paid for under their respective items shall be the actual number of manholes in shafts of each type installed in the work, including the entire cost of the shafts, excavation, its disposal, sheeting, bracing ribs and lining of the shaft excavation, cement grouting, masonry, concrete, reinforced and plain, or encasements, backfill, connecting of the sewer, steps and/or elevator for the full depth of the shaft, stubs, cast iron or ductile iron frames, covers, steps, pipe drops, replacement of all structures and pavements and the furnishing of all labor, materials, tools and equipment to complete the work as specified and as shown in the contract documents. Such payment shall include all items of expense except such items as are stated in the contract documents to have separate payments.

18. Sewers in Jacked or Bored Casing Pipe

The number of lineal feet of sewers in jacked or bored casing pipe construction to be paid for under their respective items shall be the actual number of lineal feet of each class and size, measured continuously along the center line of the sewer to manholes in shafts, but not through them, and to the end of the jacked or bored casing pipe construction wherever it is terminated. Such payment shall include the proper construction of sewers in jacked or bored casing pipe, including excavation, its disposal, sheeting, bracing and casing of the excavation, cement grouting, crane rails or channels, sewer pipe, concrete backfill, plain or reinforced or encasements, connecting and testing of the sewer, the replacement of all structures and pavements and the furnishing of all labor, materials, tools and equipment to complete the work as specified and as shown in the contract documents or ordered in writing by the responsible agency. Such payment shall include all items of expense except such items as are stated in the contract documents to have separate payments.

When a sewer in jacked or bored casing pipe construction ends at a manhole in a shaft, measurement shall be made to the nearest inside face of the wall of the manhole at the invert and will not be paid through the manhole inside diameter dimensions as it is a special structure. At all points where sewers in jacked or bored casing pipe construction change size, the measurement for each size shall be made to the nearest inside face of the wall of the manhole where the change is made.

19. Jacked or Bored Sewers

The number of lineal feet of jacked or bored sewer construction to be paid for under their respective items shall be the actual number of lineal feet of each class and size, measured continuously along the centerline of the sewer to the inside face of manholes, but not through them, and to the end of the jacked or bored sewer construction wherever it is terminated. In the event that the ends of the construction of this section are not visible, the lineal feet of such construction shall be verified before the backfill covers the ends.

Such payment shall include the proper construction of jacked or bored sewers including excavation, its disposal, sheeting and bracing of the excavation, sewer pipe, connecting and testing of the sewer, the replacement of all structures and pavements and the furnishing of all labor, materials, tools and equipment to complete the work as shown in the contract documents or as ordered in writing by the responsible agency. Such payment shall include all items as are stated in the contract documents to have separate payments.

PART 6 - STANDARD DESIGN AND CALCULATION FORMS

6.1 Sanitary Sewer Data Sheet

6.2 Sanitary Sewer Design Calculation Sheet

6.3 Storm Sewer Data Sheet

6.4 Storm Sewer Design Calculation Sheet

6.5 Pump Station Data Sheet

6.6 Pump Station Design Calculation Sheet

6.7 Wastewater Treatment Plant Data Sheet

6.8 Wastewater Treatment Plant Design Calculation Sheet

PART 6 - STANDARD DESIGN AND CALCULATION FORMS

6.1 SANITARY SEWER DATA SHEET

Name of Municipality or Sewer District

____

Name of Project ____

Original Township and Lot Number ____

Name of Engineer of Firm Preparing Plans

____

Address _________________ Telephone ____

Name and Address of Governmental Authority to Whom Plan Approval Should be Sent:

____

Brief description of project. Include information as to (a) the location, size and development of the area to be served, (b) total length of sewer to be installed, (c) possibility of future extensions, (d) exact location of connections to existing sewers, (e) treatment plant receiving wastes, (f) and other data pertinent to the project. (Use attachment if necessary).

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PIPE MATERIAL	MATERIAL SPEC.*	JOINT SPEC.*	BEDDING CLASS.	PIPE SIZE	PIPE LENGTH	MINIMUM SLOPE	MAX M.H. SPACING	TYPE MANHOLE	M.H. JOINT SPEC.*

* List ASTM, AWWA, ANSI

a. Specify the type of leakage test (air, infiltration and/or exfiltration) and the limit to be used

____

Air _________________ time for 1 psi drop in pressure, infiltration, exfiltration ____________________ gallons per inch of pipe diameter. Tested under subversion of an Engineer. YES _____ NO _____
Name of Engineer ____

b. Deflection limit specified _______ % (applies only for flexible pipe). Tested under subversion of an Engineer. YES _____ NO _____
Name of Engineer ____

c. Specifications include provision for inspection of all construction by an engineer or qualified inspector. YES _____ NO _____
Name of Engineer ____

Capacity of existing system and/or plant to which connected.

Present Treatment Facility Loading __________ MGD (based on average daily flow previous year).

Present Capacity of Treatment Facility __________ MGD (average daily flow).

If proposed sewer is to be connected to an existing sanitary sewer, give the capacity of the existing sewer available for additional loading at point of connection __________ MGD (base calculations on basis of peak flows).

Estimated hydraulic loading of proposed sewer at point of connection to plant or existing sewer:

initial: __________ Average daily flow: __________ peak flow
(based on existing homes to be served)

design: _________ Average daily flow: __________ peak flow
(design on immediate area served)

ultimate: _________ Average daily flow: __________ peak flow
(based on immediate area and extension)

If the flow figures indicate a hydraulic loading over the design capacity of the sewer or treatment plant, explain what steps are being taken to eliminate or reduce the hydraulic loading to an acceptable value.

Are the proposed sewers deep enough to serve all adjacent basements?
YES _____ NO _____ If No, explain: ____

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d. Are the sewers at least 10 feet horizontally from water lines and/or at least 18 inches below the water line. YES _____ NO _____ If No, why? ____
____

e. Are the water supply sources, public or private, located within 200 feet of the sewers?
YES _____ NO _____ If Yes, will sewers be encased or watertight? ____________________

f. Is there any connection between the sewer and a public or private potable water supply or appurtenances? YES _____ NO _____

g. Are sewers in streams constructed to remain watertight and in alignment?
YES _____ NO _____ N/A _____

h. Are watertight covers used where manholes are subject to flooding by street runoff or high water?
YES _____ NO _____

i. Are manholes provided at all changes in size, grade, alignment, and sewer intersections?
YES _____ NO _____

j. Are drop manholes provided where the entrance sewer invert is 24 inches or more above manhole invert? YES _____ NO _____

k. Where small sewers join larger ones, have the inverts of the larger sewers been lowered sufficiently to maintain the same energy gradient? YES _____ NO _____ N/A _____

l. Have provisions been made to protect sewers at velocities of over 15 feet per second?

m. Are sewers secured with concrete anchors (or equal) spaced as required?
YES _____ NO _____ N/A _____

n. Are there any overflows or bypasses? YES _____ NO _____

o. If Yes, specify plan sheet(s) where shown ____
____

p. Will this project include any pump stations? YES _____ NO _____ If Yes, please complete Pump Station Data Sheet.

q. Will there be a pump station involved in receiving sewage from the sewer extension?
YES _____ NO _____ N/A _____

If Yes, specify present and design flows of pumping station ____________________________

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____

Estimated Cost of Project $____

NOTE: A statement that "**roof drains, foundation drains, and other clean water connections to the sanitary sewer system are prohibited"**, must be shown on the plans or sewer permit.

THE FOREGOING DATA IS A TRUE STATEMENT OF FACTS PERTAINING TO THIS PROPOSED SANITARY SEWER INSTALLATION.

DATE: ________________________ SIGNED: ______________________________________

Professional Engineer
Registered in the State of Ohio

6.2 SANITARY SEWER DESIGN CALCULATION SHEET

MUNICIPALITY OR SEWER DISTRICT ______________________ **DATE** ______________________

PROJECT ______________________ **ENGINEER** ______________________ **BY** ______________________

hv $\frac{V^2}{2g}$ (1)	STREET (2)	FROM MANHOLE (3)	TO MANHOLE (4)	LENGTH FEET (5)	Area Acres INCREMENT (6)	Area Acres ACCUM. TOTAL (7)	AVERAGE FLOW PER ACRE (G.P.D.) (8)	AVERAGE FLOW FLOW (G.P.D.) (9)	PEAK FACTOR (10)	PEAK FLOW (M.G.D.) (11)	INFILT/(M.G.D.) AT 375 G/A/D (12)	INFILTRATION (ACCUMULATED) (G.P.D.) (13)	TOTAL PEAK FLOW M.G.D. (14)	n = PIPE DIAMETER (INCHES) (15)	n = SLOPE % (16)	n = CAPACITY FULL (M.G.D.) (17)	n = VELOCITY FULL (F.P.S.) (18)	n = VELOCITY ACTUAL (F.P.S) (19)

6.3 STORM SEWER DATA SHEET

Name of Municipality or Sewer District ____________________

Name of Project ____________________

Original Township and Lot Number ____________________

Name of Engineer of Firm Preparing Plans ____________________

Address ____________________ Telephone ____________________

Name and Address of Governmental Authority to Whom Plan Approval Should be Sent:

____

Brief description of project. Include information as to (a) the location, size and development of the area to be served, (b) total length of sewer to be installed, (c) possibility of future extensions, (d) exact location of location of connections to existing sewers, (e) conditions affecting natural drainage, (f) type of ground cover and average slope, (g) and other data pertinent to the project.

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PIPE MATERIAL	MATERIAL SPEC.*	JOINT SPEC.*	BEDDING CLASS. (1,2)	PIPE SIZE	PIPE LENGTH	MINIMUM SLOPE	MAX M.H. SPACING	TYPE MANHOLE	M.H. JOINT SPEC.*

* List ASTM, AWWA, ANSI, AASHTO

Deflection limit specified ______ % (Applies only for flexible pipe) Tested under supervision of an engineer.
YES _________ NO __________

Name of ENGINEER or INSPECTOR:
____

Specifications include provisions for inspection of all construction by an engineer or qualified inspector.
YES _________ NO __________

Name of ENGINEER or INSPECTOR:
____

Estimated hydraulic loading of proposed sewer; Flows full, no head. Are manholes provided at all changes in size, grade, alignment, and sewer intersections?
YES ________ NO _________

Where small sewers join larger ones, have the inverts of the larger sewers been lowered sufficiently to maintain the same energy gradient?
YES ________ NO _________ N/A __________

Have provisions been made to protect sewers at velocities of over 15 feet per second?
YES ________ NO _________ N/A __________

Are sewers secured with concrete anchors (or equal) spaced as required?
YES ________ NO _________ N/A __________

Estimated Cost of project $ ______________________

Building sewers shall be constructed in accordance with specifications equal to those indicated above.
YES ________ NO _________

Plans for connection of a proposed installation to a county, village, or municipal sewer or other political entity, must be accompanied by written consent of both entities.

If applicable to this project, written consent agreement is attached?
YES ________ NO _________

What is the minimum difference in elevation between the bottom of any existing or proposed footings and the crown of the storm sewer at the point of connection of the lateral?

What is the minimum difference in elevation between the lowest floor elevation of any existing or proposed structure and the crown of the sewer?

6.4 STORM SEWER DESIGN CALCULATION SHEET

DESIGN STORM FREQUENCY

MUNICIPALITY OR SEWER DISTRICT ______________________________ **DATE** ______________________________

PROJECT ______________________________ **ENGINEER** ______________________________ **BY** ______________________

STREET	FROM MANHOLE	TO MANHOLE	AREA ACRES		TIME OF FLOW (MINUTES)			c (RUNOFF COEFFIENT)	i (RAINFALL INTENSITY)	Q (c.f.s.)	DESIGN n				PROFILE				
			INCREMENT	TOTAL AREA	TO INLET	IN PIPE	TIME OF CONCENTRAT.				PIPE SIZE IN.	SLOPE %	CAPACITY (FULL) c.f.s.	VELOCITY FT./SEC.	LENGTH FT.	FALL FT.	OTHER LOSSES & FALL IN MH	INVERT ELEV. UPPER END	INVERT ELEV. LOWER END
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)

PART 6 - STANDARD DESIGN AND CALCULATION FORMS

6.5 PUMP STATION DATA SHEET

Name of Municipality or County Sewer District ____

Name of Project ____

Original Lot and Tract No. ____

Name of Engineer or Firm Preparing Plans ____

Address ____

Name and Address of Municipal or County Official to whom plan approval should be sent

____

SITE	**YES**	**NO**
(a) Accessible at all times?	___	___
(b) Graded around station to provide positive flow drainage away from the station?	___	___
(c) Protected to prevent vandalism and entrance by unauthorized persons or animals?	___	___
(d) Subject to flooding?	___	___

(e) Distance to nearest dwelling ____

Estimated average flow tributary to this station ___________GPD

Estimated peak flow tributary to this station ___________GPD

TYPE WASTE TO BE PUMPED

__ (a) Sanitary

__ (b) Combined (Sanitary & Storm)

__ (c) Industrial

Source of Industrial Waste ____

PNEUMATIC EJECTORS

(a) Make and Model Number ____

(b) Operating Conditions ______GPM @ ____________T.D.H.

(c) Number of Compressors ____

(d) Number of Pots ____

(e) Capacity of Pot ____

PUMPS

(a) Number ______________________________

(b) Make, Model # and Type (Suction lift, positive displacement, centrifugal, horizontal centrifugal)

Make _________________________

Model _________________________

Type _________________________

(c) Materials (Cast iron, stainless steel, etc.)

Casing _________________________

Impeller _________________________

(d) Operating conditions _____________GPM @ _____T.D.H.

(e) Maximum allowable speed _____________________RPM

	YES	NO
(f) Will pass 3" sphere	___	___
(g) Water seal unit air gapped	___	___

DRY WELL

(a) Type of construction ________________________

(b) Corrosion protection ________________________

	YES	NO
(c) Stairway or access ladder with treads of non-slip material	___	___
Stairway or safety landings provided every 10'	___	___
(d) Ventilation-positive	___	___
Outside Controls	___	___

Number of air changes per hour ____

	YES	NO
(e) Dehumidifier to insure a dry atmosphere for protection of motors and control system	___	___
(f) Lighting - explosion proof	___	___
- outside controls	___	___
(g) Sump pump to handle floor drainage	___	___
- discharge line air gapped above high water alarm elevation	___	___

WET WELL Type of Construction ______________________________

(a) ASTM C-361 joints between precast concrete section? Yes ___ No ___

(b) Effective Capacity ___Gal. Design Detention Time __ at __ flow

(c) Elevations: Inlet invert ______________________________

Outlet invert ______________________________

Bottom of wet well ______________________________

Low shut well ______________________________

No. 1 Start ______________________________

No. 2 Start ______________________________

No. 3 Start ______________________________

High Water Alarm ______________________________

Bypass or overflow ______________________________

If yes, is treatment provided? Yes___ No___

Explain ______________________________

Lowest Basement ______________________________

(d) High Water Alarm Make ______________________________

Model ______________________________

Type ______________________________

	YES	NO
Battery Operated Alarm	___	___
Telemetered Alarm	___	___
Provisions for retaining overflow waste on-site	___	___

CONTROLS Make ______________________________

Model ______________________________

Type ______________________________

Alternating Yes ___ No ___

Enclosure: ______________________________

	YES	NO
Is flow measuring device provided?	___	___
Is standby power supply available?	___	___
Is emergency pumping facilities provided?	___	___

The foregoing is a true statement of facts pertaining to this proposed pump station installation.

DATE: ______________________ SIGNED: ______________________________

Sanitary Engineer (preparing plans)

PART 6 - STANDARD DESIGN AND CALCULATION FORMS

6.6 PUMP STATION CALCULATION SHEET

Name of Municipality or Sewer District ______________________________

Original Lot, Township and Tract ______________________________

For: ____________________ By: ____________________

Location: ____________________ Date: ____________________

WET WELL CALCULATIONS:

(a) Pumping Station No. ____________________

(b) Average Daily Flow into Station incl. infiltration = ____________ GPD.

(c) Peak Factor = ____________

(d) Present Flow:

Peak Flow into Station = ____________ GPM.

Estimated ultimate Peak Flow into Station = ____________GPM.

(e) Rated pump delivery = ____________ GPM.

(f) Storage volume between high and low levels = ____________ gallons

(g) Wet well diameter = ____________ ft. & ____________ gal./ft.

(h) Total time between successive pump starts = ____________min.

$$\frac{\text{Line (f)}}{\text{Line (e) - Line (d)}} + \frac{\text{Line (f)}}{\text{Line (d)}} = \text{Line (h)}$$

TOTAL DYNAMIC HEAD CALCULATIONS:

External Loss (Dynamic)

(a) Force main size = ____________ inches

(b) Friction loss = ____________ ft./100 feet of pipe

(c) Length of force main = ____________ feet

(d) Equivalent length of pipe due to bends, etc. = _________ feet

(e) Total length of pipe (actual & equivalent) = __________feet

(f) Total friction loss = __________ feet

Internal Loss (Dynamic)

(a) Pumping Station Losses = _______________feet

STATIC HEAD:

(a) Highest Elevation of Force Main = _______________ feet

(b) Elevation of Suction = _______________ feet

(c) Static Lift = _______________ feet

TOTAL DYNAMIC HEAD = _______________ feet

Net Positive Suction Head Calculations: (when applicable)

(a) Atmospheric pressure at sea level = _____33.90_____ feet

(b) Atmospheric pressure at site = ______________ feet

(c) Atmospheric pressure available at site = ______________ feet

(d) Total dynamic suction lift = ______________ feet

(e) Vapor pressure 74° liquid = ______________ feet

(f) Safety Factor = ______________ feet

(g) N.P.S.H. Available =______________ feet

(h) N.P.S.H. Required by Pump = ______________ feet

(i) Excess N.P.S.H. Available =______________ feet

(j) Priming Lift (center line of pump suction to lead pump on) = ______________ feet

BUOYANCY CALCULATIONS:

(a) Weight of soil = ______________ lbs./cu. ft.

(b) Downward force of soil on top area of station = ______________ lbs.

(c) Water Table Elevation = ______________ feet

(d) Upward buoyant force at center of buoyancy = ______________ lbs.

(e) Weight of Station exerted at center of gravity = ______________ lbs.

(f) Resultant = Line (b) + Line (e) - Line (d) = ______________ lbs.

PUMPS: Rated Capacities

Make ____________________

Model _____________________

Flow Rate ______________ GPM at ______________ Ft. TDH

6.7 WASTEWATER TREATMENT PLANT DATA SHEET

Name of Municipality or County Sewer District ________________________________

Name of Project ____

Original Lot and Tract No. ____

Name of Engineer or Firm preparing plans ________________________________

Address ____

Name and Address of Municipal or County Official to whom plan approval should be sent:

____

SITE:

(a) Subject to flooding Yes ______ No ______ If yes, what measures will be taken to protect mechanical equipment?

____

(b) Distance to nearest dwelling ____

Design period ____________ First phase ________________________________

Ultimate ________________________________

Average daily design hydraulic flow (ADDF) ____________ gpd ______________

Design BOD_5 loading: ____________ lbs. BOD_5/day ________________

TYPE WASTE TO BE TREATED:

___ (a) Sanitary

___ (b) Combined (sanitary and storm)

___ (c) Industrial

Source of industrial waste ____

Plant influent pumping station: Yes __________ No______, number of pumps , type of pumps, influent pumping rate (IPR) ______ gal/min (with largest pump out of service).

Will pass 3" sphere: Yes _____ No _____ .

Operating conditions ______ gpm @ ______ TDH, maximum allowable speed _______ rpm.

PRETREATMENT DEVICES:

Trash trap: Yes ______ No ______ Capacity _______ gal.

Comminutor with bar screen bypass: Yes _______ No ________

Other ____

Design capacity of comminutor _______ gal/min.

Method of flow division where parallel aeration unit arrangements are planned. Describe:

____

Are inlet and outlets for each tank provided with valves, gates, stop-planks, weirs or other devices to permit flexibility in controlling the flow to any unit to maintain a reasonably constant water level and to permit cleaning of individual units?

Yes ______ No ______ N/A _______

Describe method of scum removal and disposal:

____

____

____

Describe method and frequency of sludge removal and method and location of sludge disposal:

____

____

____

Are baffles to be provided at the inlet and within six inches (6) of the outlet to prevent turbulence and short circuiting?

Yes _____ No _____

Does each sludge hopper have an individually valved withdrawal line?

Yes _____ No _____ N/A _____

(a) Minimum diameter of withdrawal is _______ inches.

(b) Head for sludge withdrawal is ________ feet.

(c) The side walls of the hopper(s) will have a minimum slope of vertical to ______ horizontal. N/A _______

A mechanical sludge collecting device will be installed:

Yes ______ No ______ If yes, type _____

Froth control equipment will be installed: Yes ______ No ______

Hosing facilities for routine flushing of walls and walkways will be installed:

Yes ______ No ______

Sludge handling facilities will be installed: Yes ______ No ______

What mode of advanced treatment or effluent disposal is to be installed?

____

____

What type of disinfection process will be employed:

Chlorination ______Ozone _______ Other_______

If other, describe: ____

____

If chlorination is to be used, in what form will it be?

gas _______ powder _______ tablet _______

Describe provision for cleaning tanks and for maintaining adequate disinfection during cleaning operations:

____

____

____

What type of flow measurement device, if any, will be installed?

Describe: ____

____

What laboratory facilities or other types of monitoring equipment will be provided: Describe:

____

____

What type of high water alarms, if any, are provided? Describe:

____

____

What is the estimated cost of the above proposed wastewater treatment facility? $ _______________

Will a certified operator be employed to use the proposed treatment works?

Yes _____ No _____ If yes, will the operator be:

Full-time ______ Part-time ______ What grade level _______

What provision, if any, will be made to provide standby power for electrical equipment? Describe:

6.8 WASTEWATER TREATMENT PLANT DESIGN CALCULATION SHEET

Municipality, County & Sewer District ______________________________

Address of Treatment Facility ______________________________

Original Lot & Tract No. ______________________________

Engineer ______________________________

Date ______________________________

Name & Address of Governmental Agency for Approval ______________________________

____

Design period: ______________ First phase ______________

Ultimate ______________

Number of persons to be served: ________ First phase ______________

Ultimate ______________

Average Daily Design Hydraulic Flow (ADDF): ________ gal./day

Design BOD_5 loading: ________lbs. BOD_5/day

Significant Runoff Period (SRP): ________ hours

Peak Factor (PF): ________ unitless

Peak Influent Flow Rate (PIR):

$$\frac{\text{ADDF} \quad \text{gal./day x PF}}{\text{SRP} \quad \text{hours x 60 min.}} = \underline{\qquad\qquad} \quad \text{gal./min}$$

If an equalization basin is to be used, its volume will be ________ gal.

Air to be supplied: ________ cu. ft./min. (with largest blower out of service)

Plant influent pumping station: Yes ________ No ________

Number of pumps ________ Type of pumps ________

Influent Pumping Rate (IPR): ________ gal./min. (with largest pump out of service)

NOTE: Influent pumping facilities shall be capable of pumping the Peak Influent Rate (PIR) with the largest pump out of service, unless a flow equalization basin is installed. Include here the wet well calculations for the pumping station - 7.601.

Pretreatment devices:

Trash trap: Yes _____________ No ____________ Capacity ___________ gal.

Comminutor with bar screen bypass: Yes _____________ No ____________

Other ____

Design capacity of comminutor _____________ gal./min.

Method of flow division where parallel aeration unit arrangements are planned. Describe:

____

____

Aeration chamber volume: (based on 80 cu. ft./lb. BOD_5)

___________ lb. BOD_5/day x 80 cu. ft. x 7.48 gal./cu. ft. = __________ gal.

______________ gallons supplied

Aeration detention time:

$$\frac{\text{Chamber volume} \quad \text{gal. x 24 hours}}{\text{ADDF \_\_\_\_\_\_\_\_\_\_\_\_ gal./day}} = \text{\_\_\_\_\_\_\_\_\_\_\_\_\_\_ hours}$$

Are the dimensions and proportions of the aeration tanks such as to maintain effective mixture and utilization of air, to prevent unaerated sections and noticeable channeling, and to maintain velocities sufficient to prevent deposition of solids?

Yes __________ No ___________

Are inlets and outlets for each aeration tank provided with valves, gates, stop-planks, weirs, or other devices to permit flexibility in controlling the flow to any unit to maintain a reasonable constant water level and to permit cleaning of individual units?

Yes __________ No ___________

Amount of air required: (based on 2600 cu. ft./lb. BOD_5/day)

$$\frac{\text{lbs. } BOD_5 \text{ /day x 2600 cu. ft.}}{\text{1440 min./day}} = \text{\_\_\_\_\_\_\_\_\_\_\_\_\_ cu. ft./min.}$$

Amount of air supplied: ______________cu. ft./min. (with largest blower out of service)

NOTE: Additional capacity should be provided to operate airlifts and skimmers.

Are the aeration plates, tubes, or jets used for the introduction of air to mixed liquor removable for inspection, maintenance, and replacement without de-watering the tank?

Yes _________ No ___________ N/A ___________

If mechanical aerators are to be used, the oxygen required will be:

____________ lbs.BOD_5/day x 2 = ______________lbs. 0_2/day

NOTE: Calculations and data should be included to verify the 0_2 transfer rate used to compute the supplied amount of 0_2/day.

Settling chamber volume: _____________ gallons

Settling chamber detention time:

Chamber volume gal. x 24 hours
______________________________ = _____________ hours
ADDF_____________ gal./day

NOTE: Non-mechanical hoppered tanks only may include the upper 1/3 (by height) of the hopper(s) in computing detention time.

Surface settling rate:

ADDF gal./day
________________________________ = ___________ GPD/sq. ft.
Surface area _____________sq. ft.

At peak flow:

PIR gal./min/ x 1400
________________________________ = ___________ GPD/sq. ft.
Surface area _____________sq. ft.

NOTE: If the Influent Pumping Rate (IPR) exceeds the peak Influent Flow Rate (PIR), then it should be substituted in the above equation for (PIR).

Weir overflow rate:

a. At peak flow:

PIR gal./min/ x 1400
________________________________ = __________ GPD/lin. ft.
Total weir length _____________feet

NOTE: If the Influent Pumping Rate (IPR) exceeds the Peak Influent Flow Rate (PIR), then it should be substituted in the above equation for (PIR).

b. Are the weirs adjustable? Yes __________ No ___________

Describe method of scum removal and disposal: ____

____

____

____

Scum storage capacity ____

Describe method and frequency of sludge removal and method and location of sludge disposal:

____

____

Amount of sludge to be removed ____________ lbs./day.

If a sludge storage tank is to be installed, the volume of the tank(s) will be: (based on at least 10% of design loading).

$$\frac{\text{Design } BOD_5 \text{ loading} \quad \text{lbs./day x 100 x 10\%}}{\text{0.167 lbs. } BOD_5\text{/population equivalent}} = \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \text{ gal. (minimum)}$$

Aeration tank vol. x 10% _____________ gallons supplied

a. Air supply: ____________ cu. ft./min. (with largest blower out of service)

Note: A minimum storage volume of 1,000 gallons will be required for plants with a design flow of less than 10,000 gal. day.

If aerobic digestion of sludge is to be utilized, the volume of the tank(s) will be: (based on three cubic feet per population equivalent)

$$\frac{\text{Design } BOD_5 \text{ loading} \quad \text{lbs./day x 3 x 7.48}}{\text{0.167 lbs. } BOD_5\text{/population equivalent}} = \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \text{ gal. (minimum)}$$

______________ gallons supplied

a. Air supply: (based on 20 cu. ft./min. per 100 cu. ft. of volume)

$$\frac{\text{gallons supplied x 20 cu. ft./min.}}{\text{7.48 gal./cu. ft. x 1,000 cu. ft.}} = \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \text{ cu. ft./min.}$$

Air supplied: ____________ cu. ft./min. (with largest blower our of service)

If anaerobic digestion of sludge is to be utilized, the volume of the tank(s) will be:

_______________ gal.

NOTE: Basis of design and calculations must be submitted for the above volume.

If sludge drying beds are to be installed, the area provided shall be: (based on one square foot per population equivalent)

$$\frac{\text{Design } BOD_5 \text{ loading \_\_\_\_\_ lbs./day}}{0.167 \text{ lbs./population equivalent}} = \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \text{ sq. ft.}$$

____________square feet provided _______________ number of beds

NOTE: Where phosphate removal or other chemical treatment processes are to be utilized, design of sludge handling facilities must take into account possible increased sludge production.

Check which of the following modes of advanced treatment of effluent disposal are to be installed:

____________ Surface slow sand filter

____________ Rapid sand gravity filter

____________ Microstrainers

____________ Lagoons

____________ Other:

If surface slow sand filters are to be installed, the area provided shall be: (Based on 11.5 gallons per square foot per day)

$$\frac{\text{ADDF \_\_\_\_\_ gal./day}}{11.5 \text{ gal./sq. ft./day}} = \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \text{ sq. ft}$$

______________square feet provided ________________ number of beds

a. Capacity of dosing chamber shall be: ______________ gallons

b. Size of dosing pumps: ______________ gal./min. (with largest pump out of service)

NOTE: Dosing chamber and pumps must be sized to dose half of the total filter to depth of three (3) inches within 10 to 15 minutes.

c. Dosing siphon height above sand beds: _____________ feet

If rapid sand gravity filters are to be installed, the area provided shall be: (based on 3.33 gpm/sq. ft. at the peak flow rate)

$$\frac{\text{Peak flow rate* \_\_\_\_ gal./min.}}{\text{3.3 gpm/sq. ft.}} = \underline{\hspace{3cm}} \text{ sq. ft}$$

______________square feet provided ______________ number of cells

***NOTE:** The peak flow rate shall be equal to the maximum rate of the pumping facilities preceding filtering.

a. Clearwell capacity: _____________ gallons

b. Rate of backwash: _____________ gpm/sq. ft.

c. Duration of backwash: ____________ minutes

d. Number of backwash pumps: ____________ @ ______________ gal./min.

e. Mudwell capacity: ____________ gallons

NOTE: Please refer to Part II of Ohio EPA's "Recommended Engineering Procedures and Design Guidelines Relative to Advanced Wastewater Treatment" in designing rapid sand gravity filters.

If microstrainers are to be installed, the net submerged effective area of the microstrainer fabric shall be: (based on 3.33 gpm/sq. ft. at the peak flow rate).

$$\frac{\text{Peak flow rate* \_\_\_\_ gal./min.}}{\text{3.3 gpm/sq. ft.}} = \underline{\hspace{3cm}} \text{ sq. ft}$$

______________submerged square feet provided

______________total square feet provided

______________number of microstrainers

***NOTE:** The peak flow rate shall be equal to the maximum rate of the pumping facilities preceding the microstrainers.

a. Continuous backwash rate: ____________ gal./min./ft. of microstrainer length.

b. Number of backwash pumps: ____________ @ ____________ gal./min.

NOTE: Please refer to Part II of Ohio EPA's "Recommended Engineering Procedures and Design Guidelines Relative to Advanced Wastewater Treatment" in designing microstrainers.

If lagoons are to be utilized, their total volume will be: (based on five (5) days detention)

Design hydraulic flow _____________ gal./day x 5 = ________ gal.

________ gallons supplied

Average design flow depth: ____________ feet

Number of cells: _______________

Minimum freeboard of _____________ feet will be provided.

The embankments of the lagoons shall have a minimum slope of ________________ vertical to

___________________ horizontal.

Does the overflow structure provide flexible water depth control and operation of facilities?

Yes ____________ No ____________

NOTE: Prior to designing tertiary lagoons, contact the Division of Waste Management and Engineering in the appropriate District Office for information relative to the acceptability of the proposal.

What type of disinfection process will be employed?

Chlorination ______________ Ozone ______________ Other ________________

Describe: ____

____

____

____

If chlorination is to be used, in what form will it be?

Gas ____________ Powder ____________ Tablet ______________

Volume of contact tank(s): (based on 15 minutes retention at the peak flow rate)

Peak flow rate* _____________ gal./min. x 15 min. = _____________ gal.

_____________ gallons supplied

***NOTE:** The peak flow rate shall be equal to the maximum rate of the pumping facilities preceding the contact chamber.

Are the tank(s) baffled or so constructed as to reduce short circuiting of flow to a minimum?

Yes ____________ No ______________

Describe provisions for cleaning tank(s) and for maintaining adequate disinfection during cleaning operations:

____

____

____

Chlorine dosage rate: ____________ mg/l (at peak flow rate)

Will duplicate chlorinators be providers? Yes ____________ No ______________

Will the chlorinator be housed? Yes ____________ No ______________

Describe: ____

____

____

What type of flow measurement device, if any, will be installed?

Describe: (indicating, recording, totalizing, etc.) ___________________________________

____

____

What laboratory facilities or other types of monitoring equipment will be provided? Describe:

____

____

What is the estimated cost of the above proposed wastewater treatment facility? $ _______________

Will a certified operator be employed to run the proposed treatment works?

Yes _____________ No ___________ If yes: full-time ___________________

part-time ___________________

Grade certification level ___________________

Is the site for the proposed treatment works subject to flooding?

Yes _____________ No ___________ If yes, what measures will be taken to protect mechanical equipment?

What provisions, if any, will be made to provide standby power for electrical equipment?

Describe: ____

____

____

____

____

Should include capacity.

Cleveland Heights

Fats, Oil and Grease (FOG) and Root Intrusion Problem Analysis

Final

August 14, 2017

WADETRIM TEAM

1.0 Introduction

This document describes the analysis of fats, oil and grease (FOG) and tree root intrusion problems from available information for the Cleveland Heights Sewer Department as required under the Interim Management, Operations and Maintenance (MOM) Measures in Appendix B (A.4.c.) of the Consent Decree between Cleveland Heights and the USEPA. According to the Consent Decree, the intent of the analysis is to provide a common understanding regarding the degree to which FOG and tree root intrusion cause or contribute to sanitary sewer overflows (SSOs) and basement/property backups in the sewer system.

The analysis is based on a review on available sewer maintenance records and other relevant information including input from the Sewer Department staff. In most cases, relevant information for the past three years was used, but older information was considered if there was a history of reoccurring issues. The analysis also updated the high frequency cleaning list based on historical maintenance calls or frequent customer complaints. The high frequency cleaning list includes locations where recurrent problems have been identified in the collection system so they can be addressed prior to resulting in a non-structural SSO or basement/property backup.

1.1 Background

The Cleveland Heights Sewer Department's public and private sewer maintenance records and construction logs date back to 2007. Although the older records were reviewed and catalogued, the analysis focused mainly on records from 2015 to 2017. This information, along with operations and maintenance issues flagged during the Northeast Ohio Regional Sewer District's Heights Hilltop Interceptor Local Sewer System Evaluation Study (HHI-LSSES), formed the basis of the FOG and root problem analysis, and was reviewed in detail with the sewer supervisor. The Cleveland Heights Sewer Department also had a previous high frequency cleaning list that was maintained by a consultant. This list was also reviewed with the Sewer Supervisor and updated with the primary cause based on results of the analysis. The updated high frequency cleaning list and associated maps are located in **Attachment A** of this document. This list will be updated, as appropriate, when field investigations ramp up during the required Integrated Overflow Control Monitoring Plan (IOCMP) and follow up SSES activities.

This analysis focused on public right-of-way issues in mainline sewers. The Cleveland Heights Sewer Department performs maintenance of private sewer laterals as a courtesy to the residents and documents grease and root problems, if known. However, these problems were not considered in this report. The CMOM program details steps for addressing private sewer laterals in the future. The following sections described FOG issues, tree root intrusion issues, SSOs related to FOG and tree root intrusion, and the high frequency cleaning list and monitoring in more detail.

2.0 Fats, Oil and Grease (FOG)

Fats, oil and grease can be generated by residential or commercial properties in Cleveland Heights. The Sewer Department has identified that most of their high frequency cleaning locations are caused by residential grease issues rather than commercial. Only two locations are associated with commercial discharge. **Table 1** shows the high frequency cleaning locations caused by FOG. A map of these locations can be found in **Attachment A** of this report.

Table 1. High Frequency Cleaning Locations Caused by FOG

Location	Residential/Commercial
Eloise in north section	Residential
Randolph intersecting Woodview	Residential
Quilliams (from Noble to Lowell)	Residential
Sylvanhurst at Henderson	Residential
Mayfield from Noble to Warrensville Center	Commercial
Coventry at Avondale	Residential
Superior and Euclid Heights Blvd	Residential
Superior and Lee	Residential
Euclid Heights at Edgehill	Residential
Nottinghill Lane	Residential
Kildare (lower)	Residential
Tullamore	Residential

Location	Residential/Commercial
North Park (Shelburne to City Line)	Residential
943 Elbon to Noble	Residential
Dresden Road	Residential
Shannon at Maple	Residential
2195 Lee Road	Commercial
Eddington Road	Residential
1714 Coventry Road	Residential
2684 Euclid Heights Blvd	Residential
Superior between Redwood and Goodnor	Residential
3390 Winsford Road	Residential
Bolton Road and Monticello Blvd	Residential
2520 - 2334 Ardleigh Drive	Residential
3244 Cedarbrook Road	Residential

These locations are checked at least twice a year to make sure flow is not being impeded by FOG. If there is a problem, the Sewer Department will take measures to clear any blockage. The HHI-LSSES field inspections identified one additional location in which grease was observed. This location has been noted and if additional problems or residential complaints are received, this location may be added to the high frequency cleaning list.

3.0 Root Intrusion

Root intrusion has occurred less commonly than FOG in the mainline sewers in Cleveland Heights. Five of the locations on the high frequency cleaning list have been noted as caused by root intrusion as shown in **Table 2**.

Table 2. High Frequency Cleaning Locations Caused by Root Intrusion

Location
Coleridge - Stratford - Corydon
North Park (Shelburne to City Line)
North Park btw Coventry and Arlington
Henderson Road
Pembrook Road

Additional review of construction and cleaning logs for the last three years showed one location in which root intrusion was observed. The HHI-LSSES field inspections identified four locations in which root intrusion was observed. These locations have been noted and if additional problems or residential complaints are received, these locations may be added to the high frequency cleaning list.

4.0 SSOs and Basement Backups caused by FOG and Root Intrusion

Cleveland Heights has not recorded any SSOs as directly attributed to FOG or root intrusion in the last three years. There are tracking and notification systems in place in the Sewer Overflow Response Plan, approved by USEPA on May 30, 2017, to report all SSOs by completing a 5-Day Follow-Up Report. In this report, there are sections to report the cause of the overflow and steps taken to eliminate and prevent additional occurrences. These reports will provide a reference to any problems that have occurred in the system and are a useful resource to sewer maintenance crews that have to deal with a potential SSO. If FOG or root intrusion causes an SSO or basement/property backup, the location and details will be tracked in the new GIS within the Information Management System (IMS) software once it is up and running.

Cleveland Heights performs house calls related to residential basement backups or other sewer problems. Records of house call locations and maintenance performed are kept by the Sewer Department. Comments indicate the sources of problems found during service. These comments were reviewed for the last three years and few problems were reported as the result of a mainline

FOG or root intrusion. Reports of mainline maintenance issues were resolved by the Sewer Department in a manner that mitigated basement backup effects in a timely fashion.

Currently, Cleveland Heights uses maintenance personnel reports from house calls to characterize if mainline FOG or roots issues from the high frequency cleaning areas are causing basement backups. The new Information Management System and GIS will allow for tracking of house calls and any local SSOs compared with locations and timing of high frequency cleaning. This will help the City better characterize the effect of high frequency cleaning on minimizing basement backups and SSOs.

5.0 Updating High Frequency Cleaning List

Before this analysis of FOG and root intrusion, the Cleveland Heights Sewer Department maintained a high frequency cleaning list that consisted of 14 locations. Through review of maintenance and construction records, the HHI-LSSES and discussions with Sewer Department personnel, an additional 15 locations were added to the high frequency cleaning list. All locations have been classified by the need of high frequency cleaning. One location, North Park from Shelburne to the Shaker Heights City Line appears on both the FOG and root intrusion list. Sewer Department personnel were also able to categorize the probable cause of the blockage at each location. Identifying the probable cause assists crews when doing their semiannual checks of these locations to have the proper equipment in case cleaning is required. These locations are currently maintained on paper maps at the Sewer Department, and will be imported and tracked in GIS once Cleveland Heights' new IMS system is in place.

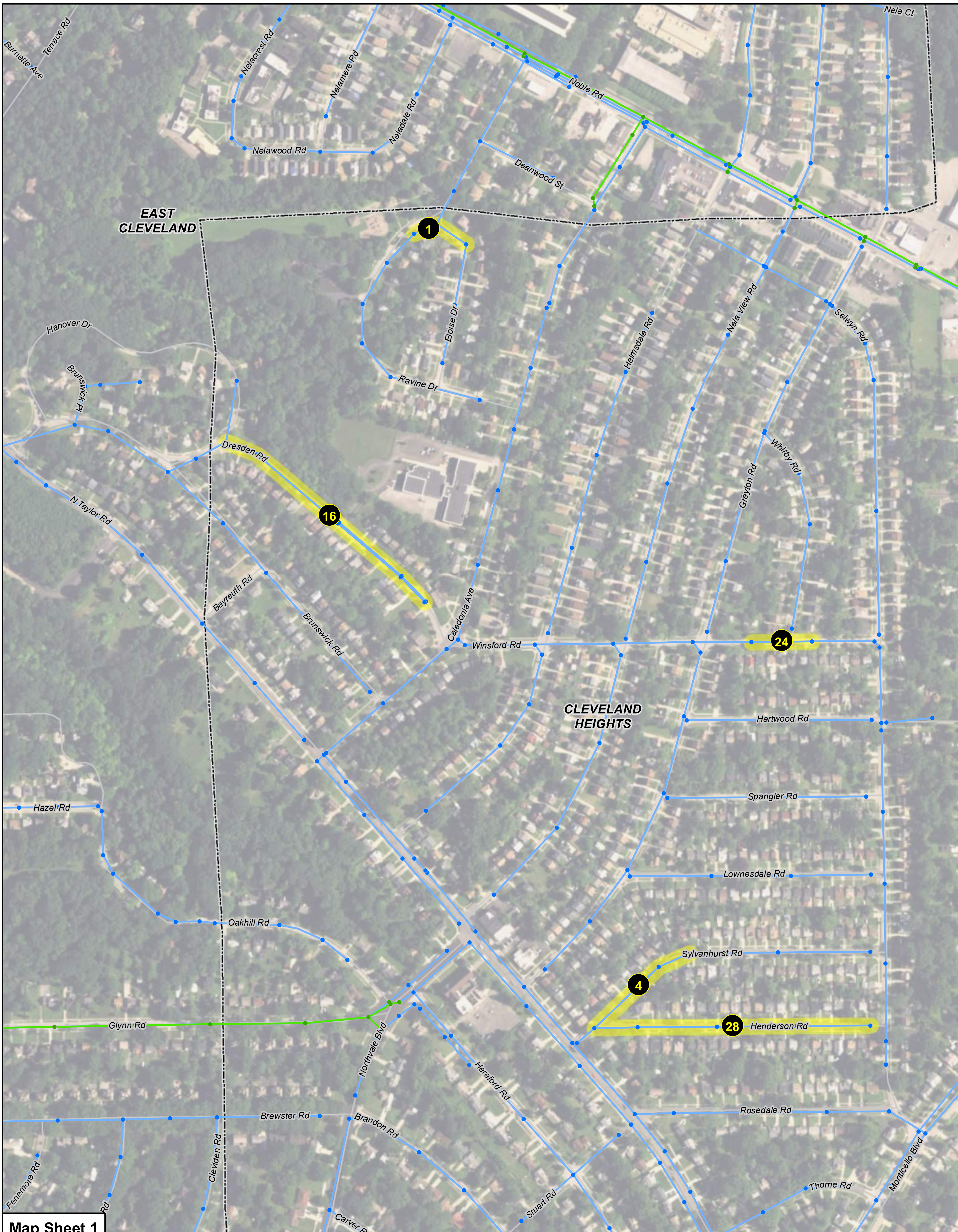
6.0 FOG and Root Intrusion CMOM Activities

Based on further findings during the IOCMP, SSES activities under CMOM and the requirements of the Consent Decree, Cleveland Heights will better understand the extent of FOG and root intrusion problems in their collection system. This understanding will support the extent to which additional activities are to be performed as described in Sections G and H in Appendix B of the Consent Decree. Currently, the Cuyahoga County Board of Health provides many of the services mentioned in Section G including maintaining a list of FOG generators, recordkeeping systems of FOG generators, and public education for commercial FOG generators.

Cleveland Heights has created a Standard Operating Procedure, which addresses many of the requirements of Section H in Appendix B of the Consent Decree, for Root Control Maintenance, as provided in **Attachment B** to this report.

The extent of additional FOG and root control program measures will be determined by documented field investigations.

Attachment A – High Frequency Cleaning List and Maps



Map Sheet 1

Legend

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- Local_Manhole
- District_Pump_Station
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- District Gravity Main
- District Pressure Main
- Local Gravity Main
- Local Pressure Main
- HFC Locations

N

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13	Coleridge - Stratford - Corydon	1,200	From CMOM March 2016	Roots
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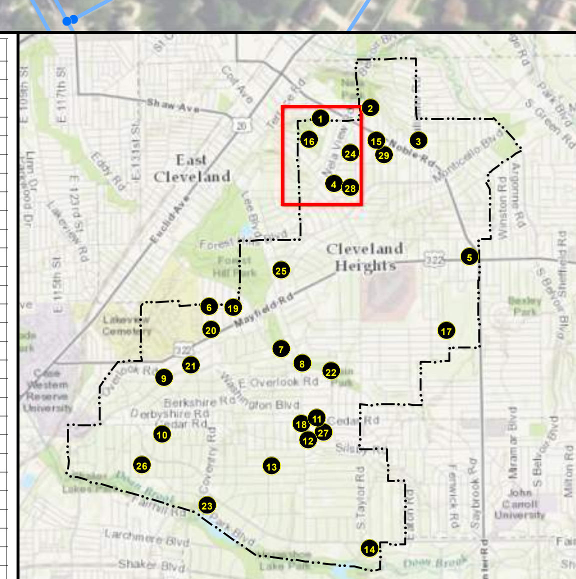

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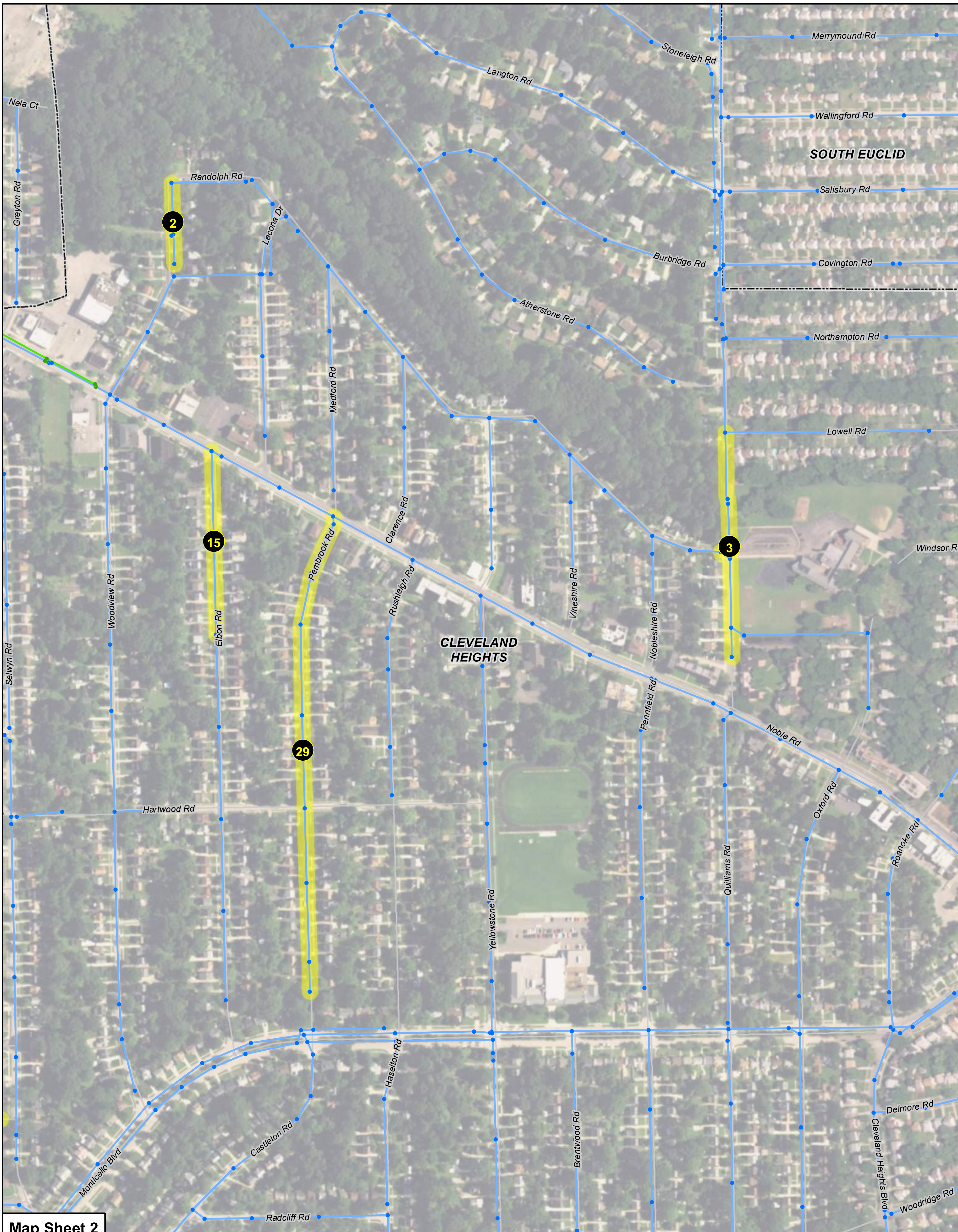

Map Sheet 2

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27	3244 Cedarbrook Road	200	Cleaning Reports	Residential Grease
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29	Pembrook Road	1,700	Identified during HHI LSSES	Roots

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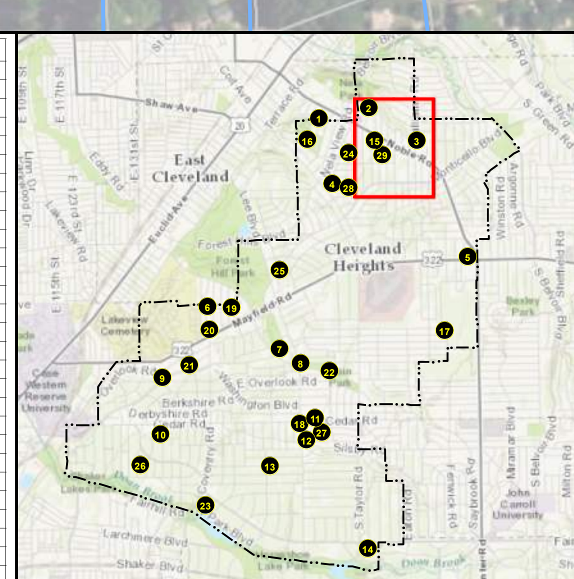
- District Pressure Main
- Local Gravity Main
- Local Pressure Main
- 1 HFC Locations



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Map Sheet 3

Legend

- Community Border
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- Local Pressure Main
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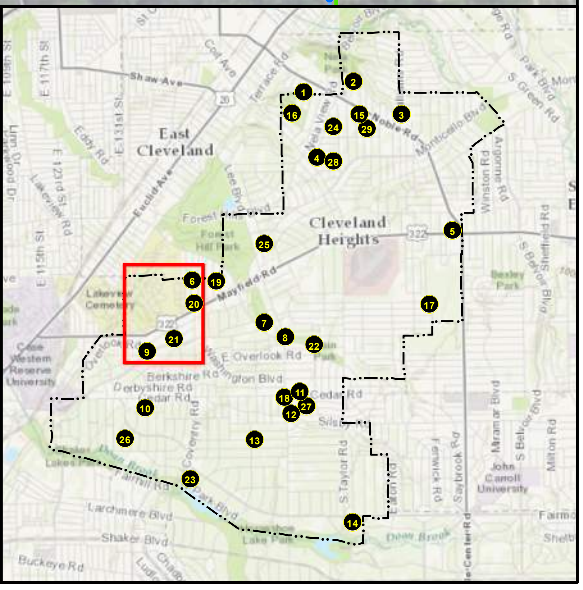

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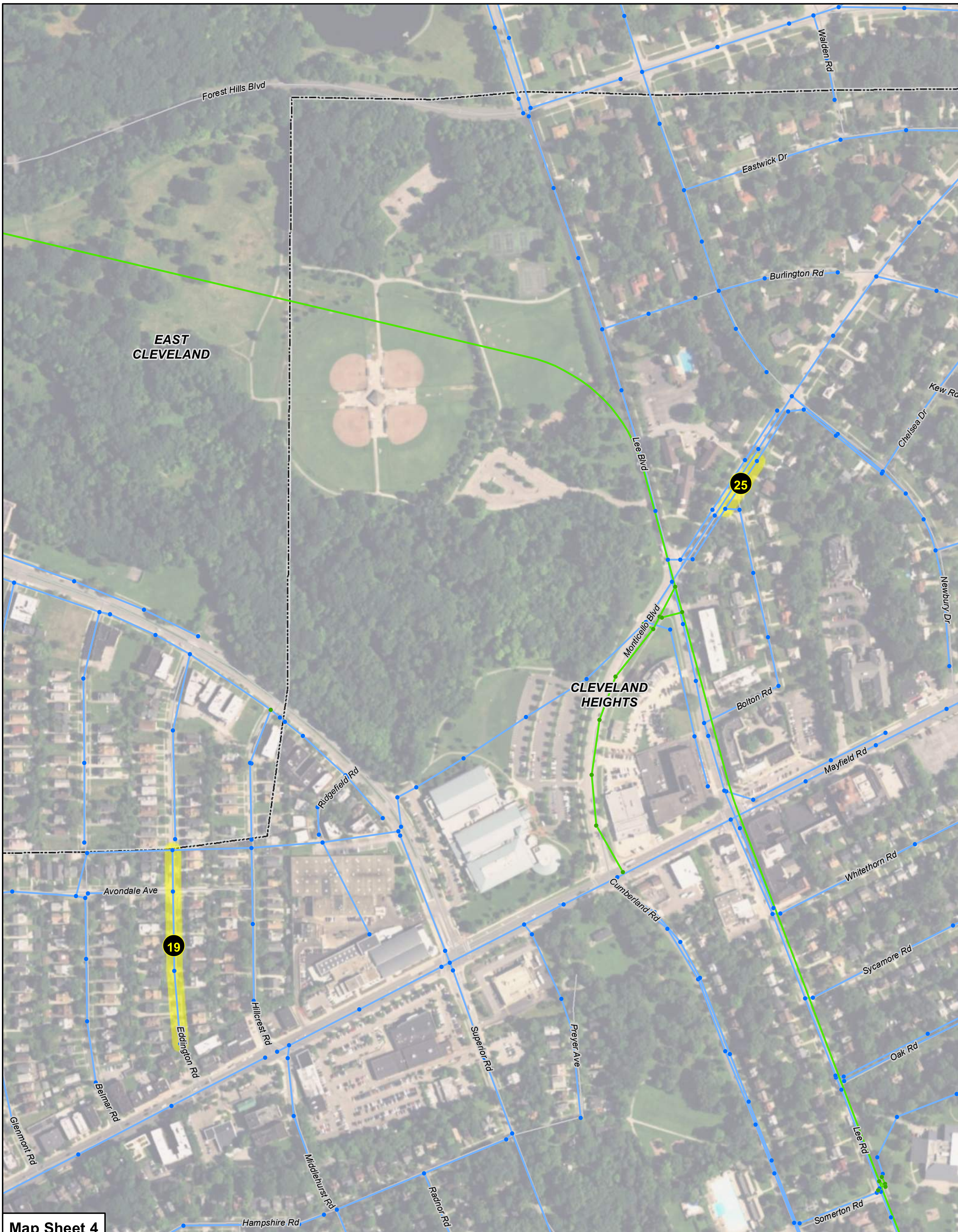

Map Sheet 4

Legend

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- District_Manhole
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- Local Gravity Main
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- HFC Locations

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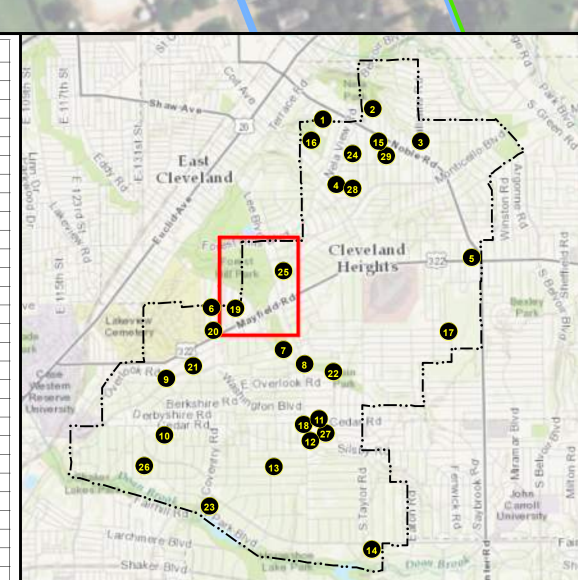

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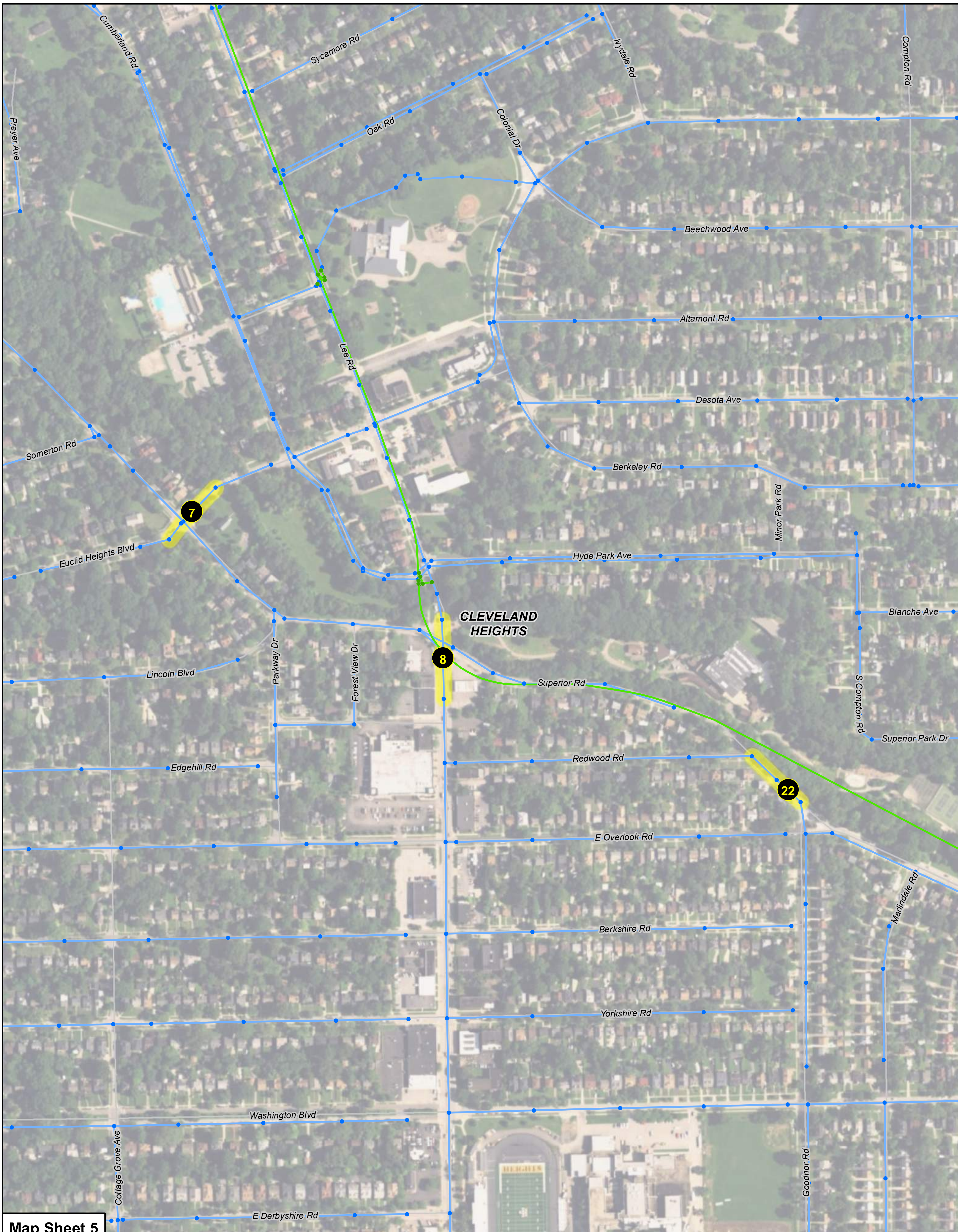

Map Sheet 5

Legend

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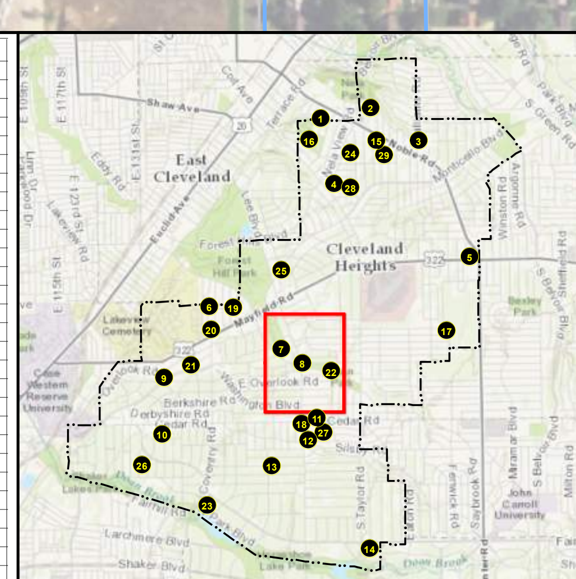

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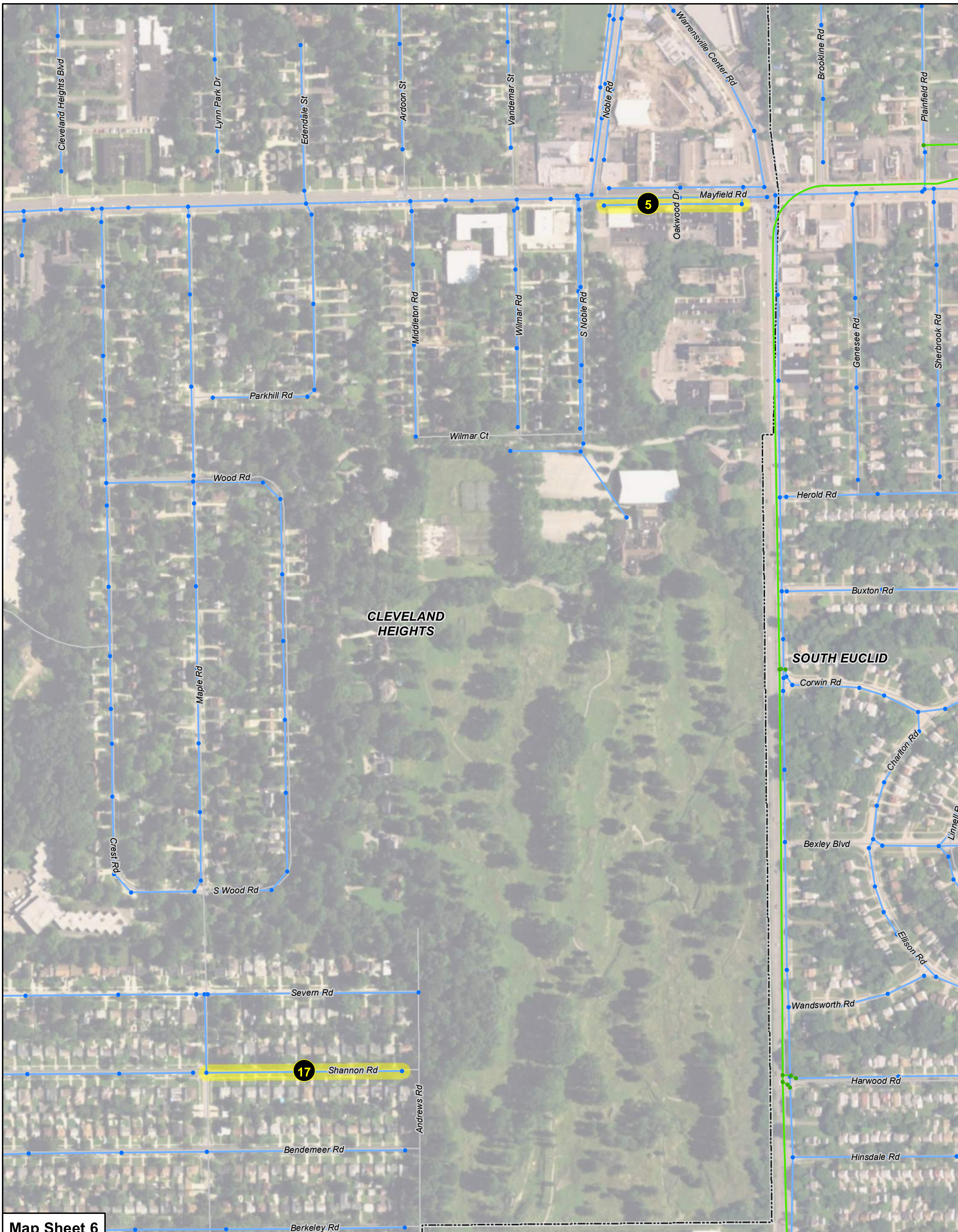

Map Sheet 6

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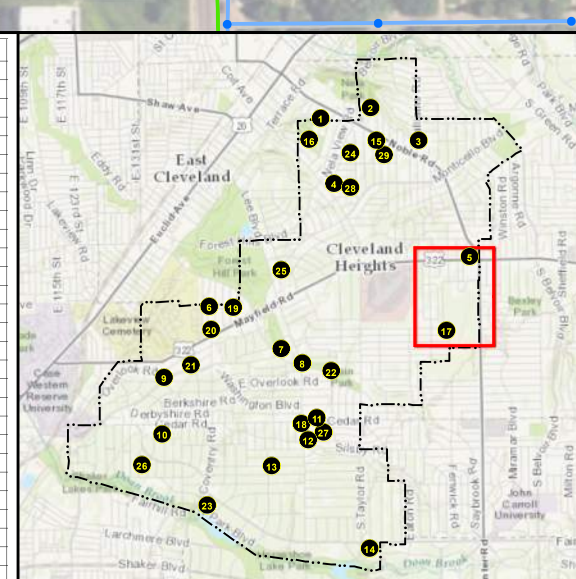

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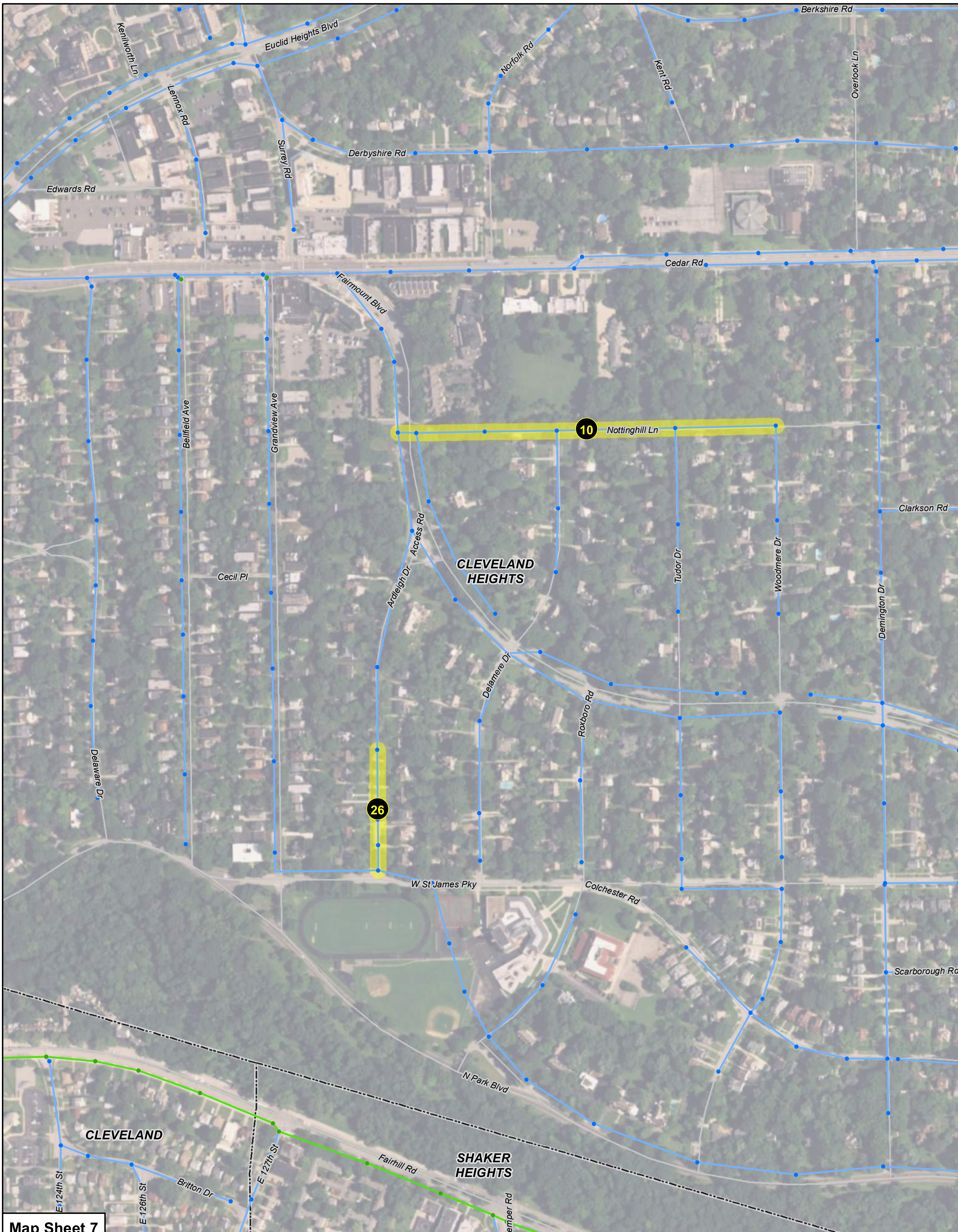

Map Sheet 7

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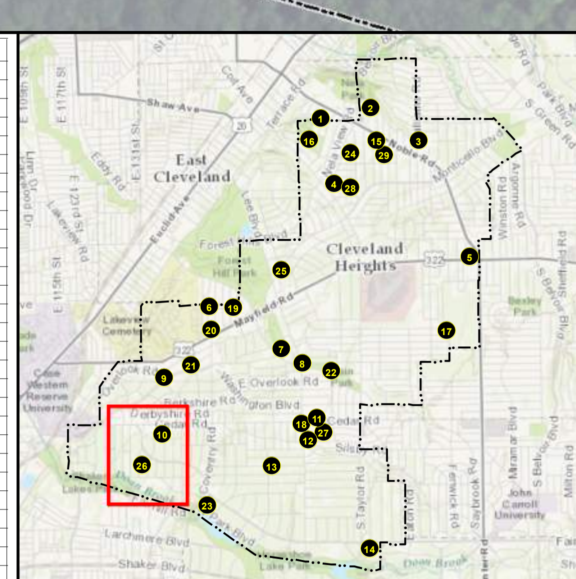

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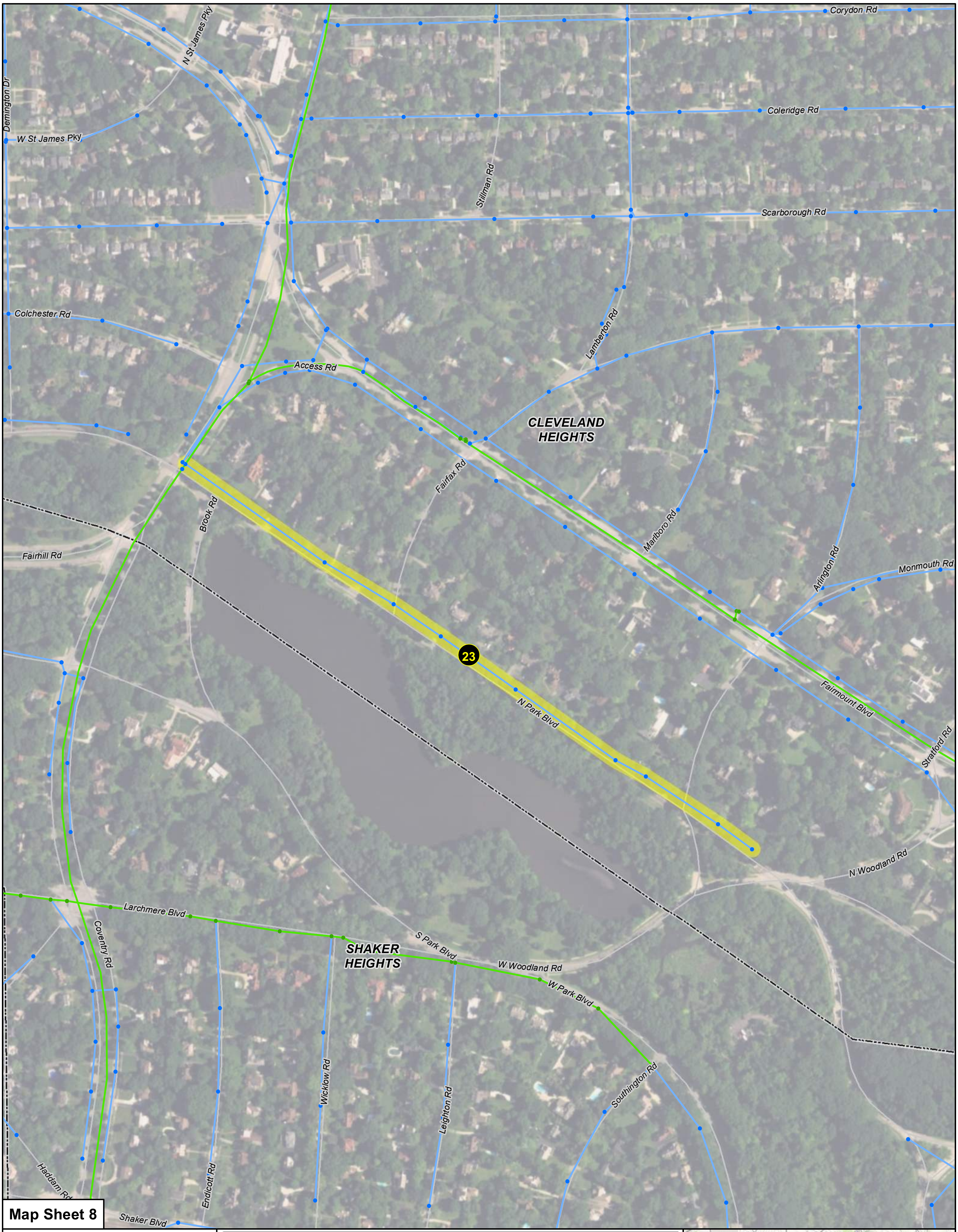

Map Sheet 8

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N

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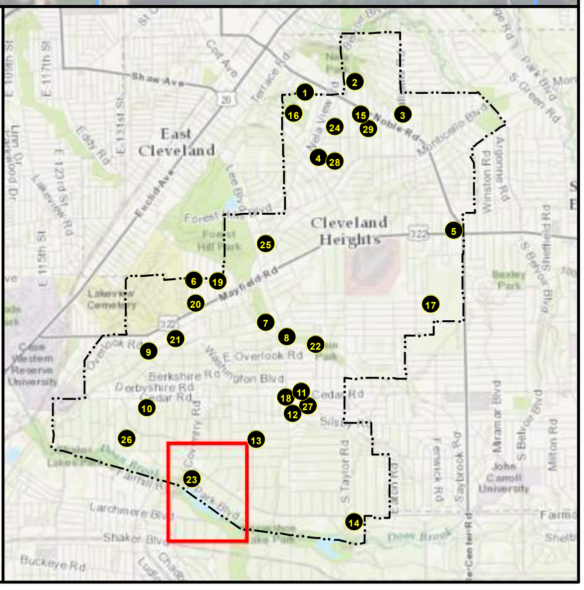
10	Nottinghill Lane	1,400	From CMOM March 2016	Residential Grease
11	Kildare (lower)	200	From CMOM March 2016	Residential Grease
12	Tullamore	200	From CMOM March 2016	Residential Grease
13	Coleridge - Stratford - Corydon	1,200	From CMOM March 2016	Roots
14	North Park Lane (Shelburne to City Line)	900	From CMOM March 2016	Residential Grease and Roots
15	943 Elbon to Noble	400	2007 Sewer Cleaning Report	Residential Grease
16	Dresdon Road	1000		Residential Grease
17	Shannon at Maple	750	2007 Sewer Cleaning Report	Residential Grease
18	2195 Lee Road	330	2007 Sewer Cleaning Report	Commercial Grease
19	Eddington Road	730	2007 Sewer Cleaning Report	Residential Grease
20	1714 Coventry Road	540	2008 Sewer Cleaning Report	Residential Grease
21	2684 Euclid Heights Blvd	570	2009 Sewer Cleaning Report	Residential Grease
22	Superior between Redwood and Goodnor	250	2009 Sewer Cleaning Report	Residential Grease
23	North Park btw Coventry and Arlington	2,800		Roots
24	3390 Winsford Road	250	Cleaning Reports	Residential Grease
25	Bolton Road & Monticello Blvd	220	Cleaning Reports	Residential Grease
26	2520 - 2334 Ardleigh Drive	460	Cleaning Reports	Residential Grease
27	3244 Cedarbrook Road	200	Cleaning Reports	Residential Grease
28	Henderson Road	1,000	Identified during HHI LSSES	Roots
29	Pembrook Road	1,700	Identified during HHI LSSES	Roots



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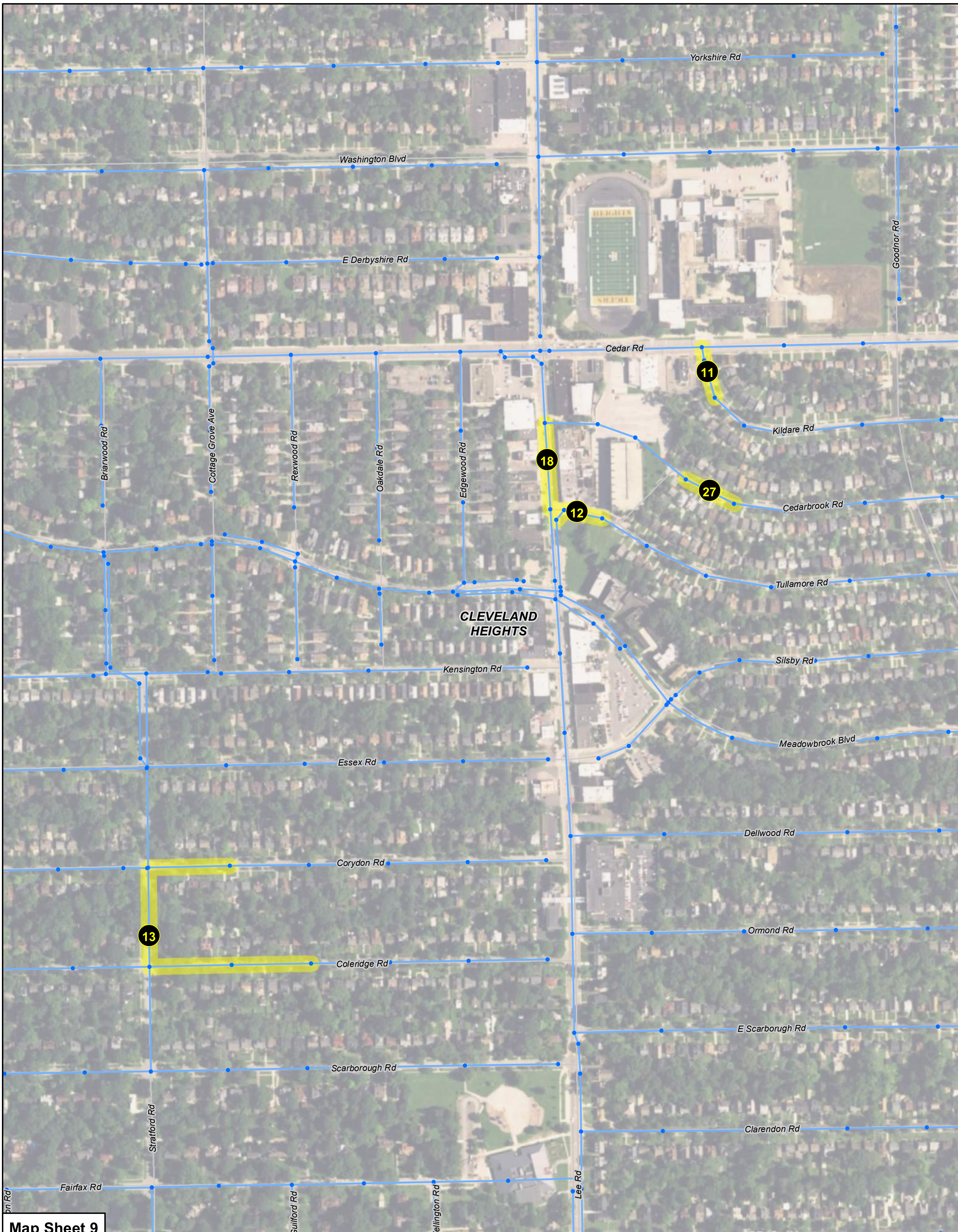

Map Sheet 9

Legend

- Community Border
- District_Manhole
- Local_Manhole
- District_Pump_Station
- Local_Pump_Station
- District Gravity Main
- District Pressure Main
- Local Gravity Main
- Local Pressure Main
- HFC Locations

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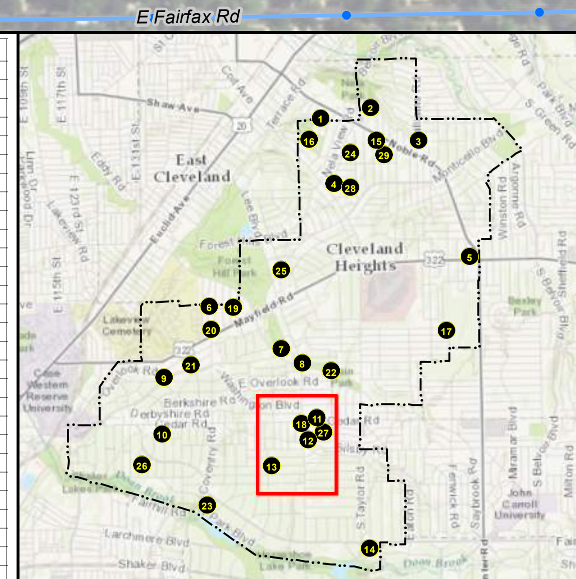

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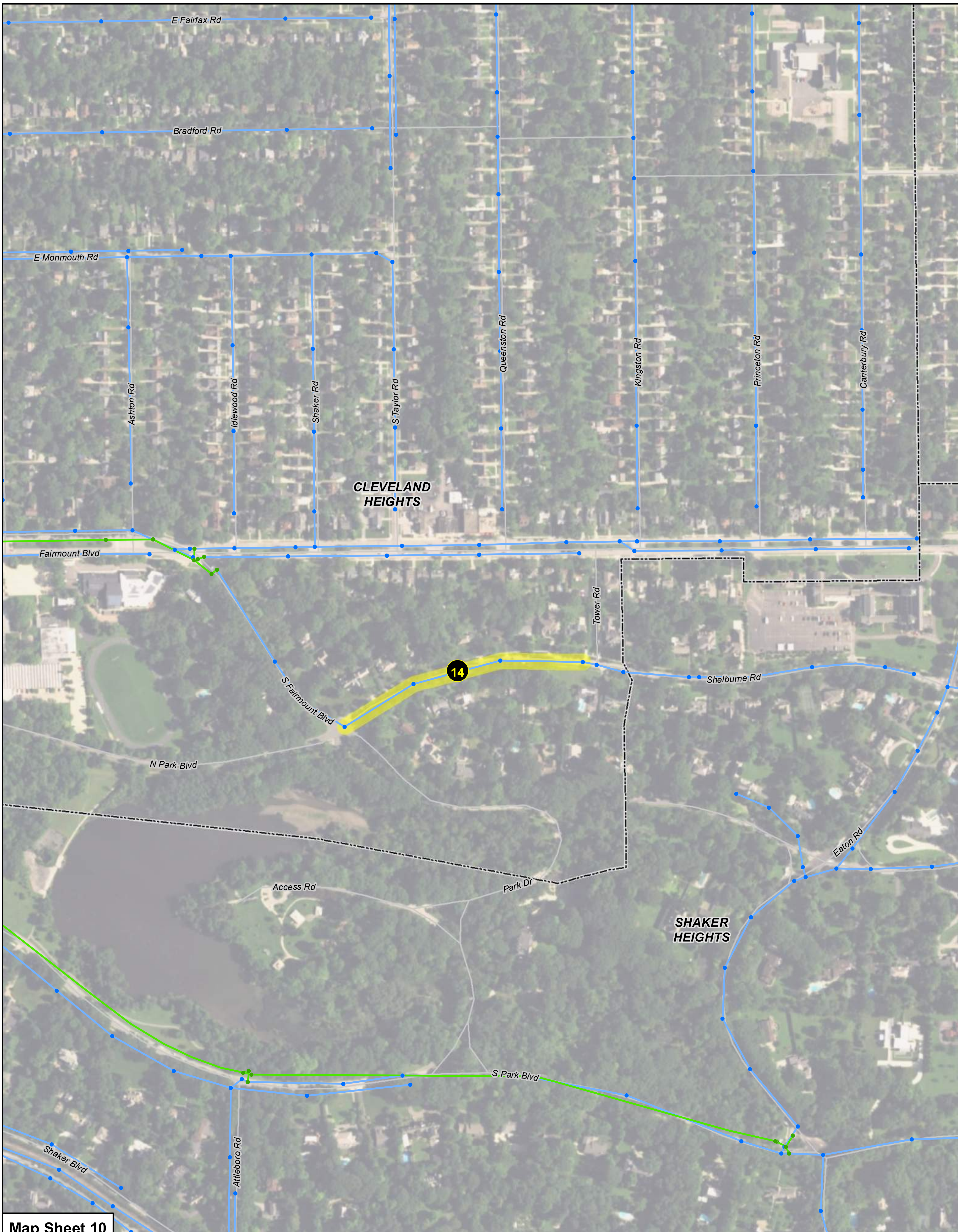

Map Sheet 10

Legend

- Community Border
- District_Manhole
- Local_Manhole
- District_Pump_Station
- Local_Pump_Station
- District Gravity Main
- District Pressure Main
- Local Gravity Main
- Local Pressure Main
- 1 HFC Locations

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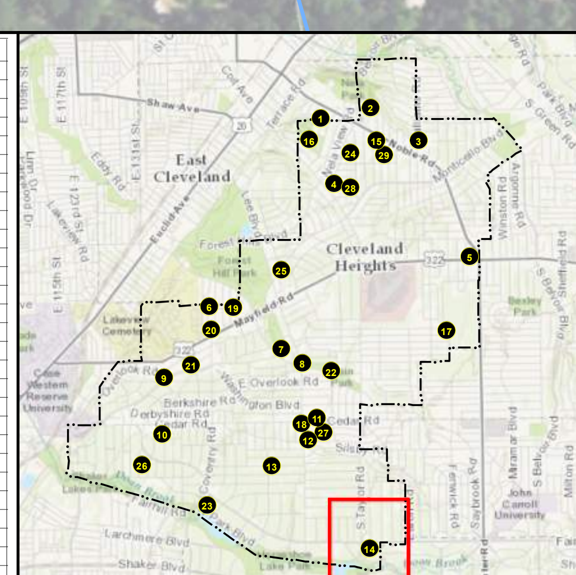

Attachment B – Root Control Maintenance SOP

SEWER MAINTENANCE
STANDARD OPERATING PROCEDURE (SOP)

CLEVELAND HEIGHTS

Administrative Support ☐ Field Operations ☒

Area: Sewer Maintenance **SOP No.:** SM-01

Title: Root Control Maintenance

Status: Draft ☒ Final ☐ **Original Date:** 07/11/17 **Revision Date:** ______

Reviewers: ______

Author: Wade Trim / Brown and Caldwell **Revision Number:** 0

INTRODUCTION / PURPOSE:

The purpose of this procedure is to provide instructions on how to remove blockages in the sanitary sewer due to root intrusion using a jet root saw. This will minimize root intrusion into the sanitary sewer within the collection system.

GENERAL FREQUENCY:

All known root hotspots will be inspected at least twice a year.

RESOURCES:

Crew
1 – Equipment Operator
1 – Utility Person
2 – Traffic Control (as needed)

MATERIALS:

Water

EQUIPMENT:

1 – Mongoose Jetter Truck
1 – Debris Basket
1 – Back-up truck with overhead arrow for traffic control (as needed)
PPE (gloves, hardhat, safety glasses, rain gear, rubber boots, hearing protection)
Laptop, charger and Sewer Cleaning Log

GENERAL WORK METHOD:

1. Sewer Maintenance Supervisor identifies area to be inspected by studying the video inspection data.
2. Clean pipe if accumulated sediment/roots are 20% or more of the pipe. (Refer to Gravity Sewer Line Cleaning and Routine Maintenance SOP)
3. Supervisor prepares work schedule and dispatches staff.
4. Place traffic control signs and safety devices as required at jobsite.
5. Use proper PPE.
6. Operator and laborer work together to remove manhole lid and position equipment.
7. Choose the appropriate nozzle for the root cutting to be performed.

8. Hydro jet with root cutter the line as needed to clean out debris, roots, etc.
9. During the jetting operations, capture any material with the appropriately size debris basket. Do not allow significant debris to travel downstream in the pipe which could result in another blockage.
10. While root cutting a sanitary sewer main use a higher pressure between about 1500-1800 psi dependent on the density of the roots that are being cut. Monitoring of cutting progression is through the vibration of the hose. When the hose is vibrating, it is cutting. When the hose is static, the head is stuck and not rotating the saw blade head.
11. Observe the conditions in the working manhole to identify if water is backing up into the manhole, to note the color of the flow during pull back and attempt to identify the type of material being flushed back to the manhole.
12. If additional resources are needed, such as heavy cleaning, contact Supervisor, for mobilization of Cuyahoga County Public Works or private contractor.
13. Collect large debris during cleaning or screening.
14. Remove equipment, including debris basket.
15. Spray out structure.
16. If additional cleaning of the structure is needed, staff cleans all areas within structure so that base of manhole is exposed. Remove debris from sanitary manhole. Clean all surfaces, walls, brick, concrete, inlet and outlet.
17. Inspect condition of inlet, outfall, and brick/concrete structure.
18. Replace and secure lid to avoid noise from traffic driving over it.
19. Clean up jobsite, tools and truck.
20. Remove traffic control signs and safety devices as required at jobsite.
21. Make notes about any further work that is needed.
22. Decant debris in appropriate location.
23. Accurately report mains and manholes cleaned in computer and on Sewer Cleaning Log.

<u>LEVELS OF RISK – </u>Inspection Frequency (1,2 at least once per year, 3,4 at least twice a year)
Food Service Operations/Retail Food Establishments L= 25,000 Ft^2 S= < 25,000 ft^2
C = COMMERCIAL N = NON-COMMERCIAL

1. **Level 1 = C1S , C1L, N1S, N1L**
   Main Concerns: General sanitation, labeling, source of food, storage temperature control, expiration dates
   - Pre-packaged non-potentially hazardous foods
   - Non-potentially hazardous beverages (packages, fountain, coffee)
   - Pre-packaged refrigerated and/or frozen potentially hazardous foods
   - Baby food, baby formula
   - Over the counter drugs

2. **Level II = C2S, C2L, N2S, N2L**
   Main Concerns: Level I concerns. Additionally-hand contact, employee health. Permits handling of potentially hazardous foods in situations where there is little or no potential for pathogen growth.

   - Baking of non-potentially hazardous food
   - Manufacturing of confectionary products
   - Bulk displays of unwrapped non-potentially hazardous foods
   - Re-packaging of non-potentially hazardous food prepared elsewhere
   - Warming of food from a commercially processed hermitically sealed container and immediately handled for retail sale or service
   - Maintaining hot potentially hazardous foods at proper holding temperature until handled for retail sale or service if it was received at 140 degrees Fahrenheit or above
   - Manufacture and bagging of ice for retail sale
   - The operation only prepares and/or serves non-potentially food
   - Hand dipping of frozen desserts, frozen dessert dispenser
   - Potentially hazardous foods received in individual portions and served immediately
   - Foods, prepackaged in individual portions, received from a licensed food operation or off premise commercial processor and served cold or heated individually and immediately served.
   - Foods received from a licensed food operation or off premise commercial processor in bulk quantities and maintained and served at the same proper temperature as received

3. **Level III = C3S, C3L, N3S, N3L**
   Main Concerns: Includes those of Level I and II. Additionally-proper cooking temperatures, proper cooling procedures, proper holding temperatures, contamination issues and/or improper heat treatment in association with longer holding times before consumption, or processing a raw food product to sell as ready-to-eat that requires bacterial load reduction procedures.
   - Heat treatment dispensing freezer
   - Processing of produce for ready-to-eat sales
   - Cutting and grinding of meat products
   - Slicing of lunch meat
   - Reheat in individual portions
   - Heating of product from intact commercial sealed package and held hot
   - Cook, cool, add additional raw ingredient, cold hold

4. **Level IV = C4S, C4L, N4S, N4L**
   Main concern: Concerns of Levels 1,2,3. Food goes through several preparation steps where temperature control is needed to prevent bacterial growth.
   - Cook/cool/reheat/hot hold, Cook/cool/reheat (with or without additional ingredients)
   - Time in lieu of temperature
   - Reheats bulk quantities of leftover potentially hazardous foods (PHF) more than once every 7 days
   - Transports PHF as a catering food service or a commissary food service operation
   - Service to high risk clientele including immune-compromised or elderly individuals in a facility that provides either healthcare or assisted living
   - Offers as a menu item raw potentially hazardous meats, poultry products, fish or foods with these items as ingredients
   - Canning, bottling, reduced oxygen packaging, smoking for preservation, juice pressing, acidified food for preservation
   - Selling of oyster, clam, and mussels from a shellfish tank.