

Wastewater Collection Systems Best Management Practices

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of Water Professionals
Collection Systems
Committee

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WASTEWATER COLLECTION SYSTEMS BEST MANAGEMENT PRACTICES

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Acronyms

ARV	Air Release Valve
BMP	Best Management Practices
CCTV	Closed Circuit Television
CERP	Contingency and Emergency Response Plan
CI	Compliance Inspector
CIP	Capital Improvement Program or Capital Improvement Plan
CMMS	Computerized Maintenance Management System
CMOM	Capacity, Management, Operations, and Maintenance
CSC	Collection System Committee
CSMP	Collection System Maintenance Program
CWA	Clean Water Act
DE	Discharge Entities
DO	Dissolved Oxygen
ft/sec	feet per second
FOG	Fats, Oil, and Grease
FSE	Food Service Establishment
GA DNR	Georgia Department of Natural Resources
GAWP	Georgia Association of Water Professionals
GA EPD	Georgia Environmental Protection Division
GIS	Geographical Information System
GPM	Gallon per minute
GWEF	Georgia Water Environment Federation
I/I	Inflow and Infiltration
KPI	Key Performance Indicators
NPDES	National Pollutant Discharge Elimination System

O&M	Operations and Maintenance
POTW	Publicly Owned Treatment Works
QA/QC	Quality Assurance/Quality Control
RCP	Reinforced Concrete Pipe
RDI/I	Rainfall Derived Infiltration/Inflow
ROW	Rights of Way
RTU	Remote Terminal Unit
SCARP	Sewer Condition Assessment and Rehabilitation Program
SECAP	Sewer Evaluation and Capacity Assurance Planning
SR	Service Request
SSES	Sanitary Sewer Evaluation Study
SSOs	Sanitary Sewer Overflow
USEPA	United States Environmental Protection Agency
WCTS	Wastewater Collection and Transmission System
WEF	Water Environment Federation
WO	Work Order

Georgia Association of Water Professionals

Founded in 1932, the Georgia Association of Water Professionals (GAWP) is a not-for-profit technical and educational organization and has been a Member Association of the Water Environment Federation (WEF) since inception. GAWP has individual and corporate members from varied disciplines who work toward preservation and enhancement of Georgia's water environment. GAWP conducts four conferences each year in Georgia and has more than 25 active committees addressing various water-related issues that impact Georgia's communities.

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Disclaimer

It is very important to understand several assumptions when using the *Wastewater Collection Systems Best Management Practices* manual:

- The practices described are generalized and one size doesn't fit all. Utilities in Georgia take many different organizational forms, not only in the service types they provide (water, wastewater, and/or stormwater), but also in their jurisdictions and forms of governance.
- Parts of the process may apply to your utility, other parts may not. The Committee's intent is to offer a buffet of best management practices that can be modified by a utility to fit its specific needs and requirements, so please feel free to pick and choose the ones applicable to your system.
- Nothing in this manual should be assumed to have any regulatory intent or to specify any standards. The best management practices are offered for information only, with the hope of improving the practice and efficacy of wastewater collection systems.
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- The *Wastewater Collection Systems Best Management Practices* manual is not copyrighted, but if quoting, users agree to credit and give reference to the Georgia Association of Water Professionals.

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Introduction

Wastewater collection systems are one of the major assets for which municipal utilities are responsible. Proper management, operation, and maintenance of these assets will extend the useful life, provide adequate capacity, reduce annual maintenance costs, and reduce controllable overflows.

The purpose of this document is to provide general guidance for municipal utilities to develop and implement best management practices (BMPs) for management of wastewater collection systems that will include the following:

- Sewer Mapping
- Hydraulic Model
- Flow and Rainfall Monitoring
- Fats, Oil, and Grease (FOG) Program
- Collection System Maintenance Program
- Sewer System Condition Assessment and Rehabilitation Program
- Contingency and Emergency Response Plan

Utilities that have been required to develop a Capacity, Management Operations and Maintenance (CMOM) Program to comply with state and/or federal Consent Decrees or Consent Agreements will be able to utilize this document to develop and implement the required CMOM Program.

This document was prepared by the Collection Systems Committee (CSC) of the Georgia Association of Water Professionals (GAWP) under the guidance of CSC members with varied perspectives and experience with collection system and CMOM Programs. The document underwent thorough technical review by the committee members (including utility representatives) who volunteered to provide input.

To enhance the value of this document, an annotated bibliography has been included. The bibliography contains a list of the materials and web sites used in the preparation of this document, and numerous other resources that may assist wastewater utility managers as they implement their CMOM program.

Information has been included in this guidance that may seem to be very basic or redundant. The purpose of this format is to ensure that all users of this guidance have the same level of understanding on which the more advanced and complex concepts are built.

Where appropriate, a range of implementation options are presented. Each utility should apply its own decision-making process as it determines which of the options most closely meet its unique needs and situations.

Section I

Benefits of Implementing Best Management Practices

Section 1: Benefits of Implementing Best Management Practices

Capacity, Management, Operations, and Maintenance (CMOM) programs are often associated by wastewater utilities with state of Georgia or federal Consent Decrees. Although the term CMOM and its associated requirements were developed by EPA, Region 4, most of the wastewater collection system operation and maintenance provisions, outlined in the EPA CMOM requirements, are similar to standard practices and procedures that well-managed utilities in Georgia had developed and followed prior to the EPA requirement.

These utilities have long recognized the importance and benefits of an effective wastewater collection system operation and maintenance (O&M) program and have taken the steps necessary to develop, implement and update the programs.

Some of the many benefits of establishing Best Management Practices or a CMOM program include:

- Preventing sanitary sewer overflows (SSOs) and maintaining a clean environment.
- Ensuring adequate capacity for peak flows and growth opportunities through sewer extensions.
- Protection of public health.
- Avoiding basement backups in your communities.
- Protecting the infrastructure investments made in pipes and pumps.
- An overall more efficient, better run collection system.

Regardless of the name given to O&M programs, it is essential to the effective operation of a utility to have a program that will:

- Provide effective and continuous management, operation, and maintenance, as well as ensuring adequate capacity and rehabilitation when necessary.
- Establish performance goals, and implement activities to meet the goals.
- Investigate capacity constrained areas of the collection system.
- Proactively prevent SSOs.
- Establish information collection and management practices to track how the elements of the O&M program are meeting performance goals, and whether overall system efficiency is improving.
- Maintain the value of the utility's investment in the collection, distribution, and treatment systems.

The development and implementation of comprehensive Best Management Practices or a CMOM program for its sewer system would provide the following benefits to the utility:

- Reduced operation, maintenance, and capital costs.
- Minimize the possibility of SSOs.
- An immediate response plan for quick mitigation of an SSO.
- Prioritize required sewer system repairs, rehabilitation, and replacements that need to be addressed via short-term and long-term solutions.
- SSO reporting procedures that ensure proper reporting and posting of SSOs that occur from the utility's sewer system, in accordance with GA EPD's rules and regulations.

Section 2

Collection System Mapping

Section 2: Collection System Mapping

2.0 Purpose and Goals

A complete and accurate map of the wastewater collection system should be available and be updated in a timely manner as new components are added or existing components are replaced or repaired.

A utility's CMOM plan should include a complete and accurate wastewater collection system map, as well as a plan to maintain the map as new lines, lift/pump stations, or force mains are added or existing lines, lift/pump stations, or force mains are replaced or repaired. All lines (public and private) located within the utility's service area should be included. Private lines should be designated to identify private responsibilities for maintenance and should include contact information, which should be confirmed and updated annually. New lines and repaired, relocated, and replaced lines should be incorporated into the map.

The accuracy, completeness, and availability of maps of the wastewater collection system are critical to the success of capacity assessment and management, operation, and maintenance activities of the collection system. It should be noted that while computerized maps are not required for an effective CMOM Program, GIS programs have made the mapping and map updating process for wastewater collection systems considerably more efficient. Whether a wastewater utility utilizes a GIS, or relies on paper maps, the following information should be included to have an effective CMOM Program.

- Main, trunk, and interceptor sewers
- Building and house laterals
- Manholes
- Cleanouts
- Force mains
- Lift stations/pump stations
- Flow monitors and rain gauges
- Service area boundaries
- Other landmarks (roads, water bodies, etc.)

In addition, collection system maps should have a permanent numbering system that uniquely identifies all manholes and sewer cleanouts and references the property served with its cleanout. Sewer line attributes should include pipe diameter, material, length, installation date, condition, rehabilitation method, rehabilitation date, invert elevations, slope, and flow direction. Manhole attributes should include size, shape, type, depth, age, condition, and materials. (When paper maps are used, a separate spreadsheet or other system should be used to maintain sewer line and manhole attribute information). Maps should include access and

overflow points, easements and property lines, and always reference the date the map was drafted and date of last revision. Separate detailed local maps should be indexed to an overall map of the system. GIS programs should be capable of accepting information from a management program such as a Computerized Maintenance Management System (CMMS). Specific procedures should be in place for correction of errors and updating maps.

Maps should be available to field personnel, who should be properly trained to recognize discrepancies between field conditions and map data, and to record changes necessary to correct the mapping system.

Problems in the collection system, such as those due to grease or industrial discharges, hydraulic bottlenecks, areas of poor design (e.g., insufficient slope), and excessive infiltration, as well as the number of stoppages experienced per mile of sewer pipe, should be noted on maps or other documents. SSOs should also be mapped or recorded on other documents.

Service area boundaries and dimensions of landmarks, such as surface streets, street addresses, surface water bodies, political boundaries, sewersheds and sewershed basins, property lines, utility easements, and rights-of-ways, should be included on the maps.

2.1 Pipes

Pipe data will typically be available from historical maps, such as collection system atlases and record drawings. Physical inspections may be used to confirm and update the location, diameter, and pipe material.

Mapping or other types of documents for pipes should include:

- Diameter
- Length
- Material
- Age
- Slope
- Flow direction
- Condition
- Date and type of last rehabilitation
- Force, gravity, and/or aerial mains
- Pipe invert levels
- Pipe roughness
- Shape
- Service laterals
- Cleanouts

As pipe condition and other information is obtained from condition assessments using pole cameras, CCTV, or pipe lamping, maps and other documents should be updated to ensure that data is current.

2.2 Manholes

The location of all manholes should be verified by physical inspection. Additional manhole data may also be available from historical maps, such as collection system atlases and record drawings. The physical inspections should document the physical condition of the sanitary sewer manholes and identify possible sources of infiltration/inflow (I/I). Such data can also be used to establish and prioritize manhole maintenance and rehabilitation needs. It is critical to have a standardized manhole inspection process that can be incorporated into routine maintenance activities. The standardization of manhole inspection and rehabilitation processes greatly reduces the effort required to verify the condition data for each manhole for proper rehabilitation. Mapping of manholes should include:

- Location (e.g., coordinates)
- Shape
- Inside diameter
- Type
- Depth
- Age
- Material of construction
- Condition including:
 - Roots
 - Evidence of infiltration
 - Active infiltration
 - Debris in manhole
 - Evidence of surcharging
 - Grease
- Date and type of rehabilitation
- Manhole ring/cover elevation
- Invert elevations of inlet/outlet sewers
- Accessibility
- Photographs

2.3 Lift/Pump Stations

The location of all lift/pump stations should be shown and verified by physical inspection. Some of the required lift/pump station information may be obtained from record drawings and during routine inspections and maintenance of the lift/pump station. Regardless of the type of mapping technology that is used, the following information should be maintained:

- Location
- Number, types, and sizes of pumps and motors
- Total capacity (all pumps operational)
- Stand-by power
- Telemetry system
- Firm capacity of the station
- Size of the wet well
- Inlet and discharge elevations
- Force main size, material, and location
- Structures that restrict flow
- Flow monitors
- Variable speed pumping installations
- Automated control systems
- Manually controlled pumps

2.4 Force Mains

Force mains are often the forgotten piece of the collection system. O&M responsibilities may fall upon the lift/pump station crews that are ill-equipped to work on pipe lines. Force main mapping may be more critical than gravity lines because when they fail, a significant SSO may occur. Mapping should include a thorough condition assessment of Air Release Valves (ARV). ARVs should receive routine inspections along with the lift/pump stations to identify problems early before they lead to internal corrosion of the force mains from H₂S gasses.

- Force main material
- Size
- Force main age
- ARV location
- ARV type
- ARV age

2.5 Program Resources

2.5.1 Staff

Staffing for support of the Collection System Mapping Program should be based on the size of the wastewater collection system, mapping system, and existing level of mapping. The following types of staff are typical for maintaining a collection system mapping program:

- System Mapping Manager
- GIS Technician and/or AutoCAD Technician
- Field Staff/Surveyors

2.5.2 Equipment

Equipment required for supporting the Collection System Mapping Program should be based on the type of system mapping used by the utility. Equipment typically required is shown below.

Field Equipment	Office Equipment and Software
• Laptop computers • Survey-grade GPS equipment • Traditional survey equipment • Pole cameras and lamping equipment • Video equipment • Digital cameras • Leveling rods and tapes • Safety equipment: hard hats, safety glasses, rubber gloves, vests, and steel capped boots	• Computers • Printers and plotters • Servers • ArcGIS® • Asset management software • CMMS

2.6 Collection System Mapping Program Performance Measures

Performance measures are important management tools that allow for continuous measurement and evaluation of program activities. Performance measures are designed to collect information that enable a utility to determine if established goals and level of service are being met and if not, what activities need to be adjusted to meet program goals.

Suggested Key Performance Indicators (KPIs) are shown in Table 1-2. Desired results should be established by the utility.

Table 1-2				
KPI	Formula	Definition	Desired Result	Data Interval
# of Sewer Mains Mapped	Value	Number of lines mapped/updated per year		Annual
% Sewer Mains Mapped	# Linear Feet Mapped / Total Linear Feet in System	Percentage of system mapped in report period		Annual
% Manholes Mapped	# of manholes mapped/Total # of manholes	Percentage of manholes mapped in report period		Annual
Number of Record Drawings Received	Value	Number of new systems received in report period		Annual
Number of Record Drawings Mapped	Value	Number of new systems located and mapped in report period		Annual
Number of Record Drawings Backlogged	Value	Number of as built's needing location and mapped	0	Annual
100% of System Mapped and Inventoried	100 x (feet of sewers, # of MHs or force mains mapped/total feet of sewers, # of MHS or total feet of force mains). 100 x # of PSSs/total # of PSSs	All manholes, sewers, force mains and PS mapped and inventoried	Accurate maps and inventory of entire collection and transmission system	

2.7 Program Procedures

Procedures for the System Mapping Program should be developed to provide consistency and accuracy in the data results.

Sample Collection Mapping Program Procedures			
SCHEDULE Schedule based on areas identified by Program Manager of mapping program or other designated personnel.			
ACTIVITY DESCRIPTION Procedure defines mapping activities for field crews and data management activities for GIS specialists.			
ACTIVITY GOALS To accurately identify assets in the field using GPS equipment and upload data into GIS database.			
LABOR		MATERIAL and EQUIPMENT	
Code	Classification	Code	Description
• •	• CMOM Program Coordinator • GIS Manager • GIS Specialists • Utility personnel that conduct field surveys • Contract personnel that conduct field surveys • Contract personnel who perform data management	• •	• Laptop computers • Traditional and survey-grade GPS equipment • Manhole etching equipment • Digital cameras • Leveling rods and tapes • Safety equipment: hard hat, safety glasses, rubber gloves, vests and steel-capped boots
SAFETY ANALYSIS			
Safety Checklist		Potential Hazards	
• Safety Program Plan • Traffic Safety Requirements		• Infectious Diseases • Slip, Trip, and Fall • Snakes, Pests, Insects • Confined Space Entry (not applicable, field crews are not entering confined space) • Traffic • Vehicle Operation • Electrical Hazards (Electrical Safety) • Lifting	

Mapping Procedures for Manholes and Cleanouts

Field personnel (utility or contractor) gather location information in the field and transmit the data in digital and/or hard-copy format to the utility GIS manager for integration into existing systems. Deliverables for each basin /sub-basin should include digital photos of manholes, GIS-compatible database, map books, and recommendations for sewer lines to be surveyed. Utility staff should be involved in quality control and integrating the information into the existing GIS, CMMS, and other systems.

- (1) Field maps are created from the existing GIS database both to assist field crews in locating sewer features and to be marked up where errors are found during field verification. Inspection crews are sent out first to collect attributes. Separate survey crews follow to collect GPS locations.
- (2) Inspection crews collect attributes information and record the data. Field maps are corrected with red-line edits. Digital photos are taken of manholes. The orientation of all incoming and outgoing pipes is recorded relative to north.
- (3) Working one basin/sub-basin at a time, the field personnel perform the initial data collection and a quality review.
- (4) The utility staff complete quality checks and return questionable data to the field personnel for verification. The utility issues internal work orders to locate any manholes noted as buried or not located.
- (5) Survey crews receive a list of manholes and the corrected field maps from the inspection crews. Control points are established, and the survey crews follow the corrected maps to collect horizontal and vertical coordinates for each manhole and cleanout with GPS or conventional survey equipment.
- (6) The new asset information should be incorporated into the utility's appropriate data management system and hydraulic model. The information should include survey coordinates and elevations of manholes, incoming and outgoing pipes, and digital photos.

Mapping Procedures for Sewer Lift Stations

- (1) Field personnel perform survey of lift station wet well, vault chambers, standby generators, fencing, and stormwater structures. Measurements are made of wet well dimensions and the elevations of level controls. All data is recorded on the Lift Station/Pump Station Inspection Form or in an electronic database.
- (2) Survey crews collect horizontal coordinates for the corners of structures, including buildings and fences, and elevations of the top of structures.

Section 3

Hydraulic Model

Section 3: Hydraulic Model

3.0 Purpose and Goals

Modeling the system will provide an understanding of the hydraulic behavior of the wastewater collection and transmission system (WCTS), which will assist utilities in making informed decisions concerning strategic planning and capital improvements required to meet the performance goals of the utility.

The Hydraulic Model should include processes to determine system capacity and its relationship with wet weather and to identify, characterize, and address hydraulic deficiencies. The purpose of the Hydraulic Model is to:

- Determine if adequate capacity exists for continued collection of wastewater for existing and projected future flows during both dry and wet weather conditions.
- Assist the utility in meeting level of service performance objectives expected by customers.
- Identify capital and operational improvements required to respond to and manage development and economic growth.

3.1 Resources

3.1.1 Staff

Staffing for support of the Hydraulic Model Program should be based on the size of the wastewater collection system and existing level of hydraulic modeling. The following types of staff are typical for maintaining a hydraulic modeling program:

- Hydraulic Modeling Manager
- Hydraulic Modeler(s)
- Engineering Consultant Support (as needed)

3.2 Activities

3.2.1 Overview

The Hydraulic Model should include the following components:

- Description of the software used to develop the model.
- Types and sources of data used to develop the model (GIS data, record drawings, operational data, sewer system maps, flow and rainfall monitoring data, and sewer system inspection records).
- The approach used to develop separate models representing each sewershed and how they will be integrated into one hydraulic system model.
- Description of how the model will be used to predict:

- o The rate of wastewater flow and capacity of major gravity sewer lines including peak flows during wet weather conditions.
- o The likelihood and location of capacity-related SSOs.
- o The hydraulic pressure and capacity of force mains and pumping stations.
- o The flow capacity of each lift station.
- o The available capacity in sanitary sewers to receive flows from proposed developments.
- o Capital improvements, including sewer rehabilitation and relief sewer construction, required to meet current and projected future flow conditions.
- Description of how the model will be calibrated using existing flow, rainfall, and inspection and operational data.
- Description of how the volume and rate of wastewater flow, groundwater infiltration, and Rainfall Derived Infiltration/Inflow (RDI/I) was projected for each sewershed and incorporated into the model.
- RDI/I hydrographs for sewersheds and sewer basins (the hydrographs should be developed using historical flow data).
- Description of how the model will be used to determine availability of capacity prior to permitting increases of wastewater flows from existing sewer service connections and from proposed new development.
- Specific definitions and parameters for determining the adequacy of collection, conveyance, and treatment capacity.

3.2.2 Hydraulic Modeling Software

A sewer system hydraulic model is a mathematical model of a fluid introduced into a wastewater sewer at various rates and pressures. It is used to analyze system hydraulic behavior under variable conditions. In general, commercial sewer modeling software is developed with a graphical user interface that allows ease of data input and extraction. In addition, data output can be accomplished by means of both tabular and graphical output.

Commercial hydraulic modeling software packages are available for hydraulic modeling. Software packages typically include a graphic interface to GIS. The modeling software typically incorporates full solution modeling of backwater effects and reverse flow, open channels, trunk sewers, complex pipe connections, and complex ancillary structures.

Free hydraulic modeling software is also available through EPA. The latest version of EPA-SWMM can be downloaded from:

<http://www2.epa.gov/water-research/storm-water-management-model-swmm#downloads>

3.2.3 Types of Data Used for Model Construction

The hydraulic model construction relates directly to two main components: physical system data and hydrologic flow data. The sources for the physical inputs for the model network are generally the utility's GIS database, record drawings, sewer system maps, and inspection records.

Modelers should determine GIS requirements and accuracy before commencing modeling input from GIS. For compatibility between GIS and modeling software, modelers should ensure connectivity between nodes.

Determining accurate, representative loads and the spatial distribution of load throughout the network model is a key element of modeling. Load data can be derived from many sources including:

- Flow metering
- Water consumption records
- Telemetered system flows
- Estimates from consumer characteristics (population, land use, traffic counts)
- Sewer System Evaluation Study (SSES) inspection results

3.2.4 Model Development

The selection of an approach for development of the hydraulic model is typically based on the size and number of drainage basins and sub-basins tributary to the utility's wastewater treatment facility or adjacent municipal system that is providing wastewater treatment services to the utility. For small systems, a single model will usually be adequate for the tributary collection system. For large systems, with large tributary basins and multiple sub-basins, the model is usually developed for each sub-basin and then integrated into a single model for the major basin(s) and for the area tributary to the treatment facility or adjacent municipal system.

The availability of accurate sewer system information from the sewer mapping program and the flow and rainfall monitoring program is critical to the development of an accurate model. When complete and accurate mapping data is not available, separate models representing selected sub-basins can be developed based on data availability as the collection system is mapped.

3.2.5 Calibration Using Existing Flow, Rainfall, and Inspection Data

Model calibration is the process of adjusting model parameters so that the model output matches the measured sewer flow for the same time period. Model calibration is achieved by providing the model with known hydrologic and hydraulic parameters at several input locations and comparing the simulated flows at one or more discharge locations with those measured in the field at the same location. For each calibration point, the percentage variance, predicted and observed dry and wet-weather hydrographs, and calibration parameters should be

provided. Calibration points should include all available flow monitored points. Local rain gauges can be used to account the rainfall special variation impact on the model calibration.

The model should be calibrated for both dry-weather and wet-weather flow conditions. The wet-weather calibration should include various rain events. The calibrated hydraulic model should also be verified through a “reality check” with the utility’s operations and maintenance personnel. Basement backup complaints, records of SSOs, maintenance records, and interviews with utility staff should be used to match the model with institutional knowledge of staff.

3.2.6 Using the Hydraulic Model

3.2.6.1 Predicting the Volume and Rate in Major Gravity Sewer Lines, Force Mains, Lift Stations, and Proposed Developments and Capacity Improvements

After the model is calibrated and verified, the model should be used to simulate and predict:

- Rate of wastewater flow in major gravity sewer lines.
- The hydraulic pressure (in psig) and flow capacity of force mains throughout the system.
- The flow capacity of each lift station in the utility’s WCTS.
- The capacity of sanitary sewers receiving flows from proposed developments: Projected flow related to proposed development can be input into the model. A “what-if” scenario can be conducted to evaluate the downstream impact from the increased flow, including pipe profile plot, surcharge condition, and overflow.

The calibrated model is an important tool for evaluating the hydraulic performance of multiple combinations of capacity enhancement alternatives and the ultimate selection of the most feasible combination of alternatives to provide adequate capacity for current and future conditions.

3.2.6.2 Assure Availability of Capacity from Existing Connections and Proposed New Development, System Evaluation, and Capacity Assurance Planning

The hydraulic model is a tool that should be used to determine the adequacy of the WCTS and treatment capacity and to ensure sustainable wastewater services are provided by the utility. Development and maintenance of a model is essential to performing a capacity assessment of the problem areas where capacity-related issues are identified (such as overflows or hydraulic overload at treatment facilities).

The model should also serve as a planning tool that assists the utility in deciding how a treatment facility’s remaining flow capacity will be used and whether an equipment or infrastructure upgrade is necessary to assure future treatment capacity. In addition, this approach prioritizes sewer pipe and lift station upgrades to increase sanitary sewer system capacity during wet weather conditions. The hydraulic model should be used to address both structural upgrades and I/I reduction.

3.2.7 Estimate Volume and Rate of Wastewater Flow, Groundwater Infiltration, and RDI/I for each Sewershed and Development of Associated Hydrographs

The calibrated model should be used to estimate the rate of wastewater flow, groundwater infiltration, and RDI/I for each sewershed. For dynamic modeling of separated sewer system, it is always challenging to determine the level of I/I into the system depending on the data availability, load condition, location of assets, and level of maintenance of the collection system components.

After this information is completed, the model should be used to determine if the existing collection system has sufficient capacity to accommodate the design storm event. Problem areas in the collection system with hydraulic limitations should be identified and this information compared with the model results. If the collection system has sufficient capacity, then the existing model should be used for verification.

Incorporation of the performance of lift stations and force mains is also a key element of the hydraulic model.

There are various model simulation scenarios that are typically run, such as current flows; 5-, 10-, 15-, and 20-year flows; ultimate development flows; and failure analysis of critical infrastructure or historical long-term or event storms. The utility should use these scenarios to identify a design condition that presents the most feasible combination of capacity enhancement alternatives.

Model outputs can be presented in a range of graphical and textural outputs. The results should be presented in a report that will describe:

- Methodology for the model.
- Design and operational criteria adopted for the model.
- Assumption used in the model.
- Limitations of the model.
- Verification of model accuracy.
- Results of the modeling, such as pump station operating periods over time, main pressure and velocity over time, and any overflow events.

3.2.8 Model Maintenance

The WCTS often changes; therefore, the future accuracy of the hydraulic model will depend on regular updating, maintenance, and even recalibration to reflect physical changes in the network and the changed flow characteristics of service connections. The model should be updated to include any changes to the system. Model Quality Checklist items include:

- Check model for data discrepancies with GIS
- Check convention discrepancies within model [e.g., Identification (ID) prefix, scenario naming convention]

- Check shutoff head on pump curve
- Check maximum flow on pump curve
- Check network connectivity and identify potential issues:
 - o Orphan nodes and pipes
 - o Parallel pipes
 - o Pipe crossing without connecting
 - o Nodes in close proximity
- Check for redundant and complex controls [programmable logic controller (PLC), controls and initial status]
- Check pump curve matches the latest energy pump test
- Check prefixes that are used to label components
- Check Named View and Bookmarks are added for key components
- Check level data are always relative to bottom elevation
- Check Pump Status = Open → Pump = ON
- Status = Closed → Pump = OFF
- Check Valve Status = Open → Valve = 100 %
- Open (Valve ≠ Active)
- Check demand pattern is added in EPS model
- Check Hazen Williams coefficients are used for force mains
- Check Manning coefficients used for gravity mains (when appropriate)

3.3 Hydraulic Modeling Performance Measures

Performance measures are important management tools that allow for continuous measurement and evaluation of utility activities. Performance measures are designed to collect information that enable the utility to determine if established goals and level of service are being met and if not, what activities need to be adjusted to meet the utility's goals.

The following are examples of KPIs:

KPI	Formula	Definition	Desired Result	Data Interval
Percent of sub-basins modeled	No of sub-basins modeled/ total # sub-basins X 100	Number of sub-basins completed	100% by (Insert date)	Ongoing data collection and modeling
Calibrate and update model annually	(# of times completed/number of years)x100	# of times completed	100%	Annual

3.4 Procedures

The following procedures for the system-wide hydraulic model have been developed to provide guidance for a utility to implement its hydraulic model.

Hydraulic model procedures should include:

- Hydraulic model management
- Effective model management is essential to the success of modeling for planning, decision support, and operation. The following components should be followed for proper management of the model:
 - One manager of the model to ensure the integrity of the base model and new data.
 - Only one master model, which should be a read-only file that is available to users to view.
 - Formal systems to ensure that the master model is up to date and that it reflects changes to the system, including new infrastructure and revised boundaries.
 - Formal systems to ensure efficient and reliable data transfer to and from other service provider information systems, such as GIS.
 - Records of the source and quality of each model component.
 - Each model should have an audit trail to document how the model was built to provide assurance on the quality of the model.
 - Processes should be in place to ensure that tedious, repetitive tasks can be automated, or at least minimized. This allows modelers to allocate more time to the analysis of network performance.
 - Operational and Engineering staff should have ownership of the model.
- Network model list of inputs

A network model requires a wide range of inputs. Inputs for network modeling are listed in table below:

Wastewater Collection and Transport Systems	
Mains	• Pipe diameter (nominal) • Pipe diameter (internal-for circular pipes or height if pipe is not circular) • Length • No. of connections • Material/class • Age • Location • Friction factors • Invert levels • Grade (pipe and manhole) • Sedimentation depth, if applicable
Maintenance Manholes	Location, invert levels, ground levels
Overflow Structures	Location, invert levels, ground levels, operating levels, diameter, volume outfall location

Wastewater Collection and Transport Systems	
Valves	• Type • Diameter • Location • Operational control settings, if applicable
Pumps	• Location • Type • System head curves, including power and efficiency • Performance testing/monitoring data (e.g., flows, suction and discharge pressure, drawdown tests, operating periods) • Operational control settings (e.g., for pump control valves and variable frequency drives) • Start/stop levels for each pump and lead/lag arrangement
Wet/Dry Wells	• Location • Volume, area • Ground level, invert levels
Treatment Plans	• Location • Operating levels • Capacity
Weirs/Flow Diversion Structures	• Type • Location • Physical parameters • Operational control strategies
Storage Basins	• Type • Location • Physical parameters • Volume • Operational control strategies
Spatial Data	• Land Use Plans • Priority Infrastructure Plan • Contour Plans • Infrastructure data for model input

Section 4

Flow and Rainfall Monitoring

Section 4: Flow and Rainfall Monitoring

4.0 Purpose and Goals

A Flow and Rainfall Monitoring Program is a key element in the development and maintenance of a Hydraulic Model and the Sewer Condition Assessment and Rehabilitation Program. The purpose of the System-Wide Flow and Rainfall Monitoring Program is to:

- *Estimate the volume of I/I entering various sewer segments, sewersheds, and drainage basins in the utility's WCTS.*
- *Provide data required for assessment of the capacity of various sewer segments.*
- *Measure or predict the effectiveness of sewer rehabilitation for I/I reduction.*
- *Provide modeling input data for system flow calibration and projections.*
- *Identify sanitary sewer segments requiring more advanced inspections and analysis so that rehabilitation results in I/I reduction and restored capacity.*

The goal of the program is to provide accurate data to assess capacity and I/I issues within the wastewater collection, transmission, and treatment systems.

4.1 Program Resources

Staffing for support of the flow and rainfall monitoring program should be based on the size of the wastewater collection system and method of flow and rainfall monitoring that is used by the utility (in-house or outside contractor). The following types of staff are typical for maintaining a flow and rainfall monitoring program:

- Flow and rainfall monitoring program or project manager
- Data analyst
- Flow monitoring technicians (If done in-house)

The following types of equipment are typical for maintaining a flow and rainfall monitoring program that is conducted with in-house staff:

- Permanent and temporary flow monitors with remote interrogation capability and software
- Spare parts and batteries
- Rain gauges
- Confined space entry equipment
- Service vehicles

4.2 Program Activities

4.2.1 Program Overview

A Flow and Rainfall Monitoring Program is a process for measurement and analyses of the wastewater system's flow, capacity, and rainfall. The program should include a description of the following items:

- Criteria used to identify locations of permanent and temporary flow and rainfall monitoring equipment
- A map showing permanent and temporary flow monitoring and rainfall monitoring sites
- A description of the computer-based data management system used to organize, store, analyze, and report flow and rainfall
- A description of the types of analyses performed by the utility
- A description of the quality assurance and quality control (QA/QC) process the utility follows to provide flow and rainfall data accuracy and reliability

4.3 Flow and Rainfall Monitoring Program

Flow monitors are used to track wastewater flow trends and aid in determining the total volume and rate of I/I entering the collection system upstream of the flow monitor. Flow monitoring should also be conducted at major pump stations and wastewater treatment facilities.

Data from rain gauges and flow monitors should be used to identify dry and wet-weather periods and in analyses to identify sewer segment with excessive Rainfall Derived Infiltration and Inflow (RDI/I).

Maintenance of flow meters should be conducted as indicated by trends in the data. Calibration should be conducted on a quarterly basis or anytime a significant change is seen in the data. Data recording of permanent flow meters, and rain gauges should be conducted simultaneously and continuously.

4.3.1 Activities

The following activities are typical for a flow and rainfall monitoring program (in-house or outside contract):

- Installation or removal of equipment: Equipment generally consists of flow meters, digital Doppler velocity sensors, wireless data acquisition Remote Terminal Unit (RTU), modems, battery/solar power option, rain gauges, and software.
- Relocation of metering site: Relocation should be done as determined by the program or project manager.
- Maintenance of hardware: Maintenance of hardware at each location should be conducted once a month and should consist of scrubbing the sensor, connecting with a computer and activating the sensor to verify proper operation, and comparing level of flow (per

instructions in scope of work: if the two readings are within 0.25 inches, then the level does not need to be calibrated). In addition, the velocity should be measured using secondary devices. Calibration readings, both manual and monitor firings, should be recorded and the physical location quality checked.

- Calibration and confirmation of all flow monitors.
- Daily QA/QC check of data.
- Processing of the data and production of monthly reports, which includes tabular data representation and hydrographs, data analysis, flow calculations, I/I, flow capacity, and flow reduction.
- Web-hosting of data.
- Software: Software is used to calibrate equipment and manage data.

4.3.2 Criteria for Establishing Location of Equipment

4.3.2.1 Flow Monitors

Depending on data requirements, there are typically two types of flow monitors that can be used, permanent and temporary. Permanent meters provide system information over a long time period and produce long-term monitoring data that can be used to provide historical trending. Temporary meters provide data as a “snapshot” in time and are especially helpful for determining pre- and post-rehabilitation conditions.

The number of flow monitoring locations is generally dependent on the size of the system and the configuration of the sewer sheds. Geographical Information System (GIS) maps should be reviewed and site conditions evaluated to determine where flow meters should be placed. The following are suggested locations within a wastewater collection system:

- Sub-basin discharge points
- Wastewater treatment plants
- Connections with other jurisdictions
- Historic SSO locations
- Isolation points upstream of the meter (for the purposes of determining I/I)
- Pump/lift stations

The following criteria are recommended for consideration when selecting flow meter types at specific locations:

- Pipe size
- Flow range
- Hydraulic conditions
- Telemetry method

- Operating principle
- Accuracy
- Duration
- Data management
- Cost

4.3.2.2 Rain Gauges

Rain gauges measure rainfall intensity and amount storms throughout the monitoring period. This data is then used in conjunction with flow monitoring data to evaluate of RDI/I and wet weather capacity of the tributary collection system. Rainfall data should be synchronized with flow monitoring data.

The number and location of rain gauges should be adequate to provide representative rainfall data for the areas where flow monitors are installed. No less than two rain gauges should be placed, regardless of the size of the basin being monitored, to provide redundancy should one gauge experience problems during the study. General guidelines are to place rain gauges equaling 10% of the total number of flow monitors. A higher density of rain gauges is typically used in development of hydraulic models.

4.3.2.3 Computer-Based Data Management System

It is recommended that the flow and rainfall monitoring system include the ability to relay data from the flow and rainfall monitors to the utility's computer system or if an outside contractor is used, the utility should have the ability to access the contractor's website to view and download the data.

4.3.2.4 Analysis of Monitoring Data

Flow monitor and rain gauge data should be used to estimate the amount of I/I entering the WCTS. The data should also be used in conjunction with the hydraulic model to assess capacity availability in the sewer system and to prioritize upgrades and rehabilitation to provide additional capacity, as needed. In addition, flow monitoring data should be used in the development and utilization of the hydraulic model.

The flow and rainfall monitoring data should be used to:

- Establish baseline flow quantities.
- Estimate the volume of I/I entering various sewer segments/sewersheds.
- Assess capacity availability in various sewer segments (in conjunction with the hydraulic model for capacity assessment).
- Prioritize sanitary sewers requiring rehabilitation.
- Evaluate the effectiveness of rehabilitation.

Flow hydrographs, depth, and velocity data plots should be used to review the consistency and reliability of the measured data under dry and wet-weather conditions. Data analyses should be used to determine meter response to rainfall events including the magnitude of peak flows, shape of hydrographs, and pattern between wet-weather response and the total rainfall. The analyses should be used to establish the hydraulic pattern at a specific meter site based on depth and velocity relationships and to identify any inconsistent behavior during various rainfall events.

A Flow Monitoring Program Report should be completed on a monthly basis for each meter and should include the following information:

- Purpose of flow monitoring, location, and type of flow monitor
- Dry weather analysis (including calculated base flows and diurnal patterns)
- Wet weather analysis (including locations impacted by I/I)
- Tables and figures necessary to explain the results and findings
- Conclusions and recommendations
- Hydrographs and tabular data for each monitor for the monitoring period
- Frequency of flow meter inspection, service, and calibration.
- Frequency of downloading flow monitoring data
- Base groundwater infiltration
- RDI/I
- Surcharged Pipes
- Capacity restrictions
- SSOs

Performance trends should be evaluated to identify areas where internal inspections or smoke testing should be conducted to identify potential sources of RDI/I.

4.3.2.5 Rainfall Data Analysis

Multiple rain events of varying intensities should be monitored to accurately assess the RDI/I response for each event. Information obtained during the monitoring period can be used to determine the following:

- Dry Weather Average Daily Flow and Peak Flow
- Wet Weather Average Daily Flow and Peak Flow
- Peak inflow rates
- Total RDI/I volume

4.3.2.6 Quality Assurance and Quality Control

To maintain the monitors in proper operation, the QA/QC should include procedures to demonstrate that readings produced by the monitors can be validated. The lack of proper

QA/QC procedures, limited onsite data reviews, and lack of proper and detailed field verifications often results in lower-quality data as well as data losses. Therefore, QA/QC checks should be performed throughout the program.

4.3.2.7 Site Inspections and Maintenance

Field verification is an important activity in collecting accurate data and assuring minimum loss of data due to malfunctioning equipment or accumulation of debris at the monitoring site. Meter maintenance is very site dependent. Some sites require minimal maintenance visits, while others are continually affected by silt and debris buildup. Field visits for telemetered sites should be conducted monthly or more frequently when indicated by analysis of the data indicates sensor fouling or other performance issues. Meter sites without telemetry should be visited weekly to prevent data loss and to protect data integrity.

Meter accuracy must be confirmed onsite with measurements taken with an independent device. Initial confirmation of the equipment as set-up is essential, with additional confirmations being made when a hydraulic shift in the data occurs. No less than two valid confirmations should be recorded for each long-term monitoring site each year.

4.3.3 Flow and Rainfall Monitoring Performance Measures

Performance measures are important management tools that allow for continuous measurement and evaluation of program activities. Performance measures should be designed to collect information that enable a utility to determine if established goals and level of service are being met and if not, what activities need to be adjusted to meet program goals.

The following are examples KPIs:

KPI	Formula	Definition	Desired Result	Data Interval	Utility Group
Ratio of Peak Daily Flow to Average Daily Flow	Peak Daily Flow, MG / Average Daily Flow, MG	Ratio of the peak daily flow from the wastewater collection system to the average daily flow from the wastewater collection system.	3.0 Maximum	Annual, based on 3-year average daily flow	
% of Flow Monitoring	# miles Monitored (>8") X 100 / Total Miles (>8")	Miles of flow monitoring to use for capacity and spill prevention	Variable	Annual	
Measure Dry Weather Capacity vs. Planned Capacity	Value	Ratio of dry weather capacity versus planned capacity	1	Annual	
Measure Wet	Value	Ratio of wet	1	Annual	

KPI	Formula	Definition	Desired Result	Data Interval	Utility Group
Weather Capacity vs. Planned Capacity		weather capacity versus planned capacity			

4.3.4 Program Procedures

Procedures for the Flow and Rainfall Monitoring Program should be developed to provide consistency and accuracy in the data results.

System-Wide Flow and Rainfall Monitoring Program procedures are provided in Appendix A and include:

- Flow Monitoring Site Inspection
- Rain Gauge Site Inspection
- Flow Monitor Installation
- Rain Gauge Installation
- Site Acceptance
- Flow Monitor Maintenance
- Rain Gauge Maintenance
- Data Analysis and Reports
- Sample of Calibration Form for Flow Meter
- Sample of Flow Data Analysis Report

Section 5

FOG Management Program

Section 5: FOG Management Program

5.0 Purpose and Goals

The purpose of a FOG Management Program is to:

- Provide necessary resources and training to sustain the program
- Develop and enforce grease trap and interceptor design standards
- Review and approve new grease traps, oil water separators and dumpster traps
- Regularly inspect grease traps, oil water interceptors, and dumpster traps for permitted entities
- Maintain a current inventory of Food Service Establishments (FSEs), car washes, automotive repair shops, and other entities that discharge FOG. For the purposes of this guidance section, these will be designated as Discharging Entities (DE)
- Establish FOG Best Management Practices (BMPs)
- Provide a fair and credible enforcement component
- Administer a public education program for residential sources of FOG
- Keep FOG data current in the CMMS

The goal of a FOG Management Program is to:

- Minimize FOG from entering the sanitary sewer system in concentrations or rates that exceed those established by the utility
- Preserve sewer capacity by minimizing FOG-related flow obstructions
- Reduce or eliminate SSOs caused by FOG-related flow obstructions
- Prevent FOG-related maintenance and operational issues associated with sanitary sewer infrastructure
- Reduce operational and maintenance costs

5.1 Program Resources

5.1.1 Staff

The staffing required for the utility's FOG Program should be based on the number and types of facilities, such as FSEs, car washes, and automotive repair shops, served by the collection system and the inspection schedules for these facilities. The following are suggested positions for the FOG Program:

- FOG Program Manager: Responsible for overall program coordination and oversight
- Regulatory Compliance Supervisor: Direct responsibility for FOG Program management and operation. Reviews work assignments and performance measures to ensure that the program maintains resources and interdepartmental relationships.

- Plan Reviewers: Responsible for review and approval of new grease traps, oil water separators, and dumpster traps.
- Regulatory Compliance Inspectors: Perform daily inspections and onsite FOG evaluations related to infrastructure and/or SSOs.
- Administrative Assistant: Manages invoicing, FOG Program customer service, and administration related to permits and data entry.

The following are suggested resources and equipment that should be provided to inspection personnel. (Additional information is included in the “Equipment List for FOG Management Program” form in Appendix C):

- Utility Identification (ID)
- Utility Inspection Sheets
- Assigned DE list
- Geographic Information System (GIS) maps and/or GPS unit
- Manufacturer's Drawings (for the type of grease removal device to be inspected)
- BMP List and Brochures (for handing out to DEs)
- Sewer Use Ordinance
- Enforcement Response Plan
- List of Georgia state-permitted waste transporters
- Manhole cover lift/hook
- Pole/digital camera
- Cell phone
- Sludge Judge and/or Depth Probe
- Mirror on a pole and flashlight (for looking inside manholes and interceptors)
- Thermometer
- Utility vehicle
- Field tablets/laptops integrated with related utility software as needed

5.2 Program Activities

5.2.1 Program Overview

The FOG Management Program should include a comprehensive system of administrative, management, regulatory oversight, and documentation activities. The Program should include a description of each program element and procedures for inspection and compliance with utility design and construction standards.

The following are suggested elements for a utility FOG Management Program:

- FOG Ordinance

- FOG Wastewater Discharge Permitting
- Interceptor Standards, Maintenance and Records, and Spill Notification
- BMPs for FSEs
- FSEs Inspection and Enforcement Procedures
- Data Management and Analysis Procedures
- Public Education Program for Residential Dischargers of FOG
- A description of the FOG Management Program, including but not limited to a summary of the extent of DEs and the utility inspections protocols including the frequencies and priorities of inspections
- A method for evaluating and determining the adequacy of the number of personnel and other resources needed to implement the FOG Management Program
- Written standard operating procedures, including procedures for identifying and permitting existing and new unpermitted facilities
- KPIs for tracking and documenting the performance and effectiveness of the FOG Management Program
- Data attributes for the Sewer Mapping Program to allow the FOG Management Program data to be compared in the utility's CMMS with other pertinent data such as the occurrence of SSOs and permit violations
- Training program to increase communication efficiency between sewer system operations and maintenance personnel and FOG Management Program personnel

SSOs are a major concern of wastewater agencies across the country. SSOs can occur due to individual or the synergistic interaction of multiple agents such as FOG, roots, infrastructure defects, or extraneous flows. Sewers are designed to carry FOG but there are many variables that can alter the initial design conveyance capacity of the sewer if sewer maintenance or FOG management are deficient. Although utilities across the United States differ on how FOG contributes to SSOs, it is widely reported that FOG can be the most frequent sole or contributory cause of SSO events. Reports also indicate wet weather infiltration/inflow (I/I) may be a less frequent SSO cause but it can be the greatest SSO volume impacting source.

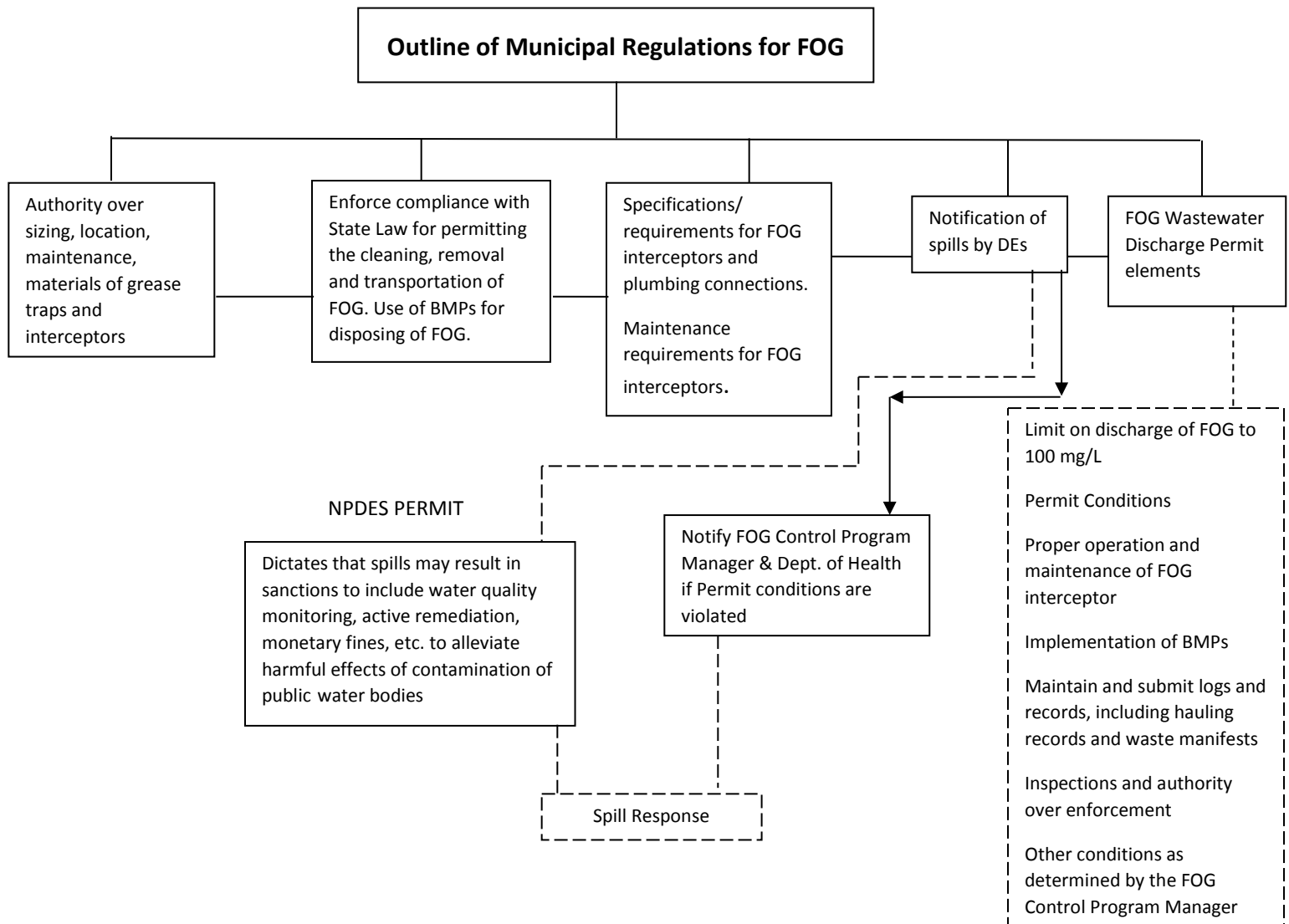
The “root cause” of SSOs is difficult to accurately assess, therefore, national reporting data on the extent of FOG being the source of SSOs should be considered with the understanding that methods of identifying the root cause will vary from surface level visual inspection to internal pipe Closed Circuit Television (CCTV). However, regardless of FOG’s actual percentage of direct or indirect causative impact on SSOs, it is good practice to manage its introduction into the sewer system, including utilization of FOG regulatory measures, especially downstream of heavy grease producing locations such as DEs or localized areas of residential housing.

5.2.2 FOG Ordinance

FOG regulations should be adopted by the municipality to include FOG grease trap and interceptor standards; legal authority for permitting, inspecting, and enforcement; and required maintenance and BMPs.

Suggested FOG regulations elements are summarized in Figure 5-1.

FIGURE 5-1: OVERVIEW OF FOG REGULATIONS



5.2.3 FOG Wastewater Discharge Permitting

FOG Regulations provide the legal authority to permit facilities that discharge FOG into the sewer system. DEs that propose to or are currently discharging wastewater with FOG into the utility sewer system should be required to obtain an annual FOG wastewater discharge permit. The FOG wastewater permit should be issued under the following conditions:

- Receipt of a complete application
- Compliance with the utility FOG Regulations
- Compliance with applicable provisions of the utility's Code of Ordinances
- Proper installation and maintenance of a FOG interceptor

All identified DEs should submit a Wastewater Discharge Permit Application Form for evaluation, which results in a field inspection, a plan and specifications review, and a completed Inspection Sheet Form by a Compliance Inspector. Upon satisfactory completion of the inspection and the payment of the applicable fees, a FOG Wastewater Discharge Permit should be issued to the DE for a period of twelve (12) months, renewable annually. The following documents are generally applicable regarding the permit application process:

- DE Wastewater Discharge Permit Application Form
- FOG Wastewater Discharge Permit
- Permit Fee Schedule
- Annual Renewal/ Invoice Fee for FOG Discharge Permit

In addition, when the owner of a new DE applies for a business license or the owner of an existing DE applies for a building permit for facility expansion, a copy of the application should be submitted to the FOG Control Program Manager.

A designated Compliance Inspector (CI) should review the submitted plans, visit the site, and deliver an Evaluation Report with the required size of grease trap, oil water separator, or dumpster trap to the DE. The following documents should be used to size traps and interceptors:

- Interceptor Sizing Form A – interceptors (exterior)
- Interceptor Sizing Form B – traps (i.e., interior interceptors)
- Interceptor Sizing Signature Form

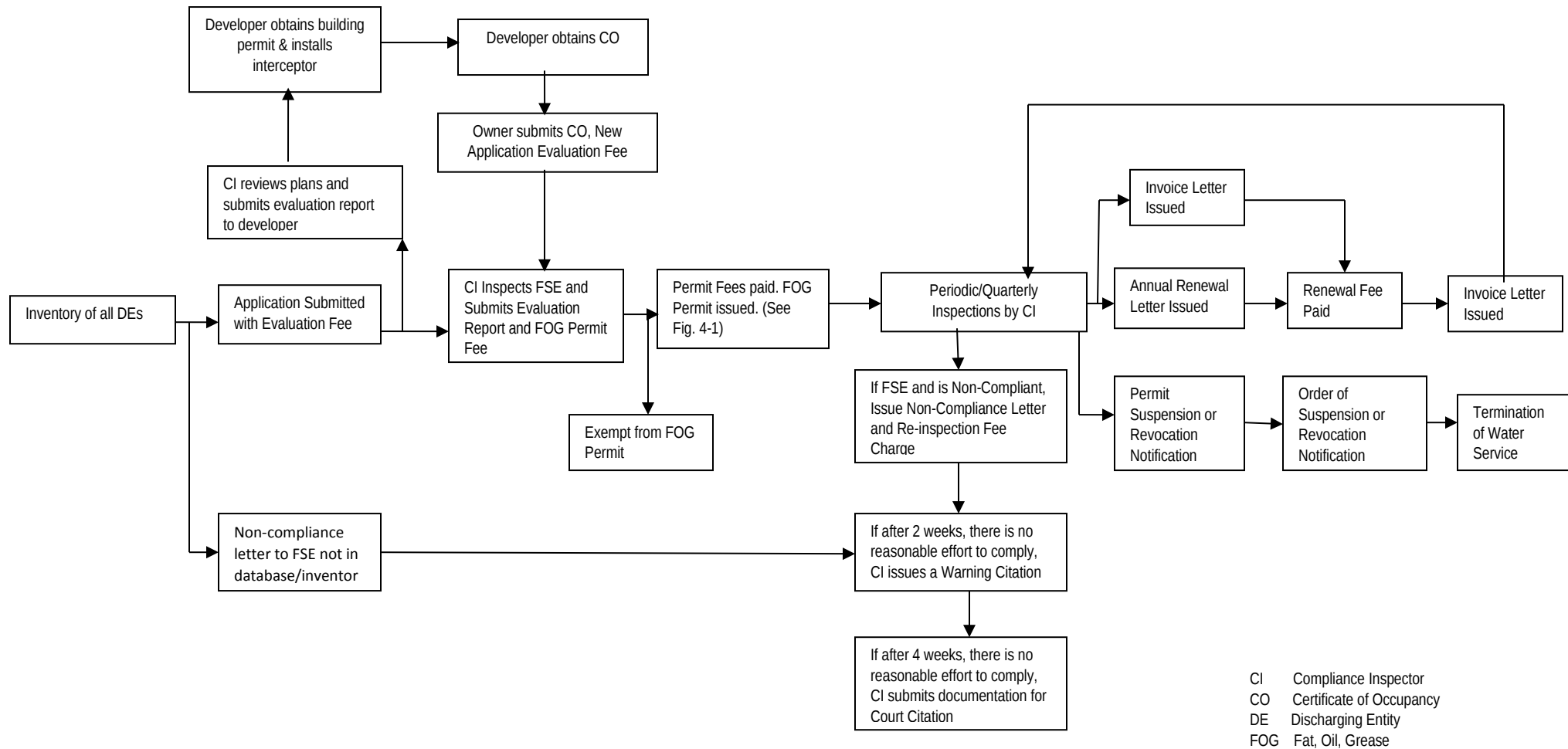
The DE should then obtain a building permit, submit trap or interceptor design plans and specifications for approval, and install the trap or interceptor. The Compliance Inspector should then visit the DE and inspect the installation of, and the plumbing to, the trap or interceptor. At the time of the inspection, the Compliance Inspector should also conduct a review of the utility's FOG regulations including, but not limited to, the following:

- FOG Wastewater Discharge Permit and inspection process
- Guidelines for FOG control (BMPs) and prohibitions
- Trap and interceptor maintenance frequencies
- FOG manifest recordkeeping requirements
- Use of Georgia state permitted waste transporters
- Enforcement schedule

An issued FOG Wastewater Discharge Permit and fees should be non-transferable, should be for a specific operation, and should not create any vested rights. A FOG Wastewater Discharge Permit should be subject to conditions or limits which may be reasonably applicable to ensure compliance with the utility FOG Regulations. The FOG Control Program Manager may modify the terms and conditions of an issued FOG Wastewater Discharge Permit, if a modification is required to comply with the utility FOG Regulations or the requirements of regulatory agencies. A DE may also request a modification to the terms and conditions of an issued FOG Wastewater Discharge Permit by submitting a written request with the reasons for that change. The FOG Control Program Manager should review and make a determination on the request within thirty (30) days of receipt of that request.

The inspection and permit cycle of actions is summarized in Figure 5-2.

**FIGURE 5-2:
Overview of FOG Program Application, Inspection, and Permit Process**



5.2.4 Interceptor Standards, Maintenance and Records, and Spill Notification

The utility should have the authority to establish design requirements and standards for the installation of new appurtenances and connections to the collection system, along with procedures for inspecting and testing new installations. Interceptors or separators should be approved in writing by the utility and located for easy inspection. Expenses of installation and maintenance should be borne by its owner, and interceptors and separators should not be required for private living quarters. All DEs should install an adequately sized grease trap or interceptor before a FOG Wastewater Discharge Permit is issued.

5.2.4.1 Standards

The utility's FOG Regulations should regulate how the grease trap/interceptor is to be plumbed and provide minimum physical specifications and requirements for traps and interceptors. Key provisions of these Sections include, but are not limited to, the following:

- FOG interceptors shall be connected to the DE's lateral line
- FOG interceptors shall not be connected to septic tanks
- The minimum permitted size for an exterior FOG interceptor is 1,000 gallons in capacity
- Interior FOG interceptors shall be a minimum of 100 pounds in capacity and made of corrosion-resistant coated metal
- FOG interceptors shall be properly sized based on the results of an inspection and FOG evaluation
- FOG interceptors shall have at least 30-minute interior retention time before grey water is discharged into the sewer system
- FOG interceptors shall have a temperature discharge not in excess of 140 degrees Fahrenheit
- FOG interceptors shall be Plumbing Drainage Institute rated, accessible for inspection, and installed by a licensed plumber in accordance with manufacturer specifications

Additional information based on industry standards for grease trap and interceptor design may be found at the following:

- Georgia FOG Alliance (<http://www.georgiafog.com/>)
- The Plumbing and Drainage Institute's Standard PDI-G 101, Testing and Rating Procedure for Type 1 Hydro Mechanical Grease Interceptors with Appendix of Installation and Maintenance, March 2010 or latest version (<http://www.pdionline.org/publications.htm>).
- Manufacturers of grease removal equipment

5.2.4.2 Maintenance and Records

The utility FOG Regulations should establish maintenance requirements for new and existing DEs. A Georgia State Permitted transporter or licensed plumber should perform all

maintenance of FOG interceptors and should be required to leave a copy of the FOG Manifest with the DE.

Maintenance requirements should specify that the depth of FOG in the FOG interceptor should not be equal to or greater than 20% of the total operating depth of the interceptor. Proper maintenance includes removal of sludge, floating materials, solids, and wastewater, and scraping of excessive solids from walls, floor, baffles, and pipes when pumping interior and exterior FOG interceptors. All waste removed from each FOG interceptor should be disposed of at an authorized disposal facility designed to receive such waste.

Maintenance scheduling may vary depending on individual circumstances. Compliance Inspectors should have the authority to change a FOG interceptor's cleaning schedule at any time. All DEs should be required to maintain records of the date and time of all cleaning and maintenance activities. Each FOG interceptor's FOG Manifest should be maintained in a book that is available on demand to Compliance Inspectors for inspection. Records should be kept available on site for a minimum of three years.

In addition, records of BMPs, employee training, spills, cleaning of lateral sewer lines, and sampling data and sludge height monitoring must be maintained by each DE.

5.2.4.3 Spill Notification

In the event that a DE is unable to comply with any permit condition due to breakdown of equipment, accidents, or human error or if the DE should have reasonable opportunity to know that its discharge could exceed provisions of the FOG Wastewater Discharge Permit and potentially result in a spill, the DE should be required to immediately notify the FOG Control Program Manager or designee. Notification should be made by telephone.

In addition, written notification of the oral notification should be provided no later than five working days from the date of the incident. Written notification should include date of the incident, reasons for the spill, steps taken to correct the problem, and steps taken to prevent the problem from recurring. Notification should not relieve the DE of any expense, loss, damage, or liability incurred as a result of damage or loss to the utility or any other damage loss to a person or property. Notification also does not relieve the DE of payment of any fees or imposition of other liability authorized by the utility's FOG Regulations or other applicable law.

5.2.4.4 Best Management Practices for Food Service Establishments

The utility's FOG Regulations should require proper disposal of FOG using BMPs. Specific BMPs regarding handling, storage, and disposal of FOG should be provided in the utility's FOG Regulations. Prohibited practices include pouring FOG down the drain, putting food scraps down the drain, or running hot water over cooking implements, dishes, and pans to rinse FOG down the drain.

In addition, the FOG Management Program should reduce FOG discharge loading into the sewer system by educating DEs on BMPs, which help reduce FOG entering the grease trap or

interceptor. BMPs include the prohibition of certain practices, good housekeeping tips and pollution prevention, operation and maintenance procedures, and other practices established by DE management.

A DE FOG management education campaign should include:

- A checklist of BMPs with the DE Wastewater Discharge Permit
- Providing posters/kitchen signage on BMPs and waste minimization practices
- Including a BMP checklist with the DE Inspection Sheet for Compliance Inspectors to use
- Witnessing kitchens practices performed by DE employees during inspection
- Dispensing of educational brochures (e.g., posters and brochures on proper grease management practices) to DEs
- Providing communications in multiple languages
- Reinforcing that specific BMPs are mandated by the FOG Regulations

A checklist of BMPs should be provided with the DE Discharge Permit and DE Inspection Checklist used during inspections. A BMP Checklist should be provided as an attachment to the Routine DE Inspections procedure in **Appendix C, FOG Program Procedures**.

5.2.4.5 Food Service Establishment Inspection and Enforcement

The utility's FOG Regulations should provide the legal authority to inspect DEs and enforce the provisions of the regulations.

5.2.4.6 FOG Management Program Compliance Inspectors

Compliance Inspectors should perform duties related to the FOG Management Program, which include: permitting DEs, inspecting grease traps and interceptors at DEs, confirming appropriate sizing and installation of traps and interceptors for new DEs, inspection and sampling of traps and interceptors, checking FOG manifests to confirm maintenance and documentation meets Georgia permitted waste transporters requirements, noncompliance enforcement, and program tracking and reporting.

Other responsibilities should include reviewing new applications, updating FOG/DE data, documenting follow-up actions, issuing enforcement actions, communicating with other departments and agencies, planning inspections, attending training, and other miscellaneous administrative duties.

Compliance Inspectors should also provide educational material to DE's employees on the proper operation and maintenance of traps and interceptors, BMPs, and the purpose and importance of the FOG Management Program.

Compliance Inspectors should maintain a "Daily Log" that records the number of DE inspections per day with monthly totals, and daily totals for all inspectors.

The FOG Management Program staff should be trained and refreshed on the utility's latest design and installation standards for FOG traps and interceptors, protocols for sizing and permitting, and procedures for inspecting new installations. Training enables program activities be performed consistently and efficiently, helps improve technical and legal sufficiency, and reduces liability. New inspectors should be required to train with experienced Compliance Inspectors.

The following local training should be made available to Compliance Inspectors:

- Georgia FOG Alliance's Conference and meetings for peer support
- Manufacturers of grease removal equipment
- Customer service
- Time management skills
- Microsoft Excel® and Word®
- Training related to any utility-specific software utilized as part of the FOG Management Program

Additional training may be found on-line:

- Water Environment Federation (WEF) FOG Management Training Course (<http://www.wef.org/>)
- Georgia F.O.G. Alliance (<http://www.georgiafog.com/homepage>)
- Georgia Association of Water Professionals Committees

5.2.5.7 General Inspections

An inspection program should be established to ensure that DEs are complying with the requirements of the utility's FOG Regulations and its FOG Wastewater Discharge Permit.

Overflow data and maintenance records should be used to identify watersheds and DEs where a higher percentage of the SSOs and/or sewer blockages occur due to FOG. The FOG Management Inspection Program should include priority inspections of the identified areas and DEs.

The utility's FOG Regulations should include provisions for the utility to inspect and have the right of entry to DEs on an unscheduled and unannounced basis and/or on a scheduled basis. Inspection of DEs includes all fixtures, equipment, food processing, and storage areas, as well as a review of the processes that produce wastewater discharge through the FOG interceptor. Deficiencies should be noted during inspections and include, but are not limited to, the following:

- Failure to report changes in operations or wastewater constituents and characteristics
- Failure to properly maintain the FOG interceptor

- Failure to maintain logs, files, records, or access for inspection or monitoring activities
- Failure to obtain or renew FOG discharge permits in a timely manner
- Any other violations of the utility's FOG Regulations or law that requires correction by the DE

Inspections should also include grease traps or interceptors, trap maintenance logs, and manifests of grease recyclers and traps and interceptors waste haulers. On completion of an inspection, the inspector should note any deficiencies and the required correction. These deficiencies should be discussed with the DE and a copy of the signed DE Inspection Sheet should be provided to the DE owner.

A thorough inspection requires opening FOG traps, interceptors, manholes, and cleanouts. Cameras are useful for documenting conditions at a DE. Photographs are also invaluable for the enforcement component of the program.

DEs should be tracked on spreadsheets within the utility tracking software or other forms, to include address, name, street, city, zip code, phone, permit number, original issue date, renewal due date, renewal amount, evaluation fee, date paid, and form of payment, amount paid, inspection dates, size, upgrade, violation, last haul, hauler, inspector initials and name, phone numbers, area designation, GIS and coordinates, and billing information. This information should also be integrated with the utility's ArcGIS and CMMS where possible.

Written procedures for New DE Inspections and Routine DE Inspections are provided in **Appendix C, FOG Program Procedures**.

5.2.4.8 Waste Material Removal

DEs should ensure that all waste material removed from FOG traps and interceptors is disposed of in a manner that complies with all federal, state, and local statutes, rules, regulations, policies, and ordinances. GAEPD approves and certifies waste transporters to properly remove and dispose of the collected FOG. The Georgia FOG Alliance (<http://www.georgiafog.com/>) maintains an updated list of commercial waste transporters registered with GAEPD. Commercial waste transporters must register with GAEPD every two years.

DEs are responsible for the proper cleaning of the FOG interceptor waste by a Georgia state permitted waste transporter and for maintaining records of disposal. Interceptors must be cleaned at least once every 90 days and/or when grease and settled solids layers in the interceptor reaches 20% of the liquid depth of the trap. Interior grease traps must be cleaned at least once every 30 days. To be properly cleaned, the entire contents of the trap or interceptor, including the grease and scum layer, the liquid, and the settled solids, must be thoroughly removed. Interceptors should be inspected by the Compliance Inspector even if recently cleaned, to confirm FOG Manifest documentation and proper cleaning by the waste hauler.

Suspicious activities by the waste hauler found by the Compliance Inspector should be confirmed and reported to GAEPD.

DEs and the utility are responsible for verifying that waste material removed from FOG traps and interceptors is disposed of in a manner that complies with the requirements of the utility's FOG Regulations. DEs should have the contract and FOG Manifests available on site for inspection by the Compliance Inspector. Compliance Inspectors should check that the FOG Manifest is complete and it proves delivery by the transporter to an authorized disposal or processing facility. FOG Manifests should be available for inspection for a period of three (3) years.

In addition, the following activities are recommended for inclusion in the FOG Regulations to enhance the FOG Manifest recordkeeping practices:

- Waste hauler should sign the transporter portion of the FOG Manifest and leave a copy of the manifest with the owner or user of the FOG trap and/or interceptor.
- FOG Manifest should be presented to the disposal operator to complete and sign the disposal section, and leave one copy of the manifest with the disposal site operator.
- Completed copy of the FOG Manifest should be sent to the owner or user of the FOG trap and/or interceptor with the signature of the disposal site operator within two weeks.
- Completed copy of the FOG Manifest should be sent to the FOG Program Manager within two weeks.
- FOG Manifest should contain all the information required on the State standardized manifest form.
- FOG manifests should be logged, tracked, and filed for efficient referencing

5.2.4.9 Enforcement

To be fully effective, the FOG Management Program should include credible enforcement authority provided by the Municipality's Code of Ordinance. The Code of Ordinances should provide for enforcement measures for non-compliance with FOG Regulations and/or DE Wastewater Discharge Permits. The following is recommended for inclusion in the utility's FOG Regulations regarding enforcement measures and procedures:

- Non-compliance fees, letters, and schedules (includes procedures and rules for re-inspection fee, non-compliance letters, compliance schedule, and fees)
- Permit Suspension and Revocation (includes procedures and rules for permit suspension and revocation, notification, damage to facilities or interruption of normal operations of the sewer system, termination of water service to the DE, emergency suspension order, and emergency suspension hearing)
- Criminal Penalties

The FOG Management Program should include a framework for identifying noncompliance and guiding inspectors on initiating enforcement.

Enforcement is critical in assisting non-compliant DEs to reach compliance. Immediately after an inspection, the DE should receive a copy of the signed Inspection Sheet from the Compliance Inspector. If the DE is in non-compliance, the FOG Control Program Manager should send a Letter of Non-Compliance by certified mail to the DE stating the deficiency, Re-inspection Fee/ Non-Compliance Fee, and a timeframe for responding.

The following are suggested form letters to be used for enforcement use:

- Annual FOG Discharge Permit Expiration
- Non-Compliance with FOG Wastewater Discharge Permit Requirement
- Non-Compliance with the utility's FOG Regulations by Inspection

If the DE continues to be in non-compliance two (2) weeks after being issued a Letter of Non-Compliance, the inspector should give the DE a Warning Citation, which can lead to a Court Citation if the DE continues in non-compliance four (4) weeks after being issued a Warning Citation. Should DEs continue to be in non-compliance, stricter enforcement measures and penalties should be applied in accordance with the utility's FOG Regulations.

5.2.4.10 Data Management and Analysis

5.2.4.10.1 Data and Records

Maintaining accurate records of all activities related to controlling FOG discharges from DEs is essential for a successful program. In order to facilitate the recordkeeping process and to provide easy access to the compiled information, databases should be created. Spreadsheets or other formats should be used in the FOG Management Program to include DE listings and DE inspections and records of action.

A list of FOG dischargers (i.e., DEs) is necessary to focus outreach efforts, issue permits, and monitor compliance with the utility's FOG Regulations. Compliance Inspectors can utilize existing records to identify DEs, including business license office, building permit office, Department of Health, Department of Agriculture, inspection, and voluntary information from DEs. This database can also assist with identification of DEs with expired FOG Wastewater Discharge permits.

A written procedure for Identifying Unpermitted DEs and Permitted DEs not in Compliance is provided in **Appendix C, FOG Program Procedures**.

Identification of "hot spot" areas where the utility experiences frequent sewer maintenance problems should be coordinated with the utility's Operations and Maintenance Staff to provide a focus on areas requiring further evaluation of the effectiveness of existing FOG controls and identification of any unpermitted DE or DE that has changed its procedures or menu.

A comprehensive database software system is recommended for efficient organization, evaluation, and response to the FOG data collected by the Compliance Inspectors. The database should include:

- Automatic DE inspection scheduling and permit renewal alerts
- Identification of non-compliance
- Access to historical information on the DE, such as permit issue date, permit fee pay date, and inspector's notes, for better communication and service to DE
- DE hours of operation and other DE attributes (e.g., name, location, owner, contact information, compliance status, size(s) of grease trap(s) and interceptor(s), etc.)
- Generation of mailings with DE contact information and utility standard form letters
- List of approved FOG waste haulers
- Tracking waste haulers and FOG Manifests
- Efficient filtering, sorting, and reporting for tracking and documenting the performance and effectiveness of the FOG Management Program

Written procedures for DE Inspection Schedule Assignment are provided in **Appendix C, FOG Program Procedures**.

5.2.4.11 Integration with Computerized Maintenance Management Systems

The databases used by the FOG Management Program should be compatible with the utility's CMMS and ArcGIS to allow for data sharing to increase communication and to provide a consistent focus on the goal of eliminating SSOs.

Identification of DEs that are non-compliant with their Wastewater Discharge Permits or the utility's FOG Regulations should be provided to the utility's Maintenance Division for evaluation and scheduling of sewer inspection and cleaning. Sewer lines downstream of these DEs may be subject to an increased potential of FOG related blockages. Cleaning and CCTV activities in these areas should be scheduled more frequently until impacts are determined.

5.2.4.12 FOG-Related Spill Analysis

Utility Operations and Maintenance staff should notify the FOG Program Manager of blockages or SSOs. A FOG Program Compliance Inspector should accompany Maintenance staff to the affected area to investigate the apparent cause of the blockage or overflow. When a SSO or blockage is determined to be FOG related, a FOG Program Compliance Inspector should inspect the DEs and grease traps in the affected area and review their FOG Manifests. Notification procedures between Maintenance staff and the FOG Program staff is essential to controlling FOG discharges.

Immediate inspections of DEs and sewer lines downstream and within approximately 1,500 to 2,000 linear feet of an SSO are important to help determine whether the root cause of the SSO was solely grease or a grease accumulation due to a structural or maintenance defect. Videos

from CCTV cameras can be invaluable to confirm the root cause and need for increased DE inspection.

After a SSO investigation, data related to the overflow (including GPS coordinates) should be used for analysis of potential causes of the SSO. The locations of the sewer “hot spots” should be overlaid with DE locations, to assist in identifying potential problem DEs or possible sewer system deficiencies.

Meetings of relevant utility staff should be held at fixed intervals to discuss the overflow occurrences and the spill data analysis and strategies for reduction. Analysis should include mapping and plotting variables such as pipe size, rainfall, sewershed, drainage basin, cause, etc., reviewing GIS information, field data, and potential impacts due to grease contributors.

5.2.5 Public Education Program for Residential Dischargers of Fats, Oil, and Grease

It is recognized that public education is a critical component of an effective FOG Management Program.

Information may be provided on the utility’s website, on FOG interceptors, permits, public education, and inspector activities.

Annual public education campaigns should be implemented by the utility and should include the following activities:

- Distribution of educational brochures at municipal facilities and other utility events (e.g., WEF brochure "Fat Free Sewers" on proper grease management practices at municipal bill payment locations and street fairs)
- Issuing periodic public service announcements (e.g., local newspapers, utility web site, radio morning shows) prior to pending holidays to remind residents of proper grease management practices
- Mailing of educational brochures to apartment complexes (e.g., FOG letter, “Fat Free Sewers” brochure) subsequent to finding FOG immediately downstream of apartment connection
- FOG door hangers distributed to homes on block upstream of discovered FOG build up in sewers
- Mailing of educational brochures (e.g., FOG BMP posters for posting around apartment complex) to apartment owners/managers; information should be provided in various languages appropriate to the local community
- Provide training to apartment owners/managers on the benefits of proper tenant grease management practices and descriptions of potential future requirements if residential grease cannot be controlled (e.g., recovery of utility sewer cleaning costs and mandating installation of grease collectors or interceptors on multi-family developments over a certain number of dwelling units)

- Conduct surveys to gauge effectiveness of public education messaging as well as public participation in any public outreach activities
- Receive feedback from utility customers related to overall impact of the FOG Management Program

5.2.6 FOG Management Performance Measures

Performance measures are important management tools that allow for continuous measurement and evaluation of program activities. Performance measures are designed to collect information that enable a utility to determine if established goals and level of service are being met and if not, what activities need to be adjusted to meet program goals.

The following are suggested KPIs.

5.2.6.1 Program Key Performance Indicators

KPI	Formula	Definition	Desired Result	Data Interval	Utility Group
Inspections	Value	DEs inspected for FOG. Number of inspections and follow-ups per day and month conducted by Compliance Inspector to determine appropriate resources and training	4 - 6 per day and 64 per month	Monthly	FOG Management Program
DEs Permitted	Value	Number of DEs in the database to determine appropriate staffing for communication and inspection of DEs	Not applicable	Quarterly	FOG Management Program
Notices of Non-Compliance	Value	Number of non-compliance letters due to DE inspection	Long-term Goal should be 0	Quarterly	FOG Management Program
% SSOs due to FOG	$(100) * [\# \text{ of SSOs due to FOG} / \text{Total \# of SSOs}]$	% of SSOs correctly attributed to FOG	Long-term Goal should be 0	Quarterly	Maintenance and FOG Management Program
New DEs Permits	Value	Number of DEs (new or previously not identified) issued FOG Wastewater Discharge Permits	Value	Quarterly	FOG Management Program
Traps/ interceptors	Value	Notices of non-compliance due to	0	Quarterly	FOG Management

KPI	Formula	Definition	Desired Result	Data Interval	Utility Group
operational failures		sizing, faulty design, incorrect installation, etc.			Program
% SSOs due to DE FOG	$(100) * [\# \text{ of SSOs due to DE FOG} / \text{Total \# of SSOs to FOG}]$	% of SSOs correctly attributed to DE FOG	0	Quarterly	FOG Management Program
% SSOs due to Residential FOG	$(100) * [\# \text{ of SSOs due to Residential FOG} / \text{Total \# of SSOs due to FOG}]$	% of SSOs correctly attributed to Residential FOG	0	Quarterly	FOG Management Program
Number of DE inspections by watershed	\# of Inspections per priority watershed	Identify number of inspections completed within each watershed	Value	Quarterly	FOG Management Program
% of DE inspections by watershed	$(100) * [\# \text{ of Inspections per watershed} / \# \text{ DEs per watershed}]$	Identify percent of DE inspections completed within each watershed	100%	Quarterly	FOG Management Program
% Follow-up inspections by watershed	$(100) * [\# \text{ of Follow-ups} / \# \text{ of First Inspections}]$	% of inspections that result in follow-ups	Value	Quarterly	FOG Management Program
Time per inspection	Sum of actual inspection times / \# of inspections	Average time per inspection to ensure appropriate staffing and training	30 min- 60 min	Quarterly	FOG Management Program

5.2.6.2 Program Procedures

The following FOG Program procedures and resources have been developed to describe how specific program activities are conducted.

FOG Management Program procedures are provided in **Appendix C** and include:

- New DE Inspections
- Equipment list for FOG Management Program
- Routine DE Inspections
- Identifying Existing Unpermitted DEs and Permitted DEs not in Compliance
- BMP Checklist for FOG Management Program
- DE Inspection Schedule Assignment
- Utility Standard Operating Procedures (SOPs)

Section 6

Collection System Maintenance Program

Section 6: Collection System Maintenance Program

6.0 Purpose and Goals

The purpose of a Collection System Maintenance Program (CSMP) is to facilitate effective operation and maintenance activities for the wastewater collection and transmission system.

The Program should be designed to meet the goal of reducing corrective and reactive maintenance requests, and ultimately eliminating SSOs through the use of planned maintenance. By properly budgeting, implementing, and managing system maintenance activities, a utility should be able to maximize service and system reliability at minimum cost while providing for long-term infrastructure sustainability.

The CSMP should include the following components:

- CMMS
- Collection System Operation and Maintenance
 - Gravity Sewer System
 - Lift stations, force mains, and air release valves
 - Inspection and clearing of sewer and force main easements, including creek crossings
 - Coordination with road improvements and maintenance
- Description of resource commitments, such as staffing, contractual support and equipment.
- Key performance indicators (KPIs) that the utility will use to measure performance of the CSMP

6.1 Computerized Maintenance Management System

6.1.1 Overview

The ability of a utility to effectively manage its wastewater collection system is directly related to its ability to maintain access to current facility information. A CMMS should provide for the following:

- An integrated system to inventory, depict, monitor, and evaluate assets
- Track customer service requests and provide follow-up
- Monitor job status and needs through work orders
- Integration of system data, and operations /maintenance activities to optimize system effectiveness and efficiency
- Preventive maintenance and inspection schedules
- Repairs and work order tracking
- Organization of capital replacement plans
- Tools, spare parts and equipment inventory

- Purchase orders
- Integration of Geographic Information Systems (GIS) or other system to map and locate facilities.
- Written instructions regarding the use of CMMS.
- Complete information and work reports from field crews

6.1.2 Computerized Maintenance Management System

CMMSs are effective tools to optimize asset reliability through proactive maintenance management. A CMMS can provide immediate benefits of work order management, as well as asset histories and data-tracking for long-term analyses that enhance the utility's effectiveness.

The following are typical CMMS modules:

- Customer Service
- Work Order
- Inventory
- Purchasing

6.1.2.1 Customer Service

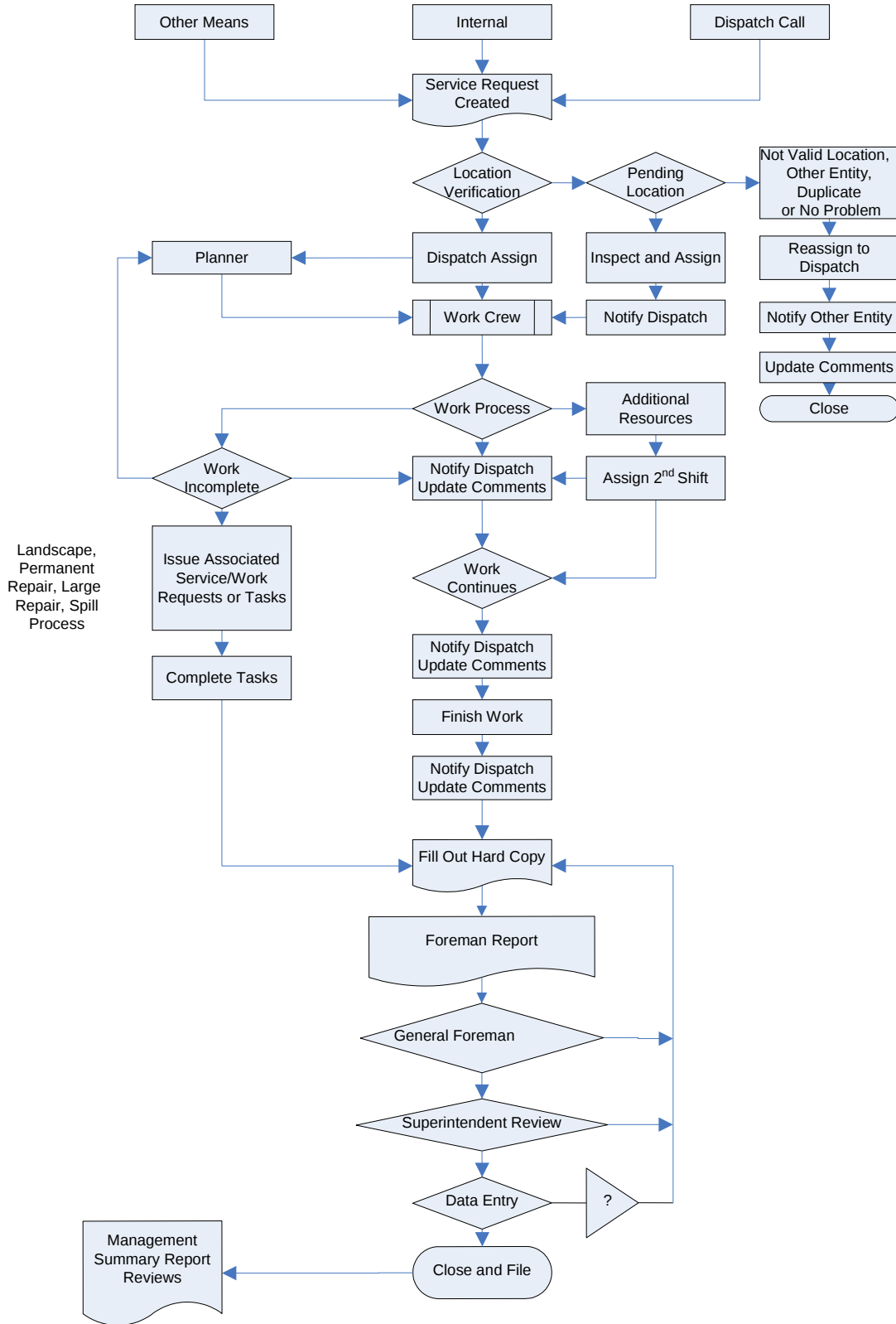
The CMMS should include a Customer Service module to provide for the receipt of customer calls and scheduling of service requests. The Customer Service module allows staff to track the service request and repair history of specific site locations.

6.1.2.2 Work Orders

The Work Order module should be used for maintenance activities conducted in the field. A list of Repair Codes and Service Request Codes should be included in the module. The module should include the capability to generate reports that include a list of all problems codes or repair codes, code descriptions, and the number of occurrences for each code during a set period of time.

Service request calls should be received at a central location and a Service Request created based on address location. Service requests should be generated and issued to Maintenance for investigation, inspection, and repair. A suggested process for service requests is shown in Figure 6-1.

FIGURE 6-1: SERVICE REQUEST FLOW CHART



6.1.2.3 Inventory Management

Management of the inventory of spare parts, tools, equipment, pipe, fittings, and related materials required for repair and replacement of lift station components, force mains, gravity sewers, service connections, and manholes is essential to preventing system failures that can lead to damage to public and private infrastructure, service interruptions, and SSOs.

The Inventory Management System should include the following:

- Tracking of stock issued from the warehouse
- Master inventory maintained in the CMMS
- List of suppliers/vendors for purchase of parts that are not maintained in inventory
- Procedures for regularly replacing stock
- Procedures for generating requisitions
- Written procedures for updating the critical spare parts and equipment inventories
- Reports
 - Inventory status and value
 - Requisitions submitted and filled
 - Cost of stock issued
 - Location of stock
- Procedures to reconcile actual and reported inventory

6.1.2.4 Purchasing

Provisions for the following types of purchase and services should be included in the CMMS:

- Outside Purchases – Items purchased with a purchase request (directly through the utility's purchasing system)
- Contracts:
 - Engineering projects (i.e., design contracts, annual projects, etc.)
 - Maintenance contracts (i.e., contracts for pipe cleaning, pipe inspection, pipe lining, manhole inspections, etc.)
 - Repair contracts (i.e., rebuild of electric motors, on-call contracts, etc.)
 - Service contracts (i.e., meter calibrations, laboratory testing, etc.)

6.2 Collection System Maintenance

6.2.1 Planned and Unplanned Maintenance

Maintenance may be planned or unplanned. Planned maintenance is predictive or preventive. Under predictive maintenance, early warning signs of potential future sewer line or equipment failure are used to identify and correct problems so that emergency maintenance is avoided. Preventive maintenance consists of scheduled maintenance activities performed on a regular basis.

Unplanned maintenance is corrective or emergency. Corrective maintenance consists of scheduled repairs to problems identified under planned or predictive maintenance. Emergency maintenance typically includes repairs or replacements performed in response to a serious equipment or line failure where immediate action is required to protect public health and safety.

A planned maintenance program is a systematic approach to performing maintenance activities so that equipment or pipe line failure is avoided. Planned maintenance is composed of predictive and preventive maintenance. A planned maintenance program should reduce material and capital repair and replacement costs, improve personnel utilization, reduce SSOs, and protect public health and safety.

Effective preventive maintenance minimizes system costs and environmental impacts by reducing breakdowns and the need for corrective or emergency maintenance, improves reliability by minimizing the time equipment is out of service, increases the useful life of equipment thereby avoiding costly premature replacement, and avoids potential noncompliance situations. An effective preventive maintenance program includes:

- Trained personnel
- Scheduling based on system-specific knowledge
- Detailed instructions related to the maintenance of various pieces of equipment
- Recordkeeping system
- Maps, historical knowledge, and records

6.2.2 Gravity Sewer System Maintenance

6.2.2.1 Sewer Cleaning

The purpose of sewer cleaning is to remove accumulated material from the sewer. Cleaning helps prevent blockages and prepare the sewer for inspections. Blockages in gravity sewers are usually caused by a structural defect, poor design, poor construction, an accumulation of material in the pipe (especially grease), or root intrusion. Protruding taps may catch debris which then causes a further buildup of solids that eventually block the sewer. If the flow is less than approximately 1.0 to 1.4 feet per second, grit and solids can accumulate leading to a potential blockage.

There are three major methods of sewer cleaning: hydraulic, mechanical, and chemical. Hydraulic cleaning (also referred to as flushing) refers to any application of water to clean the pipe. Mechanical cleaning uses physical devices to scrape, cut, or pull material from the sewer. Chemical cleaning can facilitate the control of odors, grease buildup, root growth, corrosion, and insect and rodent infestation. For additional information on sewer cleaning methods refer to Volumes I and II of *Operation and Maintenance of Wastewater Collection Systems* (CSU Sacramento 1996 and 1998).

RESULTS OF VARIOUS FLOW VELOCITIES

<u>Velocity</u>	<u>Result</u>
2.0 ft/sec.....	Very little material buildup in pipe
1.4-2.0 ft/sec...	Heavier grit (sand and gravel) begin to accumulate
1.0-1.4 ft/sec...	Inorganic grit and solids accumulate
Below 1.0 ft/sec inorganic	Significant amounts of organic and solids accumulate

The key to an effective sewer cleaning program is accurate recordkeeping. Accurate recordkeeping provides the utility with information on the areas of the collection system susceptible to stoppages such that cleaning of all portions of the system can be on an appropriate schedule.

The need for preventive cleaning of sewers varies depending on location. The collection system in a restaurant district may require cleaning every six months in order to prevent grease blockages. An area of the sewer system with new PVC piping and no significant grease contribution with reasonable and consistent slopes would probably not require cleaning for 5 to 10 years.

SEWER CLEANING RECORDS

- Date, time, and location of stoppage or routine cleaning activity
- Method of cleaning used
- Cause of stoppage
- Identity of cleaning crew
- Further actions necessary and/or initiated
- Weather conditions

6.2.2.2 Planning and Scheduling

The schedule for sewer line cleaning, inspection, root removal, and repair activities should be based on periodic inspection data. In many systems, uniform frequencies for sewer line cleaning, inspection, and root removal are not necessary and inefficient. In many systems, most of the problems are found in a relatively small percentage of the sewer lines. Efficient use of inspection data allows the utility to implement a cleaning schedule that will be effective and efficient for maintaining structural integrity and capacity.

It is recommended that the utility examine all work orders (i.e., weekly, monthly, semiannually, and annually) and compare the recommended maintenance frequency to that which is actually performed. He or she should also look at the backlog of work; not focusing solely on the number of backlogged work orders, but on what that number represents in time. A very large system can have a hundred orders backlogged and only be one week behind. In a computerized system, a listing of all open work orders is usually very simple for collection system personnel to generate. The utility should prioritize work orders.

It is recommended that the utility use GIS or other mapping system to identify problem areas in the collection system. Potential problem areas identified should include those due to grease or industrial discharges, hydraulic bottlenecks in the collection system, areas of poor design (e.g., insufficiently sloped sewers), areas prone to root intrusion, sags, and displacements. The connection between problem areas in the collection system and the preventive maintenance cleaning schedule should be clear. The utility should also be able to identify the number of blockages experienced per mile of sewer. If the system is experiencing a steady increase in blockages, the utility should determine the cause (i.e., lack of preventive maintenance, deterioration of the sewers, increase in grease producing activities, etc.).

The CMMS should be used to plan and schedule maintenance activities, including cleaning and repairs. The following steps are provided as general guidance for planning and scheduling cleaning activities so the work can be executed in a cost-effective manner and within a schedule that is appropriate for pipe segments/areas:

- **Evaluate Assets.** Use information obtained from the Sewer System Condition and Rehabilitation Program to establish baseline structural and maintenance conditions and to plan future maintenance activities. Service request information and observations obtained in field from sewer backup and overflow incidents should also be input into the CMMS.
- **Establish Work Orders and Schedule Based on CMMS.** Use the CMMS to issue work orders for cleaning and other maintenance activities based on the following priorities:
 - Priority 1 - Line segments/areas requiring quarterly to semi-annual cleaning and annual inspection.
 - Priority 2 - Line segments/areas requiring annual to bi-annual cleaning and bi-annual inspection.
 - Priority 3 - Line segments/areas requiring cleaning on a 3-year or greater interval and re-inspection in 3 years.
 - Priority 4 – Segments with no cleaning required.
- **Evaluate Service Requests.** If grease-related issues are recurring for more than a year in a specific area, then it would be prioritized for evaluation by the FOG Group for enhanced inspection and enforcement.
- **Evaluate Spill Occurrences.** Based on the number of spills that occur, cleaning activities for targeted problem areas should be scheduled. Establish short- and long-term priorities based on the data evaluation and identify areas where other factors are contributing to the spills and where actions in addition to cleaning are required.
- **Establish Root Control Program.** Determine root control needs and establish contracts, if required, to routinely control roots in problem areas, establish follow up inspection activities, and evaluate sewer lines along streams.
- **Establish Manhole Preventive Maintenance Program.** Include activities such as identification of manhole maintenance needs and repair/replacement. Develop written standard manhole inspection and maintenance/cleaning procedures, standard forms, and performance measures.

The following Preventive Maintenance procedures are provided in **Appendix C, Collection System Operation and Maintenance Program Procedures**:

- Vactor Cleaning
- Mechanical Rodding
- Jet Rodding
- Manhole Cleaning

6.3 Lift Station, Force Main, and Air Release Valve and Maintenance

6.3.1 Lift Station Predictive Maintenance, Preventive Maintenance, and Repair Program

6.3.1.1 Overview

Predictive and preventive maintenance work orders should be created in the CMMS. Completed work order information should be recorded in the CMMS. Preventive maintenance schedules should be derived from O&M manuals provided by the equipment manufacturers and the ongoing experience of the utility's O&M personnel.

Preventive maintenance tasks should be posted at each station and should include:

- Preventive maintenance and performance checks of pumps
- Pump run times
- Housekeeping
- Pump capacity performance
- High and low water alarm
- Site security check
- Security alarm check
- Mechanical check

SOPs should be developed for each lift station and should be completed by maintenance personnel on a daily and weekly interval. Copies of Preventive Maintenance Checklists/Benchmarks should be secured inside each lift station. Work order reports for lift station maintenance should be generated through the CMMS.

After inspection and maintenance tasks are completed, a copy of the completed preventive maintenance work order should be recorded into the CMMS.

Drawings, O&M manuals, technical specifications, and pump performance operating curves should be maintained and made available to O&M personnel.

6.3.1.2 Preventive Maintenance

6.3.1.2.1 Physical Maintenance

Physical maintenance should include the following procedures:

- Reading and recording information from pump run-time meters, or start counters, or taking amperage readings
- Recording wet well conditions and presence of floatables and grease accumulation
- Checking and resetting (as necessary) wet-well set points
- Checking and recording system pressure
- Checking remote monitoring and alarm equipment components
- Checking operation of alarms and stand-by power
- Reporting maintenance needs

Wet wells should be routinely cleaned to remove grit and solids deposition, floatables, free oil, and grease which can damage or restrict the flow of wastewater into the pump and cause issues within the transmission system.

6.3.1.2.2 Electrical System Maintenance

The Electrical System Maintenance should include annual inspection of major facilities using thermal photography to identify improper electrical connections and ground testing procedures utilizing electrical trouble shooting equipment.

Routine inspections and other specific checks on electrical equipment and controls should also be conducted in accordance with manufacturer's recommendations.

6.3.1.2.3 Mechanical System Maintenance

Routine mechanical inspection and service for all station equipment should include:

- Engines and generators
- Motors
- Pumps
- Impellers
- Seals
- Bearings
- Wear clearances
- Couplings
- Drives
- Related equipment

Lift station pumps should be kept primed, lubricated, and cleaned. Additionally, the following maintenance procedures are recommended:

- Vibration monitoring testing.
- Thermal scans and infrared spectroscopy (IR) checks on 50 horsepower (hp) and higher pumps on an annual basis
- Monthly pump run time vs. down time checks

6.3.1.3 Repair Program

The Repair Program should include reactive or unplanned maintenance for repair of lift stations due to age or environmental conditions requiring upgrades. The program should include:

- Established priorities for lift station repairs
- Maintaining an ongoing inventory of completed repairs in CMMS
- A work schedule for lift station repairs

The Repair Program should include prompt repair of equipment failures. In the event the maintenance or repair work required is beyond what is listed on the *Preventive Maintenance Work Order List*, the staff member performing the inspection and maintenance should make the repair and documents it on the preventive maintenance work order.

Recommended repair and replacement schedule:

- Large stations. Replacement - 50 years/Rehabilitation - 25 years
- Small stations. Replacement - 20 to 25 years/Rehabilitation - 12 years

6.3.2 Force Main Maintenance

6.3.2.1 Overview

Force mains convey wastewater under pressure from the discharge side of a pump. Depleted dissolved oxygen and increased sulfide concentrations as a byproduct of anaerobic bacteria in wastewater can affect force main integrity. At air-water interfaces, the sulfide is released in the form of hydrogen sulfide that reacts with air to form sulfuric acid that corrodes pipes until a defect is formed that leads to a pipe failure. The hydrogen sulfide gas may also lead to odor complaints when not contained and treated.

Frequent cleaning and maintenance of force mains is required to remove solids and grease build up that create operational problems in air release valves as well as in-line valves and pumps. Chemicals that provide for oxidation in the force main may be added at the lift station to minimize the formation of harmful hydrogen sulfide gas.

6.3.2.2. Maintenance

The following inspections and determinations are recommended to identify potential force main problems:

- Annual force main route inspection
- Integrity of the force main surface where exposed
- Pipeline connections
- Unusual noise
- Vibration
- Pipe and pipe joint leakage and displacement
- Valve arrangement and leakage
- Lift station operation and performance
- Discharge pump rates
- Pump suction and discharge pressures
- Routine pump station calibration

When issues are noted that may be attributed to blockages in a force main, the need for cleaning or maintenance of force mains should be evaluated and prioritized. This determination should be based on the overall performance of the lift station-force main system and the extent of grease build-up. If there is an excessive increase in pump head and the head-loss increase is caused by grease build-up, the pipeline may be flushed by periodically increasing the velocity of wastewater to scour the force main.

The percent increase of force main pressure at a pump station is information that can be used to determine blockages in the force main. Pump discharge pressure increases as internal resistance to flow increases. Resistance in force main piping may come from reduced cross-sectional area due to deposition or tubercles on the pipe wall. The maintenance program should include routine measurement of discharge pressure and comparison to the discharge pressure at the time of installation to identify decreased long-term performance of the force main.

6.3.2.3 Inspection

The following types of inspections should be used to identify and locate defects on force mains:

- External inspection of force mains
- Internal inspection of force mains

Inspection frequencies are determined based on asset data collected and grouped according to asset criticality and risk. The following inspection frequencies are recommended:

- **Group 1.** Highest risk – based on size, material, function, and if force main failure occurred in last 5 years. Inspect annually.
- **Group 2.** Medium Risk – suspected problems. Inspect once every 3 years.
- **Group 3.** Low Risk - inspect 10 percent of the force mains once every 10 years.

Ductile iron and steel force mains are vulnerable to corrosion where an air-water interface is anticipated (at high points and at points the pipeline is predominantly gravity flow) and should be monitored on a routine basis.

6.3.3 Air/Vacuum Release Valve Maintenance

6.3.3.1 Overview

The risk of force main damage due to sudden changes in pressure (high pressure surges as well as vacuum pressure) in a force main due to starting and/or stopping pumps, operation of valves appurtenant to a pump, and changes in the hydraulic gradient of the force main must be considered during design. Control devices such as air/vacuum release valves are, therefore, typically installed to reduce pipeline pressure to maintain a safe operating pressure.

Replacement of force mains is estimated at 50-year life span. Air/vacuum release valves have many renewable parts and could have a comparable life span with regular renewal of the valve. However, the life span of the valve depends on the quality of the original valve in terms of materials of construction and corrosion resistant coatings.

The air release component of wastewater air/vacuum release valves vent pockets of gas from the force main automatically and close automatically on liquid level rise. The valve is designed to open under pressure or vacuum. Grease can build up inside the valve body which prevents the air release valve from releasing air and gas pockets under pressure or opening under vacuum to prevent water hammer.

6.3.3.2 Maintenance

The following procedures and policies are recommended:

- Back-flush valves six months after start-up date.
 - During the first back-flushing, observe the time duration of flushing and quality of water that is discharged from the air/vacuum release valve body
 - If clean flushing results occur in a few minutes, the next period for back-flushing should be set at twelve (12) months.
 - If clean flushing is difficult and exceeds fifteen (15) minutes, the next back-flushing should be scheduled in four (4) months.
- In general, back flushing should be conducted at least once a year to ensure efficient operation of the air/vacuum release valve. The following maintenance schedule should be followed based on back flushing results:
- Remove inoperable or damaged air release valves from service and overhaul. In order to maintain service, it is recommended that spare air release valves be kept in the spare parts inventory to exchange with valves that require service.

- Periodically (period to be determined, potentially once a year minimum) remove each valve from service for tear-down, inspection, and maintenance. Repair and regular service requirements for air release valve include:
 - o Tear down of the air release valve for cleaning and inspection
 - o Replacement of damaged or corroded parts
 - o Lubrication of moving parts
 - o Installation of new cover gasket

6.4 Inspection and Clearing of Rights-of-Way and Easements

6.4.1 Overview

Some sanitary sewer lines are constructed in areas along streams and other locations within public rights-of-way or easements acquired from private property owners. To ensure safe access, appropriate maintenance is required on an ongoing basis to protect the easement areas from vegetative overgrowth, erosion, and the construction of private fences and structures within the utility's easement.

Inspection and clearing of rights-of-ways and easements may be carried out by utility personnel or private contractors. When private contractors are used, the contract should include procedures and standards required, and inspections to document the accuracy of work in the field and provide quality control for the work completed. Additionally, the contractor should be required to be on call on a 24-hour emergency basis

6.4.2 Inspection and Clearing

The following procedures and policies are recommended:

- Annual inspection of easements and rights-of-way to determine future clearing needs
- Determination of rights-of-way and easements maintenance needs
- Establish priorities and schedule clearing and maintenance activities
- Written standard rights-of-way and easements maintenance procedures and standard forms
- A mechanism for including maintenance information in the CMMS.

6.5 Creek Crossings Monitoring

6.5.1 Overview

Sanitary sewer lines that cross above creeks and streams are vulnerable to damage by floating debris and falling trees. Support structures for the aerial crossings are also vulnerable to the same types of damage as well as erosion of supporting soils during periods of high stream flows.

6.5.2 Inspection and Clearing

The following procedures and policies are recommended:

- Quarterly inspection of creek crossings and support structures
- Inspections of vulnerable areas after significant rain events to verify integrity of structures.
- Determination of clearing and maintenance needs
- Establish priorities and schedule clearing and maintenance activities
- A mechanism for including creek crossing inspection data in the CMMS.

6.6 Coordination with Road and Other Utility Improvements and Maintenance

6.6.1 Overview

The coordination of collection system improvements with street resurfacing projects and other utility improvements (water, gas, cable, and telephone) is extremely important to:

- Allow for sewer improvements to be made prior to the resurfacing so that manholes and valve covers may be properly realigned and repairs and replacements made in a cost-effective manner.
- Avoid conflicts or damage caused by trenchless installation of gas lines and underground cables.
- Improve customer relations by implementing a “one pass” approach to improvements in residential and commercial areas
- Avoid cutting and patching recently paved streets.

6.6.2 Implementation

- Obtain capital improvement and maintenance plans and schedules from local and state transportation departments, gas companies, and cable companies within the utility’s service area
- Conduct regular meetings with affected departments and utilities to discuss coordination of planned improvements and maintenance activities
- Evaluate opportunities to combine multiple projects under a single contract to reduce costs and public impacts. (If a sewer replacement or rehabilitation project is planned in an area where a street resurfacing or storm drainage project is also scheduled, significant cost savings and reduced public impact can be realized by combining the work into a single project)
- Mechanism for integration of planned street resurfacing and other utility improvements monitoring into the CMMS.

6.7 Program Resources

Staffing for support of the Collection System Maintenance Program should be based on the size of the wastewater collection system, number of customers, and type of CMMS used by the utility.

The following types of staff are typical for a Collection System Operation and Maintenance Program:

- Wastewater Services Manager
- Maintenance Manager(s)
- Maintenance Supervisor(s)
- Closed Circuit Television (CCTV) Crews
- Cleaning Crews trained in mechanical, hydraulic, and root control cleaning techniques
- Maintenance Mechanics
- ROW/Easement Coordinator
- 2-person Creek Crossing Inspection Crew
- CMMS Manager
- CMMS Software Program Administrator
- Database Administrator
- Planner/Scheduler
- Customer Service Representative(s)
- CMOM Coordinator
- 3-person Field Investigation Crew(s)
- 3-person MANHOLE, Trunk, and ROW Inspection Crew(s)

The following types of resources are typical for a Collection System Operation and Maintenance Program:

- Contracts for personnel and equipment for gravity line preventive maintenance, as funded
- Combo Cleaning Units assigned to reactive maintenance and service requests
- Water Jet Trucks (work with CCTV units)
- Rod Machines for blockages
- CCTV Systems
- Augers (used on rod to unstop manholes)
- Root Cutters
- Assorted Nozzles
- Vactor Truck(s)
- CCTV Truck(s)
- Water Jet Truck(s)

- Bucket Machine(s)
- Root Control Contract

6.8 Gravity Line Preventive Maintenance Program Performance Measures

Performance measures are important management tools that allow for continuous measurement and evaluation of program activities. Performance measures are designed to collect information that enable a utility to determine if established goals and level of service are being met and if not, what activities need to be adjusted to meet program goals.

The following Key Performance Indicators (KPIs) are recommended.

6.8.1 2010 Program Key Performance Indicators

KPI*	Formula	Definition	Desired Result	Data Interval	Utility Group
Main Line Repair Frequency	# Collection System Repairs/ (# miles pipe/100)	Annual number of repairs per 100 miles of sewer line. This includes gravity and pressure mains.	Less than 5 repairs per 100 miles of pipe	Annual with 3-year history	
CCTV Inspection of Sewer Lines, C&M and Contractor	#miles inspected/Total miles of sewer line. Do not include laterals in calculation.	Annual miles of sewer line inspected. Do not include laterals in the calculation. Break category down to <12", 12 to <15, 15 to <24, 24 to 36, >36.	% of total miles inspected per year. 20% total inspection target	Annual with 3-year history	Planning and Asset Management
Sewer Lines Cleaned %	# Miles Cleaned X 100/ Total Miles	Annual miles of sewer line cleaned. Do not include laterals in the calculation. Break category down to <12", 12 to <15, 15 to <24, 24 to 36, >36.	20% of total miles cleaned per year	Annual with 3-year history	Maintenance
% Root Removal per year	#feet of roots removed X 100 / (5280 ft/mile X # miles of sewer system)	Expression of the amount of roots removed and/or treated in the system		Annual	Maintenance

KPI*	Formula	Definition	Desired Result	Data Interval	Utility Group
Annual Cost for Operations and Maintenance per mile of sewer pipe	\$ per year O&M cost Collection System / mile of sewer pipe	Annual \$ spent for O&M of the wastewater collection system. This includes direct and indirect costs. This does not include capital work. Miles of pipe includes gravity sewers and force mains.	Less than \$4000 per mile of pipe	Annual	Administration
Annual Labor Cost as a ratio to Annual O&M cost collection system	\$ Annual Collection System Labor / \$ Annual O&M costs	Labor cost includes benefits and overtime. This does not include capital work.	Less than 0.4	Annual	Administration
% Inspection of Manholes	# inspected X 100 / Total # of manholes in system	Routine inspection of manholes throughout system	20% of total # inspected per year	Annual with 3-year history	Maintenance
% Manholes in need of repair	# per class X 100 / # inspected manholes	Number of manholes by category identified for repair		Annual	Maintenance
PM Hours Estimated	Synergen Value	Estimated hours from work orders			Maintenance
PM Hours Worked	Synergen Value	Actual Hours worked from work orders			Maintenance
Backlogged PM Work Orders	Synergen Value	Number of work orders not completed			Maintenance
% Inspection of Manholes	# inspected X 100 / Total # of manholes in system	Routine inspection of manholes throughout system	20% of total # inspected per year	Annual with 3-year history	Maintenance
Total Number of Feet of Collection System and Total Number of Manholes	Value	Break category down to <12", 12 to <15, 15 to <24, 24 to 36, >36.			GIS

KPI*	Formula	Definition	Desired Result	Data Interval	Utility Group
Preventive Maintenance*	Percentage of preventive maintenance (PM) work orders (WO) completed versus unscheduled. # PM WO completed /Total PM WO X 100	Resources allocated to preventive maintenance work (to decrease corrective maintenance work).	>90% completed as scheduled	Quarterly	Maintenance
Feet cleaned per Priority Ranking per year	Organized by Categories of Hydraulic, Mechanical, and Root Control and Manhole Preventive Maintenance Activities: Priority 1 = X feet Priority 2 = X feet Priority 3 = X feet	Actual sewer cleaning activities completed based on priority ranking of line segments.	Meeting established target determined at beginning of program	Quarterly or Annual depending on established schedule	Maintenance
*GAWP and GWEF CMOM Consent Agreement Guidance (2006)					

6.9 Program Procedures

The following CSMP Procedures have been developed to describe how specific activities are conducted.

Collection System Maintenance Program procedures are provided in Appendix D and include:

- Vactor Cleaning
- Mechanical Rodding
- Jet Rodding
- Manhole Cleaning

Section 7

Sewer System Condition Assessment and Rehabilitation Program

Section 7: Sewer Condition Assessment and Rehabilitation Program (SCARP)

7.0 Purpose and Goals

The purpose of the SCARP is to restore and maintain the integrity of the wastewater collection and conveyance system, prevent excessive I/I, maximize capacity within the collection system, and maintain the system free of defects that could cause structural failure.

The goals of the SCARP, which will provide for effective management of the utility's wastewater collection system, are summarized as follows:

- Eliminate SSOs
- Implement a sound and affordable program to rehabilitate and manage the utility's collection system assets and meet projected future capacity requirements which includes:
 - Condition assessments for priority areas
 - Correction of system defects identified by the condition assessments
 - Develop and implement a long-term asset management program to maintain a sound collection system
 - Identification of funding requirements for the assessment and rehabilitation of the wastewater collection and transmission system
- Move from a reactive to proactive operations and maintenance mode

The long-term goal for infrastructure rehabilitation activities is to develop an asset rehabilitation program that includes life cycle costing for comparing the cost of retaining an existing asset with the equivalent annual cost of its replacement, the optimal time for replacement, and the end of the existing asset's economic life of 50 years or longer.

7.1 Program Activities

The SCARP provides for comprehensive management of the utility's wastewater assets by maintaining maximum capacity and extending the useful life of the sewer system assets. The SCARP activities focus on rehabilitation of gravity sewer lines, force mains, manholes, and related appurtenances. The program includes a process for condition assessments, prioritization of rehabilitation needs, inventory of completed rehabilitation, performance measurement of completed rehabilitation projects, written schedules for rehabilitation work, and a mechanism for including inspection and rehabilitation information in the CMMS and GIS.

The utility's infrastructure rehabilitation program should include:

- Sewer cleaning

- Flow monitoring
- Manhole, sewer line, and service lateral inspection and condition assessment
- Manhole rehabilitation
- Manhole replacement
- CIPP sewer lining
- Point repairs (internal and external)
- Pipe bursting
- Pipe replacement
- CIPP service connection renewal
- CIPP service lateral lining

Sewer line rehabilitation methods depend on pipe size, type, location, dimensional changes, sewer flow, material deposition, surface conditions, severity of I/I, and other physical factors. Non-structural repairs typically involve the sealing of leaking joints in structurally sound pipe. Structural repairs involve either the replacement of all or a portion of a sewer line, cured-in-place lining, or pipe bursting. These repairs can be carried out by removing and replacing one or two pipe segments (point repairs) or by trenchless technologies (in which repair is carried out via existing manholes or a limited number of access excavations).

7.2 SCARP Program Organization

The condition assessment and rehabilitation program is a continual process that involves inspection, maintenance, and rehabilitation of the sewer system.

The program is conducted in two phases:

- Condition assessment
- Rehabilitation

7.2.1 Condition Assessments

Condition assessment is generally defined as the collection of data and information through direct inspection, observation, and investigation; indirect monitoring and reporting; and the analysis of the data and information to make a determination of the collection and transmission systems structural, operational, and performance status. Condition assessment is one of the core components of an asset management program. It provides the critical information needed to assess the condition and remaining useful life and long-term performance of a wastewater collection and transmission system.

The condition assessment phase typically includes:

- Identification and prioritization of basins and sub-basins requiring inspection

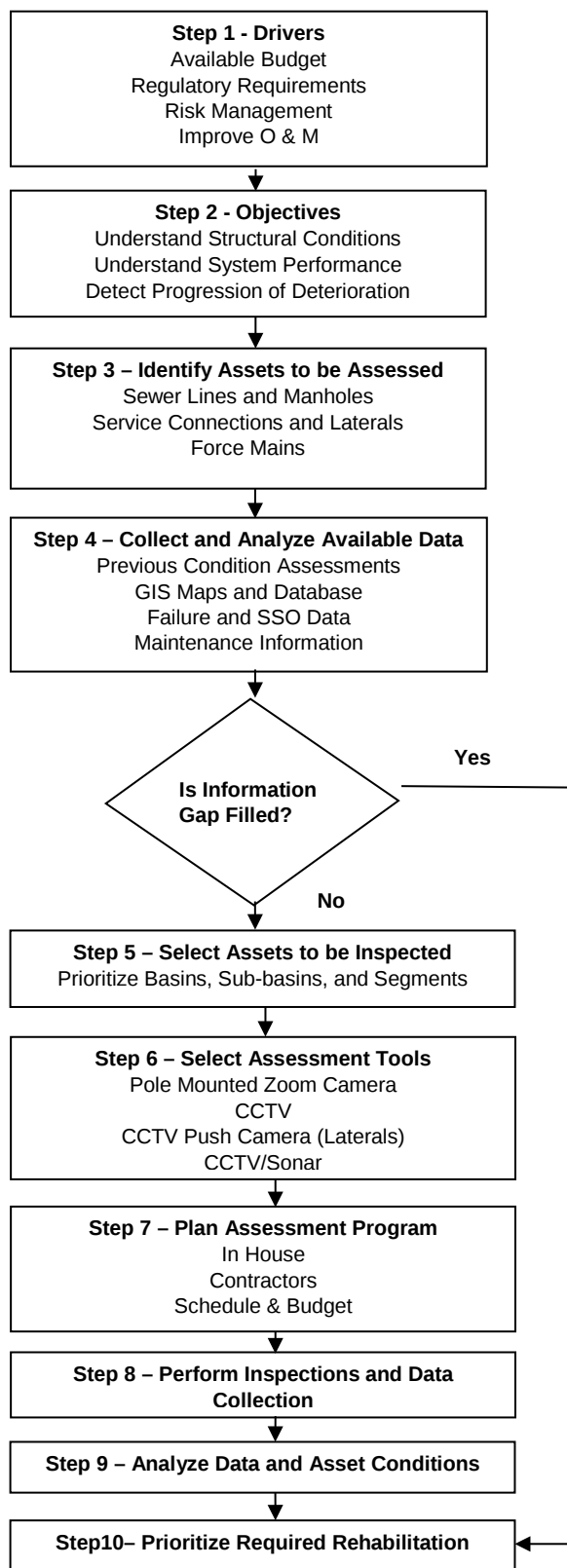
- Inspection of sewers, laterals and manholes to determine the condition of the sanitary sewer system
- Identification of needed maintenance and rehabilitation activities

Service laterals are a significant percent of the total linear footage in the collection system. Lateral joints and lateral main line connections can be a major source of infiltration; therefore, CCTV inspection of laterals can help identify lateral defects and sources of groundwater infiltration and other items not always identified through smoke testing.

A preventive maintenance program combines preventive, predictive, and corrective maintenance strategies with best management practices. The focus of sewer system maintenance activities is maintaining the hydraulic capacity and structural integrity of the sewer system. The maintenance program provides critical information on the condition of the collection system that is used in establishing priorities for condition assessments.

Structural and operational issues can reduce hydraulic capacity and reliability. Structural defects involve the degradation of the sewer pipe and can lead to pipe collapse, causing SSOs and potential damage to public and private property. Sewer repair and rehabilitation activities are focused on restoring the structural integrity of the pipe. Operational defects, which include roots, sediments, and FOG, affect the hydraulic capacity of the pipe and reduce the cross-sectional area of the pipe, which in turn reduces its hydraulic capacity. Sewer cleaning and source control activities prevent or reduce the impacts of operational defects on the collection system. Some defects, such as roots, combine structural and maintenance issues where roots are classified as a maintenance defect, but typically enter the sewer through a structural defect.

The Condition Assessment Program is a 10-step process shown in Figure 7-1.

Figure 7-1

7.2.1.1 Criteria for Identification and Prioritization

The sewer system inspection and assessment program should include priority planned and scheduled inspections and assessments of the system.

The criteria and processes presented in this section are intended to be used as a general guide for the development of a condition assessment plan. This approach should provide an efficient and effective approach to identifying and correcting conditions that could lead to system failures and SSOs.

The following are sources of information that can be used to identify and prioritize areas of the sewer system for condition assessments:

- SSO records (spills, overflows, and building backups)
- Estimated RDI/I into the system, R Value and Peak Flow Factors to determine basins and sub-basins that exhibit the highest level of RDI/I
- System information including location, pipe material and age
- Information obtained from maintenance personnel knowledgeable of the conditions of the WCTS based on actual experience and historical investigations
- Preventive and reactive maintenance records
- Customer complaints
- Proximity to public areas

An example of the process that can be used to establish priorities for conducting condition assessments is shown in Table 7-1.

Table 7-1

Sewer Segment	Location	Age	I/I	Material	Reported Spills	Subject to Corrosion	Reported Blockages	Score	Priority
102-E016D to 102-E016C	1	2	1	0	0	5	0	9	L
102-E049 to 102-E048A	3	3	3	3	0	0	0	12	I
102-E020 to 102-E019	5	4	4	2	4	0	3	22	H
102-E016C to 102-E016D	4	3	3	2	0	0	3	15	I

The weighting factors shown in Table 7-2 are examples that can be used to develop the priority ranking in Table 7-1 for each sewer segment:

Table 7-2

Location	Weighting Factor
Major thoroughfares and/or intersections	5
Adjacent to hospitals	5
Adjacent to schools	3
Adjacent to industries or large commercial developments	3
Parallel to or crossing surface water where failures have the potential to adversely impact surface water supplies	5
Areas of planned significant future development	2
Areas where SSOs may present public health and welfare concerns	4
Residential streets	2
Easements	1
Age	
≤10 years	1
10 - 20 years	2
20 – 30 years	3
30 – 50 years	4
≥ 50 years	5
Material	
PVC	0
VCP	2
RCP	3
DI	3
TRUSS	2
I/I	
Ratios less than 3:1 – mild I/I	1 - 2
Ratios between 3:1 and 5:1 – medium I/I	3 – 4
Ratios greater than 5:1 – heavy I/I	5
Reported Spills	
None	0
Due to FOG	2
Due to roots or structural issues	4
Subject to Corrosion	
Ferrous or concrete pipe downstream of Lift Station discharge	5
Truss, PVC or VCP pipe downstream of Lift Station discharge	0
Reported Blockages	
None	0
Due to FOG	1
Due to roots or structural issues	3

The following are suggested priority levels:

- **High Priority** (Priority Score = 20 – 30) – Immediate attention needed
- **Intermediate Priority** (Priority score =10 – 20) – Can be deferred until after the high-priority group is complete
- **Low Priority** (Priority score = 0 – 10) – Can be completed as time and budget allow

A sample spreadsheet that could be used to provide information on the system and the priority ranking for future condition assessments is included in Appendix A.

7.2.1.2 Prioritization Plan

The prioritization plan is a “road map” for prioritizing the sewer system inspections needed to complete the condition assessments and identify sewer system defects. It is recommended that the prioritization plan include the following:

- A list and GIS map of priority areas within the WCTS
- Schedule for completing sewer and manhole condition assessments in the priority areas
- A list of condition assessment technologies to be used
- Sewer condition defect codes
- Manhole condition defect codes

7.2.1.3 Condition Assessment Technologies and Methods

Condition assessment technologies and methods include the following, which are described in the sections that follow:

- Flow monitoring
- Manhole condition assessment
- Pole-mounted zoom cameras
- Main line and service lateral CCTV inspection
- Smoke testing
- Corrosion defect identification
- Dyed water flooding

7.2.1.3.1 Flow Monitoring

Dry and wet weather monitoring should be used to identify areas with excessive I/I. The Flow Monitoring Program supplies flow monitoring data to support engineering analyses related to sewer system capacity and peak flow evaluations, and to assist in identifying basins and sub-basins that require internal inspection.

The Flow and Rainfall Monitoring Program includes standard procedures for flow monitoring during dry and wet weather to support engineering analyses related to capacity and peak flows. Dry and wet weather monitoring provides for the characterization of base flows and I/I rates. The flow monitoring component identifies areas with excessive I/I.

7.2.1.3.2 Manhole Condition Assessment

Sanitary sewer manhole inspections are an important component of the gravity sewer system assessment due to the susceptibility of manholes to structural defects and/or I/I, which may contribute to SSOs. Manhole inspections not only provide valuable information on the physical

condition of the manholes, but also an opportunity to observe pipe diameters, inverts, network connectivity, and surcharging within main line gravity sewers. The results of manhole inspections can be used as a guide for identifying additional assessment needs such as CCTV.

The data collected during manhole inspections should be recorded using a Manhole Inspection Form (Appendix D). The data should be used to develop the Condition Assessment and Recommended Rehabilitation Summary.

Manhole inspections may be performed using a pole camera capable of recording digital video and digital still images (in electronic format) of the manhole and each pipeline entering or exiting the manhole. Sanitary sewer manholes are considered confined spaces. If a pole camera is not used, any personnel entering a manhole must adhere to OSHA and CCWA protocol for confined space entry at all times while within the structure.

Color photographs (in electronic format) should be taken of the manhole to show the above ground location, looking down at the manhole invert, and looking into the incoming and outgoing pipelines. Manhole defects should be recorded using standardized observation codes as indicated on the Manhole Inspection Form. Manhole inspections should normally be performed during daylight hours.

The sewer manhole condition assessment includes the following:

Manhole Inspection Observation Codes. Field observation codes for identifying and/or classifying defects during manhole inspections should be recorded in a standardized manner. The Manhole Inspection Form should be used for data collection using common observation codes that are recorded using checked boxes or free-hand comment. Observations of manhole defects or points of interest that are not listed in the Manhole Inspection Form should be recorded in the “Additional Information” section of the form.

Manhole Condition Scoring. To assist in prioritizing any required maintenance or repair of sanitary sewer manholes, a condition scoring system should be used to weigh the manhole defects that are observed during manhole inspections. The condition scoring system should be based on the PACP/MACP system for grading structural and O&M defects, as defined in Table 7-3. Each manhole should be scored (1-5) according to these MACP manhole condition assessment standards.

Table 7-3 Structural and O&M Defects Grading

Grade	Grade Description	Grade Definition
5	Immediate Action	Defects requiring immediate action
4	Poor	Severe defects that will become Grade 5 defects within the foreseeable
3	Fair	Moderate defects that will continue to deteriorate
2	Good	Defects that have not begun to deteriorate
1	Excellent	Minor to no defects

Manhole Inspection Procedure. The Manhole Inspection Form should be completed by the personnel performing the manhole inspection. Prior to conducting inspections of manhole components, a non-entry (topside) manhole inspection should be conducted to determine the overall condition of the manhole as viewed from the ground surface. The surrounding area should be observed and noted if manholes or adjacent cleanouts are located in areas that are conducive to flooding or ponding conditions that could allow water to enter the sanitary sewer system. Data gathered from the topside inspection should be entered into “Additional Comments” field of the standard Manhole Inspection Form.

In lieu of manual entry, pole camera technology may be used to perform non-entry (topside) manhole inspections provided that site conditions are appropriate and that sufficient data can be captured and recorded to determine if more detailed manhole inspection activities are warranted.

Manhole condition assessment includes manhole defect analysis, identification of manhole maintenance needs and establishment of priorities. The manhole inspection data to be collected should include:

- Manhole identifying number
- Location
- Construction materials
- Ring size
- Depth to invert
- Frame and cover
- Evidence of surcharge
- Offsets or misalignments
- Atmospheric hazards measurements
- Details on cause of cracks, breaks, and blockages
- Flow conditions and evidence of problems
- Record of condition of corbel, walls, bench, trough, and pipe seals
- Presence of corrosion
- Wastewater flow characteristics
- Accumulation of grease, debris, grit
- Location and estimated quantity of I/I and inflow from manhole covers.

Manhole inspections provide an up-to-date asset inventory that is used to update collection system maps, and to determine structural condition. Information should be recorded and used to schedule maintenance and repairs. A digital camera should be used during the inspection to document defects.

7.2.1.3.3 Pole-Mounted Zoom Camera

Zoom cameras are on a stationary mount, such as a truck, crane, pole or tripod, and are lowered into a manhole to capture visual information on the interior conditions of manholes and pipelines. Zoom cameras are set up at a manhole and can often capture digital images of the full length of sewer between consecutive manholes. Zoom cameras do not capture as much detailed information as CCTV, but are a cost-effective method to determine if more extensive inspections are required.



Zoom cameras are used to generate recorded digital still or video imagery to show internal manhole and sewer main conditions. The cameras can pan 360° and can zoom up to 700 ft., depending on the diameter of the pipe. The cameras cannot be used to inspect below the waterline or where the sewer line deviates from a straight line.

7.2.1.3.4 CCTV Inspection

CCTV inspection is a powerful tool for internal inspection of gravity sewer mains, service connections, and service laterals. Information obtained from CCTV inspections is used to identify defects in the sewer mains, service connections, and service laterals so that a planned rehabilitation program can be developed.

The CCTV technology for inspecting sewer lines uses a television camera mounted on a robotic device that is connected to a video monitor and digital recorder by a cable. The robotic system is placed directly into the sewer through a manhole. The robotic device is operated by remote control located inside a truck or all-terrain vehicle. The operator can examine the entire length of sewer line between two manholes. The camera's pan and tilt capabilities allow the operator to move the camera in all directions. Sonar or ultrasound systems can also be used to examine the sewer below the waterline if under high sewage flow conditions.

The CCTV system relays live footage from within the sewer or service lateral to a high-resolution monitor in a mobile survey unit. The footage is also recorded on digital media. Because the operator has full control of the robotic system, the operator can stop the camera and record detailed information on defects. With the camera's pan and tilt capabilities, service connections should also be located and documented. An electronic footage counter is connected to the camera, enabling the operator to note the exact location of sewer line defects and service connections. A structural and service condition report should be created as the live footage is viewed to document all defects and the general condition of the sewer section.

CCTV and report data is submitted in a digital format using the PACP standards for coding the defects in the sewer lines shown in Appendix C. This information is used to prioritize sewer segments for rehabilitation, repair, or replacement.

CCTV inspection of service laterals should be conducted using a “push camera” that can be operated from within the main line sewer or from a cleanout. The inspection of service laterals should include the portion of service lateral located within the utility’s rights-of way or easement. It may also be beneficial to extend the lateral inspection to obtain information on the condition of the customer’s portion of the lateral.

It is recommended that cleaning of sewers and service laterals not be conducted prior to the CCTV inspection unless necessary to provide an unobstructed view of the pipe. Cleaning may remove defects that should be observed and reported and may damage the pipe.

The CCTV inspection program includes written defect identification procedures and guidelines, a standardized process for cataloging gravity system defects, a mechanism for including gravity system defect information in the CMMS, and training specified for personnel. Standard defect and severity codes and reporting forms should be used in conjunction with the CCTV inspections.

Benefits of CCTV:

- **Cost.** CCTV inspections require only a small work crew, therefore making efficient use of man-hours. CCTV also allows efficient examination of the sewer footage and specific information on the exact condition and location of defects, enabling crews to strategically target and implement repairs or maintenance.
- **Saves Time.** Knowing the exact location of defects and blockages enables crews to quickly repair and rehabilitate problem areas.
- **Safety.** Sewers can often contain toxic, odorless gases. Though gas tests are always conducted prior to crew members entering the sewer, there is still the possibility that gases could seep in from unknown sources. Using CCTV alleviates the risk to workers.
- **Efficiency.** Through the CCTV system, operators are able to review miles and miles of sewer footage on a specialized computer program, which allows them to review problem areas as often as needed without actually having to be in the field.

7.2.1.3.5 Smoke Testing

Smoke testing is an efficient and cost-effective way to locate and identify the source of I/I and unauthorized connections. Smoke testing is conducted by placing a blower over a centrally located manhole and blowing non-toxic, smoke-filled air through a sewer line. The smoke under pressure will fill the main line and any lateral service connections and will exit the system where there are breaks, openings, or unauthorized connections, which include storm drain and downspouts. It is not uncommon to see smoke coming out of the grass, wooded areas, or cracks in the pavement. If smoke rises from the street or the ground, this is an indication of an entry point for ground water or stormwater to enter the sewer.

Smoke testing can be included as part of the CCTV inspection in areas with excessive I/I. Photographs of the areas where smoke is seen escaping from the system should be included with condition assessment information submittals. Smoke testing also aides in locating buried manholes and identifying broken sewer lines.

Smoke testing is an efficient procedure to determine if buildings are properly connected to the system. It is normal for the smoke to rise from the roof stack of a residence or building that has a properly connected plumbing system. However, if smoke enters the structure through the plumbing fixtures, this may be a sign of a plumbing connection problem that could allow dangerous sewer gases to enter the structure.

Possible causes for this smoke entering the building include:

- The vents connected to the building's sewer lateral are inadequate, defective, or improperly installed.
- The traps under sinks, tubs, basins, showers, floor drains, etc. are dry, defective, improperly installed, or missing.
- The pipes, connections, and seals of the building's sewer system are damaged, defective, have plugs missing, or are improperly installed.

7.2.1.3.6 Corrosion Defect Identification

Corrosion in sewer lines and force mains due to the presence of hydrogen sulfide and corrosion of the exterior of aerial or exposed sewer lines can lead to structural failure and adverse impacts on public safety and health.

Conditions and locations where corrosion may occur are as follows:

- Areas with odor complaints
- Flat, low-velocity gravity sewers areas where solids can accumulate
- Industrial areas where corrosive chemical discharges may be occurring
- Aerial crossings exposed to atmosphere
- Exposed pipes in creeks
- Ferrous material lines that cross major petroleum or gas transmission pipelines (risk of stray current)

A program to identify force mains and exposed pipe segments that could be subject to corrosion should include:

- GIS or other database to locate and identify ferrous material sewers and force mains
- Odor complaint log and follow up corrosion inspection
- Regular inspection of services in industrial areas
- Watch list of assets at risk

- Visual inspection of exposed pipes
- Internal inspection of force mains

Visual inspections of exposed sewer lines are an important assessment tool to assess the physical condition of the sewer lines. Written documentation and photographs of the exterior of exposed pipe lines should be taken. Visual inspections can determine the extent and depth of corrosion in the pipe. General soil condition and corrosivity analysis is a useful method to use for general quantification of corrosion risk.

There are also technologies that allow for the internal detection of corrosion in force mains and sewers. Some methods may detect the manifestation of corrosion (leakage) while others assess remaining wall thickness. Table 7-4 provides non-visual inspection methods that can be used to detect the loss of wall thickness or pipe integrity due to corrosion.

Table 7-4 Non-visual Corrosion Evaluation Methods

Evaluation Method	Conducted By	Pipe Material	Service
Soil Condition/Corrosivity	Utility or contractor	All	Active FM or gravity
Acoustic	Contractor	All	Active FM
Electromagnetic	Contractor	Metallic	Active FM
Coupons	Contractor	Metallic	Active FM
CCTV	Contractor	All	Active FM or gravity
External ultrasonic	Contractor	All	Active FM or gravity

7.2.1.3.7 Dyed Water Flooding

Dye testing is an effective method to determine connections to the collection system and sources of I/I. Through observation and utilization of CCTV video inspection equipment, dye water flooding aides in the location and quantification of specific defects during an evaluation. The procedure typically consists of forcing non-toxic dye into defects located during smoke testing and manhole inspection. In addition, dyed water should be introduced into roof drain leaders, driveway drains, or area drains. In some instances, dyed water can be injected into the ground around foundations to check for the illegal connections of foundation drains. After introducing the dyed water, field technicians should check the downstream sewer manhole, and if a cleanout is present, it should be checked for the presence of dyed water. Dye may be directly poured into suspected inflow sources without the aid of smoke testing. The path of the dye is then documented and leaks in the sewer lines or interconnections with storm drain pipes or service laterals are located.

An additional use for dyed water flooding is to verify if a service connection to the main line is active or out of service. The dye is added to service connections and observation of the flow from the service connection is observed in the system using a CCTV video camera. If the dye is

visible the service is active. If the dye is not observed the service has been abandoned or has a significant break and may need to be inspected.

Dye testing with a non-toxic dye is used to confirm rain or ground entry points into the sanitary sewer system.

7.2.2 Gravity Sewer Line and Force Main Defect Analysis

Following completion of the Condition Assessment phase, the system data and information should be analyzed so that a program for rehabilitation of the defective components of the wastewater collection and transmission system can be developed and implemented. The analysis should include review of CCTV videos, digital pictures, and reports. An example of an Excel spreadsheet used to summarize the findings of a Condition Assessment and the sewer segments recommended for rehabilitation is provided in Appendix C.

Suggested criteria for identifying and prioritizing rehabilitation measures within basins, sub-basins, and sewer segments include:

- Impact of failure on public or private property
- Impact of failure on traffic on major thoroughfares and intersections
- Impact of failure on access to hospitals, schools, or major commercial areas
- Impact of failure on public water supplies and waters of the state

It is recommended that the utility establish a uniform system to rank defects by severity and potential to cause a structural failure or SSO. The Internal condition grade descriptions shown in Table 7-5 are an example of a system that could be used to establish priorities for rehabilitation/replacement.

Table 7.5 Summary Internal Condition Grade Descriptions

Condition Grade	Defects	Condition/Action
5	Pipe collapsed; or Pipe deformation >10% and broken; or Extensive areas of missing pipe or Pipe fractured with deformation >10%	Failed: Immediate Action Required
4	Pipe broken; or Pipe deformation <10% and broken; or Pipe fractured with deformation 5-10%; or Multiple pipe fracture; or Serious loss of gradient; or Greater than 75% loss of wall thickness	Severe Damage: Preventative Action Required Renovate (lining) or Repair
3	Pipe fractured with deformation <5%; or Longitudinal cracking or multiple cracking; or Severe joint defects; or Badly made connections; or 50 – 75% loss of wall thickness	Moderate damage: Plan Renovation or Repair or Monitor
2	Light corrosion; or Circumferential pipe cracking; or Moderate joint defects	Do Nothing
1	No corrosion or structural defects	Do Nothing

The weighting factors shown in Table 7-6 are used in conjunction with the Internal Condition Grade Descriptions shown in Table 7-5 to develop the priority ranking shown in Table 7-7 for each basin or sewer segment:

Table 7.6

Location	Weighting Factor
Major thoroughfares and/or intersections	4-5
Adjacent to hospitals, schools	3-5
Adjacent to major commercial areas	3
Parallel to or crossing surface water where failures have the potential to adversely impact surface water supplies	5
Areas where SSOs may present public health and welfare concerns	2-4
Residential streets	2
Easements	1
Pipe Diameter	
6" – 12"	1
15" – 20"	2
21" – 30"	3
36" – 42"	4
≥ 48"	5

An example of the process used to establish priorities for rehabilitation is shown in Table 7-7.

Table 7-7

Sewer Segment	Location Factor	Pipe Diameter Factor	Defect Code	Weighted Score ⁽¹⁾⁽²⁾	Priority
102-E016D to 102-E016C	2	1	4	8	L
102-E049 to 102-E048A	5	3	3	45	H
102-E020 to 102-E019	3	4	2	24	I

(1) Location Factor x Pipe Diameter Factor x Defect Code

(2) If defect code is 1 or 2, no rehabilitation is required regardless of weighted score

The following are suggested priority levels:

- **High Priority** (Priority Score = 30 – 75) – Immediate attention needed
- **Intermediate Priority** (Priority score = 10 – 30) – Rehabilitation can be deferred until the high-priority areas or sewer segments is complete
- **Low Priority** (Priority score = 0 – 10) – Rehabilitation can be completed as budget allows

7.2.3 Manhole Defect Analysis

Following completion of the Condition Assessment phase, the system data and information should be analyzed so that a program for rehabilitation of the defective manholes can be

developed and implemented. The analysis should include review of pole camera videos, digital pictures, and reports. An example of an Excel spreadsheet used to summarize the findings of a Condition Assessment and the sewer segments recommended for rehabilitation is provided in Appendix C.

Suggested criteria for identifying and prioritizing manhole include:

- Impact of failure on public or private property
- Impact of failure on traffic on major thoroughfares and intersections
- Impact of failure on access to hospitals, schools, or major commercial areas
- Impact of failure on public water supplies and waters of the state

It is recommended that the utility establish a uniform system to rank manhole defects by severity and potential to cause a structural failure or SSO. The structural and O&M defects grading shown in Table 7-3 is an example of a system that could be used to establish priorities for rehabilitation/replacement.

The weighting factors shown in Table 7-6 are used in conjunction with the Structural and O&M Defects Grading shown in Table 7-3 to develop the priority ranking shown in Table 7-8 for each manhole.

An example of the process used to establish priorities for rehabilitation is shown in Table 7-8.

Table 7-8

Manhole	Location Factor	Defect Code	Weighted Score ⁽¹⁾⁽²⁾	Priority
102-E016D	2	4	8	I
102-E049	5	3	15	H
102-E020	1	4	4	L

⁽¹⁾Location Factor x Defect Code

⁽²⁾If defect code is 1 or 2, no rehabilitation is required regardless of weighted score

The following are suggested priority levels:

- **High Priority** (Priority Score = 10 – 25) – Immediate attention needed
- **Intermediate Priority** (Priority score = 5 – 10) – Rehabilitation can be deferred until the high-priority areas or sewer segments is complete
- **Low Priority** (Priority score = 0 – 5) – Rehabilitation can be completed as budget allow

A sample Condition Assessment and Recommended Rehabilitation Summary is shown in Appendix C.

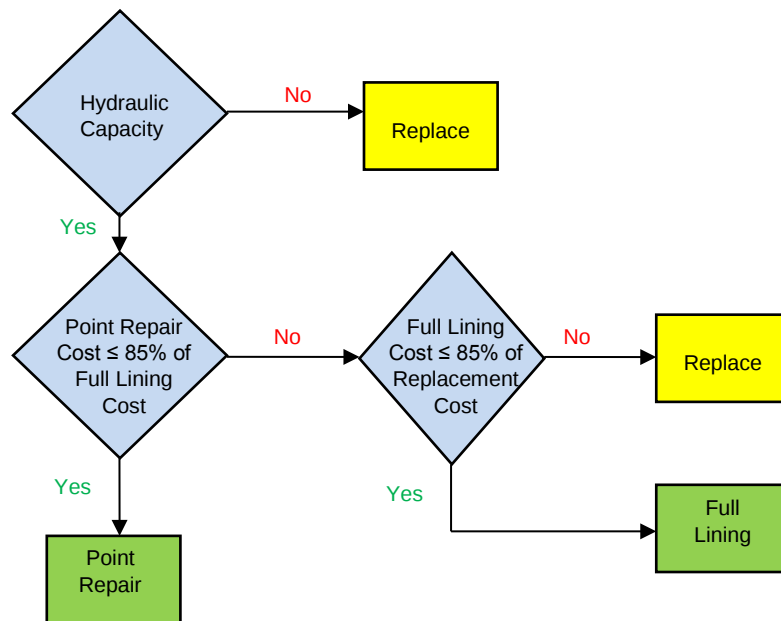
7.2.4 Rehabilitation Decision-Making Process

There are various software packages that integrate with GIS and have the capability to rapidly analyze sewer capacity and condition assessment data so that decisions can be made as to the cost-effective approach to maintaining the required capacity and structural integrity of the system.

An evaluation of available off-the-shelf software should be made and the appropriate package purchased and added to the utility's GIS.

The schematic in Figure 7-2 is an example of a decision-making process that would be included in the analysis tool. The decision-making process would be followed for each Priority Level shown in Table 7-7 and a rehabilitation program schedule would be developed for each priority level.

Figure 7-2



7.3 Rehabilitation

The purpose of sewer system rehabilitation is to restore and maintain the integrity of sanitary sewer gravity lines, manholes, lift stations and force mains; prevent excessive I/I; maximize capacity within the collection system; prevent excessive corrosion, and maintain the system free of defects that could cause structural failure or excessive I/I.

7.3.1 Main Line Sewer and Service Lateral Rehabilitation

Main line, service connections, and service lateral pipe rehabilitation methods depend on pipe size, type, location, dimensional changes, sewer flow, material deposition, surface conditions,

severity of I/I, and other physical factors. Non-structural repairs typically involve the sealing of leaking joints in structurally sound pipe.

Main line sewer and service lateral rehabilitation technologies include:

- Main line sewer CIPP lining
- Pipe bursting
- Point repairs (internal and external)
- CIPP service connection renewal
- Service lateral CIPP lining
- Cleanout installation
- Replacement of all or a portion of a sewer line, service connection, or service lateral
- Spiral-wound PVC or HDPE pipe lining

7.3.1.1 Main Line CIPP Lining

CIPP lining is a trenchless technology suitable for restoring the structural integrity of a sewer line with cracks, fractures, corrosion, holes, or open joints. Circular pipe from 8 inches to 106 inches in diameter and a variety of noncircular pipe, such as egg shapes and box culverts, can be lined. Lining with CIPP removes the pipe from service for the duration of the installation and reinstatement process so bypass pumping may be necessary.

Prior to lining, the pipe must be thoroughly cleaned and inspected by CCTV. Protruding lateral connections also must be removed. Local repairs may be required where the existing pipe is substantially deformed or damaged. After lining, the service connections or laterals are reinstated and the pipe is returned to service, usually within the same day.

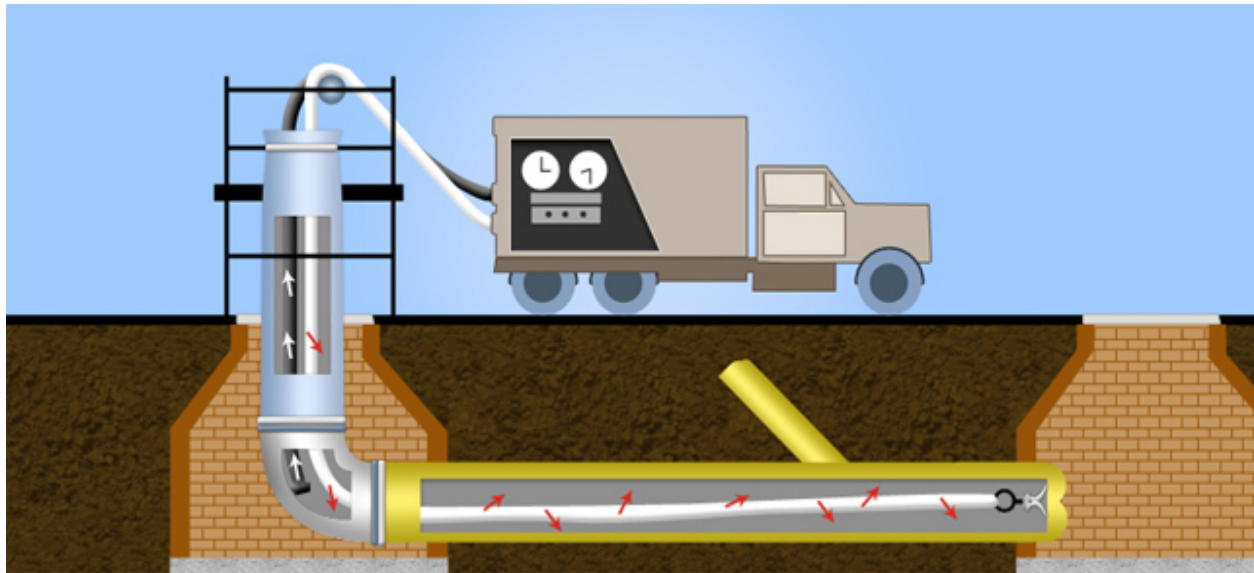
CIPP liners of non-woven polyester felt or fiber reinforced fabric are manufactured to fit the host pipe. The liners are impregnated with a polymer resin, which when cured will form a close fitting liner pipe within the host pipe. The liner should be designed with sufficient thickness when cured to sustain the loads imposed by external groundwater and internal service pressure, and by soil and traffic acting on the pipe.

The liner is thoroughly saturated with polyester, vinyl ester epoxy, or silicate resin using vacuum, gravity, or other applied pressure. The resin includes a chemical catalyst or hardener to facilitate curing. The outermost layer of the liner tube is coated with a polymer film to protect the liner during handling and installation. The impregnated liner may be chilled for transportation to maintain stability until installed.

The process includes inserting a resin-saturated felt tube into a damaged pipe. It is usually done from the upstream access point (manhole or excavation). Little to no digging is involved in this trenchless process, making it a cost-effective and less disruptive method than traditional dig-and-replace pipe repair methods. The liner can be inverted using water or air pressure. The

pressure required for inversion can be generated using pressure vessels, scaffolds, or a Chip Unit. Hot water, UV light, or ambient cure is used to cure the resin and form a tight-fitting, jointless and corrosion-resistant replacement pipe. Service laterals are restored internally with robotically controlled cutting devices. All cut surfaces should be treated and/or sealed with additional application of resin material or as otherwise specified. All laterals that are connected into rehabilitated pipelines should be designed and installed to ensure that groundwater is not permitted to enter the pipeline via the interface between the lining and the existing host pipe. The resin used is typically polyester. Because all resins shrink and it is impossible to bond to a sewer that has FOG, an annular space exists between the new CIPP liner and the host pipe. The annular space exists in all installations. The most effective way to prevent water from tracking in the annular space and entering back into the waste stream is through gasket or resin sealing technology. Gaskets or resins made from water swelling material (hydrophilic) should be placed at the ends of the host pipe. Following installation of the CIPP liner, the rehabilitated pipe should be inspected by CCTV to confirm proper installation.

Figure 7-3 Typical CIPP Installation



CIPP liners may be installed using the inversion method as shown above. The inversion method employs a scaffold tower or pressure vessel to apply air or water pressure to turn the liner inside-out and push it along the host pipe.

CIPP liners also may be installed by winching into place through a manhole or specially prepared access point and inflated to come into close contact with the circumference of the existing pipe. The liner is restrained in any intermediate manhole.

CIPP liners may be inflated or inverted with air or water pressure. Lengths installed may vary from short sections over a joint or defect, to full length linings typically 100 to 500 feet. Lengths of up to 3000 feet have been installed in a single pass.

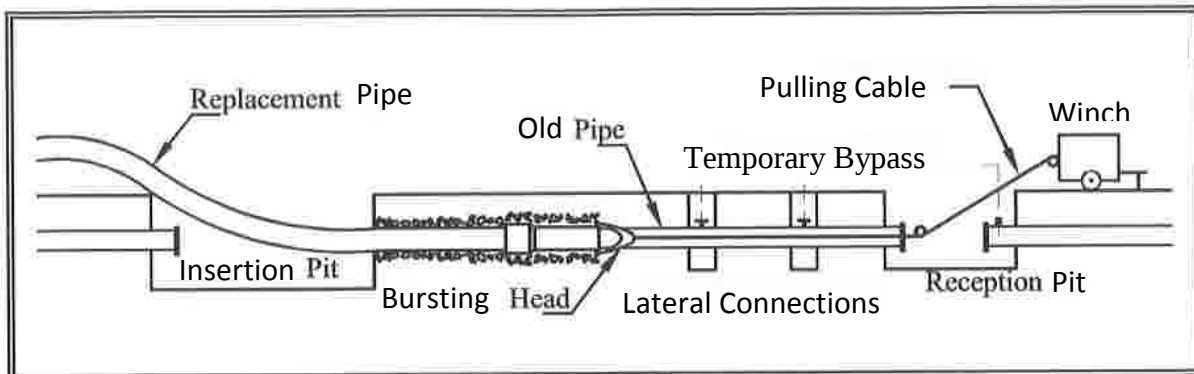
The resin impregnated liner may cure at ambient temperature but the cure is usually accelerated by application of heat by circulation of inversion water through a boiler, blending steam with inflation air or by pulling through a UV light train. After the pipe has been cured, the liner is cooled and the ends removed flush with the pipe ends, and sealed where necessary. The curing water or steam condensate and the trimmings cut from the liner are removed for safe disposal. A sample of the CIPP should be taken from pipe ends or from a mold cured under the conditions of manufacture for testing and verification that the liner met performance specifications.

7.3.1.2 Pipe Bursting

Pipe bursting is a trenchless technology that is used to rehabilitate sewer lines with cracks, fractures, corrosion, holes, or open joints when an increase in pipe size is required to provide additional hydraulic capacity. Launching and receiving pits replace the open cut trench required by conventional pipe-laying.

As shown in Figure 7-4, there are five key pieces of equipment used in a pipebursting operation: the bursting head, pulling rods, a pulling machine (winch), a retaining device, and a hydraulic power pack.

Figure 7-4 - Typical Pipe-Bursting Operation Layout



Pipe bursting, which can be either pneumatic, hydraulic expansion or static pull, fractures a pipe and displaces the fragments outwards while a new pipe is drawn in to replace the old pipe. Typical pipe bursting involves the insertion of a conically shaped tool (bursting head) into the old pipe. The head fractures the old pipe and forces its fragments into the surrounding soil. At the same time, a new pipe is pulled or pushed in behind the bursting head. The base of bursting head is larger than the inside diameter of the old pipe to fracture it. It is also slightly larger than the outside diameter of the new pipe, to reduce friction on the new pipe and to provide space

for maneuvering the pipe. The rear of the bursting head is connected to the new pipe, while its front end is connected to a cable or pulling rod.

The size of the pipe currently being replaced by pipe bursting typically ranges from 8 inches to 36 inches, although the bursting of larger diameters is increasing (pipes up to 48 inches diameter have been replaced). Theoretically there is not a limit in size of pipe to be burst; the limit depends on the cost effectiveness compared to conventional replacement, on the local ground conditions as to the potential for ground movement and vibration, and the ability to provide sufficient energy to break the existing pipe while simultaneously pulling in a new pipe.

Pipe bursting is typically carried out in 300- to 400-foot lengths, which corresponds to a typical distance between sewer manholes; however, much longer runs have been replaced. Pipes suitable for pipe bursting are typically made of brittle materials, such as vitrified clay, cast iron, plain concrete, asbestos, or some plastics. Reinforced concrete pipe (RCP) can also be successfully replaced if it is not heavily reinforced or if it is substantially deteriorated. Ductile iron and steel pipes are not suitable for pipe bursting, and can only be replaced with pipe splitting.

Pipe bursting has limitations. Difficulty can arise in expansive soils, close proximity of other service lines, point repairs that reinforce the existing pipe with ductile material, a collapsed pipe at a certain point along the pipe, etc. Pipe bursting operation creates outward ground displacements adjacent to the pipe alignment. The ground displacements tend to be localized, however, and to dissipate rapidly away from the bursting operation. The bursting operation can cause ground heave or settlement above or at some distance from the pipe alignment. The most critical conditions for ground displacement are when the pipe to be burst is shallow and ground displacements are primarily directed upward, significant upsizing percentages for large-diameter pipes are used, and deteriorated existing utilities are present within 2-3 diameters of the pipe being replaced.

The most favorable ground conditions for pipe bursting are soils that can be moderately compacted (reducing the lateral extent of outward ground movements), in which the expanded hole behind the bursting head does not cave in before the replacement pipe is installed (lowering the drag and the tensile stresses in the pipe during installation). Less favorable ground conditions involve densely compacted soils and backfills and soils below the water table. Each of these soil conditions tends to increase the force required for the bursting operation and to increase the zone of influence of the ground movements. Special soils such as highly expansive soils or collapsible soils will also cause problems. For most soil conditions, it is simply necessary to provide the required power to effect the burst, displace the soil, and pull the replacement pipe in over the length of the burst and to consider the potential effect of the ground displacements and vibrations on adjacent utilities and structures. Longer bursts can be accomplished more easily in favorable ground conditions. When the soil provides a high-friction drag on the pipe and the length of run is long enough to generate high-tensile forces on the

replacement pipe, bentonite or polymer lubrication muds may be injected into the annular space behind the bursting head to help keep the hole open and to reduce the frictional drag on the replacement pipe. HDPE and MDPE are the most common replacement pipe materials. Other types of replacement pipe used in pipe bursting include cast iron pipe, vitrified clay pipe, and reinforced concrete pipe.

7.3.1.3 Internal Point Repairs

In instances where pipe defects, such as cracks, fractures, holes, voids, or open joints, are found in a few sections of an otherwise structurally sound pipe, it may be cost effective to make an internal CIPP sectional repair instead of a full-length CIPP liner or external point repair. CIPP internal sectional repairs typically range from 3 to 30 feet in length with diameters ranging from 6 inches through 48 inches. A comparison of the cost of the internal sectional repair(s) versus full CIPP lining and internal sectional repair versus external point repair should be made to determine the approach to be used. If the cost of CIPP lining of the full length of the pipe is not 15% greater than the cost of sectional repair(s), CIPP lining of the full pipe length should be utilized.

Prior to installation of the sectional liner, the pipe must be thoroughly cleaned and inspected by CCTV.

Internal sectional CIPP repairs are typically made utilizing the liner/bladder assembly-inversion method, which includes:

- **Vacuum Impregnation.** This ensures that all of the air is completely removed from the textile lining tube while drawing the resin in, fully saturating every fiber, thus producing a very dense and uniform cured-in-place pipe.
- **Translucent Inversion Bladder.** This allows the installer and inspector an opportunity to visually inspect and verify that the liner is completely vacuum impregnated.
- **Liner/Bladder Assembly.** The liner is contained within the inversion bladder and tabs are used to connect the leading end of the liner to the bladder allowing for the liner/bladder to invert anywhere in the pipeline.
- **Launching/Inflation Device.** The liner/bladder assembly is loaded into a flexible launching device. The resin-saturated liner is contained within the launching device, completely protecting the liner from the time it is resin saturated until such time that it is properly positioned at the point of repair. Protecting the resin-saturated liner within the launching device is an integral part of any repair and ensures the resin is not wiped off or contaminated. The resin that provides a structural repair only contacts the pipe at the point of repair.

- **Visual Placement.** A CCTV camera is placed in front of the tube and launcher as it is inverted in place allowing for exact visual placement of the. The liner is positioned at the beginning of the damaged pipe section minimizing the danger of further damaging the defect area. Air pressure is then applied causing the liner/bladder assembly to invert rolling its way through the damaged pipe section.
- **Resin Migration.** By the action of the inversion bladder and air pressure, the liner is turned inside out—or inverted—forcing the resin against the existing pipe wall. Excess resin is utilized to ensure that full migration occurs through any defects or open joints. The excess resin is pressed into every existing pipe defect, sealing and mechanically locking the liner into the pipe as it is held in place under pressure by the inversion bladder.
- **Removal.** The bladder is re-inverted and peeled away from the cured liner as it is drawn back into the launching device. With a camera positioned at the end of the liner, a mechanical lock test is performed utilizing the frangible tabs attached to the end of the lining tube located around the entire circumference of the textile tube. Removal of the equipment from the pipe completes the repair.

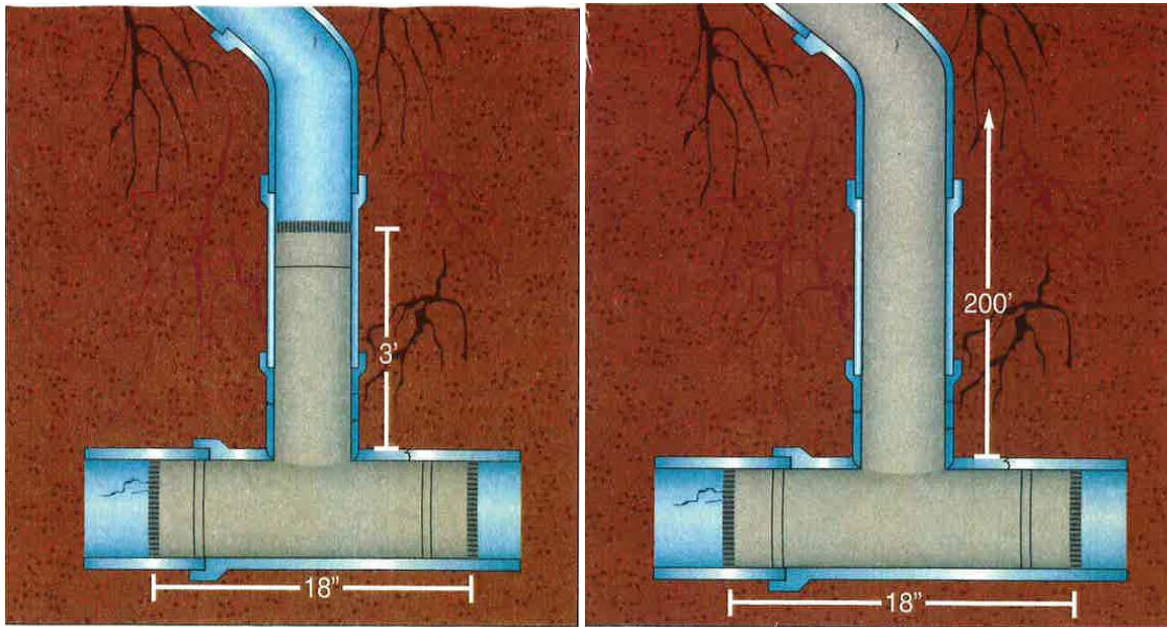
A CCTV inspection should be performed to verify the proper cure of the material, the proper trim of service connection, and the integrity of the seamless pipe.

Each end of the CIPP sectional repair should be sealed with a gasket or resins made from water-swelling material (hydrophilic).

7.3.1.4 CIPP Service Connection Renewal

In instances where service connection defects, such as break in taps, cracks, fractures, holes, voids, or open joints are found, it may be cost effective to make an internal CIPP service connection renewal instead of an external repair/replacement. CIPP service connect renewals can be made in main line sewers with diameters ranging from 6 inches through 30+ inches and laterals ranging in diameter from 6 inches to 12 inches. A comparison of the cost of the internal service connection renewal versus external repair/replacement should be made to determine the approach to be used.

As shown in Figure 7-5, the CIPP service connection renewal consists of one piece structural lining tube that is installed from the main line sewer. If the service lateral does not have defects, the CIPP service connection renewal is extended 18 inches to 36 inches into the service lateral. If the service lateral has defects requiring rehabilitation, the CIPP liner can be extended up to 200 feet.

Figure 7-5: Typical CIPP Service Connection Renewal

Prior to installation of the sectional liner, the pipe must be thoroughly cleaned and inspected by CCTV.

Internal sectional CIPP repairs are typically made utilizing the liner/bladder assembly-inversion method, which includes:

- **Vacuum Impregnation.** This ensures that all of the air is completely removed from the textile lining tube while drawing the resin in, fully saturating every fiber, thus producing a very dense and uniform cured-in-place pipe.
- **Translucent Inversion Bladder.** This allows the installer and inspector an opportunity to visually inspect and verify that the liner is completely vacuum impregnated.
- **Liner/Bladder Assembly.** The liner is contained within the inversion bladder and lirsion tabs are used to connect the leading end of the liner to the bladder allowing for the liner/bladder to invert anywhere in the pipeline.
- **Launching/Inflation Device.** The liner/bladder assembly is loaded into a flexible launching device. The resin-saturated liner is contained within the launching device, completely protecting the liner from the time it is resin saturated until such time that it is properly positioned at the point of repair. Protecting the resin-saturated liner within the launching device is an integral part of any repair and ensures the resin is not wiped off or contaminated. The resin that provides a structural repair only contacts the pipe at the point of repair.

- **Visual Placement.** A CCTV camera is placed in front of the tube and launcher as it is inverted in place allowing for exact visual placement of the. The liner is positioned at the beginning of the damaged pipe section minimizing the danger of further damaging the defect area. Air pressure is then applied causing the liner/bladder assembly to invert rolling its way through the damaged pipe section.
- **Resin Migration.** By the action of the inversion bladder and air pressure the liner is turned inside out—or inverted”—forcing the resin against the existing pipe wall. Excess resin is utilized to ensure that full migration occurs through any defects or open joints. The excess resin is pressed into every existing pipe defect, sealing and mechanically locking the liner into the pipe as it is held in-place under pressure by the inversion bladder.
- **Removal.** The bladder is re-inverted and peeled away from the cured liner as it is drawn back into the launching device. With a camera positioned at the end of the liner, a mechanical lock test is performed utilizing the frangible tabs attached to the end of the lining tube located around the entire circumference of the textile tube. Removal of the equipment from the pipe completes the repair.

A CCTV inspection should be performed to verify the proper cure of the material and the integrity of the seamless pipe.

The ends of the CIPP service connection renewal should be sealed with a gasket or resins made from water-swelling material (hydrophilic).

7.3.1.5 Service Lateral CIPP Lining

In instances where service lateral defects, such as, cracks, fractures, holes, voids, or open joints, are found, it may be cost effective to install a service lateral CIPP liner instead of an external repair/replacement. CIPP service connect renewals can be made in laterals ranging in diameter from 6 inches to 12 inches. A comparison of the cost of the CIPP service lateral liner versus external repair/replacement should be made to determine the approach to be used.

Prior to installation of the service later liner, the service lateral must be thoroughly cleaned and inspected by CCTV. Installation of the lateral liner can be made from the main line sewer or a cleanout.

CIPP service lateral liners are typically installed utilizing the liner/bladder assembly-inversion method, which includes:

- **Vacuum Impregnation.** This ensures that all of the air is completely removed from the textile lining tube while drawing the resin in, fully saturating every fiber, thus producing a very dense and uniform cured-in-place pipe.
- **Translucent Inversion Bladder.** This allows the installer and inspector an opportunity to visually inspect and verify that the liner is completely vacuum impregnated.

- **Liner/Bladder Assembly.** The liner is contained within the inversion bladder and lirsion tabs are used to connect the leading end of the liner to the bladder allowing for the liner/bladder to invert anywhere in the pipeline.
- **Launching/Inflation Device.** The liner/bladder assembly is loaded into a flexible launching device. The resin-saturated liner is contained within the launching device, completely protecting the liner from the time it is resin saturated until such time that it is properly positioned at the point of repair. Protecting the resin-saturated liner within the launching device is an integral part of any repair and ensures the resin is not wiped off or contaminated. The resin that provides a structural repair only contacts the pipe at the point of repair.
- **Visual Placement.** A CCTV camera is placed in front of the tube and launcher as it is inverted in place allowing for exact visual placement of the. The liner is positioned at the beginning of the damaged pipe section minimizing the danger of further damaging the defect area. Air pressure is then applied causing the liner/bladder assembly to invert rolling its way through the damaged pipe section.
- **Resin Migration.** By the action of the inversion bladder and air pressure the liner is turned inside out—or inverted—forcing the resin against the existing pipe wall. Excess resin is utilized to ensure that full migration occurs through any defects or open joints. The excess resin is pressed into every existing pipe defect, sealing and mechanically locking the liner into the pipe as it is held in-place under pressure by the inversion bladder.
- **Removal.** The bladder is re-inverted and peeled away from the cured liner as it is drawn back into the launching device. With a camera positioned at the end of the liner, a mechanical lock test is performed utilizing the frangible tabs attached to the end of the lining tube located around the entire circumference of the textile tube. Removal of the equipment from the pipe completes the repair.

A CCTV inspection should be performed to verify the proper material cure and the integrity of the seamless pipe.

The ends of the CIPP service connection renewal should be sealed with a gasket or resins made from water-swelling material (hydrophilic).

7.3.1.6 Cleanout Installation

New cleanouts should be installed at the edge of and within the ROW or utility easement when the utility portion of the sewer service lateral is lined or replaced.

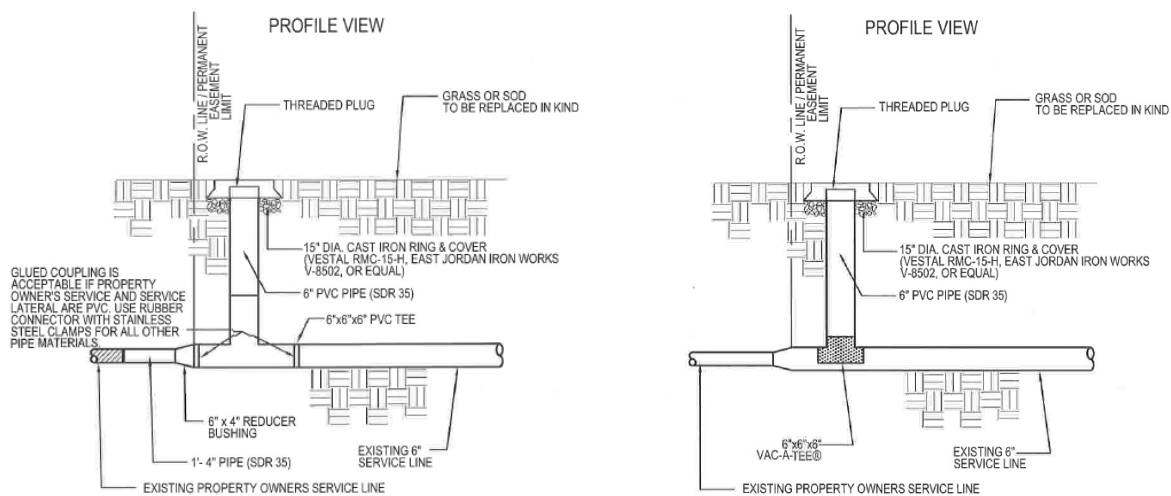
Vacuum excavation should be utilized for installation of cleanouts, whenever possible, to minimize the impacts of installation. The vacuum excavating equipment utilizes high-pressure

air or water injection to dislodge soil for safe removal by the vacuum system. Vacuum system equipment should include a tank to store materials removed for transport to disposal location.

In grassed areas, the sod should be neatly cut, removed, and protected for replacement following completion of installation, testing, and backfill of the excavation for the cleanout. In paved or sidewalk areas, the pavement or sidewalk should be straight cut and removed.

The cleanout should be installed as shown in Figure 7-6 in accordance with Cobb County Water System details. The VAC-A-Tee system is a propriety system provided by LMK Technologies and can be installed with minimum excavation and impact on adjacent property.

Figure 7-6 - Typical Cleanout Installation Options



7.3.1.7 Spiral-wound PVC or HPDE Pipe Lining

Spiral wound PVC and HDPE pipe lining is a trenchless technology suitable for restoring the structural integrity of a sewer line with cracks, fractures, corrosion, holes or open joints. Spiral wound PVC liners are typically used for pipe with diameters of 8 inches to 42 inches and Spiral wound HPDE liners are typically used for pipe with diameters of 35 inches to 118 inches. Spiral-wound liners can be installed with low flow in the sewer; however, under high flow conditions, bypassing may be required

7.3.1.7.1 Spiral-wound PVC Liner

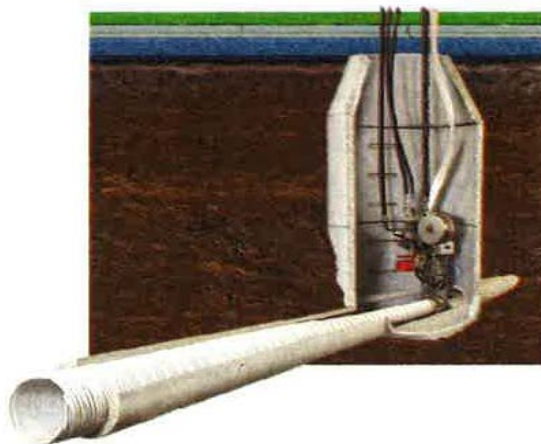
The PVC liner system consists of a factory-extruded plastic profile, winding machine, and ancillary equipment such as spools for profile handling and hydraulic power packs. The liner is placed in close contact with the host pipe and can therefore be designed as a close fit liner.

The PVC liner has double-locking configuration as shown in Figure 7-7. The secondary lock is formed using hot melt adhesive which holds the liner at a constant diameter as it is wound in the winding machine at the base of the access chamber. The winding machine also inserts a high strength steel “cutting wire” between the primary and secondary locks as the edges of the profile are locked together.

Figure 7-7 - Before and After Expansion of the Liner

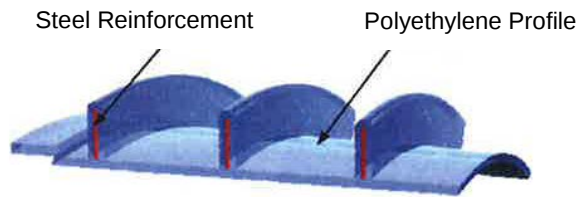
Prior to lining, the pipe must be thoroughly cleaned and inspected by CCTV. Protruding lateral connections also must be removed. Local repairs may be required where the existing pipe is substantially deformed or damaged. After lining, the service connections or laterals are reinstated and the pipe is returned to service, usually within the same day.

After the liner is wound from one manhole to the next, the end of the liner is held in position and the secondary lock progressively severed by pulling the cutting wire. The edges of the profile are then free to slide relative to one another, along the primary lock, as the winding machine continues to wind more profile thereby causing the liner to expand against the wall of the host pipe.

Figure 7-8 – Installation of Spiral-Wound PVC Liner

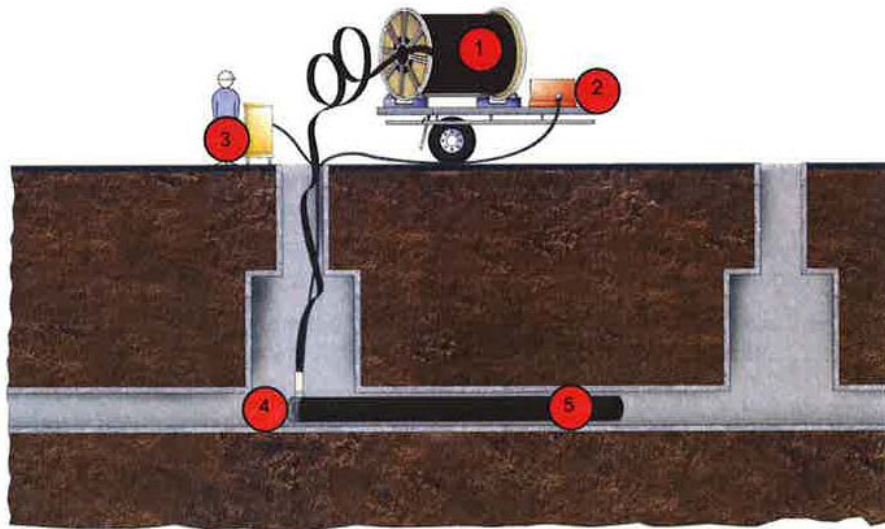
7.3.1.7.2 Spiral-wound HDPE Liner

The HDPE liner system consists of a factory-extruded plastic profile with vertical strips of steel imbedded within the profile. The liner is placed in the host pipe at a fixed diameter and the annular space between the liner and host pipe wall is subsequently grouted with cementitious grout.

Figure 7-9 – Spiral Wound HDPE Liner Profile

Prior to lining, the pipe must be thoroughly cleaned and inspected prior by CCTV. Protruding lateral connections also must be removed. Local repairs may be required where the existing pipe is substantially deformed or damaged. After lining, the service connections or laterals are reinstated and the pipe is returned to service, usually within the same day.

Installation of the liner is accomplished by placing the winding machine in the base of the access chamber and then feeding the reinforced HDPE profile liner into the machine from the above-ground spool. The winding machine winds the profile to form the liner in the host pipe and as the profile is spirally wound it is continuously welded together using molten HDPE to produce a continuous liner. Both ends of the liner are sealed and the annulus between the host pipe and liner is grouted.

Figure 7-10 – Spiral-wound HDPE Liner Profile

1. Spool of HDPE profile liner
2. Hydraulic power pack, generator, and compressor
3. Control panel, material feeder, hot air blower, distribution board, and welder
4. Winding machine
5. HDPE Liner and flotation tubes/hubs

7.3.2 Manhole Rehabilitation

Manhole rehabilitation methods depend on size, type, location, degree of deterioration, material, surface conditions, severity of I/I, and other physical factors. Manhole surfaces to be rehabilitated must be properly cleaned using a high-pressure jet wash at a minimum of 3,500 psi water pressure to remove all dust, biological growths, grease, oils, or any other surface contaminants or coatings. An abrasive blast, high-pressure water blast, or acid etching should be used to obtain a uniform sound substrate with a neutral pH prior to the application of epoxy liners.

Manhole rehabilitation technologies include the following:

- Manhole sealing and patching
- Chemical-resistant coatings and liners
 - Epoxy resins
 - Elastomeric polyurethane
 - Polyurea
- Cementitious liner
- Polymer concrete liners
- Manhole replacement
 - Composite polymer concrete
 - Pre-cast concrete

7.3.2.1 Manhole Sealing and Patching

Manholes with active leaks must be sealed prior to installation of liners. Manhole with non-leaking holes, cracks, and spalls in concrete and masonry manhole walls, benches, and slabs as well as through-flow channel dressing must be patched prior to installation of liners.

Chemical sealing materials are used to seal active leaks. The sealing material should be selected based on the type and severity of the leak(s) and should meet the following criteria:

- Ability to react/perform in the presence of water (groundwater) while being injected (i.e., the sealant should be hydrophilic)
- Ability to withstand submergence in water without degradation
- Ability to prevent, on a continuing basis, the passage of water (infiltration) through manhole joints
- The sealant material, after curing, should be flexible as opposed to brittle, able to withstand freeze/thaw and wet/dry cycles without adversely affecting sealant properties, not be biodegradable, chemically stable, and resistant to the mild concentrations of acids, alkalis, and organics found in normal sewage

Chemical sealing materials suitable for sealing active leaks include:

- Acrylamide base gel
- Acrylic base gel
- Urethane base gel
- Urethane-based foam

The patching material should be a premixed, non-shrink, cement-based patching material consisting of hydraulic cement, graded silica aggregates, and special plasticizing and accelerating agents, which has been formulated for vertical or overhead use. It should not contain chlorides, gypsums, plasters, iron particles, aluminum powder, or gas-forming agents or promote the corrosion of steel it may come into contact with.

7.3.2.2 Chemical Resistant Coatings and Liners

Chemical resistant coatings and liners should be used in manholes subject to corrosion and attack from industrial chemicals or hydrogen sulfide. Chemical resistant materials include:

- Epoxy Resins
- Elastomeric Polyurethane
- Polyurea (Pure and hybrid formulations)

These coatings are applied by spraying on to manhole surfaces to develop the specified thickness.

7.3.2.3 Cementitious Liner

Cementitious liners are used to improve the structural integrity of defective manholes and are applied by gun spraying or spincasting. Cementitious liners are not appropriate for use in manholes subject to corrosion due to the presence of hydrogen sulfide unless additives are included to prevent the growth of bacteria that produce sulphuric acid. Cementitious liners include:

- Portland cement with aggregate
- Calcium aluminate cement with select aggregates
- 100% pure-fused calcium aluminate cement with calcium aluminate aggregate
- Portland cement or calcium aluminate cement-based product with liquid additive to prevent growth of bacteria that causes microbial induced corrosion.

7.3.2.4 Polymer Concrete Liners

Polymer concrete liners can be used to rehabilitate an existing manhole and is typically less expensive than replacing the manhole. Composite polymer concrete liners are constructed in a factory using a mix of aggregates and fillers that are held together with a high-strength thermosetting resin binder. The liner can include steel or polymer rod reinforcing when

required to meet specific structural requirements. The liner system typically includes a new base section installed within the existing manhole after the existing base slab is repaired. Riser sections are installed above the base riser section as required. If required, a new cone section and grade rings are installed. Excavation will be required to remove the existing cone and grade rings and install the new cone and grade rings. After installation of the riser base and riser sections, the annular space between the existing manhole wall and the new polymer concrete liner is filled with grout.

7.3.2.5 Manhole Replacement

In situations where it has been determined that it is cost effective to replace a manhole, the following options are available:

- Composite polymer concrete
- Pre-cast concrete

In locations where the manhole is subject to attack from hydrogen sulfide or industrial chemicals, the composite polymer concrete manhole should be the selected option.

7.3.2.5.1 Composite Polymer Concrete Manhole

Composite polymer concrete manholes are constructed in a factory using a mix of aggregates and fillers that are held together with a high-strength thermosetting resin binder. The structure can include steel or polymer rod reinforcing when required to meet specific structural requirements. The manholes are typically provided with a base section, riser section(s), cone section, and grade rings. A standard manhole ring and cover is installed on top of the grade rings or cone section.

The base section includes pipe connections to match the diameter of the existing sewers to be reconnected to the manhole. The existing sewers are joined to the composite polymer concrete pipe connection with a Fernco adapter.

7.3.2.5.2 Pre-cast Concrete Manhole

Pre-cast concrete manholes are constructed in a factory using steel reinforced concrete. The manholes are typically provided with a base section, riser section(s), cone section, and grade rings. A standard manhole ring and cover is installed on top of the grade rings or cone section.

The base section includes openings sized to match the diameter of the existing sewers to be reconnected to the manhole. The existing sewers are joined to the precast concrete manhole with a standard rubber boot and stainless steel clamp.

7.3.2.6 Quality Assurance and Testing

Inspections and testing are performed following installation of manhole sealing, patching, and liner systems to ensure that the requirements of the technical specifications are met. Quality assurance and testing should include the following:

- Visual Inspection (no defects that will affect the service life or intended operational/function)
- Wet film thickness measurement
- Adhesion testing
- Vacuum testing (when entire manhole is lined)
- Holiday detection (all polymer-based liners)

7.3.3 Procedures for Tracking and Measuring

Procedures for tracking and inventorying completed condition assessments and rehabilitation measures, including identification of the rehabilitation techniques used, should be included in the Program.

It is recommended that the utility's GIS and CMMS be used to track condition assessments and rehabilitation information.

7.4 Program Resources

Staffing for support of the Condition Assessment and Rehabilitation Program should be based on the size of the wastewater collection system, amount of available system condition information, and projected or required implementation schedule. Condition assessment and system rehabilitation may be assigned to the utility's Engineering or Maintenance Division. The following types of staff are typical for maintaining a sewer mapping program:

- Program Manager
- Contract Manager(s)
- Engineer(s) (for review of condition assessments and development of condition assessment and rehabilitation contracts)
- GIS Technician
- CCTV Crew(s)
- Sewer Cleaning Crew(s)
- Field Inspectors(s)
- Surveyors
- Consultants and/or Contractors

The following are suggested resources and equipment that should be provided to inspection personnel:

- CCTV vehicle(s) and camera(s)
- Sewer cleaning vehicles
- Lateral CCTV inspection cameras

- Safety equipment
- Pole-mounted camera for manhole inspections

The SCARP Program is supported by the Engineering and Records Division Manager who oversees planning, prioritization, and contract activities that support the program. Program Contract Managers and Inspectors oversee contract activities. Refer to box inserts for current and recommended resources.

7.5 Key Performance Indicators

Performance measures are important management tools that allow for continuous measurement and evaluation of program activities. Performance measures are used to collect information to enable the utility to determine if established goals and level of service are being met and if not, what activities need to be adjusted to meet program goals.

The following are suggested KPIs.

KPI	Formula	Definition	Desired Result	Utility Group
CCTV Inspection of High Priority Sewer Lines	#miles inspected/Total miles of sewer line	Annual miles of sewer line inspected. Break category into <12", 12 to <15, 15 to <24, 24 to 36, >36.	25% of total miles inspected per year.	Eng
CCTV Inspection of Intermediate Priority Sewer Lines	#miles inspected/Total miles of sewer line	Annual miles of sewer line inspected. Break category into <12", 12 to <15, 15 to <24, 24 to 36, >36.	25% of total miles inspected per year after completion of High Priority areas.	Eng
CCTV Inspection of Sewer Service Laterals on High Priority Sewer Lines	#feet inspected/Total feet of sewer laterals on High Priority Sewer Lines	Annual feet of sewer service laterals inspected.	100% of total feet of Sewer Service Laterals on High Priority Sewer Lines Inspected	Eng
CCTV Inspection of Sewer Service Laterals on Intermediate Priority Sewer Lines	#feet inspected/Total feet of sewer laterals on Intermediate Priority Sewer Lines	Annual feet of sewer service laterals inspected.	100% of total feet of Sewer Service Laterals on Intermediate Priority Sewer Lines Inspected	Eng
Inspection of manholes on High Priority sewer segments	# inspected X 100 / Total # of manholes in system	Inspection of manholes on High Priority Sewer lines.	25% of total # on High Priority sewer lines inspected per year	Eng

KPI	Formula	Definition	Desired Result	Utility Group
Inspection of manholes on Intermediate Priority sewer segments	$\# \text{ inspected} \times 100 / \text{Total \# of manholes in system}$	Inspection of manholes on Intermediate Priority sewer lines.	25% of total # on Intermediate Priority sewer lines inspected per year	Eng
Rehabilitation/Replacement of Manholes, on High Priority sewer segments,	$\# \text{ rehabilitated/replaced manholes} / \text{Total \# of defective manholes on High Priority sewer lines}$	Number of manholes rehabilitated/replaced	100% within 5 years of identification	Eng
Rehabilitation/Replacement of Manholes on Intermediate Priority sewer segments	$\# \text{ rehabilitated and replaced manholes} \times 100 / \text{Total \# of manholes on Intermediate Priority sewer lines.}$	Number of manholes rehabilitated/replaced	100% within 5 years of completion of High Priority manholes	Eng
Rehabilitation of High Priority Sewer Mains	$100 \times \# \text{ feet by size} / \text{Total \# existing feet of High Priority sewer lines of that size}$	Rate at which existing sewer mains are being rehabilitated by size. Break category into <12", 12 to <15, 15 to <24, 24 to 36, >36.	100% within 5 years of identification	Eng
Rehabilitation of Intermediate Priority Sewer Mains	$100 \times \# \text{ feet by size} / \text{Total \# existing feet of Intermediate Priority sewer lines of that size}$	Rate at which existing sewer mains are being rehabilitated by size. Break category into <12", 12 to <15, 15 to <24, 24 to 36, >36.	100% within 5 years of completion of High Priority sewer lines	Eng
Replacement or Rehabilitation of Service Lateral/Service Connection on High Priority sewer lines	$100 \times \# \text{ completed} / \text{Total \# of connections on High Priority sewer lines}$	Rate at which existing service laterals are being replaced or rehabilitated.	100% within 5 years of identification	Eng
Replacement or Rehabilitation of Service Lateral/Service Connection on Intermediate Priority sewer lines	$100 \times \# \text{ completed} / \text{Total \# of connections on Intermediate Priority sewer lines}$	Rate at which existing service laterals are being replaced or rehabilitated.	100% within 5 years of completion of High Priority sewer lines	Eng
% of Flow Monitoring	$\# \text{ miles Monitored} (>8") \times 100 / \text{Total Miles} (>8")$	Miles of flow monitoring to use for capacity and spill prevention	100%	Eng

KPI	Formula	Definition	Desired Result	Utility Group
%RDII Reduction per year	Comparison of RDII year to year	Correlation between wet weather and dry weather flow variations due to lack of system integrity.	Annual	Eng

7.6 Program Procedures

The following sewer system condition assessment and rehabilitation program procedures have been developed to describe how specific activities are conducted.

Program procedures are provided in Appendix E and include:

- Inspection Technologies
- Manhole Inspection (Procedure and Form)
- CCTV Sewer Inspection (Procedure)
- Dye Testing (Procedure and Form)
- Smoke Testing (Procedure and Form)

Appendix A

Condition Assessment Priority List

Condition Assessment Priority List

MH UpStream	MH DownStream	MainType	Diameter	Material	Material Factor	Length	Location	Location Factor	Installation Date	Current Date	Age	Age Factor	CCTV (Date)	Rehab (Type)	I/I	I/I Factor	Spills	Spills Factor	Subject to Corrosion	Corrosion Factor	Blockages	Blockages Factor	Score	Priority
231-D001	322-9001	COLLECTOR	8	PVC	0	256	E	1	1-May-83	Oct-16	33	4							N	0			5	L
231-9001	322-0071	COLLECTOR	8	PVC	0	8	E	1	1-May-83	Oct-16	33	4							N	0			5	L
231-D002	231-D001	COLLECTOR	8	PVC	0	126	RS	2	1-May-83	Oct-16	33	4							N	0			6	L
231-D003	231-D002	COLLECTOR	8	PVC	0	286	RS	2	1-May-83	Oct-16	33	4							N	0			6	L
231-D004	231-D003	COLLECTOR	8	PVC	0	224	RS	2	1-May-83	Oct-16	33	4							N	0			6	L
231-D005	231-D004	COLLECTOR	8	PVC	0	81	RS	2	1-May-83	Oct-16	33	4							N	0			6	L
231-D006	231-D005	COLLECTOR	8	PVC	0	201	RS	2	1-May-83	Oct-16	33	4							N	0			6	L
231-D007	231-D003	COLLECTOR	8	PVC	0	122	RS	2	1-May-83	Oct-16	33	4							N	0			6	L
231-D008	231-D007	COLLECTOR	8	PVC	0	103	RS	2	1-May-83	Oct-16	33	4							N	0			6	L
231-D009	231-D001	COLLECTOR	8	PVC	0	168	RS	2	1-May-83	Oct-16	33	4							N	0			6	L
231-D010	231-D009	COLLECTOR	8	PVC	0	202	RS	2	1-May-83	Oct-16	33	4							N	0			6	L
231-D011	231-D010	COLLECTOR	8	PVC	0	236	RS	2	1-May-83	Oct-16	33	4							N	0			6	L
231-D012	231-D011	COLLECTOR	8	PVC	0	132	RS	2	1-May-83	Oct-16	33	4							N	0			6	L
231-D013	231-D012	COLLECTOR	8	PVC	0	144	RS	2	1-May-83	Oct-16	33	4							N	0			6	L
231-D014	231-D013	COLLECTOR	8	PVC	0	171	RS	2	1-May-83	Oct-16	33	4							N	0			6	L
231-D015	231-D013	COLLECTOR	8	PVC	0	166	E	1	1-May-83	Oct-16	33	4							N	0			5	L
231-D016	231-D013	COLLECTOR	8	PVC	0	293	RS	2	1-May-83	Oct-16	33	4							N	0			6	L
231-D017	231-D016	COLLECTOR	8	PVC	0	149	RS	2	1-May-83	Oct-16	33	4							N	0			6	L
231-D018	231-D017	COLLECTOR	8	PVC	0	246	RS	2	1-May-83	Oct-16	33	4							N	0			6	L
231-D019	231-D015	COLLECTOR	8	PVC	0	216	RS	2	1-Mar-84	Oct-16	32	4							N	0			6	L
231-D020	231-D015	COLLECTOR	8	PVC	0	156	E	1	1-Mar-84	Oct-16	32	4							N	0			5	L
300-0000	300-000JB3	INTERCEPTOR	72	UNKNOWN		24	E	1	1-Mar-00	Oct-16	16	2							N	0			3	L
300-0003	TP02	INTERCEPTOR	72	PC	0	495	WRF	3	1-Mar-00	Oct-16	16	2							Y	5			10	I
300-0003A	300-0003	INTERCEPTOR	72	PC	0	115	WRF	3	1-Mar-00	Oct-16	16	2							Y	5			10	I
300-0004	300-0003B	INTERCEPTOR	54	UNKNOWN		20	WRF/SW	4	1-Mar-00	Oct-16	16	2							N	0			6	L
300-0003B	300-0004	INTERCEPTOR	54	UNKNOWN		20	WRF/SW	4	1-Mar-00	Oct-16	16	2							N	0			6	L
300-0004A	300-0003A	INTERCEPTOR	72	PC		212	??		1-Mar-00	Oct-16	16	2							Y	5			7	L
300-0005A	300-0000	INTERCEPTOR	36	UNKNOWN		104	??		1-Mar-00	Oct-16	16	2							N	0			2	L
300-0006	300-B001	INTERCEPTOR	36	DI	3	639	WRF/SW	4	1-Mar-00	Oct-16	16	2							N	0			9	L
300-000JB1	TP02	INTERCEPTOR	72	DI	3	491	WRF/Under Structures	5	1-Mar-00	Oct-16	16	2							N	0			10	I
300-000JB2	300-000JB1	INTERCEPTOR	72	UNKNOWN		140	WRF/SW	4	1-Mar-00	Oct-16	16	2							N	0			6	L
300-000JB3	300-000JB2	INTERCEPTOR	72	UNKNOWN		406	WRF/SW	4	1-Mar-00	Oct-16	16	2							N	0			6	L
300-0010	300-0004A	INTERCEPTOR	72	PC	3	704	WRF/SW	4	1-Mar-00	Oct-16	16	2							Y	5			14	I
300-0011	300-0010	INTERCEPTOR	72	PC	3	78	WRF/SW	4	1-Mar-00	Oct-16	16	2							Y	5			14	I
300-0011A	300-0011	INTERCEPTOR	72	PC	3	48	WRF/SW (Discharge from Rubes Creek LS - 8440' of 20" DI)	4	1-Mar-00	Oct-16	16	2							Y	5			14	I
300-B001	300-0000	INTERCEPTOR	36	DI	3	11	WRF/SW	4	20-Mar-00	Oct-16	16	2							N	0			9	L
300-B002	300-B001	COLLECTOR	8	PVC	0	192	E	1	20-Mar-00	Oct-16	16	2							N	0			3	L
300-B003	300-B002	COLLECTOR	8	PVC	0	298	E	1	6-Aug-77	Oct-16	39	2							N	0			3	L

Appendix B

PACP Defect Codes

PACP Observation codes: All codes

Number of codes = 251

Code	Description	Parameters
ACB	Catch Basin	NNNNNNNXN
ACOH	Cleanout House	NNNNNNNXN
ACOM	Cleanout Mainline	NNNNNNNRN
ACOP	Cleanout Propertyline	NNNNNNNXN
ACOS	Cleanout Saddle	NNNNNNNXN
ADP	Discharge point	NNNNNNNXN
AEP	End of Pipe	NNNNNNNXN
AJB	Junction box	NNNNNNNRN
AM	Meter	NNNNNNNRN
AMH	Manhole	NNNNNNNRN
AML	Mainline	NNNNNNNXN
AOC	Special Chamber	NNNNNNNXN
ATC	Tee Connection	NNRXNRNXN
AW	Wye	NNNNNNNXN
AWA	Wastewater Access Device	NNNNNNNRN
AWD	Double Wye	NNNNNNNXN
AWW	Wet Well	NNNNNNNXN

Code	Description	Parameters
B	Broken	NXXXNRXXY
BSV	Broken Soil Visible	NXXXNRXXY
BVV	Broken Void Visible	NXXXNRXXY
CC	Crack Circumferential	NXXXNRXXY
CH2	Crack Longitudinal Hinge, 2	NXXXNRXXY
CH3	Crack Longitudinal Hinge, 3	NXXXNRXXY
CH4	Crack Longitudinal Hinge, 4	NXXXNRXXY
CL	Crack Longitudinal	NXXXNRXXY
CM	Crack Multiple	NXXXNRXXY
CS	Crack Spiral	NXXXNRXXY
D	Deformed	NNNNNRXXY
DAE	Deposits Attached Encrustation	NXNNNRXXY
DAGS	Deposits Attached Grease	NXNNNRXXY
DAR	Deposits Attached Ragging	NXNNNRXXY
DAZ	Deposits Attached Other	NXNNNRXXY
DB	Displaced Brick	NNNNNRXXY
DH	Deformed Horizontal	NNNNNRXXY
DI	Dropped Invert	NNNNNRXXY
DNF	Deposits Ingressed Fine	NXNNNRXXY

Code	Description	Parameters
DNGV	Deposits Ingressed Gravel	NXNNRRXXY
DNZ	Deposits Ingressed Other	NXNNRRXRY
DSC	Deposits Settled Compacted	NXNNRRXXY
DSF	Deposits Settled Fine	NXNNRRXXY
DSGV	Deposits Settled Gravel	NXNNRRXXY
DSZ	Deposits Settled Other	NXNNRRXRY
DV	Deformed Vertical	NNNNRRNNXY
FBEMD	Fitting Mitered Bend Down	NNNNRRNNXN
FBEML	Fitting Mitered Bend Left	NNNNRRNNXN
FBEMLD	Fitting Mitered Bend Left Down	NNNNRRNNXN
FBEMLU	Fitting Mitered Bend Left Up	NNNNRRNNXN
FBEMR	Fitting Mitered Bend Right	NNNNRRNNXN
FBEMRD	Fitting Mitered Bend Right Down	NNNNRRNNXN
FBEMRU	Fitting Mitered Bend Right Up	NNNNRRNNXN
FBEMU	Fitting Mitered Bend Up	NNNNRRNNXN
FBESD	Fitting Sweep Bend Down	NNNNRRNNXN
FBESL	Fitting Sweep Bend Left	NNNNRRNNXN
FBESLD	Fitting Sweep Bend Left Down	NNNNRRNNXN
FBESLU	Fitting Sweep Bend Left Up	NNNNRRNNXN

Code	Description	Parameters
FBESR	Fitting Sweep Bend Right	NNNNRRNNXN
FBESRD	Fitting Sweep Bend Right Down	NNNNRRNNXN
FBESRU	Fitting Sweep Bend Right Up	NNNNRRNNXN
FBESU	Fitting Sweep Bend Up	NNNNRRNNXN
FC	Fracture Circumferential	NXXXNRRXY
FCA	Fitting Cap	NNNNNNNNXN
FCAF	Fitting Cap Fitting	NNNNNNNNXN
FCAS	Fitting Cap Seal	NNNNNNNNXN
FH	End of Survey	NNNNNNNNXN
FH2	Fracture Longitudinal Hinge, 2	NXXXNRRXY
FH3	Fracture Longitudinal Hinge, 3	NXXXNRRXY
FH4	Fracture Longitudinal Hinge, 4	NXXXNRRXY
FL	Fracture Longitudinal	NXXXNRRXY
FM	Fracture Multiple	NXXXNRRXY
FRV	Fitting Vertical Riser	NNNNNNNNXN
FS	Fracture Spiral	NXXXNRRXY
FTDS	Fitting Double Sweep Tee	NNXRRRNXN
FTS	Fitting Sweep Tee	NNXRRRNXN
GRT	Grout done at Location	NNXNNNNXN

Code	Description	Parameters
GTFJ	Grout Air Test Fail Joint	NNXRNNNXN
GTFL	Grout Air Test Fail Lateral	NNXRNNNXN
GTPJ	Grout Air Test Pass Joint	NNNNNNNXN
GTPL	Grout Air Test Pass Lateral	NNNNNNNXN
GTUJ	Grout Air Test Unable Joint	NNNNNNNRN
GTUL	Grout Air Test Unable Lateral	NNNNNNNRN
H	Hole	NXXXNRXXY
HSV	Hole Soil Visible	NXXXNRXXY
HVV	Hole Void Visible	NXXXNRXXY
ID	Infil Dropper	NXNNNRXXY
IG	Infil Gusher	NXNNNRXXY
IR	Infil Runner	NXNNNRXXY
IS	Infil Stain	NXNNNRXXY
ISGT	Intruding Sealing Grout	NNNNRRRXY
ISSR	Intruding Sealing Ring	NNNNRRRXY
ISSRB	Intruding Sealing Ring Broken	NNNNRRRXY
ISSRH	Intruding Sealing Ring Hanging	NNNNRRRXY
ISSRL	Intruding Seal Ring Loose	NNNNRRRXY
ISZ	Intruding Sealing Other	NNNNRRRXY

Code	Description	Parameters
IW	Infil Weeper	NXNNNRXXY
JAL	Joint Angular Large	NNXNNNNXY
JAM	Joint Angular Medium	NNXNNNNXY
JOL	Joint Offset Large	NNXNNNNXY
JOM	Joint Offset Medium	NNXNNNNXY
JSL	Joint Separated Large	NNXNNNNXY
JSM	Joint Separated Medium	NNXNNNNXY
KD	Buckling Dimpling	NNNNNRXXY
KI	Inverse Curvature	NNNNRRNXY
KW	Buckling Wall	NNNNNRXXY
LD	Alignment Down	NNNNRRNXY
LFAC	Lining Failure Abandoned Connection	NXNNNRXXY
LFAS	Lining Failure Annular Space	NXNNNRXXY
LFB	Lining Failure Blistered	NXNNNRXXY
LFBK	Lining Failure Buckled	NXNNNRXXY
LFBU	Lining Failure Bulges	NXNNNRXXY
LFCS	Lining Failure Connection Cut Shifted	NXNNNRXXY
LFD	Lining Failure Detached	NXNNNRXXY
LFDC	Lining Failure Discoloration	NXNNNRXXY

Code	Description	Parameters
LFDE	Lining Failure Defective End	NXNNNRXXY
LFDL	Lining Failure Delaminating	NXNNNRXXY
LFOC	Lining Failure Overcut Service	NXNNNRXXY
LFPH	Lining Failure Pinhole	NXNNNRXXY
LFRS	Lining Failure Resin slug	NXNNNRXXY
LFUC	Lining Failure Undercut Service	NXNNNRXXY
LFW	Lining Failure Wrinkled	NXNNNRXXY
LFZ	Lining Failure Other	NXNNNRXRY
LL	Alignment Left	NNNNRNNXY
LLD	Alignment Left Down	NNNNRNNXY
LLU	Alignment Left Up	NNNNRNNXY
LR	Alignment Right	NNNNRNNXY
LRD	Alignment Right Down	NNNNRNNXY
LRU	Alignment Right Up	NNNNRNNXY
LU	Alignment Up	NNNNRNNXY
MB	Missing Brick	NNNNNRXXY
MCU	Camera Underwater	NNNNNNNXY
MGO	General Observation	NNNNNNNRN
MGP	General Photo	NNNNNNNXN

Code	Description	Parameters
MJL	Joint Length Change	NNRNNNNXXN
MLC	Lining Change	NNNNNNNRN
MMC	Material change	NNNNNNNRN
MML	Mortar Missing Large	NNNNNRXXY
MMM	Mortar Missing Medium	NNNNNRXXY
MMS	Mortar Missing Small	NNNNNRXXY
MSA	Abandoned Survey	NNNNNNNRN
MSC	Shape or Size Change	NNRXNNNXN
MWL	Water Level	NNNNRNNXXN
MWLS	Water Level Sag	NNNNRNNXY
MWM	Water Mark	NNNNRNNXXN
MYN	Dye Test Not Visible	NNNNNNNXN
MYV	Dye Test Visible	NNNNNNNRN
OBB	Obstacle Brick	NNNNRRXXY
OBC	Obstacle Thru Connection	NNNNRRXXY
OBI	Obstacle Intruding Thru Wall	NNNNRRXXY
OBJ	Obstacle In Joint	NRNNRRXXY
OBM	Obstacle Pipe Material	NNNNRRXXY
OBN	Obstacles Construction Debris	NNNNRRXXY

Code	Description	Parameters
OBP	Obstacle External Pipe or Cable	NNNNRRXXY
OBR	Obstacle Rocks	NNNNRRXXY
OBS	Obstacle Built Into Structure	NNNNRRXXY
OBZ	Obstacle Other	NNNNRRXRY
RBB	Roots Ball Barrel	NNNNRRXXY
RBC	Roots Ball Connection	NNNNRRXXY
RBJ	Roots Ball Joint	NRNNRRXXY
RBL	Roots Ball Lateral	NNNNRRXXY
RFB	Roots Fine Barrel	NNNNNRXXY
RFC	Roots Fine Connection	NNNNNRXXY
RFJ	Roots Fine Joint	NRNNNRXXY
RFL	Roots Fine Lateral	NNNNNRXXY
RMB	Roots Medium Barrel	NNNNRRXXY
RMC	Roots Medium Connection	NNNNRRXXY
RMJ	Roots Medium Joint	NRNNRRXXY
RML	Roots Medium Lateral	NNNNRRXXY
RPL	Repair Localized Pipeliner	NXNNNNNRY
RPLD	Repair Localized Liner Defective	NXNNNNNRY
RPP	Repair Patch	NXNNNRXRY

Code	Description	Parameters
RPPD	Repair Patch Defective	NXNNNRXXY
RPR	Repair Point	NXNNNNNRY
RPRD	Repair Point Defective	NXNNNNNRY
RPZ	Repair Other	NXNNNNNRY
RPZD	Repair Other Defective	NXNNNNNRY
RTB	Roots Tap Barrel	NNNNRRXXY
RTC	Roots Tap Connection	NNNNRRXXY
RTJ	Roots Tap Joint	NRNNRRXXY
RTL	Roots Tap Lateral	NNNNRRXXY
SAM	Surface Aggregate Missing	NXNNNRXXY
SAMC	Surface Aggregate Missing Chemical	NXNNNRXXY
SAMM	Surface Aggregate Missing Mechanical	NXNNNRXXY
SAMZ	Surface Aggregate Missing Unknown	NXNNNRXXY
SAP	Surface Aggregate Projecting	NXNNNRXXY
SAPC	Surface Aggregate Projecting Chemical	NXNNNRXXY
SAPM	Surface Aggregate Projecting Mechanical	NXNNNRXXY
SAPZ	Surface Aggregate Projecting Unknown	NXNNNRXXY
SAV	Surface Aggregate Visible	NXNNNRXXY
SAVC	Surface Aggregate Visible Chemical	NXNNNRXXY

Code	Description	Parameters
SAVM	Surface Aggregate Visible Mechanical	NXNNNRXXY
SAVZ	Surface Aggregate Visible Unknown	NXNNNRXXY
SCP	Surface Corrosion Metal Pipe	NXNNNRXXY
SMW	Surface Missing Wall	NXNNNRXXY
SMWC	Surface Missing Wall Chemical	NXNNNRXXY
SMWM	Surface Missing Wall Mechanical	NXNNNRXXY
SMWZ	Surface Missing Wall Unknown	NXNNNRXXY
SRC	Surface Reinforcement Corroded	NXNNNRXXY
SRCC	Surface Reinforcement Corroded	NXNNNRXXY
SRCM	Surface Reinforcement Corroded	NXNNNRXXY
SRCZ	Surface Reinforcement Corroded	NXNNNRXXY
SRI	Surface Roughness Increased	NXNNNRXXY
SRIC	Surface Roughness Increased Chemical	NXNNNRXXY
SRIM	Surface Roughness Increased	NXNNNRXXY
SRIZ	Surface Roughness Increased Unknown	NXNNNRXXY
SRP	Surface Reinforcement Projecting	NXNNNRXXY
SRPC	Surface Reinforcement Projecting	NXNNNRXXY
SRPM	Surface Reinforcement Projecting	NXNNNRXXY
SRPZ	Surface Reinforcement Projecting	NXNNNRXXY

Code	Description	Parameters
SRV	Surface Reinforcement Visible	NXNNNRXXY
SRVC	Surface Reinforcement Visible Chemical	NXNNNRXXY
SRVM	Surface Reinforcement Visible	NXNNNRXXY
SRVZ	Surface Reinforcement Visible Unknown	NXNNNRXXY
SSS	Surface Spalling	NXNNNRXXY
SSSC	Surface Spalling Chemical	NXNNNRXXY
SSSM	Surface Spalling Mechanical	NXNNNRXXY
SSSZ	Surface Spalling Other	NXNNNRXXY
ST	Start of Survey	NNNNNNNXN
SZ	Surface Other	NXNNNRXRY
SZC	Surface Other Chemical	NXNNNRXRY
SZM	Surface Other Mechanical	NXNNNRXRY
SZZ	Surface Other Unknown	NXNNNRXRY
TB	Tap Break-in	NXRNRNRNXN
TBA	Tap Break-in Active	NXRNRNRNXN
TBB	Tap Break-in Abandoned	NXRNRNRNXN
TBC	Tap Break-in Capped	NXRNRNRNXN
TBD	Tap Break-in Defective	NXRNRNRNXN
TBI	Tap Break-in Intruding	NXRNRNRNXN

Code	Description	Parameters
TF	Tap Factory	NXRNNRNXXN
TFA	Tap Factory Active	NXRNNRNXXN
TFB	Tap Factory Abandoned	NXRNNRNXXN
TFC	Tap Factory Capped	NXRNNRNXXN
TFD	Tap Factory Defective	NXRNRNRXXN
TFI	Tap Factory Intruding	NXRNRNRXXN
TR	Tap Rehabilitated	NXRNNRNXY
TRD	Tap Rehabilitated Defective	NXRNRNRXY
TRI	Tap Rehabilitated Intruding	NXRNRNRXY
TS	Tap Saddle	NXRNNRNXXN
TSA	Tap Saddle Active	NXRNNRNXXN
TSB	Tap Saddle Abandoned	NXRNNRNXXN
TSC	Tap Saddle Capped	NXRNNRNXXN
TSD	Tap Saddle Defective	NXRNRNRXXN
TSI	Tap Saddle Intruding	NXRNRNRXXN
VC	Vermin Cockroach	NXNNNNNXXN
VR	Vermin Rat	NXRNNNNXXN
VZ	Vermin Other	NXRNNNNXXN
WFC	Weld Failure Circumferential	NXNNNRXXY

Code	Description	Parameters
WFL	Weld Failure Longitudinal	NXNNNRXXY
WFM	Weld Failure Multiple	NXNNNRXXY
WFS	Weld Failure Spiral	NXNNNRXXY
WFZ	Weld Failure Other	NXNNNRXY
XB	Collapse Brick Sewer	NNNNRNNXN
XP	Collapse Pipe Sewer	NNNNRNNXN

Appendix C

Condition Assessment Results and Recommended Rehabilitation

CONDITION ASSESSMENT RESULTS AND RECOMMENDED REHABILITATION																	
				DATE INSPECTED	INSPECTED BY	LENGTH INSPECTED	GIS LENGTH	Existing CCTV		LINE	SECTIONAL POINT REPAIR	SERVICE CON. RENEW	LINE LATERAL	LATERAL LENGTH (FT.)	NO. OF CLEAN OUTS	COMMENTS	
LINE SEGMENT		SIZE	MATERIAL						COMMENTS								
From MH	To MH																
BASIN A																	
109-0048	109-0047	24	CIPP	11-Nov-13	Hydrostructures	456.2	439.0	YES	Pipe has CIPP liner. DAGS Entire Pipe.	NO							
109-0047	109-0046	24	DI	12-Nov-13	Hydrostructures	238	241.0	YES	2.7 TO 231.9 SCP	YES							
109-0046	109-0045	24	DI	12-Nov-13	Hydrostructures	154.6	160.0	YES	4.20 TO 151.70 SPC.	YES							
109-0045	109-0044	24	DI	24-Apr-14	Hydrostructures	218.2	218.0	YES	8.5 SCP 0804 START. 8.5 DAR 0804 START. 106.4 OBZ (BRICK). 211.9 DAR 0408 FINISH. 211.9 SCP 0804 FINISH. (PIPE NOT CLEANED & OBSTACLE AT 106.4 NOT REMOVED)	YES							
109-0044	109-0043	24	DI	24-Apr-14	Hydrostructures	470.9	468.0	YES	5.5 SCP 0804 START. 5.5 DAR 0804 START. 469.3 SCP 0804 FINISH. 469.3 DAR 0804 FINISH. (PIPE NOT CLEANED)	YES							
109-0043	109-0042	24	DI	24-Apr-14	Hydrostructures	99.1	96.0	YES	5.7 SCP 084 START. 89.6 SCP 0804 FINISH. (PIPE NOT CLEANED)	YES							
109-0042	109-0041	24	DI	24-Apr-14	Hydrostructures	174.9	181.0	YES	7.3 SCP 0804 START. 9.7 DAR 0804. 26.0 DAR 0804 START. 169.6 SCP 0804 FINISH. 169.6 DAR 0804 FINISH. (PIPE NOT CLEANED)	YES							
109-0041	109-0040	24	DI	24-Apr-14	Hydrostructures	210.0	203.0	YES	0.0 DAG & DAR 0309 START. 11.9 SCP 0705 START. 204.0 SCP 0705 FINISH. 209. DAG & DAR 0309 FINISH. (PIPE NOT CLEANED)	YES							
109-0040	109-0039	24	DI	24-Apr-14	Hydrostructures	398.4	375.0	YES	0.0 DAO 0309. 9.8 SCP 0804 START. 393.9 SCP 0804 FINISH. 394.0 DAO 0309 FINISH. (PIPE NOT CLEANED)	YES							
109-0039	109-0038	24	DI	24-Apr-14	Hydrostructures	267.1	263.0	YES	9.8 SCP 0804 SDTART. 63.6 DAR 0804 START. 253.7 DAR 0804 FINISH. 257.38 SCP 0804 FINISH. (PIPE NOT CLEANED)	YES							
109-0038	109-0037	24	DI	24-Apr-14	Hydrostructures	116.2	81.0	YES	4.5 SCP 0804 START. 111.1 SCP 0804 FINISH.	YES							
109-0037	109-0036	24	DI	23-Apr-14	Hydrostructures	141.0	171.0	YES	4.5 SCP 0705 START. 131.2 SCP 0705 FINISH	YES							
109-0036	109-0035	24	DI	23-Apr-14	Hydrostructures	192.8	181.0	YES	9.2 SCP 0804 START. 184.9 SCP 0904 FINISH.	YES							
109-0035	109-0034	24	DI	23-Apr-14	Hydrostructures	176.5	178.0	YES	9.3 SCP 075 START. 168.6 SCP 0705 FINISH.	YES							
109-0034	109-0033	24	DI	23-Apr-14	Hydrostructures	113.7	117.0	YES	5.4 SCP 0705 START. 39.9 DAG 1102. DAR 0205. 82.7 DAR 0903. 92.9 DAR 0903. 108.4 SCP 0705 FINISH.	YES							
109-0033	109-0032	24	DI	24-Apr-14	Hydrostructures	161	159.0	YES	4.9 SCP 0804 START. 4.9 DAR 084 START. 143.9 DAR 0804 FINISH. 152.8 SCP 0804 FINISH. (PIPE NOT CLEANED)	YES							
109-0032	109-0031	24	DI	23-Apr-14	Hydrostructures	167.7	166.0	YES	7.3 SCP 0804 START. 7.3 DAR 0804 START. 159.4 DAR 0804 FINISH. 167.4 SCP 0804 FINISH. (PIPE NOT CLEANED)	YES							
109-0031	109-0030	24	DI	23-Apr-14	Hydrostructures	246.2	240.0	YES	11.5 SCP 0705 START. 200.5 DAR 02052. 240.3 SCP 0705 FINISH.	YES							
109-0030	109-0029	24	DI	23-Apr-14	Hydrostructures	161.3	165.0	YES	10.5 SCP 0804 START. 156.5 SCP 05804 FINISH.	YES							
109-0029	109-0028	24	DI	23-Apr-14	Hydrostructures	130.6	140.0	YES	3.6 SCP 0705 START. 126.3 SCP 0705 FINISH.	YES							
109-0028	109-0027	24	DI	23-Apr-14	Hydrostructures	257.1	256.0	YES	84.4 SCP 1002 START. 253.6 SCP 1002 FINISH.	YES							
109-0027	109-0026	21	DI	23-Apr-14	Hydrostructures	112.3	116.0	YES	5.9 SPC 0804 START. 108.3 SPC 0804 FINISH.	YES							
109-0026	109-0025	36	RCP	30-Apr-14	Amtec	478.1	472.0	YES	21.0 RFJ 1002. 21.0 SAV 0804 START 73.7 RFJ 1002. 110.2 RFJ 0902. 182.7 RFJ 1002. 219.7 RFJ 1002. 338.9 IW 0912.	NO							
109-0025	109-0024	36	RCP	1-May-14	Amtec	402.0	394.0	YES	338.9 RFB 0103. 401.2 RFJ 1002. 478.1 SAV 0804 FINISH.	NO							
109-0024	109-0023	36	RCP	1-May-14	Amtec	404.3	327.0	YES	0.0 SAV 0804 START. 353.8 RFJ 0903. 361.8 RFJ 0704.402.0 SAV 0804 FINISH.	NO							
109-0023	109-0022	36	RCP	1-May-14	Amtec	403.5	386.0	YES	0.0 SAV 0903 START. 365.0 RFJ 0903. 404.3 SAV 0903 FINISH.	NO							
109-0022	109-0021	36	RCP	1-May-14	Amtec	362.9	329.0	YES	0.0 SAV 0903 START. 84.3 RFJ 0903. 170.0 RFB 1002. 228.4 MMC RCP TO DI. 228.4 SCP 0705 START. 256.5 SSS 0104. 403.5 SAV 0903 FINISH.	YES							
109-0021	109-0020	36	RCP	1-May-14	Amtec	356.9	351.0	YES	0.0 SAV 0903 START. 1.0 FL 12 ?? 9.9 LL. 140.0 DSC 0507. 194.2 SRV 0910. 261.5 RFJ 0705. 362.9 SAV 0903 FINISH.	NO							
109-0020	109-0019	36	RCP	1-May-14	Amtec	442.8	408.0	YES	0.0 SAV 0903 START. 356.9 SAV 0903 FINISH.	NO							
109-0019	109-0018	36	RCP	1-May-14	Amtec	446.3	429.0	YES	0.0 SAV 0903 START. 7.0 DSC 0705. 7.0 LP. 23.9 RFJ 0903. 23.9 DSC 0507. 100.0 DSC 0507. 129.1 RFJ 0903. 266.4 SAV 0903 FINISH. 266.4 MMC RCP TO DI. 266.4 SPC START. 349.4 MMC DI TO RCP. 349.4 SPC FINISH. 349.4. 349.4 SAV 0903 START. 427.5 RFJ 0912. 139.0 DSC 0507. 442.8 SAV 0903 FINISH.	NO							
109-0018	109-0017	36	RCP	1-May-14	Amtec	446.4	231.0	YES	0.0 SAV 0903. START. 446.3 SAV 0903 FINISH.	NO							
109-0017	109-0016	36	RCP	1-May-14	Amtec	430.2	413.0	YES	0.0 SAV 0903 START. 52.5 RFJ 0911. 61.8 RFJ 0910. 117.1 RFJ 1002. 200 LR. 446.4 SAV 0903 FINISH.	NO							
109-0016	109-0015	36	RCP	1-May-14	Amtec	414.5	397.0	YES	0.0 SAV 0903 START. 141.9 IW 0812. 146.4 DSC 0507. 224.1 RFJ 1002. 430.2 SAV 0903 FINISH. (VIDEO BREAKS UP 224 TO 230)	NO							
109-0015	109-0014	36	RCP	1-May-14	Amtec	26.5	339.0	YES	0.0 SAV 0903 START. 4.8 RFJ 1204. 4.8 LL. 68.9 RFJ 0903. 119.2 RFJ 1202. 136.3 RMJ 0903. 184.8 RFJ 0912. 249.1 RFJ 1203. 414.5 SAV 0903 FINISH. (VIDEO BREAKS UP 33.9 TO 230)	NO							
109-0014	109-0013	36	RCP	1-May-14	Hydrostructures	364.1	339.0	YES	TISCIT SURVEY BY AMTEC NOT COMPLETED. QUALITY OF VIDEO BY HYDROSTRUCTURES IS UNACCEPTABLE. (REDO CCTV)	TBD							
109-0013	109-0012	36	RCP	1-May-14	Hydrostructures	91.4	38.0	YES	(VERY POOR VIDEO QUALITY) REDO CCTV.	TBD							
109-0012	109-0011	36	RCP	1-May-14	Hydrostructures	18.2	38.0	YES	18.2 MMC RCP TO DI. 36.0 SCP 0903. 73.8 MMC DI TO RCP.	NO							

CONDITION ASSESSMENT RESULTS AND RECOMMENDED REHABILITATION																	
				DATE	INSPECTED	LENGTH	GIS	Existing		LINE	SECTIONAL POINT REPAIR	SERVICE CON. RENEW	LINE LATERAL	LATERAL LENGTH (FT.)	NO. OF CLEAN OUTS	COMMENTS	
LINE SEGMENT		SIZE	MATERIAL	INSPECTED	BY	INSPECTED	LENGTH	CCTV	COMMENTS								
From MH	To MH																
BASIN A																	
109-0048	109-0047	24	CIPP	11-Nov-13	Contractor A	456.2	439.0	YES	Pipe has CIPP liner. DAGS Entire Pipe.	NO							
109-0047	109-0046	24	DI	12-Nov-13	Contractor A	238	241.0	YES	2.7 TO 231.9 SCP	YES							
109-0046	109-0045	24	DI	12-Nov-13	Contractor A	154.6	160.0	YES	4.20 TO 151.70 SPC.	YES							
109-0045	109-0044	24	DI	24-Apr-14	Contractor A	218.2	218.0	YES	8.5 SCP 0804 START. 8.5 DAR 0804 START. 106.4 OBZ (BRICK). 211.9 DAR 0408 FINISH. 211.9 SCP 0804 FINISH. (PIPE NOT CLEANED & OBSTACLE AT 106.4 NOT REMOVED)	YES							
109-0044	109-0043	24	DI	24-Apr-14	Contractor A	470.9	468.0	YES	5.5 SCP 0804 START. 5.5 DAR 0804 START. 469.3 SCP 0804 FINISH. 469.3 DAR 0804 FINISH. (PIPE NOT CLEANED)	YES							
109-0043	109-0042	24	DI	24-Apr-14	Contractor A	99.1	96.0	YES	5.7 SCP 084 START. 89.6 SCP 0804 FINISH. (PIPE NOT CLEANED)	YES							
109-0042	109-0041	24	DI	24-Apr-14	Contractor A	174.9	181.0	YES	7.3 SCP 0804 START. 9.7 DAR 0804. 26.0 DAR 0804 START. 169.6 SCP 0804 FINISH. 169.6 DAR 0804 FINISH. (PIPE NOT CLEANED)	YES							
109-0041	109-0040	24	DI	24-Apr-14	Contractor A	210.0	203.0	YES	0.0 DAG & DAR 0309 START. 11.9 SCP 0705 START. 204.0 SCP 0705 FINISH. 209. DAG & DAR 0309 FINISH. (PIPE NOT CLEANED)	YES							
109-0040	109-0039	24	DI	24-Apr-14	Contractor A	398.4	375.0	YES	0.0 DAO 0309. 9.8 SCP 0804 START. 393.9 SCP 0804 FINISH. 394.0 DAO 0309 FINISH. (PIPE NOT CLEANED)	YES							
109-0039	109-0038	24	DI	24-Apr-14	Contractor A	267.1	263.0	YES	9.8 SCP 0804 SDTART. 63.6 DAR 0804 START. 253.7 DAR 0804 FINISH. 257.38 SCP 0804 FINISH. (PIPE NOT CLEANED)	YES							
109-0038	109-0037	24	DI	24-Apr-14	Contractor A	116.2	81.0	YES	4.5 SCP 0804 START. 111.1 SCP 0804 FINISH.	YES							
109-0037	109-0036	24	DI	23-Apr-14	Contractor A	141.0	171.0	YES	4.5 SCP 0705 START. 131.2 SCP 0705 FINISH	YES							
109-0036	109-0035	24	DI	23-Apr-14	Contractor A	192.8	181.0	YES	9.2 SCP 0804 START. 184.9 SCP 0904 FINISH.	YES							
109-0035	109-0034	24	DI	23-Apr-14	Contractor A	176.5	178.0	YES	9.3 SCP 075 START. 168.6 SCP 0705 FINISH.	YES							
109-0034	109-0033	24	DI	23-Apr-14	Contractor A	113.7	117.0	YES	5.4 SCP 0705 START. 39.9 DAG 1102. DAR 0205. 82.7 DAR 0903. 92.9 DAR 0903. 108.4 SCP 0705 FINISH.	YES							
109-0033	109-0032	24	DI	24-Apr-14	Contractor A	161	159.0	YES	4.9 SCP 0804 START. 4.9 DAR 084 START. 143.9 DAR 0804 FINISH. 152.8 SCP 0804 FINISH. (PIPE NOT CLEANED)	YES							
109-0032	109-0031	24	DI	23-Apr-14	Contractor A	167.7	166.0	YES	7.3 SCP 0804 START. 7.3 DAR 0804 START. 159.4 DAR 0804 FINISH. 167.4 SCP 0804 FINISH. (PIPE NOT CLEANED)	YES							
109-0031	109-0030	24	DI	23-Apr-14	Contractor A	246.2	240.0	YES	11.5 SCP 0705 START. 200.5 DAR 02052. 240.3 SCP 0705 FINISH.	YES							
109-0030	109-0029	24	DI	23-Apr-14	Contractor A	161.3	165.0	YES	10.5 SCP 0804 START. 156.5 SCP 05804 FINISH.	YES							
109-0029	109-0028	24	DI	23-Apr-14	Contractor A	130.6	140.0	YES	3.6 SCP 0705 START. 126.3 SCP 0705 FINISH.	YES							
109-0028	109-0027	24	DI	23-Apr-14	Contractor A	257.1	256.0	YES	84.4 SCP 1002 START. 253.6 SCP 1002 FINISH.	YES							
109-0027	109-0026	21	DI	23-Apr-14	Contractor A	112.3	116.0	YES	5.9 SPC 0804 START. 108.3 SPC 0804 FINISH.	YES							
109-0026	109-0025	36	RCP	30-Apr-14	Contractor A	478.1	472.0	YES	21.0 RFJ 1002. 21.0 SAV 0804 START 73.7 RFJ 1002. 110.2 RFJ 0902. 182.7 RFJ 1002. 219.7 RFJ 1002. 338.9 IW 0912.	NO							
109-0025	109-0024	36	RCP	1-May-14	Contractor A	402.0	394.0	YES	338.9 RFB 0103. 401.2 RFJ 1002. 478.1 SAV 0804 FINISH.	NO							
109-0024	109-0023	36	RCP	1-May-14	Contractor A	404.3	327.0	YES	0.0 SAV 0804 START, 353.8 RFJ 0903. 361.8 RFJ 0704.402.0 SAV 0804 FINISH,	NO							
109-0023	109-0022	36	RCP	1-May-14	Contractor A	403.5	386.0	YES	0.0 SAV 0903 START. 365.0 RFJ 0903. 404.3 SAV 0903 FINISH.	NO							
109-0022	109-0021	36	RCP	1-May-14	Contractor A	362.9	329.0	YES	0.0 SAV 0903 START. 84.3 RFJ 0903. 170.0 RFB 1002. 228.4 MMC RCP TO DI. 228.4 SCP 0705 START. 256.5 SSS 0104. 403.5 SAV 0903 FINISH.	YES							
109-0021	109-0020	36	RCP	1-May-14	Contractor A	356.9	351.0	YES	0.0 SAV 0903 START. 1.0 FL 12 ?? 9.9 LL. 140.0 DSC 0507. 194.2 SRV 0910. 261.5 RFJ 0705. 362.9 SAV 0903 FINISH.	NO							
109-0020	109-0019	36	RCP	1-May-14	Contractor A	442.8	408.0	YES	0.0 SAV 0903 START. 7.0 DSC 0705. 7.0 LP. 23.9 RFJ 0903. 23.9 DSC 0507. 100.0 DSC 0507. 129.1 RFJ 0903. 266.4 SAV 0903 FINISH. 266.4 MMC RCP TO DI. 266.4 SPC START. 349.4 MMC DI TO RCP. 349.4 SPC FINISH. 349.4. 349.4 SAV 0903 START. 427.5 RFJ 0912. 139.0 DSC 0507. 442.8 SAV 0903 FINISH.	NO							
109-0019	109-0018	36	RCP	1-May-14	Contractor A	446.3	429.0	YES	0.0 SAV 0903. START. 446.3 SAV 0903 FINISH.	NO							
109-0018	109-0017	36	RCP	1-May-14	Contractor A	446.4	231.0	YES	0.0 SAV 0903 START. 52.5 RFJ 0911. 61.8 RFJ 0910. 117.1 RFJ 1002. 200 LR. 446.4 SAV 0903 FINISH.	NO							
109-0017	109-0016	36	RCP	1-May-14	Contractor A	430.2	413.0	YES	0.0 SAV 0903 START. 141.9 IW 0812. 146.4 DSC 0507. 224.1 RFJ 1002. 430.2 SAV 0903 FINISH. (VIDEO BREAKS UP 224	NO							
109-0016	109-0015	36	RCP	1-May-14	Contractor A	414.5	397.0	YES	0.0 SAV 0903 START. 4.8 RFJ 1204. 4.8 LL. 68.9 RFJ 0903. 119.2 RFJ 1202. 136.3 RMJ 0903. 184.8 RFJ 0912. 249.1 RFJ 1203. 414.5 SAV 0903 FINISH. (VIDEO BREAKS UP 33.9 TO 230)	NO							
109-0015	109-0014	36	RCP	1-May-14	Contractor A	26.5	339.0	YES	TISCIT SURVEY NOT COMPLETED. QUALITY OF VIDEO IS UNACCEPTABLE. (REDO CCTV)	TBD							
109-0015	109-0014	36	RCP	1-May-14	Contractor A	364.1	339.0	YES	(VERY POOR VIDEO QUALITY) REDO CCTV.	TBD							
109-0014	109-0013	36	RCP	1-May-14	Contractor A	91.4	38.0	YES	18.2 MMC RCP TO DI. 36.0 SCP 0903. 73.8 MMC DI TO RCP.	NO							
BASIN B																	
312-0102	312-0101B	10	DI	9-Oct-13	Contractor A	126.1	126	YES	4.9 TO 109.4 SPC. 110.0 MMC DI TO PVC	YES							
312-0101B	312-0101A	10	PVC	9-Oct-13	Contractor A	32.5	31	YES	POOR QUALITY VIDEO.	NO							
312-0101A	312-0101	10	PVC	9-Oct-13	Contractor A	131.1	130	YES	POOR QUALITY VIDEO.	NO							
312-0101	312-0100A	10	PVC	9-Oct-13	Contractor A	69.6	69	YES	35.7 MMC PVC TO DI. 35.7 TO 51.4 SPC. 51.4 MMC DI TO PVC	YES							
312-0100A	312-0100	12	PVC	9-Oct-13	Contractor A	16.1	19	YES	DAZ 0507	NO							
312-0100	312-0099	12	DI	9-Oct-13	Contractor A	101.4	85	YES	5.9 TO 101.4 SPC. DAR	YES							
312-0100A	312-S050	12	DI	7-Nov-13	Contractor A	101.1	105	YES	7.1 TO 101.1 SCP 0804	YES							
BASIN C																	
212-J038	212-J037	18	DI	12-Dec-13	Utility Staff	263.8	140	YES	262.0 DSZ (VCP PIECES & IN MH INVERT. (GIS SHOWS 212-J038 TO 212-J037A at 140') (GIS SHOWS 3 SERVICE CONNECTIONS BETWEEN 212-J 038 TO 212-J037, BUT NONE SHOWN ON CCTV VIDEO)	NO							
212-J037	212-J036A	18	AC	12-Dec-13	Utility Staff	268.5	118	YES	13.4 H 09. 14.2 H 10. 52.9 TBI 10. 67.4 OBI 03 TO 09. 172.1 TBI 02. 213.7 TFC 10.	NO	13.4 (3')	52.9 & 172.1				REFER TO MAINTENANCE FOR REMOVAL OF OBSTACLE AT 67.4. (REMOVED BY GAS COMPANY 2/07/14). REMOVE PROTRUDING TAP AT 52.9 & 172.1	
212-J037	212-J036A	6	VCP	4-Jun-14	Utility Staff	39.4	NA	YES	(STA. 163.8) 8.9 MMC VCP TO DI. 26.9 PVC TO DI. 26.9 SCP START. 39.4 SCP FINISH. MSA	NO			NO				
212-J037	212-J036A	6	VCP	4-Jun-14	Utility Staff	40.4	NA	YES	(STA. 254.0) 1.0 CMU. 8.9 FC. 8.9 MMC VCP TO DI. 25.6 SCP START. 40.4 SCP FINISH. MSA.	NO			NO				
212-J036A	212-J036	18	AC	12-Dec-13	Utility Staff	232.1	512	YES	9.8 TFC 09. 9.8 TBA 01. 19.3 TBA 10. 95.1 TBA 12. 95.1 DAGS 04. 102.8 TFC 09. 106.2 TBA 02. 108.4 TBI 03. 159.2 TBI 03	NO						REMOVE PROTRUDING TAP at 159.2	
212-J036A	212-J036	6	VCP	4-Jun-14	Utility Staff	20.9	NA	YES	(STA. 160.4)	NO			NO				
212																	

CONDITION ASSESSMENT RESULTS AND RECOMMENDED REHABILITATION																	
				DATE	INSPECTED	LENGTH	GIS	Existing		LINE	SECTIONAL POINT	SERVICE CON.	LINE	LATERAL	NO. OF CLEAN		
LINE SEGMENT	SIZE	MATERIAL	INSPECTED	BY	INSPECTED	LENGTH	LENGTH	CCTV	COMMENTS	LINE	REPAIR	RENEW	LATERAL	LENGTH (FT.)	OUTS	COMMENTS	
212-J033	212-J032A	18	RCP	11-Dec-13	Utility Staff	298.6	293	YES	91.2 TFD 12. 91.2 RTL 0804. 94.0 RTJ 0309.	NO	94.0 (3')	91.2					
212-J032A	212-J032	18	DI	18-Nov-13	Utility Staff	298.5	304	YES	19.6 TDD & RTJ 10. 65.5 TBI 11. 273.0 RMJ 0205.	NO	273.0 (3')	19.6 & 65.5.				REMOVE PROTRUDING TAP AT 65.5	
212-J033	212-J032A	6	PVC	3-Jun-14	Utility Staff	43.3	NA	YES	(STA 91.2) 303 LD. 43.0 DSC. MSA. (NO ACTIVE SERVICE)	NO			NO				
212-J032	212-J031A	18	DI	18-Nov-13	Utility Staff	63.1	59	YES	NO DEFECTS REPORTED	NO							
212-J031A	212-J031	18	DI	18-Nov-13	Utility Staff	131.9	139	YES	NO DEFECTS REPORTED	NO							
212-J031	212-J030	18	DI	18-Nov-13	Utility Staff	295.4	292	YES	151. OBJ 0507.	NO						REMOVE OBSTACLE AT 151.0. (Referred to Maintenance 6/10/14)	
212-J030	212-J029	18	DI	18-Nov-13	Utility Staff	319.6	318	YES	156.7 IS 0105 & 0711. 156.8 B 11 & 01	NO	156.8 (3')						
212-J029	212-J027	18	DI or CMP?	19-Nov-13	Utility Staff	315.9	317	YES	53.0 FL 01 (?). 124.6 RBB 0804 & TBD 02. 124.6 RML 02.	NO							
212-J029	212-J027	6	VCP	2-Jun-14	Utility Staff	0.3	NA	YES	(STA. 124.6) 0.0 RBC. 0.3 MSA.	NO			TBD			MAINT. TO INSTALL NEW SERV. CONNECTION & CCTV LATERAL	
2123-J027	212-J026	18	DI	19-Nov-13	Utility Staff	58.4	57	YES	No Defects Noted	NO							
212-J026	212-J025	18	AC	19-Nov-13	Utility Staff	118.6	120	YES	Report shows 212-J027 TO 212-J025. SHOULD IT BE 212-J026 TO 212-J025? No defects noted	NO							
212-J026	212-J025	6	VCP	2-Jun-14	Utility Staff	29.5	NA	YES	(STA. 23.8). 1.3 JOM. 5.2 MMC VCP TO DI. 25.5 LL. 28.2 LR. 29.5 SCP. MSA.	NO			NO				
212-J025	212-J024	18	AC	19-Nov-13	Utility Staff	403.3	395	YES	143.5 TBI 10. 260.0 TBA 10	NO		143.5				REMOVE PROTRUDING TAP AT 143.5	
212-J025	212-J024	6	VCP	2-Jun-14	Utility Staff	36.7	NA	YES	((STA. 143.3) 4.9 IS. 4.9 JSL. 13.8 JOL. 14.	NO			6'				
212-J025	212-J024	6	VCP	2-Jun-14	Utility Staff	27.2	NA	YES	(STA. 260.0) 0.6 ID. 18.0 IR. 18.3 MMC VCP TO DIP. 18.3 SCP START. 27.2 SCP FINISH.	NO			NO				
212-J024	212-J023	18	AC	19-Nov-13	Utility Staff	150.6	162	YES	69.4 TBA & DSZ LATERAL 02.	NO							
212-J024	212-J023	6	VCP	2-Jun-14	Utility Staff	0.9	NA	YES	(STA. 69.4) 0.9 DSZ. 0.9 MSA. (LINE PLUGGED)	NO			NO				
212-J023	212-J021	18	CIPP	19-Nov-13	Utility Staff	484.8	414	YES	32.7 DEFORMED HORIZONTAL BRICK (?) (NOT A BRICK SEWER) 128.8 TBA 02. NO CONNECTION SHOWN ON GIS. SMOKE TEST?? 425.3 TBA 12 (MAY BE MH THAT WAS LINED THROUGH)	NO						SMOKE TESTED 6/9/14	
212-J023	212-J021	6	VCP	2-Jun-14	Utility Staff	6.9	NA	YES	(STA. 128.8) 4.6 DSF. 6.9 MSA (DEBRIS)	NO			TBD			MAINT. TO CHECK.	
212-J023	212-J021	6	VCP	2-Jun-14	Utility Staff	38.4	NA	YES	(STA. 425.3) 0.3 B. 0.3 LR. 0.6 JOL. 2.6 FC. 5.6 RFJ. 10.5 MMC VCP TO RCP. 38.4 MSA.	NO			TBD			MAINT. TO CHECK.	
212-J022	212-J021	18	CIPP	19-Nov-13	Utility Staff		67	NO	Contractor's Report shows 212-J023 to 212-J021.	NO							
212-J021	212-J020	18	AC	19-Nov-13	Utility Staff	280.7	283	YES	NO DEFECTS REPORTED	NO							
212-J020	212-J019	18	AC	19-Nov-13	Utility Staff	209.5	214	YES	NO DEFECTS REPORTED	NO							
212-J019	212-J018	18	AC	20-Nov-13	Utility Staff	23.9	22	YES	NO DEFECTS REPORTED	NO							
212-J018	212-J017	18	AC	20-Nov-13	Utility Staff	365.8	367	YES	8.3 TO 287.7 DSF. 0408. 42.8 TFC 02. 323.0 DSF 0408.	NO							
212-J017	212-J016	18	AC	20-Nov-13	Utility Staff	294.4	298	YES	135.6 TBA 09 & RTL 1003. 174.8 TO 278.9 DSF 0507. 226.1 MMC AC TO DI. 279.4 MMC DI TO AC.	NO		135.6					
212-J017	212-J016	6	VCP	3-Jun-14	Utility Staff	37	NA	YES	(STA. 135.6) 1.9 MCU. 13.4 RMJ. 15.0 DAG. 18.0 RMJ. 34.1 MMC VCP TO DI. 34.1 SCP. 37.0 MSA.	NA			YES	35	1		
212-J016	212-J015	18	AC	20-Nov-13	Utility Staff	267.01	268	YES	REVERSE SETUP. NO CCTV VIDEO FOR 212-J016 TO 97.2. (VIDEO ONLY FOR 212-J015 TO 169.8. 40.5 TO 72.4 DFS. 0408. 89.8 TBA 10. 97.2 TBI & RFL. 116.1 TFC 10. 230.6 DSF 0507.	NO		97.2				REMOVE PROTRUDING TAP AT 97.2	
212-J016	212-J015	6	VCP	3-Jun-14	Utility Staff	0	NA	YES	(STA. 116.1) CAPPED	NA			NO				
212-J016	212-J015	6	VCP	3-Jun-14	Utility Staff	43.8	NA	YES	(STA 89.9) 6.4 O. 29.7 MMC DIP TO PVC.	NA			NO				
212-J016	212-J015	6	VCP	3-Jun-14	Utility Staff	32.3	NA	YES	(STA. 96.5) 32.3 MSA.	NA			NO				
212-J015	212-J014	18	AC	20-Nov-13	Utility Staff	213.7	209	YES	9.7 TO 46.5 DAR 1003. 68.1 DSF 0507.	NO							
212-J014	212-J012	18	AC	20-Nov-13	Utility Staff	233.2	220	YES	GIS SHOWS 212-J014 TO 212-J013. 12.7 DFS 0508. 44.5 DSF 0507. 97.0 TFA 02. 108.8 DSF 0408. 164.5 TBA 02.	NO							
212-J014	212-J012	6	VCP	2-Jun-14	Utility Staff	18	NA	YES	(STA. 164.5) 4.6 RMJ. 10.5 LL. 10.5 JOL. 10.5 RFJ. 11.8 SCP START. 18.0 SCP FINISH.	NA			NO				
212-J014	212-J012	6	VCP	2-Jun-14	Utility Staff	4	NA	YES	(STA. 97.0) 1.0 RMJ. 4.0 RBJ. 4.0 MSA.	NA			TBD				
212-J012	212-J011	18	AC	20-Nov-13	Utility Staff	175.5	187	YES	37.5 TFA 02. 53.8 TFA 02. 134.4 TFA 02.	NO							
212-J012	212-J011	6	VCP	2-Jun-14	Utility Staff	13.1	NA	YES	(STA. 39.3) 9.5 FC. 9.5 RFJ. 10.8 LL. 11.8 SIZE CHANGE. 13.1 MSA.	NA			NO				
212-J012	212-J011	6	VCP	2-Jun-14	Utility Staff	14.1	NA	YES	(STA 53.8) 4.6 RFJ. 6.2 LL. 14.1 PLUGGED	NA			NO				
212-J012	212-J011	6	VCP	2-Jun-14	Utility Staff	6.9	NA	YES	(STA. 37.5) 6.9 DSC. 6.9 MSA.	NA							
212-J011	212-J010	18	AC	20-Nov-13	Utility Staff	264.3	259	YES	66.0 TFC 02. 75.6 RBJ 1006. 77.1 TBD 02 & RFL 0204. 120.7 TFA 10 & RML.	NO	75.6 (3')	77.1 & 120.7.				REMOVE PROTRUDING TAP AT 77.1	
212-J011	212-J010	6	VCP	3-Jun-14	Utility Staff	NA		YES	(STA. 120.7) 0.3 CAMERA COULD NOT PASS INTRUDING TAP.	NA			YES	25	1		
212-J011	212-J010	6	VCP	3-Jun-14	Utility Staff	NA		YES	(STA. 77.1) 0.0 RBJ. 0.0 MSA.	NA			YES	25	1		
212-J010	212-J008	18	AC	20-Nov-13	Utility Staff	132.0	203	YES	GIS SHOWS 212-J009. 52.7 TFA 02.	NO							
212-J010	212-J008	6	VCP	3-Jun-14	Utility Staff	21.7		YES	(STA. 52.7) 2.3 MMC VCP TO PVC. 21.7 MSA.	NO							
212-J008	212-J007	18	AC	21-Nov-13	Utility Staff	58.7	53	YES	NO DEFECTS REPORTED	NO							
212-J007	212-J006	18	AC	21-Nov-13	Utility Staff	128.7	147	YES	NO DEFECTS REPORTED	NO							
212-J006	212-J005	18	AC	21-Nov-13	Utility Staff	480.7	283	YES	25.9 RFL 0204. 26.7 TBI 02. 311.1 MCC AC TO DI. 333.8 SPC 0709. 351.2 MMC DI TO AC. 473.9 DSZ 0408.	NO	333.8 (3')	26.5				REMOVE PROTRUDING TAP AT 26.5	
212-J006	212-J005	6	PVC	3-Jun-14	Utility Staff	NA		YES	(STA. 26.7) 3.6 LD. 4.6 Wye.	NO							
212-J005	212-J004	18	CMP	21-Nov-13	Utility Staff	313.4	433	YES	1.0 TO 313.4 SPC, 90.8 MMC CMP TO DI. 171.0 MMC DI TO CMP	YES							
212-J004	212-J003	18	Steel	21-Nov-13	Utility Staff	80.1	78	YES	29.2 SSS 1002. 39.7 TO 70.4 SSS & SCP 1002. (PIPE IS 18" STEEL ON PIERS)	YES						CORECT VIDEO	
212-J003	212-J002	18	DI (CMP?)	11-Dec-13	Utility Staff	81.6	74	YES	77.4 SCP 0204. (PIPE APPEARS TO BE CMP).	YES							
212-J002	212-J001	18	DI	21-Nov-13	Utility Staff	362.7	371	YES	128.0 SSS 10. HSV 10. 140.6 SCP 1011 & HSV, 201.1 MMC CMP TO STEEL?. 242.5 TO 362.0 SSS 0903.	YES						AS BUILTS SHOW CMP AND STEEL ON PIERS	
212-J001	212-0035	18	AC	2-Dec-13	Utility Staff	221.2	242	YES	1								

CONDITION ASSESSMENT RESULTS AND RECOMMENDED REHABILITATION																	
				DATE	INSPECTED	LENGTH	GIS	Existing		LINE	SECTIONAL POINT	SERVICE CON.	LINE	LATERAL	NO. OF CLEAN		
LINE SEGMENT		SIZE	MATERIAL	INSPECTED	BY	INSPECTED	LENGTH	CCTV	COMMENTS		REPAIR	RENEW	LATERAL	LENGTH (FT.)	OUTS	COMMENTS	
212-0020	212-0019	24	STEEL	4-Dec-13	Utility Staff	513.7	505	YES	17.7 OBR 0407. 36.3 SSS 1204. 69.2 OBZ 0708. 121.7 SCP? RMJ 0705. SSS 0903 START. 301.5 SCP 0911. 58.8 SSS 0903	YES							VIDEO IS IMPROPERLY CODED. FIX.
212-0019	212-0015	24	STEEL	4-Dec-13	Utility Staff	489.8	487	YES	6.2 SSS & SCP 0804 START. 12.1 OBR 046. 485.0 SCP & SSS 0804 END.	YES							VIDEO IS IMPROPERLY CODED. FIX.
212-0015	212-0014	24	STEEL	4-Dec-13	Utility Staff	497.6	496	YES	7.5 SSS & SCP 0903 START. 154.3 DSC 0507. 228.0 DSC 0507. 480.6 SSS & SCP 0903 END.	YES							VIDEO IS IMPROPERLY CODED. FIX.
212-0014	212-0013	24	RCP	4-Dec-13	Utility Staff	194.2	197	YES	3.5 DSC 0406. 140.9 RFJ 11.	NO							
212-0013	212-0012C	24	DI	4-Dec-13	Utility Staff	19.3	45	YES	As-Built's SHOW 30" & GIS SHOW 36".	NO							VERIFY PIPE DIAMETER
212-0012C	212-0012B	24	DI	4-Dec-13	Utility Staff	285.8	254	YES	As-Built's & GIS SHOW 30". 7.9 SPC 0812. 42.7 SPC 0804.. 274.2 SPC 0812. 7.9, 42.7, 53.9, 77.3, 202.5, 218.7, 254.8 * 274.2 SPC? OR IS 0705.	NO							VERIFY PIPE DIAMETER
212-0012B	212-0012A	24	DI	4-Dec-13	Utility Staff	295	297	YES	As-Built's Show 30" & GIS SHOWS 36". 7.9 SPC 0812. 42.7 SPC 0804.. 274.2 SPC 0812. 7.9, 42.7, 53.9, 77.3, 202.5, 218.7, 254.8 * 274.2 SPC? OR IS 0705.	NO							VERIFY PIPE DIAMETER
212-0012A	212-0012	24	RCP	4-Dec-13	Utility Staff	12.7	10	YES	As-Built's Show 30" DI & GIS SHOWS 36" DI.	NO							VERIFY PIPE DIAMETER & MATERIAL
212-0012	212-0011	24	RCP	4-Dec-13	Utility Staff	118	128	YES	GIS SHOWS 36". 62.7 DSG 0408.	NO							VERIFY PIPE DIAMETER
212-0011	212-0010	24	RCP	5-Dec-13	Utility Staff	673.8	681	YES	18.2 DSF 0408. 163.9 TBA & IR 12. 163.9 IS 12. 460.6 TBA & IR 12. 516.2 IS & DAE 0804.. 570.8 DSC 0408.	NO		163.9 & 460.6					
212-0011	212-0010	6	VCP	3-Jun-14	Utility Staff	18.3	NA	YES	(STA. 460.6) 3.2 LD. 14.7 RMJ. 18.3 MSA ROOTS	NA			YES	25	1		
212-0011	212-0010	6	VCP	3-Jun-14	Utility Staff	23.2	NA	YES	(STA. 163.9) 2.9 JOL. 4.9 JOL. 4.9 MMC VCP TO DI. 12.1 RFJ. 23.2 RMJ.	NA			TBD				
212-0010	212-0009A	24	RCP	5-Dec-13	Utility Staff	439.9	431	YES	312.6 IS 0205. 420.3 IS 0804 & ID 12.	NO							
212-0009A	212-0009	24	RCP	5-Dec-13	Utility Staff	53.4	50	YES	15.9 IS 0812.	NO							
212-0009	212-0008	24	RCP	5-Dec-13	Utility Staff	177.1	179	YES	7.9 DSF 0408. 155.1 IS 0709 & RFJ 07. 172.8 RFJ 0903.	NO							
212-0008	212-0007A	24	RCP	5-Dec-13	Utility Staff	314.1	319	YES	67.0 RFJ 0804. 90.6 IS 0910. 100.2 RFJ 0804. 101.6 IS 0804. 122.3 IS 0305. 185.8 DAE 0711. 242.2 DAE 0105. 313.1 IS 0204	NO							
212-0007A	212-0007B	24	RCP	5-Dec-13	Utility Staff	160.7	351	YES	120.9 TBA 11 & ID. 120.9 IS 0711. 153.5 DSG 0408. 160.7 MH??. Crown of pipe cut out	NO		120.9					
212-0007A	212-0007B	6	PVC	3-Jun-14	Utility Staff	23	NA	YES	19.4 MMC PVC TO VCP. 20.7 JOL.	NO							
212-0007B	212-0007	24	RCP	5-Dec-13	Utility Staff	187.9		YES	182.8 DAR 1201	NO							
212-0007	212-0006	24	RCP	5-Dec-13	Utility Staff	367.2	359	YES	NO DEFECTS REPORTED	NO							
212-0006	212-0005	24	RCP	9-Dec-13	Utility Staff	296.6	293	YES	NO DEFECTS REPORTED	NO							
212-0005	212-0004	24	RCP	9-Dec-13	Utility Staff	303.8	306	YES	38.4 RFJ 0712	NO							
212-0004	212-0003	24	RCP	9-Dec-13	Utility Staff	146.7	144	YES	NO DEFECTS REPORTED	NO							
212-0003	212-0002	24	RCP	9-Dec-13	Utility Staff	202.1	215	YES	85.0 RFJ 0204.	NO							
212-0002	212-0001A	24	RCP	9-Dec-13	Utility Staff	168.1	150	YES	85.5 HVV 11. 122.0 B 02. 132.6 B 12. (None of these defects are noted on video and are not clearly visible on video	NO							CORRECT THE VIDEO
212-0001A	212-0001	24	DI	9-Dec-13	Utility Staff	188	195	YES	Inspection report and video indicate PVC pipe, but GIS shows DI.	NO							VERIFY PIPE MATERIAL
212-0001	292-0004	24	PVC	9-Dec-13	Utility Staff	251.5	244	YES	NO DEFECTS REPORTED	NO							
292-0004	292-0003	24	PVC	10-Dec-13	Utility Staff	312.6	314	YES	NO DEFECTS REPORTED	NO							
292-0003	292-0002	24	RCP	11-Dec-13	Utility Staff	190.7	198	YES	155.2 B 05.	NO		155.2 (3')					
212-1021	212-1020	15	DI		Utility Staff		9		NO DEFECTS REPORTED								
212-1020	212-1019	15	DI (AC?)	10-Dec-13	Utility Staff	206.4	196	YES	38.6 MMC DI TO AC. 116.1 DAR 0408. 165.5 MMC AC TO DI. 169.3 CM 0709. 184.7 MMC DI TO AC.	NO							
212-1019	212-1018	15	AC	10-Dec-13	Utility Staff	85.3	79	YES	18.9 DAR 0608.	NO							
212-1018	212-1017	15	AC	10-Dec-13	Utility Staff	207.9	212	YES	NO DEFECTS REPORTED	NO							
212-1017	212-1016	15	AC	10-Dec-13	Utility Staff	143.9	146	YES	74.4 DAR 0406. 80.2 OBR 0507. 102.9 DAE 0804. 117.6 DSC 0807. 125.0 DSC 0507. (HAVE CONTRACTOR CLEAN SEGMENT AND RECAMERA. THIS WILL BE AN ADDITIONAL COST)	NO							
212-1016	212-1015	15	AC	10-Dec-13	Utility Staff	341.7	335	YES	225.6 MMC AC TO DI. 248.2 DAE 0804. 258.0 TO 270.4 SSS.	NO		256.0 TO 272.0 (16')					
212-1015	212-1014	15	AC	10-Dec-13	Utility Staff	221.1	220	YES	115.5 TFC 09. 168.9 RFJ 0710.	NO							
212-1014	212-1013	15	AC	10-Dec-13	Utility Staff	178.7	181	YES	RM IN MH	NO							
212-1013	212-1012	15	AC	10-Dec-13	Utility Staff	395.8	384	YES	8.4 DSG 0408. 67.5 TFC 10. 229.8 TFC 10.	NO							
212-1012	212-1011	15	DI	10-Dec-13	Utility Staff	398.5	425	YES	56.2 SPC 1212. 66.8 LFD 0710. 79.5 MMC DI TO CMP. 319.0 MMC CMP TO DI OR STEEL. 329.1 DAE 0304.(MMCs NOT N	YES							CORRECT VIDEO AND/OR REPORT
212-1011	212-1010	15	DI	11-Dec-13	Utility Staff	95.8	99	YES	11.8 RFJ 1011. (VIDEO IS TOO HAZY TO PROPERLY ASSESS PIPE CONDITIONS.	TBD							CORRECT VIDEO
212-1010	212-1009	15	DI	11-Dec-13	Utility Staff	171	165	YES	112.4 LFD 0904. 126.3 TO 149.4 LFD 0804.	YES							CLEAN & RECAMERA
212-1009	212-1008	15	DI	11-Dec-13	Utility Staff	192.1	183	YES	76.9 IS 0204. 89.9 DAE 0507. (PIPE IS CMP. VIDEO IS HAZY)	YES							
212-1008	212-1001	15	AC	11-Dec-13	Utility Staff	162.3	170	YES	18.0 TFC 09.	NO							
212-1001	212-0035	15	AC	11-Dec-13	Utility Staff	243.3	242	YES	233.7 DSG 0408	NO							HAVE PIPE CLEANED FROM 233.7 TO MH 212-0035
BASIN D																	
504-D026D	504-D026C	30	DI	16-Dec-13	Contractor B	108	106	YES	16.2 DAE. REPORT INDICATES DI, BUT VIDEO HEADER SHOWS RCP. PIPE IS DI.	NO							CORRECT VIDEO
504-D026C	504-D026B	30	DI	16-Dec-13	Contractor B	152.8	148	YES	67.6 DAE 0205. 67.7 DAE 0709. 86.8 DAE 0408. 103.9 DAE 0711. 121.1 DAE 0408. REPORT INDICATES DI, BUT VIDEO HEADER SHOWS RCP. PIPE IS DI.	NO							CORRECT VIDEO
504-D026B	504-D026A	30	DI	16-Dec-13	Contractor B	149.3	159	YES	57.5 IS/DAE 0709. 77.1 IS/DAE 0408. 112.5 IS/DAE 04708. REPORT INDICATES DI, BUT VIDEO HEADER SHOWS RCP. PIPE IS DI.	NO							CORRECT VIDEO
504-D026A	504-D026	30	DI	17-Dec-13	Contractor B	122.8	120	YES	13.1 DAE 0305. REPORT & VIDEO INDICATE DI. PIPE IS DI.	NO							CORRECT VIDEO & REPORT
504-D026	504-D025	30	DI	31-Oct-13	Contractor B	191	192	YES	34.5 IS & DAE 07. 52.8 IS & DAE. 71.8 IS & DAE 0708. 91.5 DAE 02. 125.1 DAE 0507. 143.0 DAE 0507. 161.4 DAE 0507.	NO							
504-D025	504-D024	30	DI	16-Dec-13	Contractor B	200.2	202	YES	39.5 IS/DAE 0405. 57.0 IS/DAE 0508. 73.6 IS/DAE 0508. 91.8 IS/DAE 0709. 109.2 IS/DAE 04709. 127.3 IS/DAE 0709. 163	NO							CORRECT VIDEO
504-D024	504-D023	30	DI	16-Dec-13	Contractor B	234.8	237	YES	159.6 ISSR 0705. REPORT INDICATES DI, BUT VIDEO HEADER SHOWS RCP. PIPE IS DI.	NO							CORRECT VIDEO
504-D023	504-D022	30	DI	17-Oct-13	Contractor B	265.1	277	YES	12.8 DAE 0407.								

CONDITION ASSESSMENT RESULTS AND RECOMMENDED REHABILITATION																
				DATE INSPECTED	INSPECTED BY	LENGTH INSPECTED	GIS LENGTH	Existing CCTV		LINE	SECTIONAL POINT REPAIR	SERVICE CON. RENEW	LINE LATERAL	LATERAL LENGTH (FT.)	NO. OF CLEAN OUTS	COMMENTS
LINE SEGMENT		SIZE	MATERIAL						COMMENTS							
503-0018	503-0017	24	RCP	18-Dec-13	Contractor B	334.1	336	YES	14.6 SRI 0804 START. 308.6 IS/DAE 0305. 329.6 SRI END	NO						
503-0017	503-0016	24	RCP	11-Oct-13	Contractor B	256.7	253	YES	55.5 SAV 0804 START.135.9 SAV 0804 FINISH. 136.1 MMC RCP TO DI. 161.6 SCP 0709 START. 251.5 SPC 0709 FINISH.	YES						
503-0016	503-0015	24	DI	11-Oct-13	Contractor B	210.2	214	YES	3.6 SCP 0105 START. 197.0 SPC 0804 FINISH.	YES						
503-0015	503-0014	24	RCP	10-Oct-13	Contractor B	355.0	356	YES	40.6 SCP 0705 START. 112.7 SCP 0507 FINISH. 112.7 MMC DI TO RCP.	YES						
503-0014	503-0013B	24	RCP	10-Oct-13	Contractor B	229.9	305	YES	3.9 IS 0711. 9.7 SAV 0804 START. 66.1 SAV 0804 FINISH. 67.6 MMC RCP TO DI. 67.7 IS 0711. 68.5 SPC 0804 START. 118.6 SPC 0804 FINISH. 119.8 MMC DI TO RCP. 123.7 SAV 0804 START. 226.7 SAV 0804 FINISH..	NO						
503-0013B	503-0013A	24	RCP	10-Oct-13	Contractor B	81.4		YES	7.10 SAV 0804 START. 68.4 SAV 0804 FINISH.	NO						
503-0013A	503-0012A	24	DI	15-Oct-13	Contractor B	120.8	316	YES		NO ⁽¹⁾						
503-0012A	503-0012	24	RCP	15-Oct-13	Contractor B	196.4		YES	2.2 SAP 0804. 4.6 IR 0305. 7.0 SRC 0804. 12.1 SRC 0804. 17.8 SAM 0804. 67.0 SRC 0804. 74.9, 82.2, 92.4, 113.7 & 122.0 ISR. 184.6 SCR, SAM & SAP 0804. ISR	NO ⁽¹⁾						
503-0012	503-0011A	24	RCP	16-Oct-13	Contractor B	122.4	127	YES	6.6 IR 1002. 8.6 SRV 0903. 11.2 SAP 0804. 46.8 IR & FL 10. 93.3 SRV 0903. 119.2 SAP 0804.	NO ⁽¹⁾						
503-0011A	503-0011	24	RCP	16-Oct-13	Contractor B	196.5	190	YES	2.5 SRV 0911. 7.6 SAM 0804. 181.5 SAM 0804.	NO ⁽¹⁾						
503-0011	503-0010A	24	RCP	16-Oct-13	Contractor B	90.7	93	YES	8.6 SAM 0804. 9.8 DAR 0804. 11.1 SAM, 0804. 64.6 DAR 0804. 90.7 SAM 08041	NO ⁽¹⁾						
503-0010A	503-0010	24	RCP	16-Oct-13	Contractor B	336	337	YES	32.6 TO 334.3 SAV 0903.	NO ⁽¹⁾						

Notes: ⁽¹⁾ Line to be replaced with large diameter pipe in upcoming CIP

BASIN F																
134-C192	134-C191	8	VCP	8-Oct-13	Utility Staff	396.7	424	YES	141.5 TFA 09 & R4FL 09. 142.3 MMC VCP TO PVC. 146.8 TFA 03. 165.9 RFJ 0205. 199.1 BSV 1101. 239.7 RFJ 0205. 247.5 MMC VCP TO PVC. 249 TFA 03. 276.3 TFA 03. 278.1 TFA 09 & RFL.	NO	199.9 (3').	141.5 & 278.1				Rehab included in FY14 Sewer Rehab Project
134-C191	134-C188	8	VCP	8-Oct-13	Utility Staff	296.9	270	YES	50.3 RFJ 03. 85.2 RFJ 0709. 88.2 MMC VCP TO PVC. 95.9 TFA 03. 99.6 MMC PVC TO VCP. 153.3 TFC 09. 155.8 TBA & RMC 09. 268.8 CL 08. 280.3 TFA 09.	NO	268.8 (3')	155.8				Rehab included in FY14 Sewer Rehab Project
134-C189	134-C188	8	VCP	8-Oct-13	Utility Staff	361.1	347	YES	39.8 B 0506. 59.9 RFJ 0809. 65.1 RFJ 0205. 70.2 RTJ 02. 75.1 FC 1203. 114.4 TFA 03. 158.4 TFA 09 & RFL 09. 159.1 RFJ 0105. 162.1 TBA 09. 169.5 RFJ 0204. 189.1 RFJ 0803. 194.2 RFJ 0204. 242.1 H 01. 290.7 B 1101. 297.8 TBA 02.	YES		162.1 & 297.8				Rehab included in FY14 Sewer Rehab Project
134-C129	134-C128	8	TRUSS	8-Oct-13	Utility Staff	162.9	157	YES	81.5 TBA 09. 89.3 TBA 03. 137.6 TBA 03.	NO		81.5, 89.3 & 137.6				Rehab included in FY14 Sewer Rehab Project
134-C128	134-C127	8	TRUSS	8-Oct-13	Utility Staff	304.7	303	YES	62.9 RML 0105. 63.8 TBA 03. 108.5 RFJ 1104. 114.7 B 1112. 120.9 RFJ 0710. 187.4 JOL (Repaired by Maintenance). 293.2 H&FL 1101. 265.6 B 0607. 200.4 TBA 09. 190.6 TFA 03. 188.7 JOL (Repaired by Maintenance).	YES		190.6 & 200.4				Rehab included in FY14 Sewer Rehab Project
134-C127	134-C126	8	VCP	8-Oct-13	Utility Staff	300	299	NO	42.1 MMC TRUSS TO PVC. 47.6 MMC PVC TO TRUSS. 67.0 TBA 03.	NO		67.0				Rehab included in FY14 Sewer Rehab Project
BASIN G																
134-C143	134-C142	8	VCP	8-Oct-13	Utility Staff	274	275.9	YES	6.8 B 1201. 97.4 TBI 11. 107.2 FL 12. 113.3 TFC 10. 124.3 FL 12. 127.0 FC 0804. 136.1 FC 0804. 144.2 FC 0903. 147.3 B 0709. 190.2 FC 1004. 255.6 DAGS 1101.	YES						Rehab included in FY14 Sewer Rehab Project
134-C142	134-C141	8	VCP	8-Oct-13	Utility Staff	180.7	156	YES	11.2 FM 0804. 14.0 FL 12. 31.7 FL 12. 34.2 FC 0804. 35.1 FC 0804. 40.8 FM 0804. 44.2 FC 0804. 51.1 FC 0205. 86.2 MMC VCP TO PVC. 96.9 MMC PVC TO VCP. 176.5 FM 0804.	YES						Rehab included in FY14 Sewer Rehab Project
134-C084	134-C083	8	VCP	8-Oct-13	Utility Staff	51.9	71	NO	35.3 MMC VCP TO DI.	NO						

Appendix D

Program Procedures

CONDITION ASSESSMENT PROCEDURES

SEWER SYSTEM CONDITION ASSESSMENT

Inspection Technologies

Inspection technologies and typical applications

Technology		Sewer type			Pipe material	Pipe diameter	Defects detected			
		Gravity	Force main	Lateral			Internal condition	Pipe wall	Leakage	Pipe support
Camera	Digital cameras	■			Any	6-in.-60-in.	■	■	■	
	Zoom cameras	■			Any	>6-in.	■	■	■	
	Push-camera			■	Any	1-in.-12-in.	■	■	■	
Acoustic	In-line leak detectors	■	■		Any	>4-in.			■	
	Acoustic monitoring systems		■		PCCP	>18-in.		■		
	Sonar/ultrasonic	■	■		Any	>2-in.	■	■		
Electrical/ electromagnetic	Electrical leak location	■	■	■	Non-ferrous	>3-in.			■	
	Remote field eddy current	■	■	■	Ferrous, PCCP	>2-in.		■	■	
	Magnetic flux leakage	■	■	■	Ferrous	2-in.-56-in.		■		
Laser	Laser profiling	■	■	■	Any	4-in.-160-in.	■	■		
Innovative technologies	Gamma-gamma logging	■	■	■	Concrete	defined	Not yet			■
	Ground penetrating radar	■	■	■	Any	Not yet defined			■	■
	Infrared thermograph	■	■	■	Any	Not yet define			■	■
	Micro-deflection	■			Brick	Not yet defined		■		■
	Impact echo/SASW	■			Brick/ Concrete	>6-ft.		■		

Source: NACWA, *Condition Assessment of Wastewater Collection Systems* 2009

CONDITION ASSESSMENT AND REHABILITATION PROCEDURES

CONTINUOUS SEWER SYSTEM ASSESSMENT PROCEDURE 1.1 - CCTV Sewer Inspection

SCHEDULE

Inspection schedule established under Priority ranking system.

ACTIVITY DESCRIPTION

Televised inspection of sewers to assess the physical condition of sewer lines. CCTV is most appropriate for sewer lines 6 inch to 36 inch in diameter and when the water level in the sewer is 25% of diameter or less. Written logs and videotape reports are made during the operation. This procedure includes the inspection of manholes.

ACTIVITY GOALS

- CCTV inspection is used to assess the physical condition of the sewer system. It is used to find the exact location of cross connections, line defects, and infiltration sources.
- To locate house connections, manholes, buried structures, and taps at sewer mains
- To check or inspect the effectiveness of sewer cleaning.

LABOR

Code	Classification
	CCTV Crew

EQUIPMENT

Code	Description
	CCTV truck
	Video Tapes
	Camera
	Ladder

MATERIALS

Code	Description
	Safety equipment - vest, traffic cones and flags, men-working signs, hardhats, steel toed boots, leather /cloth and impervious gloves, Tyvec coveralls, half mask disposable respirators, eye protection, ear plugs, flashlights, life vests, safety harness and ropes. Disinfectants Eye wash Fire extinguisher First aid kit

SAFETY ANALYSIS

Safety Check List

- Safety Program
- Protective Clothing and Equipment
- Gases and other Hazardous Atmospheres Analysis (Confined Space Entry)
- Overhead Power Lines (Electrical Safety)
- Underground Services Utilities Locations
- Traffic Safety Requirements

Potential Hazards

- Infectious Diseases
- Slip, Trip, and Fall
- Poisonous Snakes, Pests
- Confined Spaces (Confined Space Entry)
- Traffic
- Vehicle Operation
- Mechanical Tools
- Electrical Hazards (Electrical Safety)
- Flooding and Inundation (Confined Space Entry)
- Lifting

CONDITION ASSESSMENT AND REHABILITATION PROCEDURES

CONTINUOUS SEWER SYSTEM ASSESSMENT PROCEDURE 1.1 - CCTV Sewer Inspection

ACTIVITY/SUBTASK

- 1. Review work order and visit site with crew. (Area Supervisor)**
 - Follow vehicle operation safety procedures.
 - Dispatch maintenance crew to work site.
- 2. Secure work site by placing traffic control signs and safety devices at the work site. (Maintenance Crew)**
 - Follow Traffic Safety Procedures
 - Don safety vests, hardhats, safety glasses, ear plugs, gloves, boots, Tyvec suit.
 - Isolate one or more lanes of traffic with flags, cones, traffic control signs, etc., where work in or immediately adjacent to roads exposes a crew member to traffic injuries.
 - Look for overhead power lines that may hit the truck or equipment. If lines are above the work area, contact Power Company to de-energize or shield the lines. Equipment must be kept at least 10 feet from the overhead lines.
- 3. Determine the location of the manholes on the GIS Map (Maintenance Crew)**
 - Locate manhole location on GIS map and identify GIS location number.
 - If manhole access is not visible, use metal detection or other equipment.
 - Check sewer main by removing manhole lids.
 - Lift the manhole cover using the hook. Drag the cover with the hook, avoid bending over and using hand whenever possible.
 - For heavier manholes, use a truck-mounted winch.
 - Follow Confined Space Procedures
 - Follow Personal Protection Equipment (**PPE**) Program
 - DO NOT place your face near the manhole opening. Let the manhole "breathe" for 10 minutes before looking in.
 - DO NOT SMOKE near manholes regardless of whether the cover is on or off.
 - DO NOT STAND on the removed manhole cover.
 - USE IMPERVIOUS GLOVES when working with an open manhole.
 - USE DISPOSABLE TYVEK COVERALLS to keep sewage off of your uniform.
- 4. Sewer line segment cleaning.**
 - It is recommended that cleaning of sewers and service laterals **not** be conducted prior to the CCTV inspection unless necessary to provide an unobstructed view of the pipe. Cleaning may remove defects that should be observed and reported and may damage the pipe.
 - If it is determined that cleaning is required, clean the line using jet rodding equipment (See Gravity Line Preventive Maintenance SOPs).
- 5. Prepare CCTV equipment for the internal inspection operation.**
 - Thread the camera cable through the sewer line segment using the jet rodding equipment or thread the camera cable through the sewer line segment with a stringer method.
 - Plug upstream manhole with inflatable plug when flow control is required (Typically when depth of flow is greater than 25% of pipe diameter).
 - Set the winch at the downstream manhole and the CCTV truck at the upstream manhole.
 - Lower the camera into the manhole and attach to the winch cable.

CONDITION ASSESSMENT AND REHABILITATION PROCEDURES

CONTINUOUS SEWER SYSTEM ASSESSMENT PROCEDURE 1.1 - CCTV Sewer Inspection

ACTIVITY/SUBTASK

6. Start the televised inspection

- Move the camera through the line in either direction at a moderate rate.
- Note whether the camera is being pulled upstream or downstream.

7. Observe and record the condition of the sewer line as it is televised.

- Record distance measurements for the purpose of locating defects.
- Record observations of root intrusion, grease and debris accumulation, pipe deterioration, pipe misalignment, pipe breaks, pipe defects, separated joints, I/I, cross connections, storm water connections, and lateral defect according to assessment procedures.

8. Break down work site and report the work completed.

- Replace manhole cover by dragging it with the hook if possible.
- When manhole cover is in place, remove Tyvek coveralls and place in garbage bag for disposal. Wash down and disinfect outside of boots. Remove gloves and ear plugs.
- Remove disposable respirator and place in plastic bag for reuse (refer to PPE Program).
- Complete clean up of work site and any sewage spills or flooding in area. Disinfect and sanitize.
- Clean camera and associated equipment and place in truck.
- Complete /fill out Work Order information. Record linear feet of sewer line inspected and document video log.

CONDITION ASSESSMENT AND REHABILITATION PROCEDURES

CONTINUOUS SEWER SYSTEM ASSESSMENT PROCEDURE 1.2 - DYE TESTING

SCHEDULE

Testing schedule established under Priority ranking system.

ACTIVITY DESCRIPTION

Dye testing of sewer mains to isolate and quantify defects within the collection system. Written documentation and photographs of dye testing results are taken as required. Results of dye testing conducted in conjunction with CCTV inspection will be recorded on the CCTV inspection logs. Results of the dye testing conducted for verification of smoke testing will be recorded on smoke testing data forms.

ACTIVITY GOALS

To verify apparent direct inflow sources identified through smoke testing or CCTV inspection. To identify interconnections between sanitary and storm sewer systems. To trace sewer pipeline segments as required to verify and update sewer system GIS layer.

LABOR

Code

Classification

Maintenance Crew

EQUIPMENT

Code

Description

Work Truck
Camera
Ladder

MATERIALS

Code

Description

Safety equipment – vest, traffic cones and flags, men-working signs, hardhats, steel toed boots, leather/cloth and impervious gloves, Tyvec coveralls, half mask disposable respirators, eye protection, ear plugs, flashlights, life vests, safety harness and ropes.

- Disinfectants
- Eye Wash
- Fire Extinguisher
- First aid kit
- Dye tablets

SAFETY ANALYSIS

Safety Check List

- Safety Program
- Protective Clothing and Equipment (Personal Protection Equipment)
- Gases and other Hazardous Atmospheres Analysis (Confined Space Entry)
- Overhead Power Lines (Electrical Safety)
- Underground Services Utilities Locations
- Traffic Safety Requirements (Traffic Safety)

Potential Hazards

- Infectious Diseases
- Slip, Trip, and Fall
- Poisonous Snakes, Pests
- Confined Spaces (Confined Space Entry)
- Traffic
- Vehicle Operation
- Mechanical Tools
- Electrical Hazards (Electrical Safety)
- Flooding and Inundation (Confined Space Entry)
- Lifting

CONDITION ASSESSMENT AND REHABILITATION PROCEDURES

CONTINUOUS SEWER SYSTEM ASSESSMENT PROCEDURE 1.2 - DYE TESTING

ACTIVITY/SUBTASK

1. **Notify nearby residents, businesses, and public safety agencies approximately 24 to 48 hours prior to initiation of dye test procedure.**
2. **Review work order and visit site with crew (Area Supervisor)**
 - Ensure all necessary material and equipment have been gathered before leaving the yard.
 - Follow Vehicle Operation Safety Procedures.
3. **Secure work site by placing traffic control signs and safety devices at the work site. (Maintenance Crew)**
 - Follow Traffic Safety Procedures.
 - Don safety vests, hardhats, safety glasses, steel toe boots, etc.
 - Crew Supervisor acts as a safety supervisor during process.
 - Isolate one or more lanes of traffic with flags, cones, traffic control signs, etc. where work in or immediately adjacent to roads exposes a crew member to traffic injuries.
 - Look for overhead power lines that may hit the truck or equipment. If lines are above the work area, contact Power Company at (xxx) xxx-xxxx to de-energize or shield the lines. Equipment must be kept at least 10 feet from the overhead lines.
4. **Prepare for dye testing.**
 - Locate manhole location on GIS map and identify GIS location number.
5. **Start dye testing.**
 - Determine the location of the manhole. Use metal detection if manhole is not visible.
 - Locate spill point or problem area.
 - Check sewer main by removing manhole lids in the vicinity of the home/business until a free flowing manhole is found.
 - Lift the manhole cover using the hook. Drag the cover with the hook, avoid bending over and using hand whenever possible.
 - For heavier manholes, use a truck-mounted winch.
 - Follow Confined Space Procedures.
 - Follow Personal Protection Equipment (PPE) Program.
 - Keep employees away from manhole when opening due to dangerous gases.
 - DO NOT place your face near the manhole opening. Let the manhole "breathe" for 10 minutes before looking in.
 - DO NOT SMOKE near the manholes regardless of whether the cover is on or off.
 - DO NOT STAND on the removed manhole cover.
 - USE IMPERVIOUS GLOVES when working with an open manhole.
 - USE DISPOSABLE TYVEK COVERALLS to keep sewage off of your uniform.
 - Drop dye tablet upstream of the sewer segment to be inspected.

CONDITION ASSESSMENT AND REHABILITATION PROCEDURES

CONTINUOUS SEWER SYSTEM ASSESSMENT PROCEDURE 1.2 - DYE TESTING

ACTIVITY/SUBTASK

6. **Observe and record evidence of dye in the suspected area.**
 - Record the presence or absence of dye in adjacent downstream manholes.
 - Recommend sewer sections for cleaning and internal inspection if necessary.
7. **Break down work site and report the work completed.**
 - Replace manhole cover by dragging it with the hook if possible.
 - When manhole cover is in place, remove Tyvek coveralls and place in garbage bag for disposal. Wash down and disinfect outside of boots. Remove gloves.
 - Remove disposable respirator and place in plastic bag for reuse (refer to PPE Program).
 - Complete clean up of work site and any sewage spills or flooding in area. Disinfect and sanitize.
 - Document testing with written reports and photographs or videos as needed.
8. **Complete /fill out Work Order information. Record linear feet of sewer line segment dye tested – note information on the GIS map.**

CONDITION ASSESSMENT AND REHABILITATION PROCEDURES

CONTINUOUS SEWER SYSTEM ASSESSMENT PROCEDURE 1.3 - SMOKE TESTING

SCHEDULE

Testing schedule established under Priority ranking system.

ACTIVITY DESCRIPTION

Smoke testing of sewer mains to identify sources of I/I from defects in the sewers, manholes, and cross connections to storm drainage facilities. Smoke testing is most effective in sewers with diameters equal to or less than 18 inches. Smoke testing should be conducted during dry weather, no wind, and low groundwater level conditions. Written documentation and photographs of smoke testing results are taken as required.

ACTIVITY GOALS

To identify direct connections to the sewer collection system, shallow pipe defects, and manhole defects. To locate lost manholes and diversion points.

LABOR

Code	Classification
	Smoke Testing Crew

MATERIALS

Code	Description
	Safety equipment — vest, traffic cones and flags, men-working signs, hardhats, steel toed boots, leather /cloth and impervious gloves, Tyvec coveralls, half mask disposable respirators, eye protection, ear plugs, flashlights, life vests, safety harness and ropes. Disinfectants Eye wash Fire extinguisher First aid kit

EQUIPMENT

Code	Description
	Work Truck Camera and Smoke Blower camera Smoke bombs or canisters (non-toxic, odorless, non-staining, 3-5 minute duration) Sandbags, baffles, or manhole plugs Floodlights or Other Lighting Aids Ladder

SAFETY ANALYSIS

Safety Check List

- Safety Program
- Protective Clothing and Equipment (Personal Protection Equipment)
- Gases and other Hazardous Atmospheres Analysis (Confined Space Entry)
- Overhead Power Lines (Electrical Safety)
- Underground Services Utilities Locations
- Traffic Safety Requirements (Traffic Safety)

Potential Hazards

- Infectious Diseases
- Slip, Trip, and Fall
- Poisonous Snakes, Pests
- Confined Spaces (Confined Space Entry)
- Traffic
- Vehicle Operation
- Mechanical Tools
- Electrical Hazards (Electrical Safety)
- Flooding and Inundation (Confined Space Entry)
- Lifting

CONDITION ASSESSMENT AND REHABILITATION PROCEDURES

CONTINUOUS SEWER SYSTEM ASSESSMENT PROCEDURE 1.3 - SMOKE TESTING

ACTIVITY/SUBTASK

- 1. Alert neighbors and businesses 24 to 48 hours prior to initiation of smoke testing procedure.**
- 2. Review work order and visit site with crew (Area Supervisor)**
 - Ensure all necessary material and equipment have been gathered before leaving the yard.
 - Follow Vehicle Operation Safety Procedures
- 3. Secure work site by placing traffic control signs and safety devices at the work site.**
 - Follow Traffic Safety Procedures.
 - Don safety vests, hardhats, safety glasses, steel toe boots.
 - Isolate one or more lanes of traffic with flags, cones, traffic control signs, etc. where work in or immediately adjacent to roads exposes a crew member to traffic injuries.
 - Look for overhead power lines that may hit the truck or equipment. If lines are above the work area, contact Power Company at (xxx) xxx-xxxx to de-energize or shield the lines. Equipment must be kept at least 10 feet from the overhead lines.
 - Alert closest Fire Department to stand by for emergencies and inquiries.
- 4. Prepare for Smoke Testing Procedure**
 - Determine the location of the manhole on GIS map. Use metal detection if manhole is not visible.
 - Check sewer main by removing manhole lids in the vicinity of the home/business until a free flowing manhole is found.
 - Lift the manhole cover using the hook. Drag the cover with the hook; avoid bending over and using hand whenever possible.
 - For heavier manholes, use a truck-mounted winch.
 - Follow Confined Space Procedures.
 - Follow Personal Protection Equipment (PPE) Program.
 - DO NOT place your face near the manhole opening. Let the manhole "breathe" for 10 minutes before looking in.
 - DO NOT SMOKE near manholes regardless of whether the cover is on or off.
 - DO NOT STAND on the removed manhole cover.
 - USE IMPERVIOUS GLOVES when working with an open manhole.
 - USE DISPOSABLE TYVEK COVERALLS to keep sewage off of your uniform.
 - Ensure proper operation of blower.
 - Isolate sections if necessary with sandbags, baffles, or other approved method.
 - Set up blower over an open manhole on the sewer segment to be inspected.

CONDITION ASSESSMENT & REHABILITATION PROCEDURES

CONTINUOUS SEWER SYSTEM ASSESSMENT PROCEDURE 1.3 - SMOKE TESTING

ACTIVITY/SUBTASK

5. Start the smoke testing procedure.

- Start the blower and force air into the line at least 5-10 minutes prior to setting off the smoke bombs.
- Stand upwind of the smoke to avoid breathing the smoke.
- Light one or more smoke bombs or canisters and lower into the sewer segment to be inspected.
- Force smoke through the sewer segment with the blower.

6. Observe and record evidence of smoke escaping from the sewer through leaks, breaks, and other I/I sources.

- Walk the surrounding area to visually detect sources of smoke emissions
- Record the smoke testing results and document each defect with photographs labeled with date, time, and location.
- Visually inspect manholes suspected of having direct inflow connections into sanitary sewers.
- Identify direct inflow connections to sewers and interconnections between sanitary and storm sewer systems.

7. Break down work site and report the work completed.

- Replace manhole cover by dragging it with the hook if possible.
- When manhole cover is in place, remove Tyvek coveralls and place in garbage bag for disposal. Wash down and disinfect outside of boots. Remove gloves.
- Complete clean up of work site and any sewage spills or flooding in area. Disinfect and sanitize.
- Complete /fill out Work Order information. Record linear feet of sewer line inspected and document all photographs and videos.

CONDITION ASSESSMENT & REHABILITATION PROCEDURES

SEWER SYSTEM CONDITION ASSESSMENT Procedure 1.4 - Manhole Inspection			
SCHEDULE Inspection schedule established under CMMS.			
ACTIVITY DESCRIPTION Visual inspection of manholes to assess the physical condition. Written logs and pictures are made during the operation.			
ACTIVITY GOALS - Manhole inspection is used to assess the physical condition of the manholes in the sewer system. It is used to find the exact location manholes, defects, and infiltration sources. - To locate manholes and connected sewer mains - To check or inspect the effectiveness of cleaning.			
LABOR		MATERIALS	
Code	Classification	Code	Description
	Manhole Inspection Crew		Safety equipment - vest, traffic cones and flags, men-working signs, hardhats, steel toed boots, leather /cloth and impervious gloves, Tyvec coveralls, half mask disposable respirators, eye protection, ear plugs, flashlights, life vests, safety harness and ropes.
EQUIPMENT			Disinfectants
Code	Description		Eye wash
	Utility truck		Fire extinguisher
	Camera		First aid kit
	Ladder		
SAFETY ANALYSIS			
Safety Check List - Safety Program - Protective Clothing and Equipment - Gases and other Hazardous Atmospheres Analysis (Confined Space Entry) - Overhead Power Lines (Electrical Safety) - Underground Services Utilities Locations - Traffic Safety Requirements		Potential Hazards - Infectious Diseases - Slip, Trip, and Fall - Poisonous Snakes, Pests - Confined Spaces (Confined Space Entry) - Traffic - Vehicle Operation - Mechanical Tools - Electrical Hazards (Electrical Safety) - Flooding and Inundation (Confined Space Entry) - Lifting	

CONDITION ASSESSMENT & REHABILITATION PROCEDURES

SEWER SYSTEM CONDITION ASSESSMENT Manhole Inspection

ACTIVITY/SUBTASK

- 1. Review work order and visit site with crew. (Area Supervisor)**
 - Follow vehicle operation safety procedures.
 - Dispatch maintenance crew to work site.
- 2. Secure work site by placing traffic control signs and safety devices at the work site. (Maintenance Crew)**
 - Follow Traffic Safety Procedures
 - Don safety vests, hardhats, safety glasses, ear plugs, gloves, boots, Tyvec suit.
 - Isolate one or more lanes of traffic with flags, cones, traffic control signs, etc., where work in or immediately adjacent to roads exposes a crew member to traffic injuries.
 - Look for overhead power lines that may hit the truck or equipment. If lines are above the work area, contact Power Company to de-energize or shield the lines. Equipment must be kept at least 10 feet from the overhead lines.
- 3. Determine the location of the manholes on the GIS Map (Maintenance Crew)**
 - Locate manhole location on GIS map and identify GIS location number.
 - If manhole access is not visible, use metal detection or other equipment.
 - Check sewer main by removing manhole lids.
 - Lift the manhole cover using the hook. Drag the cover with the hook, avoid bending over and using hand whenever possible.
 - For heavier manholes, use a truck-mounted winch.
 - Follow Confined Space Procedures
 - Follow Personal Protection Equipment (**PPE**) Program
 - DO NOT place your face near the manhole opening. Let the manhole "breathe" for 10 minutes before looking in.
 - DO NOT SMOKE near manholes regardless of whether the cover is on or off.
 - DO NOT STAND on the removed manhole cover.
 - USE IMPERVIOUS GLOVES when working with an open manhole.
 - USE DISPOSABLE TYVEK COVERALLS to keep sewage off of your uniform.
- 4. Ensure that the manhole has been cleaned.**
 - If necessary, clean the manhole using vacuum truck equipment.
- 5. Prepare for the internal inspection operation.**
 - Determine if manned entry is required to visually inspect manhole.
 - If manned entry is required, use ladder or safety harness to enter manhole for inspection.

CONDITION ASSESSMENT & REHABILITATION PROCEDURES

SEWER SYSTEM CONDITION ASSESSMENT Manhole Inspection

ACTIVITY/SUBTASK

6. Observe and record the condition of the manhole.

- Record observations on the Manhole Inspection Form.
- Take pictures where required to document observed conditions and defects.

7. Break down work site and report the work completed.

- Replace manhole cover by dragging it with the hook if possible.
- When manhole cover is in place, remove Tyvek coveralls and place in garbage bag for disposal. Wash down and disinfect outside of boots. Remove gloves and ear plugs.
- Remove disposable respirator and place in plastic bag for reuse (refer to PPE Program).
- Complete clean up of work site and any sewage spills or flooding in area. Disinfect and sanitize.
- Clean camera and associated equipment and place in truck.
- Complete/fill out Manhole Inspection Form. Record linear feet of sewer line inspected and document video log.

CONDITION ASSESSMENT AND REHABILITATION PROCEDURES

MAINTENANCE PROCEDURE 1.1 VACTOR CLEANING

SCHEDULE

Schedule of work orders established under CMMS.

ACTIVITY DESCRIPTION

Combination jet and vacuum cleaning for the removal of accumulations of silt, grease, or other debris from the sewer line.

ACTIVITY GOALS

- To remove medium/heavy accumulations of debris to prevent disruption of sewer service.
- To maintain sewer capacity and system integrity.
- To clean sewer prior to rehabilitation.
- To facilitate CCTV inspection of sewer.

LABOR

Code

Classification

Preventive Maintenance Crew

MATERIALS

Code

Description

Safety equipment - vest, traffic cones and flags, men-working signs, hardhats, steel toed boots. Leather/cloth and impervious gloves, tyvec coveralls, half mask disposable respirators, eye protection, ear plugs, flashlights, life vests, safety harness and ropes.
Disinfectants
Eye wash
Fire extinguisher
First aid kit

EQUIPMENT

Code

Description

Combination (Jet/Vactor) Truck Ladder
Floodlights or Other Lighting Aids

SAFETY ANALYSIS

Safety Check List

- Collection and Transmission Systems Safety Program Plan
- Protective Clothing and Equipment
- Gases and other Hazardous Atmospheres Analysis (Confined Space Entry)
- Overhead Power Lines (Electrical Safety)
- Underground Services Utilities Locations
- Traffic Safety Requirements

Potential Hazards

- Infectious Diseases
- Slip, Trip, and Fall
- Poisonous Snakes, Pests, Insects
- Confined Spaces (Confined Space Entry)
- Traffic
- Vehicle Operation
- Mechanical Tools
- Electrical Hazards (Electrical Safety)
- Flooding and Inundation (Confined Space Entry)
- Lifting

CONDITION ASSESSMENT AND REHABILITATION PROCEDURES

MAINTENANCE PROCEDURE 1.1 VACTOR CLEANING

ACTIVITY/SUBTASK

2. **Coordinate with other Agencies and Departments to confirm accessibility, permits required, etc.**
3. **Review work order and visit site with crew. (Area Supervisor)**
 - Follow vehicle operation safety procedures.
 - Dispatch maintenance crew to work site.
4. **Determine the location of the manholes on the GIS Map**
 - Locate manhole on GIS map and identify GIS location number.
 - If manhole access is not visible, use metal detection or other equipment.
5. **Secure work site by placing traffic control signs and safety devices at the work site.**
 - Follow Traffic Safety Procedures
 - Don safety vests, hardhats, safety glasses, etc.
 - Isolate one or more lanes of traffic with flags, cones, traffic control signs, etc., where work in or immediately adjacent to roads exposes a crew member to traffic injuries.
 - Look for overhead power lines that may hit the truck or equipment. If lines are above the work area, contact Power Company to de-energize or shield the lines. Equipment must be kept at least 10 feet from the overhead lines.
6. **Conduct activities in a safe manner**
 - Check sewer main by removing manhole lids.
 - Lift the manhole cover using the hook. Drag the cover with the hook; avoid bending over and using hands whenever possible.
 - For heavier manholes, use a truck-mounted winch.
 - Follow Confined Space Procedures, if necessary.
 - Follow Personal Protection Equipment (PPE) Program
 - DO NOT place your face near the manhole opening. Let the manhole 'breathe' for 10 minutes before looking in.
 - DO NOT SMOKE near manholes regardless of whether the cover is on or off.
 - DO NOT STAND on the removed manhole cover.
 - USE IMPERVIOUS GLOVES when working with an open manhole.
 - USE DISPOSABLE TYVEK COVERALLS to keep sewage off of your uniform.
5. **Prepare the Vactor for the cleaning operation.**
 - Locate the Vactor where the jet and suction hoses are within reach of the manhole.
 - Insert jet hose through tigertail footing.
8. **Attach extension and proper nozzle to end of jet hose.**
 - Select nozzle based on reported problem, indications of grease or roots in the line, and the diameter pipe to

CONDITION ASSESSMENT AND REHABILITATION PROCEDURES

be cleaned.

9. Insert jetting assembly into manhole.

- Two employees are needed to adjust the jetting assembly.

10. Start the Vactor, cleaning upstream in the sewer with the jetting assembly.

- Reverse the jet assembly to pull the debris back to the downstream manhole.

11. Use the Vactor to pump water and debris from the manhole.

12. Repeat steps 6 and 7 until the line is cleaned.

13. Thoroughly wash manholes — See Manhole Cleaning Procedure 1.4

- Keep hands out of the hose assembly while lowering and raising the hose in and out of the manhole.
- Report any manhole defects noticed during vactoring.
- Cleanup and disinfect work site if necessary.

14. Break down work site and report the work completed.

- Replace manhole cover by dragging it with the hook if possible.
- When manhole cover is in place, remove Tyvek coveralls and place in garbage bag for disposal.
- Remove disposable respirator and place in plastic bag for reuse (refer to PPE Program).
- Record linear feet of sewer main/service lateral cleaned on Work Order Form.
- Complete Service Request, Work Order Form, and log into CMMS
- Decant the holding tank when full.
- Fill the unit with water (as needed) and move to the next site.

15. Empty the holding tank in the Vactor when it is full.

- Transport the removed material to the disposal site.
- Record volume of disposed material.

16. Clean and wash the Vactor at the end of the shift.

CONDITION ASSESSMENT AND REHABILITATION PROCEDURES

MAINTENANCE PROCEDURE 1.2 MECHANICAL RODDING

SCHEDULE

Schedule of work orders established under CMMS.

ACTIVITY DESCRIPTION

Mechanical cleaning of grease, roots, or other blockages in sewers up to 12" in diameter by pushing cleaning tools through blockages to clear the line.

ACTIVITY GOALS

- To remove grease, roots, and/or other blockages from sewer mains and service laterals.
- To maintain sewer capacity and system integrity.
- To ensure sewer is 100% clean prior to rehabilitation.
- To facilitate CCTV inspection of sewer.

LABOR

Code

Classification

Maintenance Crew

MATERIALS

Code

Description

Safety equipment – vest, traffic cones and flags, men-working signs, hardhats, steel toed boots, leather/cloth and impervious gloves, tyvec coveralls, half mask disposable respirators, eye protection, ear plugs, flashlights, life vests, safety harness and ropes.
Disinfectants
Eye Wash
Fire Extinguisher
First aid kit

EQUIPMENT

Code

Description

Rodding Truck
Ladder
Floodlights or other Lighting Aids
Metal Detection Devices

SAFETY ANALYSIS

Safety Check List

- Safety Program
- Protective Clothing and Equipment (Personal Protection Equipment)
- Gases and other Hazardous Atmospheres Analysis (Confined Space Entry)
- Overhead Power Lines (Electrical Safety)
- Underground Services Utilities Locations
- Traffic Safety Requirements (Traffic Safety)

Potential Hazards

- Infectious Diseases
- Slip, Trip, and Fall
- Poisonous Snakes, Pests, Insects
- Confined Spaces (Confined Space Entry)
- Traffic
- Vehicle Operation
- Mechanical Tools
- Electrical Hazards (Electrical Safety)
- Flooding and Inundation (Confined Space Entry)
- Lifting

CONDITION ASSESSMENT AND REHABILITATION PROCEDURES

MAINTENANCE PROCEDURE 1.2 MECHANICAL RODDING

ACTIVITY/SUBTASK

1. Supervisor review work order and visit site with crew

- Follow vehicle operation safety procedures.
- Dispatch maintenance crew to work site.

2. Secure work site by placing traffic control signs and safety devices at the work site.

- Follow Traffic Safety Procedures.
- Don safety vests, hardhats, safety glasses, etc.
- Crew Supervisor acts as a safety supervisor during process.
- Isolate one or more lanes of traffic with flags, cones, traffic control signs, etc. where work in or immediately adjacent to roads exposes a crew member to traffic injuries.

3. Prepare the rodding equipment for the cleaning operation.

- Locate manhole on GIS map and identify GIS location number.
- If manhole access is not visible, use metal detection or other equipment.
- Lift the manhole cover using the hook. Drag the cover with the hook; avoid bending over and using hands whenever possible.
- For heavier manholes, use a truck-mounted winch.
- Follow Confined Space Procedures.
- Follow Personal Protection Equipment (PPE) Program.
- Keep employees away from manhole when opening due to dangerous gases.
- DO NOT place your face near the manhole opening. Let the manhole “breathe” for 10 minutes before looking in.
- DO NOT SMOKE near the manholes regardless of whether the cover is on or off.
- DO NOT STAND on the removed manhole cover.
- USE IMPERVIOUS GLOVES when working with an open manhole.
- USE DISPOSABLE TYVEK COVERALLS to keep sewage off of your uniform.
- Two employees are needed to lower the rodding motor from the truck or trailer.
- Check the rod for signs of cracks/stress/rust.
- Two employees are needed to pull the rodding motor.
- Locate the rodding equipment at manhole/cleanout
- Assemble guide pipe to depth of manhole/cleanout.

CONDITION ASSESSMENT AND REHABILITATION PROCEDURES

MAINTENANCE PROCEDURE 1.2 MECHANICAL RODDING

4. Attach proper cleaning tool to end of rod.

- Handle the cutting/cleaning tool with leather gloves since it is sharp.
- Select cleaning tool based on reported problem and on indications of grease or roots in the line.
- Two employees are need to move and place the Rod Guide.

5. Complete work order and break down work site.

- Complete Service Request, Work Order Form, and enter into CMMS.

CONDITION ASSESSMENT AND REHABILITATION PROCEDURES

MAINTENANCE PROCEDURE 1.3 JET RODDING

SCHEDULE

Schedule of work orders established under CMMS.

ACTIVITY DESCRIPTION

Hydraulic cleaning with a high velocity jet machine to remove grease, roots, or other blockages in sewers up to 18" in diameter. Jetting may also be used to thread the camera pull line for CCTV inspection of sewers and to wash manholes and catch basins.

ACTIVITY GOALS

- To remove grease, roots, and/or other blockages from sewer mains and service laterals.
- To maintain sewer capacity and system integrity.
- To ensure sewer is 100% clean prior to rehabilitation.
- To facilitate CCTV inspection of sewer.

LABOR

Code

Classification

Maintenance Jetting Crew

MATERIALS

Code

Description

Safety equipment — vest, traffic cones and flags, men-working signs, hardhats, steel toed boots, leather /cloth and impervious gloves, tyvec coveralls, half mask disposable respirators, eye protection, ear plugs, flashlights, life vests, safety harness and ropes.
Disinfectants
Eye wash
Fire extinguisher
First aid kit

EQUIPMENT

Code

Description

Jetting Truck
Ladder
Floodlights or Other Lighting Aids

SAFETY ANALYSIS

Safety Check List

- Safety Program
- Protective Clothing and Equipment (Personal Protection Equipment)
- Gases and other Hazardous Atmospheres Analysis (Confined Space Entry)
- Overhead Power Lines (Electrical Safety)
- Underground Services Utilities Locations
- Traffic Safety Requirements (Traffic Safety)

Potential Hazards

- Infectious Diseases
- Slip, Trip, and Fall
- Poisonous Snakes, Pests, Insects
- Confined Spaces (Confined Space Entry)
- Traffic
- Vehicle Operation
- Mechanical Tools
- Electrical Hazards (Electrical Safety)
- Flooding and Inundation (Confined Space Entry)
- Lifting

CONDITION ASSESSMENT AND REHABILITATION PROCEDURES

MAINTENANCE PROCEDURE 1.3 JET RODDING

ACTIVITY/SUBTASK

- 1. Supervisor review work order and visit site with crew (Area Supervisor)**
 - Follow vehicle operation safety procedures.
 - Dispatch maintenance crew to work site.
- 2. Secure work site by placing traffic control signs and safety devices at the work site.**
 - Follow Traffic Safety Procedures.
 - Don safety vests, hardhats, safety glasses, etc.
 - Isolate one or more lanes of traffic with flags, cones, traffic control signs, etc. where work in or immediately adjacent to roads exposes a crew member to traffic injuries.
 - Look for overhead power lines that may hit the truck or equipment. If lines are above the work area, contact Power Company to de-energize or shield the lines. Equipment must be kept at least 10 feet from the overhead lines.
- 3. Prepare for Jet Rodding**
 - Locate manhole on GIS map and identify GIS location number.
 - If manhole is not visible, use metal detection or other equipment to locate it.
 - Lift the manhole cover using the hook. Drag the cover with the hook. Avoid bending over and using hand whenever possible.
 - For heavier manholes. Use a truck-mounted winch.
 - Follow Confined Space Procedures.
 - Follow Personal Protection Equipment (PPE) Program.
 - DO NOT place your face near the manhole opening. Let the manhole "breathe" for 10 minutes before looking in.
 - DO NOT SMOKE near manholes regardless of whether the cover is on or off.
 - DO NOT STAND on the removed manhole cover.
 - USE IMPERVIOUS GLOVES when working with an open manhole.
 - USE DISPOSABLE TYVEK COVERALLS to keep sewage off of your uniform.
- 4. Prepare the jetting equipment for the cleaning operation.**
 - Locate the jetting equipment where jet hose is within reach of the manhole/cleanout.
 - Insert jet hose through tigertail footing.
- 5. Attach extension and proper nozzle to end of jet hose.**
 - Select nozzle based on reported problem, indications of grease or roots in the line, and the diameter pipe to be cleaned.
- 6. Insert jetting assembly into manhole/cleanout.**

CONDITION ASSESSMENT AND REHABILITATION PROCEDURES

MAINTENANCE PROCEDURE 1.3 JET RODDING

- Two employees are needed to adjust jetting assembly.
 - Tie tigertail footing to manhole lid or work truck for safety measure and to assist in retrieval.
- 7. Set the manhole trap into manhole.**
- Use manhole trap to catch debris removed during jetting process
- 8. Operate the jetting equipment, cleaning upstream in the sewer.**
- Keep track of the location of the jetting assembly in the line on the Work Order Form.
- 9. Move the jetting assembly approximately 50 feet upstream in the sewer.**
- 10. Repeat step 7 until the line is cleaned.**
- Reverse jetting assembly to pull debris back to the downstream manhole.
 - Replace manhole cover by dragging it with the hook if possible.
 - When manhole cover is in place, remove Tyvek coveralls and place in garbage bag for disposal.
 - Remove disposable respirator and place in plastic bag for reuse (refer to PPE Program).
 - Record linear feet of sewer main/service lateral cleaned on Work Order Form.
- 11. Thoroughly wash manholes**
- Thoroughly clean area
 - Report any manhole repairs needed.
 - Note evidence of surcharging, broken rims or covers, raised or sunken covers, etc.
- 12. Break down work site and report the work completed.**
- Complete Service Request, Work Order Form, and enter into CMMS.
 - Fill the unit with water from hydrant (as needed) and move to the next site.
- 13. Clean and wash the jetting equipment and the jetting truck at the end of the shift.**

CONDITION ASSESSMENT PROCEDURES

MAINTENANCE PROCEDURE 1.4 MANHOLE CLEANING

SCHEDULE

Schedule of work orders established under CMMS.

ACTIVITY DESCRIPTION

Combination jet and vacuum cleaning for the removal of accumulations of silt, grease, or other debris from manholes.

ACTIVITY GOALS

- To remove debris from manholes to prevent or correct disruption of sewer service.
- To maintain sewer capacity and system integrity.
- To facilitate CCTV inspection of sewer.

LABOR

Code

Classification

Maintenance Crew

MATERIALS

Code

Description

Safety equipment - vest, traffic cones and flags, men-working signs, hardhats, steel toed boots, leather /cloth and impervious gloves, tyvec coveralls, half mask disposable respirators, eye protection, ear plugs, flashlights, life vests, safety harness and ropes.
Disinfectants
Eye wash
Fire extinguisher
First aid kit
HTH (Chlorine) or Activated Lime

EQUIPMENT

Code

Description

Combination (Jet/Vactor)
Truck Ladder
Floodlights or Other Lighting Aids Metal
Detection Devices

SAFETY ANALYSIS

Safety Check List

- Safety Program
- Protective Clothing and Equipment (Personal Protection Equipment)
- Gases and other Hazardous Atmospheres Analysis (Confined Space Entry)
- Overhead Power Lines (Electrical Safety)
- Underground Services Utilities Locations
- Traffic Safety Requirements (Traffic Safety)

Potential Hazards

- Infectious Diseases
- Slip, Trip, and Fall
- Poisonous Snakes, Insects, Pests
- Confined Spaces (Confined Space Entry)
- Traffic
- Vehicle Operation
- Mechanical Tools
- Electrical Hazards (Electrical Safety)
- Flooding and Inundation
- Weather

CONDITION ASSESSMENT PROCEDURES

MAINTENANCE PROCEDURE 1.4 MANHOLE CLEANING

- 1. Supervisor review work order and visit site with crew**
 - Follow vehicle operation safety procedures.
 - Dispatch maintenance crew to work site.
- 2. Secure work site by placing traffic control signs and safety devices at the work site.**
 - Follow Traffic Safety Procedures.
 - Don safety vests, hardhats, safety glasses, etc.
 - Isolate one or more lanes of traffic with flags, cones, traffic control signs, etc. where work in or immediately adjacent to roads exposes a crew member to traffic injuries.
- 3. Determine the location of manhole.**
 - If manhole is not visible, use metal detection or other equipment to locate it.
 - Lift the manhole cover using the hook. Drag the cover with the hook; avoid bending over and using hands whenever possible.
 - For heavier manholes, use a truck-mounted winch.
 - Follow Confined Space Procedures.
 - Follow Personal Protection Equipment (PPE) Program in the Collection and Transmission Systems Safety Program Plan.
 - Keep employees away from manhole when opening due to dangerous gases.
 - DO NOT place your face near the manhole opening. Let the manhole "breathe" for 10 minutes before looking in.
 - DO NOT SMOKE near manholes regardless of whether the cover is on or off.
 - DO NOT STAND on the removed manhole cover.
 - USE IMPERVIOUS GLOVES when working with an open manhole.
 - USE DISPOSABLE TYVEK COVERALLS to keep sewage off of your uniform.
- 4. Break down work site and report the work completed.**
 - Replace manhole cover by dragging it with the hook if possible.
 - When manhole cover is in place. Remove Tyvek coveralls and place in garbage bag for disposal.
 - Remove disposable respirator and place in plastic bag for reuse (refer to PPE Program).
 - Complete clean up of work site.
 - Complete Service Request, Work Order Form, and log into CMMS.

CONDITION ASSESSMENT PROCEDURES

SEWER SYSTEM CONDITION ASSESSMENT CCTV Sewer Inspection

SCHEDULE

Inspection schedule established under CMMS or Condition Assessment Program.

ACTIVITY DESCRIPTION

Televised inspection of sewers to assess the physical condition of sewer lines. CCTV is most appropriate for sewer lines 6 inch to 36 inch in diameter and when the water level in the sewer is 25% of diameter or less. Written logs and videotape reports are made during the operation. This procedure includes the inspection of manholes.

ACTIVITY GOALS

- CCTV inspection is used to assess the physical condition of the sewer system. It is used to find the exact location of cross connections, line defects, and infiltration sources.
- To locate house connections, manholes, buried structures, and taps at sewer mains
- To check or inspect the effectiveness of sewer cleaning.

LABOR

Code

Classification

CCTV Crew

EQUIPMENT

Code

Description

CCTV truck
Video Tapes
Camera
Ladder

MATERIALS

Code

Description

Safety equipment - vest, traffic cones and flags, men-working signs, hardhats, steel toed boots, leather /cloth and impervious gloves, Tyvec coveralls, half mask disposable respirators, eye protection, ear plugs, flashlights, life vests, safety harness and ropes.
Disinfectants
Eye wash
Fire extinguisher
First aid kit

SAFETY ANALYSIS

Safety Check List

- Safety Program
- Protective Clothing and Equipment
- Gases and other Hazardous Atmospheres Analysis (Confined Space Entry)
- Overhead Power Lines (Electrical Safety)
- Underground Services Utilities Locations
- Traffic Safety Requirements

Potential Hazards

- Infectious Diseases
- Slip, Trip, and Fall
- Poisonous Snakes, Pests
- Confined Spaces (Confined Space Entry)
- Traffic
- Vehicle Operation
- Mechanical Tools
- Electrical Hazards (Electrical Safety)
- Flooding and Inundation (Confined Space Entry)
- Lifting

CONDITION ASSESSMENT PROCEDURES

SEWER SYSTEM CONDITION ASSESSMENT CCTV Sewer Inspection

ACTIVITY/SUBTASK

4. Review work order and visit site with crew. (Area Supervisor)

- Follow vehicle operation safety procedures.
- Dispatch maintenance crew to work site.

7. Secure work site by placing traffic control signs and safety devices at the work site. (Maintenance Crew)

- Follow Traffic Safety Procedures
- Don safety vests, hardhats, safety glasses, ear plugs, gloves, boots, Tyvec suit.
- Isolate one or more lanes of traffic with flags, cones, traffic control signs, etc., where work in or immediately adjacent to roads exposes a crew member to traffic injuries.
- Look for overhead power lines that may hit the truck or equipment. If lines are above the work area, contact Power Company to de-energize or shield the lines. Equipment must be kept at least 10 feet from the overhead lines.

8. Determine the location of the manholes on the GIS Map (Maintenance Crew)

- Locate manhole on GIS map and identify GIS location number.
- If manhole access is not visible, use metal detection or other equipment.
- Check sewer main by removing manhole lids.
- Lift the manhole cover using the hook. Drag the cover with the hook, avoid bending over and using hand whenever possible.
- For heavier manholes, use a truck-mounted winch.
- Follow Confined Space Procedures
- Follow Personal Protection Equipment (PPE) Program
- DO NOT place your face near the manhole opening. Let the manhole 'breathe' for 10 minutes before looking in.
- DO NOT SMOKE near manholes regardless of whether the cover is on or off.
- DO NOT STAND on the removed manhole cover.
- USE IMPERVIOUS GLOVES when working with an open manhole.
- USE DISPOSABLE TYVEK COVERALLS to keep sewage off of your uniform.

6. Ensure that the sewer line segment has been cleaned.

- If necessary, clean the line using jet rodding equipment.

17. Prepare CCTV equipment for the internal inspection operation.

- Thread the camera cable through the sewer line segment using the jet rodding equipment or thread the camera cable through the sewer line segment with a stringer method.
- Plug upstream manhole with inflatable plug.
- Set the winch at the downstream manhole and the CCTV truck at the upstream manhole.
- Lower the camera into the manhole and attach to the winch cable.

CONDITION ASSESSMENT PROCEDURES

SEWER SYSTEM CONDITION ASSESSMENT CCTV Sewer Inspection

ACTIVITY/SUBTASK

18. Start the televised inspection

- Move the camera through the line in either direction at a moderate rate.
- Note whether the camera is being pulled upstream or downstream.

19. Observe and record the condition of the sewer line as it is televised.

- Record distance measurements for the purpose of locating defects.
- Record observations of root intrusion, grease and debris accumulation, pipe deterioration, pipe misalignment, pipe breaks, pipe defects, separated joints, I/I, cross connections, storm water connections, and lateral defect according to assessment procedures.

20. Break down work site and report the work completed.

- Replace manhole cover by dragging it with the hook if possible.
- When manhole cover is in place, remove Tyvek coveralls and place in garbage bag for disposal. Wash down and disinfect outside of boots. Remove gloves and ear plugs.
- Remove disposable respirator and place in plastic bag for reuse (refer to PPE Program).
- Complete clean up of work site and any sewage spills or flooding in area. Disinfect and sanitize.
- Clean camera and associated equipment and place in truck.
- Complete /fill out Work Order information. Record linear feet of sewer line inspected and document video log.

CONDITION ASSESSMENT PROCEDURES

SEWER SYSTEM CONDITION ASSESSMENT DYE TESTING

SCHEDULE

Testing schedule established under CMMS or condition Assessment Program.

ACTIVITY DESCRIPTION

Dye testing of sewer mains to isolate and quantify defects within the collection system. Written documentation and photographs of dye testing results are taken as required. Results of dye testing conducted in conjunction with CCTV inspection will be recorded on the CCTV inspection logs. Results of the dye testing conducted for verification of smoke testing should be recorded on smoke testing data forms.

ACTIVITY GOALS

To verify apparent direct inflow sources identified through smoke testing or CCTV inspection. To identify interconnections between sanitary and storm sewer systems. To trace sewer pipeline segments as required to verify and update sewer system GIS layer.

LABOR		MATERIALS	
Code	Classification	Code	Description
	Maintenance Crew		Safety equipment – vest, traffic cones and flags, men-working signs, hardhats, steel toed boots, leather/cloth and impervious gloves, Tyvec coveralls, half mask disposable respirators, eye protection, ear plugs, flashlights, life vests, safety harness and ropes. Disinfectants Eye Wash Fire Extinguisher First aid kit Dye tablets
EQUIPMENT			
Code	Description		
	Work Truck Camera Ladder		

SAFETY ANALYSIS

Safety Check List

- Safety Program
- Protective Clothing and Equipment (Personal Protection Equipment)
- Gases and other Hazardous Atmospheres Analysis (Confined Space Entry)
- Overhead Power Lines (Electrical Safety)
- Underground Services Utilities Locations
- Traffic Safety Requirements (Traffic Safety)

Potential Hazards

- Infectious Diseases
- Slip, Trip, and Fall
- Poisonous Snakes, Pests
- Confined Spaces (Confined Space Entry)
- Traffic
- Vehicle Operation
- Mechanical Tools
- Electrical Hazards (Electrical Safety)
- Flooding and Inundation (Confined Space Entry)
- Lifting

CONDITION ASSESSMENT PROCEDURES

SEWER SYSTEM CONDITION ASSESSMENT DYE TESTING

ACTIVITY/SUBTASK

9. **Notify nearby residents, businesses, and public safety agencies approximately 24 to 48 hours prior to initiation of dye test procedure.**
10. **Review work order and visit site with crew (Area Supervisor)**
 - Ensure all necessary material and equipment have been gathered before leaving the yard.
 - Follow Vehicle Operation Safety Procedures.
11. **Secure work site by placing traffic control signs and safety devices at the work site. (Maintenance Crew)**
 - Follow Traffic Safety Procedures.
 - Don safety vests, hardhats, safety glasses, steel toe boots, etc.
 - Crew Supervisor acts as a safety supervisor during process.
 - Isolate one or more lanes of traffic with flags, cones, traffic control signs, etc. where work in or immediately adjacent to roads exposes a crew member to traffic injuries.
 - Look for overhead power lines that may hit the truck or equipment. If lines are above the work area, contact Power Company to de-energize or shield the lines. Equipment must be kept at least 10 feet from the overhead lines.
12. **Prepare for dye testing.**
 - Locate manhole location on GIS map and identify GIS location number.
13. **Start dye testing.**
 - Determine the location of the manhole. Use metal detection if manhole is not visible.
 - Visit home/business owner to determine if a plumber has been called.
 - Locate spill point or problem area.
 - Check sewer main by removing manhole lids in the vicinity of the home/business until a free flowing manhole is found.
 - Lift the manhole cover using the hook. Drag the cover with the hook, avoid bending over and using hand whenever possible.
 - For heavier manholes, use a truck-mounted winch.
 - Follow Confined Space Procedures.
 - Follow Personal Protection Equipment (PPE) Program.
 - Keep employees away from manhole when opening due to dangerous gases.
 - DO NOT place your face near the manhole opening. Let the manhole "breathe" for 10 minutes before looking in.
 - DO NOT SMOKE near the manholes regardless of whether the cover is on or off.
 - DO NOT STAND on the removed manhole cover.
 - USE IMPERVIOUS GLOVES when working with an open manhole.
 - USE DISPOSABLE TYVEK COVERALLS to keep sewage off of your uniform.
 - Drop dye tablet upstream of the sewer segment to be inspected.

CONDITION ASSESSMENT PROCEDURES

SEWER SYSTEM CONDITION ASSESSMENT DYE TESTING

ACTIVITY/SUBTASK

14. Observe and record evidence of dye in the suspected area.

- Record the presence or absence of dye in adjacent downstream manholes.
- Recommend sewer sections for cleaning and internal inspection if necessary.

15. Break down work site and report the work completed.

- Replace manhole cover by dragging it with the hook if possible.
- When manhole cover is in place, remove Tyvek coveralls and place in garbage bag for disposal. Wash down and disinfect outside of boots. Remove gloves.
- Remove disposable respirator and place in plastic bag for reuse (refer to PPE Program).
- Complete clean up of work site and any sewage spills or flooding in area. Disinfect and sanitize.
- Document testing with written reports and photographs or videos as needed.

16. Complete /fill out Work Order information. Record linear feet of sewer line segment dye tested.

CONDITION ASSESSMENT PROCEDURES

SEWER SYSTEM CONDITION ASSESSMENT SMOKE TESTING

SCHEDULE

Testing schedule established under CMMS or Condition Assessment Program.

ACTIVITY DESCRIPTION

Smoke testing of sewer mains to identify sources of I/I from defects in the sewers, manholes, and cross connections to storm drainage facilities. Smoke testing is most effective in sewers with diameters equal to or less than 18 inches. Smoke testing should be conducted during dry weather, no wind, and low groundwater level conditions. Written documentation and photographs of smoke testing results are taken as required.

ACTIVITY GOALS

To identify direct connections to the sewer collection system, shallow pipe defects, and manhole defects. To locate lost manholes and diversion points.

LABOR

Code

Classification

Smoke Testing Crew

MATERIALS

Code

Description

Safety equipment — vest, traffic cones and flags, men-working signs, hardhats, steel toed boots, leather /cloth and impervious gloves, Tyvec coveralls, half mask disposable respirators, eye protection, ear plugs, flashlights, life vests, safety harness and ropes. Disinfectants
Eye wash
Fire extinguisher
First aid kit

EQUIPMENT

Code

Description

Work Truck
Camera and Smoke Blower camera
Smoke bombs or canisters (non-toxic, odorless, non-staining, 3-5 minute duration)
Sandbags, baffles, or manhole plugs
Floodlights or Other Lighting Aids
Ladder

SAFETY ANALYSIS

Safety Check List

- Safety Program
- Protective Clothing and Equipment (Personal Protection Equipment)
- Gases and other Hazardous Atmospheres Analysis (Confined Space Entry)
- Overhead Power Lines (Electrical Safety)
- Underground Services Utilities Locations
- Traffic Safety Requirements (Traffic Safety)

Potential Hazards

- Infectious Diseases
- Slip, Trip, and Fall
- Poisonous Snakes, Pests
- Confined Spaces (Confined Space Entry)
- Traffic
- Vehicle Operation
- Mechanical Tools
- Electrical Hazards (Electrical Safety)
- Flooding and Inundation (Confined Space Entry)
- Lifting

CONDITION ASSESSMENT PROCEDURES

SEWER SYSTEM CONDITION ASSESSMENT SMOKE TESTING

ACTIVITY/SUBTASK

- 8. Alert neighbors and businesses 24 to 48 hours prior to initiation of smoke testing procedure.**
- 9. Review work order and visit site with crew (Area Supervisor)**
 - Ensure all necessary material and equipment have been gathered before leaving the yard.
 - Follow Vehicle Operation Safety Procedures
- 10. Secure work site by placing traffic control signs and safety devices at the work site.**
 - Follow Traffic Safety Procedures.
 - Don safety vests, hardhats, safety glasses, steel toe boots.
 - Isolate one or more lanes of traffic with flags, cones, traffic control signs, etc. where work in or immediately adjacent to roads exposes a crew member to traffic injuries.
 - Look for overhead power lines that may hit the truck or equipment. If lines are above the work area, contact Power company to de-energize or shield the lines. Equipment must be kept at least 10 feet from the overhead lines.
 - Alert closest Fire Department to stand by for emergencies and inquiries.
- 11. Prepare for Smoke Testing Procedure**
 - Determine the location of the manhole on GIS map. Use metal detection if manhole is not visible.
 - Check sewer main by removing manhole lids in the vicinity of the home/business until a free flowing manhole is found.
 - Lift the manhole cover using the hook. Drag the cover with the hook; avoid bending over and using hand whenever possible.
 - For heavier manholes, use a truck-mounted winch.
 - Follow Confined Space Procedures.
 - Follow Personal Protection Equipment (PPE) Program.
 - DO NOT place your face near the manhole opening. Let the manhole "breathe" for 10 minutes before looking in.
 - DO NOT SMOKE near manholes regardless of whether the cover is on or off.
 - DO NOT STAND on the removed manhole cover.
 - USE IMPERVIOUS GLOVES when working with an open manhole.
 - USE DISPOSABLE TYVEK COVERALLS to keep sewage off of your uniform.
 - Ensure proper operation of blower.
 - Isolate sections if necessary with sandbags, baffles, or other approved method.
 - Set up blower over an open manhole on the sewer segment to be inspected.

CONDITION ASSESSMENT PROCEDURES

SEWER SYSTEM CONDITION ASSESSMENT SMOKE TESTING

ACTIVITY/SUBTASK

12. Start the smoke testing procedure.

- Start the blower and force air into the line at least 5-10 minutes prior to setting off the smoke bombs.
- Stand upwind of the smoke to avoid breathing the smoke.
- Light one or more smoke bombs or canisters and lower into the sewer segment to be inspected.
- Force smoke through the sewer segment with the blower.

13. Observe and record evidence of smoke escaping from the sewer through leaks, breaks, and other I/I sources.

- Walk the surrounding area to visually detect sources of smoke emissions
- Record the smoke testing results and document each defect with photographs labeled with date, time, and location.
- Visually inspect manholes suspected of having direct inflow connections into sanitary sewers.
- Identify direct inflow connections to sewers and interconnections between sanitary and storm sewer systems.

14. Break down work site and report the work completed.

- Replace manhole cover by dragging it with the hook if possible.
- When manhole cover is in place, remove Tyvek coveralls and place in garbage bag for disposal. Wash down and disinfect outside of boots. Remove gloves.
- Complete clean up of work site and any sewage spills or flooding in area. Disinfect and sanitize.
- Clean camera and associated equipment and place in truck.
- Complete /fill out Work Order information. Record linear feet of sewer line inspected and document all photographs and videos.

Section 8

Contingency and Emergency Response Plan

Section 8: Contingency and Emergency Response Plan

8.0 Overview

A SSO Contingency and Emergency Response Plan (CERP) should provide a strategy for a utility to mobilize labor, materials, tools, and equipment to respond to and appropriately remedy any conditions that may cause or contribute to an unpermitted discharge (spill). There are a wide range of potential system failures that could create an SSO to surface waters, land, or buildings that should be considered in developing a plan for response to system failures. A SSO or potential or actual system failure should receive the highest priority response from a utility. A utility should continually update its SSO CERP to maintain its effectiveness.

8.1 Purpose

The purpose of this section is to provide a guideline for the development and implementation of a SSO CERP that will protect public health and safety and the environment.

The goals of the SSO CERP are to:

- Provide a timely and expeditious response to reports of SSOs.
- Prevent the reoccurrence SSOs.
- Protect public health and safety.
- Prevent adverse impacts to the environment.

The objectives of the SSO CERP are to:

- Eliminate preventable SSOs.
- Minimize adverse impacts of SSOs.
- Ensure corrective action is taken in a timely manner.
- Identify and implement measures to prevent the occurrence of preventable and chronic SSOs.
- Ensure compliance with current regulatory requirements and NPDES discharge permit conditions that address procedures for managing sewer overflows.
- Document and define procedures to address SSO prevention and response.
- Minimize risk of enforcement actions.

8.2 Organization

The SSO CERP is organized as follows:

- Introduction
- Notification

- o Internal
- o External
- Spill Response, Containment, and Cleanup
- Stream Monitoring and Reporting
- Investigation, Tracking, Trend Analysis, and Continuous Improvement
- Appendices
 - o Appendix A GAEPD SSO Regulations
 - o Appendix B Notification Contact Lists
 - o Appendix C Spill Evaluation Checklist and Bypass Pumping Procedure
 - o Appendix D GAEPD Spill Report Instructions and Form
 - o Appendix E Spill Volume Calculations
 - o Appendix F Stream Monitoring and Analysis Forms

8.3 Review and Update

Annual reviews of the CERP should be conducted by the utility to confirm that programs are up to date with current practices and activities. This annual review may lead to additional training to reinforce the practices outlined in the CERP with the appropriate utility resources. In addition, the SSO CERP should be reviewed and updated, if necessary, if a NPDES permit is revised.

8.4 Regulatory References

The following regulations, guidance, and references are available to assist in the development of the utility's SSO CERP:

- Clean Water Act (CWA), 33 U.S.C. §1251 et seq. (1972) and subsequent amendments
- Georgia Water Quality Control Act, OCGA 12-5-20
- Georgia Rules and Regulations for Water Quality Control (391-3-6-.05) Emergency Actions.
- Georgia River Basin Management Planning Act, OCGA 12-5-520
- Georgia Erosion and Sedimentation Act [amended 2003], OCGA 12-7-1
- Georgia Erosion and Sedimentation Rules and Regulations (391-3-7)
- U.S. Environmental Protection Agency (USEPA) Guide for Evaluating Capacity, Management, Operations, and Maintenance (CMOM) Programs at Sanitary Sewer Collection Systems, 2005; USEPA Region 4 Guide to Collection and Transmission System Management, Operation, and Maintenance Programs 2003.
- Georgia Association of Water Professionals (GAWP) and Georgia Water Environment Federation (GWEF), Guidance for the Georgia Environmental Protection Division (GAEPD) Zero Tolerance Strategy entitled Capacity, Management, Operations, and Maintenance (CMOM) Consent Agreement Guidance, 2006.

- American Public Works Association (APWA) guidance entitled Preparing Sewer Overflow Response Plans: A Guide for Local Governments
- Georgia 811 (<http://www.georgia811.com/>)
- Local Jurisdiction Rules

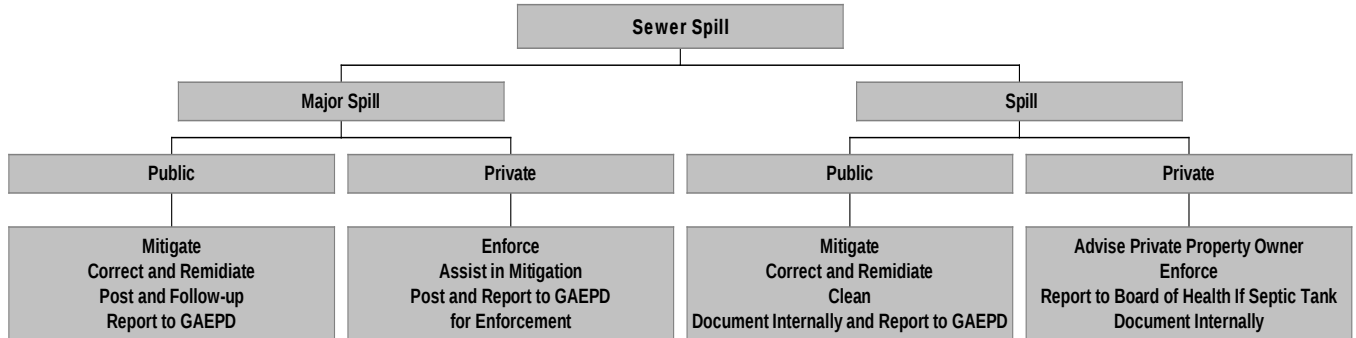
8.5 GAEPD, GAWP, and GWEF CMOM Consent Agreement Guidance

If a utility is negotiating or under a Consent Agreement, the GAWP and Georgia WEF Capacity, Management, Operations, and Maintenance (CMOM) Consent Agreement Guidance, 2006, contains useful information and guidance for the utility.

8.6 Procedures

The SSO CERP should include procedures for SSO notification, response, and tracking and analyses to comply with GAEPD Rules and Regulations for Water Quality Control Chapter 391-3-6-.05 (Appendix A). Figure 8-1 provides a summary flow chart of recommended response actions based on spill type.

FIGURE 8-1
Summary of Spill Actions Based on Spill Type



Spill types include the following:

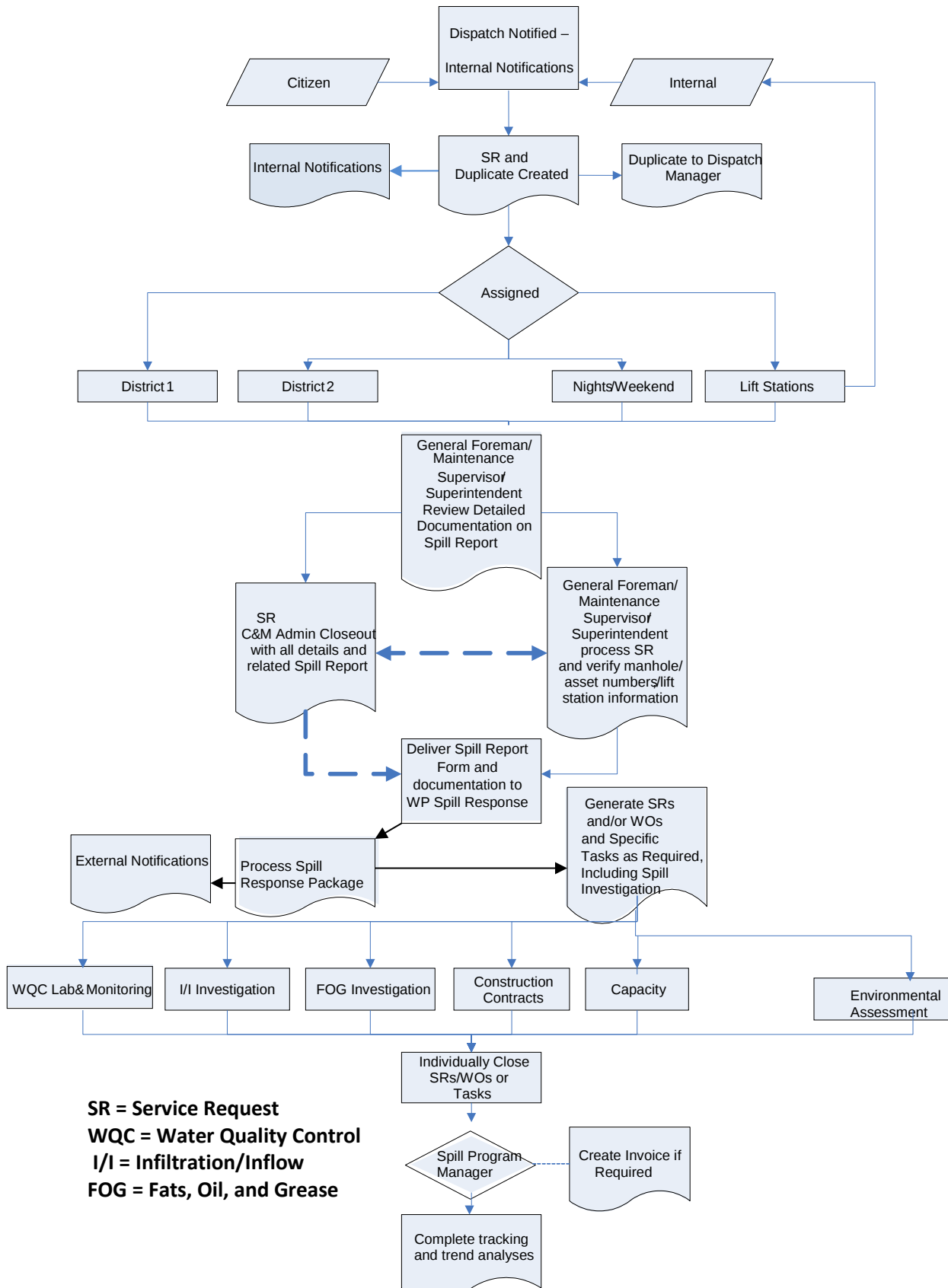
- Public Spill (spills involving utility or municipality owned property and/or assets)
- Private Spills (spills involving privately owned property assets)
- Major spills (spills greater than 10,000 gallons that reach waters of the state and/or result in fish kill or serious environmental impact)
- Spill (spills greater than 10,000 gallons that reach waters of the state)
- Surface Spill (a spill that does not reach the waters of the state)

A flow chart with suggested SSO response and investigation procedures is shown in Figure 8-2.

Utility location requirements and procedures should be met prior to any work commencing with the understanding that employee safety and environmental protection are a priority in accordance with GUPC rules regarding underground utility location.

In addition, during the emergency, the utility should comply with GAEPD *Erosion and Sedimentation Control Regulations* regarding land disturbance activities with the understanding that employee safety and environmental protection are priorities. This applies to utility personnel and contractors employed by the utility.

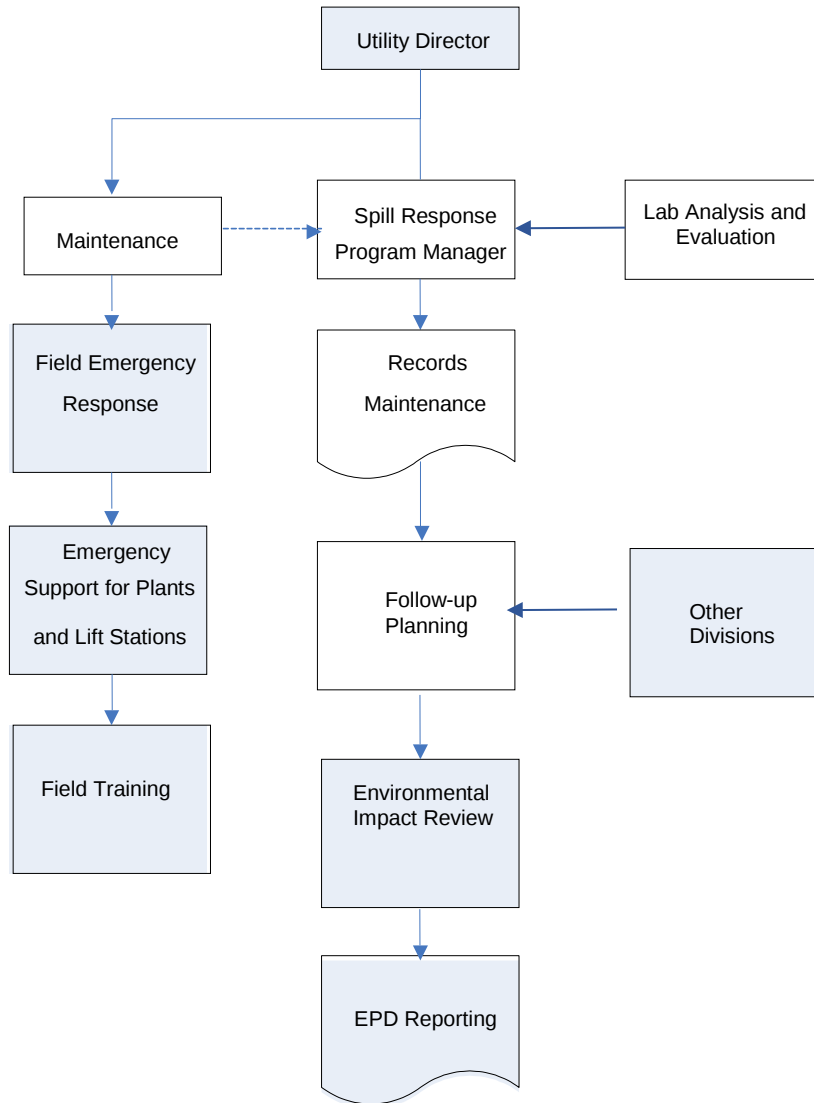
FIGURE 8-2 Response and Investigation Procedures



8.7 Roles and Responsibilities

The utility should develop a tiered structure of organizational roles and responsibilities, which should be included in its SSC CERP. An example flow chart for roles and responsibilities is shown in Figure 8-3.

Figure 8-3



Suggested staffing and equipment resources are shown below.

SSO CERP Staff	Equipment Resources
• Spill response manager • SSO Investigation crews of two persons each • Administrative staff to assist with management of SSO tracking, analysis, and reporting	• Pole cameras • Vehicles • Manhole lid openers • Dye tablets • Hand-held Global Positioning Systems (GPS)

Spill Response Program Manager

The Spill Response Program Manager should be responsible for directing and coordinating follow-up actions after a spill. After receiving the Spill Report Form, the Spill Response Program Manager should review the report and, based on the information contained, initiate the following:

- Generate Service Requests (SRs), Work Orders (WOs), and/or specific tasks as may be required. These tasks may include: monitoring/sampling; I/I investigations; FOG investigations; construction, maintenance, and repair activities; capacity analysis; engineering reviews; education; environmental assessments (fish kill surveys, etc).
- Review the updated status of the SRs/WOs/tasks, and initiate the necessary follow-up actions, until these SRs/WOs/tasks have been satisfactorily closed-out.
- Process Notification Reports.
- Finalize and update the GAEPD five-day letter and follow-up reports.
- Create invoices for services rendered, if required.
- Create monthly summary report.

In addition, the Spill Response Program Manager should analyze variables for spill cause and recommend actions to reduce number and amount of spills. The analysis should consider conditions such as clustered spill events, land use, temperature, rainfall, new development, maintenance activities, age of pipe, slope of pipe, pipe size, condition of pipe and manhole, and utilized capacity of pipe.

The Spill Response Program Manager should schedule and conduct monthly spill response meetings with other utility Division representatives. The spills and spill responses for the month prior and practices that can be improved or added to help reduce and/or prevent future spills should be discussed.

The Spill Response Program Manager should take additional measures to address major spills (those spills greater than 10,000 gallons, perform analysis of cause, check SSO cluster maps, variables listed above, and prepare a letter to GAEPD with proactive measures that will help reduce and/or prevent future spills.

Managers, Supervisors, Crew Leaders

Managers, supervisors, crew leaders and other management and supervisory personnel should be responsible for assuring that employees are trained in and practice the principles of first response to spills, the Spill Response Program, and maintenance of a compliant system. Managers, supervisors, crew leaders and other management and supervisory personnel should also have the responsibility for assuring that employees are active participants in any spill response that requires their assistance and that such assistance is rendered in a timely manner.

Managers, supervisors, crew leaders and other management and supervisory personnel should be active participants in the Spill Response Program and should participate in training, program review and suggestions, administration of proper spill response and reporting work practices, record-keeping, scheduling employees and assuring attendance in training, securing and maintaining adequate spill response equipment, job site inspections, and other duties as required to administer the Spill Response Program.

Employees

Employees should be responsible for:

- Practicing safe and compliant work methods.
- Wearing and maintaining safety equipment, tools, and equipment.
- Attending and learning from training sessions.
- Reporting all spills and incidents immediately, not to exceed 24 hours.
- Quickly responding to and controlling spills to minimize environmental impact and maintain compliance.
- Properly storing, maintaining, and operating spill response-related equipment and vehicles.
- Watching out for and reminding fellow employees of safe and compliant work practices.
- Following all utility safety and regulatory compliance requirements.

8.8 Training and Duties

The following training should be provided on an ongoing basis for all employees involved in SSO CERP activities:

- Regular training of staff, as needed, on the SSO CERP
- Regularly conducted SSO-related preparedness field and tabletop exercises

8.9 Spill Notification and Reporting

8.9.1 Internal Notification

Responsibility for internal notification of spill events (SSOs) should be the responsibility of the utility's Central Dispatch or other designated entity. A summary of this process is provided in Figure 8-4.

8.9.1.1 First Response Calls

- Spills are reported to the Spill Response Manager through the dispatch center or other designated entity.
- Spills should be reported to dispatch or other designated entity through:
 - Public communications
 - Internal communications
 - Regulatory communications

- Dispatch or other designated entity should document the following information in a SR for each spill, as appropriate.
 - o Time and date call was received
 - o Specific location
 - o Description of problem
 - o Time possible overflow was noticed by the caller
 - o Caller's name and phone number
 - o Observations of the caller
 - o Other relevant information that will enable the utility to quickly locate, assess and stop the overflow
- Following spill notification, the dispatch center or other designated entity should generate a SR to be immediately followed up for investigation and remediation by available collection system field crews.
- Internal notification and SR generation should include applicable notification to on-duty staff.
- A duplicate service requisition should be completed and forwarded to the dispatch center or other designated entity.
- Response to lift station spills should be by lift station operations or other designated staff.

8.9.2 External Notification

8.9.2.1 Overview

In cooperation with the dispatch center or other designated entity, employees responding to the spill should provide copies of all spill information and the Spill Response Form to the Spill Response Program Manager within 12 hours of spill notification.

External notification of SSOs is the responsibility of the Spill Response Program Manager. External notification includes regulator, public, and private notification of spills and should be completed upon receipt of the Spill Response Form. If, during the course of review of external notification reporting, any updated or erroneous information is presented, an appropriate corrected report should be sent to the parties that were provided with the initial notification.

8.10 Regulatory Agency Notification

8.10.1 Georgia Environmental Protection Division

Any major spill should be reported to the GAEPD hotline immediately by dispatch or other designated entity.

The Spill Response Program Manager should provide the Spill Report Form for all spills to GAEPD within 24 hours (Appendix B). This includes:

- Email notification (provision of Spill Report Form) for all spills (Appendix B)
- For major spills, GAEPD should also be notified in person or by telephone (Appendix B)

8.10.1.1 Five-Day Report

- The Spill Response Program Manager should email a written report to GAEPD (Appendix B) that includes, but is not limited to, the following information:
 - o Date of the spill
 - o Report address, spill location, and cause of spill
 - o Estimated volume discharged and name of receiving waters
 - o Corrective action taken to mitigate or reduce the adverse effects of the spill

8.10.1.2 Environmental Reports

For major spills, stream monitoring and reporting should be completed over a one-year period by the utility. Refer to Section 5 for specific details regarding water quality and biological monitoring actions and reporting to GAEPD.

- Documentation based on SSO investigations and follow-up actions, such as SRs completed, should be provided to GAEPD as completed over short- and long-term periods (two weeks to one month), as applicable, by the Spill Response Manager. Refer to Section 6 for specific details regarding short- and long-term follow-up reporting to GAEPD.
- GAEPD will make any decisions regarding additional notification of a spill to other local, state, and/or federal agencies/entities.

8.10.2 Board of Health and Downstream Users

- For all spills, a copy of the Spill Report Form should be emailed by the Spill Response Program Manager to the appropriate County Board of Health (Appendix B).
- Board of Health notification should be completed within 24 hours of notification of the spill.
- For major spills, the Spill Response Program Manager should email a written report to the Board of Health (Appendix B) that includes, but is not limited to, the following information:
 - o Date of the spill
 - o Location and cause of spill
 - o Estimated volume discharged and name of receiving waters
 - o Corrective action taken to mitigate or reduce the adverse effects of the spill
- For major spills, notification of downstream users (Water Treatment Plants) should be provided by email and/or telephone (Appendix B) by the Spill Response Program Manager.
- The County Board of Health will make any decisions regarding additional notification requirement of a spill to other entities and/or additional actions such as issuance of a public health alert as a result of a spill.

8.1.1 Public Notification

The purpose of public notification is to provide expedient notice to the public potentially affected by a SSO. The form and manner that is used to notify the public should fit the specific situation and be designed to reach the public reasonably likely to be affected by the SSO. Notification methods include, but are not be limited to, television, radio, newspapers, emails or other electronic communications, and signs posted at conspicuous public places.

8.1.1.1 Email or Facsimile Notification

The Spill Report Form for all reported spills should be provided in an email or facsimile to the public entities (community organizations, radio stations, television stations, and newspapers, in addition to regulatory entities and downstream users discussed in Section 4.2) within 24 hours of receipt of a spill notification by the utility. Email or facsimile information should include the following:

- Entities notified, and contact information.
- For major spills, the following information should be provided through email or facsimile to public entities:
 - o Date of the spill
 - o Location and cause of spill
 - o Estimated volume discharged and name of receiving waters
 - o Corrective action taken to mitigate or reduce the adverse effects of the spill

8.1.1.2 Legal Organ Newspaper Publication

Major spills should be published through advertisement placement in a local legal organ within 7 days of utility spill notification.

The following information, at a minimum, should be provided for publication:

- Date of the spill
- Location and cause of spill
- Estimated volume discharged and name of receiving waters
- Corrective action taken to mitigate or reduce the adverse effects of the spill

8.1.1.3 Sign Posting/Removal for Spills that Reach the Waters of the State

The intent of posting signs by field crews at the site of a spill is to notify citizens, who may come into contact with the affected water that a spill or a major spill has impacted. For spills that reach waters of the state, signs should be posted at the site of the spill and upstream/downstream of the site. If a spill does not reach waters of the state or enter a storm

drain, postings are not required unless there is an immediate threat to human health or the environment.

- To cover the entire spill area, a minimum of four (4) signs should be immediately posted upstream and downstream of a spill.
- Signs should be posted at the site of the spill, the entry point into the waters of the state, and upstream/downstream of the site.
- Additional signs should be posted at regular intervals at portions of the waterway affected by the flow of the contaminant.
- Sign locations should include, but are not limited to, bridge crossings, trails, boat ramps, recreation areas, and other points of public access of the affected area.
- All posting locations should be photo documented, listed on the SR by location, and removed seven (7) days after the spill has ceased.
- Documentation should be included for any missing signs during the required posting time and when they are picked up.
- The posted signs should contain the following information:
 - o Spill date
 - o Spill location
 - o Cause of the spill
 - o Estimated Volume of the spill
 - If not known “to be determined” should be entered on the sign and all signs should be updated when the volume is determined.
 - o Receiving stream
 - o Corrective action taken
 - o Contact phone number for additional information

8.11.4 Private Property Notification

- Post the spill location with appropriate signage (Section 7.12.3).
- Exhibit 8-1 is a sample letter that should be sent to the private property owners when a spill occurs on their property.
- If the spill involves a septic tank, the owner should be advised of the situation and a contact number for the Board of Health for the owner to call should be provided. If a spill involves a septic tank, whether reportable, surface spill, or private, a separate report should be sent by email to the Board of Health, which has regulatory authority over all septic tanks.

EXHIBIT 8-1
Example Private Property Letter
Language for Private Property Letter

PRIVATE PROPERTY NOTIFICATION

The (Name of Utility) has responded to a sewer spill complaint and discovered the spill was not caused by or on (Name of Utility) property. The State of Georgia Environmental Protection Division (GAEPD) has regulations covering spills of sewage or other substances that may impact the environment or which may enter the waters of the State. Immediate action is required on your part to eliminate and clean the area of the spill on your property. The (Name of Utility) is required to report all spills immediately, not to exceed 24 hours, to the GAEPD.

If the spill is entering or likely to enter the waters of the state, the (Name of Utility) will respond to prevent environmental damage and the (Name of Utility) will invoice the costs to the property owner. This response is minimal and is designed only to prevent spillage into the waters of the state. The (Name of Utility) will not undertake repairs on private property because this is the property owner's responsibility.

If the spill is caused by construction activity, the party doing the construction will be held liable for the spill. Enforcement action will be taken under the state "Call Before You Dig" rules, if applicable; county codes and ordinances; and current GAEPD rules, laws, guidelines, or consent orders. All costs associated with the repair and corrective actions will be invoiced to the entity that caused the problem.

If a commercial establishment under the FOG Program causes the spill, the (Name of Utility) FOG Program administrators will take enforcement actions.

If a multi-family establishment is involved, the property managers/owners will be notified of their responsibility to mitigate, remediate, and eliminate current or future spills.

If a septic tank is involved, the state health department will be notified to take enforcement action.

If the problem is a private house line, the homeowner is responsible for corrective action and repairs to prevent future problems. A private house line is defined as that portion of the sewer system from the property line cleanout to the house and any related plumbing in, on, or under the private house. Enforcement action may be taken if the mitigation is not undertaken in a timely manner.

For purposes of backups, the homeowner/property owner is further responsible for their expenses if the blockage occurred from the cleanout to the main as they are the only contributor to this line.

8.11.5 Documentation

All spill notification should be documented and included in a Spill Response Package for utility record-keeping purposes by the Spill Response Program Manager.

8.11.6 Public Access

The geographic extent and duration of a public access limitation due to a spill event should be determined in consultation with GAEPD and/or the County Board of Health, where appropriate.

8.12 Spill Response, Containment, and Cleanup

8.12.1 Overview

This section describes specific actions to be conducted by utility crews during an SSO. Initial SSO response actions, based on issued SR(s), are the responsibility of field crews (collection system) and/or operations (lift station and force mains). A suggested summary of overall response actions is provided in Figure 8-4.

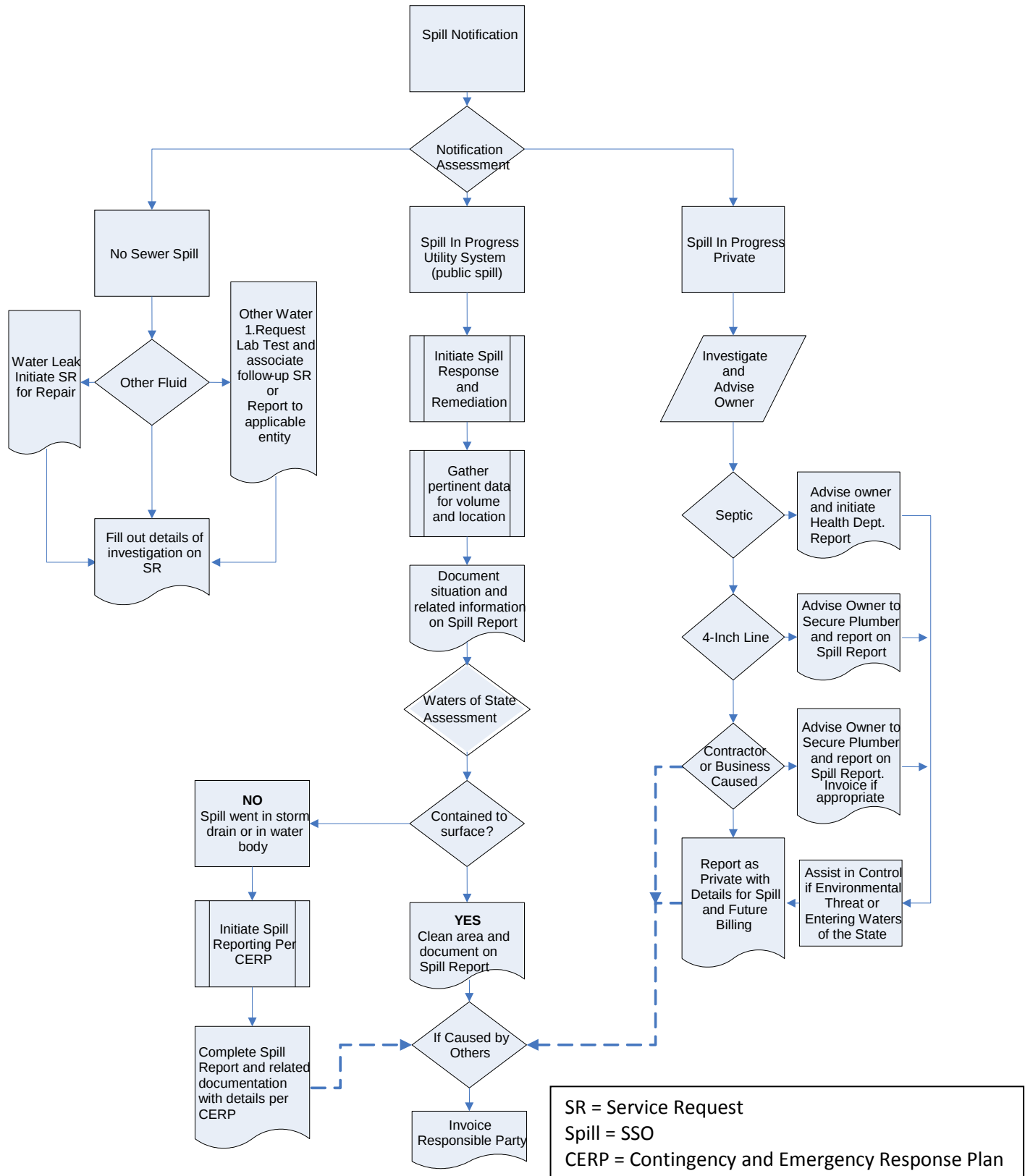
8.12.2 Response, Mitigation, and Clean-Up

It should be the responsibility of the first personnel who arrive at the SSO site to protect the health and safety of the public by mitigating the impact of the spill to the maximum extent possible. This includes initiating measures to contain the spill and recover, where possible, sewage that has already been discharged. In addition, crews should determine the immediate destination of the spill (e.g., storm drain, street curb gutter, body of water, creek bed, etc.) and take immediate action to contain the overflow (e.g., block or bag sewer drains, recover through vacuum truck, divert into downstream manhole, etc.).

Upon arrival at the scene of a spill, 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 responding sewer crew should immediately contact the immediate supervisor for guidance before taking further action.

Should the supervisor determine the need to alert the local hazardous material response team, crew personnel should await the arrival of the response team prior to taking any action. Upon arrival of the hazardous material response team, crew personnel should take direction from the lead authority of the response team. When the hazardous material team determines it is safe and appropriate for the crew to take action spill response and clean-up actions should commence.

FIGURE 8-4
Summary of Spill Response Actions



8.12.3 Collection System Response and Mitigation

The sanitary sewer collection system includes manholes, clean-outs, and gravity lines/mains. The utility Maintenance Division should be responsible for SSO response involving the collection system.

8.12.3.1 First Responders

First responders should include maintenance staff, including supervisors, equipment operators, crew workers, etc., with the capacity to respond to all spills occurring within the utility's system.

Following notification of a spill, first responders should be dispatched to the site and should have the ability to call for additional resources, as needed.

8.12.3.2 Manhole/Cleanout Overflow

When locating a manhole or cleanout overflow, an accurate assessment of the spill condition at the site, including locations of utility and private cleanouts, should be made and documented.

- Crew workers should be dispatched to investigate downstream of the spill site for any impact to water quality or possible fish kill and conduct "posting" activities as described in Section 7.3.4
- If the spill can be contained with minimal resources and support, it should be done immediately. Also, if accessible, arrangements should be made for vector-jet truck(s) to pick up the spill and clean/disinfect the ground surface at the spill site or arrange for manual clean-up of the area.
- Digital pictures of the event should be recorded to assist in follow-up investigations.

If a spill from a manhole or cleanout is continuous:

- Attempts should be made to unblock the line; if the situation warrants, setup a bypass pumping system immediately to divert flow around the blocked area (Appendix C).
- Rodding and pressure washing should be performed, as required, to unclog the existing sanitary sewer main.
- If the situation warrants, delivery of vector-jet truck(s) to support the spill response actions and to clean/disinfect the ground surface at the spill site or arrange for manual clean-up of the area should be scheduled.

8.12.4 Sanitary Sewer Line/Main Break or Lift Station Overflow

If the spill is a result of a sanitary sewer main break or lift station overflow:

- Arrangements should be made to dispatch manpower, repair/replacement parts and equipment, including a backhoe or excavator as required for repair of the break or lift station equipment.
- First responders should be immediately notified to provide support as required.

- o The dispatch center and supervisor should be informed as to the number of pumps required.
- o If the pumps are unavailable in-house, an on-call pump rental company should be called for immediate delivery.
- o Prior to arrival of the excavator(s), a containment system should be established to help supplement the bypass system.
- o If required repair/replacement parts and materials are not available on the maintenance vehicle(s), immediate arrangements for delivery of materials required to restore the sanitary sewer main or lift station should be made.
- o If additional crews are required, the maintenance supervisor should be immediately contacted.
- o Upstream and downstream manholes should be identified as required to conduct bypass pumping.
- Digital pictures of the event should be recorded to assist in follow-up investigations.

8.12.5 Collection System Private Spills

Available maps and site investigation should be used to determine if the spill is occurring on a utility-owned property or privately held property and if it is flowing into the waters of the state. If the spill is a private spill, the following actions should be taken:

- Record digital pictures of the event to assist in follow-up investigations.
- If spill is identified as entering the waters of the state, an assessment should be performed to see if work on the utility-owned property could resolve the spill. This may include inspecting the existing sanitary sewer main in the vicinity of the ongoing spill and arranging for support equipment such as vactor-jet and/or rod trucks, etc. as necessary. If a related cleanout is available, rod the existing service line to the sanitary sewer main as necessary to abate the spill.
 - o If a utility line is blocked or causing the spill, report as a utility (public) spill.
 - o If no blockage or damage is found in utility system, report as Private spill.
- If no property line cleanout is available, new cleanout(s) should be installed as applicable.
- If onsite inspection reveals that a private spill is entering the waters of the state, work should be performed to prevent the spill from entering the waters of the state and the property owner should be immediately notified to secure private resources to remedy the problem.
 - o If owner is resistant to action, a Compliance Inspector should be notified to issue a citation, shut off water to the site at the meter, and follow-up to assure that the problem has been corrected before restoring water service.
 - o If it is not possible to measure the spill volume due to system configuration, an estimated quantity should be placed on the reporting form with an explanation of the circumstances.

- o All times for each action should be noted on the report so that the timeline is complete.
- If a private spill is not immediately impacting waters of the state, a “temporary fix” to contain and prevent the spill from migrating to waters of the State should be performed. If appropriate, notify the property owner of their obligations to rectify the spill immediately.
- If the spill involves a septic tank, advise the owner of the situation and provide a contact number for the Board of Health for them to call.
 - o A follow-up investigation should be made to determine if utility sewer is available and enforcement action should be taken through the appropriate regulatory agency to require the owner to connect to the utility’s sewer system.
- The spill location should be posted with appropriate signage.

8.12.6 Spill Clean-up

The Clean-up of spill sites should be thorough with no readily identifiable residue (e.g., sewage solids, papers, rags, plastics, rubber products) remaining. Whenever possible, digital photos should be taken of the area before and after clean-up activities.

8.12.6.1 Utility System (Public) Spills

If the spill is the responsibility of the utility, the following procedure should be used for clean-up activities:

- All visible debris should be removed (solids and debris are to be flushed, swept, raked, picked-up, and transported for proper disposal).
- Sewage or solids should be manually removed and/or pumped back to the collection system or vacuumed and disposed of at an approved receiving station.
- Site should be deodorized and disinfected as soon as possible through use of absorbent material; excavation and disposal of affected soil; flushing with potable water, application, containment, and recovery of any chlorinated wash-down water and return of wash-down water to the sewer.
 - o If soil conditions do not allow immediate clean-up after the area is deodorized/disinfected, then a covering of straw is to be placed over the area and clean-up to follow as soon as soil conditions allow.
 - o Sewage discharge into a body of water that may contain fish or other aquatic life must not be disinfected through application of chlorinated products or water. The utility should coordinate with GAEPD and/or the County Board of Health regarding clean-up of sewage in bodies of water.
- Areas below the spill, including areas of any creek banks impacted by the spill, are to be cleaned. Deodorant and disinfection is used as needed.
- Documentation of clean-up and any follow-up SRs issued and completed.

8.12.6.2 Private or Contractor System Spills

The responsible Entity should be advised that clean-up is its responsibility and they must follow the guidelines listed in 8.12.

- Inspection should be made by utility inspectors to assure compliance.
- Expenses incurred by the utility in responding to a private spill may be recoverable from the property owner or entity that damaged the utility system.
 - If the spill becomes reportable under the utility responsibility and a fine is levied against the utility, such fine should be invoiced to the responsible party.

8.13 Response Documentation and Volume Calculations

8.13.1 Response Documentation

8.13.1.1 Response Service Request/Work Order Close-Out

- Proper closeout of all service and work requests within the CMMS is essential for proper historical records. Adequate detail from the field notes should be included along with employee time, supplies, and proper closeout codes.
- If spill address is different than the original problem address, an associated SR should be created for any different address and details as to how it is related to the spill incident.
- Each request related to a spill response should include information as to whether a spill actually occurred, along with details about location, if the spill reached the waters of the state, and/or if it was private in nature.
- Each request should have two codes entered on it. The first repair code is the dispatched repair code describing the problem as entered by the dispatcher. The second code is the resolution or repair code, which describes what actions the service crew completed. Typically, these repair codes are not the same.
- Examples of Repair Codes include:
 - Major Spill Codes
 - M90 General Spill
 - M91 Manhole Overflow/Spill
 - M92 Cleanout Overflow/Spill
 - M93 Creek Crossing Spill
 - M94 Sewer Main Leak/Spill
 - M95 Lift Station Spill
 - M96 Force Main Spill
 - Grease Trap Overflow/Spill
 - Minor Spill Code
 - Code M98 Surface Spill Only

- Overflow/Spill was contained to an area and did not enter state waters or storm drain
- Septic Tank Issues
 - Code M99 Septic Tank issues
 - If entered state waters or storm drain report as spill
 - If contained to surface only do not report as spill, record only
 - Report both (1) and (2) above to County Board of Health (Appendix B)

8.13.1.2 Field Notes

All field notes should be detailed to describe actions taken, methods used to calculate volumes, manpower involved, any contact information, and any other detail relative to the response.

Notes should include:

- Notification time
- Dispatch time
- Detailed narrative of work performed
- Additional support called
- Spill stopped time
- Site work completed time
- Spill cause
- Infrastructure damage, if present
- Work performed to mitigate the issue
- Work performed during clean-up
- Actual spill address, updated if different than initial call address and directions to get to site of spill
- Photographic history of the site and mitigation efforts, initial response, and post clean up
- Posting information
- Final job completion time
- Associated work required

Upstream and downstream manhole numbers and main IDs should be included as soon as they are determined.

A Spill Evaluation Checklist (Appendix C) should be completed as part of the field notes.

Field notes and the Spill Evaluation Checklist should be provided to the Spill Response Program Manager for inclusion in the Spill Response Package. The Spill Response Package should be retained for internal utility record-keeping purposes.

8.13.1.3 Spill Report Form

- For each spill, a Spill Report Form (Appendix D) should be completed based on field operational knowledge and actions.
- Copies of the Spill Report Form (Appendix D) should be delivered to the Spill Response Program Manager or designee within 12 hours to satisfy GAEPD 24-hour reporting requirements and for timely implementation of follow-up actions (external notification, investigation, and tracking).
- If there is an indication that a fish kill may have occurred, the first responders should note this situation on the Spill Report Form. A stream analysis should be requested immediately (Section 8.15).
- A copy of the spill reporting documentation should also be provided to the utility's Customer Service Manager, within 5 working days from the date of the reported spill.
 - The Customer Service Manager should be responsible for contacting the citizen that initially reported the spill to the dispatch center and to follow up to determine if the response from the utility was satisfactory. Documentation of the contact should be included in the reporting documentation.
- The Spill Report Form should also be provided to the Spill Response Program Manager for inclusion in the Spill Response Package.

8.13.2 Volume Calculations

All calculations and assumptions should be documented in the field notes.

Spill rates may vary based on line conditions and the field staff should use best judgment in determining what the “average conditions” are during the spill event so that calculations will not be based on either the minimum or maximum rate.

8.13.2.1 Manhole Overflow Line Calculation Method

- Locate spill site, and go to the downstream manhole.
- Use a Sludge Judge® or tape measure to measure the level of flow at that manhole
 - If there is no flow or minimal flow, the depth measurement should be recorded as zero value.
- Record the downstream level and the pipe size.
- Record the time the blockage is removed and/or normal flow is restored.
- Measure the level at the spill manhole.
 - Use a Sludge Judge® or tape measure to measure the level of flow.
- Record the level at the spill manhole and the pipe size when the flow returns to a normal rate.
- Using the chart in Appendix E, find the pipe size and go down its column to the depth of flow at the spill manhole
 - The number that is in the column and row intersection is the flow.

- Repeat step 7 above for the measurements at the downstream manhole.
 - The number that is in the column and row intersection is the flow.
- After the two flow rates have been determined, the downstream number should be subtracted from the upstream number and recorded.
 - If this number is negative or zero, investigate further for additional flow sources or conditions.
- A field note entry of how the flow rate was determined should be made if system configuration does not allow use of this method
- Determine the number of minutes from the time the call came into dispatch until the time the spill was stopped.
- Multiply the minutes from step 10 above by the flow rate number from step 7 above.
- Record this number as the spill volume.

8.13.2.2 Manhole Overflow Visual Calculation

- Refer to Appendix E for a visual guide for solid top manholes under normal conditions.
 - If manhole is at the bottom of a slope, use another calculation method, as appropriate.
 - If manhole is perforated, refer to Appendix E for the calculation method or use another method as appropriate.
 - If manhole has no top, refer to Appendix E for method or use another method, as appropriate.

8.13.2.3 Line Break Calculations

- Observe the flow at an upstream and downstream manhole and use the calculation sheet to determine volume and note any assumptions.
- If line is in a creek, determine and note if flow is going out of pipe or into pipe using visual means or dye test and include determinations in field notes.
- If flow is minor in nature, use a bucket and watch to calculate the volume.

8.13.2.4 Lift Station and Force Mains Calculations

- Volume should be calculated by utilizing the appropriate pump run times, meters, flow differences, etc. based on the circumstances of the overflow.
 - All calculations and assumptions should be documented and forwarded along with the Spill Report Form to the Spill Response Program Manager.

8.13.2.5 Cleanout Calculations

- The formula provided in this section should be used to calculate the volume from a standard 6-inch and 4-inch open cleanout.
 - Use the number (in ft/sec) from the Velocity Plume Guide in Appendix E

- 6-inch cleanout
 - o $\pi((0.5)^2/4)(\# \text{ from Chart ft/sec})(\text{minutes})$
 - o $\pi((0.5)^2/4) = 0.195$
 - o $(0.195)(\# \text{ ft/sec})(\text{minutes})=\text{Gallons}$
- 4-inch cleanout
 - o $\pi((0.33)^2/4)(\# \text{ from Chart ft/sec})(\text{minutes})$
 - o $\pi((0.33)^2/4) = 0.085$
 - o $(0.085)(\# \text{ ft/sec})(\text{minutes})=\text{Gallons}$

8.14 Stream Monitoring and Reporting

8.14.1 Overview

Stream monitoring and reporting should be conducted for major spills, such as spills that reach waters of the U.S., spills with a volume greater than 10,000 gallons, and/or when there is an indication that a fish kill has occurred. Stream monitoring includes water quality monitoring, biological monitoring, and monitoring reports.

Current GAEPD sampling and reporting requirements are provided in Appendix A. Appendix F also provides procedures and forms for Stream Water Quality and Biological Monitoring.

8.15 Water Quality Monitoring and Reporting

8.15.1 Water Quality Monitoring

- A water quality monitoring team (two-person crew equipped with a sampling unit and sample collection containers) should be sent to the spill site for sampling and analysis within 24 hours of the spill event.
 - o The monitoring team should establish upstream and downstream sampling sites, as appropriate, based on site conditions (location of safe site access).
 - The following physical stream analyses should be completed for each sample site:
 - pH
 - Dissolved Oxygen (DO)
 - temperature
 - conductivity
 - Results should be recorded in a field notebook.
 - One grab sample should be collected from each site for laboratory analysis of Fecal Coliform bacteria.
- Samples should be assigned chain of custody cards that are completed throughout the sampling, analysis, and reporting process.

- Samples and physical analysis results should be transported to the utility laboratory or an independent laboratory for analysis.
 - Results of physical monitoring analyses should be logged into the utility's laboratory information management system with the appropriate location code for the sampling sites has been established.
 - Fecal Coliform bacteria sample analysis results should be provided within 24 hours.
- Additional sampling of the sites should be completed, as described above, based on the following frequencies.
 - Each day following the spill for one week (total of seven days, including the first sampling event within 24 hours of the spill event).
 - A geometric mean of these samples should be calculated and used for data reporting purposes.
 - One time a week for three weeks total.
 - A geometric mean of these samples is calculated and used for data reporting purposes.
 - Within 3 months, sampling is conducted each week for a total of 4 weeks.
 - A geometric mean of these samples is calculated and used for data reporting purposes.
 - Within one year, sampling should be conducted each week for a total of 4 weeks.
 - A geometric mean of these samples should be calculated and used for data reporting purposes.

8.15.2 Water Quality Monitoring Report

For a major spill, the first week of daily water quality monitoring results should be reported to GAEPD within 5 days of completion of these samples.

A monthly Water Quality Report should be completed each month as follows:

- Data from the spreadsheet should be transcribed to a Stream Monitoring Program Report Form for a Major Spill Form for each spill event/site (Appendix F).
- These forms should be submitted to GAEPD by the 15th day of each month.
 - Spill event/site forms should be submitted for each spill event on a monthly basis for a one-year period with updated data following the last monthly report.
 - An 8-inch x 11-inch copy of a map indicating the upstream and downstream sampling locations, and location of where the major spill occurred, should be included in the monthly Water Quality Report for each major spill.
- For all applicable spills, water quality monitoring forms and reports should be retained for utility records as part of the Spill Response Package.

8.16 Biological Monitoring and Reporting

8.16.1 Biological Monitoring

Biological monitoring of spill sites should be completed as a best management practice (BMP) to facilitate an increased positive response to SSOs. This process is completed after response, clean-up, repair, or other actions that have been completed to resolve the SSO incident.

- For major spills and for spills that occur during environmental stress conditions, a Spill Report Package should be forwarded to the Spill Response Manager for an Environmental Assessment and Biological Monitoring.
- Review of Spill Report Package (Environmental Assessment of impact mitigation and actions).
 - Locate spill site.
 - Review causes and impacts of SSO.
 - Review and evaluate spill response actions taken to date.
- Environmental Assessment/Biological Monitoring
 - Coordinate biological monitoring with a seven-day water quality sampling event.
 - Complete biological evaluation within seven days of spill incident.
 - Visual assessment of detrimental impacts such as fish kill, odor, and presence of visual spill material.
 - Follow procedures provided in the Fish Kill Response – Standard Operating Procedure (SOP) (Appendix F).
 - Complete Fish Kill Investigation Report Form (Appendix F).
 - Complete Environmental Assessment documentation, including Biological Monitoring Forms (Appendix F).
 - Provide Environmental Assessment documentation to the Spill Response Program Manager.

8.16.2 Biological Monitoring Report

Biological Forms and Water Quality Report should be provided to the Spill Response Program Manager.

- For major spills, this information should be included in the monthly Water Quality Report submitted to GAEPD (Appendix B).
- For all applicable spills, Biological Monitoring forms and reports should be retained for utility records as part of the Spill Response Package.

8.17 Investigation, Tracking, Trend Analysis, and Continuous Improvement

8.17.1 Overview

SSO investigation, tracking, and trend analysis should be the responsibility of the Spill Response Program Manager. This process is depicted in Figure 8-3.

8.18 Investigation

SSO Investigations should be completed by SSO Investigators, based on the cause of the spill event.

8.18.1 Investigation of Spill Cause

- The Spill Response Program Manager should assign appropriate personnel to investigate of all SSOs.
- SSO Investigations should be completed based on spill cause including:
 - o I/I
 - o FOG
 - o Third-party contractors
 - o Inadequate capacity
 - o Roots
 - o Debris
 - o Vandalism
 - o System failures
- Investigation results should be documented on SSO investigation forms and should follow a Spill Report Checklist.
- Educational materials should be distributed or presented in person, as appropriate, based on the spill event cause.
- A summary of SSO Investigations with short- and long-term recommendations should be provided.

8.18.1.1 Service Requests/Work Orders

An investigation should be conducted to identify the root cause of the blockage in the collection system in coordination with Maintenance and other utility resources, as required. Based on the investigation, a SR/WO may be generated to perform the following work activities:

- Point repair/line replacement
- Relining
- Pipe bursting

- Closed Circuit Television (CCTV) inspection
- Manhole/cleanout repair
- Replace or seal perforated manhole lids
- Regularly scheduled root cutting or rodding/jet cleaning
- New line installation
- Enforcement action for FOG
- Capacity review
- Legal and code enforcement

Close-out of SR/WO related to a spill event should include addition of the actions completed to the Spill Report Form.

8.18.1.2 Short- and Long-Term SSO Investigation Reporting

Documentation based on SSO Investigations and SRs should be provided to GAEPD as completed.

- Additional actions completed should be recorded.
- Results of SSO Investigations (Forms and Reports), including short- and long-term recommendations for follow-up actions, should be recorded.

All documentation related to SSO Investigation, SRs, and reporting to GAEPD should be provided to the Spill Response Manager for inclusion in the appropriate Spill Response Package for utility record-keeping purposes.

8.19 Tracking

All spills should be tracked by the Spill Response Manager a period of one year.

Information recorded for each spill should be based on the completed Spill Report Forms and should include:

- Number (based on date of occurrence)
- Date reported
- Time reported
- Time cause corrected
- Fish kill
- Type of spill
- Private (denoted as P)
- Quantity (gallons)
- Address
- Manhole # or Structure #

- Pipe size, material of construction
- Repeat (R); within six months (RR)
- Cause
- Waterway/nearest named stream (HUC-12)
- Tributary to Creek (Y, N)
- Associated wastewater treatment facility
- Sewershed (sub-basin)
- Date and corrective action
- FOG education
- WO #
- SR #
- District
- Landlot
- Clean-out
- Five-day letter mailed
- Additional letter mailed
- Long-term preventive measures

8.20 SSO Trend Analysis, Reduction, and Elimination

Spill (SSO) data analysis should be completed to review the location, cause, frequency, potential corrective actions, and effect of the various spills that may occur in the utility's system. The trend analysis of SSOs should be completed on a monthly, quarterly, and annual basis. An internal report should be completed for review by utility management.

The results of these analyses, coordination, and meetings should be used to determine potential repair, rehabilitation locations, new line installations, septic tank elimination/connection to sewer system, and/or maintenance frequencies to utilize in directing utility spill reduction efforts. The types of SSO data/trend analyses that are recommended are summarized below.

8.20.1 Data and Trend Analysis

- Data from SSO tracking and flood events should be used to complete data analysis.
- SSO data graphs and charts should be compiled to produce a Spill Assessment Summary. Summary elements should be compared based on changes from past months and current month.
- Trends such as seasonal, wet weather, temperature, causes, pipe sizes, sewersheds and sub-basins, etc. should be evaluated. Geographical analysis of parameters should also be used to evaluate trends.
- GIS maps using different layers of data should be developed to assist in data analysis.

- The Spill Response Manager should conduct monthly spill response meetings with other utility representatives to discuss spills and spill responses for the month prior as well as practices that can be improved or added to help reduce and/or prevent future spills.
- Analyses of data and maps should be completed by the Spill Response Manager.
 - The Spill Response Manager should perform analysis of variables for spill cause and recommend actions to reduce number and amount of spills. The analysis should consider conditions such as clustered spill events, land use, temperature, rainfall, new development, maintenance activities, age of pipe, slope of pipe, pipe size, condition of pipe and manhole, and utilized capacity of pipe.
- The Spill Response Program Manager should take additional measures to address each major spill as follows:
 - Trend Analyses by total causes and sub-basin cluster maps to be compared to preventive maintenance activities, repairs, and rehabilitation activities.
 - Consideration should also be given to other efforts such as grease producer education and regulatory compliance.
 - This information should be reviewed during the monthly trend analysis meetings to determine effectiveness of efforts over time.

8.21 SSO CERP Performance Measures

Performance measures are important management tools that allow for continuous measurement and evaluation of SSO CERP activities. Performance measures are designed to collect information that enable the utility to determine if established goals and level of service are being met and if not, what activities need to be adjusted to meet SSO CERP goals.

The following Key Performance Indicators (KPIs) are recommended.

KPI	Formula	Definition	Desired Result	Data Interval	Utility Group
System SSO per mile per year	# spills X 100 / # miles of sewer system	Annual number of SSO per mile per year.	None	Annual with 3-year history	
System Blockages resulting in spill	# Blockages with spill / # blockages	Annual number of blockages that result in a spill.	None	Annual with 3-year history	
System Blockages	# Blockages / (# Total miles / 100)	Annual number of blockages (Mains and Laterals) per 100 miles of pipe.	Less than 10 per 100 miles	Annual with 3-year history	

KPI	Formula	Definition	Desired Result	Data Interval	Utility Group
Update and review of SSO CERP	Value	Compliance with annual review and update of SSO CERP	Once per year	Annual	
% SSO CERP Training	$(100) \times (\text{Number of employees provided training (including refresher)}/\text{Total number of employees with SSO CERP responsibilities})$	Percent appropriate personnel receiving SSO CERP training	100	Annual	
SSO CERP Exercises/Drills	Value	Compliance with annual SSO CERP spill exercise/drill	Once per year	Annual	
%Regulatory agency notification and reporting compliance	$(100) \times (\text{Number of spill notifications and reports in compliance with regulatory requirements}/\text{Total number of spill notifications and reports})$	Compliance with all spill notification and reporting regulatory requirements	100	Annual	
Trend Analysis Meetings	Value	Compliance with monthly, quarterly, and annual trend analysis meetings	12 monthly 3 quarterly 1 Annually	Annual	

Section 8 Appendices

Appendix A	GAEPD SSO Regulations
Appendix B	Notification Contact Lists
Appendix C	Spill Evaluation Checklist
Appendix D	GAEPD Spill Report Instructions and Form
Appendix E	Spill Volume Calculations
Appendix F	Stream Monitoring and Analysis Forms

Appendix A

GAEPD SSO Regulations

The following GAEPD SSO Regulations are provided in Appendix A:

- 391-3-6-.05 Rules and Regulations for Water Quality Control, Emergency Actions
- GAEPD Rules 391-3-06 (Applicable Sections)
- GAEPD sampling and reporting requirements

391-3-6-.05 Rules and Regulations for Water Quality Control, Emergency Actions.

- (1) **Purpose.** The purpose of Paragraph 391-3-6-.05 is to provide procedures to handle any emergency which endangers the waters of the State.
- (2) **Definitions.** All terms used in this Paragraph shall be interpreted in accordance with the definitions as set forth in the Act unless otherwise defined in this Paragraph or in any other Paragraph of these Rules.

(a) "Spill means any discharge of raw sewage by a Publicly Owned Treatment Works (POTW) to the waters of the State.

(b) "**Major Spill**" means:

1. The discharge of pollutants into the waters of the State by a POTW that exceeds the weekly average permitted effluent limit for biochemical oxygen demand (5-day) or total suspended solids by 50 percent or greater for any one day.
2. Any discharge of raw sewage that (1) is in excess of 10,000 gallons or (2) results in water quality violations in the waters of the State.

(c) "Consistently exceeding an effluent limitation" means a POTW exceeding the 30 day average limit for biochemical oxygen demand or total suspended solids for at least five days out of each seven day period during a total period of 180 consecutive days.

(3) **Notice Concerning Endangering Waters of the State.**

Whenever, because of an accident or otherwise, any toxic or taste-and color producing substance, or any other substance which would endanger downstream users of the waters of the State or would damage property, is discharged into such waters, or is so placed that it might flow, be washed, or fall into them, it shall be the duty of the person in charge of such substances at the time to forthwith notify the Division in person or by telephone of the location and nature of the danger, and it shall be such person's further duty to immediately take all reasonable and necessary steps to prevent injury to property and downstream users of said water. The following specific requirements shall apply to POTWs:

- (a) The owner of a POTW shall immediately notify the Division, in person or by telephone, when a spill or a major spill occurs in the system. Within five (5) days of the incident, the owner of the POTW shall submit a written report to the Division which includes, at a minimum, the information required in (3) (e) below.

(b) The owner of a POTW responsible for a major spill shall publish a notice of the major spill in the legal organ of the County where the incident occurred. The notice shall be published within seven days after the date of the major spill. The notice as a minimum shall include the following:

1. Date of the major spill
2. Location and cause of major spill
3. Estimated volume discharged and name of receiving waters
4. Corrective action taken to mitigate or reduce the adverse effects of the major spill.

(c) The owner of a POTW shall immediately establish a monitoring program of the waters affected by a major spill or by consistently exceeding an effluent limit, with such monitoring being at the expense of the POTW for at least one year. The monitoring program shall include an upstream sampling point as well as sufficient downstream locations to accurately characterize the impact of the major spill or the consistent exceedence of effluent limitations as described in (2)(c) above. As a minimum the following parameters shall be monitored in the receiving stream:

1. Dissolved Oxygen
2. Fecal Coliform Bacteria
3. pH
4. Temperature

The monitoring and reporting frequency as well as the need to monitor additional parameters will be determined by the Division. The results of the monitoring will be provided by the POTW owner to the Division and all downstream public agencies using the affected waters as a source of a public water supply.

(d) The Division and the owner of a POTW will provide notice of a major spill within 24-hours of becoming aware of the major spill to every county, municipality or other public agency whose public water supply is within a distance of 20 miles downstream and to any others which could potentially be affected by the major spill.

(e) The owner of a POTW responsible for a spill or a major spill shall report the incident to the local media (television, radio and print media) within 24 hours of becoming aware of the incident. The report shall include at a minimum the following:

1. Date of the spill or major spill
2. Location and cause of spill or major spill

3. Estimated volume discharged and name of receiving waters
4. Corrective action taken to mitigate or reduce the adverse effects of the spill or major spill.

(f) The owner of a POTW responsible for a spill or a major spill shall immediately report the incident to the local health department(s) for the area affected by the incident. The report shall include at a minimum the same information required in (3) (e) above.

(g) The owner of a POTW responsible for a spill or a major spill shall immediately post a notice as close as possible to where the spill or major spill occurred and where the spill or major spill entered State waters. The notice shall include at a minimum the same information required in (3) (e) above. The intent of this requirement is for the POTW to notify citizens, who may come into contact with the affected water that the spill or the major spill has occurred. The owner shall also post additional notices of the spill or major spill along the portions of the waterway affected by the incident (i.e. at bridge crossings, trails, boat ramps, recreational areas, and other points of public access to the affected waterway). These notices shall remain in place for a minimum of seven days after the spill or major spill has ceased.

(4) Noncompliance Notification. If, for any reason, the permittee does not comply with, or will be unable to comply with any effluent limitations specified in the permittee's NPDES permit, the permittee shall provide the Division with an oral report within 24 hours from the time the permittee becomes aware of the circumstances followed by a written report within five (5) days of becoming aware of such condition. The written submission shall contain the following information:

(a) A description of the noncompliance and its cause; and

(b) The period of noncompliance, including exact dates and times; or, if not corrected, the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the noncomplying discharge.

(5) Emergency Orders. The Director shall have the authority to issue an emergency order pursuant to Section 20 of the Act, and Section 17(a) of the Executive Reorganization Act of 1972, as amended.

(6) Effective Date. This Rule shall become effective twenty days after filing with the Secretary of State's Office.

GAEPD Rules 391-3-06 (Applicable Sections)

391-3-6-.03 Water Use Classifications and Water Quality Standards.* Amended.

(1) Purpose. The establishment of water quality standards.

(2) Water Quality Enhancement.

(a) The purposes and intent of the State in establishing Water Quality Standards are to provide enhancement of water quality and prevention of pollution; to protect the public health or welfare in accordance with the public interest for drinking water supplies, conservation of fish, wildlife and other beneficial aquatic life, and agricultural, industrial, recreational, and other reasonable and necessary uses and to maintain and improve the biological integrity of the waters of the State.

(b)(i) Existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.

(ii) Where the quality of the waters exceed levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water, that quality shall be maintained and protected unless the division finds, after full satisfaction of the intergovernmental coordination and public participation provisions of the division's continuing planning process, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located. In allowing such degradation or lower water quality, the division shall assure water quality adequate to protect existing uses fully. Further, the division shall assure that there shall be achieved the highest statutory and regulatory requirements for all new and existing point sources and all cost-effective and reasonable best management practices for nonpoint source control.

(c) Outstanding National Resource Waters (ONRW). This designation will be considered for an outstanding national resource waters, such as waters of national or State parks and wildlife refuges and waters of exceptional recreational or ecological significance. For waters designated ONRW, existing water quality shall be maintained and protected.

(i) No new point source discharges or increases in the discharge of pollutants above permitted level from existing point source discharges to ONRW shall be allowed.

(ii) Existing point source discharges to ONRW shall be allowed provided they are treated or controlled in accordance with applicable laws and regulations.

(iii) New point source discharges or expansions of existing point source discharges to waters upstream of, or tributary to, ONRW shall be regulated in accordance with applicable laws and regulations, including compliance with water quality criteria for the use classification applicable to the particular water. However, no new point source discharge or expansion of an existing point source discharge to waters upstream of, or tributary to, ONRW shall be allowed if such discharge would not maintain and protect water quality within the ONRW.

(d) In applying these policies and requirements, the division will recognize and protect

the interest of the Federal Government in interstate and intrastate (including coastal and estuarine) waters. Toward this end, the division will consult and cooperate with the Environmental Protection Agency on all matters affecting the Federal interest.

(e) In those cases where potential water quality impairment associated with a thermal discharge is involved, the division's actions shall be consistent with Section 316 of the Federal Clean Water Act.

(3) **Definitions.** All terms used in this paragraph shall be interpreted in accordance with definitions as set forth in the Act and as otherwise herein defined:

(a) "Acute criteria" corresponds to EPA's definition for Criteria Maximum Concentration which is defined in 40 CFR 131.36 as the highest concentration of a pollutant to which aquatic life can be exposed for a short period of time (1-hour average) without deleterious effects.

(b) "Biological integrity" is functionally defined as the condition of the aquatic community inhabiting least impaired waterbodies of a specified habitat measured by community structure and function.

(c) "Chronic criteria" corresponds to EPA's definition for Criteria Continuous Concentration which is defined in 40 CFR 131.36 as the highest concentration of a pollutant to which aquatic life can be exposed for an extended period of time (4 days) without deleterious effects.

(d) "Coastal waters" are those littoral recreational waters on the ocean side of the Georgia coast.

(e) "Existing instream water uses" include water uses actually attained in the waterbody on or after November 28, 1975.

(f) "Intake temperature" is the natural or background temperature of a particular waterbody unaffected by any man-made discharge or thermal input.

(g) "Critical conditions" are the collection of conditions for a particular waterbody used to develop Total Maximum Daily Loads (TMDLs), determine NPDES permit limits, or assess the protection of water quality standards. The Division considers appropriate critical conditions to represent the event that would occur once in ten years on the average or less often, unless otherwise stated.

(h) "Natural conditions" are the collection of conditions for a particular waterbody used to develop numeric criteria for water quality standards which are based on natural conditions. This is commonly the case for temperature and natural dissolved oxygen standards. For this purpose the Division defines "natural conditions" as those that would remain after removal of all point sources and water intakes, would remain after removal of manmade or induced nonpoint sources of pollution, but may include irretrievable effects of man's activities, unless otherwise stated. Natural conditions shall be developed by an examination of historic data, comparisons to reference watersheds, application of mathematical models, or any other procedure deemed appropriate by the

Director.

(i) "Reasonable and necessary uses" means drinking water supplies, conservation, protection, and propagation of fish, shellfish, wildlife and other beneficial aquatic life, agricultural, industrial, recreational, and other legitimate uses.

(j) "Secondary contact recreation" is incidental contact with the water, wading, and occasional swimming.

(k) "Shellfish" refers to clams, oysters, scallops, mussels, and other bivalve mollusks.

(l) "Water" or "waters of the State" means any and all rivers, streams, creeks, branches, lakes, reservoirs, ponds, drainage systems, springs, wells, wetlands, and all other bodies of surface or subsurface water, natural or artificial, lying within or forming a part of the boundaries of the State which are not entirely confined and retained completely upon the property of a single individual, partnership, or corporation.

(m) "Areas where salt, fresh and brackish waters mix" are those areas on the coast of Georgia having a salinity of 0.5 parts per thousand and greater. This includes all of the creeks, rivers, and sounds of the coastal areas of Georgia and portions of the Savannah, Ogeechee, Altamaha, Satilla and St. Mary's Rivers where those rivers flow into coastal sounds. Mixing areas are generally maintained by seawater transported through the sounds by tide and wind which is mixed with fresh water supplied by land runoff, subsurface water and river flow. Mixing areas have moving boundaries based upon but not limited to river stage, rainfall, moon phase and water use. (For the purposes of this rule salinity shall be analyzed by in situ measurement using a properly calibrated multi-parametric probe connected by hard line to a deck display or by measuring electrical conductivity according to one of the methods specified in *Title 40, Code of Federal Regulations, Part 136* and applying the guidance for conversion to salinity in the same volume. Collection of salinity samples must consider riverflow, precipitation, tidal influences and other variables of the estuarine environment and must conform to the *National Coastal Assessment-Quality Assurance Project Plan 2001-2004* (EPA/620/R-01/002). Measurements at each sampling location must be made in a distribution in the water column according to the *Quality Assurance Project Plan*, with the minimum observations at each station including surface, mid-depth, and nearbottom readings. In situ salinity analysis must comply with the *Quality Assurance Project Plan* and the manufacturer's guidance for the specific instrument used.)

(4) Water Use Classifications. Water use classifications for which the criteria of this Paragraph are applicable are as follows:

- (a) Drinking Water Supplies;
- (b) Recreation;
- (c) Fishing, Propagation of Fish, Shellfish, Game and Other Aquatic Life;
- (d) Wild River;
- (e) Scenic River;
- (f) Coastal Fishing.

(5) General Criteria for All Waters. The following criteria are deemed to be necessary and applicable to all waters of the State:

(a) All waters shall be free from materials associated with municipal or domestic sewage, industrial waste or any other waste which will settle to form sludge deposits that become putrescent, unsightly or otherwise objectionable.

(b) All waters shall be free from oil, scum and floating debris associated with municipal or domestic sewage, industrial waste or other discharges in amounts sufficient to be unsightly or to interfere with legitimate water uses.

(c) All waters shall be free from material related to municipal, industrial or other discharges which produce turbidity, color, odor or other objectionable conditions which interfere with legitimate water uses.

(d) Turbidity. The following standard is in addition to the narrative turbidity standard in Paragraph 391-3-6-.03(5)(c) above: All waters shall be free from turbidity which results in a substantial visual contrast in a water body due to a man-made activity. The upstream appearance of a body of water shall be as observed at a point immediately upstream of a turbidity-causing man-made activity. That upstream appearance shall be compared to a point which is located sufficiently downstream from the activity so as to provide an appropriate mixing zone. For land disturbing activities, proper design, installation, and maintenance of best management practices and compliance with issued permits shall constitute compliance with Paragraph 391-3-6-.03(5)(d).

(e) All waters shall be free from toxic, corrosive, acidic and caustic substances discharged from municipalities, industries or other sources, such as nonpoint sources, in amounts, concentrations or combinations which are harmful to humans, animals or aquatic life.

GAEPD Sampling and Reporting Requirements

Georgia Department of Natural Resources

GEORGIA ENVIRONMENTAL PROTECTION DIVISION

Permitting, Compliance and Enforcement Program

4220 International Parkway, Suite 101

Atlanta, Georgia 30354

404/362-2680

FAX 404/362-2691

December 28, 1999

RE: Reporting Major Spills

Dear Mayor Penson:

The Environmental Protection Division (EPD) is revising the sampling and reporting requirements when you have a major spill. Primarily, the modification involves changing the months that the monitoring will be conducted. Also, the municipality must continue to meet the other publishing and reporting requirements related to major spills.

In the past, EPD has required municipalities to submit data every month for a twelve-month period. This is being changed to require data during the first month, third month, and twelfth month only. Similar to the previous reporting requirements, sampling for the first month will include daily samples for the first week and weekly samples for the next 3 weeks. Month 3 and month 12 will consist of samples collected once per week for the month. The monitoring will apply to dissolved oxygen, temperature, pH and fecal coliform bacteria. The geometric mean for the fecal coliform bacteria samples will be calculated for week one, month one, month three, and month twelve. The first week's daily samples are to be reported to EPD within 5 days after completion of these samples. The remainder of the reports are to be submitted to EPD by the 15th day of the month following the sampling period.

Enclosed with this letter is a copy of the stream monitoring report form. If you choose to create your own form, please ensure that, at a minimum, the information on EPD's report form is included. The stream monitoring report form should be filled out and updated each time sampling results are being submitted to EPD. In addition to submitting the report form, please submit an 8 x 11 (approximate size) copy of a county map indicating the upstream and downstream sampling locations as well as the location of where the major spill occurred.

If you have any questions regarding this correspondence, please contact Joe Fievet at (404) 362-2680.

Sincerely,

A handwritten signature in black ink, appearing to read "Jeffrey H. Larson". The signature is written in a cursive, flowing style.

Jeffrey H. Larson, Manager
Permitting, Compliance and Enforcement Program

JHL/III

Attachment

Appendix B

Notification Contact Lists

The following notification contact lists are provided in Appendix B:

- Spill Notification Directory
- Vendor Contact List

(ADD AS APPROPRIATE FOR SPECIFIC UTILITY)

VENDOR CONTACT LIST

Pump Rentals

(Add as appropriate for specific utility)

Appendix C

Spill Evaluation Checklist and Bypass Pumping Procedure

Spill Evaluation Checklist

Spill Address _____ District _____ Section _____

Spill Date _____ Final Spill Volume _____

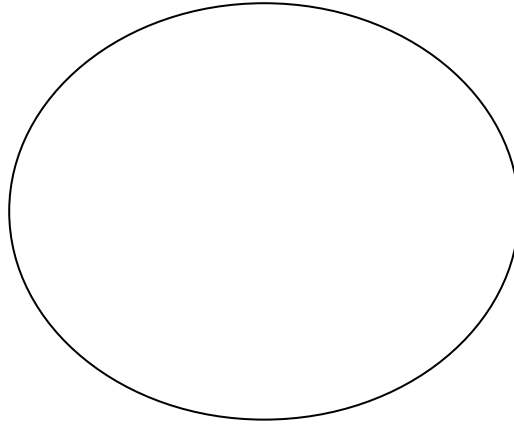
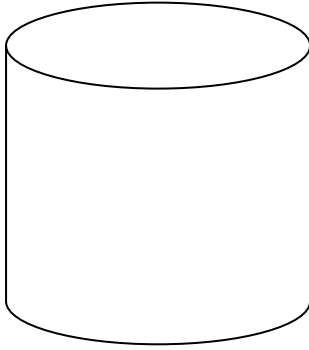
Weather _____ Rainfall _____ Temperature _____

On site Superintendent _____ Superintendent Follow-up _____

Site Inspection

Line Conditions			
		Initials	Service Request #
Size			
Material of Construction			
Slope	Flat ☐ Normal ☐ Steep ☐		
Age			
Upstream Manhole #			
Downstream Manhole #			
Collapsed			
Cracked			
Offset Joint			
Corrosion			
FOG Amount in pipe	< ¼ ¼ ½ ¾ Full		
FOG Source			
Roots	Removal: Mechanical ☐ Chemical ☐		
Debris	Source:		
Debris Removed			
Other Blockage Source			
Visual Pipe Capacity	< ¼ ¼ ½ ¾ Full		
Manhole Conditions			
		Initials	Service Request #
Manhole Number			
Interior Shaft Size			
Material of Construction			
Age			
Depth			
Invert Condition			
Wall Condition, Interior			
Wall Condition, Exterior			
Ring Condition			
Covers	Perforated ☐ Solid ☐ Seal Insert ☐ Bolted ☐ Replace ☐		
FOG Amount in MH	< ¼ ¼ ½ ¾ Full		
FOG Source			
Roots	Removed: Mechanical ☐ Chemical ☐		
Debris	Source:		
Other Blockage Source			
Rehabilitation SR			

Diagram of Invert and Connections



Site Conditions			
		Initials	Service Request #
Partial clean-up			
Clean-up Completed			
Disinfectant/Deodorant			
Trash Removed			
Straw Spread			
New top soil			
Signs Posted (Date and Number)			
Signs Removed (Date and Number)			
ROW/Easements	Clear ☐ Needs Clearing ☐ Needs Access ☐		
Area Map Accurate			
GIS Coordinates	X Y		
Grease Map			
Spill Cluster Map Update			
Photos			
Waterway Conditions			
		Initials	Service Request #
Receiving Stream Name			
Banks Clean			
Water Clean			
Downstream Clean			
Water Color			
Any Sewer Odor Noticed			
Erosion Inspection			
Bank Rebuild/Stabilization			
Super Phosphate Spread			
Storm Drain Flushed			
Street Drainage Working			
Creek Crossing Inspected			
Debris Removal			

Follow-up Requests				
			Initials	Service Request #
CCTV Line, Large	___ Upstream Segments	___ Downstream Segments		
CCTV Lateral				
Capacity Evaluation				
Education				
Enforcement	FOG ☐ Building ☐ Private ☐ IPT ☐ Board of Health ☐ Environmental ☐ Stormwater ☐			
Smoke Test				
Dye Test				
Infiltration				
Industrial Pretreatment				
Septic Tank				
Private Lift Station				
Private System				
Final 5 Day Letter Sent				

Bypass Pumping Procedure

- i) Secure work site by placing traffic control signs and safety devices at the work site.
 - (1) Follow Traffic Safety Procedures.
 - (2) Don safety vests, hardhats, safety glasses, etc.
 - (3) Isolate one or more lanes of traffic with flags, cones, traffic control signs, etc. where work in or immediately adjacent to roads exposes a crew member to traffic injuries.
 - (4) Look for overhead power lines that may hit the truck or equipment. If lines are above the work area, contact Georgia Power at (888) 850-4551 to de-energize or shield the lines. Equipment must be kept at least 10 feet from the overhead lines.
- ii) Determine the location of manhole
 - (1) Locate manhole location on city map and identify GIS location number.
 - (2) If manhole is not visible, use metal detection or other equipment to locate it.
 - (3) Check sewer main by removing manhole lids in vicinity of home/business until a free flowing manhole is found.
 - (4) Lift the manhole cover using the hook. Drag the cover with the hook, avoid bending over and using hand whenever possible.
 - (5) For heavier manholes, use a truck-mounted winch.
 - (6) Follow Confined Space Procedures.
 - (7) Follow Personal Protection Equipment (PPE) Program.
 - (8) DO NOT place your face near the manhole opening. Let the manhole "breathe" for 10 minutes before looking in.
 - (9) DO NOT SMOKE near manholes regardless of whether the cover is on or off.
 - (10) DO NOT STAND on the removed manhole cover.
 - (11) USE IMPERVIOUS GLOVES when working with an open manhole.
 - (12) USE DISPOSABLE TYVEK COVERALLS to keep sewage off of your uniform.
- iii) Prepare the pumping equipment for the bypass operation.
 - (1) Locate the pumping equipment where the hoses are within reach of the manhole upstream of the stoppage and capable of pumping to the next free-flowing point in the gravity line.
- iv) Attach suction hose and discharge hose to pumping equipment.
 - (1) Two employees are needed to position hoses.
 - (2) Determine length of suction hose needed by measuring depth from pump suction inlet to bottom of manhole.
 - (3) Determine length of discharge pipe needed by measuring distance from upstream manhole to downstream manhole.
- v) Insert free end of hoses into appropriate manholes.
 - (1) Insert suction hose into manhole upstream of stoppage.

- (2) Insert discharge hose into manhole downstream of stoppage where free-flow of sanitary sewer is restored.
 - (3) Depending on the nature of the stoppage and repairs needed, a plug may be required to completely isolate the blocked area so that appropriate remedial action can occur.
- vi) Check location of hoses in between manholes.
- (1) If hoses need to be below street/ground level, trenches may be made using a jackhammer or cement saw. Take the following precautions:
 - (a) Check underground utilities prior to starting work.
 - (b) Ensure that hose fittings are not in-line with driveways.
 - (c) If necessary, protect hoses by building protective covers over hoses or saw cutting ditches in the street in which to put hoses.
- vii) Start the pumping equipment.
- (1) Routinely monitor pumping equipment during entire bypass pumping process.
 - (2) Continue bypass pumping process until necessary repairs are made to the sewer line.
- viii) Break down work site and report the work completed.
- (1) Replace manhole cover by dragging it with the hook if possible.
 - (2) When manhole cover is in place, remove Tyvek coveralls and place in garbage bag for disposal.
 - (3) Remove disposable respirator and place in plastic bag for reuse (refer to PPE Program).
 - (4) Clean up work site, disinfect, sanitize.

Appendix D

GAEPD Spill Report Instructions and Form

Insert Name of Utility
Dispatch phone #: (Insert Number) fax#: (Insert Number)

E.P.D. SEWER SPILL REPORT INSTRUCTIONS

REPORTING PROCESS: SPILLS THAT ENTER STATE WATERS - REPORT IMMEDIATELY

****DURING NORMAL WORK WEEK****

Deliver information to (Add name).

****WEEKENDS: (Friday 4:00pm - Monday 8:00am) and Holidays****

Deliver information to (Add Name(s)).

NOTIFICATION LIST

All Spills:

FAX single sheet Spill Report Form to:

GAEPD, Board of Health AND email Initial Spill Report Form

GAEPD - phone 404-362-2680; fax 404-362-2691

Fax confirmation attached Yes ☐ No ☐

Board of Health – (Insert Number) (fax) SSO

Fax confirmation attached Yes ☐ No ☐

Initial Spill Notification List *

Email confirmation attached Yes ☐ No ☐

If Plant/Lift Station Involved Notify that list

Email confirmation attached Yes ☐ No ☐

Major Spills Additional Procedures:

GAEPD MAJOR SPILL: (Over 10,000 Gallons and/or fish kill and/or water quality impact)

CALL GAEPD at 1-800-241-4113

GAEPD Report No.: _____ GAEPD Contact Person: _____

Comments from GAEPD:

Water Suppliers Notification List

Email confirmation attached Yes ☐ No ☐

External Major Spills Notification List

Email confirmation attached Yes ☐ No ☐

Call C&M

Confirmation Time _____

Call Watershed Protection Assistant Director

Confirmation Time _____

Who sent faxes? _____

*Initial notification list includes Internal Staff, media, and other utility Staff

(Add name of Utility)
GAEPD SEWER SPILL REPORT FORM

Today's Date: _____

Initial ☐ Updated ☐

Weather conditions: _____

Who reported spill: _____

Address of Caller Reporting Spill: _____ City: _____

Date & time spill reported to us: _____ Private Spill? : Yes ☐ No ☐

Address of Spill: _____ City: _____

Date and time spill was stopped: _____ Estimated spill amount, gallons: _____

Reporting Foreman & # _____

Service Request # _____

Did Spill Enter Waterway ☐ or Storm Drain ☐

Name of waterway/tributary that spill entered: _____

Were signs posted at site, upstream and entry to State waters, and along/at bridge crossings, trails, boat ramps, recreation areas and other points of public access? Yes ☐ No ☐

How many signs were posted? _____ (Minimum of 4)

Lift Station Spill: _____

Yes ☐ No ☐

If yes, List Station Name: _____

Cause of Spill

Grease ☐ Root ☐ Debris ☐ Broken Main ☐ Storm Even ☐ Manhole Damage ☐

Roots & Debris ☐ Grease & Debris ☐ Grease & Roots ☐ Grease, Roots & Debris ☐

Unknown ☐ Vandalism ☐ Outside Contractor ☐ Other ☐

Explanation: _____

Action taken to correct problem: _____

Date & time Infrastructure Defect was repaired: _____

Manhole #'s _____ and _____

Highlighted map attached? _____

Yes ☐ No ☐

INITIATE MAJOR SPILL REPORTING IF

Fish Kill ☐ or Water Quality Impact ☐ Observed? _____

Yes ☐ No ☐

Volume Greater than 10,000 Gallons _____

Yes ☐ No ☐

Appendix E

Spill Volume Calculations

The following Spill Volume Calculation Information is provided in Appendix E:

- Sanitary Sewer Flow Rates
- Manhole Visual Volume Estimation
- Wet Weather Overflow Calculation

Depth of Flow (in)	Pipe Size (in)				
	36	42	48	54	60
1	40	60	55	65	55
2	135	140	150	160	195
3	260	265	275	305	330
4	380	415	460	485	485
5	540	585	460	635	720
6	685	735	815	855	915
7	870	930	1010	1090	1125
8	1035	1140	1215	1280	1420
9	1240	1365	1435	1540	1660
10	1420	1595	1720	1815	1900
11	1640	1785	1960	2105	2244
12	1865	2030	2205	2330	2510
13	2055	2280	2455	2635	2780
14	2290	2535	2715	2950	3155
15	2490	2745	2980	3190	3445
16	2730	3010	3315	3520	3740
17	2930	3280	3585	3855	4140
18	3170	3550	3865	4195	4445
19	3375	3770	4145	4455	4760
20	3615	4045	4425	4800	5180
21	3855	4315	4710	5155	5495
22	4055	4590	5065	5420	5820
23	4290	4810	5350	5780	6255
24	4480	5085	5640	6140	6585
25	4705	5355	5925	6500	6915
26	4890	5625	6215	6775	7355
27	5105	5835	6500	7135	7690
28	5275	6100	6855	7500	8025
29	5475	6355	7135	7775	8475
30	5660	6605	7415	8135	8810

Depth of Flow (in)	Pipe Size (in)				
	36	42	48	54	60
31	5805	6850	7690	8495	9150
32	5965	7040	7965	8765	9595
33	6085	7270	8235	9120	9930
34	6205	7495	8565	9475	10265
35	6290	7705	8820	9820	10710
36	6345	7860	9075	10080	11040
37		8050	9320	10420	11370
38		8220	9555	10755	11805
39		8370	9785	11005	12125
40		8475	10060	11325	12445
41		8575	10270	11640	12865
42		8635	10465	11870	13175
43			10650	12170	13485
44			10815	12460	13885
45			10965	12735	14175
46			11100	12930	14465
47			11225	13185	14840
48			11280	13420	15115
49				13585	15380
50				13790	15720
51				13965	15965
52				14115	16200
53				14205	16495
54				14275	16705
55					16900
56					17135
57					17295
58					17430
59					17565
60					17625

D.2.3 WET WEATHER OVERFLOW CALCULATION:

The following can be used to help in estimating the rate of loss of flow out of manholes. As this is an estimate, judgment by the observing person and/or estimator must always be used.

All calculations are based on an estimate of the size of the opening involved, the velocity of flow through the opening, and the duration of time the overflow occurred. In most all occurrences, the opening size and velocity will change over an event from low to high back to low. Judgment on an average condition must thus be attempted to reach a realistic rate of loss.

D.2.3.A Loss through vent holes

1. Size of opening:

Assume holes at 1- inch diameter

$$\text{Area} = (\text{number of holes}) (\pi) (D^2/4) (1\text{ft}^2/144)$$

$$\text{Area} = (\text{number of holes}) (3.14) (1/4) (1/144)$$

$$\text{Area} = (\text{number of holes}) (0.0055\text{ft}^2/\text{hole})$$

2. Velocity Plume Guide

Velocity through holes, based on Velocity Head = $(\text{Velocity}^2/2g)$

<u>Plume height</u>	<u>Velocity</u>
1-inch	2.0 ft/sec
2-inch	3.3 ft/sec
3-inch	4.0 ft/sec
4-inch	4.6 ft/sec
5-inch	5.2 ft/sec
6-inch	5.7 ft/sec

3. Time = convert to minutes

$$\text{Volume (Gal.)} = (\text{Area}) (\text{Velocity}) (\text{Time}) (448 \text{ gpm/cfs})$$

Example: Top with six hole, flow through holes makes a one-inch high plume, last for 4 hours, 15 minutes

$$\begin{aligned}\text{Volume} &= (6 \text{ holes} \times 0.0055 \text{ ft}^3/\text{hole}) (2\text{ft}/\text{sec}) (255 \text{ min}) (448 \text{ gpm}/\text{cfs}) \\ \text{Volume} &= (0.033) (2) (255) (448) = 7540 \text{ gallons}\end{aligned}$$

D.2.3.B. Loss around edge of non-vented cover

1. Size of opening:

As the weight of manhole lid will generally hold it in place until internal pressures exceed 0.4 pounds/sq. in., loss occurs through imperfections, grit, etc. between the lid and manhole frame. Observations are generally a vertical ring of water from side gap between the lid and frame of approximately 1/4 inch width.

$$\begin{aligned}\text{Area} &= (\pi) (D) (1/4 \text{ inch}) (1/12 \text{ in}/\text{ft}) \\ &= (3.14) (2\text{ft}) (1/4) (1/12)\end{aligned}$$

$$\text{Area} = 0.131 \text{ ft}^2$$

2. Velocity through gap
(see vertical plume guide above, D.3.A.2.)

3. Time – convert to minutes

Example: Manhole with 4-inch plume around edge for 2 hours, 15 minutes

$$\begin{aligned}\text{Volume (Gal.)} &= (\text{Area}) (\text{Velocity}) (\text{Time}) (448 \text{ gpm}/\text{cfs}) \\ &= (0.131 \text{ ft}^2) (4.6 \text{ ft}/\text{sec}) (135) (448) \\ &= 36,445 \text{ gallons}\end{aligned}$$

D.2.3.C. Loss from tilted cover

1. Size of opening:

Some estimate has to be made in the field concerning how much gap exists in order to do this calculation. For the following amounts of lift of one side, the areas are as follows:

$$\begin{aligned}A &= (\pi) (D) (\text{in. of lift}) (1/12 \text{ ft}/\text{in}) (1/2) \\ A &= (3.14) (2\text{ft}) (\text{in. of lift}) (1/12) (1/2) \\ A &= 0.262 (\text{in. of lift})\end{aligned}$$

Lift (inches)	Area (ft ²)
1	0.262
2	0.524
3	0.786
4	1.048

2. Velocity through opening

This must be estimated from visual observation. A low rate would be 2 ft/sec, moderate rate at 4 to 5 ft/sec, high rates up to 7 ft/sec. Over 7 ft/sec, the lid will

probably blow off the manhole. The gap (lift) will generally increase with higher velocity as well.

3. Time - convert to minutes

$$\text{Volume (Gal.)} = (\text{Area}) (\text{Velocity}) (\text{Time}) (448 \text{ gpm/cfs})$$

Example: Field observation of 2-inch gap and velocity of 4 ft/sec for a period of 3 hours, 30 minutes.

$$\begin{aligned} \text{Volume (Gal.)} &= (0.524 \text{ ft}^2) (4 \text{ ft/sec}) (210 \text{ min}) (448) \\ &= 197,192 \text{ gallons} \end{aligned}$$

D.2.3.D. Loss from Manhole without a lid in place

If no cover exists, an estimate of the average height the water column (plume) extends above the top of the manhole frame must be made. Use the height to velocity estimate from (A) above to estimate the velocity. Be sure to adjust the height estimate downward for the affects of debris around the edge of the rim which will cause the height to be incorrectly high.

$$\text{Area} = (\pi) (D^2/4) = (3.14) (2^2/4) = 3.14 \text{ ft}^2$$

Velocity - from field observation of water column height

Time - convert to minutes

$$\text{Volume (Gal.)} = (\text{Area}) (\text{Velocity}) (\text{Time}) (448 \text{ gpm/cfs})$$

Example: A manhole without a lid was observed to have an overflow with a 3 - inch high column of water for a period of 6 hours, 10 minutes

$$\begin{aligned} \text{Volume (Gal.)} &= (3.14) (4.0 \text{ ft/sec}) (370) (448) \\ \text{Volume} &= 2,081,946 \text{ gallons} \end{aligned}$$

D.2.3.E. Other

1. Generally approach of estimating a cross sectional area where the flow is leaving and a velocity of flow can be used to determine a rate. This can be applied to any situation.
2. Several observations over an event to estimate the area and velocity are better than a single observation. The overflow examples above assume a constant rate over the period which will estimate volumes too high. As an example, if an hour at the beginning and end of each event is assumed for the flow to build up from zero to maximum and back to zero, a calculation could be done as follows:

probably blow off the manhole. The gap (lift) will generally increase with higher velocity as well.

3. Time – convert to minutes

$$\text{Volume (Gal.)} = (\text{Area}) (\text{Velocity}) (\text{Time}) (448 \text{ gpm/cfs})$$

Example: Field observation of 2-inch gap and velocity of 4 ft/sec for a period of 3 hours, 30 minutes.

$$\begin{aligned} \text{Volume (Gal.)} &= (0.524 \text{ ft}^2) (4 \text{ ft/sec}) (210 \text{ min}) (448) \\ &= 197,192 \text{ gallons} \end{aligned}$$

D.2.3.D. Loss from Manhole without a lid in place

If no cover exists, an estimate of the average height the water column (plume) extends above the top of the manhole frame must be made. Use the height to velocity estimate from (A) above to estimate the velocity. Be sure to adjust the height estimate downward for the affects of debris around the edge of the rim which will cause the height to be incorrectly high.

$$\text{Area} = (\pi) (D^2/4) = (3.14) (2^2/4) = 3.14 \text{ ft}^2$$

Velocity – from field observation of water column height

Time - convert to minutes

$$\text{Volume (Gal.)} = (\text{Area}) (\text{Velocity}) (\text{Time}) (448 \text{ gpm/cfs})$$

Example: A manhole without a lid was observed to have an overflow with a 3 – inch high column of water for a period of 6 hours, 10 minutes

$$\begin{aligned} \text{Volume (Gal.)} &= (3.14) (4.0 \text{ ft/sec}) (370) (448) \\ \text{Volume} &= 2,081,946 \text{ gallons} \end{aligned}$$

D.2.3.E. Other

1. Generally approach of estimating a cross sectional area where the flow is leaving and a velocity of flow can be used to determine a rate. This can be applied to any situation.
2. Several observations over an event to estimate the area and velocity are better than a single observation. The overflow examples above assume a constant rate over the period which will estimate volumes too high. As an example, if an hour at the beginning and end of each event is assumed for the flow to build up from zero to maximum and back to zero, a calculation could be done as follows:

Appendix F

Stream Monitoring and Analysis Forms

The following Stream Monitoring and Analysis Information is provided in Appendix F:

- Stream Quality Survey
- Stream Monitoring Program Report Form for a Major Spill
- Biological Survey
- Fish Kill Response - Standard Operating Procedure (SOP)

STREAM QUALITY SURVEY

STREAM NAME _____

DATE _____

INVESTIGATOR _____

TIME _____

COUNTY _____

SITE LOCATION _____

WEATHER CONDITION _____

STREAM QUALITY SURVEY REPORT

1. **STREAM REACH SAMPLE:** BANKFULL WIDTH _____ x12 = STREAM REACH

2. **WATER FLOW:** PRESENT CONDITIONS

IN CHANNEL

☐ FLOODING OVER BANKS

☐ DRY / NO FLOW

3. **EMBEDDEDNESS:** EXTENT COBBLES OR ROCKS ARE EMBEDDED IN SILT.

☐ SOMEWHAT / NOT EMBEDDED 0-25%

☐ HALFWAY EMBEDDED 50%

☐ MOSTLY EMBEDDED 75%

☐ TOTALLY EMBEDDED 100%

4. **ORGANIC MATERIAL IN STREAM:**

☐ NONE

☐ OCCASIONAL

☐ PLENTIFUL

5. **WATER ODOR:**

☐ NONE

☐ CHEMICAL

☐ SEWAGE

☐ CHLORINE

☐ ROTTEN EGG

6. **WATER SURFACE:**

☐ CLEAR

☐ FOAMY

☐ OIL SHEEN

☐ OTHER

7. STREAM SHADE COVER:

TOTAL SHADING

NO SHADING

100% 90% 80% 70% 60% 50% 40% 30% 20% 10% 0%

8. WATER CLARITY:

☐ TURBID – SUSPENDED SOLIDS

☐ NOT TURBID – NO SUSPENDED SOLIDS

9. BANK EROSION:

HOW VEGETATED IS THE LEFT BANK / LOOKING DOWNSTREAM / FOR THE LENGTH OF THE REACH?

100% 90% 80% 70% 60% 50% 40% 30% 20% 10% 0%

HOW VEGETATED IS THE LEFT BANK / LOOKING DOWNSTREAM / FOR THE LENGTH OF THE REACH?

100% 90% 80% 70% 60% 50% 40% 30% 20% 10% 0%

10. ADDITIONAL COMMENTS AND OBSERVATIONS:

Name of City/County:	_____	Spill Amount:	_____
Date Spill Occurred:	_____	Date Spill Reported to GAEPD:	_____
Spill Location:	_____	Date of Public Notice (PN):	_____

Downstream Sampling Location: Below Spill: Copy of PN Submitted to GAEPD:

		ABOVE			
	DATE	DO	TEMP	pH	#/100 mL Fecal Coliform
DAY 1					
DAY 2					
DAY 3					
DAY 4					
DAY 5					
DAY 6					
DAY 7					
WEEK 1 Geometric Mean:					
WEEK 2					
WEEK 3					
WEEK 4					
Month 1 Geometric Mean:(Use all 10 data points)					
Month 3					
WEEK 1					
WEEK 2					
WEEK 3					
WEEK 4					
Month 3 Geometric Mean:					
MONTH 12					
WEEK 1					
WEEK 2					
WEEK 3					
WEEK 4					
MONTH 12 Geometric Mean:					

[illegible]

BIOLOGICAL SURVEY

11. WILDLIFE IN AND AROUND STREAM:

- ☐ AMPHIBIANS ☐ REPTILES ☐ MAMMALS
☐ WATERFLOW ☐ MUSSELS / CLAMS ☐ CRUSTACEANS

12. ARE THERE FISH IN THE STREAM:

- ☐ NO ☐ YES / BUT RARE ☐ LARGE 7" AND ABOVE
☐ SMALL 1-2" ☐ MEDIUM 3-6"

13. AQUATIC PLANTS IN STREAM:

- ☐ NONE ☐ ATTACHED PLANTS ☐ FREE FLOATING

14. EXTENT OF ALGAE IN STREAM:

- ☐ NONE
☐ BROWNISH
☐ GREENISH
☐ OTHER

MACROINVERTEBRATE COUNT: A=1-9 B=10-99 C=100 PLUS

SENSITIVE	LESS SENSITIVE	TOLERANT
☐ CADDISFLIES ☐ MAYFLIES ☐ STONEFLIES ☐ RIFFLE BEETLES ☐ WATER PENNIES ☐ GILLED SNAILS	☐ DOBSONFLIES ☐ FISHFLIES ☐ CRANE FLIES ☐ DAMSELFLIES ☐ DRAGONFLIES ☐ ALDERFLIES ☐ CRAYFISH ☐ SCUDS ☐ CLAMS ☐ MUSSELS	☐ AQUATIC WORMS ☐ BLACK FLIES ☐ MIDGE FLIES ☐ LEECHES ☐ LUNGED SNAILS
____ # LETTERS X 3	____ # LETTERS X 2	____ # LETTERS X 1

ADD TOTAL OF THESE FOR STREAM INDEX VALUE _____

WATER QUALITY RATING

____ > 20 EXCELLENT 17 – 22 GOOD 11- 16 FAIR < 11 POOR

Fish Kill Response - Standard Operating Procedure (SOP)

This SOP is a guide for Fisheries staff in responding to reports of fish kills, and will be applicable to all fish, shellfish and other invertebrates found within County waters.

Definition of a fish kill:

A 'fish kill' is a significant and sudden death of fish, shellfish and other aquatic animals. Such events are characterized by large numbers of animals dying over a short time, usually in a defined area.

Initial Notification

1. Based on the initial report, proper staff should be notified to respond.
2. The number of staff to respond will be determined by the size/severity of the kill.
3. Responding staff should locate proper forms, equipment and ice (located in dry lab freezer), and proceed to the site.

Once on location:

1. Talk to any witnesses/observers. Take a statement from any person at the scene who may have pertinent information. Their identity should be established, and statements should be signed and witnessed.
2. Any information recorded during an inspection should be written in pen. Do NOT use pencil!
3. Determine the extent of the kill by walking the length of shoreline or accessing the site by boat.
4. If a fish kill is observed, proceed with an investigation. Fill out the **Fish Kill Investigation Report Form** and continue to use it throughout site inspection. Information should include, but is not limited to:
 - # of fish - Symptoms/ conditions
 - Weather - Dimensions
 - Species affected - Water quality
5. Photographs should be taken of the entire site. Evidence of dead or affected fish and any other materials suspected of being associated with the fish kill should also be photographed. The date, time and location of sequential photographs, and the name of the photographer should be recorded in the field notebook.
6. Make physical observations, look for any abnormalities which could lead to a possible explanation of the fish kill. Record any relevant information in field notebook and data sheets. Photographs SHOULD be taken of dead or affected fish and any other affected organisms!!!!
7. Based on the type of kill and/or location, the most accurate counting method should be determined by using one of the following:

a. Shoreline Count

- Determine the length of the affected shoreline by subdividing the shoreline into equal segments of a fixed length.
- Count the total number of segments in the affected shoreline.
- Then randomly select at least 3 segments.
- Multiply the average or total count of fish in each segment by the appropriate expansion factor.
- Hence: $(\# \text{ of fish/segment}) \times (\text{total number of segments in fish kill zone}) = \text{Estimate of total population killed}$

b. Area sampling (lakes)

- Total Number = $(\# \text{ fish counted}) \times EV$
- $EV = (\text{Total area effected})/(\text{area sampled})$
- For example: 100 fish were counted in an area of 10 acres². The lake was 100 acres². Hence: Total number = $100 \times (100/10) = 1000 \text{ fish}$

c. Complete Count

- Count all fish over the entire extent of the kill. (This method is appropriate for a relatively small kill.)

Bibliography

Bibliography

This section provides an annotated list of resources that can assist the Utility in understanding general standards and program components of a CMOM program. Please refer to the Collection Committee Bulletin Board on GAWP website for an updated bibliography.

Reference	Annotation
EPA Region 4 <i>Guide to Collection and Transmission System Management, Operation, and Maintenance Programs</i> , Version 1.0, September 2003	A brief guide for conducting collection system evaluations.
EPA Region 4 <i>Introduction to Conducting Evaluations of Municipal Wastewater Collection System Management, Operation, and Maintenance Programs</i> , Version 1.0, September 2003	A brief overview of MOM information and questions for conducting collection system evaluations.
EPA <i>Guide For Evaluating Capacity, Management, Operation and Maintenance Programs at Wastewater Treatment Plants</i> , EPA 300-B-00-015, September 2000	A comprehensive overview and questionnaire for evaluating treatment plants.
EPA <i>Guide For Evaluating Capacity, Management, Operation and Maintenance Programs for Sanitary Sewer Collection Systems</i> , EPA 300-B-00-014, September 2000	A comprehensive overview and questionnaire for evaluating collection systems.
EPA Region 4 Publicly Owned Treatment Works Management, Operations and Maintenance (MOM) Programs Project; Region 4 Management, Operations and Maintenance Work Group Standard Management Procedure; <i>Results of EPA Region 4 Audit or Utility Self-Audit Review</i> , February 2000	An overview and results of EPA Region 4 MOM Programs Project.
http://www.georgiafog.com/Comtruckinfo/transporterinformation.html	Includes information on Commercial Waste Hauler registration, original bill, and related GA EPD rules and regulations.
http://www.gaepd.org/Documents/rules_exist.html	GA EPD's spill reporting rules

CMOM Performance Measures

The following information is provided as guidance in performance indicators and performance measures that can be used to demonstrate success of the CMOM program.

Exhibit E.1 Suggested Performance Measures for Wastewater Collection System

Wastewater System		
MEASURE	PERFORMANCE INDICATOR	PERFORMANCE MEASURE
Effluent Quality	Zero notices of violation.	Zero violations per year.
Reliability	Provide wastewater collection services to all customers 24/7.	Restore temporary wastewater service within 4 hours.
Recurring and Preventive Maintenance	Percentage of preventive maintenance work orders completed versus un-scheduled.	Spend more time on preventive maintenance work to decrease corrective maintenance work. >90% completed as scheduled.
Pre-Treatment Requirements	Pretreatment system maintained properly. Trend of permitted locations complying with permit conditions. Scheduled inspections of all point sources with grease traps, dining facilities, and medical facilities.	All locations meeting pretreatment requirements.
Safety of Government Personnel and Property	Training, Accident Incident Rate.	Training in accident reduction techniques. Establish safety program. Goal of Zero OSHA recordable incidents
Service Connection Standards and Specifications	Service connections installed in accordance with standards.	Compliance with AWWA, WEF, State of Georgia standards.
Blockages and Cross Connections	Reduction and elimination programs.	Identify troublesome sewer line areas and implement PM programs. Train wastewater personnel on cross connection control program and perform cross connection survey.
Water and Sewer Line Separation	Water and Sewer line separation in accordance with State of Georgia regulations.	Compliance with State of Georgia requirements 100% of the time.
New Construction Standards	Standards drafted and adopted.	Compliance with AWWA, WEF, State of Georgia standards.

Wastewater System		
MEASURE	PERFORMANCE INDICATOR	PERFORMANCE MEASURE
System Inspections	Standards drafted and adopted.	20% collection system inspected annually. Video inspections of wastewater collection system segments scheduled as needed.
Meter and Equipment Calibration	Meters and equipment operational within manufactures specs.	Calibration of major meters and equipment within manufacturer's periodicity by certified technician.
Service Interruption Frequency	Provide wastewater collection and treatment services to all customers 24/7.	Provide wastewater collection and treatment services to all customers 24/7. Maximum 4 hours of system wide outages per year.
Operating Permits	Operated under appropriate permits.	Operated under appropriate permits. Zero violations.
Employee Certifications	Training and certifications.	Meet Qualifications and Certifications required by the State of Georgia 100% of the time.
CMOM Organizational Structure	CMOM Roles and Responsibilities are defined	Organizational structure is adequate to implement and sustain a CMOM effort
CMOM Funding	Adequate funding for CMOM elements	25% of the sanitary sewer system annual operating budget funds CMOM elements
Mapping	Timely update of sewer map and assets.	A complete inventory of the sewer system assets (a system map) and a plan to maintain the map to include new lines.
Lift Stations	Achieving a high level of operational efficiency	Reducing the number of SSOs
Inspections	Inspection through a walk through survey	100% of all problem areas identified during annual inspection
Minimization of Inflow and Infiltration	Correlation between wet weather and dry weather flow variations due to lack of system integrity.	Conduct manhole inspections. Conduct smoke testing to identify I/I areas in need of repair.
Compliance with Spill Reporting	Maintain an Overflow Response Plan and train personnel annually in the procedures	Demonstrate 100% compliance with Spill Reporting to GA EPD

Appendix A

Sewer Mapping Program Procedures

COLLECTION SYSTEM MAPPING PROCEDURE

SCHEDULE

Schedule based on areas identified by Program Manager of Mapping Program or other designated personnel.

ACTIVITY DESCRIPTION

Procedure defines mapping activities for field crews and data management activities for GIS Specialists.

ACTIVITY GOALS

To accurately identify assets in the field using GPS equipment and upload data into GIS database.

LABOR

Code	Classification
	CMOM Program Coordinator GIS Manager GIS Specialists Utility personnel that conduct field surveys Contract personnel that conduct field surveys Contract personnel who perform data management

MATERIAL and EQUIPMENT

Code	Description
	Laptop computers Traditional and Survey grade GPS equipment Manhole etching equipment Digital cameras Leveling rods and tapes Safety equipment: Hard hat, Safety glasses, Rubber gloves, Vests and Steel capped boots

SAFETY ANALYSIS

Safety Check List

- Safety Program Plan
- Traffic Safety Requirements

Potential Hazards

- Infectious Diseases
- Slip, Trip, and Fall
- Snakes, Pests, Insects
- Confined Space Entry (not applicable, field crews are not entering confined space)
- Traffic
- Vehicle Operation
- Electrical Hazards (Electrical Safety)
- Lifting

COLLECTION SYSTEM MAPPING PROCEDURE

Mapping Procedures for Manholes and Cleanouts

Field personnel (Utility or Contractor) gather location information in the field and transmit the data in digital and/or hard copy format to the Utility GIS Manager for integration into existing systems. Deliverables for each basin /sub-basin should include digital photos of manholes, GIS compatible database, map books and recommendations for sewer lines to be surveyed. Utility staff should be involved in quality control and integrating the information into the existing GIS, CMMS and other systems.

- (1) Field maps are created from the existing GIS database both to assist field crews in locating sewer features and to be marked up where errors are found during field verification. Inspection crews are sent out first to collect attributes. Separate survey crews follow to collect GPS locations.
- (2) Inspection crews collect attributes information and record the data. Field maps are corrected with red-line edits. Digital photos are taken of manholes. The orientation of all incoming and outgoing pipes is recorded relative to north.
- (3) Working one basin/sub basin at a time, the field personnel perform the initial data collection and a quality review.
- (4) The Utility staff complete quality checks and return questionable data to the field personnel for verification. The Utility issues internal work orders to locate any manholes noted as buried or not located.
- (5) Survey crews receive a list of manholes and the corrected field maps from the inspection crews. Control points are established, and the survey crews follow the corrected maps to collect horizontal and vertical coordinates for each manhole and cleanout with GPS or conventional survey equipment.
- (6) The new asset information should be incorporated into the Utility's appropriate data management system and hydraulic model. The information should include survey coordinates and elevations of manholes, incoming and outgoing pipes, and digital photos.

Mapping Procedures for Sewer Lift Stations

- 1) Field personnel perform survey of lift station wet well, vault chambers, standby generators, fencing, and stormwater structures. Measurements are made of wet well dimensions and the elevations of level controls. All data is recorded on the Lift Station/Pump Station Inspection Form or in an electronic database.
- 2) Survey crews collect horizontal coordinates for the corners of structures, including buildings and fences, and elevations of the top of structures.

Appendix B

Flow Monitoring Program Procedures

FLOW MONITORING SITE INSPECTION PROCEDURE

SCHEDULE

Schedule of flow monitoring site inspection should be determined by the System-Wide Flow and Rainfall Monitoring Program.

ACTIVITY DESCRIPTION

Inspection of flow monitors site for possible installation of flow monitoring unit.

ACTIVITY GOALS

- To inspect site to ensure that flow monitoring unit can obtain optimum flow monitoring data.
- To document the site inspection (e.g. site-specific conditions) and hydraulic suitability of the site for flow monitoring.

LABOR

Code

Classification

Flow Monitoring or Contractor Staff

EQUIPMENT

Code

Description

Camera
Manhole Pick
Measuring Rod
Possible Confined Space Equipment
Gas Detector
Site Logbook

MATERIALS

Code

Description

Safety equipment - vest, traffic cones and flags, men-working signs, hardhats, steel toed boots. Leather/cloth and impervious gloves, tyvec coveralls, half mask disposable respirators, eye protection, ear plugs, flashlights, life vests, safety harness and ropes.
Disinfectants
Eye wash
Fire extinguisher
First aid kit

SAFETY ANALYSIS

Safety Check List

- Safety Program Plan
- Design Drawings
- Protective Clothing and Equipment
- Gases and other Hazardous Atmospheres Analysis (Confined Space Entry)
- Traffic Safety Requirements

Potential Hazards

- Infectious Diseases
- Slip, Trip, and Fall
- Poisonous Snakes, Pests, Insects
- Confined Spaces (Confined Space Entry)
- Traffic
- Vehicle Operation
- Mechanical Tools
- Flooding and Inundation (Confined Space Entry)

FLOW MONITORING SITE INSPECTION PROCEDURE

ACTIVITY/SUBTASK

The criteria below are identified for flow monitoring site inspection. The reliability of the data provided by the flow monitor depends on the hydraulic suitability of the installation site.

- Typically, sewer lines contained limited quantities of dirt, silt, sand gravel, rocks, roots, grease, garbage, settled sludge with depth and quantities of debris being unknown. However, the presence of these materials will cause the flow in the sewer line to be naturally turbulent. The goal is to choose a site that has the least amount of turbulence at all times. NOTE: Staff will notify their Supervisor if sewer line needs maintenance but the site should be avoided because it will likely be a problem site.
- Examine the manhole where the monitor is to be installed to determine the hydraulic suitability of the site. There will be one (1) incoming sewer line into the manhole and one (1) outgoing sewer line from the manhole. Determine the difficulties that may be encountered in gaining access to the manhole and installing the required monitoring equipment. Design drawings are useful to assist in understanding the system layout.
- The installation site should have as little turbulence as possible in the incoming sewer line flow. The level of flow in the sewer line has to be such that the sensor is completely submerged and covered by at least one (1) inch of flow at all times.
- After field investigations are complete, a Site Investigation Report describing observed conditions will be submitted to the Division responsible for Flow and Rainfall Monitoring. This information includes site-specific conditions such as access, safety condition, traffic control, structural conditions, hydraulic suitability, level of flow, and any other pertinent observations (within 7 days after Site Investigation).
- The Utility must approve all proposed flow monitoring sites.

RAIN GAUGE SITE INSPECTION PROCEDURE

SCHEDULE

Schedule of rain gauge site inspection should be determined by the System-Wide Flow and Rainfall Monitoring Program.

ACTIVITY DESCRIPTION

Inspection of rain gauge site for possible installation of rain gauge unit.

ACTIVITY GOALS

- To identify a possible location which allows for rain to fall freely into the bucket and ease access to the rain gauge site.
- To document the site inspection (e.g. site-specific conditions) such as access, safety consideration, traffic control, and structural condition.

LABOR

Code

Classification

Flow Monitoring of Contractor Staff

EQUIPMENT

Code

Description

Camera
Ladder
Site Logbook

MATERIALS

Code

Description

Safety equipment - vest, traffic cones and flags, men-working signs, hardhats, steel toed boots. Leather/cloth and impervious gloves, tyvec coveralls, half mask disposable respirators, eye protection, ear plugs, flashlights, life vests, safety harness and ropes.
Disinfectants
Eye wash
Fire extinguisher
First aid kit

SAFETY ANALYSIS

Safety Check List

- Safety Program Plan
- Protective Clothing and Equipment
- Traffic Safety Requirements

Potential Hazards

- Infectious Diseases
- Slip, Trip, and Fall
- Poisonous Snakes, Pests, Insects
- Traffic
- Vehicle Operation
- Mechanical Tools

RAIN GAUGE SITE INSPECTION PROCEDURE

ACTIVITY/SUBTASK

The criteria below are used for site selection of rain gauge within a sub-basin.

- The site chosen for rain gauge installation should allow the rain to fall freely into the bucket. There should be no obstructions, such as tree canopy or buildings, in the path of the rainfall. The best sites may be on the roof-tops of the Utility or Municipality owned buildings, allowing for easy access. Other locations may be chosen per Utility's approval.
- The Utility may request that a rain gauge be installed in combination with a permanent flow monitor site. In such case a permanent flow monitor should be chosen with no tree canopy in the area to obstruct rainfall.
- After field investigations are complete, a Site Investigation Report describing observed conditions should be submitted to the Utility. This information should include site-specific conditions such as access, safety condition, traffic control, structural conditions, hydraulic suitability, level of flow, and any other pertinent observations (within 7 days after Site Investigation).
- The Utility should approve all proposed rain gauge sites.

FLOW MONITOR INSTALLATION PROCEDURE

SCHEDULE

Schedule of flow monitor installation should be determined after flow monitor site inspection has been evaluated and approved by System-Wide Flow and Rainfall Monitoring Program.

ACTIVITY DESCRIPTION

Installation and inspection of flow monitoring unit.

ACTIVITY GOALS

- To ensure the incoming sewer line is clean.
- To install and inspect flow monitoring unit by calibrating the unit for initial usage.

LABOR

Code

Classification

Flow Monitoring or Contractor Staff

MATERIALS

Code

Description

Safety equipment - vest, traffic cones and flags, men-working signs, hardhats, steel toed boots. Leather/cloth and impervious gloves, tyvec coveralls, half mask disposable respirators, eye protection, ear plugs, flashlights, life vests, safety harness and ropes.
Disinfectants
Eye wash
Fire extinguisher
First aid kit
PVC Pipes

EQUIPMENT

Code

Description

Camera
Manhole Pick
Measuring Rod
Confined Space Equipment
Gas Detector
Flow Monitoring Unit and accessories
Portable Velocity Meter
Computer

SAFETY ANALYSIS

Safety Check List

- Safety Program Plan
- Protective Clothing and Equipment
- Gases and other Hazardous Atmospheres Analysis (Confined Space Entry)
- Traffic Safety Requirements

Potential Hazards

- Infectious Diseases
- Slip, Trip, and Fall
- Poisonous Snakes, Pests, Insects
- Confined Spaces (Confined Space Entry)
- Traffic
- Vehicle Operation
- Mechanical Tools
- Flooding and Inundation (Confined Space Entry)

FLOW MONITOR INSTALLATION PROCEDURE

ACTIVITY/SUBTASK

- Flow Monitoring Staff should have the proper training including traffic control and confined space entry. Installation of the meters in a manhole generally requires confined space entry. The hazards encountered and associated with entering and workings in confined spaces to perform flow monitoring, although remote, are capable of causing bodily injury, illness, or death to the worker if proper precautions are not taken. Accidents occur among workers because of failure to recognize that a confined space is a potential hazard. It shall therefore be considered that the most unfavorable situation exists in every case and that the danger of explosion, poisoning, and asphyxiation will be present at the onset of entry. Site testing and monitoring should be conducted to determine the presence of these potential hazards.
- Flow monitoring staff should receive the proper safety training. Field installers wear a harness, gas meter, and hard hat, and use equipment to lower and raise personnel into manholes, as needed. Roadway safety is important during a flow monitoring study. Sometimes sites are located on busy roads. In some area, roadway safety equipment is required.
- If the site requires cleaning then the cleaning should be done in the incoming sewer line before the sensor is installed (two feet or more inside the incoming pipe). The term "Clean" as used herein shall mean the complete removal of all debris, dirt, gravel, rocks, roots, grease, settled sludge, and all other solid or semi-solid materials from the sewer lines (up to two feet inside the incoming pipe) and manholes to facilitate the installation of the flow monitor.
- The ring and sensor should be installed two (2) feet inside the incoming pipe. The ring should be flush with the pipe wall. If the silt inside the pipe cannot be cleaned and has adhered to the pipe, then the ring and sensor may be installed on top of the silt. The level of silt should be measured and entered into the flow monitor setup. An alternate site should be evaluated if possible.
- The sensor should be installed at the 6:00 o'clock position. If the site velocity is determined to be slow enough that debris could get caught on the sensor, then the sensor may be placed in an offset position. The offset should be measured and entered into the flow monitor setup. NOTE: The sensor must be covered by one (1) inch of flow at all times, unless the sensor is designed to measure at lower levels or if a surface velocity sensor is installed on the pipe crown.
- The flow monitor site setup includes naming the site properly in the software (naming convention will be provided by the Utility), measuring the pipe size, measuring the level of flow, setting up the correct flow conversion method, choosing the correct pipe geometry, setting the date and time, and setting the data retrieval interval to every fifteen (15) minutes.

FLOW MONITOR INSTALLATION PROCEDURE

ACTIVITY/SUBTASK

- The level of flow should be determined by measuring from the top of the flow to the top of the pipe and subtracting from the pipe size. At no time shall the measuring device be put into the path of the flow. At no time during the level measurement shall the Contractor obstruct the path of the flow; this may cause a backup into the pipe which may alter the level measurement. The manual level measurement should be used to calibrate the sensor level measurement.
- The velocity in the incoming pipe should be measured by a secondary device and be used to verify the sensor measured velocity.
- Installation includes the flow monitor unit and accessories, rain gauge unit (when requested by the Utility), telemetry, voice grade telephone service (when applicable), enclosures, phone lines, power lines (when needed), and solar panel.
- All cables and phone lines should be enclosed by PVC pipes (where possible) and buried to a depth of eighteen (18) inches.
- Any poles/posts that are installed into the ground to accommodate flow monitoring, wireless data acquisition, solar panel, fencing, or any other incidental work should be stabilized using concrete blocks and by pouring concrete as necessary.
- All installations are subject to approval by the Utility. Site Acceptance Report should be submitted to Utility within 30 days of commencement of monitoring.

RAIN GAUGE INSTALLATION PROCEDURE

SCHEDULE

Schedule of rain gauge installation should be determined after rain gauge site inspection has been evaluated and approved by System-Wide Flow and Rainfall Monitoring Program.

ACTIVITY DESCRIPTION

Installation and inspection of rain gauge.

ACTIVITY GOALS

- To identify a flat balanced surface away and away from obstruction of the rainfall path such as tree canopy or building.
- To install and inspect rain gauge by calibrating the unit for initial usage.

LABOR

Code

Classification

Flow Monitoring of Contractor Staff

EQUIPMENT

Code

Description

Camera

Ladder

Leveler

Computer

Logbook

MATERIALS

Code

Description

Safety equipment - vest, traffic cones and flags, men-working signs, hardhats, steel toed boots. Leather/cloth and impervious gloves, tyvec coveralls, half mask disposable respirators, eye protection, ear plugs, flashlights, life vests, safety harness and ropes.
Disinfectants
Eye wash
Fire extinguisher
First aid kit

SAFETY ANALYSIS

Safety Check List

- Safety Program Plan
- Protective Clothing and Equipment
- Traffic Safety Requirements

Potential Hazards

- Infectious Diseases
- Slip, Trip, and Fall
- Poisonous Snakes, Pests, Insects
- Confined Spaces (Confined Space Entry)
- Traffic
- Vehicle Operation
- Mechanical Tools

RAIN GAUGE INSTALLATION PROCEDURE

ACTIVITY/SUBTASK
• The rain gauge should be installed on a flat surface and the surface plate should be balanced. • The rain gauge site setup includes naming the site properly in the software (naming convention will be provided by the Utility), setting the date and time, setting the reading interval to every five (5) minutes. • Installations are subject to approval by the Utility. Site Acceptance Report must be submitted to Utility with 30-days period of commencement of monitoring.

SITE ACCEPTANCE PROCEDURE

SCHEDULE

Schedule for the acceptance of installation of rain gauge or flow monitoring site should be determined by the System-Wide Flow and Rainfall Monitoring Program.

ACTIVITY DESCRIPTION

Provide documentation and demonstration that rain gauge or flowing monitoring site are calibrated and providing accurate data.

ACTIVITY GOALS

- To evaluate and approve rain gauge or flowing monitoring site by ensuring that equipment is calibrated and providing accurate data.

LABOR

Code

Classification

Flow Monitoring or Contractor Staff

EQUIPMENT

Code

Description

Camera
Ladder
Leveler
Computer
Logbook
Manhole Pick
Measuring Rod
Possible Confined Space Equipment
Gas Detector
Portable Velocity Meter

MATERIALS

Code

Description

Safety equipment - vest, traffic cones and flags, men-working signs, hardhats, steel toed boots. Leather/cloth and impervious gloves, tyvec coveralls, half mask disposable respirators, eye protection, ear plugs, flashlights, life vests, safety harness and ropes.
Disinfectants
Eye wash
Fire extinguisher
First aid kit

SAFETY ANALYSIS

Safety Check List

- Safety Program Plan
- Protective Clothing and Equipment
- Gases and other Hazardous Atmospheres Analysis (Confined Space Entry)
- Traffic Safety Requirements

Potential Hazards

- Infectious Diseases
- Slip, Trip, and Fall
- Poisonous Snakes, Pests, Insects
- Confined Spaces (Confined Space Entry)
- Traffic
- Vehicle Operation
- Mechanical Tools
- Flooding and Inundation (Confined Space Entry)

SITE ACCEPTANCE PROCEDURE

ACTIVITY/SUBTASK

Flow Monitoring Staff should provide documentation for each flow monitoring site showing that sensors are calibrated and are reporting the level, velocity, and flow rate correctly.

- Flow monitoring staff should demonstrate that each site maintains telemetry connectivity at a rate of ninety-eight (98) percent or better for a period of thirty (30) days.
- During the thirty (30) day period, the Flow monitoring staff should demonstrate that the sensor can maintain its calibration. The Flow monitoring staff should be responsible for site maintenance and performance during this period.
- At the end of the thirty (30) day period, Flow monitoring staff should provide to the Utility, a calibration sheet, diagnostic report from the flow monitor along with a graph of quality and average gain versus time, and a graph demonstrating telemetry connectivity.
- A thirty (30) day flow data analysis report should be provided for each site.
- The Site Acceptance Report should contain the calibration sheet, diagnostics report, graph of quality and average gain versus time and data analysis, and Pole Camera Recording (DVD Format). The pole-camera recording, in DVD format, demonstrates the proper installation of the flow monitor and the hydraulic suitability of the installation site.

FLOW MONITOR MAINTENANCE PROCEDURE

SCHEDULE

Schedule of flow monitoring unit maintenance should be determined by the System-Wide Flow and Rainfall Monitoring Program.

ACTIVITY DESCRIPTION

Maintenance of Flow monitoring unit including calibrating and documenting reading from units.

ACTIVITY GOALS

- To provide maintenance to the flow monitoring unit to ensure that unit is calibrated, cleaned and recording accurate data.
- To ensure that the surrounding area is not hindering the proper usage of the flow monitoring unit.

LABOR		MATERIALS	
Code	Classification	Code	Description
	Flow Monitoring Staff		Safety equipment - vest, traffic cones and flags, men-working signs, hardhats, steel toed boots. Leather/cloth and impervious gloves, tyvec coveralls, half mask disposable respirators, eye protection, ear plugs, flashlights, life vests, safety harness and ropes. Disinfectants Eye wash Fire extinguisher First aid kit
EQUIPMENT			
Code	Description		
	Camera Manhole Pick Measuring Rod Possible Confined Space Equipment Gas Detector Flow Monitoring Unit and accessories Portable Velocity Meter Computer		

SAFETY ANALYSIS

Safety Check List

- Safety Program Plan
- Protective Clothing and Equipment
- Gases and other Hazardous Atmospheres Analysis (Confined Space Entry)
- Traffic Safety Requirements

Potential Hazards

- Infectious Diseases
- Slip, Trip, and Fall
- Poisonous Snakes, Pests, Insects
- Confined Spaces (Confined Space Entry)
- Traffic
- Vehicle Operation
- Mechanical Tools
- Flooding and Inundation (Confined Space Entry)

FLOW MONITOR MAINTENANCE PROCEDURE

ACTIVITY/SUBTASK

After a flow monitor site has been accepted by the Utility, the following procedures should be followed:

- The field monitoring staff should visit a flow monitor site once a month or as warranted by the data.
- During this visit, the sensor should be scrubbed to remove any build up of materials. The flow monitor should be connected to a computer and the sensor should be activated to verify its proper operation.
- The field monitoring staff should measure the level of flow and compare it to the level reading of the flow monitor. If the two readings are within 0.25 inches of each other, then the level does not need to be calibrated.
- The Field monitoring staff should measure the velocity using a secondary device and document the reading. A diagnostic report should be downloaded from the flow monitor as well.
- The Field monitoring staff should check all cable connections and battery levels. The Field monitoring staff should replace any part that is not functioning properly. The desiccant should be changed and documented if necessary. All sites visited should be left in a properly functional state of operation.
- The Field monitoring staff should check the flow monitoring sites as they are displayed in real time on a daily basis for data transmission and to determine the performance of the sensor. The Field monitoring staff should be responsible for gaining access to the real time data. If any site requires additional visits for abnormal readings or lack of real time data display, then the Field monitoring staff should advise the Utility. Upon approval from the Utility the Field monitoring staff should visit the site again for corrective action and document the extra visit.
- The Field monitoring staff should be responsible to keep all flow monitoring sites, under its maintenance, up and running at all times.

RAIN GAUGE MAINTENANCE PROCEDURE

SCHEDULE

Schedule of rain gauge unit maintenance should be determined by the System-Wide Flow and Rainfall Monitoring Program.

ACTIVITY DESCRIPTION

Maintenance of rain gauge including calibrating and documenting reading from units.

ACTIVITY GOALS

- To provide maintenance to the rain gauge to ensure that unit is calibrating, cleaning and balancing of the unit and recording accurate data.
- To ensure that the surrounding area is not hindering the proper usage of the rain gauge.

LABOR		MATERIALS	
Code	Classification	Code	Description
	Flow monitoring or Contractor staff		Safety equipment - vest, traffic cones and flags, men-working signs, hardhats, steel toed boots. Leather/cloth and impervious gloves, tyvec coveralls, half mask disposable respirators, eye protection, ear plugs, flashlights, life vests, safety harness and ropes. Disinfectants Eye wash Fire extinguisher First aid kit
EQUIPMENT			
Code	Description		
	Camera Ladder Leveler Computer Logbook		

SAFETY ANALYSIS

Safety Check List

- Safety Program Plan
- Protective Clothing and Equipment
- Traffic Safety Requirements

Potential Hazards

- Infectious Diseases
- Slip, Trip, and Fall
- Poisonous Snakes, Pests, Insects
- Traffic
- Vehicle Operation
- Mechanical Tools

RAIN GAUGE MAINTENANCE PROCEDURE

ACTIVITY/SUBTASK
After a rain gauge site has been accepted by the Utility, the following procedures should be followed: • The field monitoring staff should visit rain gauge site(s) once a month. • During this visit, the field monitoring staff should ensure that the surface plate is balanced, the tipping bucket is cleaned and the battery is good. The data from the rain gauge should be retrieved by connecting the logger to a laptop computer and downloading the data if not connected to telemetry.

DATA ANALYSIS AND REPORTS PROCEDURE

SCHEDULE

Schedule of reporting and data analysis of the rain gauge and/or flow monitoring data should be determined by the System-Wide Flow and Rainfall Monitoring Program.

ACTIVITY DESCRIPTION

Creation of the data reports and evaluation of the data analysis of each of the maintained site for rain gauge or flow monitoring data provides insight of the Sewer Collection and Transmission System.

ACTIVITY GOALS

- To provide data results from either rain gauge or flow monitoring unit in a report.
- To evaluate the data and reports in analysis to determine the efficiencies of the system.

LABOR

Code	Classification
	Flow monitoring or Contractor staff

EQUIPMENT

Code	Description
	Computer

MATERIALS

Code	Description
	None

SAFETY ANALYSIS

Safety Check List

- None

Potential Hazards

- None

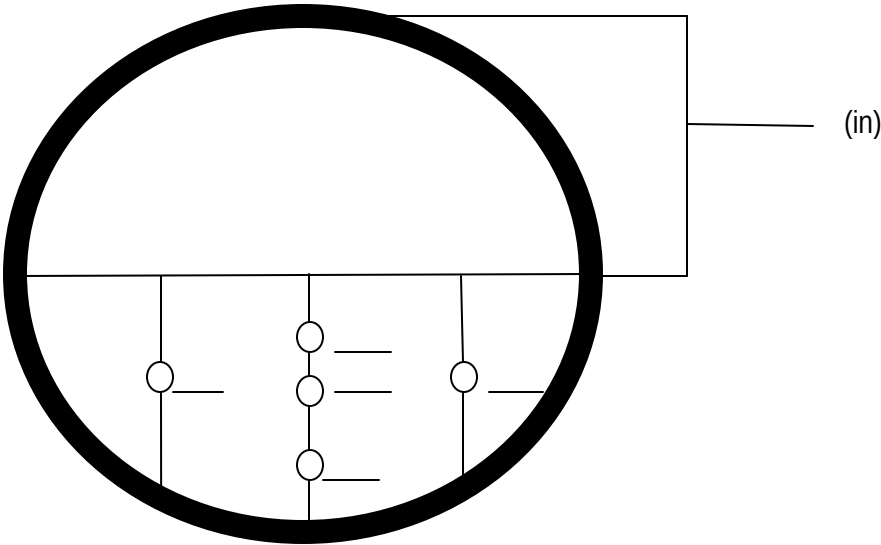
DATA ANALYSIS AND REPORTS PROCEDURE

ACTIVITY/SUBTASK
Field monitoring staff, as part of the maintenance program, should provide reports on each maintained site that includes a calibration sheet, a diagnostic report, a graph of the quality and average gain versus time that is inclusive of all previous months' data in order to demonstrate a trend. The Utility may request, in writing, that data analysis reports on the installed flow monitors and rain gauges be provided by the Field monitoring staff. The types of reports should include wet weather versus dry weather study, or flow data analysis per sub-basin to identify areas with I/I.

CALIBRATION SHEET

SITE NAME:		DATE:
PROJECT NO.:	SITE ID:	SITE ADDRESS:
MANHOLE NO.:	SITE DESCRIPTION:	
AREA VELOCITY SERIAL NO.:		SENSOR SERIAL NO.:
LOGGER SERIAL NO.:		
ASSIGNED RECORDER NO.:		CELLULAR PHONE NO.:
PHYSICAL DATA:		
INSIDE DIA. (INCH):	PIPE MATERIAL:	MANHOLE DEPTH (INCHES):
MANHOLE DIAMETER (INCH):	FLOW CHARACTERISTICS:	EVIDENCE OF SURCHARGE:
DEPTH OF SURCHARGE (INCH):	STEP CONDITION:	
COMMENTS:		
METER SETUP:		
INSTALL CREW:	INSTALL DATE:	INSTALL TIME:
DEPTH OFFSET:	SITE COEFFICIENT:	CYCLE TIME:
NEW BATTERY:	VOLTAGE:	PIPE SHAPE:
CONFINED SPACE ENTRY:		
ENTRANCE:		
ASSISTANT:		
ATTENDENT:		
OXYGEN LEVEL:	CARBON MONOXIDE LEVEL:	FLAMMABLE LEVEL:
HYDROGEN SULFIDE LEVEL:		

CALIBRATION:		
BEFORE CALIBRATION TIME STAMP:		
RULER LEVEL (INCH)	SENSOR LEVEL (INCH)	VELOCITY (FPS)
		FLOW RATE (GPM)



AFTER CALIBRATION TIME STAMP:

Appendix C

FOG Program Procedures

FOG MANAGEMENT PROGRAM PROCEDURES

FOG MANAGEMENT PROGRAM PROCEDURE 1.1 New Discharging Entities Inspection

SCHEDULE

ACTIVITY DESCRIPTION

Inspection of new Fats, Oil, and Grease (FOG) traps and interceptors in the Utility Service Area. This discussion is intended to provide general inspection procedures guidance, but is not meant to be a thorough presentation of all activities occurring during an inspection.

ACTIVITY GOALS

- Maintain a current Discharging Entity (DE) inventory.
- Minimize FOG from entering the Utility's sanitary sewer infrastructure in concentrations or rates that exceed those established by the Utility.
- Preserve sewer capacity by minimizing FOG related flow obstructions.
- Reduce or eliminate Sanitary Sewer Overflows (SSOs) caused by FOG related flow obstruction
- Prevent FOG related maintenance and operational issues associated with sanitary sewer infrastructure, thereby reducing operational and maintenance costs.

LABOR

Code	Classification
	Compliance Inspector

EQUIPMENT

Code	Description
	See Equipment List for FOG Management Program.

MATERIALS

Code	Description
	• Safety cones • Steel-toed shoes • Safety glasses • Safety vests • Construction hardhat • Back-braces • Work gloves • Box of latex gloves • Disinfectant/ hand sanitizer • Rags/ paper towels • Rain gear

SAFETY ANALYSIS

Safety Check List

- Safety Program

Potential Hazards

- Vehicle Operation
- Traffic
- Slip, Trip, and Fall
- Lifting

FOG MANAGEMENT PROGRAM PROCEDURES

FOG MANAGEMENT PROGRAM PROCEDURE 1.1 New Discharging Entities Inspection

ACTIVITY/SUBTASK

1. Pre-Use Equipment Inspection

- Verify you have all required equipment (tools and safety equipment) provided by the Utility
- Inspect all equipment for any damages
- Carry out a “pre-use” inspection of all equipment for functionality
- Ensure that all equipment is readily available for use
- Be prepared for unscheduled inspections by FOG Control Program Manager, Supervisors, and/or Utility Safety Coordinator

2. Paperwork

- Verify you have all required paperwork, in addition to:
 - Evaluation Report
 - Grease trap or interceptor design plans and specifications
 - Interceptor Sizing Form A – interceptors (exterior)
 - Interceptor Sizing Form B – traps (i.e., interior interceptors)
 - Interceptor Sizing Signature Form
 - DE Wastewater Discharge Permit Application Form
 - Permit Fee Schedule

3. Inspection

- Record the required information on the **FOG Inspection Sheet**.
- Confirm information on **Wastewater Discharge Permit Application Form**.
- Location of grease interceptor should be shown on approved building plans. Check that drawings of interceptor are complete and show all dimensions, capacities, reinforcing and structural design calculations.
- Confirm trap or interceptor matches approved design plans and specifications.
- Trap or interceptor should be permanently and legibly marked with the manufacturer's name of trademark, model number, UPC certification mark and registration, and any other markings required by law.
- Request information/contract on renderable yellow grease collection and recycling company and grease trap/interceptor hauler.
- Grease trap or interceptor should be easily accessible for inspection and cleaning and access does not require the use of ladders or the removal of bulky equipment. Confirm that FOG interceptors are installed in the proper orientation. It is not uncommon for outdoor and indoor FOG interceptors to be installed backwards (kitchen drain connected to the trap outlet and the trap inlet connected to the municipal sewer). Improper installation allows FOG to be released to the sewer system and reduces capacity of the unit.
- Inspect connections to the grease trap or interceptor to ensure that only authorized equipment and fixtures discharge to the device.
 - Pot sink
 - Pre-rinse sink

FOG MANAGEMENT PROGRAM PROCEDURES

- o Any other sinks into which FOG may be introduced
 - o Tilt kettles or tilt braising pans
 - o Floor drains or sinks into which kettles may be drained
 - o Work station drains
 - o Automatic hood wash units
 - o Any other fixtures or drains that can allow FOG to be discharged into the sewer.
- Check for an automatic dishwasher. Make sure the dishwasher bypasses the grease trap or interceptor, as the hot temperature (> 140 °F) will not allow the grease in the trap to be contained (solidify), and cause bypass of the treatment system.
- Check that no food grinders are connected to or discharges into any grease trap (interior units).
- Check for screening devices in sinks. Screens should be placed in all sinks to prevent solids from entering drain. Eliminate or avoid using an under-the-sink garbage disposal unit when possible.
- Inform management or designee that, “employees should scrape food and grease off pots, pans, plates and cooking utensils before pre-rinsing and washing. Also wipe with paper towels any excess fats, oil and grease. Discard in solid waste receptacle. *This is one of the best ways to prevent sewer line clogs, save money and lost time, and avoid environmental and enforcement issues.*”
- Ask how waste grease is collected from work stoves, deep fat fryers, and grills.
- Check for the presence of floor drains and the potential entry of any unwanted chemicals to the sanitary sewer. Floor drains must have a screen to capture solids.
- Verify the destination of the grill cleaning residuals. It should end up in a grease storage container or solid waste bin.
- If wastewater is plumbed to the sanitary sewer from the render or grease storage area, the wastewater must flow through the grease interceptor.
- If wastewater is plumbed to the sanitary sewer from the washing of floor mats, serving carts, or any other equipment, the wastewater must flow through the grease interceptor.

4. Grease Collection

- The renderable grease container should be covered to ensure they are protected from spills or overflow during rain events. Grease collection containers should be placed to avoid grease entering floor drains or storm drains. The preferred location for rendering containers is in a walk-in freezer if possible to reduce the exposure to rodents, flies and other nuisance conditions. However, many facilities have no choice but to place rendering containers outside.

5. Best Management Practices

- Review the Utility FOG Regulations:
 - o FOG Wastewater Discharge Permit and inspection process
 - o Guidelines for FOG control (BMPs) and prohibitions
 - o Trap and interceptor maintenance frequencies
 - o FOG Manifest recordkeeping requirements
 - o Use of GA state permitted waste transporters
 - o Enforcement schedule
- Hand the manager or designee a copy of Utility’s FOG Best Management Practices brochure. *“Here is a guide developed by the (Name of Utility), that provides good information for your business such as addressing FOG and solids control measures, tips on ways to prevent unnecessary and costly cleanup and plumbing repairs, and avoid regulatory enforcement.”*

FOG MANAGEMENT PROGRAM PROCEDURES

- Have the FOG BMP poster posted at sinks. Signs are a good method of instructing new employees on proper procedures particularly when employee turnover is high.
- Locate FOG Regulations requirements on trap or interceptor maintenance requirements, 20% rule, FOG Manifest recordkeeping, and information on GA state permitted waste transporters.
- Review stormwater protection: *"Pour wash water into a utility sink or curbed cleaning facility with a floor drain. Don't pour it out onto a parking lot, alley, sidewalk or street."*

6. Hazardous Materials and Cleaning Agents

- What janitorial cleaners, chemicals, and quantities are on site? Is storage area adequate? Is secondary containment needed? Observe if chemicals can be spilled into the sanitary sewer. Advise manager or designee if a problem is observed. Check for Material Safety Data Sheets on file when applicable. Advise DE of this requirement.
- Check for caustics as well. The pH of the discharge must be within 5.0 - 11.5 units.

7. Dealing with Contacts

- You are not a consultant. Do not endorse products; you can describe how similar problems have been handled, but be cautious about giving advice.

8. Inspection Close-out

- Complete the FOG Inspection Sheet and indicate whether the DE is in compliance or violation. The Inspection Sheet must be completed before discussing the inspection results with the DE contact. If the DE is in noncompliance, discuss the corrective action with the DE and when re-inspection will occur. Leave a copy of the Inspection Sheet with the DE.

FOG MANAGEMENT PROGRAM PROCEDURES

Equipment List for FOG Management Program

Documents:

- Utility Identification (ID)
- Business cards
- Waterproof pens and clipboard with the Utility Inspection Sheets
- Assigned DE list
- Geographic information system (GIS) maps and/or GPS unit
- Manufacturer's Drawings (for the type of grease removal device to be inspected)
- BMP Checklist for FOG Management Program
- BMP List and Brochures (for handing out to DEs)
- Sewer Use Ordinance (for reference)
- Enforcement Plan
- List of Georgia state permitted waste transporters; contacts/ phone numbers

Tools per Vehicle:

- 12-inch adjustable wrench
- Two 12-inch standard head screwdrivers
- Two 8-inch standard head screwdrivers
- One 12-inch Phillips head screwdriver
- One 8-inch Phillips head screwdriver
- One Allen wrench
- One 8-inch pliers
- One ratchet and socket set, metric and standard
- One power drill set, with attachments
- One 30-lb sledgehammer
- Dye for dye testing
- Manhole cover lift/ hook
- Pole/ digital camera
- Cell phone
- Sludge Judge and/or Depth Probe
- Mirror on a pole and flashlight (for looking inside manholes and interceptors)
- 5-gallon bucket
- Shovel
- GPS unit
- Field tablets/laptops
- Thermometer
- Utility truck/vehicle

FOG MANAGEMENT PROGRAM PROCEDURES

FOG MANAGEMENT PROGRAM PROCEDURE 1.2 Routine Food Service Establishment Inspection

SCHEDULE

ACTIVITY DESCRIPTION

Inspection of existing Fats, Oil, and Grease (FOG) traps and interceptors in the Utility Service Area. This discussion is intended to provide general inspection procedures guidance, but is not meant to be a thorough presentation of all activities occurring during an inspection.

ACTIVITY GOALS

- Maintain a current Discharging Entity (DE) inventory.
- Minimize FOG from entering the Utility's sanitary sewer infrastructure in concentrations or rates that exceed those established by the Utility.
- Preserve sewer capacity by minimizing FOG related flow obstructions.
- Reduce or eliminate Sanitary Sewer Overflows (SSOs) caused by FOG related flow obstruction
- Prevent FOG related maintenance and operational issues associated with sanitary sewer infrastructure, thereby reducing operational and maintenance costs.

LABOR		MATERIALS	
Code	Classification	Code	Description
	Compliance Inspector		• Safety cones • Steel-toed shoes • Safety glasses • Safety vests • Construction hardhat • Back-braces • Work gloves • Box of latex gloves • Disinfectant/ hand sanitizer • Rags/ paper towels • Rain gear
EQUIPMENT			
Code	Description		
	See Equipment List for FOG Management Program.		

SAFETY ANALYSIS

Safety Check List	Potential Hazards
• Safety Program	• DEs Owners and Managers • Vehicle Operation • Traffic • Slip, Trip, and Fall • Lifting

FOG MANAGEMENT PROGRAM PROCEDURES

FOG MANAGEMENT PROGRAM PROCEDURE 1.2 Routine Food Service Establishment Inspection

ACTIVITY/SUBTASK

1. Pre-Use Equipment Inspection

- Verify you have all required equipment (tools and safety equipment) provided by the Utility.
- Inspect all equipment for any damages.
- Carry out a “pre-use” inspection of all equipment for functionality.
- Ensure that all equipment is readily available for use.
- Be prepared for unscheduled inspections by FOG Management Program Manager, Supervisors, and/or Safety Coordinator.

2. Paperwork

- Verify you have all required paperwork, in addition to:
 - List of DEs to be inspected and appointment times for any scheduled inspections
 - DEs hours of operation/ contact information
 - DEs compliance history
 - DEs permit fee history

3. Meeting Your Contact

- Introduce yourself...Give your name...give your business card... and that you are an inspector from (Name of Utility.... *“The (Name of Utility) has authority over all potential discharges to the sanitary sewer system”....“This is a routine inspection...I will try not to take up too much of your time...I appreciate you giving me this time... The purpose of the inspection is to verify that there is a grease removal device or procedure, that the device and procedure is adequate to avoid excess discharge of FOG and solids to the sewer, and that the grease removal device is in good working order and maintained properly. I will be looking at the sinks and floor drains in the food preparation areas. I will be looking for screens on floor drains and in sinks. I will also check cleaning/service records. The reason for the inspection is to reduce the discharge of fats, oil, grease, and solids to the sewer. The grease and solids cause backups and overflows in the sewer system that can cause property damage, environmental problems such as sewage flows into public water bodies and health hazards including sewage out in the street. Our crews are out in the streets on a daily basis servicing the main lines with large equipment such as the vactor, hydro, and rodder, removing grease, roots, and solids from the sewer system.”*
- Present yourself to your contact in a friendly, but an official and polite, manner. Be positive with regard to the regulations that you enforce. The DE contact should have no doubts regarding whether you believe in what you are doing and that you reflect the attitude of Utility and its managers.

4. Inspection

- Start out the inspection by completing the top section of the Inspection Sheet. Attach the contact’s business card for later use, if needed.
- Review information/contract on renderable yellow grease collection and recycling company and grease trap/interceptor hauler.
- Review SOPs for trap and interceptor maintenance.
- Review maintenance logs for traps and FOG Manifests for hauler services.

FOG MANAGEMENT PROGRAM PROCEDURES

- Locate the grease traps and interceptors to be inspected. Check for the type, size, and condition of all grease removal systems (traps or interceptors) or other pretreatment options devices.
- Inspect connections to the grease trap or interceptor to ensure that only authorized equipment and fixtures discharge to the device.
 - Pot sink
 - Pre-rinse sink
 - Any other sinks into which FOG may be introduced
 - Tilt kettles or tilt braising pans
 - Floor drains or sinks into which kettles may be drained
 - Work station drains
 - Automatic hood wash units
 - Any other fixtures or drains that can allow FOG to be discharged into the sewer.
- Physically observe the condition inside the grease removal system(s):
 - a. For grease traps (inside), remove the lid and observe. A pliers or wrench may be needed to remove the lid of some models. Ask who maintains the “trap,” the procedure (e.g. employee scoops out the trap and puts in bin or garbage) and the frequency of cleaning. Check that a cleaning log is maintained, filled, and kept on-site to verify cleaning and maintenance. This is when you might need to recommend or require increased cleaning to prevent pass-through.
 - b. For the grease interceptors (outside), a safety perimeter must be established around the grease interceptor. Using the manhole hook, pry open and remove the lid(s). You might need to dislodge a tight lid by hammering on the lid with a rubber mallet. Do not leave an opened interceptor unattended.
 - c. Inspect grease removal equipment to determine if the equipment is being operated and maintained properly. Check for grease build-up and/or clogging. Observe the contents in the interceptor in both manholes. Take a sludge judge and lower it into the interceptor until it reaches the bottom of the tank. Hold it there for about 30 seconds to give liquid time to flow into sludge judge opening. At this point, the suspended solids on the bottom of the tank are being measured. Pull the sludge judge up from the tank and there will be liquid and solids in the sludge judge. Check the measurement where the solids are located. Depress the ball on the end of the sludge judge and release the liquid back into the tank. If the interceptor has a thick sludge cap on the top, repeat the process to measure the sludge cap of the tank. Put the measurement numbers on the Inspection Sheet. If the measurements for top and bottom add up to equal or greater than 20 percent of the total operating depth of the tank, then the tank needs to be pumped. (Using the yardstick, measure the thickness of the grease and floating debris. Wipe off the depth probe with paper towels.) Excessive solids from produce and meats may prove that garbage is discharged directly to the drain and not in solids waste container (garbage receptacle). If this is observed, be sure to advise the manager or designee of the DE, *“screens need to be placed in the drains and sinks”*. This is when you need to recommend or require increased cleaning to prevent pass-through.
 - d. Check the test manhole visually. The immediate downstream manhole should also be relatively free of FOG and debris. Look for any grease accumulations in the invert. If grease is present, then the test manhole must be pumped. Mark findings on the Inspection Sheet. DE’s interceptor maintenance schedule may need to be increased.
 - e. Check the Inspection Sheet for completion. Close all manhole openings once the inspection is complete.

FOG MANAGEMENT PROGRAM PROCEDURES

- f. TAKE PICTURES for enforcement actions if needed.

5. Sampling, if necessary

- Advise DE contact that (Name of Utility) intends to do random sampling for compliance verification. The oil and grease limit is 100 mg/L. Grab samples are collected in 1-liter amber bottles with sulfuric acid as a preservative. The samples are brought to a commercial lab for analysis.
- Make sure that there is a cleanout or port for sampling on the discharge side of the grease interceptor. Be aware that some large facilities may have the cleanout outside and not directly attached to the grease interceptor. *"All new vaults are required to have a sampling port on the discharge side."*
- In the event that analysis shows consistent exceedence of oil and grease, this DE may be required to resample, install additional grease removal equipment, placed on a surcharge schedule, and/or subject to a fine. This would include the recovery of additional treatment costs incurred by the Utility.

6. Best Management Practices

- Hand the manager or designee a copy of the Utility's FOG Best Management Practices brochure. *"Here is a guide developed by (Name of Utility) that provides good information for your business such as addressing FOG and solids control measures, tips on ways to prevent unnecessary and costly cleanup and plumbing repairs, and avoid regulatory enforcement."* Have the FOG-BMP poster posted.
- Determine how waste grease is collected from work stoves, deep fat fryers, and grills.
- Discuss cleaning methods for roof vents and vent hoods. If they have a self-cleaning hood, where does the wash water discharge?
- Check for the presence of floor drains and the potential entry of any unwanted chemicals to the sanitary sewer. Floor drains must have a screen to capture solids. The screen must be clean, especially before cleaning the floor.
- Check for screening devices in sinks. Screens should be placed in all sinks to prevent solids from entering drain. Eliminate or avoid using an under-the-sink garbage disposal unit when possible. Excessive solids from produce and meats in grease traps and interceptors may prove that garbage is discharged directly to the drain and not in the solids waste container (garbage receptacle).
- Check if any acids, enzymes, emulsifiers, or solvents are being used. These substances are prohibited because it defeats the purpose of the grease trap by breaking down the grease and allowing it to pass-through the system and solidifying later in the sewer lines downstream.

7. Grease Collection

- Inspect grease storage area to determine if grease is being stored properly. Inform manager or designee that, *"all facility staff must drain and capture oil and grease and transfer to bin for proper disposal or recycling firm. Recycle grease and oil. Don't pour it into sinks, floor drains, or onto a parking lot or street."*
- Inspect rendering bin outside for fryer oil disposal. Observe housekeeping practices in surrounding area for potential storm contamination problems.
- Check for FOG Manifests/ request copies of receipts detailing pickup dates/volumes collected by grease recyclers. Document the name of the recycling firm.

FOG MANAGEMENT PROGRAM PROCEDURES

8. Hazardous Materials and Cleaning Agents

- What janitorial cleaners, chemicals and quantities are on site? Is storage area adequate? Is secondary containment needed? Observe if chemicals can be spilled into the sanitary sewer. Advise manager or designee if a problem is observed. Check for Material Safety Data Sheets on file when applicable? Advise DE of this requirement.
- When hoods are cleaned, how is the slug of grease prevented from being discharged to the storm or sewer? Remember that the water will probably be hot enough to cause pass-through of the grease interceptor.
- Check for caustics as well. The pH of the discharge must be within 5.0 - 11.5 units.

9. Maintenance Records

- Verify cleaning and maintenance by checking FOG Manifests and document most recent pick-up. Ask if the DE is on a cleaning schedule. Record hauler company and name of hauler. (Note: Be aware that paperwork may be confused with fryer oil disposal). Documentation of maintenance is required. This DE shall maintain copies of cleaning receipts when commercially cleaned. *"Hauling records need to be maintained at the facility for at least 3 years."* If the DE has not been recording the cleaning events, require them to do so. Advise DE that *"the records are a (Name of Utility) requirement and failure to do so is non-compliance of Utility FOG Regulations. This facility must maintain a copy of the cleaning records when in-house maintenance is done. The "log" will include service performed, date, and maintenance employee's name and owner/manager verification."*
- Vaults must be totally pumped out to verify the removal of grease, oil, and separated solids. Inform the DE of this requirement. If the hauler does not pump out the interceptor completely, the oil and solids accumulate. A DE could be in noncompliance status of its oil and grease discharge limit directly after pumping if the oil is not removed. Alert the DE that, *"it is their responsibility to direct the pumping firm/hauler to remove the entire contents of the vault."*

10. Dealing With Contacts

- You are not a consultant. Do not endorse products, you can describe how similar problems have been handled, but be cautious about giving advice.

11. Storm System Concerns

- Any discharge to the storm drains from any food or grease-laden cleaning operations are prohibited. The Utility should be notified whenever violations are observed.

12. Inspection Close-out

- Complete the Inspection Sheet and indicate whether the DE is in compliance or violation. The Inspection Sheet must be completed before entering the DE to discuss the inspection results with the DE contact. If the DE is in noncompliance, discuss the corrective action with the DE and when re-inspection will occur. Review the Enforcement Response Plan. Leave a copy of the Inspection Sheet with the DE.

13. Follow-up Inspections

- A follow-up inspection will occur whenever the DE needed to clean the trap or interceptor during the inspection, records such as FOG Manifests were not available, etc.

14. Compliance Schedule

- A compliance schedule, with milestones should be considered when during the inspection, it is determined that installation of a treatment device a trap or interceptor is needed, cleaning or bypassing, illegal connections observed, sampling results exceed local limits for oil and grease as well as pH. Things to consider: TV inspection of the sewer line, determine if the DE contributes to a "hot spot" area.

FOG MANAGEMENT PROGRAM PROCEDURES

FOG MANAGEMENT PROGRAM PROCEDURE 1.3

Identifying Unpermitted DEs and Permitted DEs not in Compliance

ACTIVITY DESCRIPTION

Use of records kept by other City or County offices to identify the existing DEs in the City or County that are not permitted or not in compliance.

ACTIVITY GOALS

- Maintain a current inventory of FOG dischargers to focus outreach efforts, issue permits, and conduct inspections.
- Minimize FOG from entering the Utility sanitary sewer infrastructure in concentrations or rates that exceed those established by the Utility.
- Preserve sewer capacity by minimizing FOG related flow obstructions.
- Reduce or eliminate Sanitary Sewer Overflows (SSOs) caused by FOG related flow obstruction
- Prevent FOG related maintenance and operational issues associated with sanitary sewer infrastructure, thereby reducing operational and maintenance costs.

Data collected by other City or County offices in their day-to-day operations may be utilized to identify DEs in the City or County which are not permitted.

Useful Records for Identifying DEs	
City or County Office	Available Records
Business License Office	List of business licenses holders
Building Permit Office	List of permits granted for construction and expansion of commercial facilities
Health Department	Business list/inspection reports
Chamber of Commerce	Existing and new business lists
Sanitation District or Collection System Agency	Field inspection reports
Building, Utility, and Fire Departments	Field inspection reports

FOG MANAGEMENT PROGRAM PROCEDURES

Data collected by other Utility Division offices in their day-to-day operations may be utilized to identify DEs not in compliance.

Useful Records for Identifying DEs not in compliance with FOG Regulations	
Utility Division	Available Records
Maintenance	Sewer “hot spots” on high cleaning frequency or frequent SSOs CCTV videos before and after sewer maintenance to use as backup material for enforcement (by identifying specific lateral of FOG contribution) and to identify the true cause of the blockage (roots, structural defects, etc.)
Health Department	Noncompliance
Maintenance Division	“High priority” watersheds
GIS/Mapping department	Locate DEs on the sewer system Identify DEs upstream of “hot spots”

FOG MANAGEMENT PROGRAM PROCEDURES

BMP Checklist for FOG Management Program

Ensure of use of BMPs by DEs to maximize the efficiencies of the FOG traps and interceptors and minimize their cleaning frequencies, thereby reducing maintenance costs for the DE. The FOG Management Program reduces the discharge of FOG into the sewer system by also educating DEs. The Utility FOG Regulations, Section (Enter proper reference), outlines required BMPs.

BMP	Reason	Benefits	Compliance Inspectors
Train kitchen staff and other employees about how they can help ensure BMPs are implemented.	People are more willing to support an effort if they understand the basis for it.	All of the subsequent benefits of BMPs will have a better chance of being implemented and you can avoid enforcement actions.	Talk to the DE manager about the training program that he/she has implemented.
Post "No Grease" signs above sinks and on the front of dishwashers.	Signs serve as a constant reminder for staff working in kitchens.	These reminders will help minimize grease discharge to the traps and interceptors and reduce the cost of cleaning and disposal.	Check appropriate locations of "No Grease" signs.
Use a low temp chemical sanitization type dishwasher. Follow Health Department regulations for sanitizing.	Temperatures in excess of 140° F will dissolve grease, but the grease can re-congeal or solidify in the sanitary sewer collection system as the water cools.	The food service establishment will reduce its costs for the energy – gas or electric – for heating the water.	Check boiler or hot water heater discharge temperature. Measure the temperature of the hot water being discharged from the closest sink.
Use a three-sink dishwashing system, which includes sinks for washing, rinsing, and sanitizing in a 50-100 ppm bleach solution. Follow Health Department regulations for sanitizing.	The three-sink system uses water temperatures less than 140° F where a mechanical dishwasher requires a minimum temperature of 160° F. (See above)	The food service establishment will reduce its costs for the energy - gas or electric - for heating the water for the mechanical dishwasher and for operating the dishwasher.	Check boiler or hot water heater discharge temperature. Measure the temperature of the hot water being discharged from the closest sink.
Recycle waste cooking oil.	This is a good recycling opportunity.	The food service establishment will be paid for the waste material and will reduce the amount of garbage it must pay to have hauled away.	Obtain name of recycler used. Review recycling records. Confirm records with recycler.
"Dry wipe" pots, pans, and dishware prior to dishwashing.	By "dry wiping" and disposing in garbage receptacles, the material will not be sent to the grease traps and interceptors.	This helps keep grease from going to grease traps and interceptors, which will require less frequent cleaning, reducing maintenance costs.	Observe dishwashing practices.

FOG MANAGEMENT PROGRAM PROCEDURES

BMP	Reason	Benefits	Compliance Inspectors
Scrape plates to dry trash. Use screens in your sinks to catch food waste. Dispose of food waste by recycling and/or to dumpster as solid waste.	Some recyclers will take food waste for animal feed. The food waste can be disposed to the dumpster.	Recycling of food wastes will reduce the cost of solid waste disposal. Solid waste disposal of food waste will reduce the frequency and cost of grease trap and interceptor cleaning.	Inspect dumpster corral for cleanliness. Check bottom of grease interceptor for solids accumulation.
Cover outdoor grease and oil storage containers. Secure barrels to an outside wall or post to prevent tipping spills.	Uncovered grease and oil storage containers can collect rainwater. Since grease and oil float, the rainwater can cause an overflow onto the ground. Such an overflow will eventually reach the stormwater system and nearby streams.	Discharge of grease and oil to the storm drain might also result in legal penalties or fines.	Observe storage area for signs of oil and grease. Inspect containers for covers. Remove covers to ensure containers have not overflowed and do not have excess water.
Locate grease dumpsters and storage containers away from storm drain catch basins. Be aware of oil and grease dripped on the ground while carrying waste to the dumpster, as well as oil and grease that may "ooze" from the dumpster.	The farther away from the catch basin, the more time someone has to clean up spills or drainage prior to entering the storm drain system.	Discharge of grease and oil to the storm drain might also result in legal penalties or fines.	Observe storage area for signs of oil and grease. Inspect the closest catch basin for signs of accumulated grease and oil.
Use absorbent pads or other material in the storm drain catch basins if grease dumpsters and containers must be located nearby. Use absorbent materials such as "kitty litter" and sweep up for disposal to dumpster.	Absorbent pads and other materials can serve as an effective barrier to grease and oil entering the storm drain system.	Discharge of grease and oil to the storm drain might also result in legal penalties or fines.	Check the nearest catch basin and drainage paths for signs of grease and oil. Require absorbent pads if the basin is within 20 feet of grease dumpsters or containers or if there are signs of grease in the catch basin at any distance.
Routinely clean kitchen exhaust system filters inside at sinks connected to grease a trap or outside interceptor.	If grease and oil escape through the kitchen exhaust system, it can accumulate on the roof of the establishment and eventually enter the storm drain system when it rains.	Discharge of grease and oil to the storm drain might also result in legal penalties or fines.	Inspect roof downspouts for signs of oil and grease. Require a maintenance schedule and records for cleaning exhaust filters.

FOG MANAGEMENT PROGRAM PROCEDURES

FOG MANAGEMENT PROGRAM PROCEDURE 1.4 DE Inspection Schedule Assignment

ACTIVITY DESCRIPTION

ACTIVITY GOALS

- Streamline DE inspection coordination, scheduling, and resource allocation.
- Minimize FOG from entering the Utility sanitary sewer infrastructure in concentrations or rates that exceed those established by the Utility.
- Preserve sewer capacity by minimizing FOG related flow obstructions.
- Reduce or eliminate Sanitary Sewer Overflows (SSOs) caused by FOG related flow obstruction
- Prevent FOG related maintenance and operational issues associated with sanitary sewer infrastructure, thereby reducing operational and maintenance costs.

Condition	Recommended DE Inspection
DE upstream of a SSO	Immediately if SSO is found by Utility's Watershed Protection Division (or other appropriate division) SSO Investigator to be caused by FOG
DE upstream of a FOG related "hot spot"	Quarterly schedule until hot spot is eliminated
DE located in a priority watershed:	
DE in Compliance	Quarterly schedule for 12 months
DE in Non-Compliance	Re-inspection in 30 to 45 days Stays on Quarterly schedule
DE in Compliance after 12 months	Semi-Annual schedule
DE in Compliance for three years	Semi-Annual schedule
DE located outside of a priority watershed:	
DE in Compliance	Semi-Annual schedule for 12 months
DE in Non-Compliance	Re-inspection in 30 to 45 days Put on Quarterly schedule
DE returns to Compliance after 6 months	Semi-Annual schedule
DE returns to Compliance after 12 months	Annual schedule
DE in Compliance for three years	Annual schedule

Utility Standard Operating Procedures (SOP)

Scope

Federal, State and Local Regulations dictate how Fats, Oil and Grease (FOG) are to be discharged within the Utility's Service Area. The wide range of regulatory programs and enabling legislations should require the FOG Control Program Manager to maintain a current inventory of all DEs within Utility's Service Area; regulating their discharge of FOG for the purposes of protecting public health and safety, preserving and restoring the natural environment, while generating economic growth.

The following guidelines will set to define an DE, and provide standards for regulating the discharge of FOG into the Utility's Sewer System. The administering of Sanitary Sewer Overflows (SSO), and sewer blockages caused by FOG is also noted since these could cause harmful contamination of Public Water Bodies.

Standard Operating Procedures (SOP). (See FOG SOP: Figure 5-1)

(Enter appropriate references) contain the FOG Regulations of (Name of Utility).

The standards described in the SOP shall apply to all DEs within the Utility's Service Area.

A Food Service Establishment (FSE) is any person who prepares and/or packages food or beverage for sale or consumption, on or off site, with the exception of private residences so long as the private residence is not used to prepare or package food or beverage for sale. Food Service Establishments include but are not limited to , food courts, food manufacturers, food packagers, restaurants, catering services, bars/taverns, cafeterias, soda fountains, institutions, mobile food vehicles, wing trailers, diners, grocery stores, bakeries, coffee shops, ice cream shops, lounges, hospitals, hotels, nursing homes, churches, schools, and daycare centers.

DEs, which exist, or are newly proposed, constructed; or existing facilities which will be expanded, renovated, remodeled or modified are all subject to the Ordinance, hence should be in compliance with the regulations.

Permitting. (See FOG SOP Figure 5- 2)

The process of compliance is initiated by the Permitting Stage. – All DEs must submit an application for Evaluation, followed by a field inspection by a Compliance Inspector (CI), in order to be permitted. On satisfactory completion of the evaluation and inspection, and the payment of the applicable Fees, a FOG Wastewater Discharge Permit is issued to the DE owner for a period of twelve (12) months, renewable annually. An issued FOG Permit and fees are Nontransferable, and are for a specific DE, for a specific operation and create no vested rights.

A FOG Permit may be subject to conditions or limits which may be reasonably applicable to ensure compliance with the Regulations. The terms and conditions of an issued FOG Permit may be modified by the FOG Control Program Manager (FOG CPM), if he determines that such modification is required to comply with the regulations or the requirements of regulatory agencies which affect the Utility. An DE may also request a modification to the terms and conditions of an issued FOG Permit, by submitting a written request with the reasons for that change. The FOG CPM will review and make a determination on the request within thirty (30) days of receipt of that request.

Inspections. (See FOG SOP Figure 5-2)

Compliance Inspectors (CI) have been authorized to inspect DEs, on an unscheduled, unannounced and/or a scheduled basis. Whereas an DE may be inspected up to four (4) times a year, inspection of a FOG Interceptor shall be performed at frequencies necessary to protect the capacity of the sewer system against the accumulation of FOG in an amount that would exceed the twenty percent (20%) rule.

Inspections shall include all fixtures, equipment, food processing and storage areas, FOG Interceptors, Maintenance Logs and FOG Manifests. On completion of an inspection the CI shall note any deficiencies, to include any violations of the regulations and state law that requires correction by the DE. These deficiencies are to be discussed with the DE, and a copy of the signed Inspection Report shall be given to the DE owner.

Non-Compliance. (See FOG SOP Figure 5-2)

The deficiencies noted by the CI on completion of an Inspection of an DE, is an indication that, that DE is in Non-Compliance with the terms and conditions specified in its Permit, or with any provision of the regulations.

Immediately after an Inspection (as described above), and/or a FOG Evaluation, the DE inspected shall receive a copy of the signed Inspection Report, or a letter indicating the results of the inspection. Any DE determined to be in Non-Compliance will be issued a Letter of Non-Compliance by certified mail. Letters of Non-Compliance shall include a Reinspection Fee/ Non-Compliance Fee, and a description of the conditions being violated, and the immediate course of action the DE shall be required to take to come into compliance.

Violations. (See FOG SOP Figure 5-2)

Failure to comply with a Letter of Non-Compliance is also a violation of the regulations. Upon determination that an DE is non-compliant, the FOG CPM may also issue and require the DE to abide by a compliance schedule. At this time all amounts owed by the DE should be paid in full.

If after two (2) weeks of issuing a Letter of Non-Compliance to an DE, there is no reasonable effort to comply, then the CI may issue a Warning Citation to the DE.

If after four (4) weeks of issuing a Warning Citation to an DE, there is no reasonable effort to comply, then the CI may submit to the FOG CPM documentation to support and justify 'Consideration for a Court Citation' to be issued to the DE.

The FOG CPM will review the 'Consideration for a Court Citation' and submit comments to the appropriate Utility Manager or Director to make recommendations as to the issuance of a Court Citation by the CI to the DE.

The FOG CPM may Suspend or Revoke any Permit when it is determined that a DE:

- fails to comply with the terms and conditions of a Non-Compliance Letter or compliance schedule order
- knowingly provides false statements
- destroys, removes or conceals records/reports

- does not make timely payments of amounts owed
- causes interference, a sewer blockage or a SSO in a sewer system
- refuses to accept a notice by personal service or certified mail
- or any other violation of any provision of the regulations.

When the FOG CPM has reason to believe that grounds exist for a Permit Suspension or Revocation, an Order of Permit Suspension or Revocation should be issued by certified mail to the DE, stating the facts and grounds deemed to exist, together with the time and place where charges shall be heard.

Termination of Water Service. (See FOG SOP Figure 5- 2)

The Utility, by order of the FOG CPM, may physically Terminate Water Service to any DE property, if so ordered by any Order of Suspension or Revocation of a Permit; or any other reason provided for in the regulations.

Emergency Suspension Order/ Suspend Water Service.

The Utility, by order of the FOG CPM, may Suspend Water Service to an DE property, when he determines that such suspension is necessary in order to stop an actual or impending discharge which presents or may present an imminent or substantial endangerment to the health and welfare of persons, or to the environment, or may cause SSOs, sewer blockages, interference to the Utility's sewer facilities, or may cause (Name of Utility) to violate any state or federal law or regulation.

Damages/Penalties.

Any person who discharges any waste which causes or contributes to any of the conditions contained in the Emergency Suspension Order (as described above), shall be liable for all costs required to clean and /or repair the facilities and/or equipment, including expenses incurred by (Name of Utility) to resume normal operations, regulatory fines, penalties, and assessments made by other agencies or a court.

Appendix D

Collection System Maintenance Program Procedures

MAINTENANCE PROCEDURES

MAINTENANCE PROCEDURE 1.1 VACTOR CLEANING			
SCHEDULE Schedule of work orders established under Priority ranking system.			
ACTIVITY DESCRIPTION Combination jet and vacuum cleaning for the removal of accumulations of silt, grease, or other debris from the sewer line.			
ACTIVITY GOALS - To remove medium/heavy accumulations of debris to prevent disruption of sewer service. - To maintain sewer capacity and system integrity. - To target sewer is clean prior to rehabilitation. - To facilitate CCTV inspection of sewer and inspection of defects.			
LABOR		MATERIALS	
Code	Classification	Code	Description
	Preventive Maintenance Crew		Safety equipment - vest, traffic cones and flags, men-working signs, hardhats, steel toed boots. Leather/cloth and impervious gloves, tyvec coveralls, half mask disposable respirators, eye protection, ear plugs, flashlights, life vests, safety harness and ropes. Disinfectants Eye wash Fire extinguisher First aid kit
EQUIPMENT			
Code	Description		
	Combination (Jet/Vactor) Truck Ladder Floodlights or Other Lighting Aids		
SAFETY ANALYSIS			
Safety Check List - Collection and Transmission Systems Safety Program Plan - Protective Clothing and Equipment - Gases and other Hazardous Atmospheres Analysis (Confined Space Entry) - Overhead Power Lines (Electrical Safety) - Underground Services Utilities Locations - Traffic Safety Requirements		Potential Hazards - Infectious Diseases - Slip, Trip, and Fall - Poisonous Snakes, Pests, Insects - Confined Spaces (Confined Space Entry) - Traffic - Vehicle Operation - Mechanical Tools - Electrical Hazards (Electrical Safety) - Flooding and Inundation (Confined Space Entry) - Lifting	

MAINTENANCE PROCEDURES

MAINTENANCE PROCEDURE 1.1 VACTOR CLEANING

ACTIVITY/SUBTASK

1. **Coordinate with other Agencies and Departments to confirm accessibility, permits required, etc.**
2. **Review work order and visit site with crew. (Area Supervisor)**
 - Follow vehicle operation safety procedures.
 - Dispatch maintenance crew to work site.
2. **Determine the location of the manholes on the GIS Map**
 - Locate manhole location on GIS map and identify GIS location number.
 - If manhole access is not visible, use metal detection or other equipment.
3. **Secure work site by placing traffic control signs and safety devices at the work site.**
 - Follow Traffic Safety Procedures
 - Don safety vests, hardhats, safety glasses, etc.
 - Isolate one or more lanes of traffic with flags, cones, traffic control signs, etc., where work in or immediately adjacent to roads exposes a crew member to traffic injuries.
 - Look for overhead power lines that may hit the truck or equipment. If lines are above the work area, contact Power Company to de-energize or shield the lines. Equipment must be kept at least 10 feet from the overhead lines.
4. **Conduct activities in a safe manner**
 - Check sewer main by removing manhole lids.
 - Lift the manhole cover using the hook. Drag the cover with the hook; avoid bending over and using hands whenever possible.
 - For heavier manholes, use a truck-mounted winch.
 - Follow Confined Space Procedures, if necessary.
 - Follow Personal Protection Equipment (PPE) Program
 - DO NOT place your face near the manhole opening. Let the manhole "breathe" for 10 minutes before looking in.
 - DO NOT SMOKE near manholes regardless of whether the cover is on or off.
 - DO NOT STAND on the removed manhole cover.
 - USE IMPERVIOUS GLOVES when working with an open manhole.
 - USE DISPOSABLE TYVEK COVERALLS to keep sewage off of your uniform.
4. **Prepare the Vactor for the cleaning operation.**
 - Locate the Vactor where the jet and suction hoses are within reach of the manhole.
 - Insert jet hose through tigertail footing.
5. **Attach extension and proper nozzle to end of jet hose.**
 - Select nozzle based on reported problem, indications of grease or roots in the line, and the diameter pipe to be cleaned.

MAINTENANCE PROCEDURES

MAINTENANCE PROCEDURE 1.1 VACTOR CLEANING

ACTIVITY/SUBTASK

- 6. Insert jetting assembly into manhole.**
 - Two employees are needed to adjust the jetting assembly.
- 7. Start the Vactor, cleaning upstream in the sewer with the jetting assembly.**
 - Reverse the jet assembly to pull the debris back to the downstream manhole.
- 8. Use the Vactor to pump water and debris from the manhole.**
- 9. Repeat steps 6 and 7 until the line is cleaned.**
- 10. Thoroughly wash manholes — See Manhole Cleaning Procedure 1.4**
 - Keep hands out of the hose assembly while lowering and raising the hose in and out of the manhole.
 - Report any manhole defects noticed during vactoring.
 - Cleanup and disinfect work site if necessary—
- 11. Break down work site and report the work completed.**
 - Replace manhole cover by dragging it with the hook if possible.
 - When manhole cover is in place, remove Tyvek coveralls and place in garbage bag for disposal.
 - Remove disposable respirator and place in plastic bag for reuse (refer to PPE Program).
 - Record linear feet of sewer main/service lateral cleaned on Work Order Form.
 - Complete Service Request, Work Order Form, and log into CMMS
 - Decant the holding tank when full.
 - Fill the unit with water (as needed) and move to the next site.
- 12. Empty the holding tank in the Vactor when it is full.**
 - Transport the removed material to the an approved disposal site.
 - Record volume of disposed material.
- 13. Clean and wash the Vactor at the end of the shift.**

MAINTENANCE PROCEDURES

MAINTENANCE PROCEDURE 1.2 MECHANICAL RODDING

SCHEDULE

Schedule of work orders established under Priority ranking system.

ACTIVITY DESCRIPTION

Mechanical cleaning of grease, roots, or other blockages in sewers up to 12" in diameter by pushing cleaning tools through blockages to clear the line.

ACTIVITY GOALS

- To remove grease, roots, and/or other blockages from sewer mains and service laterals.
- To maintain sewer capacity and system integrity.
- To ensure sewer is 100% clean prior to rehabilitation.
- To facilitate CCTV inspection of sewer and inspection of defects.

LABOR

Code

Classification

Maintenance Crew

MATERIALS

Code

Description

Safety equipment – vest, traffic cones and flags, men-working signs, hardhats, steel toed boots, leather/cloth and impervious gloves, tyvec coveralls, half mask disposable respirators, eye protection, ear plugs, flashlights, life vests, safety harness and ropes.
Disinfectants
Eye Wash
Fire Extinguisher
First aid kit

EQUIPMENT

Code

Description

Rodding Truck
Ladder
Floodlights or other Lighting Aids
Metal Detection Devices

SAFETY ANALYSIS

Safety Check List

- Safety Program
- Protective Clothing and Equipment (Personal Protection Equipment)
- Gases and other Hazardous Atmospheres Analysis (Confined Space Entry)
- Overhead Power Lines (Electrical Safety)
- Underground Services Utilities Locations
- Traffic Safety Requirements (Traffic Safety)

Potential Hazards

- Infectious Diseases
- Slip, Trip, and Fall
- Poisonous Snakes, Pests, Insects
- Confined Spaces (Confined Space Entry)
- Traffic
- Vehicle Operation
- Mechanical Tools
- Electrical Hazards (Electrical Safety)
- Flooding and Inundation (Confined Space Entry)
- Lifting

MAINTENANCE PROCEDURES

MAINTENANCE PROCEDURE 1.2 MECHANICAL RODDING

ACTIVITY/SUBTASK

1. Supervisor review work order and visit site with crew

- Follow vehicle operation safety procedures.
- Dispatch maintenance crew to work site.

2. Secure work site by placing traffic control signs and safety devices at the work site.

- Follow Traffic Safety Procedures.
- Don safety vests, hardhats, safety glasses, etc.
- Crew Supervisor acts as a safety supervisor during process.
- Isolate one or more lanes of traffic with flags, cones, traffic control signs, etc. where work in or immediately adjacent to roads exposes a crew member to traffic injuries.

3. Prepare the rodding equipment for the cleaning operation.

- Locate manhole location on GIS map and identify GIS location number.
- If manhole access is not visible, use metal detection or other equipment.
- Lift the manhole cover using the hook. Drag the cover with the hook; avoid bending over and using hands whenever possible.
- For heavier manholes, use a truck-mounted winch.
- Follow Confined Space Procedures.
- Follow Personal Protection Equipment (PPE) Program.
- Keep employees away from manhole when opening due to dangerous gases.
- DO NOT place your face near the manhole opening. Let the manhole “breathe” for 10 minutes before looking in.
- DO NOT SMOKE near the manholes regardless of whether the cover is on or off.
- DO NOT STAND on the removed manhole cover.
- USW IMPERVIOUS GLOVES when working with an open manhole.
- USE DISPOSABLE TYVEK COVERALLS to keep sewage off of your uniform.
- Two employees are needed to lower the rodding motor from the truck or trailer.
- Check the rod for signs of cracks/stress/rust.
- Two employees are needed to pull the rodding motor.
- Locate the rodding equipment at manhole/cleanout
- Assemble guide pipe to depth of manhole/cleanout.

MAINTENANCE PROCEDURES

MAINTENANCE PROCEDURE 1.2 MECHANICAL RODDING

4. **Attach proper cleaning tool to end of rod.**
 - Handle the cutting/cleaning tool with leather gloves since it is sharp.
 - Select cleaning tool based on reported problem and on indications of grease or roots in the line.
 - Two employees are need to move and place the Rod Guide.
5. **Complete work order and break down work site.**
 - Complete Service Request, Work Order Form, and log into CMMS.

MAINTENANCE PROCEDURES

MAINTENANCE PROCEDURE 1.3 JET RODDING

SCHEDULE

Schedule of work orders established under Priority ranking system.

ACTIVITY DESCRIPTION

Hydraulic cleaning with a high velocity jet machine to remove grease, roots, or other blockages in sewers up to 18" in diameter. Jetting may also be used to thread the camera pull line for CCTV inspection of sewers and wash manholes and catch basins.

ACTIVITY GOALS

- To remove grease, roots, and/or other blockages from sewer mains and service laterals.
- To maintain sewer capacity and system integrity.
- To ensure sewer is 100% clean prior to rehabilitation.
- To facilitate CCTV inspection of sewer and inspection of defects.

LABOR

Code

Classification

Maintenance Jetting Crew

MATERIALS

Code

Description

Safety equipment — vest, traffic cones and flags, men-working signs, hardhats, steel toed boots, leather /cloth and impervious gloves, tyvec coveralls, half mask disposable respirators, eye protection, ear plugs, flashlights, life vests, safety harness and ropes.
Disinfectants
Eye wash
Fire extinguisher
First aid kit

EQUIPMENT

Code

Description

Jetting Truck
Ladder
Floodlights or Other Lighting Aids

SAFETY ANALYSIS

Safety Check List

- Safety Program
- Protective Clothing and Equipment (Personal Protection Equipment)
- Gases and other Hazardous Atmospheres Analysis (Confined Space Entry)
- Overhead Power Lines (Electrical Safety)
- Underground Services Utilities Locations
- Traffic Safety Requirements (Traffic Safety)

Potential Hazards

- Infectious Diseases
- Slip, Trip, and Fall
- Poisonous Snakes, Pests, Insects
- Confined Spaces (Confined Space Entry)
- Traffic
- Vehicle Operation
- Mechanical Tools
- Electrical Hazards (Electrical Safety)
- Flooding and Inundation (Confined Space Entry)
- Lifting

MAINTENANCE PROCEDURES

MAINTENANCE PROCEDURE 1.3 JET RODDING

ACTIVITY/SUBTASK

- 1. Supervisor review work order and visit site with crew (Area Supervisor)**
 - Follow vehicle operation safety procedures.
 - Dispatch maintenance crew to work site.
- 2. Secure work site by placing traffic control signs and safety devices at the work site.**
 - Follow Traffic Safety Procedures.
 - Don safety vests, hardhats, safety glasses, etc.
 - Isolate one or more lanes of traffic with flags, cones, traffic control signs, etc. where work in or immediately adjacent to roads exposes a crew member to traffic injuries.
 - Look for overhead power lines that may hit the truck or equipment. If lines are above the work area, contact Power Company at (xxx) xxx-xxxx to de-energize or shield the lines. Equipment must be kept at least 10 feet from the overhead lines.
- 3. Prepare for Jet Rodding**
 - Locate manhole location on GIS map and identify GIS location number.
 - If manhole is not visible, use metal detection or other equipment to locate it.
 - Lift the manhole cover using the hook. Drag the cover with the hook. Avoid bending over and using hand whenever possible.
 - For heavier manholes. Use a truck-mounted winch.
 - Follow Confined Space Procedures.
 - Follow Personal Protection Equipment (PPE) Program.
 - DO NOT place your face near the manhole opening. Let the manhole "breathe" for 10 minutes before looking in.
 - DO NOT SMOKE near manholes regardless of whether the cover is on or off.
 - DO NOT STAND on the removed manhole cover.
 - USE IMPERVIOUS GLOVES when working with an open manhole.
 - USE DISPOSABLE TYVEK COVERALLS to keep sewage off of your uniform.
- 4. Prepare the jetting equipment for the cleaning operation.**
 - Locate the jetting equipment where jet hose is within reach of the manhole/cleanout.
 - Insert jet hose through tigertail footing.
- 5. Attach extension and proper nozzle to end of jet hose.**
 - Select nozzle based on reported problem, indications of grease or roots in the line, and the diameter pipe to be cleaned.
- 6. Insert jetting assembly into manhole/cleanout.**
 - Two employees are needed to adjust jetting assembly.

MAINTENANCE PROCEDURES

MAINTENANCE PROCEDURE 1.3 JET RODDING

- Tie tigertail footing to manhole lid or work truck for safety measure and to assist in retrieval.
- 7. Set the manhole trap into manhole.**
 - Use manhole trap to catch debris removed during jetting process
 - 8. Operate the jetting equipment, cleaning upstream in the sewer.**
 - Keep track of the location of the jetting assembly in the line on the Work Order Form.
 - 9. Move the jetting assembly approximately 50 feet upstream in the sewer.**
 - 10. Repeat step 7 until the line is cleaned.**
 - Reverse jetting assembly to pull debris back to the downstream manhole.
 - Replace manhole cover by dragging it with the hook if possible.
 - When manhole cover is in place, remove Tyvek coveralls and place in garbage bag for disposal.
 - Remove disposable respirator and place in plastic bag for reuse (refer to PPE Program).
 - Record linear feet of sewer main/service lateral cleaned on Work Order Form.
 - 11. Thoroughly wash manholes**
 - Thoroughly clean area
 - Report any manhole repairs needed.
 - Note evidence of surcharging, broken rims or covers, raised or sunken covers, etc.
 - 12. Break down work site and report the work completed.**
 - Complete Service Request, Work Order Form, and log into CMMS.
 - Fill the unit with water from hydrant (as needed) and move to the next site.
 - 13. Clean and wash the jetting equipment and the jetting truck at the end of the shift.**

MAINTENANCE PROCEDURES

MAINTENANCE PROCEDURE 1.4 MANHOLE CLEANING

- 1. Supervisor review work order and visit site with crew**
 - Follow vehicle operation safety procedures.
 - Dispatch maintenance crew to work site.
- 2. Secure work site by placing traffic control signs and safety devices at the work site.**
 - Follow Traffic Safety Procedures.
 - Don safety vests, hardhats, safety glasses, etc.
 - Isolate one or more lanes of traffic with flags, cones, traffic control signs, etc. where work in or immediately adjacent to roads exposes a crew member to traffic injuries.
- 3. Determine the location of manhole.**
 - If manhole is not visible, use metal detection or other equipment to locate it.
 - Lift the manhole cover using the hook. Drag the cover with the hook; avoid bending over and using hands whenever possible.
 - For heavier manholes, use a truck-mounted winch.
 - Follow Confined Space Procedures.
 - Follow Personal Protection Equipment (PPE) Program in the Collection and Transmission Systems Safety Program Plan.
 - Keep employees away from manhole when opening due to dangerous gases.
 - DO NOT place your face near the manhole opening. Let the manhole 'breathe' for 10 minutes before looking in.
 - DO NOT SMOKE near manholes regardless of whether the cover is on or off.
 - DO NOT STAND on the removed manhole cover.
 - USE IMPERVIOUS GLOVES when working with an open manhole.
 - USE DISPOSABLE TYVEK COVERALLS to keep sewage off of your uniform.
- 4. Break down work site and report the work completed.**
 - Replace manhole cover by dragging it with the hook if possible.
 - When manhole cover is in place. Remove Tyvek coveralls and place in garbage bag for disposal.
 - Remove disposable respirator and place in plastic bag for reuse (refer to PPE Program).
 - Complete clean up of work site.
 - Complete Service Request, Work Order Form, and log into CMMS.