

# Collection System Maintenance: Part 2

## "Your Road to Sewer Rehab"

Conducting a Rehabilitative  
Tour of your Subterranean  
Sewage Collection System

### FEATURING:

Sewer Cleaning  
Root Removal  
Mainline Rehabilitation  
Manhole Rehabilitation  
Lift Station Maintenance  
Illegal Connections



Municipal Staff Tours Begin Here

# SEWER TOUR MYSTERIES PRESENTS



## Part 2: Rehabilitative and Repair Tours

A collection system is an underground network of both sanitary and storm water collection lines. Your tour begins as you evaluate the information from the investigation of the subterranean areas beneath your streets that assessed the location and condition of your collection system. During the investigative tour, you used flow monitoring, smoke testing, sewer line testing, manhole inspections, lift station inspections, and/or private sewer inspection methods to identify problem areas in your collection system.

This brochure explains the methods you can use in rehabilitating and repairing the defects identified in your collection system. You may choose to use one or more of these corrective methods. Once your rehabilitation and repairs are completed, you will have removed or repaired:

- Excess groundwater and rainwater (also referred to as Infiltration and Inflow or I/I) that enters the collection system from cracks and holes in sewers and manhole covers.
- Constrictions in sanitary sewer pipes caused by scum, dirt, oil, grease, and tree roots.
- Cracked and broken pipes.
- Corroded pipes and manhole covers.
- Illicit discharges of cooling water and other fluids.
- Illegal plumbing connections.

These repairs prevent overflows and basement backups of untreated wastewater that can spread disease and cause environmental damage. A wastewater system is usually a community's largest infrastructure investment. Identifying and fixing problem areas in your sewage collection system maximizes the useful life and performance of this asset, and also protects the public health and welfare of your community. Enjoy the tour – and ensure your community's health!

# Sewer Cleaning

There are several ways to clean sewers. Hydraulic, mechanical, or chemical methods are the most common.

Hydraulic methods use high-pressure streams of water aimed at the sewer surfaces. High-velocity cleaners can be either truck mounted or trailer mounted. Vacuum units may be added to a high-velocity cleaner to remove debris such as sand, silt, or other materials. It is important to remove sand and gravel at the nearest downstream manhole. Debris materials washed downstream in the sewer can cause problems at pumping stations and treatment plants.

**Flushing:** A heavy flow of water is introduced into the line at a manhole to remove lighter deposits of settled inorganic matter and grease buildups.

**Jetting:** High velocities of water are directed against pipe walls to remove and flush more difficult materials. This method removes heavier debris, grease build-up, other clogs, and cuts roots within small diameter pipes. Jetting is efficient for routine cleaning of small diameter, low-flow sewers.

**Balling:** High velocities of water are forced through a threaded rubber cleaning ball that spins and scrubs the pipe interior. The ball is attached to a restraining cable. This method removes deposits of settled inorganic material and grease build-up. Balling is most effective for sewers ranging in size from 5-24 inches.

Mechanical methods use devices that scrape, cut, or pull material from the main line gravity sewer.

**Bucket:** A machine equipped with a set of special winches pulls a bucket through the pipe to collect and remove debris. The bucket has one end open with the opposite end having a set of jaws. It partially removes silt, sand, gravel, and some types of solid wastes.

**Rodding:** An engine and a drive unit rotate blades that break up grease deposits, cut roots, and loosen debris. This method does not have the ability to remove debris from the collection system and is not effective for removal of sand or gravel. Rodding is most effective in up to 12 inch diameter sewers.

**Cable Machines:** These machines operate similarly to a bucket machine except they are usually truck-mounted with a winch. Cable Machines are very effective in large diameter sewers.

Chemical cleaning methods include the application of chemicals as foams, dusts, or liquids formulated for collection system use. Tree root retardants are applied to retard the growth of roots in the wastewater collection system. Grease can also be cleaned from sewers with enzymes, hydroxides, caustics, biocides, and neutralizers.

# Root Removal

Tree roots enter sewer pipes through cracks, breaks, and joints. Root masses inside collection system pipes can become matted with grease, toilet paper, and other debris. Uncontrolled tree root growth can eventually fracture sewer pipes and cause extensive damage. Clay tile pipe that was commonly installed until the late 1980s is more easily penetrated and damaged by tree roots. Plastic PVC pipe is more resistant to root intrusion because it typically has fewer joints.

The most common methods of removing roots from the collection system are with augers, root saws, and high pressure flushers.

**Augers:** These are metal attachments connected to cable machines that spin and cut root masses.



**Root Saws:** These are usually circular metal attachments with sharp metal teeth connected to cable machines that rotate to grind and cut root masses.

**High-pressure Flushers:** A high-pressure flusher is inserted into a sewer from a nearby manhole and roots are pulverized with high-velocity water.

# Mainline Rehabilitation

Trenchless mainline sewer rehabilitation methods do not require digging up the sewer to make repairs. Rehabilitation methods to control infiltration in mainline sewers include:

**Chemical Grouting:** Grouting is a soil sealing process that uses a two-part liquid chemical grout that solidifies after curing. The grout is remotely applied under pressure to leaking joints, laterals, and small cracks in sewers and manholes.

**Fold and Form Liner:** A folded thermoplastic pipe is pulled into place through a manhole and then rounded, using heat, steam, and air pressure to conform to the internal diameter of the existing pipe.



**Slip Lining:** An access pit is excavated adjacent to an existing sewer and a liner pipe of slightly smaller diameter is slid into the existing pipe to create a continuous, watertight liner between the two manholes.

**Cured-In-Place (CIP) Lining:** An internal liner is formed by inserting a resin-impregnated felt tube through the manhole into the sewer. The liner is then expanded against the inner wall of the existing pipe and allowed to cure.

**Pipe Bursting:** An access pit is excavated adjacent to an existing sewer and the pipe is broken outward by means of an expansion tool. A flexible liner pipe of equal or larger diameter is pulled behind the bursting device as a replacement sewer

# Manhole Rehabilitation

Most manholes need rehabilitation or repair due to these three main problems:

- Infiltration of groundwater and rainwater at manhole rings, through loose mortar and precast joints, and around mainline connections.
- Structural fatigue from traffic loading, shifting and expanding soils, and temperature variations.
- Corrosion from microbiological agents and hydrogen sulfide.

There are six basic types of manhole rehabilitation:

**Mechanical Seals:** Ethylene, polyethylene, diene, monomer rubber, and stainless steel expansion rings can be used for joints between barrel sections of manholes.

## Manhole Cured In-Place (CIP)

**Technology:** Manhole surfaces are pressure washed, and leaks are grouted, sealed, and cured-in-place with resin impregnated liners or spray-applied epoxy. Resin impregnated liners are inflated inside of the manhole and cured using steam or hot water. A spray gun is used for the direct application of epoxy.

**Resealing or Replacing Ring and Cover:** To reseal or replace a manhole, old grout and mortar are removed, exposed surfaces are cleaned, new mortar and grout are applied, desired grade is checked, and a new ring and cover are set.

**Grouting:** Polyurethane or expansive grouts are injected into prepared surfaces of the manholes to seal fractures and prevent infiltration.

**Complete Structural Rehabilitation of a Manhole:** A new fiberglass, polyvinylchloride (PVC) or polyethylene (PE) liner is installed from the top of the manhole to the bench.

**Mortar Coating:** Manhole surfaces are pressure washed, and leaks are grouted and sealed prior to the application of a ½-inch or more mortar to the entire surface of the manhole.



# Lift Station O & M

Follow the equipment manufacturer's recommendations on maintenance of the following during the warranty period:

- Lubrication of bearings.
- Oil changes.
- Parts.

## Safety Caution:



Sanitary sewers may contain harmful gases such as hydrogen sulfide or methane, or low concentrations of oxygen. Hydrogen sulfide gas is produced by anaerobic bacteria in slow moving wastewater. This gas is a major source of odors in collection systems and smells like rotten eggs. Heavier than air, hydrogen sulfide gas is often in the lower portion of manholes.

If the concentration of hydrogen sulfide or methane gas is high enough, unconsciousness will come suddenly to workers exposed to this gas. Each collection system utility should have a confined space safety program that includes a written plan, entry procedures, and the appropriate three gas monitoring meters for hydrogen sulfide, methane, and oxygen.

When entering a manhole, use the proper safety harness, calibrated gas detection devices, and ventilation equipment. For more information, see the Occupational Safety and Health Administration confined space regulations at this web site: <http://www.osha.gov/SLTC/confinedspaces/index.html>



## Illegal Connections and Illicit Discharges

Residences and businesses should be required to remove the following types of connections into the collection system unless they are permitted discharges:

### Illegal Connections

- Roof downspouts
- Groundwater sump pumps
- Foundation drains
- Drains from window wells/driveways

### Illicit Discharges

- Cooling and heating waters
- Chemical discharges

## Cleaning Plastic Pipes:

High-velocity cleaning methods are the best choice when cleaning plastic sanitary sewer pipe. Power rodders can be used to carefully remove obstructions, but there is the possibility of damaging plastic pipes. Mechanical cleaning tools should not be used in plastic pipes because they can score the pipe and increase pipe wall roughness. Scoring and roughness reduce the rate of flow of wastewater through the pipe. A pipe identification system should be in place to warn maintenance crews where plastic pipe has been installed so the appropriate cleaning method can be used.

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## Credits/Contacts:

This brochure can be downloaded from: <http://www.dnr.state.wi.us/org/water/wm/ww/cmar/brochures.htm>

References used in the production of this brochure:

- “Methods to Control Leaks in Sewer Collection Systems”, October 2004, University of Houston.
- “Optimizing Operation, Maintenance, and Rehabilitation of Sanitary Sewer Collection Systems”, December 2003, New England Interstate Water Pollution Control Commission.
- “Collection Systems O&M Fact Sheet: Sewer Cleaning and Inspection”, September 1999, United States Environmental Protection Agency.

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For information on collection system operation and maintenance classes, see the University of Wisconsin, Madison, Department of Engineering Professional Development web site: [epd.engr.wisc.edu](http://epd.engr.wisc.edu).

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