Municipal Technical Advisory Service
INSTITUTE FOR PUBLIC SERVICE

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# Wastewater

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Dear Reader:

The following document was created from the MTAS website (mtas.tennessee.edu). This website is maintained daily by MTAS staff and seeks to represent the most current information regarding issues relative to Tennessee municipal government.

We hope this information will be useful to you; reference to it will assist you with many of the questions that will arise in your tenure with municipal government. However, the *Tennessee Code Annotated* and other relevant laws or regulations should always be consulted before any action is taken based upon the contents of this document.

Please feel free to contact us if you have questions or comments regarding this information or any other MTAS website material.

Sincerely,

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# Table of Contents

# Wastewater

**Reference Number:** MTAS-367

Click on the topics below in this section for more information.

# Developing a New Sewer System

**Reference Number:** MTAS-572

### *Why Build a New Sewer System?*

The usual reasons are:

- To solve health, environmental and ground water concerns caused by failing septic tanks/ drainfields;
- To attract new or expanded commercial/business/industrial growth;
- To serve new residential growth; and
- To preserve and increase property values.

### *What to Consider*

- Are citizens in favor of centralized sewer service? City leaders may have to do an extensive job of public education to get the residents on-board with the idea.
- Sewer systems provide a valuable service. The primary reasons for having a sewer system are public health environmental protection and growth. Having well designed and well operated centralized sewer likely will increase property values and business tax revenues.
- If your city decides to develop a sewer system, mandatory hookup is a must. For financial viability, cities with standalone sewer systems (those where the town does not own the water system) should require mandatory hookup where sewer is available. Many lenders require mandatory hookup. If a city is able to avoid mandatory hookup requirements, at a minimum all properties where sewer is available, but who choose not to hookup, should be charged a minimum bill. Where old structures are demolished and new ones built, the new structures should have mandatory hookup requirements.
- The financial capability of the sewer system is subject to state law and enforcement. The Water and Wastewater Financing Board, under the state comptroller, regulates financial capability of municipal water and sewer systems. Those systems must be operated as enterprise funds (be financially self sufficient, i.e., revenues from user fees must cover expenses).
- Building a new sewer system may be the biggest project any community ever undertakes. It will be administratively and financially challenging, especially in the first few years.
- Sewer systems will change your community. For growth to occur, centralized sewer service must be available. Growth will occur where centralized sewer service is available.
- When city A's wastewater is treated and discharged by city B and city B owns the national pollution discharge elimination system (NPDES) permit, there are advantages and disadvantages for city A.
    - The advantage is that the contributing city (city A) does not have the liability of the NPDES permit and does not have to operate and maintain a sewage treatment plant.
    - The disadvantages are that city A is dependent on city B for short-term and long-term capacity to handle wastewater from city A in its lines and its plant. City A has no control over rates passed on by city B.

- If city B treats wastewater from city A, a contract satisfactory to both sides must be developed. City A will still have the administrative, financial, and operating and maintenance responsibilities that go along with operating a sewer collection system. Considerations include:
    - A contract between two municipalities that includes the following and is prepared and or reviewed by an attorney:
        - Identifies parties and purposes;
        - Specifies each party's responsibilities;
        - Clearly specifies any capacity guarantees;
        - Addresses sewer use ordinance differences and industrial pretreatment permitting if applicable;
        - Has a dispute resolution and/or termination clause;
        - Is specific about what rates are to be charged and how, how often and on what basis they can be changed;
        - Describes the services to be performed;
        - Stipulates how and when payments are to be made;
        - Includes an indemnity or hold harmless clause; and
        - Includes a severability clause.
    - Administrative responsibilities:
        - Developing and managing the contract between the two cities;
        - Planning, engineering, and construction responsibilities and managing those functions, for instance, procuring engineering services and obtaining easements;
        - Procuring financing for the project, including setting tap fees; connection fees, capacity fees, and clearly defining what each of terms means. There is often significant confusion on the meaning of these terms and what is or is not included in the fees.
        - Keeping residents and businesses informed;
        - Developing policies and procedures such as a sewer use ordinance and customer forms such as applications;
        - Determining how billing and revenue collection will be done;
        - Setting sewer rates; and
        - Receiving and handling complaints.
    - Operation and Maintenance
      Determining who will be responsible for operation and maintenance and managing the work, i.e., will you hire certified operator(s) or contract for these services?
    - Funding the project
        - Several options for grants and loans are available. The city will have to decide how to proceed on funding questions.
        - Be aware that the cost of installing a sewer main is only part of the costs. The construction costs to install collector sewers to residences that are widely dispersed can be enormous.

# How to Proceed and Costs Involved

**Reference Number:** MTAS-804

### *How to Proceed*

- Retain an engineering firm to propose viable alternatives and cost estimates.

- Be in charge. Don't turn the project over entirely to your engineer. Appoint a champion — a person or committee who will coordinate the project, devote time to it and promote it.
- Get buy-in from as many local groups and citizens as possible. Develop a consistent message about why you are doing this.
- Ask for free help from state agencies. Check out cities that have been through this process, and talk to them and learn from their mistakes.
- Have realistic expectations. Keep your eyes wide open. Don't get tunnel vision by listening to one way of doing things and thus not considering other options. Check out everything.
- Organize. Have a written list of action steps and concrete plans. Work your plan, but stay loose and flexible.
- Keep excellent detailed records of all contacts, costs, etc.

### *How Much Will it Cost?*

Probably far more than anyone initially thought. Be cautions comparing your expectations. The sewer bills for new systems are often far higher than those of an old established system. The single most important factor in the costs will be the infrastructure installation followed by the quality of system management. There usually are many different methods that a city can choose from to provide sewer service, for instance, the city could:

- Build collection lines and a discharging plant;
- Build collection lines and a non-discharging treatment system such as a drip field discharge (originally applied only to small systems or subdivisions but increasingly is used for larger systems including some small cities);
- Build collection lines and a trunk line to another city and discharge into a neighboring city's system;
- Allow a neighboring city to build collection mains within your city limits. The neighboring city would "own" all the system and serve customers directly. Your city would have no vested interest in the sewer system, but could benefit from the growth that will occur; or
- Allow a private company to build and operate a sewer system within your city limits.

### *When?*

- Set goals and deadlines for when certain actions must occur. This will require close communication with other parties involved in the project. Don't get into a situation where you have to make crisis decisions. Allow enough time to think things through and get the information you need to make good decisions. Make sure you understand the financial consequences of your decisions.
- If seeking grants, become aware of application deadlines.
- A note about grant funded projects. The infrastructure constructed with grant funds must be depreciated and rates must cover that depreciation.

### *Where?*

- Phasing in sewer systems may make sense for your city especially if houses are widely dispersed. Again, know WHY you are installing sewers.
- Start with areas of greatest need. Plan and budget to add other areas later.

### *Who?*

Again, appoint a spokesman or committee who will commit the time and effort it will take to make this project successful. Consider the skills needed — good communication skills, organizational capabilities, etc.

See Steps to a Successful Utility Construction Project [1] for more information on this topic.

## Managing Infiltration Inflow in Wastewater Collection Systems

**Reference Number:**

MTAS-587

### *What Is Infiltration/Inflow (I/I)?*

Infliltration is water that enters the sewage collection system from the soil through foundation drains, defective pipes or joints and faulty connections (i.e., ground water).

Inflow is water that enters the sewage collection system from sources such as roof down spouts, basement and yard drains and cross connections with drainage lines (i.e., surface or rainwater).

If you have a wastewater collection system, chances are you have infiltration and inflow (I/I) problems. A third party engineer located in Tennessee says Tennessee sewer utilities average 47percent I/I. Many systems have recognized I/I problems, but they are not addressed because the problems seem overwhelming — both in terms of money and manpower.

### *Is It Really I/I?*

When an overflow occurs in the system, you may think it is I/I. But, it could be

- debris, roots, or grease in the system, restricting flow;
- sags in lines;
- protruding taps;
- collapsed lines due to corrosion;
- design bottlenecks;
- pump station problems — leaking check valves, improperly sized impeller, improperly sized motor, impeller wear, etc.; or
- forced main issues — corrosion, sedement, air locking, etc.

These are mostly operations and maintenance issues which can be identified and corrected with diligent operations and maintenance.

## Managing Infiltration Inflow

**Reference Number:** MTAS-1457

There are two ways to manage infiltration and inflow problems — the outside expert way or the operator's way. The first way is usually an expensive and slow approach that may or may not prove effective. The operator's way is generally less expensive and often produces quicker results. However, like the traditional way, it may or may not prove effective. The best approach may be a combination of the two.

### *The Traditional Way: Bring in the Outside Experts*

Bring in the Outside Experts to conduct a Sanitary Sewer Evaluation Study.

### *The Operator’s Way: Use In-House Resources*

Use In-House Resources

- Map the sewage collection system.
- Get flowcharts from the treatment plant and pump station capacities. Also get run times. (*Note: this requires run time meters at all pump stations.*) Pump capacities can be obtained from the manufacturer's literature or the wastewater system's equipment specifications.
- Install long-term flow monitors at key location throughout the system.
- Staff members who know the collection system best should study the map and list the most likely areas for I/I. Use pump run times (*you will need data through a wet and dry season*), records of overflows, rainfall records and knowledge of the collection system.
- Locate and document all overflows at pump stations, including complaints of sewage backups, surcharging manholes and so forth.
- Start with the worst areas (*based on information from Steps 3 and 4 above*) and physically walk the sewer lines to look for problems.

- Do nighttime flow isolations. If there is water in the line at night, it is probably coming from an I/I source.
- Check maintenance practices: Clean the lines, manholes, forced mains, siphons.
- Investigate the system repeatedly in all seasons and differing weather conations. Use visual, smoke, dye, temperature, and CCTV techniques.
- If the line is lower than the ground water table, televise it. If it is above the ground water table, smoke test.
- Fix the inflow points, and bundle the infiltration location information for use by consulting engineers.

If the problem is mostly system-wide infiltration, the traditional way may be the best approach. If the problem is mostly inflow, the operator's way may be the best approach. A study of the outsde expert way and the operator's way shows that they have many elements in common. Therefore, it is easy to switch to the traditional way if the operator's way does not yield results.

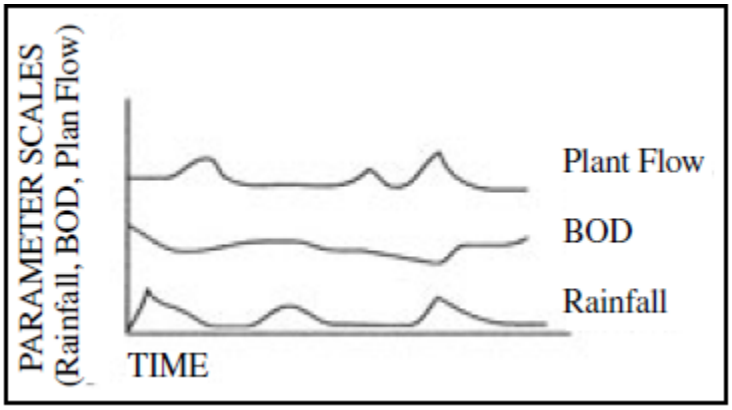
To help decide whether you should use the traditional way or the operator's way to solve I/I problems, you must first define the problem.

## Defining the I/I Problem

**Reference Number:** MTAS-791

To help decide whether you should use the traditional way or the operator's way to solve I/I problems, you must first define the problem.

**Document and be as specific as possible.** Use complaint records. Does sewage back up in Mr. Johnson's basement every time it rains? Use influent biochemical oxygen demand (BOD) and suspended solids (SS) data. Weak (or low) BOD and SS influent readings usually indicate dilution of sewage by extraneous water. Use rainfall records. It is easier to see the impacts if the data is plotted on a graph. At the wastewater plant, post a running record of these parameters.




**Identify and Document Problem Areas.** Operators generally know the manholes that surcharge, pump stations that overflow, and lines that run full during rainfall events. Document the information.

**Discuss the Information.** Using the map, operator's knowledge of the system and data you've collected, ask the following:

- Do influent flows spike up during a rainfall event then go down quickly? If so, suspect roof leader, storm sewer or surface drain cross-connections. If flow jumps up and declines slowly, suspect stream inflow and/or groundwater infiltration.
- Where do lines cross creeks? Do the creeks stay up about the same length of time as the flow in ;the lines?
- Where are likely cross-connections with drainage lines or roof downspouts?
- Do lines pass through swampy areas or near springs?

- What color is the plant influent during a heavy rainfall? Normal raw wastewater is gray. If the influent is muddy, you may have an inflow source.
- Are grinder pumps located in depressions or near down spouts?

**Look, Listen, Document and Analyze.** Take a close look at the system. Walk the lines, open manholes, and make notes of the following:

- Surface depressions, cave ins, or road collapses;
- Debris in inverts;
- Broken manhole lids;
- Brick manholes showing active I/I;
- Clear flow in lines;
- Unusual flows; and
- Sluggish flow.

# Develop an Infiltration/Inflow Correction Plan

**Reference Number:** MTAS-792

### *What Are You Trying to Solve?*

Not every problem has a cost-effective solution. What is the benefit-to-cost ratio? It should be 1.0 or greater.

- Is there environmental damage? Are there health problems? Are regulatory agencies pressuring the town to solve its I/I problems?
- Are you trying to eliminate lift station overflows or excessive pumping costs?
- Are you trying to reduce treatment costs?
- Are you trying to solve a specific problem — solids washout of the treatment plant, a backup in Mr. Smith's basement.
- Reduce potential regulatory or legal liability.

### *Develop an I/I Correction Plan*

At this point, you have in mind what you want to accomplish and why. You have accumulated data to help identify where the worst problems are, and you have ruled out other possible causes of the high water problems. During this process, you will be able to assess how much time and expertise you have in house for solving I/I problems. Now you are ready to tackle solutions. If you have decided your staff does not have the time, equipment, and/or expertise to identify, analyze and fix the problems, it is time to hire consultants and contractors.

If you can use in house resources to further identify, analyze and fix I/I problems, here are some tips:

- Look at the geologic and topographic conditions for the part of the system you will be working on first. Is the collection system under the ground water table? If yes, use nighttime flow isolation, televising the lines and flow monitoring to get more information. If no, use smoke testing, rainfall simulation, dye testing and flow monitoring to gain more information. In either case, use physical inspection of manholes. They can be big sources of I/I. Brick manholes are especially subject to I/I. Manhole covers that are in depressions, near streams or in streets or other areas subject to sheet runoff are subject to I/I.
- Focus on interceptors (large sewers), especially those near creeks. They can carry more I/I on a per-inch basis than smaller lines. For this reason, many sewer line rehabilitation experts advocate working from the sewer plant up to the system and not from the dead ends down.

- Size up the magnitude of the problem and what it is going to cost. Does the town need to borrow money and make an all out effort to improve the system? Or does a phased approach interest the town's governing body? First, you will have to answer why you have decided to fix I/I problems. Once you get the present I/I crisis solved by either the traditional way or the operator's way, MTAS strongly advocates annual budgeting for collection system maintenance. The goal is to strengthen the collection system infrastructure in order to minimize future I/I problems.

### *Rehabilitate the System*

Use in house and/or outside expertise to fix the problems. Until your operators have experience with repair methods, outside contractors will be needed to make many of these repairs. Rehabilitation methods include:

- Point repairs;
- Cured in place pipe lining;
- Grouting;
- Manhole liners, coatings, and specialty seals;
- Pipebursting;
- Root control; and
- Line replacement.

Experience has shown that groundwater migrates along sewer pipes, sometimes for long distances. Because of migration rehabilitation starting low in the system is the recommended strategy. Also when working on a section of pipe, always renew all mains, taps, and service lines to a level above the groundwater,  When possible include groundwater dams along pipes especially PVC to reduce the migration. A good rehabilitation strategy should reduce I/I in the renewed area by 50 percent. I rehabilitation work is successful, expect the former I/I water to appear at some other location.

In rehabilitation or new construction, 100 percent inspection is recommended.

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**Links:**
[1] http://www.mtas.tennessee.edu/reference/steps-successful-construction-project