

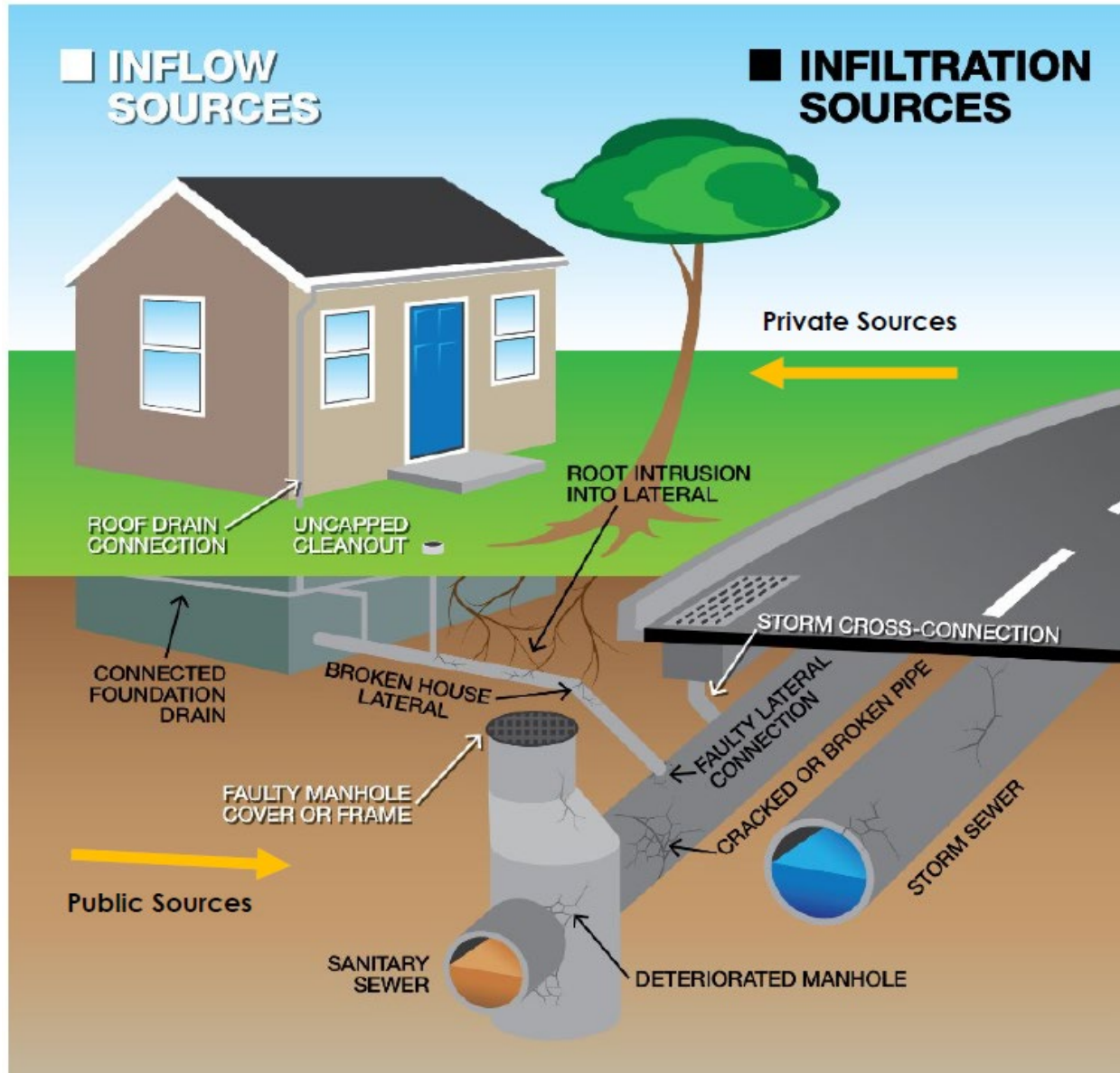
Inflow and Infiltration

Not all sewers are the same, and they certainly are not designed the same. Sanitary sewers are generally smaller in diameter and are meant only for normal wastes generated by flushing the toilet, showers, sinks, dishwashers, and washing machines – these are generally predictable. Storm sewers on the other hand are generally larger diameter and are meant for storm water and other clear water (rainwater, melted snow, runoff from lawns, roadways, rooftops, basement drains, footer drains, sump pumps, etc.) – these are generally unpredictable in terms of occurrence, frequency, and quantity.

Most local sanitary sewers are 8" diameter gravity sewer pipes. Modern Stark County Sanitary Engineering (SCSE) standards require 8" sanitary sewers to be installed with a slope of no less than 0.50%, which equals a 6" drop in elevation for every 100 feet of pipe. This minimum slope results in a maximum flow capacity of approximately 380 gallons per minute (gpm) or a total daily volume of about 550,000 gallons. This is generally more than sufficient for local sewers, but not when that capacity is taken up by clear water illegally entering the sanitary sewer system.

Sanitary sewers and storm sewers are not to be interconnected. It is prohibited for sanitary wastes to be transported through storm sewers and discharged into the environment because they require treatment. It is irresponsible and wasteful (not to mention illegal under The Clean Water Act of 1972) to allow clear water to enter sanitary sewers because it unnecessarily uses sanitary sewer capacity and requires treatment resources that would otherwise not be needed. Yet clear water does still enter our sanitary sewer system, which it is not designed to handle. This clear water is called inflow and infiltration, more commonly referred to as "I&I", and some of its sources include:

- Inflow (storm/clear water misdirected into the sanitary sewer system):
 - Illegal sump pump connections to the sanitary sewer system
 - Illegal downspout and/or footer drain connections to the sanitary sewer system
 - Illegal yard drain connections to the sanitary sewer system
 - Missing or removed lateral cleanout caps
 - Missing, damaged or open hole manhole lids
 - Storm-sanitary cross connections
- Infiltration (groundwater seepage into the sanitary sewer system):
 - Leaky private lateral connections (cracked or broken pipes, separated joints, root intrusion, etc.)
 - Aging county system infrastructure (cracked or broken pipes, offset or broken joints, leaking manholes, etc.)



Typical Sources of I/I in Sanitary Sewer Systems (Source WEF, 2017)

SCSE focuses considerable ongoing efforts, including millions of dollars in annual capital repair projects, to eliminate I&I. In doing so, SCSE's goal is to provide reliable sanitary sewer service, free from sewer backups, at the lowest possible cost to customers. SCSE uses several methods to discover sources of I&I, that include the following:

- flow monitoring data
- sanitary sewer smoke testing
- robotic camera inspections of the public sanitary sewers
- other reported customer concerns
- periodic inspections of manholes
- dye testing

SCSE then tailors and develops the best corrective approach for each source discovered.

SCSE prioritizes identifying and eliminating clear water connections since they have a severe limiting effect on sanitary sewer systems. It is easy to understand how. For example, an 8" sanitary sewer can be overwhelmed in a short time during even a moderate storm event of ½-inch of rainfall per hour, when you consider the following possible illegal connections:

- A typical 1,500 square foot home (footprint including the garage) with downspouts connected to the sanitary sewer has the potential to introduce about 8 gpm⁽¹⁾ of clear water into the sanitary sewer system – 48 such connections are enough to exceed the sewer capacity
- A common 1/3 horsepower sump pump will easily pump about 35 gpm of clear water – 11 such connections are enough to exceed the sewer capacity
- A ¼-acre yard, parking lot, or similar area that drains through a connection to the sanitary sewer has the potential to introduce about 56 gpm⁽²⁾ of clear water into the sanitary sewer system – 7 such ¼-acre areas are more than enough to exceed the sewer capacity

Further consider that on average, the Canton area receives about 39 inches of rainfall each year. As a result:

- Each typical 1,500 square foot home (footprint including the garage) with downspouts connected to the sanitary sewer has the potential to add over 36,000 gallons⁽³⁾ of clear water directly into the sanitary sewer system each year
- Each ¼-acre yard, parking lot, or similar area that drains through connections to the sanitary sewer has the potential to add over 250,000 gallons⁽⁴⁾ of clear water directly into the sanitary sewer system each year

Factor in any number of the other I&I sources, and you also begin to realize how quickly the sanitary sewer capacity can be exceeded, and how unhealthy overflows and/or costly backups into private residences can easily occur. Not only that, but all that clear water ultimately costs everyone more to pump and treat at the wastewater treatment plant.

For those of you who like to see the math, here you go:

$$(1) \quad 1,500 \text{ ft}^2 * \frac{\frac{1}{2} \text{ in}}{1 \text{ hr}} * \frac{144 \text{ in}^2}{1 \text{ ft}^2} * \frac{1 \text{ ft}^3}{1,728 \text{ in}^3} * \frac{7.48 \text{ gal}}{1 \text{ ft}^3} * \frac{1 \text{ hr}}{60 \text{ min}} = \pm 8 \frac{\text{gallons}}{\text{min}}$$

$$(2) \quad \frac{1}{4} \text{ acre} * \frac{\frac{1}{2} \text{ in}}{1 \text{ hr}} * \frac{43,560 \text{ ft}^2}{1 \text{ acre}} * \frac{144 \text{ in}^2}{1 \text{ ft}^2} * \frac{1 \text{ ft}^3}{1,728 \text{ in}^3} * \frac{7.48 \text{ gal}}{1 \text{ ft}^3} * \frac{1 \text{ hr}}{60 \text{ min}} = \pm 56 \frac{\text{gallons}}{\text{min}}$$

$$(3) \quad 1,500 \text{ ft}^2 * \frac{39 \text{ in}}{1 \text{ year}} * \frac{144 \text{ in}^2}{1 \text{ ft}^2} * \frac{1 \text{ ft}^3}{1,728 \text{ in}^3} * \frac{7.48 \text{ gal}}{1 \text{ ft}^3} = 36,465 \frac{\text{gallons}}{\text{year}}$$

$$(4) \quad \frac{1}{4} \text{ acre} * \frac{39 \text{ in}}{1 \text{ year}} * \frac{43,560 \text{ ft}^2}{1 \text{ acre}} * \frac{144 \text{ in}^2}{1 \text{ ft}^2} * \frac{1 \text{ ft}^3}{1,728 \text{ in}^3} * \frac{7.48 \text{ gal}}{1 \text{ ft}^3} = 264,736 \frac{\text{gallons}}{\text{year}}$$

I&I source identification and elimination can result in significant long-term improvement to the sanitary sewer system in a relatively short period of time. This is why it is so important to find and eliminate them – which is the more economical and cost-effective action versus costly expansions of wastewater treatment plants and replacing sanitary sewers with larger pipes. SCSE will continue to use our tools to discover and mitigate I&I, but we are only authorized to repair the county owned infrastructure in the right-of-way. Below are just some of the ways that our customers can help us remove storm water from their properties:

- Disconnect any known illegal stormwater connections to the sanitary sewer such as downspouts, yard drains, basement footer drains, and sump pumps – all of these can be redirected to storm sewers or ditches, and there are even several reuse options available like rain barrels and cisterns
- If your sanitary lateral has a cleanout, make sure that the cap is not leaking, missing or damaged – and if it is, replace it with a new one that seals properly; we suggest burying the cap to reduce the possibility of future damage
- Have your private sanitary lateral inspected and repaired as needed by a licensed and registered drain layer – please contact SCSE for a current list
- Avoid planting any shrubs or trees above sanitary laterals, as over time the roots can damage the pipe and/or joints and cause leaks, blockages, or backups
- Avoid installing fence posts, playground structures, pole buildings, decks, or similar structures above sanitary laterals for the same reasons
- Always contact the Ohio Utilities Protection Service before any digging to have your lateral marked to prevent potential damage:

1-800-362-2764 or 811

- Report any suspected I&I issues or concerns to the Stark County Sanitary Engineering Department:

1701 Mahoning Road NE

PO Box 9972

Canton, OH 44711-0972

Phone: (330) 451-2303

Email: scse-inflow@starkcountyohio.gov

It is in all our best interests to eliminate sources of I&I – because we all benefit as we eliminate I&I sources. Not only can we gain back lost capacity of our sanitary sewer system and reduce the occurrence of backups and wet weather overflows, but the costs to provide sanitary sewer service become more efficient, and sanitary sewer service becomes that much more reliable.

↓ Inflow/Infiltration = ↓ Operations ↓ Treatment ↓ Labor ↓ Maintenance = ↑ Reliability

Working to efficiently serve our customers and protect our environment.