# WASTEWATER 101

## Part 2
## How is wastewater collected?

NWBE

# Wastewater Surveillance Program
# Water Environment Federation

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nwbe@wef.org

# DISCLAIMER

Development and production of this material was made possible through funding from the US Centers for Disease Control and Prevention (CDC) to the Water Environment Federation (WEF) under Cooperative Agreement CK20-2003 (Improving Clinical and Public Health Outcomes through National Partnerships to Prevent and Control Emerging and Re-Emerging Infectious Disease Threats). This material is solely the responsibility of WEF and does not necessarily represent the official position of CDC.

# HOW MANY U.S. RESIDENTS ARE CONNECTED TO A SEWER?

**74.8% of people**
1990 U.S. Census data

**81.9% of households**
2017 American Household Survey data

*In other words:* **probably more than 75 to 80%**

*But:* **1 in 3,500 households reported no wastewater treatment in 2017**

Image source: iStock Photo

# DOES SEWER CONNECTIVITY VARY BY JURISDICTION?

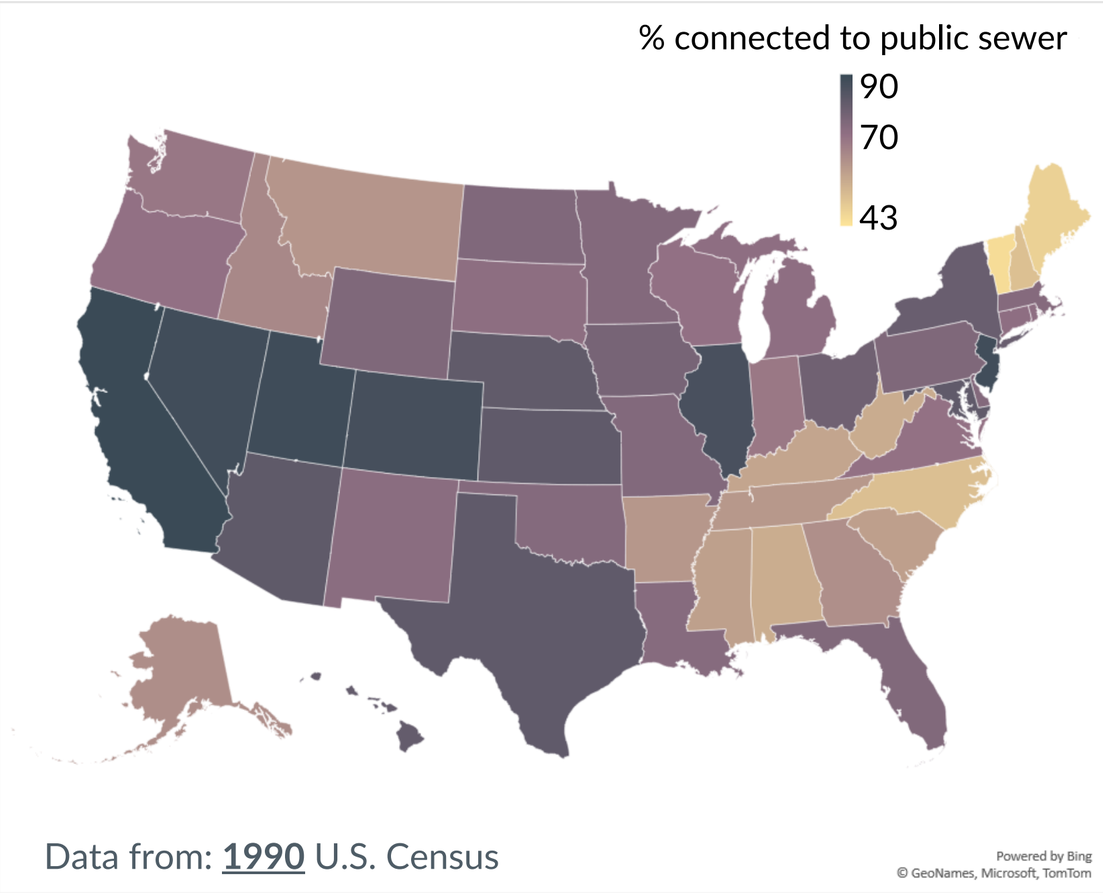
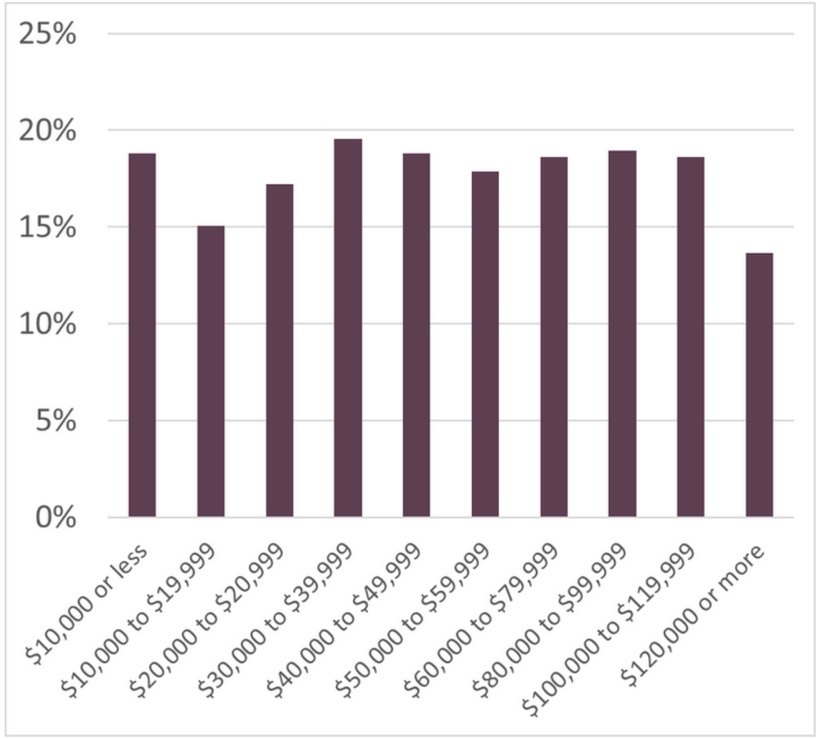



Image source: iStock Photo

# DOES SEWER CONNECTIVITY VARY BY INCOME?




Data from: 2017 Current Population Survey by U.S. Bureau of Labor Statistics and Census

Image source: iStock Photo

# COLLECTION SYSTEM

The system that conveys wastewater from its point of use to a treatment facility

*Also known as:*

- Service area
- Sewershed

Image source: iStock Photo

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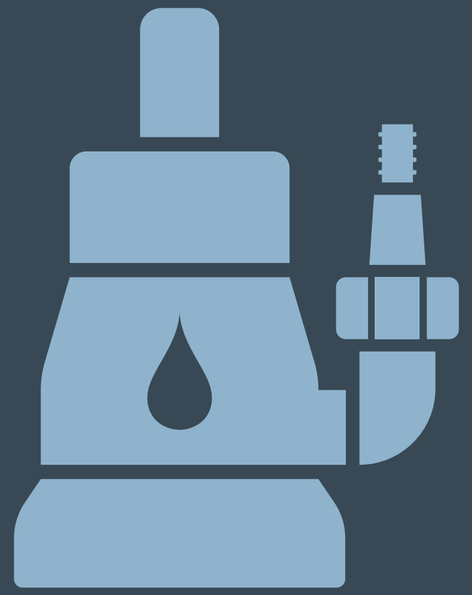
# *Collection systems include:*

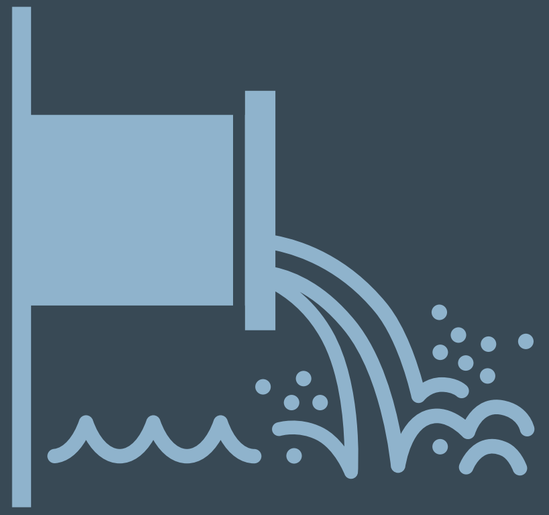
## PIPING

## STORAGE

## PUMPS



## OUTFALLS



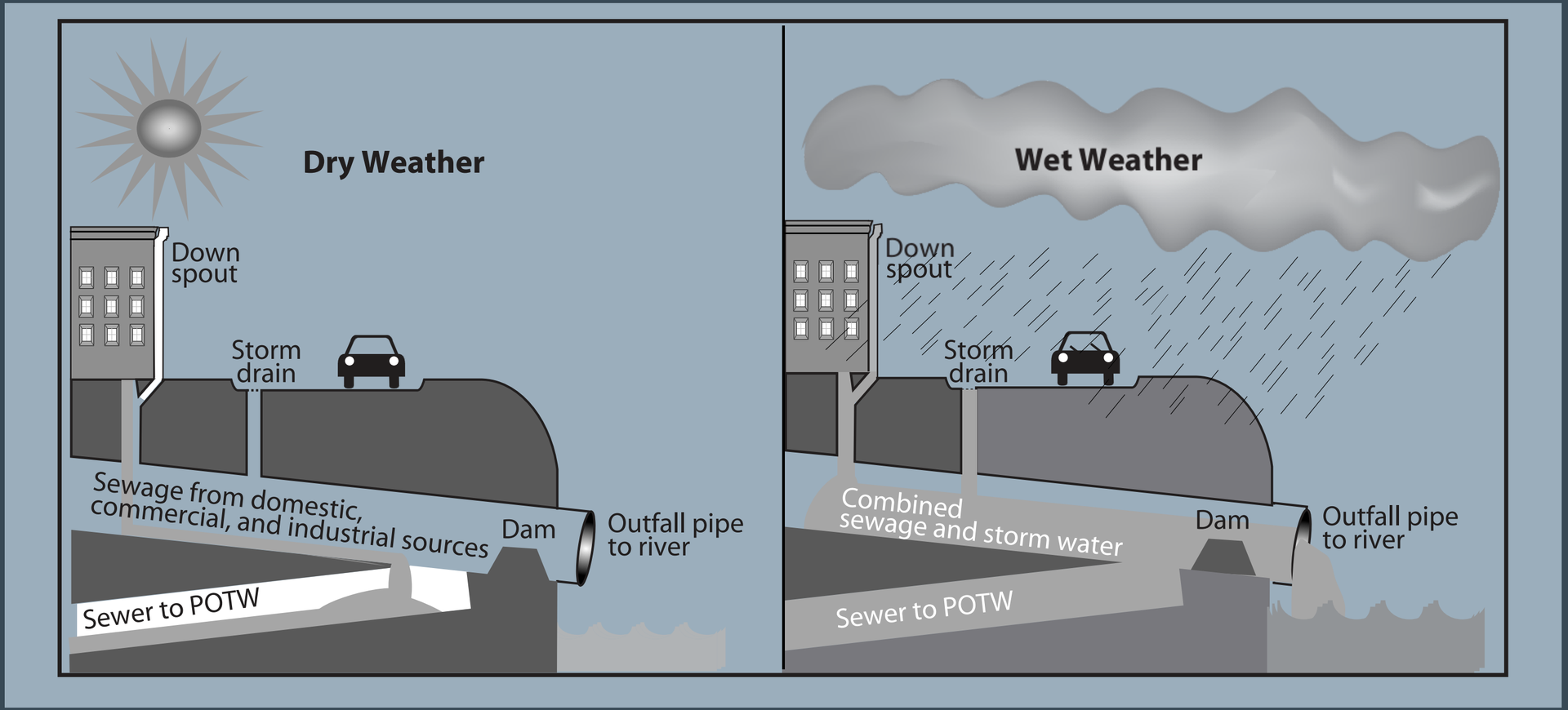
# UNSEEN ASSET

> In most urban and suburban communities, the wastewater collection system ... is one of the largest, most valuable infrastructure assets.

Image source: iStock Photo

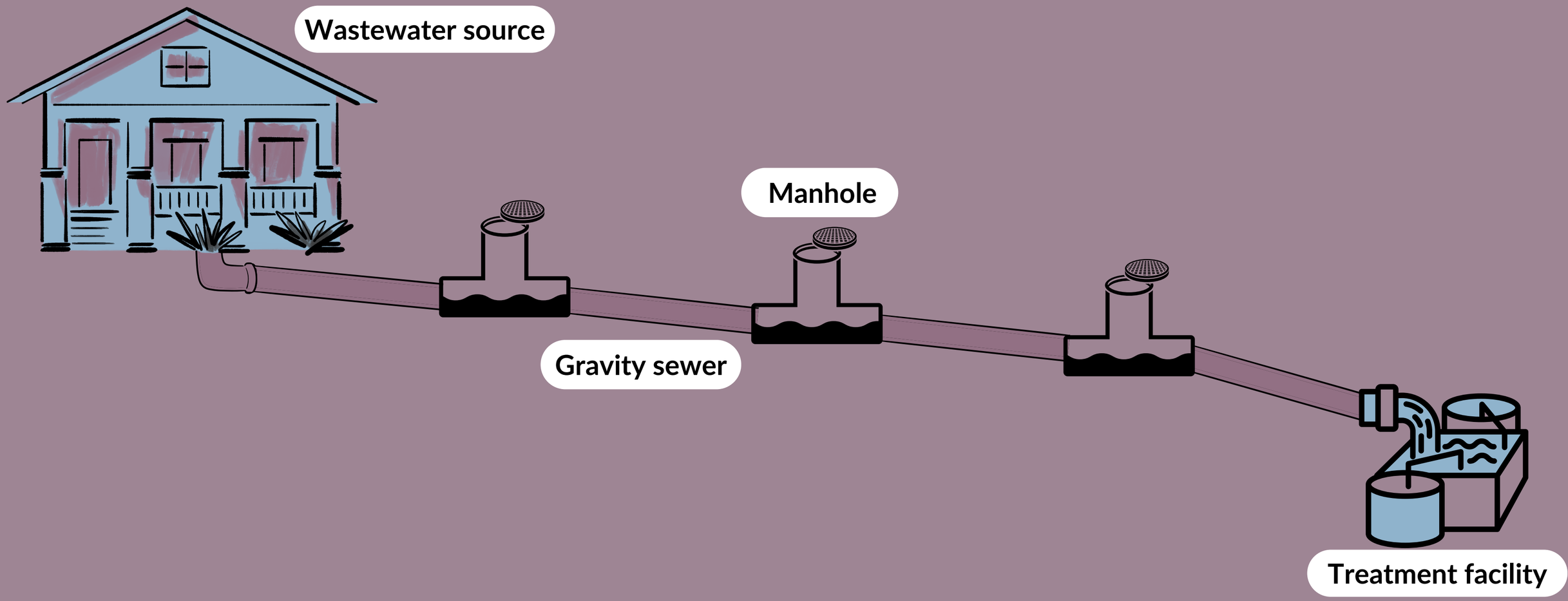
WEF. 2021. Wastewater Collection Systems Management

# COMBINED (VS. SEPARATE) SEWERS




By U.S. Environmental Protection Agency (EPA) - U.S. Environmental Protection Agency, Washington, D.C. “Report to Congress: Impacts and Control of CSOs and SSOs”, Document No. EPA 833-R-04-001, Public Domain, https://commons.wikimedia.org/w/index.php?curid=82076004

# GRAVITY VS. PRESSURE SEWERS



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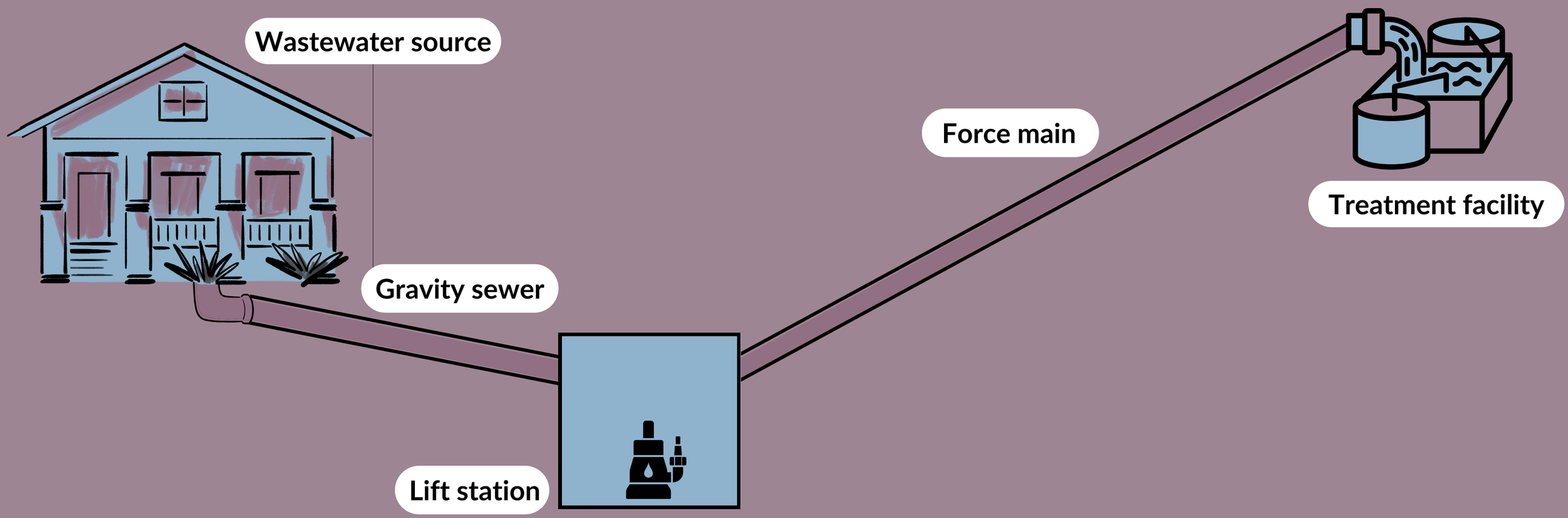
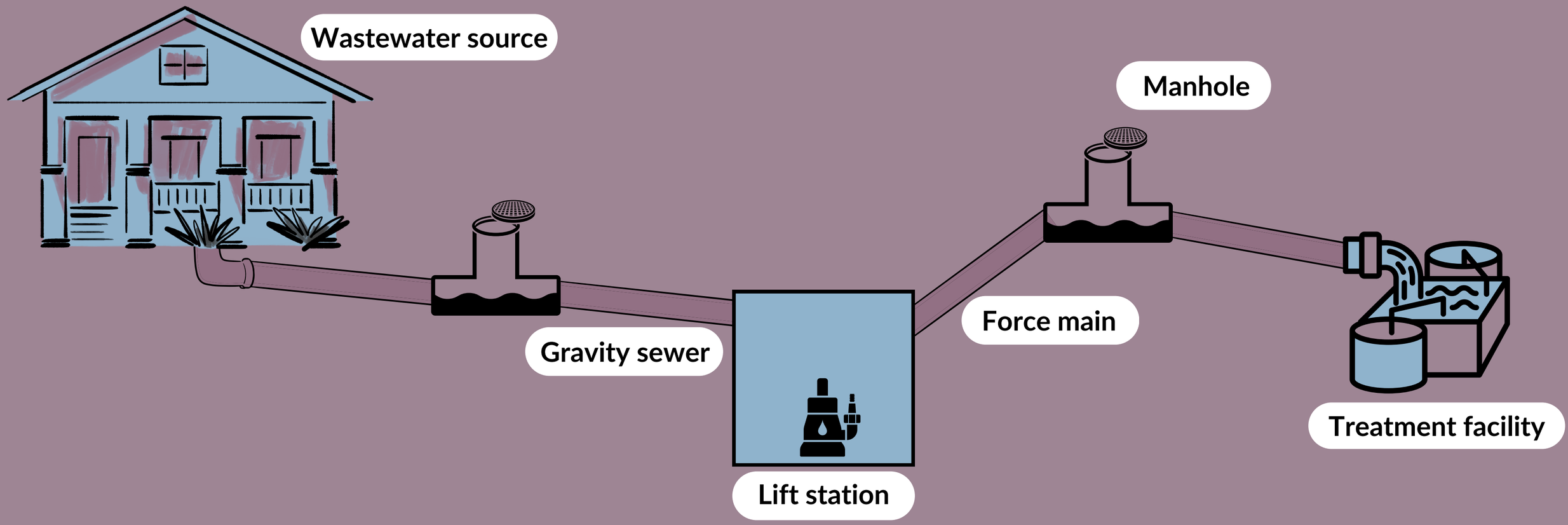


# REALITY


Wastewater source
Manhole
Gravity sewer
Force main
Lift station
Treatment facility

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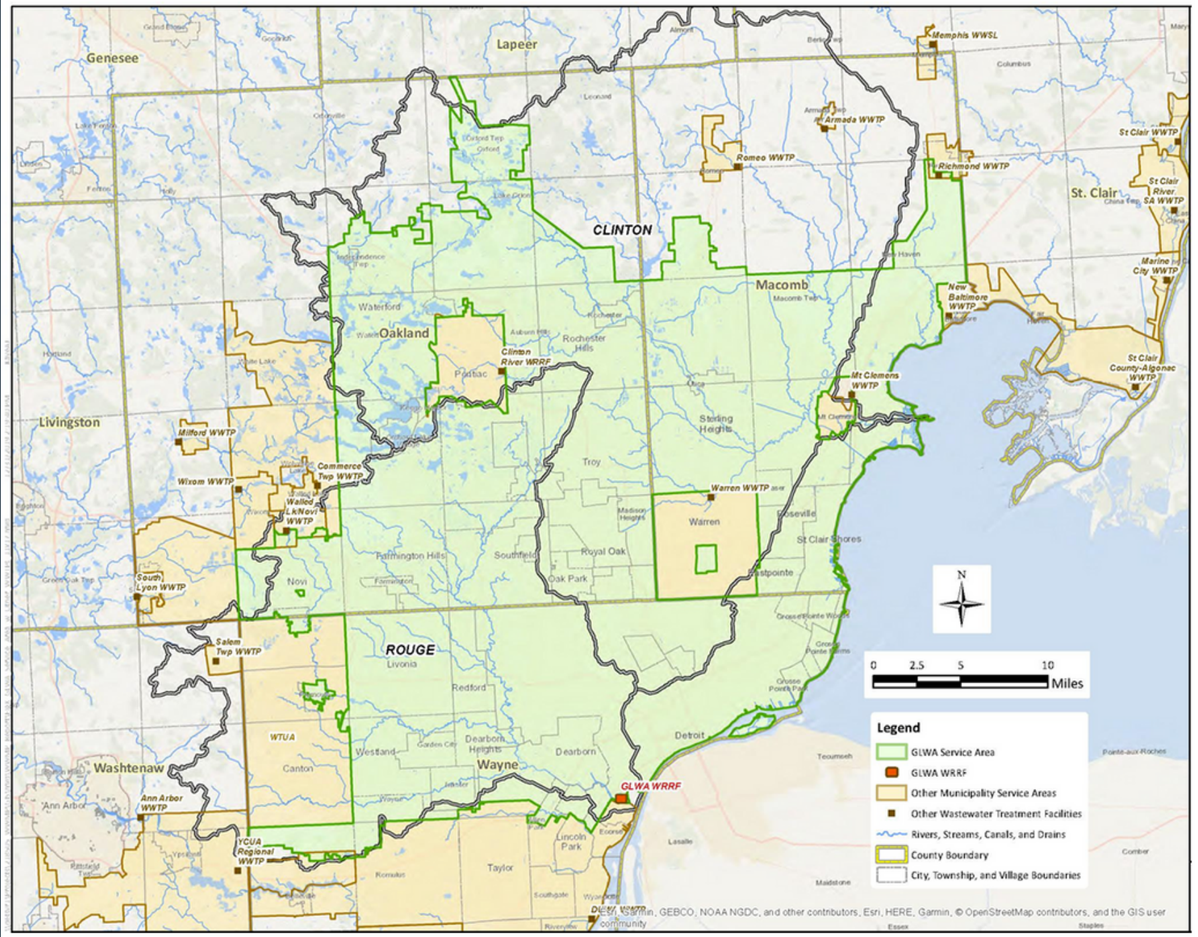
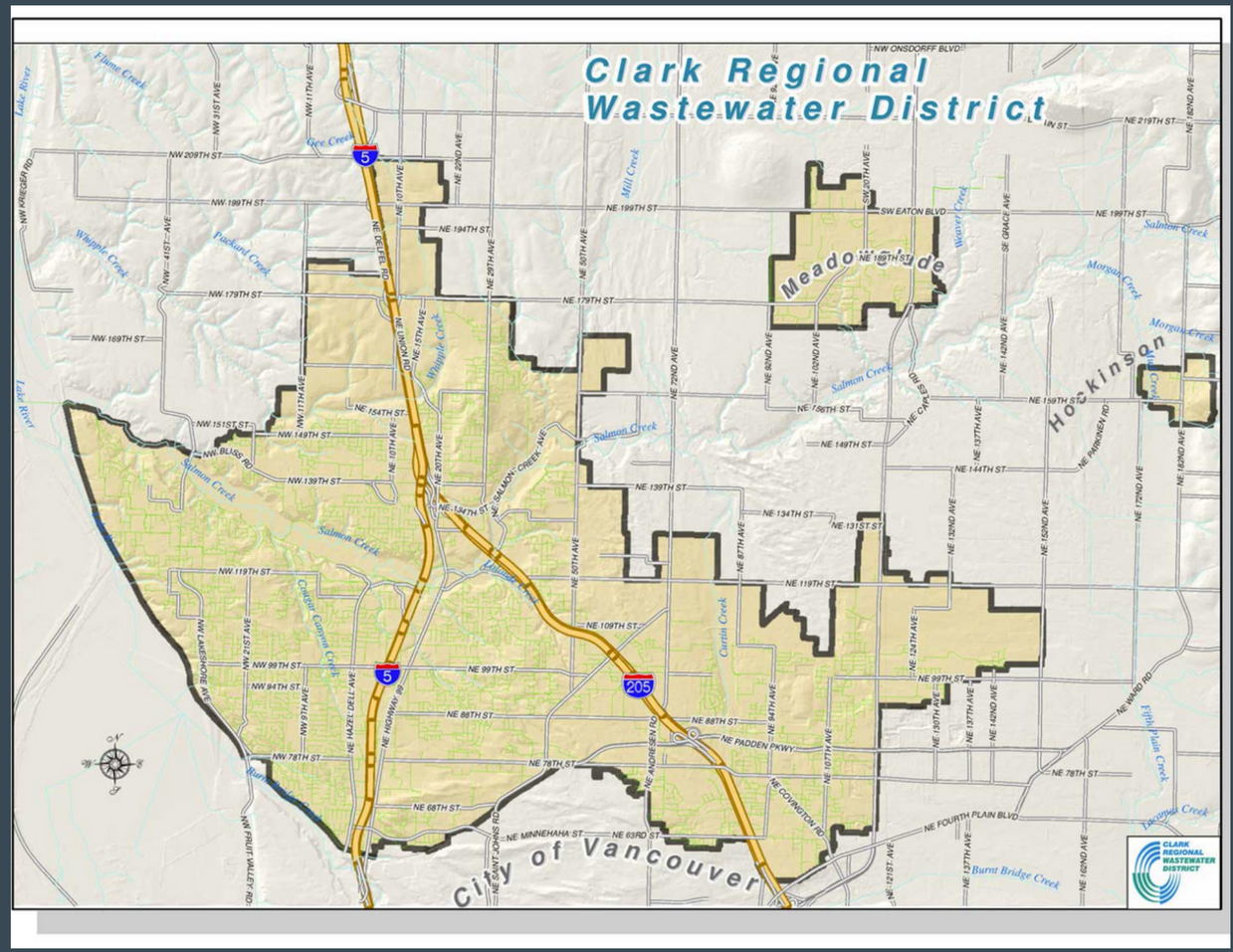
## Great Lakes Water Authority
Southeastern Michigan
946 square miles
19 sewer districts
Nearly 3 million people




CDM Smith. 2020. Wastewater Master Plan for Great Lakes Water Authority

## Clark Regional Wastewater District
Southern Washington
47 square miles
750 miles of sewer & 85 lift stations
100,000 people




https://www.crwwd.com/about/service-area/

# SEWER HIERARCHY

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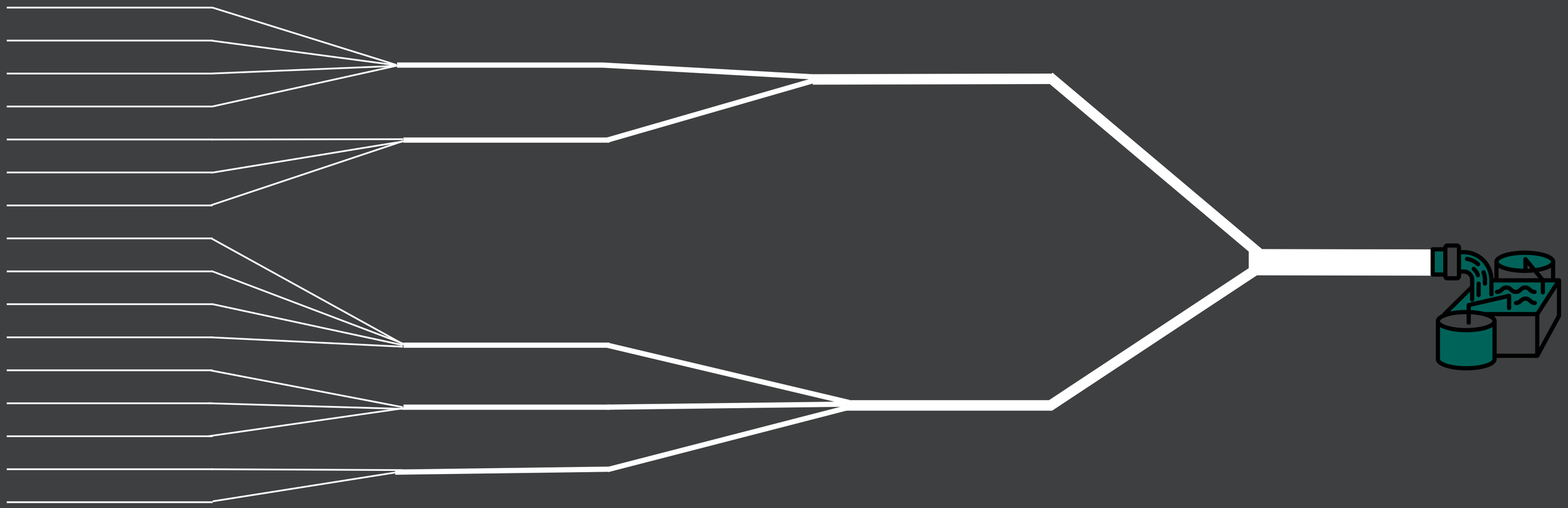
LATERALS

LOCAL MAIN SEWERS

REGIONAL TRUNK LINES

INTERCEPTOR



# MANHOLES

- Provide access to gravity sewers
- Allow change in direction, pipe diameter, slope
- Usually at least 4 feet in diameter, but can be smaller or larger
- Usually spaced ~400 to 500 feet apart
- Can have mini works of art as covers


Image sources: A. Mehrotra personal collection

Image source: A. Mehrotra personal collection

# COLLECTION SYSTEM SAMPLING: MANHOLES

- Captures flows from neighborhoods, institutions, or buildings
- Potential challenges:
  - Safe access
  - Lack of power
  - Depth to sewer
  - Keeping intake tubing in flow
  - Lack of permanent flow metering

# COLLECTION SYSTEM SAMPLING: LIFT STATIONS

Image source: A. Mehrotra personal collection

- Captures flows from regions or neighborhoods
- Potential challenges:
  - Safe access
  - Depth to wet well
  - Keeping intake tubing in flow

# ESTIMATING FLOW IN THE SYSTEM

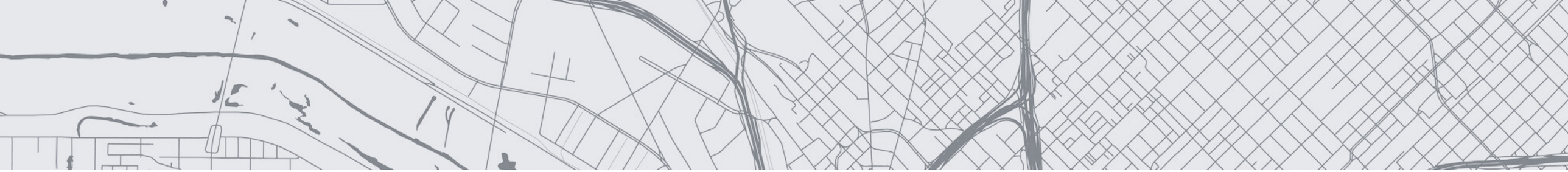
Take advantage of flow metering already in place

Use temporary flow metering to develop a rating curve

Install a flow metering insert

Use a calibrated hydrologic & hydraulic (H&H) model

Estimate flow using per capita values



# MAPPING THE SYSTEM

Shapefiles

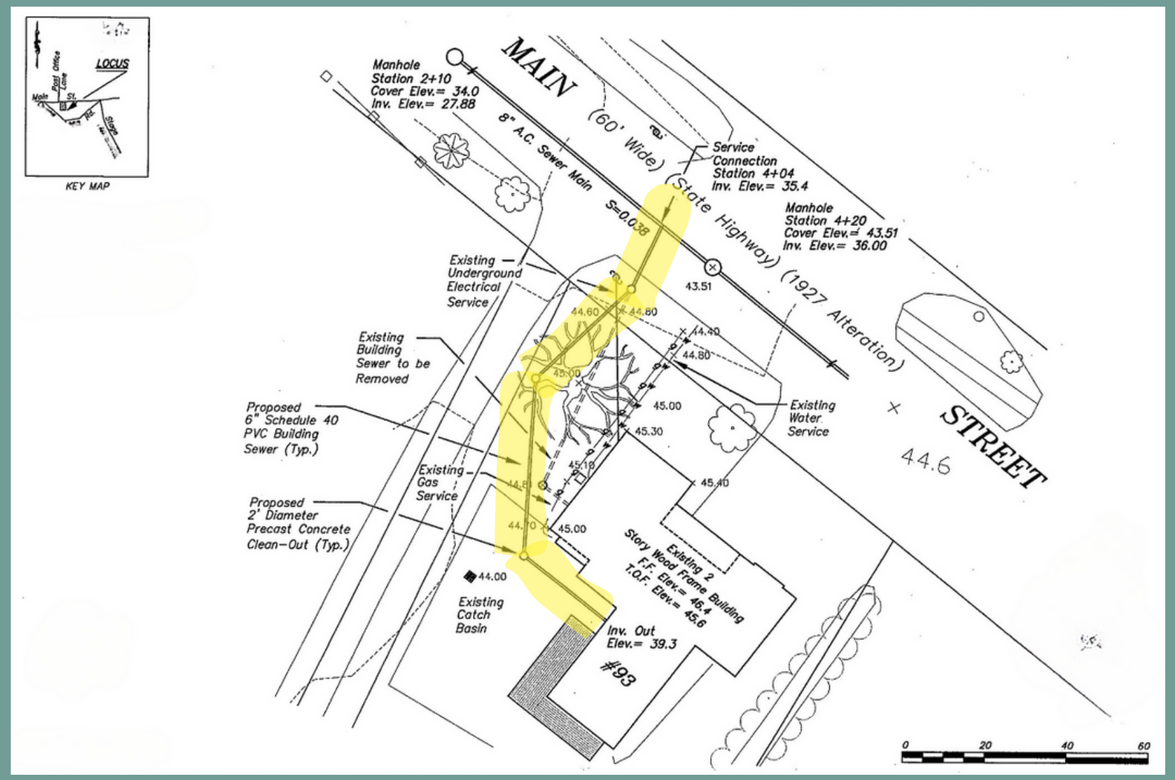
As-builts/record drawings

Institutional knowledge

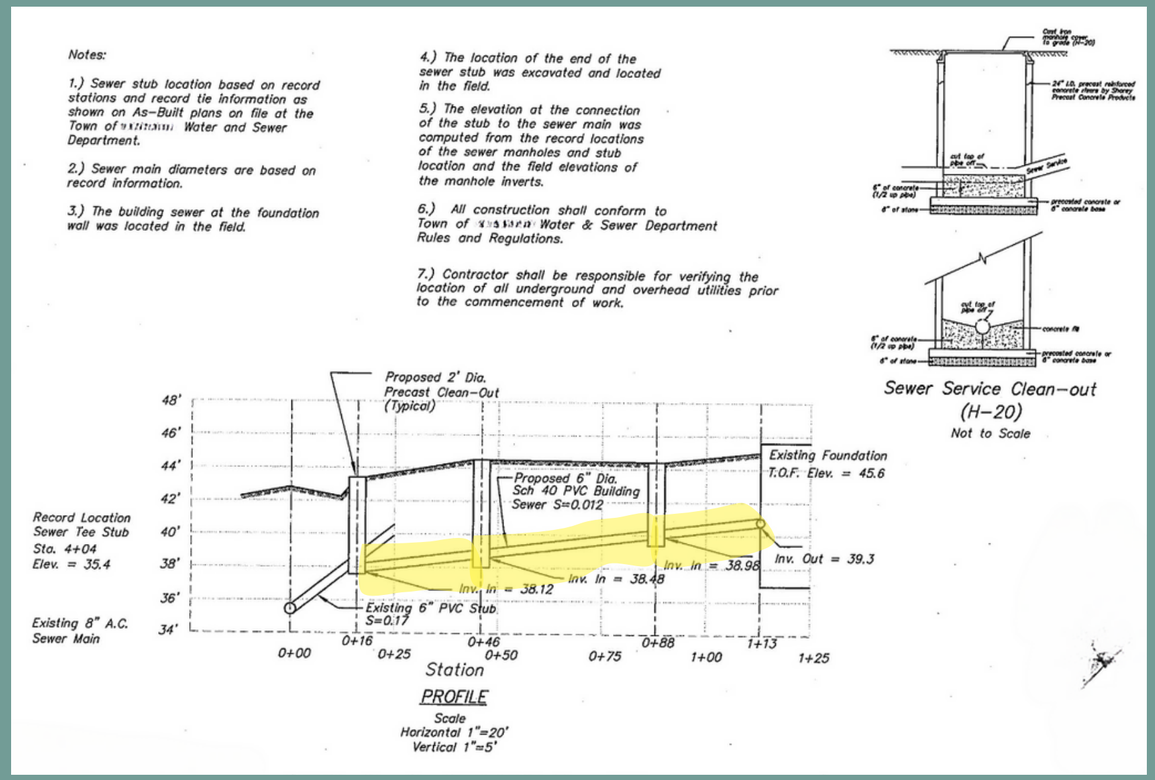
Google Streetview

# AS-BUILTS

## PLAN




## PROFILE



# TERMINOLOGY

## COLLECTION SYSTEM

The system that conveys wastewater from its point of use to a treatment facility

Also known as **service area** or **sewershed**

Includes piping, storage, pumps, and outfalls

## COMBINED SEWER

Sewer system in which storm drain flows are routed to the **same** pipe network as the one that conveys sewage, industrial discharges, and I/I

## SEPARATE SEWER

Sewer system in which storm drain flows are routed to a **different** pipe network than the one that conveys sewage, industrial discharges, and I/I

# TERMINOLOGY

## GRAVITY SEWER

Sewers in which wastewater flows by gravity; commonly called, from smallest to largest diameter: **laterals**, **local main sewers**, **trunk sewers**, and **interceptors**

## LIFT STATION

A small structure that houses pumps designed to “lift” wastewater to a higher elevation; also known as pump station or pumping station

## FORCE MAIN

Sewers in which wastewater is flowing under pressure due to the action of the pumps in lift stations

# TERMINOLOGY

## FLOW METER

An instrument used to detect the **amount of wastewater** moving through a pipe; there are many types of flow meters and all require ongoing maintenance and calibration

## LEVEL SENSOR

A sensor, often ultrasonic, that can detect the **depth to the surface of wastewater** from a given location; can be part of a “smart” manhole cover

## H&H MODEL

A numerical model that can be used to **predict flows** in a sewer based on precipitation amounts and system characteristics; also used to predict flows in rivers and streams

# TERMINOLOGY

## SHAPEFILE

Digital storage format for geographic information, such as **vector coordinates of sewershed geometry**; used in Geographic Information Systems analysis; doesn't store topographic information

## AS-BUILT

Drawings of a sewer as it was **actually constructed** (vs. design drawings); also known as record drawings; often imperfect representations of reality

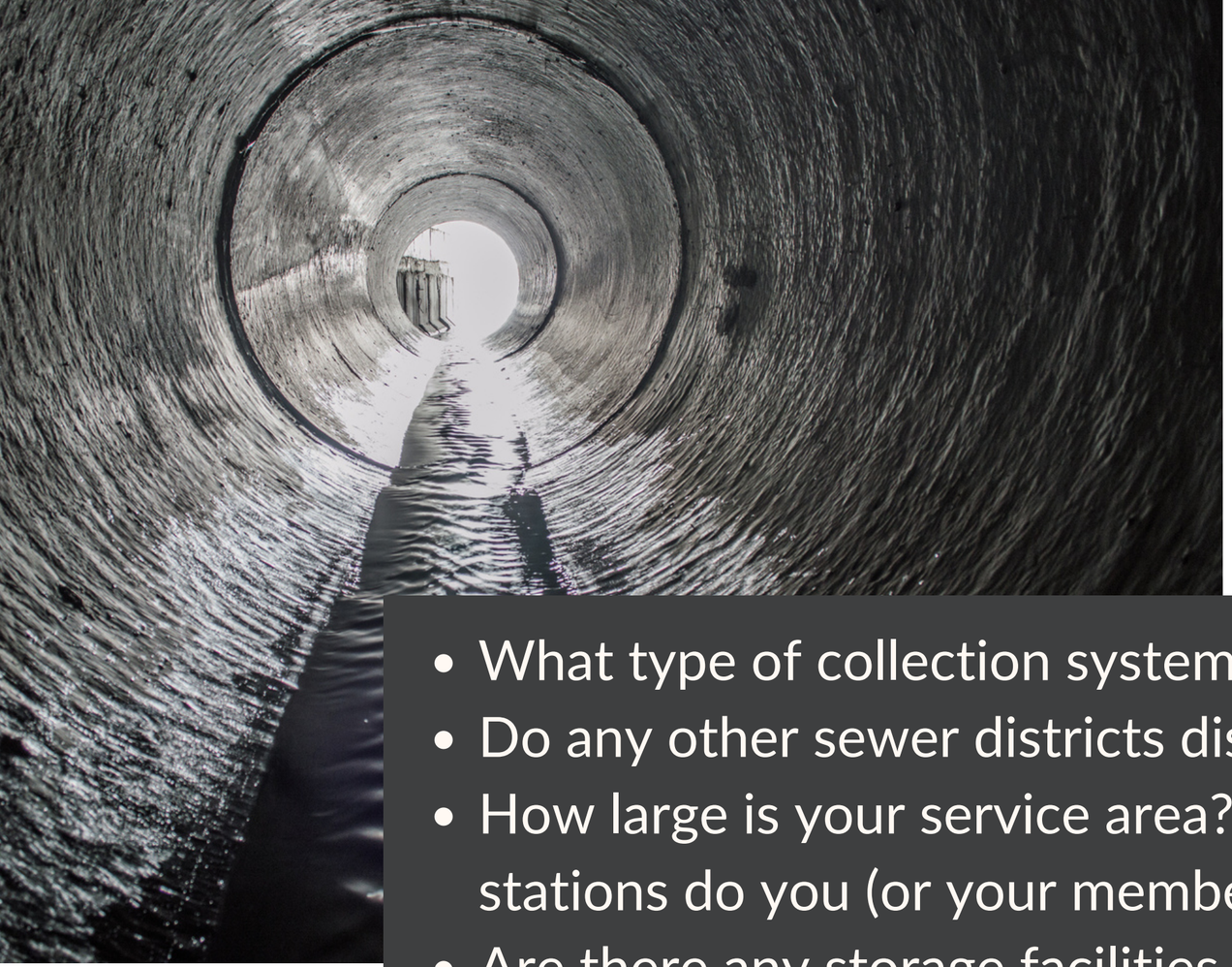


Image source: iStock Photo

# WHAT TO ASK YOUR UTILITY PARTNERS

- What type of collection system do you operate: combined, separate, or mixed?
- Do any other sewer districts discharge to your system/treatment plant?
- How large is your service area? How many miles of sewer and how many lift stations do you (or your member sewer districts) operate?
- Are there any storage facilities (retention basins, deep tunnels) in your system?
- How do you map your collection system? Using as-builts/record drawings? GIS? How up-to-date is your information?
- Where do you currently meter flow, if at all, in your system?
- Do you have an H&H model of your collection system? If so, has it been calibrated recently?

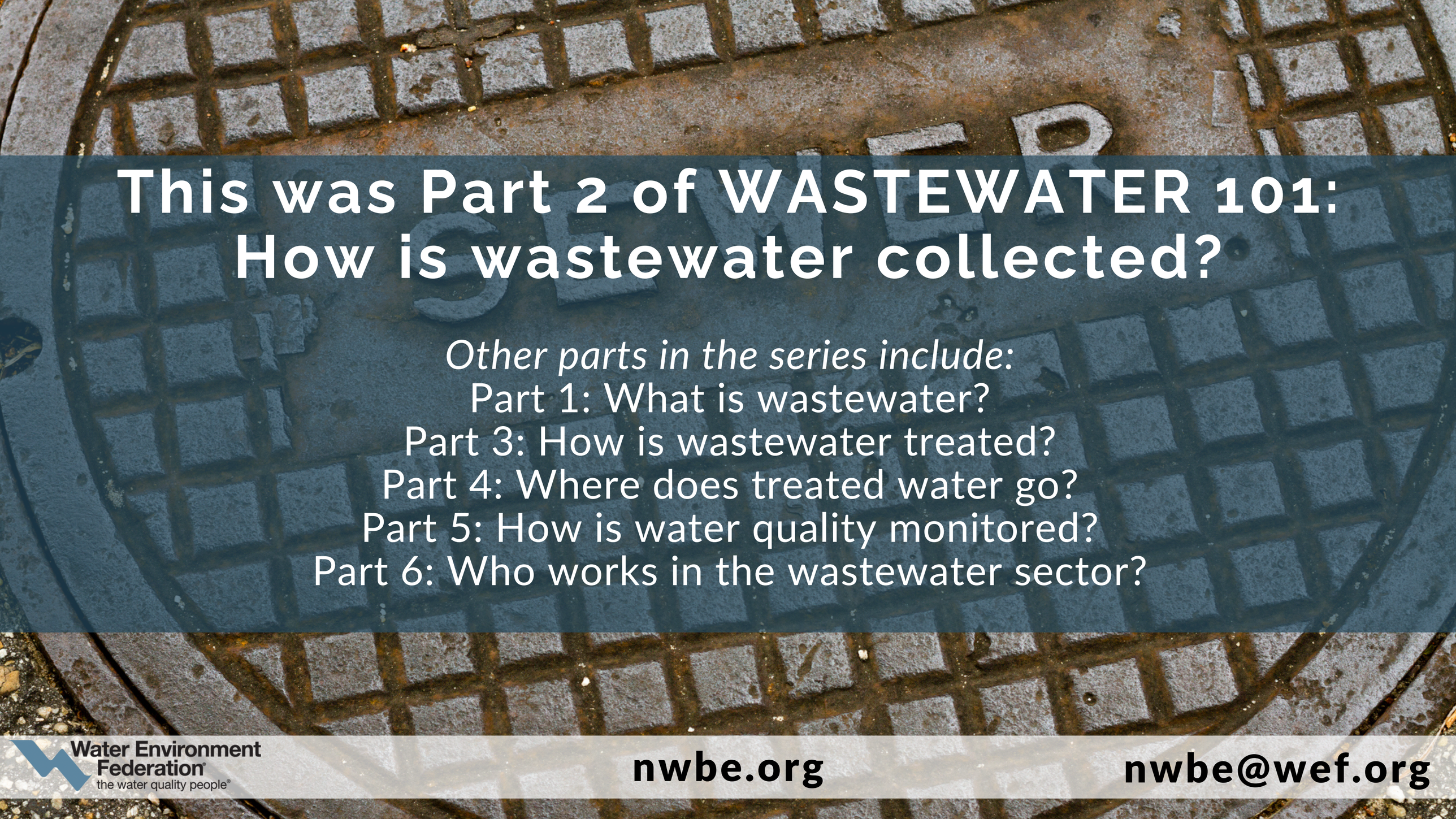
# COLLECTION SYSTEMS RESOURCES FROM WEF

Wastewater Collection Systems Management MOP 7, 7th Edition
accesswater.org

Wastewater Collection Systems Community
community.wef.org

Wastewater Collection Systems Conference
wef.org/collectionsystems

Image source: iStock Photo



# This was Part 2 of WASTEWATER 101: How is wastewater collected?

*Other parts in the series include:*

Part 1: What is wastewater?
Part 3: How is wastewater treated?
Part 4: Where does treated water go?
Part 5: How is water quality monitored?
Part 6: Who works in the wastewater sector?


# Thank you!

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the water quality people®

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