UCT
THE UNDERGROUND UTILITIES EVENT
Underground Construction Technology | Jan. 29-31, 2019 | Fort Worth, TX

When, Why, and How of Manhole I&I Elimination

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UCT

THE **UNDERGROUND** UTILITIES EVENT

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DOUBLE TROUBLE

UNITE TO FIGHT INFILTRATION AND INFL

I&I eliminATIO

The Problem with I&I

"According to the EPA estimates, infiltration and inflow represent almost **half** of all flow at treatment plants nationwide. Infiltration and inflow (I/I) is a huge problem, and it only worsens over time if it is not addressed."

United States Environmental Protection Agency; Office of Research and Development, Washington DC 20460

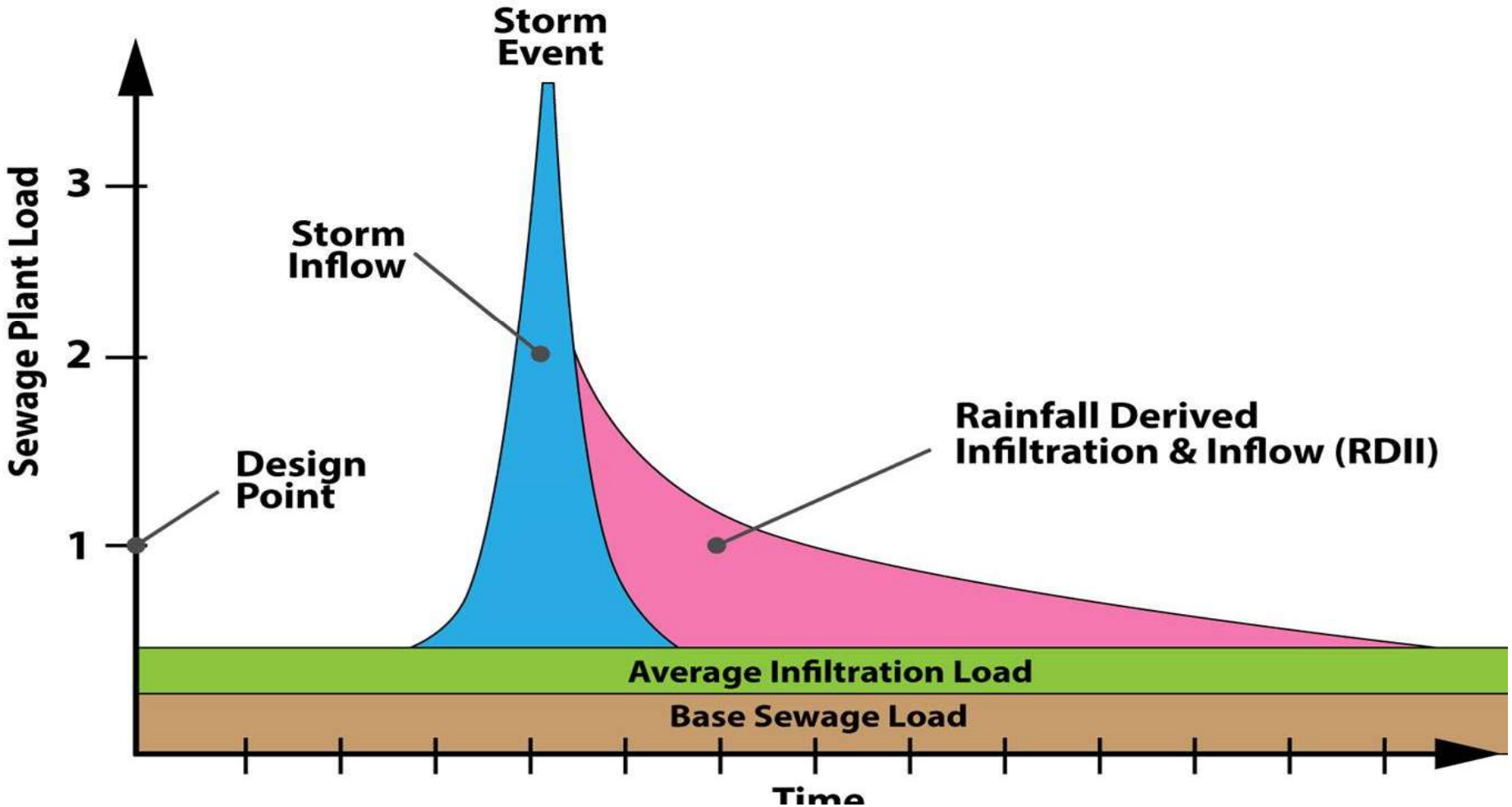
Infiltration vs. Inflow (I&I)

What is the difference between Infiltration and Inflow?

Infiltration is **groundwater** which enters the sewer collection system (pipelines and manholes) through defects in the sewer system.

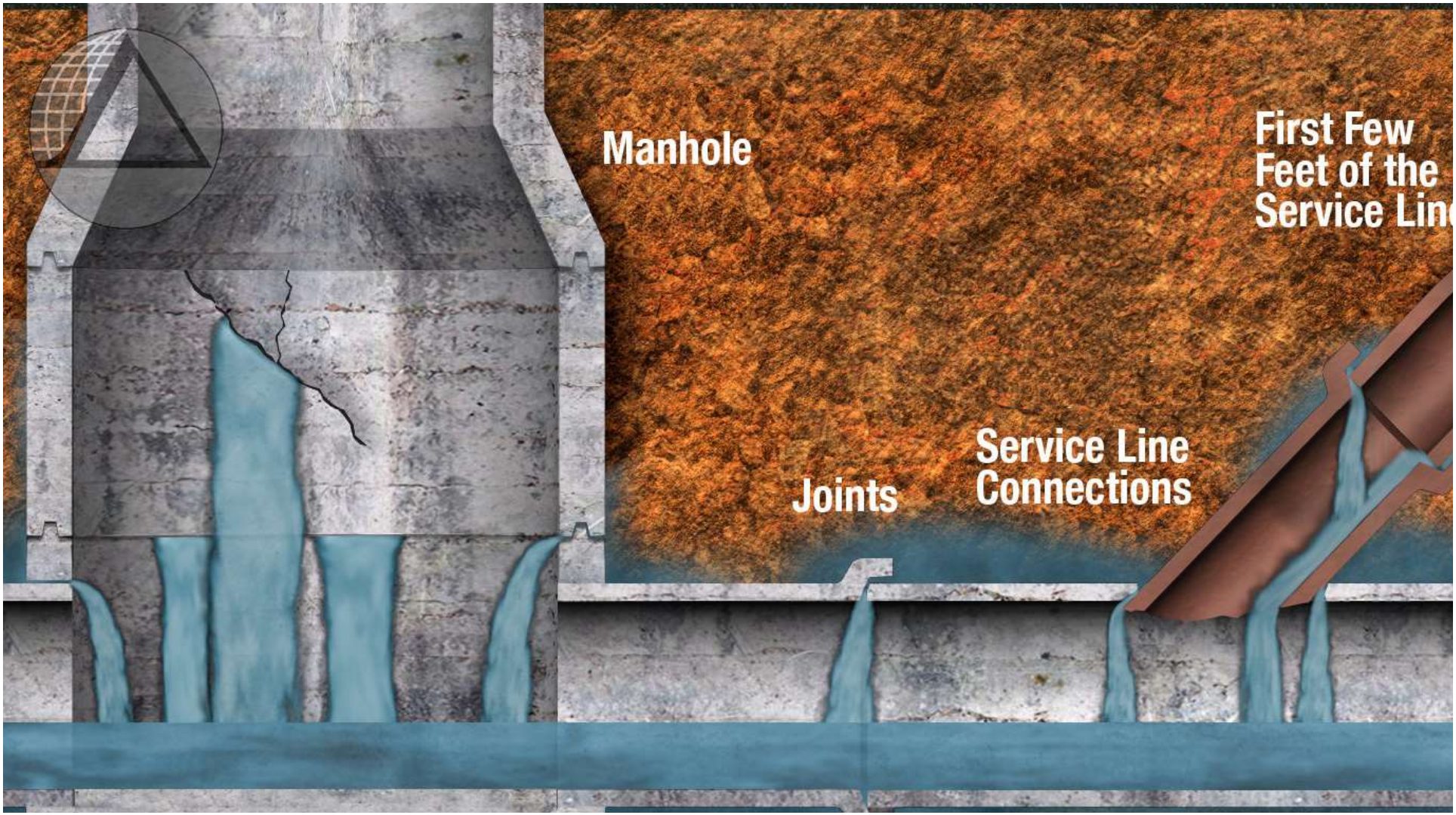
Inflow is defined as **surface water** entering the sewer via flooded sewer vents, leaky manholes, storm drains, basement drains and by means other than groundwater.

Simplified Sewage Treatment Plant Loading Scenario




Storm to Sanitary Trench
STORM TRENCH
STORM WATER
SEWER TRENCH
SEWER WATER

4 Critical Points of I&I



What is Injection Grouting?

Liquid resin that turns into an impermeable solid in a predictable time frame used to:

- Stop leaks in above grade structures
- Stop infiltration in below grade structures
- Stabilize soils
- Control groundwater

Primary Grout Families

ACRYLIC GROUTS

- Acrylamide
- NMA / Acrylic
- Acrylate

POLYURETHANE GROUTS

- Gel / Foam
- Flexible / Rigid

CEMENTITIOUS GROUTS

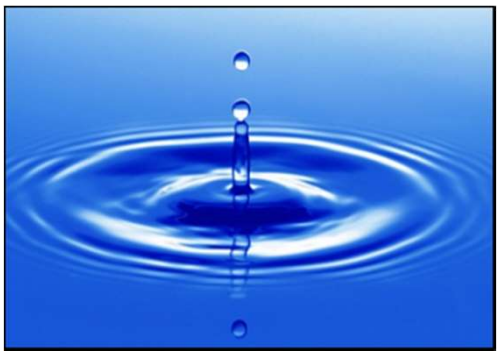
Hydrophobic/Hydrophilic

Hydrophobic: Water fearing

- Uses very little water in its reaction. (5-7%)
- Requires a catalyst. (allows for adjustment of the reaction time)
- No post reaction swelling, has a closed chemical structure

Hydrophilic: Water loving

- Can use up to 50% water in its reaction
- Uses no catalyst required
- Has post reaction swell, retains an open chemical structure



Hydrophobic Grouts

Hydrophobic Urethanes:

AV-248

AV-248-LV

AV-275

AV-290

Hydrophobic Grouts

Hydrophobic Urethanes:

AV-248 **AV-248-LV** **AV-275** **AV-290**

- Forms a flexible or rigid foam
- Adjustable set times with an accelerator
- Pumped with single component equipment
- Expands upon reaction – Moderate to high expansion
- 400 to 600% and 1,500 to 3,000%

Hydrophilic Grouts

Hydrophilic Urethanes:

AV-202

AV-202-LV

AV-315

AV-330

Hydrophilic Grouts

Hydrophilic Urethanes:

AV-202 **AV-202-LV** **AV-315** **AV-330**

- Forms a flexible foam
- Set times generally between 30 to 45 seconds
- Pumped with single component equipment
- Expands upon reaction – Moderate expansion 400 to 600%
- Can have post-reaction swelling capabilities

Need to Know

Properties to take into account when selecting a Product

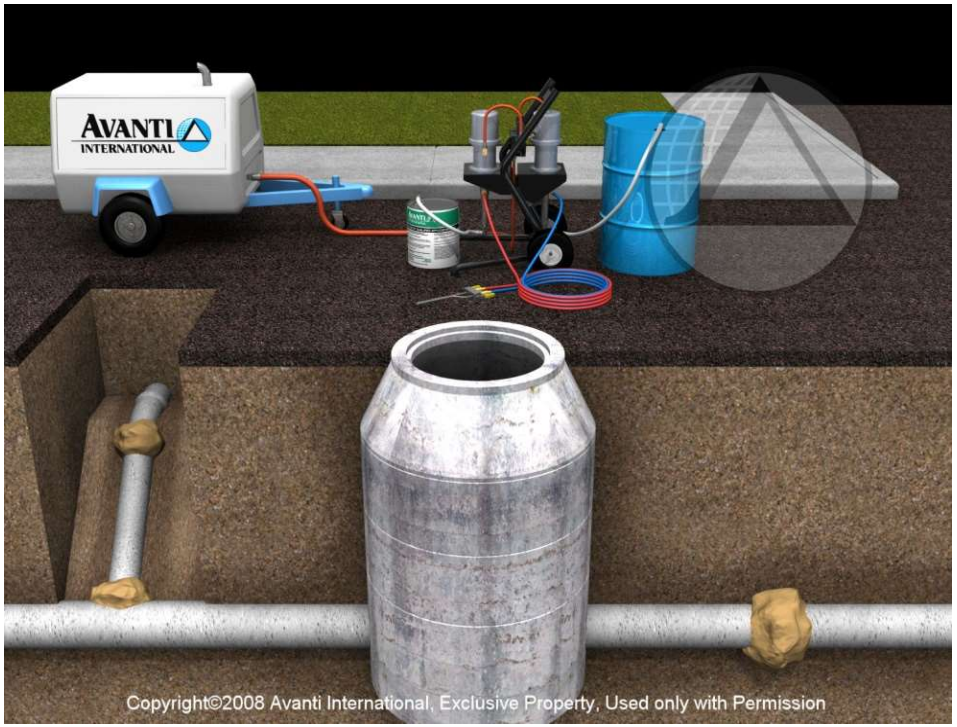
1. Viscosity
    1. Measured in Centipoise
        1. Comparison
            1. AV-315 - 50 to 200 CP
            2. AV-248 LV – 150 to 250 CP
            3. AV-202 – 3200 to 6000 CP
2. Expansion
    1. Hydrophilic 4 to 6 times expansion
    2. Hydrophobic 4 to 30 times expansion
3. Environment
    1. Temperature Variations
    2. Water table
    3. Soils
4. Project Goals

Item	Approximate Viscosity in Centipoise (cps)
Water at 70	1 to 5 cps
Blood	10 to 20 cps
Antifreeze	20 cps
Corn Oil or Motor Oil SAE 10	50 to 100 cps
Maple Syrup or Motor Oil SAE 30	150 to 200 cps
Castor Oil or Motor Oil SAE 40	250 to 500 cps
Glycerin or Moto Oil SAE 60	1,000 to 2,000 cps
Honey or Corn Syrup	2,000 to 3,000 cps
Blackstrap Molasses	5,000 to 10,000 cps
Chocolate Syrup	10,000 to 25,000 cps
Ketchup or Mustard	50,000 to 70,000 cps
Tomato Paste or Peanut Butter	500,000 cps
Shortening or Lard	1,000,000 to 2,000,000 cps
Caulking Compound	5,000,000 to 10,000,000 cps
Window Putty	100,000,000 cps

Low Hanging Fruit of I&I

First Defense for Sealing the System

- Easy Access
- Vulnerable to Defects
  - Cracks
  - Pipe insertions
  - Faulty seals
  - Step inserts
  - Lifting holes

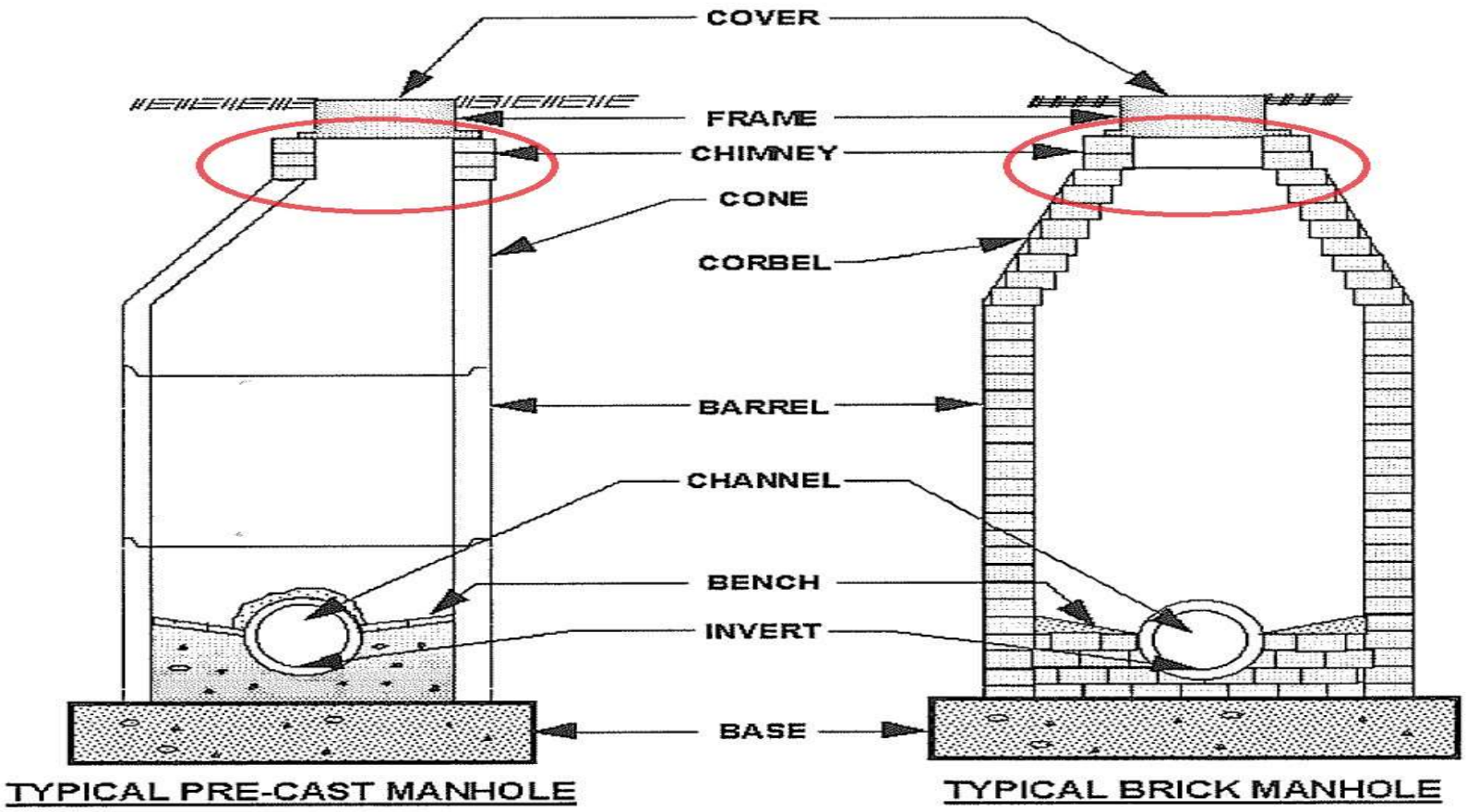


Types of Manholes

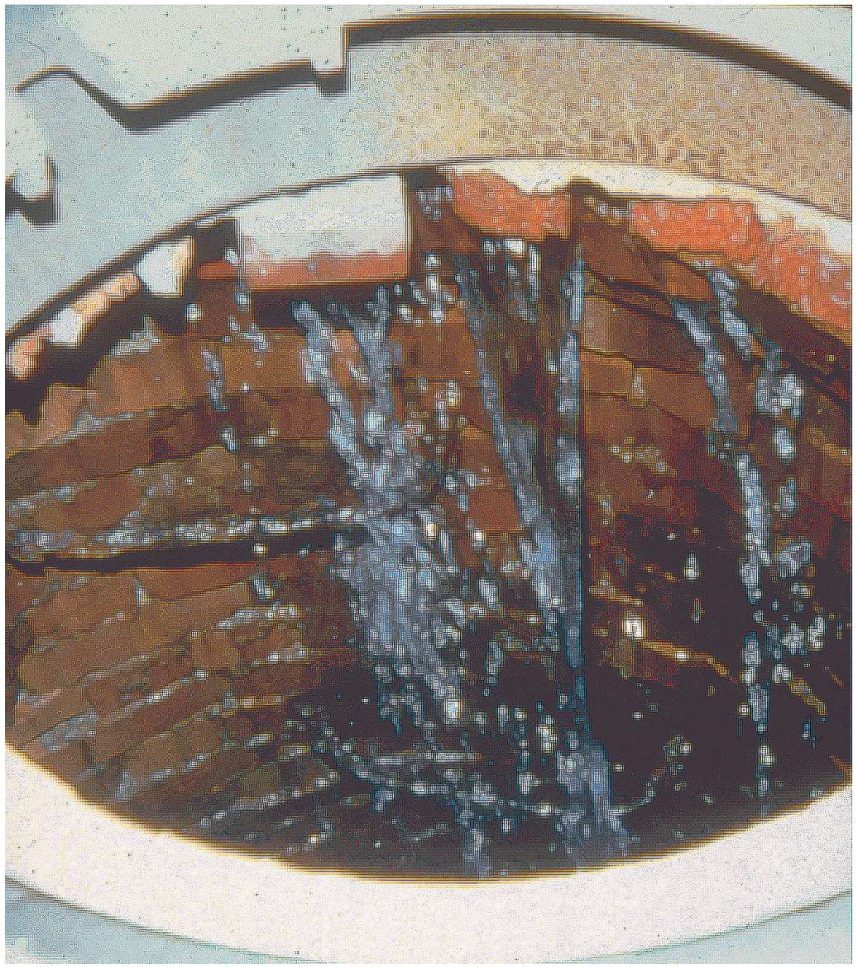
Brick and Mortar

Pre-cast Concrete

Sources of Inflow in Manholes



Sources of Inflow in Manholes



Sources of Inflow in Manholes

Most exposure to the elements

Damage from Freeze/Thaw cycle

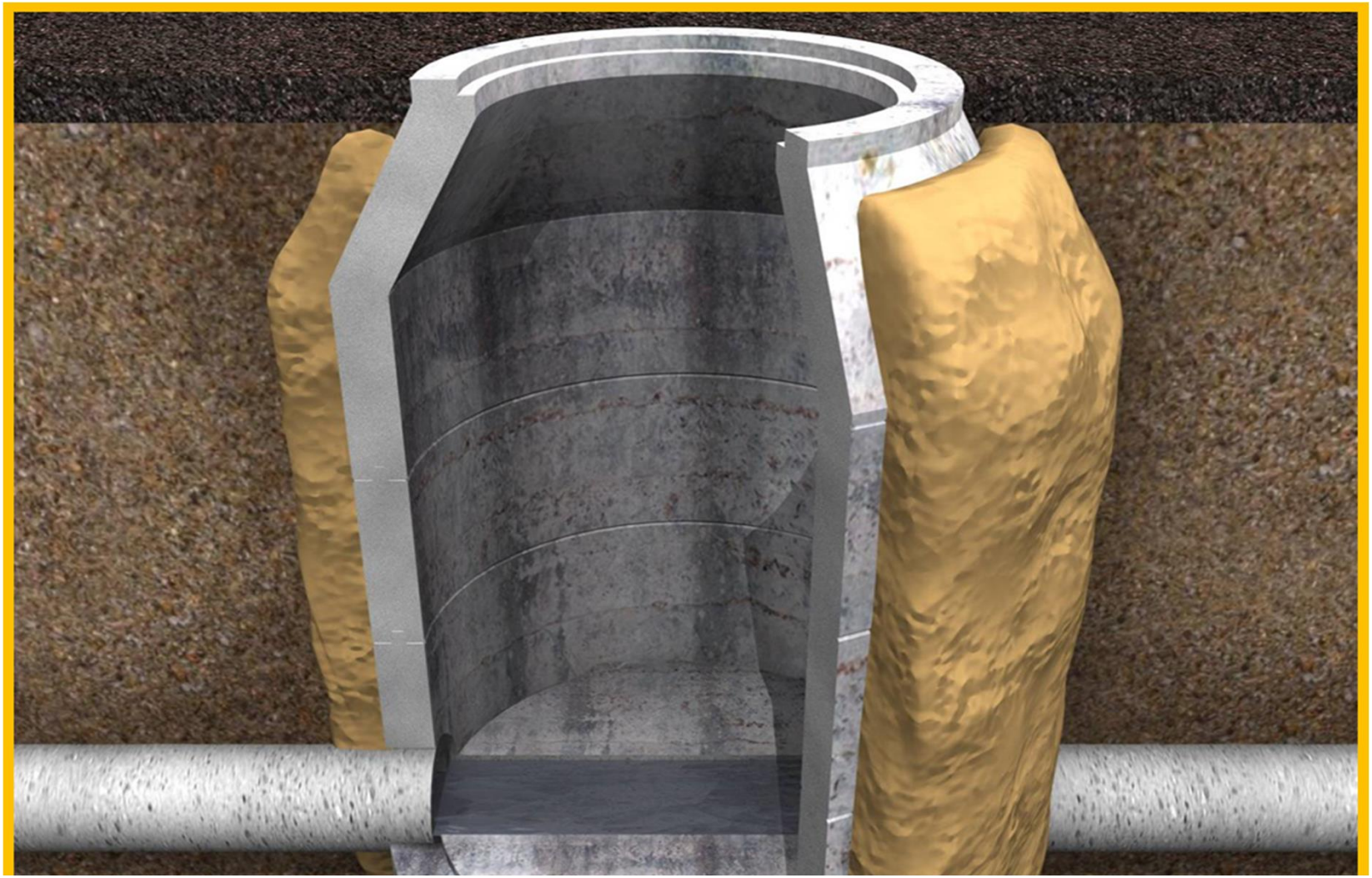
Constant Auto/Truck Traffic and Loads

Sources of Inflow in Manholes

Sources of Infiltration in Manholes

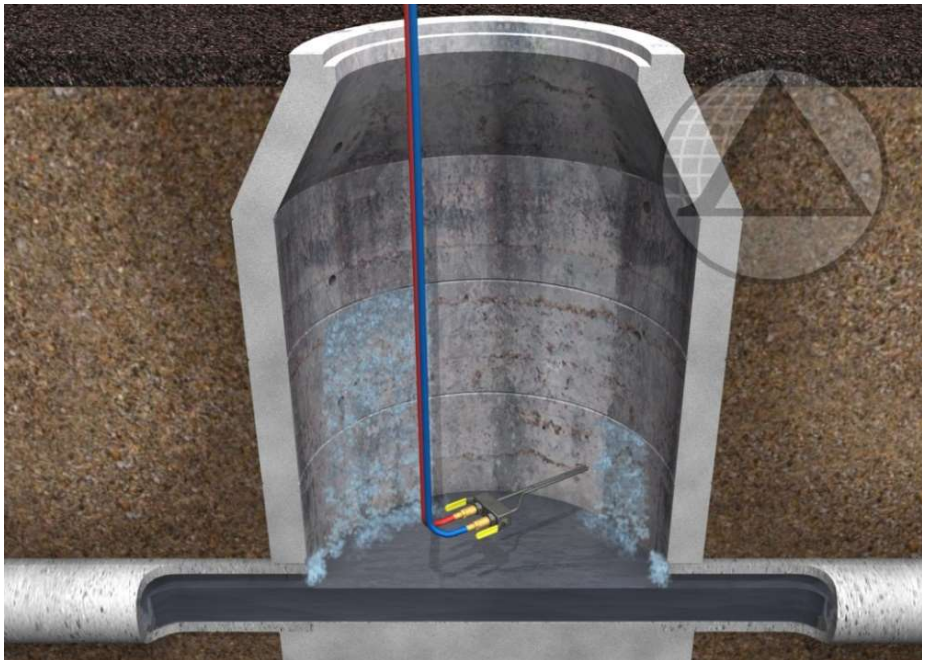
Spot Repair

Encapsulation



5 Techniques for Sealing MH

1. Vertical Crack Injection
2. Horizontal Joint Injection
3. Oakum Soakum
4. Curtain Grouting
5. Probe Grouting



Vertical Crack Injection

Horizontal Joint Injection

Oakum Soakum

Oakum Soakum

Curtain Grouting

Probe Grouting

Injection Grouting Manholes

First Defense for MH Rehabilitation

As a **stand-alone** solution

- Least cost, high return-on-effort
- Reduce flow & cost of I&I
- Fill voids, extend lifecycle of structure

Injection Grouting Manholes

First Defense for MH Rehabilitation

As part of a **multi-step** solution

- Step 1: stop active water leaks
- Required for cement coatings, epoxy linings
- More durable, long-term solution

Question & Answer

Thank You!

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