Winner of the "Not My Job" Award - ADOT
Litchfield Park, AZ 85
Infiltration/Inflow & Sanitary Sewer Flow Metering
Why We Meter, What We Do with the Meter Data and How Meters Work
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Flow Metering – Why We Meter

• Quantify Infiltration and Inflow (I/I)
Flow Metering – Why We Meter

• Combined vs Separate
SEPARATE SEWER SYSTEM
Combined Sewer System

- Medium Storm
- Big Storm
- Small Storm

Dry Weather Sanitary Flow

STORM MANHOLE → CATCH BASIN

FOOTING DRAIN → SANITARY LEAD → BASEMENT

TOILET
Small Storm
Typical Problem: Tree Roots
Combined Sewer System
Small Storm
Typical Problem: Pipe Collapse
Combined Sewer System
A Solution: Check Valve
A Solution: Relief Sewers
A Solution: Sewer Separation

COMBINED SEWER SYSTEM
A Solution: Sewer Separation

Old Combined = Sanitary Manhole
New Storm Manhole

Old Combined = Sanitary
New = Storm
A Solution: Sewer Separation

Old Combined = Sanitary Manhole

New = Storm manhole

Splash Block

CATCH BASIN

FOOTING DRAIN

SANITARY LEAD

TOILET

BASEMENT

Old Combined = Sanitary

New = Storm
A Solution: Sewer Separation

Old Combined = Sanitary
New = Storm

Old Combined = Sanitary
New = Storm
A Solution: Sewer Separation

Old Combined = Sanitary Manhole
New = Storm Manhole

Old Combined = Sanitary
New = Storm
Flow Metering – Why We Meter

- Combined vs Separate
- Rain causes system to back up
- Options: basement flooding and/or overflow
  - Old systems = “not water tight”
- Tree roots, cracks in pipes, cracks in manholes
- Legal direct connections
- Illegal direct connections
Sources of Infiltration and Inflow (I/I)

**Infiltration Sources**

1. Broken House Lateral
2. Root Intrusion into Lateral
3. Faulty Lateral Connection
4. Cracked or Broken Pipe
5. Deteriorated Manhole

**Inflow Sources**

1. Roof Drain Connection
2. Sump Pump/Foot Drain Connection
3. Uncapped Clean-Out
4. Storm Cross-Connection
5. Faulty Manhole Cover or Frame
Flow Metering – Why We Meter

- Quantify Infiltration and Inflow (I/I)

How much rain water is getting into the system
Engineering Flowchart

DOES IT MOVE?

No

No

Should it?

No

No

Problem

Yes

WD-40

Yes

No

No Problem

Yes

No

No

Problem

Yes

No

No

Problem

No

No

Problem

No

No

Problem
Flow Metering – What We Do with the Data

• Project the amount of I/I for a certain size storm

  • Step 1 = DWF

    Usually the 10 Year Storm
Flow Metering – What We Do with the Data

- Project the amount of I/I for a certain size storm
  - Step 1 = DWF
  - Step 2 = WWF
Flow Metering – What We Do with the Data

• Project the amount of I/I for a certain size storm
  • Step 1 = DWF
  • Step 2 = WWF
Peak Intensity vs. Peak Inflow

Inflow (mgd) vs. Intensity (in/hr)

10 Year Event: 2.06

Button:
One rain
More rain
Peak Intensity vs. Peak Inflow

Inflow Intensity (in/hr)

Peak Intensity vs. Peak Inflow

Inflow

Intensity (in/hr)

2.06
Flow Metering – What We Do with the Data

• Project the amount of I/I for a certain size storm
• Compare flows to accepted rates:
  – Infiltration is excessive if DWF > 120 gpcd
  – Inflow is excessive if WWF > 275 gpcd
Flow Metering – How Meters Work

• Area Velocity Meters
  • Depth Measurement
    • Ultrasonic Sensor
    • Pressure Sensor
  • Velocity Measurement
    • Doppler

Courtesy of American Sigma
Velocity/Level Probe
Although they restricted themselves to one drink at lunch time, Howard and Tom still found they were not at their most productive in the afternoons.
Infiltration/Inflow & Sanitary Sewer Flow Metering

Why We Meter

What We Do with the Data

How Meters Work

Infiltration/Inflow & Sanitary Sewer Flow Metering

End
Infiltration/Inflow & Sanitary Sewer Flow Metering
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