

LESSONS LEARNED FROM ICAP

Presented by
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SEWER SYSTEM EVALUATIONS, INC.

A Carylon Company



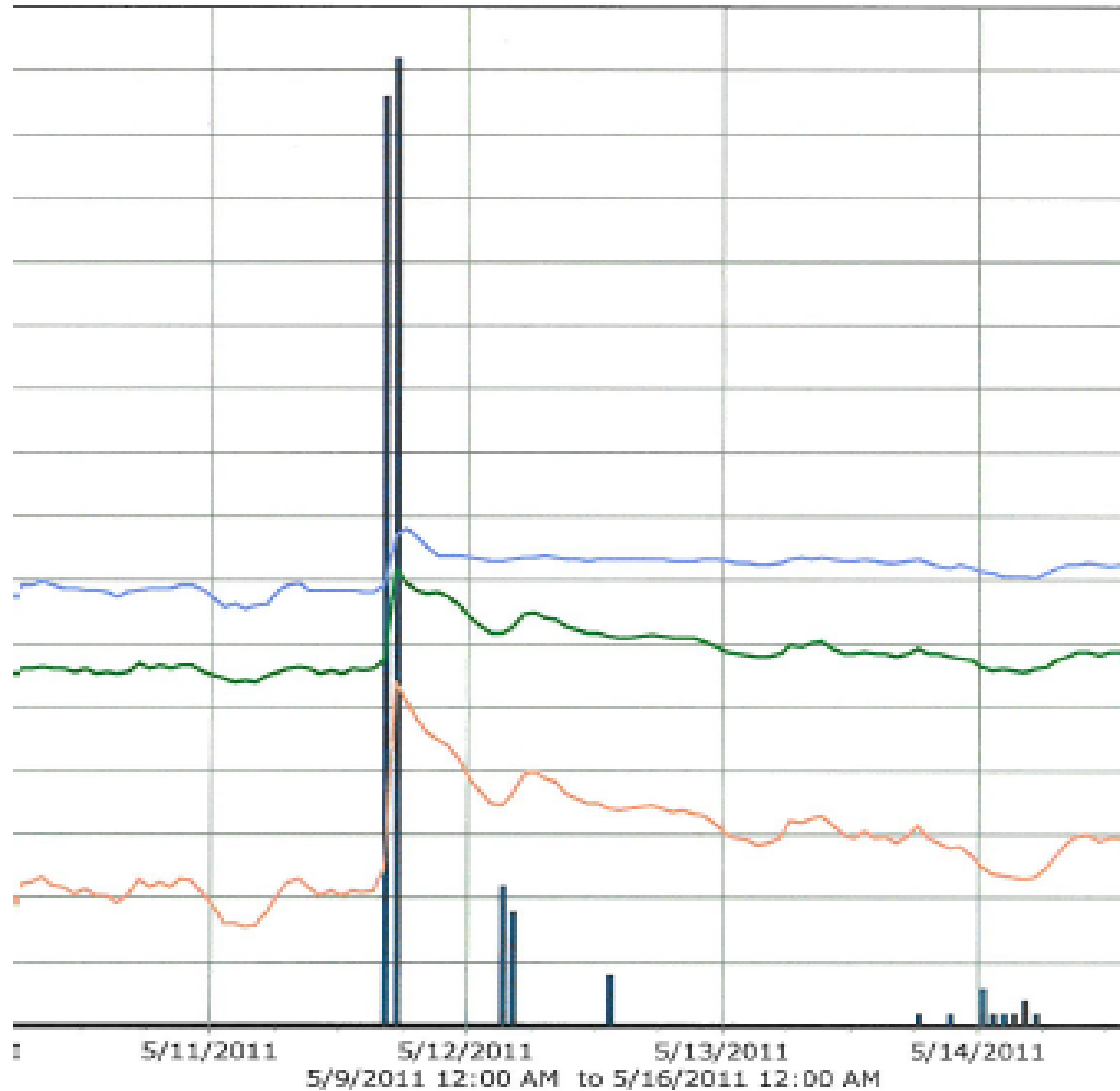
ISSUES

- ADVANCES IN METERING EQUIPMENT
- DIFFERENT WAYS OF FLOW ANALYSIS
- RAINFALL VARIATIONS
- ADVANCES IN INSPECTION EQUIPMENT
- REPAIR EFFECTIVENESS



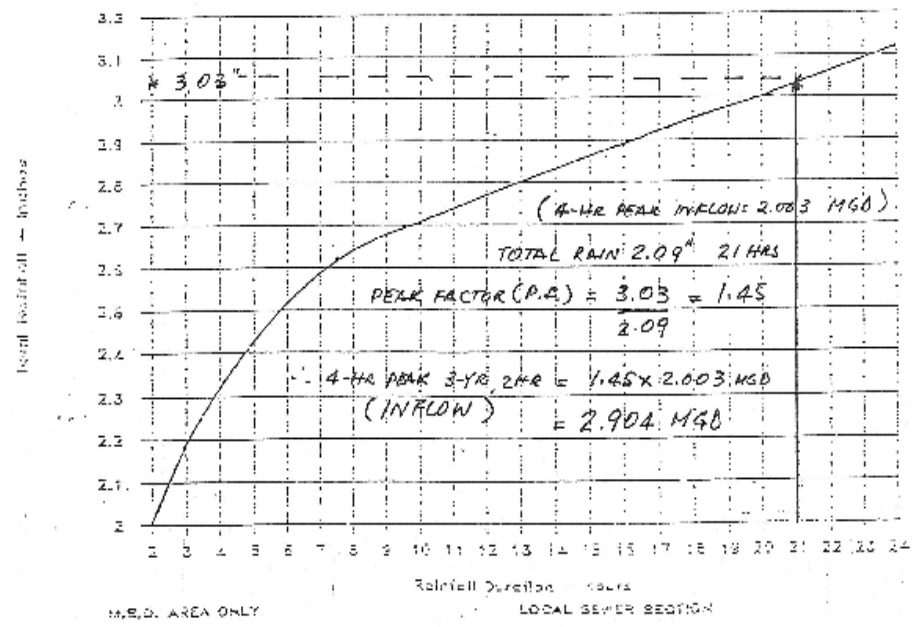
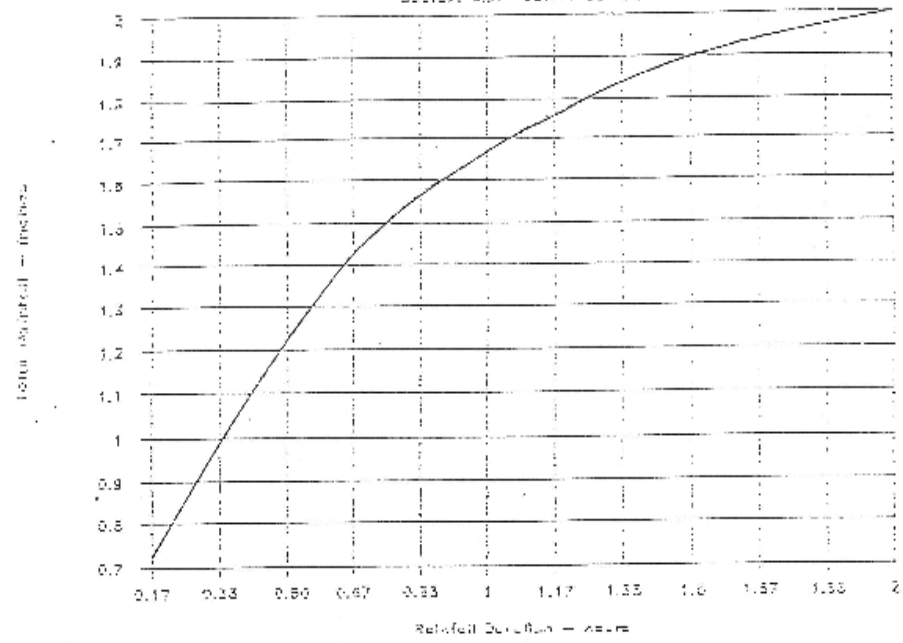
Storm data analysis

— Velocity (fps) — Level (in) — Flow (mgd) ■ Rain (In)

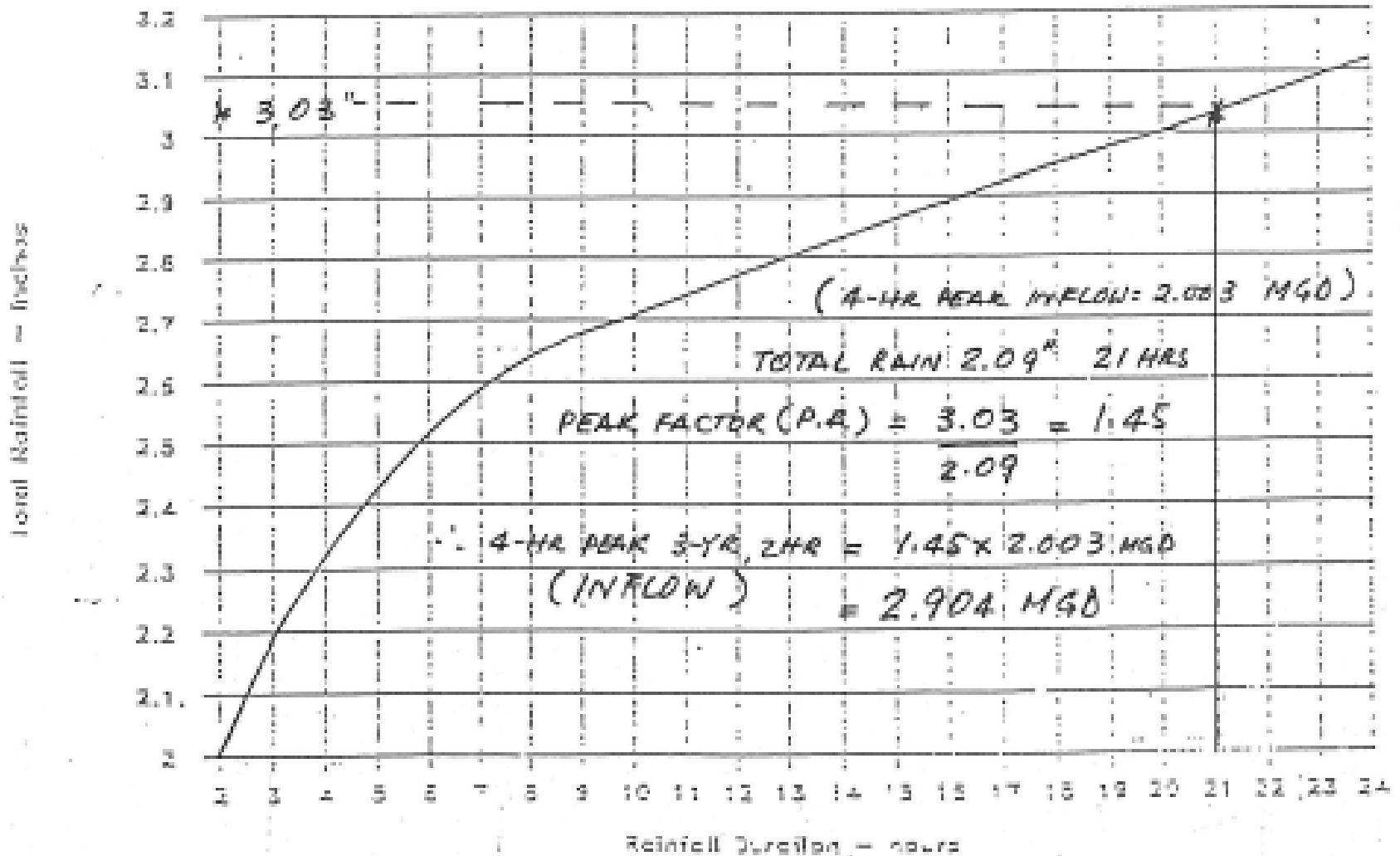


THREE YEAR RAINFALL RECURRENCE INTERVAL

Source: U.S. Weather Bureau



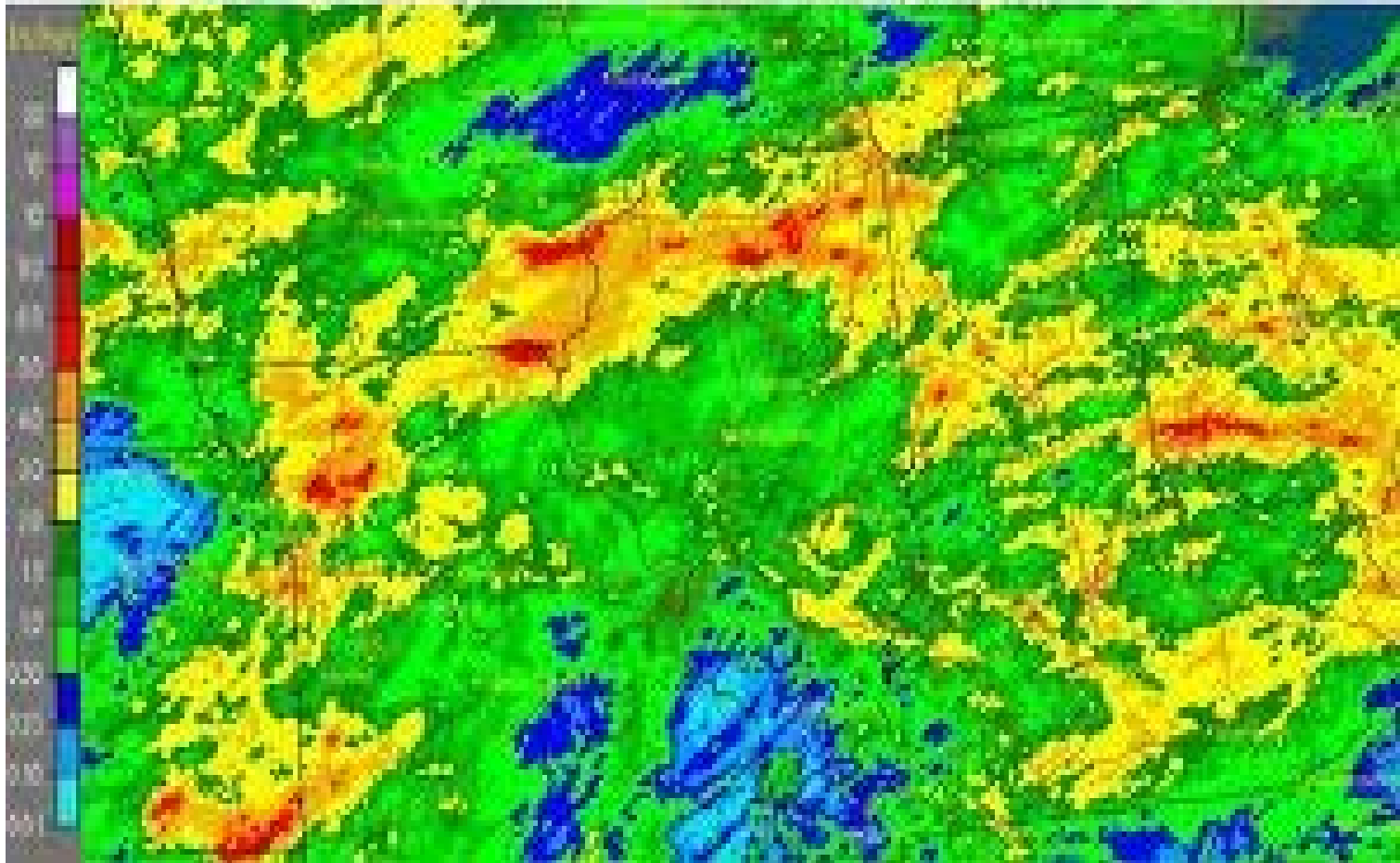
3-year intensity curve



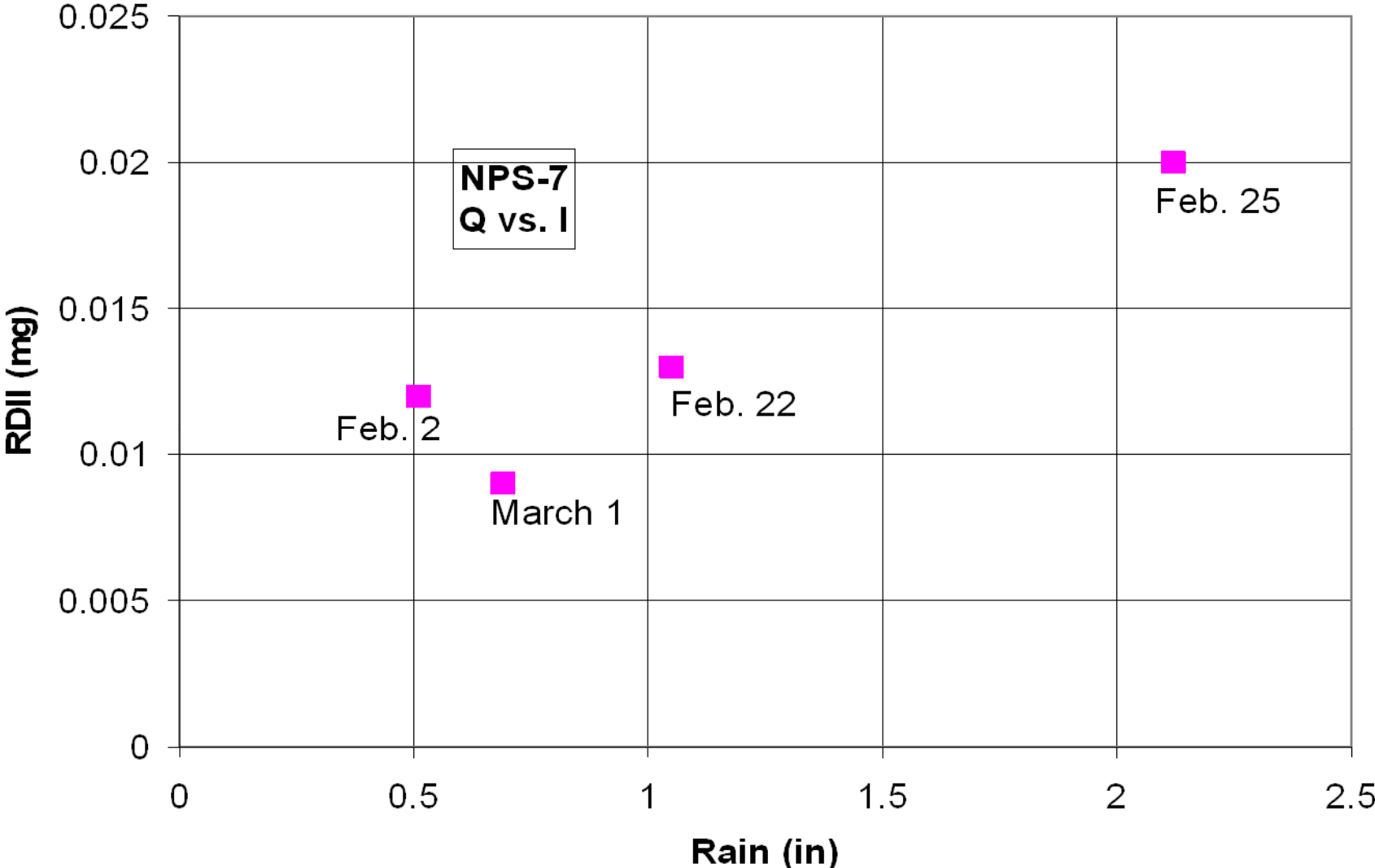
Weather radar

Illinois: Current 7-Day Observed Precipitation

Valid at 5/7/2012 1200 UTC - Created 5/7/12 17:55 UTC



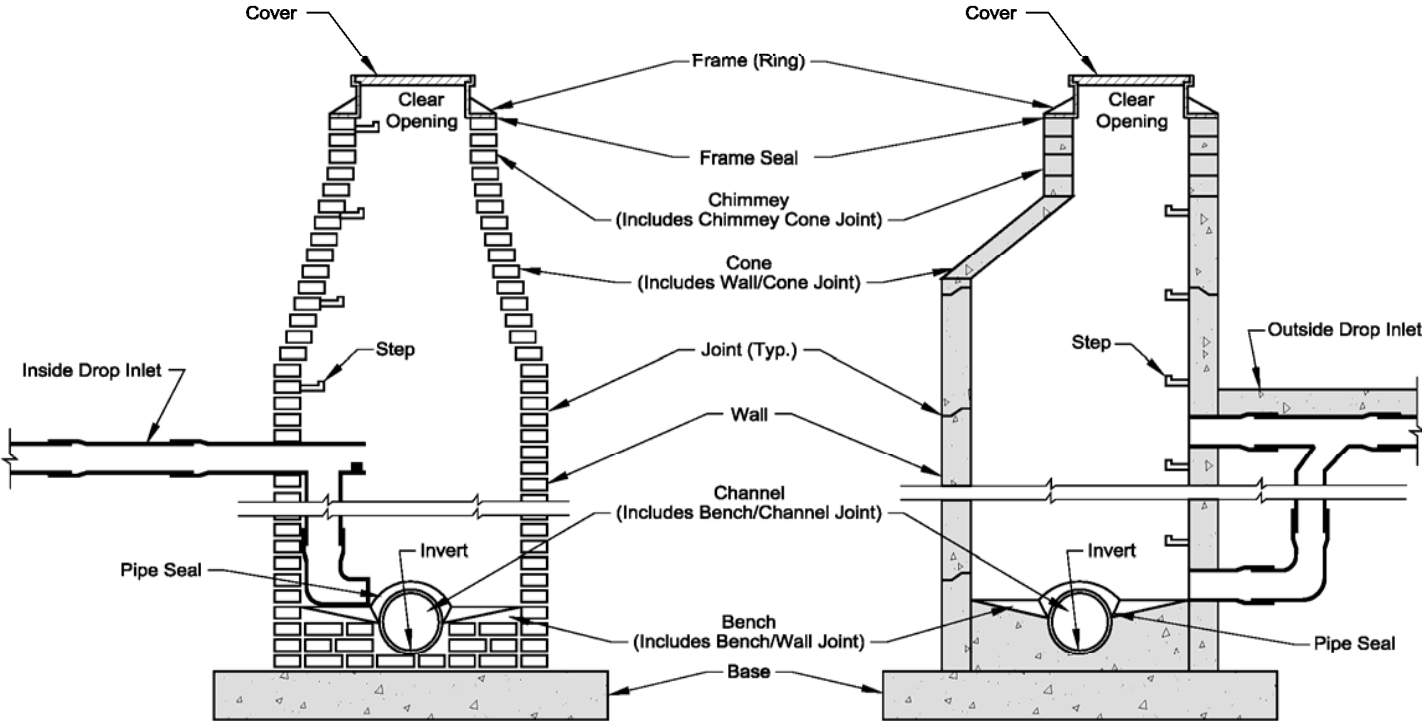
Flow projection by rainfall total



MANHOLE DIAGRAM

Typical Brick Manhole
No Scale

Typical Pre-Cast Manhole
No Scale



Mechanical chimney seal



Mechanical chimney seal



CUES Manhole Camera





Pipeline Assessment and Certification Program (PACP)

User Training

November 2010

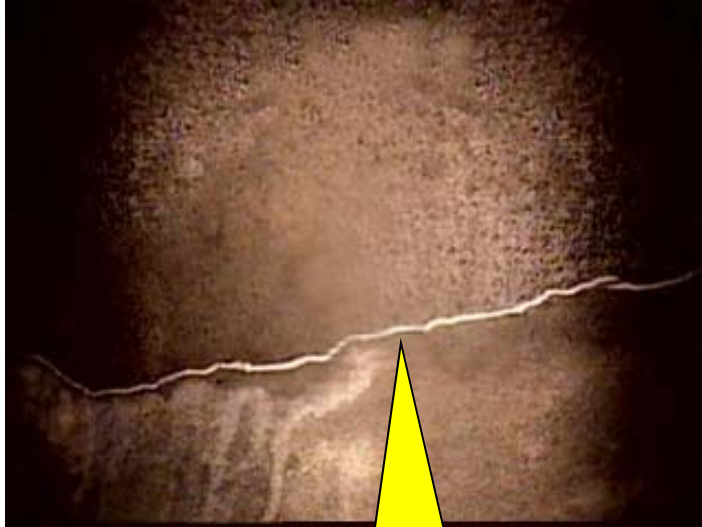
Version 6.0.1

Structural Defects

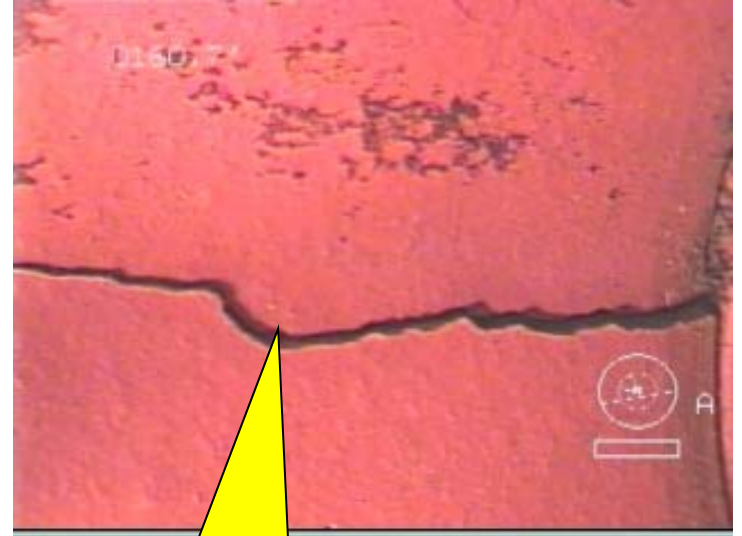
13 Groups

- Crack
- Fracture
- Broken
- Hole
- Deformed pipe
- Collapse
- Joint defects
- Surface damage
- Buckling
- Lining defect
- Weld failure
- Point repair
- Brickwork

Crack and Fracture



Crack = not open



Fracture = visibly open

Defect Grades – Express Likelihood of Failure

- 5 – Pipe has failed or will likely fail within the next 5 years
- 4 – Pipe will probably fail in 5 to 10 years
- 3 – Pipe may fail in 10 to 20 years
- 2 – Pipe unlikely to fail for at least 20 years
- 1 – Failure unlikely in the foreseeable future

Manhole Adjustment Defect



Dyed-Water Flooding

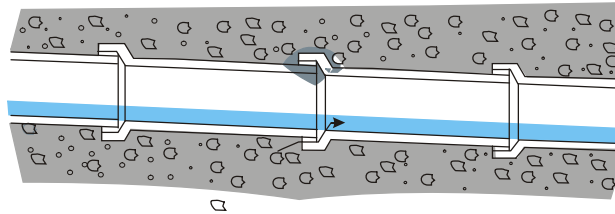


Subsidence of sewer

STAGE 1:

Gap in sewer at joint or a poor lateral connection.

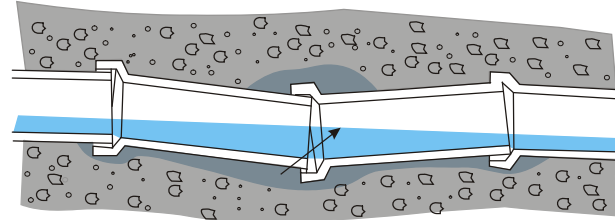
Visible defects: Offset joint, badly made connection. Infiltration, lack of long lived joint sealing method



STAGE 2:

Infiltration of groundwater or infiltration/exfiltration caused by surcharging of the sewer washes in soil particles. Loss of soil support around the sewer allows pipe to move, opening joints and increasing the in wash of soil.

Visible defects: Open and displaced joints, loss of line and level. Infiltration. History of surcharge. NOTE: Care must be exercised when viewing video tape recordings as displaced or slightly displaced joints can be overcompensated by the camera's lighting system.

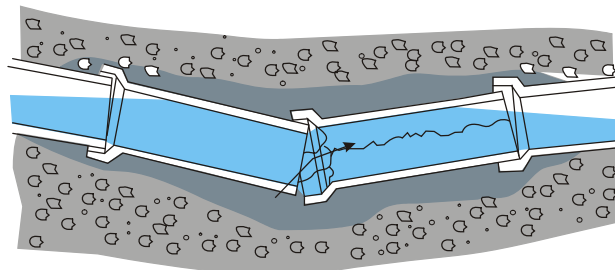


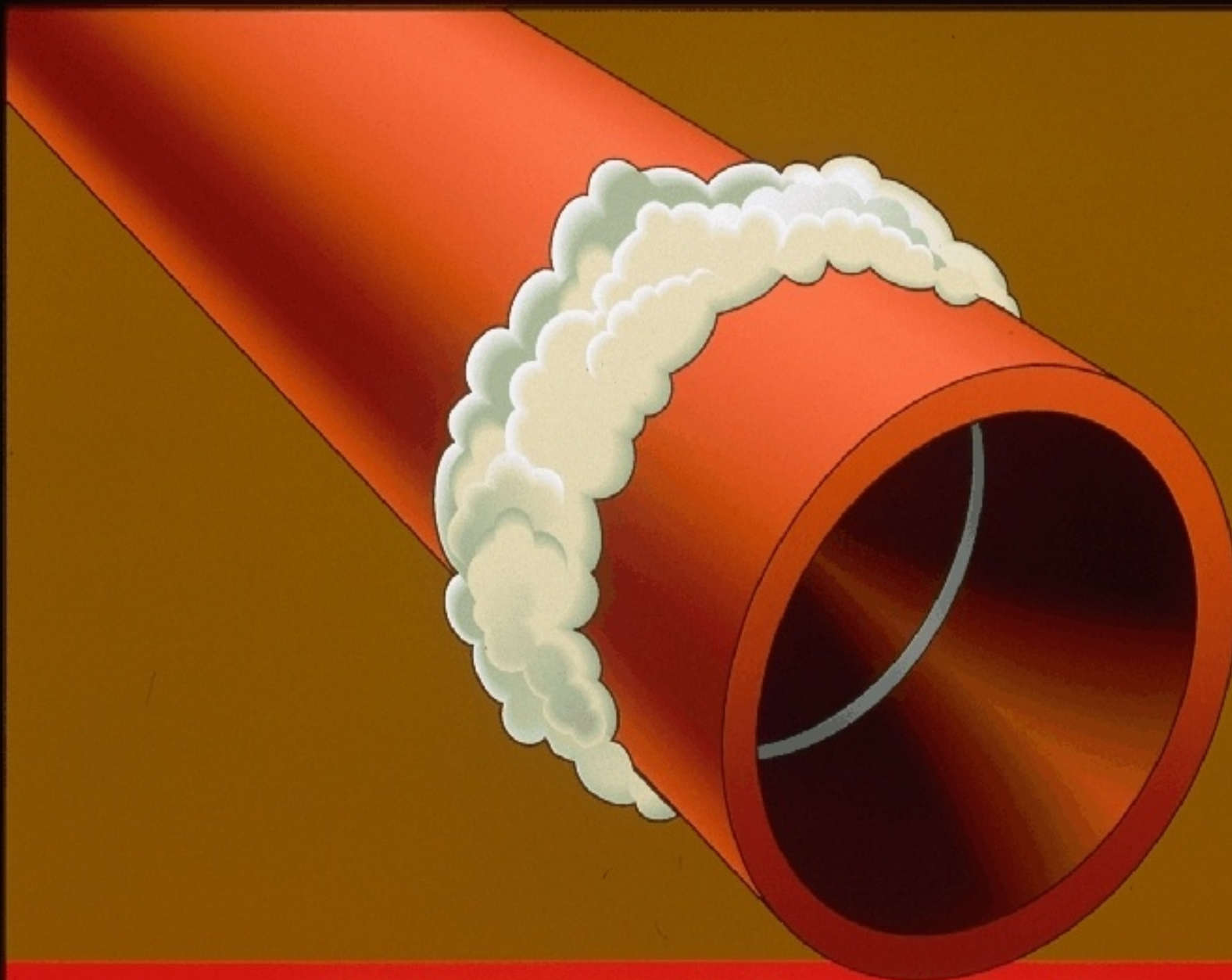
STAGE 3:

Uneven loading of pipes due to joint displacement causes cracking of pipes. Process then accelerates and cracked pipes may also deform.

Visible Defects: Open and displaced joints, cracked and fractured pipes, loss of line and level. NOTE: The camera may be submerged due to loss of gradient.

Development of Zones of Loose ground or voids caused by loss of soil into sewer



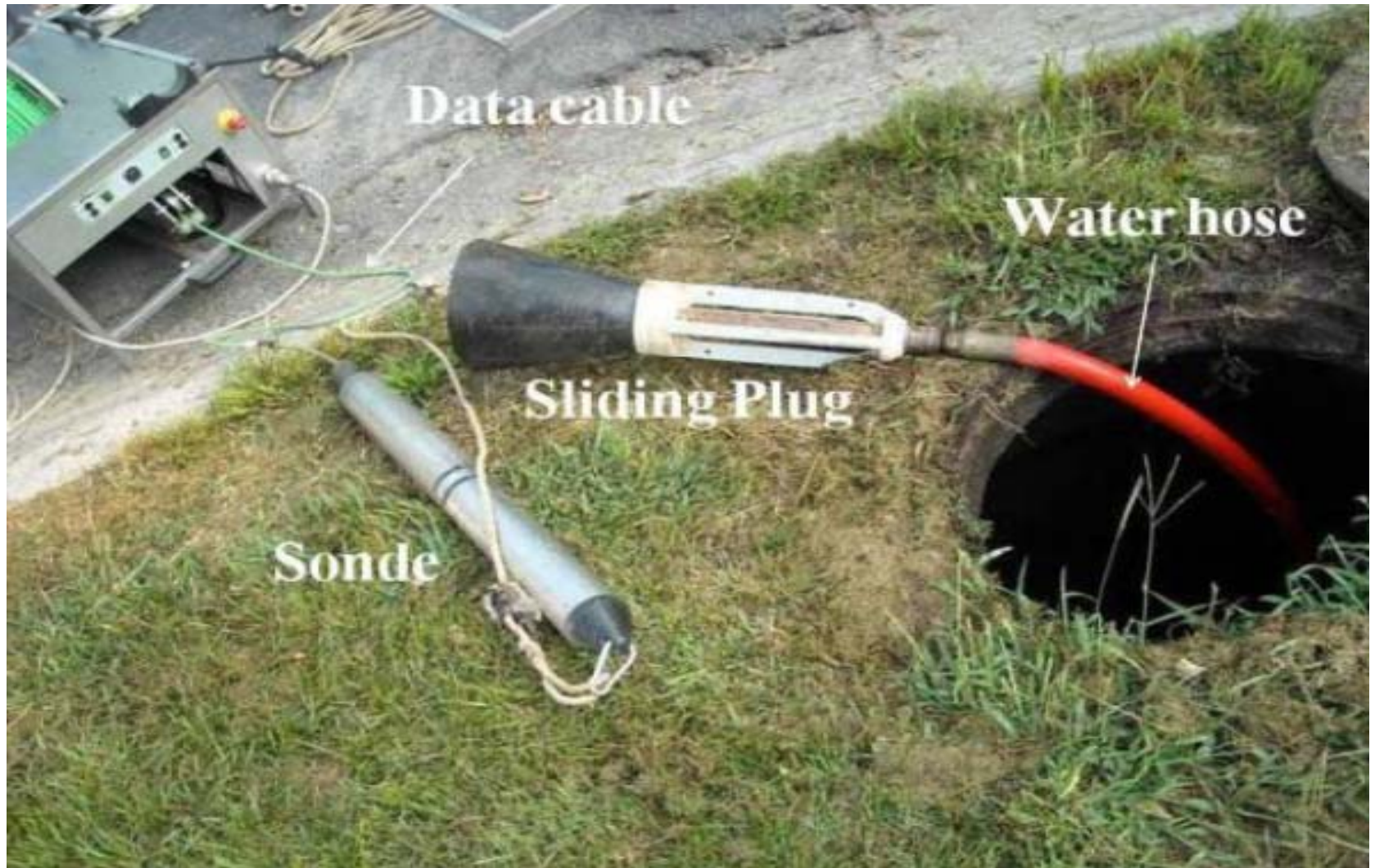


Waterproof Grout Collar

Manhole 3-D Scanner



Electro-scan components



Electro-can data

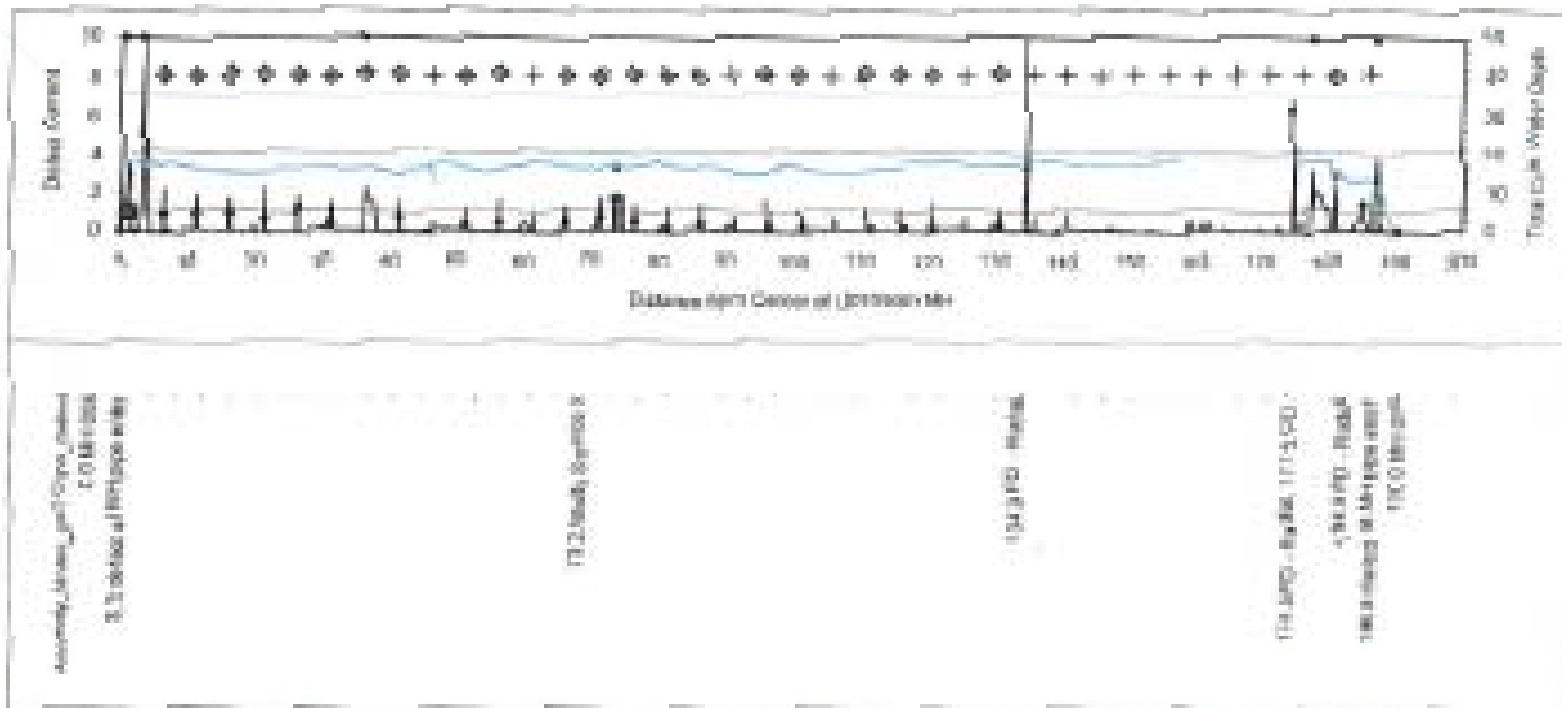


Figure 2. Electro-scanning results for the pipe segment MH 095 to MH 094.

Five Types of Pipe Inspections

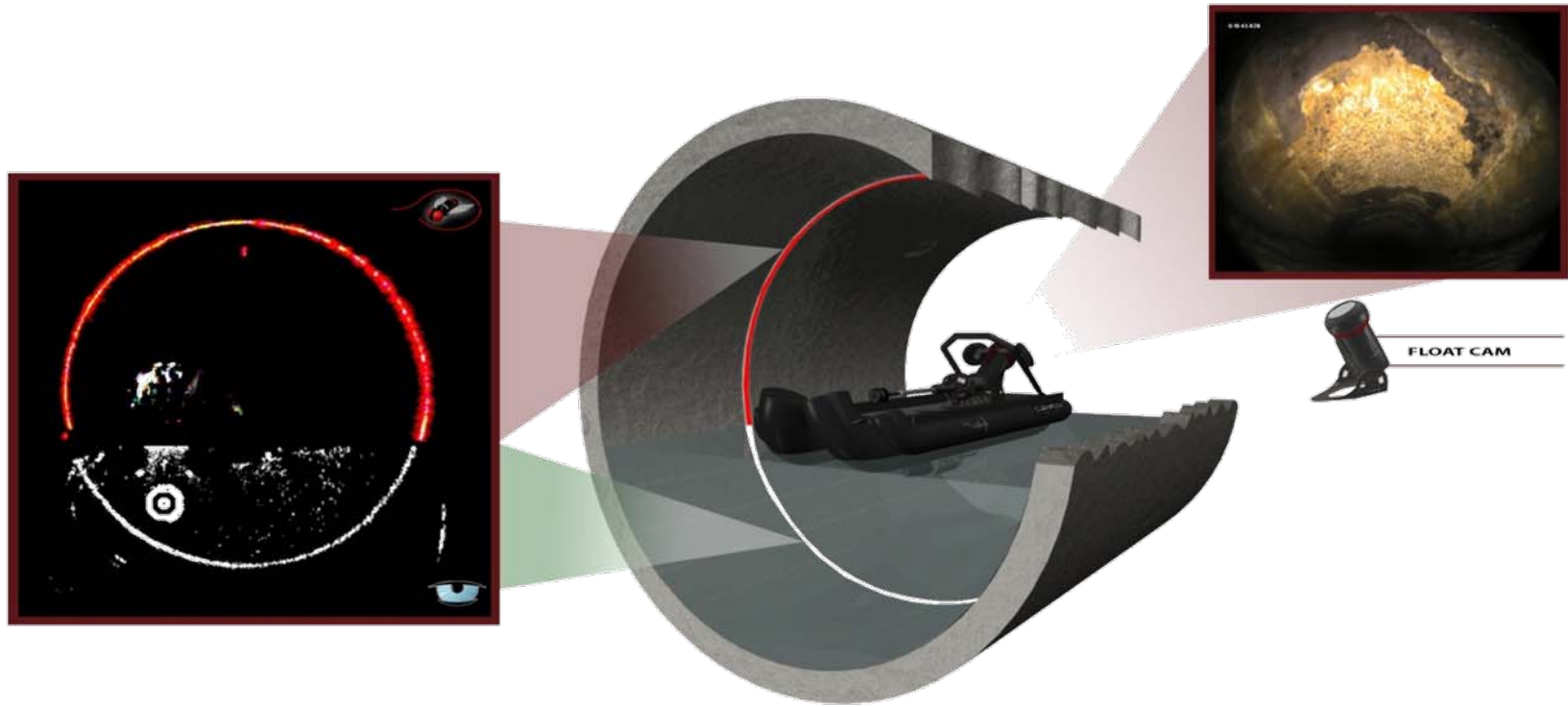
Basic Level

- CCTV (Level 1 Inspection)

Advanced Level

- CCTV and Laser
- CCTV and Sonar
- Advanced Sonar
- Combination Sonar/Laser/HDCCTV

Advanced Multi Platform Technologies



Acoustic Assessment Tool



Why Eliminate Infiltration?

- **Infiltration causes damage!**

Active inflow from the exterior of systems undermines the backfill which hold them in place. Structures without proper support can shift causing unnecessary blockages, and collapses.

Fine material in backfill will find its way into open joints and ultimately the system. Resulting in lower capacities and higher maintenance costs.

**SIDE
FILL**

Soil Stabilization

**SOIL
VOID**



**LEAKING
PIPE**









Where does the water go?

