Baywork Training Buffet
Sewer Collection Operations and Emergency Response

November 19, 2014

Dan Stevenson

A little bit about me….. Dan Stevenson

City of Sunnyvale, Wastewater Operations Manager (2009-2014)

B.A. in Leadership and Organizational Studies from St. Mary's College of California

BACWA Collections System Committee Chair (2011-2014)

CWEA SCVS Collections Systems Committee past-Chair (2010-2013), Grade 4 CSM Certified, SME for CSM Cert Tests

CDPH Water Distribution D4 Certified

AWWA Cross-Connection Control Specialist Certified

Sewers doubled your life…

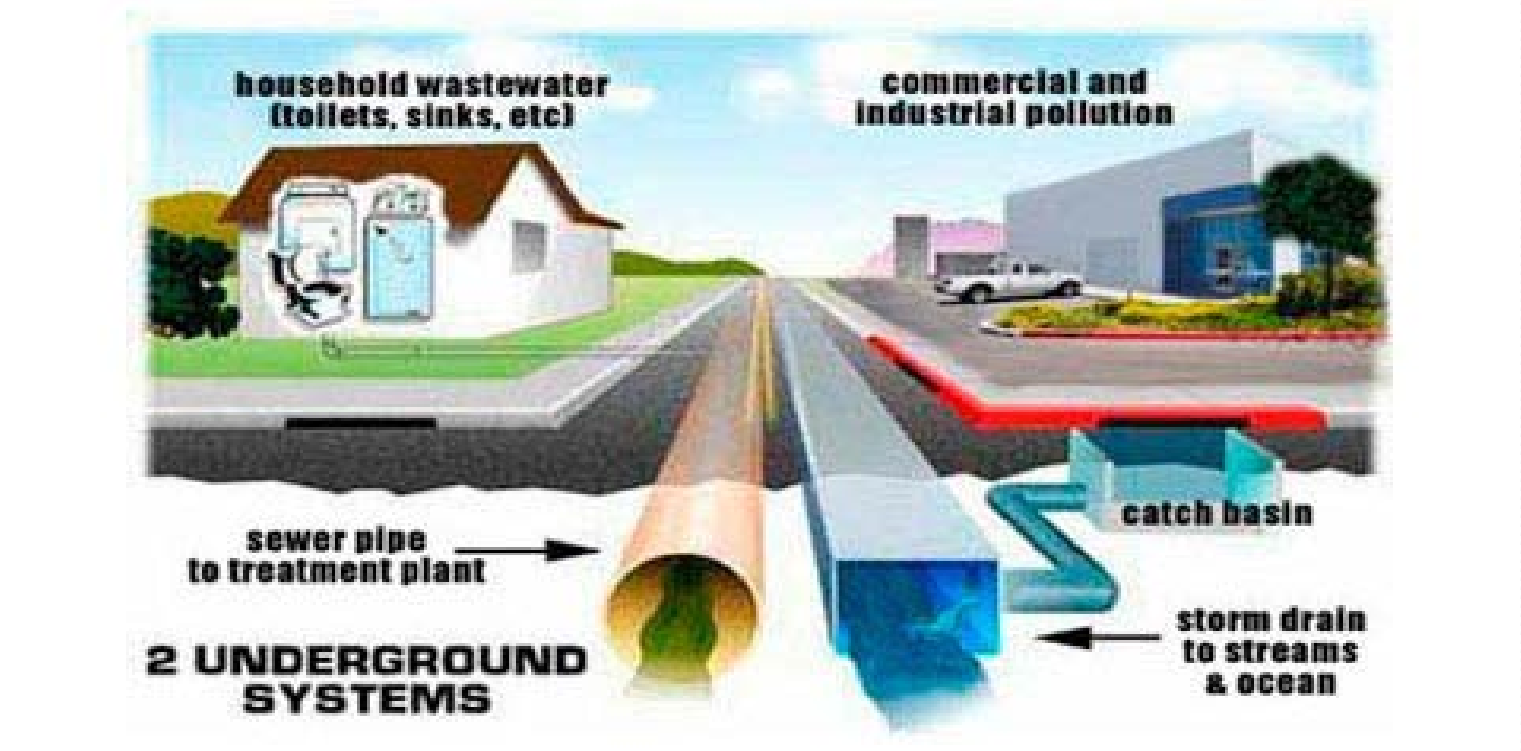
- The best medical advancement in the past 150 years…
- Life expectancies doubled after 1840

Sanitary Sewer Systems

- Evolved from population expansion and waste disposal needs (odors)…
  - Animal transportation.
  - Night cleaning
- Recently recognized as integral to protect public health and the environment

Sanitary Sewer Systems

- Independent from Sanitary Sewers (in most cases)



Sewer Collection System

- Gravity Flow
- Sub-surface (pipe system)
- Pump/Lift Stations

BLD080172 [RF] © www.visualphotos.com

Sewer Collection System

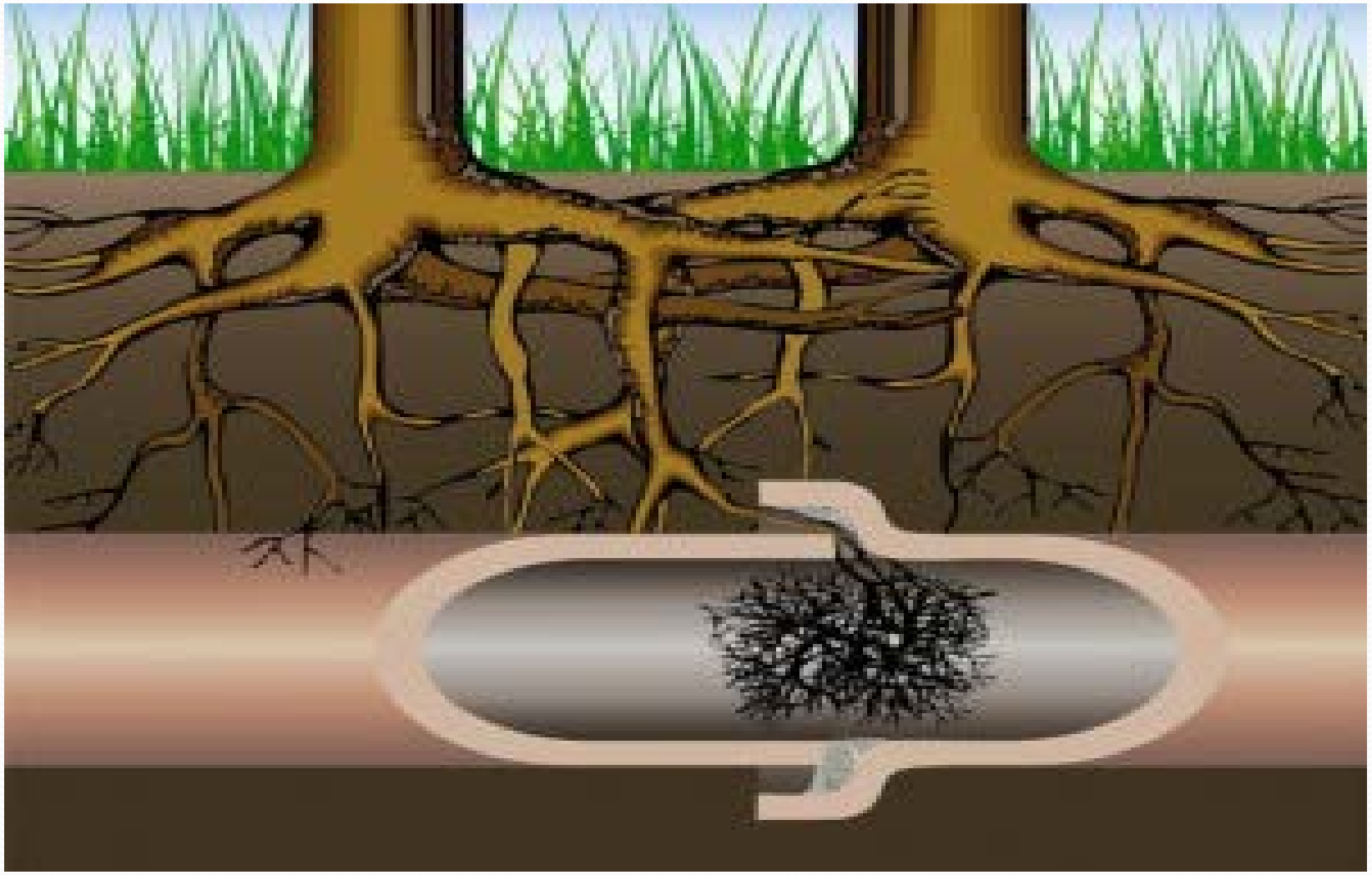
- SSOs (Sanitary Sewer Overflows)
  - Blockages (roots, FOG, debris, etc.)
  - Structure failures
  - Pump station failures
  - Vandalism
  - Etc.

- *Keep it in the pipe!*

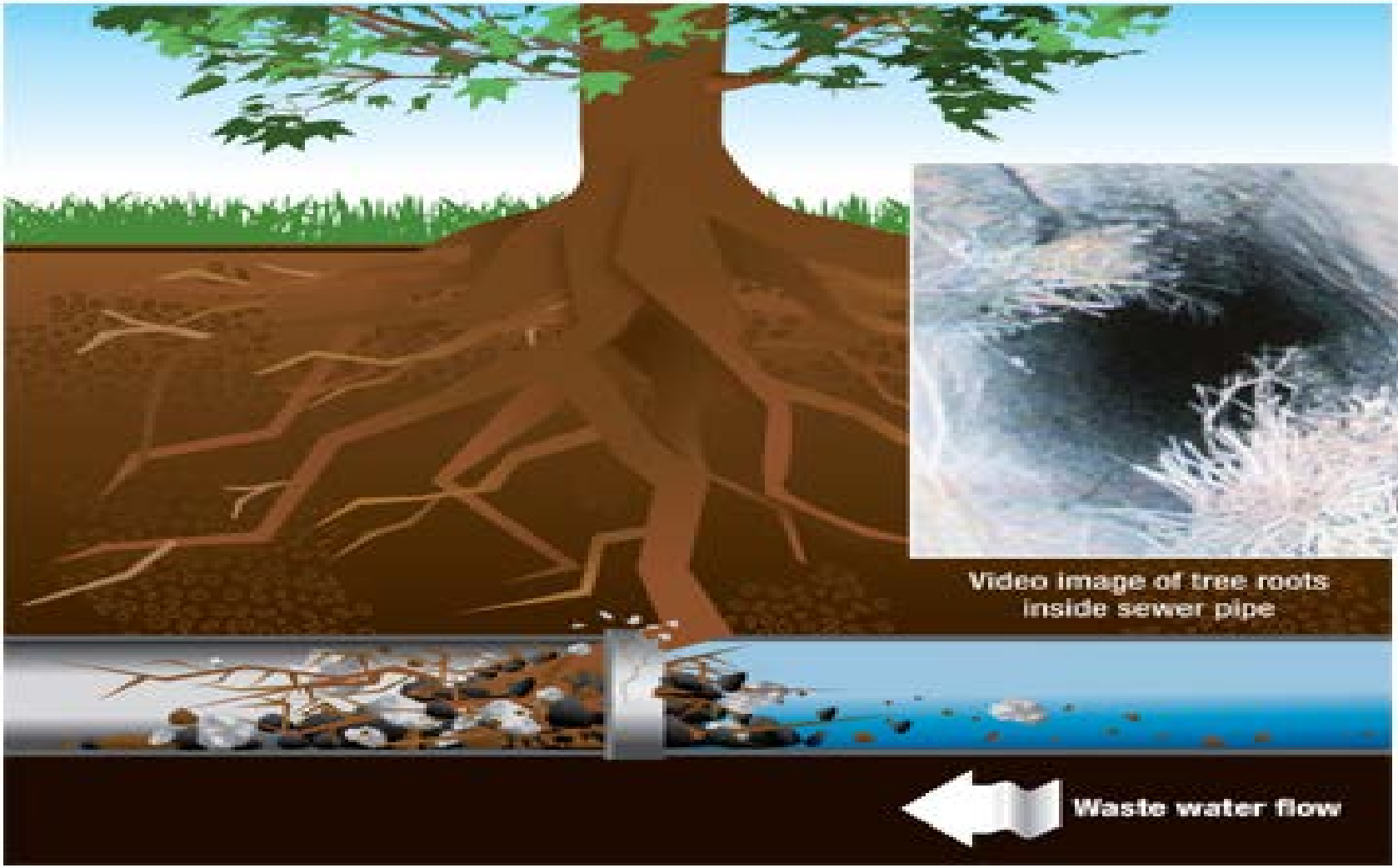
Roots


COVE SPRINGS MH 1 S TO MH 2
SEVERE ROOT INTRUSION AT OFFSETT JOINT

Roots



Roots


Video image of tree roots inside sewer pipe
Waste water flow

Grease (FOG)

Grease (FOG)

Sewer Collection System

- Limited Control Over What People Put Into Sewers

- *Keep it in the pipe!*

SSO

Sanitary Sewer Systems

- Some agencies had 'Out of sight, out of mind' as an operating mode- high SSOs
- Gov't had to step in after Richardson Bay

Who is looking at us?

- State Water Resources Control Board
- Regional Water Control Board (RWQCB)
- Environmental Protection Agency (EPA)
- County Environmental Heath
- Non-Governmental Organizations (NGO's)

Regulatory Authority

- Clean Water Act
- State Water Codes
- WDR/MRP

WDR-MRP

WDR/MRP (2013 MRP Revision)

SSMP

3 Spill Categories

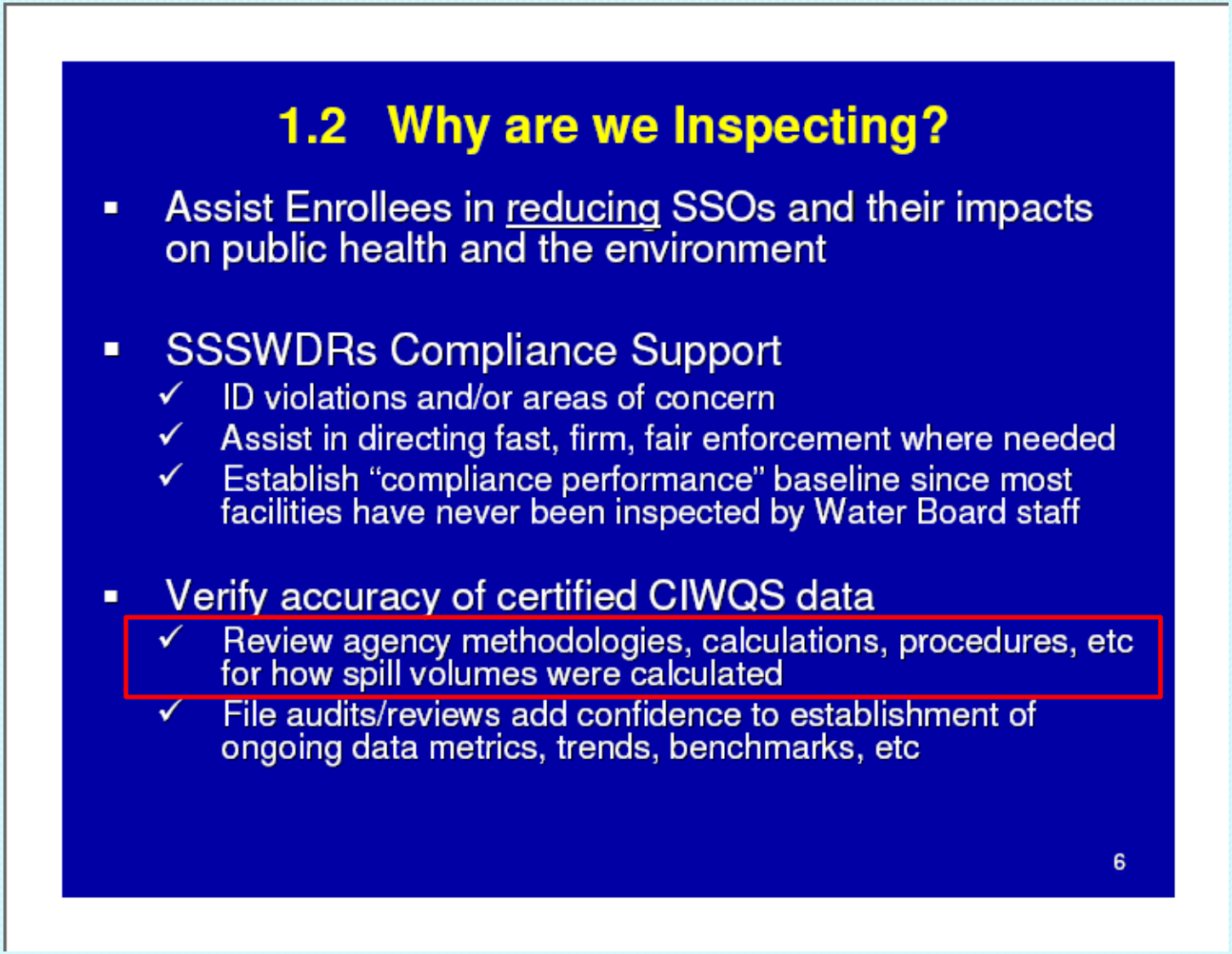
What are regulators looking for?

- Written procedures
- Consistent documentation
- Methods used
- Calculations used

What are regulators looking for?

- Written procedures
- Consistent documentation
- Methods used
- Calculations used

Excerpt - State Water Board Presentation



What Are They Finding During Inspections?

- Agency " … did not maintain adequate documentation to verify and substantiate the SSO volumes reported in certified SSO reports in CIWQS"
- "failed to document the method of estimating…"
- "likely …underestimated" volumes due to "start time was the same time that the agency was first notified"
- Field reports did not match CIWQS

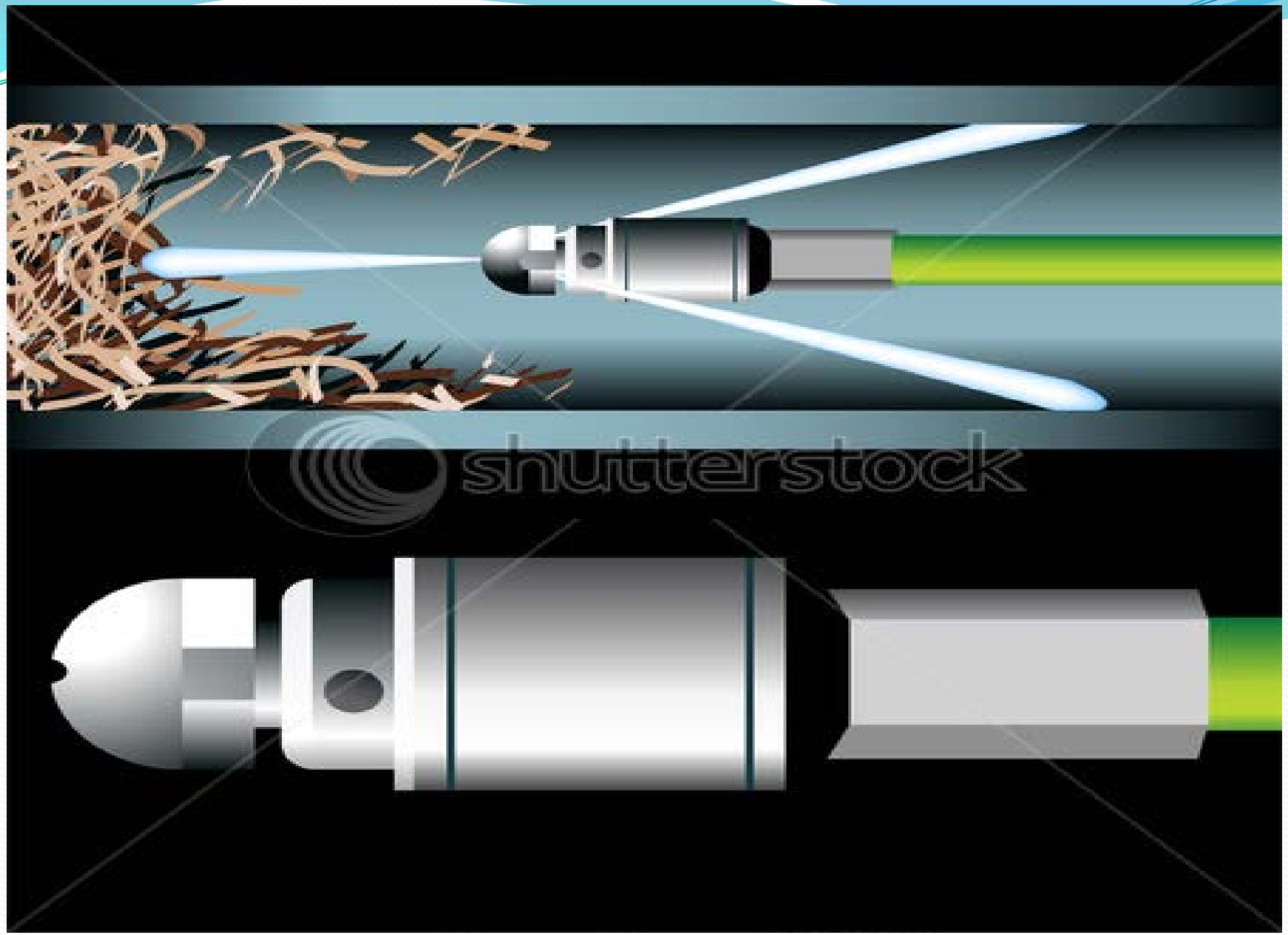
Pre-2006 and Post-2006 thinking…

- **Pre-2006**
- Dilution is the solution…
- General apathy toward CSs and improvements
- Environmental impacts
- Staff intellectual capacity

- **Post-2006**
- Extensive guidelines
- Guilty until proven innocent (defensible)
- Irrational/ unreasonable/ costly measures
- 3rd party litigation

Typical Maintenance

- Hydro cleaning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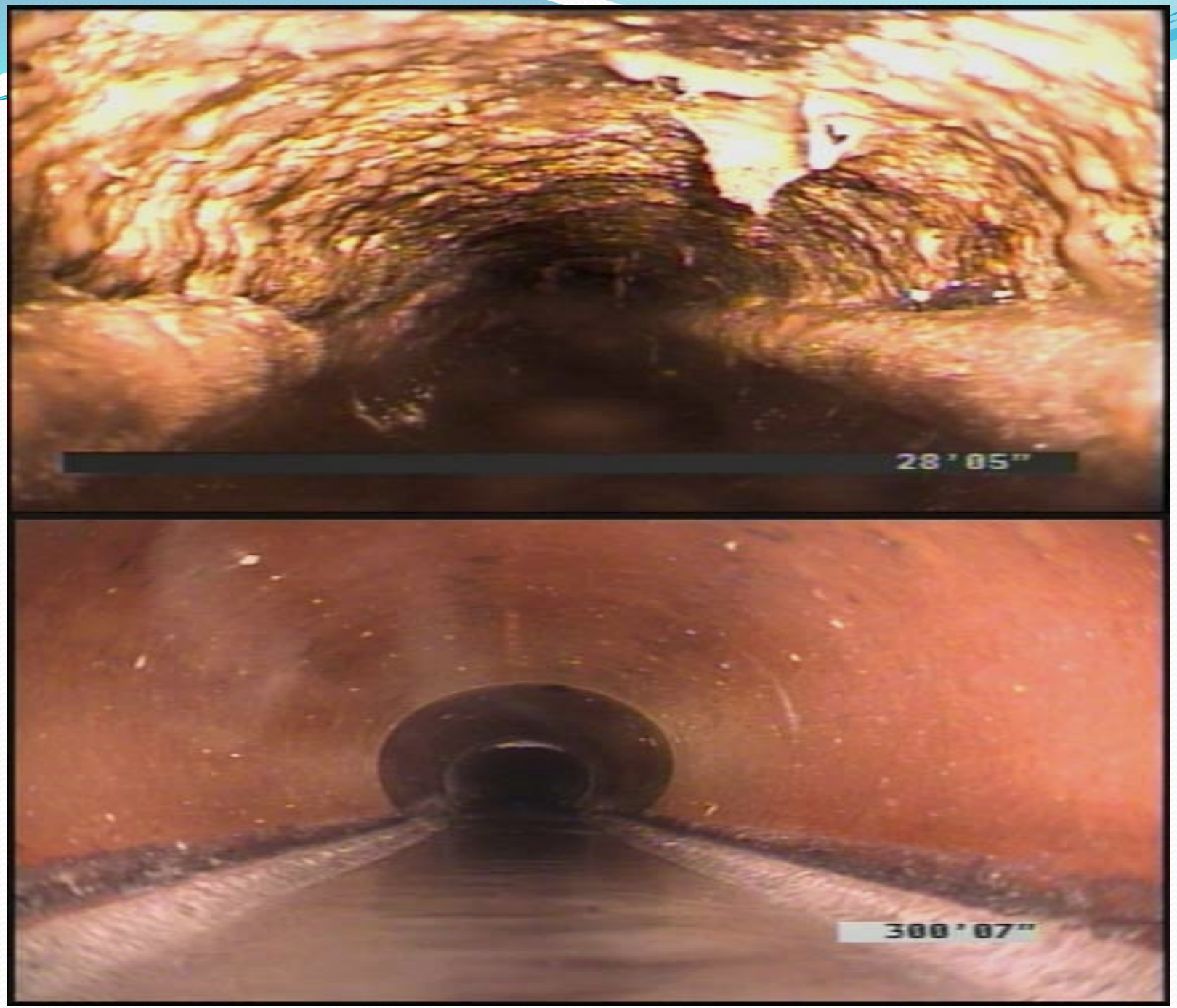
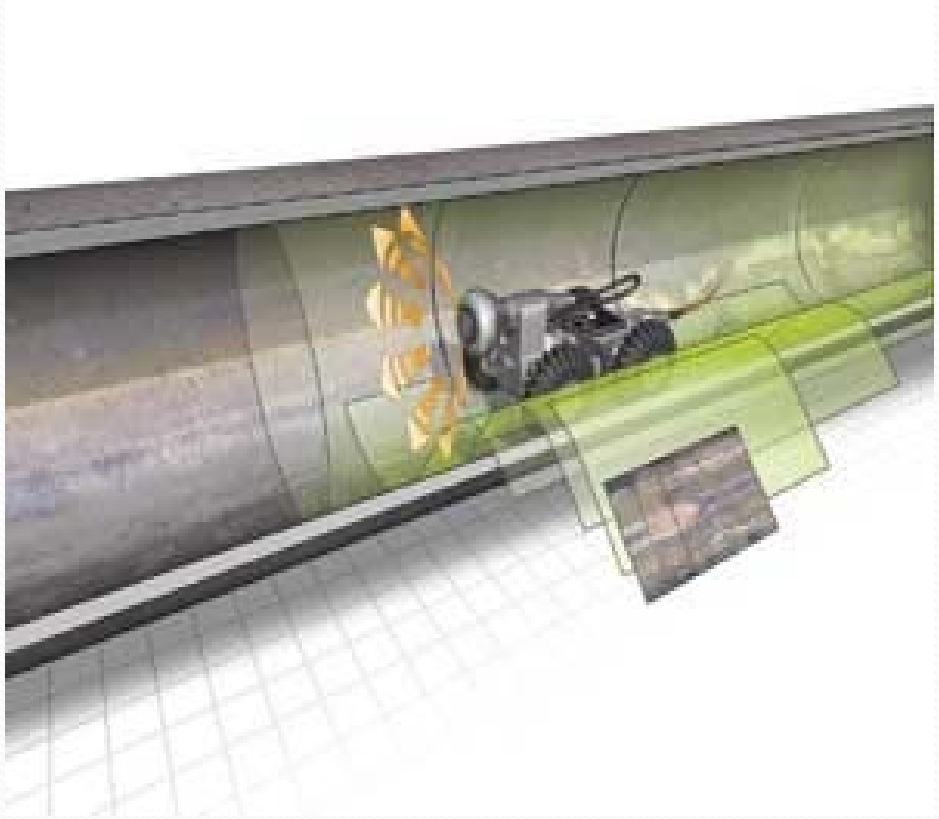

28'05"
300'07"

Robot Camera

Video Inspection Equipment

Pearpoint Mainline Inspection System



Emergency Response

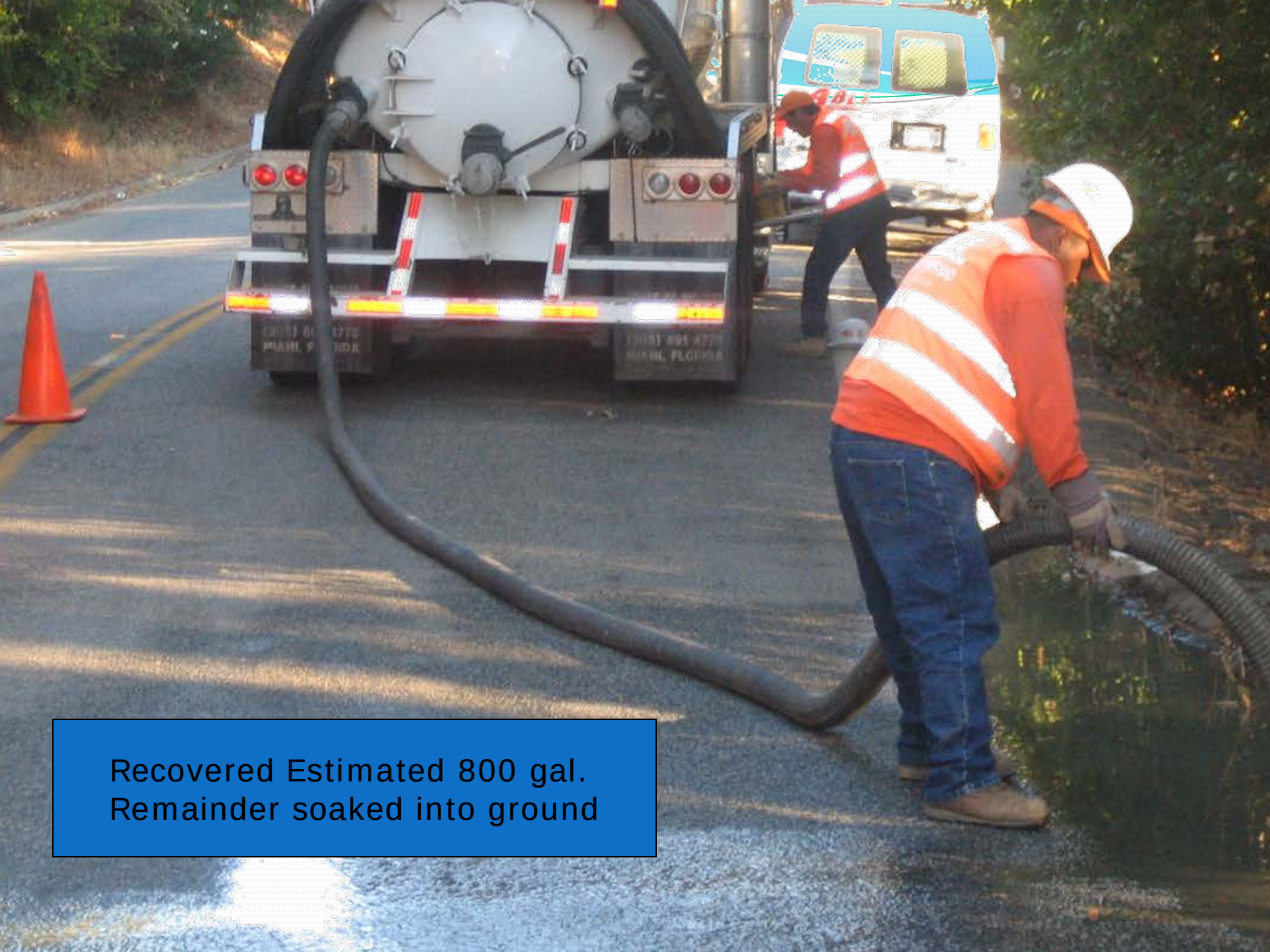
- SSOs

Fire Department Analogy

- Dual standard
- Purpose-
  - FD- Lives and property
  - CS- Public health and the environment
- Control over behaviors
- Quantification of impacts


50 gpm flow rate


Pig Blanket??
750 Gal. Spill (6.25gpm -2hrs)


Recovered Estimated 800 gal.
Remainder soaked into ground


LOLPix.com

Estimation

- Remember-
- it is an estimation, but it
- needs ‘due diligence’
- at how you arrived at the total.
- Include ***ALL*** available data for due diligence

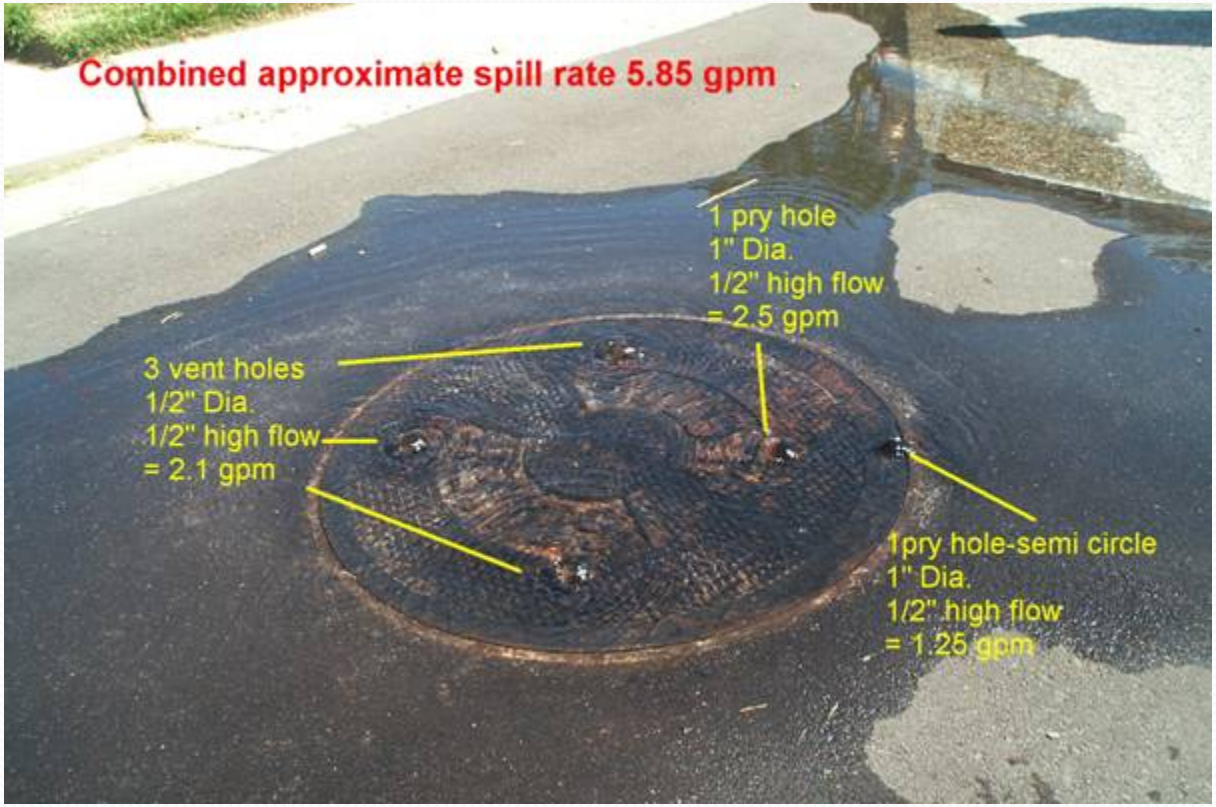
Why Are Volume Estimates So Important?

California Water Code

- Section 13350 - Civil Liability on a per gallon basis may not exceed ten dollars ($10) per gallon for each gallon of waste discharged.
- Section 13385 - Where there is a discharge, any portion of which is not susceptible to cleanup or is not cleaned up, and the volume discharged but not cleaned up exceeds 1,000 gallons, an additional liability not to exceed ten dollars ($10) multiplied by the number of gallons by which the volume discharged but not cleaned up exceeds 1,000 gallons.

…also why data is investigated in so much detail

Estimating Flow Rates



Eyeball Estimation

- Definition: Making a determination using your experience and ‘sizing up’ the observed volume
- Recommend drills/practice to ‘calibrate’ your eyes
- Recommend documenting your Training

Kick the Bucket

Spill it:

- On asphalt
- On concrete
- On sloped surface
- On flat surface

Spill:

- One gallon
- Five gallons
- Fifty gallons
- Etc.

Kick the Bucket

One gallon on
a
sloped surface

Better with a point of reference in the photo

Kick the Bucket

2 Gallons on very slight slope

Kick the Bucket

Eyeball Estimation Method

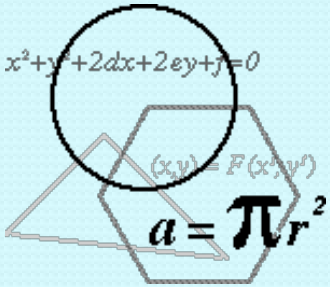
Pros

- Sometimes it is the only method we have
- Useful on smaller spills

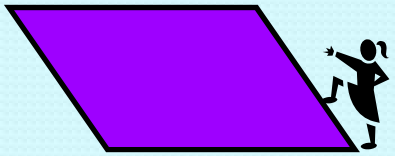
Cons

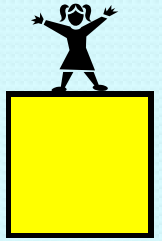
- It has it's place, but is difficult to defend
- Difficult to repeat (will two different people come up with essentially the same number?)
- Not very good for large spills

Area / Volume Estimations



- Size of “wetted footprint” or stain
- Amount captured / contained

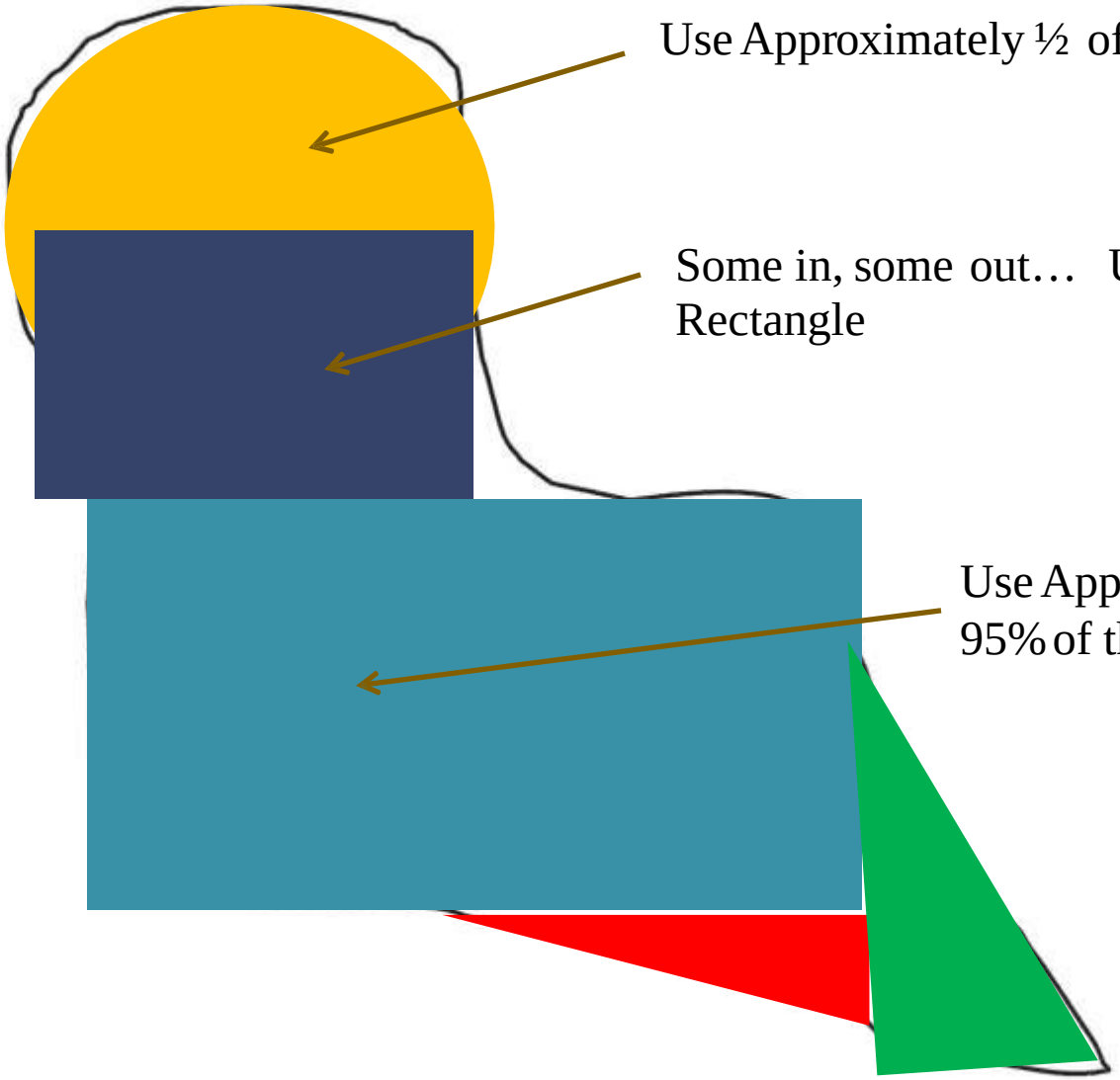




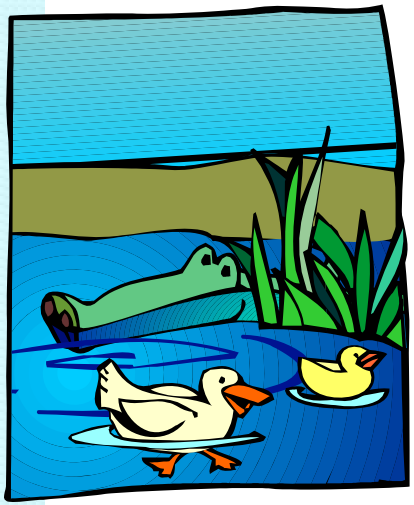
‘Pooled’ or ‘Ponded’ Sewage

Spill contained. Determine Area (L x W = Area)

The Spill Footprint

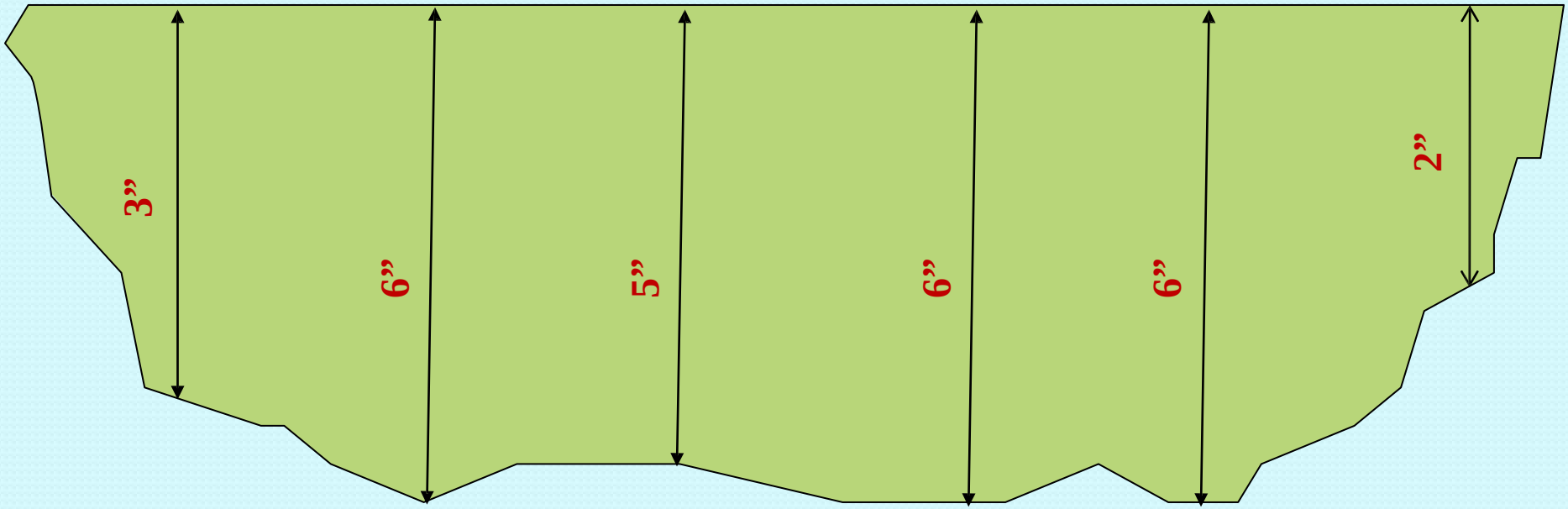


The Spill Footprint
with “pooling” or “ponded” sewage



Same Process, Except Depth is Determined Differently

‘Pooled’ or ‘Ponded’ Water



3” + 6” + 5” + 6” + 6” + 2” = **28”**

.

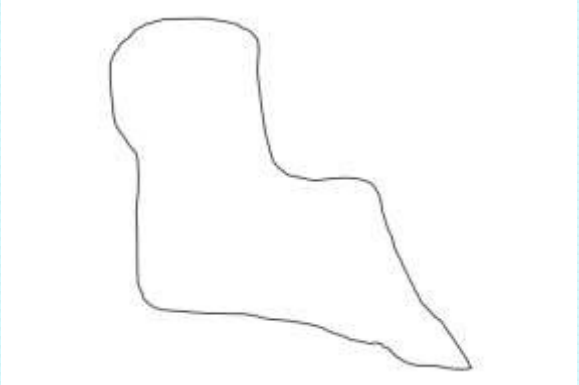
28” / 6 = **4.66”** average depth

Representative Sample

Average Depth (Profile View)

‘Pooled’ or ‘Ponded’ Water

EXAMPLE:



Area = 1,125 square feet

Average depth = 4.66 inches

Convert depth to feet: 4.66 / 12 = 0.39 feet

1,125 sqf x 0.39 depth = 438.75 cubic feet

438.75 cft x 7.48 gpcf = **3,282 gallons**

Areas and Volumes

AREA OF A RIGHT TRIANGLE

Base x Height x 0.05 x Depth = Area in Cubic Feet

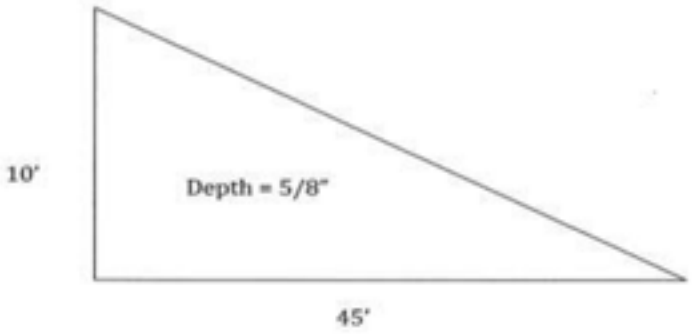
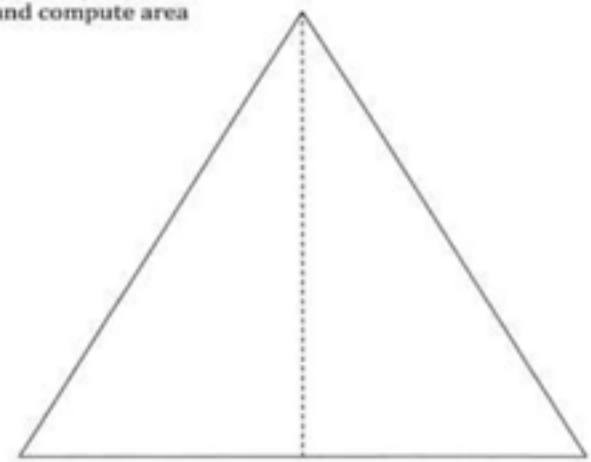


Chart - A		
Conversion: Inches to Feet		
1/8"	=	0.01'
1/4"	=	0.02'
3/8"	=	0.03'
1/2"	=	0.04'
5/8"	=	0.05'
3/4"	=	0.06'
7/8"	=	0.07'
1"	=	0.08'
2"	=	0.17'
3"	=	0.25'
4"	=	0.33'
5"	=	0.42'
6"	=	0.50'
7"	=	0.58'
8"	=	0.67'
9"	=	0.75'
10"	=	0.83'
11"	=	0.92'
12"	=	1.00'

Base (45') x Height (10') x 0.5 x Depth (.05') x 7.48 gallons/cubic foot = 22.5 gallons

For Isosceles Triangles (two sides are equal lengths), Break it down into two Right Triangles and compute area as you for the Right Triangle above.



South Placer Municipal Utility District

Spill Volume Guide

Areas and Volumes

AREA OF A CIRCLE

Diameter Squared x 0.785 x Depth = Area in cubic feet.

Diameter = Any straight line segment that passes through the center of a circle.

For our purposes, it is the measurement across the widest part of a circle.

D^2 x 0.785 x depth = Volume in cubic feet

Example:

27' x 27' x 0.785 x 0.03 = 17.17 cubic feet

17.17 cubic feet x 7.48 gallons/cubic feet = **128 gallons**

Chart - A		
Conversion: Inches to Feet		
1/8"	=	0.01'
1/4"	=	0.02'
3/8"	=	0.03'
1/2"	=	0.04'
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1"	=	0.08'
2"	=	0.17'
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4"	=	0.33'
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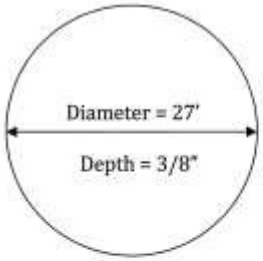


South Placer Municipal Utility District

Spill Volume Guide

Depth

(Determined by Trial-and-Error)

1/32 inch on concrete

1/64 inch on asphalt

SR:11 #1

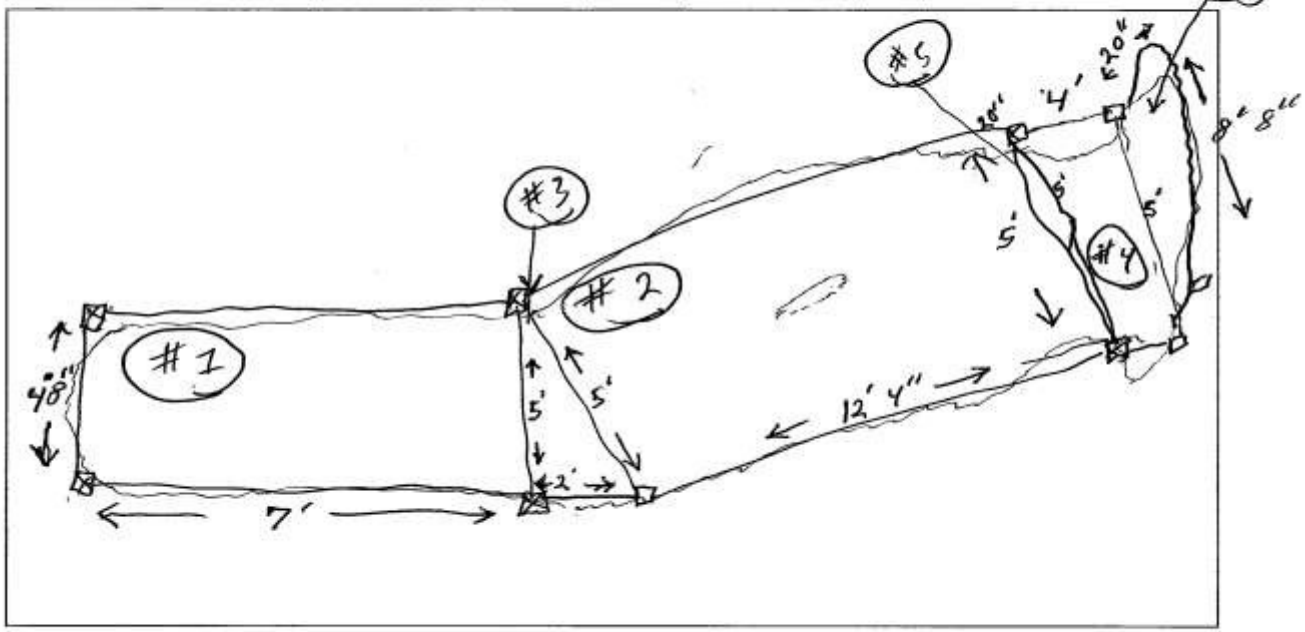
8/4/11

Area **Spill Estimation Work Sheet**

Side 1

Surface: ☒ Asphalt ☐ Concrete ☐ Dirt ☐ Landscape ☐ Inside Building Other _____

(Draw / Sketch outline of Spill 'Footprint' and attach photos)



~~ *Breakdown the 'Footprint' into Recognizable Shapes and Determine Dimensions of Each Shape* ~~

Area #1 4' 8" by 7' % Wet 90

☐ Stain. Depth1____ Depth2____ Depth3____ Depth4____ Depth5____ Depth6____

Area #2 12' by 5' % Wet 99

☐ Stain. Depth1____ Depth2____ Depth3____ Depth4____ Depth5____ Depth6____

Area #3 5' by 2' % Wet 100

☐ Stain. Depth1____ Depth2____ Depth3____ Depth4____ Depth5____ Depth6____

Area #4 4' by 5' % Wet 98

☐ Stain. Depth1____ Depth2____ Depth3____ Depth4____ Depth5____ Depth6____

Area #5 20" by 5' % Wet 95

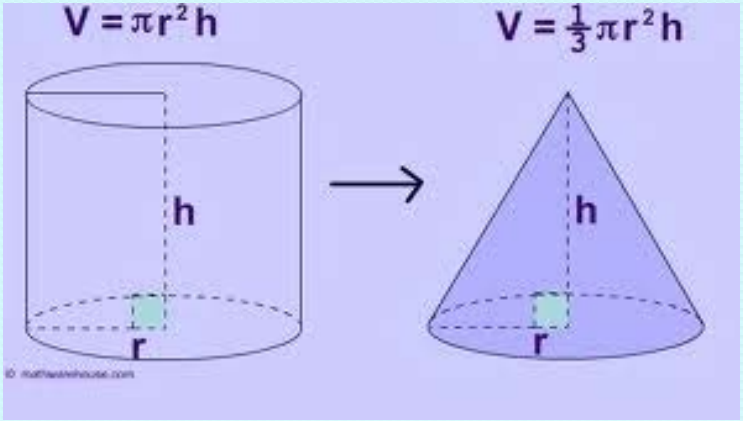
☐ Stain. Depth1____ Depth2____ Depth3____ Depth4____ Depth5____ Depth6____

Area #6 8' 8" by 20" % Wet 100

☐ Stain. Depth1____ Depth2____ Depth3____ Depth4____ Depth5____ Depth6____

Area / Volume Estimations

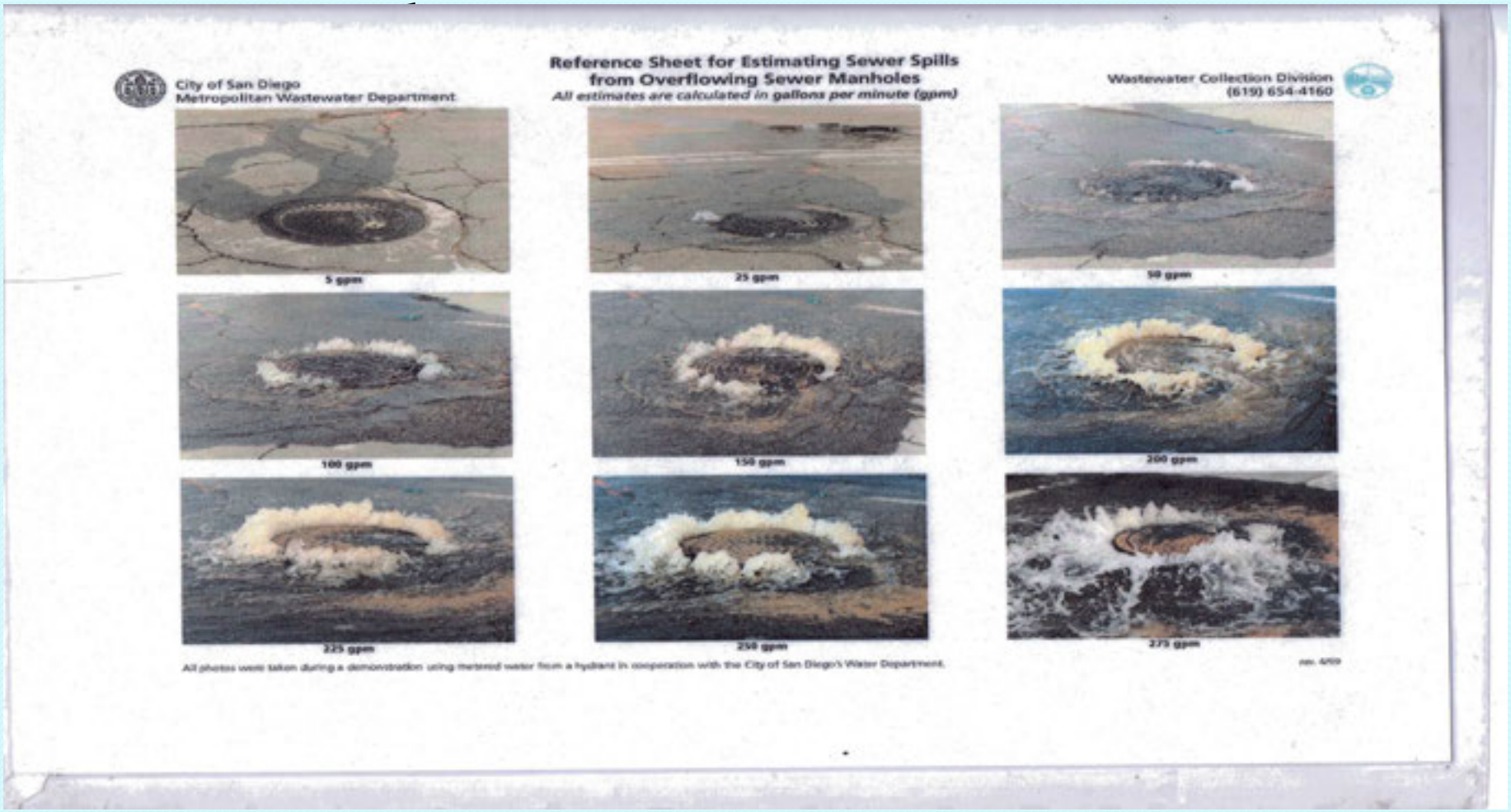
- PROS:
- Relatively accurate for surface spills
- Easy to diagram
- Photo evidence can support



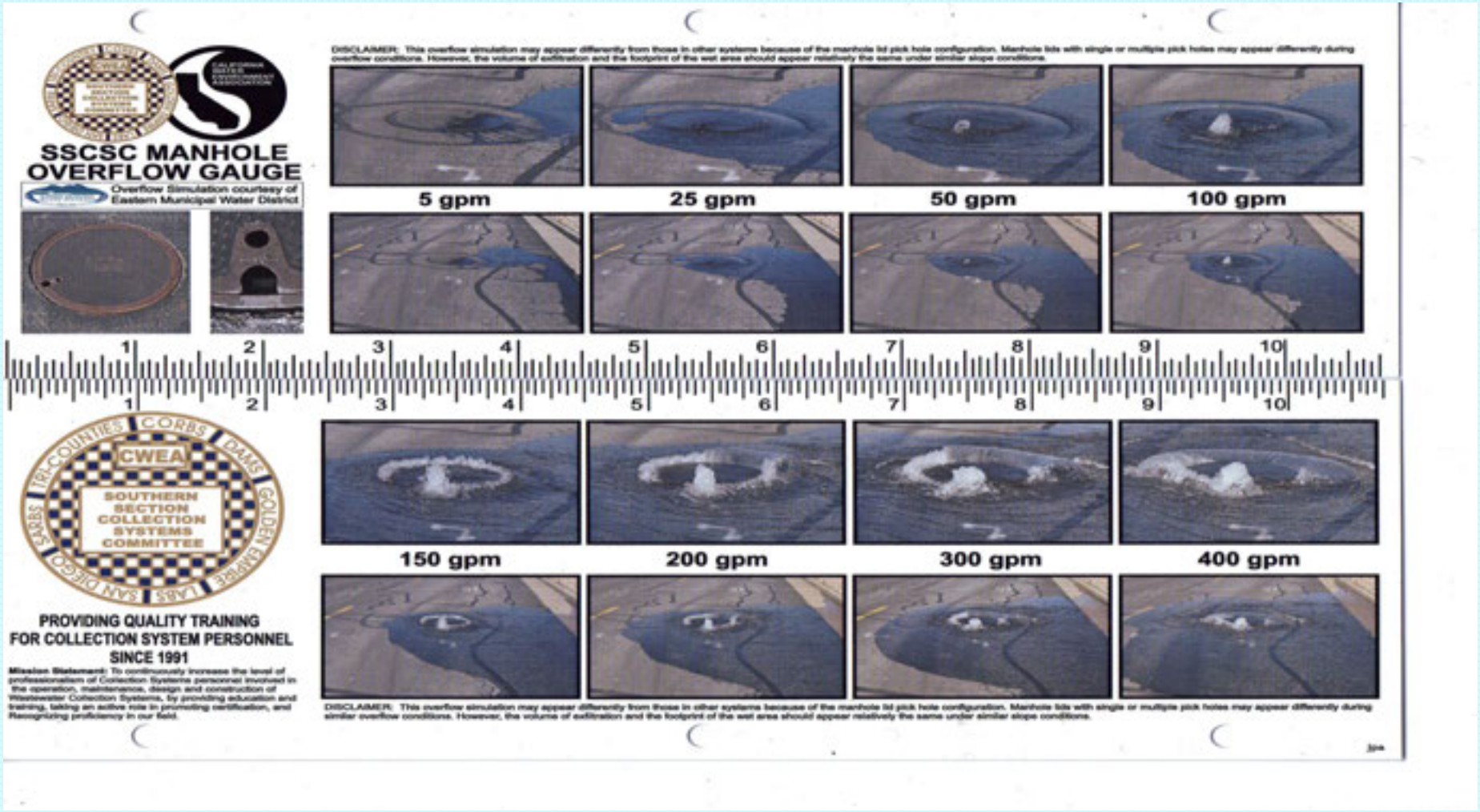
- CONS:
- Difficult to determine if portion of spill went into storm system
- Requires extensive math
- Field staff typically does not like or have capacity to comprehend

What if some went into the storm drain…

Flow Method= Rate x Time



Flow Method= Rate x Time



Flow Method= Rate x Time

- Select a flow rate (based on observed)
- Determine a start time and end time
- Multiply the quantities
  - For example:
  - 50 gpm X 30 mins. = 1,500 total gallons

Flow Method Estimations

- PROS:
- Maybe the only useful method
- Provides at least some quantification

- CONS:
- Rate is subjective (rate, lid weight, # of holes, etc.)
- Rate can vary depending on upstream head pressure
- Start time is often difficult to determine

Recovery Method

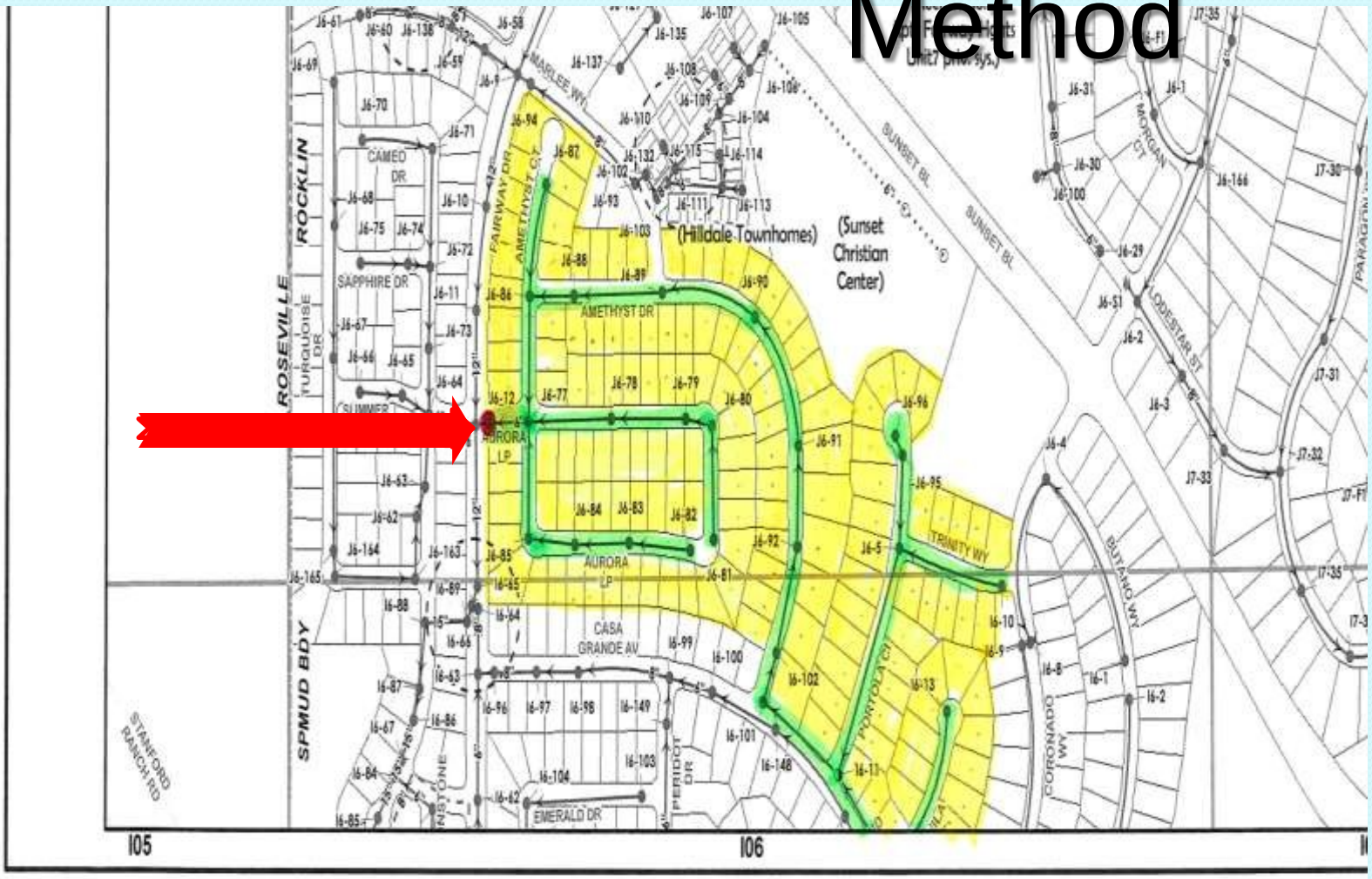
- Quantify Amount Recovered in Vacuum Truck
  - Figure out vac tank volume (9 cu. yds = ~ 1,800 gals.)
- Subtract Wash Water
- I may have made this one up, but it has proven useful

Recovery Method Estimations

- PROS:
- Can support other methods
- Provides good quantification if all spill contents accessible/recoverable

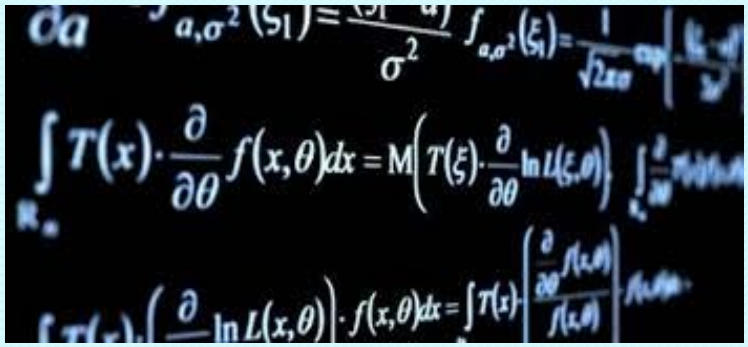
- CONS:
- Volume is subjective based on approximations of tank levels
- Field crews tend to include wash water
- Not accurate if some lost due to drift, evaporation, percolation, etc.

Upstream Map of Overflow Method



Upstream Connections Based on Total Water Usage

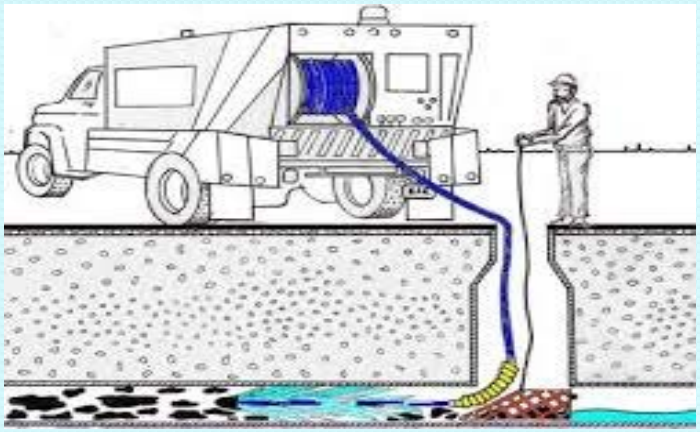
- 132 homes @ 180 GPD = 23,760 GPD
- 23,760 GPD / 1440 Minutes = 16.5 GPM
- Estimated spill duration 180 min x 16.5 GPM = ***2,970 Total Gallons***



Upstream Connections Method

Pros

- Good for spills only affecting a small portion of the collection system
- A method that can be applied consistently by crews/staff



Cons

- Must have a reliable volume per household or Equivalent Dwelling Units (EDU)
- Can be difficult to apply to large portions of the system with mixed use (residential, commercial, industrial)
- Estimation is maximum calculated overflow

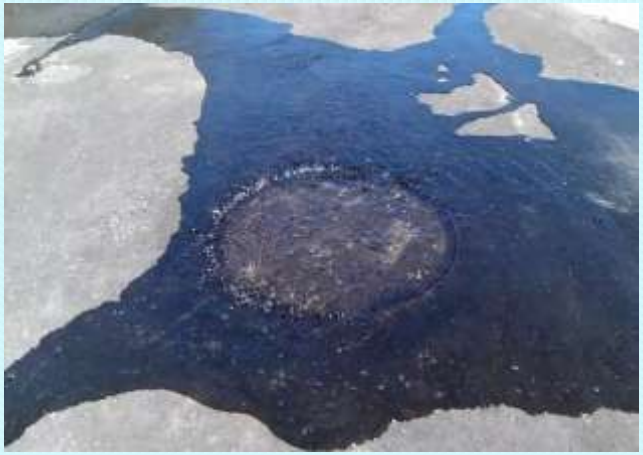
Manhole/Clean-out Overflow Test Facility Simulators

City of San Luis Obispo Spill Simulator

City of San Luis Obispo Manhole/Clean-out Overflow Test Facility

- Variable manhole flows

- Variable cleanout flows



City of San Luis Obispo Spill Simulator

15 Gallons per minute

25 Gallons per minute

Spill Simulators

- Compare spill with documented pictures
- Simulate and compare actual overflows by varying a gauged, pumped amount

Spill Simulator Estimations

- PROS:
- Accurate estimating
- Accurate flow rates
- Controlled environment

- CONS:
- Start time is often difficult to determine diminishing the accuracy of the simulator
- Spill rates can vary depending on upstream head pressure during spill events
- Expensive to install

Conclusions

- Prevent/eliminate SSOs
- No ‘one size fits all’
- Regulatory Compliance is essential
- Pictures, pictures, pictures!
- Make sure it makes sense, and
- ***MAKE SURE IT IS DOCUMENTED!***

If it isn’t documented,
it doesn’t exist.

Questions?

Dan Stevenson,