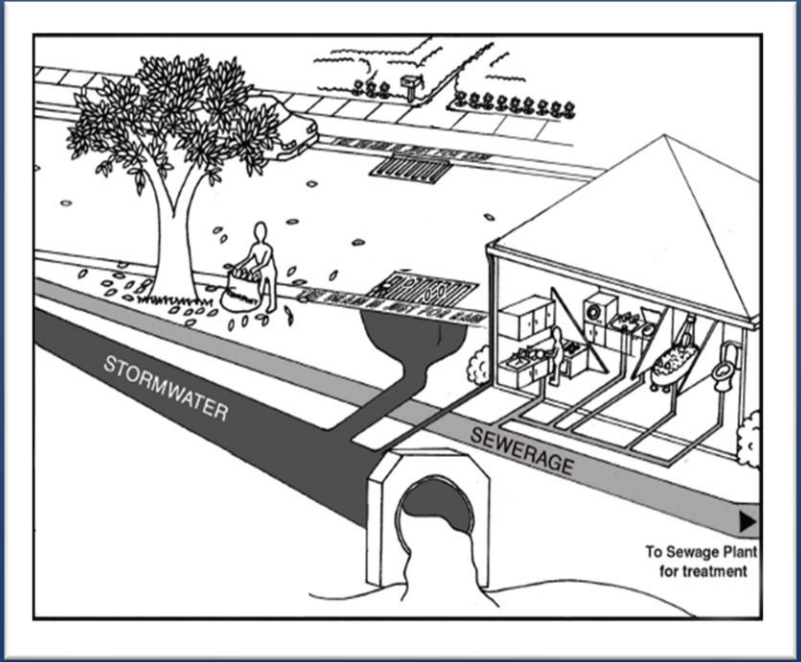
Stormwater Sewer Maintenance

UTC Nashville 2021 Session

Presented by:

Malvin "Rusty" Nezat: Director of Nezat Training & Consulting, Inc.

Braxton Coles: PW Maintenance Manager City of Houston



Pneumatic Plug Safety

Review Evaluation and Findings

City of Houston

Storm Water Maintenance Branch
Street & Drainage Division

Section One: Equipment Evaluation

Section Two: Personnel and Operation Observations including Recommendations

UTC Nashville 2021

A message from Braxton Coles

P.W. Maintenance Manager
Transportation & Drainage Operations

City of Houston

They all do the same thing….?

Current Equipment Purchase and Maintenance Cost (Undisclosed Municipality)

Maintenance of Sewer Cleaning Units Cost History to Date:	Year	Purchase	Maintenance
1. Unit # 08F294 Vactor Combination Cleaning Unit	2008	$133,999	$199,274
2. Unit # 085297 Vac-con Combination Cleaning Unit	2008	$230,954	$241,976
3. Unit # 08F300 Vactor Combination Cleaning Unit	2008	$237,813	$299,863
4. Unit # 08F403 Vactor Combination Cleaning Unit	2008	$171,804	$207,284
5. Unit # 04F551 Vactor Combination Cleaning Unit		$132,999	$199,274
6. Unit # 08F293 Vactor Combination Cleaning Unit	2008	$171,804	$182,564
7. Unit # 085296 Vactor Combination Cleaning Unit			
8. Unit # 085298 Vac-con Combination Cleaning Unit	2008	$171,804	$215,032
9. Unit # 085299 Vactor Combination Cleaning Unit	2008	$171,804	$200,415
10. Unit # 11J071 Ram Jet Unit	2011	$170,103	$106,058
11. Unit # 14J858 Ram Jet Unit	2014	$198,655	$31,148
12. Unit # 15J396 Ram Jet Unit	2014	$205,524	$44,017

Total Purchase Price $1,998,263
Total Maintenance Cost $1,926,905

RECOMMENDATION: In purchasing new equipment, the following are recommendations that should be considered.

1. Equipment to be purchased should reflect the goals and needs of the group receiving it.
2. The considered equipment to be purchased should be researched and vetted.
3. Cities that are currently employing the considered equipment should be contacted and consulted concerning any maintenance or performance issues that they may have encountered.
4. Arrangements should be made for a representative crew from the City to work with the city from which this information was acquired, if possible. This representative crew should work with the considered unit for a minimum of one day, giving them the opportunity to discuss the unit's operation and performance with the owner's crew. At this time, the representative crew should operate the equipment in all its functions, if possible.
5. The representative crew should write up a brief description of the pros and cons of the unit once the crew has completed their time with the unit.
6. Information gathered from all sources should be evaluated and specifications written according to these findings.
7. Another thing to consider is that some vendors offer a maintenance/lease purchase option which could prove more cost-effective as opposed to a standard purchase of the units. Page 2-8 report

The specifications we provided which included input from your field people and supervisory personnel appear to have been overlooked by purchasing. Our input in the specification's reflects multiple evaluations conducted over the past several years. These specifications include requirements that as far as we are concerned will prove to be the safest, easiest to operates and most reliable combination machine. Most notable are the following:

1. *All operating components be hydrostatically driven. No transfer case.*
2. *Unit must operate with transmission in the neutral position.*
3. *Computers must not be used in the operation or engagement of the sewer cleaning module.*
4. *Hose reel rotation controls must be direct hydraulic powered through operator control lever, no electric over hydraulic controller.*

RECOMMENDATION: Development of a formal operator-training program should include a minimum of the following elements for operator requirements:

1. Attend a specific number of hours of classroom training in the following topics:
    - O&M of a specific piece of sewer cleaning equipment
    - Sewer flow control (plugging, by-pass pumping)
    - Preventative maintenance sewer cleaning
    - Step cleaning
    - Map reading
    - Completing required documentation
    - Standard operating procedures as they relate to his/ her job description
    - Dye water flood testing

1. Demonstrate their competency by passing written and field testing to ensure their complete understanding of the classroom training and their willingness to maintain the equipment and achieve the standard production rate or other KPI consistently as set forth by supervisors.
2. Undergo evaluation based upon their performance. If performance is acceptable, then the operator would be approved.

Combination Sewer Cleaning Unit

1 CHAPTER - Equipment Overview

- Program Goals and Objectives
- Overview Of Unit Capabilities
- Warning Decals
- Overview Of Unit Systems

2 CHAPTER - Checks

- Pre-Trip Inspection/ Chassis DOT
- Personal Protective Equipment
- Traffic Control Devices
- Traffic Control
- Small Tools And Supplies
- Daily Oil Checks And Grease Points Front Hose Reel
- Tailgate
- Boom
- Body Lift Cylinder
- Blower Drive Shaft, U Joint
- Blower
- Water Pump and Drive Shaft
- Auxiliary Hose Reel
- Hydraulic Oil
- Transfer Case
- Vacuum Filter
- Re-Fueling Unit
- DEF Fill
- Post Dot Trip Inspection
- Completion Of Work Orders

3 CHAPTER - Systems Engagement And Set-Up

- Caution Of Activities Not To be Conducted
- Caution Of Activities That Must Be Conducted
- Filling The Unit
- Wheel Chocks
- Flushing The Hydrant
- Installing Hydrant Valve
- Hydrant Usage
- Job Planning On Site
- Parking The Unit
- Transmission Sequence
- Parking Brake
- Arrow Board And Beacon
- Wheel Chocks
- Traffic Control
- Control Box Switch Protocol
- Air Pressure
- DPF Indicator
- Braking Caution
- Engaging Blower
- Engaging Hydraulics
- Engaging Water Pump
- Engaging Transmission
- Engaging Cruise Control
- Engaging Fan Control
- Caution: If Unit Runs Out Of Water
- Observation To Be Made During Operations

Next Step – Convert the Manual into a Script

1. Include pertinent information provided by supervisors.
2. Follow current SOP,s
3. Develop script to redirect current behaviors in a new direction
4. Ensure all components in the systems are identified, maintenance explained, and operating controls and sequences covered.

Arriving On-Site: Jobsite Survey

Look over the job site once you have identified your access point manhole.

Discuss the following items with your team prior to setting up:

1. Your surroundings, including traffic, pedestrians, and overhead obstructions.
2. Decide the best safest position of your unit that will protect you and allow traffic flow.
3. Review the best traffic control scenario, if the traffic control requirements exceed your current capability, then contact a supervisor.
4. Look for possible water sources to determine if dynamic filling is an option if needed.

Getting Out of the Unit

1

Exit the cab and set the wheel chocks. This will prevent any unexpected movement of truck in case of brake failure.

2

You must use the three-point contact method when exiting the cab, e.g., two hands and one foot.

3

After complete both sequences we are now ready to exit the cab. The cab is elevated and falling while exiting could cause an injury.

Chock the Wheels

Deaths have occurred within sewer groups, due to failure to utilize wheel chocks.

How to Fill Your ECO 900

As you arrive close to your job site, you will need to fill your water tanks. Set out the appropriate traffic control devices, engage beacon and arrow board.

First, let the water run clear

The connect the hose to fill the tanks

Arrow Board

Depending on which pattern you decide, the arrow board will reflect your choice. Always visually check your arrow board after leaving the cab to ensure the pattern you chose is appropriate.

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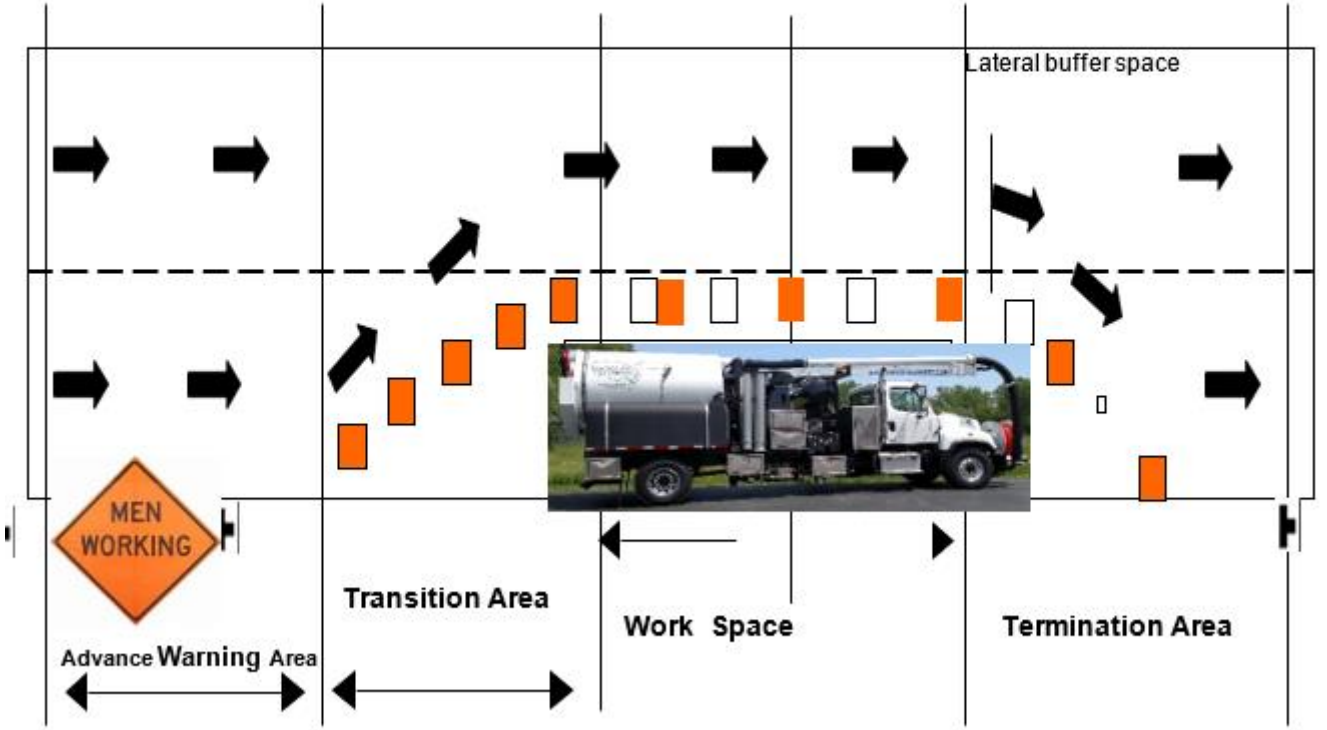
This is a typical set up for a residential area. Use your knowledge you gained from your online traffic control course when deciding how to set up with you limited traffic control equipment.



Creating video

- Following the script use animation ,video and still pictures to convey information
- Create modules that can be modified, expanded

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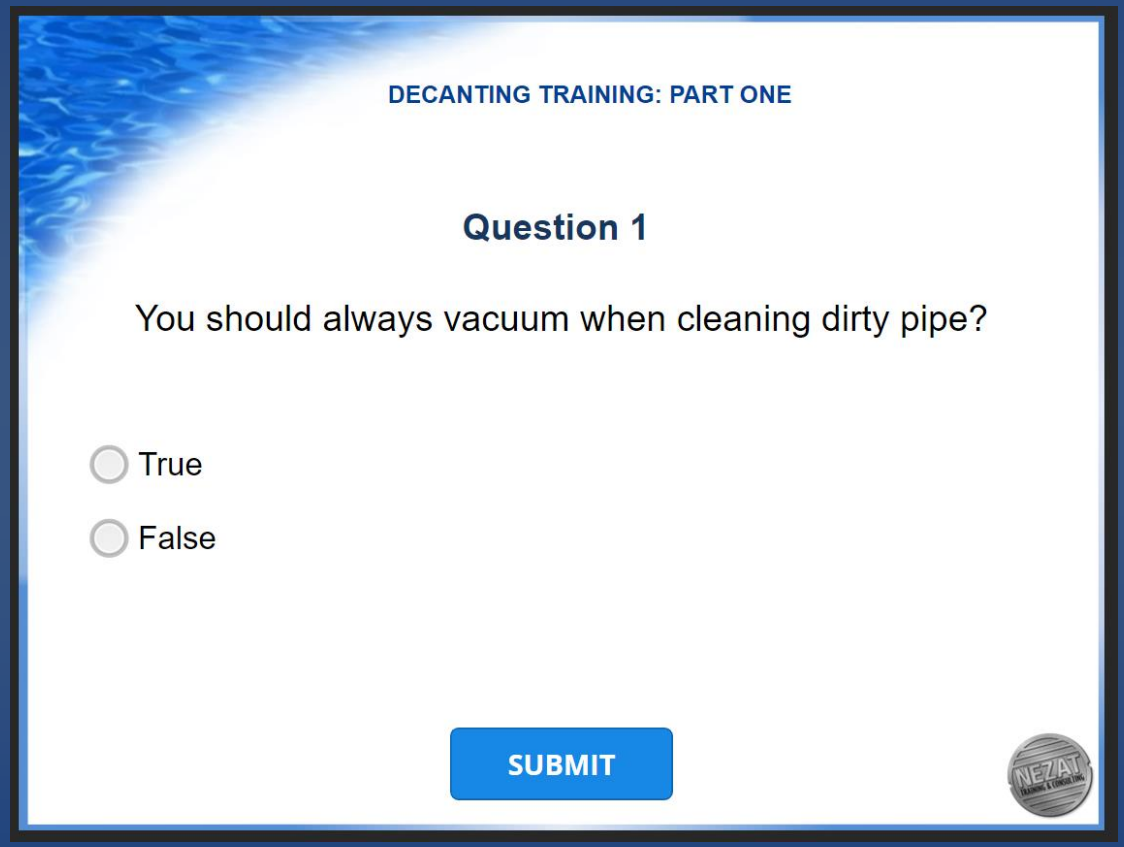
Dynamic Filling

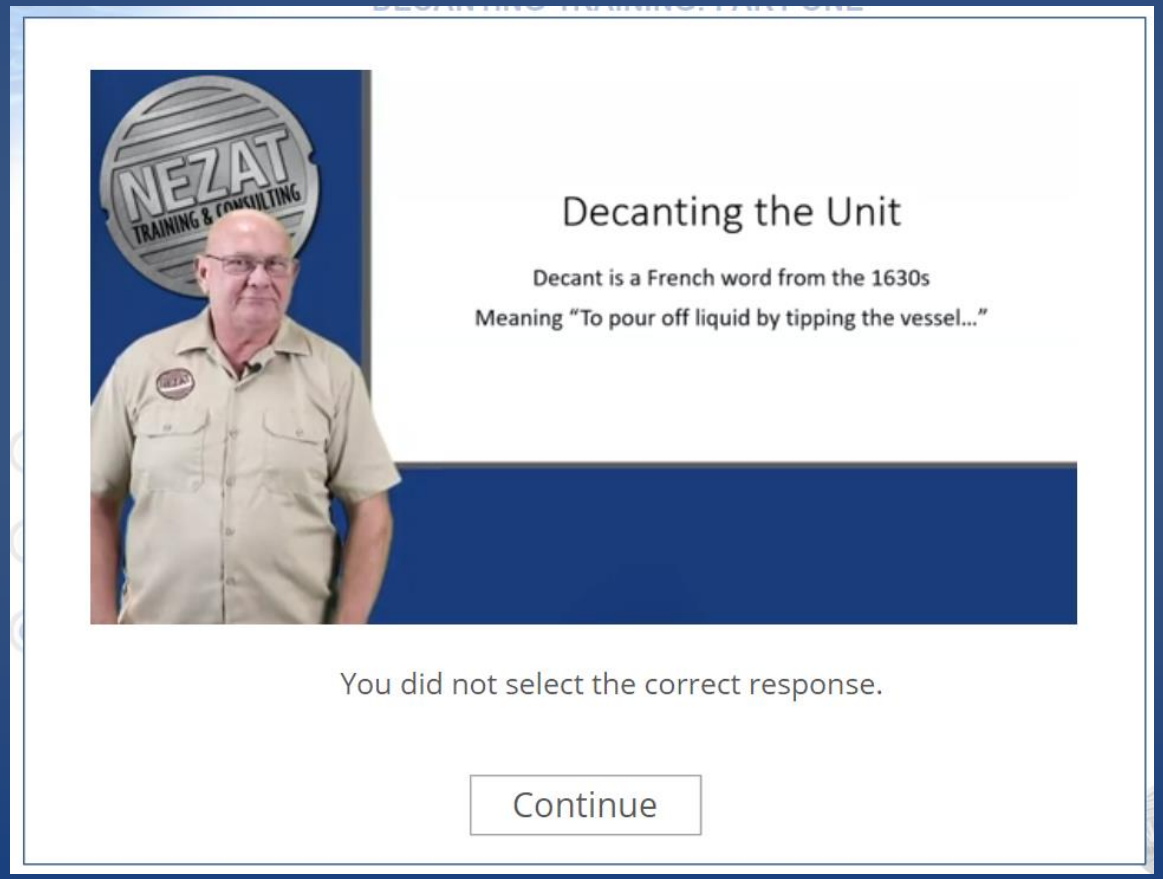
Module Quiz

The completed modules are deposited into an on-line management system where employees are given access to review the program. The employees will be tested upon completion of each module to ensure the information has been retained.



Module Quiz

If the employee selects the incorrect answer the video is replayed with the specific selection that pertains to the subject matter of the question.



Course Completion

Upon completion of the course and achieving a passing grade the student will receive a certificate of completion.

NEZAT TRAINING AND CONSULTING, INC.

CERTIFICATE OF COMPLETION

SEWER CLEANING 102

Operator's Name

In recognition of the successful completion of the required course of study in conjunction with City of _____

DATE

DIRECTOR, RUSTY NEZAT

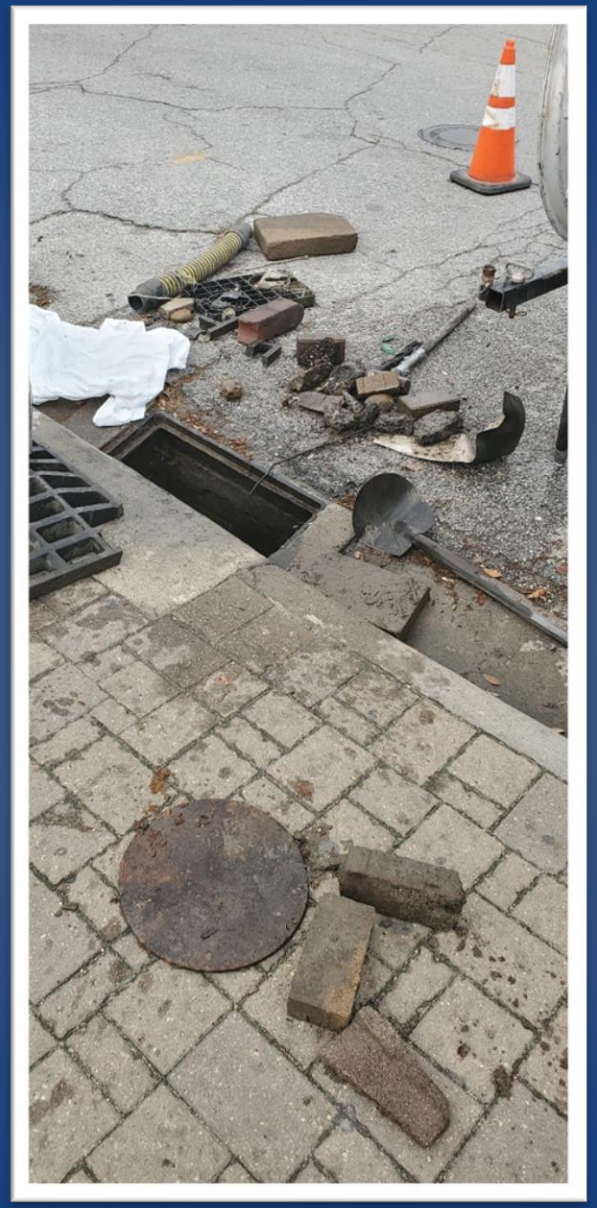
On the Job Training

Once the student has completed the on-line training course, they will proceed to on-the-job training.

This training is conducted by designated trainer to allow the student hands-on experience with the equipment.

After weeks of supervision, the trainee is evaluated based on their ability and knowledge to perform the required tasks.

If approved by the trainer they are now allowed to operated their own unit.



Storm Sewer Basic Components

- Catch Basin
- Lateral lines (minimum 18”)
- Main Lines (minimum 24”)
- Long Run Culverts (Most Are Not Permitted)
- Sediment Tanks (Debris and Floatable Collection)
- Out Fall (Waterway)

Storm Sewer Design and Function

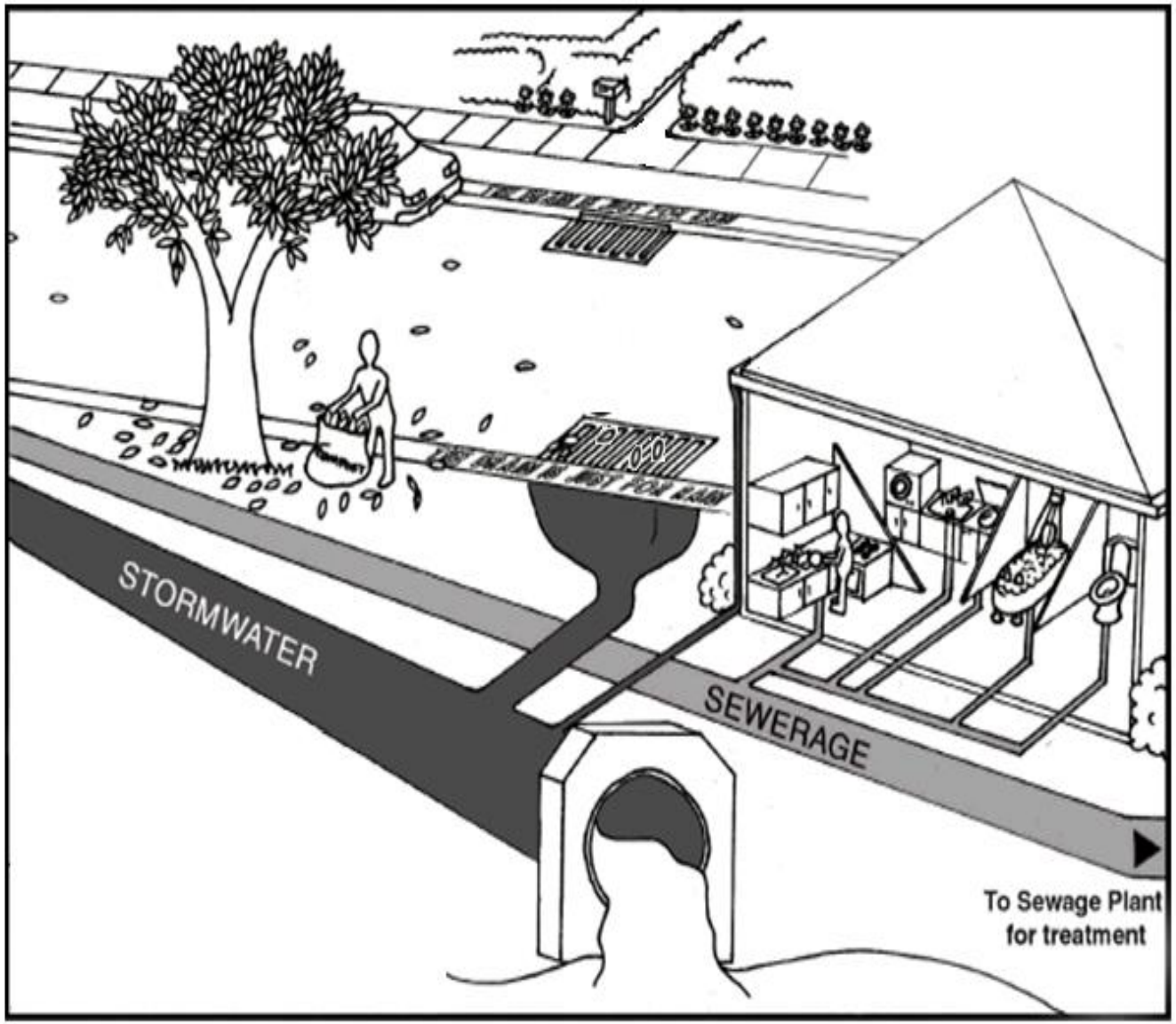
By design, storm sewers are self-cleaning. Most storm sewers are designed to flow at a minimum rate of 2.5 feet per second during a rain event.

Water flowing into a catch basin will drop down a few feet into the outgoing lateral.

Then all the laterals from many catch basins will send the flow dropping down several feet into the mainline, where the flow will make its way to the outfall.

With the combined head pressure of the falling water and the degree of the pipe's grade, the water now becomes a raging torrent. This is what makes the system self-cleaning .

However, there are circumstances that arise that will cause a partial or complete failure of the system.


STORMWATER
SEWERAGE
To Sewage Plant
for treatment

There are three main problem areas with the storm water structures as observed.

Root intrusion in shallow lines.

Accumulation of debris in and on catch basins.

What are a few circumstances that can cause performance failures that are O&M related?

About 80% of gravity storm sewer performance issues are due to the following.

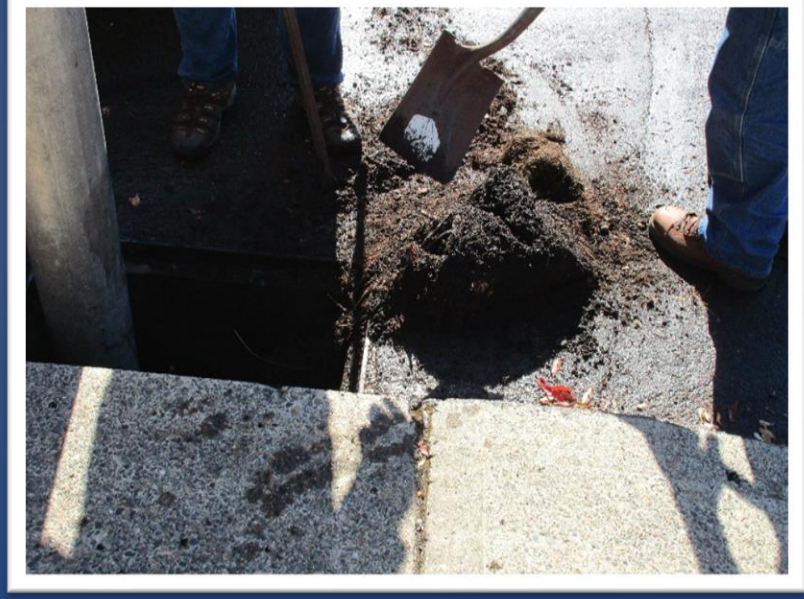
Issues with catch basins and adjoining laterals becoming plugged with root and debris.



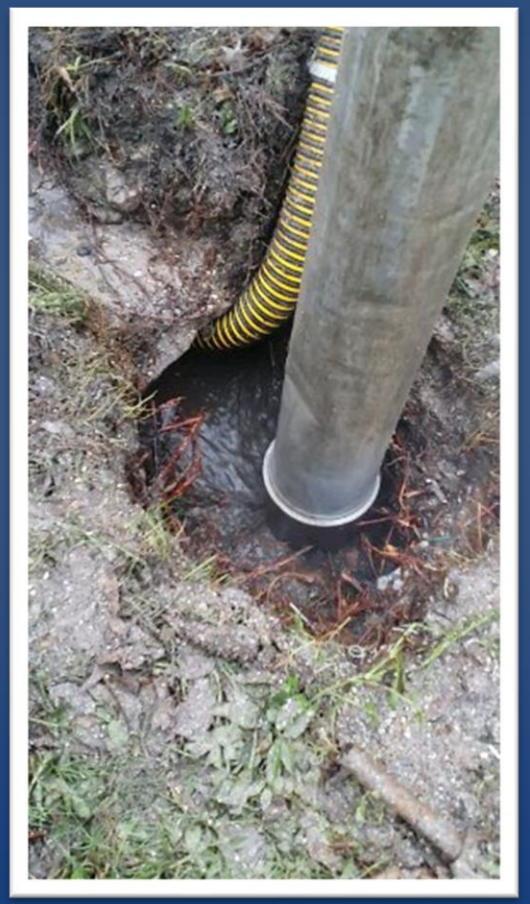

1) Accumulation of Debris in & on Catch Basins

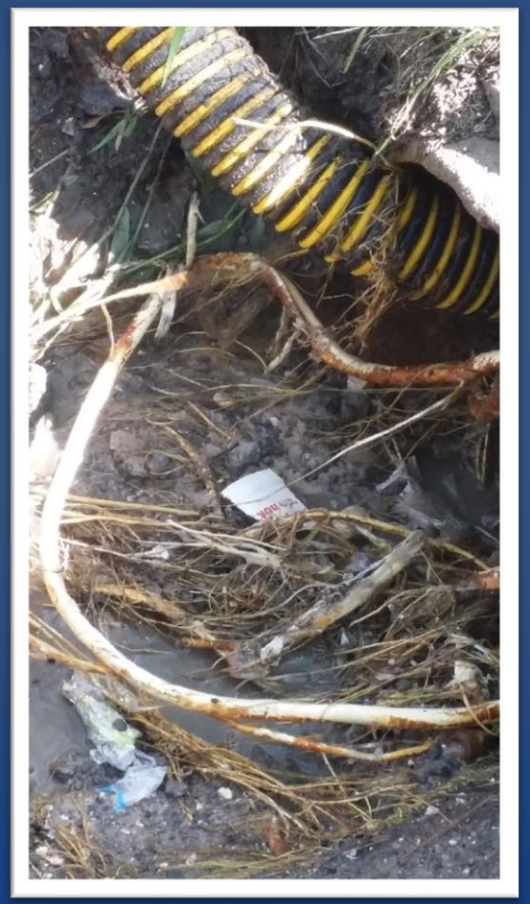
The result is a net-like trap that catches all types of floatable's and eventually restricts the flow. These issues are usually found with shallow lines in subdivisions on the upper ends of the system. Mains that are typically deeper do not usually have root issues.

A majority of 311 generated work orders issued for cleaning were related to shallow lines. These shallow lines were all less than 4 feet in depth and most contained roots. The roots had made their way into the pipes through open joints while seeking water during the dry season. It is typical for the joint compound used in the laying of older pipe to fail. This failure allows the roots to penetrate the joints and eventually develop large root masses inside the pipe.



2) Sediment build-up in waterways where outfall lines empty

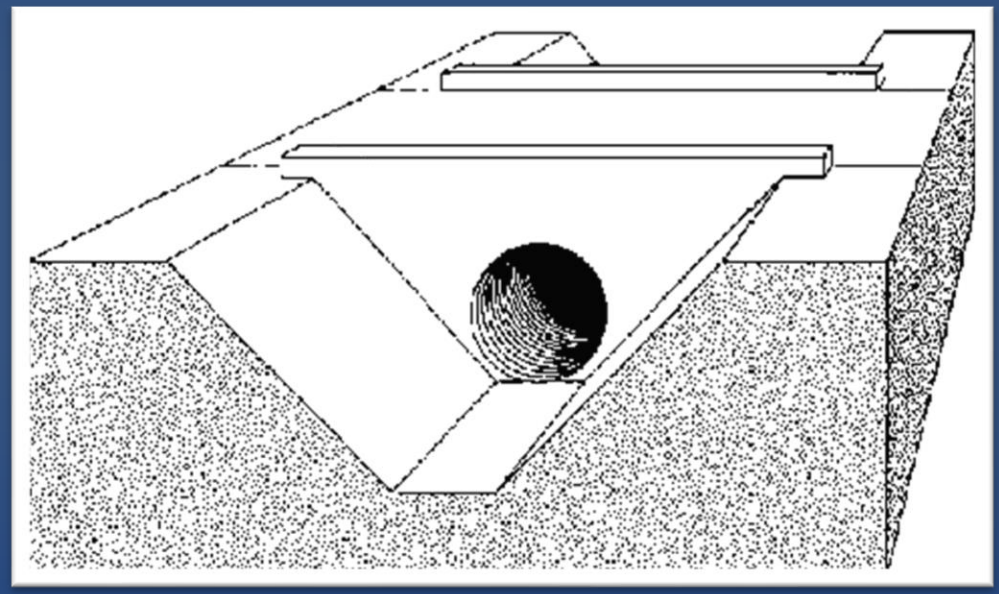




3) Ditches And Culverts

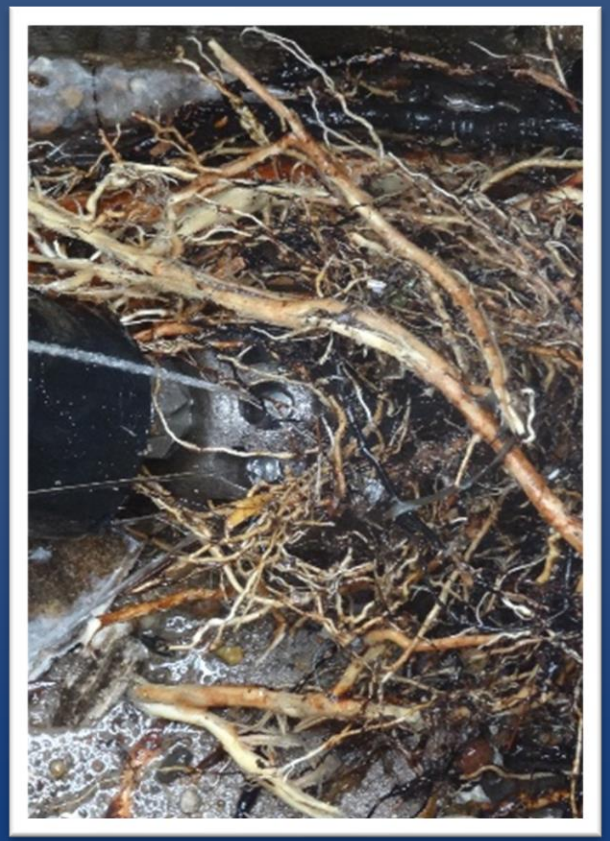
The majority of the build up of debris in culverts are due to poor grade on ditches.

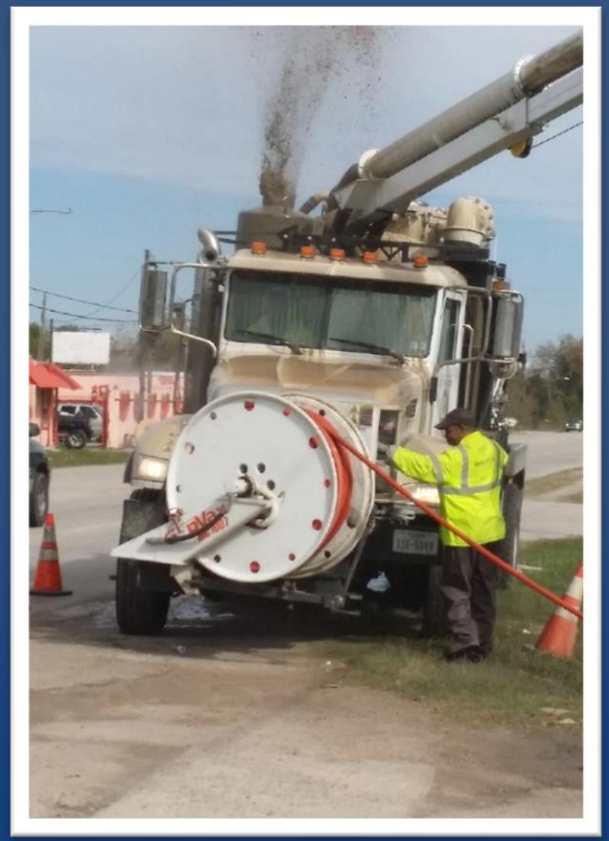
In most cases, culverts are laid on a grade that would make them virtually self-cleaning. Water traveling through an open ditch typically moves at a moderate pace. Once the water is funneled down into a smaller opening, the cross-sectional area of the flow path is reduced, and the velocity of the water is increased. This velocity will keep the culvert relatively free of debris.

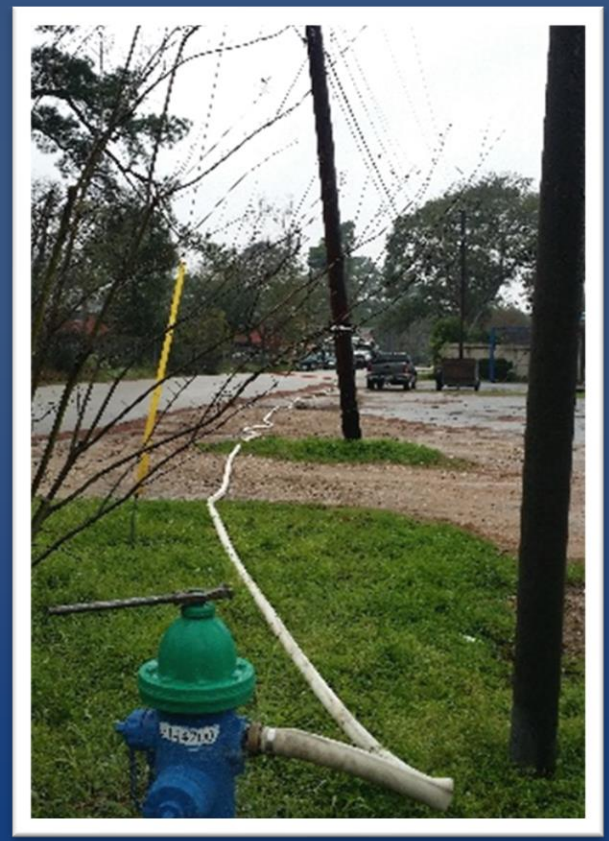


Outfalls located where the sediment in the receiving open drainage area has risen above the outfall opening. This condition will cause flow restriction in the storm sewer and eventually, sediment will begin to be deposited in the outfall line and reduce flow capacity.

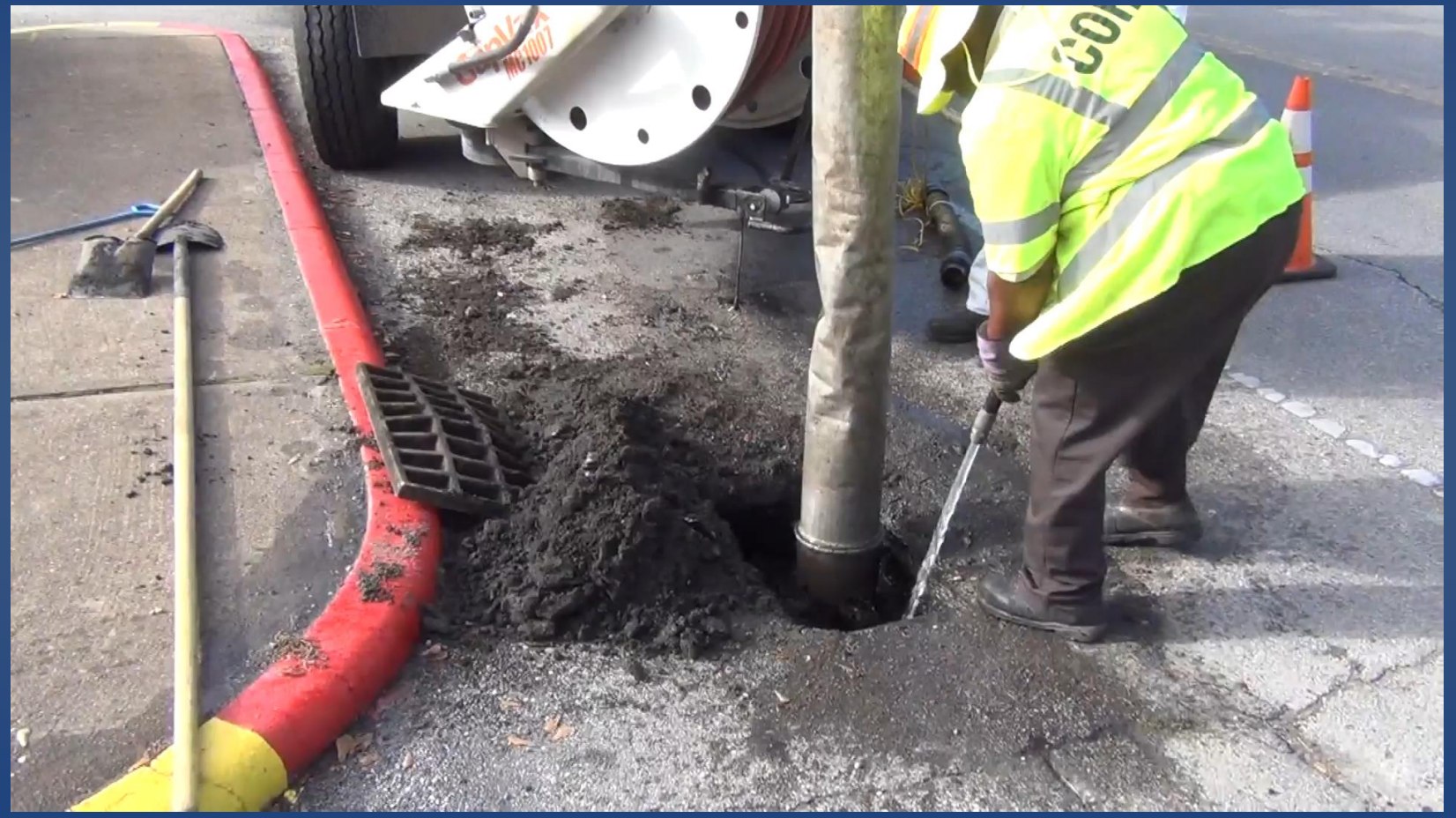
Maintenance







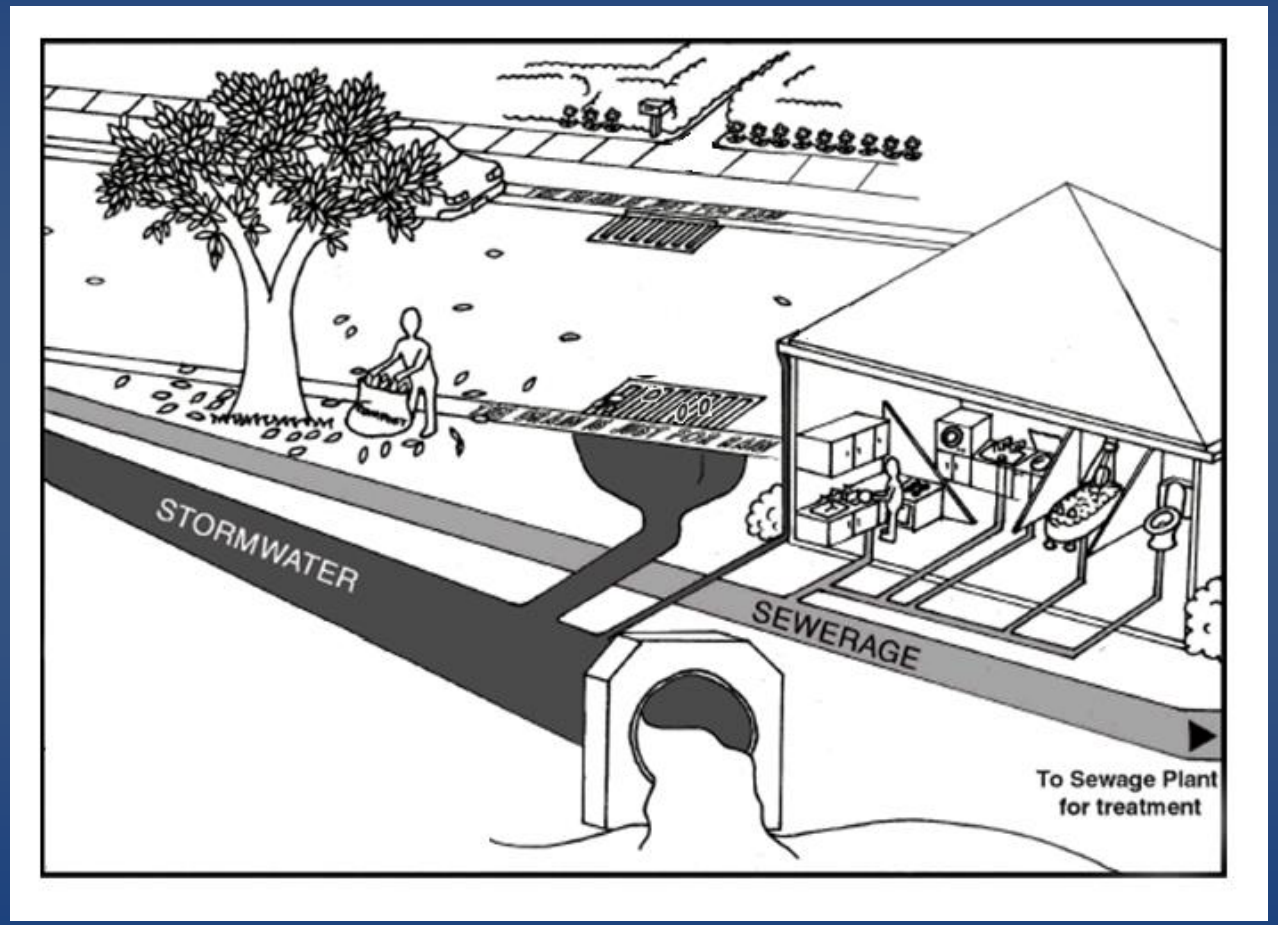
Catch Basin Cleaning



Sediment Tank Cleaning

- When Dirty / Not Functional
- Scheduled Maintenance

When is a Storm Line in need of Cleaning?

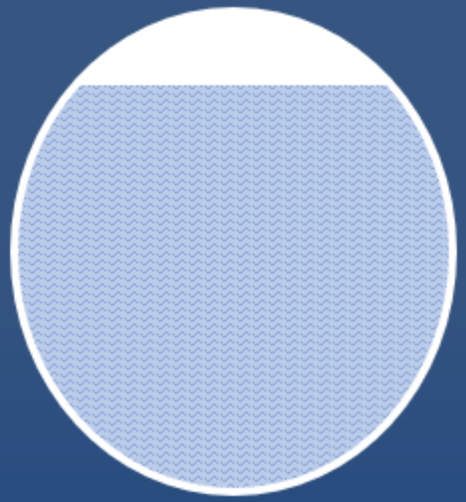


The following pages illustrates how much material could have been contained in a particular line segment cleaned during the evaluation period. This line segment was 602 feet in length and 30 inches in diameter. This comparative representation is designed to help evaluate when a line needs to be cleaned. The possible levels of debris are represented the number of cleaning units, each representing 10 yards of material. This allows us to understand how many loads of material would be contained within the pipe according to the levels of debris within the line.

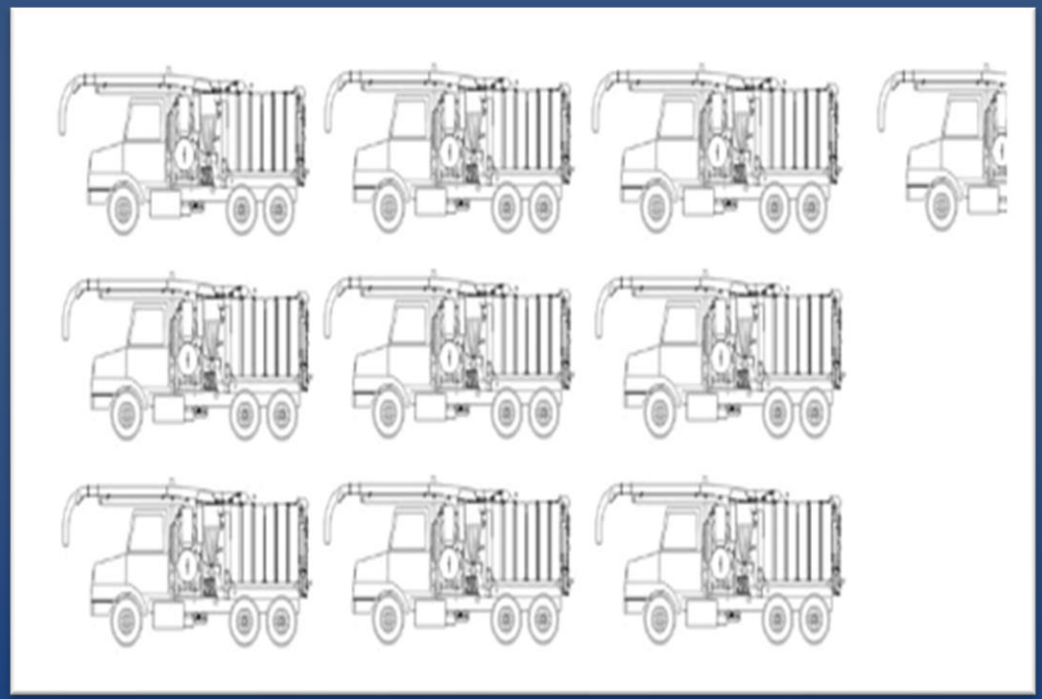
This line was not in need of maintenance and will likely never need to be cleaned again unless there is a major event upstream, such as a line collapsing, major soil erosion, or foreign objects introduced into the line by vandalism.

Example Pipe: 30in x 602ft

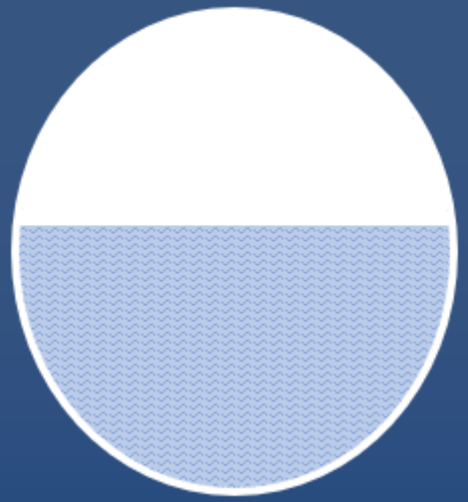
22.5in of debris would be equal to 94cu yards



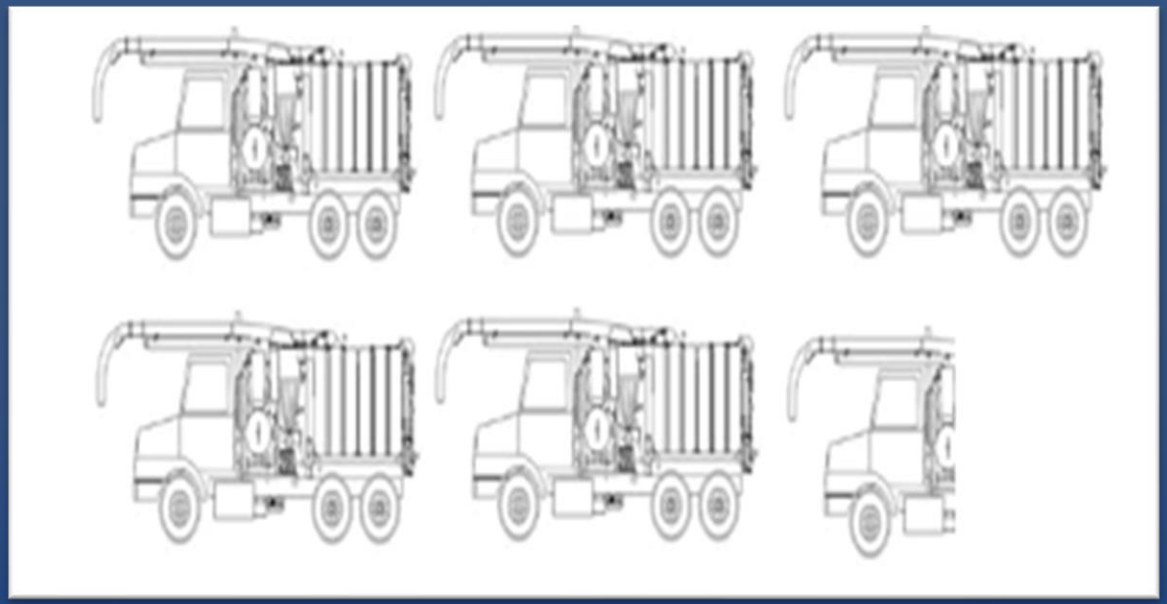
3/4 Full



15in of debris would be equal to 55cu yards

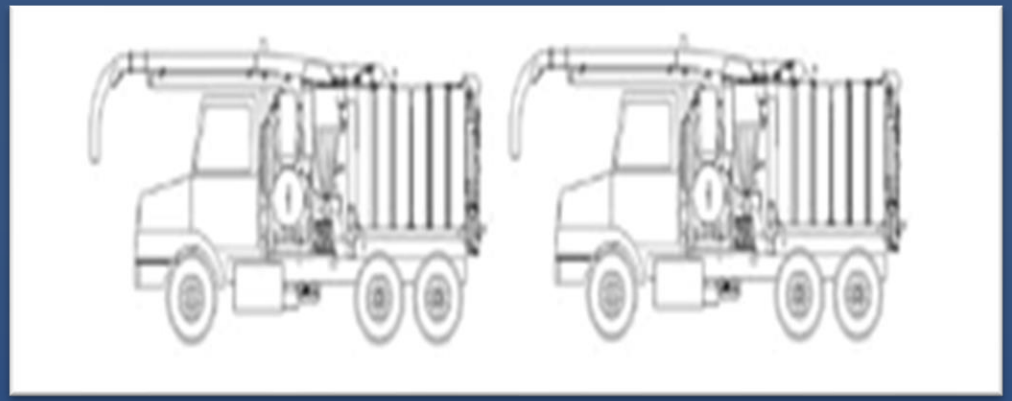


1/2 Full

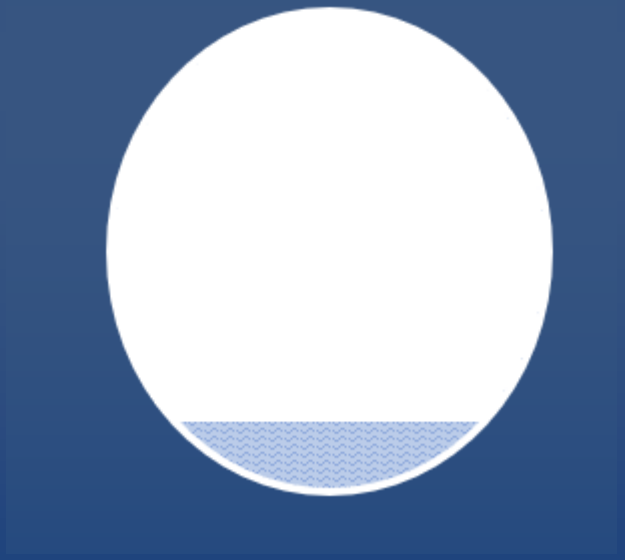


7.5in of debris would be equal to 21cu yards

1/4 Full

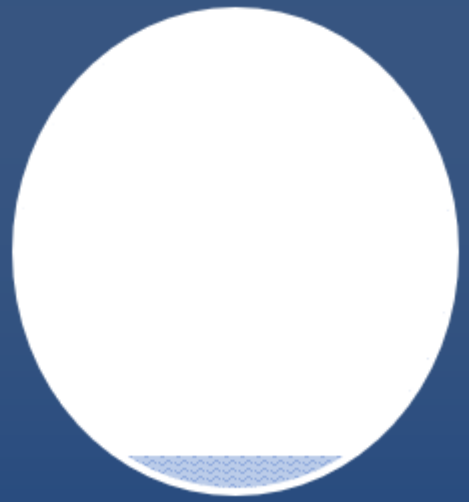


3.75in of debris would be equal to 8cu yards



1/8 Full

1.875in of debris would be equal to 3cu yards



1/16 Full

The majority of the dirty culverts cleaned had become filled with material due to the buildup of sediment in the ditch. The amount of sediment deposited in the ditch was equal to or greater than the top of the outgoing culvert. The solution to this issue is to maintain the ditches to the correct grade.

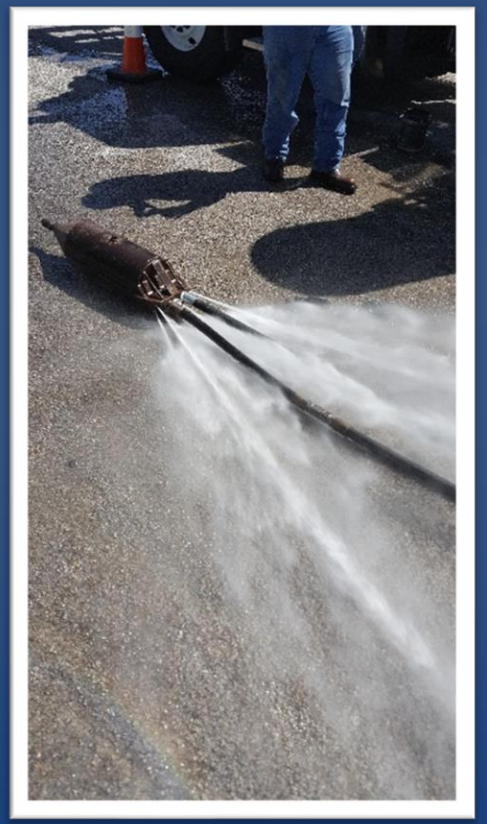
Nozzle Performance

Issues with Culverts in Open Ditches

Screw Jack

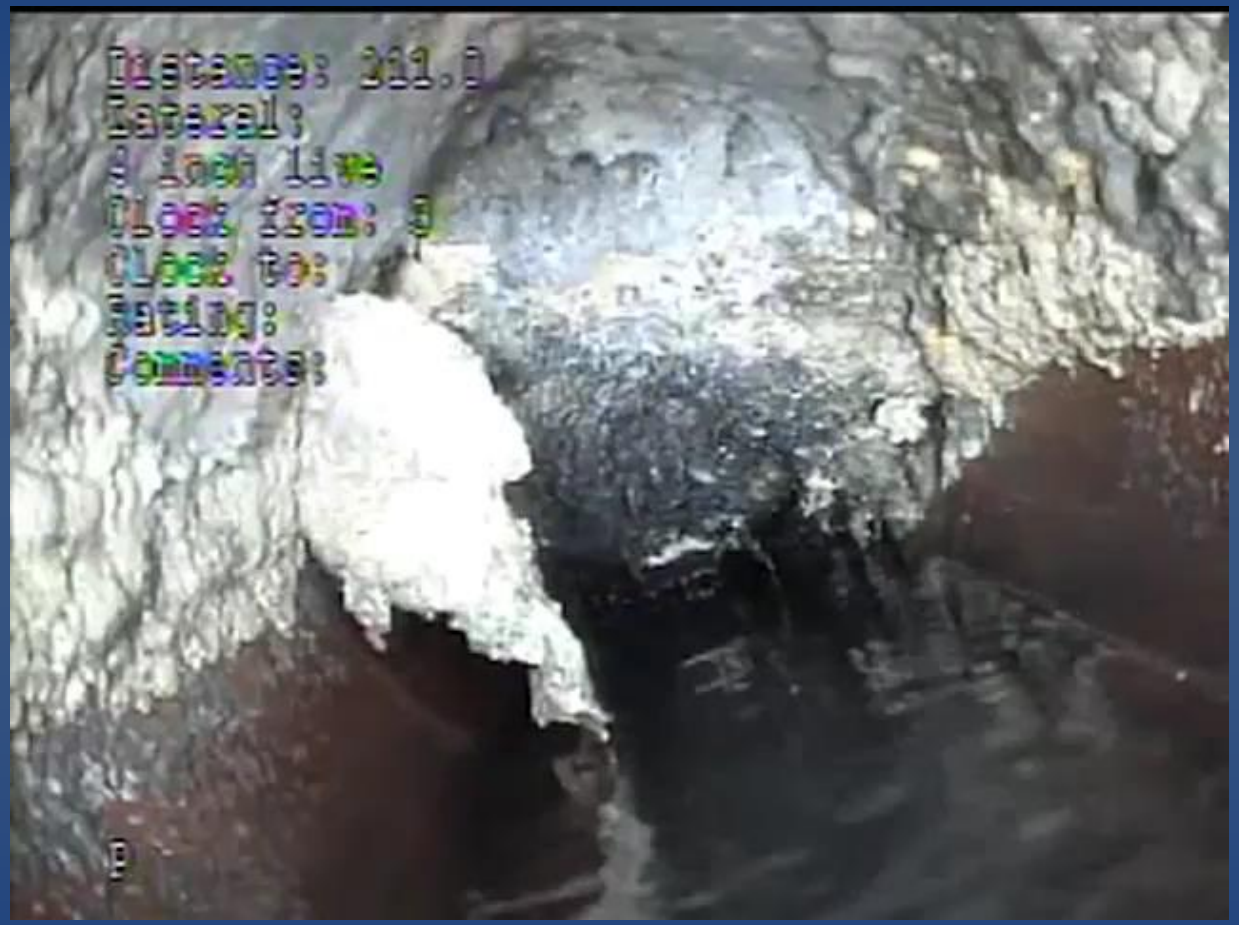
Compacted Debris

Whart Hog with Extensions




UPSTREAM MH: 35843
DOWNSTREAM MH: 35824
DATE: 06-02-2009
TIME: 3:36 PM
DIRECTION OF SURVEY: DOWNSTREAM
FEET: 0256.0


11
Downstream
5
70ther
Eco Clean
Feet
167'08"
-7.7%
11:07a
02.02.2009


Distance: 211.0
Lateral:
Joint line
Clock from: 9
Clock to:
Rating:
Comments: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TRAINING & CONSULTING


Rootmaestro
Haalt alle wortels uit ieder riool
internet http://www.rootmaestro.com
size 28" ... size 28" ...
13:34:13
23.03.2007
Heense molenweg thv huisnr25
0.5%
5.48m


6.6 FT
Upstream Manhole No:33643
Downstream Manhole No:30752
33643_DS_Reverse_MP

Hydraulic Root Cutter

“Stacking” Vacuum Machines

“Stacking” Vacuum Machines

“Stacking” Vacuum Machines

“Stacking” Vacuum Machines

Your crews need to see this too!

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www.nezat.com

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