Sinkholes: Recognition Remediation and the Latest Technology

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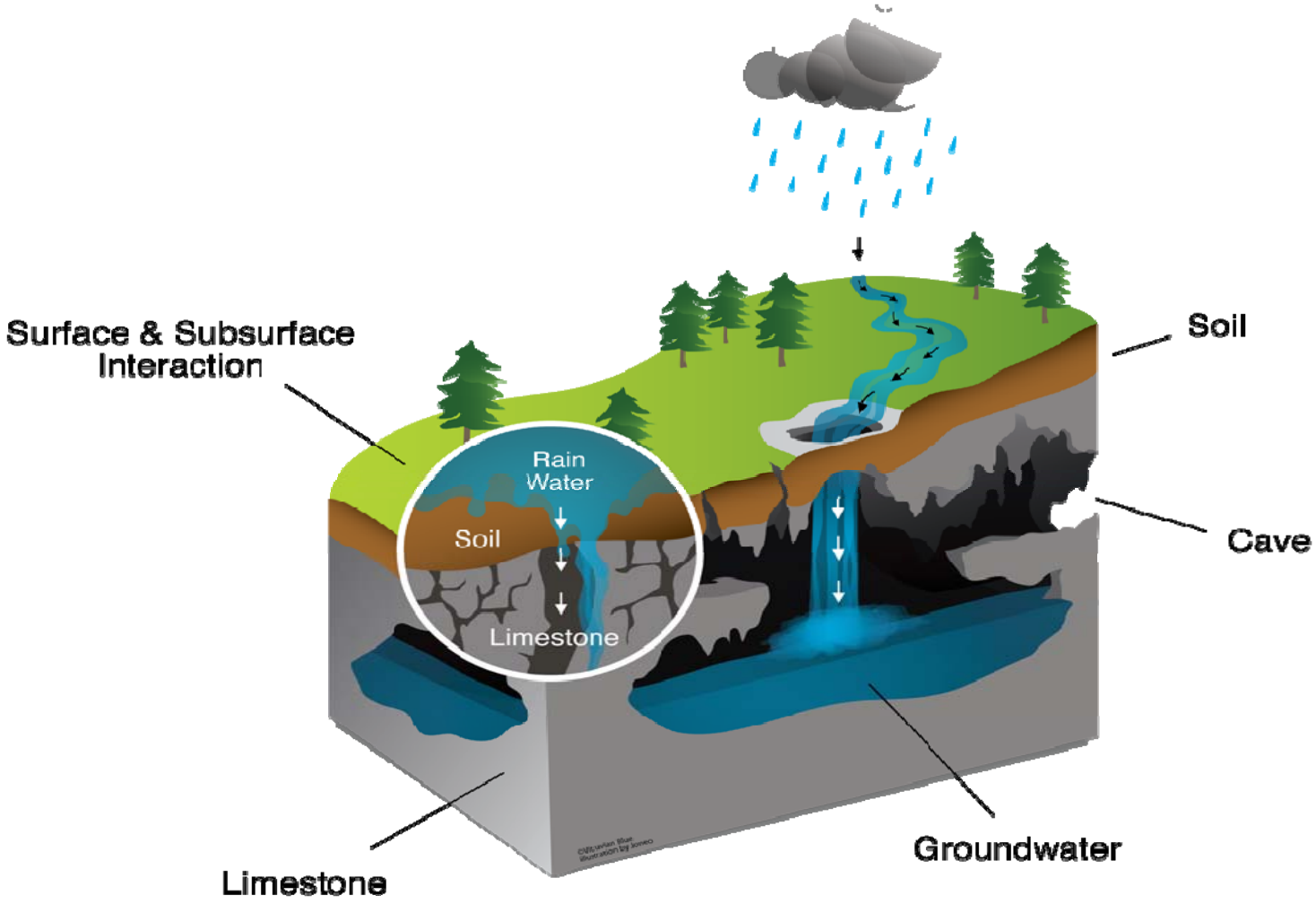
Western Kentucky University

What is a Sinkhole?



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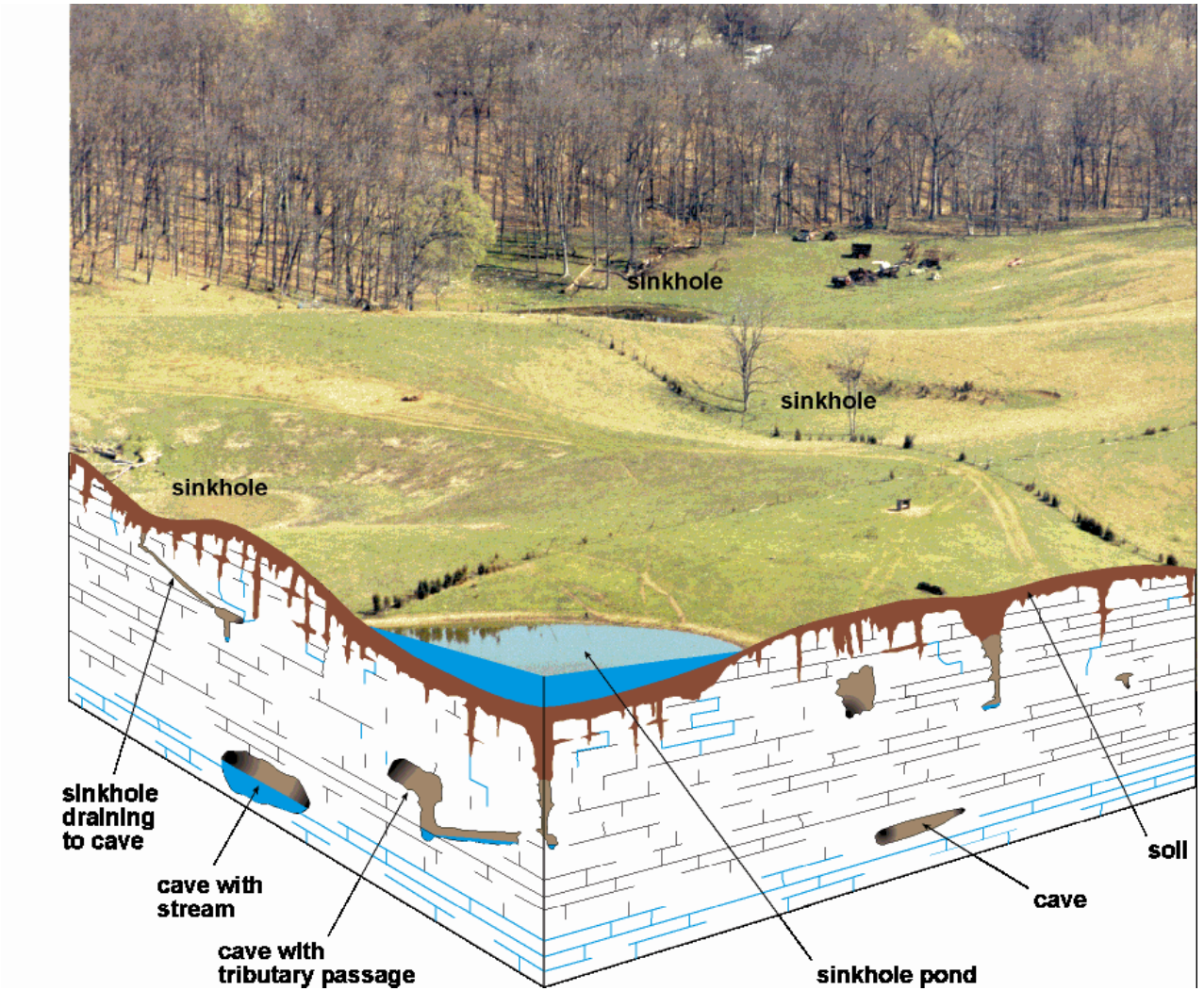
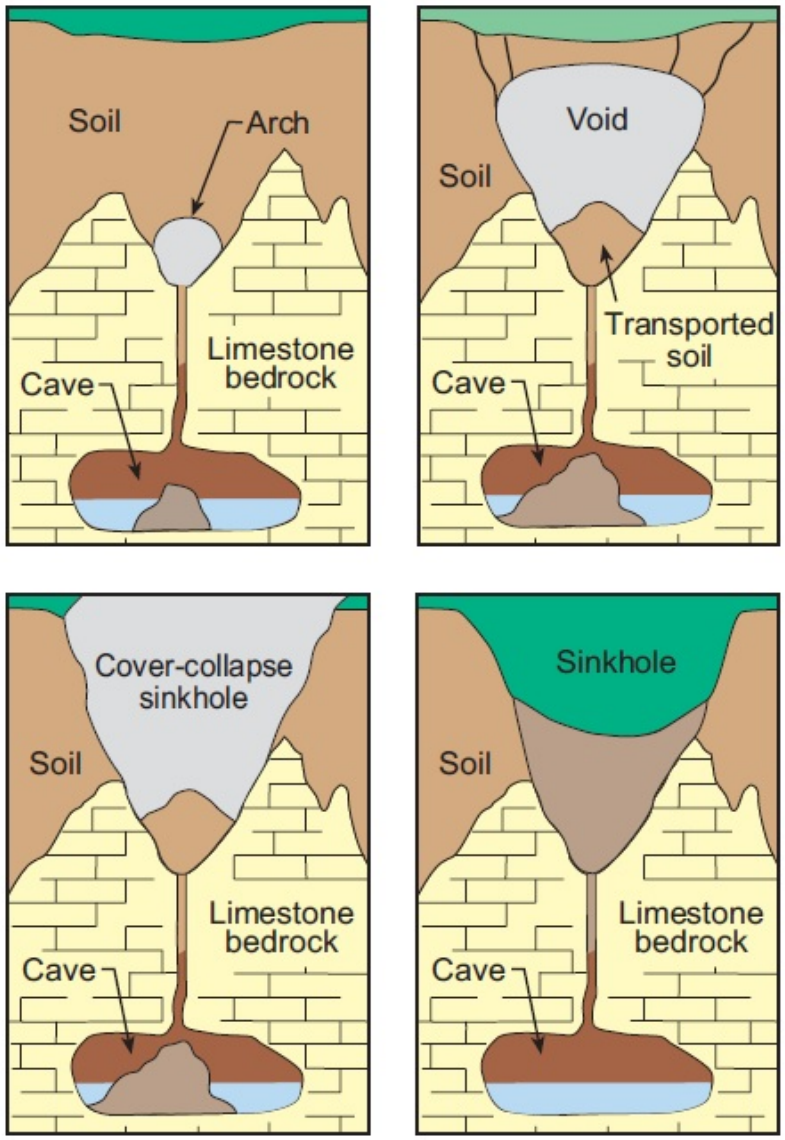
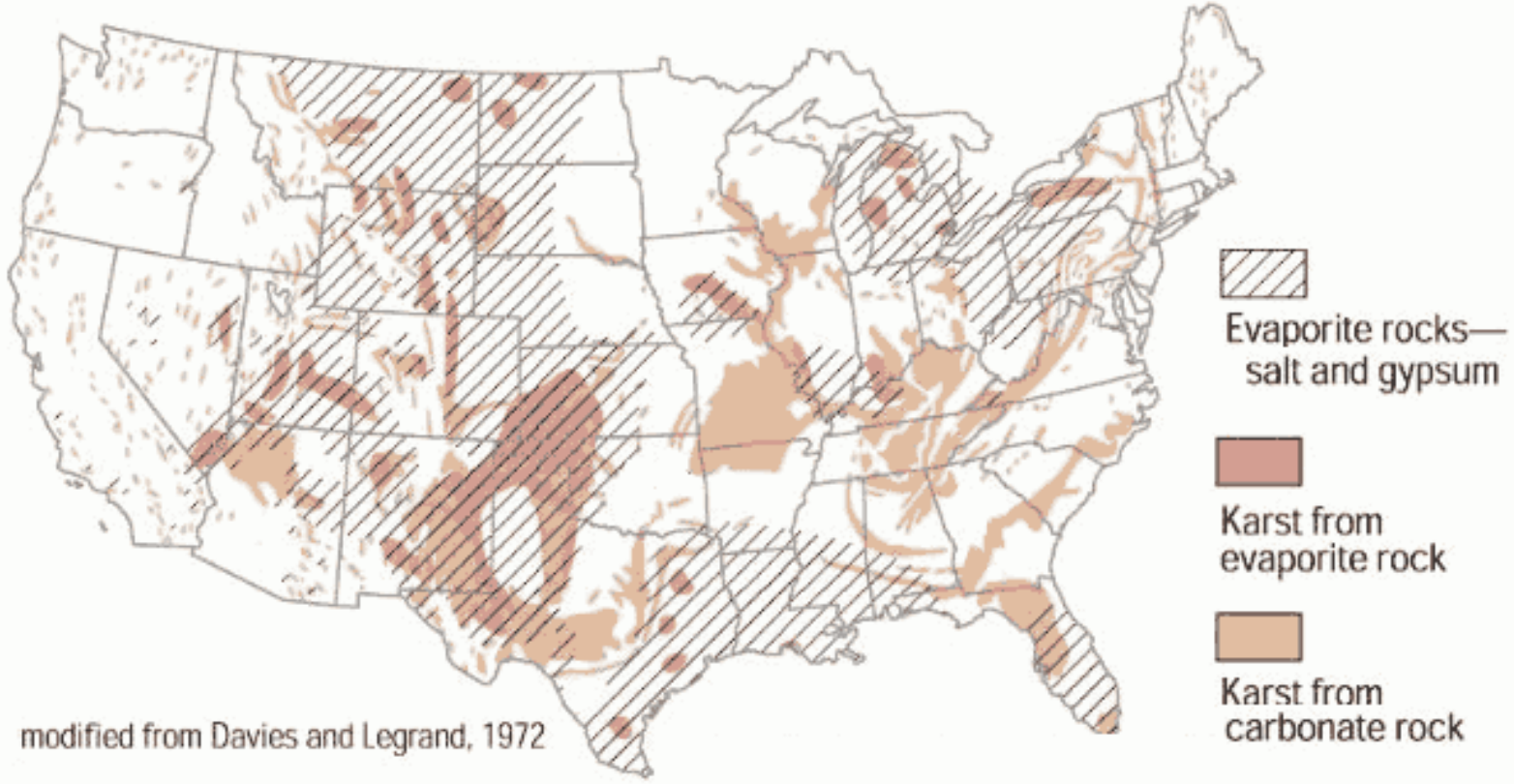




The development of a cover-collapse sinkhole.

What is a Sinkhole?



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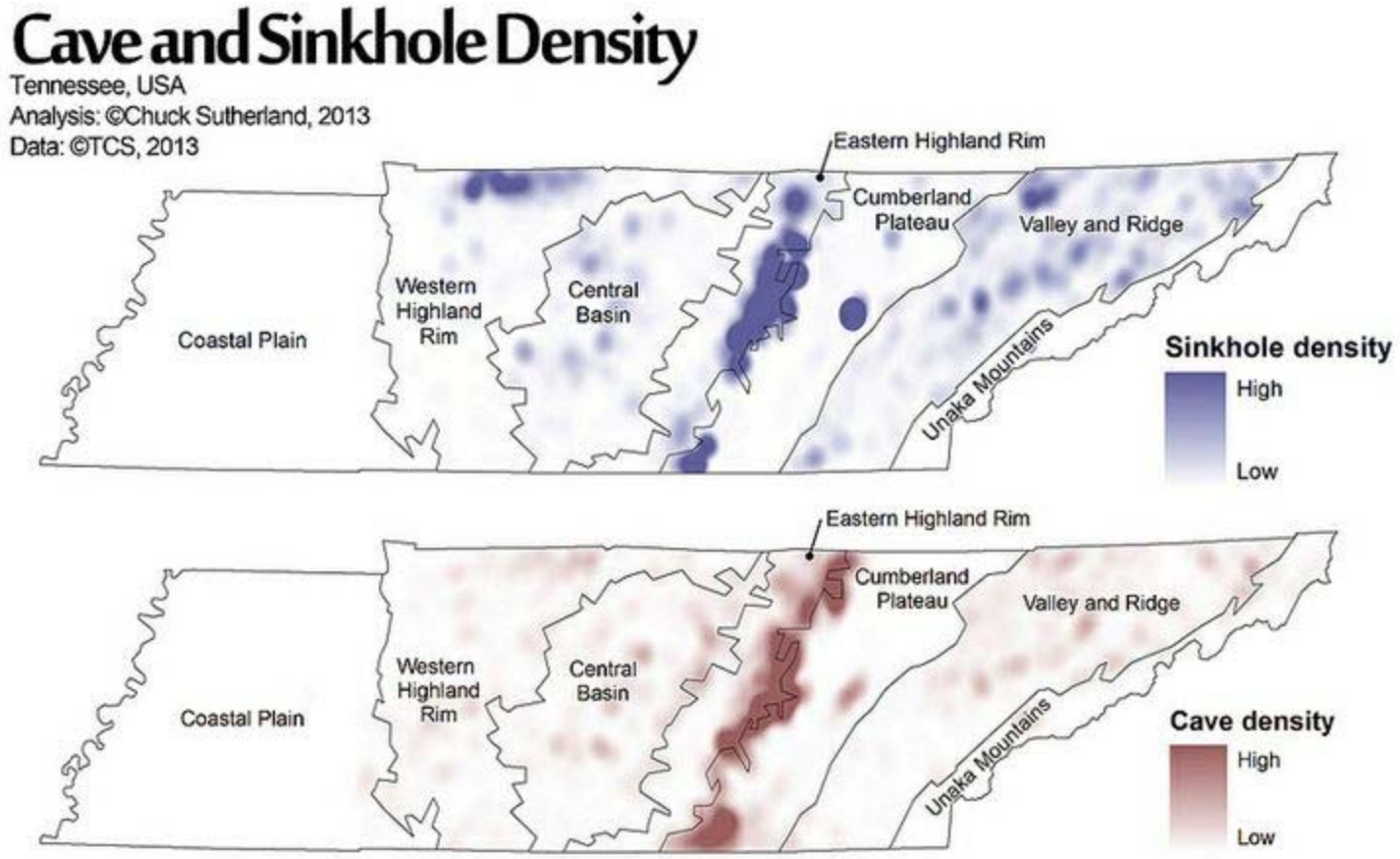
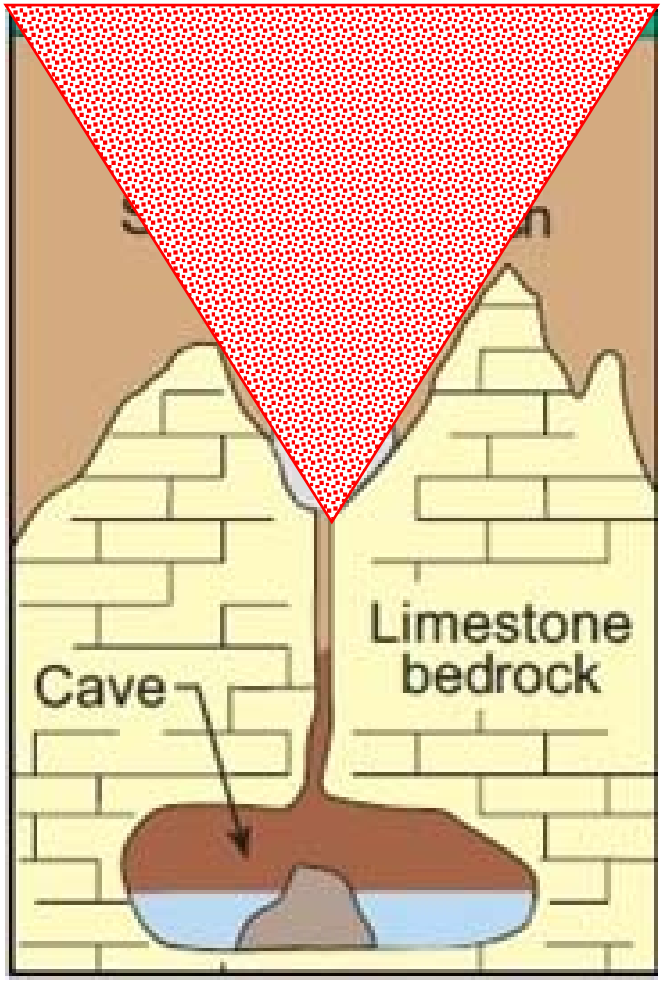


How Do We Build on a Sinkhole?

1. Identify
   - During the Geotechnical Investigation, during construction, or throughout the life of the structure sinkhole features may appear
2. Excavate
   - Excavate the sinkhole to expose the “Throat”
   - Remove the “high void ratio soil” that is created during the life of the sinkhole
3. Repair
   - Replace the removed soil with a stabilizing material
   - Try to allow the sinkhole to continue to do what it does naturally
   - Maintain stability of the soil underlying the structure

The High Void Ratio Soil – Regolith Arch



Identify

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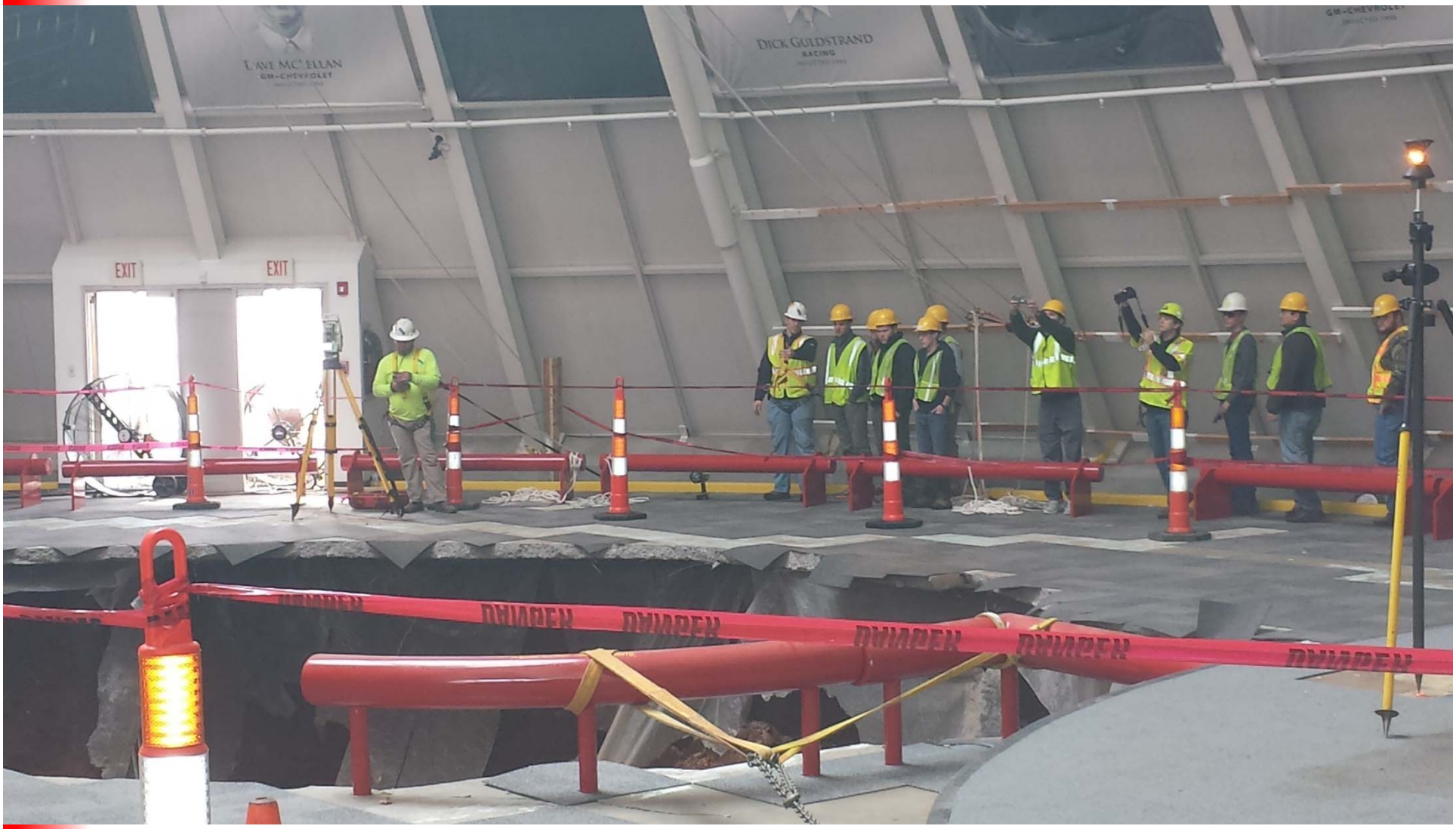
Identify

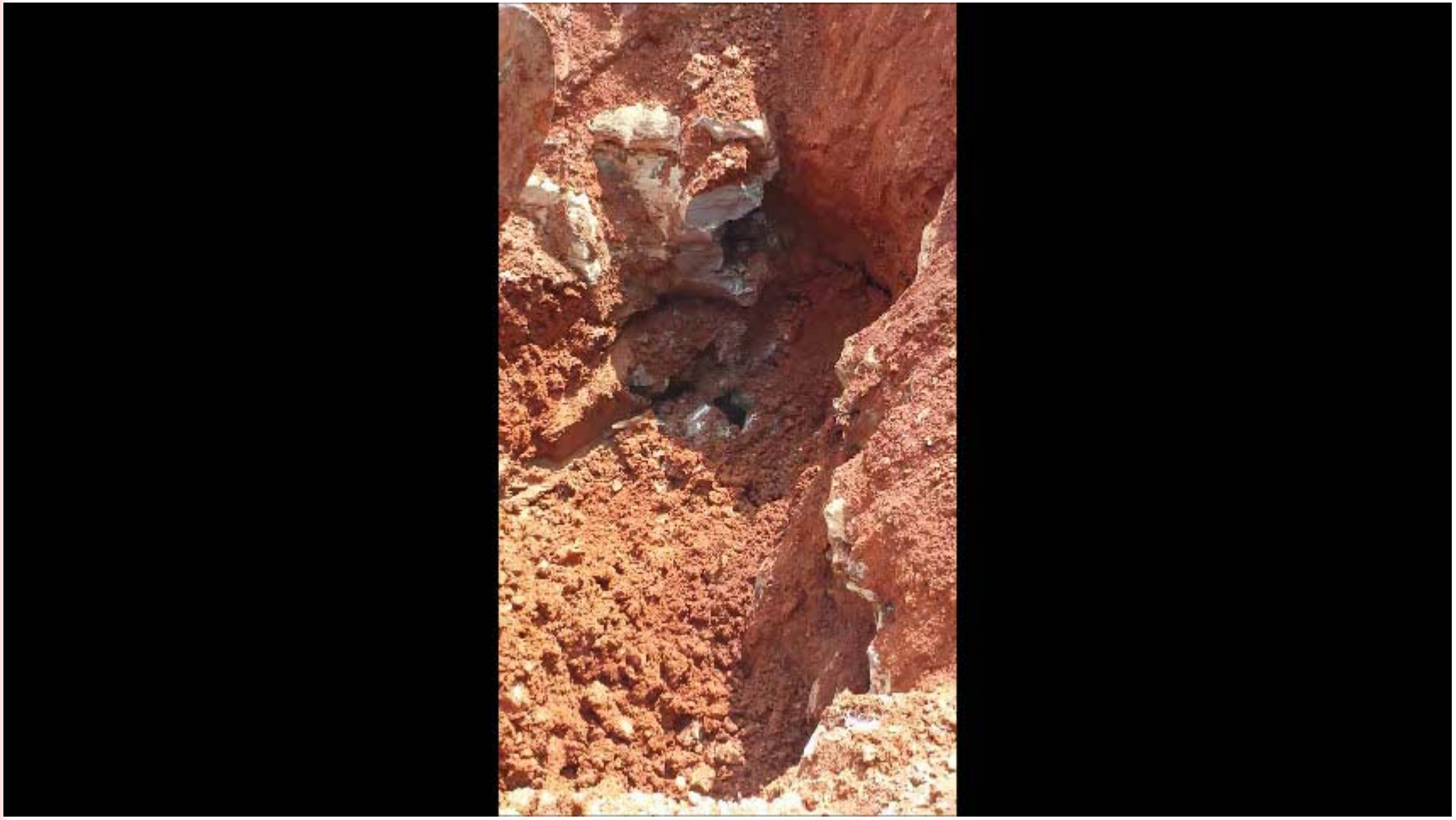
Identify


EXIT
EXIT
DICK GULDSTRAND
RACING

Dishman Lane – Bowling Green

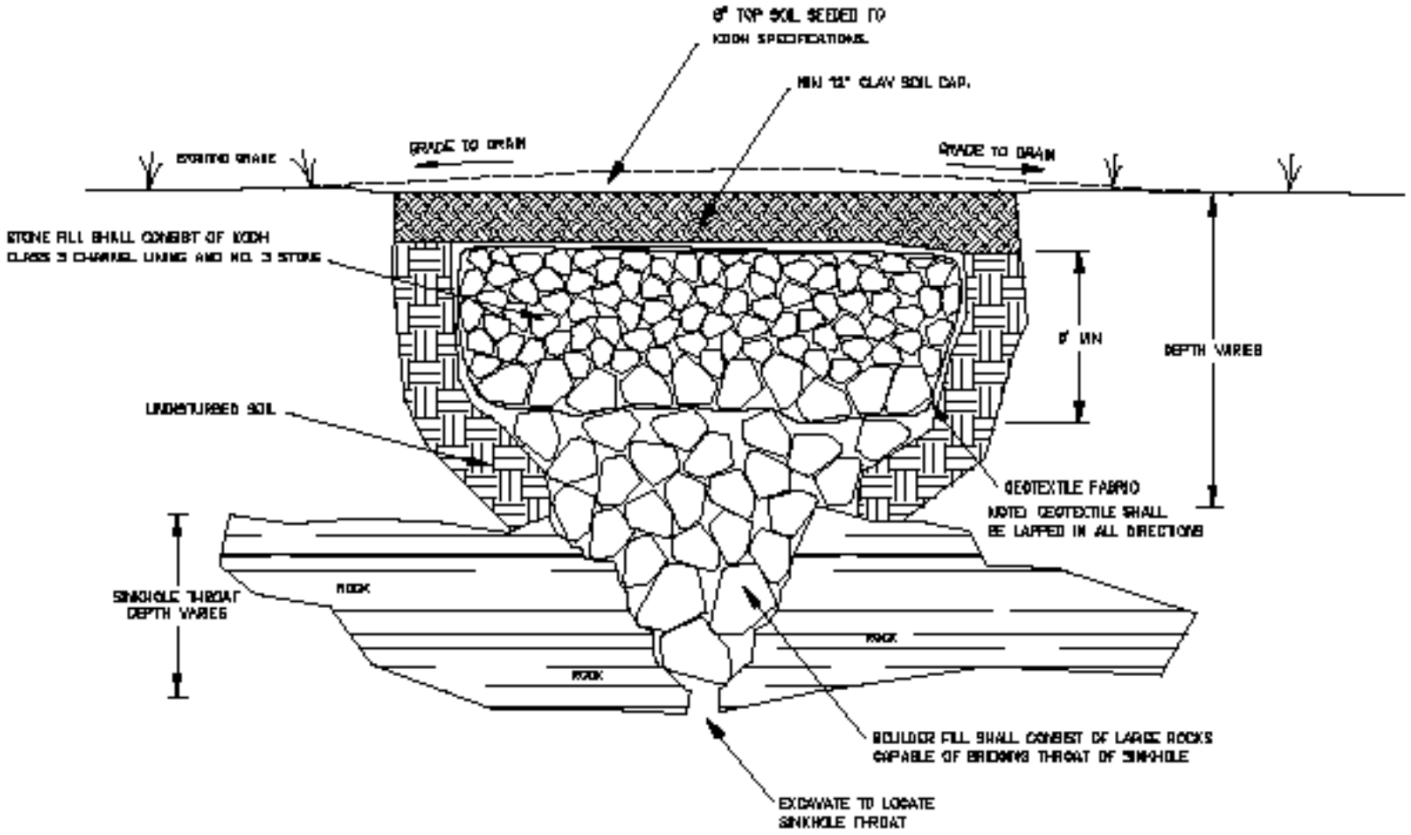
Excavate

Excavate



Excavate

Excavate



CITY OF BOWLING GREEN
PUBLIC WORKS
PLANNING AND DESIGN

STANDARD DRAWING
SINKHOLE REPAIR

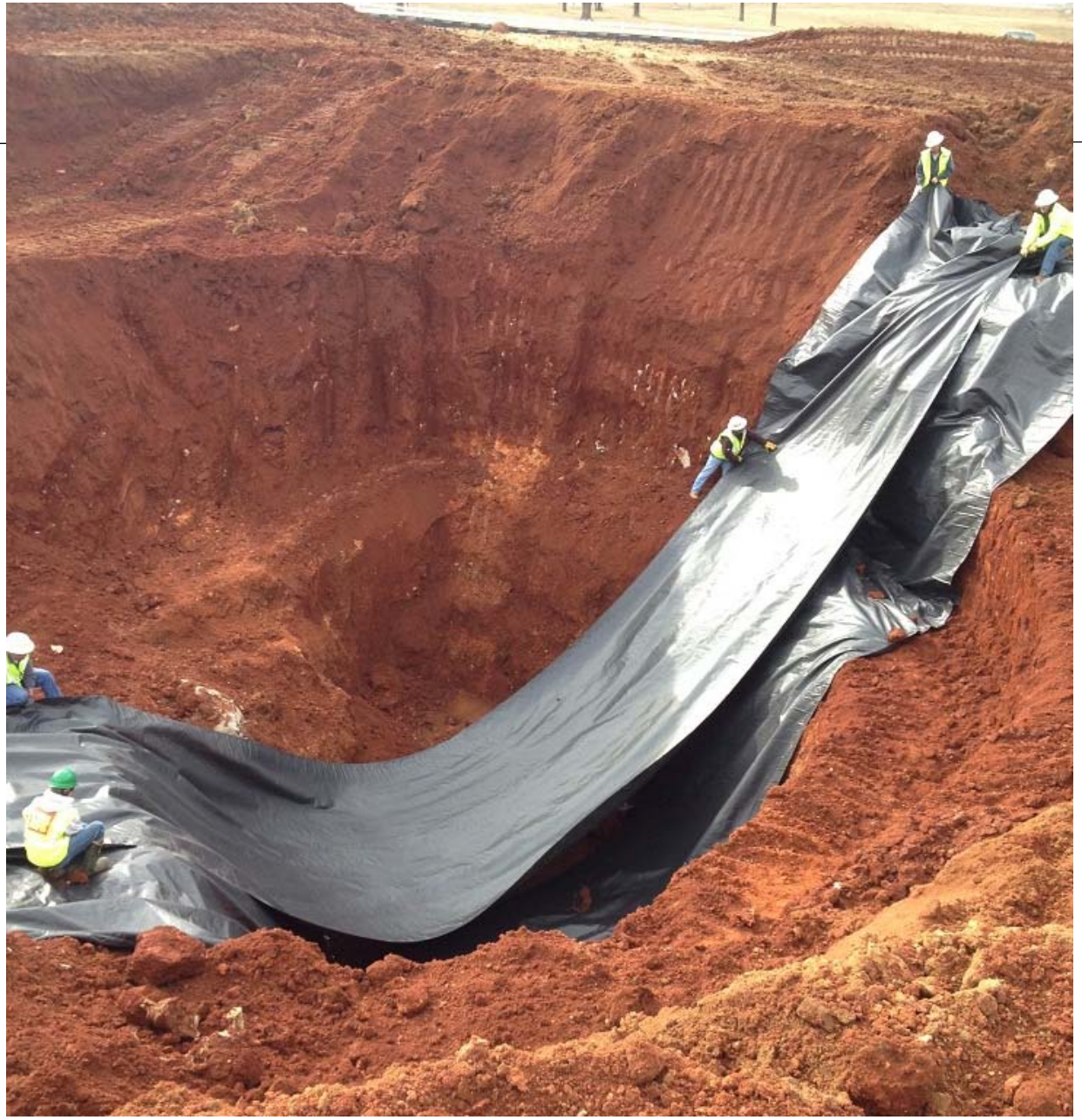
J:\DWG\DETAIL\SINKHOLE REPAIR.DWG

SHEET 1 OF 1

JOB NO.	SCALE	DATE
00-0000	1" = 3'	14 JUNE 04

Repair

Filter fabric is used to line the excavation. This fabric has high tensile strength and also allows water to pass through.



Repair

Repair

Repair

Repair

Repair

Repair – Racks Sporting Goods

Repair – Bowling Green Ballpark

Repair – Lowes Bowling Green

Repair For Existing Structures

- Micro Piles – Helical Piles – Push Piles

Repair For Existing Structures

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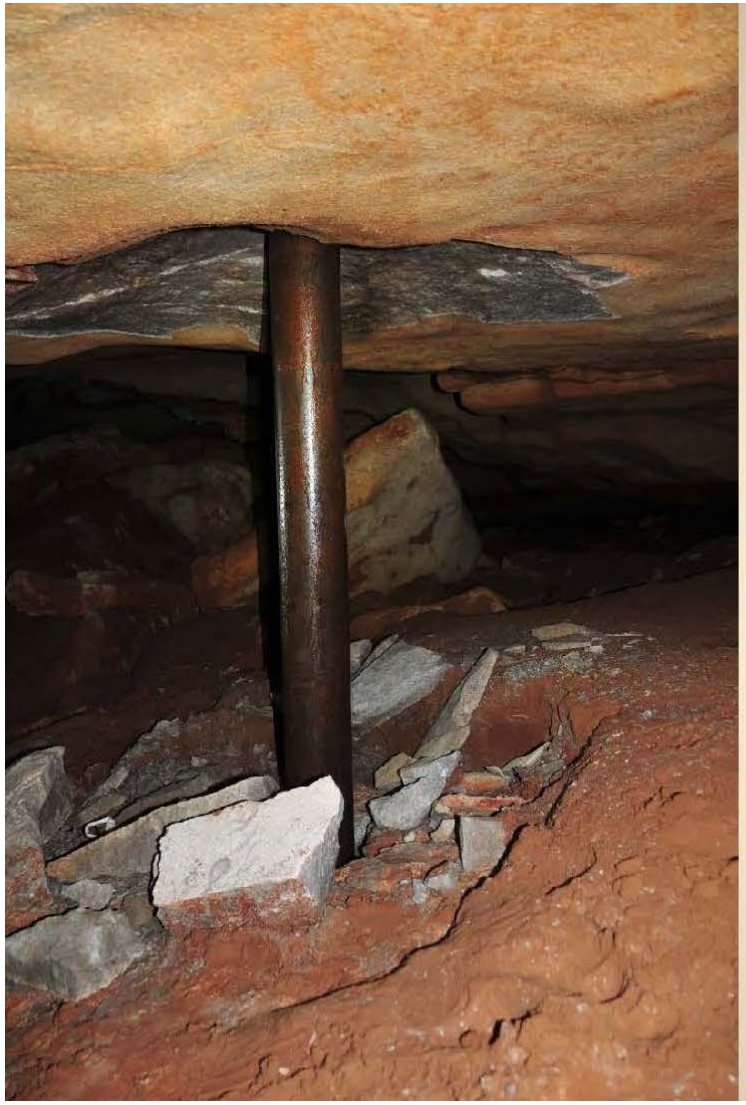
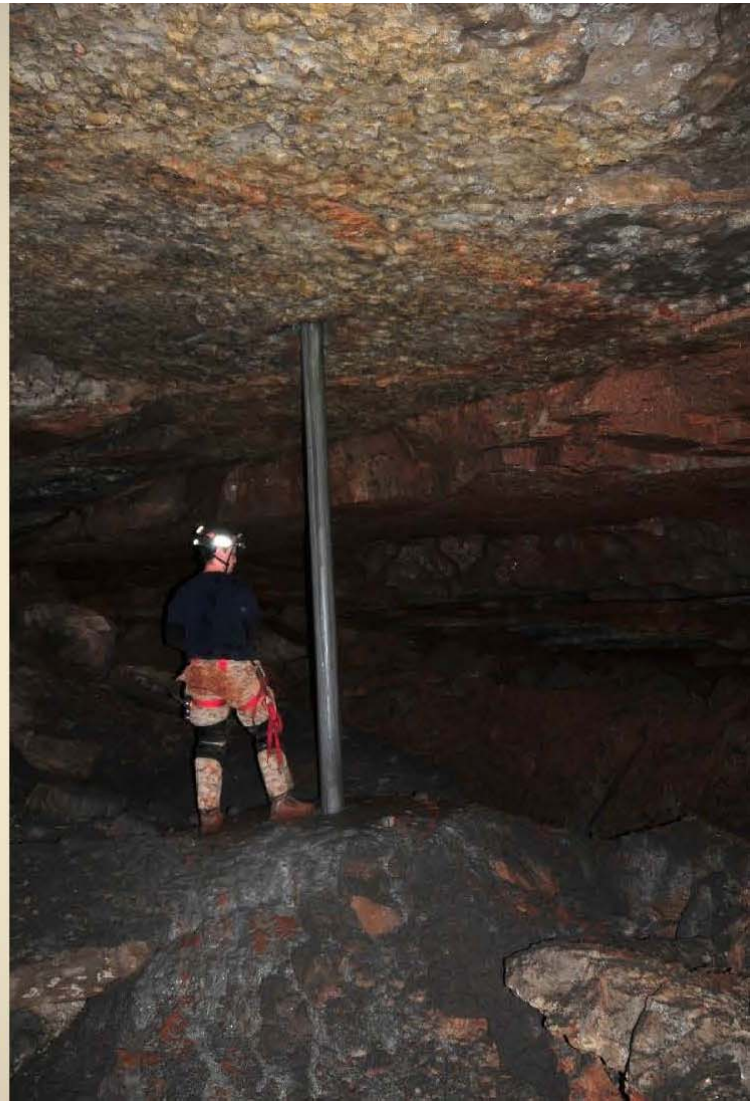
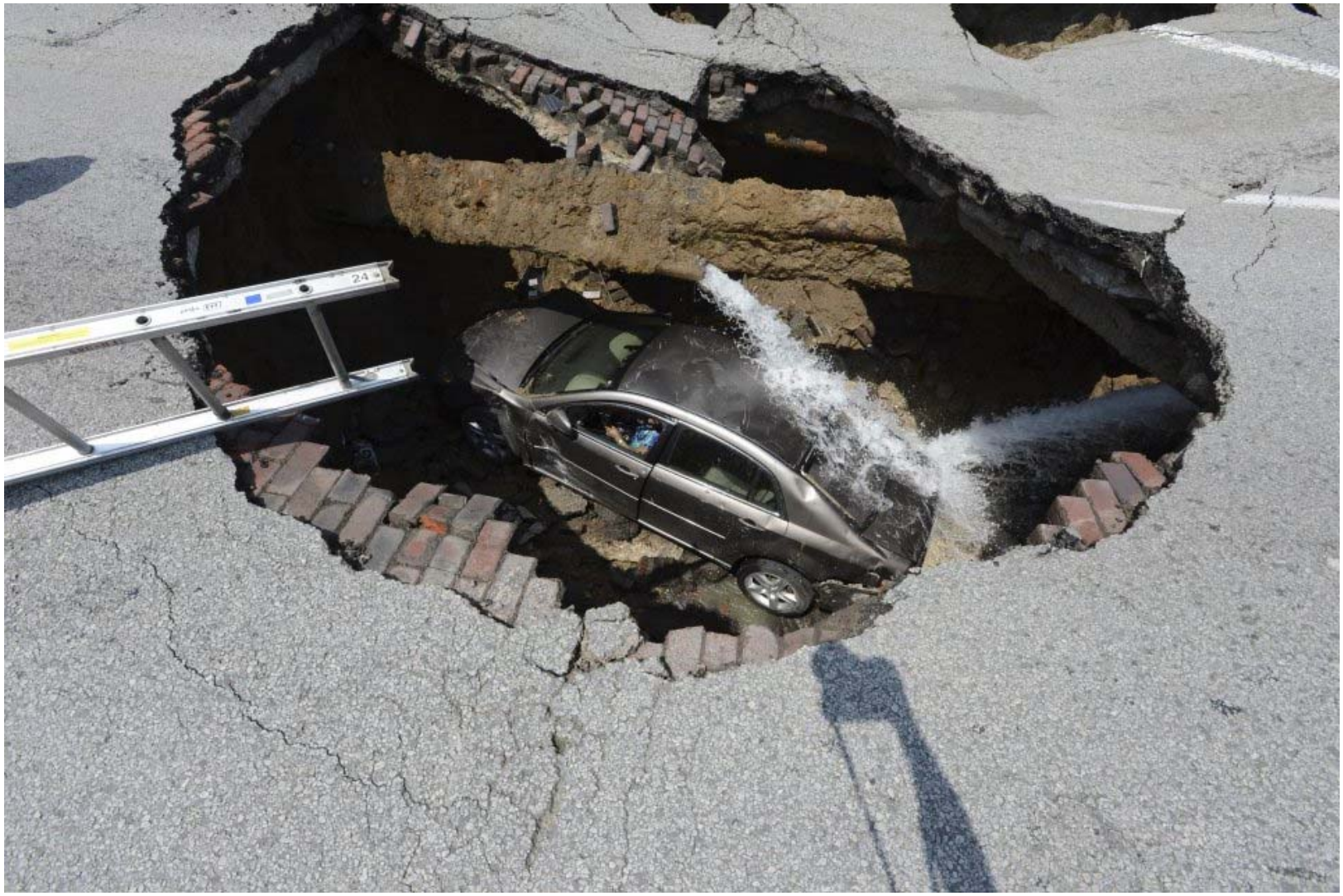




What Else Can We Do?

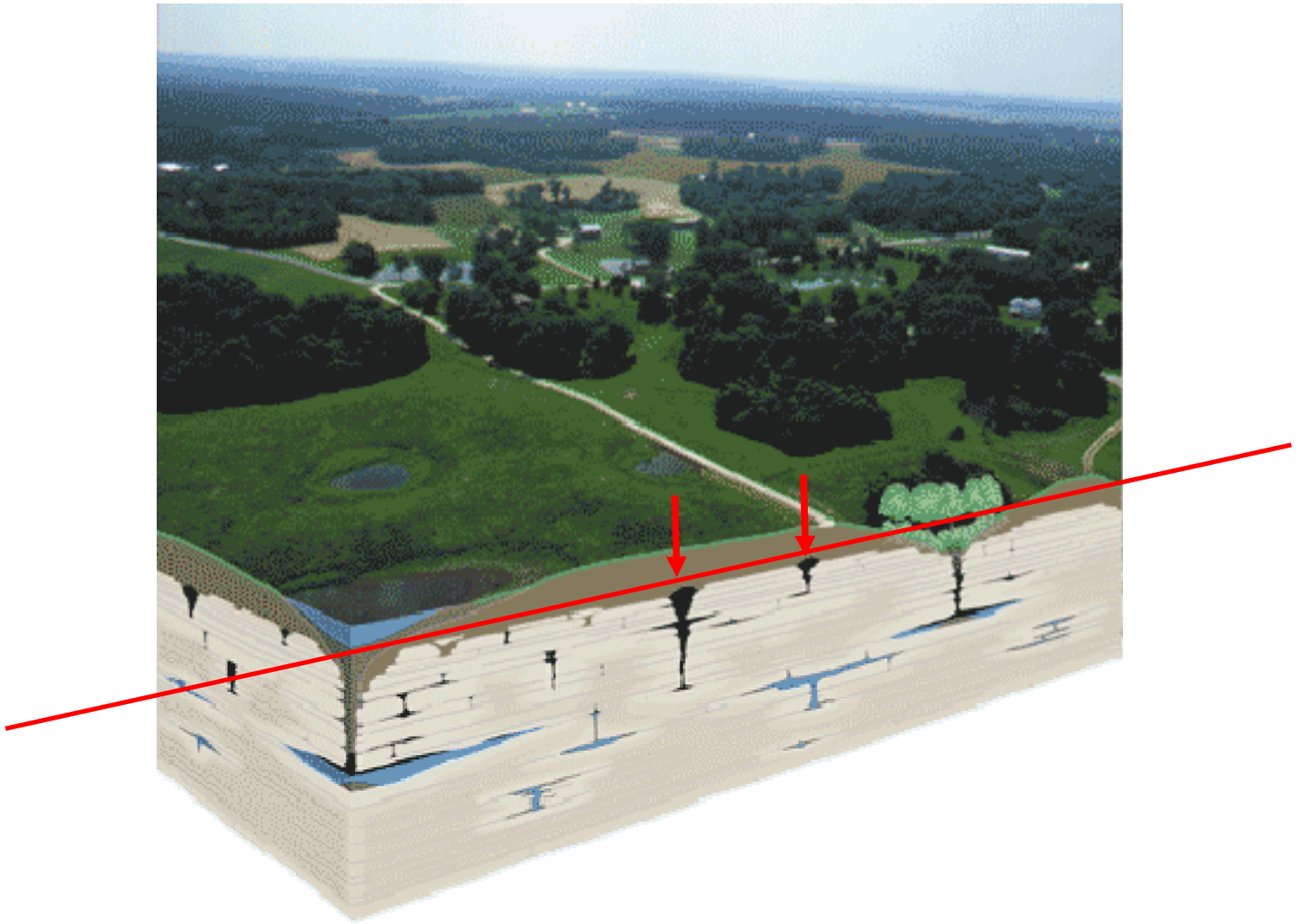


What Else Can We Do?

Change Construction Practices

- Instead of backfilling utility lines with gravel….

Change Construction Practices



Change Construction Practices

Change Construction Practices

- We need to use a low permeability material such as flowable fill which is a low strength, low permeability concrete that can be excavated with a shovel

Change Construction Practices

- Broader use of subsurface mapping methods such as microgravity and electric resistivity

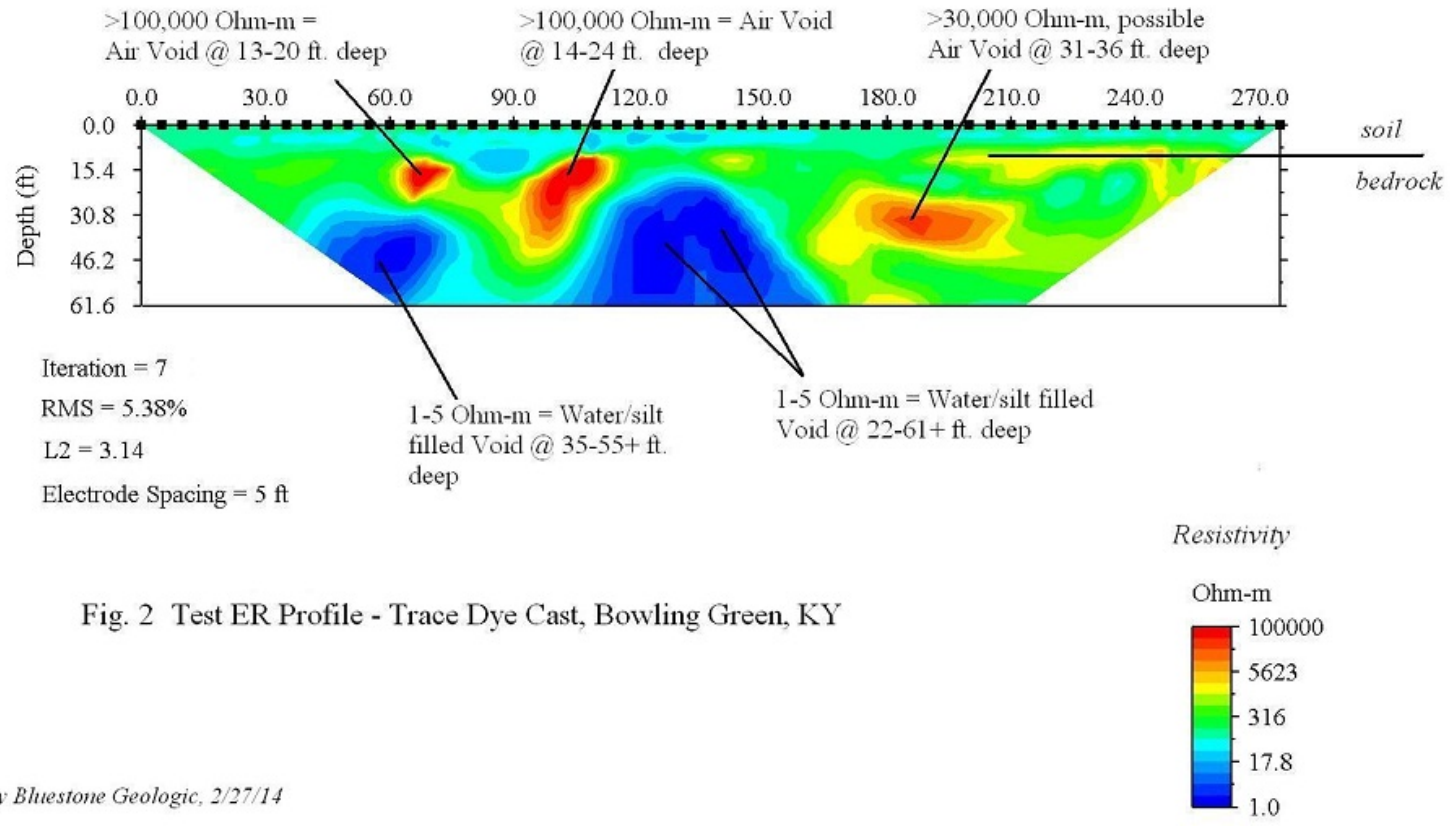
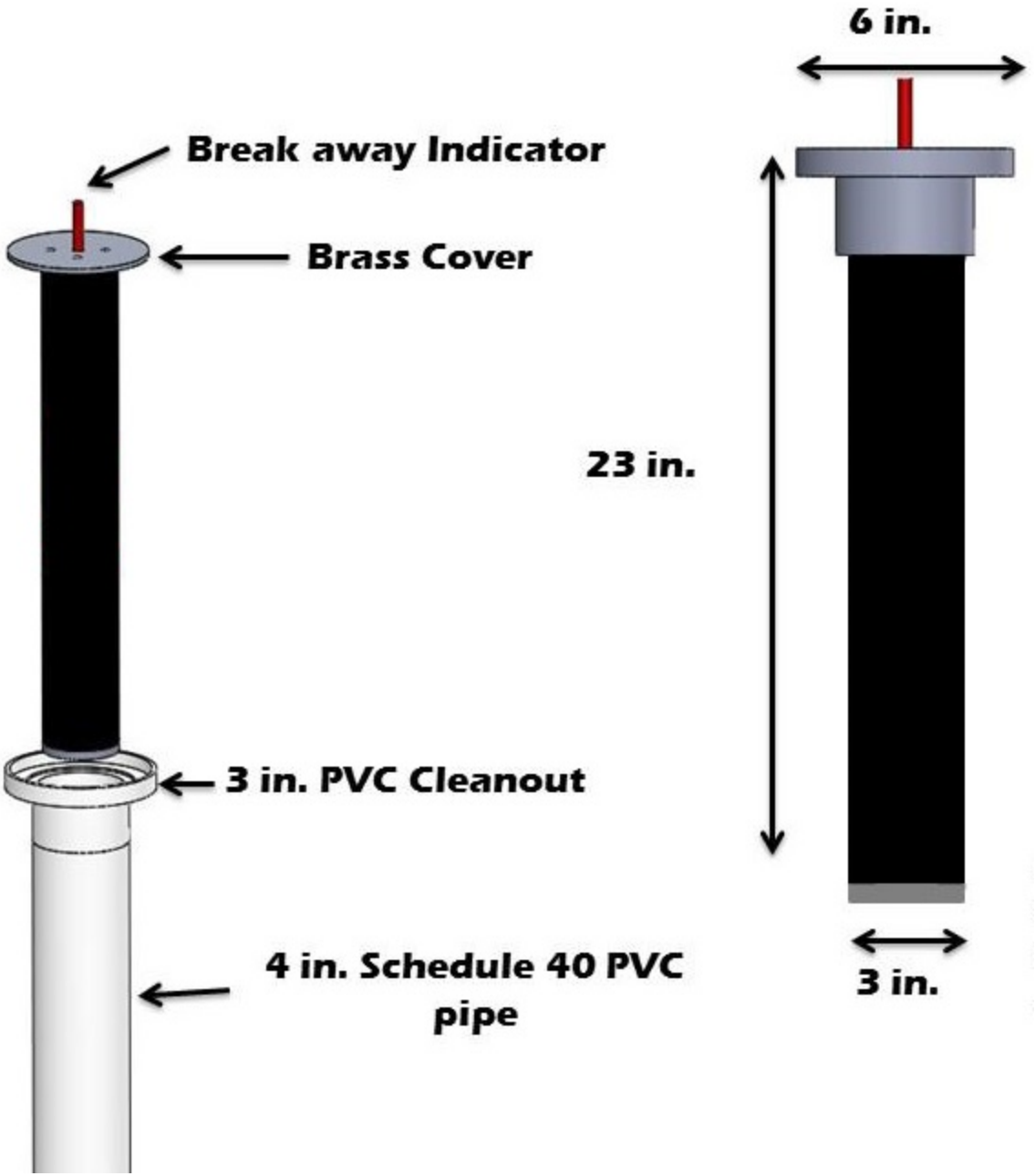


Fig. 2 Test ER Profile - Trace Dye Cast, Bowling Green, KY

Early Sinkhole Detection



Early Sinkhole Detection

The Device
Will Trigger
Once the Void
Reaches the Device

First Actual Installation

The first actual installation was performed at the National Corvette Museum on August 7th and 8th, 2014.

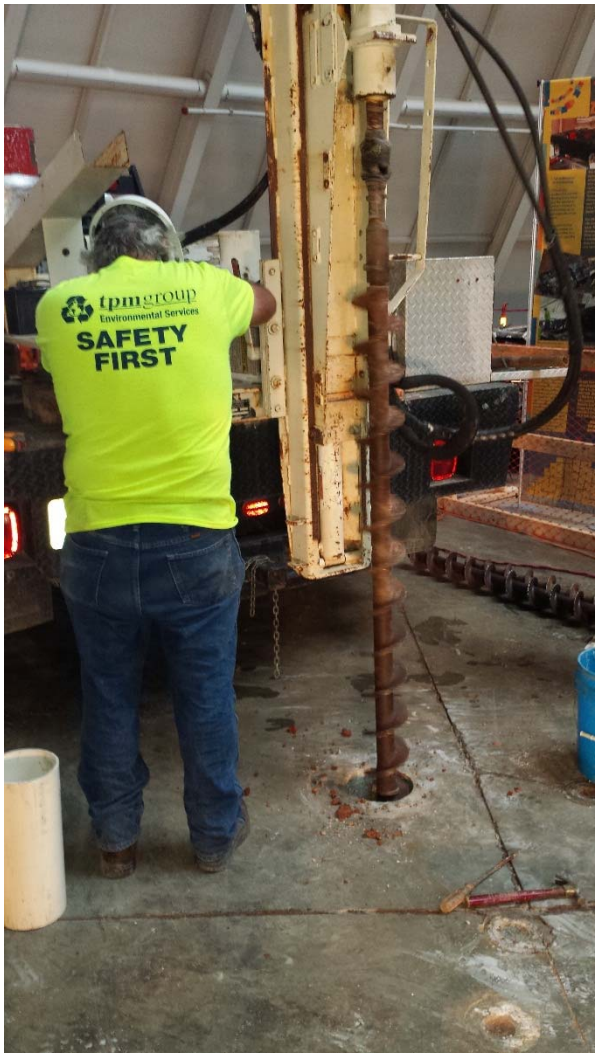
Based on existing Geotechnical data at the site, a location was selected in the Skydome room where the sinkhole was located

Step 1 was to core an 8 inch hole into the slab.

First Actual Installation

First Actual Installation

Step 2 in the process was to drill a boring into the soil to the desired depth. The typical desired depth is approximately half way to bedrock. In this case bedrock was at 10 feet so we drilled to a depth of 5 feet.



First Actual Installation

After the boring was drilled a PVC casing was set into the hole

First Actual Installation

Once the casing was set it was filled with sand to the appropriate elevation

First Actual Installation

Finalizing the sand elevation

First Actual Installation

With the sand elevation set, the VoidX device is installed

First Actual Installation

Once installed the VoidX device is grouted into place

First Actual Installation

The finished product

What If…..?

Questions?