

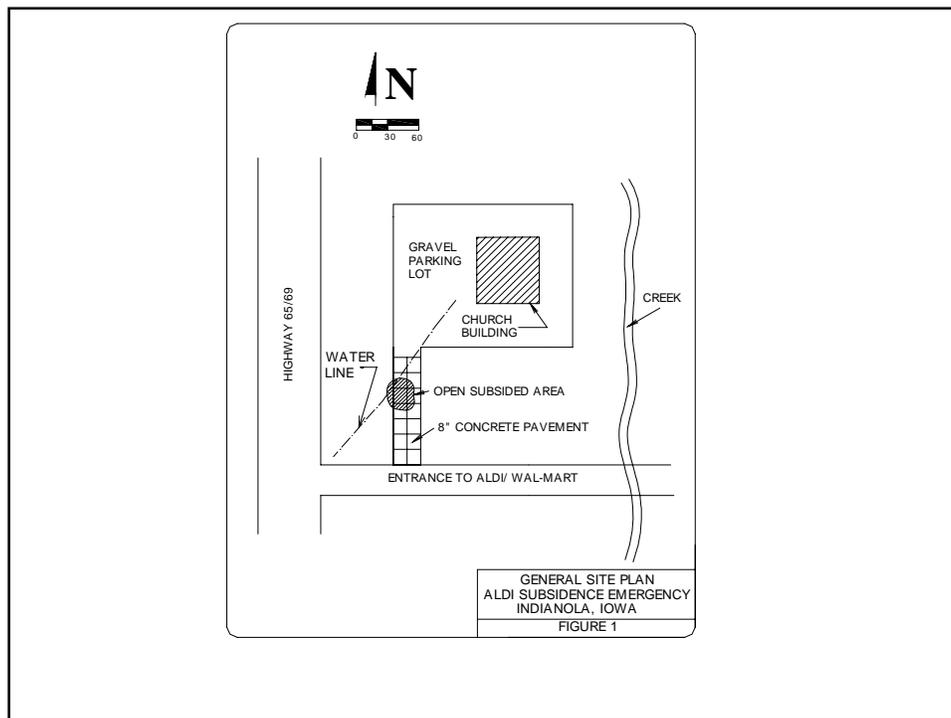
# LESSONS LEARNED FROM PRESSURE GROUTING AN OPEN SHAFT

*Authored by:*

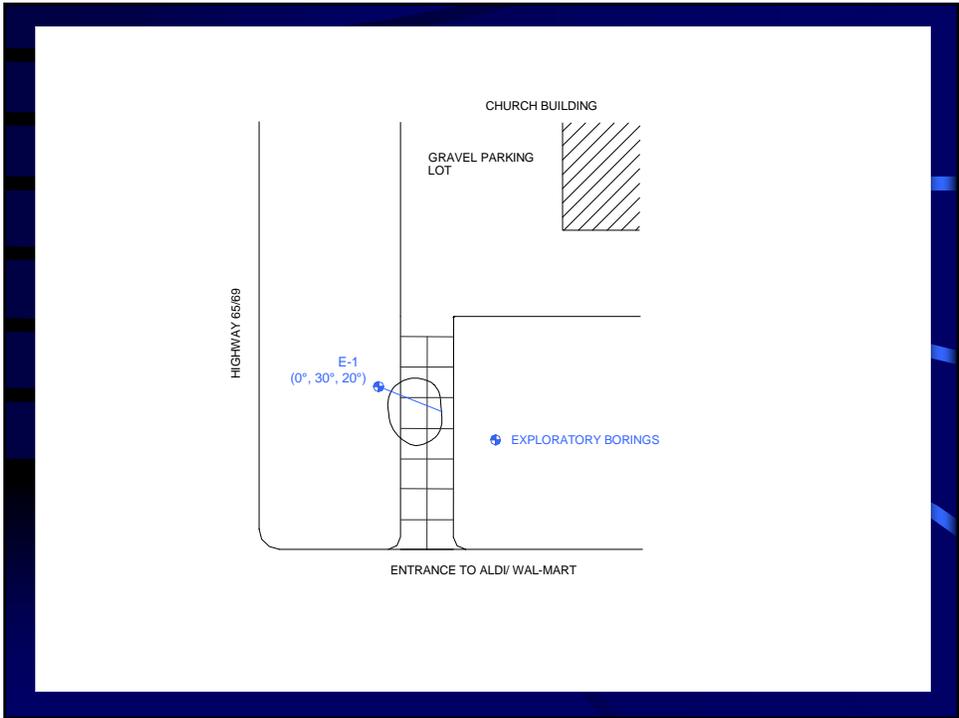
Michael L. Bourland, P.E., Iowa AML Program

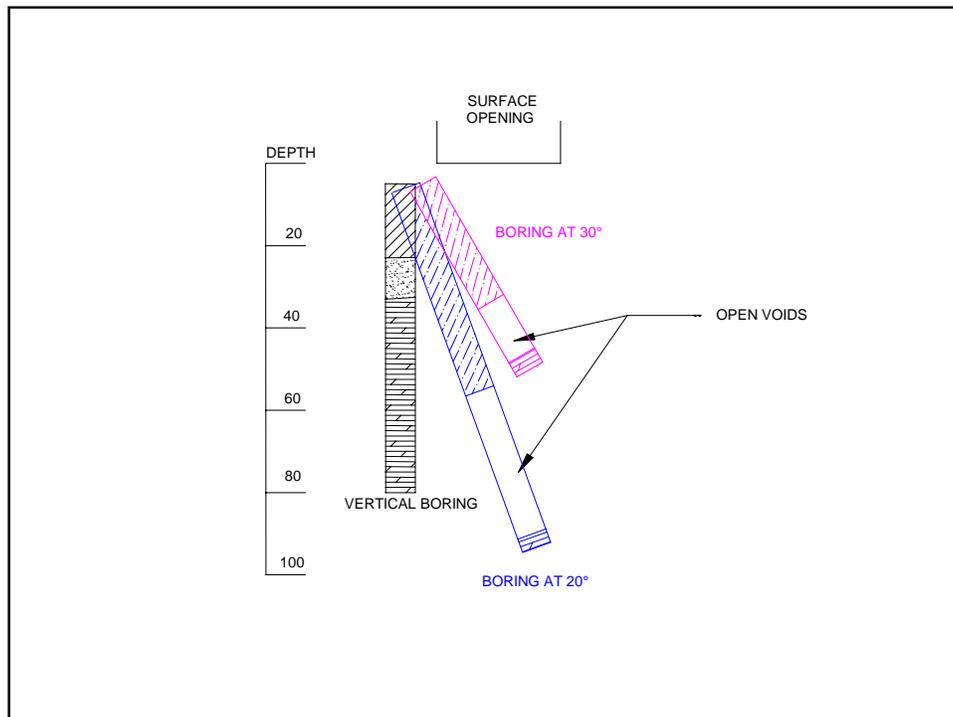
Len Meier, MCRCC, OSM

*Presented by:* Mike Bourland









## DESIGN OPTIONS CONSIDERED

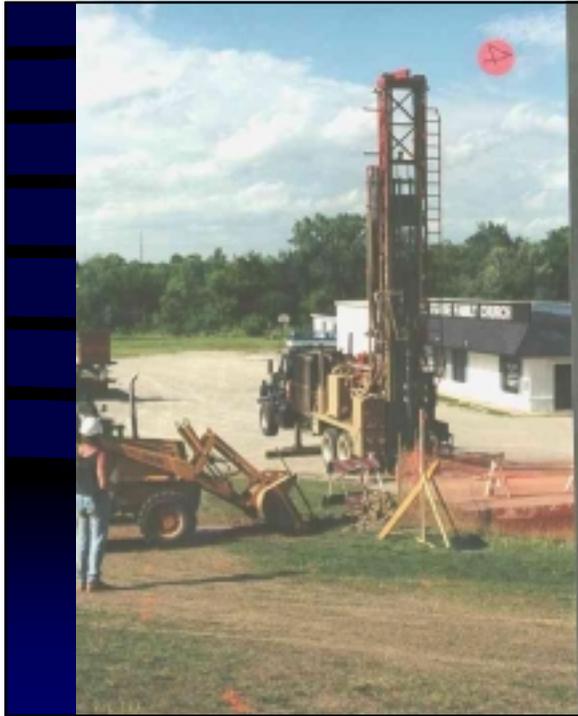
- Excavation and Backfill
  - too deep
- Poured Concrete Cap
  - concern with future erosion and settlement
- Compaction Grouting

## Contract Requirements

- Drill rig capable of drilling at an angles from 10 to 40 degrees, either pneumatic, hydraulic, percussion, or rotary.
- Steel casing for grouting, advanced with drill rig to avoid re-drilling.
- Positive displacement, piston-type grout pump capable of pressures up to 1000 psi and controllable rates from 0.5 to 4 cfm.

## Contract Requirements

- Gout mix design by contractor for both low slump (1 inch) and high slump (4 inch), with minimum requirement of 1 part cement to 4 parts sand, and 400 psi compressive strength.
- Definitions of stage completion of grouting.
- Backfilling procedures for the surface feature.
- Site restoration.
- Test drilling with sampling after completion to determine effectiveness.

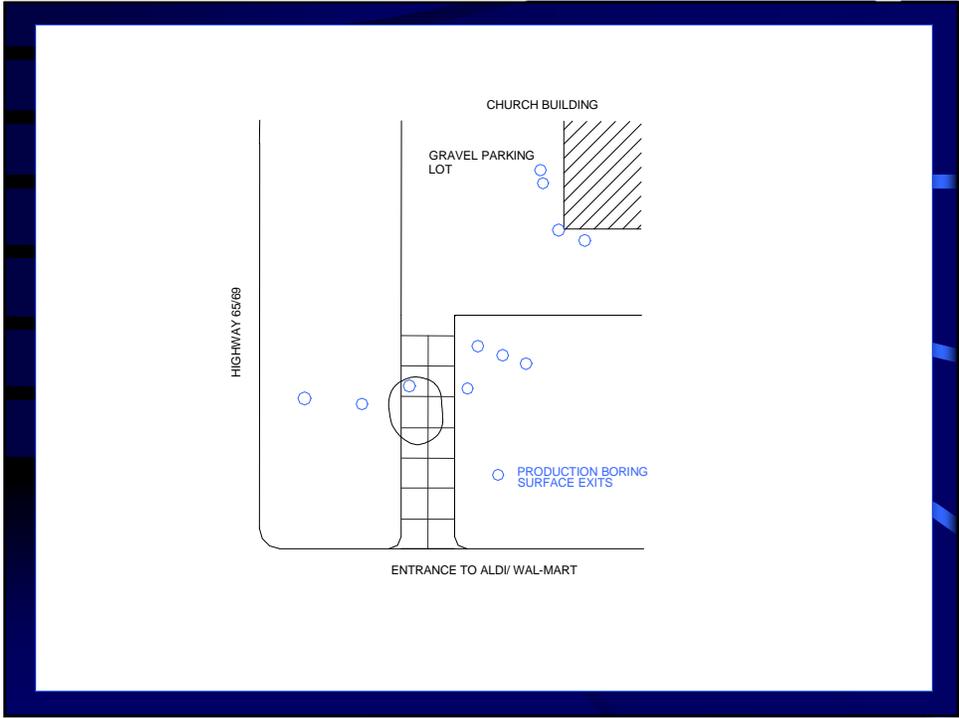


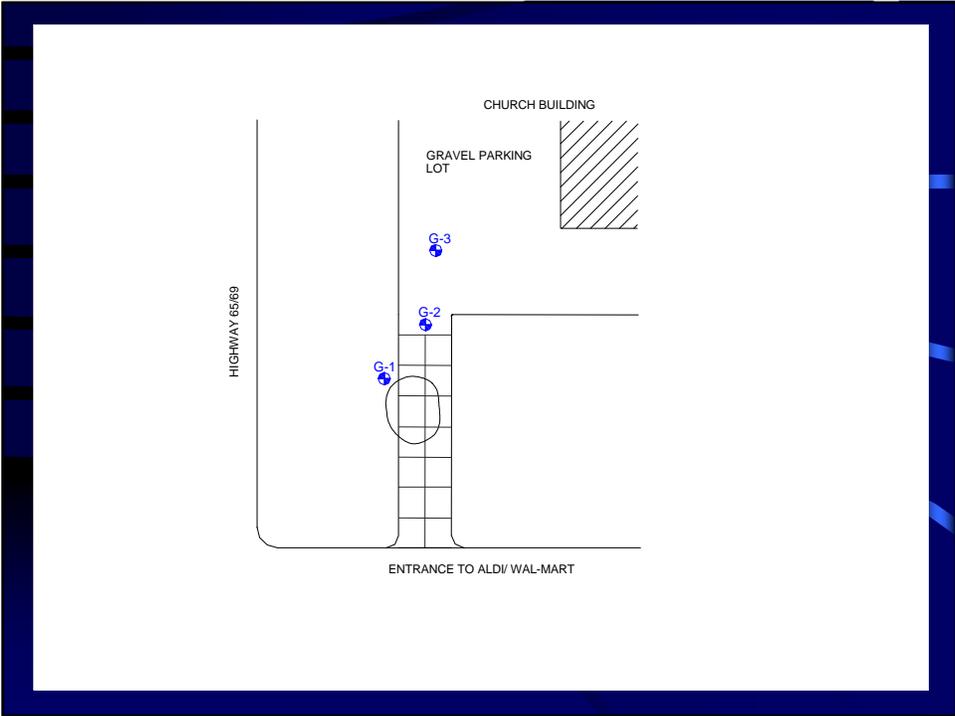
### SR-20 Drill Rig

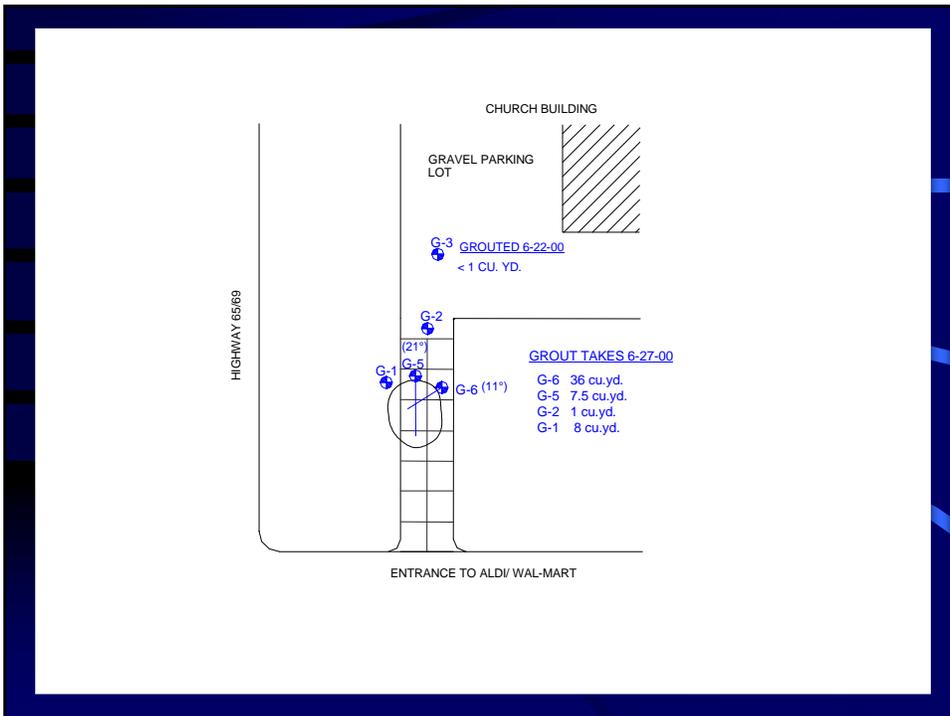
Air used as drilling fluid with:

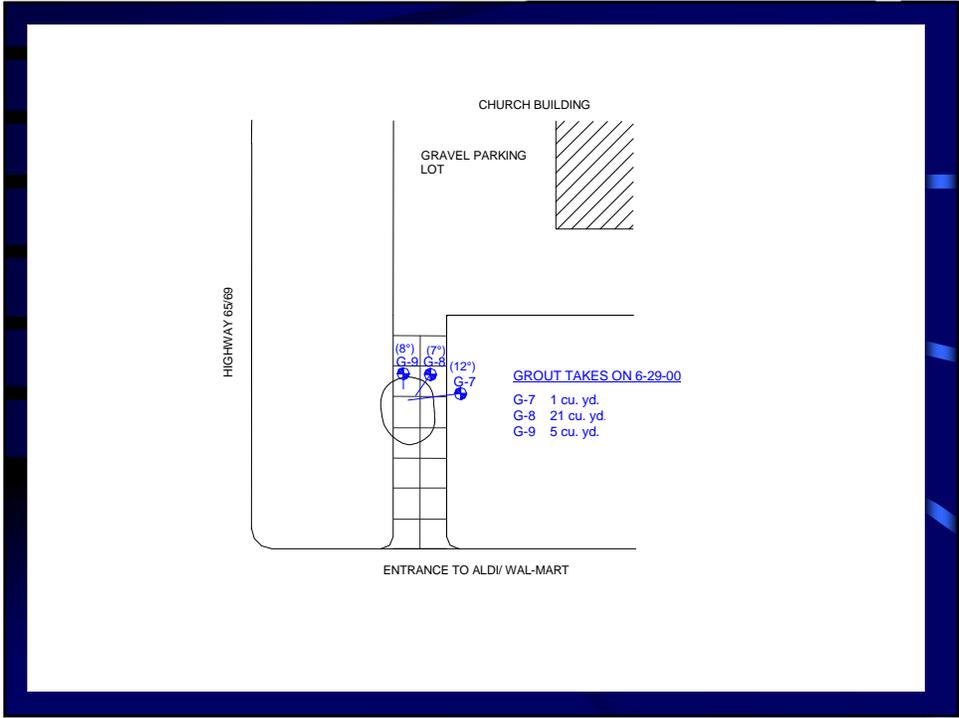
- 200 psi pressure
- 700 cfm air flow

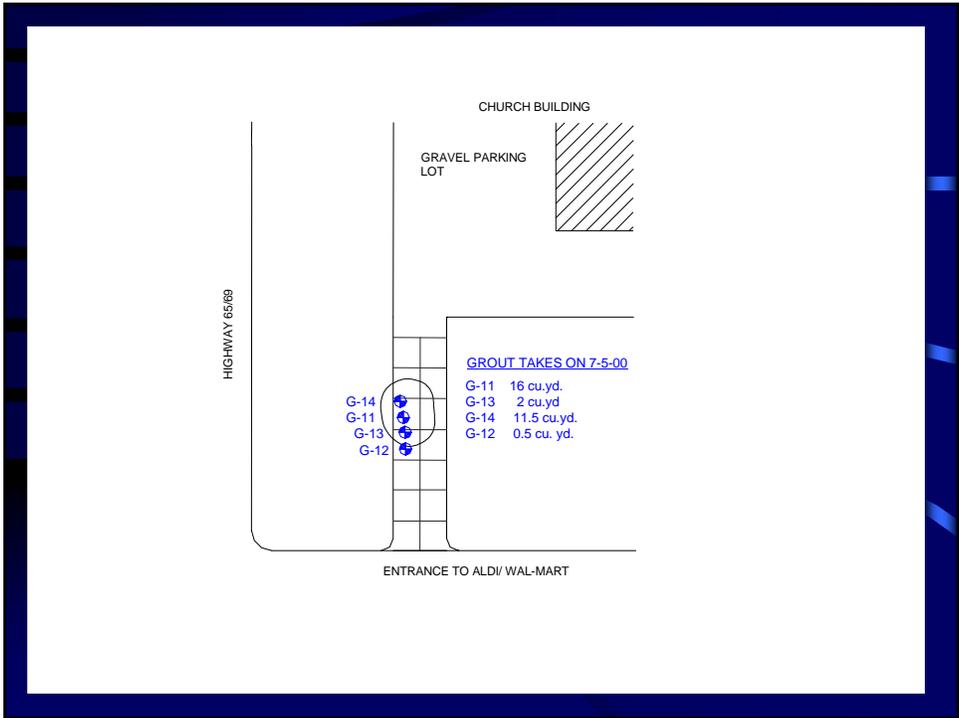
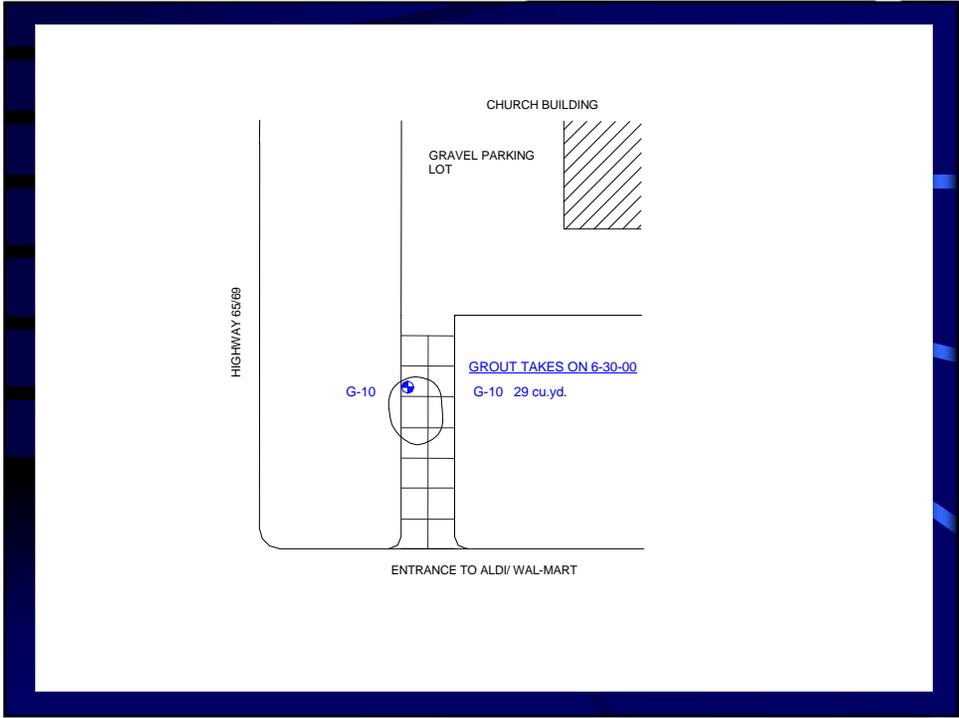


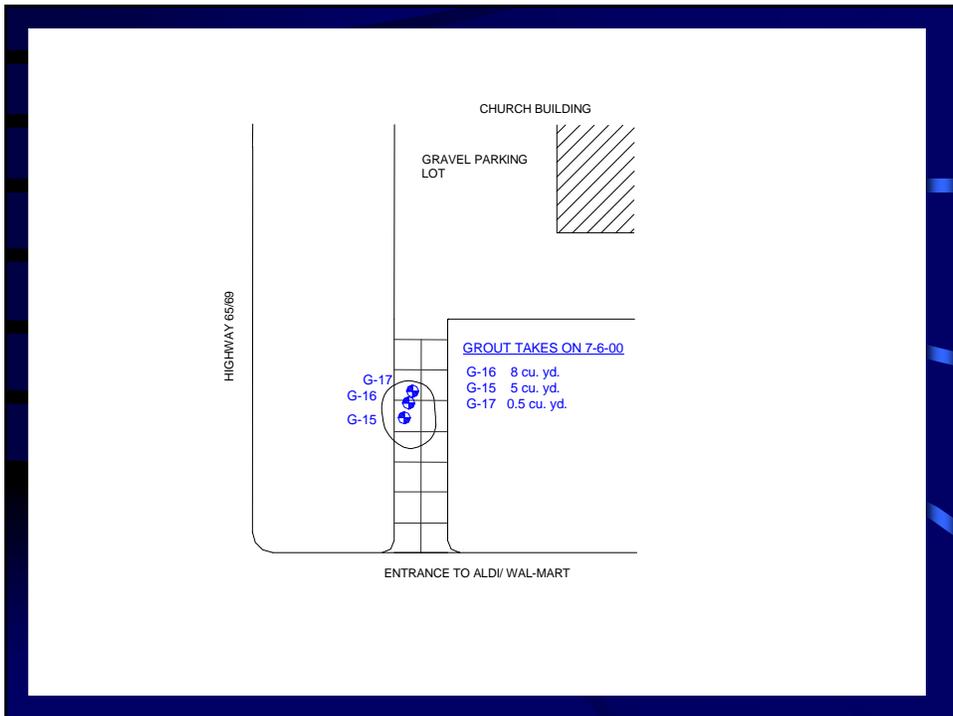




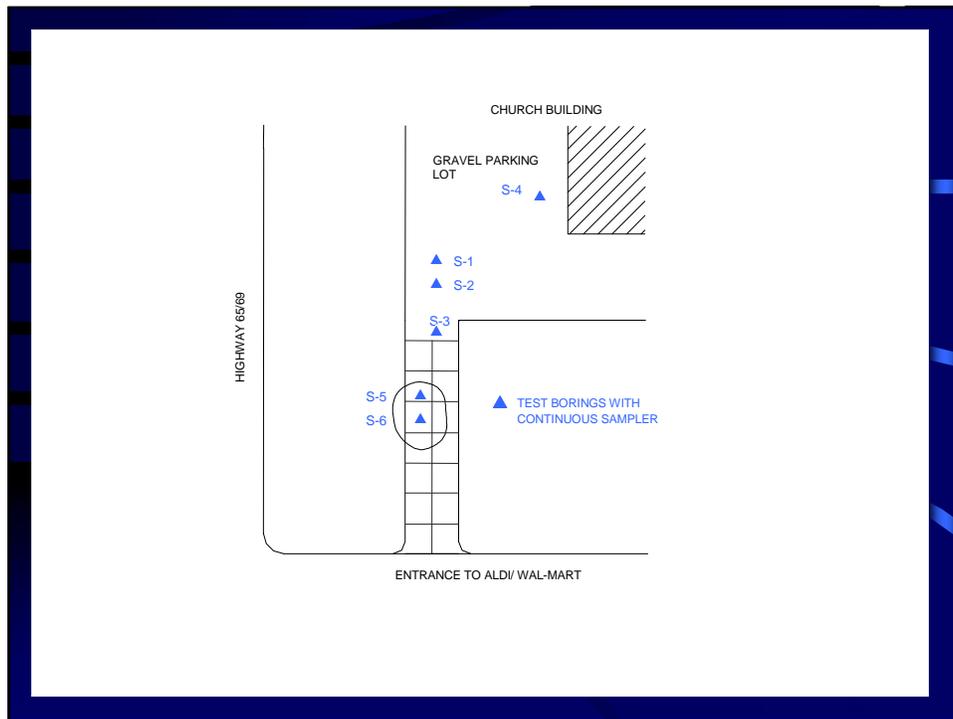












## PROJECT SUMMARY

- 17 Grout Holes
- 1,261 Linear Feet of Drilling  
(*Bid Quantity of 600 feet*)
- 4,117.5 Cubic Feet of Grout  
(*Bid Quantities: 7,000 cubic feet of low slump grout*  
*2,000 cubic feet of high slump grout*)
- Gravel and Topsoil at bid quantities
- Total Cost \$87,124.46 (*Bid Price \$89,849*)

## **LESSONS LEARNED**

- More information is better and worthwhile.
- Separate out drilling and casing costs.
- Be familiar with the construction equipment.
- Recognize that specifications can limit the equipment selection.

## **LESSONS LEARNED**

- Document changes in the field as they happen.
- Limit the amount and types of work that the General Contractor can subcontract.