2022 Garrison Phase 5 AML Project Summary

Drilling and Grouting Contractor: Earth Energy & Water Systems, Inc.
Drilling and Grouting Project Cost: $721,511
Drilling and Grouting Contract Number: AM-864-22

Material Testing Contractor: Geoserv, Inc.
Material Testing Contract Cost: $23,594
Material Testing Contract Number: AM-865-22

Total Project Costs: $721,511 + $23,594 + $1920 (Abstract) = **$747,025**

Location: Along McLean County Highway 15 and other infrastructure located less than one mile south of Garrison. Legal Description: Sections 17, 18, T148N, R84W

2022 eAMLIS Project Information							
Project	Problem Area Number & Name	Project Start Date	Project End Date	Working Days	Project Cost	Estimated Population Impacted	Estimated Acres Reclaimed
2022 Garrison Phase 5 AML Project	ND019/ Garrison	8/08/2022	10/14/2022	20	$747,025	4250 people is based on the 2021 vehicle count of McLean County Highway 15.	0.29 Acres

Background

The Public Service Commission administers the Abandoned Mine Lands (AML) Program on behalf of the State of North Dakota. The State AML Program was approved by the U.S. Department of the Interior in 1981 under the authority of the Surface Mining Control and Reclamation Act of 1977 (P.L. 95-87, Title IV). Program funding comes from a federal reclamation fee on coal that has been mined in the United States since the late 1970's. These fees are placed into the AML fund and the money that North Dakota receives from this fund is used to eliminate existing and potential public hazards resulting from abandoned surface and underground coal mines.

Three known abandoned underground lignite coal mines are located approximately one mile south of Garrison. The Rupp, Kunkel, and Garrison Coal Mines operated in the 1910s and 1920s. However, the Public Service Commission (PSC) Abandoned Mine Lands (AML) Division does not have a mine map of the Garrison Coal Mine. Without accurate mine maps, exploratory drilling is used to characterize and determine the extent of abandoned underground mine workings. The legacy of these mines is exhibited through sinkholes (**Figure 1**).

The AML Division has conducted multiple sinkhole-filling projects in the area and conducted four phases of drilling and grouting. A gasoline leak from an underground storage tank at a nearby gas station was discovered while drilling in 2005. This caused work to be halted until the spill was remediated under the guidance of the North Dakota Department of Environmental Quality (NDDEQ).

Exploratory drilling resumed in 2021 and it identified hazardous underground mine voids near public roads and homes. With this newly found information, the AML Division began planning the next phase of work in Garrison. A public meeting was held on November 1, 2021, at the Garrison City Hall seeking

input from nearby landowners, local government officials, and anyone who may be concerned about the abandoned mines near Garrison.

Two months prior to the start of the Garrison Phase 5 AML Project, a 2022 Exploratory Drilling AML Project was conducted. The Garrison portion of the 2022 Exploratory Drilling Project was completed by August 4, 2022. Project totals included 20,072 feet of drilling and 3,765 feet of PVC casing was installed in 108 drill holes encountering mine voids (**Figure 2**). All drilling was done near McLean County Highway 15 and other infrastructure. The drilling in this project revealed the extent of the abandoned underground mines in Garrison were much larger than previously anticipated (**Figure 3)**.

Narrative

The competitive bidding process was completed in March of 2022, and the Garrison Phase 5 AML Project was awarded to Earth Energy & Water Systems, Inc. of New Salem, ND. The material testing contract was awarded to GEOSERV, Inc. of Bismarck, ND.

The bid quantities for this project included 2,000 cubic yards of grout injection, 5,000 feet of drilling, 1,000 feet of casing, and 50 feet of coring. Grout was first pumped near private residences in the South Garrison Subdivision (**Figure 4**). During this time, the contractor continuously monitored the elevations of the buildings using a laser level to detect any changes in building elevations. Grout is tested by the material testing contractor every 50 cubic yards to ensure it meets contract requirements for flowablity and strength (**Figure 5)**. After pumping near the homes was complete, the grout pump moved to the McLean County Highway 15 right of way until the end of the project (**Figure 6**). A total of 2,139 cubic yards of grout was pumped at the locations shown on the map (**Figure 7**).

The Garrison Phase 5 AML Project also included drilling in high-priority areas. Previous drilling indicated that some of the power poles in the area are likely undermined. The local power company was able to shield their lines which allowed drilling near the poles (**Figure 8**). Four of the power poles were found to be undermined. Additional drilling in the ditch of McLean County Highway 15 also revealed more voids.

Two core samples were taken near one of the houses and one core was taken from the east and west ditches of McLean County Highway 15 where grout had recently been pumped. All the cores showed a strong, continuous grout sample and confirmed the pumping was effective.

Approximately 130 cased holes remain onsite. The 2023 Garrison Phase 6 Project is planned for the summer of 2023. The project will utilize the remaining cased holes.

Project Statistics

Total days pumping- 13
Average grout pumped per day- 164.50
Total grout pumped- 2,139
Average 14-day grout break strength 364.48 psi
Total days drilled- 7
Feet drilled per day- 698.4
Feet cased per day- 162.3
Total feet drilled- 4,889
Total feet cased- 1,143
Total holes cased- 37
Total holes pumped- 27
Average grout yards per hole pumped- 79
Holes filled adjacent- 41
Cased holes remaining on-site- ~130
Area reclaimed- 0.29 acres

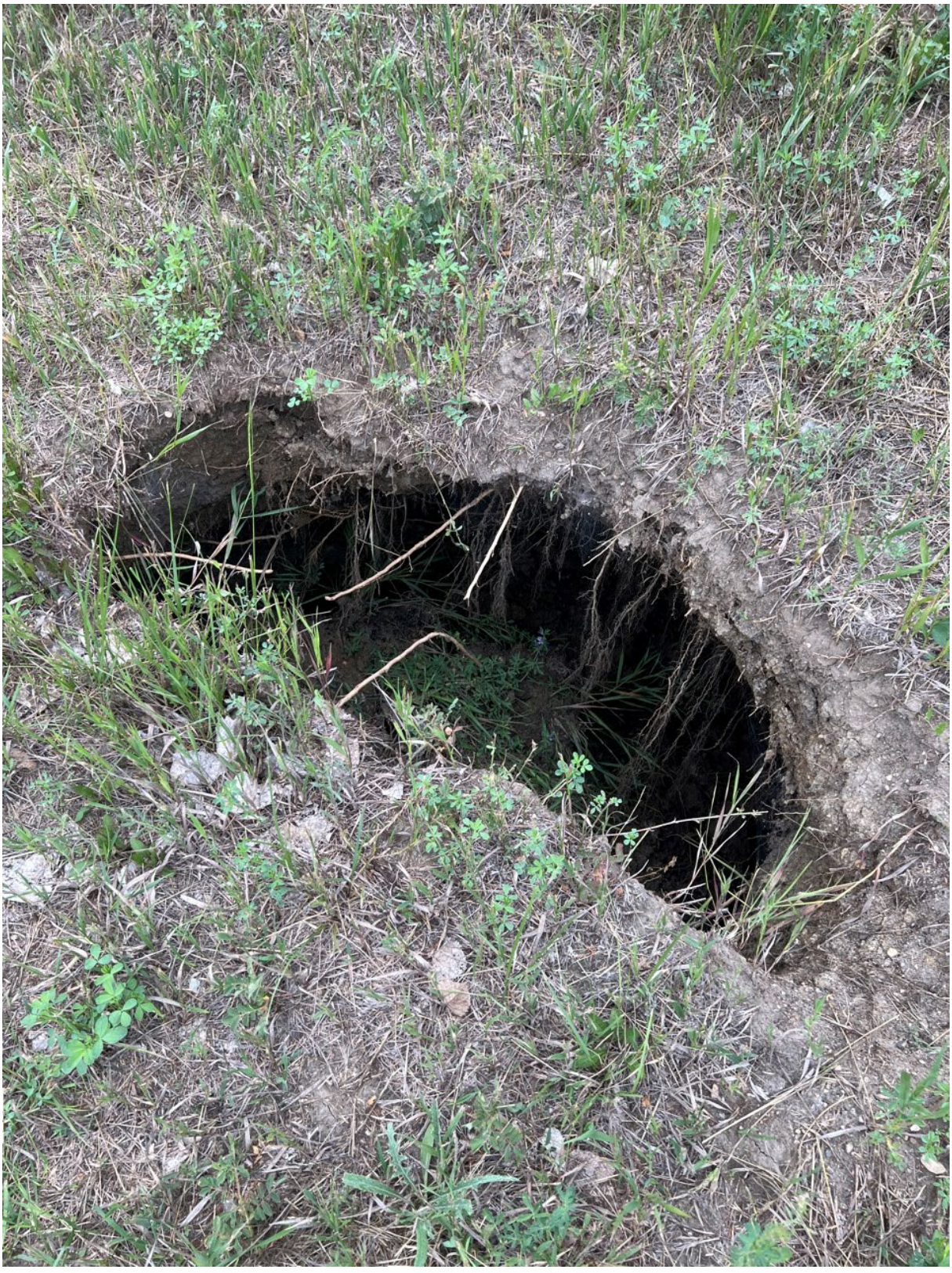

Figure 1: *A sinkhole opened up in the McLean County Highway 15 right of way in the spring of 2022.*

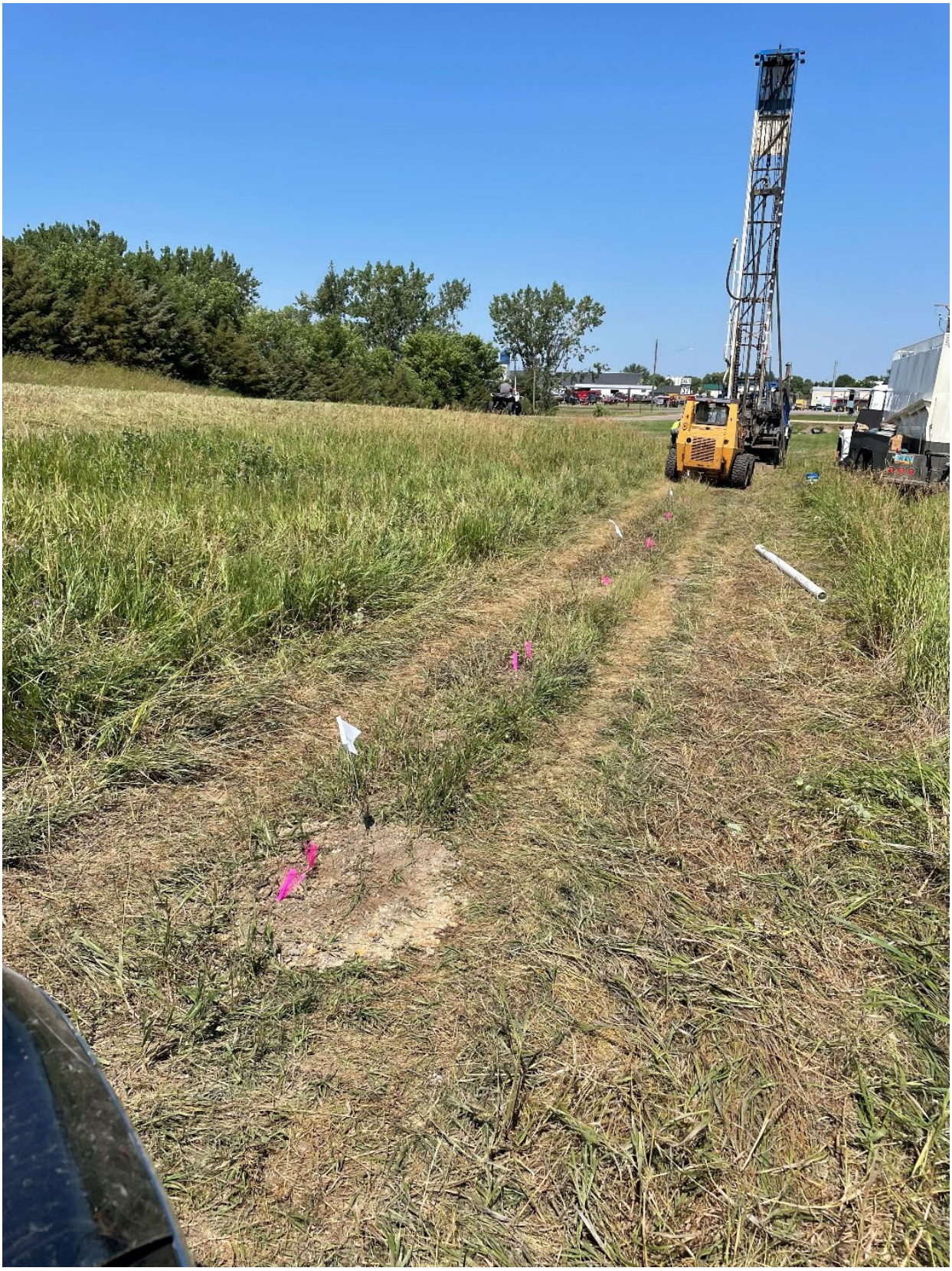

Figure 2*: The drilling rig is moving north in the east right of way of McLean County Highway 15 as part of the 2022 Exploratory Drilling AML Project. The pink markers indicate a hole was cased.*

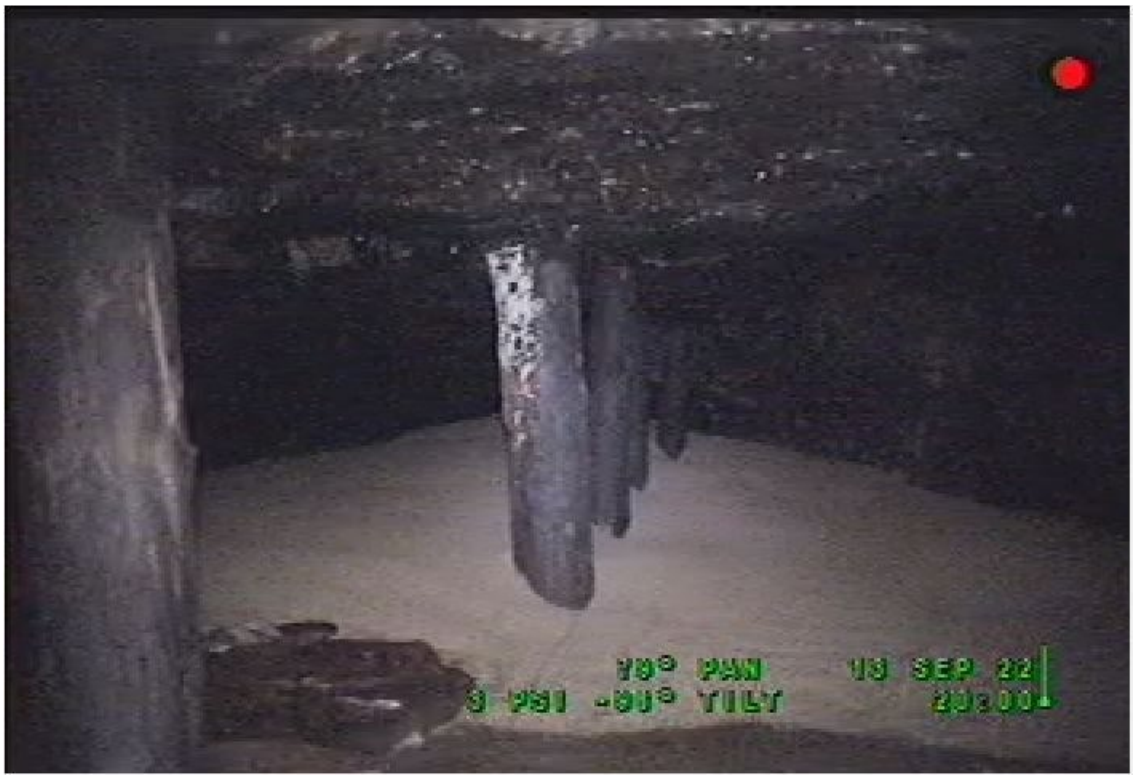

***Figure 3**: A borehole camera image shows timbers in the mine workings. The tan material is grout slowly filling this portion of the mine.*

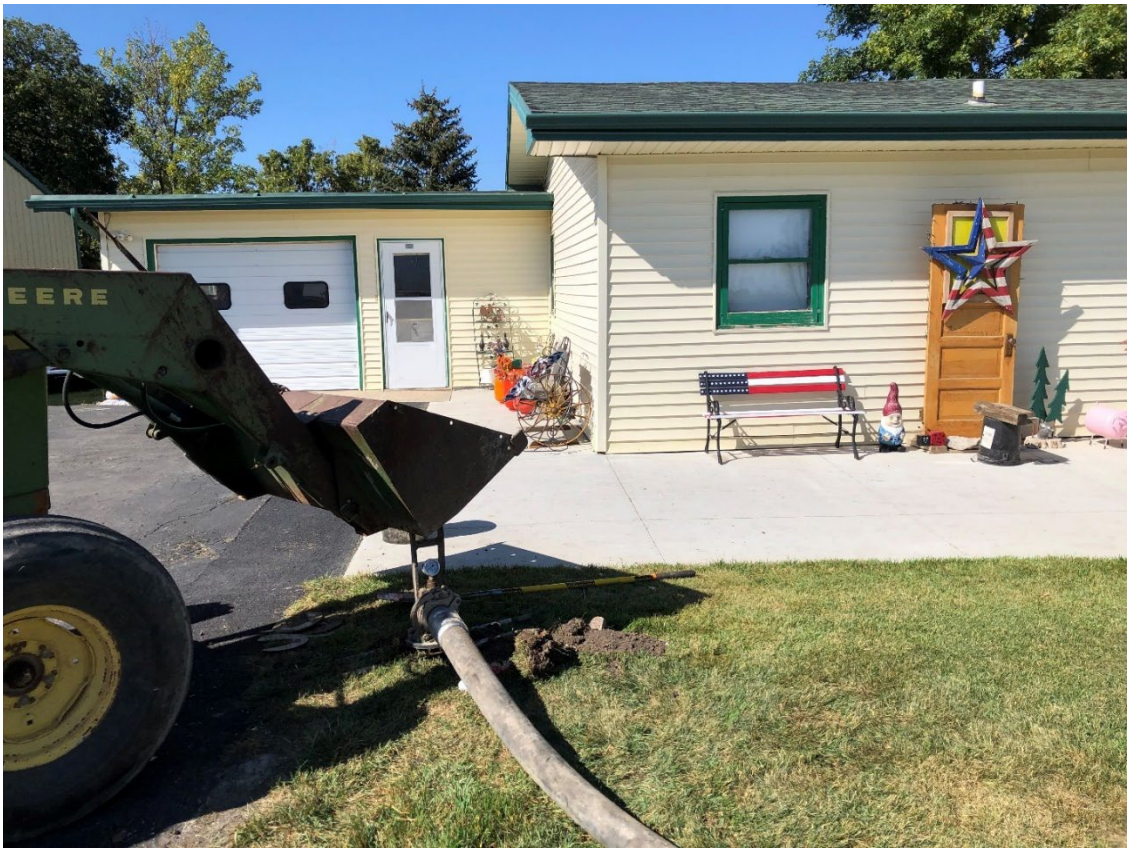

***Figure 4**: Approximately 60 yards of grout was pumped into this hole.*

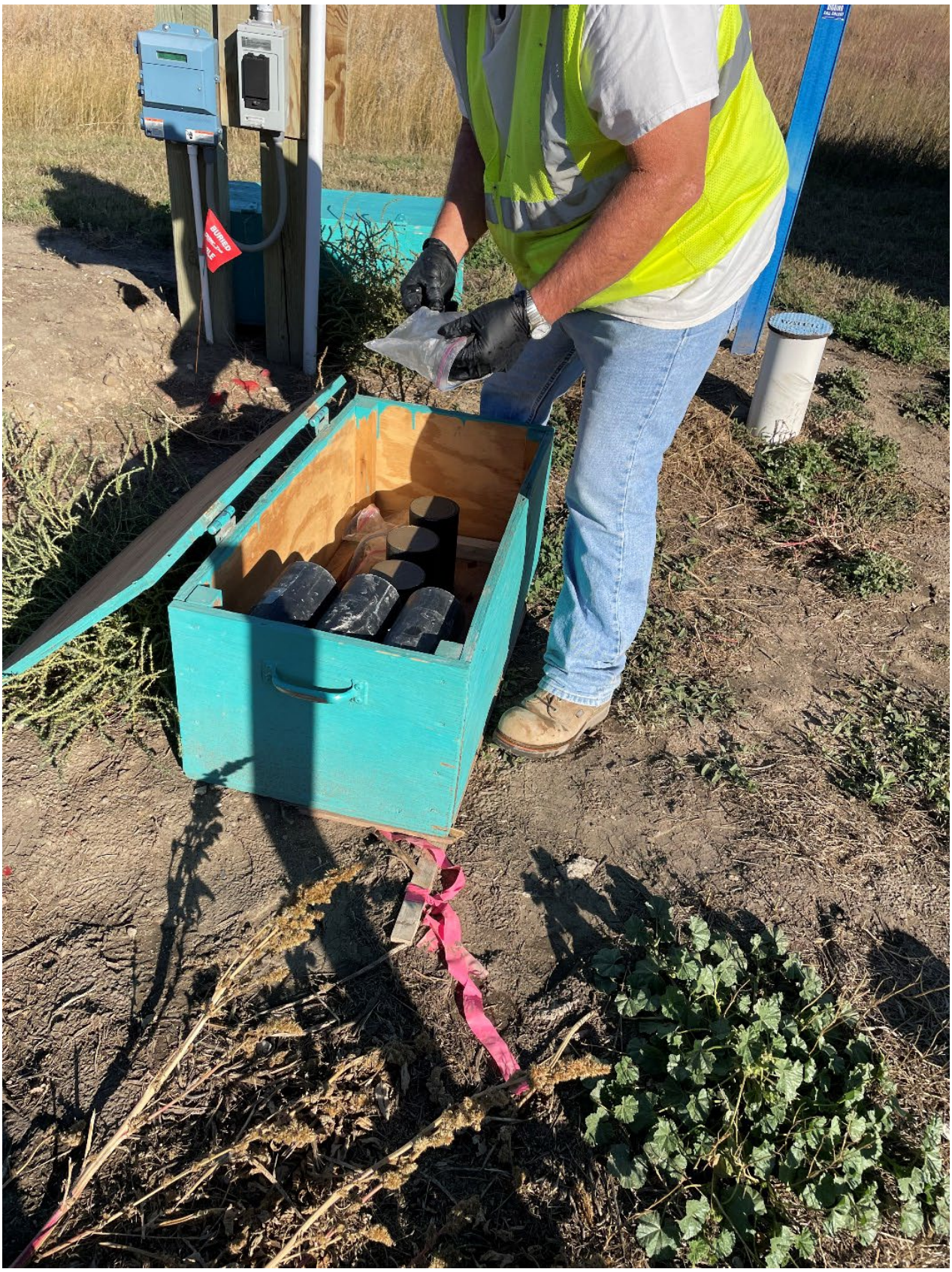

Figure 5*: The material tester is storing grout samples for field curing. Once cured, they will be tested for strength.*

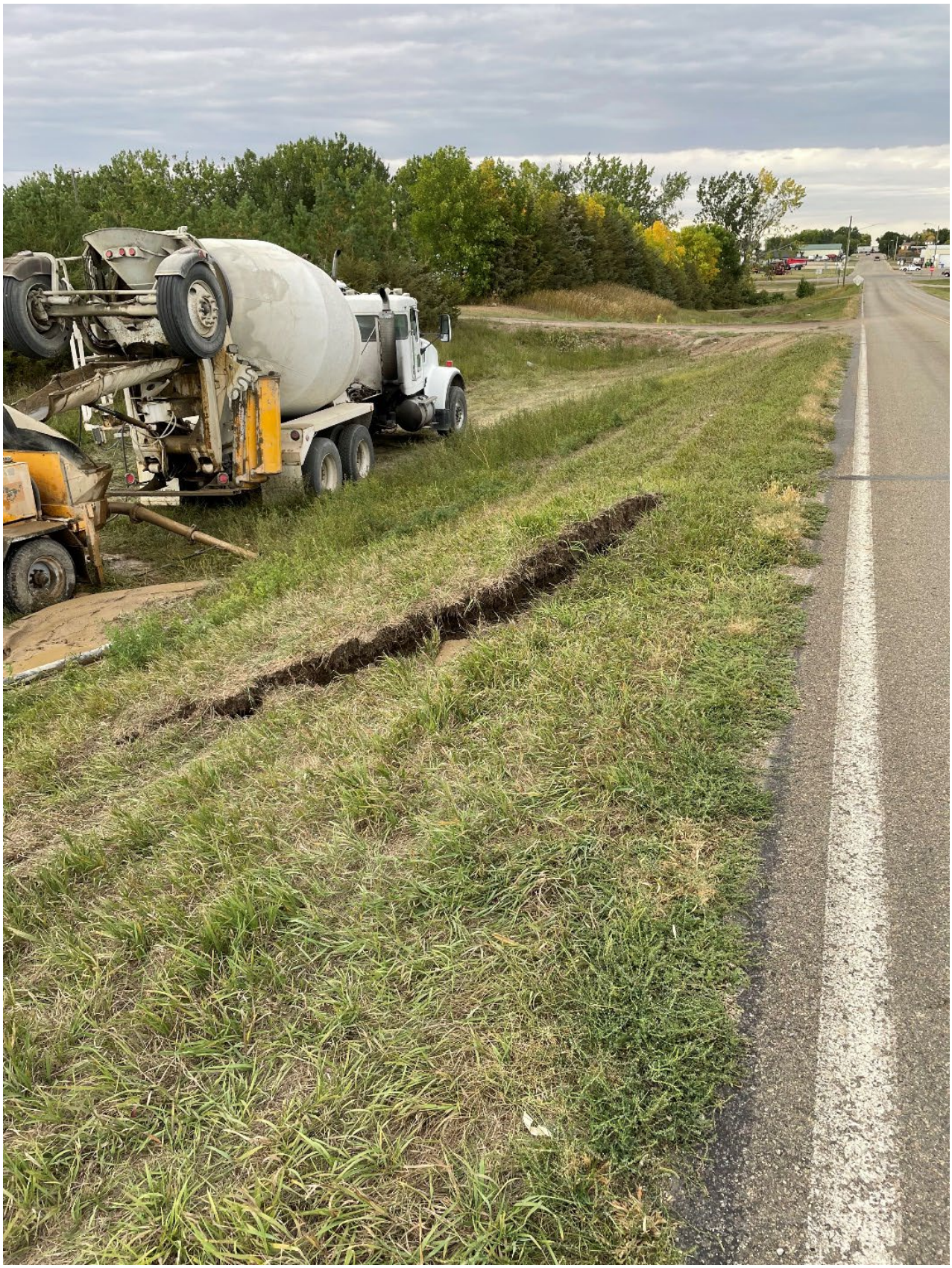

Figure 6*: Surface lifting often occurs when a mine void is filled with grout. The grout will find the path of least resistance.*

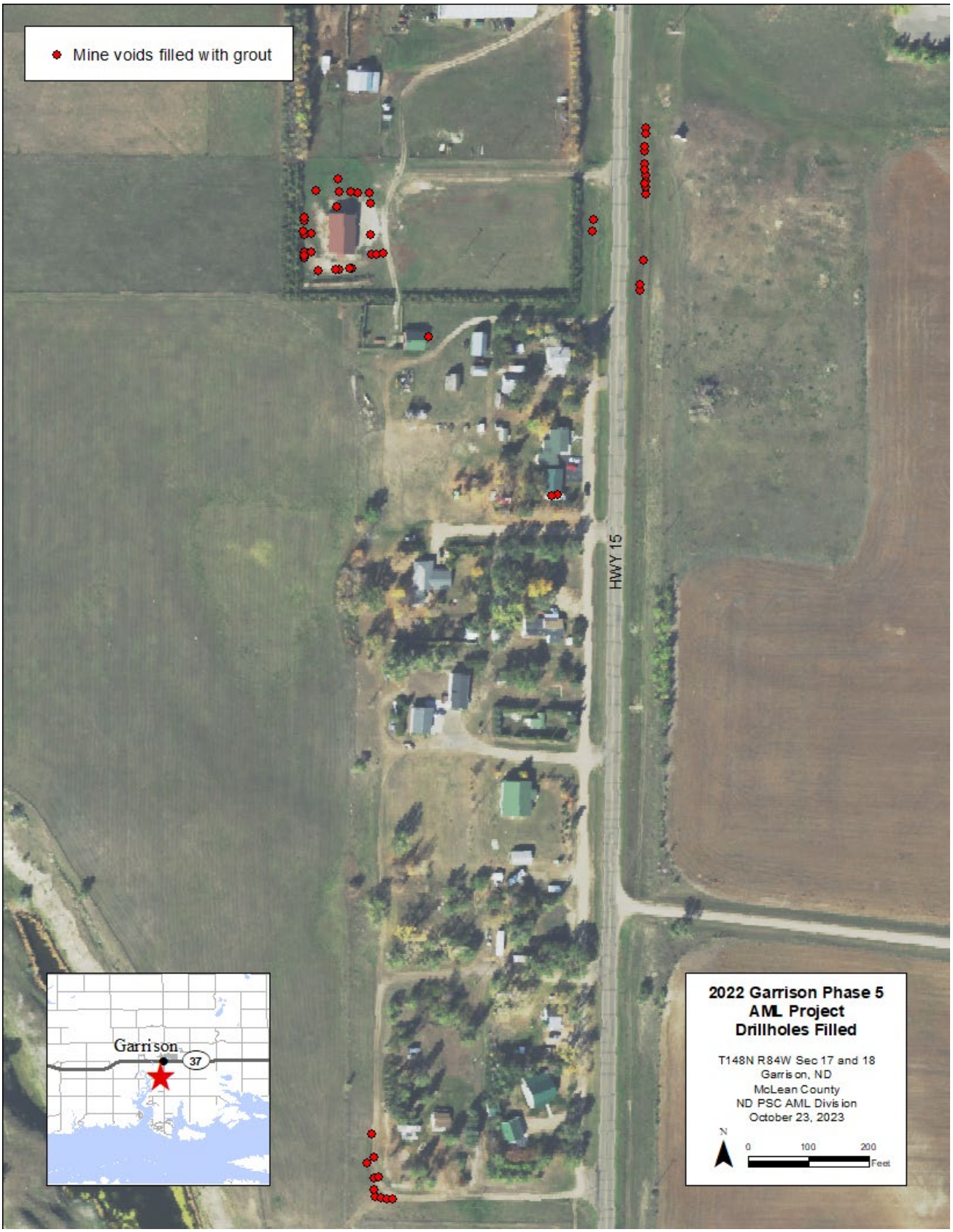

Figure 7: *Map showing the 2022 holes that were pumped with grout or filled by adjacent pumping.*

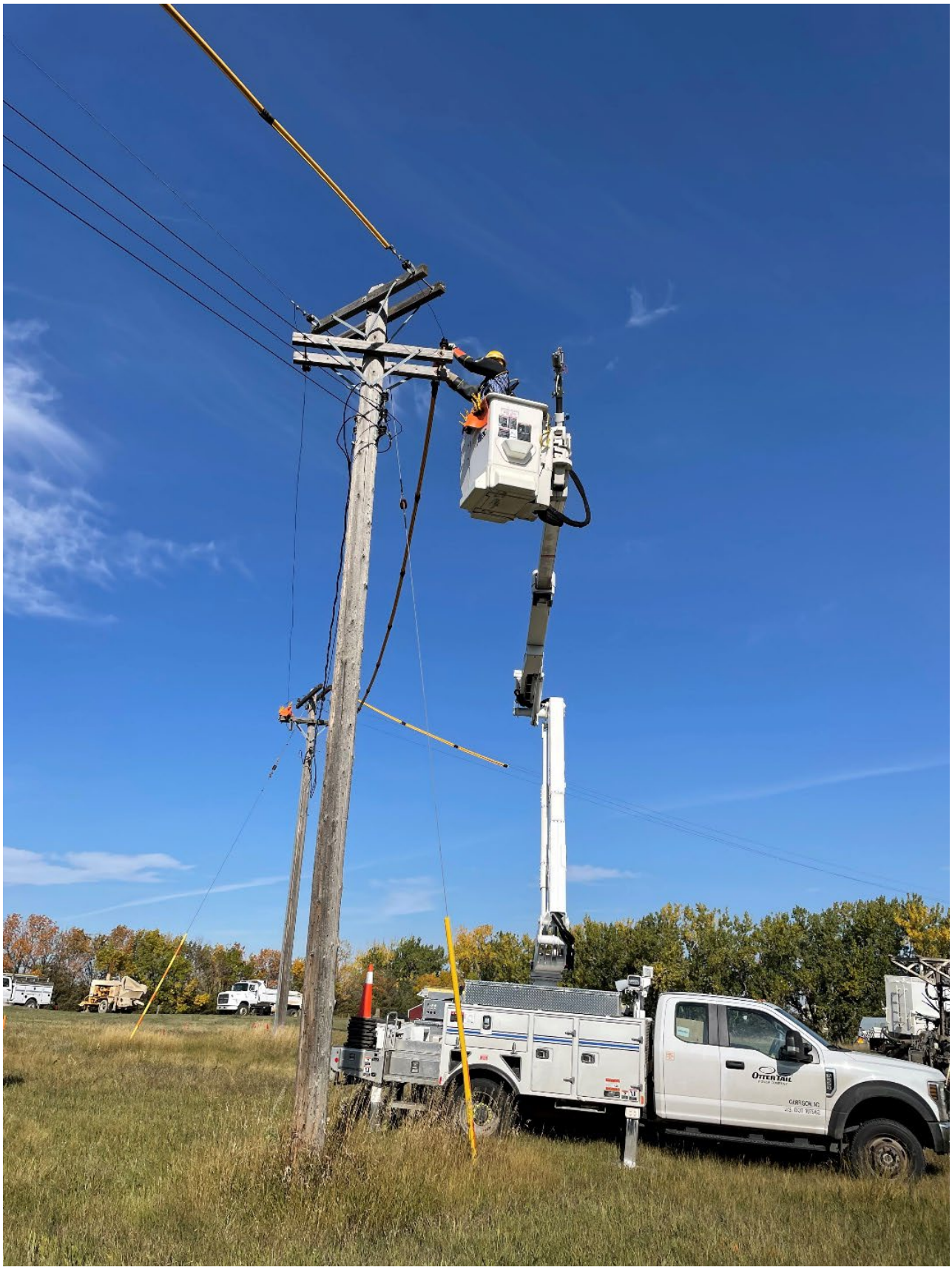

***Figure 8**: The power company covered the lines to allow safe drilling near these powerlines. Drilling confirmed these poles are undermined.*