

# Abandoned Underground Coal Mine Reclamation on The ND Prairie

Lignite coal mining played a vital role in North Dakota's history. Hundreds of coal mines operated between the late 1800s and 1940s. These mines were abandoned for cheaper alternative fuels or increased government involvement. Abandoned mines have caused public hazards including deep sinkholes, as underground mines collapsed, and steep highwalls at the final pits of surface mines.

The Halleck Underground Mine operated five miles north of Bowman, in southwestern North Dakota, from 1919 until 1944. Halleck provided coal to heat homes in the area. The top of the 30-40 foot thick coal seam is less than 50 feet below surface in mostly soft overburden. Several huge sinkholes have opened at this abandoned mine site.

Local authorities reported several large and dangerous sinkholes in January 2014 within 70 feet of two well-travelled roads and 90 feet of the TransCanada Bison Pipeline, a 30-inch interstate natural gas transmission pipeline. The sinkholes also severed a fiber optic telecommunication cable. The North Dakota AML Division conducted an emergency project to fill these dangerous sinkholes with more than 1200 cubic yards of waste concrete and dirt.

In consultation and meetings with the City of Bowman, Bowman County and TransCanada, the AML Division planned and conducted a 2015 drilling and grouting project to stabilize the roads and pipeline threatened by mine collapse. The Bison Pipeline was located above the entry tunnel of the Halleck Mine as it passed near the Farm to Market road. This increased the difficulty of the project. Safety was a prime concern when working around this high-pressure pipeline. TransCanada was active both in the planning and execution of this work.

Drilling near the pipeline revealed tightly packed rubble 16-24 feet below surface, which was the expected depth of the entry tunnel. This verified anecdotal reports that the entry tunnel was excavated when the Farm to Market Road was improved and paved. No drilling or grouting was conducted within the 50-foot pipeline easement. Grout injection within 75 feet of the pipeline was conducted carefully without pumping pressure and was monitored closely.

*2015 Google Earth image of the Halleck Mine site during the drilling and grouting project with mine map, drill holes and Bison pipeline overlays. The cluster of equipment in the center is an onsite batch operation. Blue dots represent void holes that were filled with grout. Toward the bottom center is where the pipeline, Farm to Market road and entry tunnel all merge.*

The Halleck mine entry passed directly under 81st Street (see map). We used a borehole camera to determine the tunnel was open but supporting timbers were failing. Grout was pumped into this tunnel through a hole drilled on the 81st Street until it "blew out" and broke through the ground surface in the south ditch. Using the borehole camera, we could also see the west ditch of 146th Avenue was significantly undermined with large open mine voids 60 feet or less below surface.

A total of 4500 cubic yards - about 500 truckloads - of cementitious grout were pumped into underground mine voids at the Bowman Site. We believe our goal of stabilizing these undermined public roads and areas near the Bison Pipeline were met. This successful project was a collaborative effort between the North Dakota AML Division and many interested shareholders.

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