North Dakota LEGENDARY
Public Service Commission

2015 AML PROJECT SUMMARY

March 2016

Scranton/Bowman Phase 3 & Wilton

Project Type

Drilling and pressurized remote backfilling with cementitious grout

Locations

Robert & Betty Verkaik Farmstead, Reeder
133rd Avenue SW, Scranton
Scranton Equity Exchange Bypass Road, Scranton
Intersection of 146th Ave & 81st Street, Bowman
41st Street at State Highway 36, Wilton

Contractors

B & C Concrete Pumping, Inc. of Williston (S & S Drilling, Williston-subcontractor)
Northeast Technical Services, Inc. of Virginia, MN (Material Testing)
Water Supply, Inc. of Mandan (Ground Water Monitoring)

Total Project Cost

$1,515,454

Contract AM 730-15
(Construction)
$1,457,398

Contract AM-731-15
(Material Testing)
$52,052

Contract AM-680-13
(Groundwater Monitoring)
$6,004

Reeder: Discharge of grout into grout pump.

Contents

2015 AML Project Statistics (Total of All Locations)	
Project Dates	June 15 — November 20
Project Length (consecutive days)	149
Total Work Days	101
Total Days of Pumping Grout	52
Holes Drilled	401
Holes Cased	92
Feet Drilled	24,291
Feet Cased	3,409
Grout Pumped (cubic yards)	7,940
Grout Pumped (cu. yd.) per Grout Day	153
Holes Pumped	47
Holes filled by Pumping Adjacent Holes	72
Average Grout Take (cu. yd.) per Hole pumped	169
Average Grout Take (cu. yd.) per Hole filled	74
Slump-Project Average (inches)	9.9
Project Costs	$1,515,454

The 2015 drilling and grouting AML project included five areas near Reeder, Scranton, Bowman and Wilton, ND. This photo was taken near Wilton. Grout is being pumped into a haul tunnel that is about 45 feet below the surface. The Bobcat hides the grout pump. The two stakes mark the locations of cased drill holes that are located on the road.

North Dakota Public Service Commission and Abandoned Mine Lands

North Dakota has records for about 1,800 abandoned coal mines which are mostly in the western half of the state. The Surface Mining Control and Reclamation Act of 1977 (SMCRA) set up a federal fund with fees collected on coal mined since that time for the reclamation of abandoned mine lands. In 1981 the North Dakota Legislature approved an Abandoned Mine Lands (AML) Program to be administered by the Public Service Commission (PSC) on behalf of the State of North Dakota.

ND PSC AML Mission

The AML Program is charged with eliminating existing and potential public hazards resulting from abandoned surface and underground coal mines. Thus the AML Program is a service (not regulatory) program aimed at protecting North Dakotans while reclaiming hazardous abandoned mines. The mines that are reclaimed are either on our inventory, found by exploratory drilling or we informed about it by a landowner or other member of the public. The PSC's selection of reclamation projects is also approved by federal officials. If necessary, reclamation can be conducted on an emergency basis.

Program Funding

Reclamation costs are covered through a federal tax on actively mined coal. The current rate for lignite coal is 8¢ per ton. The federal government, through the Office of Surface Mining Reclamation and Enforcement (OSMRE), reallocates the money to each state or tribe with an AML program. North Dakota's allocation is about $3 million per year. Federal fee collection is scheduled to end in 2021 unless reauthorized by the US Congress.

Drilling and Grouting

Reclamation by drilling and grouting involves drilling through the overburden into the coal to locate areas where the coal was removed. When these openings (voids) are found, a cement-like grout mixture is pumped into the void to replace the removed coal. The goal is to stabilize the mine and reduce to likelihood of the mine collapsing. This will reduce the chances of sinkholes forming at the surface.

Verkaik Farmstead Project area: The white pin flags mark the locations of holes drilled to locate the mine workings. With no mine map to use as a guide, drilling was the only way to find the mine. The contractor's batch plant is in the background. The two white pipes are hole casings that hit obstructions when inserted into the drill hole.

The Schwartz Mine at Reeder

The family of Gary and Linda Schwartz formerly owned a small personal mine on their farmstead. This property is less than one mile south of Reeder, ND and is currently owned by Robert and Betty Verkaik.

Only a small hand drawn map with no scale or reference points is known to exist of this mine. The mine was small, encompassing less than one acre, but is in the farm yard near two homes and other buildings. Exploratory drilling in 1997 and 2012 indicated void spaces in the mine workings and the potential for additional subsidence features at the surface. The PSC had previously reclaimed several mine related sinkholes. Two of the sinkholes have continued to subside. Several outbuildings are within a few feet of the mine. The mine presented a safety hazard to anyone driving or working in the farm yard, and it was eligible for reclamation.

Drilling and Grouting: Reeder

Although exploratory drilling projects in 1997 and 2015 located voids in the mine workings, additional drilling was needed to determine the extent of the mine.

Drilling began on June 28, 2015. An additional 121 holes were drilled and 36 of these were cased. The coal is about 30 feet below the surface. The thickness of coal mined was about six feet. The drilling not only intercepted the mine workings, but various types of garbage from rags to wire to household items. In the past, sinkholes were commonly used as garbage dumps.

Grout injection began on July 6 on the east side of the mine and worked toward the west. In several places the grout broke through the surface while being injected. In at least three places the ground surface was raised several inches. These occurrences show where the grout is flowing as it is being pumped. Much of the overburden in this area is a fine sand with very few rocks. Grout will find the path of least resistance when pumped into the mine. Sometimes that path leads to the surface. We can judge how well we have filled mine by these surface breaches.

A bore hole camera (see page 5) was also used to help estimate how much grout was needed and which holes to pump.

Verkaik farmstead: Project Inspector, Matt Keller (right) takes notes as the drilling crew prepares to add another pipe to the drill string.

Map of the work done at Reeder. The black dots represent holes that were drilled and hit solid coal. The blue dots show where either a void or rubble was encountered when drilling. These were pumped with grout. The pink dots represent either void or rubble holes that were filled when grout being pumped on a nearby hole flowed into it. This map includes holes that were drilled in 1997, 2012 and 2015. The coal in the mine was about 30 feet below the surface.

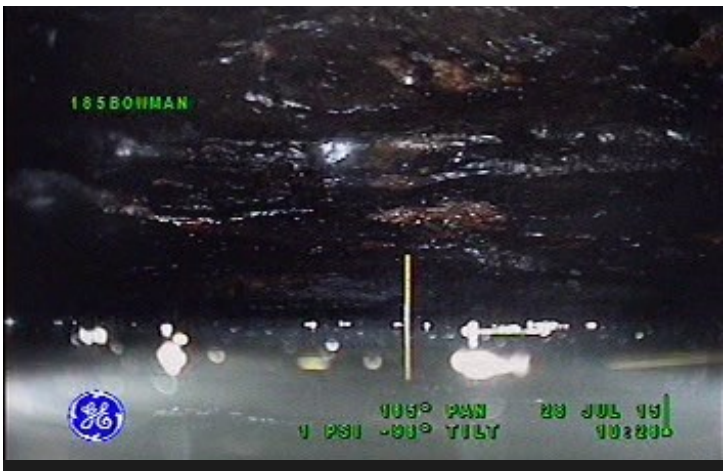
2015 Reeder AML Project Statistics	
Project Dates	June 25 — July 17
Project Length (consecutive days)	22
Total Work Days	15
Grout Pumping Days	9
Holes Drilled	121
Holes Cased	36
Feet Drilled	4844
Feet Cased	770
Grout Pumped (cubic yards)	954
Grout Pumped (cu. yd.) per Grout Day	119
Holes Pumped	18
Adjacent Holes filled by Pumping	36
Average Grout Take (cu. yd.) per Hole pumped	53
Average Grout Take (cu. yd.) per Hole filled	18
Slump-Project Average (inches)	11
Cost	$213,756.66

Verkaik Farmstead: Matt Keller (center) gets ready to put the borehole camera into a casing as Matt Fischer (left) and Preston Ripplinger (right) look on.

Borehole Camera

The AML Division's borehole camera proved an invaluable asset in 2015. The camera is designed to feed down the 3 inch diameter casing to the void. The camera head can be tilted and rotated giving a 360 degree view in nearly every direction. Below are two images captured with the camera.

Seeing the condition of the mine helps us to estimate how much grout will be needed. We look to see if it open or caved in, and if we see coal. If coal is not seen, it could mean the roof has collapsed leaving a hole above the coal– called void migration. Eventually this may become a sinkhole at the surface. In Reeder, we could see an open haul tunnel that we didn't find with drilling. In Bowman we could tell the rooms were very large—too large to fill completely, so we modified our grouting plan. Also at Bowman, we watched grout flow in a haul tunnel as the grout was being pumped over 100 feet away. This confirmed the grout was going where we wanted it.



Halleck Mine: The vertical line is a tape measure in a drill hole ten feet away. This room extends well beyond the tape. At the top is the coal roof. At the bottom the mine is partially filled with water.

Halleck Mine: Timbers are part of the haul tunnel leading to the rooms. On the right the tunnel has partially collapsed.

What is Grout?

Grout, concrete and mortar have similar components. Each contain cement, water and aggregate. The difference between grout and concrete or mortar is the water to cement ratio, in other words its flowability. Concrete is very stiff and not very flowable. It stays where is it put. Mortar is less stiff and grout is the most flowable.

Grout is a commonly used flowable fill in reclamation of abandoned underground coal mines. The North Dakota AML Division uses grout exclusively in its abandoned underground mine reclamation projects.

Our grout mix contains cement, water and flyash which has been determined to be a "beneficial use" of flyash by the ND Department of Health. Our mix also contains un-washed aggregate. We have found that this "dirty" sand adds to the flowability of the grout.

Flowability in grout is essential for our projects. The grout is pumped into the void spaces in the mine. These spaces can be very large or very small. In either case, the grout must be flowable enough to fill all the void spaces left when the coal was removed. Our formula is designed to mimic the strength of the coal it is replacing once the grout has hardened.

Mining in Scranton, ND

Scranton is one of those towns that just popped up on the North Dakota prairie in 1907. Who knows what the draw was. Cheap land? New opportunities? One thing was for certain. Newcomers found lignite coal was available and easily mined. Scranton, named after the famous coal mining town in Pennsylvania, became home to at least five surface and underground mining operations.

Newspaper advertisement from 1943 for Andy's Mine.

Andy's Mine

Originally named the Scranton Lignite Coal Company, Andy's Mine operated from about 1923 until 1946. It was a slope, double entry, room and pillar mine. The overburden is approximately 75 feet thick with the coal seam averaging 17 feet thick. Only about nine feet of the seam was removed. Andy's mine provided about 3,000 to 5,000 tons coal per year for local use with eight employees. The largest outputs topped 7,500 tons per year in 1937, 1943 and 1944. Andy's Mine is straddled by 133rd Avenue near the Seifert home south of Scranton.

Scranton Equity Exchange Bypass Road

The Scranton Equity Exchange bypass road lies directly over the abandoned Scranton Coal Mine. According to an article in the Scranton Register on May 10, 1917, Mr. Charles (Chet) Johnson started a coal briquetting plant in 1917 using coal from the upper seam which was thought to be 23-28 feet thick with a 16 foot overburden. This was easy to strip mine with a steam shovel. Mr. Johnson noted that this seam was separated from the lower 19-foot lignite coal seam by nearly 6 feet of brick quality clay. It is not known how long the briquetting plant operated, but it seems to have burned down at some point.

The strip mine portion of the Scranton Coal Mine ran parallel to Highway 67. The rest of the mine was an underground room and pillar mining operation with a slope entry. An average of 14,500 tons of coal were produced annually with the majority being shipped out of the local area. The mine employed an average of 21 people. The Scranton Coal Mine operated from the 1910s to about 1936.

In an early 1980s AML project, a small portion of the underground mine was completely dug up (daylighted) and reclaimed while the remainder was surface graded. This area is still susceptible to collapsing mine workings which may migrate to the surface and form sinkholes.

Scranton circa 1980. The pock marked surface of sinkholes shows the location of the abandoned Scranton Lignite Mine. Highway 67 runs diagonally across the picture. The surface portion of the mine is visible near the highway.

Drilling & Grouting: Scranton

The majority of the work on the Scranton Coal Mine and Scranton Lignite Coal Mine was done in the two previous phases in 2013 and 2014. Grout work on the Scranton Equity Exchange bypass road was completed in 2014. In 2015 confirmation bore holes drilled on the road confirmed that grout did fill voids under the road.

Four bore holes in the same void in the east ditch of 133rd Avenue was all that remained at the end of 2014. The void above the mined coal indicating that the mine had collapsed. Eventually the void would reach the surface as a sinkhole. In 2014 about 45 cubic yards were pumped into this void. Another 86 were added in 2015 to completely fill the void. The 2015 project completed the work at both Scranton mines.

2015 Scranton AML Project Statistics	
Project Dates	July 10-13
Total Work Days	2
Grout Pumping Days	1
Holes Drilled	5
Feet Drilled	199
Grout Pumped (cu.yd.)	86
Holes Pumped	1
Adjacent Holes filled by Pumping	3
Average Grout Take (cu. yd.) per Hole pumped	86
Average Grout Take (cu. yd.) per Hole filled	23
Average Slump-Project Average (inches)	11.25
Cost	$16,411.38

South of Scranton circa 1980. The pock marked surface of sinkholes shows the location of the abandoned Andy's Mine. US Highway 12 runs diagonally at the bottom of the picture. The current 133rd Avenue runs behind the tree row.

Andy's Mine Confirmation drilling: Solid coal was encountered on this confirmation drill hole.

Can we see into the mine?

Many people are curious about how we know what the underground mine looks like. We have a couple of tools that we use to help us design a project. The most important pieces of information are the mine maps. Early in the twentieth century North Dakota required a surveyed map of each commercial mine. Although these maps are not 100 percent accurate, they often contain information that would otherwise be lost to us.

Using the mine maps to guide us, we then use drilling to try to find the mine workings. Open spaces where the coal was removed are called voids. Sometimes we do not find open voids, but loose, rubbly material is encountered. This usually indicates that the roof has collapsed in that part of the mine. Potentially this collapse will become visible at the surface as a sinkhole. Drilling helps confirm the accuracy of the mine maps.

We also have a bore hole camera that can be lowered into the void. With the right conditions, we are able to see a small part of the mine. The camera was instrumental in 2015 for estimating the amount of grout needed in Reeder & Bowman.

Gravity back filling drill holes with grout in the ditch of the Farm to Market road.

Bowman: Halleck Mine & Bison Pipeline

Halleck Mine

The Halleck Mine was in operation from sometime before 1919 until 1944. The underground slope mine produce coal from a 30 to 40-foot thick coal seam almost exclusively for local trade. The Halleck Mine had an average production of about 2,400 tons annually with a high of 4,600 tons in 1932 and a low of 560 tons in 1919. It consistently employed 6-7 people.

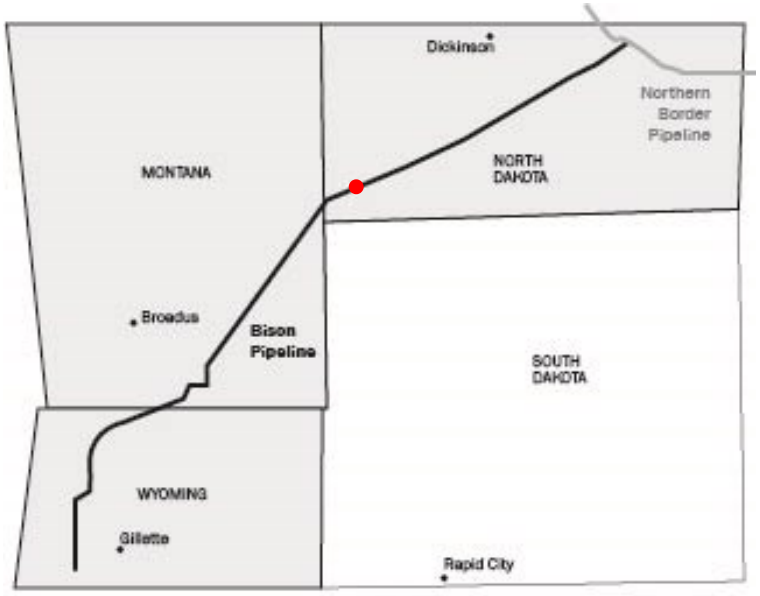
Bison Pipeline

In 2010, TransCanada built a 30-inch diameter high pressure natural gas transmission pipeline between Gillette, WY and Morton County, ND. The Bison pipeline spans 302 miles, crossing from Wyoming to southeastern Montana and into southwestern North Dakota. It connects to the Northern Border pipeline outside of Mandan, ND. It was designed for an operational capacity of 407 MMCF/d and a maximum allowable operating pressure of 1,440M psig.

Original pipeline plans had the pipeline intersecting the Halleck mine workings. These plans were revised so that the pipeline went south of the mine workings, but it still crossed the mine entry tunnel.

Subsidence

Subsidence of the Halleck Mine is evident at the surface. The latest event occurred In February of 2014 when three very large holes opened near the intersection of 81st Street and 146th Avenue. It severed a fiber optic cable and was within 90 feet of the Bison pipeline. The hole took nearly 1,200 yards (or about 150 truck loads) of fill material.



Above: Map showing the location of the Bison Natural Gas Pipeline. The red dot is the approximate location of the Halleck Mine.
Left: Pipeline warning sign located just to the east of the Halleck Mine.

Drilling & Grouting: Bowman

Reclamation of the Halleck mine was a bit tricky near the Bison Pipeline. The Bison pipeline intercepted the mine entry tunnel at the curve of the Farm to Market road (see map on page 11). The problem was how to reclaim that portion of the mine without affecting traffic or the pipeline. Safety was a primary concern when working around this high pressure gas line. The plan was to stay out of the pipeline easement unless we encountered voids that indicated additional drilling was necessary closer to the pipeline. Drilling and grouting inside the easement would require extensive safety measures. A TransCanada representative was on site when the holes nearest (but still outside) the easement were drilled.

Good News

Drilling near the Bison pipeline encountered tightly packed rubble between 16 and 24 feet which was the expected depth of the entry tunnel. This verified the anecdotal evidence that the entry tunnel was collapsed when the this portion of the Farm to Market road was paved. This indeed was good news. No additional drilling or grouting would be required within the pipeline easement. Still, with safety in mind, the holes closest to the easement were gravity back-filled (lower right photo) rather than pumped under pressure.

The Rest of the Mine

A portion of the entry haul tunnel passed under 81st Street. With the borehole camera, we could see the void was open, but the supporting timbers were beginning to fail (see lower right photo on page 5). This tunnel was filled until grout was forced to break the surface in the opposite ditch. Drilling and grouting continued in the ditch of 146th Avenue north of 81st Street. Here the voids were very large and open. Often the rooms were 15-20 feet high and 30 feet wide. The rooms extended 100 feet or more to the west according to the mine map. Our goal was to protect the road right of way. Therefore it was not necessary nor cost effective to completely fill these large open rooms with

Continued on page 10.

Gravity back filling drill holes with grout in the ditch of the Farm to Market road.

Filling Up the Mine

We pump grout into the mine workings to prevent the mine from collapsing and forming sinkholes at the surface. But how do we know when the mine is full? Well, we don't know really. We do use different indicators that tell us we have done the best job possible.

The top and lower left pictures show grout on the ground. Look closely at the photos. The pumping equipment is in the back ground. While pumping on a hole, the grout found the path of least resistance which led to the surface and what we term as a "blowout".

At times, there is a point at which the pump can no longer push grout into the hole. The hole "refuses" to take any more grout. After grouting, we drill more holes looking to see where the grout flowed. Then we take a core sample (lower right picture). We call this confirmation drilling. Together, blowouts, refusals and cores are used determine if have done our best. That said, we cannot guarantee that sinkholes won't form over the reclaimed mine in the future.

2015 Bowman AML Project Statistics

Project Dates	July 8-September 10
Project Length (consecutive days)	64
Total Work Days	38
Total Days of Pumping Grout	27
Holes Drilled	133
Holes Cased	31
Feet Drilled	8118
Feet Cased	1166
Grout Pumped (cubic yards)	4500
Grout Pumped (cubic yards) per Grout Day	167
Holes Pumped	24
Holes filled by Pumping Adjacent Holes	14
Holes filled by gravity backfill	12
Average Grout Take (cubic yards) per Hole pumped	196
Average Grout Take (cubic yards) per Hole filled	92
Remaining holes to be pumped	0
Slump-Project Average (inches)	9.4
Cost	$807,810.47

Continued from page 9.

grout. With two rows of drill holes (see map on page 11), the ones farthest from the road were pumped with a stiff grout to create walls as barriers to more flowable grout pumped into the holes closest to the road. Flowable grout was pumped to fill the void space between the road and the barrier wall. In total, 4,500 cubic yards (about 500 trucks) of grout were pumped on the project. While we are confident we have done our best to protect the roads, sinkholes may still form at the surface in the field above the mine. Caution is always advised around abandoned coal mines.

Map of the work done on the Halleck Mine near Bowman. The black dots represent holes that were drilled and only hit coal. The blue dots show where either a void or rubble was encountered when drilling. These were pumped with grout. The pink dots represent either void or rubble holes that were filled when grout being pumped on a nearby hole flowed into it. This map includes holes that were drilled in 2012 and 2015. As much as 20 feet of coal was mined out of the 30 to 40-foot coal seam.

THE WEATHER Generally Fair. **THE BISMARCK TRIBUNE** LAST EDITION

THIRTY-NINTH YEAR, BISMARCK, NORTH DAKOTA THURSDAY, NOVEMBER 13, 1919 PRICE FIVE CENTS

WASHBURN LIGNITE CO. GIVES UP PROPERTY UNDER PROTEST; CLAIMS FRAZIER'S ACTION TO BE UNLAWFUL

NORTH DAKOTA IS NOT MINING COAL TODAY; WILTON MINERS BALK WHEN ASKED TO WALK MILES TO THE MINES

THE WEATHER Generally Fair. **THE BISMARCK TRIBUNE** LAST EDITION

THIRTY-NINTH YEAR, BISMARCK, NORTH DAKOTA MONDAY, NOV. 17, 1919 PRICE FIVE CENTS

FRAZIER'S CONFISCATION OF STATE MINES ATTACKED

COURT ORDERS STATE TO SHOW WHY IT SHOULD RETAIN WASHBURN CO.'S COAL MINING PROPERTY AT WILTON

General Fraser and Captain Baird Commanded to Appear Before Judge Nuessle on Wednesday to Defend Seizure of Private Property Under Governor's Proclamation Held to Be Unlawful, Unconstitutional and Void—Washburn Makes Statement

NOTICE

TELEPHONE 270 FOR

COAL

Wilton Lignite Coal mined by the State of North Dakota

Phone 270

Consumers Co.
216 North Eighth St.
Baled Hay Ice Stove Wood

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Coal has been in integral part of North Dakota's history from the beginning. In the fall of 1919 a nationwide coal miner's strike had a big effect on coal mining in the state. Fearing a lack of coal for the up coming winter, Governor Fraisier declared martial law on November 12 and seized North Dakota's commercial coal mines. People needed coal to heat their homes. The seizure was immediately challenged and short lived as evidenced by the Bismarck Tribune Ads to the left. The left is from November 21 and right is December 2, 1919. The only difference? The "by" has been exchanged for "in". District Court Judge Nuessle quickly issued an order and the Wilton mine was returned to its original owner by December 4, 1919. The strike ended and North Dakotans once again had access to the famous Wilton lignite that produced no chinks or soot. Presumably a Wilton Lignite Coal funded UND study concluded that Wilton lignite coal did not produce chinks or soot. So why not advertise those properties.

Material Testing

Material testing is an important part of our drilling and grouting projects. The grout must meet certain flowability and strength requirements. The material testing firm is on site during grouting and collects samples to test every 7-9 truck loads.

Flowability is measured by a slump test. The higher the slump the more flowable the mixture. When we want the grout to flow a long distance or into the rubble of a collapsed portion, we us a high slump between 10 - 11 inches. If we have an open void or don't want the grout to travel as far we use a lower slump grout between 6 and 8 inches. Just for comparison, most poured cement has a 1-3 inch slump-very stiff.

Material testers also test the yield and temperature and cast grout cylinders which are broken by a special machine that measures the hardness or strength of the grout. Our goal is for the grout to be at least as strong as the coal it is replacing.

Other responsibilities of the material tester include inspecting the grout raw materials and the batch operation.

Material Tester Sasha Johnson performing a slump test.

Mining coal at the Wilton Mine circa 1915. Courtesy of the NDSHS digital archives.

Wilton: Once Home of The World's Largest Lignite Coal Mine

Today, Wilton is a small bedroom community just 22 miles north of Bismarck, North Dakota with population of around 900. One hundred years ago, the story was much different. Wilton was home to the Washburn Lignite Coal Company's Wilton Mine No. 2, the largest lignite coal mine in the world at that time. The mine employed over 400 workers and produced more than 1,500 tons of coal per day. Wilton boasted a population of well over 1000 and a thriving business district. The mine was electrified early on and homeowners in Wilton benefited with early electrification. By 1920 Wilton No. 2 coal mine accounted for nearly one-third of the State's commercial coal output. Coal from the Wilton mines heated the State Capitol for many years.

General William D. Washburn had a vision for the lignite coal when he purchased 114,000 acres from the Northern Pacific Railroad in 1898. Step one: plat a city (Wilton). Step two: build a railroad from Bismarck to Wilton. Step three: begin mining. The Wilton Coal Mine No. 1 (T142N, R80W, Section 1) was in operation from 1900-1915. After nearly 16 years of heavy output the mine closed and the Wilton Coal Mine No. 2 (T142N, R79W, Sections 5, 6 and 8), also owned by the Washburn Lignite Coal Company, began operation.

In 1928 the Washburn Lignite Coal Company was sold to Otter Tail Power Company. Two years later the coal lands were leased to Truax-Traer Coal Company. Truax-Traer converted the mine from an underground mine to a surface mine. The mine ceased operation in 1946, likely as a result of more competitive fuels.

The Wilton Coal Mine No. 2 was an underground, slope, room and pillar mine that was typical in North Dakota at that time. The mine produced more than 200,000 tons per year with mining operations active for less than six months per year. Production remained consistent until mining ended in 1946.

2015 Wilton AML Project Statistics	
Project Dates	October 6— November 20
Project Length (consecutive days)	45
Total Work Days	21
Total Days of Pumping Grout	15
Holes Drilled	142
Holes Cased	25
Feet Drilled	11,130
Feet Cased	1,473
Grout Pumped (cubic yards)	2400
Grout Pumped (cubic yards) per Grout Day	160
Holes Pumped	5
Holes filled by Pumping Adjacent Holes	7
Average Grout Take (cubic yards) per Hole pumped	480
Average Grout Take (cubic yards) per Hole filled	200
Remaining holes to be pumped at Wilton	120
Slump-Project Average (inches)	10.4
Cost	$453,382.63

Glossary of Terms

Backfill— Material used to fill an opening or depression. Material placed in the mine void to support the mine roof.

Casing—A tubular structure installed in a drill hole to prevent the wall of the hole from caving and to provide a conduit for grout.

Core—A cylindrical sample taken from a formation for analysis. Usually a core barrel is substituted for the drilling bit and it procures a sample as it penetrates the formation.

Cribbing— Timbers laid at right angles to each other, sometimes filled with earth, as a roof support or as a support for machinery.

Drift mine— An underground coal mine that enters a coal seam horizontally usually from a coal outcrop.

Haul Tunnel— Any underground entry or passageway designed for transport of coal, other material, personnel, or equipment.

Highwall— The unexcavated face of exposed overburden and coal in a surface mine.

Mine Workings— The entire system of openings in a mine.

Overburden— Layers of soil and rock covering a coal seam.

Pillar—The part of coal left between individual rooms and entries to support the overlying strata.

Rob— To mine or remove coal pillars left for support.

Roof —The stratum of rock or other material above a coal seam; the overhead surface of a coal working place.

Roof Fall— a coal mine cave-in.

Room and Pillar Mining— A method of underground mining in which a portion of the coal is left in place to support the roof of the active mining area. Large "pillars" are left while "rooms" of coal are extracted.

Rubble— Debris encountered when drilling into mine workings that may indicate mine collapse or roof fall.

Seam— A stratum or bed of coal.

Shaft— a vertical opening from the mine to the surface that may be used for ventilation, drainage or transportation.

Slope— An inclined connection to the surface from underground workings used for transportation, drainage and ventilation.

Slump—In material testing it is a measure of flowability of concrete or grout on a scale from 0-12. The higher the number the more liquid or flowable the mixture.

Void— A general term for openings in rock. In mine reclamation-the open space remaining after coal was removed by underground mining.

Pumping grout along 41st Street north of Highway 36 near Wilton, ND.

Drilling and Grouting: Wilton

Despite previous reclamation work done at Wilton in the 1980s and 1990s, sinkholes continue to appear in the road ditch of North Dakota State Highway 36 and near 41st Street. The mine maps indicate that the pillars were “robbed” in certain areas. This means that the pillars that held up the roof of the mined rooms were either partially or fully removed as the miners retreated from the room. Without adequate support, the mine roof may collapse. This collapse can lead to sinkholes at the surface.

Approximately 35 cased holes remained from a previous project. In the fall of 2014 and spring of 2015, an exploratory drilling project located and cased another 71 void or rubble holes. With this many voids, a full scale drilling and grouting project was needed.

Grouting began on 41st street with the hopes of completing the work necessary on this road by the end of the 2015 project. Unlike Reeder and Bowman, this mine is inundated with water thus limiting the usefulness of the borehole camera. The exploratory drilling project had located at least four haul tunnels connecting the mine between Sections 5 and 6 on 41st Street. Depth of the mined coal along this road ranged from 35-96 feet below the surface depending upon surface topography. The coal seam averaged 10 feet thick. The two northern most haul tunnels took over 1,100 cubic yards of grout before refusal. Another nearly 1,300 cubic yards of grout was pumped into two haul tunnels located nearer Highway 36. Three holes on this road remain to be grouted.

Drilling started in the northeast ditch of the intersection of Highway 36 and 41st Street. Drilling moved east in both the north and south ditch of Highway 36. Another 25 holes were cased, 142 holes encountered solid coal and over 11,000 feet were drilled. A second phase of the project is scheduled for 2016.

Map of the work done on the Wilton No. 2 Mine near Wilton. The black dots represent holes that were drilled and hit solid coal. The red dots are holes that intercepted mine voids and have not been filled. The blue dots are void or rubble holes that have been filled with grout. The pink dots represent either void or rubble holes that were filled when grout being pumped on a nearby hole flowed into it. This map includes holes that were drilled in 2014 and 2015. The pock marks in the center of the map are sinkholes caused by the collapse of the mine workings.

PLACE
STAMP
HERE

North Dakota Public Service Commission
Abandoned Mine Lands Division
600 East Boulevard Avenue, Department 408
Bismarck, ND 58505-0480

When a Hole Is Not Just a Hole

Underground coal mining was common in Western North Dakota in the early part of the twentieth century. After WWII many mines converted to surface mines or ceased operation becoming abandoned.

The legacy that abandoned underground mines leave behind is the potential for sinkhole formation at the surface. If you live or work near an abandoned underground coal mine, please use caution. Sinkholes can open unexpectedly.

This happened in this photo in 2013. A sinkhole opened as a small excavator drove across the surface. The operator emerged unscathed. The excavator wasn't so lucky.

Contact Us

To report a sinkhole or request more information about our program

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