Lignite Mining and Reclamation Process

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Presentation Overview

- History of Regulation
- The Process of Mining and Reclamation
- Harmony Lake
Which of the following are not currently active lignite coal mines in North Dakota?

1) The Center Mine
2) The Gascoyne Mine
3) The Freedom Mine
4) Indian Head Mine
5) The Falkirk Mine
6) Both 1 and 5
7) Both 2 and 4
8) Both 1 and 4
• Which of the following are not currently active lignite coal mines in North Dakota?

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4) Indian Head Mine
5) The Falkirk Mine
6) Both 1 and 5
7) **Both 2 and 4**
8) Both 1 and 4
Increased surface mining in the early 1900s led to passage of the first reclamation laws in the 1930s in the East.
Some 14,000 acres of abandoned mined lands, or “orphan spoils”, still exist in North Dakota. Much of this land is managed by the Game & Fish Department for wildlife habitat and hunting.
Regulatory Developments

- 1969 - North Dakota Strip Mined Lands Act
- 1971 - Grade spoils to accommodate farm machinery
- 1973 - Save and replace topsoil
- 1975 - Mined lands must be returned to 100% of pre-mine productivity
Look closely and you can read the history of North Dakota reclamation in the landscape.
1977 Passage of the Federal Surface Mining Control and Reclamation Act (SMCRA)

US DEPARTMENT OF INTERIOR

Office of Surface Mining

other bureaus, offices

NORTH DAKOTA PUBLIC SERVICE COMMISSION

other divisions

oversight

Reclamation Division

(REGULATES NORTH DAKOTA SURFACE COAL MINING)

(if PSC fails)
HOW DO YOU DETERMINE WHERE TO ESTABLISH A COAL MINE?
Criteria For Economically Recoverable Coal

- A minimum of 10 feet cumulative thickness in not more than two beds (no bed less than 2.5 feet thick)
- More than 25 feet beneath the surface
- Not more than 175 feet beneath the surface
- A stripping ratio of not more than 10:1 (i.e., not more than 10 feet of overburden per every foot of coal)
Coal Seams and Overburden

- Overburden
  - A-1 Seam: 30 feet thick
  - A-2 Seam: 10 feet thick
  - B Seam: 4 feet thick
- Interburden
- Parting
- 30 feet thick
Economic to Mine

- A -1 Seam
- A -2 Seam
- B Seam
- Interburden
- Parting

- Overburden: 150 feet thick
- 100 feet thick
- 10 feet thick
- 4 feet thick
- 18 feet thick
- 100 feet thick
- 150 feet thick
Not Economic to Mine

Overburden

A-1 Seam

A-2 Seam

Interburden

B Seam

Parting

18 feet thick

150 feet thick

200 feet thick

10 feet thick

4 feet thick

18 feet thick

200 feet thick
Mining methods

Underground Mining Methods
- Drift mine
- Slope mine
- Shaft mine
- coal beds
- rock spoil

Surface Mining Methods
- Dragline removing mountain top
- Dozer along contour bench
- Auger or thin-seam miner along contour bench
- Dragline in area mine
- coal beds
- rock spoil
The Process of Mining and Reclamation

1. Obtain mining rights and regulatory approvals
2. Establish water management
3. Remove topsoil and subsoil
4. Move overburden and remove coal
5. Grade spoils to approximate original contour
6. Spread subsoil and topsoil and seed with grasses or crops
7. Obtain bond release
Step 1. Obtain Mining Rights and Regulatory Approvals
Secure Leases or Ownership...
Geological drilling is done to characterize the extent and quality of coal and the type and amount of overburden that must be moved.

An exploration permit must be obtained. Drill hole sites are reclaimed immediately after completion.
Pre-mine soils, vegetation, land use and wildlife surveys are conducted.
Surface water and ground water quantity and quality are assessed. This includes stockponds, wetlands, springs and water wells.
Cultural resource surveys identify important archaeological and historical sites that must be studied further or mitigated prior to mining, or avoided completely.
All this information, plus proposed mining and reclamation plans, is compiled into a mining permit application...

...and submitted to the Public Service Commission for their review and approval.
Required warning signs are placed on the permit area perimeter immediately after permit approval.
The first earthwork activity is to build sediment ponds downstream from areas to be mined.
Water running into sediment ponds is allowed to settle until it meets EPA effluent standards, consisting of total suspended solids, pH and iron.
When water is clean enough to meet these standards it can be discharged off the mine and down its normal drainage.
The size and shape of a sediment pond depends on the size of its contributing watershed and the topography of the pond site.
Some ponds have a valve for discharging and some must be pumped...

...regardless of the discharge method, all water leaving the mine is sampled for compliance.
Sediment ponds must be cleaned out occasionally.
Step 3. Remove Topsoil and Subsoil
Soil is hauled with tractor-scrapers, shovels, backhoes or loaders into haul trucks.
Soil monuments are staked islands of topsoil and subsoil left after stripping, to tell how much soil has been removed.
Soil is either directly spread on reclaimed land behind the active pit...

...or stockpiled for later respread on reclaimed land. All soil stockpiles are numbered and identified by owner.
All operations are inspected regularly by the Public Service Commission.

Some areas require PSC approval after all soil has been removed.
Step 4. Move Overburden and Remove Coal
All mines in North Dakota use electric powered draglines as their primary overburden removal machine.
Supplemental earthmoving machinery includes large electric loading shovels, hydraulic excavators and front end loaders, combined with large haul trucks.

These have advantages in flexibility. Spoil can be placed exactly where desired, reducing final reclamation grading costs.
After the coal is exposed it is cleaned and ripped or blasted to prepare it for loading...
Coal is then loaded out of the pit using electric loading shovels or front end loaders.
Coal is hauled to the truck dump, or tipple, where it is crushed and delivered to the customer.
How many years after coal removal does the law require land to be graded and seeded?

1) 1
2) 3
3) 5

33.3% for each option.
How many years after coal removal does the law require land to be graded and seeded?

1) 1
2) 3
3) 5
Step 5. Grade Spoils
Spoils are normally graded toward the active pit.
Spoils must be graded to the “approximate original contour” of the land prior to mining. Graded spoils must be approved by the PSC before soil can be spread over them.
Step 6. Spread Subsoil and Topsoil and Seed With Grasses and Crops
Soil may be hauled by tractor-scrapers or trucks. Soil dumped by trucks is spread with bulldozers. Soil depth stakes are set or a GPS system is used to control soil depths.
Topsoil is tilled and a seedbed is prepared. Rocks are picked off reclaimed land prior to seeding.
Native grasses are seeded on areas reclaimed to prairie...
...and local farmers plant and harvest crops on reclaimed cropland. In North Dakota mining companies do not farm reclaimed croplands.
Some reclaimed lands are seeded to a hay crop of alfalfa and grasses.
- How many acres have North Dakota coal mines released from bond?

1) Over 5,000
2) Over 12,000
3) Over 20,000

33.3% 33.3% 33.3%
• How many acres have North Dakota coal mines released from bond?

1) Over 5,000
2) Over 12,000
3) Over 20,000 – 21,877
Step 7. Achieve Bond Release

Once the land is being utilized for its approved post mine land use, it is managed to achieve bond release. According to law, the land must be monitored for at least ten years after it has been seeded before bond release can be obtained.
Surface water and ground water are monitored closely.

Wildlife is also monitored closely. Wildlife habitat removed during mining must be replaced, and the number of wildlife on reclaimed land must compare to adjacent, undisturbed areas.
Local farmers seed crops on reclaimed land with the goal to exceed pre-mine production.

Native grassland is managed to obtain production, cover, and diversity necessary to restore North Dakota prairie.
The ultimate goal is to make the land just as or more productive than it was pre-mining.

Final bond release can then be granted by the Public Service Commission, and the land can be removed from the permit and sold or traded.
Freedom Mine
Freedom Mine

Freedom Mine
Harmony Lake

- A unique reclamation opportunity is presented at the Freedom Mine
The project was developed at The Coteau Properties Company Freedom Mine near Beulah, North Dakota.
Pre-Mining Conditions in 1991

direction of Coteau's mining

cotoneau spoils
abandoned final highwall & pit

coa to be mined

direction of historic mining

orphan spoils
Double Final Pit Created

newly cast spoils  final pit from Coteau’s mining  final pit from historic mining  orphan spoils
Standard Reclamation as Required by Regulations

ccoal has been removed; spoil hauled back in to tie to abandoned orphan spoils

topography graded to “approximate original contour”
Alternative Reclamation: Development of Harmony Lake

spoil not hauled in to fill double final pit; lake and surrounding landscape shaped to a wildlife management area, under a recreation land use
Submerged and exposed rock islands, a convoluted shoreline with steep banks, and earthen fishing piers enhance the lake fishery
The Game and Fish Department has stocked the lake with largemouth bass, bluegills, minnows, and trout.
On August 28, 2003, the Public Service Commission approved final bond release for the Harmony Lake Wildlife Management Area. Interest in the project was so great that the story made front-page news in the Bismarck Tribune.
Harmony Lake... from dragline to fishing line!