

# A PROGRAM TO EXPEDITE RECLAMATION WHILE REDUCING COSTS<sup>1</sup>

by

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**Abstract.** The Coteau Properties Company (Coteau) operates the Freedom Mine, a large surface coal mine in western North Dakota. About 5,000 acres have been reclaimed since 1986. Through partnerships with local farmers and ranchers, the mining company has developed a program to expedite a return of reclaimed cropland and prairie to full economic use. Reclaimed croplands are being farmed immediately after topsoil is spread, rather than following the common industry practice of planting a hayland crop and breaking it several years later. This reduces seeding and tillage costs and allows local producers to manage a quick economic return on reclaimed lands. It also provides crop yield data earlier in the bond liability period. Cattle grazing is used as a vegetation management tool as soon as grass stands are established. This also provides a local economic benefit in addition to reducing management costs. Grazing is an essential element in managing reclaimed stands for diversity. The mine works closely with local producers in developing annual farm plans that will satisfy the ultimate goal of final bond release. Amenities provided to enhance land use include all-weather section line roads, designed field approaches, shelterbelts, pasture fencing, stockponds and stockwater tanks, and livestock corrals.

## Introduction

The Coteau Properties Company (Coteau) owns and operates the Freedom Mine in western North Dakota. This is a surface coal mine currently producing over 15 million tons of lignite per year. Production began in 1983, followed by the initiation of reclamation in 1986. Since that time, over 4,000 acres have been reclaimed. Disturbance and reclamation average about 700 acres annually.

Land is reclaimed to its premining land uses; about 75% dryland small grain cropland (primarily spring wheat), and 25% rangeland seeded to native grassland species. The mining company owns most land mined and reclaimed and contracts this land to local landowners for their use immediately after reclamation. The mine has developed methods to expedite reclamation to full postmine potential.

Prior to 1993, most of the company's reclaimed lands were placed into hay production and allocated to local producers. Hay from reclaimed tracts was then used for cattle feed by producers, who in

return would provide the mine with straw bales to be used for reclamation mulch. In 1993 the mine revised its reclaimed land use policies, following discussions with the North Dakota Public Service Commission, to encourage full scale wheat and cattle production. Strategies were developed to place newly reclaimed tracts into full production immediately after soil respread. Working with local partnership farm and ranch producers to develop full production farm plans, reclaimed tracts can be placed into full production sooner and at reduced costs. Involving local partnership producers in the planning and management process promotes a more positive image toward reclamation of mined lands, provides economic benefits to producers and the mining company, and affects a better understanding of mining requirements and government regulations by local farmers. By working with the producers, the mine has become more knowledgeable about farming practices and their applications to reclaimed lands. The final result of full production reclaimed land use will be the rapid transfer of agricultural lands at the time of bond release.

## Annual Farm Planning Process

Since 1993 the mine has selected six local partnership producers to assist in achieving full scale agricultural production objectives. Partnership producers were chosen based on various criteria, including proximity of their farm operations to the Freedom Mine, current mining activities or the potential for mining activities to occur on their lands, and their past and present cattle and/or crop production requirements. Each selected reclaimed section (640 acres) or part thereof is allocated to only one producer.

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Using only one producer per section works well with the mine's practice of calculating revegetation standards separately for each section. Using neighboring producers also allows comparisons of field harvest data between reclaimed and undisturbed croplands (Table 1).

Annual farm plan meetings are held in February of each year with the individual producers. Plans are finalized for cropping, haying, grazing, and breakage of reclaimed tracts. Field numbers are assigned to each cropland tract and management plans for fields are discussed to ensure that vegetation information needed for bond release purposes is collected. Grazing plans and requirements are discussed with livestock producers, including stocking rates, grazing duration, fencing, and water development needs. Finalized maps and tables summarizing the results of the respective planning meetings are sent to each producer to help guide the year's activities. As more and more land is reclaimed and ready for production, additional producers will be chosen for partnerships with the mine, or existing partnership producers will be given more lands. A copy of a 1996 farm plan for one producer is attached (Table 2) and shows the type of detail generated from the planning process.

Such cooperative farm planning between producers and the mining company facilitates an integration of agricultural, industrial, and governmental requirements to hasten the transition of reclaimed land back to full agricultural production, private ownership, and private control.

#### Farm Planning Accomplishments

##### Land Utilization

Many mine operators allow only hay cutting with minimal grain production and livestock grazing. At the Freedom Mine, however, all land is used to its fullest potential as soon after reclamation as possible. To date over 2,500 acres of reclaimed land have been broken for wheat production. In 1996 three ranchers grazed 330 head of cattle on 470 acres of reclaimed grasslands.

##### Fencing

Since 1993 the mine has constructed 63,000 feet of fence to establish large grazing tracts in five sections. Large reclaimed pastures have been fenced into smaller cells for rotational grazing, and two

corrals have been constructed using ideas generated by local ranchers. Tree, shrub, and wetland habitats important to wildlife have been fenced out of grazing pastures to protect their value.

##### Improved Access

Vastly improved section line roads, providing year around access for farmers and ranchers, have always been a high priority at the Freedom Mine. Following suggestions of the partnership farmers and ranchers, secondary approaches are being constructed to improve access to cropland fields and pastures.

##### Direct Cropping and Grazing

Common practice on reclaimed croplands has been to plant an initial temporary precrop hayland mix of grasses and legumes. The theory behind this practice is that a hay crop will stabilize freshly respread soil, reducing erosion potentials and adding a measure of soil tilth through root development. Experience at the Freedom Mine has suggested that the precrop hayland mix may not be necessary.

For newly reclaimed areas seeded directly to wheat, erosion has not been a problem. This is likely because of shallow slopes, in most cases shallower than before mining (Table 3). Precluding a hayland mix reduces initial seeding costs and later breakage costs to prepare lands for small grain production. Small grain crops usually perform poorly the first year or two after a hayland area has been broken. This may be because hay crops tend to deplete soil moisture and possibly some nutrients. Additionally, remaining sod and volunteer alfalfa interfere with initial grain production following breakage (Table 4). Immediate tillage and common fallow and seeding methods allow soil moisture to return faster, because there are no perennial plants depleting soil moisture reserves. Immediately cropped soils allow improved crop production much earlier in the ten year liability period. By not planting a grass-legume hay mix, small grain cropping can start the first year of the liability period, rather than the sixth or seventh year (Table 5). Field maintenance (rock picking, weed control, etc.) can start immediately and continue through the entire liability period as needed. Partnership farmers are able to develop field layouts, crop/fallow plans, and fertilizer and herbicide programs early in the bond liability period.

Reclaimed grasslands at the Freedom Mine are grazed as soon as viable grass stands are

**TABLE 1. Comparison of Reclaimed and Undisturbed Croplands at the Freedom Mine in 1996**

<u>Field Number</u>	<u>Prior Year Crop</u>	<u>Acres</u>	<u>Yield bu/ac</u>	<u>Unmined Land Yield bu/ac<sup>1</sup></u>	<u>Reclaimed Land Yield/ Unmined Land Yield</u>
20-5-1	fallow	16	45.2	35.5	127.3%
18-9-2	wheat	92.8	37.3	32.2	115.8%
20-2-2	wheat	14.2	39.4	35.5	111.0%
20-2-2P	wheat	6.9	40.1	36.6	109.6%
18-7-1P,-2P	1/2 fallow, 1/2 wheat	29.6	43.1	39.7	108.6%
18-1-2	wheat	25	34.3	32.2	106.5%
18-3-2	wheat	38.3	33.5	32.2	104.0%
18-1-1	fallow	25.4	36	36.2	99.4%
19-2-1P	fallow	31.1	41	42	97.6%
20-1-1P	fallow	22.7	39.6	41.1	96.4%
17-4a-1	fallow	13.8	33	39.7	83.1%
18-4-2,-5-2	wheat	62.7	25.1	32.2	78.0%
17-2-2P	wheat	16	23.8	35.3	67.4%
07-odds	hayland	231	13.8	33.4	41.3%
19-1-1	hayland	53	7.2	32.2	22.4%

<sup>1</sup>Unmined land yields based on Mercer County averages from *North Dakota Agricultural Statistic Service, USDA. 1997. Durum and other spring wheat county estimates, North Dakota, 1996. February 1997. Fargo, North Dakota.*

**TABLE 2. Farm Plan for 1996**

	<u>Field #</u>	<u>Acres</u> <u>Section 18</u>	<u>Acres</u> <u>Section 19</u>	<u>Acres</u> <u>Section 17</u>	<u>Acres</u> <u>Section 13</u>	<u>Total</u> <u>Acres</u>
1st Year Crop	18-1-1	50.4				
	18-7-1P	15.6				
	19-1-1		53.0			
	19-2-1		31.1			
	17-4a-1			13.8		
		66.0	84.1	13.8		163.9
2nd Year Crop	18-3-2	22.3				
	18-4-2	14.1				
	18-5-2	59.5				
	18-8-2P	14.0				
	18-9-2	92.8				
	17-2-2			16.0		
		202.7	0.0	16.0	0.0	218.7
Fallow	18-2-F	40.7				
	18-6-F	41.2				
	19-3-F		50.0			
	17-3-F			20.7		
		81.9	50.0	20.7	0.0	152.6
Spring/Fall Breakage		0.0	0.0	42.9	0.0	42.9
		0.0	58.6	67.6	0.0	126.2
		0.0	58.6	110.5	0.0	169.1
Grazing		127.8	0.0	0.0	0.0	127.8
Hay		21.0	148.9	88.2	50.6	308.7
<b>Total Acres/Section</b>		<b>499.4</b>	<b>283.0</b>	<b>181.6</b>	<b>50.6</b>	<b>1014.6</b>

**Notes:**

1. Field # = Section #, Field #, and 1st or 2nd year crop or fallow (F). "P" designates a prime field.
2. Yields will be kept by section and crop year. For example, all 1st year crop fields in Section 18 may be harvested together.
3. Prime yields will be kept by section and crop year, and separately from nonprime yields.

**TABLE 3. Comparison of Premining and Reclaimed Lands at the Freedom Mine**

	Slope class					Average weighted slope by percent
	0% to 3%	3% to 6%	6% to 9%	9% to 15%	>15%	
Total lands reclaimed (2,294.5 ac.):						
Premining acreage	1,244.1 (54%)	709.4 (31%)	181.7 (8%)	107.3 (5%)	52.1 (2%)	3.77
Reclaimed acreage	1,557.3 (68%)	479.5 (21%)	175.2 (8%)	71.9 (3%)	10.7 (0%)	2.99
Croplands reclaimed (1,447.6 ac.):						
Premining acreage	960.5 (66%)	434.0 (30%)	38.1 (3%)	15.0 (1%)	0.0 (0%)	2.66
Reclaimed acreage	1,185.2 (82%)	247.6 (17%)	13.9 (1%)	0.9 (0%)	0.0 (0%)	2.08
Native rangeland reclaimed (405.6 ac.):						
Premining acreage	98.0 (24%)	116.9 (29%)	91.0 (22%)	54.5 (13%)	45.2 (11%)	6.97
Reclaimed acreage	119.2 (29%)	119.3 (29%)	119.7 (29%)	40.3 (10%)	7.1 (2%)	5.48

From: Friedlander, J. D. 1994. Quantifying topographic differences between premining and reclaimed landscapes at a large surface coal mine. In: Proceedings of the International Land Reclamation and Mine Drainage Conference and Third International Conference on the Abatement of Acid Mine Drainage. USDI Bureau of Mines Special Report SP 06C-4. Pittsburgh, PA. April 24-29, 1994. pp. 241-248.

**TABLE 4. Comparison of Wheat Yields from Reclaimed Lands Having Different Treatments the Previous Year**

<u>Year</u>	<u>Average Yield bu/ac<sup>1</sup></u>	<u>Previous Year</u>
1993	26.2a	hayland
1993	28.2a	wheat
1993	29.6a	fallow
1996	10.5ab	hayland
1996	23.0b	mined/reclaimed
1996	32.5c	wheat
1996	39.0c	fallow

<sup>1</sup>For each year, the same letters following yields indicate no significant difference ( $p < 0.05$ ).

**TABLE 5. Changes in Wheat Yield on Reclaimed Land Following Years After Breakage From Hayland**

<u>Year</u>	<u>Year Following Breakage</u>	<u>Wheat Yield bu/ac</u>	<u>Unmined Land Wheat Yield bu/ac<sup>1</sup></u>	<u>Reclaimed Land Yield/ Unmined Land Yield</u>
1992	1	21.2	31.3	67.7%
1993	2	26.7	32.8	81.4%
1994	3	24.7	35.3	70.0%
1995	4	24.6	27.2	90.4%
1996	5	36.6	34.9	104.9%

<sup>1</sup>Unmined land yields based on Mercer County averages from *North Dakota Agricultural Statistic Service, USDA. 1997. Durum and other spring wheat county estimates, North Dakota, 1996. February 1997. Fargo, North Dakota.*

established, fences and corrals are in place, and stockponds or stockwater tanks are ready for use. Grazing reclaimed native pasture lands provides an immediate local economic benefit. In cooperation with partnership ranchers providing livestock, the mine uses grazing early in the liability period as a tool to promote favorable species composition. Grazing also provides a more natural and greater ecological benefit than haying as it is the historical and future use and encourages nutrient cycling and native seed redistribution.

#### Enhanced Farmer and Public Perception

Perhaps the greatest accomplishment of the farm planning process and associated partnerships is improved local farmer and public perceptions. Local farmers and ranchers using reclaimed lands to their full potential demonstrates that industry, agriculture, and state regulatory authorities are working together to ensure that quality reclamation is achieved expeditiously.

#### Fine Tuning For Final Land Uses

By placing reclaimed lands into full scale agricultural uses, the mining company has unexpectedly discovered factors that would not have been considered previously. Crop production shows where erosion is likely to occur and exactly where grassed waterways are needed. Operational limits around wetlands and road ditches can be defined early. It has also shown where wider or new gates and approaches are needed to accommodate large farm equipment and farm operations. And it has shown how to best design field layouts for crop and fallow rotation sequences and windbreak tree plantings.

Livestock production has shown where cattle trails are likely to develop, where associated erosion may take place, where additional fencing may be needed, and how stockpond embankments and side slopes are affected by livestock. These and other factors have allowed the mine to fine tune existing reclamation and better plan future reclamation.

#### Evaluation Criteria to Determine Success of the Program

The North Dakota Public Service Commission evaluated several criteria to determine if this program represents a unique and innovative approach to land reclamation.

#### Actual or Potential Benefit to the Mining/Reclamation Process

The primary objectives of the reclamation process are to return mined lands to intended land uses with equal or higher productivity and capability, obtain bond release, and transfer lands to private ownership and control. The mine's reclaimed land use policy and innovative farm planning partnerships with local producers provide the necessary means to meet these objectives. For croplands, full scale production on large tracts using single producers allows productivity to be measured and assessed in a variety of ways throughout the liability period. Hand sampling or whole field combine harvest methods can be used on identically managed reclaimed and undisturbed crop fields. Large tract production also results in better overall crop and land management practices than does small tract production.

For grasslands, full production grazing provides the surface disturbance and forage manipulation needed to promote diversity required for bond release. Fencing of large cells, corral construction, and water developments have allowed large numbers of livestock to be efficiently utilized and moved as needed. Land management decisions can be made early to ensure that reclaimed tracts will meet success standards for bond release five to ten years into the future.

Working with partnership producers on large scale production demonstrates to the outside community that mining and agriculture can coexist, and the mine's commitment to quickly return lands that are totally ready for full production agriculture. Producer involvement in final reclamation practices provides an excellent method by which to inform and educate landowners about the mining and reclamation process and the various regulations that guide this process. Likewise, industry learns more about agricultural practices from partnership producers.

#### Alleviation of Adverse Economic/Environmental Impact

The allocation and utilization of reclaimed lands in full production hastens positive agricultural and financial benefits for partnership producers. All agricultural revenue generated by reclaimed lands belongs to partnership producers. The cash value of livestock and crop production from reclaimed lands provides an increased local economic benefit as compared to land sitting idle or farmed on a small acre

basis. Seed, fuel, fertilizer, herbicides, fencing supplies, water tanks, and contracted labor needed to return land to full production are provided through local suppliers, thus creating a more immediate economic benefit to the community. Additionally, no rent is charged to producers using reclaimed lands owned by the mine during the bond liability period, making reclaimed lands even more attractive to producers.

#### Application to Other Mines, Agricultural or Other Activities that Affect North Dakota's Environment

Full production reclaimed land use planning and producer partnerships are quite applicable to other mines in the state as well as surrounding states. These practices can demonstrate the mining industry's commitment to expeditious quality reclamation and the timely return of mined lands to the private sector. Such practices are also applicable to any activity which temporarily alters current land uses. The mining company and producers are demonstrating that it is feasible to expeditiously return reclaimed lands to high levels of use.

#### Contribution to the Economic Development of the Industry and the State

The rapid transition of reclaimed lands to full production capabilities contributes to the development

of the industry and the state. As new ideas like full production land use are tried and shown successful, the information thus generated may be used to demonstrate productivity, reduce costs, and educate the general public.

#### Actual or Potential Impact on Public Perception of Mining/Reclamation

Full production reclaimed land use planning and producer partnerships has had a direct and positive impact on public perceptions of mining and reclamation. Many neighboring producers have cut hay on reclaimed lands for years, observing firsthand the lengthy transition to full production. However, partnership producers now involved in full production reclaimed land use are more than pleased with the more rapid transition and the levels of production achieved thus far under this new program. Producers working with the mine also gain an understanding and appreciation of certain laws, regulations, and guidelines pertaining to mining, reclamation, and bond release performance standards.

Each year over 6,000 people tour the Freedom Mine and observe mining, reclamation, and land use activities. Tourists leave with a better understanding and a different, more positive perception of mining and reclamation than when they arrived.