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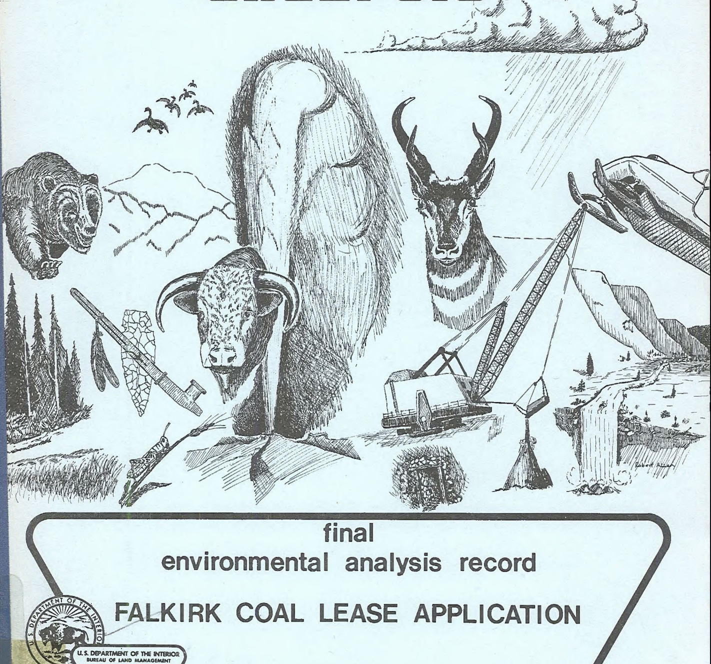

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## FALKIRK COAL LEASE APPLICATION

miles city district montana

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# FALKIRK COAL LEASE APPLICATION M-31053(ND)

# ENVIRONMENTAL ANALYSIS RECORD

March 1976

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Miles City District
U.S. Department of the Interior - Bureau of Land Management

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FALKIRK COAL LEASE APPLICATION - #31053(ND)

Environmental Analysis Record

# I. DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

The proposed action to be analysed in this Environmental Analysis Record, is the lease of 998.87 acres of federal coal located in McLean County, North Dakota, to Falkirk Mining Company. The proposed tracts lay near the community of Underwood. Legal descriptions are as follows:

T. 146 N., R. 81 W., 5th P. M.
Section 30: Lot 4, SE¼SW¼, S½SE¼.

T. 146 N., R. 82 W., 5th P. M.
Section 2: Lots 3, 4, S½NW¼;
Section 6: SE¼;
Section 20: NW¼;
Section 24: NE¼NW¼;
Section 34: NE¼NE¼, S½SW¼, NW¼SW¼.

T. 146 N., R. 83 W., 5th P. M.
Section 24: SE¼.

The mining operation meets the Secretary of Interior's Short-Term Criteria #2 for coal leasing; coal needed as a reserve for production in the near future. Federal coal in the S½SW¼, NW¼SW¼ of Section 34, T. 146 N., R. 82 W., will be needed within six months after beginning operations if a logical mining plan is to be followed.

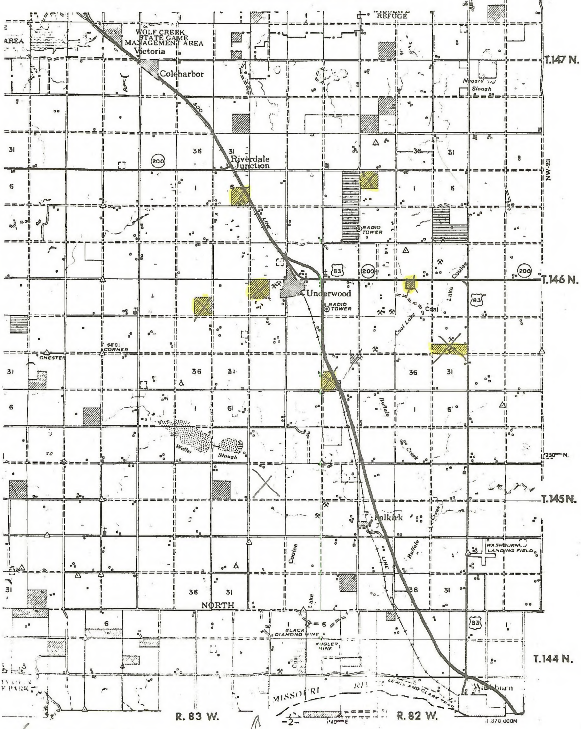
The community of Underwood is located on U.S. Highway 83 approximately 51 miles north of Bismarck, North Dakota, and south of Lake Sakakawea (see vicinity map).

## A. Background Data

The federal government does not own any surface rights in the proposed lease. The mineral rights are administered by the Bureau of Land Management.

The lessee is Falkirk Mining Company, a wholly owned subsidiary of North American Coal Corp., a corporation organized under the laws of the State of Ohio. The company was organized in August of 1974 to acquire and hold fee and/or leased coal lands in the State of North Dakota and to construct and operate

FALKIRK COAL MINE VICINITY MAP - UNDERWOOD, NORTH DAKOTA




Fed Coal in Proposed Action

X - Power plant

a mine, or mines, to supply lignite as fuel for a two-unit electric generating plant. The plant will have a total generating capacity of 1000 megawatts (MW), and is presently under construction south of Underwood, North Dakota, (T. 145 N., R. 82 W., Sec. 17). The plant will be owned and operated by United Power Association, Elk River, Minnesota; and Cooperative Power Association, Minneapolis, Minnesota.

Mine operations are scheduled to begin in mid 1978 and supply the first unit with 1,415,000 tons of coal that year. Production will increase to a planned level of 5-6 million tons of coal per year by 1981, when both units are operational. The entire output is dedicated, under a 35 year contract, to Coal Creek Generating Station, the 1000 MW generating plant currently under construction.

The planned life of the power plant, and consequently the mine, is thirty-five years (Burns and McDonnell, 1973). The actual life could be longer, depending on the market price and supply of coal, coupled with future energy demand. These interacting factors could extend the life of the mine for a much greater period. Room for additional generating capacity is available and could be developed if needed.

The federal coal represents approximately 3.5% of the total mining area. The mining area controlled by the company, is 26,412 acres of surface area, and 27,588 acres of coal. All of this surface area is leased from private landowners.

Work has already begun on some of the improvements at the mine site which are required prior to actual mining. These include surveying and engineering work on main haul roads, relocation of county roads, and closure of some existing county roads.

The U.S. Bureau of Land Management (BLM) has not, as of this time, initiated any planning in the area. BLM planning has been concentrated on Planning Units lying west of the Missouri River.

The McLean County Planning Commission has completed a comprehensive plan for McLean County. The County is in the process of implementing the plan. Within the scheme of the comprehensive plan, the mine and power plant were located in an agricultural area. The development was approved prior to the effective date of the county zoning ordinance.

The U.S. Fish and Wildlife Service (FWS) has tentative plans to obtain long term leases, or easements, for wildlife use on some of the wet lands outside the mine area. They also hope to salvage wetlands over federal coal inside the mine area.

Falkirk Mining Company is required to prepare a mining plan which must be approved by the State of North Dakota Public Service Commission. The U.S. Geological Survey (USGS) must approve that portion of the plan that deals with mining federal coal. Additionally, that portion of the plan which deals with the reclamation of private surface over federal coal is subject to BLM approval and recommendations. The mining plan review is a joint effort.

North Dakota reclamation laws and Public Service Commission rules and regulations require certain specific environmental and health safeguards to be incorporated in mining plans of ongoing developments in North Dakota. Some of the measures required of the mining company by these rules and regulations include:

1. Regrading spoils to approximate the original contour.

2. The company must save and segregate suitable plant growth material and respread it on the disturbed site.

3. They must impound, drain, or treat all runoff water so as to minimize soil erosion, damage to agricultural lands, and pollution of streams and other waters.

4. All final cuts, highwalls, and endwalls must be back-sloped to 35% or less, unless a final pit pond is planned.

5. They must remove or bury all refuse resulting from the operation.

6. The surface landowner designates his preference for the final land use pattern and vegetative cover, and the reclamation process must conform to his preferences.

7. The mining company must sow, set out, or plant the prescribed vegetation.

8. Reclamation of the disturbed site must be completed prior to the expiration of three years after termination of the permit term. However, according to Chapter 38-14-05 of the North Dakota Century Code, the Public Service Commission shall extend the reclamation period from year to year for a period of five years from the termination of the permit term at the operator's request, on the land in question. Additionally, the commission may grant a further discretionary extension of the reclamation period if deemed necessary.

9. The mining company must repair any surface water damages, and reconstruct any water facilities affected by the mining operation.

10. The mine must comply with <u>all</u> state air and water quality standards.

11. Full use must be made of available technology to prevent or minimize subsurface piping and slumping by support material.

B. Action Purpose

The primary objective of the federal coal lease, and the mining at Falkirk, is to meet the anticipated energy needs of rural areas in Minnesota and Wisconsin over the next ten years. United Power Association and Cooperative Power Association presently provide power to about 200,000 consumers in much of rural Minnesota and parts of Wisconsin.

Additionally, both utilities are members of various utility pools and energy agreement pacts, such as the Upper Mississippi Valley Power Pool (U.M.V.P.P.), the Mid-Continent Area Power Pool (M.A.P.P.), and the Mid-Continent Area Reliability Coordination Agreement (M.A.R.C.A.). Through membership in these pools and agreements, they are part of a power supply system that provides energy reserves for a major portion of the upper mid-western United States (Burns and McDonnell, 1973).

If projected energy needs are accurate, the power plant is necessary to provide the increasing energy demands in the service area of the two utilities over the next ten years (Burns and McDonnell, 1973).

C. Available Alternatives

The single alternative to the proposed action is to refuse to lease the coal. Although not considered an alternative to the lease of federal coal, selective denial of specific tracts in this application for "overriding" environmental reasons is an option of the BLM. To consider denial of specific tracts as alternatives would mean fragmenting the analysis based on assumed impacts prior to the analysis. It was felt that if the whole lease is considered, impacts that would warrant selective denial of individual tracts would surface and they would be considered as mitigating actions. The mining, however, will proceed without action on the part of the BLM in that federal coal will be mined around and isolated.

Because of the limited amount of federal coal, the mine does not rely on the lease to provide a source of coal for the generating plant. The company has an adequate reserve of coal to meet its commitments from the private coal leases it presently holds and is, therefore, not reliant on the limited federal coal. Consequently, the alternative would simply prohibit the extraction of federal coal. Refusal to lease federal coal will not prevent the mine and power plant from going into operation.

D. Action Components

Three stages of implementation were entertained under both the proposed action and the alternative. These were mine site preparation, mining, and reclamation. These stages contain several discrete operations which are discussed in the following sections.

Mine Site Preparation

The discrete operations under this stage are:

1. Survey and design of roads and facilities.

2. Construction of 2.5 miles of main haul road with highway underpass and 2 miles of access roads.

3. Construction of truck dump and coal crushing facilities, office maintenance and storage buildings, and fuel storage and dispensing facilities.

Mining

Mining will include the following discrete operations:

1. Topsoil removal and stockpiling: Following a complete soils thickness and distribution determination by a state-registered soils classifier, which is prescribed by North Dakota state law, suitable surface and subsurface material up to five feet thick (final amount as suggested by the independent soils classifier's report) as approved by the State Public Service Commission, BLM, and USGS will be removed and stockpiled.

   Wind and water erosion of the stockpile will be controlled by proper positioning and selected grass seeding. Subsoil material judged harmful to future plant growth will be flagged for non-surface replacement during the reclamation process in accordance with State regulations.

2. Removal of overburden: Due to the location of U.S. Highway 83, volume of coal needed, and to reduce the

amount of haul road, the mine will be in two units. Subsequently, there will be two complete mining operations, one east and one west of U.S. Highway 83. A main haul road passing under U.S. Highway 83 will connect the two operations to the coal dumping and conveying point. The overburden in both operations will be removed by two large electric (105 cubic yard, 22,000 volt ground-laid cable) draglines with a 328 foot operating radius. Overburden will be piled adjacent to the first cut (box cut) and placed in the immediately preceding trench for each of the following cuts. A pit with a minimum width of 120 feet and approximately 5,000 feet long, if possible, will be exposed in each cut. This operation will continue 24 hours a day. A grader or bulldozer will follow the dragline removing loose clay to fully clean off the coal seam.

3. Blasting and Excavation: Following removal of the overburden the exposed coal seam will be progressively drilled and blasted using "Anfo" (ammonium nitrate-fuel oil mixture) to fracture the lignite. A coal loading shovel will then excavate the coal seam and load it into 150 ton, diesel powered, "coal haulers" (off-highway, trailer-type, bottom-dump trucks).

4. Transportation, Crushing, and Delivery: The coal will be transported from the pit on isolated haul roads approximately 100 feet wide to the truck dump where it is dumped and moved to a crusher. The coal is then crushed by primary and secondary units to a maximum size of 1½" in diameter and moved by conveyor to the power plant. Surge facilities which permit continuous mine operation are planned. In addition, the generating plant will maintain a large stockpile to insure a consistant fuel source should mine delivery fail.

<u>Reclamation</u>

This involves three discrete operations:

1. Regrading: Reclamation will involve regrading spoil piles to a level or rolling configuration. This includes the final highwall, or last cut, which normally will have no overburden put back into it. The highwall will be cut back and graded to blend with the adjacent terrain. Two smaller (17-20 cubic yard) draglines may be used to assist bulldozers in these operations. Regrading spoils will usually begin two to three spoil piles behind the mining.

2. Topsoiling: Following the leveling process, the topsoil is replaced according to BLM and USGS requirements and

the State regulations, as stipulated in the mining permit, wherein a registered soils classifier tests the entire area, suggests reclamation replacement of up to five feet of top- and subsoil and is approved by the Public Service Commission. Replacement of topsoil is normally undertaken using wheeled-tractor scrapers. This step and the regrading step must be undertaken during the dry seasons of the year to prevent loss of soil material.

3. Seeding: This operation involves site preparation, such as contour plowing, and seeding the site back to native plant species, if rangeland, or crops if desired by the surface owner.

The preceding stages and operations, with the exception of Mine Site Preparation stage, will be taking place simultaneously at two separate locations within the mine area.

## II. DESCRIPTION OF THE EXISTING ENVIRONMENT

### A. Non-Living Components

#### 1. Air

a. Climate (Air movement patterns, temperature, moisture, soil temperature)

The climate of an area cannot be described as a single element. It is the combination and interaction of many elements such as temperature, precipitation, humidity, wind velocity and direction, atmospheric pressure, solar and terrestrial radiation, and snow cover. To portray the climate of a given location such as the Underwood-Falkirk area one must be familiar with climatic controls that govern the climate. North Dakota is located near the geographic center of North America resulting in a typical continental climate. This results in large annual, daily, and day to day changes, light irregular precipitation, low relative humidity, high amount of sunshine, and constant air movement.

The Rocky Mountains, located to the west of North Dakota, act as a barrier to the westerly flow of air in the atmosphere. This barrier effectively modifies the character of air which originates over the Pacific Ocean, and reinforces the continental nature of the atmosphere of North Dakota.

Air masses originating in the northern polar area and in the Gulf of Mexico area are not modified by any barriers and easily overflow the area. The fact that these air masses easily flow over the area, and that they originate from vastly different sources, results in frequent, often rapid, changes in the weather regime over the area.

Day light length ranges from 9 hours in December to 16 hours in June. The sun angles are much higher in the summer than winter, producing much more solar radiation and contributing to large seasonal temperature extremes (Jensen, Ray E.). In 1974, the average daily temperature ranged from 8.8 degrees F. in January to 73.2 degrees F. in July at Underwood (U.S. Department of Commerce, National Oceanic and Atmospheric Administration, NOAA). The highest temperature at Underwood that same year was 98 degrees F. on July 18, 1974. The lowest was -32 degrees F. on January 10, 1974. Temperatures of 100 degrees F. and over are not uncommon and temperatures less than -32 degrees F. are also possible at this location. The most rapid warming occurs during April. In 1974 the average daily temperature went from 25.5 degrees F. in March to 42.4 degrees F. in April. Although the average daily temperature is above freezing the frequency of freezing temperatures during this month is still high.

The average length of frost free periods in North Dakota are from 110 days to 130 days. "The frost free period may or may not be synonymous with the length of growing season although it's a close approximation." (Jensen, Ray E.). The topography of the area has much to do with when the first frost occurs. Cool air flows down hill, and will collect in the depressions resulting in an earlier frost there than adjacent high ground. It would be expected that the area in and around Weller Slough will have its first frost prior to the areas adjacent to it due to its lower elevation.

Soil temperature and frost penetration data in North Dakota is scarce. Work by Dr. Guy Wilkinson (North Dakota State University) indicates that the first date of soil freezing was November 26 on the average at Fargo. Specific information for the Falkirk-Underwood area is unavailable. Surface thawing usually begins on March 26th, which is just several days earlier than the occurrence of maximum frost depth. In Bismarck, the average frost depth is 4.5 feet and the maximum is 7 feet. In Minot, the average is 4 feet and the maximum is 6.5 feet. Bismarck is approximately 51 miles south of the mine area, and Minot is approximately 56 miles north. It can be expected that the frost depth information for the mine area would be similar to that in these locations. It must be kept in mind that freezing depth of a soil depends mainly on the winter air temperature; the soil itself, including moisture content; type of soil, and presence or absence of vegetative cover; and snow cover, including its presence or absence, depth, and density.

Precipitation averages over 16" a year for the Bismarck area (NOAA). The annual rainfall at Underwood was 14.95" in 1974. More than 75% of this amount falls from April through September and more than 50% falls in May, June, and July. Most summer rainfall occurs as thunderstorms in the late afternoons and evenings. Winter precipitation is light and nearly always occurs as snow.

Relative humidity, or atmospheric moisture, depends on temperature. Warm air holds more moisture than cold. Large daily changes can occur without any change in the absolute amount of moisture in the air due to temperature changes. On a statewide basis the eastern portion of North Dakota has a higher relative humidity than the western portion. The average daily relative humidity at Bismarck is 53% while the eastern portion of the state is 10% higher at the same time, i.e., 6 p.m. (Jensen, Ray E.). In the summer and fall this difference can be as much as 15%.

Obstructions to visibility may be in the form of blowing snow, fog, or dust. From the point of view of gasses, the air is pristine. Fog is most apt to reduce visibility in February and March. Dust, smoke, and haze are usually present for a few short hours in any month. In April, however, dust may limit visibility up to 3% of the time. This is due to the strong winds that occur and sweep the bare soils which have been exposed for cultivation (Jensen, Ray E.).

Wind speeds vary in the Bismarck locality from a low mean speed of 9.8 miles per hour (MPH) in the month of December to 12.8 MPH in April. The average daily variation is quite small. The yearly average is 10.8 MPH. The mean daily maximums run from 54 MPH in January to 72 MPH in July and August. The winds are primarily west-northwest except in the spring and summer, they then shift to south-southeast and east (Jensen, Ray E.).

Tornadoes occur in North Dakota at the average rate of 12.9 per year. The chance of occurrence in the Falkirk-Underwood area is unpredictable. Two thirds of the tornadoes occur in June and July. July is the peak month of occurrence. No part of the State is free from tornadoes, but the southeast portion seems to have the highest frequency of occurrence (Jensen, Ray E.).

The occurrence of hail storms in the Underwood area is calculated to occur between 40 and 50 days per year. July is the major month of occurrence. Most frequently, hail storms appear in the afternoon and early evenings. Storm activity appears highest from 2 p.m. to 8 p.m. on those days it occurs.

Blizzards are not a frequent wintertime event in North Dakota contrary to popular belief. They average only slightly more than two per winter season and usually last for only a day or two. Only a small number of "low pressure areas" migrate out of the formation areas, which are in Alberta and Colorado, and eventually become blizzards somewhere in the Plains or North Central States.

b. Air Quality

The Environmental Protection Agency and the State of North Dakota have established air sampling stations throughout North Dakota. Two sampling stations close to the Falkirk-Underwood area reflect the air quality on the proposed lease site. They are at Garrison, approximately 20 miles north, and Washburn, approximately 13 miles south of the site.

The Washburn site collects and analyzes air samples for three pollutants; total suspended particulates (dust), sulfur dioxides and nitrogen dioxides. Suspended particulates are sampled using a high-volume sampler. The other pollutants are sampled using gas bubbles and continuous analyzers. The Garrison site collects dust samples only. The data available represents samples taken for the period of September 1974 through June 1975; and therefore, does not represent a complete year. It does however, give a good idea of the quality of air in the area with respect to the pollutants sampled and is the only currently available information specific to the site.

Table 1. Air Quality Data From the Washburn and Garrison Reporting Sites

| Month | Total Suspended Particulates* | $SO_2$*** | $NO_2$*** |
|---|---|---|---|
| Sept. 1974 | 44.7/39.5** | -/7.60 | -/ .8 |
| Oct. 1974 | 61.4/62.0 | -/4.40 | -/2.20 |
| Nov. 1974 | 21.4/23.6 | -/29.4 | -/2.4 |
| Dec. 1974 | 14.0/13.3 | -/31.7 | -/3.17 |
| Jan. 1975 | 53.0/21.5 | -/29.8 | -/2.25 |
| Feb. 1975 | 122.0/44.5 | -/14.0 | -/2.00 |
| March 1975 | 23.4/24.8 | -/24.8 | -/2.75 |
| April 1975 | 11.8/14.8 | -/ 3.80 | -/1.80 |
| May 1975 | 33.8/42.6 | -/ 6.20 | -/12.6 |
| June 1975 | 22.0/28.0 | -/15.8 | -/1.2 |

* Measured in micrograms per cubic meter ($ug/m^3$)
** Garrison/Washburn
*** Measured in parts per million (ppm)

The State of North Dakota has established ambient air quality standards. For particulates, the standard is 60 micrograms per cubic meter ($ug/m^3$) maximum annual geometric mean and 150 $ug/m^3$, maximum 24-hour concentration not to be exceeded more than once per year (North Dakota Department of Health). The area is within this standard most of the year. There are months, however, that the maximum levels are approached and exceeded. It appears that the dust level is a function of the season of year, the resulting seasonal winds, and the exposed agricultural lands. The sulfur dioxide ambient standard is 60 $ug/m^3$ of air (0.02 parts per million, ppm), maximum annual arithmetic mean, 260 $ug/m^3$ of air (0.10 ppm), maximum 24-hour concentration, 715 $ug/m^3$ of air (0.28 ppm), maximum 1-hour concentration. The ambient standard for nitrogen dioxide is 100 $ug/m^3$ of air (0.05 ppm), maximum arithmetic mean, 200 $ug/m^3$ of air (0.1 ppm), maximum 1-hour concentration not to be exceeded over 1% of the time in any three-month period. The data does not reflect any point where pollutant concentrations approach these standards. It can be concluded, based on the available information, that dust is currently the biggest pollutant problem.

2. Land

a. Soils

Soils of the Underwood area are forming in poorly sorted glacial till or alluvium from glacial till of the Coleharbor Formation, which is 9000 to several hundred thousand years old. Nearly all landforms in McLean County are a direct or indirect result of glacial action and are predominatly of a depositional nature.

The Soil Conservation Service's (SCS) general soils map shows that the Underwood area is in the Williams-Max-Temvik soil association. It consists of nearly level to gently rolling soils with thick, dark brown surface layers formed in glacial till and wind blown silt deposits, and associated steeply sloping soils with a thin surface layer. It is suitable for cropland on the gentler slopes, and range on the steeper ones.

Detailed soil maps and descriptions (Appendix 2) of the federal coal tracts were provided by the SCS in Washburn, North Dakota.

b. Geology

Much of the following text and illustrations (Appendix 3) were taken directly from the North Dakota Geological Survey Bulletin 60, written by John P. Bluemle. In many cases, the wording was not changed significantly. Other information was obtained from the USGS in Billings and the Falkirk Mining Company. The private leasing information was taken from county records in 1974 by Mr. William Eastwood, who was at that time an instructor at Dickinson State College.

The Underwood area lies within the Coteau Slope physiographic area. The relief is moderate and generally less than 25 feet, except near some of the deeper valleys. The topography is mainly a stream-dissected bedrock with a veneer of glacial deposits.

Geologic History

McLean County and the Underwood area are located in the eastern part of the central Williston Basin. The area was invaded by marine seas at least four times during Paleozoic time and carbonates, sandstones, shales, and evaporites were deposited. Marine invasion and emergence continued during the Mesozoic time and the last marine invasion deposited the Cannonball Formation of Paleocene Age. The overlying Tongue River and Sentinel Butte Formations of the Fort Union Group are of non-marine origin. The post-Eocene Tertiary period was a time of erosion and development of an integrated drainage system. Finally, the effects of glacial deposition and subsequent erosion combined with the pre-glacial to create the present land forms. A detailed description of the individual formations is included in Appendix 3.

Land Forms

Nearly all landforms in the mine area are a result of glacial action and are depositional in character. Only the landforms present in the mine area will be McLean County.

Ground Moraine and Sheet Moraine - Most of the western and southern parts of McLean County are covered by ground and sheet moraine. Areas of sheet moraine (see geomorphology overlay in Appendix 3) are generally characterized by a thin, discontinuous layer of glacial drift over stream-eroded topography. Sheet moraine is a veneer of glacial drift that was deposited directly from glacial ice. This deposit has a low constructional relief with few kettles. Sheet moraine generally inherits the shape of the pre-existing landscape.

Dead Ice Moraine - A band of dead ice moraine occurs in the Falkirk mine area, while most of the dead ice moraine in McLean County is in the Missouri Coteau physiographic area further east. The relief of the dead ice moraine in this area is only 20-25 feet in a mile. Differences in relief on this moraine are shown on the geomorphology overlay (Appendix 3). Areas of dead ice moraine are generally characterized by knob and kettle topography, non-integrated drainage with numerous small ponds and sloughs, and a bouldery surface on till.

Glacio-Fluvial Forms - Melt water trenches are the only major glacio-fluvial forms within the area. These trenches are valleys that were cut by water flowing from melting glaciers.

## Bedrock Topography

The pre-glacial topography developed on the Tertiary in age Cannonball, Tongue River, and Sentinel Butte Formations was a moderately rolling plain dominated by three northeast-trending valleys. The Falkirk area is located on an island of Sentinel Butte Formation surrounded by partially buried valleys, which to the north and south of the area are eroded to the Tongue River Formation. The lignite deposits within the Sentinel Butte Formation are isolated by these valleys. The areas of Sentinel Butte islands are shown roughly by the location of USGS proposed Known Coal Leasing Areas (KCLA, see base map for their boundaries in Appendix 3).

## Lignite Deposits

The lignite deposits of major interest in the Falkirk area are within the Sentinel Butte Formation of the Fort Union Group.

The Falkirk Mining Company plans to mine two seams in this deposit for electric power generation. The upper seam is the thickest, being more than twice the average thickness of the lower. The average thickness for both beds over the entire area is 11 feet. This gives a tonnage of 19,250 short tons per acre.

The total reserves of high potential lignite in the deposit are approximately 300 million short tons (based on the average lignite thickness in the mine area). The federal coal reserves on 998.87 acres are approximately 19.2 million short tons or 5% of the total tonnage.

The lignite analysis shown in Table 2 below is from company records.

Table 2. Lignite Analysis From the Falkirk Mine

| Components | As Received(%) | Moisture Equilibrium(%) |
|---|---|---|
| Moisture | 39.45 | 35.45 |
| Ash | 6.81 | 7.26 |
| Sulfur | .61 | .65 |
| Volatile Matter | 27.97 | 29.82 |
| Fixed Carbon | 25.76 | 27.46 |
| B.T.U. per Pound | 6,415 | 6,839 |

Drill logs and chemical analyses were made available by the Falkirk Mining Company for study in their offices.

This information and published information was summarized and used in producing the lignite development potential map for the area (Appendix 3). The deposit as mapped was based on stripping ratios and overburden thicknesses. The Falkirk Mining Company will probably mine parts of the deposit classified as moderate potential. The criteria used are loosely based on USGS criteria and may be considered conservative by the mining company.

Most of the Falkirk area has been included in the USGS proposed Underwood Known Coal Leasing Area.

Approximately 95% of the area is currently under private leases between companies and private surface and/or mineral owners. The major part of the high potential deposit has been leased by the A. G. Golden Firm. These leases have been assigned to the North American Coal Company (Falkirk Mining Company) possibly through another subsidary, Coteau Properties. The next major leaseholder is Consolidated Coal Company, but most of their leases are outside the area of interest. A minor leaseholder is Westex with approximately 800 acres. Little is known about this organization. (See Private Leasing Overlay in Appendix 3.)

3. Water

a. Surface Water

Climatic conditions, topography, and landform (all previously described) influence surface water characteristics. Surface water in the mine area predominantly occurs as "prairie potholes" and sloughs.

The two prominent surface drainages in and around the proposed mine area are Coal Lake Coulee and Weller Slough (see Surface Water Overlay in Appendix 4). Throughout the area surface streams generally flow intermittently in a southerly direction except for Weller Slough, which is an area of central drainage with a local base level. Prairie potholes in the area are from 2 to 5 feet deep and receive water from precipitation and ground water inflow. The salinity count of the potholes ranges from brackish to brine depending on the time of the year and the amount of water available. No monitoring stations are located in or near the mine area. The closest is in Turtle Creek Basin just east of Coal Lake Coulee. Turtle Creek appears to have approximately the same amount of drainage area as Coal Lake Coulee in and above the proposed mine area. At this point the contributing drainage area is about 115 square miles and has an average discharge of 0.5 cubic feet/second (cfs) (USGS, 1973).

b. Ground Water

Ground water moves under the influence of gravity, through layers, pockets, and stringers of subsurface material called aquifers. The rate of movement is governed by hydraulic conductivity. Coarse sand, gravel, and well sorted materials have a high conductivity and generally form aquifers.

Ground water is obtained mainly from sandstone and lignite aquifers and glacial aquifers. Water from the Fox Hills and Hell Creek Formations is a soft, sodium bicarbonate type. The potential yields from these aquifers are unknown. Water from the Fort Union Group is a hard to very hard, sodium bicarbonate type. Yields range from 5 to 75 gallons per minute (gpm), but potentially may be as high as 200 gpm. The city of Underwood obtains its water supply from this group. At the present time, the existing municipal wells provide adequate water for the city's needs. The aquifers with the greatest potential for development are those in the glacial deposits. Surrounding the proposed mine site, the Coal Lake Coulee segment of the Turtle Lake aquifer and the Weller Slough aquifer are the glacial aquifers of primary importance.

Surface and groundwater characteristics are discussed in detail in Appendix 4.

B. Living Components

1. Plants (Aquatic)

No site-specific quantitative vegetation information is available for the wetlands overlying the subject federal coal of this lease application. As a result, the material presented here relys heavily on data and the classification systems of Shaw and Fredine (1971), Stewart and Kantrud (1971), Woodward-Clyde (1975), and the SCS (1973).

Stewart and Kantrud (1971) discuss a detailed pond and lake classification system that is based on the situation of the glaciated northern great plains (Appendix 5).

The U.S. Fish and Wildlife Service, using Shaw and Fredine's wetland classification system, have 1,750 acres of identified wetlands under easement within the coal lease line. This includes 320 acres of easement over federal coal of this lease application. Approximately 50 of these 320 acres actually occupy a wetland drainage basin (Appendix 5).

The SCS has described a wetland, and wet-meadow, range sites that are found overlying the subject federal coal of this lease application (Appendix 5). The juxtaposition of these range sites are shown in the diagrams of Appendix 5. The wetland range site, comprising approximately 21 acres (2%) of the surface lands over the subject federal coal, is characterized by poorly drained, saturated soils (often with standing water during part of the year) and a vegetative cover of sedges, rushes, marshgrasses, and hydrophytic forbs. In drier years this site may be cut for hay. The wet meadow range site (comprising roughly 4½ acres, or 0.4% of the surface over the subject federal coal) is typified by poorly drained soils of shallow depressions and a vegetative cover of sedges, reedgrass, cordgrass, switchgrass, bluegrass, and some hydro/mesophytic forbs.

Approximately 900 acres of wetlands were identified in September 1975 by the BLM (from 1966 vintage SCS aerial photos) overlying coal inside the Falkirk mine "take-line". This acreage comprized about 4% of the surface lands over the coal "take-line." This wetland acreage approximation is considered relatively accurate.

Three species of plants in North Dakota are considered "candidates" for listing as endangered or threatened species. These three species are Yellow Marsh Cress (Rorippa calycina), Small White Ladyslipper (Cypripedium candidum), and Prairie Fringed Orchis (Platanthera leueophaea). Any occurrence of these species on the Falkirk coal lease area is undetermined at this time.

2. Plants (Terrestrial)

This region of the Coteau Slope has been identified by Küchler (1964) as the Wheatgrass-Needlegrass (*Agropyron-Stipa*) physiognomic type in the grassland vegetation formation. Oosting (1956), Odum (1959), (Northern Great Plains Resource Program, NGPRP, 1974), and Woodward-Clyde (1975) classify this area as belonging to the mid-grass prairie biome, or ecosystem. The dominant species of this physiognomic type include western wheatgrass, blue grama, needle-and-thread, and green needlegrass. These species would be expected to prevail as "climax" (potential) vegetation in this area under "natural" conditions. However, McLean County, including the Underwood vicinity, is highly agricultural. Within the coal "take-line" of the Falkirk mine, 81% of the surface is cultivated and managed as cropland. Only 18% (estimate) of the surface lands over the coal "take-line" remain as undisturbed prairie lands (including wetlands). What little prairie still exists is usually found along the edges of sloughs, fencelines, and in limited areas too rough for cultivation. Photos showing the surface aspect over the subject federal coal are shown in Appendix 9.

The SCS has classified and mapped the soils of McLean County and established range site categories based on available soil information and vegetation species composition of the "climax" plant communities. Two of these range site categories (silty and thin upland) were found overlying the subject federal coal lands of this lease application (Appendix 5). Silty range sites comprised roughly 63% (631 acres) of the surface lands overlying the subject federal coal. These sites occur on nearly level to hilly terrain in glaciated and residual plains and on high stream terraces (Appendix 5). The site appears on well drained soils of medium and moderately fine texture and moderate to moderately slow permeability. The sites are dominated by the presence of western wheatgrass, needle-and-thread, green needlegrass, and blue grama. Fringed sagewort is a common half-shrub on these sites. Due to the smooth terrain occupied by much of this range site, this category is heavily cultivated and very little native prairie aspect remains.

Thin upland range sites comprise approximately 34% (344 acres) of the surface overlying federal coal. These sites occur on rolling to hilly and steep glacial till areas (Appendix 5). Soils are deep, medium textured, and exhibit moderate to moderately slow permeability. Characteristic plant composition is dominated by little bluestem, needle-and-thread, western wheatgrass, and porcupine-grass. Shrubs (including snowberry) are relatively common. This range site, where maintained in good range condition, provides good cover and protection for both wildlife and domestic livestock. Due to its occurrence in relatively steep terrain, this range site is generally less disturbed for cultivation than the silty range sites.

3. Animals (Aquatic)

Very little significant habitat for major aquatic animals occurs directly on any of the lands affected by the subject coal lease application (Appendix 6).

Since the surface waters of the subject wetlands and adjacent sloughs are expected to be only slightly brackish, and not severely limiting, zooplankton and macro-invertebrate populations are expected to occur where these aquatic habitats are present. The status of these populations vary in relation to the dynamic, physical state of the aquatic habitat. The zooplankton and macro-invertebrate populations of these wetlands are regarded as very important seasonal items in the food chains of the higher animal forms (i.e., fish, waterfowl) dependent on these wetlands.

Due to the intermittent and temporary nature of wetlands overlying the federal coal of this lease application, no fish populations are anticipated to be present. The Institute for Ecological Studies did report the likely occurrence of brook stickleback (*Eucalia inconstans*), and golden shiners (*Notemigonus crysoleucas*), in Samuelson and Weller Sloughs (Burns and McDonnell, 1973). Although not reported, Coal Lake may also have a similar fishery contingent to Weller and Samuelson Sloughs.

Wheeler and Wheeler (1966) have developed a comprehensive synopsis of the amphibians and reptiles of North Dakota, and the BLM (Montgomery, 1975a) has developed a wildlife physical profile for the Oliver-Mercer Planning Units. These sources, as well as Woodward-Clyde (1975), provide species lists which may be extrapolated to infer species occurrence of amphibians and reptiles in the Underwood vicinity. No endangered or threatened aquatic amphibians or reptiles are known to occur in this area.

Waterfowl is by far the most abundant category of major wildlife on the wetlands habitat overlying the federal coal of this lease application. The Underwood area lies on the western edge of the immensely productive prairie pothole region, which is known for its vast waterfowl breeding grounds. This area lies in the central flyway for waterfowl migration. According to the U.S. Fish and Wildlife Service 15 species of ducks commonly nest in the prairie pothole region. The North Dakota Game and Fish Department identifies the Coteau region as having a high duck value in their 5-Year Plan for Wildlife Habitat Development - Maintenance (Enyeart, 1975). The NGPRP also identifies the Coteau region as an excellent waterfowl area in its regional profile (NGPRP, 1974). The U.S. Fish and Wildlife Service has compiled a checklist of birds found on the Audubon National Wildlife Refuge, approximately 9 miles north of Underwood (FWS, 1968). Numerous shorebirds and aquatic feeding birds are found in this area and are quite likely to be found in the Underwood vicinity. Stewart and Kantrud (1972) considered the Coteau slope stratum as a relatively important region of the state for all birds based on the relative overall use. The whooping crane, an endangered species, is known to frequent the Audobon National Wildlife Refuge north of Underwood. Whooping Crane use of the subject coal lease area is undetermined although this area lies along their annual migration route.

Bailey (1926), Genoways and Jones (1972), and Montgomery (1975a) indicate mammal distribution throughout the North Dakota entirety, southwestern North Dakota, and Oliver-Mercer County, respectively. Much of this information can be extrapolated for the Underwood vicinity. Several species of furbearers occur in the wetlands habitats (i.e., Class III - seasonal ponds) of the subject coal lease application. Adams (1961) discusses the distribution and ecology of the furbearers in this area (mink, raccoon, muskrat, long-tailed weasel, short-tailed weasel, striped skunk, red fox). Many of the furbearers are found in wetland habitat.

In their 5-Year Plan for wildlife habitat, the North Dakota Game and Fish Department (Enyeart, 1975) indicates high value whitetail deer habitat in some of the rougher, lightly grazed areas. Some of the larger sloughs in the Underwood vicinity would fall in this category.

4. Animals (Terrestrial)

Montomery (1975b) has outlined a wildlife habitat component identification and delineation system for use on terrestrial environs in southwestern North Dakota. Although this system was keyed for use with color infrared photography in a different physiographic region, it should be reasonably applicable for the Underwood-Falkirk vicinity (Appendix 6).

The overall physiographic aspect of the Underwood vicinity is dominated by relatively flat to rolling uplands used for agricultural purposes (small grain, flax farming, haylands) containing small reminants of native rangeland, bissecting brushland coulees, and wet meadows and sloughs.

Woodward-Clyde (1975) discuss the occurrence, relative abundance, and distribution of terrestrial amphibians and reptiles near Beulah in Mercer County. The most commonly observed terrestrial reptile during their studies was the plains garter snake (Thamnophis radix). During a field examination of the surface overlying the federal coal of this lease application, plains garter snakes were commonly observed. No critical habitat for these animals was thought to occur on the surface over federal coal. No threatened or endangered amphibian or reptile species are thought to occur on these areas.

Terrestrial bird life expected in the Underwood vicinity may be extrapolated from Stewart and Kantrud's North Dakota breeding bird population estimates (Stewart and Kantrud, 1972). Additionally, bird life occurrence in this area may be interpolated from FWS's checklist of birds found on the Audobon National Wildlife Refuge (Appendix 6), the BLM's Mercer-Oliver Unit Resource Analysis (URA) (Montgomery, 1975a), and the Ang Coal Gasification Project environmental analysis (Woodward-Clyde, 1975). A brief discussion of habitat preference for most bird groups is presented in the Ang project report.

A few bird species of major economic and recreational significance may be found in the Underwood vicinity. Enyeart (1975) indicates medium to low sharptail grouse populations and habitat throughout District V of the North Dakota Game and Fish Department. The only sizeable blocks of native grassland and brushlands (sharptail habitat) directly involved in this coal lease occur in Sections 6, 24, 34 (T. 146 N., R. 82 W.), and Section 30 (T. 146 N., R. 81 W.), and constitute less than 160 acres total. Hungarian partridge occur in this area, however, their populations are identified as being of medium to low value by the North Dakota Game and Fish Department

(Enyeart, 1975). Sections 30 (T. 146 N., R. 81 W.), 2, 6, and possibly 24 (T. 146 N., R. 82 W.) are the only lands overlying the subject federal coal that meet prime "hun" habitat criteria. Pheasant population values for District V of the North Dakota Game and Fish Department are rated as being low to medium with the higher populations occurring along major rivers and streams (Enyeart, 1975). The only significant blocks of land meeting pheasant habitat criteria overlying the subject federal coal occur in Sections 2, 6, 24 (T. 146 N., R. 82 W.), and 30 (T. 146 N., R. 81 W.). A wild turkey population presently inhabits the Missouri River bottom west of Underwood (Jacobsen, 1963). It is conceivable that these birds could occasionally frequent the Underwood vicinity, although it is doubtful that any resident birds occur there. Only Section 24 (T. 146 N., R. 82 W.) and the surrounding private lands would appear to provide a turkey habitat complex.

Woodward-Clyde (1975) discuss the status of endangered and threatened bird species in the Beulah vicinity of Mercer County. No site-specific information on endangered and threatened species exists for the Falkirk mining area, but, the Ang project information and the BLM, Mercer-Oliver URA material (Montgomery, 1975a) are probably applicable.

The peregrine falcon (an endangered species) is observed occasionally during migration in western North Dakota.

Bailey (1926), Genoways and Jones (1972), and Montgomery (1975a) discuss the distribution of mammals in the North Dakota entirety, southwestern North Dakota, and Mercer-Oliver Counties, respectively. Some species, due to their economic and recreational importance, have been given extra consideration. Adams (1961) indicates that long-tailed weasels, striped skunks, red foxes, coyote, white-tailed jackrabbit, and possibly badgers and bobcats may range into McLean County. No specific data of these animals over the subject federal coal lands are immediately available.

The only known endangered mammal species that could feasibly be found in the Underwood vicinity is the black-footed ferret. Since no prairie dog towns were identified in this area, and since black-footed ferrets are associated with prairie dogs, it seems very unlikely that black-footed ferrets could be found in the Underwood vicinity (Grondahl, 1973). Woodward-Clyde (1975) discusses the species-habitat relationships of many of the mammals of this region. Leppart (1975), in the State Comprehensive Outdoor Recreation Plan (SCORP) draft, also indicates this area as having a good value for tree squirrels (both eastern gray and eastern fox). Mule deer are probably not residents of the Underwood vicinity, although an occasional observation may be recorded there. Mule deer are typically found in less intensively farmed regions. White-tailed deer are the most prevalent big game animal in the Underwood vicinity, although intensive agricultural practices have depleted much of the prime white-tail habitat in this area. The only noteworthy white-tail habitat on the surface lands overlying the subject federal coal appears to be in Sections 2, 6, 24, and 34 (T. 146 N., R. 82 W.). Enyeart (1975) indicates that pronghorn antelope may be found throughout District V of the North Dakota Game and Fish Department although values for populations and habitat are generally considered low. None of the lands overlying the subject federal coal could be considered "typical" antelope habitat.

## C. Ecological Interrelationships

### 1. Unique Ecosystems-Environmentally Sensitive Areas

Woodward-Clyde (1975) defines a unique biotic community ". . . as one which is extremely limited in extent or occurrence and/or possess attributes of special academic interest". Using this definition, none of the lands affected by this federal coal lease application appear to be "unique". Both the floral and faunal communities found here are well exhibited throughout the physiographic region and do not possess any particular known academic significance. Section 24 (T. 146 N., R. 82 W.) may hold potential academic interest as a peripheral area, if Coal Lake slough is developed as a mitigation area for the Garrison diversion project.

Due to their specific site requirements, areas of natural woody vegetation and wetland sloughs may be considered as environmentally sensitive areas. These areas also provide a certain degree of biological diversity within the biome. The only areas of meaningful quantities of native rangeland and natural woody vegetation occur in Sections 6, 24, and 34 (T. 146 N., R. 82 W.). The only significant wetlands over the subject federal coal occur on Sections 2 and 6 (T. 146 N., R. 82 W.), and Section 24 (T. 146 N., R. 83 W.). The overall sensitivity of these areas is related to a steady supply of available moisture and reasonable protection from surface disturbance (NGPRP, 1974).

2. Succession-Climax-Limiting Factors

Since most of this vicinity is under an agricultural land use, natural succession is indefinitely suspended at an early seral stage. What little native rangeland does exist in this area is well grazed by livestock and, therefore, is held at varying degrees of a disclimax state of succession. This area lies in the 15"-16" precipitation zone and belongs to the wheatgrass-needlegrass (Agropyron-Stipa) biome (Küchler, 1964) of the mid-grass prairie vegetation formation. The principle limiting factor in this area is available moisture for plant growth. Additionally, the man-caused, land use practices are also limiting to native vegetation and wildlife due to the disturbance factor. NGPRP (1974) indicates this region to have relatively good rehabilitative potential following surface land disturbance.

3. Community-Food Relationships

Approximately 81% of the lease area within the coal outcrop line is overlain with cropland. The remaining acreage is primarily native grassland. The Underwood vicinity exhibits relatively little community diversity. Due to this relative lack of diversity, natural vegetation and wildlife habitats are limited and some natural ecological niches remain unfilled. Some of these niches are filled, or replaced, by agricultural plantings and species introductions. Dispersion and distribution of all these communities is relatively well mixed. The natural food chain relationships in the vicinity remain relatively well represented at all trophic levels, with the possible exception of large herbivores and large carnivores. Large carnivores remain scarce, however, large native herbivores have been replaced by domestic livestock in most cases. Natural nutrient cycles are very likely altered through fertilization of croplands for agricultural production.

D. Human Values

1. Aesthetics

Aesthetics, as used in this analysis, concerns the overall appearance of the landscape as perceived through the senses of sight, sound, smell, taste, and touch. Since 87% of man's perception is based on sight, major emphasis will be focused on visual resources. Taste and touch are too insignificant to warrant consideration.

a. Visual Resources

The lands involved in the proposed lease area consists of gently rolling hills weakly dissected by small intermittent drainages. Small sloughs and "potholes" are scattered throughout. Most of these dry up during the summer but generally create patches of green vegetation which provides a pleasant contrast with the yellows and browns of the grainfields and native grasses in late summer. Permanent water bodies of note are Weller Slough and Coal Lake. The water and associated vegetation provides a pleasant visual contrast with the surrounding landscape. They also provide habitat for large numbers of waterfowl and shorebirds which are the major wildlife portion of the visual resource.

The majority of the land surface is devoted to agriculture. Major crops are wheat, flax, hay, and native pasture. The overall impression is similar to a giant "crazy" quilt pattern when viewed from the air. Farming practices create a more or less repetitious pattern of alternating fields of grain and summer fallow broken at random intervals by tracts of native range and hay fields. The rectangular geometric pattern created by the roads around nearly every section is broken by the small circular potholes and sloughs randomly scattered through the area.

The relatively flat nature of the topography tends to increase the visual effect of anything erected above ground. Buildings, powerlines, trees planted for windbreaks, etc. become strong, visually dominent, focal features. They have an advantage, however, in providing a sense of scale, or proportion, to what would otherwise appear to be a vast, never ending, array of grain fields reaching out to the horizon.

The net result is a chaotic landscape strongly dominated by the artificial form element resulting from agricultural practices and roads. This conflicts with the free-flowing, smooth textured, and relatively formless nature of the topography.

The scenic values of the mining area were qualitively rated according to procedures contained in BLM Manual 6111. This involves rating various elements of homogenous areas in order to obtain a numerical score. The possible scores range from 1 to 24. After the numerical score is obtained, the rated areas are grouped into the following classes:

1. Class A (15-24 pts.) Excellent or outstanding scenic values.

2. Class B (10-14 pts.) Moderate (above average) scenic values.

3. Class C (1-9 pts.) Low (common or average) scenic values.

A copy of the rating scenic criteria and rating charts are attached (Appendix 7).

The mining area was divided into three units and independently rated for their scenic value by two individuals. These three units were Weller Slough, Coal Lake Coulee, and the remainder of the area.

Weller Slough and Coal Lake Coulee received a score of 9 (Class C) by both raters. Scenic elements which received a moderate or high rating included water, vegetation, and color.

The remaining area received scenic ratings of 6 and 7. All scenic elements scored low except intrusions which received a moderate rating. All of the federal coal lands fall in this category.

b. Noise and Odors

There are no significant, identified noise or odors in the mining area which can be considered offensive or annoying, presently. There is some increased noise from construction operations at the power plant site south of the mined area, but this is noticeable only in the immediate plant vicinity. All other noises and odors are at a low level. They are associated with the agricultural practices.

2. Socio-Cultural Interests

a. Cultural Values

1.) Historical and Archeological Summary

The Buchfink archeological site, occupied about 1100 A.D., near Stanton, in Mercer County, represents the earliest demonstrable human occupation in the general vicinity of the mining area (U.S., National Park Service (NPS). At the time of white contact, the region around the mouth of Knife River was occupied by Hidatsa earth-lodge villages. These, and similar village dwellers of the Mandan and Arikara further south, apparently subsisted on an agricultural base supplemented by some bison hunting. They also apparently served as important intermediaries in trade between the French and English based in Quebec and other Canadian points (Lehmer, 1971). The Crow Tribe of Montana are descendents of Hidatsas who became nomadic hunters upon acquisition of the horse. During the late 1700's, or early 1800's, the Sioux migrated through the region from their ancestral home in Minnesota. After being decimated by disease, presumably smallpox, the remaining Hidatsa and some Mandans consolidated into a single group and, in 1845, moved to the Fort Berthold area. They were later joined by the remaining Mandans and Arikaras.

The fur trade, a major source of contact between Europeans and Indians in the early historic period, had a profound influence on the Indian way-of-life and on the subsequent settlement of the area by whites (Leppart, 1975). The original fur trade centers were far to the north and east. The traffic in goods was diffused with many groups or tribes acting as middle men at various stages. Efforts to expand trade centers west led to the first recorded white visit to the area. Pierre Gaultier de Varennes, Sieur de la Verendrye, reached the Missouri River in McLean County in 1738. Shortly thereafter various "tenant traders" began to move into the Indian villages. Characteristic of these were Toussaint Charbonneau, the husband of Sacajawea, and Rene Jessaume who joined the Lewis and Clark Expedition from the Knife River Hidatsa Villages. Upon the return of the Lewis and Clark expedition, St. Louis became the focal point of fur trade activities. The Missouri River became a major travel route (Lehmer, 1971). Organized companies established substantial posts such as Fort Union (1829) and Fort Clark (1831). These forts provided facilities for such men as George Catlin (1832) whose art and writings later influenced the decisions of many prospective settlers (Leppart, 1975).

The demise of the Knife River Hidatsa and concurrent reduction in the fur trade created a relatively stagnant period in the area. The outbreak of war with the Minnesota Sioux in 1862, resulted in military expeditions, led by Generals Sibley (1863) and Sully (1863-65), to North Dakota. Several forts including Fort Stevenson (1867) were established to protect settlers and gold miners traveling to Montana.

The defeat of the Plains Indians in 1876 and railroad expansion westward led to settlement of eastern North Dakota by whites during the period of 1878-1886. Economic reversals and inclement weather created a depression and halted settlement efforts until 1898. Major settlement of western North Dakota occurred between 1898 and 1918 (Leppart, 1975). The majority of the settlers were 19th century European immigrants recruited through the efforts of American railroad and land company recruiting efforts in Europe. This led to block settlement patterns by distinct ethnic groups. The dominant group in McLean County and vicinity are descendents of the original German-Russian immigrants.

Since settlement by whites, agriculture has been the mainstay of the local economy and subject to its periodic fluctuations. The only significant alteration, or input, to the economy of McLean County resulted from the construction of Garrison Dam between 1946 and 1953. Since 1950, McLean County's population has been on a steady decline as a result of a trend toward larger farms and a concurrent decline in local service and trade industries.

2.) Known Archeological, Historical, and Paleontological Values

The North Dakota State Historical Society was contacted regarding archeological and historical values in the mining area. The Historical Society found archaeological sites containing stone circles, rock cairns, and burial mounds adjacent to the mine area during a 1975 survey.

In conjunction with a preliminary environmental assessment of the nearby UPA-CPA power plant, Dr. Lawrence Loendorf, University of North Dakota, conducted a literature search and scanned aerial photographs for possible detection of archeological sites. Loendorf indicated that a field reconnaisance is needed to fully assess archaeological values. The types of sites which may be encountered include house depressions, linear mounds, tepee rings, and boulder effigies (animal forms).

With the exception of historic coal mines, there are no known features of historical interest in the area. The stage route from Bismarck to Fort Berthold passed through the general area, but its exact route is unknown at the present time.

There are no known areas with paleontological values. The mining area is underlain by the Fort Union Formation which is known to contain significant fossil deposits in other areas. The mining area lies approximately on the southern terminus of the late pleistocene glacial advances. This creates a possibility that pleistocene faunal remains may be present.

b. Social Welfare

1.) Recreation

The proposed mining area does not contain any developed recreation sites. The major form of recreation use is probably hunting of waterfowl, deer, and upland game. The estimated hunting use (summarized in Table 1, Appendix 7) in McLean County is 41,473 user days (1 person participating for any part of one day). This use data was extrapolated from various harvest data reports of the North Dakota Fish and Game Department.

The mining area receives an estimated 456 user days. The presence of many game management areas associated with Garrison Reservoir, extremes of habitat types (riverbottom hardwoods and upland grain farms) within management units, and lack of specific data from the area in question, make these figures statistically questionable. At best, it is only a reasonable estimate of the maximum existing use.

Developed recreation sites associated with Garrison Reservoir provide a considerable amount of public outdoor recreation use opportunities in close proximity to the proposed mining area. Those recreation areas within McLean County are within one hour's driving time and can be considered available for day use. These areas, available facilities, opportunities available, and present use (where available) are summarized in Tables 2 and 3 (Appendix 7). Other areas in Oliver and Mercer Counties are summarized in Tables 4 and 5 (Appendix 7).

It is recognized that the recreation and game management areas associated with Garrison Reservoir provide destination areas for significant numbers of non-local users. No effort has been made to determine what portion of the total use is non-local.

No attempt was made to determine the availability of indoor recreation facilities such as bowling alleys and theaters. Outdoor sports facilities (i.e., baseball fields, golf courses, etc.) are included in Table 2 (Appendix 7).

2.) Economics

McLean County is a part of the Minot region as delineated by the Regional Economics Division of the Bureau of Economic Analysis (BEA), U.S. Department of Commerce. The Minot region of North Dakota is one of 173 regions in the United States. Each region centers on a standard metropolitan statistical area (SMSA). The Minot region contains those counties clustered around and influenced by Minot. Since data is standard by counties, the regions are defined along county boundaries. This is not to say that portions of McLean County are not influenced by Bismarck; in fact they are. Portions of the county are closer to Bismarck than to Minot, including the mine area. Due to the availability of information on the region, however, discussion of the economic environment will be limited to the Minot region, and where possible, McLean County itself.

Any region has two related economic activities. One is the industry, or group of industries, in which a region specializes and whose output is exported to other regions. These are called export-base or basic industries. They supply the region with the income necessary to purchase the exports of other regions. The second group of industries is supportive. This group produces goods and services for consumption by local residencies as well as raw and semi-finished materials and services needed by the region's export-base industries. These local, or residentiary, industries are functionally related to the export-base industry by their dependence on the size and vitality of the export section (Regional Economics Division, BEA).

At this time the base industries in McLean County are agriculture, the Federal Government, and, to a limited degree, mining (including oil and gas) and manufacturing. Within the Minot region the Federal Government plays a somewhat larger role due to the Air Force base near Minot. There is some mining, primarily oil and gas, and limited manufacturing. A breakdown of percentage of earnings by industry is shown below for 1929 and 1969 for the Minot Region.

Table 3. Industrial Category Earnings in the Minot Region - 1929 and 1969

| Industry | Percent of Total Earnings | |
|---|---|---|
| | 1929 | 1969 |
| Agriculture | 43.1 | 28.7 |
| Mining | .7 | 2.8 |
| Manufacturing | 2.0 | 3.3 |
| Armed Forces | .1 | 9.9 |
| Total Basic | 45.9 | 44.7 |
| Total Residentiary | 54.1 | 55.3 |
| Total All-Industry | 100.0 | 100.0 |

The industrial earnings shown above reflect 78% of the region's total personal income. It is the sum of wages, salaries, proprietors' income, and other labor income. It does not include other sources of income such as returns on bonds, transfer payments, and similar monies.

Both years show that agriculture is the dominant export-base industry. Agriculture is a lagging industry nationally. Although it's a somewhat faster growing industry statewide than nationally, it's growth is still slower than most other industries. Each of the region's other industries has grown at a much faster rate. As a consequence, their relative increase, and agriculture's relative decline, as percentages of the region's total earnings is evident (Regional Economic Division, BEA).

Slow relative growth of agriculture and other basic industries in this region caused the residentiary industries to grow more slowly than similar industries elsewhere. However, residentiary industries have still grown faster than basic industries. This growth rate is attributed to a national trend of faster residentiary growth relative to other industries.

Projections of future growth indicate that the region's present basic industries will be at below average rates following the national trend. Residentiary industries, follow the growth pattern of basic industries but, considering increased productivity, are expected to grow more rapidly than basic industries. Residentiary growth in this region will be less rapid than residentiary industries elsewhere (Regional Economics Division, BEA).

Population, jobs, and income, are all tied together. McLean County shows a decrease in population since 1930. In that year the population was 17,991 people. As of 1970, the population stood at 11,251 people (BLM, 1975). This reflects a long term out migration of people, which is typical of most agricultural areas. Data for the last ten years indicate that, of those people leaving McLean County, 70.3% were between the ages of 20-24 years old (Gustafson and Cohan, 1974). This is generally attributed to lack of job opportunity. It can also be tied to more productive farming methods, improved transportation, and the nature of the people in this age group. Most people in this age group are just beginning their own lives and families and are normally highly mobile. In order for an area to retain its young people it must be economically attractive.

Median family income is a measure of the economic status of an area. In 1970, the median family income was $9,590 nationally. In North Dakota, it was $7,838. In McLean County, it was $7,106. The per capita personal income in 1970 in McLean County was $2,769, which is 84% of the national average (BLM, 1975). It's hard for an area to keep its young people when they can move readily to areas where higher wages are demanded and received. Those that stay receive compensation in a form other than income for remaining.

Another indicator of annual income, and an indication of distribution of wealth, is the percent of people in a county that receive incomes below the official poverty level. In 1970, 17.9% of the McLean County families received incomes below the poverty level while 8% of the families had incomes in excess of $15,000. "Poverty levels vary by several factors. For example, the level in 1969 for an unrelated female living on a farm and over 65 in age was $1,487. The level for a male-headed household not living on a farm with seven or more persons was $6,116. The average poverty level established, for a male-headed household with four persons not living on a farm, was $3,745 in 1969" (BLM, 1975).

The following chart was prepared to illustrate the employment and economic picture of McLean County in 1970. It shows the number of people and the various industries that employ them (BLM, 1975).

Table 4. Employment Statistics for McLean County in 1970

| Type of Employment | Number of People Employed |
|---|---|
| Wage and Salary Employment | 2,644 |
| Farm Employment (Proprietors, Wage and Salary) | 1,817 |
| Manufacturing Employment | 40 |
| All Government Employment | 1,016 |
| Mining Employment | 32 |
| Construction Employment | 189 |
| Transportation, Communication and Public Utilities | 82 |
| Finance, Insurance, and Real Estate Employment | 42 |
| Services and Other Employment* | 528 |
| Trade Employment* | 482 |

* Does not include proprietors.

This table reflects most of the important categories of workers, but does not mention the number of unemployed. According to the North Dakota Employment Security Division, the average annual unemployment rate for McLean County varied from 8.7% to 8.1% from 1972 to 1974. This amounts to about 350 wage and salary employees.

The economic position of McLean County is not unique. Most regions of the country that have a single, non-growing basic export industry are in the same position. The fact that agriculture is vital assures it will be a continuing source of income to the people of the area. Unless the industry's growth rate increases substantially, however, the area will lag behind other areas of the United States.

3.) Present Mine Area Agricultural Land Status

The following acreages were computed with the aid of aerial photographs and soils maps supplied by the SCS and North American Coal Company. These acreages can vary according to peripheral coal which may be available for mining. Acreages were rounded to the nearest hundred acres.

Table 5. Land Status Overlying Coal in the Falkirk Lease Area

| | | |
|---|---|---|
| Total Acreage Within Coal Line: | | 21,100 ac. |
| Cropland | 17,000 ac. | 81% |
| Wetlands | 900 ac. | 4% |
| Native Range | 2,900 ac. | 14% |
| Homesites | 300 ac. | 1% |
| | 21,100 ac. | 100% |

The proposed lease area includes approximately 28,000 to 29,000 acres. This allows for any peripheral coal, spoiling area, and a buffer zone.

c. Attitudes and Expectations

It is felt that the attitudes of the local people are typical of any community faced with new development. You have a few people on both ends of the spectrum either strongly for or against the project and the majority of the people in the middle are concerned, but less vocal until directly affected by an impact. The level of public interest seems to be relatively high, however, it is directed at the development as a whole (i.e., power generating plant, transmission line, coal mine, etc.) rather than at the lease of the specific federal coal in this application.

The impact of construction has been felt by the surrounding communities ever since the start of the Garrison Dam. Since then, there has been the missile site and power line construction, and now the coal development. Each development has caused a temporary influx of people with different attitudes and values. The influx in each case has been temporary. The basic attitudes of the residents have remained that of a self dependent people who are close to the land. However, the businessmen in the small communities have come to rely on the income generated by various temporary projects.

## III. ANALYSIS OF PROPOSED ACTION AND ALTERNATIVES

### A. Environmental Impacts

Several constraints and limitations were necessary to formulate and conduct a comprehensive impact analysis.

For the purpose of this analysis, short term impacts were defined as those resulting from initial on-site project activities up to and including 5 successive years from any point in time. Long term impacts were those extending beyond this initial 5 year period.

The impact analysis ratings varied in relation to the resource being analyzed. For instance: one impact rating on aesthetics is warranted if strip mine spoils are viewed from within a mine by a mining engineer while a different perspective and impact rating might be assigned to the same spoils banks when viewed from the air by a landscape architect. Likewise, impact ratings for wildlife may vary from highly beneficial to strongly detrimental for the same operation depending upon the season of year and/or environmental protection measures incorporated in the project. All impact ratings are ordinal in nature and not absolute in quantitative value. The impacts assessed in this analysis are "anticipated", or prospective in nature since the action has not yet taken place. Therefore, no detailed quantitative impact analysis data presently exists for this site.

The relative area size considered in the analysis depended on the time period of impact. As proposed, the mine is expected to disturb approximately 400 surface acres per year when operating at full capacity. Although reclamation will follow mining as soon as possible, it is anticipated that roughly 1200 acres will be in a disturbed, unreclaimed state at any one time. Over the short term (5 year) period approximately 2000 acres will be disturbed and part of this acreage will be reclaimed. For the sake of long term impact rating assignments, the entire present mine leased area (approximately 28,000 acres) was considered.

For this analysis, three implementation stages were analysed. The impact ratings for the proposed action and the alternative during two of these stages (mine site preparation and reclamation) were considered functionally and effectually the same whether federal coal was leased, or not. That is, mine site preparation and reclamation will take place regardless of BLM action. Therefore, the "no action alternative" and the "proposed action" were analysed as one during these implementation stages. During the third implementation stage (mining operation) the impacts of mining federal coal were considered separately from other coal mining impacts for analysis purposes. Each implementation stage and discrete operation was considered independently during the analysis and no mitigating measures, other than those inherently required by law, were included in consideration of the anticipated environmental impacts.

Usually, the present environment would be considered neutral, and any movement from neutral would be assigned a positive or negative value. For the purposes of this analysis, this is the case during the site preparation and mining stages. The condition following mining (prior to beginning reclamation) is considered neutral again. Therefore, the positive or negative trend of reclamation is expressed in relation to the last condition (neutrality). Thus, the analysis does not evaluate whether the environment is returned to its original per-mined condition.

Appendix 8 contains the analysis work sheets which were used to rate the expected impacts in terms of magnitude and direction (beneficial or adverse). The ratings (Low, Medium, High, or insignificant) are ordinal in nature, and based on a consensus of the specialists preparing the document.

1. Anticipated Impacts

a. Non-Living Components

1.) Air

a.) Mine Site Preparation

Each discrete operation (survey, road construction, and facilities construction) will produce short term impacts, in that there will be a slight increase in particulate matter. The dust will disperse rapidly. No long term impact is expected. The overall rating was considered a short term insignificant negative impact.

Exhaust emissions during the survey operation will result in a short term insignificant negative impact. The only source would be light vehicle operation, and this would be a limited increase over the existing level of vehicle use in the area.

In road and facility construction it can be expected that there will be a larger increase in exhaust emissions. Heavy and light internal combustion powered equipment will be used in both discrete operations. This activity will be at a considerably higher level than normal. The emissions will disperse rapidly and will only be significant close to the machinery. Consequently, this was given a negative low impact for the short term.

b.) Mining Operation

No Action Alternative - Two discrete operations will result in long term negative low impacts due to increases in the particulate matter. Both the process of topsoil removal and stockpiling, as well as transportation, crushing and delivery of the coal, will be sources of increased fugitive dust. Both of these processes will be continuous for the life of the mine. During some periods of the year it will be more of a problem than at others. During adverse weather conditions (high winds) additional dust could cause the ambient air standards to be exceeded locally at the mine. The dust will disperse rapidly. A low negative impact is all that is justified as a consequence, since these operations must meet State air quality standards to continue.

Overburden removal, with spoil piling, and blasting with excavation, will also cause increased fugitive dust, but it is thought to be insignificant in magnitude.

All the discrete operations will result in an increase in exhaust emissions. Heavy equipment powered by gas or diesel engines, will cause local gas emission increases. This will result in a negative impact, but the magnitude is so low that it was deemed insignificant.

Proposed Action - Under the proposed action fugitive dust levels will not change, but if the federal coal is leased the amount of time that in which these increases will occur will be lenghtened. This impact was considered negative, but insignificant.

The same concept is advanced for exhaust emissions. The level will not change, just the length of time over which the impact will occur. The mine will be able to operate approximately two years longer if the coal is leased. This impact was considered negative, but insignificant in magnitude.

c.) Reclamation

Particulate matter will increase during all operations of the reclamation stage of implementation. The regrading and top-soiling operations will create most of the dust because of the disturbance by heavy equipment. These were rated as negative, low, long and short term impacts. These are on-going processes that will continue for the life of the mine. The impact from seeding the reclaimed land is expected to be insignificant in terms of additional dust.

Exhaust emissions will also increase. This is expected to result in an insignificant impact.

2.) Land

a.) Soils

i. Mine Site Preparation

Survey operations will have little or no affect on soil depth, structure, nutrients, or erosion in the short run or long run. Level to gently rolling topography and well drained soils are suited to surveying activities.

Road and facility construction activities will have a negative, but minor, affect on soil depth, nutrients, and erosion as they expose the soil to potential water and wind erosion. Operations to remove and stockpile the topsoil from the road right-of-way will destroy the soils natural structure, however, compared to the entire mining area, the impact is minor. Impacts of these activities are negative, but low for both the short and long run.

The topography and soils are generally well suited to road and facilities construction. In some areas, rocks or boulders may cause problems in topsoil removal or road and facilities construction.

ii. Mining Operations

<u>No Action Alternative</u>: Topsoil removal and Stockpiling operations will have some affect on soil depth. In some areas 5 feet of soil material will be removed and stockpiled and in other areas, where soils are shallower, less soil will be available for respreading. The result will probably be a more uniform depth of topsoil and subsoil than exists in the present natural state.

Operations to remove and stockpile the soil will result in virtually complete destruction of the soils material structure. This impact will be high and negative in both the short and long run. It will take many years for soil structure to develop again.

Soil nutrients will be negatively impacted by these operations, primarily by the destruction and mixing of organic matter and by the disruption and loss of soil micro and macro organisims.

Two potential natural soil pollutants are excess adsorbed sodium and excess calcium carbonate. Excess sodium is not expected to be a problem in these glacially derived soils unless high sodium overburden materials are mixed with the soils. Most of the soils in the area have highly calcareous subsoils, (e.g., Williams and Bowbells series). If these calcareous materials are ultimately placed on the surface, fertility problems could result. However, as the soils are to be removed in two separate lifts, this problem could be largely avoided by controlling the depth of each lift.

In the short run, erosion of the soil stockpiles by wind or water could be a problem until the piles are vegetated.

These impacts are considered to be negatively medium in the short run and low in the long run.

Overall, these soils present few problems to stripmining operations, since the soils and underlying materials are unconsolidated. Rocks and boulders will be a problem in topsoil and subsoil removal and stockpiling.

Overburden removal and spoil piling will have no impacts on soil depth, structure, nutrients, pollutants, or erosion in either the short or long run. The soft, unconsolidated sedimentary beds are well suited to excavation and piling.

Blasting and coal excavation will have no impacts on soil depth, structure, nutrients, pollutants, or erosion in either the short or long run. The relatively soft lignite beds are easily blasted and excavated.

Transportation, crushing, and delivery will have no impacts on soil depth, structure, nutrients, pollutants, or erosion in either the short or long run.

<u>Proposed Action</u>: The impacts and rationale are similar to the "No Action Alternative," with only slight additive impact magnitude values.

iii. Reclamation

Effects of regrading the spoil are variable in regard to soil depth, structure, nutrients, and erosion. Initial results of some research studies indicate that the methods of regrading spoils, and the time of year when the regrading takes place, can have a very great effect upon the erosion and stability characteristics of the regraded spoils, as well as the overlying soil materials (Groenewold, 1976). Regrading should, however, have a high direct and positive effect on material erosion from the spoil piles. It should greatly decrease erosion simply by reducing the slopes.

Except for the rocks and boulders, which may cause some handling difficulties, this material is well suited to regrading.

Of all the activities in the mining operations, topsoiling will have the greatest impact on soil depth. The amount of topsoil actually returned to the leveled spoil piles will depend directly on the amount removed and stockpiled during the mining operations. Where available, up to 5 feet of soil in 2 lifts will be removed, stockpiled, and returned to the regraded spoils. In this area at least 5 feet of soil and subsoil are generally available. However, in their natural state, some soils are deep and some are shallow; respreading the soil materials will probably have the effect of making soil depth much more uniform over the entire area by averaging the deep and shallow soils. Removing, stockpiling, and respreading the soil material will cause unavoidable mixing of the organic-matter, rich surface soil with the subsoil. This adverse action will be partly alleviated by removing the topsoil and subsoil in 2 lifts.

The operations necessary to remove, stockpile, and respread the soil materials will destroy the soil's natural structure thus decreasing water and air infiltration and root penetration.

Soil nutrients will be primarily affected by the mixing of the soil materials during handling operations. The majority of the soil's organic-matter is contained in the upper few inches of soil and will be mixed with whatever is removed during the first lift (e.g., parts of calcareous subsoils will be mixed with topsoil).

Initially, soil erosion will be higher than normal as these operations leave the soil bare and consequently susceptible to increased water and wind erosion. Erosion impacts will be negative in the short run and insignificant in the long run. These soils, except for occasional large rocks and boulders, are well suited to topsoiling operations.

Seeding will have an indirect, but beneficial effect on soil depth as roots, soil micro-organisims, and macro-organisims increase to their natural levels.

Soil structure will be directly affected by the seeding operation; a low positive impact in the short run and a high positive impact in the long run. It is not known exactly what causes structure to form in the soil, but it is known that organic-matter (plants, roots, micro- and macro-organisims) has a highly beneficial effect on it.

Seeding will directly affect soil nutrients in 2 ways: it will add organic matter to the soil as the plants die, decay, and are incorporated; and it is assumed that fertilizer will be added during seeding, thus enhancing the soil nutrients.

Seeding will produce a plant cover, increase water infiltration, and decrease soil susceptibility to erosion.

Again, except for a few rocks and boulders, the soil is well suited to seeding operations.

b.) Geologic Structure

i. Mine Site Preparation

The geologic structure is not expected to be impacted during this implementation stage.

ii. Mining Operations

No Action Alternative: Negative high impacts in the short and long term for overburden removal and blasting and coal extraction can be expected. Geologic structure from the top of the overburden to the base of coal will be completely disrupted during the mining operation.

Proposed Action: The mining of Federal coal reserves would disrupt approximately 1,000 additional acres of geologic structure. This is a very slight increase over the entire development. This action has been given an overall insignificant negative rating.

iii. Reclamation

The geologic structure is not expected to be impacted during this implementation stage.

c.) Land Use

i. Mine Site Preparation

The land use compatibility subcomponent of the environment will be uneffected by the survey operation. It will, however, receive negative low long and short term impacts in the road and facilities construction operation. On site, the impacts on land use compatibility (the manner with which the activity matches the adjacent land uses) will result in a high negative impact. When considered in relation to the magnitude of off site activities (including the construction of the coal generating plant) the impact of road and facilities construction at the mine site is low. This will be a long term impact in that the roads and facilities will be present for the duration of the mine operation.

ii. Mine Operation

No Action Alternative: The land use compatibility subcomponent will receive high negative long and short term impacts for two unrelated reasons. First, the topsoil removal and overburden removal will create a high negative impact in the short term because the activity will conflict directly with the current land use, which is farming. The second impact relates to not leasing the federal coal scattered through the mine area. If the federal coal is not mined, as advanced in the no action alternative, the land use will be highly noncompatible because it will make an efficient mining plan for the area as a whole, an impossibility. This would mean that the coal under each of the tracts would be left, and in all probability never mined. It would be uneconomical to go back to the site and mine only the isolated tracts of Federal coal after the private coal has been removed. The Federal coal, for all practical purposes, would be lost as a resource.

Transportation, crushing, and delivery of coal will have a relatively low negative impact. Impact on land use compatibility was rated as insignificant in both the long and short term.

Proposed Action: The lease of federal coal would create a highly favorable impact on the land use compatibility subcomponent of the environment. Lease of federal coal would allow the coal company to develop a mining plan for the entire area incorporating the most efficient methods into the plan. It would also mean that the federal coal would be used, and not lost, as a resource.

iii. Reclamation

The entire reclamation stage of implementation is expected to result in high positive impacts on land use compatibility. The entire stage is aimed at putting the mined area back into as good, or if possible, better condition than that preceeding the mining. The existing land use is largely agricultural. Reclamation in this area is expected to emphasis agriculture.

3.) Water

a.) Mine Site Preparation

Survey work throughout the mine site area will have little if any affect on the area's hydrology.

Road and facility construction in the mine site area will have an insignificant to a low negative impact on the area's hydrology depending on the material disturbed, the time of the year, and the length of time the area remains disturbed. Most affected will be the area's sediment load. Runoff will increase in the short run, but should decrease in the long run as the area stabilizes.

b.) Mining Operations

No Action Alternative: Topsoil Removal and Stockpiling operations will have only insignificant impacts on the area's hydrology. The hydrologic cycle, as a whole, will be affected somewhat by changes in runoff, interception, infiltration, and percolation. Coliform contamination in and adjacent to the mine area is unknown. However, it should be noted that the city of Underwood has its sewage ponds located in a major intermittent surface drain of the mine area. This location is the approximate center of the geologic island existing in the topography of the Fort Union Group. Here, piezometric surface maps (Moran and Groenewold, 1974) of the area indicate ground water movement is outward and downward.

Overburden removal and spoil piling operations will have similar affects as topsoil removal and stockpiling. During this phase of the operation, the hydrologic cycle will be further disturbed by changing ground water characteristics. Generally, existing aquifers will be eliminated. Sediment load will also be affected. Sediment load should increase, but only slightly if proper precautions are taken.

Blasting and coal excavation will have little additional affects on the area's hydrology. Again, one exception might be the hydrologic cycle. Generally, the coal to be removed is the confining material of ground water aquifers in the area. The effects of removing the coal, as related to ground water may be predicted, according to some sources (Groenewold, 1976).

Transportation, crushing, and delivery operations will have no impact on the area's hydrology.

Proposed Action: The impacts and rationale are similar to the "No Action Alternatives," with only slight additive impact magnitude values.

c.) Reclamation

Reclamation of the area after mining will have positive effects in both the short and long run.

Regrading, topsoiling, and seeding will all affect the hydrology of the mine area in about the same way. Generally, with reclamation, runoff should be decreased and infiltration increased. Some surface and ground water could, however, be adversely affected with changing pH values. As soil nutrients are applied, pH values can change, but to what extent and for how long is unknown.

b. Living Components

1.) Plants (aquatic)

a.) Mine Site Preparation

The activities and impacts of this stage of implementation will occur, whether federal coal is leased or not. No environmental impact is expected during the survey stage of operations.

During road and facility construction minor detrimental impacts are expected. These will be both short and long term. All topsoil will be removed from the proposed roads and facility site. Soil erosion from these sites is expected to have the major impact on wetlands and their vegetation. The floor of most shallow wetland areas have rooted vegetation. Any soil erosion can wash material into adjoining wetlands, thus speeding up succession and permanently destroying the wetland and associated vegetation. This impact will be high at any one specific site, but low in relation to the entire project.

b.) Mining Operations

No Action Alternative: It is during this stage that the greatest detrimental effects to plants will occur. Topsoil removal will completely destroy any wetland and its associated vegetation types. The removal of the overburden will compound the action by destroying the topsoil base and topography. The removal of topsoil was rated as medium negative in the short term and negative high in the long term. These ratings took into consideration; time, plant production, and the relationship of the area being disturbed to the total mine area.

The coal excavation and transportation operation will have no effect on the aquatic vegetation.

Proposed Action: Considering the small percentage of federal coal, any effect of mining this coal would be minimal on the total operation. The major soil and vegetative disturbance will occur with the mining of the private coal. The mining of the federal coal will add a low negative effect to the total operation.

c.) Reclamation

The anticipated impacts of the reclamation stage of implementation are the same for the proposed action and "No Action Alternative". Regrading the surface would have very little effect in the short term. In the long run it would have a high effect in that it creates the topography which will be left after the mining operation is finished. This topography will help determine what type of vegetation will grow on the site in the future.

Topsoiling is rated positive low in the short term and positive medium in the long term. Topsoil provides favorable media in which plants can grow. A good job of topsoiling will improve the chances of revegetation on the disturbed site. Seeding the area back to native upland species, or cereal grain crops, will not benefit wetlands and the associated vegetative types directly. The seeding of aquatic plants is not normally practiced.

2.) Plants (Terrestrial)

a.) Mine Site Preparation

The impacts of this stage of implementation will occur whether the BLM leases federal coal, or not. No impact is expected during the survey stage of this operation.

During road and facility construction minor detrimental impacts are expected. These will be both short and long term.

All topsoil on the roads and facility site will be removed. This will, in effect, destroy any plant life on that site. This impact will be high on any one specific site, but low in relation to the entire mining area.

b.) Mining Operations

No Action Alternative: It is during this stage that the greatest detrimental effects will occur. The removal of topsoil will completely destroy any terrestrial plants. Some seeds from the terrestrial plants will remain in the soil and will be available for regeneration. The removal of the overburden will compound the action by removing the topsoil base. Topsoil removal was rated a medium negative impact in the short term and a high negative impact in the long term. These ratings took into consideration; time span, plant production, and the relationship of the site being disturbed to the total mine area.

The coal excavation and transportation operations will have no effect on terrestrial plants.

Proposed Action: Given the small percentage of federal coal, any effect of mining this coal would be minimal on the total operation. The major soil and vegetative disturbance will occur with the mining of the private coal. The mining of the federal coal will add a low negative effect to the total operation.

c.) Reclamation

The anticipated impacts of the reclamation stage of implementation are the same for the proposed action and "No Action Alternative". Regrading the surface would have little effect in the short term, but a more significant effect in the long term. The topography created by regrading will have an effect on the plants which will grow on the site.

Topsoiling is rated positive low in the short term and positive medium in the long run. Topsoil provides media in which plants can grow. A good job of topsoiling will improve the chances of revegetation on the disturbed site. In the long run, topsoil is more important for grasses, shrubs and forbs than trees.

Seeding the suitable areas with native grasses mixed with forb and shrub seeds would be very beneficial in re-establishing the native plant communities.

3.) Aquatic Animals

a.) Mine Site Preparation

The activities and impacts of this implementation stage occur regardless of the lease of federal coal. No major environmental impacts are expected on aquatic animals during the operations of this stage. A minor detrimental impact is anticipated on waterfowl and shorebirds during the survey operation. Human disturbance during nesting periods is the principle causative factor. Due to their relative inabundance, and stability during disturbance, the remaining aquatic animal species are not expected to be significantly affected by survey operations.

During the road and facilities construction operations detrimental impacts of minor magnitude are expected in both the short and long run on all categories of aquatic animals. Any aquatic habitat crossed by roads or occupied by facilities will be completely obliterated. Although this impact would be high at any specific site, the small area affected in comparison to the entire mine area dictates an overall insignificant impact rating. A secondary impact of the road and facilities construction may be realized off-site by the degradation of aquatic habitat due to siltation and soil erosion from the construction area. This impact would likely be only short term, until exposed areas become revegetated and stabilized.

b.) Mining Operations

No Action Alternative: The major detrimental impacts on aquatic animals of the entire coal mine development occur during this implementation stage. These negative effects are realized through the total destruction or disruption of wetland habitats, and thereby, the elimination of aquatic wildlife. Included in this destruction would be 1,430 acres of habitat easement held by the FWS, of which 99 acres are wetlands. The topsoil removal operation was rated as a medium magnitude impact for the immediate mine site and high in magnitude when considering the entire mine area. It is felt the major impacts of the mining operation implementation stage will occur with the initial soil disturbance (topsoil removal and stockpiling operation) and be compounded by the overburden removal operation and resulting wetland basin destruction. Since no known significant fish populations occur in the area, the impacts on fish are expected to be negligible. The transportation, crushing, and delivery operation may have a very minor negative impact on aquatic animal populations due to the disturbance created by human activity. This impact is expected to affect only the larger animals to any noticeable degree.

Proposed Action: Since federal coal makes up only 3.5% of the entire mining area, the additive impact created by the mining of federal coal is expected to be negligible. However, if the federal coal is leased the wetlands upon which the FWS holds habitat easements will be destroyed. This constitutes approximately 320 acres under easement, of which approximately 50 acres are identified wetlands. These impacts were rated minor for all respective categories of aquatic animals as the "No Action Alternative".

c.) Reclamation

The anticipated impacts of the reclamation operations are the same for both the proposed action and "No Action Alternative". The regrading operations are expected to have very little impact on aquatic wildlife, overall. No impact is anticipated in the short run of this operation. The regrading of the entire mine area creates a desireable physiographic aspect for the wildlife community, although vegetative cover is necessary before actual habitation. Potholes and wetland basins could be formed, thereby, dictating a beneficial impact rating. Beneficial impact ratings of short term insignificant and long term low were assigned for the topsoiling and seeding operations. Topsoiling provides a plant growth substrate and seeding assures the reintroduction of vegetation around the wetlands. More land is affected in the long run, and thus, a higher impact rating is warranted. Eventually, any depressions in the land are likely to develop wetland habitats and the reclamation process is expected to speed this occurrence. The exact nature and degree of use of reclaimed wetlands is largely undetermined, since few of these areas have been created to date.

4.) Terrestrial Animals

a.) Mine Site Preparation

No measureable impacts on terrestrial animals are anticipated during the survey operations of this stage. During the road and facilities construction operations detrimental impacts of minor magnitude are expected in both the short and long run. As habitat surface area is disturbed or destroyed and replaced with roads or facilities, wildlife populations are depleted. Since the effected area, throughout the life of the mine, is relatively small only a minor impact rating was assigned. This impact occurs from the time of initial disturbance, continuous with the facility use. A short term negative impact was assigned to the road and facility construction operations as they affect man, the living being. This impact was assigned due to the possible safety hazard of the construction process.

b.) Mining Operations

No Action Alternative: The topsoil removal operation is expected to have a profound impact on terrestrial animals. Detrimental impact ratings of medium to high magnitude for the short and long term, respectively, were assigned. The removal of all habitat during these operations dictated these anticipated impact ratings. Since a larger area is effected in the long run, a higher relative impact rating was assigned. These impacts occur from the time of the initial disturbance throughout the life of the mine. These impacts are further compounded by the overburden removal operation, thus warranting a minor negative impact rating for both the short and long term of this operation. The activity and human disturbance of transportation, crushing, and delivery operations is expected to have a slight negative impact on terrestrial mammals. This impact could be expected throughout the life of the mine, thus warranting an impact rating in both the short and long run. A short run insignificant negative impact might be expected on man, as an animal, during all operations due to the safety hazards involved in mining.

Proposed Action: With federal coal making up only 3.5% of the mining area, the impacts resulting from the mining of federal coal are expected to be additive in effect and negligible in magnitude. These impacts were rated slight for all respective categories of terrestrial animals as the "No Action Alternative".

c.) Reclamation

The regrading operation is not expected to have any significant impact on most terrestrial animals. Some ungraded spoils banks, when naturally revegetated, provide good mechanical cover for deer. In this case, where regrading closely follows mining, little natural revegetation would have occurred prior, and the impacts are expected to be negligible. The topsoiling operations provide a valuable plant growth substrate and expedite revegetation. This impact was rated positive in both the short and long run with a greater rating magnitude in the long run due to the larger area effected. Soil invertebrates would be benefited more by the topsoiling operations than other terrestrial animals since their principle habitat is replaced with the soil. The seeding operation and resultant vegetation establishment has the most profound beneficial impact on terrestrial animals of any of the reclamation operations. The cover and food requirements of most terrestrial animal species will be returned with the proper vegetation complex and, thereby, deservè beneficial medium and high impact ratings for the short and long term, respectively. Soil invertebrates are less impacted by this operation than other terrestrial animals. A detrimental, short term impact on man may occur as a result of any safety or health hazard present during the reclamation operations.

c. Ecological Interrelationships

1.) Mine Site Preparation

The survey operations are not expected to measurably impact any of the ecological functions of the area. The road and facilities construction operations will destroy the on-site vegetation complex and occupy some areal surface. Succession is a continuing process and responds immediately to any set back or disturbance, therefore, the impact rating of these operations are of progressively decreasing magnitude and non-permanent. Since the area effected is relatively small, a detrimental impact rating of minor magnitude was assigned to the road and facilities construction stage in the short run. Long term impacts on ecological succession from these operations are expected to be of lesser magnitude, thus, a nominal impact rating was assigned. Food and community relationships are expected to be impacted in a similar and parallel fashion to succession, therefore, the same impact ratings were assigned these processes during the road and facilities construction operations.

2.) Mining Operations

No Action Alternative: The primary environmental impacts on the ecological processes during this implementation stage occur during topsoil and overburden removal. Since the majority of plants and animals are either directly or indirectly dependent on the topsoil, the removal and stockpiling of this material was rated as having a detrimental impact rating of medium in the short run and high in the long term. Because more area is affected in the long run, an impact rating of higher magnitude was assigned. Food and community relationships closely parallel the seral stage of the vegetation, and therefore, similar impact ratings were assigned as for the succession process. The overburden removal operation was rated as having a negative insignificant and low impact on all the ecological processes in the short and long run, respectively. These impacts were assigned due to the physiographic change resulting from the overburden removal and its resulting effect on succession. Since more area is affected in the long run, a greater impact rating was assigned for this time period. The excavation and transporation operations are expected to have no significant impact on the ecological processes.

Proposed Action: With federal coal making up only 3.5% of the mining area, the impact of mining federal coal is considered additive and negligible on ecological processes. These impacts were rated minor for all respective categories as the "No Action Alternative".

3.) Reclamation

The regrading operations of this stage are expected to have a beneficial impact on succession and are rated as insignificant and medium in the short and long run, respectively.

The regrading procedure improves the physiography by decreasing the slope and, thereby, allowing for greater water infiltration and less run-off. This situation is favorable for vegetation establishment and the successional process. Since more area is affected in the long term the impact ratings assigned were greater. Food and community relationships are not expected to be impacted by the regrading operations. The topsoiling operation is anticipated to have a favorable medium and high impact on the successional process in the short and long term, respectively. The replacement of topsoil is expected to speed the rate of revegetation by providing a more favorable plant growth material than raw spoils banks. Due to the extent of the area involved, topsoiling was given a higher impact rating on succession in the long term. Topsoiling alone does not assure revegetation, therefore, impact ratings of beneficial minor and low were assigned to the food and community relationships in the long and short term. The anticipated impact on these processes was not expected to be as great as for the succession process. The seeding operation was rated a beneficial low impact on succession in both the short and long term. In this area, natural succession is expected to be suspended by farming operations in most cases. The seeding mixture for reclamation is apt to be an agricultural mixture going light on native species. This situation bears very little resemblance to natural succession, with very early seral stages likely to be the only manifestation of this process. Without any reclamation, raw spoils banks will, in time, revegetate with native vegetation. Naturally revegetated orphan spoils are often in a desirable successional stage for many wild animals. In these cases, the entire reclamation process, and in particular, reseeding with a predominately agriculatural mixture is detrimental to the native plant and animal species. For these reasons, relatively low impact ratings were assigned the succession process in the reseeding operation. Once vegetation is established as a result of the seeding operation, a beneficial impact is anticipated on food and community relationships. Therefore, a beneficial medium and high impact rating was assigned to these processes during the seeding operation in both the short and long term. With vegetation establishment, the primary (autotrophic) level of the food chain is founded. With a generally monotypic agricultural emphasis in reclamation seeding, the food and community relationships may be relatively narrow or limited, but the seeding operation is favorable to both processes. Since more area is affected in the long run, a higher impact rating was assigned for this period.

d. Human Values

1.) Landscape Character

a.) Mine Site Preparation

Road construction activities will create an adverse short term impact of low magnitude. This impact will result from the sights and sounds of the construction activities which are out of character with the rural agricultural nature of the present landscape character.

Facilities construction will have an adverse impact of low magnitude which is both short and long term. The short term impacts are similar to those described for road construction. The long term impacts will result from the physical presence of the facilities which are out of character with the existing landscape.

b.) Mining Operations

No Action Alternative: Topsoil removal will have an adverse impact on the harmonious and accentuating elements. Short term impacts will be low and long term will be moderate. These magnitudes are based on the relative amounts of disturbance. Approximately 400 acres per year will be stripped and approximately 27,000 acres will ultimately be disturbed. The major factors involved are that the equipment used in this operation and the physical removal of the existing vegetation are not harmonious with the existing landscape character. The stripping does not significantly affect any existing accentuating features but it does create an artificial and undesireable feature.

Proposed Action: The impacts on landscape character resulting from the lease of federal coal is rated adverse and insignificant for both short and long terms. It should be noted that there was a difference of opinion among team members as to whether this should be an adverse or positive impact. One point of view is that mining the federal coal would be in harmony with the landscape created by the assumed mining of non-federal coal. The prevailing view is that it would create a slight additional negative impact.

c.) Reclamation

Regrading, topsoiling, and seeding operations will have an adverse short term impact of low magnitude on the harmonious element. This negative impact will largely result from the sound and noise created by the equipment involved.

The long term impacts will be positive and of high magnitude. Regrading will return the land to its approximate original shape. Topsoiling and seeding, if successful, will restore vegetative cover similar to present conditions.

These operations will have a favorable impact of low magnitude for both short and long term on the accentuating elements. They will, in effect, eliminate the undesireable accentuating features created by spoil piles, mine pits, and lack of vegetation.

2.) Socio-Cultural Interests

a.) Cultural Values

i. Mine Site Preparation

These operations will have a short term negative impact of moderate magnitude on the recreation resource. This impact will result from increased demands on the existing recreation opportunities. Employment associated with mine site preparation is estimated to be 100 in the peak years of 1977 and 1978. Assuming an average family size of 3.6 (Lewis and Clark-1805, 1975) this will result in a population increase of 360 people. If this population follows the same recreation use patterns as other North Dakotans, it will result in an increased demand of 16,276 user days. See Table 2 (Appendix 7) for a list of the activities used in making this estimate.

This amount of use may not appear very significant. To gain proper perspective it must be considered in relationship to the existing situation where existing demand is in excess of the available supply. This is particularly true for facility oriented activities.

ii. Mine Operations

No Action Alternative: The cumulative impacts of the various discrete operations associated with mining operations are adverse and have moderate and high magnitudes respectively for the short and long terms. The impacts are the same as for mine site preparations except that there will be 300 employees and last for approximately 30 years. The estimated increase in recreation use is 50,178 activity days per year.

Proposed Action: The impact of leasing federal coal on the recreation resource will be negligible. At most, it will result in a 2 year extension of mining operations.

iii. Reclamation

Reclamation will have an adverse insignificant short term impact and a positive insignificant long term impact. Short term impacts result from the small number of employees creating additional use. The reclamation procedures will result in lands which, in the long run, will be available for recreation use.

b.) Social Welfare

Whether the BLM leases federal coal or not will make little difference in the social welfare impacts that one might expect on the region. Additionally, it is difficult to isolate stages of implementation and identify impacts that one may expect by a given discrete operation. For this reason the following discussion of the economic impacts will address the whole mining operation and try to identify the related socio-economic impacts.

The North Dakota State Planning Divison has prepared some tentative figures reflecting peak employment projections for construction and operation of new coal conversion plants and coal mines in the Dunn-Mercer-Oliver-McLean County areas. All the figures are tentative and subject to change. The figures, however, were prepared in August of 1975 and therefore, should still be reasonable. These figures are reflected in the chart below for the Falkirk Mine.

Table 6. Employment Projects for the Falkirk Mine

| | Year | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 |
| Mine Construction | 20 | 50 | 100 | 100 | 80 | 20 | | | |
| Mine Operation | | | | 100 | 200 | 300 | 300 | 300 | 300 |

Beyond the year 1981 it is projected that it will take 300 persons to continue to operate the mine for the life of the facility. This will make mining one of the most significant types of employment within the county. It will also make minerals extraction a vastly expanded export-base or basic industry, along with agriculture. By expanding the export-base industry an additional supportive group of industries will be created or expanded to support the basic industry. There will also be some indirect effects of export-base industry expansion. There will be an increase in the personal income of the residents of the area employed by the supportive industries linked to the mining activity. This increase will stimulate more demand for goods and services, and also give further incentive for expansion in these activities.

From Appendix 5 it is estimated that the annual dollar value of the agricultural lands taken out of production due to the mine is $93,240.00. This agricultural income is lost to the surrounding community but is offset by the additional income brought in to the community by the mine.

As an example, if the mine employs 230 people at an average wage of $6.50/hr. the following income can be estimated:

$6.50/hr. X 40 hrs. = $ 260 weekly wage
$260.00/wk. X 52 wks. = $13,520 yearly wage
$13,520.00/yr. X 230 employees = $3,109,600.00 Total Wages.

3,109,600.00
\- 93,240.00
$3,016,360.00 added income to the community due to mining.

Besides the wages generated there will also be coal royalities paid to local people which will increase the local income.

The mine alone will actually generate 300 new jobs by 1980 and most of these employees will reside in McLean County. There may be some commuting but it is felt that this will be limited by the relatively long distances to population centers with available housing, and by the weather. Using an average family size of 3.62 members (Woodward-Clyde, 1975) the resulting increase in population is 1,086 people. This not only represents a large population increase for the county, but it also represents a large potential market increase, and source of demand for goods and services. In relation to the size of the county this represents a high favorable economic impact.

Other economic impacts will be brought about by the housing demand that must be met by the construction industry. Contractors in the region will have an advantage in this area, but a considerable market for a product (i.e., housing) could easily bring outside suppliers into the area.

The demand for labor will develop a negative impact on agriculture. Both industries will be competing for the same people. Both will be looking for young, healthy, mechanically oriented people. The possibility of either industry to get all its needed labor from within the area is not realistic. One could expect to see those currently unemployed, yet reasonably qualified, living within the area, becoming employed first. This will result in lowering unemployment initially and result in a redistribution of money to a needing group. This is considered a highly favorable impact. Eventually, competition between the two industries will develop. Ability to pay for labor will be the deciding factor in determining which industry will get, and retain, its required labor force. Given the agricultural fluctuations in price for products, and increasing costs it would appear that this industry probably would not be able to successfully compete with mining. A result is that the mine will employ local people, thus creating jobs in agriculture, as well as in mining. To satisfy the demand in both industries people will have to move into the area.

An additional possibility is that marginal farm operators will go to work at the mine thus becoming part-time farmers. This then would enable some of those that would normally be forced to leave the county to remain. A consequence of increasing the population is an increased demand for services. New services and facilities will have to be provided, thus increasing the tax burden. Additional income should be provided to the community thru property tax, sales, and use taxes generated by the mine. This tax burden will be especially hard on the older people and those on a fixed income. It will have the effect of decreasing their real income.

An overall rating for the impact of the Falkirk mine on the area's economics would have to be a positive high. The area's industry will expand and personal income will go up. The exception is those on a fixed income. The impact on this group is negative, but the magnitude is unknown. An area of impact which is beyond the scope of this analysis, but which should be brought out, is that impact which the energy derived from the coal at Falkirk will have on the consumers. The utilities providing the energy presently serve 200,000 customers in the Upper Midwest. It is to be expected that this number will grow, as will the amount of energy that each of the present customers demands. It can be expected that satisfying this demand will have a high positive impact on those people.

c.) Educational-Scientific

i. Mine Site Preparation

Road and facilities construction may have an adverse long term impact on archeological and paleontological values. The impact magnitude is unknown. The State Historical Society has conducted surveys of the main haul road and coal processing and mine office areas. We assume the State of North Dakota will evaluate the significance of any cultural resources found. The potential impacts are considered to be long term since any sites which may be destroyed will be lost forever.

ii. Mining Operations

No Action Alternative: Topsoil removal and overburden removal and spoils piling impacts are rated medium in the short term and high in the long term. The use of both short term and long term is to focus attention on the fact that in the short term a relatively small area will be impacted, but over time a large area will be disturbed. There are both positive and negative impacts involved.

The potential impacts on archeological and paleontological resources are the same as in mine site preparation except that a much larger area will be impacted. Impacts on these resources are considered negative and long term.

There is an opportunity to study the effect of strip mining on waterfowl and their habitat. A major area of potentially favorable impact involves determining capabilities for restoring prairie potholes after mining. This is considered to have both short and long term effects. To realize these impacts, studies and research projects will have to be started in the immmediate future.

Proposed Action: Lease of federal coal would have the same impacts as the "No Action Alternatives" on an additional 1000 acres. The only significant impact identified involves the potential disturbance of archeological and paleontological values.

iii. Reclamation

The cumulative impact of reclamation on educational-scientific values is favorable with medium short term and high long term magnitudes. These potential impacts are conjectural and are related to the waterfowl study impacts identified under mining operations. They involve determining whether or not waterfowl production areas can be re-created to approximate the present situation. The knowledge derived from these studies is considered to be the significant impact and not the success or failure of reproducing the habitat.

d.) Attitudes and Expectations

i. Mine Site Preparation

The attitudes and expectations of the local community are varied. In talking to the local people it is felt that there are a few on each end of the attitude spectrum with the majority of the people in the middle. Generally those persons receiving either direct or indirect benefits from the overall development favor it, while those receiving no apparent benefit, or who feel they will receive adverse effects, oppose it. The attitudes and expectations expressed are directed primarily at the overall development (i.e., power plant, transmission line, coal mine, etc.) rather than solely at the development of federal coal within the mine.

ii. Mining Operations

<u>No Action Alternative</u>: In talking to the local people we were unable to categorically determine what the exact local attitudes and expectations were. It appears, however, that what opposition there initially may have been to the development seems to have been replaced by one of acceptance or tolerance by many area people.

Some feel they will make money as a result of the new jobs created, consequently, they favor the development. Certainly there are others who oppose it. Some very vocal entities oppose the development because it represents an intrusion on the current, and past, community attitude profile and "way-of-life". Others may oppose it because they feel they have not been sufficiently reimbursed, financially or materially.

In all probability, people moving into the area will have significantly different attitudes than those presently living in the area. Their values will be vastly different. The impacts of this influx of new people is unknown.

<u>Proposed Action</u>: It is felt that local attitudes and expectations would favor the lease of federal coal since all the surrounding private coal is leased.

iii. Reclamation

The reclamation of spoil piles and returning the mined land to a productive agricultural frame will have a high favorable impact on the local people.

e.) Local Regulatory Structure

i. Mine Site Preparation

The impacts on the local regulatory structure were given a negative rating. This was due to the fact that the McLean County Zoning Commission modified the proposed zoning in order to consider the mine and its facilities.

ii. Mining Operations

<u>No Action Alternative</u>: There would be no effect on the local regulatory structure. The zoning proposals were previously modified to permit the mining operation. The mining operation may conflict with the Federal Water Pollution Control Act, and related court cases which give the Corps of Engineers the authority to regulate fill in navigable waters and lakes over five acres. The nature and magnitude of this impact and the possible conflict is unknown.

<u>Proposed Action</u>: The lease of the federal coal would have no effect on the local regulatory structure.

iii. Reclamation

If the reclamation complies with the state and federal reclamation laws this will have a high positive effect on the local regulatory structure.

2. <u>Possible Mitigating or Enhancing Measures</u>

The following is prepared as a list of measures that may help to reduce or enhance the impacts identified in the preceding analysis. They are made without regard to the practicality of the actions. In some cases they may not be directly applicable, but are brought out for consideration only. From this list those that are reasonable and practical are selected and recommended. These measures will be identified in the following section of the E.A.R. on Recommendations for Mitigation or Enhancement.

The Possible Mitigating or Enhancing Measures are the same for both the "No Action Alternative" alternative and the proposed action.

a. Construction of roads and mine facilities could be limited to the more moist seasons of the year. This would reduce the level of dust that would be expected from these operations.

b. The area in which the roads and facilities are constructed could be oiled to reduce the amount of dust to be expected.

c. The areas in which road and facility construction is taking place could be watered to reduce the amount of expected particulate matter.

d. The areas that would receive the most vehicle traffic, and therefore, cause most of the dust, could be surfaced with asphalt or similar material. Examples would be county roads into the mining area, and roads in and around the facilities.

e. In the mining operation it may be possible to irrigate the topsoil prior to removal in the topsoil removal operation. This would reduce the expected increase in particulate matter.

f. Seeding of the stockpiled topsoil as soon as possible would reduce a long term source of dust increase. It would also reduce soil erosion and decrease any sediment load that may result.

g. Dust collectors and a covered conveyor system may be used to reduce the amount of dust resulting from moving the coal from the crusher to the power plant site.

h. The coal could be oiled prior to movement to the power plant. This would also reduce the level of expected dust.

i. During the mining operation the coal haul roads could be kept watered to reduce the level of expected dust.

j. In reclamation the spoils and topsoil could be irrigated following sloping and topsoiling. This could also reduce the level of dust.

k. By keeping all of the mining equipment in proper tune and well maintained the level of exhaust emissions could be reduced.

l. The effects of site construction and road construction on soil depth could be reduced by stockpiling the topsoil removed and replacing it following closure of the mine.

m. In mining, the effects on soil depth, soil erosion, and sediment load could be reduced by installation of control devices such as, settling ponds, water bars, culverts, and check dams. This will also assist in reducing impacts on water temperature and dissolved oxygen.

n. By orienting the stockpiled topsoil to reduce wind action on the piles the amount of dust could be reduced. This would also prevent soil loss and aid in reducing the effects on soil structure in the reclamation process.

o. By reducing the slopes on stockpiled topsoil the loss of topsoil by water action can be reduced. This will reduce the impacts on soil structure, sediment load, and soil erosion.

p. By revegetating the stockpiled topsoil as soon as possible, soil structure, particulate matter, soil erosion, and sediment load impacts could be reduced.

q. Soil structure impacts could be reduced by practicing minimum tillage on the reclaimed areas. After spreading the topsoil on the reclaimed spoils, try to keep additional earth movement to a minimum. This prevents any further break-down in soil structure.

r. In keeping with the concept of minimum tillage, the areas could be seeded by air or hydroseeded to keep traffic over the spread topsoil to a minimum.

s. By revegetating with deep rooting species the soil structure on the reclaimed areas can be improved.

t. To prevent mixing of soils, and to reduce the impacts on the soil nutrient properties, as well as soil depth, use may be made of a machine similar to the Vermeer T600B. This device will cut a seven foot trench down through 30 inches of soil and load it into trucks. The depth to which it cuts can be adjusted. This would enable the operator to remove an exact level of topsoil, or subsoil. The machine may have to be modified to meet the needed use, but the concept may be applicable for topsoil removal.

u. If the topsoil and subsoil were removed in two lifts, and put back on the reclaimed areas in reverse order, the impacts on soil nutrients properties would be reduced. This would also reduce the impacts on the successional process in soil formation.

v. If possible avoid mixing any calcareous material in the topsoil or subsoil removed. This would reduce the expected impacts on the soil nutrient properties.

w. Use of fertilizers to establish vegetation would mitigate impacts on soil nutrient properties, soil erosion, and sediment load. This should be done following guidelines established through soil testing.

x. By keeping the regraded spoil piles to a minimum slope the soil erosion and sediment load impacts could be reduced.

y. Accepted soil manipulation procedures should be monitored for compliance and effectiveness.

z. The only way to mitigate the land use compatibility impacts is to put the land back into a compatible use as quickly as feasible.

aa. Geologic structure, and soil pollutant property impacts could be reduced by replacing calcareous or toxic material removed in mining well below the surface on reclaimed areas.

bb. By discing or cultivating the regraded spoils prior to replacing topsoil, the crust is broken on the spoils, allowing the infilitration rate to be improved, and mitigating some impacts to the hydrologic cycle and to soil depth.

cc. By pitting or gouging the surface of side hills in the reclaimed areas the infiltration, interception, and retention capacity of the soil is improved. This has beneficial effects on the sediment load, soil erosion, vegetation, and hydrologic cycle. This could also be applied to those lands to be used as range rather than for agricultural.

dd. By placing a mulch with seeding on road cuts the amount of soil erosion and sediment load could be reduced. This could also faciltiate revegetation.

ee. Excess mine water could be pumped into a settling pond and its rate of release controlled. This would help control impacts resulting from increased sediment load, and reduce soil and stream bank erosion.

ff. Energy dispersion structures could be placed on water courses to reduce water velocity. This would reduce soil erosion, sediment load, and minimize the impacts on aquatic vegetation and animals.

gg. Monitoring of water courses would assist in maintaining water quality in and around the mining site. This could reduce the impacts from increased sediment load, dissolved oxygen, dissolved solids, nutrients, chemicals, and heavy metals, and changes in pH and temperature. In order to establish a base line of information studies should be started prior to mining and continue through the mining and into the period following reclamation.

hh. Herbicides and pesticides should be used only with caution if needed for the reclamation process. This measure will help maintain water quality.

ii. In case the water supply for Underwood and other communities is affected by the mining, contingency plans for alternative water sources should be developed.

jj. Ground water studies could be initiated to investigate the largely unknown impacts of mining on the aquifers.

kk. By avoiding significant aquatic and riparian habitat with road and facility construction, the impacts on this subcomponent of the environment could be reduced.

ll. In the reclamation process the attempt to replace aquatic habitat destroyed in mining should be made. This would reduce the impact on this subcomponent as well as on aquatic animals.

mm. Where FWS easements are destroyed replace the wetlands where possible. If not possible to restore the wetlands arrange an easement exchange of similar wetlands within or adjacent to the mined area. Where not possible to restore or exchange like type wetlands the construction of shallow impoundments (dams in natural drainage areas) would help mitigate the loss of habitat. Such impoundments present seasonal, semipermanent or permanent wetland characteristics. A strip of herbaceous cover at least 2 rods wide should surround such impoundments, and be protected from livestock grazing by fencing.

nn. If studies could be made with regard to the replacement of wetland habitat this would be a significant enhancing measure not only for this mine, but for other mines throughout the area. Cooperation between the mining company and the FWS with regard to funding and research objectives and procedures is a viable consideration.

oo. Where wet areas are created aquatic plants should be seeded. This will help mitigate impacts on this subcomponent.

pp. The site could be surveyed for officially endangered plants and animals.

qq. In the reclamation process impacts on terrestrial plants could be mitigated by replacing trees and woody plants where suitable conditions exist. This would minimize impacts on plants and animals. Woody plantings could be a combination of clump plantings (¼ to 1 acre), block plantings (4 to 10 acres), ponded water horder plantings, two row shrub travel lane plantings, and odd area woody plantings. Native woodland habitat should be considered for replacement on a 2 to 1 basis.

rr. Between-the-row cultivation should be considered for tree plantings that will be developed on relatively level sites. Where soil erosion is a definite site problem, native grass should be planted on the site prior to tree planting <u>or</u> a tree planting seed mixture should be seeded between the planted tree rows.

ss. Diverse native plant species could be used for revegetation where suitable in the reclamation process. This would mitigate impacts on terrestrial plants.

tt. No grazing should be allowed in newly established tree and shrub plantings, or newly seeded grass areas, until the vegetation is well established and can be expected to withstand grazing pressure.

uu. On those areas to be leased for grazing after reclamation is completed, carefully monitored management procedures should be instituted. Grazing should be managed on an AUM basis to achieve proper use, as determined by a range management specialist. Water retention structures should be protected from livestock grazing by protective fencing.

vv. By irrigating the seeded areas following reclamation, the area could be revegetated at a more rapid rate.

ww. If the opportunity exists, deep water ponds could be created for recreation use and for the creation of fisheries and wildlife habitat.

xx. In the reclamation process, if possible, create some undulating terrain for animal cover.

yy. Impacts on landscape character could be mitigated if the facilities were landscaped while the mine is in use, and if when the mine operation is finished, the facility were removed and the terrain put into the then-current land use.

zz. Enhancing values could be realized by instituting a survey for archaeologic, historic, and paleontologic values prior to surface disturbance in unsurveyed areas. The significance of any cultural resources located should be evaluated by qualified professionals and appropriate mitigation constituted.

aaa. If possible, create ponds for recreation use. This could mitigate some of the impacts that the influx of people will create on existing recreation facilities. Where possible, these sites should be orientated toward day use for swimming, fishing, and picnicking.

bbb. In anticipating the influx of people, land use agencies with programs directed toward recreation should develop plans for meeting increased demands for recreational use of those lands. These plans should be oriented toward water-based recreation and camping.

ccc. Local governments and planning agencies will want to coordinate their activities with the mining company's activities and mine development. This may help in mitigating some of the social and economic problems that will arise. This would have to be a cooperative effort between the agencies, governments and the coal company.

ddd. Keeping the communities and local residents informed will help mitigate adverse impacts on local attitudes and expectations.

eee. All agencies and governments involved should recognize that social problems are going to arise in the form of inadequate police and fire protection, schools, medical care, and funding for these services. This may be solved by front-end financing. Detailed planning is essential for this impact to be mitigated.

fff. The mining company should contact the U.S. Army Corps of Engineers to determine the necessity of getting a permit for their operation.

3. Recommendations for Mitigation or Enhancement

The following list is composed of mitigating measures which could be incorporated into the policy of operation, mining plan, reclamation plan, or stipulations for the lease of Federal coal.

a. Water the road and facility construction sites for dust abatement.

b. Surface the roads into the mine and the area around the offices with asphalt to reduce dust.

c. Water or oil the haul roads during the dry seasons to reduce dust.

d. Maintain gas and diesel powered equipment in proper tune and condition to assure efficiency and reduce gaseous emissions.

e. Stockpile topsoil from the roadway for use when the mine is abandoned.

f. Install appropriate erosion control devices such as, settling ponds, water bars, culverts, seedings, check dams, etc., where required to prevent road side erosion, and erosion throughout the mine.

g. Orient stockpiled roadway topsoil to prevent loss of material by wind action.

h. Keep the stockpiled roadway topsoil at a minimum grade.

i. Vegetate the stockpiled roadway topsoil as soon as growing conditions permit.

j. Keep earth work and soil movement to a minimum, and practice minimum tillage as a policy.

k. Avoid placing calcarious material in the respread topsoil.

l. Use fertilizer to re-establish the soil fertility as recommended based on the results of soil analysis and testing.

m. Use deep rooting species to revegetate where possible to facilitate soil structuring.

n. Keep slopes to a minimum in regrading spoils, and in stockpiling topsoil in reclamation.

o. Put the disturbed sites back into compatible land uses as soon as possible after reclamation.

p. Bury toxic material, and avoid soils with high salt concentrations near the surface.

q. All of the preceding soil manipulation procedures should be monitored for compliance and effectiveness.

r. Disk or cultivate the regraded spoil piles prior to topsoiling to prevent slippage and to improve infiltration.

s. Pit or gouge the reclaimed surface on side hills and on those areas to be put into rangeland.

t. Mulch road cuts and fills and on reclaimed areas subject to soil and water movement.

u. Pump excess mine water into settling ponds and control its release into the surface water system.

v. On drainage systems that may receive accelerated water velocity, construct energy dissipators.

w. Monitor for sediment load, dissolved oxygen, toxic substances, chemicals, temperatures, pollutants, and water Ph in and around the mine on water bodies and streams to determine base line quality and to determine if adverse effects are taking place during the mining and following reclamation.

x. Care should be used in the application of herbicides and insecticides in the revegetation process.

y. If the water supply of Underwood, or other communities, is adversely affected by the mine, contingency plans for alternative water supplies should be developed.

z. Since impacts on ground water aquifers are largely unknown, hydrologic investigations should be initiated.

aa. Avoid placing roads and facilities on or near significant aquatic habitat.

bb. Replace suitable aquatic habitat in the reclamation process for fisheries and water birds.

cc. Seed aquatic plants in the reclamation process where applicable.

dd. Initiate a research project to determine if comparable wetland habitat can be re-established in reclamation.

ee. Survey the site for officially endangered plant and animal species.

ff. Replace trees and woody plants where suitable terrain is created in the reclamation process. Woody planting should be in clumps ¼ to 1 acre in size, in blocks 4-10 acres in size, and in an irregular shape. Ponded water horder plantings should also be done in and around water sources. Two-row shrub travel lane plantings and odd area woody plantings should also be made. Native woodland habitat should be considered for replacement on a 2 to 1 basis.

gg. Reseed the reclaimed terrain with diverse native plant species.

hh. Put some of the land back to native range vegetation on areas unsuited for agricultural crops.

ii. Where trees are planted, the area around the trees should be cultivated to reduce grass competition until the trees are well established.

jj. Where soil erosion is expected to be a problem, plant native grass species prior to planting trees to stabilize the soil.

kk. Where an area that has been reclaimed is to be grazed, prevent animal use until the vegetation is well established and can withstand grazing pressure.

ll. If ponds are created design them such that they are irregular in shape and suitable for recreational use. The recreational use should be oriented primarily toward day use.

mm. Initiate an archaeologic, historic, and paleontologic investigation of unsurveyed areas to determine if cultrual values exist. Take appropriate steps to preserve or salvage any sites located.

nn. Facilitate legitimate socio-economic studies in the mine area that could answer questions on impacts of future mining operations in the region.

oo. Investigate the possibility of front-end monies being used to develop recreation facilities and social services that must be provided for additional demands resulting from the expanded population.

pp. Keep the communities informed on development affecting them.

qq. Establish lines of communication between the coal company and the planning agencies of the government bodies concerned so that steps can be taken by all to identify problems as they arise.

rr. The mining company should contact the U.S. Army Corps of Engineers with regard to the necessity of getting a permit for their operation.

4. Residual Impacts

If the recommended mitigating and enhancing measures are incorporated, some impacts will still occur. The following is a list of the impacts which are felt to be residual.

No Action Alternative

a. Dust will increase during the topsoil removal and stockpiling operations of the mining operation stage and in the regrading and topsoiling operations of the reclamation stage.

b. Soil depth will be negatively affected by the mining even with topsoil stockpiling and reclamation.

c. Soil structure will also be affected. Simply moving and replacing it will breakdown this structure until vegetation builds it up again.

d. Soil nutrients will be affected in all the stages of operation because the organic material will be disturbed and will take time to rebuild.

e. There will be an increase in soil erosion in the short term even with the implementation of all the recommended erosion control practices. This will occur simply because the ground is being moved and is exposed to wind and water action.

f. For the period of the mining operation the site will be noncompatible with adjacent land uses.

g. The geologic structure of the area will be affected. The area of the mine will have the coal removed, and the structure from the top of the coal seam to the bottom of the subsoil may be rearranged.

h. The non-lease of federal coal will result in the bypassing of all federal coal within the mining area and will cause additional inefficiencies in mine operations and mine reclamation.

i. The hydrologic cycle will change. There will be increased runoff in the site preparation and reclamation stages. In the mining stage, part of an aquifer will be removed. The impacts of this and ground water characteristics are largely unknown at this time. This could be significant if Underwood gets its water from this aquifer.

j. Sediment load will increase somewhat even with the incorporation of mitigating measures, at least until the ground has stabilized following reclamation.

k. Water nutrients will be affected somewhat similarly to sediment load.

l. The impacts on water pH are unknown in the reclamation stage. The pH is a function of the addition of soil nutrients in the reclamation stage.

m. The potential of coliform contamination is unknown at present.

n. Aquatic vegetation will be destroyed on the area to be mined. If the aquatic vegetation is not replaced it will be lost over the entire area.

o. Grasses, forbs, lichens and mosses will be impacted for the period of the mining operation until the reclamation stage is completed and vegetation is well established. On the road surfaces and on the site of the mining facilities the vegetation will be gone for the duration of the mining.

p. Shrubs and trees will be impacted the same as the lesser vegetation, but the length of time required to re-establish them will be considerably longer.

q. Aquatic mammals and birds will be displaced and their habitat destroyed through the mining and reclamation process up to the point where aquatic habitat is again re-established. There is some question as to the ability to re-establish comparable habitat.

r. Invertebrates will also have their habitat destroyed in the mining operation. These are expected to recover more rapidly in the reclamation process, however.

s. Mine site preparation is expected to disturb terrestrial animals, but have little impact beyond this. The disturbance will be chronic for the duration of the mining.

t. The mining itself, and topsoil removal specifically, will destroy the terrestrial animal habitat until reclamation re-establishes it, and depending on the surface owners wishes, it may not be re-established.

u. Succession will be highly impacted by topsoil removal. This impact will also affect food and community relationships. Following reclamation these processes will have to begin anew. The reclamation process will go a long way toward mitigating this impact, but a time will be required before new balances are reached.

v. For the duration of the mining the present harmony of the landscape will be disrupted.

w. The mining operation will become a focal feature of the landscape. This will last for the duration of the mining.

x. The mining activities will cause short term over-use of recreational facilities in and around the mining area.

y. Personal income will go up for many people on the area.

z. There will be a housing shortage.

aa. There will be a shortage of services initially.

bb. More jobs will be created.

cc. People will move into the area and there will be a conflict of attitudes and values.

dd. Unemployment should go down.

ee. People on a fixed income will suffer a loss of real income.

ff. Residual impacts with regard to archeological, historical, and paleontological values are unknown.

gg. If studies of waterfowl habitat restoration and strip mining effects on prairie pot holes are made, the results could be highly beneficial.

hh. Approximately 1200 acres annually will be lost to agricultural production, resulting in a monetary loss of approximately $93,000 annually.

Proposed Action

The impacts of mining federal coal can only be identified in the mining operation stage. In each case they are the same as the residual impacts discussed in the "No Action Alternative". The marginal, or additional impact resulting from the lease of federal coal has been identified as being insignificant in all but the following areas:

a. A highly favorable impact will result on land use compatibility if federal coal is mined. The mine could be developed in a more efficient and less costly manner. This rationale applies for reclamation as well. The loss of federal coal as a resource would be avoided.

b. Leasing of the federal coal would result in destruction of FWS administered wetland easements on the surface of some of those lands over federal coal.

c. A high positive impact would be realized with regard to local expectation. It is felt that most people would expect the BLM to lease the federal coal in the context of an ongoing mine, unless there is a compelling reason not to, especially if it would mean the loss of the resource.

B. Relationship Between Short-Term Use and Long-Term Productivity

No Action Alternative

The short-term, in this action is that period during which the substantive part of the action takes place and the long-term is that time in which subsequent effects of the action will still impact the environment. The Falkirk Mine will be an ongoing action which will last for the next thirty-five years. The short-term can, therefore, be considered the life span of the mine. The long-term would be that period of time beyond the operating life of the mine.

The short-term use of the environment is mining for the purpose of providing for the UPA-CPA power plant (Coal Creek Station). This will proceed at a slow rate, not excluding farming, but rather reducing the amount of farming for the period of mining operation. Only the disturbed site (i.e., the area of the mine plus that terrain in various stages of reclamation) would be excluded from farming. This would amount to a reduction in the farmable area of at least 1200 acres in any year.

In the long term, the trade off between the mining and farming will be eliminated if reclamation is successful. In fact, the reclaimed area may be even more suitable to farming than previous to the mine operation. This could then be a long-term beneficial impact on farming.

It's difficult to see a benefit for wildlife unless the reclamation process is aimed at improving wildlife habitat. It could be assumed that the primary direction of reclamation will be toward agriculture. Long-term impacts to wildlife will be manifested in fewer numbers due to less habitat or different habitat and changes in the environmental conditions that create and maintain habitat. This long-term change will include altered topography, a modified runoff pattern for surface water, and to a limited degree, a change in local air movement patterns as they are influenced by topography. When the mine closes all these changes will remain in the environment.

Other long-term impacts that will be traded off for the short-term use are social and economic changes. After the mine closes the economy will again shrink unless another basic industry is attracted or the coal industry expands in the area.

The action will sacrifice aesthetics and land use compatibility in order to produce the needed coal. This sacrafice will be in the short-term unless reclamation is not entirely successful. Assuming successful reclamation aimed at a diversity of use, and given adequate time, the potential productive capacity of the site will be re-established.

The choice to not lease will foreclose for future generations the choice to regain the coal resource. For all practical purposes, once the decision to leave the coal is made, and the federal coal is mined around, it cannot be economically or practically recovered. For the foreseeable future it becomes a lost resource. Future generations will have to share the cost of this decision.

Proposed Action

The relationships discussed under the "No Action Alternative" are applicable to the proposed action. No additional relationship with regard to long-term impacts versus the short-term use were identified with the exception of use of the coal.

Under the proposed action the coal would be used in the short-term. It would not be lost as a resource, but rather utilized. Its use would delay the choice of development of additional energy reserves at some other location into the future, and allow future generations a part in the decision.

## C. Irreversible and Irretrievable Commitments of Resources

No Action Alternative

In the case of this action no federal coal will be committed for use directly. That is to say, it will not be consumed.

The coal will be committed, however, to be unused and lost for the forseeable future. Private coal will be consumed, leaving isolated tracts of public coal. Due to the economics and practical considerations in strip mining, it is highly unlikely that the public coal would ever be mined once it has been mined around. The only way it could be recovered is if the economics of coal drastically change, and an advanced technology is developed where by it could be recovered.

Proposed Action

Under the proposed action both public and private coal will be consumed. Approximately 1000 acres of public coal will be committed to the Falkirk Mining Co. for use in generating electric power at the Coal Creek Station.

## IV. RECORDATION OF PERSONS, GROUPS, AND GOVERNMENT AGENCIES CONSULTED

Most of the non-BLM input during the preparation of this analysis was in the form of source information used in Part II - "Description of the Existing Environment". Several agencies, most notably the FWS and the North Dakota State Game and Fish Department, also contributed suggestions for possible mitigating and enhancing measures. Falkirk Mining Company provided the background information for the assimilation of Part I - "Description of the Proposed Action and Alternatives". The following agencies were contacted or consulted during the preparation of this Environmental Analysis Record.

1. City of Underwood, North Dakota - Mayor's Office
2. Falkirk Mining Company - Bismarck, North Dakota
3. Institute for Ecological Studies - Grand Forks, North Dakota
4. Lewis and Clark Regional Development Council - Mandan, North Dakota
5. McLean County, North Dakota - County Assessor's Office
6. North Dakota State Board of Health
7. North Dakota State Game and Fish Department
8. North Dakota State Geological Survey
9. North Dakota State Historical Society
10. North Dakota State Outdoor Recreation Agency
11. North Dakota State Planning Division
12. North Dakota State Public Service Commission
13. U.S. Department of Agriculture - SCS, State Office at Bismarck, North Dakota
14. U.S. Department of Agriculture - SCS, District Office at Washburn, North Dakota
15. U.S. Department of Commerce - National Weather Service, Bismarck, North Dakota
16. U.S. Department of Defense - Corps of Engineers, Riverdale, North Dakota

17. U.S. Environmental Protection Agency - Denver, Colorado
18. U.S. Department of Interior - Fish & Wildlife Service, Bismarck, North Dakota
19. U.S. Department of Interior - Geological Survey, Bismarck, North Dakota

## V. INTENSITY OF PUBLIC INTEREST

The major public interest was expressed some time ago when the original plans for the power plant and mine were unveiled. The construction of the power plant is under way, and preparation of the mine area is beginning. Some opposition to the overall development (power plants, transmission line, pipeline, coal mine, etc.) can be found in the community. However, this opposition does not appear to be directed at the specific lease of the subject federal coal.

With regard to the lease of the public coal it is felt that public interest would be aroused if the coal were not leased, in that most people would see the action as a waste of a resource. If the coal were leased, people are expected to express little or no interest because the facility is already being developed.

## VI. PARTICIPATING STAFF

The following persons on the BLM staff participated in the preparation of this Environmental Analysis Record:

| | |
|---|---|
| Dave Lindberg | Surface Protection Specialist - Miles City District Office |
| Dave Roberts | Biologist/Ecologist - Miles City District Office |
| Ed McTaggart | Recreation Planner - Miles City District Office |
| Bob Bennett | Environmental Coordinator - Miles City District Office |
| Roger Underwood | Geologist - North Dakota Project Office |
| Dick Jewell | Hydrologist - North Dakota Project Office |
| Craig Garland | Soils Specialist - North Dakota Project Office |
| Gary Gebhardt | Fisheries Biologist - Montana State Office |
| Gary Roam | Environmental Specialist - Montana State Office |

## VII. SUMMARY CONCLUSION

From the environmental analysis there are several points which can be concluded. Under the proposed action the negative environmental impacts to be expected are not significantly larger than those that would be expected under the "No Action Alternative". There may be justification for selectively denying the lease of two portions of this application (NE¼NW¼, Section 24, T. 146 N., R. 82 W., and NE¼NE¼, Section 34, T. 146 N., R. 82 W.) based on the eminent environmental impacts analyzed herein, the relatively marginal coal, and the expressed interest and concern presented by the North Dakota Game and Fish Department. Also, consideration should be given to modification of the proposed lease, based on information provided by Falkirk Mining Company, which reflects that two tracts (NW¼, Section 2 and SE¼, Section 6, T. 146 N., R. 82 W.) may not be mined due to: 1) a greater than 8:1 stripping ratio and, 2) the coal may not be needed to meet Falkirk's contractual requirements in the foreseeable future. There are wetland habitat easements maintained by the FWS which will have their value destroyed by the lease of the federal coal.

There are some beneficial impacts that one should consider. The lease of the coal will facilitate an efficient mining plan. That is, the expense to the mining company in going around public coal would be avoided. The resource would be used to meet the projected coal demand of Coal Creek Station, and not lost.

During a time of high energy concern the use and conservation of energy is an important issue which this lease would facilitate.

This lease would commit approximately 1,000 acres of federal coal to a consumptive use. This is an irreversible commitment of the resource.

Public interest seems to be low with regard to the lease of the subject federal coal. However, the entire development (power complex, transmission line, pipeline, and coal mine), projects over which the BLM can exercise no control, have generated considerable public interest. With regard to the actions over which the BLM can exercise control (i.e., lease of federal coal), it is felt that failure to lease the coal would create more public controversy than would leasing. The waste of a public resource without good and sufficient reason would be highly subject to criticism, particularly in view of the mining of private coal on the adjacent lands.

FALKIRK COAL LEASE APPLICATION M-31053(ND)

Environmental Analysis Record

APPENDICES

FALKIRK EAR

Appendix 1

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FALKIRK EAR

Appendix 2

Soils

## APPENDIX 2

Table 1

### SOIL IDENTIFICATION LEGEND
### Falkirk EAR

| Map Symbol | Map Unit and Slope | Capability Class |
|---|---|---|
| 12 | Parnell silty clay loam, 0-1 % | VwWL/IIIw7 |
| 16 | Tonka-Parnell complex, 0-1 % | IVw/IIw6 |
| 62 | Bowbells loam, 1-3% | IIc6 |
| 63 | Williams-Bowbells loams, 1-3% | IIc6 |
| 63B | Williams-Bowbells loams, 3-6% | IIe6 |
| 63C | Williams-Bowbells loams, 6-9% | IIIe6 |
| 66E | Zahl-Max loams, 9-35% | VIeTU |
| 79B | Max loam, 3-6% | IIe6 |
| 79C | Max-Zahl loams, 6-9% | IIIe6 |
| 79D | Max-Zahl loams, 9-15% | IVe6 |
| 85B | Williams-Bowbells-Zahl loams, 3-6% | IIe6 |
| 85C | Max-Bowbells-Zahl loams, 6-9% | IIIe6 |
| 143 | Williams-Mine Sinkhole Complex, 1-9% | VIIeSi |

APPENDIX 2

Table 2

BRIEF SOIL DESCRIPTIONS BASED
ON SOIL CAPABILITY CLASS *
FALKIRK EAR

| | |
|---|---|
| IIc6 | Deep, well drained, heavy loam and clay loam soils on nearly level slopes. The surface layer contains more than 18% clay. |
| IIe6 | Deep, moderately well and well drained loam, silt loam and clay loam soils on undulating slopes. The surface layer contains more than 18 % clay. |
| IIIe6 | Deep, well drained, loam, silt loam, and clay loam soils on gently rolling acres. The surface layer contains more than 18% clay. |
| IIw6 | Moderately deep, poorly drained silt loam and silty clay loam soils on nearly level areas. These soils are ponded and have a seasonal high water table. IVw undrained. |
| IIIw7 | Deep, poorly drained, silty clay loam soils. They are in depressions and are ponded for part of the season. VwWL undrained. |
| IVe6 | Deep well drained loam, silt loam, and clay loam soils on strongly sloping or rolling areas. The surface layer contains more than 18% clay. |
| VIeTU | Deep to shallow well drained loamy soils. They have thin surface layers and are on hilly to steep areas. |
| VIIeSi | Areas of deep, well drained loamy soils with numerous mine sinkholes. |

* Complete soil mapping unit descriptions and official soil series descriptions are available in the BLM, North Dakota Project Office.

APPENDIX 2

SOIL CHARACTERISTICS AND PROPERTIES

| Map Symbol | Map Unit and Slope | Capability Class | Range Site | Parent Material | Landscape Position | Texture | Effective Rooting Depth | Natural Drainage | Perme-ability | Available Water Capacity | PH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 | Parnell silty clay loam, 0-1% | IIIw7<br>VwWL<br>Undrained | Wetland | Alluvium from glacial till | Deeper "pot-hole" | Fine | 20 to 40" | Very Poor | Slow | High | 6.1 to 8.4 |
| 16 | Tonka-Parnell complex 0-1%<br>Tonka sil<br>Parnell sicl | IIw6<br>IVw<br>Undrained | Wet Meadow<br>Wetland | Alluvium from glacial till | Shallow "pot-holes", deeper "potholes" | Fine | 20 to 40" | Poor to Very Poor | Slow<br>Slow | High<br>High | 6.1 to 8.4 |
| 62 | Bowbells loam 1-3% | IIc6 | Silty | Calcareous glacial till and alluvium | Slightly con-cave glacial till, Plains | Fine loamy | 20 to 40" | Well to Mod. Well | Mod. | High | 6.1 to 8.4 |
| 63 | Williams-Bowbells loams, 1-3%<br>Williams l<br>Bowbells l | IIc6 | Silty<br>Silty | Calcareous glacial till and alluvium | Plane or con-vex, nearly level to slight-ly concave till plains | Fine loamy | > 40"<br>20 to 40" | Well to Mod. Well | Mod. to Mod. Slow | High<br>High | 6.1 to 8.4 |
| 63B | Williams-Bowbells loams, 3-6%<br>Williams l<br>Bowbells l | IIe6 | Silty<br>Silty | Calcareous glacial till and alluvium | Plane or con-vex, gently sloping to slightly con-cave till plains | Fine loamy | > 40"<br>20 to 40" | Well to Mod. Well | Mod. to Mod. Slow | High<br>High | 6.1 to 8.4 |

APPENDIX 2

SOIL CHARACTERISTICS AND PROPERTIES

| Map Symbol | Map Unit and Slope | Capability Class | Range Site | Parent Material | Landscape Position | Texture | Effective Rooting Depth | Natural Drainage | Perme-ability | Available Water Capacity | PH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 63C | Williams-Bowbells loams, 6-9%<br>Williams 1<br>Bowbells 1 | IIIe6 | <br><br>Silty<br>Silty | Calcareous Glacial till and alluvium | Plane or convex sloping to slightly concave till plains | Fine loamy | > 40"<br><br>20 to 40" | Well to Mod. Well | Mod. to Mod. Slow | <br><br>High<br>High | 6.1 to 8.4 |
| 66E | Zahl-Max loams 9-35%<br>Zahl loam<br><br>Max loam | VIeTU | <br><br>Thin Up-land<br>Silty | Calcareous glacial till | Tillplains, moraines and steep valley sides | Fine loamy | 12-30"<br><br>20-40" | Exc. to Well | Mod. to Slow | <br><br>Mod.<br><br>Mod. | 6.6 to 8.4 |
| 79B | Max loam 3-6% | IIe6 | Silty | Calcareous glacial till | Gently undulating glacial till plains | Fine loamy | 20 to 40" | Well | Mod. to Mod. Slow | Mod. | 6.6 to 8.4 |
| 79C | Max-Zahl loams 6-9%<br>Max loams<br>Zahl loam | IIIe6 | <br><br>Silty<br>Thin up-land | Calcareous glacial till | Undulating glacial till plains | Fine loamy | 20-40"<br><br>12-30" | Well to Exc. | Mod. to Slow | Mod. | 6.6 to 8.4 |

APPENDIX 2

SOIL CHARACTERISTICS AND PROPERTIES

| Map Symbol | Map Unit and Slope | Capability Class | Range Site | Parent Material | Landscape Position | Texture | Effective Rooting Depth | Natural Drainage | Permeability | Available Water Capacity | PH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 79D | Max-Zahl loams 9-15%<br>Max loam<br>Zahl loam | IVe6 | <br><br>Silty<br>Thin upland | Calcareous glacial till | Rolling glacial till plains | Fine loamy | 20-40"<br><br>12-30" | Well to Exc. | Mod. to Slow | Mod. | 6.6 to 8.4 |
| 85B | Williams-Bowbells Zahl loams 3-6%<br>Williams l<br>Bowbells l<br>Zahl l | IIe6 | <br><br>Silty<br>Silty<br>Thin upland | Calcareous glacial till and alluvium | Gently undulating glacial till, plains | Fine loamy | >40"<br><br>20-40"<br><br>12-30" | Well to Exc. | Mod. to Slow | Mod. to High | 6.1 to 8.4 |
| 85C | Max-Bowbells-Zahl loams 6-9%<br>Max l<br>Bowbells l<br>Zahl | IIIe6 | <br><br>Silty<br>Silty<br>Thin upland | Calcareous glacial till and alluvium | Undulating glacial till plains | Fine loamy | 20-40"<br><br>20-40"<br><br>12-30" | Mod. Well to Exc. | Mod. to Slow | Mod. to High | 6.1 to 8.4 |

APPENDIX 2

SOIL CHARACTERISTICS AND PROPERTIES

| Map Symbol | Map Unit and Slope | Capability Class | Range Site | Parent Material | Landscape Position | Texture | Effective Rooting Depth | Natural Drainage | Perme-ability | Available Water Capacity | PH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 143 | Williams-Mine Sinkhole complex 1-9%<br>Williams<br>Mine Sinkhole Complex | VIIeSi<br><br><br> | <br><br><br>Silty | Calcareous glacial till | Undulating glacial till plains | Fine loamy | >40" | Well | Mod. to Mod. Slow | High | 6.6 to 8.4 |

APPENDIX 2

Table 3

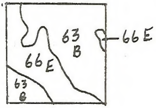
FALKIRK EAR

| Map Symbol | Total Federal Subsurface Acres | Percent Of Total |
|---|---|---|
| 12 | 21.2 | 2.1 |
| 16 | 4.4 | 0.4 |
| 62 | 4.0 | 0.4 |
| 63 | 153.4 | 15.3 |
| 63B | 425.8 | 42.6 |
| 63C | 10.4 | 1.0 |
| 66E | 36.8 | 3.7 |
| 79B | 25.6 | 2.6 |
| 79C | 198.1 | 19.8 |
| 79D | 17.6 | 1.8 |
| 85B | 71.0 | 7.1 |
| 85C | 20.9 | 2.1 |
| 143 | 10.8 | 1.1 |
| $\sum$ | 1,000.0 | 100.0 |

APPENDIX 2

T 146 N R 82 W

NE 1/4 NW 1/4 Sec. 24



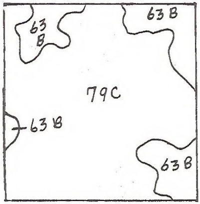

Scale: 4" = 1 mile

| Map Symbol | Map Unit and Slope | Acres | % of Area |
|---|---|---|---|
| 63B | Williams - Bowbells loams, 3-6% | 26.8 | 67.0 |
| 66E | Zahl - Max loams, 9-35% | 13.2 | 33.0 |
| | | 40.0 | 100.0 |

APPENDIX 2

T 146 N R 82 W

NW 1/4 Sec. 20



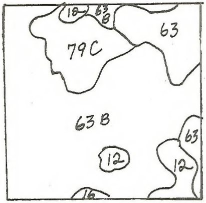

Scale: 4" = 1 mile

| Map Symbol | Map Unit and Slope | Acres | % of Area |
|---|---|---|---|
| 63B | Williams - Bowbells loams, 3-6% | 34.0 | 21.3 |
| 79C | Max - Zahl loams, 6-9% | 126.0 | 78.7 |
| | | 160.0 | 100.0 |

APPENDIX 2

T 146 N R 82 W

SE 1/4 Sec.6



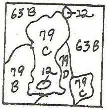

Scale: 4" = 1 mile

| Map Symbol | Map Unit and Slope | Acres | % of Area |
|---|---|---|---|
| 12 | Parnell silty clay loam, 0-1% | 10.8 | 6.8 |
| 16 | Tonka - Parnell complex, 0-1% | 1.2 | 0.8 |
| 63 | Williams - Bowbells loams, 1-3% | 22.2 | 13.8 |
| 63B | Williams - Bowbells loams, 3-6% | 107.7 | 67.3 |
| 79C | Max - Zahl loams, 6-9% | 18.1 | 11.3 |
| | | 160.0 | 100.0 |

APPENDIX 2

T 146 N R 82 W

NW 1/4 Sec. 2



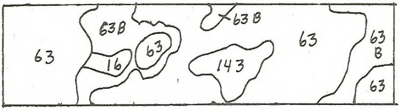

Scale: 2" = 1 mile

| Map Symbol | Map Unit and Slope | Acres | % of Area |
|---|---|---|---|
| 12 | Parnell silty clay loam, 0-1% | 6.4 | 4.0 |
| 63B | Williams - Bowbells loams, 3-6% | 60.8 | 38.0 |
| 79B | Max loam, 3-6% | 25.6 | 16.0 |
| 79C | Max - Zahl loams, 6-9% | 49.6 | 31.0 |
| 79D | Max - Zahl loams, 9-15% | 17.6 | 11.0 |
| | | 160.0 | 100.0 |

APPENDIX 2

T 146 N R 81 W

S 1/2 S 1/2 Sec. 30



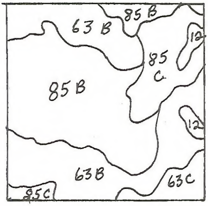

Scale: 4" = 1 mile

| Map Symbol | Map Unit and Slope | Acres | % of Area |
|---|---|---|---|
| 16 | Tonka - Parnell Complex, 0-1% | 3.2 | 2.0 |
| 63 | Williams - Bowbells loams, 1-3% | 112.4 | 70.3 |
| 63B | Williams - Bowbells loams, 3-6% | 33.6 | 21.0 |
| 143 | Williams - Mine sink hole complex, 1-9% | 10.8 | 6.7 |
| | | 160.0 | 100.0 |

APPENDIX 2

T 146 N R 83 W

SE 1/4 Sec. 24



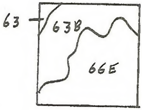

Scale: 4" = 1 mile

| Map Symbol | Map Unit and Slope | Acres | % of Area |
|---|---|---|---|
| 12 | Parnell silty clay loam, 0-1% | 4.0 | 2.5 |
| 63B | Williams - Bowbells loams, 3-6% | 56.1 | 35.0 |
| 63C | Williams - Bowbells loams, 6-9% | 8.0 | 5.0 |
| 85B | Williams - Bowbells - Zahl loams, 3-6% | 71.0 | 44.4 |
| 85C | Max - Bowbells - Zahl loams, 6-9% | 20.9 | 13.1 |
| | | 160.0 | 100.0 |

APPENDIX 2

T 146 N R 82 W

NE 1/4 NE 1/4 Sec. 34



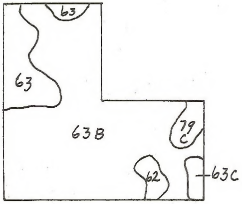

Scale: 4" = 1 mile

| Map Symbol | Map Unit and Slope | Acres | % of Area |
|---|---|---|---|
| 63 | Williams - Bowbells loams, 1-3% | 1.6 | 4.0 |
| 63B | Williams - Bowbells loams, 3-6% | 14.8 | 37.0 |
| 66E | Zahl - Max loams, 9-35% | 23.6 | 59.0 |
| | | 40.0 | 100.0 |

APPENDIX 2

T 146 N R 82 W

S 1/2 SW 1/4, NW 1/4 SW 1/4 Sec. 34




| Map Symbol | Map Unit and Slope | Acres | % of Area |
|---|---|---|---|
| 62 | Bowbells loam, 1-3% | 4.0 | 3.3 |
| 63 | Williams - Bowbells loams, 1-3% | 17.2 | 14.4 |
| 63B | Williams - Bowbells loams, 3-6% | 92.0 | 76.7 |
| 63C | Williams - Bowbells loams, 6-9% | 2.4 | 2.0 |
| 79C | Max - Zahl loams, 6-9% | 4.4 | 3.6 |
| | | 120.0 | 100.0 |

FALKIRK EAR

Appendix 3

Geology

| SEQUENCE | SYSTEM | GROUP OR FORMATION | | DOMINANT LITHOLOGY | |
|---|---|---|---|---|---|
| TEJAS | TERTIARY | Coleharbor | | Glacial Drift | |
| | | White River | | Clay, Sand, Limestone | |
| ZUNI | | Golden Valley | | Clay, Sand, Silt | — Coal GW |
| | | Fort Union Group | Sentinel Butte | Sandstone, Shale, Lignite | |
| | | | Tongue River | Sandstone, Shale, Lignite | |
| | | | Cannonball | Marine Sandstone, Shale | |
| | CRETACEOUS | Hell Creek | | Sandstone, Shale and Lignite | — GW |
| | | Montana Group | Fox Hills | Marine Sandstone | — GW |
| | | | Pierre | Shale | |
| | | | Niobrara | Shale, calcareous | |
| | | Colorado Group | Carlile | Shale | |
| | | | Greenhorn | Shale, calcareous | |
| | | | Belle Fourche | Shale | |
| | | Dakota Group | Mowry | Shale | |
| | | | Newcastle | Sandstone | |
| | | | Skull Creek | Shale | |
| | | | Fall River | Sandstone and Shale | |
| | | | Lakota | Sandstone and Shale | |
| | JURASSIC | Morrison | | Shale and Clay | |
| | | Sundance | | Shale, green & brown, Sandstone | |
| | | Piper | | Limestone, Anhydrite, Salt and red shale | |
| ABSAROKA | TRIASSIC | Spearfish | | Siltstone, Salt and Sandstone | |
| | PERMIAN | Minnekahta | | Limestone | |
| | | Opeche | | Shale, Siltstone and Salt | |
| | PENNSYLVANIAN | Minnelusa | | Sandstone and Dolomite | |
| | | Amsden | | Limestone, dolomitic, Shale and Sandstone | |
| KASKASKIA | MISSISSIPPIAN | Big Snowy Group | Heath | Shale | |
| | | | Otter | Sandstone | |
| | | | Kibbey | Limestone | |
| | | Madison | | Limestones and Evaporites | |
| | | Bakken | | Siltstone and Shale | |
| | DEVONIAN | Three Forks | | Shale, Siltstone and Dolomite | |
| | | Birdbear | | Limestone | |
| | | Duperow | | Dolomite and Limestone | |
| | | Souris River | | Dolomite and Limestone | |
| | | Dawson Bay | | Dolomite and Limestone | |
| | | Prairie | | Halite | |
| | | Winnipegosis | | Limestone and Dolomite | |
| TIPPECANOE | SILURIAN | Interlake | | Dolomite | |
| | ORDOVICIAN | Stonewall | | Dolomite and Limestone | |
| | | Stony Mountain Fm. | Gunton Mbr. | Dolomite and Limestone | |
| | | | Stoughton Member | Argillaceous Limestone | |
| | | Red River | | Limestone and Dolomite | |
| | | Winnipeg Group | Roughlock | Calcareous Shale & Siltstone | |
| | | | Icebox | Shale | |
| | | | Black Island | Sandstone | |
| SAUK | CAMBRIAN | Deadwood | | Limestone, Shale and Sandstone | |
| | PRE-CAMBRIAN | | | | |

FIGURE 1, Stratigraphic column of North Dakota. Heavy dashed lines represent major regional unconformities. Modified from Carlson and Anderson, 1966, p. 1835.

APPENDIX 3

## Stratigraphy of the Underwood Area

### Fort Union Group

The Cannonball Formation is the lower-most member of the Fort Union Group. It is probably the marine equivalent of the Ludlow Formation. It consists of olive black, carbonaceous and lignite siltstone and shale, lignite, and micaceous friable sandstones. They grade upward into similarly colored non-calcareous sandstones. The Cannonball Formation is approximately 250 to 300 feet thick in the Falkirk area.

The Tongue River and Sentinel Butte Formations are continental formations of Paleocene Age and are the youngest bedrock formations in McLean County. They directly underlie the glacial drift in the Falkirk area. The maximum thickness of these formations is approximately 800 feet in western McLean County.

The Tongue River Formation underlies the Sentinel Butte and consists of buff to orange buff and gray sands, silts, and clays which range from poorly to fairly well cemented. The sands are crossbedded and channeled in places and contain local sandstone concretions. Thin lignite beds are found in the Tongue River Formation, but no commercially useful lignite was found (Bluemle, 1971).

About 200 feet of Sentinel Butte has been measured in western McLean County and thins to the east in the Falkirk area. Generally, the Sentinel Butte consists of light gray to brownish gray sands and silts. The lignite beds of economic significance are in the Sentinel Butte Formation.

Coleharbor Formation - The Coleharbor Formation is glacial in origin and is one of the most widespread formations in the state. The Coleharbor consists of thousands of alternating beds, but only three main facies: (1) interlayered bouldery, cobbly, pebbly, sandy, silty clay; (2) sand and gravel; and (3) silt and clay. The Coleharbor Formation covers about 95 percent of McLean County and reaches a thickness of more than 400 feet. In the Falkirk area, the Coleharbor Formation averages less than 50 feet thick.

Boulder Clay Facies - The Coleharbor Formation consists of approximately 70 percent boulder clay by volume and much is in thin deposits. The boulder clay facies is relatively uniform, non-bedded mixture of approximately equal parts of sand, silt, and clay with small percentages of pebbles, cobbles, and boulders.

The color is generally dark gray below the water table, and grayish brown above. Mineralogically, this formation is montmorillonite and other clay minerals with small amounts of carbonates, quartz, and feldspars in the clay size fraction. The silt and sand fraction consists mainly of quartz and feldspar with some carbonates, shale, and lignite. Pebbles consist of limestone, dolomite, various igneous and metamorphic rocks, shale and lignite. The cobbles and boulders are largely igneous and metamorphic rock types.

The boulder clay has a natural dry weight ranging from 92 to 122 pounds per cubic foot, and averages 111 pounds per cubic foot. The natural moisture content ranges from 16 to 28 percent and averages 20.8 percent.

Sand and Gravel Facies - In McLean County about 25 percent of the Coleharbor Formation by volume consists of sand and gravel. The deposits occur both as thin layers and lenses within the boulder clay facies and as thick continuous sequences independent of the boulder clay. Quality ranges from sandy gravel and gravelly sand that is relatively free of fine materials to very dirty gravel with high percentages of silt and clay.

The mineralogy is similary to the boulder clay facies and indicates that both were derived largely from the northeast in Canada. The sand size fraction is largely quartz and feldspars with minor amounts of shale and carbonates. The gravel is largely igneous and metamorphic types, limestone, and dolomite. Some gravel has a high percentage of shale. The sand and gravel is generally uncemented, but may be cemented locally by iron oxide forming a conglomerate.

Silt and Clay Facies - This facies comprises approximately 5 percent by volume of the Coleharbor Formation and consists of layers and lenses of silt and clay. Much of this facies occurs in buried valleys. Layering is commonly horizontal and finely laminated (fraction of an inch thickness per lamination). The silt and clay facies is mineralogically the same as the silt and clay fraction of the boulder clay facies. (Montmorillonite and other clay minerals, carbonates, quartz, and feldspars.)

## Age and Origin of the Coleharbor Formation

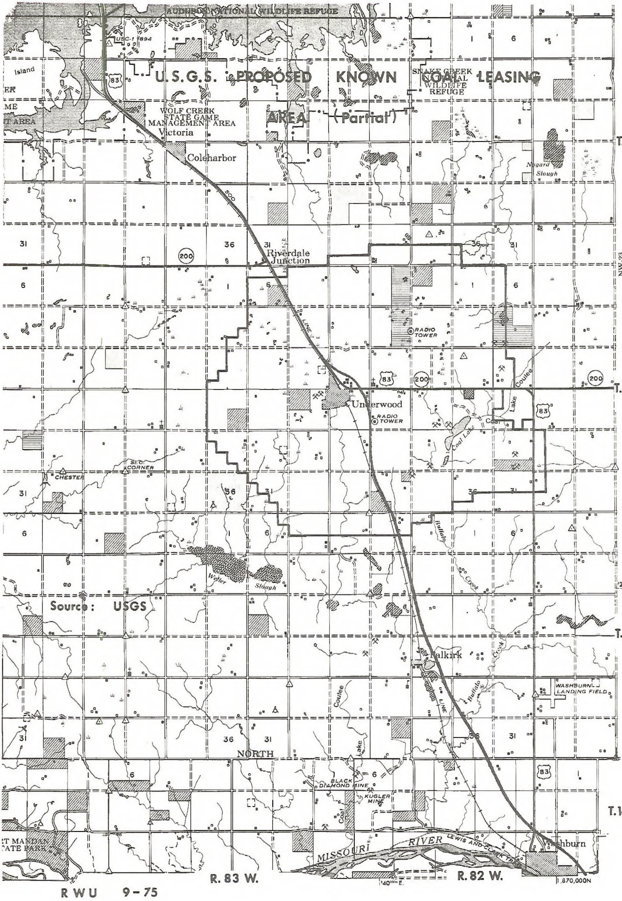
The Coleharbor was deposited during the Ice Age from 9,000 to several hundred thousand years ago. The boulder clay facies is mainly glacial till and was partially deposited directly from moving ice. The remainder slid, slumped, and flowed to its present position when the ice melted. The sand and gravel facies were deposited mainly by rivers and streams during glacial times. The Coleharbor silt and clay facies was deposited in lakes, both partially enclosed in glacial ice (eastern McLean) and natural non-ice walled lakes (western McLean).

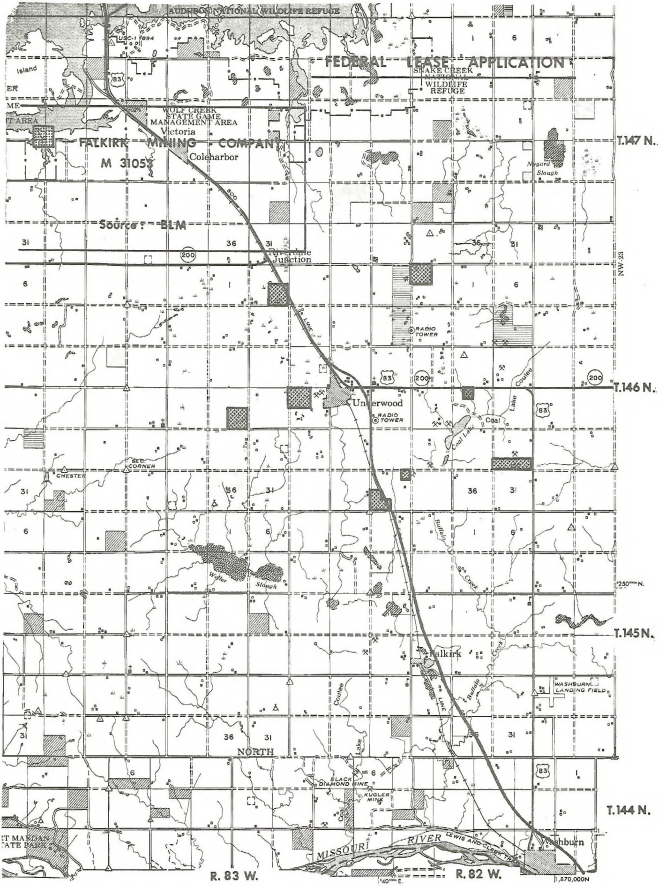
## Post-Glacial Sediments

Holocene sediments have been deposited since the Ice Age throughout McLean County. These deposits are beneath river and stream valley floodplains, slough floors and occur as sand dunes. The first two are present in the Falkirk study area.

Alluvial Sediments - Alluvial sediments occur within the Falkirk study area as stream deposits along former melt water trenches (see Geomorphology and Surface Geology Overlays). These deposits are relatively thin and consist mainly of clay, silt, sand, and gravel. Silts and clays comprise approximately 90 percent of these sediments.

Slough Sediments - Slough sediments occur within and near the Falkirk study area. The sediment is at most a few tens of feet thick and generally consist of very dark brown and black clays with a high organic content.


U.S.G.S. PROPOSED KNOWN COAL LEASING AREA (Partial)
AUDUBON NATIONAL WILDLIFE REFUGE
SNAKE CREEK NATIONAL WILDLIFE REFUGE
WOLF CREEK STATE GAME MANAGEMENT AREA
Victoria
Coleharbor
Riverdale Junction
Underwood
RADIO TOWER
Coal Lake
Lake Coulee
Weller Slough
Nygard Slough
CHESTER
SEC. CORNER
Buffalo Creek
Falkirk
WASHBURN LANDING FIELD
NORTH
BLACK DIAMOND MINE
KUGLER MINE
MISSOURI RIVER
LEWIS AND CLARK TR
Washburn
Source: USGS
T.147 N.
T.146 N.
T.145 N.
T.144 N.
R. 83 W.
R. 82 W.
NW-23
1,870,000N
RWU 9-75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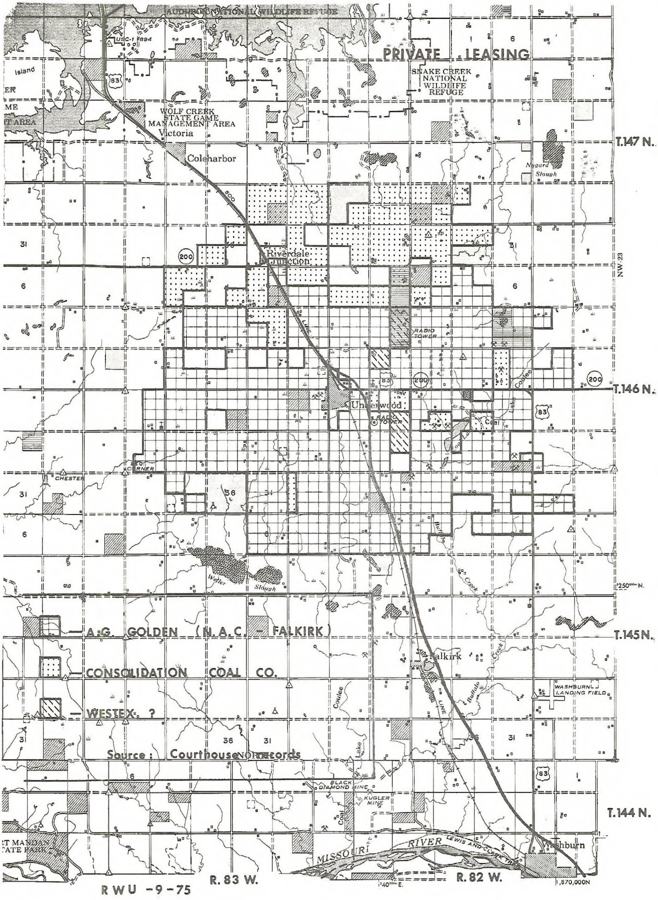
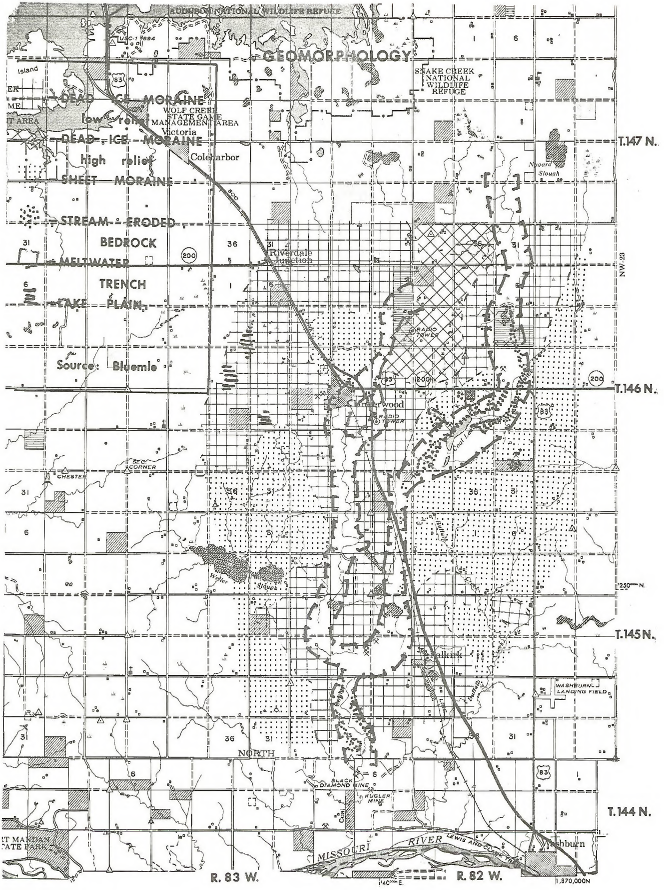
FEDERAL LEASE APPLICATION
SNAKE CREEK NATIONAL WILDLIFE REFUGE
WOLF CREEK STATE GAME MANAGEMENT AREA
Victoria
FALKIRK MINING COMPANY
M 31053
Coleharbor
Source: BLM
Riverdale Junction
T.147 N.
Nygard Slough
RADIO TOWER
Underwood
RADIO TOWER
Coal Lake
Coal
Lake
Coulee
T.146 N.
CHESTER
SEC. CORNER
Buffalo
Creek
Weller
Slough
T.145 N.
Falkirk
WASHBURN LANDING FIELD
Coulee
NORTH
Lake
BLACK DIAMOND MINE
KUGLER MINE
Coal
T.144 N.
MISSOURI RIVER
LEWIS AND CLARK TR.
Washburn
R. 83 W.
R. 82 W.
1,870,000N
NW 23
Island


A3-6

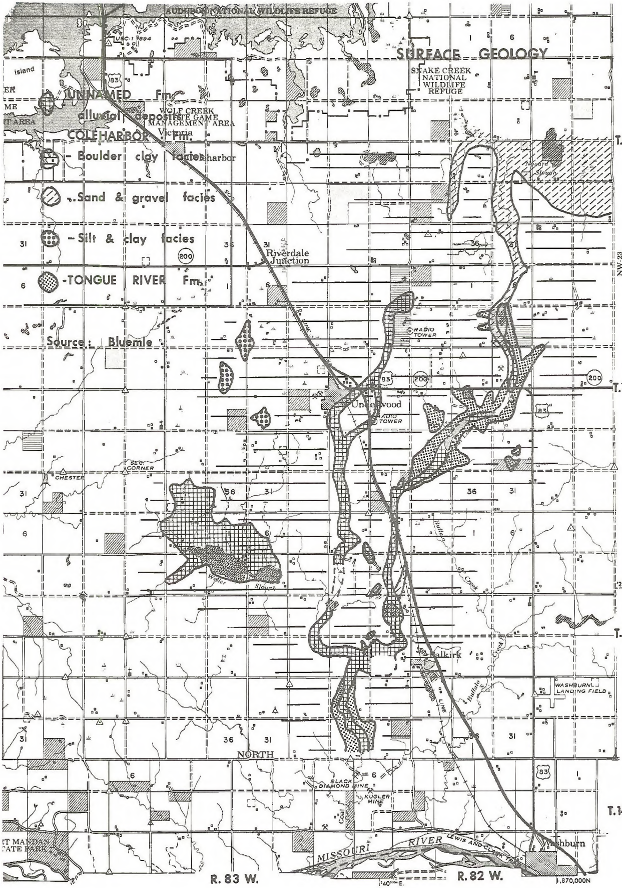
RWU - 9-75



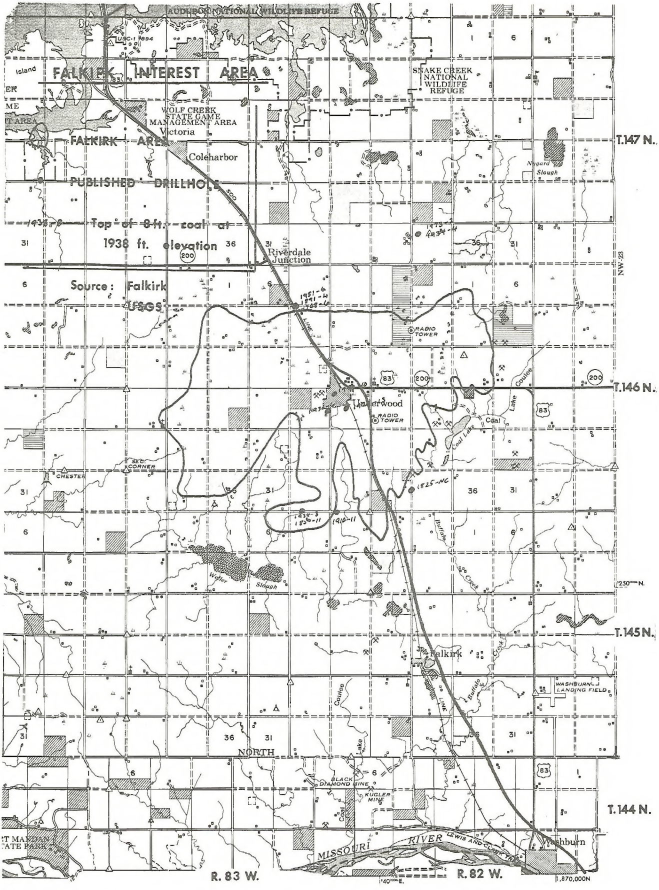
PRIVATE LEASING
SNAKE CREEK NATIONAL WILDLIFE REFUGE
WOLF CREEK STATE GAME MANAGEMENT AREA
Victoria
Coleharbor
Riverdale Junction
Underwood
Coal Lake
RADIO TOWER
Falkirk
WASHBURN LANDING FIELD
BLACK DIAMOND MINE
KUGLER MINE
MISSOURI RIVER
LEWIS AND CLARK TR.
Washburn
Weller Slough
Nygard Slough
Buffalo Creek
CHESTER
T.147 N.
T.146 N.
T.145 N.
T.144 N.
R. 83 W.
R. 82 W.
A.G. GOLDEN (N.A.C. - FALKIRK)
CONSOLIDATION COAL CO.
WESTEX ?
Source : Courthouse records
RWU -9-75



AUDUBON NATIONAL WILDLIFE REFUGE
GEOMORPHOLOGY
SNAKE CREEK NATIONAL WILDLIFE REFUGE
DEAD ICE MORAINE
low relief
WOLF CREEK STATE GAME MANAGEMENT AREA
Victoria
DEAD ICE MORAINE
high relief
Coleharbor
SHEET MORAINE
STREAM - ERODED BEDROCK
MELTWATER TRENCH
LAKE PLAIN
Source: Bluemle
Riverdale Junction
Nygaard Slough
T.147 N.
T.146 N.
T.145 N.
T.144 N.
NW-23
RADIO TOWER
Underwood
Coal Lake
CHESTER
Weller Slough
Falkirk
WASHBURN LANDING FIELD
NORTH
BLACK DIAMOND MINE
KUGLER MINE
MISSOURI RIVER
LEWIS AND CLARK TRAIL
Washburn
R. 83 W.
R. 82 W.
1,870,000N



SURFACE GEOLOGY
UNNAMED Fm.
alluvial deposits
COLEHARBOR Fm.
- Boulder clay facies
- Sand & gravel facies
- Silt & clay facies
-TONGUE RIVER Fm.
Source: Bluemle
AUDUBON NATIONAL WILDLIFE REFUGE
SNAKE CREEK NATIONAL WILDLIFE REFUGE
WOLF CREEK STATE GAME MANAGEMENT AREA
Victoria
Riverdale Junction
Underwood
RADIO TOWER
CHESTER
SEC CORNER
Falkirk
WASHBURN LANDING FIELD
BLACK DIAMOND MINE
KUGLER MINE
MISSOURI RIVER
LEWIS AND CLARK TR
Washburn
Weller Slough
Buffalo Creek
T.147 N.
T.146 N.
T.145 N.
T.144 N.
R. 83 W.
R. 82 W.
NORTH
1,870,000N
250,000 N.
NW-23


AUDUBON NATIONAL WILDLIFE REFUGE
FALKIRK INTEREST AREA
SNAKE CREEK NATIONAL WILDLIFE REFUGE
WOLF CREEK STATE GAME MANAGEMENT AREA
Victoria
FALKIRK AREA
Coleharbor
PUBLISHED DRILLHOLE
Top of 8 ft. coal at 1938 ft. elevation
Source: Falkirk USGS
Riverdale Junction
Nygard Slough
T.147 N.
T.146 N.
T.145 N.
T.144 N.
RADIO TOWER
Underwood
Coal Lake
Coal Lake Coulee
SEC. CORNER
CHESTER
1825-NC
1910-11
Weller Slough
Buffalo Creek
Falkirk
WASHBURN LANDING FIELD
NORTH
Coulee Lake
BLACK DIAMOND MINE
KUGLER MINE
MISSOURI RIVER
LEWIS AND CLARK TR
Washburn
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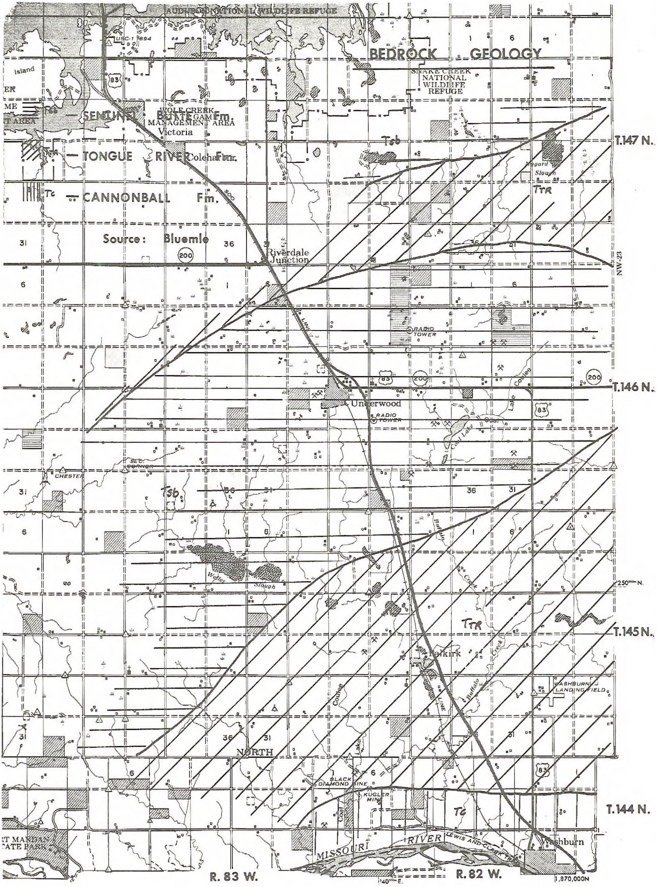
R. 83 W.
R. 82 W.
1,870,000N
250,000N
NW 23

RWU 9-75


BEDROCK GEOLOGY
Tsb — SENTINEL BUTTE Fm.
TTR — TONGUE RIVER Fm.
Tc — CANNONBALL Fm.
Source: Bluemle
AUDUBON NATIONAL WILDLIFE REFUGE
SNAKE CREEK NATIONAL WILDLIFE REFUGE
WOLF CREEK GAME MANAGEMENT AREA
Island
Victoria
Coleharbor
Riverdale Junction
Underwood
RADIO TOWER
CHESTER
SEC. CORNER
Nygard Slough
Weller Slough
Coal Lake
Lake Coulee
Buffalo Creek
Falkirk
WASHBURN LANDING FIELD
NORTH
BLACK DIAMOND MINE
KUGLER MINE
MISSOURI RIVER
LEWIS AND CLARK TR
Washburn
Tsb
TTR
Tc
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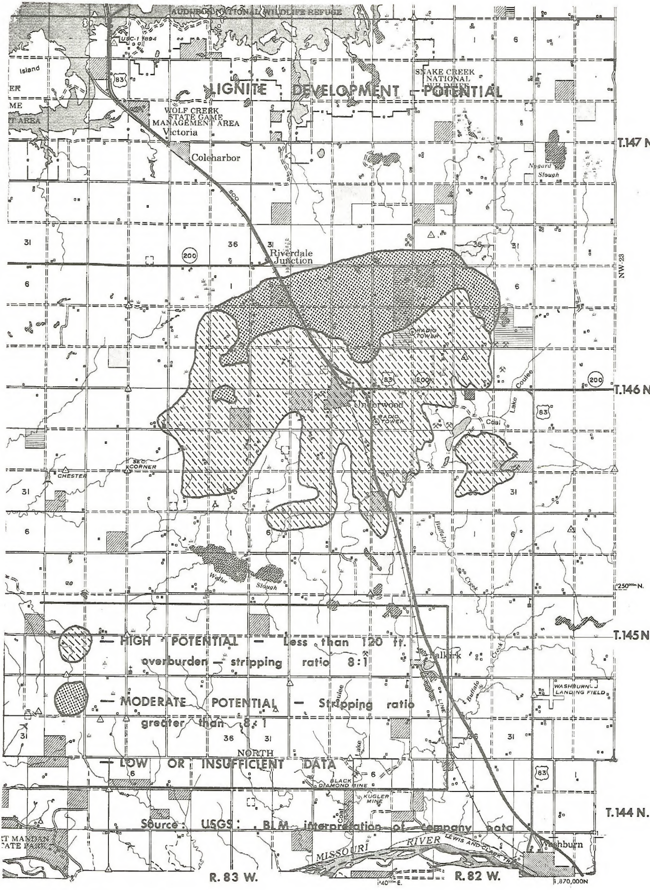
T.146 N.
T.145 N.
T.144 N.
R. 83 W.
R. 82 W.
NW-23
1,870,000N


LIGNITE DEVELOPMENT POTENTIAL
AUDUBON NATIONAL WILDLIFE REFUGE
SNAKE CREEK NATIONAL
WOLF CREEK STATE GAME MANAGEMENT AREA
Victoria
Colenarbor
Island
Nygard Slough
Riverdale Junction
RADIO TOWER
Underwood
Coal
Lake
Coulee
SEC. CORNER
CHESTER
Buffalo
Creek
Weller
Slough
Falkirk
WASHBURN LANDING FIELD
BLACK DIAMOND MINE
KUGLER MINE
MISSOURI
RIVER
LEWIS AND CLARK TR
Washburn
T.147 N.
T.146 N.
T.145 N.
T.144 N.
R. 83 W.
R. 82 W.
1,870,000N
250000 N.
NW-23
HIGH POTENTIAL — Less than 120 ft. overburden — stripping ratio 8:1
MODERATE POTENTIAL — Stripping ratio greater than 8:1
LOW OR INSUFFICIENT DATA
NORTH
Source: USGS: BLM interpretation of company data

FALKIRK EAR

Appendix 4

Water

(Hydrology)

APPENDIX 4

Table 1

CLASSIFICATION OF WATER BY TDS

| Total Dissolved Solids (PPM) | Salinity Rating |
|---|---|
| 0-1,000 | Fresh |
| 1,000-10,000 | Brackish |
| 10,000-100,000 | Saline |
| < 1,000,000 | Brine |

Note: As published by S. N. Davis and R. J. DeWiest, "Hydrogeology", 1966, John Wiley & Sons, Inc., New York, New York, page 118.

APPENDIX 4

Table 2

## MAJOR GROUND WATER BEARING FORMATIONS

Land Surface

| GPM | Group or Formation | TDS | Dominant Lithology |
|---|---|---|---|
| 50-200 | Glacial Deposits | 277-1360 | Sand, gravel |
| 5-75 | Fort Union Group | 206-3550 | |
| | Sentinel Butte Formation | | Sandstone, shale, lignite |
| | Tongue River Formation | | Sandstone, shale, lignite |
| | Cannonball Formation | | Marine sandstone, shale |
| 50 | Hell Creek Formation | 1200-1630 | Sandstone, shale, lignite |
| 10 | Fox Hills Formation | 1370-1550 | Marine sandstone |

Sea Level

Note: Reference, John P. Bluemle, North Dakota Geological Survey, "Geology of McLean County, North Dakota," Part I, 1971, page 9.

Form 1600–6
(August 1969)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Table 3a

PHYSICAL PROFILE
HYDROLOGIC DATA

| Unit Ground Water Fox Hills Formation | Date 1974 By USGS | | |
|---|---|---|---|
| ITEM | UNIT | ESTIMATED ANNUAL AMOUNT | SOURCE REFERENCE* |
| 1. Water Yield † | | 10 gpm | (1) |
| 2. Water Use † (municipal, domestic) | | | |
| 3. Sediment Production | | | |
| 4. Other Pollutants ‡ TDS | mg/l | 1370-1550 | (1) |
| a. Sulfate | mg/l | <10 | (1) |
| b. Iron | ug/l | 70-820 | (1) |
| c. Chloride | mg/l | 249-355 | (1) |
| d. Salinity and Sodium Hazard (2) | | very high | (1) |
| e. | | | |

Remarks

(1) R.L. Klausing, USGS, "Ground Water Resources of McLean County, North Dakota," Part 3, 1974, page 11.

(2) Refer to Salinity and Sodium Hazard Index (Irrigation Classification) Table 4.

† 1 cu. ft./sec (cfs) = 2 ac. ft./day = 730 ac. ft./year. 1 gal./min = .00223 cfs = 1.63 ac. ft./year.

‡ Show total mean annual concentration of all salts on line 4. List mean annual concentration of major salts on lines 4a, b, c, etc.

* If additional space is required, footnote under "Remarks"

APPENDIX 4

Form 1600–6
(August 1969)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Table 3b

PHYSICAL PROFILE
HYDROLOGIC DATA

| Unit Ground Water Hell Creek Formation | Date 1974<br>By USGS | | |
|---|---|---|---|
| ITEM | UNIT | ESTIMATED ANNUAL AMOUNT | SOURCE REFERENCE* |
| 1. Water Yield † | | 50 gpm | (1) |
| 2. Water Use † (municipal, domestic) | | | |
| 3. Sediment Production | | | |
| 4. Other Pollutants ‡ TDS | mg/l | 1200-1630 | (1) |
| a. Sulfate | mg/l | <25 | (1) |
| b. Iron | ug/l | 80-660 | (1) |
| c. Salinity and Sodium Hazard (2) | | very high | (1) |
| d. | | | |
| e. | | | |

Remarks

(1) R.L. Klausing, USGS, "Ground Water Resources of McLean County, North Dakota," Part 3, 1974 page 13.

(2) Refer to Salinity and Sodium Hazard Index (Irrigation Classification) Table 4.

† 1 cu. ft./sec (cfs) = 2 ac. ft./day = 730 ac. ft./year. 1 gal./min = .00223 cfs = 1.63 ac. ft./year.

‡ Show total mean annual concentration of all salts on line 4. List mean annual concentration of major salts on lines 4a, b, c, etc.

* If additional space is required, footnote under "Remarks"

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Table 3c

PHYSICAL PROFILE
HYDROLOGIC DATA

| | |
|---|---|
| Unit Ground Water Fort Union Group | Date 1974<br>By USGS |

| ITEM | UNIT | ESTIMATED ANNUAL AMOUNT | SOURCE REFERENCE* |
|---|---|---|---|
| 1. Water Yield † | | 5-75 gpm | (1) |
| 2. Water Use † (municipal, domestic, livestock) | | | |
| 3. Sediment Production | | | |
| 4. Other Pollutants ‡ TDS | mg/l | 206-3550 | (1) |
| a. Sulfate | mg/l | 3.2-2,000 | (1) |
| b. Iron | ug/l | 0-95,000 | (1) |
| c. Chloride | mg/l | 0.2-423 | (1) |
| d. Nitrate | mg/l | 0-350 | (1) |
| e. Salinity and Sodium Hazard (2) | | 48% C4-S4 | (1) |

Remarks

23% C3-S2 to C3-S3
29% C2-S1

(1) R.L. Klausing, USGS, "Ground Water Resources of McLean County, North Dakota," Part 3, 1974, page 14.

(2) Refer to Salinity and Sodium Hazard Index (Irrigation Classification) Table 4.

† 1 cu. ft./sec (cfs) = 2 ac. ft./day = 730 ac. ft./year. 1 gal./min = .00223 cfs = 1.63 ac. ft./year.

‡ Show total mean annual concentration of all salts on line 4. List mean annual concentration of major salts on lines 4a, b, c, etc.

* If additional space is required, footnote under "Remarks"

APPENDIX 4

Form 1600-6
(August 1969)

UNITED STATES
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BUREAU OF LAND MANAGEMENT

Table 3d

PHYSICAL PROFILE
HYDROLOGIC DATA

| Unit | Ground Water<br>Turtle Lake Glacial Aquifer | Date 1974<br>By USGS | |
|---|---|---|---|
| **ITEM** | **UNIT** | **ESTIMATED ANNUAL AMOUNT** | **SOURCE REFERENCE*** |
| 1. Water Yield † | | 50-200 gpm | (1) |
| 2. Water Use † (municipal, domestic, livestock) | | | |
| 3. Sediment Production | | | |
| 4. Other Pollutants ‡ TDS | mg/l | 277-1360 | (1) |
| a. Sulfate | mg/l | 37-447 | (1) |
| b. Iron | ug/l | 0-5,000 | (1) |
| c. Salinity and Sodium Hazard (2) | | C2-S1 to C3-S4 | (1) |
| d. | | | |
| e. | | | |

Remarks

(1) R.L. Klausing, USGS, "Ground Water Resources of McLean County, North Dakota," Part 3, 1974, page 30.

(2) Refer to Salinity and Sodium Hazard Index (Irrigation Classification) Table 4.

† 1 cu. ft./sec (cfs) = 2 ac. ft./day = 730 ac. ft./year. 1 gal./min = .00223 cfs = 1.63 ac. ft./year.

‡ Show total mean annual concentration of all salts on line 4. List mean annual concentration of major salts on lines 4a, b, c, etc.

* If additional space is required, footnote under "Remarks"

APPENDIX 4

Form 1600–6
(August 1969)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Table 3e

PHYSICAL PROFILE
HYDROLOGIC DATA

| Unit | Ground Water<br>Weller Slough Glacial Aquifer | Date 1974<br>By USGS | |
|---|---|---|---|
| ITEM | UNIT | ESTIMATED ANNUAL AMOUNT | SOURCE REFERENCE* |
| 1. Water Yield † | | 50-1,000 gpm | (1) |
| 2. Water Use † (domestic and livestock) | | | |
| 3. Sediment Production | | | |
| 4. Other Pollutants ‡ TDS | mg/l | 867-1730 | (1) |
| a. Sulfate | mg/l | 188-561 | (1) |
| b. Iron | ug/l | 80-4200 | (1) |
| c. Salinity and Sodium Hazard (2) | | C3-S1 to C4-S4 | (1) |
| d. | | | |
| e. | | | |

Remarks

(1) R.L. Klausing, USGS "Ground Water Resources of McLean County, North Dakota," Part 3, 1974, page 41.

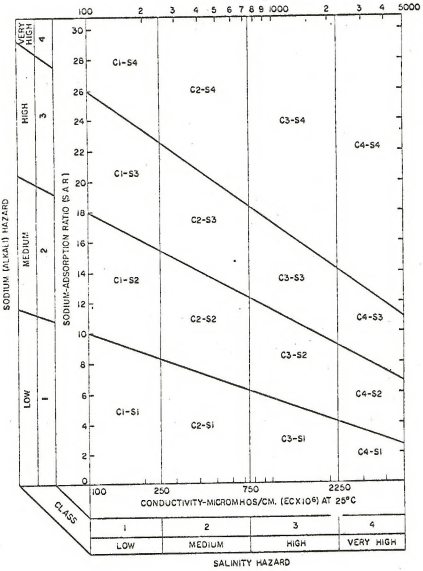
(2) Refer to Salinity and Sodium Hazard Index (Irrigation Classification) Table 4.

† 1 cu. ft./sec (cfs) = 2 ac. ft./day = 730 ac. ft./year. 1 gal./min = .00223 cfs = 1.63 ac. ft./year.

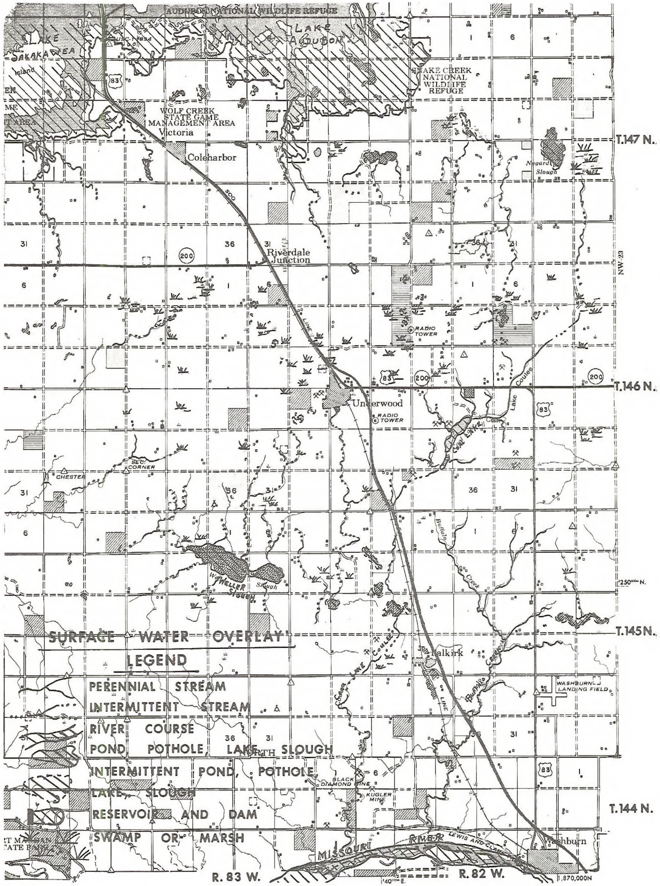
‡ Show total mean annual concentration of all salts on line 4. List mean annual concentration of major salts on lines 4a, b, c, etc.

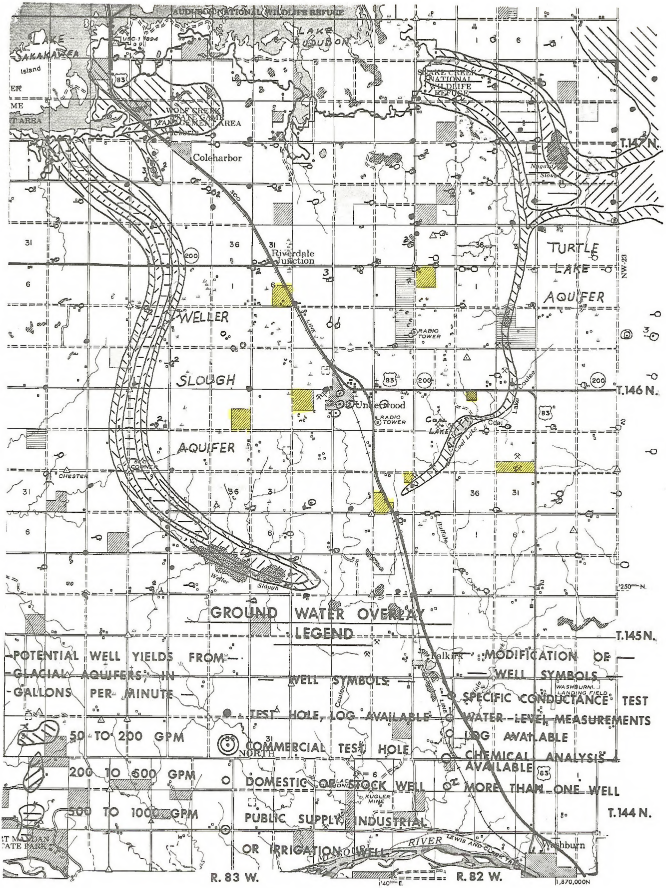
* If additional space is required, footnote under "Remarks"

Table 4 IRRIGATION CLASSIFICATION




Salinity and sodium hazard classification. (From U.S. Salinity Laboratory Staff, 1954).


AUDUBON NATIONAL WILDLIFE REFUGE
LAKE SAKAKAWEA
LAKE AUDUBON
SNAKE CREEK NATIONAL WILDLIFE REFUGE
WOLF CREEK STATE GAME MANAGEMENT AREA
Victoria
Coleharbor
Riverdale Junction
Underwood
RADIO TOWER
Nygard Slough
T.147 N.
T.146 N.
T.145 N.
T.144 N.
Lake Coulee
CHESTER
SEC. CORNER
Weller Slough
Buffalo Creek
Falkirk
WASHBURN LANDING FIELD
BLACK DIAMOND MINE
KUGLER MINE
MISSOURI RIVER
LEWIS AND CLARK
Washburn
R. 83 W.
R. 82 W.
1,870,000N
250,000 N.
NW-23
SURFACE WATER OVERLAY
LEGEND
PERENNIAL STREAM
INTERMITTENT STREAM
RIVER COURSE
POND, POTHOLE, LAKE, SLOUGH
INTERMITTENT POND, POTHOLE, LAKE, SLOUGH
RESERVOIR AND DAM
SWAMP OR MARSH


AUDUBON NATIONAL WILDLIFE REFUGE
LAKE SAKAKAWEA
LAKE AUDUBON
Island
WOLF CREEK STATE GAME MANAGEMENT AREA
SNAKE CREEK NATIONAL WILDLIFE REFUGE
Coleharbor
T.147 N.
Nygaard Slough
Riverdale Junction
SOO LINE
TURTLE LAKE AQUIFER
WELLER SLOUGH AQUIFER
RADIO TOWER
Underwood
Coal Lake
Lake Coulee
T.146 N.
CHESTER
Buffalo Creek
Weller Slough
GROUND WATER OVERLAY LEGEND
POTENTIAL WELL YIELDS FROM GLACIAL AQUIFERS, IN GALLONS PER MINUTE
50 TO 200 GPM
200 TO 500 GPM
500 TO 1000 GPM
WELL SYMBOLS
TEST HOLE, LOG AVAILABLE
COMMERCIAL TEST HOLE
DOMESTIC OR STOCK WELL
PUBLIC SUPPLY, INDUSTRIAL OR IRRIGATION WELL
MODIFICATION OF WELL SYMBOLS
SPECIFIC CONDUCTANCE TEST
WATER LEVEL MEASUREMENTS
LOG AVAILABLE
CHEMICAL ANALYSIS AVAILABLE
MORE THAN ONE WELL
Falkirk
WASHBURN LANDING FIELD
KUGLER MINE
T.145 N.
T.144 N.
MISSOURI RIVER
LEWIS AND CLARK TRAIL
Washburn
R. 83 W.
R. 82 W.
NORTH
FORT MANDAN STATE PARK
250,000 N.
1,870,000 N

APPENDIX 4

## Hydrologic Characteristics of the Underwood Vicinity

a. Surface Water Characteristics

The physiography of the Falkirk Mine area in McLean County, North Dakota is attributed to thin ground moraines and dead ice moraines of the Pleistocene geologic period. When the dead ice moraines melted, a hummocky knob and kettle topography, not having a systematic linear form or an integrated drainage system, resulted. This distinctive terrain is filled with prairie potholes and has changed little since its origin (Sloan, 1972).

Precipitation in the area is somewhat erratic with the greatest amount occurring during the 6-month period extending from April through September. During the winter months approximately 25% of the annual precipitation falls as snow.

Prairie potholes and sloughs are water holding depressions of glacial origin averaging from 2 to 5 feet in depth (Sloan, 1972). Water is supplied by precipitation, basin runoff, and seepage inflow of ground water. Depletion of pothole water is a result of evapotranspiration, overflow (which rarely occurs), and seepage outflow (Sloan, 1972).

Potholes can be classified into two groups. The first go dry because the water source is mainly precipitation and runoff. The second is permanent because the water supply includes substantial seepage inflow (Eisenlohr, 1972).

Precipitation over the area varies from year to year, but seasonal replenishment of pothole water can be expected to average from 12 to 15 inches annually. Average precipitation in this area is too small to meet the demands of evaporation. Therefore, permanent potholes must have basin inflow large enough to overcome all the factors of pothole depletion (Eisenlohr, 1972). The total amount of water lost from May to October from potholes due to evapotranspiration is about 30 inches. Annual precipitation on a pond surface averages about 12 inches, leaving about 18 inches to be replenished by runoff and groundwater inflow (Eisenlohr, 1972).

All water, except direct precipitation, entering a pothole contains some dissolved solids. The only means of removal is by overflow, which rarely occurs, and seepage outflow. Evapotranspiration removes only pure water resulting in higher concentrations of dissolved solids. If a pond dries completely, minor amounts may be removed by wind and bacterial action transforming dissolved solids into gasses (Eisenlohr, 1972).

As a general rule, seepage outflow is the major contributing factor in removing dissolved solids from a pothole. At a pothole where the rate of seepage outflow is high, water will be relatively fresh. Where there is little or no seepage outflow, solids will accumulate and the water can range from brackish to brine (Eisenlohr, 1972). (See Table 1, "Classification of Water By TDS" - Appendix 4.)

b. Ground Water Characteristics

Beneath the surface of the land are numerous layers, stringers, and pockets of material that are saturated with water. This water is called ground water. The water bearing material is called a ground water reservoir or aquifer.

Ground water moves under the influence of gravity from areas of recharge to areas of discharge. This movement is generally very slow, usually only a few feet per year. The rate of movement is governed by the hydraulic conductivity of the material through which the water moves and the hydraulic gradient. Coarse sand, gravel, and well sorted materials have a high conductivity and commonly form aquifers. Fine grained materials such as silt, clay, and shale usually have a low conductivity (Klausing, 1974).

Water in aquifers fluctuates in response to recharge and discharge. Shallow aquifers surrounding the area are in hydraulic connection with surface water sources. These aquifers may either receive recharge from or discharge into surface water sources depending on head relationships (Klausing, 1974). (See Ground Water Overlay - Appendix 4.) Currently, there appears to be sufficient recharge to the aquifers underlaying the proposed mine area to replace losses caused by natural processes and the pumping of wells (Klausing, 1974).

Throughout the area, the ground water contains dissolved mineral matter in varying degrees. The amount and kind of dissolved materials in water depends upon the solubility and types of rocks encountered, length of time the water was in contact with the rocks, and the carbon dioxide and soil acids in the water (Klausing, 1974).

Underlaying the proposed mine area are four major ground water aquifers (See Table 2, Major Ground Water Aquifers - Appendix 4) located in the Fox Hills Formation, Hell Creek Formation, Fort Union Group, and Glacial Drift and Alluvial areas. The glacial aquifers are in old glacial channels cut into the surface level geology. The water from all aquifers is suitable for most purposes. However, the water in the material underlying the Fox Hills Formation is generally brine (Klausing, 1974). (See Table 3, for chemical analysis of aquifers - Appendix 4.)

The Fox Hills Formation underlies the entire county. This formation is under artesian pressure with a potentiometric gradient toward the east. Generally, the water from this aquifer is a soft, sodium bicarbonate type. Dissolved solids range from 1,370 to 1,550 mg/l (milligrams per liter). The sulfate content is less than 10 mg/l, iron from 70 to 820 ug/l (micrograms per liter), and chloride from 249 to 355 mg/l. The salinity and sodium hazard index is very high (See Table 3a for chemical analysis - Appendix 4). The potential water yield of the Fox Hills is unknown, but wells yielding 10 gpm (gallons per minute) have been measured (Klausing, 1974).

The Hell Creek Formation overlies the Fox Hills Formation and consists of interbedded silty shale and sandstone. The water in the Hell Creek Formation is a soft, sodium bicarbonate type. The dissolved solids range from 1,200 to 1,630 mg/l, iron from 80 to 660 ug/l. Sulfate content is less than 25 mg/l. The water has a very high salinity and sodium hazard index rating (See Table 3b for chemical analysis - Appendix 4). Water yields of this formation have been reported to be 50 gpm (Klausing, 1974).

The Fort Union Group underlies the entire county and overlies the Hell Creek Formation. Generally, it is covered by glacial deposits except where it outcrops and ranges in thickness from 127 feet in the east to 1,100 feet in the western part of the county. This group consists of interbedded silt, siltstone, clay, shale, sandstone, and lignite. The beds vary in thickness and are not uniform over the area. The sandstone beds are the major water bearing units and are generally very fine to fine grained. They range in thickness from a few feet to 225 feet. Lignite beds in this area also serve as a source of water for domestic and livestock wells and range in thickness from 0.5 to 20 feet.

The water levels in the Fort Union Group are generally less than 100 feet deep and in some cases are only a few feet below the ground surface. Some wells in this group flow.

A geologic island, containing the mine area, exists in the pre-glacial bedrock topography of the Fort Union Group. An unpublished piezometic surface map prepared by the North Dakota Geological Survey (Moran and Groenewold, 1974) indicates the ground water is moving outward and downward from the Underwood area. An area just south of Underwood appears to be the island's center and highest point.

Water quality measurements vary. The water is predominantly a sodium bicarbonate type. Most of the water samples analyzed were classified as hard to very hard. The dissolved solids ranged from 206 to 3,550 mg/l, iron from 0 to 95,000 ug/l, and sulfate from 3.2 to 2,000 mg/l. Chloride concentrations ranged from 0.2 to 423 mg/l. The nitrates ranged from 0 to 350 mg/l. The irrigation classification ranged from C4-S4 in 48 percent of the samples, C3-S2 to C3-S3 in 23 percent of the samples, and C2-S1 in 29 percent of the samples. (See Table 3c for chemical analysis - Appendix 4.)

The town of Underwood derives its water supply from this aquifer. Well yields generally range from 5 to 75 gpm and could possibly be increased to 200 gpm if developed in the thick sandstone (Klausing, 1974).

Glacial aquifers in McLean County have the greatest potential for ground water development (See Ground Water Overlay - Appendix 4). These aquifers are classified into four main groups. These are: (1) aquifers associated with buried valleys, (2) melt water channel aquifers, (3) surficial outwash aquifers, and (4) undifferentiated sand and gravel aquifers.

Surrounding the proposed mine area are 2 major glacial aquifer systems associated with buried valleys. To the east and running north and south is the Coal Lake Slough segment of the Turtle Lake Aquifer. To the west of the area and running north and south is the Weller Slough Aquifer.

The Turtle Lake Aquifer covers some 26 square miles and generally flows in a north westerly direction to Lake Audubon. The Coal Lake Coulee portion is one of the Aquifers smaller segments. Generally, it extends south about 7 miles from the main body of the Turtle Lake Aquifer and averages about ¼ mile wide.

The top of the Turtle Lake Aquifer lies from 3 to 84 feet below the ground surface and has a thickness from 12 to 127 feet, it averages about 42 feet. The aquifer consists of very fine to very coarse sand that is imbedded and intermixed with fine to coarse gravel. Water level fluctuations of the aquifer appear to be related to both precipitation and the changing levels of Lake Audubon. The highest water levels generally occur between March and June. The Coal Lake Coulee segment is capable of producing from 50 to 200 gallons per minute at the present rate of withdrawal.

The water quality of the Turtle Lake Aquifer is a moderately hard to very hard, sodium bicarbonate or a calcium bicarbonate type. The dissolved solids range from 277 to 1,360 mg/l, sulfate from 37 to 447 mg/l, and iron from 0 to 5,000 ug/l. The Salinity and Sodium Hazard Index (Irrigation Classification) ranges from C2-S1 to C3-S4 (See Table 3d for chemical analysis - Appendix 4).

This aquifer is used mainly for domestic and livestock wells. The city of Turtle Lake to the north of the proposed mine site derives its supply from the aquifer (Klausing, 1974).

The Weller Slough Aquifer extends in a north westerly direction from T. 145 N., R. 82 W., Section 8, to Lake Sakakawea. From here the aquifer extends an unknown distance under the lake. The aquifer is about 14 miles long and varies in width from ½ to 1 mile.

The Weller Slough Aquifer consists of beds and lenses of sand and gravel extending to a depth of 200 feet. Its maximum thickness is about 90 feet and has an average thickness of about 40 feet. The water levels range from 57 feet to 101 feet below the land surface. The water levels in the aquifer have been rising. This trend is probably the combined result of recharge from precipitation and an increasing head in the aquifer system as a result of rising water levels in Lake Sakakawea. Currently the wells tapping this aquifer are capable of producing from 50 to 1,000 gpm and are used for domestic and livestock purposes (Klausing, 1974).

The water in the Weller Slough Aquifer is a hard to very hard, sodium bicarbonate type. The dissolved solids range from 867 to 1,730 mg/l, sulfate from 188 to 561 mg/l, and iron from 80 to 4,200 ug/l. The Salinity and Sodium Hazard Index (Irrigation Classification) ranges from C3-S1 to C4-S4 (See Table 3e for chemical analysis - Appendix 4).

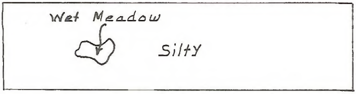
FALKIRK EAR

Appendix 5

Vegetation

| | Approximate Acres | % of Area |
|---|---|---|
| Silty - | 157 | 98 |
| Wet Meadow | 3 | 2 |
| | 160 | |

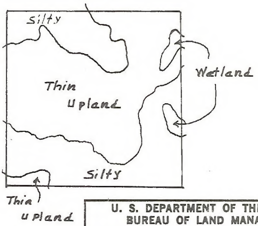
Scale: 4" = 1 mile




Section 30, S ½ S ½
T. 146 N., R. 81 W.

Scale: 4" = 1 mile

| | Approximate Acres | % of Area |
|---|---|---|
| Wetland - | 4 | 3 |
| Silty - | 64 | 40 |
| Thin upland - | 92 | 57 |
| | 160 | |




Section 24 SE ¼
T. 146 N R. 83 W

U. S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Appendix 5
Range sites

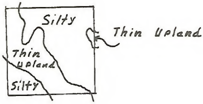
| | |
|---|---|
| DESIGNED____ | RECOMM.____ |
| DRAWN____ | RECOMM.____ CHIEF, DIV. OF ENG. |
| CHECKED____ | APPROVED____ |
| SCALE | |
| DATE | SHEET___OF___ |
| DRAWING NO. | |



☆ GPO 853-660

Scale: 4" = 1 Mile

| | Approximate | |
|---|---|---|
| | Acres | % of Area |
| Silty – | 27 | 67 |
| Thin Upland – | 13 | 33 |
| | 40 | |




Section 24 NE 1/4 NW 1/4

T. 146 N., R. 82 W.

Scale: 4" = 1 Mile

| | Approximate | |
|---|---|---|
| | Acres | % of Area |
| Silty – | 34 | 21 |
| Thin Upland – | 126 | 79 |
| | 160 | |


Section 20, NW 1/4

T. 146 N. R. 82 W.

Appendix 5

U. S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Range Sites

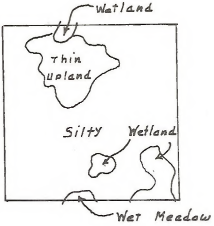
| | |
|---|---|
| DESIGNED | RECOMM. |
| DRAWN W. P. | RECOMM. CHIEF, DIV. OF ENG. |
| CHECKED | APPROVED |
| SCALE 4" = 1 Mile | |
| DATE 10-29-75 | SHEET ___ OF ___ |
| DRAWING NO. | |



☆ GPO 853-660

Scale: 4" = 1 Mile

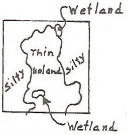
| | Approximate Acres | Approximate % of Area |
|---|---|---|
| Wetland - | 11 | 7 |
| Wet Meadow - | 1 | 1 |
| Silty | 120 | 81 |
| Thin Upland - | 18 | 11 |
| | 160 | |




Section 6. SE 1/4
T. 146 N. R. 82 W.

Scale: 2" = 1 Mile

| | Approximate Acres | Approximate % of Area |
|---|---|---|
| Wetland - | 6 | 4 |
| Silty - | 86 | 54 |
| Thin Upland - | 68 | 42 |
| | 160 | |



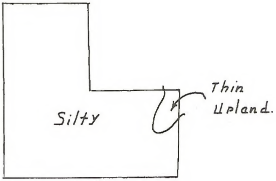

Section 2, NW 1/4
T. 146 N R. 82 W.
Appendix. 5

| U. S. DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT | |
|---|---|
| Range sites | |
| DESIGNED____ | RECOMM.____ |
| DRAWN W. P. | RECOMM.____ CHIEF, DIV. OF ENG. |
| CHECKED____ | APPROVED____ |
| SCALE 4" = 1 Mile 2" = 1 Mile | |
| DATE 10-29-75 | SHEET___OF___ |
| DRAWING NO. | |

☆ GPO 853-660

Scale: 4" = 1 Mile

| | Approximate Acres | % of Area |
|---|---|---|
| Silty - | 116 | 97 |
| Thin upland | 4 | 3 |
| | 120 | |




Section 34, NW¼ SW¼, S½ SW¼
T. 146 N., R. 82 W.

Scale: 4" = 1 mile

| | Approximate Acres | % of Area |
|---|---|---|
| Silty - | 17 | 41 |
| Thin Upland - | 23 | 59 |
| | 40 | |


Section 34, NE¼ NE¼
T. 146 N, R. 82 W.

SCS - McLean Co, No. Dakota

Appendix 5

U. S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Range sites

| | |
|---|---|
| DESIGNED____ | RECOMM.____ |
| DRAWN W.P. | RECOMM.____ CHIEF, DIV. OF ENG. |
| CHECKED____ | APPROVED____ |
| SCALE 4" = 1 Mile | |
| DATE 10-29-75 | SHEET___OF___ |
| DRAWING NO. | |

☆ GPO 853-660

# CHARACTERISTIC PLANT SPECIES IN PRAIRIE PONDS AND LAKES (from Stewart and Kantrud - Classification of Natural Ponds and Lakes in the Glaciated Prairie Region, 1971).

The more important plant species characteristic of classes and subclasses of prairie ponds and lakes are listed here. Major groupings are the vegetational zones and phases. In Classes III, IV, and VII, dominant and subdominant categories are referred to. Dominant species are relatively tall emergents that form the canopy, or overstory, of plant associations; subdominants are submerged, floating, or short emergent species that ordinarily compose the understory. Plants are grouped as primary and secondary species to show their prevalence as related to cover under normal conditions within a plant community. A more detailed description of wetland vegetation in northern prairie ponds and lakes may be found in Stewart and Kantrud (in press).

Except for a few extralimital species, the identification of vascular plants is according to the eighth edition of Gray's Manual (Fernald, 1950). A few western species of vascular plants not treated in Gray's Manual follow the nomenclature used by Stevens (1963). References to algae are according to Smith (1950), while names of mosses and liverworts follow Conard (1956). Altogether, 174 plant species are listed here. Scientific and common names of all plants referred to are listed in appendix B. Voucher specimens for all of these are preserved in the herbarium at the Northern Prairie Wildlife Research Center.

Class I—ephemeral ponds:
- Central wetland-low-prairie zone:
  - Normal emergent phase:
    - Primary species:
      - *Poa pratensis*
      - *Agropyron trachycaulum*
      - *Anemone canadensis*
      - *Symphoricarpos occidentalis*
      - *Solidago altissima*
      - *Aster ericoides*
      - *Ambrosia psilostachya*
    - Secondary species:
      - *Panicum virgatum*
      - *Andropogon gerardi*
      - *Carex brevior*
      - *Zigadenus elegans*
      - *Lilium philadelphicum*
      - *Rosa woodsii*
      - *Glycyrrhiza lepidota*
      - *Zizia aptera*
      - *Helianthus maximiliani*
      - *Artemisia ludoviciana*
      - *Taraxacum officinale*
      - *Agoseris glauca*
      - *Crepis runcinata*
  - Cropland tillage phase:
    - Primary species:
      - *Setaria glauca*
      - *Polygonum convolvulus*
      - *Kochia scoparia*
    - Secondary species:
      - *Agropyron smithii*
      - *Agropyron repens*
      - *Salsola kali*
      - *Amaranthus retroflexus*
      - *Thlaspi arvense*
      - *Brassica kaber*
      - *Descurainia sophia*
      - *Rosa arkansan*
      - *Androsace occidentalis*
      - *Ellisia nyctelea*
      - *Erigeron canadensis*
      - *Iva xanthifolia*

Class II—temporary ponds:
- Subclass A—fresh:
  - Central wet-meadow zone:
    - Normal emergent phase:
      - Primary species:
        - *Poa palustris*
        - *Carex praegracilis*
        - *Carex sartwellii*
        - *Carex lanuginosa*
        - *Boltonia latisquama*
        - *Aster simplex*
      - Secondary species:
        - *Hordeum jubatum*
        - *Calamagrostis canadensis* var. *macouniana*
        - *Calamagrostis inexpansa*
        - *Spartina pectinata*
        - *Hierochloe odorata*
        - *Carex vulpinoidea*
        - *Carex laeviconica*
        - *Juncus balticus*
        - *Juncus dudleyi*
        - *Juncus interior*
        - *Rumex mexicanus*
        - *Rumex occidentalis*
        - *Ranunculus macounii*

*Rorippa islandica*
*Potentilla norvegica*
*Epilobium glandulosum*
*Lysimachia hybrida*
*Apocynum sibiricum*
*Asclepias speciosa*
*Teucrium occidentale*
*Stachys palustris*
*Mentha arvensis*
*Vernonia fasciculata*
*Helenium autumnale*
*Artemisia biennis*
*Cirsium arvense*
*Sonchus arvensis*

Cropland drawdown phase:
Primary species:
*Agropyron repens*
*Echinochloa crusgalli*
*Polygonum lapathifolium*
*Veronica peregrina*
Secondary species:
*Hordeum jubatum*
*Plagiobothrys scopulorum*
*Xanthium italicum*
*Bidens frondosa*

Peripheral wetland-low-prairie zone:
The species composition is the same as that of the central wetland-low-prairie zone of ephemeral ponds (Class I).

Subclass B—slightly brackish:
Central wet-meadow zone:
Normal emergent phase:
Primary species:
*Hordeum jubatum*
*Calamagrostis inexpansa*
*Spartina pectinata*
*Carex sartwellii*
*Juncus balticus*
*Aster simplex*
Secondary species:
*Poa palustris*
*Carex praegracilis*
*Carex lanuginosa*
*Juncus interior*
*Juncus dudleyi*
*Juncus torreyi*
*Rumex mexicanus*
*Epilobium glandulosum*
*Stachys palustris*
*Lycopus asper*
*Mentha arvensis*
*Artemisia biennis*
*Cirsium arvense*
*Sonchus arvensis*

Cropland drawdown phase:
The species composition is the same as that of the cropland drawdown phase of the central wet-meadow zone in fresh temporary ponds (Class II-A).

Peripheral wetland-low-prairie zone:
The species composition is the same as that of the central wetland-low-prairie zone of ephemeral ponds (Class I).

Class III—seasonal ponds and lakes:
Subclass A—fresh:
Central shallow-marsh zone:
Normal emergent phase:
Dominants:
Primary species:
*Sparganium eurycarpum*
*Alisma triviale*
*Glyceria grandis*
*Beckmannia syzigachne*
*Carex atherodes*
*Polygonum coccineum*
Secondary species:
*Alopecurus aequalis*
*Phalaris arundinacea*
*Sium suave*
Subdominants:
Primary species:
*Riccia fluitans*
*Lemna trisulca*
*Utricularia vulgaris*
Secondary species:
*Drepanocladus* spp.
*Lemna minor*

Open-water phase:
Primary species:
*Potamogeton gramineus*
*Callitriche palustris*
*Utricularia vulgaris*
Secondary species:
*Drepanocladus* spp.
*Potamogeton pusillus*
*Eleocharis acicularis*, submerged form.
*Ranunculus trichophyllus*

Natural drawdown phase:
Primary species:
*Eleocharis acicularis*, terrestrial form.
Secondary species:
*Rumex maritimus*
*Kochia scoparia*
*Xanthium italicum*
*Senecio congestus*

Cropland drawdown phase:

Primary species:
*Eleocharis engelmanni*
*Eleocharis acicularis*
*Gratiola neglecta*

Secondary species:
*Marsilea mucronata*
*Cyperus acuminatus*
*Bacopa rotundifolia*
*Lindernia dubia*

Peripheral wet-meadow zone:
The species composition is the same as that of the central wet-meadow zone of fresh temporary ponds. (Class II–A).

Peripheral wetland-low-prairie zone:
The species composition is the same as that of the central wetland-low-prairie zone of ephemeral ponds (Class I).

Subclass B—slightly brackish:
Central shallow-marsh zone:
Normal emergent phase:
Dominants:
Primary species:
*Alisma triviale*
*Scolochloa festucacea*
*Beckmannia syzigachne*
*Eleocharis palustris*
*Carex atherodes*
*Polygonum coccineum*

Secondary species:
*Sparganium eurycarpum*
*Alisma gramineum*
*Sagittaria cuneata*
*Alopecurus aequalis*
*Phalaris arundinacea*
*Polygonum amphibium*, terrestrial form
*Sium suave*

Subdominants:
Primary species:
*Drepanocladus* spp.
*Ricciocarpus natans*
*Lemna trisulca*
*Lemna minor*
*Utricularia vulgaris*

Secondary species:
*Riccia fluitans*
*Ranunculus sceleratus*
*Ranunculus cymbalaria*

Open-water phase:
Primary species:
*Drepanocladus* spp.
*Ranunculus trichophyllus*
*Utricularia vulgaris*

Secondary species:
*Potamogeton pusillus*
*Eleocharis acicularis*, submerged form.
*Polygonum amphibium*, aquatic form

Natural drawdown phase:
Primary species:
*Eleocharis acicularis*

Secondary species:
*Hordeum jubatum*
*Rumex maritimus*
*Chenopodium rubrum*
*Kochia scoparia*
*Xanthium italicum*
*Senecio congestus*

Cropland drawdown phase:
The species composition is the same as that of the cropland drawdown phase of fresh seasonal ponds (Class III–A).

Peripheral wet-meadow zone:
The species composition is the same as that of the central wet-meadow zone of slightly brackish temporary ponds (Class II–B).

Peripheral wetland-low-prairie zone:
The species composition is the same as that of the central wetland-low-prairie zone of ephemeral ponds (Class I).

Subclass C—moderately brackish:
Central shallow-marsh zone:
Normal emergent phase:
Dominants:
Primary species:
*Alisma gramineum*
*Scolochloa festucacea*
*Beckmannia syzigachne*
*Eleocharis palustris*

Secondary species:
*Scirpus americanus*
*Carex atherodes*

Subdominants:
Primary species:
*Lemna minor*

Secondary species:
*Drepanocladus* spp.
*Lemna trisulca*
*Ranunculus cymbalaria*
*Utricularia vulgaris*

Open-water phase:
Primary species:
None

Secondary species:
*Chara* spp.
*Drepanocladus* spp.

*Ranunculus trichophyllus*
*Utricularia vulgaris*
Natural drawdown phase:
Primary species:
*Hordeum jubatum*
Secondary species:
*Eleocharis acicularis*
*Rumex maritimus*
*Chenopodium rubrum*
*Kochia scoparia*
Cropland drawdown phase:
Primary species:
*Eleocharis acicularis*
Secondary species:
*Gratiola neglecta*
Peripheral wet-meadow zone:
Normal emergent phase:
Primary species:
*Hordeum jubatum*
*Calamagrostis inexpansa*
*Spartina pectinata*
*Juncus balticus*
Secondary species:
*Distichlis stricta*
*Atriplex patula*
*Potentilla anserina*
*Glaux maritima*
*Lycopus asper*
*Plantago eriopoda*
*Aster simplex*
*Artemisia biennis*
Cropland drawdown phase:
Primary species:
*Agropyron repens*
Secondary species:
*Hordeum jubatum*
*Echinochloa crusgalli*
*Xanthium italicum*
Peripheral wetland-low-prairie zone:
The species composition is the same as that of the central wetland-low-prairie zone of ephemeral ponds (Class I).

Class IV—semipermanent ponds and lakes:
Subclass A—fresh:
Central deep-marsh zone:
Normal emergent phase:
Dominants:
Primary species:
*Scirpus heterochaetus*
Secondary species:
*Typha latifolia*
*Scirpus fluviatilis*
Subdominants:
Primary species:
*Riccia fluitans*
*Lemna trisulca*
*Utricularia vulgaris*
Secondary species:
*Drepanocladus* spp.
*Ricciocarpus natans*
*Lemna minor*
Open-water phase:
Primary species:
*Potamogeton pusillus*
*Utricularia vulgaris*
Secondary species:
*Potamogeton richardsonii*
*Ceratophyllum demersum*
*Ranunculus trichophyllus*
*Myriophyllum exalbescens*
Natural drawdown phase:
Primary species:
*Eleocharis acicularis*
*Senecio congestus*
Secondary species:
*Kochia scoparia*
Peripheral shallow-marsh zone:
The species composition is the same as that of the central shallow-marsh zone of fresh seasonal ponds and lakes (Class III–A).
Peripheral wet-meadow zone:
The species composition is the same as that of the central wet-meadow zone of fresh temporary ponds (Class II–A).
Peripheral wetland-low-prairie zone:
The species composition is the same as that of the central wetland-low-prairie zone of ephemeral ponds (Class I).

Subclass B—slightly brackish:
Central deep-marsh zone:
Normal emergent phase:
Dominants:
Primary species:
*Typha "glauca"*
*Scirpus acutus*
*Scirpus fluviatilis*
Secondary species:
*Typha latifolia*
*Scirpus validus*
Subdominants:
Primary species:
*Drepanocladus* spp.
*Ricciocarpus natans*
*Lemna trisulca*
*Lemna minor*
*Utricularia vulgaris*

Secondary species:
*Riccia fluitans*
Open-water phase:
Primary species:
*Potamogeton richardsonii*
*Potamogeton pusillus*
*Ceratophyllum demersum*
*Ranunculus trichophyllus*
*Myriophyllum exalbescens*
*Utricularia vulgaris*
Secondary species:
*Chara* spp.
*Drepanocladus* spp.
*Zannichellia palustris*
*Potamogeton pectinatus*
*Callitriche hermaphroditica*
Natural drawdown phase:
Primary species:
*Eleocharis acicularis*
*Rumex maritimus*
*Chenopodium rubrum*
*Kochia scoparia*
*Senecio congestus*
Secondary species:
*Hordeum jubatum*
Peripheral shallow-marsh zone:
The species composition is the same as that of the central shallow-marsh zone of slightly brackish seasonal ponds and lakes (Class III–B).
Peripheral wet-meadow zone:
The species composition is the same as that of the central wet-meadow zone of slightly brackish temporary ponds (Class II–B).
Peripheral wetland-low-prairie zone:
The species composition is the same as that of the central wetland-low-prairie zone of ephemeral ponds (Class I).

Subclass C—moderately brackish:
Central deep-marsh zone:
Normal emergent phase:
Dominants:
Primary species:
*Scirpus acutus*
Secondary species:
*Scirpus paludosus*
Subdominants:
Primary species:
*Lemna minor*
Secondary species:
*Drepanocladus* spp.
*Lemna trisulca*
*Utricularia vulgaris*
Open-water phase:
Primary species:
*Chara* spp.
*Zannichellia palustris*
*Potamogeton pectinatus*
Secondary species:
*Ranunculus trichophyllus*
*Myriophyllum exalbescens*
Natural drawdown phase:
Primary species
*Hordeum jubatum*
*Rumex maritimus*
*Chenopodium rubrum*
*Kochia scoparia*
Secondary species:
*Panicum capillare*
*Eleocharis acicularis*
*Chenopodium salinum*
*Aster brachyactis*
Peripheral shallow-marsh zone:
The species composition is the same as that of the central shallow-marsh zone of moderately brackish seasonal ponds and lakes (Class III–C).
Peripheral wet-meadow zone:
The species composition is the same as that of the peripheral wet-meadow zone of moderately brackish seasonal ponds and lakes (Class III–C).
Peripheral wetland-low-prairie zone:
The species composition is the same as that of the central wetland-low-prairie zone of ephemeral ponds (Class I).
Peripheral fen zone (marginal pockets):
The species composition is the same as that of the central fen zone of fen ponds (Class VII).

Subclass D—brackish:
Central deep-marsh zone:
Normal emergent phase:
Dominants:
Primary species:
*Scirpus paludosus*
Secondary species:
*Scirpus acutus*
Subdominants:
None.
Open-water phase:
Primary species:
*Chara* spp.
*Zannichellia palustris*
*Potamogeton pectinatus*
Secondary species:
None.

Natural drawdown phase:
Primary species:
*Hordeum jubatum*
*Chenopodium salinum*
*Kochia scoparia*
*Aster brachyactis*
Secondary species:
*Panicum capillare*
*Rumex maritimus*
Peripheral shallow-marsh zone:
Normal emergent phase:
Dominants:
Primary species:
*Scirpus americanus*
Secondary species:
*Puccinellia nuttalliana*
*Eleocharis palustris*
*Salicornia rubra*
Subdominants:
None.
Open-water phase:
Primary species:
*Zannichellia palustris*
Secondary species:
*Chara* spp.
Natural drawdown phase:
Primary species:
*Hordeum jubatum*
*Aster brachyactis*
Secondary species:
*Chenopodium salinum*
*Kochia scoparia*
Peripheral wet-meadow zone:
Normal emergent phase:
Primary species:
*Distichlis stricta*
*Hordeum jubatum*
Secondary species:
*Triglochin maritima*
*Muhlenbergia asperifolia*
*Juncus balticus*
*Polygonum prolificum*
*Atriplex patula*
*Potentilla anserina*
*Lactuca scariola*
Peripheral wetland-low-prairie zone:
The species composition is the same as that of the central wetland-low-prairie zone of ephemeral ponds (Class I).
Peripheral fen zone (marginal pockets):
The species composition is the same as that of the central fen zone of fen ponds (Class VII).

Subclass E—subsaline:
Central deep-marsh zone:
Normal emergent phase:
Dominants:
Primary species:
*Scirpus paludosus*
Secondary species:
None.
Subdominants:
None.
Open-water phase:
Primary species:
*Ruppia maritima*
Secondary species:
*Chara* spp.
*Potamogeton pectinatus*
Natural drawdown phase:
Primary species:
None.
Secondary species:
*Kochia scoparia*
Peripheral shallow-marsh zone:
Normal emergent phase:
Dominants:
Primary species:
*Puccinellia nuttalliana*
*Salicornia rubra*
Secondary species:
*Scirpus nevadensis*
*Scirpus americanus*
*Suaeda depressa*
Subdominants:
None.
Open-water phase:
None.
Natural drawdown phase:
None.
Peripheral wet-meadow zone:
Normal emergent phase:
Primary species:
*Distichlis stricta*
Secondary species:
*Triglochin maritima*
*Hordeum jubatum*
*Muhlenbergia asperifolia*
*Spartina gracilis*
*Atriplex patula*
Peripheral wetland-low-prairie zone:
The species composition is the same as that of the wetland-low-prairie zone of ephemeral ponds (Class I).
Peripheral fen zone (marginal pockets):
The species composition is the same as that of the central fen zone of fen ponds (Class VII).

Class V—permanent ponds and lakes:

Subclass B—slightly brackish:

Central permanent-open-water zone:

Primary species:

*Ruppia occidentalis*

Secondary species:

None.

Peripheral deep-marsh zone:

The species composition is the same as that of the central deep-marsh zone of slightly brackish semipermanent ponds and lakes (Class IV–B).

Peripheral shallow-marsh zone:

The species composition is the same as that of the central shallow-marsh zone of slightly brackish seasonal ponds and lakes (Class III–B).

Peripheral wet-meadow zone:

The species composition is the same as that of the central wet-meadow zone of slightly brackish temporary ponds (Class II–B).

Peripheral wetland-low-prairie zone:

The species composition is the same as that of the central wetland-low-prairie zone of ephemeral ponds (Class I).

Peripheral fen zone (marginal pockets):

The species composition is the same as that of the central fen zone of fen ponds (Class VII).

Subclass C—moderately brackish:

Central permanent-open-water zone:

Primary species:

*Ruppia occidentalis*

Secondary species:

None.

Peripheral deep-marsh zone:

The species composition is the same as that of the central deep-marsh zone of moderately brackish semipermanent ponds and lakes (Class IV–C).

Peripheral shallow-marsh zone:

The species composition is the same as that of the central shallow-marsh zone of moderately brackish seasonal ponds and lakes (Class III–C).

Peripheral wet-meadow zone:

The species composition is the same as that of the peripheral wet-meadow zone of moderately brackish seasonal ponds and lakes (Class III–C).

Peripheral wetland-low-prairie zone:

The species composition is the same as that of the central wetland-low-prairie zone of ephemeral ponds (Class I).

Peripheral fen zone (marginal pockets):

The species composition is the same as that of the central fen zone of fen ponds (Class VII).

Subclass D—brackish:

Central permanent-open-water zone:

Primary species:

*Ruppia occidentalis*

Secondary species:

*Potamogeton vaginatus*

Peripheral deep-marsh zone:

The species composition is the same as that of the central deep-marsh zone of brackish semipermanent ponds and lakes (Class IV–D).

Peripheral shallow-marsh zone:

The species composition is the same as that of the peripheral shallow-marsh zone of brackish semipermanent ponds and lakes (Class IV–D).

Peripheral wet-meadow zone:

The species composition is the same as that of the peripheral wet-meadow zone of brackish semipermanent ponds and lakes (Class IV–D).

Peripheral wetland-low-prairie zone:

The species composition is the same as that of the central wetland-low-prairie zone of ephemeral ponds (Class I).

Peripheral fen zone (marginal pockets):

The species composition is the same as that of the central fen zone of fen ponds (Class VII).

Subclass E—subsaline:

Central permanent-open-water zone:

Primary species:

None.

Secondary species:

None.

Peripheral deep-marsh zone:

This zone is often poorly represented; when present, the characteristic species are the same as those of the central deep-marsh zone of subsaline semipermanent ponds and lakes (Class IV–E).

Peripheral shallow-marsh zone:

The species composition is the same as that of the peripheral shallow-marsh zone of subsaline semipermanent ponds and lakes (Class IV–E).

Peripheral wet-meadow zone:

The species composition is the same as that of the peripheral wet-meadow zone of subsaline semipermanent ponds and lakes (Class IV–E).

Peripheral wetland-low-prairie zone:
The species composition is the same as that of the central wetland-low-prairie zone of ephemeral ponds (Class I).
Peripheral fen zone (marginal pockets):
The species composition is the same as that of the central fen zone of fen ponds (Class VII).

Class VI—alkali ponds and lakes:
Central intermittent-alkali zone:
Primary species:
*Ruppia maritima*
Secondary species:
None.
Peripheral shallow-marsh zone:
The species composition is the same as that of the peripheral shallow-marsh zone of subsaline semipermanent ponds and lakes (Class IV–E).
Peripheral wet-meadow zone:
The species composition is the same as that of the peripheral wet-meadow zone of subsaline semipermanent ponds and lakes (Class IV–E).
Peripheral wetland-low-prairie zone:
The species composition is the same as that of the central wetland-low-prairie zone of ephemeral ponds (Class I).
Peripheral fen zone (marginal pockets):
The species composition is the same as that of the central fen zone of fen ponds (Class VII).

Class VII—fen ponds:
Central fen zone:
Normal emergent phase:
Dominants:
Primary species:
*Typha latifolia*
*Glyceria striata*
*Phragmites communis*
*Scirpus validus*
*Carex aquatilis*
*Salix interior*
*Salix candida*
*Cicuta maculata*
*Aster junciformis*
Secondary species:
*Triglochin maritima*
*Deschampsia caespitosa*
*Calamagrostis inexpansa*
*Muhlenbergia glomerata*
*Eleocharis calva*
*Eriophorum angustifolium*
*Scirpus atrovirens*
*Carex sartwellii*
*Carex interior*
*Carex aurea*
*Carex lanuginosa*
*Carex rostrata*
*Juncus torreyi*
*Hypoxis hirsuta*
*Ranunculus septentrionalis*
*Epilobium leptophyllum*
*Lysimachia thrysiflora*
*Gentiana procera*
*Asclepias incarnata*
*Scutellaria epilobiifolia*
*Lobelia kalmii*
*Eupatorium maculatum*
*Solidago graminifolia*
*Helianthus rydbergii*
Subdominants:
Primary species:
*Drepanocladus* spp.
Secondary species:
*Lemna minor*
*Parnassia palustris*
*Viola nephrophylla*
Open-water phase:
Primary species:
*Chara* spp.
*Drepanocladus* spp.
Secondary species:
*Zannichellia palustris*
*Ceratophyllum demersum*
*Ranunculus gmelini*
*Hippuris vulgaris*
*Utricularia vulgaris*
Peripheral wet-meadow zone:
The species composition is the same as that of the central wet-meadow zone of slightly brackish temporary ponds (Class II–B).
Peripheral wetland-low-prairie zone:
The species composition is the same as that of the central wetland-low-prairie zone of ephemeral ponds (Class I).

APPENDIX 5

Wetland Classification System Currently Used by the U.S. Fish and Wildlife Service in the Underwood Area.*

The following is a description of wetland types that may be involved in replacement.

| | |
|---|---|
| Type I | Temporarily flooded by snow melting or heavy rains and are usually dry during the growing season. |
| Type II | Inland fresh meadows where the soil is usually without standing water during most of the growing season, but is waterlogged within a few inches of the surface. |
| Type III | Shallow basins where the soil is usually waterlogged during the growing season; often it is covered with as much as 6 inches or more of water. |
| Type IV | Inland permanent marshes with water depths generally from 6 inches to 3 feet or more. During drought, however these areas could be dry. |
| Type V | Open inland, fresh water ponds and reservoirs with water depths usually less than 10 feet. |
| *Type VI | Shrub swamps where the soil is usually waterlogged during the growing season and often covered with as much as 6 inches of water. |
| *Type VII | Areas where the soil is waterlogged to within a few inches of the surface and are periodically covered by standing water and supporting a growth of trees, shrubs and grasses. |
| *Type VIII | There are areas where the soil is usually waterlogged and spongy supporting either woody or herbaceous cover or both. |
| Type IX | Inland saline flats usually without standing water except after peiods of heavy precipitation, but are waterlogged to within a few inches of the surface during the growing season. Vegetation is sparse consisting of salt tolerant species. |
| Type X | Inland saline marshes when the soil is usually waterlogged during the growing season and often covered with as much as 2 or 3 feet of water. Vegetation consists of salt tolerant species. |
| Type XI | Inland open saline lakes often closely associated with Types IX and X. |

* These wetland types should be considered for replacement on a case by case basis.

* This system follows closely that outlined in U.S. Department of the Interior - Fish & Wildlife Service Circular 39 - "Wetlands of the United States".

## APPENDIX 5

### List of U.S. Fish and Wildlife Service Easements Within Lease Line of Federal Coal Lease #31053(ND)*

| Township-Range | Land Surface Controller | Total Acreage | Wetland Type (acres) I | III | IV | V | Total |
|---|---|---|---|---|---|---|---|
| 146-82 | (198X) Stadick, Arthur<br>Sec. 27, $S\frac{1}{2}NW\frac{1}{4}$<br>Sec. 28, $E\frac{1}{2}$ | 400 | 15 | 4 | - | - | 19 |
| 146-83<br>USA Coal | (188X) Swanson, Arthur W.<br>Sec. 24, $SE\frac{1}{4}$ | 160 | 10 | 6 | - | - | 16 |
| 146-82 | (207X) Duban et al, Edward<br>Sec. 18, $NE\frac{1}{4}$, Fr $SW\frac{1}{4}$ | 316.70 | 7 | 12 | 17 | - | 36 |
| 146-82 | (194X) Swanson, Russel L.<br>Sec. 17, $NE\frac{1}{4}$ Less Clm. | 154.00 | 5 | 15 | - | - | 20 |
| 146-82<br>USA Coal | (80X) Smidt et al, Amalea<br>Sec. 6, $W\frac{1}{2}SE\frac{1}{4}$<br>$SE\frac{1}{4}SE\frac{1}{4}$ less Clm. | 160.00 | 2 | 8 | - | - | 10 |
| | Sec. 7, $E\frac{1}{2}$*In Mine Area-<br>Not Leased | 320.00 | 13 | 27 | - | - | 40 |
| 146-82 | (191X) Bartz, Erna<br>Sec. 7, lot 2, $SE\frac{1}{4}$<br>$NW\frac{1}{4}$ | 80.00 | 1 | 9 | - | - | 10 |
| 146-83 | Sec. 1, $SE\frac{1}{4}$ | 160.00 | 4 | 11 | - | - | 15 |
| | Sec. 12, $N\frac{1}{2}N\frac{1}{2}$ | 160.00 | 13 | - | - | - | 13 |
| 146-83 | (281X-3) Anderson, George C.<br>Sec. 12, $SW\frac{1}{4}$ | 160.00 | 7 | 3 | - | - | 10 |
| | TOTALS | 1,750.00 | 64 | 68 | 17 | - | 149 |

Thirty-one acres of Type I's and nineteen acres of Type III's are contained in the 998.75 mineral acres owned by U.S.A. This includes the 320 acres under easement.

* Assembled by U.S. Fish and Wildlife Service from existing inventory information (November 1975).

APPENDIX 5

Range Site Descriptions over Federal Coal

Falkirk Coal Lease Application #31053 (ND)

(From SCS - McLean Co., No. Dakota)

Wetland Range Site

This range site includes soils of lower positions which receive additional amounts of water from surface runoff. Soils on this site are very poorly drained and water stands over the surface or the soil remains saturated for most of the growing season. Soil series common to this site are Parnell, Dimmick, and Grano. Additional moisture is the major factor affecting the kinds of plants that grow on the site. The composition of the plant community is as follows:

APPROXIMATED SPECIES COMPOSITION OF THE CLIMAX (POTENTIAL) PLANT COMMUNITY

| Plants | Percent Composition by Weight |
|---|---|
| Slough sedge | 30 |
| Rivergrass | 35 |
| Prairie cordgrass | 5 |
| Northern reedgrass | 2 |
| American mannagrass | 2 |
| Other perennial grasses | 5 |
| Slim sedge | 5 |
| Baltic rush | 3 |
| Common spikesedge | 3 |
| Other perennial grasslikes | 3 |
| Long-rooted smartweed | 3 |
| Silver leaf cinquefoil* | 2 |
| Other perennial forbs | 2 |
| Total | 100 |

* These plants are not usually utilized by cattle.

APPENDIX 5

This site produces approximately 6300 pounds of air-dry herbage per acre in years with above average growing conditions to 4700 pounds per acre in below average years.

Under continued heavy grazing by cattle, slough sedge, rivergrass, prairie cordgrass, northern reedgrass, and American mannagrass decrease in the plant community. Plants such as slim sedge, Baltic rush, common spikesedge, and silver leaf cinquefoil increase on the site. If overuse is prolonged the plant community is reduced to low growing sedges and forbs that are undesirable for cattle and wildlife.

Because the soils are wet, this range site is most suitable for late season grazing. Generally, most of the plants are grazed by cattle and horses throughout the summer. The site is commonly cut for hay in dryer years. The quality of hay is lowered if mowing is prolonged to plant maturity.

APPENDIX 5

## Wet Meadow Range Site

This range site includes poorly drained soils of shallow depressions and seeped lands. The site is normally flooded during the spring and summer from runoff. The seeped lands usually dry up at the surface about mid-summer, but have free water in the root zone for most of the growing season. Soil series which occur on this site are Colvin, Fossum, Marysland, and Tonka. The wetness factor primarily affects the kinds of plants that grow on the site. The composition of the plant community is as follows:

APPROXIMATED SPECIES COMPOSITION OF THE CLIMAX (POTENTIAL) PLANT COMMUNITY

| Plants | Percent Composition by Weight |
|---|---|
| Slim sedge | 35 |
| Woolly sedge | 10 |
| Fescue sedge | 5 |
| Baltic rush* | 3 |
| Common spikesedge | 5 |
| Other perennial grasslikes | 5 |
| Northern reedgrass | 8 |
| Prairie cordgrass | 5 |
| Switchgrass | 5 |
| Fowl bluegrass | 5 |
| Other perennial grasses | 3 |
| Rydberg's sunflower | 4 |
| Wild mint* | 2 |
| Other perennial forbs | 5 |
| Total | 100 |

* These plants are not usually utilized by cattle.

APPENDIX 5

This site produces approximately 4900 pounds of air-dry herbage per acre in years with above average growing conditions to 3700 pounds per acre in below average years.

Under continued heavy grazing by cattle, slim sedge, woolly sedge, northern reedgrass, prairie cordgrass, swithchgrass, and Rydberg's sunflower decrease in the plant community. Plants such as Baltic rush, fescue sedge, common spikesedge, fowl bluegrass, and mat muhly increase on the site. With prolonged overuse the plant community is reduced to low-growing sedges and forbs that are undesirable for cattle and wildlife.

This site is most suitable for late season grazing since the surface soils are wet until summer. Generally, most plants are grazed by cattle and horses throughout the summer due to their succulence.

APPENDIX 5

## Silty Range Site

The site occurs on nearly level to hilly terrain in glaciated and residual plains and on high stream terraces. The site includes well drained soils of medium and moderately fine texture that are deep and moderately deep. These soils have high available water capacity and moderate and moderately slow permeability. A large number of soils series are included in this site; among the more common of these are Max, Mandan, Williams, Bowbells, Temvik, and Bowdle. The composition of the plant community is as follows:

APPROXIMATED SPECIES COMPOSITION OF THE CLIMAX (POTENTIAL) PLANT COMMUNITY

| Plant | Percent Composition by Weight |
|---|---|
| Western wheatgrass | 25 |
| Green needlegrass | 10 |
| Needle-and-thread | 15 |
| Porcupinegrass | 5 |
| Blue grama | 10 |
| Prairie junegrass | 5 |
| Kentucky bluegrass | 5 |
| Other perennial grasses | 3 |
| Penn sedge | 4 |
| Other perennial grasslikes | 3 |
| Cudweed sagewort* | 2 |
| Silverleaf scurfpea | 2 |
| Other perennial forbs | 5 |
| Fringed sagewort* | 2 |
| Western snowberry | 2 |
| Other shrubs | 2 |
| Total | 100 |

*These plants are not usually utilized by cattle.

APPENDIX 5

This site produces approximately 2500 pounds of air-dry herbage per acre in years with above average growing conditions to 1800 pounds per acre in below average years.

Under continued heavy grazing by cattle plants such as green needle-grass, needle-and-thread, and prairie junegrass decrease in the plant community. Plants that increase with heavy use are western wheatgrass, blue grama, Kentucky bluegrass, upland sedges, unpalatable forbs and shrubs. Further deterioration is shown by a predominance of blue grama upland sedges, sagewort species, and other unpalatable plants.

Because of the smooth terrain, management is not difficult where pastures are not usually large and watering facilities are adequate. The most important range plants on this site grow in the spring and early summer. Early spring grazing before the major species have made some growth should be avoided in order to maintain productivity of the site.

APPENDIX 5

Thin Upland Range Site

This range site is on rolling to hilly and steep glacial till areas. Soils are deep, medium textured, having a thin surface overlying strongly calcareous parent material. Permeability is moderate in the upper profile and moderately slow in the glacial till. The available water capacity is high and plant roots can penetrate to five feet or more. The only soil series in this range site is Zahl. The composition of the plant community is as follows:

APPROXIMATED SPECIES COMPOSITION OF THE CLIMAX (POTENTIAL) PLANT COMMUNITY

| Plants | Percent Composition by Weight |
|---|---|
| Little bluestem | 20 |
| Needle-and-thread | 10 |
| Western wheatgrass | 10 |
| Porcupinegrass | 10 |
| Green needlegrass | 5 |
| Plains muhly | 5 |
| Sideoats grama | 5 |
| Blue grama | 5 |
| Other perennial grasses | 5 |
| Penn sedge | 8 |
| Other perennial grasslikes | 2 |
| Stiff goldenrod | 2 |
| Silverleaf scurfpea | 2 |
| Other perennial forbs | 6 |
| Western snowberry | 2 |
| Other shrubs | 3 |
| Total | 100 |

APPENDIX 5

This site produces approximately 2175 pounds of air-dry herbage per acre in years with above average growing conditions to 1575 pounds per acre in below average years.

Under continued heavy grazing by cattle, little bluestem, needle-and-thread, porcupinegrass, green needlegrass, and sideoats grama decrease in the plant community. Species such as blue grama, western wheatgrass, red three-awn, upland sedges, and unpalatable forbs increase with heavy grazing. Further site deterioration results in a plant community of shortgrasses, sedges, forbs, and shrubs of poor forage quality.

This site produces good quality forage for spring and summer grazing. It is also highly desirable for fall and winter use because of livestock protection from weather. Grazing distribution is more difficult to attain and water facilities need to be closer spaced than in more open areas of range. The Thin Upland Site provides good habitat for deer and upland game birds.

APPENDIX 5

## Mine Area Agricultural Production Potential

The total land area to be disturbed by mining in any one year will be approximately 400 acres. This will be accumulative for the first three years of the mine then remain constant at 1,200 acres until the last three years of the mine when it will decrease at the rate of 400 acres per year, assuming no reclamation extensions are granted.

The three years of soil disturbance can be broken down as follows:

| | |
|---|---|
| First Year: | Stripping the overburden one year in advance of the loading shovel. |
| Second Year: | Removal of the coal. |
| Third Year: | Level and rehabilitate the spoil piles. This schedule depends upon four things:<br>1) High or low ratio of overburden to coal.<br>2) High or low volume of coal.<br>3) Time of year the coal is mined.<br>4) Length of pit. |

Using the percentages of land types derived from aerial photographs within the coal take line, 400 acres would break down as follows:

| | |
|---|---|
| Cropland | 324 acres |
| Wetlands | 16 acres |
| Native Range | 56 acres |
| Homesteads | 4 acres |
| Total | 400 acres |

Using the proceeding acreages and estimating average price received for products from the North Dakota Crop and Livestock Data Reporting Service, the following values were calculated:

Cropland: 324 acres.

| | |
|---|---|
| 1/3 Summer Fallow | 64 acres |
| 2/3 Crop Production | 260 acres |

| Crop | Land Used | Acreage | Average Yield | Average Price Received |
|---|---|---|---|---|
| Wheat (all) | 80% | 208 | 26 bushels/acre | \$4.75/bushel |
| Flax | 5% | 13 | 10 bushels/acre | \$7.60/bushel |
| Oats | 5% | 13 | 38 bushels/acre | \$1.65/bushel |
| Barley (all) | 5% | 13 | 37 bushels/acre | \$3.00/bushel |
| Hay | 5% | 13 | 2.5 ton/acre | \$45.00/ton |

| | | | | | | |
|---|---|---|---|---|---|---|
| Wheat: | 208 acres | X 26 bushels | = | 5,408 bushels | X $4.75 = | $25,688.00 |
| Flax: | 13 acres | X 10 bushels | = | 130 bushels | X $7.60 = | $ 988.00 |
| Oats: | 13 acres | X 38 bushels | = | 494 bushels | X $1.65 = | $ 815.10 |
| Barley: | 13 acres | X 37 bushels | = | 481 bushels | X $3.00 = | $ 1,443.00 |
| Hay: | 13 acres | X 2.5 Tons | = | 32.5 Tons | X $45.00= | $ 1,462.50 |
| | 260 acres | | | | | $30,396.60 |

These totals will fluctuate according to the weather and markets.

Wetlands

Wetland values relate directly to their location and duration. If a wetland is shallow and can be farmed or hayed, it has a greater monetary (although not necessarily biological) value than a permanent wetland which cannot be farmed. Averaging several different land values a productive value of $5.00 per acre was placed on the wetlands.

16 acres X $5.00 = $80.00

Native Range and Homestead

Due to their similar productivity the native range and homestead types were consolidated. Taking the hay and grazing potential into consideration a production value of $10.00 per acre was placed on this land type.

60 acres X $10.00 = $600.00

In determining the production value for a specific tract of land one must add the production values for each type of land within that tract. The following is an estimation of the yearly agriculture value lost when taking 400 acres of land out of production.

| | |
|---|---|
| Cropland | $30,400.00 |
| Wetlands | 80.00 |
| Native Range | 600.00 |
| Total | $31,080.00 |

It will take at least three years to put the disturbed land back into production thus the total value lost will be $93,240.00. If the additional 5 years of possible reclamation extensions are added to this figure, a total land production value loss of $248,640.00 is feasible.

FALKIRK EAR

Appendix 6

Wildlife

## APPENDIX 6

(From BLM Mercer-Oliver Planning Unit URA)

### ANIMALS

The list of animals that follows includes all species which are known to exist or could be expected to exist in Mercer-Oliver Counties as permanent residents, migrants, or occasional residents. Some species exist in the two counties in very small numbers because their required habitat in the counties is marginal or is of small quantity. The riparian habitat along the Missouri River makes up only a small proportion of the total land area of the two counties; however, it provides a greater diversity of habitat and therefore allows a greater diversity of species.

Where applicable, the following selected status designations are listed alongside the common and scientific names of the species.

- N - Birds species that are the most common nesting species in the management area.
- I - Animal species that have been introduced and are not native.
- S - Fish species that are stocked from fish hatcheries, may or may not be native.
- G - Animal species that are taken for sport, fur, or flesh.
- P - Animal species which cause significant damage to man, his crops, his livestock, or his property.
- E - Endangered animals species - those animal species that are threatened with extinction, as determined by either Federal or State officials.
- U - Status - undetermined - Animal species that have been suggested to be threatened with extermination, but there is not enough information to determine its status.
- R - "Rough" fish species which are taken for commercial sale from Lake Sakakawea.
- M - Occurs in the area principally when in migration.

## APPENDIX 6

## FISH

| | Status Designation |
|---|---|
| Pallid sturgeon (*Scaphirhynchus albus*) | U |
| Shovelnose sturgeon (*Scaphirhynchus platorynchus*) | |
| Paddlefish (*Polyodon spathula*) | R |
| Shortnose gar (*Lepisosteus platostomus*) | |
| Gizzard shad (*Dorosoma cepedianum*) | |
| Brown trout (*Salmo trutta*) | G, I, S |
| Rainbow trout (*Salmo gairdneri*) | G, I, S |
| Coho salmon (*Oncorhynchus kisutch*) | G, I, S |
| Goldeye (*Hiodon alosoides*) | R |
| Northern pike (*Esox lucius*) | G, S |
| Brassy minnow (*Hybognathus hankinsoni*) | |
| Silvery minnow (*Hybognathus nuchalis*) | |
| Plains minnow (*Hybognathus placitus*) | |
| Hornyhead chub (*Hybopsis biguttatta*) | |
| Flathead chub (*Hybopsis gracilis*) | |
| Lake chub (*Hybopsis plumbea*) | |
| Golden shiner (*Notemigonus crysoleucas*) | |
| Emerald shiner (*Notropis antherinoides*) | |
| Common shiner (*Notropis cornutus*) | |
| Bigmouth shiner (*Notropis dorsalis*) | |
| Plains shiner (*Notropis percobromus*) | |

| | Status Designation |
|---|---|
| Red shiner (_Notropis lutrensis_) | |
| Sand shiner (_Notropis stramineus_) | |
| Fathead minnow (_Pimephales promelas_) | |
| Creek chub (_Semotilus atromaculatus_) | |
| Longnose dace (_Rhinichthys cataractae_) | |
| River carpsucker (_Carpiodes carpio_) | R |
| White sucker (_Catostomus commersoni_) | R |
| Northern redhorse (_Moxostoma macrolepidotum_) | |
| Longnose sucker (_Catostomus catostomus_) | |
| Blue sucker (_Cycleptus elongatus_) | |
| Smallmouth buffalo (_Ictiobus balalus_) | R |
| Bigmouth buffalo (_Ictiobus cyprinellus_) | R |
| Carp (_Cyprinus carpio_) | I, R |
| Black bullhead (_Ictalurus melas_) | G |
| Brown bullhead (_Ictalurus nebulosus_) | G |
| Channel catfish (_Ictalurus punctatus_) | G |
| Blue catfish (_Ictalurus furcatus_) | G |
| Flathead catfish (_Pilodictis olivaris_ | G |
| Tadpole madtom (_Noturus gyrinus_) | |
| Stonecat (_Noturus flavus_) | |
| White bass (_Roccus chrysops_) | G |
| Rockbass (_Ambloplites rutestris_) | G |
| Pumpkinseed (_Lepomis gibbosus_) | G |
| Orangespotted sunfish (_Lepomis humilis_) | |

| | Status Designation |
|---|---|
| Bluegill (*Lepomis machrochirus*) | G |
| Longear sunfish (*Lepomis megalotis*) | |
| White crappie (*Pomoxis annularis*) | G |
| Black crappie (*Pomoxis nigromaculatus*) | G |
| Largemouth bass (*Micropterus salmoides*) | G |
| Iowa darter (*Etheostoma exile*) | |
| Johnny darter (*Etheostoma nigrum*) | |
| Yellow perch (*Perca flavescens*) | G, I, S |
| Sauger (*Stizostedion canadense*) | G |
| Walleye (*Stizostedion vitreum vitreum*) | S, G |
| Freshwater drum (*Aplodinotus grunniens*) | R |
| Burbot (*Lota lota*) | |

AMPHIBIANS AND REPTILES

Tiger salamander (*Ambystoma tigrinum*)

Plains spadefoot (*Scaphiopus bombifrons*)

Great plains toad (*Bufo cognatus*)

Rocky Mountain toad (*B. woodhousei*)

Boreal Chorus Frog (*Pseudacris nigrita*)

Leopard frog (*Rana pipiens*)

Common snapping turtle (*Chelydra serpentina*)

Western painted turtle (*Chrysemys picta*)

Smooth soft-shelled turtle (*Trionyx muticus*)

Plains garter snake (*Thamnophis radix*)

| | Status Designation |
|---|---|
| Red-sided garter snake (*T. sirtalis*) | |
| Western hog-nosed snake (*Heterodon nasicus*) | |
| Racer (*Coluber constrictor*) | |
| Smooth green snake (*Opheodrys vernalis*) | |
| Bull snake (*Pituophis melanoleucus*) | |
| Prairie rattlesnake (*Crotatus viridis*) | |
| **BIRDS** | |
| Horned Grebe (*Podiceps auritus*) | |
| Eared Grebe (*P. caspicus*) | |
| Western Grebe (*Aechmophorus occidentalis*) | |
| Pied-billed Grebe (*Podilymbus podiceps*) | |
| White Pelican (*Pelecanus erythrorhynchos*) | |
| Double-crested Cormorant (*Phalacrocorax auritus*) | |
| Great Blue Heron (*Ardea herodias*) | N |
| Green Heron (*Butorides virescens*) | |
| Cattle Egret (*Bubulcus ibis*) | |
| Common Egret (*Casmerodius albus*) | |
| Snowy Egret (*Leucophoyx thula*) | |
| Black-crowned Night Heron (*Nycticorax nycticorax*) | |
| Least Bittern (*Ixobrychus exilis*) | |
| American Bittern (*Botaurus lentiginosus*) | |
| White-faced Ibis (*Plegadis chihi*) | |
| Whistling Swan (*Olor columbianus*) | |

| | Status Designation |
|---|---|
| Canada Goose (Branta canadensis) | G |
| Black Brant (B. nigricans) | G |
| White-fronted Goose (Anser albifrons) | G |
| Snow Goose (Chen hyperborea) | G, M |
| Blue Goose (C. caerulescens) | G, M |
| Ross' Goose (C. rossii) | G |
| Mallard (Anas platyrhynchos) | G |
| Black Duck (A. rubripes) | G |
| Gadwall (A. strepera) | G |
| Pintail (A. acuta) | G, N |
| Green-winged Teal (A. carolinensis) | G |
| Blue-winged Teal (A. discors) | G |
| Cinnamon Teal (A. cyanoptera) | G |
| European Widgeon (Mareca penelope) | G |
| American Widgeon (M. americana) | G |
| Shoveler (Spatula clypeata) | G |
| Wood Duck (Aix sponsa) | G |
| Redhead (Aythya americana) | G, M |
| Ring-necked Duck (A. collaris) | G, M |
| Canvasback (A. valisineria) | G |
| Greater Scaup (A. marila) | G |
| Lesser Scaup (A. affinis) | G, N |
| Common Goldeneye (Bucephala clangula) | G |

| | Status Designation |
|---|---|
| Bufflehead (*B. albeola*) | G, M |
| Oldsquaw (*Clangula hyemalis*) | G |
| Harlequin Duck (*Histrionicus histrionicus*) | G |
| White-winged Scoter (*Melanitta deglandi*) | G |
| Common Scoter (*Oidemia nigra*) | G |
| Ruddy Duck (*Oxyura jamaicensis*) | G |
| Hooded Merganser (*Lophodytes cucullaius*) | G |
| Common Merganser (*Mergus merganser*) | G |
| Red-breasted Merganser (*M. serrator*) | G, M |
| Turkey Vulture (*Cathartes aura*) | |
| Goshawk (*Accipiter gentilis*) | M |
| Sharp-shinned Hawk (*A. striatus*) | |
| Cooper's Hawk (*A. Cooperii*) | N |
| Red-tailed Hawk (*Buteo jamaicensis*) | N |
| Harlan's Hawk (*B. harlani*) | |
| Red-shouldered Hawk (*B. lineatus*) | |
| Broad-winged Hawk (*B. platypterus*) | |
| Swainson's Hawk (*B. swainsoni*) | N, M |
| Rough-legged Hawk (*B. lagopus*) | M |
| Ferruginous Hawk (*B. regalis*) | U |
| Golden Eagle (*Aquila chrysaetos*) | |
| Bald Eagle (*Haliaeetus leucocephalus*) | M |
| Marsh Hawk (*Circus cyaneus*) | N, M |
| Osprey (*Pandion haliaetus*) | |

| | Status Designation |
|---|---|
| Gyrfalcon (*Falco rusticolus*) | |
| Prairie Falcon (*F. mexicanus*) | E |
| Peregrine Falcon (*F. peregrinus*) | E, M |
| Pigeon Hawk (*F. columbarius*) | |
| Sparrow Hawk (*F. sparverius*) | N |
| Sharp-tailed Grouse (*Pedioecetes phasianellus*) | G, N |
| Ring-necked Pheasant (*Phasianus colchicus*) | G, I, N |
| Gray Partridge (*Perdix perdix*) | G, I, N |
| Turkey (*Meleagris gallopavo*) | G, I, N |
| Whooping Crane (*Grus americana*) | M |
| Sandhill Crane (*G. canadensis*) | G, M |
| King Rail (*Rallus elegans*) | |
| Virginia Rail (*R. limicola*) | N |
| Sora (*Porzana carolina*) | |
| Yellow Rail (*Coturnicops noveboracensis*) | |
| American Coot (*Fulica americana*) | G |
| Semipalmated Plover (*Charadrius semipalmaius*) | |
| Piping plover (*C. melodus*) | |
| Killdeer (*C. vociferus*) | N |
| American Golden Plover (*Pluvialis dominica*) | |
| Black-bellied Plover (*Squatarola squatarola*) | |
| Ruddy Turnstone (*Arenaria interpres*) | M |
| American Woodcock (*Philohela minor*) | |
| Common Snipe (*Capella gallinago*) | G, M |

| | Status Designation |
|---|---|
| Long-billed Curlew (Numenius americanus) | |
| Upland Plover (Bartramia longicauda) | N |
| Spotted Sandpiper (Actitis macularia) | N |
| Solitary Sandpiper (Tringa solitaria) | |
| Willet (Catoptrophorus semipalmatus) | |
| Greater Yellowlegs (Totanus melanoleucus) | M |
| Lesser Yellowlegs (T. flavipes) | |
| Knot (Calidris canutus) | |
| Pectoral Sandpiper (Erolia melanotos) | M |
| White-rumped Sandpiper (E. fuscicollis) | |
| Baird's Sandpiper (E. bairdii) | |
| Least Sandpiper (E. minutilla) | |
| Dunlin (E. alpina) | M |
| Short-billed Dowitcher (Limnodromus griseus) | |
| Long-billed Dowitcher (L. scolopaceus) | M |
| Stilt Sandpiper (Micropalama himantopus) | |
| Semipalmated Sandpiper (Ereunetes pusillus) | M |
| Western Sandpiper (E. mauri) | |
| Buff-breasted Sandpiper (Tryngites subruficollis) | |
| Marbled Godwit (Limosa fedoa) | N |
| Hudsonian Godwit (L. haemastica) | |
| Sanderling (Crocethia alba) | |
| American Avocet (Recurvirostra americana) | |
| Black-necked Stilt (Himantopus mexicanus) | |
| Wislon's Phalarope (Steganopus tricolor) | |

| | Status Designation |
|---|---|
| Northern Phalarope (*Lobipes lobatus*) | |
| Glaucous Gull (*Larus hyperboreus*) | |
| Herring Gull (*L. argentatus*) | |
| California Gull (*L. californicus*) | |
| Ring-billed Gull (*L. delawarensis*) | |
| Franklin's Gull (*l. pipixcan*) | N |
| Bonaparte's Gull (*L. philadelphia*) | M |
| Forster's Tern (*Sterna forsteri*) | |
| Common Tern (*S. hirundo*) | |
| Least Tern (*S. albifrons*) | |
| Caspian Tern (*Hydroprogne caspia*) | |
| Black Tern (*Chlidonias niger*) | |
| Rock Dove (*Columba livia*) | I, N |
| Mourning Dove (*Zenaidura macroura*) | N |
| Yellow-billed Cuckoo (*Coccyzus americanus*) | |
| Black-billed Cuckoo (*C. erythropthalmus*) | N |
| Barn Owl (*Tyto alba*) | |
| Screech Owl (*Otus asio*) | |
| Great Horned Owl (*Bubo virginianus*) | N |
| Snowy Owl (*Nyctea scandiaca*) | M |
| Hawk Owl (*Surnia ulula*) | |
| Burrowing Owl (*Speotyto cunicularia*) | N, U |
| Barred Owl (*Strix varia*) | |
| Great Gray Owl (*S. nebulosa*) | |
| Long-eared Owl (*Asio otus*) | |

| Species | Status Designation |
|---|---|
| Short-eared Owl (*A. flammeus*) | |
| Boreal Owl (*Aegolius funereus*) | |
| Saw-whet Owl (*A. acadicus*) | |
| Whip-poor-will (*Caprimulgus vociferus*) | |
| Poor-will (*Phalaenoptilus nuttallii*) | |
| Common Nighthawk (*Chordeiles minor*) | N |
| Chimney Swift (*Chaetura pelagica*) | N |
| Ruby-throated Hummingbird (*Archilochus colubris*) | |
| Belted Kingfisher (*Megaceryle alcyon*) | |
| Yellow-shafted Flicker (*Colaptes auratus*) | N |
| Red-shafted Flicker (*C. cafer*) | N |
| Pileated Woodpecker (*Dryocopus pileatus*) | |
| Red-bellied Woodpecker (*Centurus carolinus*) | |
| Red-headed Woodpecker (*Melanerpes erythrocephalus*) | N |
| Lewis' Woodpecker (*Asyndesmus lewis*) | |
| Yellow-bellied Sapsucker (*Sphyrapicus varius*) | |
| Hairy Woodpecker (*Dendrocopos villosus*) | |
| Downy Woodpecker (*D. pubescens*) | |
| Black-backed Three-toed Woodpecker (*Picoides arcticus*) | |
| Eastern Kingbird (*Tyrannus tyrannus*) | N |
| Western Kingbird (*T. verticalis*) | N |
| Great Crested Flycatcher (*Myiarchus crinitus*) | |
| Eastern Phoebe (*Sayornis phoebe*) | |
| Say's Phoebe (*S. saya*) | N |
| Yellow-bellied Flycatcher (*Empidonax flaviventris*) | |

| | Status Designation |
|---|---|
| Traill's Flycatcher (E. traillii) | N |
| Least Flycatcher (E. minimus) | N |
| Eastern Wood Pewee (Contopus virens) | |
| Western Wood Pewee (C. sordidulus) | |
| Olive-sided Flycatcher (Nuttallornis borealis) | |
| Horned Lark (Eremophila alpestris) | N |
| Violet-green Swallow (Tachycineta thalassina) | |
| Tree Swallow (Iridoprocne bicolor) | |
| Bank Swallow (Riparia riparia) | N |
| Rough-winged Swallow (Stelgidopteryx ruficollis) | N |
| Barn Swallow (Hirundo rustica) | N |
| Cliff Swallow (Petrochelidon pyrrhonota) | N |
| Purple Martin (Progne subis) | |
| Gray Jay (Perisoreus canadensis) | |
| Blue Jay (Cyanocitta cristata) | N |
| Black-billed Magpie (Pica pica) | N, P |
| Common Raven (Corvus corax) | |
| Common Crow (C. brachyrhynchos) | N, P |
| Clark's Nutcracker (Nucifraga columbiana) | |
| Black-capped chickadee (Parus atricapillus) | N |
| White-breasted Nuthatch (Sitta carolinensis) | |
| Red-breasted Nuthatch (S. canadensis) | |
| Brown Creeper (Certhia familiaris) | |
| House Wren (Troglodytes aedon) | N |

| | Status Designation |
|---|---|
| Winter Wren (T. troglodytes) | |
| Long-billed Marsh Wren (Telmatodytes palustris) | |
| Short-billed Marsh Wren (Cistothorus platensis) | |
| Rock Wren (Salpinctes obsoletus) | |
| Mockingbird (Mimus polyglottos) | |
| Catbird (Dumetella carolinensis) | N |
| Brown Thrasher (Toxostoma rufum) | N |
| Sage Thrasher (Oreoscoptes montanus) | |
| Robin (Turdus migratorius) | N |
| Wood Thrush (Hylocichla mustelina) | |
| Hermit Thrush (H. guttata) | |
| Swainson's Thrush (H. ustulata) | |
| Gray-cheeked Thrush (H. minima) | |
| Veery (H. fuscescens) | |
| Eastern bluebird (Sialia sialis) | |
| Mountain Bluebird (S. currucoides) | |
| Townsend's Solitaire (Myadestes townsendi) | |
| Golden-crowned Kinglet (Regulus satrapa) | |
| Ruby-crowned Kinglet (R. calendula) | |
| Water Pipit (Anthus spinoletta) | |
| Sprauge's Pipit (A. spragueii) | N |
| Bohemian Waxwing (Bombycilla garrula) | |
| Cedar Waxwing (B. cedrorum) | N |
| Northern Shrike (Lanius excubitor) | M |
| Loggerhead Shrike (L. ludovicianus) | N |

| | Status Designation |
|---|---|
| Starling (<u>Sturnus vulgaris</u>) | I, N, P |
| Bell's Vireo (<u>Vireo bellii</u>) | |
| Yellow-throated Vireo (<u>V. flavifrons</u>) | |
| Solitary Vireo (<u>V. solitarius</u>) | |
| Red-eyed Vireo (<u>V. olivaceus</u>) | |
| Philadelphia Vireo (<u>Vireo philadelphicus</u>) | |
| Warbling Vireo (<u>V. gilvus</u>) | N |
| Black-and-white Warbler (<u>Mniotilta varia</u>) | |
| Prothonotary Warbler (<u>Protonotria citrea</u>) | |
| Golden-winged Warbler (<u>Vermivora chrysoptera</u>) | |
| Tennessee warbler (<u>V. peregrina</u>) | |
| Orange-crowned Warbler (<u>V. celata</u>) | |
| Nashville Warbler (<u>V. ruficapilla</u>) | |
| Parula Warbler (<u>Parula americana</u>) | |
| Yellow Warbler (<u>Dendrocia petechia</u>) | N |
| Magnolia Warbler (<u>D. magnolia</u>) | |
| Cape May Warbler (<u>D. tigrina</u>) | |
| Black-throated Blue Warbler (<u>D. caerulescens</u>) | |
| Myrtle Warbler (<u>D. coronata</u>) | |
| Audubon's Warbler (<u>D. auduboni</u>) | |
| Black-throated Green Warbler (<u>D. virens</u>) | |
| Cerulean Warbler (<u>D. cerulea</u>) | |
| Blackburnian Warbler (<u>D. fusca</u>) | |
| Chestnut-sided Warbler (<u>D. pensylvanica</u>) | |
| Bay-breasted Warbler (<u>D. castanea</u>) | |

| | Status Designation |
|---|---|
| Blackpoll Warbler (D. striata) | |
| Palm Warbler (D. palmarum) | |
| Ovenbird (Seiurus aurocapillus) | |
| Northern Waterthrush (S. noveboracensis) | |
| Connecticut Warbler (Oporornis agilis) | |
| Mourning Warbler (O. philadelphia) | |
| MacGillivray's Warbler (Oporornis tolmiei) | |
| Yellowthroat (Geothlypis trichas) | |
| Yellow-breasted chat (Icteria virens) | |
| Wilson's Warbler (Wilsonia pusilla) | |
| Canada Warbler (W. canadensis) | |
| American Redstart (Setophaga ruticilla) | |
| House Sparrow (Passer domesticus) | N, P |
| Bobolink (Dolichonyx oryzivorus) | N |
| Western Meadowlark (Sturnella neglecta) | N |
| Yellow-headed Blackbird (Xanthocephalus xanthocephalus) | P |
| Red-winged Blackbird (Agelaius phoeniceus) | P |
| Orchard Oriole (Icterus spurius) | N |
| Baltimore Oriole (I. galbula) | |
| Bullock's Oriole (I. bullockii) | P |
| Rusty Blackbird (Euphagus carolinus) | P |
| Brewer's Blackbird (E. cyanocephalus) | N, P |
| Common Grackle (Quiscalus quiscula) | N, P |
| Brown-headed Cowbird (Molothrus ater) | N, P |

| | Status Designation |
|---|---|
| Western Tanager (Piranga ludoviciana) | |
| Scarlet Tanager (P. olivacea) | |
| Cardinal (Richmondena cardinalis) | |
| Rose-breasted Grosbeak (Pheucticus ludovicianus) | N |
| Black-headed Grosbeak (P. melanocephalus) | N |
| Blue Grosbeak (Guiraca caerulea) | N |
| Indigo Bunting (Passerina cyanea) | N |
| Lazuli Bunting (P. amoena) | N |
| Dickcissel (Spiza americana) | N |
| Evening Grosbeak (Hesperiphona vespertina) | |
| Purple Finch (Carpodacus purpureus) | |
| Pine Grosbeak (Pinicola enucleator) | |
| Gray-crowned Rosy Finch (Leucosticte tephrocotis) | |
| Hoary Redpoll (Acanthis hornemanni) | |
| Common Redpoll (A. flammea) | M |
| Pine Siskin (Spinus pinus) | |
| American Goldfinch (S. tristis) | N |
| Red Crossbill (Loxia curvirostra) | |
| White-winged Crossbill (L. leucoptera) | |
| Rufous-sided Towhee (Pipilo erythrophthalmus) | |
| Lark Bunting (Calamospiza melanocorys) | N |
| Savannah Sparrow (Passerculus sandwichensis) | N |
| Grasshopper Sparrow (Ammodramus savannarum) | N |
| Baird's Sparrow (A. bairdii) | N |
| LeConte's Sparrow (Passerherbulus caudacustus) | |
| Sharp-tailed Sparrow (Ammospiza caudacuta) | |

| | Status Designation |
|---|---|
| Vesper Sparrow (Pooecetes gramineus) | |
| Lark Sparrow (Chondestes grammacus) | N |
| Slate-colored Junco (Junco hyemalis) | M |
| Oregon Junco (J. oreganus) | |
| Tree Sparrow (Spizella arborea) | M |
| Chipping Sparrow (S. passerina) | |
| Clay-colored Sparrow (S. pallida) | |
| Brewer's Sparrow (S. breweri) | |
| Field Sparrow (S. pusilla) | |
| Harris' Sparrow (Zonotrichia querula) | M |
| White-crowned Sparrow (Z. leucophrys) | M |
| White-throated Sparrow (Z. albicollis) | M |
| Fox Sparrow (Passerella iliaca) | |
| Lincoln's Sparrow (Melospiza lincolnii) | |
| Swamp Sparrow (M. georgiana) | |
| Song Sparrow (M. melodia) | N |
| McCown's Longspur (Rhynchophanes mccownii) | N |
| Lapland Longspur (Calcarius lapponicus) | M |
| Smith's Longspur (C. pictus) | M |
| Chestnut-collard Longspur (C. ornatus) | N |
| Snow Bunting (Plectrophenax nivalis) | M |

MAMMALS

| | Status Designation |
|---|---|
| Masked shrew (Sorex cinereus) | |
| Merriams shrew (S. Merriami) | |
| Little Brown Myotis (Myotis lucifugus) | |
| Long-eared bat (M. evotis) | |
| Keen's bat (M. Keenii) | |
| Long-legged bat (M. volans) | |
| Silver-haired bat (Lasionycteris noctivagans) | |
| Big brown bat (Eptesicus fuscus) | |
| Red bat (Lasiurus borealis) | |
| Hoary bat (L. cinereus) | M |
| Eastern cottontail (Sylvilagus floridanus) | |
| Snowshoe hare (Lepus americana) | |
| White-tailed jackrabbit (L. Townsendii) | G |
| Least chipmunk (Eutamias minimum) | |
| Richardson's groung squirrel (Spermophilus richardsonii) | |
| Thirteen-lined ground squirrel (S. tridecemlineatus) | |
| Black-tailed prairie dog (Cynomys ludovicianus) | |
| Fox squirrel (Sciurus niger) | G |
| Gray squirrel (S. carolinensis) | G |
| Plains pocket gopher (Thomomys talpoides) | P |
| Olive-backed pocket mouse (Perognathus faciatus) | |
| Beaver (Castor canadensis) | G |
| Western harvest mouse (Reithrodontomys megalotis) | |
| Deer mouse (Peromyscus maniculatus) | |

| | Status Designation |
|---|---|
| White-footed mouse (*Peromyscus leucopus*) | |
| Northern Grasshopper mouse (*Onychomys leucogaster*) | |
| Bushy-tailed wood rat (*Neotoma cinerea*) | |
| Gapper's red-backed mouse (*Clethrionomys grapperi*) | |
| Meadow vole (*Microtus pennsylvanicus*) | |
| Sagebrush vole (*Lagurus curtatus*) | |
| Muskrat (*Ondatra zibethicus*) | G |
| Norway rat (*Rattus norvegicus*) | P |
| House mouse (*Mus musculus*) | P |
| Meadow jumping mouse (*Zapus hudsonicus*) | |
| Porcupine (*Erethizon dorsatum*) | P |
| Coyote (*Canis latrans*) | P, G |
| Red fox (*Vulpes vulpes*) | G |
| Swift fox (*V. velox*) | E, U* |
| Racoon (*Procyon lotor*) | G |
| Least weasel (*Mustela rixosa*) | |
| Long-tailed weasel (*M. frenata*) | G |
| Mink (*M. vison*) | G |
| Black-footed ferret (*M. nigripes*) | E |
| Badger (*Taxidea taxus*) | G |

*The Swift Fox is designated endangered by the North Dakota Game and Fish Department; however, it is designated as status-undetermined by the U.S. Department of Interior.

| | Status Designation |
|---|---|
| Striped skunk (Mephitis mephitis) | P |
| Bobcat (Lynx rufus) | G |
| Mule deer (Odocoileus hemionus) | G |
| White-tailed deer (O. virginianus) | G |
| Pronghorn (Antilocapra americana) | G |

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APPENDIX 6

BIRDS OF THE AUDUBON NATIONAL WILDLIFE REFUGE 1/

The following list names 159 bird species found on the Audubon National Wildlife Refuge since 1955. The Audubon National Wildlife Refuge is approximately 12 miles from the northeast corner of Mercer County. Because the refuge is located in the prairie pothole region, the occurrence and abundance of some species may differ from Mercer-Oliver Counties. The abundance and occurrence of woodland bird species may also differ because of the presence of extensive woodlands along the Missouri River in Mercer-Oliver Counties which do not exist in the Audubon Refuge. However, this is the only list of this kind for the region and its applicability is probably sufficient.

Birds marked with an asterisk (*) nest on the refuge. Abundance symbols are given seasonally for each species.

| | |
|---|---|
| S - March-May | a - abundant |
| S - June-August | c - common |
| F - September-November | u - uncommon |
| W - December-February | o - occasional |
| | r - rare |

| | S | S | F | W |
|---|---|---|---|---|
| Common Loon | o | | o | |
| Red-necked Grebe | o | o | | |
| Horned Grebe | u | o | o | |
| *Eared Grebe | c | c | u | |
| *Western Grebe | c | c | c | |
| *Pied-billed Grebe | u | u | u | |
| White Pelican | a | a | a | |
| *Double-crested Cormorant | a | a | a | |
| Great Blue Heron | u | o | u | |
| Snowy Egret | | o | | |
| *Black-crowned Night Heron | c | a | c | |
| American Bittern | u | u | u | |
| Whistling Swan | u | r | u | |
| *Canada Goose (giant) | a | c | a | o |
| Canada Goose (lesser) | c | r | c | o |
| White-fronted Goose | c | r | a | |
| Snow Goose | u | | c | |
| Blue Goose | u | | c | |
| *Mallard | a | a | a | o |
| Black Duck | o | | o | |
| *Gadwall | a | a | a | |
| *Pintail | a | a | a | r |
| *Green-winged Teal | c | c | c | |
| *Blue-winged Teal | a | a | a | |
| *American Widgeon | a | a | a | |
| *Shoveler | a | a | a | |
| Wood Duck | o | o | o | |
| *Redhead | c | u | c | |
| Ring-necked Duck | o | | o | |
| *Canvasback | u | o | u | |
| *Lesser Scaup | a | c | a | |
| Common Goldeneye | c | o | c | r |
| Bufflehead | c | r | c | r |
| Oldsquaw | r | | r | |
| White-winged Scoter | o | | o | |
| *Ruddy Duck | c | c | c | |
| Common Merganser | c | r | c | r |
| Red-breasted Merganser | r | | r | |
| Goshawk | r | | r | |
| Red-tailed Hawk | c | o | c | r |
| Broad-winged Hawk | o | o | o | |
| Swainson's Hawk | o | u | o | |
| Rough-legged Hawk | u | | u | |
| Golden Eagle | c | r | c | c |
| Bald Eagle | u | r | u | u |
| Marsh Hawk | c | u | c | r |
| Osprey | o | o | o | |
| Prairie Falcon | o | o | o | |
| Peregrine Falcon | o | | o | |
| Pigeon Hawk | u | o | u | |

1/ U.S. Department of the Interior - Bureau of Sport Fisheries and Wildlife, 1968, Refuge Leaflet 210-R, Page 4.

| | S | S | F | W |
|---|---|---|---|---|
| Sparrow Hawk | u | o | u | |
| *Sharp-tailed Grouse | c | c | c | c |
| *Ring-necked Pheasant | u | u | u | u |
| *Gray Partridge | c | c | c | c |
| Whooping Crane | r | | r | |
| Sandhill Crane | c | o | a | |
| Virginia Rail | o | o | o | |
| *Sora | c | c | u | |
| *American Coot | a | a | a | r |
| Semipalmated Plover | o | o | o | |
| Piping Plover | o | o | o | |
| *Killdeer | a | a | c | |
| American Golden Plover | o | o | o | |
| Black-bellied Plover | o | o | o | |
| Ruddy Turnstone | o | | | |
| Common Snipe | u | r | c | |
| *Upland Plover | a | a | c | |
| Spotted Sandpiper | c | u | c | |
| Solitary Sandpiper | o | o | o | |
| *Willet | c | c | o | |
| Greater Yellowlegs | o | | o | |
| Lesser Yellowlegs | c | c | c | |
| Pectoral Sandpiper | o | u | o | |
| White-rumped Sandpiper | u | u | u | |
| Baird's Sandpiper | u | u | u | |
| Least Sandpiper | c | c | c | |
| Dunlin | r | | r | |
| Long-billed Dowitcher | c | o | u | |
| Semipalmated Sandpiper | c | u | c | |
| *Marbled Godwit | c | c | u | |
| *American Avocet | c | c | u | |
| *Wilson's Phalarope | a | a | c | |
| Herring Gull | o | o | o | |
| Ring-billed Gull | c | c | c | |
| Franklin's Gull | c | c | a | |
| Bonaparte's Gull | o | | o | |
| Forster's Tern | o | o | | |
| *Common Tern | a | a | u | |
| Caspian Tern | o | o | | |
| *Black Tern | c | a | u | |
| Rock Dove | c | c | c | c |
| *Mourning Dove | c | c | c | |
| *Black-billed Cuckoo | u | u | | |
| Great Horned Owl | u | u | u | o |
| Snowy Owl | u | | u | c |
| *Burrowing Owl | o | o | o | |
| Long-eared Owl | r | | r | |
| Short-eared Owl | u | o | u | r |
| Common Nighthawk | o | u | u | |

| | S | S | F | W |
|---|---|---|---|---|
| Belted Kingfisher | r | r | | |
| Yellow-shafted Flicker | c | u | c | |
| Red-shafted Flicker | r | | r | |
| *Eastern Kingbird | c | c | u | |
| *Western Kingbird | u | u | u | |
| *Horned Lark | c | c | c | a |
| Tree Swallow | o | o | o | |
| Bank Swallow | o | o | o | |
| *Barn Swallow | c | c | c | |
| Cliff Swallow | o | o | o | |
| *Purple Martin | c | c | o | |
| Blue Jay | o | o | o | |
| Black-billed Magpie | o | | o | o |
| Common Crow | c | o | c | r |
| *Long-billed Marsh Wren | c | c | | |
| Catbird | o | o | | |
| *Brown Thrasher | c | c | | |
| *Robin | u | u | u | |
| Mountain Bluebird | o | o | | |
| American Pipit | o | | | o |
| Cedar Waxwing | o | | | o |
| Northern Shrike | o | | o | o |
| Starling | o | o | o | o |
| Black-and-white Warbler | o | o | | |
| Orange-crowned Warbler | u | | u | |
| Yellow Warbler | c | c | | |
| Myrtle Warbler | c | | o | |
| Palm Warbler | o | | o | |
| *Yellowthroat | c | c | o | |
| *House Sparrow | c | c | o | o |
| *Bobolink | u | c | o | |
| *Western Meadowlark | a | a | c | r |
| *Yellow-headed Blackbird | c | c | c | |
| *Red-winged Blackbird | a | a | a | r |
| Baltimore Oriole | u | u | | |
| Brewer's Blackbird | c | c | c | |
| Common Grackle | u | u | r | |
| *Brown-headed Cowbird | c | a | c | |
| *Dickcissel | u | u | u | |
| Common Redpoll | | | | c |
| Pine Siskin | u | | u | |
| *American Goldfinch | c | u | c | |
| *Lark Bunting | u | a | r | |
| *Savannah Sparrow | c | c | c | |
| Grasshopper Sparrow | u | u | | |
| *Le Conte's Sparrow | o | o | | |
| *Sharp-tailed Sparrow | u | u | | |
| *Vesper Sparrow | c | c | c | |
| Lark Sparrow | o | o | | |

| | S | S | F | W | | S | S | F | W |
|---|---|---|---|---|---|---|---|---|---|
| Slate-colored Junco | c | | c | r | White-throated Sparrow | u | | u | |
| Tree Sparrow | a | | a | r | *Song Sparrow | c | o | c | |
| *Chipping Sparrow | a | c | a | | Lapland Longspur | o | | o | o |
| *Clay-colored Sparrow | c | c | c | | Smith's Longspur | o | | o | o |
| Harris' Sparrow | u | | u | | *Chestnut-collared Longspur | a | c | o | |
| White-crowned Sparrow | c | | u | | Snow Bunting | o | | r | c |

These additional species are classed as rare, either because of only one or two observations on the refuge, or because they are outside their normal range.

Black Brant
Ross' Goose
Cinnamon Teal
Barrow's Goldeneye
Hooded Merganser
Long-billed Curlew
Screech Owl
Red-headed Woodpecker
Black-capped Chickadee
White-winged Crossbill

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APPENDIX 6

Occurrence of Aquatic Habitat
over Federal Coal of Falkirk Coal Lease Application #31053(ND)

Section 34 (T. 146 N., R. 82 W.) has only a couple Class I - ephemeral ponds (Stewart and Kantrud, 1971) occurring on surface lands over federal coal. No aquatic habitat whatsoever, was identified on Section 30 (T. 146 N., R. 81 W.) overlying federal coal. One man-made stockwater dugout was identified in the draw along the west edge of NE¼NW¼ of Section 24 (T. 146 N., R. 82 W.) overlying federal coal. One Class III - seasonal pond, and several Class I - ephemeral ponds, were located on lands overlying public domain coal in Section 2 (T. 146 N., R. 82 W.). One Class III - seasonal pond and one Class I - ephemeral pond are located in the SE¼, Section 6 (T. 146 N., R. 82 W.) overlying federal coal. The U.S. Fish and Wildlife Service presently holds a wetland easement on the privately owned surface lands in the NW¼SE¼, and S½SE¼ of Section 6. Several Class I - seasonal ponds, and Class II - temporary ponds, were identified in Section 20 (T. 146 N., R. 82 W.) overlying public domain coal. One Class III - seasonal pond and one Class I - ephemeral pond were identified overlying federal coal in the SE¼ of Section 24 (T. 146 N., R. 83 W.). A U.S. Fish and Wildlife Service wetland easement also exists on this 160 acre block of private lands. In addition to these wetlands overlying the federal coal subject to this lease application, several large Class V - permanent ponds have been identified in the Underwood vicinity and may be impacted by the overall mining operation (i.e., Weller Slough, Samuelson Slough, and Coal Lake). The Institute for Ecological Studies of the University of North Dakota has identified Samuelson and Weller sloughs as primarily waterfowl feeding areas (Burns and McDonnell, 1973). It is also noteworthy that the Coal Lake Slough complex extending north across old Highway 83 has been identified as a possible mitigation area for the Garrison diversion project by the U.S. Fish and Wildlife Service. No immediate plans are prescribed for this area.

APPENDIX 6

The following major wildlife habitats were identified on the surface lands overlying the federal coal of this lease application (see wildlife habitat component diagrams, Appendix 6).

<u>Section 30, T. 146 N., R. 81 W., 5th P.M.</u> - Approx. 160 ac.
SW¼SW¼ - Alternate strips of small grain and summer fallow.
SE¼SW¼ - Native grassland and abandoned native hay.
S½SE¼ - A farmstead and alternate strips of shelterbelts and flax fields.

<u>Section 2, T. 146 N., R. 82 W., 5th P.M.</u> - Approx. 160 ac.
- Farmstead and small grain fields (wheat). Boulder strewn knobs with abandoned native hay.

<u>Section 6, T. 146 N., R. 82 W., 5th P.M.</u> - Approx. 160 ac.
N½SE¼ - Small grain (wheat) cropland east of Highway 83. Small grain cropland (wheat) and fallow plus native grassland west of Highway 83.
SW¼SE¼ - Native grassland pasture.
SE¼SE¼ - Farmstead and shelterbelts with some small grain (wheat) cropland. Also brushland and wet meadow.

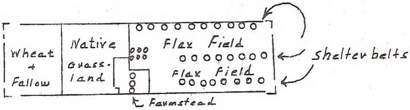
<u>Section 20, T. 146 N., R. 82 W., 5th P.M.</u> - Approx. 160 ac.
- Alternate strips of small grain cropland (wheat) and summer fallow.

<u>Section 24, T. 146 N., R. 82 W., 5th P.M.</u> - Approx. 160 ac.
- Small portion of alfalfa hayland. Mostly native grassland with two brushland (hawthorn/wolfberry) draws bissecting the area.

<u>Section 34, T. 146 N., R. 82 W., 5th P.M.</u> - Approx. 160 ac.
NW¼SW¼ - Small grain cropland (wheat).
S½SW¼ - Small grain (wheat) cropland with boulder strewn knobs west of the highway. Small grain (wheat) cropland and native grassland east of the highway.
NE¼NE¼ - Small portion of alfalfa haylands and native grassland. One brushland draw (hawthorn/wolfberry/chokecherry) bissects the area.

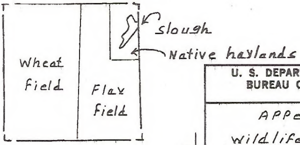
<u>Section 24, T. 146 N., R. 83 W., 5th P.M.</u> - Approx. 160 ac.
W½SE¼ - Small grain (wheat) cropland with boulder strewn knobs.
E½SE¼ - Flax fields with a small portion of native haylands. Also wet meadow.

30




S ½ S ½ Section 30, T. 146 N. R. 81 W.

24




SE ¼ Section 24.
T. 146 N., R 83 W.

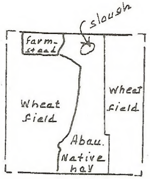
U. S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Appendix 6
Wildlife Cover Type

| | |
|---|---|
| DESIGNED | RECOMM. |
| DRAWN W.P. | RECOMM. CHIEF, DIV. OF ENG. |
| CHECKED | APPROVED |

SCALE 3" = 1 Mile
DATE 10-29-75 SHEET ___ OF ___
DRAWING NO.

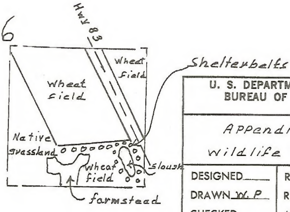
☆ GPO 853-660




2

NW 1/4 Section 2, T. 146 N., R. 82 W.

6




SE 1/4 section 6,
T. 146 N. R. 82 W.

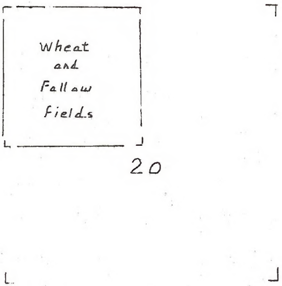
U. S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Appendix 6
Wildlife cover Type

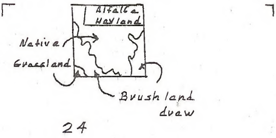
| | |
|---|---|
| DESIGNED____ | RECOMM.____ |
| DRAWN W. P | RECOMM.____ CHIEF, DIV. OF ENG. |
| CHECKED____ | APPROVED____ |
| SCALE 3" = 1 Mile | |
| DATE 10-29-75 | SHEET___OF___ |
| DRAWING NO. | |



☆ GPO 853-660




NW¼ Section 20, T. 146 N. R. 82 W.




NE¼ NW¼ Section 24,

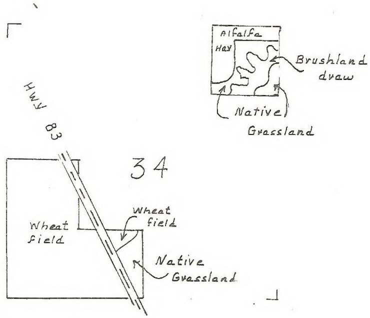
T. 146 N. R. 82 W.

**U. S. DEPARTMENT OF THE INTERIOR**
**BUREAU OF LAND MANAGEMENT**

Appendix 6
Wildlife cover Type

| | |
|---|---|
| DESIGNED____ | RECOMM.____ |
| DRAWN W.P. | RECOMM.____ CHIEF, DIV. OF ENG. |
| CHECKED____ | APPROVED____ |
| SCALE 3" = 1 Mile | |
| DATE 10-29-75 | SHEET____OF____ |
| DRAWING NO. | |

☆ GPO 853-660




NE¼ NE¼
NW¼ SW¼ Section 34 T. 146 N., R. 82 W.
S½ SW¼

**U. S. DEPARTMENT OF THE INTERIOR**
**BUREAU OF LAND MANAGEMENT**

Appendix 6
Wildlife Cover Type.

| | |
|---|---|
| DESIGNED____ | RECOMM.____ |
| DRAWN W.R. | RECOMM.____ CHIEF, DIV. OF ENG. |
| CHECKED____ | APPROVED____ |

SCALE 3" = 1 Mile
DATE 10-29-75 SHEET___OF___
DRAWING NO.



☆ GPO 853-660

FALKIRK EAR

Appendix 7

Aesthetics and Recreation

(Landscape Character)

QUALITY EVALUATION OF RECREATION USE OPPORTUNITIES

Quality Evaluation Chart for Sightseeing - Scenery

Quality Evaluation Chart

SCENERY

| KEY FACTORS | RATING CRITERIA AND SCORE | | |
|---|---|---|---|
| ① LAND FORM | Vertical or near vertical cliffs, spires, highly eroded formations, massive rock outcrops, severe surface variation. 4 | Steep canyon walls, mesas, interesting erosional patterns, variety in size & shape of land forms. 2 | Rolling hills, foothills, flat valley bottoms. 1 |
| ② COLOR | Rich color combinations variety or vivid contrasts in the color of soil, rocks, vegetation or water. 4 | Some variety in colors and contrast of the soil, rocks & vegetation, but not dominant. 2 | Subtle color variations, little contrast, generally muted tones. Nothing really eye-catching. 1 |
| ③ WATER | Still, chance for reflections or cascading white water, a dominant factor in the landscape. 4 | Moving and in view or still but not dominant. 2 | Absent or present but seldom seen. 1 |
| ④ VEGETATION | A harmonious variation in form, texture, pattern, and type. 4 | Some variation in pattern and texture, but only one or two major types. 2 | Little or no variation, contrast lacking. 1 |
| ⑤ UNIQUENESS | One of a kind or very rare within region. 6 | Unusual but similar to others within the region. 2 | Interesting in its setting, but fairly common within the region. 1 |
| ⑥ INTRUSIONS | Free from aesthetically undesirable or discordant sights and influences. 2 | Scenic quality is somewhat depreciated by inharmoneous intrusions but not so extensive that the scenic qualities are entirely negated. 1 | Intrusions are so extensive that scenic qualities are for the most part nullified. -4 |

A = 15-24 B = 10-14 C = 1-9

EXPLANATION OF RATING CRITERIA

① Land Form or topography becomes more interesting as it gets steeper and more massive. Examples of outstanding land forms are found in Grand Canyon, the Sawtooth Mountain Range in Idaho, the Wrangle Mountain Range in Alaska, Rocky Mountain National Park, etc.

② Color. Consider the overall color of the basic components of the landscape (i.e., soil, rocks, vegetation, etc.) as they appear during the high use season. Key factors to consider in rating "color" are variety, contrast, and harmony.

③ Water is that ingredient which adds movement or serenity to a scene. The degree to which water dominates the scene is the primary consideration in selecting the rating score.

④ Vegetation. Give primary consideration to the variety of patterns, forms, and texture created by the vegetation.

⑤ Uniqueness. This factor provides an opportunity to give added importance to one or all of the scenic features that appear to be relatively unique within any one physiographic region. There may also be cases where a separate evaluation of each of the key factors does not give a true picture of the overall scenic quality of an area. Often it is a number of not so spectacular elements in the proper combination that produces the most pleasing scenery -- the uniqueness factor can be used to recognize this type of area and give it the added emphasis it needs.

⑥ Intrusions. Consider the impact of man-made improvements on the aesthetic quality. These intrusions can have a positive or negative aesthetic impact. Rate accordingly.

INSTRUCTIONS (See Sec. .1 for general procedures)

Purpose: To rate the aesthetic quality of the scenic resource on all BLM lands.

How to Identify Scenery Value: All Bureau lands have scenic value.

How to Determine Minimum Suitability: All BLM lands are rated for scenic values. Also rate adjacent or intermingling non-BLM lands.

How to Delineate Rating Areas: Consider the following factors when delineating rating areas:

1. Like physiographic characteristics (i.e., land form, vegetation, etc.
2. Similar visual patterns, texture, color, variety, etc.
3. Areas which have a similar impact from intrusions (i.e., roads, structures, mining operations, or other surface disturbances).

APPENDIX 7

| | | | |
|---|---|---|---|
| 1. Date 9/19/75<br>2. Rater Ed McTaggart<br>3. State<br>4. District<br>5. Plan Unit | UNITED STATES<br>DEPARTMENT OF THE INTERIOR<br>BUREAU OF LAND MANAGEMENT<br><br>**QUALITY EVALUATION SCORESHEET**<br><br>6. Recreation Activity<br>Scenery | CLASS | SCORE RANGE<br>7 |

8. KEY FACTORS

*Opportunity for rater to add or subtract points for special reasons

| 9. RATING AREA NO. (a) | NAME (b) | Landform | Color | Water | Vegetation | Uniqueness | Intrusions | Rater's Option* | | 11. TOTAL SCORE | 12. CLASS | 13. REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10. POINT MAXIMUM | 4 | 4 | 4 | 4 | 6 | 2 | | | 24 | | |
| 1 | Weller Slough | 1 | 1 | 4 | 2 | 1 | 1 | -1 | | 9 | C | Feel water is slightly over rated in this case. |
| 2 | Coal Lake Coulee | 1 | 1 | 2 | 2 | 2 | 1 | | | 9 | C | |
| 3 | Remaining Mine Area | 1 | 1 | 1 | 1 | 1 | 1 | +1 | | 7 | C | Numerous small sloughs & occasional trees add variety |
| | Specific Fed. Coal Tracts | | | | | | | | | | | |
| A | Sec. 6,T146N,R82W | 1 | 2 | 1 | 2 | 1 | 1 | | | 8 | C | Highway & R/R,Slough & Native veg provide contrast |
| B | Sec. 2,T146N,R82W | 1 | 1 | 1 | 1 | 1 | 1 | | | 6 | C | Farm land mostly |
| C | Sec. 20,T146N,R82W | 1 | 1 | 1 | 1 | 1 | 2 | | | 7 | C | Wheat land |
| D | Sec. 24,T146N,R82W | 1 | 1 | 1 | 2 | 1 | 2 | | | 8 | C | ½ hay, ½ native some hardwoods |
| E | NENE,Sec34,T146N,R82W | 1 | 1 | 1 | 1 | 1 | 2 | | | 7 | C | Mostly native some brush |
| F | SW,Sec.34,T146N,R82W | 1 | 1 | 1 | 1 | 1 | 1 | | | 6 | C | Highway & R/R |
| G | Sec. 24,T146N,R83W | 1 | 1 | 1 | 1 | 1 | 1 | | | 6 | C | P/L Crosses Area |
| H | Sec. 30,T146N,R81W | 1 | 1 | 1 | 1 | 1 | 1 | +1 | | 7 | C | Windbreaks add contrast & variety |
| | | | | | | | | | | | | 55 |
| | | | | | | | | | | | | 192 |

(Instructions on reverse)

Form 6110-10 (August 1972)

| | | | |
|---|---|---|---|
| 1. Date 9-19-75 | UNITED STATES<br>DEPARTMENT OF THE INTERIOR<br>BUREAU OF LAND MANAGEMENT | CLASS | SCORE RANGE |
| 2. Rater D. Roberts | | | 7 |
| 3. State | QUALITY EVALUATION SCORESHEET | A<br>B<br>C | 15-24<br>10-14<br>1-9 |
| 4. District | 6. Recreation Activity | | |
| 5. Plan Unit | Scenery | | |

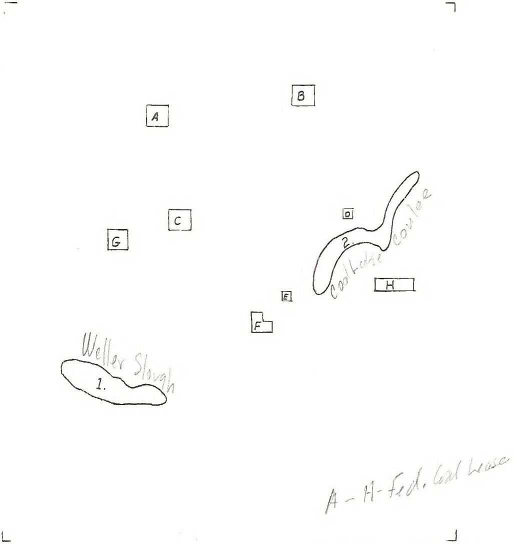
8. KEY FACTORS

*Opportunity for rater to add or subtract points for special reasons.

| 9. RATING AREA | | 10. POINT MAXIMUM | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NO. (a) | NAME (b) | Landform 4 | Color 4 | Water 4 | Vegetation 4 | Uniqueness 6 | Intrusions 2 | Rater's Option* | | 11. TOTAL SCORE | 12. CLASS | 13. REMARKS |
| 1 | Weller Slough | 1 | 2 | 2 | 2 | 1 | 1 | | | 9 | C | Rated in |
| 2 | Coal Lake Coulee | 1 | 2 | 2 | 2 | 1 | 1 | | | 9 | C | relation |
| 3 | Remaining Mine Area | 1 | 1 | 1 | 1 | 1 | 1 | | | 6 | C | to region |
| | Specific Fed. Coal Tracts | | | | | | | | | | | |
| A | Sec. 6,T.146N,R82W | 1 | 2 | 1 | 2 | 1 | 1 | | | 8 | C | Rated |
| B | Sec. 2,T146N,R82W | 1 | 1 | 1 | 1 | 1 | 1 | | | 6 | C | in |
| C | Sec. 20,T146N,R82W | 1 | 1 | 1 | 1 | 1 | 1 | | | 6 | C | relation |
| D | Sec. 24,T146N,R82W | 1 | 2 | 1 | 2 | 1 | 1 | | | 8 | C | to |
| E | NENE,Sec34,T146N,R82W | 1 | 2 | 1 | 2 | 1 | 1 | | | 8 | C | each |
| F | SW,Sec34,T146N,R82W | 1 | 1 | 1 | 1 | 1 | 1 | | | 6 | C | other |
| G | Sec. 24,T146N,R83W | 1 | 1 | 1 | 1 | 1 | 1 | | | 6 | C | |
| H | Sec. 30,T146N,R81W | 1 | 2 | 1 | 2 | 1 | 1 | | | 8 | C | |
| | | | | | | | | | | 56 | | |

*(Instructions on reverse)*

Form 6110-10 (August 1972)




U. S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Scenery
Rating Areas
Underwood Vicinity

| | |
|---|---|
| DESIGNED____ | RECOMM.____ |
| DRAWN W.P. | RECOMM.____ CHIEF, DIV. OF ENG. |
| CHECKED____ | APPROVED____ |
| SCALE ½" = 1 Mile | |
| DATE 10-29-75 | SHEET___OF___ |
| DRAWING NO. | |



☆ GPO 853-660

APPENDIX 7

Table 1

McLean County 1973 Hunting Data Estimates 1/

| Species | No. Hunters | Hunter Days/Hunter | Total Hunter Days |
|---|---|---|---|
| Deer | 3000 | 4 | 12,000 |
| Waterfowl | 2465 | 8.8 | 21,692 |
| Sharptail | 624 | 2.75 | 1,715 |
| Turkey | 105 | 1.35 | 142 |
| Pheasant | 2418 | 2.45 | 5,924 |
| Totals | 8612 | | 41,473 |

1/ Estimated from various North Dakota State Game and Fish Department Reports

APPENDIX 7

Table 2

MCLEAN COUNTY VISITATION

| Recreation Areas | 1970 | 1971 | 1972 | 1973 | 1974 | 1975** |
|---|---|---|---|---|---|---|
| Corps of Eng Mgmt | | | | | | |
| Downstream | 61,881 | 77,985 | 78,960 | 74,325 | 79,152 | 51,400 |
| Tailrace | 77,730 | 108,516 | 97,515 | 124,629 | 107,964 | 72,462 |
| Powerplant | 37,236 | 42,030 | 59,355 | 54,444 | 15,012 | 15,683 |
| Intake Picnic* | 38,166 | 41,025 | 42,555 | 40,260 | 42,068 | 19,690 |
| Wolf Creek | 42,954 | 48,720 | 49,005 | 43,083 | 41,271 | 31,526 |
| Totten Trail | 99,927 | 105,885 | 115,710 | 122,430 | 121,976 | 36,010 |
| Douglas Creek | 12,696 | 14,385 | 15,660 | 11,706 | 7,837 | 2,419 |
| Deepwater | 22,485 | 23,055 | 24,390 | 24,567 | 26,000 | 13,652 |
| Riverdale Rec Area | No data | No data | 59,775 | 50,616 | 46,599 | 41,940 |
| Spillway Overlook | 78,648 | 99,900 | 97,575 | 70,554 | 100,920 | 52,772 |
| State Parks Mgmt | | | | | | |
| Fort Stevenson | 61,056 | 70,461 | 72,225 | 59,745 | 40,311 | 17,929 |
| Lake Sakakawea* | 65,754 | 75,816 | 77,715 | 69,225 | 172,464 | 173,444 |
| Total for entire lake project | 1,044,438 | 1,075,305 | 1,122,954 | 1,134,723 | 1,320,835 | 861,638 |

* Located on eastern edge of Mercer County and therefore directly affected by McLean County

** Through September 1975

APPENDIX 7

Table 3

## 1974 INVENTORY OF NORTH DAKOTA OUTDOOR RECREATION FACILITIES

STATE OUTDOOR RECREATION AGENCY, 900 EAST BOULEVARD, BISMARCK, NORTH DAKOTA 58501 701/224-2430

MCLEAN COUNTY

| NAME OF AREA | LOCATION | OWNERSHIP | TOTAL ACRES | SURFACE WATER ACRES | FISHING ACRES | RAMPS | DOCKS | BOATING, WATER SKIING ACRES | HUNTING ACRES | BEACHES | POOLS | POOL AREA (SQ. FT.) | HIKING, HORSEBACK MILES | BICYCLE MILES | MOTORCYCLE, SNOWMOBILE MILES | ACRES | TENT SITES | TRAILER SITES | ELECTRIC OUTLETS | ACRES | TABLES | SHELTERS | ACRES | GRASS GREENS | SAND GREENS | DIAMONDS BASEBALL AND SOFTBALL | HORSESHOE | VOLLEY BALL | BASKETBALL | TENNIS | PLAYGROUNDS | TRAP, SKEET | ARCHERY | ARENAS | SEATING | AMPHITHEATERS | SEATING | ICE SKATING RINKS | SLEDDING AREAS | SLEDDING ACRES | HOCKEY RINKS | WARMING HOUSES | SKI RUNS | SKI TOWS | VERTICAL RISE (No. FEET) | CAR, MOTORCYCLE (No. MILES) | SNOWMOBILE (No. MILES) | SEATING | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | FISHING | | | | | SWIMMING | | | TRAILS | | | CAMPING | | | | PICNICKING | | | GOLFING | | | | COURTS | | | | | RANGES | | RODEOS | | DRAMAS, CONCERTS | | WINTER SPORTS | | | | | | | | RACING | | | |
| Lake Sakakawea - total * | County | F | 82,595 | 82595 | 54457 | | | 54457 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Douglas Creek Recreation Area | 148-86-28 | F | 600 | * | * | 1 | | * | | 1 | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Garrison Bible Camp | S. of City | P | 25 | * | * | 1 | 1 | * | | | | | | | | | | | | 2 | 6 | | | | | | | 1 | 2 | | | | | | | | | | | | | | | | | | | | |
| Lee's Resort | S. of Garrison | P | 20 | * | * | 2 | | * | | | | | | | | 6 | 15 | 15 | 15 | 6 | 15 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| YMCA Camp | S. of Garrison | P | 320 | * | * | | | | | | | | 10 | | | 8 | 10 | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lutheran Bible Camp | S. of Garrison | P | 80 | * | * | | | | | | | | | | | 8 | 10 | 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ft. Stevenson State Park | 3mi.S. " | F/S | 438 | * | * | 1 | 2 | * | | | | | | | | 4 | 10 | 10 | | 5 | 23 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Totten Trail Public Use Area | Lake Audubon | F | 116 | * | * | 1 | | | | 1 | | | | | | 30 | 20 | | | 10 | 13 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Wolf Creek Public Use Area | E. of Riverdale | P | 40 | * | * | 1 | | * | | 1 | | | | | | | | | | 5 | 20 | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Deep Water Creek GMA | 7mi.W.Raub | F/S | 2,242 | * | * | 1 | | * | 2,242 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Missouri River - total** | County | F | 5,253 | 5253 | 3677 | | | 3677 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Washburn Park | City | M | 8 | ** | ** | 1 | 1 | ** | | | | | | | | | | | | 5 | 12 | 2 | | | | | | | 1 | | | | | | | | | 2 | | | | 1 | | | | | | | |
| Western 4-H Camp | 144-81 | P | 87 | ** | ** | | | | | | | | 3 | | 2 | | | | | 1 | 20 | | | | | 1 | 2 | 1 | 2 | | | 1 | | | | | | | | | | | | | | | 4 | | |
| Downstream Recreation Area | 3mi. SW of Riverdale | F | 502 | ** | ** | | | | | | | | 3 | | 1 | 8 | | 60 | 60 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lewis & Clark Historic Site | W. of Washburn | C | 10 | | | | | | | | | | | | | | | | | 5 | 3 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lake Nettie | 148-81 | C | 150 | 140 | 140 | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Riverdale | City | F | 5 | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | |
| Garrison Park | City | M | 1 | | | | | | | | | | | | | | | | | 1 | 12 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Underwood Golf Course | City | P | 60 | | | | | | | | | | | | | | | | | | | | 60 | | 9 | | | | | | | | | | | | | | | | | | | | | | | | |
| Garrison Golf Course | City | P | 80 | | | | | | | | | | | | | | | | | | | | 60 | | 9 | | | | | | | | | | | | | | | | | | | | | | | | |
| Underwood Park | City | M | 1 | | | | | | | | | | | | | | | | | 1 | 12 | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | |
| Garrison Swimming Pool | City | M | 1 | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Washburn Swimming Pool | City | M | 1 | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Wilton Park | City | M | 11 | | | | | | | | | | | | | | | | | 3 | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Conklin Dam | 149-85-25 | S-C | 82 | 62 | 62 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Yanktonai Dam, Wilton | 143-80-30 | S-P | 80 | 32 | 32 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Blue Lake | 147-79-16 | S-P | 400 | 400 | 400 | | | | | 1 | | | | | | | | | | 1 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | |
| Brush Lake Recreation Area | 147-79-27 | S-P | 320 | 200 | 200 | 1 | 2 | | | 1 | | | | | | | | | | 20 | 10 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Crooked Lake, Turtle Lake | 148-80-8 | S-P | 375 | 375 | 375 | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Strawberry Lake, Ruso | 149-80-2 | S-P | 260 | 140 | 140 | 1 | 5 | 140 | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Turtle Lake Park | City | M | 10 | | | | | | | | | | | | | | | | | 2 | 5 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Riverdale Overlook Picnic | Riverdale | F | 10 | | | | | | | | | | | | | | | | | 10 | 12 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| City of Butte | City | M | 1 | | | | | | | | | | | | | | | | | 1 | 7 | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | |

FWS — U.S. FISH AND WILDLIFE SERVICE
BLM — BUREAU OF LAND MANAGEMENT
WPA — WATERFOWL PRODUCTION AREA
GMA — GAME MANAGEMENT AREA
MA — MANAGEMENT AREA
PR — OPERATED FOR PROFIT
NP — NON PROFIT
F,M,C,S — FEDERAL, MUNICIPAL, COUNTY OR STATE
P — PRIVATELY OWNED

APPENDIX 7 Table 4

# 1974 INVENTORY OF NORTH DAKOTA OUTDOOR RECREATION FACILITIES

STATE OUTDOOR RECREATION AGENCY, 900 EAST BOULEVARD, BISMARCK, NORTH DAKOTA 58505 701/224-2430

OLIVER COUNTY

| NAME OF AREA | LOCATION | OWNERSHIP | TOTAL ACRES | SURFACE WATER ACRES | FISHING: FISHING ACRES | FISHING: RAMPS | FISHING: DOCKS | BOATING, WATER SKIING ACRES | HUNTING ACRES | SWIMMING: BEACHES | SWIMMING: POOLS | SWIMMING: POOL AREA (SQ. FT.) | TRAILS: HIKING, HORSEBACK MILES | TRAILS: BICYCLE MILES | TRAILS: MOTORCYCLE, SNOWMOBILE MILES | CAMPING: ACRES | CAMPING: TENT SITES | CAMPING: TRAILER SITES | CAMPING: ELECTRIC OUTLETS | PICNICKING: ACRES | PICNICKING: TABLES | PICNICKING: SHELTERS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rubel Rodeo Arena | 142-84-5 | P | 5 | | | | | | | | | | | | | | | | | | | |
| Marcus Mosbrucker Dam | 141-83-32 | P | 16 | 14 | 14 | | | | | | | | | | | | | | | | | |
| Gullickson Dam | 142-83-2 | P | 7 | 5 | 5 | | | | | | | | | | | | | | | | | |
| Price Dam | 142-81-33 | P | 6 | 4 | 4 | | | | | | | | | | | | | | | | | |
| Olander Dam | 141-81-9 | P | 14 | 10 | 10 | | | | | | | | | | | | | | | 4 | 1 | - |
| Zahn Dam | 142-87-28 | P | 10 | 2 | 2 | | | | | | | | | | | | | | | | | |
| Keller Dam | 142-87-27 | P | 16 | 12 | 12 | | | | | | | | | | | | | | | | | |
| Ragerott Dam | 142-84-19 | P | 4 | 2 | 2 | | | | | | | | | | | | | | | | | |
| Moon Dam | 142-83-3 | P | 4 | 2 | 2 | | | | | | | | | | | | | | | | | |
| Tony Mosbrucker Dam | 27-141-83 | P | 12 | 10 | 10 | | | | | | | | | | | | | | | 2 | - | - |
| Van Oosting Dam | 6-143-82 | P | 80 | 15 | 15 | | | | | | | | | | | | | | | 1 | 1 | - |
| Center Park | City | M | 17 | 1 | 1 | | | | | | | | | | | 2 | | 3 | 3 | | | |
| Nelson Lake | 4-141-83 | P | 415 | 415 | 415 | | | | | 1 | | | | | | | | | | 5 | 2 | 2 |
| BLM Areas (10) | County | P | 274 | | | | | | 274 | | | | | | | | | | | | | |
| Missouri River | County | P | 4,530 | 4530 | 3171 | | | 3171 | | | | | | | | | | | | | | |
| Ridge Runner Cycle Club Track | Beulah | P | 20 | | | | | | | | | | | | | | | | | | | |
| Aroda Lake Management Area | R83-T143 | S | 384 | 35 | 35 | | | | | | | | | | | | | | | | | |
| Lewis & Clark GMA | | S | 121 | | | | | | 121 | | | | | | | | | | | | | |
| Smith Grove Management Area | | S | 24 | 24 | 24 | | | | | | | | | | | | | | | | | |
| TOTAL | | | 5,959 | [illegible] | [illegible] | | | 3,171 | 395 | 1 | | | | | | 2 | | 3 | 3 | 12 | 4 | 2 |

| NAME OF AREA | GOLFING: ACRES | GOLFING: GRASS GREENS | GOLFING: SAND GREENS | DIAMONDS BASEBALL AND SOFTBALL | COURTS: HORSESHOE | COURTS: VOLLEY BALL | COURTS: BASKETBALL | COURTS: TENNIS | PLAYGROUNDS | RANGES: TRAP, SKEET | RANGES: ARCHERY | RODEOS: ARENAS | RODEOS: SEATING | DRAMAS, CONCERTS: AMPHITHEATERS | DRAMAS, CONCERTS: SEATING | WINTER SPORTS: ICE SKATING RINKS | WINTER SPORTS: SLEDDING AREAS | WINTER SPORTS: SLEDDING ACRES | WINTER SPORTS: HOCKEY RINKS | WINTER SPORTS: WARMING HOUSES | WINTER SPORTS: SKI RUNS | WINTER SPORTS: SKI TOWS | WINTER SPORTS: VERTICAL RISE (No. FEET) | RACING: CAR, MOTORCYCLE (No. MILES) | RACING: SNOWMOBILE (No. MILES) | RACING: SEATING | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rubel Rodeo Arena | | | | | | | | | | | | 1 | 50 | | | | | | | | | | | | | | |
| Marcus Mosbrucker Dam | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Gullickson Dam | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Price Dam | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Olander Dam | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Zahn Dam | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Keller Dam | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ragerott Dam | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Moon Dam | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Tony Mosbrucker Dam | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Van Oosting Dam | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Center Park | | | | 1 | | | | 1 | 3 | | | | | | | | | | | | | | | | | | |
| Nelson Lake | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BLM Areas (10) | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Missouri River | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ridge Runner Cycle Club Track | | | | | | | | | | | | | | | | | | | | | | | | 1 | | 800 | |
| Aroda Lake Management Area | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lewis & Clark GMA | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Smith Grove Management Area | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TOTAL | | | | 1 | | | | 1 | 3 | | | 1 | 50 | | | | | | | | | | | 1 | | 800 | |

FWS — U.S. FISH AND WILDLIFE SERVICE
BLM — BUREAU OF LAND MANAGEMENT
WPA — WATERFOWL PRODUCTION AREA
GMA — GAME MANAGEMENT AREA
MA — MANAGEMENT AREA
PR — OPERATED FOR PROFIT
NP — NON PROFIT
F,M,C,S — FEDERAL, MUNICIPAL, COUNTY OR STATE
P — PRIVATELY OWNED

## 1974 INVENTORY OF NORTH DAKOTA OUTDOOR RECREATION FACILITIES

STATE OUTDOOR RECREATION AGENCY, 900 EAST BOULEVARD, BISMARCK, NORTH DAKOTA 58505 701/224-2430

MERCER COUNTY

| NAME OF AREA | LOCATION | OWNERSHIP | TOTAL ACRES | SURFACE WATER ACRES | FISHING: FISHING ACRES | FISHING: RAMPS | FISHING: DOCKS | BOATING, WATER SKIING ACRES | HUNTING ACRES | SWIMMING: BEACHES | SWIMMING: POOLS | SWIMMING: POOL AREA (SQ FT) | TRAILS: HIKING, HORSEBACK MILES | TRAILS: BICYCLE MILES | TRAILS: MOTORCYCLE, SNOWMOBILE MILES | CAMPING: ACRES | CAMPING: TENT SITES | CAMPING: TRAILER SITES | CAMPING: ELECTRIC OUTLETS | PICNICKING: ACRES | PICNICKING: TABLES | PICNICKING: SHELTERS | GOLFING: ACRES | GOLFING: GRASS GREENS | GOLFING: SAND GREENS | DIAMONDS-BASEBALL AND SOFTBALL | COURTS: HORSESHOE | COURTS: VOLLEY BALL | COURTS: BASKETBALL | COURTS: TENNIS | PLAYGROUNDS | RANGES: TRAP, SKEET | RANGES: ARCHERY | RODEOS: ARENAS | RODEOS: SEATING | DRAMAS, CONCERTS: AMPHITHEATERS | DRAMAS, CONCERTS: SEATING | WINTER SPORTS: ICE SKATING RINKS | WINTER SPORTS: SLEDDING AREAS | WINTER SPORTS: SLEDDING ACRES | WINTER SPORTS: HOCKEY RINKS | WINTER SPORTS: WARMING HOUSES | WINTER SPORTS: SKI RUNS | WINTER SPORTS: SKI TOWS | WINTER SPORTS: VERTICAL RISE (No FEET) | RACING: CAR, MOTORCYCLE (No MILES) | RACING: SNOWMOBILE (No MILES) | RACING: SEATING | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Little Missouri River ** | County | F | 2,388 | 2388 | 1672 | | | 1672 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Garrison Dam Tailwaters | 6-146-85 | F | 260 | ** | ** | 1 | 1 | | | | | | | | | | | | | 2 | 18 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lake Sakakawea * | County | | 36,240 | 36240 | 25362 | | | 25362 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Camp Dominic Savio | West of Pick City | P | 98 | * | * | | | * | | | | | | | | | | | | 2 | 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Beulah Bay Recreation Area | 8-146-87 | M | 102 | * | * | 2 | 5 | * | | | | | | | | | | 4 | 4 | | 15 | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hazen Recreation Area | Sakakawea | M | 80 | * | * | | 1 | * | | | | | | | | | | | | | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Intake Picnic Area | 31-147-84 | F | 103 | * | * | | | * | | | | | | | | | | | | 50 | 35 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sakakawea State Park | 25-147-85 | S | 661 | * | * | 1 | 4 | * | | 1 | | | | | 3 | 300 | | 75 | 75 | 35 | 177 | 10 | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | |
| Bad Butte Bay | 17-147-90 | F | * | * | * | 1 | 1 | * | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sakakawea Park | Stanton | M | 112 | 100 | 100 | 1 | 1 | | | 1 | | | | | | | | | | 5 | 8 | 1 | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | |
| Hazen Country Club | Hazen | P | 50 | | | | | | | | | | | | | | | | | | | | 50 | | 9 | | | | | | | | | | | | | | | | | | | | | | | | |
| Horse Show Arena | E. of Hazen | P | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 500 | | | | | | | | | | | | | | |
| Hazen City Park | City | M | 10 | | | | | | | | 1 | | | | | | | | | 5 | 12 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hazen-Burlington North Park | City | M | 2 | | | | | | | | | | | | | | | | | 1 | 4 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Riverside & City Center Park | Beulah | M | 120 | 50 | 50 | | 5 | | | 1 | | | | | | 5 | | 6 | 6 | 35 | 15 | 3 | 175 | | 9 | 1 | 1 | | 3 | 1 | 2 | | | 1 | 5000 | | | 2 | | | | | | | | | 10 | | |
| Beulah Swimming Pool & Park | City | M | 4 | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Zap Sportsman Club | City | P | 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | |
| Zap Municipal Park | City | M | 7 | | | | | | | | | | | | | | | | | 1 | 4 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Beulah Mine Pond | N. of Beulah | S | 25 | 3 | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BLM Areas (16) | County | S | 459 | | | | | | 459 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Leonard Sailer Campground | Beulah | P | 20 | | | | | | | | | | | | | 20 | | 20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Jacob Weidner Campground | Beulah | P | 15 | | | | | | | | | | | | | 15 | | 30 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hazen Trailer Camper Park | City | M | 4 | | | | | | | | | | | | | 4 | | 6 | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Beaver Creek GMA | R89-T146 | S/F | 163 | | | | | | 163 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Beulah Mine GMA | 1&2-87-144 | S/F | 1,174 | | | | | | 1,174 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hille GMA | F87-T146 | S/F | 924 | | | | | | 924 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TOTAL | | | 43,036 | 38,781 | 37,187 | 6 | 18 | 27,034 | 2,720 | 3 | 2 | | | | 3 | 349 | | 141 | 91 | 136 | 300 | 21 | 225 | | 18 | 1 | 1 | | 3 | 1 | 5 | 1 | | 2 | 5500 | | | 2 | | | | | | | | | 10 | | |

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P — PRIVATELY OWNED

FALKIRK EAR

Appendix 8

Environmental Analysis
Worksheets

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

## ENVIRONMENTAL ANALYSIS WORKSHEET

1. Action

Falkirk Coal Lease Application #31053 (ND)

2. Stages of implementation

Mine Site Preparation (Same for proposed action and alternatives)

3. DISCRETE OPERATIONS

Short/Long

| 4. COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED | | 5. ANTICIPATED IMPACTS: Survey | Road Construction | Facilities Construction | | Cumulative | 6. REMARKS |
|---|---|---|---|---|---|---|---|
| I. NONLIVING COMPONENTS | A. AIR | | | | | | |
| | Particulate Matter | -/O | -/O | -/O | | | negative due to surface disturbance |
| | Exhaust Emissions | -/O | -L/O | -L/O | | | negative due to machinery use. |
| | B. LAND | | | | | | |
| | Soil Depth | O/O | -L/-L | -L/-L | | | - insig. for entire mine area |
| | Soil Structure | O/O | -L/-L | -L/-L | | | - insig. for entire mine area |
| | Soil Nutrients | O/O | -/- | -/- | | | |
| | Soil Erosion | O/O | -L/-L | -L/-L | | | exposure created |
| | Land Use Compatability | O/O | -L/-L | -L/-L | | | high on site; low for entire area |
| | Land Use Suitability | +/O | +M/+M | +M/+M | | | slope favorable; soils well drained |
| | C. WATER | | | | | | |
| | Hydrologic Cycle | O/O | -/- | -/- | | | increased runoff & infiltration rate |
| | Sediment Load | O/O | -L/- | -L/- | | | decrease as area is stabolized |
| | Dissolved Solids | O/O | -L/- | -L/- | | | |
| | Nutrients | O/O | -/- | -/- | | | parallels sediment load |
| | pH | O/O | X/X | X/X | | | depends on strata bissected |
| | Dissolved Oxygen | O/O | -/- | -/- | | | decreases with temperature increase |
| | Temperature | O/O | -/- | -/- | | | due to heat absorption |
| II. LIVING COMPONENTS | A. PLANTS *(Aquatic)* | | | | | | |
| | Vascular | O/O | -/- | -/- | | | impairment increases with sediment load |
| | Phytoplankton | O/O | -/- | -/- | | | impairment increases with sediment load |

*(Continued on reverse)*



Form 1790–3 (June 1974)

| DISCRETE OPERATIONS | Survey | Road Construction | Facilities Construction | | Cumulative | Short / Long |
|---|---|---|---|---|---|---|
| COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED | ANTICIPATED IMPACTS | | | | | REMARKS |
| **II. LIVING COMPONENTS (Con.)** | | | | | | |
| B. PLANTS *(Terrestrial)* | | | | | | |
| Lichens & Mosses | 0/0 | -/- | -/- | | | annihilated by disturbance |
| Grasses & Forbs | 0/0 | -/- | -/- | | | annihilated by disturbance |
| Shrubs | 0/0 | -L/-L | -/- | | | annihilated by disturbance |
| Broadleaf Trees | 0/0 | -L/-L | 0/0 | | | annihilated by disturbance |
| | | | | | | |
| C. ANIMALS *(Aquatic)* | | | | | | |
| Mammals | 0/0 | -/- | -/- | | | |
| Birds | -/- | -/- | -/- | | | may be disturbance during nesting period |
| Amphibians & Reptiles | 0/0 | -/- | -/- | | | |
| Fish | 0/0 | -/- | -/- | | | |
| Invertebrates | 0/0 | -/- | -/- | | | |
| D. ANIMALS *(Terrestrial)* | | | | | | |
| Mammals | 0/0 | -/- | -/- | | | |
| Birds | 0/0 | -/- | -/- | | | |
| Reptiles | 0/0 | -/- | -/- | | | |
| Invertebrate | 0/0 | -/- | -/- | | | |
| Man | 0/0 | -/0 | -/0 | | | may be a safety hazard |
| **III. INTERRELATIONSHIPS** | | | | | | |
| A. ECOLOGICAL PROCESSES | | | | | | |
| Succession | 0/0 | -/0 | -/0 | | | immediate disturbance sets back |
| Food Relationships | 0/0 | -/0 | -/0 | | | parallels succession |
| Community Relationships | 0/0 | -/0 | -/0 | | | parallels succession |
| | | | | | | |
| **IV. HUMAN VALUES** | | | | | | |
| A. LANDSCAPE CHARACTER | | | | | | |
| Harmonious | -/0 | -L/0 | -L/-L | | | Out of character to present (status quo) |
| Accentuating | 0/0 | -/- | -/- | | | |
| | | | | | | |
| B. SOCIOCULTURAL INTERESTS | | | | | | |
| Educa. / Scien. | 0/0 | X/X | X/X | | | |
| Social Welfare | +/0 | +L/0 | +L/- | | | value as money flow locally |
| Attitudes/Expect. | X/X | X/X | X/X | | | |
| Local Requ. Structure | - | - | - | | | changed McLean County Plan |
| Cultural (Recreation) | | | | | -M/0 | |

## INSTRUCTIONS

1. *Action* – Enter action being taken, analytic step for which worksheet is being used, environmental viewpoint of impact, and any assumptions relating to impact.
   a. Worksheet is normally used to analyze *"Anticipated Impacts"* of action; *however*, it may be used to analyze *"Residual Impacts."* Worksheets may also be used to compare impacts before and after mitigating measures are applied.
   b. State viewpoint that best describes environmental impact. For example, a fence viewed down the fence line has greater impact than the same fence viewed over an entire allotment. Generally, narrow viewpoints better illustrate specific impacts than will broad viewpoints.
   c. Assumptions may be made to establish a base for analysis *(e.g. estimated time periods, season of year, etc.)*.
2. *Stages of Implementation* – Identify different phases of proposed project *(e.g. a road project consists of survey, construction, use, and maintenance stages)*.
3. *Discrete Operations* – Identify separate actions comprising a particular stage of implementation *(e.g. the construction stage of the road project has the discrete operations of clearing, grading, and surfacing)*.
4. *Elements Impacted* – Enter under appropriate heading all environmental elements susceptible to impact from action and alternatives. Relevant elements not contained in the digest should also be entered. See BLM Manual 1791, Appendix 2, Environmental Digest.
5. *Anticipated Impact* – Evaluate anticipated impact on each element and place an entry in the appropriate square indicating degree of impact as low (L), medium (M), high (H), no impact (O), or unknown or negligable (X). Preceed each entry by a plus (+) or minus (–) sign indicating a beneficial or adverse type of impact. If type of impact reflects a matter of opinion or is not known, *do not* preceed with a sign. For example, construction of a wind mill on open range has a definite visual impact; *however*, to some people the effect is detrimental while to others it is an improvement. By not entering a plus (+) or minus (–) sign the worksheet is kept factual and unbiased. If both degree and type of impact are unknown, place an (x) in the appropriate square.
   a. The measures of impact *(e.g. low, medium, and high)* are relative and their meaning may vary slightly from action to action. The term *"low"* should not be applied to impacts of a negligible nature. For example, we know that a pickup truck driving down a proposed fence line laying wire has some impact on air quality. However, the significance of this impact is not normally great enough to warrant even a *"low"* rating. In cases like this, the impact will usually be marked "O" or the element left off the worksheet.
   b. It is recognized that some environmental elements may defy accurate measurement or in-depth analysis within current Bureau capabilities or expertise. The nature of the action as well as type and degree of impact should guide in the decision to seek outside expertise or assistance.
6. *Remarks* – Enter clarifying information.



GPO 857-541

Non-lease of Federal Coal Alternative of No Action

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Short / Long

## ENVIRONMENTAL ANALYSIS WORKSHEET

1. Action

Falkirk Coal Lease Application #31053 (ND)

2. Stages of implementation

Mining Operations

3. DISCRETE OPERATIONS

| 4. COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED | 5. ANTICIPATED IMPACTS: Topsoil Removal & Stockpiling | Overburden Removal & Spoils piling | Blasting & Coal Excavation | Transportation Crushing & Delivery | Cumulative of all discrete operations | 6. REMARKS |
|---|---|---|---|---|---|---|
| **I. NONLIVING COMPONENTS** | | | | | | |
| A. AIR | | | | | | |
| Particulate Matter | -L/-L | -/- | -/- | -L/-L | | disturbance created |
| Exhaust Emmissions | -/- | -/- | -/- | -/- | | |
| B. LANO | | | | | | |
| Soil Depth | -L/-L | O/O | O/O | O/O | | Soil considered top 5 feet |
| Soil Structure | -H/-H | O/O | O/O | O/O | | complete restructuring |
| Soil Nutrients | -L/-L | O/O | O/O | O/O | | destruction of organic matter |
| Soil Pollutants | -L/-L | O/O | O/O | O/O | | possible calcarious sub-soils |
| Soil Erosion | -M/-L | O/O | O/O | O/O | | decrease as stabilized |
| Geologic Structure | O/O | -H/-H | -H/-H | O/O | | from 5' to bottom of coal seam, Complete restructioning |
| Land Use Compatability | -H/-H | -H/-H | -H/-H | -/- | | most contrast initial |
| (Non-lease of Federal Coal highly noncompatible) | | | | | | |
| Land Use Suitability | +M/+M | +M/+M | +M/+M | +M/+M | | large rocks create a problem |
| C. WATER | | | | | | |
| Ground Water Characteristic | O/O | -M/X | -H/X | O/O | | Refer to hydrologic cycle |
| Hydrologic Cycle | -L/-L | X/X | X/X | O/O | | present aquifer removed; results unknown |
| Sediment Load | -/- | -L/-L | O/O | O/O | | parallels soil erosion |
| Dissolved Solids | -/O | -/- | O/O | O/O | | most won't leave mine site |
| Chemicals & Toxic Substance | -/- | -/- | O/O | O/O | | |
| Nutrients | -/- | -/- | O/O | O/O | | |
| Acid Balance | -/- | -/- | O/O | O/O | | parallels dissolved solids |
| Dissolved Oxygen | -/- | -/- | O/O | O/O | | inverse to sediment load |
| Temperature | -/- | -/- | O/O | O/O | | parallels sediment load |
| Coliform Contamination | X/X | X/X | X/X | O/O | | possible local influence |
| **II. LIVING COMPONENTS** | | | | | | |
| A. PLANTS *(Aquatic)* | | | | | | |
| Vascular Plants | -M/-H | O/O | O/O | O/O | | greatest loss initially with topsoil |
| Phytoplankton | -M/-H | -/- | O/O | O/O | | may be present anywhere water pools |
| Floating Plants | -L/-M | O/O | O/O | O/O | | probably less abundant than vasculars |

*(Continued on reverse)*

| DISCRETE OPERATIONS | | Topsoil Removal & Stockpiling | Overburden Removal & Spoils piling | Blasting & Coal Excavation | Transportation Crushing & Delivery | Cumulative of all discrete operations | Short / Long |
|---|---|---|---|---|---|---|---|
| | COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED | ANTICIPATED IMPACTS | | | | | REMARKS |
| II. LIVING COMPONENTS (Con.) | B. PLANTS *(Terrestrial)* | | | | | | |
| | Lichens & Mosses | -M/-H | O/O | O/O | O/O | | |
| | Grasses & Forbs | -M/-H | O/O | O/O | O/O | | |
| | Shrubs | -M/-H | O/O | O/O | O/O | | Higher due to relative importance |
| | Broadleaf Trees | -M/-H | O/O | O/O | O/O | | Higher due to relative importance |
| | C. ANIMALS *(Aquatic)* | | | | | | |
| | Mammals | -M/-H | O/- | O/O | -/- | | Physiography destroyed by overburden removal |
| | Birds | -M/-H | O/- | O/O | -/- | | |
| | Amphibians & Reptiles | -M/-H | O/- | O/O | -/- | | |
| | Fish | -/- | O/O | O/O | O/O | | Only fish in Weller Slough, etc. |
| | Invertebrates | -M/-H | O/- | O/O | O/O | | |
| | Zooplankton | -M/-H | O/O | O/O | O/O | | |
| | D. ANIMALS *(Terrestrial)* | | | | | | |
| | Mammals | -M/-H | -/- | O/O | -/- | | |
| | Birds | -M/-H | -/- | O/O | -/- | | |
| | Reptiles | -M/-H | -/- | O/O | -/- | | |
| | Invertebrates | -M/-H | -/- | O/O | -/- | | |
| | Man | -/O | -/O | -/O | -/O | | Safety hazard |
| III. INTERRELATIONSHIPS | A. ECOLOGICAL PROCESSES | | | | | | |
| | Succession | -M/-H | -/-L | O/O | O/O | | Increase due to change of physiography |
| | Food Relationships | -M/-H | -/-L | O/O | O/O | | |
| | Community Relationships | -M/-H | -/-L | O/O | O/O | | |
| IV. HUMAN VALUES | A. LANDSCAPE CHARACTER | | | | | | |
| | Harmonious | -L/-M | -M/-H | -/- | -/- | | |
| | Accentuating | -L/-M | -M/-H | -/- | -/- | | |
| | B. SOCIOCULTURAL INTERESTS | | | | | | |
| | Educat./Scien. | M/H | M/H | O/+ | O/+ | | Provides unique study area |
| | Cultural (Recreation) | O/O | O/O | O/O | O/O | -M/-H | Individual operation impossible to analyse. |
| | Social Welfare | | | | | +H/+H | After 35 years? increased economy during life of mine |
| | Attitude/Expect. | X/X | X/X | X/X | X/X | | |
| | Local Regul. Structure | O | O | O | O | | |

## INSTRUCTIONS

1. *Action* – Enter action being taken, analytic step for which worksheet is being used, environmental viewpoint of impact, and any assumptions relating to impact.
   a. Worksheet is normally used to analyze *"Anticipated Impacts"* of action; *however,* it may be used to analyze *"Residual Impacts."* Worksheets may also be used to compare impacts before and after mitigating measures are applied.
   b. State viewpoint that best describes environmental impact. For example, a fence viewed down the fence line has greater impact than the same fence viewed over an entire allotment. Generally, narrow viewpoints better illustrate specific impacts than will broad viewpoints.
   c. Assumptions may be made to establish a base for analysis *(e.g. estimated time periods, season of year, etc.).*
2. *Stages of Implementation* – Identify different phases of proposed project *(e.g. a road project consists of survey, construction, use, and maintenance stages).*
3. *Discrete Operations* – Identify separate actions comprising a particular stage of implementation *(e.g. the construction stage of the road project has the discrete operations of clearing, grading, and surfacing).*
4. *Elements Impacted* – Enter under appropriate heading all environmental elements susceptible to impact from action and alternatives. Relevant elements not contained in the digest should also be entered. See BLM Manual 1791, Appendix 2, Environmental Digest.
5. *Anticipated Impact* – Evaluate anticipated impact on each element and place an entry in the appropriate square indicating degree of impact as low (L), medium (M), high (H), no impact (O), or unknown or negligable (X). Preceed each entry by a plus (+) or minus (-) sign indicating a beneficial or adverse type of impact. If type of impact reflects a matter of opinion or is not known, *do not* preceed with a sign. For example, construction of a wind mill on open range has a definite visual impact; *however,* to some people the effect is detrimental while to others it is an improvement. By not entering a plus (+) or minus (-) sign the worksheet is kept factual and unbiased. If both degree and type of impact are unknown, place an (x) in the appropriate square.
   a. The measures of impact *(e.g. low, medium, and high)* are relative and their meaning may vary slightly from action to action. The term *"low"* should not be applied to impacts of a negligible nature. For example, we know that a pickup truck driving down a proposed fence line laying wire has some impact on air quality. However, the significance of this impact is not normally great enough to warrant even a *"low"* rating. In cases like this, the impact will usually be marked "O" or the element left off the worksheet.
   b. It is recognized that some environmental elements may defy accurate measurement or in-depth analysis within current Bureau capabilities or expertise. The nature of the action as well as type and degree of impact should guide in the decision to seek outside expertise or assistance.
6. *Remarks* – Enter clarifying information.



GPO 857-541

APPENDIX 8
Lease of Federal Coal

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

## ENVIRONMENTAL ANALYSIS WORKSHEET

1. Action

Falkirk Coal Lease Application # 31053 (ND)

2. Stages of implementation

Mining Operation

| 3. DISCRETE OPERATIONS | Topsoil Removal & Stockpiling | Overburden Removal and Spoiling | Blasting & Excavation | Transportation of Coal Crushing & Delivery | Cumulative | Short / Long |
|---|---|---|---|---|---|---|
| **4. COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED** | **5. ANTICIPATED IMPACTS** | | | | | **6. REMARKS** |
| **I. NONLIVING COMPONENTS** | | | | | | |
| A. AIR | | | | | | |
| Particulate Matter | -/- | -/- | -/- | -/- | | |
| Exhaust Emissions | -/- | -/- | -/- | -/- | | |
| B. LAND | | | | | | |
| Soil Depth | -/- | O | O | O | | |
| Soil Structure | -/- | O | O | O | | |
| Soil Nutrients | -/- | O | O | O | | |
| Soil Pollutants | -/- | O | O | O | | |
| Soil Erosion | -/- | O | O | O | | |
| Geologic Structure | -/- | -/- | -/- | -/- | | |
| Land Use Compatibility | +H/+H | +H/+H | +H/+H | +H/+H | | Compatable with surrounding mining area |
| Land Use Suitability | +/+ | +/+ | +/+ | +/+ | | |
| C. WATER | | | | | | |
| Ground Water Characteristic | O/O | -/X | -/X | O/O | | |
| Hydrologic Cycle | O | O | O | O | | |
| Sediment Load | O | O | O | O | | |
| Dissolved Solids | O | O | O | O | | |
| Chemicals & Toxic Substance | O | O | O | O | | |
| Nutrients | O | O | O | O | | |
| Acid Balance | O | O | O | O | | |
| Dissolved Oxygen | O | O | O | O | | |
| Temperature | O | O | O | O | | |
| Coliform Contamination | O | O | O | O | | |
| **II. LIVING COMPONENTS** | | | | | | |
| A. PLANTS *(Aquatic)* | | | | | | |
| Vascular Plants | -/- | O | O | O | | |
| Phytoplankton | -/- | -/- | O | O | | |
| Floating Plants | -/- | O | O | O | | |

*(Continued on reverse)*

| DISCRETE OPERATIONS | Topsoil Removal & Stockpiling | Overburden Removal & Spoiling | Blasting & Excavation of Coal | Transportation Crushing & Delivery | Cumulative | Short / Long |
|---|---|---|---|---|---|---|
| COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED | ANTICIPATED IMPACTS | | | | | REMARKS |
| **II. LIVING COMPONENTS (Cont.)** | | | | | | |
| B. PLANTS *(Terrestrial)* | | | | | | |
| Lichens & Mosses | -/- | O/O | O | O | | |
| Grasses & Forbs | -/- | O/O | O/O | O/O | | |
| Shrubs | -/- | O/O | O/O | O/O | | |
| Broadleaf Trees | -/- | O/O | O | O | | |
| C. ANIMALS *(Aquatic)* | | | | | | |
| Mammals | -/- | O/- | O | -/- | | |
| Birds | -/- | O/- | O | -/- | | |
| Amphibians & Reptiles | -/- | O/- | O | -/- | | |
| Fish | O | O | O | O | | |
| Invertebrates | -/- | O/- | O | O | | |
| Zooplankton | -/- | O | O | O | | |
| D. ANIMALS *(Terrestrial)* | | | | | | |
| Mammals | -/- | -/- | O/O | -/- | | |
| Birds | -/- | -/- | O | -/- | | |
| Reptiles | -/- | -/- | O | -/- | | |
| Invertebrates | -/- | -/- | O | -/- | | |
| Man | -/ | -/ | -/ | -/ | | |
| **III. INTERRELATIONSHIPS** | | | | | | |
| A. ECOLOGICAL PROCESSES | | | | | | |
| Succession | -/- | -/- | O | O | | |
| Food Relationships | -/- | -/- | O | O | | |
| Community Relationships | -/- | -/- | O | O | | |
| **IV. HUMAN VALUES** | | | | | | |
| A. LANDSCAPE CHARACTER | | | | | | |
| Harmonious | -/- | -/- | -/- | -/- | | |
| Accentuating | -/- | -/- | -/- | -/- | | |
| B. SOCIOCULTURAL INTERESTS | | | | | | More area will be disturbed and |
| Education/Scientific | -L/-L | -L/-L | O | O | | possible sites destoyed. |
| Cultural (Recreation) | O | O | O | O | -/- | Slight increase in use |
| Social Welfare | +/+ | +/+ | +L/+L | +/+ | | Slight increase in local income |
| Attitude/ Expectation | | | | | +H | Generally, less when mined all around the area |
| Local Reg. | O | O | O | O | | |

## INSTRUCTIONS

1. *Action* – Enter action being taken, analytic step for which worksheet is being used, environmental viewpoint of impact, and any assumptions relating to impact.
   a. Worksheet is normally used to analyze *"Anticipated Impacts"* of action; *however*, it may be used to enelyze *"Residual Impacts."* Worksheets may also be used to compare impacts before and after mitigating measures are applied.
   b. State viewpoint that best describes environmental impact. For example, a fence viewed down the fence line has greater impact then the same fence viewed over an entire ellotment. Generally, narrow viewpoints better illustrate specific impacts than will broad viewpoints.
   c. Assumptions may be made to establish a base for analysis *(e.g. estimated time periods, season of year, etc.)*.
2. *Stages of Implementation* – Identify different phases of proposed project *(e.g. a road project consists of survey, construction, use, and maintenance stages)*.
3. *Discrete Operations* – Identify separate actions comprising a particular stege of implementation *(e.g. the construction stage of the road project has the discrete operations of clearing, grading, and surfacing)*.
4. *Elements Impacted* – Enter under appropriate heading all environmental elemente susceptible to impact from action and alternatives. Relevant elements not contained in the digest ehould also be entered. See BLM Manual 1791, Appendix 2, Environmental Digest.
5. *Anticipated Impact* – Evaluate anticipated impact on each element and plece an entry in the appropriate square indicating degree of impact as low (L), medium (M), high (H), no impact (O), or unknown or negligable (X). Preceed each entry by a plus (+) or minus (-) sign indicating a beneficial or adverse type of impact. If type of impact reflects a matter of opinion or is not known, *do not* preceed with a sign. For example, construction of a wind mill on open range hes e definite visual impact; *however*, to some people the effect is detrimental while to others it is an improvement. By not entering a plus (+) or minus (-) eign the worksheet is kept factual and unbiased. If both degree and type of impact are unknown, place an (x) in the appropriate square.
   a. The measures of impact *(e.g. low, medium, and high)* are relative and their meaning may vary slightly from action to action. The term *"low"* should not be applied to impects of a nagligible nature. For example, we know that a pickup truck driving down a proposed fence line laying wire has some impact on air quality. However, the significance of this impact is not normally great enough to warrant even a *"low"* rating. In cases like this, the impact will usually be marked "O" or the element left off the worksheet.
   b. It is recognized that some environmental elemente may defy accurate measurement or in-depth analysis within current Bureau capabilities or expertise. The nature of the action as well as type and degree of impact should guide in the decision to seek outside expertise or assistance.
6. *Remarks* – Enter clarifying information.



GPO 857-541

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

## ENVIRONMENTAL ANALYSIS WORKSHEET

1. Action

Falkirk Coal Lease Application # 31053 (ND)

2. Stages of implementation

Reclamation (Same for proposed action and alternatives)

3. DISCRETE OPERATIONS

Short / Long

| 4. COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED | 5. ANTICIPATED IMPACTS: Regrading | Topsoiling | Seeding | | Cumulative | 6. REMARKS |
|---|---|---|---|---|---|---|
| **I. NONLIVING COMPONENTS** | | | | | | |
| A. AIR | | | | | | |
| Particulate Matter | -L/-L | -L/-L | -/- | | | Disturbance (activity) created |
| Exhaust Emmission | -/- | -/- | -/- | | | |
| B. LAND | | | | | | |
| Soil Depth | O/O | +H/+H | +H/+H | | | Rebuilding process |
| Soil Structure | O/O | -M/O | +L/+H | | | Breaks down soil aggregates; seeding aids restructuring |
| Soil Nutrients | O/ | -/O | +H/+H | | | Vegetation adds nutrients |
| Soil Erosion | +H/+H | -L/- | +H/+H | | | Decrease slope; increased stability |
| Land Use Compatability | +H/+H | +H/+H | +H/+H | | | |
| Land Use Suitability | +H/+H | +H/+H | +H/+H | | | |
| C. WATER | | | | | | |
| Ground Water Characteristic | X/X | X/X | O/O | | | Refers to hydrologic cycle |
| Hydrologic Cycle | +H/+L | +H/+L | +H/+L | | | decreased runoff/ increase infiltration |
| Sediment Load | +H/+L | +H/+L | +H/+L | | | |
| Dissolved Solids | +L/+ | +L/+ | +L/+ | | | |
| Nutrients | +H/+L | +H/+L | +H/+L | | | |
| pH | O/O | O/O | O/O | | | Fertilizing decreases pH toward neutrality |
| Dissolved Oxygen | O/O | O/O | O/O | | | Inverse with sediment load |
| Temperature | O/O | O/O | O/O | | | Parallels sediment load |
| Chemicals & Heavy metals, etc. | O/O | O/O | O/O | | | |
| Coliform Contamination | X | X | X | | | |
| **II. LIVING COMPONENTS** | | | | | | |
| A. PLANTS (*Aquatic*) | | | | | | |
| Vascular | +/+H | +L/+M | O/O | | | Could have high impact if aquatics seeded |
| Phytoplankton | +/+H | +L/+M | O/O | | | |
| Floating Plants | +/+H | +L/+M | O/O | | | |

(Continued on reverse)



Form 1790-3 (June 1974)

| DISCRETE OPERATIONS | Regrading | Topsoiling | Seeding | | Cumulative | Short / Long |
|---|---|---|---|---|---|---|
| **COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED** | **ANTICIPATED IMPACTS** | | | | | **REMARKS** |
| **II. LIVING COMPONENTS (Con.)** | | | | | | |
| B. PLANTS *(Terrestrial)* | | | | | | |
| Lichens & Mosses | O/O | +/+L | -/- | | | Decreased by competition |
| Grasses & Forbs | +L/+M | +L/+M | +M/+H | | | |
| Shrubs | -L/-M | -L/-M | O/O | | | Reclamation relatively detrimental |
| Broadleaf Trees | -L/-M | -L/-M | O/O | | | Grow in trenches of spoils banks |
| | | | | | | |
| | | | | | | |
| C. ANIMALS *(Aquatic)* | | | | | | |
| Zooplankton | O/O | +/+ | +/+ | | | |
| Mammals | O/+ | +/+L | +/+L | | | |
| Birds | O/+ | +/+L | +/+L | | | |
| Amphibians & Reptiles | O/+ | +/+L | +/+L | | | |
| Fish | O/+ | +/+L | +/+L | | | Potholes could be created. |
| Invertebrates | O/+ | +/+L | +/+L | | | |
| D. ANIMALS *(Terrestrial)* | | | | | | |
| Mammals | O/O | +/+L | +M/+H | | | |
| Birds | O/O | +/+L | +M/+H | | | |
| Reptiles | O/O | +/+L | +M/+H | | | |
| Invertebrates | O/O | +M/+H | +M/+H | | | Realize greater benefit from top- soiling relatively |
| Man | -/O | -/O | -/O | | | Safety hazard |
| **III. INTERRE-LATIONSHIPS** | | | | | | |
| A. ECOLOGICAL PROCESSES | | | | *see explanation | | |
| Succession | +/+M | +M/+H | +L/+L | | | Regrading improves physiography |
| Food Relationships | O/O | +/+L | +M/+H | | | For plants: depends on what's |
| Community Relationships | O/O | +/+L | +M/+H | | | seeded: Natural succession |
| | | | | | | suspended by farming. |
| | | | | | | |
| **IV. HUMAN VALUES** | | | | | | |
| A. LANDSCAPE CHARACTER | | | | | | |
| Harmonious | -L/+H | -L/ O | -L/+H | | | Activity negative/effect positive |
| Accentuating | +L/+L | +L/+L | +L/+L | | | de-emphasizing process |
| | | | | | | |
| | | | | | | |
| B. SOCIOCULTURAL INTERESTS | | | | | | |
| Educational/Scientific | | | | | +M/+H | Opportunity for study |
| Social Welfare | | | | | +L/+L | Not many jobs generated |
| Attutides / Expectations | +H/+H | +H/+H | +H/+H | | | Generally reclamation favored |
| Local Regulatory | +H/+H | +H/+H | +H/+H | | | Complies with the law |
| Cultural (Recreation) | | | | | -/+ | Slight short term increase in use during rehabilitation. Land is again available for use in the long term. |

INSTRUCTIONS

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   b. State viewpoint that best describes environmental impact. For example, a fence viewed down the fence line has greater impact than the same fence viewed over an entire allotment. Generally, narrow viewpoints better illustrate specific impacts than will broad viewpoints.
   c. Assumptions may be made to establish a base for analysis *(e.g. estimated time periods, season of year, etc.)*.
2. *Stages of Implementation* – Identify different phases of proposed project *(e.g. a road project consists of survey, construction, use, and maintenance stages)*.
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   a. The measures of impact *(e.g. low, medium, and high)* are relative and their meaning may vary slightly from action to action. The term *"low"* should not be applied to impacts of a negligible nature. For example, we know that a pickup truck driving down a proposed fence line laying wire has some impact on air quality. However, the significance of this impact is not normally great enough to warrant even a *"low"* rating. In cases like this, the impact will usually be marked "O" or the element left off the worksheet.
   b. It is recognized that some environmental elements may defy accurate measurement or in-depth analysis within current Bureau capabilities or expertise. The nature of the action as well as type and degree of impact should guide in the decision to seek outside expertise or assistance.
6. *Remarks* – Enter clarifying information.



GPO 857-541

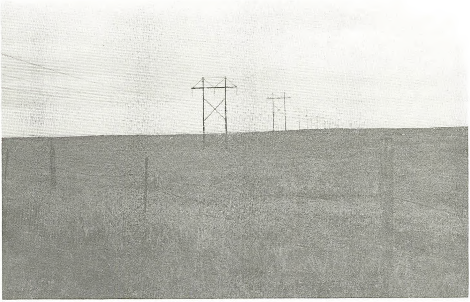
FALKIRK EAR

Appendix 9

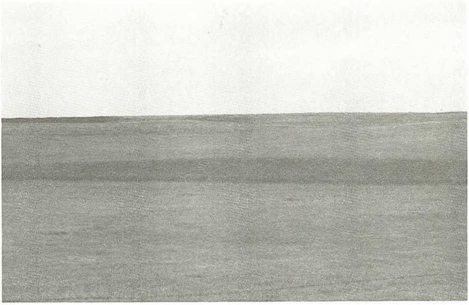
Photographs of Surface Lands Over
Subject Federal Coal

Native rangeland and tilled strip. S½SW¼, Section 30, T. 146 N., R. 81 W. 08/14/75.

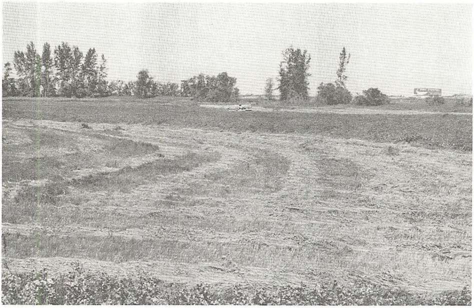
Cropland (Flax fields) and shelterbelts. S½SE¼, Section 30, T. 146 N., R. 81 W. 08/14/75.



Cropland (Flax fields) and native hayland. SE¼, Section 24, T. 146 N., R. 83 W. 08/14/75.



Native hayland and wetland slough (Type III). SE¼, Section 24, T. 146 N., R. 83 W. 08/14/75.

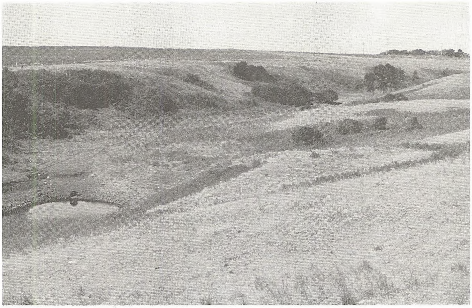


Wetland slough (Type III) being mowed in late summer.
SE¼, Section 6, T. 146 N., R. 82 W. 09/10/75.

Croplands (Wheat and fallow fields) in NW¼, Section 20,
T. 146 N., R. 82 W. 08/14/75.

Cropland (alfalfa hayfield) in NE¼NW¼, Section 24,
T. 146 N., R. 82 W. 09/10/75.

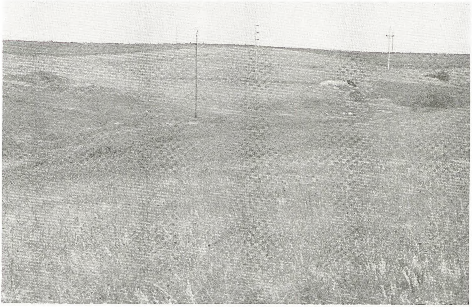
Native grassland (silty range site) in NE¼NW¼, Section 24,
T. 146 N., R. 82 W. 09/10/75.



Brushy (woodland) draw in a thin upland range site. NE¼NW¼, Section 24, T. 146 N., R. 82 W. 09/10/75.

Brushy (woodland) draw in a thin upland range site. NE¼NW¼, Section 24, T. 146 N., R. 82 W. 09/10/75.

Brushy (woodland) draw in NE¼NE¼, Section 34, T. 146 N., R. 82 W. Cropland (alfalfa hayfield) in background. 09/10/75.



Brushy (woodland) draw and native grassland in NE¼NE¼, Section 34, T. 146 N., R. 82 W. Cropland (alfalfa hayfield) in background. 09/10/75.

Cropland (wheat field) in the SW¼SW¼, Section 34, T. 146 N., R. 82 W. Harvested field. 09/10/75.

Cropland (Wheat field) and wetland slough (Type I). SW¼SW¼, Section 34, T. 146 N., R. 82 W. 09/10/75.

FALKIRK E.A.R.

Appendix 10

Public Involvement

## Appendix 10

## Public Involvement

The draft environmental analysis record was prepared during the late summer and fall of 1975. The draft document was printed in mid December, 1975, and distributed immediately following printing with an interest and comment solicitation letter (see accompanying letter) to 45 governmental agencies and potentially interested parties (see accompanying mailing list). Copies were also supplied to newspapers, TV stations, and libraries in the Bismarck-Underwood region, as well as the North Dakota State Clearing House. An initial comment period of approximately 30 days (through February 2, 1976) was allotted for public comment and response to the draft. This comment period was later extended to late February.

Comments and responses were received from 15 entitites for a response rate of approximately 33%. Since some of the solicitations were not of an individual nature, exact response rates are difficult to determine. Several respondents did not reply in writing, but telephoned their comments or replied in person. All letters and comments received were first reviewed relative to either draft corrections or issues raised. Appropriate academic or technical corrections were then subsequently made into the final document.

The majority of comments and responses received came from other governmental agencies. Descriptive comments ranged from support of the draft document to negative declarations claiming it to be a farce. Some responses were non-descript, or noncommittal in nature, while others represented opinion assessments and philisophical viewpoints. Four fields of consistent concern were readily apparent from the responses. These fields were: 1) limited resource knowledge and "data-gaps" (i.e., ground water hydrology, mined soil reaction relationships, etc.); 2) relative merits of reclamation "success"; 3) administrative procedures surrounding the lease of federal coal; and 4) adequate assessment of public concern over the development. Generally, the draft document appeared to be relatively well received by those responding.

Copies of the correspondence received are included here-in along with notations indicating the BLM action taken in regard to the comments. Non-written comments are summarized here and treated in the same manner as written comments.

# INTEREST AND COMMENT SOLICITATION LETTER

The Bureau of Land Management has received an application for the lease of approximately 1,000 acres of federal coal in McLean County, North Dakota. The Bureau has prepared a draft impact analysis dealing with the proposed lease. This draft will be available for comment during the month of January, 1976. The final analysis will be initiated at the end of that period.

Any comments you may have with regard to the analysis would be greatly appreciated. Your comments should be directed to, District Manager, Miles City District, Bureau of Land Management, P.O. Box 940, Miles City, Montana 59301, Attention: Environmental Coordinator. It is requested that your comments be sent so that they may be received no later than February 2, 1976.

FALKIRK COAL LEASE APPLICATION M-31053(ND)

MAILING LIST

Valorie Burlingame
U.S. Dept. of Defense
Corps of Engineers
Riverdale, ND 58565

Chief Engineer & Secretary
ND State Water Commission
Capitol Building
Bismarck, ND 58501

Commissioner
ND State Land Department
Capitol Building
Bismarck, ND 58501

Director
ND State Business & Industrial Development Department
523 Bismarck Avenue
Bismarck, ND 58501

Director
ND State Economic Opportunity Office
Capitol Building
Bismarck, ND 58501

Executive Secretary
ND State Soil Conservation Committee
Capitol Building
Bismarck, ND 58501

Federal Energy Administration
3rd and Rosser Avenue
Bismarck, ND 58501

Mr. Nick Frank
ND State Historical Society
Liberty Memorial Building
Bismarck, ND 58501

Mr. Jim Gritman
U.S. Dept. of Interior
Fish and Wildlife Service
1500 Capitol Avenue
P.O. Box 1897
Bismarck, ND 58501

Mrs. Betty Morgan
North Dakota Wildlife Federation
200 West Main
P.O. Box 1694
Bismarck, ND 58501

Mr. Doug Huber
Falkirk Mining Company
304 East Rosser Avenue
P.O. Box 2136
Bismarck, ND 58501

Dr. Bill Johnson
ND Regional Environmental Assessment Program
Capitol Building
Bismarck, ND 58501

Dr. Paul Kannowski
Institute for Ecological Studies
University of North Dakota
Grand Forks, ND 58201

Dr. Larry Loendorf
University of North Dakota
Grand Forks, ND 58201

Mayor's Office
City of Underwood
Underwood, ND 58576

McLean County Assessor's Office
Washburn, ND 58577

Missouri River Basin Commission
601 Bismarck Avenue
Bismarck, ND 58501

Mr. Bob Morgan
ND State Game & Fish Department
2121 Lovett Avenue
Bismarck, ND 58501

ND State Coal Development Impact Office
Capitol Building
Bismarck, ND 58501

KFYR - TV
Bismarck, North Dakota 58501

McLean County Commission
Washburn, ND 58577

McLean County Library
Washburn, ND 58577

ND State Geological Survey
219 North 7th
Bismarck, ND 58501

ND State Legislative Council
Capitol Building
Bismarck, ND 58501

Mr. Norm Peterson
ND State Helath Department
Capitol Building
Bismarck, ND 58501

Planning and Evaluation Staff
ND State Social Service Board
Highway 83 North
Bismarck, ND 58501

Dr. Schriver
ND State University
Fargo, ND 58102

Secretary
ND State Public Service Commission
Capitol Building
Bismarck, ND 58501

Mr. Russ Staiger
ND State Planning Division
Capitol Building
Bismarck, ND 58501

Terry Thoen
U.S. Environmental Protection Agency,
Region VIII
Suite 900 Lincoln Building
1860 Lincoln Street
Denver, CO 80203

Karen Thompson
ND State Outdoor Recreation Agency
900 East Boulevard
Bismarck, ND 58501

U.S. Dept. of Agriculture
Soil Conservation Service -
McLean County
Washburn, ND 58577

Frank Bavendick
WESTEX Petroleum
P.O. Box 313
Bismarck, ND 58501

KXMB - TV
Bismarck, ND 58501

U. S. Dept. of Agriculture
Forest Service - Custer National
Forest
ND Coordinator
Bismarck, ND 58501

U.S. Dept. of Agriculture
Soil Conservation Service -
State Office
3rd and Rosser Avenue
Bismarck, ND 58501

U.S. Dept. of Commerce
National Weather Service
Municipal Airport
Bismarck, ND 58501

U.S. Dept. of Interior
Bureau of Reclamation
504 E. Broadway
Bismarck, ND 58501

U.S. Dept. of Interior
Geological Survey
Water Resources Division
3rd and Rosser Avenue
Bismarck, ND 58501

U.S. Environmental Protection Agency
State Capitol
Bismarck, ND 58501

Mr. Duncan Warren
Lewis and Clark Resource Conservation
and Development Project
Mandan, ND 58554

Bismarck Tribune
Bismarck, ND 58501

Bismarck Public Library
Bismarck, ND 58501

Bonnie Austin
ND State Clearing House
Bismarck, ND 58501

McLean County Independent
Garrison, ND 58540

LETTER #1

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VIII
1860 LINCOLN STREET
DENVER, COLORADO 80203

January 15, 1976

Miles City District
DM ........ ASD ........ BB
RPM ........ Opr ........
JAN 21 1976
Adm ........ BGD ........ Pwdr ........
Pr ........ SD ........ NDPO ........
Action ........ File ........
Bennett OB

Copy sent to each 01/21/76

District Manager, Miles City District
Bureau of Land Management
P.O. Box 940
Miles City, Montana 59301
Attn: Environmental Coordinator

Dear Sirs:

Thank you for the opportunity to review the Draft Environmental Analysis (1791) for the Falkirk Coal Lease Application M-31053 (ND). The Environmental Protection Agency currently has a research project in the Underwood area. Therefore, we would appreciate it if you would send a copy of the Draft Environmental Analysis to the following individuals:

S. Jackson Hubbard
Resource Extraction and Handling Division
Industrial Environmental Research Laboratory
U.S. Environmental Protection Agency
Cincinnati, Ohio 45268

Steve Moran
Department of Geology
University of North Dakota
Grand Forks, North Dakota 58201

1-1 Please contact Dan Kimball (303-837-3073; FTS - 327-3073) regarding any questions you may have with respect to EPA's review of this Environmental Analysis Record. Thank you for your assistance.

Sincerely,

Cooper H. Wayman

Cooper H. Wayman
Director
Office of Energy Activities

Dan Kimball was contacted - 3/24/76.
DAR

BLM Action - U.S. Environmental Protection Agency Letter #1

Key No.

1-1 Dan Kimball was contacted by telephone with respect to the EPA's review of this analysis. The EPA had no official written response to submit. Mr. Kimball's overall impression was that the draft document was reasonably well done. He also mentioned several ongoing resource studies being conducted in the Underwood vicinity.

LETTER #2

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

Miles City District
1 Asst. DM KB
RPM 2 BW Opr
JAN 19 1976
Adm BCD Pwdr
Pr SD NDPO
Action File
Bennett

Area Office - North Dakota
1500 Capitol Avenue
P. O. Box 1897
Bismarck, North Dakota 58501

JAN 16 1976

MEMORANDUM

To: District Manager, Bureau of Land Management, Miles City District, Miles City, Montana

From: Area Manager, Bismarck, North Dakota

Subject: Fish and Wildlife Service Review of Environmental Analysis Draft - Falkirk Coal Lease Application

Bureau of Land Management has received an application for the lease of approximately 1,000 acres of federal coal in McLean County, North Dakota. In addition to the 1,000 acres of federal coal, about 26,000 acres of privately-owned coal have already been leased by the Falkirk Coal Company on surrounding land. BLM has prepared a draft Environmental Analysis on the impact of leasing, or not leasing, the 1,000 acres which we received for review on January 5, 1976. The following comments are offered based on that specific draft EA and BLM's request for comments.

General Comments

2-1 The basic theme and conclusion of the EA is "with federal coal making up only 3.5 percent of the mining area, the impact of mining federal coal... is negligible." While this might be true as a net statement, we do not believe it is accurate in regard to fish and wildlife (specifically wetlands and waterfowl), unless all federal leases clearly stipulate that destroyed wetlands and upland wildlife cover are to be adequately replaced upon removal of coal by the Falkirk Mining Corporation. We believe that your agency can and should exert influence to require mitigation measures on the surrounding 26,000 acres leased from private landowners by the Corporation.

Specific Comments

2-2 Map opposite page 3. You might want to include newly constructed and realigned portions of Rt. 83 on this map.

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

Page 3, bottom. "The U.S. Fish and Wildlife Service has tentative plans to obtain long term leases, or easements, for wildlife use on some of the wetlands in and around the mine area."

2-3 Our agency does not intend to acquire in fee, or easement, any additional wetlands on coal leased lands in the 26,000-acre Falkirk mining area. We expect to salvage our present interest in the 1,000 acres of federal coal land and are hopeful of success on the other 26,000 acres leased by private owners to Falkirk Coal Corporation. We will continue to obtain fee and easement areas outside the mining area in McLean County.

Page 4, first paragraph. "Additionally, that portion of the plan which deals with the reclamation of private surface over federal coal is subject to Bureau of Land Management approval and recommendations."

2-4 We interpret this sentence to mean Bureau of Land Management has the authority to insure that on the 1,000 acres of coal lease lands under their jurisdiction wetland losses will be mitigated. We assume Falkirk Coal Corporation will be agreeable to practicable mitigation measures.

Page 14. Dead Ice Moraine. "Areas of dead ice moraine are generally characterized by knob and kettle topography, nonintegrated drainage with numerous small ponds and sloughs and a bouldery surface as till."

2-5 This statement adequately reinforces our knowledge that the Falkirk area encompasses considerable wetlands. This fact generates deep concern on our part about the impact coal extraction will have on those wetlands and more importantly what mitigation and compensation measures will be available to offset losses.

Page 18, second paragraph. "The USFWS using Shaw and Fredine's wetland classification system, have 1,750 acres of identified wetlands under easement within the coal lease line. This includes 320 acres of easement over federal coal of this (1,000 acre $\pm$) lease application. Approximately 50 of these 320 acres actually occupy a wetland drainage basin (Appendix 5)."

2-6 This statement conforms to data forwarded by this office dated November 1975.

Page 18, fourth full paragraph. "Approximately 900 acres of wetlands were identified (from aerial photos) overlying coal inside the Falkirk mine 'take-line.' This acreage comprised about 4 percent of the surface lands over the coal 'take-line'."

2-7 This statement would mean more if the date of the survey were given and the agency that conducted it. Is the 900 acres $\pm$ considered a reliable figure by BLM?

Page 18, last paragraph. "Three species of plants in North Dakota are considered 'candidates' for listing as endangered and threatened...any occurrence of these species on the Falkirk coal lease area is undetermined at this time."

2-8 Will a determination be made of the presence of any of these species before leasing is undertaken? Omissions such as this weaken Environmental Analyses and statements.

Page 26, first paragraph. "Permanent water bodies of note are Weller Slough and Coal Lake. The water and associated vegetation provide a pleasant visual contrast with the surrounding landscape. They also provide habitat for large numbers of waterfowl and shorebirds which are the major portion of the visual resources."

In addition to Weller Slough and Coal Lake, the relatively numerous small seasonal wetlands are also contributory to pleasant visual contrast and waterfowl-shorebird production.

Page 27. "Weller Slough and Coal Lake Coulee received a score of nine (Class C) by both raters."

2-9 Class C is rated 1-9 points and is considered to possess low (common or average) scenic value. We do not believe this low rating for those areas conforms to your paragraph partially quoted above (page 26, first paragraph). These two sloughs and the many other small wetlands should, in our opinion, rate at least moderate scenic value.

Page 40, last paragraph. "It will take many years for soil structure to develop again."

2-10 We believe centuries rather than years may be more accurate in this sentence.

Page 41, third paragraph. "In the short run, erosion of the soil stockpiles by wind and water could be a problem until the piles are vegetated. Impacts are considered to be negative moderate in the short run and low in the long run."

2-11 Since most of the soils in the area have highly calcareous subsoils with associated fertility problems, we wonder if mixing of topsoil and subsoil will not occur regardless of efforts to avoid this problem. We hope that somewhere, someone has taken note of this calcareous subsoil problem and has either contracted for or are themselves conducting adequate studies leading to acceptable solutions. The 1,000 acres under your direct concern and also the additional 26,000 acres within the Falkirk coal field should be thoroughly investigated for possible long term soil damage prior to the excavation process. No other effect except effect on water resources could be more important.

Page 43, top of page. "Removing, stockpiling and respreading the soil material will cause unavoidable mixing of the organic matter rich surface with the subsoil. This adverse action will be partly alleviated..."

2-12 We refer to our comments immediately above.

Page 46. Proposed Action. "The lease of federal coal would create a highly favorable impact on the land use compatibility subcomponent of the environment. Lease of federal coal would allow the coal company to develop a mining plan for the entire area incorporating the most efficient methods into the plan. It would also mean that the federal coal would be used and not lost as a resource."

We believe this statement could only be valid if existing wetlands plus woody and herbaceous wildlife habitat losses are offset by specific recommendations acceptable to both the mining interests and federal and
2-13 state biologists. Federal coal would be used as resource but federal interest in wetlands would be lost unless mining interests are compelled to make suitable compensation.

Page 47, last paragraph. "Blasting and coal excavation will have little additional affects on the area's hydrology. Again, one exception might be the hydrological cycle. Generally, the coal to be removed is the confining material of ground water aquifers in the area. The affects of removing the coal, as related to ground water, is unknown."

We believe this is an unacceptable gap in knowledge of the effects of the
2-14 proposed action on the environment. We suspect opponents of the proposed action will be delighted with such an admission.

Page 48. Reclamation. "As soil nutrients are applied, pH values can change but to what extent and for how long is unknown."

We believe this is also an unacceptable gap in knowledge concerning probable effects. The pH values will have a major effect on vegetation
2-15 composition, ground water quality and possible wetland mitigation efforts. Some indication of extent and duration should be available.

Page 49. Mining Operations. "Topsoil removal will completely destroy any wetland and its associated vegetation types. The removal of the overburden will compound the action by destroying the topsoil base and topography."

We are in complete agreement with this statement which we believe applies wherever strip mining occurs. It is the basic reason for our position that mitigation of destroyed wetlands, as well as upland game habitat, should be a prerequisite to issuance of federal coal leases. It is our
2-16 view that federal interest in wetlands need not and should not be traded off against federal coal interest. We see no reason why the federal wetland interest on such lands should not be protected through required mitigation measures on the part of Falkirk Coal Corporation.

Page 53, bottom paragraph. "Potholes and wetland basins could be formed, thereby, dictating a beneficial impact rating." Page 54, top of page. "Although, eventually any depressions in the land are likely to develop wetland habitats, the reclamation process is expected to speed this occurrence."

2-17 Can you enlarge on these statements? If it were likely that there would be (numerous) depressions following coal extraction on both federal lease and private lease lands and these depressions would hold water, support suitable aquatic growth and in general parallel natural wetland parameters in all respects our concern over wetland losses would be greatly diminished.

Page 55. Proposed Action. "With federal coal making up only 3.5% of the mining area, the impacts resulting from the mining of federal coal are expected to be additive in effect and negligible in magnitude. These impacts were rated slight for all respective categories of terrestrial animals as the non-lease alternative."

2-18 As we understand this statement it means that compared to effects on terrestrial animals of mining operations on 26,000 acres, the same effects on only 1,000 acres are bound to be minimal simply because the 1,000 acres is a much smaller area. In our opinion this line of reasoning could be open to challenge by opponents of leasing. This premise is found all through the Environmental Analysis. It appears on pages 44, 49, 51, 53, 55, 57 and 59 among others.

Page 60. Socio-cultural Interests (no quote)

2-19 Somewhere, perhaps under this section, we believe some information should be provided concerning the effects of increased human population on fish and wildlife resources.

Page 66, first paragraph. "Road and facilities construction may have an adverse long term impact on archeological and paleontological values. The magnitude is unknown. No surveys have been conducted to determine the presence or significance of these values."

2-20 In our opinion statements such as this may very well provide opponents of federal coal leasing with large caliber ammunition.

Page 66, last paragraph. "There is an opportunity to study the effect of strip mining on waterfowl and their habitat which has never been done. The major area of potential favorable impacts involves determining the effect on the existing prairie potholes. This is considered to have both short and long term impacts."

2-21 We strongly endorse studies which might lead to creation of new productive wetlands in strip mined topography. We know the effects of strip

mining on existing wetlands situated over the Falkirk Coal seam will be
their complete obliteration. It is after the existing wetlands have been
destroyed and the coal diggers have moved on that appropriate studies may
2-21 show a way to replace productive wetlands. We do not know if productive
wetlands can be created in strip mined topography but it should be deter-
mined one way or the other.

Page 67, third paragraph. "The attitudes and expectations of the local community are unknown at this time."

2-22 Another unknown. The attached clipping from the Bismarck Tribune indi-
cates at least some opposition. We assume there is also some support.

Page 73. <u>Possible Mitigating and Enhancing Measures</u>. "kk. Where USFWS easements are destroyed replace the wetlands where possible. If not possible to restore the wetlands arrange an easement exchange of similar wetlands or adjacent to the mined area. Where not possible to restore or exchange like type wetlands, the construction of shallow impoundments (dams in natural drainage areas) would help mitigate the loss of habitat. Such impoundments present seasonal semipermanent or permanent wetland characteristics. A strip of herbaceous cover at least 2 rods wide should surround such impoundments and be protected from livestock grazing by fencing."

This measure should be incorporated into the policy of operation, mining
plan, reclamation plan or lease stipulations for lease of federal coal.
2-23 It, of course, would be refined through additional contact with USFWS and
BLM personnel and representatives of Falkirk Coal Corporation, but the
basic requirements are present in the above paragraph.

Page 83. "b. Leasing of the federal coal would result in a conflict with the USFWS in that they maintain wetland easements on the surface of some of those lands over federal coal."

This conflict would be essentially eliminated by requiring mitigation of
2-24 wetland losses through proper lease stipulations before lease of federal
coal. Those basic stipulations are discussed above.

We appreciate the opportunity to comment on the draft Environmental Analysis. We are aware that it is easier to review and criticize a document than to assemble it. All our comments are offered as constructive criticism.

James C. Gritman

Attachment

cc: Regional Director, Denver (ES, OBS)
N.D. State Planning Division, Bismarck

BLM Action - U.S. Fish and Wildlife Service Letter #2

Key No.

2-1 FWS viewpoint. No action deemed necessary in this EAR.

2-2 Coal mine vicinity map on page 2 has been corrected to indicate approximately the newly realigned section of U.S. Highway 83.

2-3 The EAR was corrected to reflect the FWS standpoint as outlined in the letter of comment (see bottom of page 3).

2-4 The FWS interpretation may, or may not, be correct. The analysis was changed to indicate the joint nature of the mining plan review. No one reviewing entity necessarily has its way, exclusively (see page 4).

2-5 No action deemed necessary in the EAR.

2-6 No response necessary.

2-7 This statement in the draft analysis was modified to reflect the photo vintage and expected accuracy (see page 18).

2-8 This determination is the appropriate decision-maker's option. It is not an independent activity that the analysis team is authorized to undertake. The need for such studies is reflected in the mitigating measures (see pages 74 and 78).

2-9 Whether an area is a "high" class C or a "low" class B is relative, since the point value assignments are subjective in nature and reflect, principally, the rater's opinion. A wide differential, however, would be significant. The analysis team felt the draft, as originally written, was not contradictory when the area scenery was considered from the relative, rather than abstract, standpoint, therefore, no change was made in the document.

2-10 FWS assessment. No action required.

2-11 FWS viewpoint. Calcareous soils and the problems associated with them are discussed on pages 41, 71, 72, and 76. The BLM is led to understand that studies regarding soil quality are presently being conducted in the Underwood vicinity by the North Dakota Geological Survey.

2-12 No action required.

Key No.

2-13 Philosophical viewpoint. This viewpoint is entertained in the succeeding paragraph (Reclamation) on pages 46 and 47.

2-14 FWS viewpoint. An environmental analysis is suppose to be an objective, un-biased presentation of the facts. If it were not, it would have no functional value to a decision-maker. At times, this factual reporting means acknowledging a lack of available information. "Plugging" this data-gap (by contracting studies, etc.), when appropriate, then becomes the responsibility of the decision-maker in the process of the action decision, not the perogative of the environmental analysis team. It is the understanding of this team that the North Dakota Geological Survey is presently conducting some hydrology studies in this area. No action required in the analysis.

2-15 Same response applies as for the previous comment.

2-16 FWS viewpoint. No action required in the EAR.

2-17 The exact configuration and nature of the future reclaimed lands where mining will take place is undetermined at this time, since the action has not yet taken place. The analysis narrative was expanded to reflect this status (see pages 53 and 54).

2-18 FWS assessment. The analysis team feels the original statement is correct as written. No change was made in the document.

2-19 Aside from the obvious impacts previously described in the analysis, the team felt further analytic elaboration along this line would be conjectural and speculative. For this reason, no modification was made in the analysis narrative.

2-20 Same response applies as for comment 2-14.

2-21 No action required in the analysis.

2-22 The analysis narrative was modified and expanded to reflect a further assessment of the public attitudes in the impact region (see pages 36, 67, 86, and 87).

2-23 No action required in the analysis.

2-24 No action required in the analysis.

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
ND Coordinator, Custer NF
Bismarck, ND 58501

LETTER #3

*REPLY TO:* 8420 Other Agencies Environmental Statements

January 6, 1976

*SUBJECT:* Falkirk Coal Lease Application

*TO:* ND State Planning Division
Capitol Building
Bismarck, ND 58505

Attention: Bonnie Austin

Thank you for allowing me to review the BLM Environmental Analysis of the proposed Falkirk Coal Lease Application #M-31053 (ND).

Although the U.S. Forest Service does not have any land which may be affected by the proposal, I would like to make a couple of comments which may be pertinent.

First, I think the report is excellent. It seems to cover the problem with alternatives very thoroughly.

3-1 I noted one piece of proposed lease land is within one-half mile of the town of Underwood and two other pieces are within two miles of town. Should the close proximity to town be a consideration in not leasing them? Perhaps they could be considered as areas to be kept in a natural condition.

3-2 The chart on BTU's indicated 6415 BTUs per pound of coal. How does this compare with other coal deposits in the area as far as BTU output. A comparison chart may be helpful.

3-3 A thought on temporary cover to prevent erosion while the land is still unreclaimed would be quick growing grain crops such as oats or flax.

3-4 The report mentioned that it might be well to irrigate the land immediately before disturbing to make it easier to lift the top soil. If this was done, would it be possible to lift the surface vegetation and store it temporarily such as is done by contractors who furnish sod for homes?

BERNARD W. ALT

BERNARD W. ALT
ND Coordinator

BLM Action - U.S. Forest Service Letter #3

Key No.

3-1 Falkirk Mining Company plans to mine the private coal which lies, between this parcel of federal coal (NW¼, Sec. 20, T. 146 N., R. 82 W.) and the town of Underwood. If this parcel were not leased it would only be isolated within the mine and would still not function as a "buffer" for the town of Underwood. This parcel is completely farmed at present, and therefore, not in a natural condition. Selective denial of specific tracts is a decision-maker's option during the final lease application disposition process. No action was taken on the analysis document.

3-2 Aside from purely academic interest, the analysis team felt a coal BTU comparision chart would not contribute significantly to the content of the analysis. No action was taken in the EAR.

3-3 No response necessary.

3-4 Most of the mine area is cultivated farmland, and as such, has no real "sod" structure. On a project of this scale and magnitude, sodding was not considered a realistic mitigating measure, although this procedure did "surface" during the analysis process. No action was taken on the EAR document.

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Box 1458, Bismarck, North Dakota 58501

LETTER #4

January 12, 1976

Miss Bonnie E. Austin
Associate Planner
N.D. State Planning Division
State Capitol
Bismarck, North Dakota 58505

Dear Miss Austin:

4-1 As per your request concerning the Falkirk Coal Lease Application, I am returning NDSIC Form B. No briefing is requested. Reclamation of mined soils appears to be adequately treated according to expr[illegible] plans in the statement.

Sincerely,

Neal A. McClure

Neal A. McClure
Asst. State Conservationist

Attachment

BLM Action - U.S. Soil Conservation Service Letter #4

Key No.

4-1 No response required.

IN HUNTING & FISHING

VARIETY

LETTER #5

# NORTH DAKOTA GAME AND FISH DEPARTMENT

January 30, 1976

Miles City District
DM ... Asst. DM ... RB
RPM ... Opr. ...
FEB 2 1976
Adm. ... BGD ... Pwdr. ...
Pr. ... SD ... NDPO ...
Action ... File ...

Mr. Kannon Richards
District Manager
Miles City District
Bureau of Land Management
P.O. Box 940
Miles City, MT 59301

Dear Mr. Richards:

This Department has completed a review of your Falkirk Coal Lease Application M-31053 (ND) Environmental Analysis Record, and we would make the following limited comments concerning this report:

1. Page 3. C. <u>Available Alternatives</u> - We agree that all tracts should be included in this analysis. We do, however, consider the denial to lease certain tracts <u>or</u> portions of certain tracts as a viable alternative open to the Bureau of Land Management. Example - the NE¼NE¼ of Section 34-146-82 has 23.6 acres of Zahl-Max loams, 9-35% slope. A natural brushland draw (waterway) runs this portion of the NE¼NE¼ of 34. We would consider this portion of the tract to be very difficult, if not impossible, to properly reclaim due to soil, slope and the waterway. We would consider it justifiable for BLM to lease just the northwest portion of this tract containing soils mapped as 63 and 63B (soils appendix).

5-1

The same consideration would apply to the NE¼NW¼ of Section 24-146-82 containing Zahl-Max loams, 9-35% slope and brushland draws (waterways). Mining could be done parallel to these steep waterways and then reshaped to conform to the edge of the draw(s). We presently know of no way to properly reclaim these steep shaped waterways or draws to "equal or better" than original condition. Water quality in the area would be badly degraded if these steep waterways are mined on either federal or private coal leases. Significant waterways should be protected to allow the cover in these waterways to act as filter traps for mined area runoff.

RUSSELL W. STUART
COMMISSIONER

WILBUR BOLDT
DEPUTY COMMISSIONER

H. H. SPITZER
CHIEF, ENFORCEMENT DIVISION

DALE HENEGAR
CHIEF, FISHERIES DIVISION

C. R. GRONDAHL
LEADER, GAME INVESTIGATIONS

R. L. MORGAN
LEADER, HABITAT DEVELOPMENT

PERSHING CARLSON
CHIEF, PUBLIC RELATIONS DIVISION

5-2 2. Page 74. 00. - Block planting acreage is listed as 2 to 5 acres. Normally, winter cover block tree plantings are usually 4 to 10 acres in size. Odd area woody plantings should be added to the list of woody plantings in this paragraph.

5-3 3. General - BLM should request that surface habitat be restored to its original condition. Native grasslands, woody habitat and wetlands should be compensated for in reclamation planning and plans. Compensation for wetlands should be worked out with the Fish and Wildlife Service (State office). Native woodland habitat should be replaced on a 2 for 1 basis. Native grasslands should be restored by seeding like acreages to native grass seed mixtures.

Sincerely,

Robert L. Morgan

Robert L. Morgan
Chief: Lands & Development Division

RLM:hk

BLM Action - North Dakota State Game and Fish Department Letter #5

Key No.

5-1 Lease denial on some tracts of this application may be environmentally justified. The summary-conclusion portion of the analysis (see page 86) was modified to reflect this situation. Selective denial of lease tracts is a managerial decision option that must be considered in the ultimate evaluation of a lease application. The environmental analysis record (EAR) is a guidance document (aid to a manger), not a decision document in itself. Therefore, specific lease action decisions are not appropriate in the context of the EAR.

5-2 This mitigating measure was modified to reflect the corrected acreages and planting options (see page 74).

5-3 These mitigating measures are presented on pages 73, 74, 77 and 78.

COMMENTS #6

Ed Englerth of the North Dakota State Public Service Commission made the following comments concerning the draft Falkirk environmental analysis, in person, to Jerry Pittman of the North Dakota Project Office - BLM.

6-1 1. The draft analysis assumed only a mandatory 3 year reclamation period. In actuality, 5-one year extensions and a discretionary period may be granted beyond the mandatory 3 year period.

6-2 2. An apparent conflict exists in the draft analysis on page 20 regarding the significance of aquatic animal habitat and populations on the surface lands overlying federal coal.

BLM Action - Ed Englerth's, North Dakota Public Service Commission, Comments #6

Key No.

6-1 The analysis document was changed to reflect the correct reclamation periods (see pages 4 and A5-24).

6-2 The analysis narrative on page 20 was modified in an attempt to correct any confusing or apparently conflicting phraseology.

NDSIC FORM B (9/71) COMMENTS #7

| PNRS NO. |
|---|
| Date Received |

RECEIVED
FEB 26 1976
State Planning Division

FROM: STATE INTERGOVERNMENTAL CLEARINGHOUSE
STATE PLANNING DIVISION
STATE CAPITOL
BISMARCK, NORTH DAKOTA 58501

ENVIRONMENTAL IMPACT STATEMENT TO BE REVIEWED

TO: Gary Leppart
State Parks And Recreation

ISSUED BY: USDI - Bureau of Land Management

DATE: December 31, 1975

NAME OF PROJECT: Falkir Coal Lease Application

The attached Environmental Impact Statement is referred to your agency for review and possible comments. If you consider it satisfactory, please check the box labeled, "no comment." Otherwise, please check one of the other appropriate boxes. Your cooperation is asked in completing this memo and returning it to the State Intergovernmental Clearinghouse within 10 days from date of receipt. If no response is received within 15 days of date of notification it will be assumed you have no comment.

☐ No comment

☐ Meeting desired with applicant

☒ Comments submitted herewith

.................................................................................................

1. Specific comments which are to be attached to the review statement which will be submitted by the State Intergovernmental Clearinghouse: (Use reverse side or separate sheets if necessary)

7-1 Mining should be contemplated on a staged basis as per discussion between B.L.M. and State Natural Resources Council in February.

2. Reasons why meeting is desired with applicant:

Reviewer's Signature: Gary Leppart Date: 2/25/76

Title: Director Tele: 663-9571

BLM Action - North Dakota State Parks and Recreation Comments #7

Key No.

7-1 No action deemed necessary in the analysis document. The North Dakota Public Service Commission has the authority to regulate the mining on a staged basis through their permitting system.

LETTER #8

# NORTH DAKOTA STATE PLANNING DIVISION

STATE CAPITOL – FOURTH FLOOR – BISMARCK, NORTH DAKOTA 58505
701 224-2818

February 24, 1976

STATE INTERGOVERNMENTAL CLEARINGHOUSE "LETTER OF COMMENT"
ON PROJECT REVIEW IN CONFORMANCE WITH OMB CIRCULAR NO. A-95

To: USDI - Bureau of Land Management

STATE APPLICATION IDENTIFIER: 7512307657

Miles City District
DM / Asst. DM BB
RPM / 130 Opr.

FEB 25 1976

Adm. BGD Pwdr
Pr. SD NDPO
Action File
Bonnett

Mr. Kannon Richards, District Manager
U.S. Department of the Interior
Bureau of Land Management
P.O. Box 940
Miles City, Montana 59301

Dear Mr. Richards:

Subject: Draft Environmental Analysis by the Bureau of Land Management for the Falkirk Coal Lease Application.

This draft analysis was received in our office on December 30, 1976.

8-1 In the process of the A-95 review, the attached comments were received from the Lewis & Clark RC&D, State Planning Division, Public Service Commission, Wildlife Federation, Fish and Wildlife Service, Health Department, U.S. Forest Service, Soil Conservation Service and the State Historical Society.

This document and attachments constitute the comment of the State Intergovernmental Clearinghouse, made in compliance with OMB Circular No. A-95.

Sincerely yours,

Bonnie E. Austin

Miss Bonnie E. Austin
Associate Planner

BEA/ds

Attachments

BLM Action - North Dakota State Intergovernmental Clearinghouse Letter #8

Key No.

8-1 No response required.

**MEMORANDUM** LETTER #9

# NORTH DAKOTA STATE PLANNING DIVISION

STATE CAPITOL—FOURTH FLOOR—BISMARCK, NORTH DAKOTA 58501
701 224-2818

RECEIVED
FEB 12 1976
State Planning
Division

DATE: February 11, 1976

TO: Bonnie

FROM: Austin

RE: BLM Environmental Draft Analysis of Falkirk Coal Lease Application

Bonnie:

In looking over the above named document, I would make the following comments for possible inclusion in the final draft of the environmental analysis.

9-1 1) Strong measures should be included in the lease stipulation to prevent the mixing of top soil with sub-soil. Measures to accomplish such prevention are discussed in points T, U and V on page 71.

9-2 2) The final lease stipulations should include not only the technology to prevent mixing of top soil and sub-soil but also on-site monitoring to make sure maching operators are following the technology.

9-3 3) Research being carried out by the Mined Land Planning Group and funded with OWRC funds includes the following task: "Determination of the influence of sub-surface geologic materials on rehabilitation potential and of the effects of surface mining on shallow ground water supplies". Mr. Jerry Groenewald of UND (phone: 777-2231) has directed the work on this task. He should be consulted regarding ground water problems.

4) Mr. Groenewald has also been concerned with drag line techniques as they affect the problems of shifting, piping and slumping spoils even after they have been reshaped. He should be consulted on these problems.

SIGNED:

Austin Engel /ds

Austin Engel, Director

BLM Action - North Dakota State Planning Division Letter #9

Key No.

9-1 No action necessary.

9-2 On-site soils monitoring was added as a mitigating measure on pages 72 and 77 of the analysis document. Some technically feasible procedures to prevent top and sub soil mixing are discussed in the mitigating measures sections of the document.

9-3 Mr. Groenewold was contacted in regard to the subject studies. He stated that some of the reports resulting from these studies should be available by summer, 1976. This information should help fill some of the existing "data-gaps" and knowledge deficiencies.

Comments by Robert E. King
COMMENTS: North Dakota State Health Department

1. In paragraphs III. A.1.a.1.)b.)c.) pertaining to mining operations and
reclamation, statements are made that particulate matter emissions would
have a low negative or an insignificant impact on air quality. This may or may
not be true. Particulate emissions from mining operations and reclamation
10-1 may have a significant impact on air quality. The Environmental Analysis
Draft should include a detailed quantitative analysis and assessment of
the impact of mining operations and reclamation on air quality.

2. Paragraph III A.3. of the Environmental Analysis Draft presents a list
of 41 recommendations for mitigation or enhancement of environmental
impact that could be incorporated into the policy of operation, mining
plan, reclamation plan or lease stipulations for leases of Federal coal.
We feel that the Environmental Analysis Draft must be more positive and
10-2 state that these mitigating and enhancement measures will be required to
be a part of the policy of operation, mining plan, reclamation plan, or
lease stipulations in order that leases for Federal coal be granted.

BLM Action - North Dakota State Health Department Comments #10

Key No.

10-1 The impact rating values represent a consensus of the analysis team. The values are abitrary and relative in nature, not absolute. Any assigned value could be argued. The introductory paragraphs of Part III of the document were modified to re-emphasize the relative nature of the impacts (see pages 37 and 38). The analysis team assigned a low negative impact rating value in this particular instance because it was felt that if particulate emissions degraded the air quality to any significant extent, the State of North Dakota would close the mine for violation of their air quality standards. Therefore, due to administrative and legal procedures, particulate emissions would never have an opportunity to become more than a low negative impact.

10-2 Stronger actions than those listed in the analysis become a question of legal and regulatory authority and jurisdiction of the BLM. Therefore, no change was made in the phraseology of the mitigating measures listed in the analysis.

LETTER #11

State Historical Society
of north dakota LIBERTY MEMORIAL BUILDING - BISMARCK, NORTH DAKOTA 58505

February 2, 1976

ENVIRONMENTAL IMPACT STATEMENT TO BE REVIEWED-COMMENTS

U.S.D.I. - Bureau of Land Management
Re: Falkirk Coal Lease Application

11-1 1.) The statement in section 2.) on pages 29 and 30 should be amended to take note of the presence of archaeological sites found near the areas under consideration. Stone circles, rock cairns, burial mounds and historic coal mines were found in a survey conducted by the Historical Society subsequent to the Bureau of Land Management's request for information.

BLM Action - North Dakota State Historical Society Letter #11

Key No.

11-1 The narrative on pages 29 and 30 was amended to reflect this information.

LETTER #12


**Lewis and Clark - 1805**

RESOURCE CONSERVATION & DEVELOPMENT PROJECT

Box 236 Mandan, North Dakota 58554 Phone 663-6587


January 8, 1976

Miles City District

JAN 12 1976

Bennett

Director
Miles City District Office
Bureau of Land Management
Miles City, Montana 59301

Dear Sir:

I recently had the opportunity to review the 1791--Environmental Analysis Draft of the Falkirk Mining Company Coal lease application M-31053(ND).

The draft was well written; however, the second paragraph from the bottom on page 3 contains some inaccuracies.

1. The State was not involved in the completion of the comprehensive plan for McLean County.

2. The State is not involved in the process of implementing the plan.

12-1 3. A variance was not granted to the complex. The County Planning Commission approved the proposed development in March of 1975 but took no other action since the county zoning ordinance was not yet in effect. The only variance which has ever been granted allowed for a railroad spur to be extended to the site after the zoning ordinance was adopted.

12-2 4. A North Dakota State Planning Commission does not exist, although there is a North Dakota State Planning Division. (The same error appears on p. 85. Page 85 also lists the Lewis and Clark address as Bismarck rather than Mandan, North Dakota.)

I hope it is not too late to have this erroneous information corrected.

Sincerely,

Gregg Larson

Gregg Larson
Land Use Planner

GL/kas

cc: John Kinney, BLM, Dickinson

BLM Action - Lewis and Clark Resource Conservation & Development Project Letter #12

Key No.

| | |
|---|---|
| 12-1 | The narrative was revised with the corrections as stated in the comment letter (see page 3). |
| 12-2 | The title was corrected to reflect the proper name (see page 85). |

*North Dakota Wildlife Federation*

LETTER #13

Publishers of FLICKERTALES
North Dakota's Leading Environmental Publication

200 West Main
P. O. Box 1694
Bismarck, North Dakota 58501

Phone 223-8741

January 27, 1976

REVIEW

1791 - Environmental Analysis
Draft
Falkrik Coal Lease Application M-31053 (ND)
Bureau of Land Management

The North Dakota Wildlife Federation wishes to make the following comments on the Environmental Analysis draft-Falkirk Coal Lease Application.

The North Dakota Wildlife Federation is a non-profit, non-political organization made up of some 6,500 citizens concerned with the utilization and management of the state's natural rosources (including wildlife) and their effect upon the environment. We are an affiliate of the National Wildlife Federation.

13-1 It is assumed that reclamation will be carried out as provided by laws adopted in the 1975 legislative session.

13-2 Since the area receives less than sixteen inches of precipitation annually with only a limited amount of intermittent surface water existing, we suggest construction of small reservoirs for waterfowl habitat as enhancement of wildlife values.

13-3 Protection of natural groundwater flows and aquifers appears important to provide human and domestic stock with a water supply. Therefore, we recommend more data on water hydrology than is presently available. Groundwater in this area will be important for agricultural pivot type irrigation following reclamation.

13-4 Air flows from the north will carry pollutants to Bismarck and Mandan, the two most populated cities located south of the plant. We therefore insist upon the best modern pollution controls known to exist.

13-5 The Environmental Analysis Draft indicates that both upper and lower lignite seams will be mined at the same time. We agree that this type of extraction is desirable.



— AFFILIATE OF THE NATIONAL WILDLIFE FEDERATION —

BLM Action - North Dakota Wildlife Federation Letter #13

Key No.

| | |
|---|---|
| 13-1 | Pages 4 and 5 of the analysis say that the North Dakota reclamation laws are pertinent. |
| 13-2 | This mitigating measure is listed on pages 73, 74, 77 and 78 of the analysis. |
| 13-3 | Ground water studies are listed as mitigating measures on pages 73 and 77 of the analysis. |
| 13-4 | It was thought that this comment refers to the steam plant, therefore, no action was required in this analysis. |
| 13-5 | No response required. |

LETTER #14

Ardell Tharaldson

1119 E. Thayer
Bismarck, ND
58501

Miles City District
DM 1 Asst. DM RB
RPM 2 Opr
FEB 10 1976
Adm BGD Pwdr
Pr NDPO
Action File

District Manager
Miles City District
Bureau of Land Management
P.O Box 940
Miles City, Montana
59301

Dear Environmental Coordinator,

Reading Environmental impact statements, to me, has always been similar to reading James Bond novels. The first one is kind of good but, the rest are all the same. However, the U.S. Bureau of Land Management, " Falkirk Coal Lease Application Environmental Analysis Record" is the most amazing federal document I have read.
14-1 A more apt title for the publication is, " The Bureau's Efforts to Persuade its Readers to Support the Granting of a Gift of One Thousand Acres of Coal to North American Coal Company".

The so-called " Environmental Analysis, designed from page one, to support the application, contains errors and omissions of fact coupled with conclusions seemingly pulled out of a hat.

The following are highlights of the analysis:

* The report states that Falkirk Mining Company, a wholly owned subsidiary of North American Coal Company of Ohio, has applied for a federal lease of 1,000 acres of coal near Underwood, North Dakota in Mclean County. Falkirk Mining presently controls 27,588 acres of private coal leases for the purpose of providing the coal to a 1,000 megawatt power complex owned by United Power Association and Cooperative Power Association (UPA-CPA) of Minnesota.

The report does not mention that the coal mine operation is really owned by United Power and Cooperative Power Association, through a $100 million plus loan from the Rural Electric Administration.
14-2 UPA-CPA loaned this loan to Falkirk Mining Company to construct the mine. UPA-CPA has a contract with Falkirk Mining Company as their coal supplier but, the cooperatives have an option to assume control of the mining operation if they are not satisfied with Falkirk Mining Company. Moreover, if the members of the Bureau staff had done a little research, they would have found that serious legal questions exist as to the propriety of UPA-CPA'receiving a loan from the federal government for the purpose of owning a mine without first filing a comprehensive environmental impact statement on the mine in accordance with the National Environmental Policy Act.

14-3 * Page one states, " The federal government does not own any surface rights in the proposed lease".

* Page five says, " The company has an adequate reserve of coal to meet is commitments from the private coal leases it presently
14-4 holds and is, therefore, not reliant on the limited federal coal". " Refusal to lease federal coal will not prevent the mine and power plant from going into operation."

* Page one of the report lists the legal descriptions of the 1,000 acres contained in the lease application. It is not mentioned
14-5 that all of these tracts are less than four miles from the city of Underwood, with one parcel less than six blocks from the legal corpórate limits of Underwood. Underwood is a rural community of roughly one thousand people.

* Page four lists some of the measures within the North Dakota Reclamation law and page 48 states, " Reclamation of the area after mining will have positive affects in both the short and long run". There is, however, no discussion of the objective and practical realities of reclamation in North Dakota.

14-6 Sixteen thousand acres of land have been strip mined for coal in North Dakota. Approximately 4,000 acres have been stripped since the first reclamation law went into effect in 1970. None of this land has been reclaimed to its original productivity. No empirical evidence that strip mined land in North Dakota can be fully reclaimed presently exists. Reclamation is still in an experimental stage and thus far efforts have not achieved sustained production equal to yields prior to mining, under the various climatic conditions occurring on the Great Plains.

* Page three states, " the State and County Planning commission has completed a comprehensive plan for McLean County. Both the State and County are in the process of implementing
14-7 the plan."

Page 86 says, " the major public interest was expressed some time ago when the original plans for the power plant and mine were unveiled. The construction of the power plan is underway, and preparation of the mine is beginning. Opposition has subsided and a feeling of acceptance has taken place."

The truth is, in November of 1975 the Mclean County Citizens Advisory Committee angrily disbanded. The group was organized by UPA-CPA to assist the companies in efforts to
14-8 alleviate the social and economic impacts stemming from their 1,000 megawatt power plant and mine, which will double the coal fired mine mouth electrical power production in North Dakota. The group disbanded, according to the newspaper accounts, because there was not a fair and adequate plan for alleviating impact and because the group was disgusted with the lack of sensitivity and interest on the part of UPA-CPA to take any action at all to deal with area impact from their project.

In addition to the disgruntled advisory committee, an area landowners group opposing the project's transmission line has brought the companies "right of way" easement acquisitions to a standstill. Recently landowner opposition to the transmission lines has spread out to several counties in eastern North Dakota as well.

Moreover, these county groups have aligned with similar
organizations opposing the UPA-CPA transmission line in Minnesota.
They have also recently filed an action with the North Dakota
Public Service Commission in effort to force the project to
comply with North Dakota's new Plant and Transmission Siting Act.
14-8 The two Minnesota Cooperatives argue they do not come under the
jurisdiction of this law.

It is also pertinent to know that UPA-CPA have a conditional water permit from the North Dakota Water Commission and a conditional land re-zoning permit from Mclean County. Both conditional permits specifically say the companies must obey all the rules and regulations of all state and federal agencies, including those that shall be promulgated or risk losing their permit.

* The Underwood area, according to the report, " lies on
the western edge of the immensely productive prairie pothole
region, which is known for its vast water fowl breeding grounds.
This area lies in the central fly way of water fowl migration."
14-9 Fifteen species of ducks commonly nest is this region as well
as numerous shore birds and other water feeders. The nearly
extinct whooping cranes frequent the Audobon National Wildlife
Refuge which is less than four miles from the leasing area, and
the general mining area of the lease application lies in their annual
migration route.

* Page 86 says " There are wetland habitat easements
maintained by the U.S. Fish and Wildlife Service which will
14-10 have their value destroyed by the lease of the federal coal".

14-11 * The lease area is prime habitat for whitetail deer, and
pheasants and wild turkeys frequent the area.

* The report states there is no site specific information
14-12 onvegetation and rare animal species. Their analysis is extrapolated
from other reports which are " probably" applicable.

* Page 27 says "there are no noise or odors in the mining area
14-13 which can be considered offensive or annoying at the present time".
This keen observation is not suprising since neither the mine or
the power plant are in operation.

* The report concludes that " under the proposed action
14-14 the negative environmental impacts to be expected are not
significantly larger than those that would be expected under the
'No Action Alternative'".

The following opinion is also expressed at the end of this
report: "With regard to the lease of public coal it is felt that
14-15 public interest would be aroused if the coal were not leased, in
that most people would see the action as a waste of a resource."

"If the coal were leased, people would express little or no interest, due tc the fact, that the facility is already being developed and is an accepted fact." "....Public interest seems to be low. It is felt that failure to lease the coal would create more public controversy than leasing the coal would."

14-15 Naturally, there is no factual support for this "off the wall" conclusion. Were interviews taken to ascertain the attitudes of the people toward this application? Were the farmers who operate the surface asked if they would be angry if the coal were not leased? Did the project staff read the newspapers to find this sentiment that the people would rise up in anger because of the inefficiency of not stripping every inch of available coal in the mine area? Or perhaps were the writers referring to the coal industry when they talked of a public controversy?

The conclusions of the " Falkirk Coal Lease Application
14-16 Environmental Analysis Record " are patently inaccurate.

A more accurate description of the facts would be :

1. The 1,000 acres of land in the application contain highly unique and important breeding habitat for the nation's
14-17 waterfowl population as well as a stopping place for the almost extinct whooping crane; and this habitat will be destroyed. The are is also prime habitat for whitetail deer and pheasants.

2. Most of the lease area is excellent cropland, tilled by farmers who have absolutely no authority over the future of it.
14-18 And, they know that full and complete reclamation is, at best, hypothetical.

3. The lease area is extremely close to the city of Underwood, with one tract virtually adjacent to the city. If this land is stripped, it means huge draglines, dynamiting, spoil banks and
14-19 blowing dust, high noise levels, huge coal hauling trucks emitting diesel fumes, and all the other activities associated with strip mining at the city's edge.

4. It is a fact that the federal coal is not needed for the operation of the power project. Although, it is certain North American Coal Company would not mind the additional 20 million tons of coal to their proven reserves, interms of its affect upon their stockholders and financiers.

14-20

The argument of an efficient mining plan is weak and uncompelling in light of the destruction of the wetlands and the present way of life of the powerless surface owning farmers; and the disruption to the city of Underwood. The efficient mining argument would make sense if, in return for the federal coal,

an equal amount of private coal, on the out skirts of the mine
14-20 area, were released from the jowels of the dragline.

In my opinion, the lease application is unneeded, unnecessary, and
14-21 probablly harmful; and should be denied post haste.

Sincerely,

Ardell Tharaldson

Ardell Tharaldson

BLM Action - Ardell Tharaldson Letter #14

Key No.

14-1 Opinion assessment. No action required.

14-2 The origin of the information in this statement is obscure. Falkirk Mining Company is considered a legitimate coal development operation, and as such, is eligible for a Federal coal lease. Falkirk's internal corporate structure is beyond the scope of this analysis.

14-3 No response required.

14-4 No response required.

14-5 The tracts under consideration are described and clearly shown on maps within the EAR.

14-6 The exact point of this statement is somewhat unclear with regard to the proposed coal lease. The analysis team felt that any reclamation, regardless of its relative merit and degree of success, is better than raw spoil banks and, therefore, warrants a positive impact rating.

14-7 The North Dakota State Planning Division was not involved in the formulation of the McLean County Comprehensive Plan. No further response necessary.

14-8 This environmental analysis deals with the proposed leasing of 1,000 acres of Federal coal, not with power plants or transmission lines. The analysis narrative was modified and expanded to reflect a further assessment of the public attitudes in the impact region (see pages 36, 67, 86, and 87).

14-9 No response required.

14-10 No response required.

14-11 This statement is a mis-interpretation of the analysis (see pages 23 and 24).

14-12 No response required.

14-13 No response required.

14-14 No response required.

14-15 Action response 14-8 applies to this statement.

14-16 Opinion assessment. No response required.

14-17 This statement is completely in error. The subject 1,000 acres is neither highly unique nor is it likely to be a stopping place for whooping cranes. There is also very little prime habitat for white-tailed deer on the subject lands. No action warranted in the analysis.

14-18 Under North Dakota State law, the surface landowner plays a very significant part in the final reclamation recommendations. As for reclamation "success", this issue is presently enshrouded in a myriad of opinions, however, research indicates that proper reclamation can return mined lands to a useful and productive state. No action warranted in the analysis.

14-19 The analysis team feels it has adequately discussed each of the points brought out.

14-20 No response required.

14-21 Reader's assessment. No response required.

LETTER #15

# NORTH DAKOTA GEOLOGICAL SURVEY

UNIVERSITY STATION • GRAND FORKS, N. DAK. 58202 • AREA CODE 701-777-2231

EDWIN A. NOBLE
State Geologist

March 30, 1976

ND PROJECT OFFICE
PM ... S ...
SP ... ME ...
GE ... WR ...
H ... W ...
MAR 3 1 1976
MCDO ...
ACTION ... FILE ...

Mr. John Kenny
Project Manager, BLM
P. O. Box 1072
235 Sims Ave.
Dickinson, ND 58601

Dear Mr. Kenny:

I am returning your copy of the Falkirk EAR. I appreciate the opportunity to review the document. In this regard I have a few comments as follows:

15-1 P. 42, iii Reclamation
You state that regrading of the spoil will have no direct effect on various soil characteristics. Initial results of research which we have undertaken at the Indian Head Mine at Zap, N.D., indicate that the methods of regrading spoils and time of year when the regrading takes place can have a very great effect upon the erosion and stability characteristics of the regraded spoils, as well as the overlying soil materials.

15-2 P. 47, b) Mining Operations
I feel that you should reference the piezometric surface maps to which you are referring. I assume you are referring to one of the maps prepared last year by either myself or one of our graduate students. These maps are constantly being updated as new information becomes available, therefore, it may be advisable to indicate date of the map being used.

15-3 P. 47, last paragraph
With the information gathered thus far through ongoing research at Falkirk, we <u>can</u> predict with a fair degree of accuracy the short and long-term effects of strip mining upon groundwater conditions in the study area. We are presently refining this data utilizing digital modeling techniques. In the near future, we should be able to predict, in detail, the effects that mining in any particular part of the area will have upon groundwater in the area.

P. 79, g)

15-4 We have recently initiated a project at the Indian Head Mine which involves the detailed monitoring of the stripping operations. We are watching an area in which we have detailed 3-dimensional lithostratigraphic baseline data on the overburden materials. We have found that inversion of the overburden materials during mining is the exception rather than the rule. The final rearrangement of the overburden materials is dependent upon factors including thickness of overburden, curvature of pit, and capabilities of equipment.

I hope my comments are of some help. Contact me if you have any questions. I will be looking forward to seeing a copy of the final report.

Sincerely,

Gerald Groenewold
Geologist

crb
Enc.

BLM Action - Gerald Groenewold, North Dakota Geological Survey  Letter #15

Key No.

| Key No. | |
|---|---|
| 15-1 | The analysis narrative was modified to reflect the information in this comment. (See pages 42 and 43.) |
| 15-2 | The piezometric surface maps used for the analysis were cited in the narrative and referenced in the literature cited appendix (Appendix 1 and pages 47 and A4-13). |
| 15-3 | This comment was incorporated in the analysis narrative on page 48. |
| 15-4 | This comment is reflected on pages 79 and 80 of the analysis. |

FALKIRK EAR

Appendix 11

Glossary

alluvium - Clay, silt, sand, gravel, or other rock materials transported by flowing water and deposited in comparatively recent geologic time as sorted or semisorted sediments in riverbeds, estuaries, and flood plains, on lakes, shores, and in fans.

aquifer - A stratum or zone below the surface of the earth that is capable of producing water, as from a well.

artesian water - Ground water that is under sufficient pressure to rise above the level at which it is encountered by a well, but which does not necessarily rise to or above the surface of the ground.

autotrophic - Ecologically speaking, these are "producer" organisms which construct or build organic substances (i.e., green (chlorophyll) plants).

biome - A major biotic unit consisting of plant and animal communities having similarities in form and environmental conditions.

biotic - Anything being of, or related to life, or having a specified mode of life.

box cut - The initial cut driven in a property, where no open side exists; this results in a highwall on both sides of the cut.

carnivore - Flesh eating organism.

climax - The final or mature community in the natural process of succession.

coliform - A group of bacterial microorganisms commonly found in the intestinal wastes from warm-blooded animals. This bacterial group is often used as an indicator of sewage pollution in water supplies.

community - All the populations occupying a given area.

cropline - A line following the coal outcrop.

dead ice moraine - Ablation till.

disclimax - The biotic state when a stable community, which is not the climatic or edaphic climax for the given site, is maintained by man or his domestic animals disturbance climax.

dragline - A type of excavating equipment which casts a rope-hung bucket a considerable distance, collects the dug material by pulling the bucket toward itself on the ground with a second rope, elevates the bucket, and dumps the material on a spoil bank, in a hopper, or on a pile.

ecosystem - Complex self-sustaining natural system which includes living and non-living components of the environment and the interactions that bind them together. Its functioning involves the circulation of matter and energy between organisms and their environment.

final cut - The last cut in a strip mine. A highwall will result on one side.

fluvial - Applied to sand and gravel deposits laid down by streams or rivers. Such deposits are of fluvial origin.

food chain - The process of the transfer of food energy from the source in plants through a series of organisms with repeated eating and being eaten.

glacial drift - Boulders, till, gravel, sand, or clay transported by a glacier or its meltwater.

glacial till - Material deposited by glaciation, usually composed of a wide range of particle sizes, which have not been subjected to the sorting action of water.

ground moraine - The irregular sheet of till deposited partly beneath the advancing glacier and partly directly from the ice when it melts away.

habitat - A specific set of physical conditions that surround the single species, a group of species, or a large community. For wildlife, the major habitat components are considered to be food, water, cover, and living space. An organism's "home".

head (hydraulic head) - The height of a fluid column, usually considered as water, which maintains a pressure on a surface.

herbivore - Plant eating organism.

heterotrophic - Ecologically speaking, these are "consumer" (i.e., mammals) and "reducer" (i.e., fungi) organisms which destory organic substance.

highwall - The face or bank on the uphill side of a contour strip mine excavation.

hydraulic conductivity (K) - The proportionality coefficient, K, of Darcy's law, commonly referred to as the hydraulic conductivity, expresses the interaction between the fluid and the media. Its dimensions are those of velocity ($LT^{-1}$) as ft/sec, cm/sec, in/hr, etc.

hydrophyte - A plant that grows in water or in wet or saturated soils.

kettle - A depression in the ground surface formed by the melting of a block of ice buried or partially buried by glacial drift, either outwash or till.

knob - An isolated, prominent rounded hill or mountain.

Known Coal Leasing Area (KCLA) - A region, designated by the U.S. Geological Survey, as an area where coal of commercial quantities is known to exist.

lignite - A brownish-black coal in which the alteration of vegetal material has proceeded further than in peat but not so far as subbituminous coal.

limiting factor - A critical living or non-living element of an ecosystem necessary for an organism to survive that is in the least supply.

long ton - 2,240 pounds (= a metric ton).

macro-invertebrate - Any invertebrate animal which can be viewed or observed without the aid of a microscope.

megawatt - A million watts.

mesophyte - A plant that grows under intermediate moisture conditions.

micro-invertebrate - An invertebrate animal so small as to require a microscope for easy viewing.

moraine - An accumulation of earth and stones carried and finally deposited by a glacier.

niche - The functional status of an organism in the ecosystem. An organism's "job".

orphan spoils - A spoils pile or waste dump not reclaimed or leveled.

overburden - Material of any nature, consolidated or unconsolidated, that overlies a deposit of useful materials, ores, or coal, especially those deposits that are mined from the surface by strip mining.

physiognomy - The surface character or features of the land, external aspect.

physiography - Physical geography; a description of the natural features of the surface of the earth.

piezometric surface - The surface to which the water from a given aquifer will rise under its full head.

piping - The movement of soil particles by percolating water leading to the development of channels.

pollutant - Any agent or form that makes entrance into another material or organism and affects that material or organism in a deleterious fashion or creates a condition in the environment that's offensive to the aesthetic sense.

potentiometric gradient - Potential gradient means an ascending or descending value of voltage related to a linear measurement, as a distance along the earth surface or ground.

relief - The elevations or inequalities of a land surface.

selective denial - An administrative process by which an action can be modified, in part, by denying the prescribed activity.

seral stage - The relatively transitory, intermediate communities prior to climax in the ecological process of succession.

sheet moraine - Ground moraine - dead ice moraine - ablation till.

short ton - 2000 pounds.

slumping - When the soil and earthy material on a steep slope become charged with water, their weight is greatly increased. At the same time the water makes them more mobile. Under these circumstances the material sometimes slides down the slopes.

stratigraphy - That part of the descriptive geology of an area or district which pertains to the discrimination, character, thickness, sequence, age, and correlation of the rocks of the district.

stripping ratio - The unit amount of spoil or waste that must be removed to gain access to a similar unit amount of ore or mineral material (coal).

succession - The progressive development of vegetation toward its highest ecologcial expression, the climax; the natural process of replacement of one plant community by another.

topography - The configuration of a surface including its relief.

trophic level - Feeding level in the food chain. In complex natural communities, organisms whose food is obtained by the same number of steps are said to belong to the same trophic (feeding) level (i.e., producers, primary consumers, secondary consumers, etc.).

zooplankton - Minute floating animals found in aquatic habitats.

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