The Mathis Tract and New Federal Summit Creek Lease boundary change will not require any changes to engineering practices currently employed at the Aberdeen Mine. The change simply involves an extension of underground mine workings and does not involve the surface in any way. See 301-522 and 301-525 for additional comments on subsidence. See also IBC PHC, Appendix L.

Most of the maps previously submitted as part of the Mining and Reclamation Plan are applicable. Where necessary, original maps have been revised to indicate the newly acquired lease area and these revisions are included with this submittal as figures or as plates in Volume II. Plates which have been changed to show the location of the incidental boundary change are included.

It should be noted that no man made surface or subsurface features are located in or around the Mathis Tract I.B.C. or on adjacent proposed Federal Lease Applications shown on Plate I-A.

All categories within this section have been addressed, primarily in Volume II of the MRP which contains most of the plates.

a) Surface and subsurface ownership of lands contiguous to the permit area are shown on Plates 2 and 3.

b) The leases for which we have the legal right of entry are shown on Plate 4.

c) Andalex has submitted a permit modification to include the new AEP Lease recently acquired. Also, a permit will be sought in 1993 for a new fan installation immediately adjacent to Andalex's leases in the left hand fork in Deadman Canyon.

d) There are no buildings within 1,000 feet of the permit area except those used as part of the mining operation. They are shown on Plates 6 and 7.

e) There are no surface or subsurface man-made features within, passing through or passing over the permit area except the powerline, telephone cables, culverts, and etc., installed for the operation of this mine. See Plate 6 for their locations.

f) These reference areas are shown on Plate 9 as R-1, R-3 and R-4. They are each 200 feet square approximately.

g) The only user of surface water within this immediate hydrologic area is Andalex (Refer to Figure 5, Appendix L, which shows additional water use on Emma Park in the form of
which shows additional water use on Emma Park in the form of stock watering). Water rights for this area are found in Appendix L Tables 1 and 5. The intake location for this water into the mine is located on Plate 6. Disturbed area runoff is collected in a culvert and taken directly into the mine. Andalex controls this water right. If a discharge were to occur from any sediment pond (this has yet to occur), it would discharge into the Deadman Canyon drainage (Plate 21) which is ephemeral.

h) County Road 299 starts at highway 6 in Price and terminates at Andalex Resources' minesite (Plate 1).

i) There are no public parks nor any cultural or historical sites eligible for listing in the National Register in or adjacent to the mine plan area.

j) There are no cemeteries or burial grounds in or within 100 feet of the permit area.

k) There is no land which is within the boundaries of any units of the National System of Trails or the Wild and Scenic Rivers System including study rivers.

Cross Sections, Maps, and Plans

Most of the cross sections, maps, and plans of the approved plan remain applicable. Where necessary, original maps have been revised to indicate the addition of the newly acquired lease area and are included in this submittal, primarily in Volume II.

All categories within this section have been addressed. Specifically,

a) Plates 26, 27, and 28 show all the test borings locations and elevations. Specific information relating to these drill holes and the strata encountered can be found in Appendix E (coal quality, description of other strata). Into regarding roof & floor analyses is in Appendix E.

b) Monitoring stations for water quality are shown on Figure IV-11. Fish and wildlife monitoring stations were not set up for this application. However, refer to Plate 34 which depicts wildlife distribution. Air quality monitoring was not required for this application. Figure 6 in Appendix L shows proposed monitoring stations. Andalex has adhered to the locations shown on Figure IV-11 which is included in Andalex's operating plan.

c) Refer to Appendix E for specific drill hole lithologies as well as data on quality and chemical characteristics.
d) Crop lines and strikes and dips can be found on the coal thickness isopachs in Volume II, Plates 26, 27, 28, and 40.

e) All old workings in the three coal seams to be mined are shown on Plates 29, 30, and 31. There are no old workings in the Centennial Seam. (plate 41)

f) All subsurface water on the permit area exists in perched aquifers. The Aberdeen sandstone is the lowest water bearing unit within the permit area and is discussed in this chapter, Geology. The only water well drilled on the property which has been used with any frequency (well #1) has not depicted any seasonal variation. It is always a low producer.

g) There are no surface waters within the permit area. All drainages (natural) are shown on the topography on Plate 21. All constructed drainages are shown on Plates 6 and 7. There are no irrigation ditches. Appendix L, which is the Hydrologic Inventory, contains Figure 4 which clearly depicts the location of springs in the permit area and adjacent areas. This figure, along with Figures 5 and 6, depict the areal extent of the inventory. See Plate 1 for other spring locations in the adjacent area (Emma Park).

h) N/A

i) Plate 6 shows the location of temporary storage for underground development waste and excess spoil which can be stored in an area which was previously used as a sediment pond. Plate 6 now also shows the location of a new area above the Apex Mine which can be used for temporary and permanent storage of coal mine development waste such as sediment pond material. All dams and impoundments are shown on Plates 6 and 7, and detailed on Plates 11, 12, and 13. There are no other water treatment or air pollution control facilities on the permit area.

j) There are no oil or gas wells within the permit area. Three water wells are shown on Plate 6. Well number 1 is 220 feet deep; number 2 is 100 feet deep, and number 3 is 120 feet deep. Also, there are no oil or gas wells located in the adjacent areas.

k) Plates 14 and 15 accurately depict the area currently affected by mining as well as the area to be affected. They show the slopes as they exist as well as after construction and upon final reclamation.
Introduction

Mine Property

The coal leases owned by Andalex Resources are located in the Deadman Canyon area of the Book Cliffs coal field. The property is located about 10 miles north-northeast of Price, Utah in Carbon County. Mining has progressed onto all of Andalex's federal leases except the AEP Lease which will occur immediately upon approval. As is shown on the enclosed Plate 6, development into all seams involves separate surface facilities which are located adjacent to each other in Deadman. The newly discovered Centennial coal seam which is an isolated pocket of recoverable coal will be accessed from the Pinnacle Mine via rock slopes. There will be three rock slopes constructed each of which will be approximately 500' in length. The three tunnels will be for intake air, return air, and belt line. No waste rock will be removed from the Pinnacle Mine either during or after construction. All waste rock will be disposed of underground.

Economic Geology

This project is located in a region where coal mining has historically been the only industry. The main coal-bearing rocks occur in the Blackhawk Formation of the Upper Cretaceous Mesa
Verde Group. Several small operations have mined coal in the Deadman Canyon area over the past 70 years. These mines, however, merely scratched the surface of the estimated reserve. There are no other economically recoverable, replenishable or non-replenishable resources within this property.

**Exploration**

All exploration and drilling programs have been completed. The drilling and exploration activities were supplemented by mine samples and outcrop information, and the results used to estimate the coal reserves of the lease area. Numerous samples were taken from the outcrops of the Lower Sunnyside, Gilson, and Aberdeen seams, as well as from mine faces in the Hileman, Zion's, Star Point, and Blue Flame No. 1 mines. Samples have been taken from the Centennial Seam at 89-1-CP and underground. See appendix E.

A five hole drilling program was conducted by Centennial Coal Associates in 1971. A seven hole drilling program was conducted by Andalex in 1977. These programs were supplemented by two holes drilled west of the property by North American Coal Company in 1948 and one drilled by Pacific, Gas and Electric in 1980. All drill sites are shown on Plates 26, 27, and 28. Refer to Appendix E.

**Reserves**

By U.S. Geological Survey definition, approximately 30% of the entire reserve is classified as "measured". The remainder is classified as indicated, based on all available measurements.

Total coal reserves in the four seams have been estimated at 50.8 million tons. Recoverable coal has been estimated at 30.5 million tons (9.3 million has been mined to date). Andalex expects an initial recovery rate of about 35 percent and upon final pillar extraction, total recovery is expected to be more than 65 percent. Cover ranges from 0 feet to more than 2,700 feet on the northern end of the property.

**Underground Operation and Facilities**

**Mine Layout (Refer to Plates 26, 27, 28 and 29).**

**Multiple Seam Considerations**

There are four economic seams present on the property. The uppermost seam is the Lower Sunnyside which varies from four to six feet thick. The second highest seam is the Centennial Seam which varies from four to eight feet thick. The third seam is the Gilson Seam which also varies from 4' to 8' thick. The lowermost seam is the Aberdeen which varies from four to thirteen feet in thickness. The bottom two seams are separated by a 200 foot interval which includes a massive sandstone. The Gilson and the Centennial Seams are separated by approximately 130' and the
Centennial and Lower Sunnyside Seams are separated by 80' including a massive sandstone. It should be noted that the area in which the Centennial Seam is to mined does not contain any reserves in either the Lower Sunnyside nor the Gilson Seams. Only the Aberdeen Seam is present where the Centennial Seam is to be mined. The mine plans for each seam are shown on Plates 26, 27, 28 and 29.

**Portals**

Portals for the present mining operations in the Aberdeen, Gilson and Lower Sunnyside seams are located in Deadman Canyon as shown on Plate 6. The portal areas consist of a conveyor portal, two air intake portals, and an 88" fan portal.

Portals have been enlarged above the coal seam to facilitate men and equipment at the mine opening. Steel sets have been used to support mine roof in the portal areas. The Aberdeen portals have been constructed in a similar fashion, facilitating air intake, conveyor, and an exhaust fan.

The portals are generally 6' high and 20' wide in the Pinnacle and Aberdeen Mines and 4.5' high in the Apex Mine. The portal mine pads consist of approximately one acre. Located on these pads are the fans, conveyor portals, air intake portals, and mine water storage tanks. It should be noted that the mining of the Centennial Seam did not require new portals on the surface. The Centennial Seam is accessed via rock tunnels from the existing Pinnacle Mine.

**Mains, Submains, and Slopes**

A five entry system is being used (two intake portals) and using a continuous miner, the entries are being driven to the property line. Generally, entries on 80 foot centers with crosscuts every 80 feet are being driven on the strike and dip of the coal seam. Development mining for the longwall panels are on 5th entry and 3rd entry systems. Refer to Plates 26 through 29. There exists only one return air portal on the surface, however, two exist underground making the five entry system.

**Shafts and Interconnecting of Slopes**

Mining plans called for rock tunnels to be constructed from the existing Pinnacle Mine up to the Centennial Seam mining area. These rock slopes are each approximately 500' in length. The three tunnels consist of an intake air tunnel, a return air tunnel, and a belt tunnel. Coal is transported via the belt tunnel and transferred on to the existing Pinnacle Mine conveyor belts. These tunnels were constructed in the Spring of 1990 and mining has commenced.

**Longwall Panels**
The mining sequence calls for the development of panels longwall using 2, 3 and 5 entry systems. These panels will be generally 650 to 800 feet in width and up to 800 feet in length.

**Barrier Pillars**

A barrier pillar will be left between the bleeders and the longwall panels. A barrier will also be left wherever old mine workings are skirted such as the Olsen Mine on the east side of Deadman Canyon in the Gilson Seam.

**Bleeder System**

A bleeder system will be maintained and pillars left to provide for ventilation, eventually extending around all mined out areas.

**Ventilation**

The ventilation plan calls for a fan of sufficient capacity to provide air to each working section to control methane and dust; there has been small amounts only found to date in any of the old works or new faces. The longwall faces will be ventilated with a live brattice system consisting of a line curtains. The conveyor systems will be isolated from intake and return except in 2 entry gate systems when the belt will double as the intake. All ventilation requirements of the Coal Mine Health and Safety Act will be met. This ventilation plan will be strictly adhered to, in order to insure safety of all personnel. Please note that the Centennial Seam mining area is ventilated by the existing Pinnacle Mine fan system. The new left fork fan installation will provide additional required ventilation for the Aberdeen Mine longwall faces.

**Roof Control**

All Andalex Mines operate under an approved M.S.H.A. roof support plan which calls for bolting on five foot centers with a minimum 42" bolt length in our development entries. Roof control in the longwall faces will be accomplished using hydraulic shields. The roof in all four seams is a massive sandstone (60'+) and offers excellent support in itself. The old mine workings which were rehabilitated for the Pinnacle Mine main entries had stood unsupported for 40 years. This roof control plan will be strictly adhered to, in order to insure the safety of all personnel.

**Explosives and Blasting**

All blasting performed underground will conform to both state and federal regulations governing explosives and blasting in underground coal mines. The rock tunnels to the Centennial Seam were constructed by professional hard rock mining company.
All surface blasting activities necessary for present operations have been completed in compliance with sections 817.61 through 817.68 of Chapter VIII of Title 30 of the Code of Federal Regulations.

Blasting consisted of portal highwall construction for purposes of stability. A powder magazine has been set up on one of the surface pads, located in a remote area. It is built to conform to all regulations, such as segregation, regarding such a structure (see plate 6). All blasting operations shall be conducted by experienced, trained, and competent persons who understand the hazards involved and who possess a valid certificate as required by Title 30 of the Code of Federal Regulations.

**General Safety Measures**

A great emphasis is put on assuring a safe mine operation and the mine and surface facilities will be operated within prudent standards to insure the health and safety of all employees. The facilities will be carefully inspected by company-trained safety engineers and state and federal mine inspectors.

The operation will abide by Utah State Coal Mine Regulations and the 1969 Federal Coal Mine Health and Safety Act. In addition, these regulations will be supplemented by a company safety policy. Various training programs will be utilized such as the following:

- Methane Measurements
- Roof and Rib Control
- Oxygen Deficiency Testing
- Ventilation
- First Aid
- Mine Rescue
- Mine Electrical Certification
- Self Rescue Training
- Use of Personal Protective Equipment
- Recognition of Electrical Hazards
- General Accident Prevention
- Mine Communications
- Job Safety Training

Many of the training programs will run continuously, such as those involving roof control and ventilation. Other programs are held annually with many oriented toward new employees.

**Mine Development (Refer to Plates 26, 27, 28 and 29).**

**Room and Pillar**

Room and pillar design will be employed in fringe areas surrounding the longwall panels as conditions allow.
Pillar Extraction

Once development in fringe areas is completed, pillar extraction will commence as conditions permit. Final pillar extraction will result in a total recovery rate of approximately 65 percent.

Cycle and Sequence of Mining

As mining progresses, the following equipment will be added to start up additional mining areas and increase production (currently four units have been employed):
- 4th Mining Unit - January, 1990
- Longwall - August, 1994

As there are four coal seams of minable thickness on the leases, a systematic plan of mining will be followed to assure maximum recovery of the coal reserves. When mining is progressing concurrently in two seams, the room and pillar design and layout will be columnized to assure maximum roof support.

Underground Equipment

Production Units

In each mine, the longwall development entry systems, will be mined with a drum-type continuous miner similar to the Joy 12 CM. Presently, Joy 12 CM-11's and 14 CM's are being used in the operation. Coal is transported by shuttle car (Joy) to a loading point consisting of a Long Airdox Feeder Breaker or similar machine, which will discharge onto a 42" panel conveyor or a 42" main conveyor. Roofbolting is and will be accomplished by a Lee Norse Roof Bolter or a similar type machine. The longwall panels will employ a Joy, 4-L8, or similar shearer. Coal will be discharged into a pan face conveyor which will carry the coal to a crusher 1 stage loader for transportation by belt conveyor to the surface. Roof support will be by hydraulic shields. Additional production units will be added as previously outlined.

Belt Conveyors

The feeder breaker or state loader will discharge the coal onto either a 48" panel conveyor or a 42" main conveyor. The conveyor will transport the coal to the outside, where it will be discharged to a live stockpile, (see Plate 6). Currently, Long Airdox conveyor belt drives are being used. For the longwall installations, the same, or similar drives will be employed.

Water System

Water for mining use, such as for providing face fire protection and dust suppression, will be obtained from Water Well No. 1, shown on Plate 6. Water is also collected from the disturbed area via a system of culverts to underground workings connected to the Pinnacle Mine. This water will be pumped to the Mine Water Storage Tank and from there into the mine using a high pressure pump. Several sumps have been cut in the mine for the purpose of reclaiming water as most available water will be
needed. Enough water is currently generated from the formation and coal seam that Andalex currently discharges approximately 50% of the time through approved UPDES point 002.

Power System and Communication Facilities

A 7200 volt, 3 phase, 60 hertz power distribution system has been taken underground from a 2500 KW substation located on the surface plant area. The primary feed into the substation is 46,000 volts from the Utah Power and Light Company transmission system located approximately 6 miles south, adjacent to the airport. This 46 KV line taps Utah Power and Light's Helper - Columbia 46 KV line, at structure #89. The powerline was designed according to Utah Power and Light's specifications. After approval by Utah Power and Light, it was installed by a private local contractor at the expense of Andalex Resources.

Within the minesite area, the power is reduced to 7200 volts for the primary underground usage. This is fracture reduced up to 2300 to 6000, 480 and 240 volts for equipment operation. Surface power is on a 480 volt system. Electrical Specifications for the Deadman Canyon Mine Substation are included as Appendix I.

A 25-pair telephone communications cable is buried along the existing Deadman Canyon road, with its origin at Carbon County Airport approximately 7.5 miles from the minesite. Currently, 13 pairs are in use with additional capacity to add as the mine facilities expand. This cable was designed, supplied and installed by Mountain Bell Telephone at the expense of Andalex Resources. Mountain Bell is responsible for maintenance.

The mine permit area has no utilities or services through it other than those which are accurately depicted on Plate 6. All utilities have been constructed under the close scrutiny of the Utah DWR and the U.S. Fish and Wildlife Service.

Other Equipment

Other equipment being utilized includes mantrips, rock dusters, tractors, rubber tired scoops, power cables, communication equipment, and miscellaneous section tools. The mine is also equipped with emergency tools and necessary supplies in the unlikely event that a fire or explosion should occur, in accordance with M.S.H.A. regulations.

Surface Equipment

Surface equipment includes a Cat 980-B front-end loader. Also, there is a grader for road maintenance. Other equipment such as diesel scoops and tractors will be utilized on the surface from time to time for material haulage. There are two bulk rock dust silos on the surface.

Employment
Andalex Resources is an Equal Employment Opportunity Employer. The type of hourly employees to be hired are highly skilled personnel, including miner operators, shuttle car operators, roof bolters, mechanics, and electricians. All hourly employees will be properly trained and certified where necessary in accordance with M.S.H.A. regulations. Currently, Andalex Resources' employs 75 hourly wage earners. Employment at the mine will not change significantly with the installation of the longwall. The Pinnacle Andalex's Mines, are located in Carbon County near the town of Price. Since this area is supported to a large degree by coal mining and other related industries, it is anticipated that a labor force will always be readily available.

Management and other salaried employees will consist of the Manager of Mines, the General Superintendent, the Mine Superintendents, the Mine Foremen, Safety Personnel, Secretarial and Clerical, Geologists, and Engineers (see Table IV-1).

Schedule of Development and Mining

There are four economic seams present on the property; mining plans are based on simultaneously developing longwall panels in 3 of the 4 seams. The incremental increases listed below represent the first eight years of production (from 1982):

<table>
<thead>
<tr>
<th>Year</th>
<th>Production Rate Tons/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st year (1982)</td>
<td>700,000</td>
</tr>
<tr>
<td>2nd year (1983)</td>
<td>350,000</td>
</tr>
<tr>
<td>3rd year (1984)</td>
<td>300,000</td>
</tr>
<tr>
<td>4th year (1985)</td>
<td>650,000</td>
</tr>
<tr>
<td>5th year (1986)</td>
<td>700,000</td>
</tr>
<tr>
<td>6th year (1987)</td>
<td>400,000</td>
</tr>
<tr>
<td>7th year (1988)</td>
<td>700,000</td>
</tr>
<tr>
<td>8th year (1989)</td>
<td>1,100,000</td>
</tr>
</tbody>
</table>

Mining progression for the life of the mine is shown on Plates 26, 27, 28, and 29, and will increase from 1,100,000 tpy current to 1.5 mm tpy by 1995 and will stay at this rate until mining is completed making a mine life of approximately 15-20 years.

<table>
<thead>
<tr>
<th>Estimated Year</th>
<th>Estimated Recovery Tons Remaining</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>1,200,000 estimated 21.2 million</td>
</tr>
<tr>
<td>1994</td>
<td>1,200,000 estimated 20.0</td>
</tr>
<tr>
<td>1995</td>
<td>1,500,000 estimated 18.5</td>
</tr>
<tr>
<td>1996</td>
<td>1,500,000 estimated 17.0</td>
</tr>
<tr>
<td>1997</td>
<td>2,000,000 estimated 15.5</td>
</tr>
<tr>
<td>Duration</td>
<td>2,000,000 estimated 10 years</td>
</tr>
</tbody>
</table>

To date, Andalex has mined approximately 20% of its Lower Sunnyside Reserve, 80% of its Gilson Reserve, 5% of its Aberdeen.
Reserve and 20% of its Centennial Reserve (The Centennial Reserve consisted originally of approximately 2.5 million recoverable tons).
ORGANIZATION CHART

GENERAL MANAGER

GENERAL SUPT.

E.R. SUPERVISOR

MAINTENANCE SUPT.

SAFETY DIRECTOR

MINE SUPT.

MINE ENGINEER

CLERK

SAFETY ENGS.

E.R. FUNCTIONS

UNDERGRND MAINT.

SURFACE MAINT.

MINE PROD.

SURFACE

TABLE IV-1
Support Structures and Buildings

Support structures and buildings are shown on Plates 6 and 7.

Parking Areas

Parking areas have been covered with gravel and magnesium chloride and will be maintained. These are shown on Plate 6. The main office parking area is paved.

Storage Areas

There are several storage areas at the site. These include the Material Storage Area No. 1, Raw Coal Pile Area, Material Storage Area No. 2, and the Topsoil Storage Area. All areas are shown on Plate 6.

Water Supply

Water for use in the mine is described. Water for culinary use is hauled in approved water haulers from Price City. There is a sump cut in the mine from which water can be reclaimed as all available water will be needed. Since all mining is down dip from the portals, little water will exit from the mine. Information concerning the wells and water analysis is presented as Appendix L.

Landscaping

All disturbed areas have been graded to the most moderate slope possible to assure stability. Vegetative cover has been promptly re-established to stabilize erosion. REVEGATATION was accomplished by Andalex under the recommendations of the U.S. Department of Agriculture, Soil Conservation Service and the Division of Oil, Gas, and Mining.

Signs, Markers, Fences, and Gates

Signs of a uniform design, showing the company name, business address, and telephone number as well as the identification number of the current regulatory program permit authorizing the underground mining activities, have been placed at all access points to the permit area. These signs have been placed to be easily seen, are made of a durable material, and conform to local laws and regulations. The topsoil storage area is clearly marked.

As this is an underground mine, there will be no blasting conducted on the surface with the exception of highwall construction. When blasting for highwall construction does occur, conspicuous signs and flagging will be posted as required by 30 CFR Parts 817.11 (f) and 817.65 (e).

As the Left Hand Fork is classified as an intermittent drainage, stream buffer zone markers will be placed within 100 feet of the drainage disallowing access except for the disturbed site.
As there are no perennial streams or a stream with a biological community on the permit area, buffer zone markers will not be necessary. The perimeters of all areas affected by surface operations and facilities are clearly marked. These signs and markers shall be maintained during all activities and retained and maintained until after the release of all bonds for the permit area.

**R645-301-512.120. SURFACE FACILITIES AND OPERATIONS**

See Volume II.

Support structures and buildings are shown on Plates 6 and 7 and LF-1.

**Parking Areas**

Parking areas have been covered with gravel and magnesium chloride and will be maintained. These are shown on Plate 6. The main office parking area is paved.

**Storage Areas**

There are several storage areas at the site. These include the Material Storage Area No. 1, Raw Coal Pile Area, Material Storage Area No. 2, and the Topsoil Storage Area. All areas are shown on Plate 6.

**R645-301-512.130. SURFACE CONFIGURATIONS**

See Volume II, Plates 6 and 7.

**R645-301-512.140. HYDROLOGY**

**Introduction**

Water quality monitoring stations will be set up at the wells as shown on Figure IV-11, and also at the sedimentation pond discharge structures.

**Sewage System**

The nature of the overburden in the area offers excellent drainage. As a result, a septic system with drain fields conforming to the state codes has been established to handle the waste water disposal from the bathhouse and office facilities. The drain fields are located in native material (valley fill) cast of the bath houses in the parking area. Enclosed as Appendix G are the two septic system plans as designed by a Utah Registered Professional Engineer and approved by the State of Utah Department of Health.

**Water Treatment**

**INTEGRATED**

**OCT 07 2002**

**DIV OF OIL GAS & MINING**
Based on the State of Utah, Department of Health review of the septic systems, water treatment is not needed. (Personal communication, Mr. Gerald Story, Utah Department of Health, Price, Utah).

Drainage Control - Diversions, etc.

The drainage control plan is presented in this Chapter.

Sediment Control

The sedimentation plan is presented in this Chapter.

R645-301-512.150. GEOLOGIC CROSS SECTIONS AND MAPS

Introduction

The proposed permit area is in Book Cliffs which is the major physiographic feature in the region. The cliffs rise from a base at approximately 5,500 feet in elevation, to over 8,500 feet. Numerous canyons dissect the Book Cliffs. Soldier Creek and Coal Creek are the major area drainages. The permit area exhibits extreme topographic relief and is mountainous with steep cliffs and deeply incised drainages. With the exception of the Mancos Shale Formation, the Fiasco, Deadman, Straight Canyons, Hoffman Creek Canyon, Graves Lease and AEP Lease exhibit similar stratigraphic and topographic characteristics.

Tectonic Setting

The major coal seams of the Book Cliffs Coal Field lie within the Cretaceous Mesa Verde group which overlies the thick shales of the Cretaceous Mancos formation. The Mesa Verde group consists of the Star Point Sandstone, Blackhawk formation and Price River formation. The major coal seams lie within the Blackhawk formation.

The Tertiary Wasatch and Green River formations, along with the Price River formation, form the Roan Cliffs, the Tavaputs Plateau and the southern rim of the Uintah Basin. Lithologies present include fluvial, deltaic, and marine sandstones, mudstones, and shales.

Geologic History

During the Triassic and Jurassic periods, the area of the Book Cliffs was relatively stable, but gradually subsided and received sediments. The area, assumed to have been a relatively flat lowland, was occasionally covered by a shallow sea of short geologic duration. A thick red bed sequence suggests tropical conditions and the great thickness of sand accumulation suggests acid conditions. During Triassic times, the sediments probably came from all directions but, during the Jurassic time, the major source areas lay to the south and west.

During the early Cretaceous time, a trough developed in the
Colorado Rockies area and the sea invaded. Gradually the sea crept westward as the trough continued to subside, reaching the east edge of the Colorado Plateau by the beginning of the Upper Cretaceous age.

Unconformities and thinning of various members indicate that volcanic activity to the west caused sediments to fill the basin faster than it could subside, causing the shoreline to be pushed eastward. When lulls in this activity developed, the incoming sediments diminished and the sea moved westward once more. With each pulse, the boundaries of the depositional environments moved eastward and then returned westward. The sandstone tongues of the Mesa Verde, which project into the Mancos, were deposited at these times.

After the sea retreated, the area continued to receive sediments under continental conditions which lasted well into Eocene time. In Oligocene time, the area began to rise in earnest. Erosion attacked the newly formed formation creating the present mountain ranges and cliffs.

**Stratigraphy**

The main coal bearing beds in the region occur in the Blackhawk formation. There are various more or less distinct coal beds or zones as listed below from top to bottom according to stratigraphic position.

Upper Sunnyside Bed
Lower Sunnyside Bed
Centennial Bed
Rock Canyon Bed
Fishcreek Bed
Gilson Bed
Kenilworth Bed
Castlegate "B" Bed

Castlegate "A" Bed

These zones are lenticular and reach minable thickness only in certain areas. The Lower Sunnyside Bed is the major bed in the area.

**Structure**

The Book Cliffs are basically a homocline (dip slope) dipping into the Uintah Basin with the cliff front roughly paralleling the strike of the feature. The strike of the beds is generally parallel to the face of the Book Cliffs. The beds are mostly uniform with dips of from 3° to 8° to the north and northeast toward the Uintah Basin.

Occasional faults cut the coal measures but are of small displacement and have been of little consequence in mining. The most serious group of faults lies in the Sunnyside area. These faults, which have a maximum separation of 200 feet, effect
mining, but, fortunately, are not closely spaced.

**History of Mining**
Mining has been the major industry in the region for many years.

Coal was discovered in the Wasatch Plateau in 1874 and exploration soon spread to the Book Cliffs. Mines began operating in the area in 1889. The Castlegate and Sunnyside area was first developed, the areas in between being developed later. Coal was usually discovered away from settled areas and towns were built for employees by the companies. Production from mines generally increased until 1920, but began to decline in the 1920's and 1930's. World War II brought production back to the 1920 levels and production continued to increase until 1957 when production again declined.

Book Cliff mines to present have produced about 75 percent of Utah's coal annually. Well over 200 million tons of coal have been extracted from the coal measures of the area. Much coal remains and numerous mines are presently operating in the area.

**Geologic Hazard**
There are occasional faults cutting the coal measures of the area. They are of relatively small displacement. The most serious faults occur in the Sunnyside area. There is no indication of faulting within our lease area.

Faults in the Sunnyside district of the Book Cliffs field have been thought, by some, to have a causative relationship to the bounces experiences there. The outcrops on the lease premises and our own aerial photos have been carefully studied. In our judgement, no faults cut the lease area. The bulk of the tonnage to be mined is under less than 1,500 feet of cover, with only a very limited amount of coal under cover, up to 2,700 feet. Water inflows have never been a problem in the Book Cliffs field. The dip of the coal measures prevents entrapment of personnel, in any event.
Stratigraphy

The coal seams in the Blackhawk formation are listed stratigraphically:

Upper Sunnyside Bed
Lower Sunnyside Bed
Centennial Bed
Rock Canyon Bed
Fishcreek Bed
Gilson Bed
Kenilworth Bed
Castlegate "B" Bed
Castlegate "A" Bed (Aberdeen)

Only the Lower Sunnyside, Centennial, Gilson, and Castlegate "A" beds are formed in commercial thickness on the Centennial Property. Andalex has discovered a new coal seam which is referred to as the Centennial Seam. This coal was originally thought to have been in the Lower Sunnyside Seam. This coal has been accessed through rock tunnels from the existing Pinnacle Mine. Waste from these rock tunnels was disposed of in the Pinnacle Mine. The Mine in the Centennial Seam as well as the Mine in the Aberdeen Seam will both progress onto the Graves Lease. Andalex is applying for approval for the new AEP Lease in the Centennial and Aberdeen Seams only.

Stratigraphic sections of the coal beds are shown in Figures III-1, III-2, and III-3. Seam thicknesses are shown on Plates 26, 27, 28, and 29.

Structure

The structure between Deadman and Soldier Canyons is relatively simple. Structure contours are aligned basically east-west. The coal beds dip northward at approximately six degrees. No faults are thought to exist in the Deadman Canyon area.

History of Mining

Several small operations have mined a considerable amount of coal over the past 70 years in the Deadman Canyon Area. Mining ceased in the area in 1964. These mines, however, merely scratched the surface of the reserve. The remaining recoverable reserve is estimated to be greater than twenty-eight million tons and ranging in cover from 0 to 2,700 feet.

Identification of Strata

Strata disturbed by surface operations consist of sandstone and siltstone of a colluvial nature.

Design of Boring and Sampling Program

Sites - Numbers, Location and Relationship to the Disturbed Area
The number, locations, and relationship of drill holes and sampling are indicated on Plates 26, 27, and 28.

Methodology - Sample Collection, Compositing of Samples for Each Strata, Laboratory Analyses

Samples of the immediate floor and roof below and above each seam were sampled using conventional core drilling equipment. Also, samples of the overburden which was disturbed in surface operation has been sampled by "grab" methods, as well as auger drilling.

Data

Field Log and Description of Samples - Lithologic Classification, Description, and Hydrologic Aspects

In November and December, 1971, a five-hole drilling program was conducted by Centennial Coal Associates, supplemented by mine samples and outcrop information, and the results used to estimate the coal reserves of the leases. Pertinent information on these drill holes is given in Table III-1 and Appendix E. Complete lithologic logs of each drill hole are included in Appendix E. Numerous samples were taken from the outcrops of the Lower Sunnyside, Gilson, and Aberdeen seams, as well as from mine faces in the Hileman, Olsen, Star Point, and Blue Flame No. 1 mines. Information from those samples as well as the location of the drill holes is shown on Plates 26, 27, and 28.
TABLE III-1

Centennial Drill Holes

<table>
<thead>
<tr>
<th>Number</th>
<th>Location</th>
<th>Total Depth</th>
<th>Coal Seams</th>
</tr>
</thead>
<tbody>
<tr>
<td>DH-1</td>
<td>NW1/4 NW1/4 SE1/4</td>
<td>516 ft.</td>
<td>Lower Sunnyside</td>
</tr>
<tr>
<td></td>
<td>Sec. 8 T13S, R11E, SLBM</td>
<td></td>
<td>Gilson</td>
</tr>
<tr>
<td></td>
<td>Elevation - 7,230 ft.</td>
<td></td>
<td>Aberdeen</td>
</tr>
<tr>
<td>DH-2</td>
<td>SW1/4 NW1/4 NW1/4</td>
<td>580 ft.</td>
<td>Lower Sunnyside</td>
</tr>
<tr>
<td></td>
<td>Sec. 7 T13S, R11E, SLBM</td>
<td></td>
<td>Gilson</td>
</tr>
<tr>
<td></td>
<td>Elevation - 7,275 ft.</td>
<td></td>
<td>Aberdeen</td>
</tr>
<tr>
<td>DH-2-A</td>
<td>SW1/4 NW1/4 SE1/4</td>
<td>303 ft.</td>
<td>Gilson</td>
</tr>
<tr>
<td></td>
<td>Sec. 7 T13S, R11E, SLBM</td>
<td></td>
<td>Aberdeen</td>
</tr>
<tr>
<td></td>
<td>Elevation - 7,165 ft.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DH-5</td>
<td>SE1/4 SW1/4 NE1/4</td>
<td>832 ft.</td>
<td>Lower Sunnyside</td>
</tr>
<tr>
<td></td>
<td>Sec. 7 T13S, R11E, SLBM</td>
<td></td>
<td>Gilson</td>
</tr>
<tr>
<td></td>
<td>Elevation - 7,275 ft.</td>
<td></td>
<td>Aberdeen</td>
</tr>
<tr>
<td>DH-6</td>
<td>NW1/4 SE1/4 SW1/4</td>
<td>2,275 ft.</td>
<td>Lower Sunnyside</td>
</tr>
<tr>
<td></td>
<td>Sec. 5 T13S, R11E, SLBM</td>
<td></td>
<td>Gilson</td>
</tr>
<tr>
<td></td>
<td>Elevation - 8,558 ft.</td>
<td></td>
<td>Aberdeen</td>
</tr>
</tbody>
</table>
Stratigraphic Sections
Figure III-1
CENTENNIAL PROJECT
DEADMAN CANYON

GENERALIZED SECTION, BLACKHAWK FORMATION
NOT TO SCALE

CASTLE GATE SANDSTONE

APEX MINE
LOWER SUNNYSIDE COAL SEAM
4' - 5'
LOWER SUNNYSIDE SANDSTONE

PINNACLE MINE
CENTENNIAL COAL SEAM
4' - 7'

PINNACLE MINE
GILSON COAL SEAM
4' - 9'

KENILWORTH SANDSTONE

ABERDEEN MINE
ABERDEEN COAL SEAM
4' - 13'
ABERDEEN SANDSTONE

MANCOS SHALE 3,000 FT

INCORPORATED
CCT 07 2002
DIV OF OIL GAS & MINING

ANDALEX
RESOURCES, INC.
Tower Division

GENERALIZED SECTION

SCALE REFERENCE PLATE

5-22
In October and November, 1977, a seven-hole drilling program was conducted by Andalex in order to better define the coal reserves for mine planning on the Zion's fee. Pertinent information on these drill holes is presented in Table III-2. Complete lithologic logs of each drill hole are included in Appendix E. Locations are indicated on Plates 26, 27, and 28. Andalex drilled six holes underground and one on the surface in the summer of 1989 (Drill hole numbers 89-1-AP, 89-2-AP, 89-3-AP, 89-1-PIN, 89-2-PIN, 89-3-PIN, 89-1-CP). These holes were primarily to substantiate the existence of the new Centennial Seam.

Andalex has also acquired lithologic logs of two drill holes completed by North American Coal Corp., in 1948 and one by Pacific Gas & Electric in 1980. Although these holes are not located within the permit area, but to the west and east of its boundary, the information has been utilized in estimating reserves. Pertinent information is given in Table III-3. Complete lithologic logs are included in Appendix E and their location is indicated on Plates 26, 27, 28, and 29.
<table>
<thead>
<tr>
<th>Number</th>
<th>Location</th>
<th>Total Depth</th>
<th>Coal Seams</th>
</tr>
</thead>
<tbody>
<tr>
<td>77-1-CP</td>
<td>NE1/4 SE1/4 SW1/4</td>
<td>675 ft.</td>
<td>Gilson</td>
</tr>
<tr>
<td></td>
<td>Sec. 7 T13S, R11E, SLBM</td>
<td></td>
<td>Aberdeen</td>
</tr>
<tr>
<td></td>
<td>Elevation - 7,555 ft.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>77-2-CP</td>
<td>SE1/4 NE1/4 SW1/4</td>
<td>690 ft.</td>
<td>Gilson</td>
</tr>
<tr>
<td></td>
<td>Sec. 7 T13S, R11E, SLBM</td>
<td></td>
<td>Aberdeen</td>
</tr>
<tr>
<td></td>
<td>Elevation - 7,520 ft.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>77-3-CP</td>
<td>SE1/4 SE1/4 NW1/4</td>
<td>868 ft.</td>
<td>Lower Sunnyside</td>
</tr>
<tr>
<td></td>
<td>Sec. 7 T13S, R11E, SLBM</td>
<td></td>
<td>Gilson</td>
</tr>
<tr>
<td></td>
<td>Elevation - 7,425 ft.</td>
<td></td>
<td>Aberdeen</td>
</tr>
<tr>
<td>77-4-CP</td>
<td>SE1/4 SE1/4 SW1/4</td>
<td>105 ft.</td>
<td>Aberdeen</td>
</tr>
<tr>
<td></td>
<td>Sec. 7 T13S, R11E, SLBM</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Elevation - 7,070 ft.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>77-5-CP</td>
<td>SE1/4 SE1/4 SW1/4</td>
<td>85 ft.</td>
<td>Aberdeen</td>
</tr>
<tr>
<td></td>
<td>Sec. 7 T13S, R11E, SLBM</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Elevation - 7,085 ft.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>77-6-CP</td>
<td>NE1/4 NE1/4 NW1/4</td>
<td>80 ft.</td>
<td>Aberdeen</td>
</tr>
<tr>
<td></td>
<td>Sec. 18 T13S, R11E, SLBM</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Elevation - 7,080 ft.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>77-7-CP</td>
<td>NE1/4 NE1/4 NW1/4</td>
<td>45 ft.</td>
<td>Aberdeen</td>
</tr>
<tr>
<td></td>
<td>Sec. 18 T13S, R11E, SLBM</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Elevation - 7,010 ft.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>89-1-AP</td>
<td>SW1/4 SE1/4 NW1/4</td>
<td>460 ft.</td>
<td>Centennial</td>
</tr>
<tr>
<td></td>
<td>Sec. 7 T13S, R11E, SLBM</td>
<td></td>
<td>Aberdeen</td>
</tr>
<tr>
<td></td>
<td>Elevation - 7,239 ft.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>89-2-AP</td>
<td>NE1/4 NW1/4 SW1/4</td>
<td>90 ft.</td>
<td>Centennial</td>
</tr>
<tr>
<td></td>
<td>Sec. 7 T13S, R11E, SLBM</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Elevation - 7,283 ft.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>89-3-AP</td>
<td>SW1/4 SE1/4 NW1/4</td>
<td>90 ft.</td>
<td>Centennial</td>
</tr>
<tr>
<td></td>
<td>Sec. 7 T13S, R11E, SLBM</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Elevation - 7,169 ft.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>89-1-PIN</td>
<td>SE1/4 NE1/4 SE1/4</td>
<td>260 ft.</td>
<td>Aberdeen</td>
</tr>
<tr>
<td></td>
<td>Sec. 8 T13S, R11E, SLBM</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Elevation - 6,951 ft.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>Location</td>
<td>Total Depth</td>
<td>Coal Seams</td>
</tr>
<tr>
<td>----------</td>
<td>-------------------</td>
<td>-------------</td>
<td>------------</td>
</tr>
<tr>
<td>89-2-PIN</td>
<td>SW1/4 NW1/4 SW1/4</td>
<td>250 ft.</td>
<td>Aberdeen</td>
</tr>
<tr>
<td></td>
<td>Sec. 8 T13S, R11E, SLBM</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Elevation - 7,014</td>
<td></td>
<td></td>
</tr>
<tr>
<td>89-3-PIN</td>
<td>NW1/4 SE1/4 SW1/4</td>
<td>240 ft.</td>
<td>Aberdeen</td>
</tr>
<tr>
<td></td>
<td>Sec. 7 T13S, R11E, SLBM</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Elevation - 7,483 ft.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>89-1-CP</td>
<td>SE1/4 SE1/4 SW1/4</td>
<td>1,880 ft.</td>
<td>Centennial</td>
</tr>
<tr>
<td></td>
<td>Sec. 6 T13S, R11E, SLBM</td>
<td></td>
<td>Aberdeen</td>
</tr>
<tr>
<td></td>
<td>Elevation - 8,307 ft.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### TABLE III-3
North American Drill Holes

<table>
<thead>
<tr>
<th>Number</th>
<th>Location</th>
<th>Total Depth</th>
<th>Coal Seams</th>
</tr>
</thead>
<tbody>
<tr>
<td>DH-NACC-6</td>
<td>SE1/4 SE1/4 SE1/4</td>
<td>Approx. 1,020 ft.</td>
<td>Centennial</td>
</tr>
<tr>
<td></td>
<td>Sec. 1 T13S, R10E, SLBM</td>
<td>Elevation - 7,460 ft.</td>
<td>Gilson</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Aberdeen</td>
</tr>
<tr>
<td>DH-NACC-7</td>
<td>SW1/4 NE1/4 SE1/4</td>
<td></td>
<td>Gilson</td>
</tr>
<tr>
<td></td>
<td>Sec. 12 T13S, R10E, SLBM</td>
<td>Elevation - 7,192 ft.</td>
<td>Aberdeen</td>
</tr>
</tbody>
</table>

Pacific Gas and Electric Drill Hole

<table>
<thead>
<tr>
<th>Number</th>
<th>Location</th>
<th>Total Depth</th>
<th>Coal Seams</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC9-1</td>
<td>NW1/4 NW1/4 NW1/4</td>
<td>Approx. 930 ft.</td>
<td>Lower Sunnyside</td>
</tr>
<tr>
<td></td>
<td>Sec. 9 T13S, R11E, SLBM</td>
<td>Elevation - 7,225 ft.</td>
<td>Gilson</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Aberdeen</td>
</tr>
</tbody>
</table>
Laboratory Analyses - Chemical Acidity, Toxicity, Alkalinity, and Physical (Erodibility and Compaction) Properties

Complete laboratory analysis is included in Appendix E. Appendix E has been updated to include coal quality information pertaining to the Centennial Seam.

Identification of Potential Acid, Toxic or Alkaline Producing Horizons

Refer to Appendix E for the laboratory analyses. Andalex has committed to sampling roof and floor material in all four coal seams in the most recently mine areas. This material will be analyzed for identification of Potential Acid, Toxic or Alkaline Producing Horizons. As this material is collected it will be placed into Appendix E with the rest of the laboratory data.

Location of Subsurface Water at Face-Up Areas

No water was encountered at face-up areas.

Stratigraphy

There are four coal seams of minable thickness in the mine plan area. All four are part of the Blackhawk Formation of the Cretaceous Mesa Verde Group. The Blackhawk consists of three members. Stratigraphically, from bottom to top, they are the Aberdeen Member, the Kenilworth Member, and the Sunnyside Member (see Figure III-2).

The bottom coal seam is the Aberdeen (also known as the Castlegate "A" Seam). It is found in the Aberdeen Member of the Blackhawk. This coal seam rests directly on approximately 150 feet of basal sandstone. This sandstone is of littoral marine origin and is known as the Aberdeen Sandstone. The coal seam ranges from 4 feet to 13 feet in thickness over the property. Above the seam is approximately 90 feet of interbedded sandstone, siltstone, and carbonaceous shale containing coal riders.

The second seam is the Gilson Seam and ranges in thickness from 4 feet to 8 feet over the property. The Gilson is part of the Kenilworth Member of the Blackhawk. Directly below the Gilson is approximately 90 feet of interbedded sandstone, siltstone, and carbonaceous shale with coal riders. Below this is approximately 70 feet of barrier beach sandstone known as the Kenilworth Sandstone. Above the Gilson is approximately 100 feet of interbedded sandstone, siltstone, shale, and coal riders.

The third seam is the Centennial Seam ranging from 4' to 8' in thickness. The Centennial Seam is part of the Sunnyside member of the Blackhawk. The Centennial Seam lies approximately 40' below the Lower Sunnyside Sandstone. Below the Centennial Seam is approximately 130' of interbedded sandstone, siltstone, shale,
and coal riders.

The top seam is the Lower Sunnyside Seam, ranging from 4 feet to 5 feet in thickness. The Lower Sunnyside is part of the Sunnyside Member of the Blackhawk. Below the coal seam is approximately 50 feet of barrier beach sandstone known as the Lower Sunnyside Sandstone. Above the coal seam is about 250 feet of interbedded sandstone, siltstone, shale, and coal riders.

Above the Blackhawk, the Castlegate Sandstone and Price River Formation of the Mesa Verde Group can be found over various parts of the property. The North Horn Formation is also present in certain areas of the property. Total overburden on the mine plan area ranges from 0 to 2,700 feet.

There are unleased federally owned coal reserves adjacent to the permit area. Andalex has assumed ownership on part of this coal contained in the Graves Tract which is now a part of this MRP. Andalex will access this lease from the existing underground workings as has been done in the past when Andalex has added new leases. In addition to the Graves Tract there is still some unleased federal adjacent to the Centennial property which is of questionable value. The Centennial coal seam is accessed from the existing Pinnacle Mine which is in the Gilson Seam. It is accessed via rock tunnels which are approximately 500' in length. The Centennial and Aberdeen Seams on the AEP Lease will be accessed through an extension of existing underground workings.

The Aberdeen sandstone in our vicinity is 80 to 100 feet thick. Its lateral extent is from Castlegate to well east of the Centennial property. It is a very well known geologic marker in the Book Cliffs coal field. It is a medium grained, tightly cemented, cross bedded sandstone which contains very little or no water. It has been drilled into in every exploration hole in our leases. All other aquifers or water tables within our leases are perched.
Structure
Structure contours are aligned basically east-west. The coal beds dip northward at approximately six degrees. No faults are known to exist in the mine plan area. Overburden ranges from 0 to 2,700 feet.

Hydrologic Aspects
All groundwater exists as perched aquifers in the mine plan area. Due to the lenticular nature of the geology in the area, any groundwater is isolated and very limited. Please see Water Quality Data in Appendix L. Also, please note that the Sunedco property recently acquired by Andalex was included in the Vaughn Hansen/Andalex Hydrologic Inventory prepared for the original PAP and the emergency lease (please see Appendix L). Also included in Appendix L are the Graves and AEP PHC's.

The occurrence the Division has referred to where Andalex intercepted groundwater was actually not groundwater per se but water which had accumulated in old mine workings over a number of years (45 to 50 years). This was a one time occurrence. Water accumulates in small burned out voids because they are down dip from the burned outcrop. Andalex uses the practice of advanced drilling to avoid these areas. This is the only water which has been or will be encountered as the Andalex permit area is free from faulting or any other means of water conveyance.

Location of Subsurface Water
Some of the sandstone beds of the Blackhawk Formation are water bearing in the mine plan area. Most of the beds are dry however, and partially drained of water near the cliff faces. Groundwater is perched due to the lenticular geology and any groundwater is isolated. The geology and specifically the lenticular nature of the beds on the new AEP lease are the same as what has been described in the original permit area. Also, any water bearing units are small in areal extent. The lowermost aquifer known in this area is the Aberdeen Sandstone, which is monitored below the lowermost coal seam. The newly acquired AEP Lease is included in the Andalex Hydrologic Inventory.

Source of Data
Analysis was performed on rib samples and core samples obtained during the exploration activities described. Results of these analyses are listed according to seam in Appendix E.

Analysis was performed by: Commercial Testing and Engineering Company, 10775 East 51st Avenue, Denver, Colorado 80239, and other commercial testing laboratories.
Coal Seams

Total Sulfur Content

Please see Appendix E.

Other Characteristics

Please see Appendix E.

Stratum Immediately Overlying Each Coal Seam to be Mined

Lithology (See Figures III-2 and III-3).

Aberdeen Coal Seam (Castlegate "A") - overlying this seam is interbedded sandstone, siltstone, and carbonaceous shales of the Aberdeen Member of the Blackhawk.

Gilson Coal Seam - overlying this seam is interbedded sandstone, siltstone, and shale with coal riders of the Kenilworth Member of the Blackhawk.

Centennial Coal Seam - overlying is interbedded sandstone, siltstone, and shale, and coal riders of the Sunnyside Member of the Blackhawk.

Lower Sunnyside Seam - overlying this seam is interbedded sandstone, siltstone, shale and coal riders of the Sunnyside Member of the Blackhawk.

It should be noted however, that the immediate "roof" over each seam is a sandstone unit, over which is found the silts, shales, and various coal riders.

Pyritic Content (Laboratory Analyses)
Complete analyses of these strata are included in Appendix E.

Potential Alkalinity (Laboratory Analyses)
Complete analyses of these strata are included in Appendix E.

Stratum Immediately Underlying Each Coal Seam to be Mined

Lithology (See Figure III-2 and III-3).

Aberdeen (Castlegate "A" Seam) - underlying this seam is basal sandstone of littoral marine sandstone, the Aberdeen Sandstone of the Aberdeen Member.
Gilson Seam - underlying this seam is interbedded sandstone, siltstone, shale, and coal riders of the Kenilworth Member.

Centennial Seam - underlying this seam is interbedded sandstone, siltstone, and shale, and coal riders of the Kenilworth Member.

Lower Sunnyside Seam - underlying this seam is barrier beach sandstone, the Lower Sunnyside Sandstone of the Sunnyside Member.

It should be noted however, that the immediate "floor" below the seams is sandstone in the case of the Lower Sunnyside and Aberdeen; and beneath the Gilson, and Centennial, siltstone.

Pyritic Content (Laboratory Analyses)

Complete analyses of these strata are included in Appendix E.

Potential Alkalinity (Laboratory Analyses)

Complete analyses of these strata are included in Appendix E.

Clay Content (Laboratory Analyses)

Complete analyses of these strata are included in Appendix E.

R645-301-512.200. PLANS AND ENGINEERING DESIGNS

Existing Structures

All existing structures are situated on the Zion's fee land, on federal lease SL-027304, or on right-of-way UTU-62045 and are shown on Plate 6. There are no structures existing as part as Andalex's facility which were constructed prior to 1980. Originally it was anticipated that all buildings and structures were to be completed during the first five year permit term. Obviously this is not the case since the Aberdeen Mine has only recently been completely finished to this date. Plate 6 depicts the Aberdeen Mine with the surface facilities completed in early 1990. A new fan for the Aberdeen Mine will be constructed in the left fork of Deadman Canyon. Underground rock tunnels access the Centennial Seam. See 1.1, 2.1-1, 2.1-4.

Existing structures include the following:

- Bathhouse (5) 14' x 60'
- Mine Water Storage Tanks (3) 12' x 16'
- Warehouse (1) 14' x 60'
- Lamphouse (2) 40' x 40'
- Substations (2) 60' x 100'
- Office Building 28' x 60'
- Mine Fans (4) 88''
- Portals (15) 6' x 20'
- Culinary Water Tanks (3) 12' x 10'
- Shop 80' x 120'
- Guard Shack 8' x 8'
The Aberdeen Mine surface facilities will include one additional bathhouse, and one lamphouse.

Upon completion of mining activities, the portals will be sealed according to existing state and federal regulations and all buildings and structures not being utilized as part of the reclamation sequence, will be removed.

Construction Schedule

All of the above structures have been completed. The earthwork for the Aberdeen Mine was completed in 1989. The surface facilities were in early 1990. Construction has been located and carried out so as to prevent and control erosion, siltation, water pollution, and damage to property. All facilities have been designed and constructed and will be maintained and used in a manner which prevents damage to wildlife and related environmental values. Any future construction will be conducted in a similar manner according to regulations regarding protection of the hydrologic system, etc. The rock tunnels for the Centennial Seam development were constructed in the spring of 1990 and completed late in 1990. As previously discussed this mining will require no new surface facilities except the left fork fan installation (1994). It should be noted that no construction activities will occur within one-half mile of the Golden Eagle nest located in the left hand fork during the nesting season, February 15 through July 15, if it is determined that the nest is active. Also, to minimize disturbance to wintering elk and deer there shall be no construction activities from December 1 through April 15. Except for snow removal, all routine maintenance will be accomplished from inside the mine.

Upon completion of construction of the left hand fork fan installation, Andalex will perform a slope stability study to ensure that all road embankments of a minimum static safety factor of 1.3. This study will also determine that the cut and fill slopes of the pad have a minimum static safety factor of 1.3. It should be noted that the construction of the pad will be consistent with common construction practices including limiting the thickness of lifts to a maximum of four (4) feet.

Reclamation of the pad, which is shown on the Cut Fill Cross Section Plates, will occur immediately after cessation of mining. Reclamation will consist of culvert removal with appropriate drainage protection, and regrading and backfilling to the original contour. Recontouring of the access road will take place following cessation of mining activities. As this road has been in place for many years sufficient fill material may not be available for complete recontouring; however, every effort will be made to achieve the approximate original contour. This will
be followed by replacement of topsoil and permanent revegetation. At all times during reclamation appropriate sediment control such as straw dikes and silt fences will be employed to prevent additional sediment contributions to the drainage system.

**Construction Methods**

**Major Equipment**

The portal and building sites were leveled using dozers, trucks, and loaders. At the building sites, the topsoil was removed and transported to a nearby area for storage.

All surface pads have been graveled and all other disturbed areas (pond embankments, etc.) have been reseeded.

**R645-301-512.210.** **EXCESS SPOIL**

N/A Revised 8/8/95

**R645-301-512.220.** **DURABLE ROCK FILLS**

N/A

**R645-301-512.230.** **COAL MINE WASTE**

There has been no development waste or excess spoil to date excepting sedimentation pond material. In the event sediment pond material were to catch fire, it would be compacted. MSHA and the Division have approved the disposal of sediment pond material (coal mine wash) underground. Therefore, inspections are not required.

**Coal Processing Waste**

N/A - Text removed as directed in Technical Analysis Requirements.

**Coal Refuse**

Please refer to Plate 6 for location of disposal areas.
Impoundments

Three sedimentation ponds have been constructed so far as shown on Plate 6. Pond A, as its capacity was not required, is now being used for snow storage and topsoil storage. The sedimentation and drainage control plan has been designed according to OSM regulations and the design and construction certified by a Utah Registered Professional Engineer. No other embankments, or other impoundments have been built nor are any proposed.

General Description

The Andalex Deadman Canyon Project is comprised of three mines located closely together in Deadman Canyon. The Pinnacle Mine, Apex Mine, and the Aberdeen Mine are all presently in operation mining the Gilson and Lower Sunnyside Seams and the A Seam. The Centennial Seam is mined via rock tunnels from the existing Pinnacle Mine. Surface runoff from the Pinnacle Mine and Apex Mine is controlled by Settling Basin B and Pond C. Engineering Design for these ponds have been presented to the Division of Oil, Gas, and Mining on 4-3-80 and 8-21-81. Surface runoff from the Aberdeen Mine is controlled by Pond E. Designs for these basins and ponds are shown on Plates 11, 12, and 13 included herein.

The mines are located in the Right Fork of Deadman Canyon. This is an ephemeral drainage flowing only from direct runoff and eventually reaches the Price River some 12 miles to the south. The major drainages in the minesite area will be routed under the site through large culverts. The existing minesite has a disturbed area of 34.2 acres. Please note that a certain percentage of the disturbed area does not report to sedimentation ponds. Please refer to Plates 7 and 8 for these areas. Actual disturbed area reporting to basins and ponds is approximately 26 acres. Sediment pond designs include undisturbed areas reporting to ponds. In order to minimize additional sediment loading to the main drainage, these ponds and basins will collect runoff from these approximately 27 acres. Berms will be placed on the lower edge of all disturbed areas to prevent runoff from reaching natural drainages before it has passed through the sedimentation ponds except in small area exemptions. Ponds are designed for maximum runoff including the chidister water. Areas draining to Pinnacle and Apex portals are to be included.

Sedimentation Pond Specifications

Location

The ponds are located over the main drainage of the Right Fork of Deadman Canyon. The main canyon drainage is routed through a 36-42" culvert located under the ponds. The sites are located downslope of the disturbed areas to simplify collection of runoff.
Design

The ponds are designed to fully contain the expected runoff and sediment load from a 10-year 24-hour precipitation event in this area. Pond "C" has additionally been shown to fully contain the runoff from a 100-year 6-hour storm. The design has been certified by a registered professional engineer. A certification statement for the ponds can be found at the end of Appendix N.

Construction

The construction of the ponds have been completed as per the specifications set forth in the Construction Specifications sheet (part 2.3).

Capacity

Each pond is designed to contain the runoff and sediment load from a 10-year 24-hour precipitation event in the area of drainage. In addition, each pond has an overflow capacity in excess of that required for a 25-year X-hour event. Pond "C" has been designed to contain and pass the runoff from a 100-year 6-hour event.

Safety Precautions

The ponds were built as per specifications and under supervision of a qualified, registered professional engineer. The ponds are inspected quarterly for safety and compliance. Inspection reports are maintained on-site, and submitted to the Division on an annual basis. Ponds will be cleaned at minimum when sediment reaches 60% of designed sediment volume. Measuring devices will be installed in the ponds to show when the ponds have filled with sediment to the clean-out level (please see plates 11, 12, and 13). Drainage directly into the Pinnacle and Apex Portals is not part of the calculation for sediment pond sizing. (Pond C)

Monitoring

Water monitoring stations will be established at the outlet of the ponds. Sample parameters and frequencies shall be as per specification of the NPDES permit.

Maintenance

The ponds shall be inspected after each storm and the sediment cleaned as necessary. In no event shall sediment be allowed to build beyond 60% of sediment design capacity.

Seeding

[Seeding Details]
An approved seed mix will be applied to all feasible disturbed areas in an effort to minimize erosion and sediment loading to the ponds. The proper seed mixture for this area has been obtained through the local BLM.

**Culverts**

All culverts are shown on Plate 9. Calculations for sizing are also included. It should be noted that all culvert sizes were arrived at and approved through consultation with the DOGM hydrologic engineer.

**Calculations**

The following reflects the calculations for sizing and details of each separate pond. Plates 6 through 13 show pond locations and volumes as well as watershed areas.

**Construction Specifications for Sedimentation Ponds**

All construction of sedimentation ponds have been performed under the direction of a qualified registered professional engineer.

Dams are constructed with primary overflows at least 2 ft. from the top, and emergency overflows at least 1.5 ft. from the top. The areas of the pond construction had been examined for topsoil, and if present in removable quantities such soil was removed separately and stored in an approved topsoil storage location.

In areas where fill was to be placed, natural ground was removed for at least 12" below the base of the structure.

Native materials were used where practical. Fill was placed in lifts not exceeding 15" and compacted prior to placement of the next lift. Compaction of all fill materials is at least 95%.

Grouted rip-rap or culverts have been placed at all inlets and outlets to prevent scouring. Each pond is fitted with an inverted inlet to the primary overflow, to prevent the passage of oil into the discharge.

Slopes of the dams are not steeper than 2.0:1, inside and outside, with a total of the inslope and outslope not less than 5:1. The inside slope of Pond E exceeded the steepness of 2:1. In part these slopes are incised and in part are constructed in from fill. Because of the steepness of these side slopes an investigation of stability was performed by Palmer Wilding Engineers. The conclusion was that the stability analysis is adequate and a stable section with respect to shear under static loading conditions is indicated. Please Appendix K.

Tops and external slopes of the dams were planted with an...
approved seed mix to prevent erosion and promote stability. Compaction of the slopes were at least 95%. Top width of dams are not less than \((H + 35)/5\).

**Primary Settling Basins (Formerly Pond B)**

**General Notes**

The primary settling basins (formerly Pond B) are located above Pond "C". A disturbed area of 9.42 acres drain into the settling basins as shown on Plate 8. These basins collect sediment and runoff from this area; however, since they are a series of cells, any overflow from the basins will be cleaned and go into Pond "C".

It is proposed that 18" culverts be added between cells B-1 and B-2, and between B-2 and B-3. An 18" culvert already exists between cells B-3 and B-4. These culverts will prevent breaching of the dikes between cells during major runoff events. The inflow to the basins is from culverts CD-12 and CD-13, which is a total of 2.79 cfs, as shown on Table IV-3C. Based on the Manning's Equation for culverts (p.169-C), the required diameter to carry a flow of 2.79 cfs is only 0.95 feet; therefore, the 18" culvert overflows are more than adequate to pass the design flow. The placement of the culverts will not affect the maximum water levels or sediment storage capacity of the basins.

The basins are cleaned when sediment accumulations reach 50% of the original volume. The original volume was 0.540 acre feet, and the sediment cleanout level (0.270 acre feet) is at the culvert inlet level between cells B-2 and B-1 as shown on certified Plate 11.
Pond C

1. Use 1.82” for 10 year - 24 hour event
   Use 1.91” for 100 year - 6 hour event

2. Disturbed Watershed - 14.79 acres

3. Runoff Curve No. = CN = 90

4. Area Runoff = \(Q\) (in.) = \((P-0.2S)^2/(P+0.8S)\); Where:
   \[S = (1,000/CN) - 10\]
   \[Q_{10/24} = 0.942 \text{ in.}/12 = 0.0785 \text{ ft.}\]
   \[Q_{100/6} = 1.018 \text{ in.}/12 = 0.0848 \text{ ft.}\]
   Disturbed Volume \(10/24\) = 14.79 ac. \(\times\) 0.0785 ft. = 1.161 ac. ft.
   Disturbed Volume \(100/6\) = 14.79 ac. \(\times\) 0.0848 ft. = 1.254 ac. ft.

5. Undisturbed Watershed - 30.89 acres

6. Runoff Curve No. = CN = 70

7. Area Runoff:
   \[Q_{10/24} = 0.180 \text{ in.}/12 = 0.0150 \text{ ft.}\]
   \[Q_{100/6} = 0.208 \text{ in.}/12 = 0.0173 \text{ ft.}\]
   Undisturbed Volume \(10/24\) = 30.89 ac. \(\times\) 0.0150 ft. = 0.463 ac. ft.
   Undisturbed Volume \(100/6\) = 30.89 ac. \(\times\) 0.0173 ft. = 0.534 ac. ft.

8. Sediment Storage:
   **Disturbed Area 14.79 ac. \(\times\) 0.05 ac. ft./ac. = 0.740 ac. ft.
   ***Undisturbed Area 30.89 ac. \(\times\) 0.016 ac. ft./ac.
   = 0.494 ac. ft.
   Total Sediment Storage Volume Required = 1.234 ac. ft.
   60% Cleaning Point = 0.740 ac. ft.

9. Direct Precipitation into Pond
Area of Ponds = 0.39 acres

Volume $10/24 = 0.39 \text{ ac.} \times 1.82 \text{ in.}/12 \text{ in.}/\text{ft.} = 0.059 \text{ ac. ft.}$

Volume $100/6 = 0.39 \text{ ac.} \times 1.91 \text{ in.}/12 \text{ in.}/\text{ft.} = 0.062 \text{ ac. ft.}$

10. Total Required Pond Volume

Volume $10/24 = 1.161 + 0.463 + 1.234 + 0.059 = 2.917 \text{ ac. ft.}$

Volume $100/6 = 1.254 + 0.534 + 1.234 + 0.062 = 3.084 \text{ ac. ft.}$

11. Pond Volume at Outlet

18" cmp oil skimmer = 3.321 ac. ft.

36" cmp overflow = 4.264 ac. ft.

12. Conclusions:

A. Pond size is adequate to contain the runoff and sediment load from a 10 year - 24 hour precipitation event.

B. Pond size is also adequate to contain the runoff and sediment load from a 100 year - 6 hour precipitation event.

* Includes runoff to "Primary Settling Basins" (Formerly Pond B)

** Does not include sediment to "Primary Settling Basins". The sediment factor of 0.05 acre-ft./acre is considered conservative due to the extensive paving (roads and loadout area), and the grouted or paved ditches to the pond.

The USLE calculation for Disturbed Areas (Table IV-9) shows the actual expected sediment yield to be much lower than the 0.05 figure used.

*** Sediment yield taken from the USLE calculations on Table IV-10, "Sediment Yield for Undisturbed Areas".

INCORPORATED

OCT 07 2002

DIV OF OIL GAS & MINING

5-39
## STAGE-VOLUME DATA FOR POND "C"

<table>
<thead>
<tr>
<th>STAGE</th>
<th>ELEVATION</th>
<th>VOLUME (Ac. Ft.)</th>
<th>ACC. VOL. (Ac. Ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottom</td>
<td>7040.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>7042.0</td>
<td>0.082</td>
<td>0.082</td>
</tr>
<tr>
<td></td>
<td>7044.0</td>
<td>0.162</td>
<td>0.244</td>
</tr>
<tr>
<td></td>
<td>7046.0</td>
<td>0.293</td>
<td>0.537</td>
</tr>
<tr>
<td>60% Sed. Cleanout</td>
<td>7046.9</td>
<td>0.203</td>
<td>0.740</td>
</tr>
<tr>
<td></td>
<td>7048.0</td>
<td>0.266</td>
<td>1.006</td>
</tr>
<tr>
<td>Max. Sed. Level</td>
<td>7048.7</td>
<td>0.228</td>
<td>1.234</td>
</tr>
<tr>
<td>Decant Level</td>
<td>7049.7</td>
<td>0.330</td>
<td>1.564</td>
</tr>
<tr>
<td></td>
<td>7050.0</td>
<td>0.099</td>
<td>1.663</td>
</tr>
<tr>
<td></td>
<td>7052.0</td>
<td>0.862</td>
<td>2.525</td>
</tr>
<tr>
<td>10yr.- 24 hr. Volume</td>
<td>7052.7</td>
<td>0.392</td>
<td>2.917</td>
</tr>
<tr>
<td>100yr.- 6 hr. Volume</td>
<td>7053.1</td>
<td>0.167</td>
<td>3.084</td>
</tr>
<tr>
<td>18&quot; Oil Skimmer</td>
<td>7053.5</td>
<td>0.237</td>
<td>3.321</td>
</tr>
<tr>
<td></td>
<td>7054.0</td>
<td>0.297</td>
<td>3.618</td>
</tr>
<tr>
<td>36&quot; CMP Overflow</td>
<td>7055.0</td>
<td>0.646</td>
<td>4.264</td>
</tr>
<tr>
<td>Crest of Embankment</td>
<td>7056.5</td>
<td>0.969</td>
<td>5.233</td>
</tr>
</tbody>
</table>
Pond "C" - General Notes

The sizing of Pond C is based on the drainage areas delineated on Plate 8 - "Drainage Map". As can be seen from this Plate, a portion of the minesite drainage goes into the Pinnacle Mine, the old Chidister Portal, and the Apex Mine. The actual disturbed area draining directly to Pond "C" was planimetered from this Plate and determined to be 10.72 acres. The disturbed area flowing to the "Primary Settling Basins" was measured to be 4.07 acres. This flow drains to Pond "C" and is therefore considered in the sizing; however, the projected sediment load to the Primary Settling Basins is not considered in sizing Pond "C", since the basins could be completely full of sediment before it could impact Pond "C". As stated earlier, the Primary Settling Basins will be cleaned when sediment accumulation reaches one-half of the total basin volume; therefore, sediment from this area will not impact Pond "C".

In addition, a certain amount of undisturbed area does not flow into the undisturbed drainage culverts, and thus drains onto the mine site (see plates 8 and 9). The portion of this drainage that flows to Pond "C" was measured at 30.89 acres, and is included in the Pond "C" sizing calculations.

Runoff Curve numbers used in the calculations were: 90 for disturbed areas and 70 for undisturbed areas.

An "As-Constructed" plan and profile of Pond "C" is shown on Plate 12. This plate has been certified by a registered, professional engineer. Also shown on this plate is a proposed sediment marker, and maximum and cleaning point depths for sediment. The cleaning point for sediment is at 60% of the maximum design depth for sediment storage. This point will be clearly marked on the sediment marker.

Also shown on Plate 12 is the location of each of the pond inlets. Inlets are either grouted concrete or culvert, and do not require rip-rap or other additional erosion protection.

Pond "C" will be removed during the earthwork portion of reclamation. The culvert will also be removed and the main channel restored throughout the area. All reclaimed area above will then drain into Pond "E" below.

Decanting for Pond C, as needed, will be accomplished with pumps located at the minesite. Decanted water will be pumped into the primary spillway once the 24 hour retention time has been met. An access ramp will be constructed to allow for inspection and sampling at the overflow riser pipe.
1. Use 1.82" for 10 year - 24 hour event
2. Disturbed Watershed - 12.21 acres
3. Runoff Curve No. = CN = 90
4. Area Runoff = $Q \ (\text{in.}) = \frac{(P-0.2S)^2}{(P+0.8S)}$; Where:
   
   $$S = \frac{(1,000/CN)}{10}$$
   $$P = 1.82"$$
   $$Q \ (\text{in.}) = \frac{[1.82-0.2(1.11)]^2}{[1.82+0.8(1.11)]} = \frac{2.553}{2.709} = .94 \text{ in.} = .0785 \text{ ft.}$$
   
   Volume = 12.21 acres x 0.0785 ft. = 0.959 acre-ft.
5. Undisturbed Watershed - 12.20 acres
6. Runoff Curve No. = CN = 70
7. Area Runoff = 12.20 ac. x 0.2 in./12 = 0.203 acre-ft.
8. Sediment Storage Volume
   
   12.21 acres x 0.1 acre-ft./acre = 1.221 acre-ft. *
   
   60% Cleaning Point = 0.733 acre-ft.
9. Direct Precipitation into Pond
   
   Area of Ponds = 0.500 acres
   
   0.500 acres x 1.82 in. x 1/12 ft./in. = 0.076 acre-ft.
10. Total Required Pond Volume
    
    0.959 + 0.203 + 1.221 + 0.076 = 2.459 acre-ft.
11. Pond Volume @ Outlet (Principle Spillway)
    
    Total Pond Volume = 2.569 acre-ft. (As constructed)
12. Conclusion: Pond size is adequate to contain the runoff and sediment load from a 10 year - 24 hour precipitation event in the area of drainage to the pond.
Due to the elevation of the decant inlet, the maximum sediment storage volume is .930 ac-ft. However the 60% cleanout level will not be exceeded and the total pond volume takes into account the disturbed area of 12.21 acres.
### STAGE-VOLUME DATA FOR POND "E"

<table>
<thead>
<tr>
<th>STAGE</th>
<th>ELEVATION</th>
<th>VOLUME (Ac. Ft.)</th>
<th>ACC. VOL. (Ac. Ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5' Above Bottom</td>
<td>6936.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>6938.0</td>
<td>0.040</td>
<td>0.040</td>
</tr>
<tr>
<td></td>
<td>6940.0</td>
<td>0.070</td>
<td>0.110</td>
</tr>
<tr>
<td></td>
<td>6942.0</td>
<td>0.106</td>
<td>0.216</td>
</tr>
<tr>
<td></td>
<td>6944.0</td>
<td>0.141</td>
<td>0.357</td>
</tr>
<tr>
<td></td>
<td>6946.0</td>
<td>0.180</td>
<td>0.537</td>
</tr>
<tr>
<td>60% Sed. Level</td>
<td>6947.8</td>
<td>0.196</td>
<td>0.733</td>
</tr>
<tr>
<td></td>
<td>6948.0</td>
<td>0.025</td>
<td>0.758</td>
</tr>
<tr>
<td>Decant/Max. Sed. Level</td>
<td>6949.3</td>
<td>0.172</td>
<td>0.930</td>
</tr>
<tr>
<td></td>
<td>6950.0</td>
<td>0.092</td>
<td>1.022</td>
</tr>
<tr>
<td></td>
<td>6952.0</td>
<td>0.316</td>
<td>1.338</td>
</tr>
<tr>
<td></td>
<td>6954.0</td>
<td>0.376</td>
<td>1.714</td>
</tr>
<tr>
<td></td>
<td>6956.0</td>
<td>0.444</td>
<td>2.158</td>
</tr>
<tr>
<td>10yr.- 24hr. Volume</td>
<td>6957.2</td>
<td>0.301</td>
<td>2.459</td>
</tr>
<tr>
<td>Principle Spillway</td>
<td>6957.6</td>
<td>0.110</td>
<td>2.569</td>
</tr>
<tr>
<td>Emergency Spillway</td>
<td>6958.6</td>
<td>0.562</td>
<td>3.131</td>
</tr>
<tr>
<td>Top of Dam</td>
<td>6961.0</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Pond "E" - PM

Post Mining Sediment Control

1. Use 1.82" for 10 year - 24 hour event.

2. Disturbed (Reclaimed) Watershed - 34.2 acres
   a. Runoff Curve No. = 90
   b. Runoff Volume = 2.740 ac. ft.

3. Undisturbed Watershed = 805.50 acres
   a. Runoff Curve No. = 70
   b. Runoff Volume = 13.425 ac. ft.

4. Sediment Storage Volume = 0.150 ac. ft. (Upper Cell)

5. Direct Precipitation into Pond
   a. Use 0.5 acres
   b. 0.5 ac. x 1.82 in. x 1/12 = 0.076 ac. ft.

6. Expected Flow (10 yr. - 24 hr. event) = 88.94 cfs

7. Inflow Velocity (from RC-1) = 8.78 fps

8. Pond Configuration
   3 cells: 2 Gravel Filter Dikes and 1 Compacted Earthen Dam

9. Pond Capacity - 1.592 ac. ft.

Note: Pond is designed to clean and discharge runoff. Sediment will be removed by gravel filter dikes, and cleaned from pond when maximum sediment storage level is reached. Ponds will be cleaned when the 0.150 acre feet capacity of the upper cell is reached.

Pond "E" - General Notes

Pond "E" is to control runoff from the Aberdeen Mine. The disturbed area to drain to this pond is 12.21 acres. Pond E for the Aberdeen minesite was constructed prior to any other disturbance of the drainage area which report to the ponds.
Plate 13 shows the plan and profile of the pond. Also shown on this plate is a sediment marker and the level of the sediment 60% cleaning point. The constructed height of the dam includes a 5% settling factor. The elevations on Plate 13 are final.

Grouted rip-rap or culvert is used on all pond inlets; therefore, additional rip-rap or energy dissipators are not required.

Twelve 60" x 60" anti-seepage collars were installed on the main culvert beneath the pond. The collars are of concrete or a standard, manufactured design. Collar sizes and numbers are based on the following:

- Flow length = 340'
- Increase in flow length = 10% or 34'
- Use 60" x 60" anti-seep collars
- Each collar increases flow length by 2 x 8" or 3' therefore, use 12 anti-seep collars.

An emergency spillway has been constructed to convey overflow from the pond into undisturbed diversion UD-4 as shown on Plates 8 and 13. This spillway consists of 12" D50 grouted rip-rap as shown on Figure IV-6. The dimensions of this spillway are shown of Figure IV-6.

Pond E was constructed prior to any disturbance of the drainage area to the pond.

As built certified drawings of Sediment Pond E have been submitted.

**Pond "E" - PM - General Notes**

Upon reclamation, Pond "E" will be enlarged and left in place until revegetation standards are met, as shown on Plate 16. The culvert will be removed, and the pond will be reconstructed to clean and discharge the entire runoff from the drainage area above. Pond sizing calculations are shown on the page entitled "Pond E - PM", "Post-Mining Sediment Control". Andalex will commit to the concept of allowing the entire undisturbed and reclaimed area to drain into this one structure if approved.

The rationale for removing all upper ponds and diversions is based on the following:

1. Pond E is the lowermost structure, and can be rebuilt and later removed and reclaimed with minimum damage to the reclaimed site.

**INCORPORATED**

CCT 07 2692

DIV OF OIL GAS & MINING

5-47
2. The upper site can be reclaimed in a more natural and permanent manner, as shown on the post-mining topography map, Plate 17, without leaving temporary structures such as diversions, ponds, etc. Once vegetation is established, it will not have to be re-disturbed.

3. The extensive use of loose-rock check dams in the restored drainages will serve as effective sediment and erosion control, and will promote the establishment of a riparian area along the drainage.

Because of the large size of the undisturbed drainage above (805.5 acres), upon reclamation, it is proposed to construct a series of filtering ponds to clean and discharge the water rather than try to fully contain the runoff. The expected flow from a 10-year 24-hour event for the entire undisturbed and reclaimed area is 88.94 cfs at a velocity of 8.78 fps. The total volume of water would be approximately 16.2 acre-ft. It is proposed to build a 3-celled system with 2 gravel filter dikes and concrete grouted overflows. The upper 2 cells will act as filters for sediment removal, and the lower cell will become a settling basin for final cleaning prior to discharge. The pond discharge will be sampled per NPDES requirements to check for compliance with effluent standards.

It is expected that effluent standards will be met by this structure; similar filtering ponds have cleaned and discharged up to 1,000,000 gallons per day of sediment-laden mine water and remained in compliance.

The rationale for proposing such a filtering discharge system is based on the following:

1. The main purpose of sediment ponds or any other treatment facility is to control and minimize water pollution by causing the water to meet effluent standards; this type of system will accomplish this purpose:

2. Acceptable practices to control and minimize water pollution include:

   (i) Stabilizing the disturbed area through land shaping;

   (ii) Diverting runoff;

   (iii) Achieving vegetation standards;

   (iv) Regulating channel velocity of water;

   (v) Lining channels with rock or vegetation;

   (vi) Mulching;
(vii) Selectively placing and sealing acid-forming and toxic-forming materials;

(viii) Designing mines to prevent gravity drainage of acid waters;

(ix) Sealing;

(x) Controlling subsidence; and

(xi) Preventing acid mine drainage.

The planned reclamation at this site will meet the above criteria;

3. All surface drainage from the disturbed area, including areas that have been graded, seeded, or planted, shall be passed through a sedimentation pond, a series of sedimentation ponds, or a treatment facility before leaving the permit area.

The proposed pond will be equipped with a sediment marker, and cleaned as needed. The pond will also be fitted with a combined primary and emergency spillway, sized and protected to handle the 25-year 6-hour event.

When revegetation standards are met on the reclaimed site, the Pond "E -PM" will be removed, the main channel restored, and the area reseeded according to the approved plan.

Pond Discharge Structures

Principle Spillways

Pond C has a single spillway consisting of a 36" cmp riser pipe located 1.5' below the top of the dam at elevation 7,055.0. This pipe discharges directly into the main 42" culvert located beneath the pond. An 18" cmp skimmer pipe is located in the side of the 36" riser 1.5' below the riser inlet at an elevation of 7,053.5. This pipe will be the first to discharge, and will act as an oil skimmer since the pipe inlet is inverted with the intake approximately 1' below water level. Pond C will be decanted as needed by the use of a pump. Decanted water will go into the 36" riser and be discharged into the 42" cmp passing beneath the disturbed area.

The Pond E principle spillway consists of a 30" riser pipe, connected to the 42" culvert beneath the ponds. A decant device is also attached to the riser pipe for de-watering, and is controlled by a hand-operated valve. Both the riser pipe and decant are constructed to minimize oil from entering the discharging water. Please see Plate 13 for details on the
spillway structures for Pond E.

Emergency Spillways

The emergency spillway for Pond E is the open notch type with a trapezoidal cross section. The spillway is of grouted rip-rap as shown on Figure IV-6. The spillway dimensions are as shown on the Figure IV-6. This is located 12" above the principal spillway and 2' below the top of the dam. This structure is rip-rapped through the point of discharge and into the main channel. This spillway provides an added safety factor to protect the dam in the event of overload on the culvert discharge.

Pond E - PM Spillway

Pond E - PM will be constructed with an open-notch spillway in the lower cell to allow for safe discharge of runoff from the reclaimed area as well as the contributing undisturbed area. The spillway will be of grouted rip-rap and dimension as shown on Figure IV-6. Calculations for the spillway are shown.

The spillway for Pond C consists of an open 36" culvert which empties directly into the main 42" culvert which drains the main canyon. This spillway is open at the top and extends to within 2.5' of the top of the dam. At right angle to this spillway culvert is an 18" culvert to handle pre-design overflow conditions. This 18" pipe has an inverted inlet to skim oil and grease and flotsam from the water. This is considered a single spillway; however, the following discussion will explain how the pond meets the criteria for exemption of combination spillways required by R645-301-742-223.

Pond C - Exemption from R645-301-742-223

The following will describe how Pond C meets the criteria for exemption of the combination spillway requirements of R645-301-742.223 as provided in R645-301-742.225.2:
1 - Storage - The pond has been shown to be adequately sized to safely control the 100 year - 6 hour precipitation event. The pond will not only contain the 100 year - 6 hour event (including sediment), but the overflow will safely pass the runoff from such an event if necessary.

2 - Dewatering - Water can be safely removed from the pond in accordance with current, prudent engineering practices. For this pond, water will be removed by the use of a portable pump system. The following is a description of details relating to the dewatering operation:

a - The pump to be used is an electric 220 volt unit. The pump will be powered by a portable generator set. These units will be available on an as-needed basis.

b - The pump will dewater at a rate of approximately 350 gallons per minute. At 1.0' above the maximum sediment elevation, the 10 year - 24 hour volume is 1.683 acre-feet. At the proposed pumping rate, the pond would be dewatered in approximately 26 hours.

c - The decant water will be discharged directly into the 36" cmp overflow. Any discharge will be done in accordance with the UPDES permit conditions. Samples will also be taken as required.

d - The pump inlet line will be equipped with a floating intake and an oil skimming device. A typical drawing is included as Figure IV-13.

e - The 36" outlet pipe will be visibly marked to show the limit of the decant level. This marker will be placed 2' above the maximum sediment level. This allows for the 18" oil skimmer shown on Figure IV-13, plus the required 1' shutoff above maximum sediment elevation. The pump will be turned off when the water level is drawn down to this marker.

f - All storm water will be retained in the pond for a minimum of 24 hours, or until effluent limitations will be met prior to decanting.
Sedimentation Pond C to this date has never discharged. It is unlikely at any future date that the pond will discharge water. However, if a discharge ever occurs Andalex will construct an access ramp at that time. The access ramp will consist of a walk-way from the bank to the top of the stand-pipe. It will be equipped with hand rails and safety chains.

Certification Statement

A certification statement by a qualified, registered professional engineer that the pond will safely control the 100 year - 6 hour precipitation event, is included with this section.

Location

The pond is located where failure could be expected to cause loss of life or serious property damage. In accordance with the requirements, the pond is designed and constructed to safely control the runoff from a 100 year - 6 hour precipitation event. (See related table and certification with this section for designs, and Plates 8 and 12 for location and "As-Constructed" details of the pond).

Calculations:

The following pond spillway calculations have been shown separately for each sediment pond at this site. Each of the sheets is separately certified by a registered professional engineer, as required. (appendix N)

<table>
<thead>
<tr>
<th>Pond C - Spillway Calculations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Design Parameters</strong></td>
</tr>
<tr>
<td>(1) Disturbed Drainage Area (a.c.)</td>
</tr>
<tr>
<td>(1) Undisturbed Drainage Area (a.c.)</td>
</tr>
<tr>
<td>Runoff Curve No. (Dist.)</td>
</tr>
<tr>
<td>Runoff Curve No. (Undist.)</td>
</tr>
<tr>
<td>(2) Time of Concentration (hrs.)</td>
</tr>
<tr>
<td>Land Slope (%)</td>
</tr>
<tr>
<td>Hydraulic Length (ft.)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overflow</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 yr. - 24 hr. Event (in.)</td>
</tr>
<tr>
<td>Peak Flow 10/24 (cfs)</td>
</tr>
<tr>
<td>25 yr. - 6 hr. Event (in.)</td>
</tr>
<tr>
<td>Peak Flow 25/6 (cfs)</td>
</tr>
<tr>
<td>100 yr. - 6 hr. Event (in.)</td>
</tr>
<tr>
<td>Peak Flow 100/6 (cfs)</td>
</tr>
<tr>
<td>(3) Oil Skimmer Diameter (in.)</td>
</tr>
<tr>
<td>Overflow Diameter (in.)</td>
</tr>
<tr>
<td>Required Head</td>
</tr>
<tr>
<td>-------------------------</td>
</tr>
<tr>
<td>10/24 (ft.)</td>
</tr>
<tr>
<td>25/6 (ft.)</td>
</tr>
<tr>
<td>100/6 (ft.)</td>
</tr>
</tbody>
</table>

Notes:
1. Digitized from Plate 8.
2. Taken from Table IV-3A; Total Flows from DD-1, DD-2, & DD-3
3. Reference Only - Not included in calculations.
4. Taken from Stage Volume Curve - 36" riser only.
## Pond E - Spillway Calculations

### Design Parameters

1. Disturbed Drainage Area (ac.) 12.21  
1. Undisturbed Drainage Area (ac.) 12.20  

<table>
<thead>
<tr>
<th>Runoff Curve No. (Dist.)</th>
<th>90</th>
</tr>
</thead>
<tbody>
<tr>
<td>Runoff Curve No. (Undist.)</td>
<td>70</td>
</tr>
<tr>
<td>Time of Concentration (hrs.)</td>
<td>0.289</td>
</tr>
<tr>
<td>Land Slope (%)</td>
<td>8.00</td>
</tr>
<tr>
<td>Hydraulic Length (ft.)</td>
<td>1200</td>
</tr>
</tbody>
</table>

### Primary Overflow

<table>
<thead>
<tr>
<th>10 yr. - 24 hr. Event (in.)</th>
<th>1.82</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Flow 10/24 (cfs)</td>
<td>14.55</td>
</tr>
<tr>
<td>Riser Diameter (in.)</td>
<td>30&quot;</td>
</tr>
<tr>
<td>Required Head (ft.)</td>
<td>0.73</td>
</tr>
</tbody>
</table>

### Emergency Overflow

<table>
<thead>
<tr>
<th>25 yr. - 6 hr. Event (in.)</th>
<th>1.50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Flow 25/6 (cfs)</td>
<td>9.96</td>
</tr>
<tr>
<td>Structure Area Used (ft.²)</td>
<td>18.00</td>
</tr>
<tr>
<td>Required Structure Area (ft.²)</td>
<td>2.40</td>
</tr>
<tr>
<td>Depth of Flow (ft.)</td>
<td>0.41</td>
</tr>
<tr>
<td>Slope (%)</td>
<td>5.00</td>
</tr>
<tr>
<td>Velocity (fps)</td>
<td>4.15</td>
</tr>
</tbody>
</table>

### Notes:

1. Digitized from Plate 8.  
2. Taken from Table IV-3A; DD-4.
Pond E - PM - Spillway Calculations

**Design Parameters:**

1. **Disturbed Drainage Area (ac.)** 34.91
2. **Undisturbed Drainage Area (ac.)** 805.50
   - Runoff Curve No. (Dist.) 90
   - Runoff Curve No. (Undist.) 70
3. **Time of Concentration (hrs.)** 1.02
   - Land Slope (%) 19.83
   - Hydraulic Length (ft.) 10,200

**Overflow**

- 10 yr. - 24 hr. Event (in.) 1.82
  - Peak Flow 10/24 (cfs) 88.94
  - 25 yr. - 6 hr. Event (in.) 1.50
  - Peak Flow 25/6 (cfs) 45.77
  - Structure Area Used (ft.²) 18.0
  - Slope of Spillway (%) 33.3
  - Required Structure Area
    - 10/24 (ft.²) 5.58
    - 25/6 (ft.²) 3.54
  - Depth of Flow 10/24 (ft.) 0.84
  - Depth of Flow 25/6 (ft.) 0.58
  - Velocity 10/24 (fps) 15.94
  - Velocity 25/6 (fps) 12.94

**Notes:**
1. From Plates 8 & 9; Includes B.T.C.A. Areas
2. Taken from Table IV-4
3. Single, open channel spillway

---

**INTEGRATED**

**OCT 07 2002**

**DIV OF OIL GAS & MINING**

---

5-55
STAGE-DISCHARGE DATA
FOR
SEDIMENT POND "C"

<table>
<thead>
<tr>
<th>Elevation</th>
<th>$Q_w$</th>
<th>$Q_o$</th>
<th>$Q_p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>7055.00</td>
<td>0</td>
<td>0</td>
<td>42.66</td>
</tr>
<tr>
<td>7055.50</td>
<td>*10.00</td>
<td>24.07</td>
<td>43.25</td>
</tr>
<tr>
<td>7055.74</td>
<td>*18.00</td>
<td>29.28</td>
<td>43.52 (25/6)</td>
</tr>
<tr>
<td>7055.98</td>
<td>*27.43</td>
<td>33.69</td>
<td>43.80 (10/24)</td>
</tr>
<tr>
<td>7056.00</td>
<td>*28.27</td>
<td>34.04</td>
<td>43.82</td>
</tr>
<tr>
<td>7056.05</td>
<td>*30.42</td>
<td>34.88</td>
<td>43.88 (100/6)</td>
</tr>
<tr>
<td>7056.50</td>
<td>51.94</td>
<td>*41.68</td>
<td>44.39</td>
</tr>
</tbody>
</table>

Notes: (1) $Q_w = \text{Weir Flow} = CLH^{3/2} ; C=3.0$

(2) $Q_o = \text{Orifice Flow} = C'a \sqrt{2gH} ; C'=0.6$

(3) $Q_p = \frac{a(2gH')^{1/2}}{1+K_e+K_b+K_cL}^{1/2}$
$L=1600'; K_e=1.0; K_b=0.5; K_c=0.0246; H'=H+18.1$

(4) For 36" Overflow Culvert only. Effects of 18" Oil Skimmer have been ignored.
STAGE-DISCHARGE
CENTENNIAL POND C

STAGE (Elev. - Ft.)

STAGE-VOLUME CURVE

Weir Flow  Orifice Flow  Pipe Flow

Note: Does not include 18" Oil Skimmer.
CERTIFICATION STATEMENT

FOR

CENTENNIAL MINES

SEDIMENT POND "C"

In accordance with the requirements of R645-301-742.225.2, I, Dan W. Guy, Registered Professional Engineer, State of Utah No. 4548, do hereby certify that the Centennial Mines Sediment Pond "C" will safely control the 100 year - 6 hour design precipitation event.

This certification is based on the calculations and discussions pertaining to Pond "C" in Chapter IV, Section K.2 of the Centennial Mines M.R.P. and the "As-Constructed" map of Pond "C" (Plate 12).

INCORPORATED

OCT 07 2002

DIV OF OIL GAS & MINING
## CHANNEL FLOW CALCULATIONS

FOR: POND "E" - EMERGENCY SPILLWAY

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bed Slope</td>
<td>0.05</td>
</tr>
<tr>
<td>Manning's N</td>
<td>0.04</td>
</tr>
<tr>
<td>Bottom Width</td>
<td>5 feet</td>
</tr>
<tr>
<td>Channel Side Slope</td>
<td>0.5</td>
</tr>
<tr>
<td>Flow Depth</td>
<td>0.6950414 feet</td>
</tr>
<tr>
<td>Cross Sectional Area</td>
<td>4.441372 square feet</td>
</tr>
<tr>
<td>Wetted Perimeter</td>
<td>8.10832 feet</td>
</tr>
<tr>
<td>Hydraulic Radius</td>
<td>0.547755 feet</td>
</tr>
<tr>
<td>Discharge</td>
<td>24.74 cubic feet / sec</td>
</tr>
<tr>
<td>Velocity</td>
<td>5.570351 feet / sec</td>
</tr>
</tbody>
</table>

**INCORPORATED**

OCT 07 2002
DIV OF OIL GAS & MINING
Culverts

General

Culverts have been sized as per the designations on Plates 8 and 9, and are placed to drain on a minimum of 0.0556 (1 ft./18 ft.) slope. Undisturbed drainage culverts (shown on Plate 9) are fitted with trash racks in drainages where introduction of rocks and other debris into the main culvert is foreseen as a problem. The main culvert inlet (C-1a) is fitted with a trash rack. All disturbed area culverts are designated with a CD-number as shown on Plate 8. These culverts handle much smaller flows and are thus not fitted with trash racks in most cases.

The undisturbed area culverts (C-0 through C-13) flow into the main culvert. The main culvert outlets at section C-15, which is protected from erosion as described on Table IV-7. Disturbed area culverts (CD-1 through CD-7) as shown on Plate 8 discharge onto grouted rip-rap surfaces for protection from erosion. Energy dissipators are also employed where necessary to reduce velocities and prevent erosion from culvert discharges (see Plate 8).

Maintenance

Culverts shall be inspected regularly, and cleaned as necessary to provide for passage of designed flows. Inlets and outlets shall also be maintained so as to prevent plugging or undue restriction of water flow.

Size Justification

The following note on the undisturbed culverts is for reference only, to show the original design criteria. Due to the complicated nature of the undisturbed culvert flows, it was decided that a drainage system analysis would be used to demonstrate the ability of the system to pass the design event. This system analysis is provided in Appendix 0 and shows the existing system to be more than adequate for the design storm event.

Undisturbed Area Culvert Size Determination*

Source:

Peak Flow - SCS-TR-55 Method For Type II Storms:

\[ q_p = q_p'LQ; \]

- \( A \) = Watershed in square miles;
- \( Q \) = Runoff volume in inches;
- \( q_p' \) = Discharge from Fig. 2.40
- \( q_p \) = Peak Discharge in cfs.

**Source:**

B.L.M. State Engineer

**Manning Equation:**

\[ D = 2.16Qn^{0.375} \]

- \( D \) = Diameter (feet)
- \( Q \) = \( q_p \) = Peak Discharge (cfs)
- \( n \) = roughness factor (0.02 for steel culvert)
- \( s \) = slope (0.0556\% = 1 foot for 18 feet)

Using the above formulas, minimum culvert sizes were calculated based on 100% runoff from a 10 year - 24 hour storm.

* Reference Only - See Appendix 0 for justification of culvert sizes.

**Watershed and Culvert Sizing Map (Plate 9)**
<table>
<thead>
<tr>
<th>Culvert</th>
<th>Watershed Area (acres)</th>
<th>Culvert Needed (in.)</th>
<th>Culvert Used (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-0</td>
<td>36.65</td>
<td>13</td>
<td>18</td>
</tr>
<tr>
<td>C-1a</td>
<td>469.51</td>
<td>22</td>
<td>36</td>
</tr>
<tr>
<td>C1</td>
<td>506.16</td>
<td>22</td>
<td>36</td>
</tr>
<tr>
<td>C2</td>
<td>23.03</td>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td>C3</td>
<td>529.19</td>
<td>23</td>
<td>36</td>
</tr>
<tr>
<td>C4</td>
<td>77.29</td>
<td>16</td>
<td>30</td>
</tr>
<tr>
<td>C5</td>
<td>606.48</td>
<td>23</td>
<td>36</td>
</tr>
<tr>
<td>C6</td>
<td>26.87</td>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td>C7</td>
<td>633.35</td>
<td>24</td>
<td>42</td>
</tr>
<tr>
<td>C8</td>
<td>45.25</td>
<td>14</td>
<td>30</td>
</tr>
<tr>
<td>C9</td>
<td>678.60</td>
<td>25</td>
<td>42</td>
</tr>
<tr>
<td>C10</td>
<td>18.16</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td>C11</td>
<td>696.73</td>
<td>25</td>
<td>42</td>
</tr>
<tr>
<td>C12</td>
<td>55.31</td>
<td>14</td>
<td>18</td>
</tr>
<tr>
<td>C13</td>
<td>752.04</td>
<td>27</td>
<td>42</td>
</tr>
<tr>
<td>C15</td>
<td>752.04</td>
<td>27</td>
<td>42</td>
</tr>
</tbody>
</table>

Note: Culvert C14 flow has been routed to diversion UD-4, and C14 has been eliminated.
Diversion Structures

General

Diversion ditch locations are shown on the Surface Facilities Map and Drainage Map, Plate 8. The direction of flow is also shown. All diversions are classed as temporary, and will be removed upon final reclamation.

Note: (1) The runoff curve number of 65 was used only for calculation of the undisturbed culvert diversions. All other diversions, culverts, and pond designs are based on a more conservative runoff curve number of 70 for undisturbed drainages.

(2) Brycan is Hydrologic Soil Group B, Datino (stoney) is also Hydrologic Soil Group B; reference "SCS, National Engineering Handbook, Section 4, 1972".

Specifications

Diversions along the upslope side of the road will be as per specifications on the haul road design. At a minimum, these, and any other diversions shown, will meet the minimum size specifications on the Diversion Ditch Summary sheet (Table IV-3B). Disturbed divisions DD-1 and DD-8 through DD-11 are sized to carry the runoff from a 2 year - 6 hour precipitation event in the area, per requirements of R645-301-742.330 "Division of Miscellaneous Flow". There are no divisions of intermittent or perennial flows.

Undisturbed diversions and drainage control for primary roads are sized to carry runoff from a 10 year - 6 hour precipitation event in the area.

Calculations for the 10 year - 24 hour runoff are included only for sediment pond sizing purposes.

Maintenance

All diversions will be maintained so as to pass the volumes of water for which they were designed. Sloughage will be cleaned out along with regular road maintenance procedures, and any blockage will be removed as soon as practicable after occurrence. Velocities will be controlled as needed to prevent excessive scouring.
Diversions and Conveyance of Overland Flow

There are two types of diversions at this property: undisturbed and disturbed. The undisturbed diversions are labeled UD-1, through UD-5, and C-1 through C-15, and carry undisturbed drainage around and under the disturbed area. All undisturbed diversions are in place, and are shown on Plate 8, along with respective drainage areas. Cross sections of the undisturbed diversions are shown on the "Undisturbed Diversion Ditch Typical" (Figure IV-4). Design calculations are shown on the tables entitled "Diversion Design" (Table IV-3), "Diversion Ditch Summary Sheet" (Table IV-3B) "Main Channel Culvert Design" (Table IV-4), and "Side Drainage Culvert Design" (Table IV-5).

The disturbed diversions carry disturbed drainage to the sediment ponds. The existing disturbed diversions are labeled DD-1, through DD-11 and are shown on Plate 6 "Support Facilities - As Constructed" and on Plate 8 "Support Facilities - Surface Area Drainage and Topography". The diversion DD-4 is shown on Plate 7 "Aberdeen Mine Surface Facilities - As Constructed". Cross sections of the disturbed diversions are shown on the Division Ditch Typical" (Figure IV-3) Design calculations are shown on the table entitled "Disturbed Diversion Design" (Table IV-3A) and on the "Diversion Ditch Summary" (Table IV-3B).

Peak flows for all diversions were calculated by the SCS-TR55 Method for Type II storms using the computer program: Office of Surface Mining Watershed Model, Version: Storm 6.20, by Gary E. McIntosh.

A runoff curve number of 70 was used for all undisturbed areas, except for the undisturbed culvert diversions, which use a CN of 65. A CN of 90 was used for the disturbed area.

The curve numbers are based on Table 2.20 "Runoff Curve Numbers for Selected Agricultural, Suburban, and Urban Land Use" (Antecedent Moisture Condition II), page 82 of "Applied Hydrology and Sedimentology for Disturbed Areas", Barfield, Warner, and Haan, 1983.
A runoff curve number of 65 was selected for the undisturbed culvert diversion areas, based on the following:

(1) Land Use Description - Wood or Forest Land: thin stand, moderate to poor cover, no mulch.

(a) The above description was selected from SCS soils and vegetation data in Appendix M, wherein the site is described as not-desirable as rangeland due to the steep slopes and moderately sparse vegetative cover. The predominant vegetation is trees or large shrubs (pine, juniper, oak, sagebrush) with a mixture of grasses (wildrye, bluegrass, etc.). This land form and vegetation type best fits the Wood or Forest Land Category.

(2) Hydrologic Soil Group - B.

(a) The undisturbed soils of the permit area are predominantly bouldery loam or bouldery fine sandy loam, as described in the SCS report in Appendix M. These soils are further defined as deep and well-drained with moderate permeability and infiltration rates. This description fits the SCS Hydrologic Soil Group B very well.

(3) The runoff curve number of 65 is further supported by an on-site visit and professional judgement of a respected professional engineer/hydrologist from Horrocks, Carollo Engineers. In his opinion, a curve number of 65 best fits the site conditions, based on the site visit, and Richard H. McCuen's, "A Guide to Hydrologic Analysis Using SCS Methods".

(4) Appendix O, which is the calculations performed by Horrocks Engineering reflects a curve number of 65. Tables IV-4 and IV-5 are also included and use a curve number of 70. Both calculations show adequately sized culverts; the curve number of 70 is slightly more conservative.

The Curve Number of 90 for the disturbed area is based on Hydrologic Soil Group B, Streets and Roads, with a weighted average of 40% paved area and 60% gravel area.

The outlet of C-15 (Main-Channel Culvert) shows a velocity of 7.28 fps, which could be slightly erosive in this area; however, existing boulders at this outlet range from 12 to 36 inches in diameter and function as an adequate energy dissipator and erosion control device. Based on past history of storms with little or no evidence of erosion, at this point it is not felt necessary to install additional protection. Erosion protection parameters are shown on the "Erosion Protection" (Table IV-7), for reference only, to
show that the existing natural rock is adequate size for erosion control.

The culvert outlet will be visually examined after each major storm to ensure that erosion is not occurring. If erosion does become evident as determined by visual observation, protection will be installed according to the design on the table entitled "Erosion Protection" (Table IV-7).

Velocities on undisturbed diversions UD-1, UD-3 and UD-5 and portions of UD-2 and UD-4 are less than 6.0 fps, and are not considered erosive. Velocities on disturbed diversions DD-1, through DD-11 are also less than 6.0 fps, and are not considered erosive on this site.

Velocities on the upper and lower portion of UD-2 and the lower 150' of UD-4 and are greater than 6.0 fps, and are considered potentially erosive; therefore, rip-rap will be placed at these locations (see Plate 8). Rip-rap or liner is placed as described in Table IV-7, and is sized according to Figure IV-12. Diversion UD-2 has been observed to be non-erosive.

Undisturbed diversion UD-2 was resurveyed in November 1992. Based on this survey, the division can be divided into four separate components, as follows:

Upper Section - This is the extreme upper end of the division near the disturbed area boundary. This is a fairly steep, rocky area, and is quite inaccessible to equipment. The average grade through this section is 12.33%. The ditch is protected by a liner, which appears to have been effective in preventing erosion over the last 10 years. The liner will be maintained throughout this section;

Undisturbed Section - This is an area below the upper (lined) section and the office pad section. The drainage flows through an undisturbed, vegetated area for approximately 100 feet, at an average slope of 12.11%. There is no evidence of erosion through this area;

Office Pad Section - This is an extremely flat portion of the diversion with an average grade of 3.50% for approximately 200 feet. Velocities through this section are non-erosive, and this is the only portion of the diversion which has required periodic maintenance for silt cleaning;

Lower Section - This section is approximately 100 feet in length with an average slope of 41.60%. The ditch is rip-rapped through this section.

Flow calculations are provided in Table IV-3 for the various
sections, and erosion protection requirements are provided in Table IV-7. The diversion has been in place for approximately 10 years, and has required only minimal maintenance for silt clean out in that time. It has been designed, located, constructed, maintained, used and will be removed in accordance with requirements of R645-301-742.300.

A loose rock check dam will be placed at the discharge point of UD-4 for energy dissipation. The dam will be constructed as described in Figure IV-9 and located as shown on Plate 8.

All diversion ditches are sized and maintained to at least the minimum requirements of R645-301-742.330 "Diversion of Miscellaneous Flows" and R645-301-742.423 "(Road) Drainage Control". There are no diversions of intermittent or perennial drainages at this minesite. Ditch sizes, including flow depths and minimum size for maintenance are summarized on Table IV-3B, "Division Ditch Summary". Computer backup sheets for all calculations are provided in Appendix O.

Stream Channel Diversions

Re-establishment of drainages is shown on Plates 15 and 16 which are reclamation contours and cross sections. The cross sections show cut and fill which has occurred on-site versus the original contours and reclaimed contours.

The reclamation plans for the drainage in the area consist of replacing each of the culverts C-1 through C-15 with restored channels. The undisturbed diversions UD-1 and UD-2 will also be removed and replaced with appropriate sized channels, corresponding to the channels at culverts C-4 and C-12 respectively. The restored channels are all sized to carry the runoff from a 100 year - 24 hour precipitation event. Cross sections of the restored channels are shown in the "Restored Channel Typicals" (Figure IV-10). Design calculations are summarized in the table entitled Restored Channel Designs" (Table IV-6).

Culverts C-1, C-3, C-5, C-7, C-9, C-11, C-13, and C-15 will be replaced by the Main Channel RC-1, and culverts C-2, C-4, C-6, C-8, C-10, C-12, and C-14 will be replaced by the Side Channels entitled RC-2, RC-4,...,RC-14, respectively.

The only restored channels with erosive velocities for this area (greater than 4.5 fps) are RC-1, RC-4, and RC-12. Erosion protection is planned for these channels, as shown on the table entitled "Erosion Protection" (Table IV-7). All other restored channels are expected to have non-erosive velocities, and will not require erosion protection.
Loose rock check dams will be placed at the exit of each side drainage prior to entering RC-1. Please see Figure IV-9, for a typical section of the Loose Rock Check Dams.

**Hydrologic Balance:**

**Sedimentation Ponds**

The sedimentation ponds are shown on Plates 11, 12 and 13. Pond C is constructed as shown on Plate 6 "Support Facilities - As Built". There will be no Pond D. Pond E has been constructed (Plate 13), and is shown on Plate 7 "Aberdeen Mine Surface Facilities - As Constructed". The plans and profiles shown on Plate 12 are for Pond C, as constructed. Plate 13 (Pond E) plans and profiles are as built.

All elevations of inflow and discharge are shown on the plates. Also, the embankment slopes are shown not to exceed 5:1 as required. The embankment widths are greater than the required width of height of embankment plus 35 feet divided by 5' as required. (Please note the different horizontal and vertical scales used on the section views of Pond C. Horizontal and vertical scales for Pond E are the same.)

Previous Pond "B" has been redesignated as "Primary Settling Basins" since all the runoff from the basins reports to Sediment Pond "C" (See Plate 11).

**Sediment Pond "C"**

Design specifications for Sediment Pond "C" are shown in this submittal.

**Sediment Pond "E"**

Design specifications for Sediment Pond "E" are covered under this submittal.
Discharge Structures

Discharge structures from the sediment ponds have been included.

Permanent and Temporary Impoundments

The sedimentation pond E will remain in place after reclamation, until adequate revegetation is established on the reseeded areas. At this time, the pond will be removed and reclaimed.

Discharge of Water into an Underground Mine

The Drainage Map, Plate 8, delineates various drainage areas on the site. Based on planimeter areas from this map, the following areas are drained into the respective mines:

<table>
<thead>
<tr>
<th>Mine</th>
<th>Disturbed (ac.)</th>
<th>Undisturbed (ac.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pinnacle Mine</td>
<td>0.81</td>
<td>0.13</td>
</tr>
<tr>
<td>Apex</td>
<td>1.23</td>
<td>2.06</td>
</tr>
<tr>
<td>Old Chidister Mine</td>
<td>4.53</td>
<td>16.21</td>
</tr>
</tbody>
</table>

The water flowing into the mines is strictly from surface runoff, and the quantity is thus highly variable. Because this is such a dry canyon, it is necessary to capture as much water as possible to allow for underground mining operations. The water is directed into storage sumps in the mine, where it is settled and used for dust suppression. Any water going into the mine is used in sprays or remains in the sumps. Water flowing into the mines is strictly from surface runoff, and the quantity is thus highly variable. Because this is such a dry canyon, it is necessary to capture as much water as possible to allow for underground mining operations. The water is directed into storage sumps in the mine, where it is settled and used for dust suppression. Any water going into the mine is used in sprays or remains in the sumps.

Andalex owns the rights to this water.

Hydrologic Balance:

Water Quality Standards and Limitations.

Sediment control for Office Facilities

The office facilities area is a small paved parking area and runoff from a portion of this area will report to Sediment Pond "E" as shown on Plate 8. The remaining portion is classified as a B.T.C.A. Area (2.19-2).
Natural runoff from above the office area is diverted to the south of the pad, and flows in an open ditch down to the lower (road) level where it enters an 18" culvert going into the 42" culvert carrying undisturbed drainage off site. Straw bales are maintained in the open ditch to minimize sediment in the undisturbed flow.

Most of the office pad and access road are paved. Runoff from a portion of the pad and road flow down a grouted ditch along the north and south sides of the road, through a culvert and then down the east side of the main paved road. From here the runoff flows into Pond E. See Plate 8. Sediment contributions from the office facilities area are negligible (if any) due to the pavement and concrete grouted ditch. Straw bales are also maintained along the main haul road to minimize sediment loading from this area.

**Disturbed Area Drainage not Reporting to Sediment Ponds**

Please refer to Plate 8 in Volume II of the PAP for exempt "Alternate Sediment Control Area" or (ASCA) (areas not reporting to sedimentation ponds). There are 3 areas, 2 of which are shown on Plate 8 as ASCA's and a third in Appendix U as an SAE, with a total area of 1.08 acres or 3.2% of the Disturbed Area:

1. ASCA #1 - 0.72 acres - near the office, which includes a topsoil storage pile, UD-2, a portion of the main office pad and a portion of the weather station outslope.
   
   (a) Treatment: As a result of a 10 year - 24 hour storm, there would potentially be a discharge of 2,462 cubic feet of runoff from this area. Alternate sediment controls consist of straw dikes, vegetation on the topsoil pile, chemically treated gravel parking areas and paved parking areas.

2. ASCA #2 - 0.27 acres - Substation area.
   
   (a) Treatment: A 10 year - 24 hour storm will potentially have a discharge of 923 cubic feet of runoff from this area. Alternate sediment controls on this site consist of a graveled surface, a straw dike and snow fences.

3. Small Area Exemption (SAE) #1 - 0.09 acres - Left Fork Fan Powerline area.
   
   (a) Treatment: A 10 year - 24 hour storm will potentially have a discharge of 308 cubic feet of runoff from this area. As these are power poles, there will be no sediment runoff.

These three areas are exempt from the requirement that the
drainage report to a sedimentation pond (817.42a) as provided for in 817.42b. The drainage from these areas will meet the effluent standards of 817.42 and State and Federal water quality standards for the receiving waters. In order to assure this, any discharge from these ASCA's will be monitored for suspended solids, total suspended solids and total dissolved solids.

There are three additional undisturbed diversions constructed just inside the disturbed area boundary (UD-1, UD-3 and UD-4). These ditches carry only undisturbed runoff from the areas above, are well vegetated, and discharge directly to the main channel undisturbed drainage without further treatment. Only undisturbed diversion UD-2 is included as a ASCA (#1), due to the fact that it also picks up drainage from a topsoil storage pile and a portion of the office pad as described on the previous page.

NPDES Permit

Three point sources are included in Andalex's new UPDES Permit issued in May of 1989. Quarterly reports are submitted to the Utah Department of Health and the EPA.
TYPICAL

SCS - TR55 Method of Diversion Calculation

1. Find Drainage Area - Plate 8 or 9

2. Find Runoff from Appropriate Event:
   \[ Q = \frac{(P-0.2S)^2}{(P+0.8S)} \]
   where: \( P = \text{Precip. in inches} \)
   \( S = 1,000 - 10 \frac{CN}{CN} \)
   
   \( CN = 70 \) for Undisturbed
   \( CN = 90 \) for Disturbed

3. Find Hydraulic Length of Watershed - Plate 8 or 9

4. Find Land Slope - Plate 8 or 9

5. Calculate Lag Time; \( t_L = \frac{L^{0.8}(S+1)^{0.7}}{1900^{0.5}} \)
   
   where: \( t_L = \text{Lag Time in Hrs.} \)
   \( L = \text{Hydraulic Length in ft.} \)
   \( S = \frac{(1,000 - 10)}{CN} \)
   \( y = \text{Land Slope in \%} \)

6. Find Time of Concentration; \( t_c = t_L \times 0.6 \)

**7. Find Peak Flow (qp) from: \( qp = qp^1 \times AQ \)
   where \( qp = \text{Peak Flow in cfs} \)
   \( qp^1 = \text{Peak Discharge from Figure 2.40, page 115***} \)

   \( A = \text{Drainage Area in Square Miles} \)
   \( Q = \text{Runoff (from \#2 above)} \)

**8. Find Velocity of Flow from:
   \[ V = 1.42 \times R^{0.67}S^{0.5} \]
   \( n \)

   where: \( V = \text{Velocity in fps} \)
   \( n = \text{Manning's Number for ditch} \)
   \( R = \text{Hydraulic Radius in ft.} = \frac{\text{Area}}{\text{Wetted Perim.}} \)
   \( S = \text{Slope in ft./ft.} \)

**9. Find Required Ditch Area by dividing peak flow by the velocity.
   \( Q = AV; A = Q \times V \)

**10. Find depth of flow by applying required area to

5-72
ditch size.

* Where undisturbed and disturbed flows enter the same ditch, a weighted curve number is used, calculated by:

\[
\left( \frac{\text{Area Undisturbed}}{70} \right) + \left( \frac{\text{Area Disturbed}}{90} \right) / \text{(Total Area)}
\]

** Items 7 through 10 can also be calculated by the computer program "Office of Surface Mining Watershed Model", Version: Storm 6.20, by Gary E. McIntosh.

# TABLE IV-3

## UNDISTURBED DIVERSION DESIGN

<table>
<thead>
<tr>
<th>Structure</th>
<th>UD-1</th>
<th>UD-2</th>
<th>UD-3</th>
<th>UD-4</th>
<th>UD-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage Area (acres)</td>
<td>87.78</td>
<td>56.20</td>
<td>23.87</td>
<td>26.14</td>
<td>16.90</td>
</tr>
<tr>
<td>Time of Conc. (hours)</td>
<td>0.24</td>
<td>0.21</td>
<td>0.22</td>
<td>0.06</td>
<td>0.14</td>
</tr>
<tr>
<td>Runoff Curve Number (CN)</td>
<td>70</td>
<td>70</td>
<td>70</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>Manning's Number (n)</td>
<td>0.038</td>
<td>0.038</td>
<td>0.040</td>
<td>0.040</td>
<td>0.040</td>
</tr>
<tr>
<td>Ditch Slope (%)</td>
<td>6.75</td>
<td>3.50</td>
<td>6.75</td>
<td>4.50</td>
<td>3.79</td>
</tr>
<tr>
<td>Hydraulic Length (ft.)</td>
<td>2850</td>
<td>2800</td>
<td>1400</td>
<td>600</td>
<td>1800</td>
</tr>
<tr>
<td>Land Slope (%)</td>
<td>47.22</td>
<td>58.33</td>
<td>56.67</td>
<td>66.67</td>
<td>62.50</td>
</tr>
<tr>
<td>10 yr. 6 hr. Event (in.)</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
</tr>
<tr>
<td>Time of Conc. (hrs.)</td>
<td>0.24</td>
<td>0.21</td>
<td>0.22</td>
<td>0.06</td>
<td>0.14</td>
</tr>
<tr>
<td>Peak Flow 10/6 (cfs)</td>
<td>1.35</td>
<td>0.99</td>
<td>0.11</td>
<td>0.47</td>
<td>0.29</td>
</tr>
<tr>
<td>Required Area 10/6 (ft²)</td>
<td>0.37</td>
<td>0.37</td>
<td>0.06</td>
<td>0.20</td>
<td>0.15</td>
</tr>
<tr>
<td>Flow Depth 10/6 (ft)</td>
<td>0.61</td>
<td>0.61</td>
<td>0.24</td>
<td>0.45</td>
<td>0.39</td>
</tr>
<tr>
<td>Velocity 10/6 (fps)</td>
<td>3.65</td>
<td>2.64</td>
<td>1.88</td>
<td>2.32</td>
<td>1.93</td>
</tr>
<tr>
<td>10 yr.-24 hr. Event (in.)</td>
<td>1.82</td>
<td>1.82</td>
<td>1.82</td>
<td>1.82</td>
<td>1.82</td>
</tr>
<tr>
<td>Peak Flow 10/24 (cfs)</td>
<td>7.94</td>
<td>4.75</td>
<td>2.03</td>
<td>3.45</td>
<td>1.59</td>
</tr>
<tr>
<td>Req'd Area 10/24 (ft²)</td>
<td>1.40</td>
<td>1.21</td>
<td>0.52</td>
<td>0.90</td>
<td>0.54</td>
</tr>
<tr>
<td>Flow Depth 10/24 (ft²)</td>
<td>1.18</td>
<td>1.10</td>
<td>0.72</td>
<td>0.95</td>
<td>0.73</td>
</tr>
<tr>
<td>Velocity 10/24 (fps)</td>
<td>5.69</td>
<td>3.91</td>
<td>3.90</td>
<td>3.82</td>
<td>2.95</td>
</tr>
</tbody>
</table>

Notes:
1- Ditch slopes measured from Plate 8.
2- UD-2 slope measured directly in field.
3- Peak flows by SCS-TR55 Method using "Storm 6.20" computer program.
5- See Appendix O for computer back-up.
6- All calculations are based on minimum ditch size - "V" shape with 1:1 side slopes. Ditch configurations may vary in field.
### TABLE IV-3 (cont'd)

#### UNDISTURBED DIVERSION DESIGN

<table>
<thead>
<tr>
<th>Structure</th>
<th>UD-2 (upper)</th>
<th>UD-2 (lower)</th>
<th>UD-4 (max)</th>
<th>UD-5 (max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage Area (acres)</td>
<td>56.20</td>
<td>56.20</td>
<td>26.14</td>
<td>16.90</td>
</tr>
<tr>
<td>Time of Conc. (hrs.)</td>
<td>0.21</td>
<td>0.21</td>
<td>0.06</td>
<td>0.14</td>
</tr>
<tr>
<td>Runoff Curve Number (CN)</td>
<td>70</td>
<td>70</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>Manning's Number (n)</td>
<td>0.025</td>
<td>0.040</td>
<td>0.040</td>
<td>0.040</td>
</tr>
<tr>
<td>Ditch Slope (%)</td>
<td>12.33</td>
<td>42.60</td>
<td>20.00</td>
<td>17.75</td>
</tr>
<tr>
<td>Hydraulic Length (ft.)</td>
<td>2800</td>
<td>2800</td>
<td>600</td>
<td>1800</td>
</tr>
<tr>
<td>Land Slope (%)</td>
<td>58.33</td>
<td>58.33</td>
<td>66.67</td>
<td>62.50</td>
</tr>
<tr>
<td>10 yr.-6 hr. Event (in.)</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
</tr>
<tr>
<td>Peak Flow 10/6 (cfs)</td>
<td>0.99</td>
<td>0.99</td>
<td>*10.43</td>
<td>0.29</td>
</tr>
<tr>
<td>Req'd Area 10/6 (ft.²)</td>
<td>0.17</td>
<td>0.15</td>
<td>1.18</td>
<td>0.08</td>
</tr>
<tr>
<td>Flow Depth 10/6 (ft.)</td>
<td>0.41</td>
<td>0.39</td>
<td>1.09</td>
<td>0.29</td>
</tr>
<tr>
<td>Velocity 10/6 (fps)</td>
<td>5.80</td>
<td>6.49</td>
<td>8.81</td>
<td>3.44</td>
</tr>
<tr>
<td>10 yr.-24 hr. Event (in)</td>
<td>1.82</td>
<td>1.82</td>
<td>1.82</td>
<td>1.82</td>
</tr>
<tr>
<td>Peak Flow (cfs)</td>
<td>4.75</td>
<td>4.75</td>
<td>*13.41</td>
<td>1.59</td>
</tr>
<tr>
<td>Req'd Area (ft.²)</td>
<td>0.55</td>
<td>0.49</td>
<td>1.43</td>
<td>0.30</td>
</tr>
<tr>
<td>Flow Depth 10/24 (ft)</td>
<td>0.74</td>
<td>0.70</td>
<td>1.20</td>
<td>0.55</td>
</tr>
<tr>
<td>Velocity 10/24 (fps)</td>
<td>8.59</td>
<td>9.61</td>
<td>9.38</td>
<td>5.27</td>
</tr>
</tbody>
</table>

* Includes discharge from Pond E Emergency Spillway.

Note: 1. Ditch slopes measured from Plate 8.
2. UD-2 Slopes Measured Directly in Field; UD-2 (Upper) is a lined channel. UD-2 (lower) is rip-rapped.
5. See Appendix O for computer back-up.
6. All calculations are based on minimum ditch size-"V" shape with 1:1 side slopes. Ditch Configurations may vary in field.
### TABLE IV-3A

**DISTURBED DIVERSION DESIGN**  
(MISCELLANEOUS FLOWS-2YR.-6 HR. DESIGN)

<table>
<thead>
<tr>
<th>Structure</th>
<th>DD-1</th>
<th>DD-8</th>
<th>DD-9</th>
<th>DD-10</th>
<th>DD-11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage Area (acres)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disturbed</td>
<td>3.31</td>
<td>-</td>
<td>-</td>
<td>0.34</td>
<td>5.35</td>
</tr>
<tr>
<td>Undisturbed</td>
<td>5.40</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>6.12</td>
</tr>
<tr>
<td>Time of Conc. (hrs.)</td>
<td>0.08</td>
<td>0.327</td>
<td>0.327</td>
<td>0.11</td>
<td>0.08</td>
</tr>
<tr>
<td>Runoff Curve Number (CN)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disturbed</td>
<td>90</td>
<td>-</td>
<td>-</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>Undisturbed</td>
<td>70</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>70</td>
</tr>
<tr>
<td>Weighted CN</td>
<td>78</td>
<td>-</td>
<td>-</td>
<td>90</td>
<td>79</td>
</tr>
<tr>
<td>Manning's Number (n)</td>
<td>0.040</td>
<td>0.040</td>
<td>0.040</td>
<td>0.040</td>
<td>0.040</td>
</tr>
<tr>
<td>Ditch Slope (%)</td>
<td>6.25</td>
<td>6.25</td>
<td>6.25</td>
<td>6.25</td>
<td>5.25</td>
</tr>
<tr>
<td>Hydraulic Length (ft.)</td>
<td>200</td>
<td>1200</td>
<td>1200</td>
<td>300</td>
<td>800</td>
</tr>
<tr>
<td>Land Slope (%)</td>
<td>6.25</td>
<td>6.25</td>
<td>6.25</td>
<td>6.25</td>
<td>56.25</td>
</tr>
<tr>
<td>2 yr.-6 hr. Event (in)</td>
<td>0.80</td>
<td>0.80</td>
<td>0.80</td>
<td>0.80</td>
<td>0.80</td>
</tr>
<tr>
<td>Peak Flow 2/6 (cfs)</td>
<td>0.08</td>
<td>0.07</td>
<td>0.07</td>
<td>0.05</td>
<td>0.13</td>
</tr>
<tr>
<td>Required Area 2/6 (ft²)</td>
<td>0.05</td>
<td>0.04</td>
<td>0.04</td>
<td>0.03</td>
<td>0.07</td>
</tr>
<tr>
<td>Flow Depth 2/6 (ft.)</td>
<td>0.22</td>
<td>0.21</td>
<td>0.21</td>
<td>0.18</td>
<td>0.26</td>
</tr>
<tr>
<td>Velocity 2/6 (fps)</td>
<td>1.69</td>
<td>1.63</td>
<td>1.63</td>
<td>1.50</td>
<td>1.90</td>
</tr>
<tr>
<td>10 yr.-24 hr. Event (in.)</td>
<td>1.82</td>
<td>1.82</td>
<td>1.82</td>
<td>1.82</td>
<td>1.82</td>
</tr>
<tr>
<td>Peak Flow 10/24 (cfs)</td>
<td>3.49</td>
<td>2.88</td>
<td>2.88</td>
<td>0.31</td>
<td>4.75</td>
</tr>
</tbody>
</table>

* Based on flow from DD-3, which is 0.13 cfs for 2 yr.-6 hr. event. See Appendix O.
TABLE IV-3A (Continued)

DISTURBED DIVERSION DESIGN
(PRIMARY ROAD DRAINAGE - 10YR. - 6HR. DESIGN)

<table>
<thead>
<tr>
<th>Structure</th>
<th>DD-2</th>
<th>DD-3</th>
<th>DD-4</th>
<th>DD-6</th>
<th>DD-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage Area (acres)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disturbed</td>
<td>4.07</td>
<td>7.41</td>
<td>12.21</td>
<td>-</td>
<td>1.28</td>
</tr>
<tr>
<td>Undisturbed</td>
<td>-</td>
<td>25.49</td>
<td>12.20</td>
<td>-</td>
<td>6.12</td>
</tr>
<tr>
<td>Time of Conc. (hrs.)</td>
<td>0.04</td>
<td>0.327</td>
<td>0.289</td>
<td>0.289</td>
<td>0.08</td>
</tr>
<tr>
<td>Runoff Curve Number (CN)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disturbed</td>
<td>90</td>
<td>90</td>
<td>90</td>
<td>-</td>
<td>90</td>
</tr>
<tr>
<td>Undisturbed</td>
<td>-</td>
<td>70</td>
<td>70</td>
<td>-</td>
<td>70</td>
</tr>
<tr>
<td>Weighted CN</td>
<td>90</td>
<td>75</td>
<td>80</td>
<td>-</td>
<td>74</td>
</tr>
<tr>
<td>Manning's Number (n)</td>
<td>0.040</td>
<td>0.040</td>
<td>0.040</td>
<td>0.040</td>
<td>0.040</td>
</tr>
<tr>
<td>Ditch Slope (%)</td>
<td>6.25</td>
<td>6.25</td>
<td>6.25</td>
<td>5.95</td>
<td>5.56</td>
</tr>
<tr>
<td>Hydraulic Length (ft.)</td>
<td>200</td>
<td>1200</td>
<td>1200</td>
<td>-</td>
<td>800</td>
</tr>
<tr>
<td>Land Slope (%)</td>
<td>6.25</td>
<td>6.25</td>
<td>8.00</td>
<td>-</td>
<td>56.25</td>
</tr>
<tr>
<td>10 yr. - 6 hr. Event (in)</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
</tr>
<tr>
<td>Peak Flow 10/6 (cfs)</td>
<td>1.70</td>
<td>0.90</td>
<td>1.67</td>
<td>0.84</td>
<td>0.20</td>
</tr>
<tr>
<td>Required Area 10/6 (ft²)</td>
<td>0.47</td>
<td>0.30</td>
<td>0.40</td>
<td>0.28</td>
<td>0.10</td>
</tr>
<tr>
<td>Flow Depth 10/6 (ft.)</td>
<td>0.69</td>
<td>0.24</td>
<td>0.68</td>
<td>0.53</td>
<td>0.31</td>
</tr>
<tr>
<td>Velocity 10/6 (fps)</td>
<td>3.62</td>
<td>2.96</td>
<td>3.60</td>
<td>2.98</td>
<td>2.03</td>
</tr>
<tr>
<td>10 yr. -24hr. Event (in.)</td>
<td>1.82</td>
<td>1.82</td>
<td>1.82</td>
<td>1.82</td>
<td>1.82</td>
</tr>
<tr>
<td>Peak Flow 10/24 (cfs)</td>
<td>3.50</td>
<td>5.75</td>
<td>8.06</td>
<td>4.03</td>
<td>1.92</td>
</tr>
</tbody>
</table>

* Based on ¼ flow for DD-4

Notes:

1. Ditch Slopes measured from Plate 8.
4. See Appendix 0 for computer back-up.
5. All calculations are based on minimum ditch size- "V" shape with 1:1 side slopes, except DD-3 which has a 1' bottom width. Ditch configurations may vary in field.

INCORPORATED
NOV 24 2003
DIV OF OIL
### TABLE IV -3B
DIVERSION DITCH SUMMARY

<table>
<thead>
<tr>
<th>DITCH NO.</th>
<th>FLOW (cfs)</th>
<th>REQ'D FLOW DEPTH (ft.)</th>
<th>REQ'D FLOW AREA (ft^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UD-1</td>
<td>1.35</td>
<td>0.61</td>
<td>0.37</td>
</tr>
<tr>
<td>UD-2 (PAD)</td>
<td>0.99</td>
<td>0.61</td>
<td>0.37</td>
</tr>
<tr>
<td>UD-2 (UPPER)</td>
<td>0.99</td>
<td>0.41</td>
<td>0.17</td>
</tr>
<tr>
<td>UD-2 (LOWER)</td>
<td>0.99</td>
<td>0.39</td>
<td>0.15</td>
</tr>
<tr>
<td>UD-3</td>
<td>0.11</td>
<td>0.24</td>
<td>0.06</td>
</tr>
<tr>
<td>UD-4</td>
<td>0.47</td>
<td>0.45</td>
<td>0.20</td>
</tr>
<tr>
<td>UD-4 (MAX)</td>
<td>10.43</td>
<td>1.09</td>
<td>1.18</td>
</tr>
<tr>
<td>UD-5</td>
<td>0.29</td>
<td>0.39</td>
<td>0.15</td>
</tr>
<tr>
<td>UD-5 (MAX)</td>
<td>0.29</td>
<td>0.29</td>
<td>0.08</td>
</tr>
<tr>
<td>DD-1</td>
<td>0.08</td>
<td>0.22</td>
<td>0.05</td>
</tr>
<tr>
<td>DD-2</td>
<td>1.70</td>
<td>0.69</td>
<td>0.47</td>
</tr>
<tr>
<td>DD-3</td>
<td>0.90</td>
<td>0.24</td>
<td>0.30</td>
</tr>
<tr>
<td>DD-4</td>
<td>1.67</td>
<td>0.68</td>
<td>0.46</td>
</tr>
<tr>
<td>DD-6</td>
<td>0.84</td>
<td>0.53</td>
<td>0.28</td>
</tr>
<tr>
<td>DD-7</td>
<td>0.20</td>
<td>0.31</td>
<td>0.10</td>
</tr>
<tr>
<td>DD-8</td>
<td>0.07</td>
<td>0.21</td>
<td>0.04</td>
</tr>
<tr>
<td>DD-9</td>
<td>0.07</td>
<td>0.21</td>
<td>0.04</td>
</tr>
<tr>
<td>DD-10</td>
<td>0.05</td>
<td>0.18</td>
<td>0.03</td>
</tr>
<tr>
<td>DD-11</td>
<td>0.13</td>
<td>0.26</td>
<td>0.07</td>
</tr>
</tbody>
</table>

**Notes:**
1- Flows for UD ditches and primary road ditches (D-2 through DD-7) based on 10 yr.-6hr. event (1.25).
2- Flows for Ditches DD-1 and DD-8 through DD-11 based on 2yr.-6hr. event (0.80').
3- All calculations based on minimum ditch size - "V" ditch with 1:1 side slopes, except DD-3, which has a 1' bottom width. Ditch configurations may vary in field.
4- Ditches will be maintained to minimum depth and/or area shown in this table.
METHOD OF CULVERT CALCULATION
(TYPICAL)
See Appendix N for calculation reference

1. Find Drainage Area - Plate 9

2. Find Runoff from Appropriate Event:
   \[ Q = \frac{(P - 0.2S)^2}{(P + 0.8S)} \]
   Where: \( P \) = Precipitation in Inches.
   \[ S = \frac{1,000 - 10}{\text{CN}} \]
   or \( \text{CN} = 70 \)


4. Find Land Slope - Plate 9

5. Calculate Lag Time; \( t_L = \frac{L^{0.8}(S+1)^{0.7}}{1,900 Y^{2.8}} \)
   Where: \( t_L \) = Lag Time in Hrs.
   \( L \) = Hydraulic Length in Ft.
   \( S = \frac{1,000 - 10}{\text{CN}} \)
   \( Y \) = Land Slope in %.

6. Find Time of Concentration; \( t_c = \frac{t_L}{0.6} \)

**7. Find Peak Flow \( (qp) \) from:
   \[ qp = qp^i AQ \]
   Where: \( qp = \) Peak Flow
   \( qp^i = \) Peak Discharge from Figure 2.40, page 115*.
   \( A = \) Drainage Area in Square Miles
   \( Q = \) Runoff (from #2 above)

8. Find Required Culvert Size by Manning's Equation:
   \[ D = \left( \frac{2.16}{Ons} \right)^{0.375} \]
   Where: \( D \) = Required Culvert Diameter in Ft.
   \( Q = \) Peak Flow \( (qp) \) from 7.
   \( n = \) Manning's Number (0.025 for culv.)
   \( s = \) Slope in ft./ft.

** Item 7 can also be calculated by using the computer program "Office of Surface Mining Watershed Model", Version: Storm 6.20, by Gary E. McIntosh.
**TABLE IV-3C**

**DISTURBED AREA CULVERT DESIGN**
(Drainage to Old Works)

<table>
<thead>
<tr>
<th>Structure</th>
<th>CD-1</th>
<th>CD-2</th>
<th>CD-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage Area (ac.)</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Undisturbed</td>
<td>10.09</td>
<td>6.12</td>
<td>10.09</td>
</tr>
<tr>
<td>Disturbed</td>
<td>3.25</td>
<td>1.28</td>
<td>3.25</td>
</tr>
<tr>
<td>10 yr. - 6 hr. event (in.)</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
</tr>
<tr>
<td>Time of Conc. (hrs.)</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
</tr>
<tr>
<td>Curve Number</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Undisturbed</td>
<td>70</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>Disturbed</td>
<td>90</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>Manning's Number</td>
<td>0.025</td>
<td>0.025</td>
<td>0.025</td>
</tr>
<tr>
<td>Culvert Slope (%)</td>
<td>5.56</td>
<td>5.56</td>
<td>5.56</td>
</tr>
<tr>
<td>Peak Flow (cfs)</td>
<td>1.73</td>
<td>0.72</td>
<td>1.73</td>
</tr>
<tr>
<td>Velocity</td>
<td>4.41</td>
<td>3.49</td>
<td>3.08</td>
</tr>
<tr>
<td>D Req'd (ft.)</td>
<td>0.71</td>
<td>0.51</td>
<td>0.71</td>
</tr>
<tr>
<td>D in Place (ft.)</td>
<td>1.00</td>
<td>1.00</td>
<td>1.50</td>
</tr>
</tbody>
</table>
### TABLE IV-3C (Continued)

**DISTURBED AREA CULVERT DESIGN**

<table>
<thead>
<tr>
<th>Structure</th>
<th>CD-4</th>
<th>CD-5</th>
<th>CD-6</th>
<th>CD-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 yr. - 6 hr. Event (in.)</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
</tr>
<tr>
<td>Manning's Number (n)</td>
<td>0.025</td>
<td>0.025</td>
<td>0.025</td>
<td>0.025</td>
</tr>
<tr>
<td>Culvert Slope (%)</td>
<td>5.56</td>
<td>5.56</td>
<td>5.56</td>
<td>5.56</td>
</tr>
<tr>
<td>Peak Flow</td>
<td>1.50</td>
<td>1.55</td>
<td>2.33</td>
<td>4.65</td>
</tr>
<tr>
<td>Velocity</td>
<td>4.26</td>
<td>4.29</td>
<td>4.75</td>
<td>5.65</td>
</tr>
<tr>
<td>D Req'd (ft.)</td>
<td>0.67</td>
<td>0.68</td>
<td>0.79</td>
<td>1.02</td>
</tr>
<tr>
<td>D in Place (ft.)</td>
<td>1.50</td>
<td>1.50</td>
<td>2.00</td>
<td>2.00</td>
</tr>
</tbody>
</table>

**Note:** All culverts have adequate headwater to allow flow.
### TABLE IV-3C (Continued)

#### CULVERT CD-3
(Inlet to Sed. Pond "C")

<table>
<thead>
<tr>
<th>10-yr.6-hr. Event</th>
<th>1.25&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mannings Number</td>
<td>0.025</td>
</tr>
<tr>
<td>Culvert Slope</td>
<td>3.30%</td>
</tr>
<tr>
<td>Peak Flow</td>
<td>3.00 cfs</td>
</tr>
<tr>
<td>Velocity</td>
<td>4.16 fps</td>
</tr>
<tr>
<td>D. Required</td>
<td>0.96 ft.</td>
</tr>
<tr>
<td>D. In Place</td>
<td>1.50 ft.</td>
</tr>
</tbody>
</table>

**NOTES:**
1. Peak flow is based on entire flow from Diversion DD-3.
2. Details for Diversion DD-3 are on Table IV-3A.
3. Culvert slope is based on actual field measurement.
4. A headwall of 4' exists at the culvert inlet, which is adequate to allow the calculated peak flow of 3.00 cfs.
5. Please refer to Plate 8 for CD-3 location and drainage areas.
<table>
<thead>
<tr>
<th>STRUCTURE</th>
<th>CD-9</th>
<th>CD-10</th>
<th>CD-11</th>
<th>CD-12</th>
<th>CD-13</th>
</tr>
</thead>
<tbody>
<tr>
<td>10yr.-6hr. Event (in)</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
</tr>
<tr>
<td>Manning's Number (n)</td>
<td>0.025</td>
<td>0.025</td>
<td>0.025</td>
<td>0.025</td>
<td>0.025</td>
</tr>
<tr>
<td>Culvert Slope (%)</td>
<td>8.00</td>
<td>6.25</td>
<td>8.00</td>
<td>5.56</td>
<td>6.25</td>
</tr>
<tr>
<td>Peak Flow 10/6 (cfs)</td>
<td>0.31*</td>
<td>0.31*</td>
<td>0.31**</td>
<td>0.92**</td>
<td>1.87**</td>
</tr>
<tr>
<td>Velocity 10/6 (fps)</td>
<td>3.29</td>
<td>3.00</td>
<td>3.29</td>
<td>3.77</td>
<td>4.70</td>
</tr>
<tr>
<td>Diam. Req'd. (ft.)</td>
<td>0.35</td>
<td>0.36</td>
<td>0.35</td>
<td>0.56</td>
<td>0.71</td>
</tr>
<tr>
<td>Diam. In Place (ft.)</td>
<td>1.50</td>
<td>1.50</td>
<td>1.00</td>
<td>2.00</td>
<td>1.50</td>
</tr>
</tbody>
</table>

* Based on 1/3 flow form DD-11.
** Based on entire flow from DD-11.
**** Based on entire flow from DD-2.
### TABLE IV-3C (Continued)
#### DISTURBED AREA CULVERT DESIGN

<table>
<thead>
<tr>
<th>STRUCTURE</th>
<th>CD-14</th>
<th>CD-15</th>
<th>CD-16</th>
<th>CD-17</th>
<th>CD-18</th>
</tr>
</thead>
<tbody>
<tr>
<td>10yr.-6hr. Event (in)</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
</tr>
<tr>
<td>Manning's Number (n)</td>
<td>0.025</td>
<td>0.025</td>
<td>0.025</td>
<td>0.025</td>
<td>0.0025</td>
</tr>
<tr>
<td>Culvert Slope (%)</td>
<td>3.50</td>
<td>3.50</td>
<td>6.25</td>
<td>5.56</td>
<td>57.74</td>
</tr>
<tr>
<td>Peak Flow 10/6 (cfs)</td>
<td>1.35*</td>
<td>2.84**</td>
<td>4.65***</td>
<td>4.65***</td>
<td>0.29</td>
</tr>
<tr>
<td>Velocity 10/6 (fps)</td>
<td>3.51</td>
<td>4.20</td>
<td>5.90</td>
<td>5.65</td>
<td>6.79</td>
</tr>
<tr>
<td>Diam. Req'd. (ft.)</td>
<td>0.70</td>
<td>0.93</td>
<td>1.00</td>
<td>1.02</td>
<td>0.23</td>
</tr>
<tr>
<td>Diam. In Place (ft.)</td>
<td>1.50</td>
<td>1.50</td>
<td>2.00</td>
<td>2.00</td>
<td>1.50</td>
</tr>
</tbody>
</table>

* Based on entire flow from DD-1.
** Based on entire flows from DD-2, DD-10 & DD-11
*** Based on entire flow from DD-4.
### TABLE IV-4

**MAIN CHANNEL CULVERT DESIGN**

<table>
<thead>
<tr>
<th>Structure</th>
<th>(optional)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-1a</td>
<td></td>
</tr>
</tbody>
</table>

| Drainage Area  | 469.51     |
| 10 yr. - 24 hr. Event | 1.82 |
| Time of Conc. (hrs.) | 1.02 |
| Curve number     | 70         |
| Manning's Number | 0.025      |
| Ditch Slope (%)  | 5.56       |
| Peak Flow        | 22.12      |
| Structure Area Used (ft.$^2$) | 7.07 |
| Velocity (fps)   | 9.20       |
| Hydraulic Length | 10,200     |
| Land Slope       | 19.83      |
| Headwater Req'd (ft.) | 2.22 |
| D Req'd (ft.)    | 1.84       |
| D in Place       | 3.00       |

**Note:** See Appendix O for culvert justification.
<table>
<thead>
<tr>
<th>Structure</th>
<th>C1</th>
<th>C3</th>
<th>C5</th>
<th>C7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage Area</td>
<td>506.16</td>
<td>529.19</td>
<td>606.48</td>
<td>633.35</td>
</tr>
<tr>
<td>10 yr. - 24 hr. Event</td>
<td>1.82</td>
<td>1.82</td>
<td>1.82</td>
<td>1.82</td>
</tr>
<tr>
<td>Time of Conc. (hrs.)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Curve number</td>
<td>70</td>
<td>70</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>Manning's number</td>
<td>0.025</td>
<td>0.025</td>
<td>0.025</td>
<td>0.025</td>
</tr>
<tr>
<td>Ditch Slope (%)</td>
<td>5.56</td>
<td>5.56</td>
<td>5.56</td>
<td>5.56</td>
</tr>
<tr>
<td>Peak Flow</td>
<td>23.12</td>
<td>23.62</td>
<td>26.02</td>
<td>26.72</td>
</tr>
<tr>
<td>Structure Area Used (ft.²)</td>
<td>7.07</td>
<td>7.07</td>
<td>7.07</td>
<td>9.62</td>
</tr>
<tr>
<td>Velocity (fps)</td>
<td>9.20</td>
<td>9.20</td>
<td>9.20</td>
<td>9.20</td>
</tr>
<tr>
<td>Hydraulic Length</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Land Slope</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Headwater Req'd (ft.)</td>
<td>N/A</td>
<td>N/A</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>D Req'd (ft.)</td>
<td>1.86</td>
<td>1.88</td>
<td>1.95</td>
<td>1.97</td>
</tr>
<tr>
<td>D in Place</td>
<td>3.00</td>
<td>3.00</td>
<td>3.00</td>
<td>3.50</td>
</tr>
</tbody>
</table>

Note: See Appendix 0 for culvert justification.
### TABLE IV-4 (cont'd)

**MAIN CHANNEL CULVERT DESIGN**

<table>
<thead>
<tr>
<th>Structure</th>
<th>C9</th>
<th>C11</th>
<th>C13</th>
<th>C15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage Area</td>
<td>678.60</td>
<td>696.73</td>
<td>752.04</td>
<td>752.04</td>
</tr>
<tr>
<td>10 yr. - 24 hr. Event</td>
<td>1.82</td>
<td>1.82</td>
<td>1.82</td>
<td>1.82</td>
</tr>
<tr>
<td>Time of Conc. (hrs.)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Curve number</td>
<td>70</td>
<td>70</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>Manning's number</td>
<td>0.025</td>
<td>0.025</td>
<td>0.025</td>
<td>0.025</td>
</tr>
<tr>
<td>Ditch Slope (%)</td>
<td>5.56</td>
<td>5.56</td>
<td>5.56</td>
<td>5.56</td>
</tr>
<tr>
<td>Peak Flow</td>
<td>29.82</td>
<td>32.42</td>
<td>38.92*</td>
<td>38.92*</td>
</tr>
<tr>
<td>Velocity (fps)</td>
<td>9.20</td>
<td>9.20</td>
<td>9.20</td>
<td>9.20</td>
</tr>
<tr>
<td>Hydraulic Length</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Land Slope</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Headwater Req'd (ft.)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>D Req'd (ft.)</td>
<td>2.06</td>
<td>2.12</td>
<td>2.27</td>
<td>2.27</td>
</tr>
<tr>
<td>D in Place</td>
<td>3.50</td>
<td>3.50</td>
<td>3.50</td>
<td>3.50</td>
</tr>
</tbody>
</table>

Note: See Appendix 0 for culvert justification.

Note: All culverts are within capacity for open-channel flow.

* If design peak flows for primary spillways from Ponds C and E are included, the peak flows for C-13 and C-15 are **65.6 cfs** and **90.9 cfs** respectively.
### TABLE IV-5

**SIDE DRAINAGE CULVERT DESIGN**

<table>
<thead>
<tr>
<th>Structure</th>
<th>C-0</th>
<th>C-2</th>
<th>C-4</th>
<th>C-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage Area</td>
<td>36.65</td>
<td>23.03</td>
<td>77.29</td>
<td>26.87</td>
</tr>
<tr>
<td>10 yr. - 24 hr. Event</td>
<td>1.82</td>
<td>1.82</td>
<td>1.82</td>
<td>1.82</td>
</tr>
<tr>
<td>Time of Conc. (hrs.)</td>
<td>0.12</td>
<td>0.08</td>
<td>0.24</td>
<td>0.22</td>
</tr>
<tr>
<td>Curve number</td>
<td>70</td>
<td>70</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>Manning's number</td>
<td>0.025</td>
<td>0.025</td>
<td>0.025</td>
<td>0.025</td>
</tr>
<tr>
<td>Ditch Slope (%)</td>
<td>4.00</td>
<td>4.00</td>
<td>10.00</td>
<td>4.00</td>
</tr>
<tr>
<td>Peak Flow</td>
<td>5.65</td>
<td>3.90</td>
<td>8.77</td>
<td>4.17</td>
</tr>
<tr>
<td>Structure Area Used (ft.²)</td>
<td>1.767</td>
<td>1.767</td>
<td>1.767</td>
<td>1.767</td>
</tr>
<tr>
<td>Velocity (fps)</td>
<td>6.18</td>
<td>6.18</td>
<td>8.73</td>
<td>6.18</td>
</tr>
<tr>
<td>Hydraulic Length</td>
<td>1300</td>
<td>850</td>
<td>2850</td>
<td>1400</td>
</tr>
<tr>
<td>Land Slope</td>
<td>51.43</td>
<td>61.54</td>
<td>47.22</td>
<td>56.67</td>
</tr>
<tr>
<td>Headwater Req'd (ft.)</td>
<td>1.35</td>
<td>1.12</td>
<td>*2.40</td>
<td>1.02</td>
</tr>
<tr>
<td>D Req'd (ft.)</td>
<td>1.10</td>
<td>0.96</td>
<td>*1.30</td>
<td>0.98</td>
</tr>
<tr>
<td>D In Place (ft.)</td>
<td>1.50</td>
<td>1.50</td>
<td>1.50</td>
<td>1.50</td>
</tr>
</tbody>
</table>

* Available headwater at culvert inlet is greater than that required to allow for surge storage and passage of flows.

Headwater = distance from base of culvert to top of headwall.
<table>
<thead>
<tr>
<th>Structure</th>
<th>C-8</th>
<th>C-10</th>
<th>C-12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage Area</td>
<td>45.25</td>
<td>18.16</td>
<td>55.31</td>
</tr>
<tr>
<td>10 yr. - 24 hr. Event</td>
<td>1.82</td>
<td>1.82</td>
<td>1.82</td>
</tr>
<tr>
<td>Time of Conc. (hrs.)</td>
<td>0.14</td>
<td>0.11</td>
<td>0.21</td>
</tr>
<tr>
<td>Curve Number</td>
<td>70</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>Manning's Number</td>
<td>0.025</td>
<td>0.025</td>
<td>0.025</td>
</tr>
<tr>
<td>Ditch Slope (%)</td>
<td>4.00</td>
<td>4.00</td>
<td>10.00</td>
</tr>
<tr>
<td>Peak Flow</td>
<td>7.09</td>
<td>2.65</td>
<td>6.50</td>
</tr>
<tr>
<td>Structure Area Used (ft.²)</td>
<td>4.91</td>
<td>3.14</td>
<td>1.767</td>
</tr>
<tr>
<td>Velocity (fps)</td>
<td>6.18</td>
<td>4.90</td>
<td>9.77</td>
</tr>
<tr>
<td>Hydraulic Length</td>
<td>1600</td>
<td>1250</td>
<td>2800</td>
</tr>
<tr>
<td>Land Slope</td>
<td>58.62</td>
<td>63.16</td>
<td>58.33</td>
</tr>
<tr>
<td>Headwater Req'd (ft.)</td>
<td>1.25</td>
<td>0.98</td>
<td>1.60</td>
</tr>
<tr>
<td>D Req'd (ft.)</td>
<td>1.20</td>
<td>0.83</td>
<td>1.16</td>
</tr>
<tr>
<td>D In Place (ft.)</td>
<td>2.50</td>
<td>2.00</td>
<td>1.5</td>
</tr>
</tbody>
</table>
TABLE IV-6

RESTORED CHANNEL DESIGNS*

<table>
<thead>
<tr>
<th>Structure</th>
<th>Main Channel</th>
<th>Side Channel*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RC-1</td>
<td>RC-O</td>
</tr>
<tr>
<td>Drainage Area</td>
<td>469.22</td>
<td>34.55</td>
</tr>
<tr>
<td>100 yr.- 6 hr. Event</td>
<td>1.91</td>
<td>1.91</td>
</tr>
<tr>
<td>Time of Conc. (hrs.)</td>
<td>3.19</td>
<td>0.18</td>
</tr>
<tr>
<td>Curve number</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>Manning's Number</td>
<td>0.040</td>
<td>0.040</td>
</tr>
<tr>
<td>Ditch Slope (%)</td>
<td>6.60</td>
<td>4.00</td>
</tr>
<tr>
<td>Peak Flow</td>
<td>60.31**</td>
<td>2.64</td>
</tr>
<tr>
<td>Min. Structure Area (ft.²)</td>
<td>27.00</td>
<td>8.00</td>
</tr>
<tr>
<td>Req'd Area (ft.²)</td>
<td>7.26</td>
<td>0.84</td>
</tr>
<tr>
<td>Depth of Flow (ft.)</td>
<td>1.03</td>
<td>0.35</td>
</tr>
<tr>
<td>Velocity (fps)</td>
<td>8.31</td>
<td>3.16</td>
</tr>
<tr>
<td>Hydraulic Length</td>
<td>10,200</td>
<td>1,300</td>
</tr>
<tr>
<td>Land Slope (%)</td>
<td>19.80</td>
<td>51.40</td>
</tr>
<tr>
<td>Erosion Protection (Y/N)</td>
<td>Y</td>
<td>N</td>
</tr>
</tbody>
</table>

* In areas where these side drainages cross the road after final reclamation, road dips at least as substantial as the restored channels shown in Table IV-6 will be put in place. Locations of these are shown on Plate 17.

** Includes Reclaimed Area.

Note: Ditch Slopes measured from Plate 17.
Areas from Plate 17-A
### TABLE IV-6 (cont'd)

**RESTORED CHANNEL DESIGNS**

<table>
<thead>
<tr>
<th>Structure</th>
<th>RC-6</th>
<th>RC-8</th>
<th>RC-10</th>
<th>RC-12</th>
<th>RC-14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage Area</td>
<td>28.74</td>
<td>46.92</td>
<td>20.74</td>
<td>58.20</td>
<td>24.37</td>
</tr>
<tr>
<td>100 yr. - 6 hr. Event</td>
<td>1.91</td>
<td>1.91</td>
<td>1.91</td>
<td>1.91</td>
<td>1.91</td>
</tr>
<tr>
<td>Time of Conc. (hrs.)</td>
<td>0.20</td>
<td>0.24</td>
<td>0.18</td>
<td>0.53</td>
<td>0.20</td>
</tr>
<tr>
<td>Curve number</td>
<td>70</td>
<td>70</td>
<td>70</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>Manning's Number</td>
<td>0.040</td>
<td>0.040</td>
<td>0.040</td>
<td>0.040</td>
<td>0.040</td>
</tr>
<tr>
<td>Ditch Slope (%)</td>
<td>4.00</td>
<td>4.00</td>
<td>4.00</td>
<td>10.00</td>
<td>4.00</td>
</tr>
<tr>
<td>Peak Flow</td>
<td>2.15</td>
<td>3.39</td>
<td>1.60</td>
<td>3.12</td>
<td>1.82</td>
</tr>
<tr>
<td>Min. Structure Area (ft.²)</td>
<td>8.00</td>
<td>8.00</td>
<td>8.00</td>
<td>8.00</td>
<td>8.00</td>
</tr>
<tr>
<td>Req'd Area (ft.²)</td>
<td>0.73</td>
<td>0.99</td>
<td>0.60</td>
<td>0.69</td>
<td>0.65</td>
</tr>
<tr>
<td>Depth of Flow (ft.)</td>
<td>0.31</td>
<td>0.41</td>
<td>0.26</td>
<td>0.30</td>
<td>0.29</td>
</tr>
<tr>
<td>Velocity (fps)</td>
<td>2.96</td>
<td>3.43</td>
<td>2.68</td>
<td>4.55</td>
<td>2.80</td>
</tr>
<tr>
<td>Hydraulic Length</td>
<td>1,400</td>
<td>1,600</td>
<td>1,250</td>
<td>2,800</td>
<td>1,300</td>
</tr>
<tr>
<td>Land Slope (%)</td>
<td>57.00</td>
<td>58.60</td>
<td>63.20</td>
<td>58.30</td>
<td>46.80</td>
</tr>
<tr>
<td>Erosion Protection (Y/N)</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
</tr>
</tbody>
</table>

* In areas where these side drainages cross the road after final reclamation, road dips at least as substantial as the restored channels shown in Table IV-6 will be put in place. Locations of these are shown on Plate 17.

Note: Ditch Slopes measured from Plate 17.
### TABLE IV-6 (con't)

**RESTORED CHANNEL DESIGNS**

(Sub-Areas)*

<table>
<thead>
<tr>
<th>Structure</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage Area (ac.)</td>
<td>4.72</td>
<td>1.09</td>
<td>8.73</td>
<td>24.37</td>
<td>4.37</td>
<td>24.00</td>
<td>12.74</td>
</tr>
<tr>
<td>100 yr.-6 hr. event (in.)</td>
<td>1.91</td>
<td>1.91</td>
<td>1.91</td>
<td>1.91</td>
<td>1.91</td>
<td>1.91</td>
<td>1.91</td>
</tr>
<tr>
<td>Time of Conc. (hrs.)</td>
<td>0.08</td>
<td>0.07</td>
<td>0.13</td>
<td>0.22</td>
<td>0.09</td>
<td>0.20</td>
<td>0.17</td>
</tr>
<tr>
<td>Curve Number</td>
<td>70</td>
<td>70</td>
<td>70</td>
<td>70</td>
<td>70</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>Peak Flow (cfs)</td>
<td>0.42</td>
<td>0.10</td>
<td>0.72</td>
<td>1.78</td>
<td>0.38</td>
<td>1.78</td>
<td>0.99</td>
</tr>
<tr>
<td>Hydraulic Length (ft.)</td>
<td>600</td>
<td>400</td>
<td>800</td>
<td>1,500</td>
<td>700</td>
<td>1,200</td>
<td>1,100</td>
</tr>
<tr>
<td>Land Slope (%)</td>
<td>66.67</td>
<td>55.17</td>
<td>58.33</td>
<td>66.67</td>
<td>60.00</td>
<td>60.87</td>
<td>60.00</td>
</tr>
</tbody>
</table>

* These areas drain directly to RC-1 by sheet flow, without entering other channels. See Plate 17-A.
### TABLE IV-6 (con't)

**RESTORED CHANNEL DESIGNS**

<table>
<thead>
<tr>
<th>Structure</th>
<th>*Reclaimed Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage Area (ac.)</td>
<td>32.34</td>
</tr>
<tr>
<td>100 yr.-6 hr. event (in.)</td>
<td>1.91</td>
</tr>
<tr>
<td>Time of Conc. (hrs.)</td>
<td>0.54</td>
</tr>
<tr>
<td>Curve Number</td>
<td>90</td>
</tr>
<tr>
<td>Peak Flow (cfs)</td>
<td>23.17</td>
</tr>
<tr>
<td>Hydraulic Length (ft.)</td>
<td>49.50</td>
</tr>
<tr>
<td>Land Slope (%)</td>
<td>6.60</td>
</tr>
</tbody>
</table>

* This area drains directly to RC-1 by sheet flow, without entering other channels. See Plate 17-A.
RESTORED CHANNEL DESIGNS

Peak flow for RC-1 is based on the total of peak flows for RC-1 (Upper) plus channels RC-0 through RC-14, plus sub-areas 1 through 7, plus the reclaimed area. Peak flows for each of these are shown in Appendix P.
**TABLE IV-7**

**EROSION PROTECTION**

<table>
<thead>
<tr>
<th>Structure</th>
<th>*Main Channel C-15</th>
<th>Restored Main Channel RC-1</th>
<th>Restored Side Channel RC-4</th>
<th>Restored Side Channel RC-12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow (cfs)</td>
<td>-</td>
<td>-</td>
<td>4.12</td>
<td>3.12</td>
</tr>
<tr>
<td>Slope (%)</td>
<td>5.56</td>
<td>6.60</td>
<td>10.00</td>
<td>10.00</td>
</tr>
<tr>
<td>Velocity (fps)</td>
<td>9.20</td>
<td>8.31</td>
<td>4.98</td>
<td>4.55</td>
</tr>
<tr>
<td>Rip-rap Size (D50)</td>
<td>15&quot;</td>
<td>12&quot;</td>
<td>12&quot;</td>
<td>6&quot;</td>
</tr>
<tr>
<td>Bedding (-3/4&quot; gravel)</td>
<td>25&quot;</td>
<td>20&quot;</td>
<td>10&quot;</td>
<td>10&quot;</td>
</tr>
<tr>
<td>Length of Protection (ft.)</td>
<td>20'</td>
<td>All</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Width of Protection (ft.)</td>
<td>10'</td>
<td>6'</td>
<td>6'</td>
<td>6'</td>
</tr>
<tr>
<td>Rip-Rap Depth</td>
<td>18&quot;</td>
<td>15&quot;</td>
<td>8&quot;</td>
<td>8&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UD-1 (Max.)</th>
<th>UD-4 (Max.)</th>
<th>UD-5 (Max.)</th>
<th>DD-3 (Max.)</th>
<th>DD-4 (Max.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow (cfs)</td>
<td>20.57</td>
<td>14.82</td>
<td>4.75</td>
<td>15.18</td>
</tr>
<tr>
<td>Slope (%)</td>
<td>6.75</td>
<td>20.00</td>
<td>17.75</td>
<td>6.25</td>
</tr>
<tr>
<td>Velocity (fps)</td>
<td>7.25</td>
<td>9.67</td>
<td>6.98</td>
<td>6.28</td>
</tr>
<tr>
<td>Rip-rap Size (D50)</td>
<td>9&quot;</td>
<td>15&quot;</td>
<td>9&quot;</td>
<td>9&quot;</td>
</tr>
<tr>
<td>Bedding (-3/4&quot; gravel)</td>
<td>15&quot;</td>
<td>25&quot;</td>
<td>15&quot;</td>
<td>15&quot;</td>
</tr>
<tr>
<td>Length of Protection (ft.)</td>
<td>All</td>
<td>150'</td>
<td>150'</td>
<td>All</td>
</tr>
<tr>
<td>Width of Protection (ft.)</td>
<td>5'</td>
<td>5'</td>
<td>5'</td>
<td>4'</td>
</tr>
<tr>
<td>Rip-Rap Depth</td>
<td>12&quot;</td>
<td>18&quot;</td>
<td>12&quot;</td>
<td>12&quot;</td>
</tr>
</tbody>
</table>

* For Reference Only. Natural Rip-rap is more than adequate for erosion protection.

Note: Rip-Rap shall be graded according to the following:

- D15 = 0.42D; D50 = 1D; D85 = 1.6D.
- For Median Diameter of 12", D15 = 5", D50 = 12", D85 = 19.25".
- For Median Diameter of 21", D15 = 9", D50 = 21", D85 = 34.00".
<table>
<thead>
<tr>
<th></th>
<th>UD-2 (upper)</th>
<th>UD-2 (lower)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow (cfs)</td>
<td>13.87</td>
<td>13.87</td>
</tr>
<tr>
<td>Slope (%)</td>
<td>12.33</td>
<td>42.60</td>
</tr>
<tr>
<td>Velocity (fps)</td>
<td>10.63</td>
<td>11.90</td>
</tr>
<tr>
<td>Rip-Rap Size (D50)</td>
<td>N/A**</td>
<td>12&quot;</td>
</tr>
<tr>
<td>Bedding (-3/4&quot; gravel)</td>
<td>N/A**</td>
<td>20&quot;</td>
</tr>
<tr>
<td>Length of Protection</td>
<td>150'</td>
<td>100'</td>
</tr>
<tr>
<td>Width of Protection</td>
<td>5'</td>
<td>5'</td>
</tr>
<tr>
<td>Rip-Rap Depth</td>
<td>N/A**</td>
<td>15&quot;</td>
</tr>
</tbody>
</table>

** UD-2 (upper) is protected by a channel liner.
During the earthwork portion of the reclamation suitable rip-rap will be segregated and stored on site for later use in the stream channel restorations it will not be necessary to haul rip-rap in from an outside source. Also native material will be used for the filter blanket under the rip-rap. This material can be used because of its sandy nature it will not be necessary to haul gravel in.
TABLE IV-8
VALUES FOR MANNING'S n AND MAXIMUM PERMISSIBLE VELOCITY OF FLOW IN OPEN CHANNELS

<table>
<thead>
<tr>
<th>Ditch lining</th>
<th>Manning's n</th>
<th>( V_{\text{max}} ) fps</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Natural earth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Without vegetation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1) Rock</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Smooth and uniform</td>
<td>0.035-0.040</td>
<td>20</td>
</tr>
<tr>
<td>(b) Jagged &amp; Irregular</td>
<td>0.040-0.045</td>
<td>15-18</td>
</tr>
<tr>
<td>(2) Soils</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gravel and gravelly soils</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Unified USDA</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GW Gravel</td>
<td>0.022-0.024</td>
<td>6-7</td>
</tr>
<tr>
<td>GP Gravel</td>
<td>0.023-0.026</td>
<td>7-8</td>
</tr>
<tr>
<td>GM Loamy Gravel</td>
<td>0.023-0.025</td>
<td>3-5</td>
</tr>
<tr>
<td>u</td>
<td>0.022-0.020</td>
<td>2-4</td>
</tr>
<tr>
<td>QC Gravelly Clay</td>
<td>0.024-0.026</td>
<td>5-7</td>
</tr>
<tr>
<td>Coarse grained Sand and sandy soils</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SW Sand</td>
<td>0.020-0.024</td>
<td>1-2</td>
</tr>
<tr>
<td>SP Sand</td>
<td>0.022-0.024</td>
<td>1-2</td>
</tr>
<tr>
<td>SM Loamy Sand</td>
<td>0.020-0.023</td>
<td>2-3</td>
</tr>
<tr>
<td>u</td>
<td>0.021-0.023</td>
<td>2-3</td>
</tr>
<tr>
<td>SC Sandy Loam</td>
<td>0.023-0.025</td>
<td>3-4</td>
</tr>
<tr>
<td>Fine grained Silts and clays</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 CL Clay Loam</td>
<td>0.022-0.024</td>
<td>2-3</td>
</tr>
<tr>
<td>Sandy Clay Loam</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silty Clay</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LL ML Very Fine Sand</td>
<td>0.023-0.024</td>
<td>3-4</td>
</tr>
<tr>
<td>Silt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 OL Mucky Loam</td>
<td>0.022-0.024</td>
<td>2-3</td>
</tr>
<tr>
<td>CL Clay</td>
<td>0.022-0.023</td>
<td>2-3</td>
</tr>
<tr>
<td>MH Silty Clay</td>
<td>0.023-0.024</td>
<td>3-5</td>
</tr>
<tr>
<td>LL OH Mucky Clay</td>
<td>0.022-0.024</td>
<td>2-3</td>
</tr>
<tr>
<td>Highly Organic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PT Peat</td>
<td>0.022-0.025</td>
<td>2-3</td>
</tr>
</tbody>
</table>

1 Maximum recommended velocities
Table IV-9
Sediment Yield
for
Disturbed Area

Using the Universal Soil Loss Equation:
A = RKLSCP; Where:

\[ R = 16.53 \text{ from } R = 27P^{2.2}_{2.6} ; P_{2.6} = 0.8 \text{ inches} \]

\[ K = 0.50 \text{ from Table 5.5 (Ref. Below)} \]
\[ LS = 2.5 \text{ Length/Slope factors from Fig. 5-15 (Ref. Below)} \]
Average Length = 1200'
Average Slope = 6.25%
CP = 1.0 from Table 5.A.1 (Ref. Below)
Based on combination of compacted surface and pavement with grouted ditches.

\[ *A = 16.53 \times 0.50 \times 2.5 \times 1.0 = 20.6625 \text{ tons/acre/year} \]
Sediment Yield = A = 0.010 ac./ft./acre/yr.

(2) Sediment Yield based on a weight of 100 lbs./cu. ft.

* Included for reference only. A more conservative figure of 0.05 ac. ft./acre has been used for Pond C, and 0.1 ac. ft./acre has been used for Pond E sizing.
Using the Universal Soil Loss Equation:
\[ A = RKLSCP; \]
Where:
\[ R = 16.53 \text{ from } R = 27P^{2.2}; \ P_{2.6} = 0.8 \text{ inches} \]
\[ K = 0.37 \text{ from Table 5.5 (Ref. Below)} \]
\[ LS = \text{Average Length/Slope Factor from Equation} = 56.04 \]
\[ LS = \left( \frac{L}{72.6} \right)^{0.5} \left( \frac{430X^2 + 30X + 0.43}{6.613} \right) \]
\[ L = \text{Avg. Slope Length} = 1,000' \]
\[ X = \sin 0; \ O = \text{Avg. Slope Angle} = 26.57^\circ \text{ (50%)} \]
\[ C = 0.1 \text{ from Table 5.A.3 (Ref. Below)} \]
\[ \text{25% Canopy Cover; 40% Ground Cover} \]
\[ P = 1 \text{ (No. Control Practice)} \]
\[ A = 16.53 \times 0.37 \times 56.04 \times 0.1 = 34.275 \text{ tons/acre/yr.} \]
\[ \text{Sed. Yield} = 34.275 \times 2,000 = 0.016 \text{ ac. ft./acre/yr.} \]
\[ \frac{100 \times 43,560}{1} \]

(2) Sediment yield based on a weight of 100 lbs./cu. ft.
# Table IV-11
Minesite Drainage Area Summary

<table>
<thead>
<tr>
<th>Drainage No.</th>
<th>Area (ac.)</th>
<th>Type</th>
<th>Drains To:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4.23</td>
<td>Undisturbed</td>
<td>Pond E</td>
</tr>
<tr>
<td>2</td>
<td>5.40</td>
<td>&quot;</td>
<td>Pond C</td>
</tr>
<tr>
<td>3</td>
<td>3.00</td>
<td>&quot;</td>
<td>Old Works (Chidister Mine)</td>
</tr>
<tr>
<td>4</td>
<td>3.12</td>
<td>&quot;</td>
<td>&quot; &quot; &quot;</td>
</tr>
<tr>
<td>5</td>
<td>11.97</td>
<td>&quot;</td>
<td>Pond C</td>
</tr>
<tr>
<td>6</td>
<td>2.06</td>
<td>&quot;</td>
<td>Apex Mine</td>
</tr>
<tr>
<td>7</td>
<td>1.12</td>
<td>&quot;</td>
<td>Old Works (Chidister Mine)</td>
</tr>
<tr>
<td>8</td>
<td>0.55</td>
<td>&quot;</td>
<td>&quot; &quot; &quot;</td>
</tr>
<tr>
<td>9</td>
<td>1.01</td>
<td>&quot;</td>
<td>&quot; &quot; &quot;</td>
</tr>
<tr>
<td>10</td>
<td>7.41</td>
<td>&quot;</td>
<td>&quot; &quot; &quot;</td>
</tr>
<tr>
<td>11</td>
<td>0.13</td>
<td>&quot;</td>
<td>Pinnacle Mine</td>
</tr>
<tr>
<td>12</td>
<td>13.52</td>
<td>&quot;</td>
<td>Pond C</td>
</tr>
<tr>
<td>13</td>
<td>6.20</td>
<td>&quot;</td>
<td>Pond E</td>
</tr>
<tr>
<td>14</td>
<td>1.77</td>
<td>&quot;</td>
<td>&quot; &quot;</td>
</tr>
<tr>
<td>15</td>
<td>12.21</td>
<td>Disturbed</td>
<td>&quot; &quot; &quot;</td>
</tr>
<tr>
<td>16</td>
<td>6.04</td>
<td>&quot;</td>
<td>Pond C</td>
</tr>
<tr>
<td>17</td>
<td>4.07</td>
<td>&quot;</td>
<td>Catch Basin B</td>
</tr>
<tr>
<td>18</td>
<td>1.28</td>
<td>&quot;</td>
<td>Old Works (Chidister Mine)</td>
</tr>
<tr>
<td>19</td>
<td>0.81</td>
<td>&quot;</td>
<td>Pinnacle Mine</td>
</tr>
<tr>
<td>20</td>
<td>4.68</td>
<td>&quot;</td>
<td>Pond C</td>
</tr>
<tr>
<td>21</td>
<td>3.25</td>
<td>&quot;</td>
<td>Old Works (Chidister Mine)</td>
</tr>
<tr>
<td>22</td>
<td>1.23</td>
<td>&quot;</td>
<td>Apex Mine</td>
</tr>
</tbody>
</table>

Total = 95.06;

Disturbed = 33.57 Acres;
Undisturbed = 61.49 Acres

Notes: (1) Areas disturbed from Plate 8 (and Plate 9 as necessary).
(2) Does not include diverted undisturbed drainage.
Andalex Resources, Inc.
Centennial Project

Typical Disturbed Diversion Ditch
Figure IV-3

Note:
(1) Ditch configuration may vary; however, minimum flow depth and/or flow area will be maintained per Table IV-3B.
(2) Applies to all disturbed diversion ditches except DD-3, which has a one-foot bottom width.
FIGURE IV-3A

Typical Section For Trapezoidal Ditch

Ditch DD-3 is of this type

Note: Ditch configuration may vary slightly in the field; however, minimum depth and/or area will be maintained to dimensions shown on Table IV-3B

Centennial Project

Typical Section for Trapezoidal Ditch

Figure IV-3A

5-103
Note: Ditch configuration may vary; however, minimum flow depth and/or flow area will be maintained per Table IV-3B

Typical Undisturbed Diversion Ditch
Figure IV-4
Typical Section of Emergency Spillway

Structure | W | D  
---|---|---
Pond E   | 5.0' | 2.0' 
Pond E - PM | 5.0' | 2.0' 

Area of spillway = WxD + 2D²

LEGEND

D - Spillway depth
W - Spillway Bottom Width

FIGURE IV-6
Notes:

1. A well-graded distribution of angular rock from 6-24 inches must be used. The angle of rest for this angular rock should correspond to a slope ratio not less than 1.5 to 1.0. The structure shall be 24-30 inches high. The angular rock shall be placed so as to form a 36 inch wide by 6 inch deep notch in the center of the creek channel to form a centralized spillway.

2. The keyway must be 24 inches wide and deep and excavated into the streambed and banks. The keyway into the banks must be 36 inches deep.

3. The apron section must be 15 feet long and placed with an adverse slope of 6 inches over the 15 feet length. A filter blanket (3 inch minus material, 6 inches deep) must be placed under aprons. Riprap side slope protection measures for the length of the apron and 2 feet above the gabion crest must be included. The angle of rest for the 6-24 inch well-graded material used to construct the gabion must be strictly adhered to. The apron will be at least 10 feet wide.

Construction Plans for a Loose-Rock Check Dam/Stilling Basin

1. Section of the dam parallel to the centerline of the gully.
2. Section of the dam at the cross section of the gully.
A = original gully bottom; B = original gully cross section; C = spillway; D = crest of free board; E = excavation for key; F = excavation for apron; G = filter blanket.

Loose Rock Check Dam
(Restored Main Drainage Channel)
Figure IV-8
Construction Plans for a Loose-Rock Check Dam/Stilling Basin

Notes:

1. A well-graded distribution of angular rock from 6-24 inches must be used. The angle of rest for this angular rock should correspond to a slope ratio not less than 1.5 to 1.0. The structure shall be 24-30 inches high. The angular rock shall be placed so as to form an 18 inch wide by 5 inch deep notch in the center of the creek channel to form a centralized spillway.

2. The keyway must be 24 inches wide and deep and excavated into the streambed and banks. The keyway into the banks must be 36 inches deep.

3. The apron section must be 10 feet long and placed with an adverse slope of 6 inches over the 10 feet length. A filter blanket (3 inches minus material, 6 inches deep) must be placed under aprons. Riprap side slope protection measures for the length of the apron and 2 feet above the gabion crest must be included. The angle of rest for the 6-24 inch well-graded material used to construct the gabion must be strictly adhered to. The apron will be at least 8 feet wide.

1. Section of the dam parallel to the centerline of the gully.
2. Section of the dam at the cross section of the gully;
   A = original gully bottom; B = original gully cross section; C = spillway; D = crest of free board;
   E = excavation for key; F = excavation for apron; G = filter blanket.

Loose Rock Check Dam
(Restored Side Drainage Channel)
Figure IV-9
MAIN CHANNEL - RC-1

SIDE CHANNELS

FIGURE IV-10

12" M.D.
Rip-Rap
RC-4 and
RC-12 Only.

20" Thick
Filter Blanket
-3/4" Well-Graded
Gravel

4/10/89

5-108
FIG. 2—SIZE OF STONE THAT WILL RESIST DISPLACEMENT
FOR VARIOUS VELOCITIES AND SIDE SLOPES

FOR STONE WEIGHING 165 LBS. PER CU. FT.

ADAPTED FROM REPORT OF
SUBCOMMITTEE ON SLOPE
PROTECTION, AM. SOC. CIVIL
ENGINEERS PROC. JUNE 1948

11-6

Figure IV-12

5-109
Top of Dam
7056.5

Concrete Pillars (2)

36" CMP
Overflow

18" oil skimmer

Handrails
std. 1½" dia pipe

Safety Chain

Pipe anchors
std. 2" or 2½" dia. pipe

36" x 3" x ½"

Expanded metal decking
X-braces on 48" centers

INCORPORATED
CCT 07-2C92
DIV OF OIL GAS & MINING

Figure IV-13
Pond C - Sampling Access Ramp
5-110
Figure IV-14
Floating Decant - Typical
All roads within the permit area are classified as "Primary Roads" in accordance with R614-301-527.100 or "Ancillary Roads" in accordance with R645-301-527.130. Roads on the site are of 2 typical designs:

1. Single-lane, gravel or asphalt surfaced roads approximately 12 - 15' wide; and

2. Double-lane, either gravel or asphalt surfaced roads, approximately 26' wide.

Although all roads on site are not used for coal hauling, each primary road is constructed to the respective typical design and dimensions shown on Plate 35.

All roads are shown on Plate 6 and Plate 8. Specifics about the road are described individually and include road widths, gradients and surfaces. Drainage ditches and drainage structures for each road (disturbed area ditches or culverts) can be found in Tables IV-2 through IV-8.

Because of the variance in road types, widths and lengths, the roads have been designated on Plate 6 with numbers (i.e. PR-1= Primary Road 1, AR-1= Ancillary Road 1) to facilitate the description of each.

All paved roads within the permit area are maintained by Carbon County. Maintenance measures include tarring and chipping as well as pothole repair. All decisions regarding maintenance of the paved roads are made by Carbon County Road Department. Gravel roads within the permit area are maintained by adding new gravel as necessary and treating with magnesium chloride. Drainage ditches along roadways are generally stable as they have reached bedrock; however, rocks and other debris are removed with graders and/or loaders as needed.

Steep slope cuts on the mining property, including those for roads, will be reclaimed in accordance with the approved mining and reclamation plan. All road cuts will be backfilled to the extent practical; please refer to Andalex's approved reclamation plan (Plates 14 & 15).

Primary Road 1 (PR-1) - This road connects Carbon County Road 199 to the two lane paved road which travels past the Aberdeen Mine facilities, past the office driveway and bath house drive ways and
past the Pinnacle truck loadout. This is an asphalt surfaced road approximately 26 feet wide and 2700 feet long. The grade on PR-1 ranges from 4% to 8%. It is used for hauling coal and for men and material access to the mines.

**Primary Road 2 (PR-2)** - This road begins at the end of PR-1 and continues north past the shop/warehouse and ends at the eastern side of the Apex Mine stockpile. This is a two lane gravel surfaced road which is approximately 26 feet wide and 1400 feet long. It is treated annually with Magnesium Chloride. The grade on this stretch of road ranges from 5% to 9%. It is used for hauling coal and equipment as well as providing men and materials access to the mines.

**Primary Road 3 (PR-3)** - This road provides access to the Aberdeen Mine truck loadout. It is a single lane gravel surfaced road approximately 15 feet wide and 590 feet long. It is treated with Magnesium Chloride annually. The grade on this road ranges from 0% to 4%.

**Primary Road 4 (PR-4)** - This road provides access for the coal haul trucks to the Pinnacle Mine truck loadout. It is also crossed to access the bath house parking area. This is a single lane, paved surface road which is approximately 15 feet wide and 500 feet long. The grade on this loop ranges from 0% to 9%.

**Primary Road 5 (PR-5)** - This road provides access for the coal haul trucks coming off of PR-2 to the Apex Mine truck loadout. It is a single lane gravel surfaced road approximately 15 feet wide and 425 feet in length. The grade on this road ranges from 0% to 7%. It is treated annually with Magnesium Chloride. The three truck loadout roads are also accessed by front-end loaders for the purpose of cleaning up occasional coal spills.

**Primary Road 6 (PR-6)** - This is an access road which leads to the main office parking area. It is a single lane, paved surface road which is approximately 15 feet wide and 600 feet long. The average grade of this road is 5% to 7%.

**Primary Road 7 (PR-7)** - This is an access road for mining equipment. It provides heavy equipment access to and from the Aberdeen Mine. It begins at the south inlet to pond C and it ends at the bath house parking area. It is a gravel surfaced road and is approximately 12 feet wide and 450 feet long. It has grades which range from 4% to 14%. Magnesium Chloride is applied annually.

**Primary Road 8 (PR-8)** - This road leads from the fuel storage area at the Pinnacle Mine facility to the oil storage area near the upper Pinnacle portals. This is a single lane, gravel surface road approximately 15 feet wide and 325 feet long. The grade on this road has a range of 9% to 11%. It is treated with Magnesium Chloride annually.
Primary Road 9 (PR-9) - This road leads from PR-2 and turns west over the top of the Apex Mine conveyor belt. The road leads to the Apex Mine material storage area, adjacent to the mine fan. This is a single lane gravel surfaced road which is approximately 15 feet wide and 200 feet long and includes a steel deck bridge over the mine conveyor. The grade on this road ranges between 0% and 8%, and the gravel is treated with Magnesium Chloride.

Primary Road 10 (PR-10) - This is an access road which leads from the upper Aberdeen Mine material storage area down to the Aberdeen Mine stockpile pad. This is a short stretch of road which is approximately 12 feet wide and 150 feet long. It is a single lane road with an average grade of 12% to 15%.

Primary Road 11 (PR-11) - This is a very short access road which accesses the bath house pad from two directions; both from PR-1 and from PR-4. This road is approximately 12 feet wide and 150 feet long. It is a single lane road with a grade of 0% to 6%. This road is treated with magnesium chloride annually.

Ancillary Road 1 (AR-1) - This is an access road which leads from the south Aberdeen intake portal to the Aberdeen mine fan. It is a single lane road which has a surface of sandstone. The road is used primarily for access to the fan, water system and conveyor. This road is approximately 20 feet wide and 400 feet long. There is a steel deck bridge over the Aberdeen mine conveyor. The grade on this road ranges from 8% to 10%.

Ancillary Road 2 (AR-2) - This road leads from the upper Pinnacle Mine intake portals to the Pinnacle Mine fan. It is a single lane gravel surfaced road which has a steel deck bridge where the road crosses the Pinnacle Mine conveyor. Its primary use is to access the Pinnacle Mine fan. It is approximately 12 feet wide and 250 feet long. The grade on this road ranges from 0% to 12%.

Ancillary Road 3 (AR-3) - This road leads from PR-2 up to the Apex material storage area (Gun range). This is a single lane gravel surface road which is approximately 12 feet wide and 175 feet long. The grade on this road is an average of 9%. It is treated with Magnesium Chloride annually. It is used primarily for access.

Ancillary Road 4 (AR-4) - This road is access from the upper Apex material storage area to the Powder Magazines. This road continues beyond the north end of our permit area but it becomes a private road beyond the permit area. This is a single lane dirt road which is approximately 12 feet wide and 150 feet long. The grade on this short stretch of road is 5% to 8%.

Ancillary Road 5 (AR-5) - This road is access from Carbon County Road 299 to the left hand fork installation. This existing road will be upgraded adequately for maintenance and emergency access only. It will be equipped with a locked gate. This is a single lane dirt road which is approximately 15 feet wide and 4000 feet.
long. There will be 3 or 4 locations specifically widened so that two vehicles may pass. The grade on this stretch of road ranges from 0\% to 15\%. This road will be reclaimed upon cessation of mining pending the approval of Mrs. Gladys Artman.

Revised 8/8/95

Andalex commits to repair roads damaged by a catastrophic event as soon as practical R645-301-534.100 Andalex has located, designed, constructed, used and maintained Primary Roads so as to prevent or control damage to private and public property. Andalex has used non-acid or non-toxic forming materials in road surfacing. Roads have, at a minimum a static safety factor of 1.3 on embankments. Andalex has a schedule and plan to remove roads that will not be retained as part of the approved post mining land use. Ancillary roads will be traveled only by light vehicles for routine access. Occasionally, they will be traveled by larger equipment but probably only in emergency or repair situations, as 2 of the 4 Ancillary Roads lead to fan installations. All Primary Roads will meet the requirements of R645-301-358, R645-301.527.100, R645-301-527.230, R645-301-534.100, R645-301-534.200, R645-301-542.600 and R645-301-762. Primary Roads will be located in so far as practical on the most stable available surfaces. The roads are surfaced with rock, gravel or asphalt according to R645-301-534.320. They will be routinely maintained, and have culverts which are designed and installed as necessary according to the requirements of R645-301-534.340.

All outside conveyor systems at the three minesites consist of rigid steel structure, 30-degree troughing idlers and 42-inch rubber conveyor belt. The stockpile conveyors each drop into a central pile, which in turn gravity feed truck loadout conveyors underneath each stockpile. The truck loadout conveyors are equipped with belt scales for making legal highway loads. All truck loadouts are also equipped with chutes to minimize dust.

R645-301-512.260. VARIANCE FROM APPROXIMATE ORIGINAL CONTOUR

Only cut slopes at Apex, Pinnacle and Aberdeen will vary from the AOC. Slopes will be backfilled to the extent possible.

R645-301-513. COMPLIANCE WITH MSHA REGULATIONS AND MSHA APPROVALS

Ventilation

The ventilation plan calls for a fan of sufficient capacity to provide air to each working section to control methane and dust; there has been small amounts only found to date in any of the old works or new faces. The longwall faces will be ventilated with a live brattice system consisting of a line curtains. The conveyor systems will be isolated from intake and return except in 2-entrygate systems when the belt will double as the intake. All
ventilation requirements of the Coal Mine Health and Safety Act will be met. This ventilation plan will be strictly adhered to, in order to insure safety of all personnel. Please note that the Centennial Seam mining area is ventilated by the existing Pinnacle Mine fan system.

General Safety Measures

A great emphasis is put on assuring a safe mine operation and the mine and surface facilities will be operated within prudent standards to insure the health and safety of all employees. The facilities will be carefully inspected by company-trained safety engineers and state and federal mine inspectors.

The operation will abide by Utah State Coal Mine Regulations and the 1969 Federal Coal Mine Health and Safety Act. In addition, these regulations will be supplemented by a company safety policy. Various training programs will be utilized such as the following:

- Methane Measurements
- Roof and Rib Control
- Oxygen Deficiency Testing
- Ventilation
- First Aid
- Mine Rescue
- Mine Electrical Certification
- Self Rescue Training
- Use of Personal Protective Equipment
- Recognition of Electrical Hazards
- General Accident Prevention
- Mine Communications
- Job Safety Training

Many of the training programs will run continuously, such as those involving roof control and ventilation. Other programs are held annually with many oriented toward new employees.

All Andalex Mines operate under an approved M.S.H.A. roof support plan which calls for bolting on five foot centers with a minimum 42" bolt length in our development entries. Roof control in the longwall faces will be accomplished using hydraulic shields. The roof in all four seams is a massive sandstone (60'+) and offers excellent support in itself. The old mine workings which were rehabilitated for the Pinnacle Mine main entries had stood unsupported for 40 years. This roof control plan will be strictly adhered to, in order to insure the safety of all personnel.
Return of Coal Processing Waste to Abandoned Underground Workings

As raw coal is hauled from the permit area, there will be no processing waste and no return of processing waste to underground workings. If in the future it is decided that a processing facility is to be incorporated, waste or reject would taken to an approved refuse disposal site. Please note that underground development waste rock generated by the Centennial Seam rock tunnels was disposed of underground in the existing Pinnacle Mine workings.

There has been no development waste or excess spoil to date excepting sedimentation pond material.

The only coal processing waste to date is rock material manually separated from Andalex Resources' lump coal product at Wildcat. This is currently placed in an approved area at Wildcat Loadout. This MRP contains an Appendix Q. Appendix Q references the plan for reclamation of the waste rock pile at the Wildcat Loadout and should not be confused with the Centennial Reclamation Plan. Disposal of sediment pond material (temporary and permanent) is shown on Plate 6. Sediment pond waste has already been tested in one case to be non toxic and non acid forming and is being used currently in the Aberdeen Mine fill areas. Other material which is generated will be placed in temporary storage above the Apex Mine as shown on Plate 6 and will be disposed of permanently as back fill in high walls upon final reclamation. This material will be tested prior to final reclamation if used for final reclamation purposes. Based on previous experience, Andalex estimates that up to 3,000 yards of material at most will be generated. This material is included in the earthwork estimates. Please note that the rock tunnels constructed to the Centennial coal seam generated significant amounts of waste rock. One hundred percent of this waste rock was disposed of underground in the existing Pinnacle Mine. None of the waste rock appeared at the surface.

Please refer to Plate 6 for location of disposal areas.
Portals for the present mining operations in the Aberdeen, Gilson and Lower Sunnyside seams are located in Deadman Canyon as shown on Plate 6. The portal areas consist of a conveyor portal, two air intake portals, and an 88" fan portal.

Portals have been enlarged above the coal seam to facilitate men and equipment at the mine opening. Steel sets have been used to support mine roof in the portal areas. The Aberdeen portals have been constructed in a similar fashion, facilitating air intake, conveyor, and an exhaust fan.

The portals are generally 6' high and 20' wide in the Pinnacle and Aberdeen Mines and 4.5' high in the Apex Mine.

The portal mine pads consist of approximately one acre. Located on these pads are the fans, conveyor portals, air intake portals, and mine water storage tanks. It should be noted that the mining of the Centennial Seam did not require new portals on the surface. The Centennial Seam is accessed via rock tunnels from the existing Pinnacle Mine.

Andalex has approved water rights for collection of disturbed area drainage for collection in the underground workings. This is used as needed.
QUARTERLY INSPECTIONS AND CRITICAL CONSTRUCTION PERIODS

FOUNDATION PREPARATION, TOPSOIL REMOVAL

UNDERDRAINS AND PROTECTIVE FILTER SYSTEMS

FINAL SURFACE DRAINAGE SYSTEMS

FINAL GRADED AND REVEGETATED FILL

CERTIFIED REPORTS

CERTIFIED REPORTS ON DRAINAGE SYSTEM AND PROTECTIVE FILTERS

PHASES OF CERTIFICATION

UNDERDRAINS

PHOTOGRAPHS

INSPECTION REPORTS
R645-301-514.200. REFUSE PILES
N/A

R645-301-514.210. REGULAR INSPECTIONS
N/A

R645-301-514.220. CRITICAL CONSTRUCTION PERIODS
Construction of the left fork break-out and fan will occur during the Golden Eagle off-nesting period (January 15 through July 15).

R645-301-514.221. FOUNDATION PREPARATION AND TOPSOIL REMOVAL
N/A

R645-301-514.222. UNDERDRAINS
N/A

R645-301-514.223. FINAL SURFACE DRAINAGE SYSTEMS
N/A

R645-301-514.224. FINAL GRADING AND REVEGETATION
N/A

R645-301-514.230. CERTIFIED REPORT
N/A

R645-301-514.240. SEPARATE CERTIFICATION FOR EACH PHASE OF CONSTRUCTION
N/A

R645-301-514.250. ON-SITE COPY OF CERTIFICATION REPORTS
N/A

R645-301-514.300. IMPOUNDMENTS
See R645-301-512.240.

5-120
R645-301-514.310. CERTIFIED INSPECTION
This is performed annually by a registered P.E.

R645-301-514.311. COMPLETION OF CONSTRUCTION AND YEARLY INSPECTIONS
See R645-301-514.310.

R645-301-514.312. CERTIFIED REPORTS
Certified reports are kept on-site.

R645-301-514.313. ON-SITE COPY OF CERTIFICATION REPORTS
See R645-301-514.312.

R645-301-514.320. WEEKLY INSPECTIONS
N/A

R645-301-514.330. QUARTERLY INSPECTIONS
These are conducted quarterly by on-site personnel to evaluate erosion, stability, and other items.

R645-301-515. REPORTING AND EMERGENCY PROCEDURES

R645-301-515.100. SLIDES AND OTHER DAMAGE

Schedule of Construction, Mine Development, Mining and Reclamation

All surface facilities have been constructed for the Pinnacle, Apex and Aberdeen Mines. Earthwork for the Aberdeen Mine was completed in 1989. The surface facilities for the Aberdeen Mine were completed in early 1990. No additional surface facilities are required for any new leases. There will be no additional construction activities or surface disturbance whatsoever in Hoffman Creek or Alrad Canyon.

However, Andalex does intend to add a fan installation in the left-hand fork of Deadman Canyon at some point in time. This installation will be according to measures outlined by the Bureau of Land Management as part of Right-of-Way U-64158. (Copy of Right-of-Way is included in Appendix B.) Andalex will submit detailed plans for this installation at the appropriate time. The location of this breakout is shown on Plate 29 (R.O.W.).

Mining in the Gilson seam began in October, 1980 with a single
unit's production. As mining progresses, additional units will be added with three production units and the longwall scheduled to be operating by mid-1994. A systematic mining plan will be followed to assure maximum recovery. All planning and scheduled production, however, will be contingent upon the coal market. Upon the conclusion of mining activities in the area, the scheduled reclamation phase will begin immediately.

Andalex will fill, regrade and stabilize rills and gullies over 9 inches in depth. Further, Andalex has agreed to interim stabilization of all slopes and embankments within the disturbed area and has done so. One slope located at the bottom of the office driveway, has been attempted through hydroseeding, fertilizing and mulching techniques on three separate occasions. Although no significant erosion problems have occurred, Andalex will notify the Division by the fastest available means of any slides or other damage and comply with any remedial measures required by the Division (generally, reporting will be accomplished by telephone).

Andalex will cover acid or toxic forming materials if any are encountered.

Andalex will advise the Division in the event of a temporary shutdown, such as a letter sent to the Division when Andalex's Apex Mine was temporarily closed.

R645-301-515.200. IMPOUNDMENT HAZARDS

Safety Precautions

The ponds were built as per specifications and under supervision of a qualified, registered professional engineer. The ponds are inspected quarterly for safety and compliance. Inspection reports are maintained on-site, and submitted to the Division on an annual basis. Ponds will be cleaned at minimum when sediment reaches 60% of designed sediment volume. Measuring devices will be installed in the ponds to show when the ponds have filled with sediment to the clean-out level (please see plates 11, 12, and 13). Drainage directly into the Pinnacle and Apex Portals is not part of the calculation for sediment pond sizing (Pond C).

R645-301-515.300. TEMPORARY CESSION OF OPERATIONS

Whenever it is known that operations are to be temporarily ceased for more than 30 days, Andalex Resources will submit to the Division a notice of intention to cease or abandon the operations, in accordance with R645-301-515.320 and to MSHA standards.

This notice will describe mitigation measures to be employed in accordance with the terms and conditions of the permit approval, such as a statement of the number of surface areas involved in the cessation, extent of
cessation, extent of sub-surface strata, prior reclamation efforts accomplished on the property, and identification of all backfilling, regrading, revegation, environmental monitoring, underground opening closures and water treatment activities that will continue during the temporary cessation.

Temporary closing of underground workings will be accomplished with chain link fence material as recommended by MSHA. This prevents access by unauthorized individuals during idle periods. It is not anticipated that once Andalex reaches its peak production that this will occur.

If underground openings are to remain inactive for a period greater than 90 days, such openings will be temporarily closed off from access. Such closures will consist of a chain link or other substantial wire mesh fabric fence placed over the portals to prevent public access while allowing for air flow. Locked gates may be installed in the portal to allow for mine inspection.

HISTORICAL NOTE: On June 11, 2008 the company requested permission from the BLM to modify the R2P2 to allow the mine to be temporarily idled due to economic factors. The BLM approved the modification on June 20, 2008. The portals were then sealed to prevent public access. The idle status has continued for more than 30 days. The surface facilities are secured by a security guard at all times. At the time of the temporary idling, the permit area included 6516.91 acres, and the total disturbed area included 52.64 acres (minesite = 34.2 acres, Left Fork fan and access road = 1.45 acres, and seventeen GVH sites = 17 acres). The subsurface strata extends from zero at the outcrop to more than 3000' under the northernmost longwall panels, and the horizontal extent of the subsurface strata over the permit area is about 21,432' measured north-south and about 21,768' measured east-west. There has been no reclamation done at the site as a result of the temporary closure, although two GVH sites were reclaimed in the meantime. There are no water treatment activity going on at the mine.

The normal required environmental monitoring has continued since the mine has been idled, including hydrologic monitoring of springs, seeps and wells, UPDES monitoring, subsidence monitoring, and raptor surveys. The UPDES outfall points continue to be monitored but there has been no reported flow since the mine was shut down and the pumps were shut off. Nearly all water in the mine was created from the floor strata as mining occurred, and would normally dry up after the mine advanced several hundred feet. None of the flow was attributed to geological structures such as faults or dikes. Since all mining was advancing down-dip the water had to be continually pumped out to the surface since there were no sumps constructed below the workings to collect and store the water. Now that mining has stopped there is no reason to believe that the floor strata will continue to make water, especially at the liberation rate of 800 gpm typical of the operational period. Also, since all the water was being made in the extreme down-dip section of the mine, the water that does continue out of the floor...
will fill up the bottom of the mine until it reaches a level of potentiometric equilibrium. The portals are at the highest end of the mine, and are 1,640' vertically above the impounding area, and more than 14,000' vertically separated. This situation is very different than, for example the Crandall Mine where water is presently discharging from the portals. There, the mine is essentially flat and the source of the water is likely the Joe’s Valley Fault which probably serves as a direct conduit for surface water draining through Joe’s Valley above down to the mine workings. At the Tower Mine there is no primary recharge mechanism, and the vertical dip should serve to allow the water level to stabilize within the mine without discharging from the portals.

R645-301-515.310. TEMPORARY ABANDONMENT
See R645-301-515.300.

R645-301-515.311. SUPPORT AND MAINTENANCE
See R645-301-515.300.

R645-301-515.312. SECURING SURFACE FACILITIES
See R645-301-515.300.

R645-301-515.320. NOTICE OF INTENT TO CEASE OR ABANDON OPERATIONS
See R645-301-515.300.

R645-301-515.321. STATEMENT OF CONDITIONS PRIOR TO CESSATION OR ABANDONMENT, UNDERGROUND
See R645-301-515.300.

R645-301-515.322. STATEMENT OF CONDITIONS PRIOR TO CESSATION OR ABANDONMENT, SURFACE
See R645-301-515.300.

R645-301-516. PREVENTION OF SLIDES
Andalex has agreed to interim stabilization of all slopes and embankments within the disturbed area and has done so. One slope located at the bottom of the office driveway, has been attempted...
through hydroseeding, fertilizing and mulching techniques on three separate occasions. No significant erosion problems have occurred, Andalex will notify the Division in the event of any slides or other damage.

R645-301-520. OPERATION PLAN

R645-301-521. GENERAL

Requirements for Reclamation and Operation Plan

Operation Plan: General Requirements

Andalex Resources, Inc. has added 802 acres in the AEP lease #UTU 69600 to its currently approved Centennial Project. The lease contains 3.0 million tons of recoverable coal in the Centennial and Aberdeen Seams. All reserves will be mined simply as an underground extension of the existing, approved, and currently operating Pinnacle and Aberdeen Mines. As such, no additional surface facilities are required. Access to and handling and extraction of all coal will be through the existing Pinnacle and Aberdeen Mines.

All necessary surface and support facilities have been constructed, approved, and are currently in operation for the Pinnacle, Apex and Aberdeen Mines. There will be no change in the currently approved Environmental Protection Plan.

Overview of Project

Type of Mine

The initial underground mining operation known as the Pinnacle Mine, located on the Zion's fee property, began production on October 3, 1980. It consisted of a single unit's production with an output projected to be approximately 200,000 tons per year and with 20 employees. The mine moved onto the federal leases and with the addition of the Apex Mine in 1982, the Centennial Project now has a production capacity of 1,200,000 tons per year. As there are four minable seams present, the Aberdeen, Gilson, Centennial, and Lower Sunnyside, in ascending order, mining plans call for simultaneous operation of a mine in each seam. The existing operations are in all four seams. The Centennial Seam has been accessed via rock tunnels from the existing Pinnacle Mines (Gilson Seam).

Mining will consist of the underground method of coal extraction using continuous miners and longwall. Room and pillar longwall panel development will be employed with final overall extraction estimated to be about 80 percent of the reserve.

Coal is presently being loaded into 40-ton coal trucks and hauled to Wildcat Jct. near Helper. All seams will be mined using
continuous miners and longwall extraction. Because there is deep cover over the reserves on portions of the Graves Lease, it is likely that first mining only will be possible. Please refer to Plate 26, 27, 28, & 29 which show depth of cover over the seams.

Area of Operations

Mine Plan Area

The mine plan area is limited to and contained within the proposed permit area. Mine plans for each of the minable seams are included as Plates 29, 30, 31 and 41.

Permit Area

The permit area consists of seven federal leases and two fee leases, all controlled by Andalex Resources. The Hoffman Creek federal coal Lease (U-52341) has been relinquished although the acreage still remains in the permit area. Presently, mining operations are taking place on five federal coal leases. Federal leases are U-010581, SL-027304, SL-063058, #U-05067 and UTU-66060. These leases are shown on Plate 4. Mining commenced on #U-05067 in July of 1989. Mining commenced on #UTU-66060 in late 1990. Mining will commence on UTU-69600 in June of 1993.

Disturbed Surface Area

Surface disturbances are minimal due to the nature of the mining activities. The permit area has been previously impacted by mining. Surface disturbances will be limited to the existing facilities which have been constructed. The total existing surface area disturbed is 34.2 acres. Existing facilities are indicated on Plate 6 and 7.

The land affected by mining operations which shall be reclaimed, in compliance with the Mining and Reclamation Plan and all requirements of the Mined Land Reclamation Act and Rules and Regulations adopted in accordance therewith, can be described as follows:

34.2 acres located in T13S, R11E, S.L.B.&M., Carbon County, Utah and contained within,
SE 1/4 SW 1/4 Section 7
NE 1/4 SW 1/4 Section 7
SW 1/4 SE 1/4 Section 7
NW 1/4 SE 1/4 Section 7
SW 1/4 NE 1/4 Section 7
NE 1/4 NW 1/4 Section 18
NW 1/4 NE 1/4 Section 18

Reserves, Production, and Life of Mine

Andalex's most recent reserve estimates, using the longwall mining method, are calculated at 23 million recoverable tons. This includes all seams on all leases.
If the extraction rate of 1.5 million tons is accomplished according to schedule, the project life will be about 15 years. The theoretical life could be closer to 25 years however due to the existence of unleased federal coal logically accessible through only the existing and future Andalex mine workings.

**R645-301-521.100. CROSS SECTIONS AND MAPS**
See R645-301-510, Volume II

**R645-301-532.110. PREVIOUSLY MINED AREAS**
See R645-301-510, Volume II

**R645-301-521.111. LOCATION AND EXTENT OF KNOWN WORKINGS**
See R645-301-510, Volume II

**R645-301-521.112. EXISTING OR PREVIOUSLY SURFACE MINED AREAS**
N/A

**R645-301-521.120. EXISTING SURFACE AND SUBSURFACE FACILITIES AND FEATURES**
See R645-301-510.

**R645-301-521.121. BUILDINGS IN AND WITHIN 1000 FEET OF THE PERMIT AREA**
There are no buildings within 1,000 feet of the permit area except those used as part of the mining operation. They are shown on Plates 6 and 7.

**R645-301-521.122. SURFACE AND SUBSURFACE MAN-MADE FEATURES WITHIN THE PERMIT AREA**
There are no surface or subsurface man-made features within, passing through or passing over the permit area except the powerline, telephone cables, culverts, and etc., installed for the operation of this mine. See Plates 6 and 7 for their locations.

**R645-301-521.123. PUBLIC ROADS IN OR WITHIN 100 FEET OF THE PERMIT AREA**
County Road 299 starts at highway 6 in Price and terminates at Andalex Resources' minesite (Plate 1).
R645-301-521.124. EXISTING FACILITIES WITHIN THE PERMIT AREAS

There are no surface or subsurface man-made features within, passing through or passing over the permit area except the powerline, telephone cables, culverts, and etc., installed for the operation of this mine. See Plates 6 and 7 for their locations.

R645-301-521.125. SEDIMENTATION PONDS AND IMPOUNDMENTS

See R645-301-512.240.

R645-301-521.130. LANDOWNERS AND RIGHT OF ENTRY AND PUBLIC INTEREST MAPS

The leases for which we have the legal right of entry are shown on Plate 4. See Appendix R.

R645-301-521.131. SURFACE AND SUBSURFACE OWNERS

Owners of Record of Surface and Subsurface Contiguous Areas

Names and addresses of all owners of record for all surface and subsurface areas contiguous to and within the permit area are listed below and indicated on Plates 2 and 3.

Subsurface Owners

Franklin Real Estate Company (American Electric Power)
#2 Broadway
New York, New York (contiguous)

Bureau of Land Management
Utah State Office
136 East South Temple
Salt Lake City, Utah 84111 (contiguous & within)

State of Utah
School Trust Lands Administration
355 West North Temple
3 Triad Center, Suite 400
Salt Lake City, Utah 84180 (contiguous)

Andalex Resources, Inc.
PO Box 902
Price, Utah 84501 (within)

Sunedco Coal Company
7401 West Mansfield Avenue
Suite 418
P.O. Box 35-B
Lakewood, Colorado  80235 (contiguous & within)

Zion Security Corp.
10 East South Temple
Salt Lake City, Utah  84111 (within)

Mathis Land Co.
Sunnyside Star Route
Price, Utah  84501 (contiguous & within)

Surface Owners

Bureau of Land Management
Utah State Office
136 East South Temple
Salt Lake City, Utah  84111 (contiguous & within)

Gladys R. Artman
P.O. Box 22
Mountain City, Georgia  30562 (contiguous & within)
F. and D. Shimmin
711 North 5th East
Price, Utah  84501 (contiguous)

SunEdco Coal Company
7401 West Mansfield Avenue
Suite 418
P.O. Box 35-B
Lakewood, Colorado  80235 (contiguous & within)

R. and E. Nelson
583 Sundial Drive
Moab, Utah  84532 (within)

D. Mathis
Sunnyside Star Route
Price, Utah  84501 (contiguous & within)

J & S Critchlow (Cave, et.al)
144 South 1650 East
Price, Utah  84501 (contiguous & within)

Andalex Resources Inc.
P.O. Box 902
Price, Utah  84501 (within)

Zion Security Corporation
10 East South Temple
Salt Lake City, Utah  84111 (within)

State of Utah
School Trust Lands Administration
355 West North Temple
3 Triad Center, Suite 400
Salt Lake City, Utah  84180 (contiguous & within)
R645-301-521.132.  RIGHT TO ENTER AND CONDUCT MINING ACTIVITIES

See R645-301-114.230.

R645-301-521.133.1  OPERATIONS WITHIN 100 FEET OF ROAD RIGHT-OF-WAY

County Road 299 starts at highway 6 in Price and terminates at Andalex Resources' minesite (Plate 1).

R645-301-521.133.2  RELOCATING A PUBLIC ROAD

N/A

R645-301-521.140.  MINE AND PERMIT AREA MAPS

Cross Sections, Maps, and Plans

Most of the cross sections, maps, and plans previously submitted as part of the approved Mining and Reclamation Plan, are applicable. Where necessary, the original maps have been revised to indicate the lease in Hoffman Creek and the revisions are included in this submittal in Volume II.

All categories within this section have been addressed. Specifically,

a) Plates 26, 27, and 28 and 40 show all the test borings locations and elevations. Specific information relating to these drill holes and the strata encountered can be found in Appendix E (coal quality, description of other strata).

b) Monitoring stations for water quality are shown on Figure IV-11. Including the new 12-11 in Aldred Canyon. Fish and wildlife monitoring stations were not set up for this application. However, refer to Plate 34 which depicts wildlife distribution. Air quality monitoring was not required for this application. Figure 6 in Appendix L shows proposed monitoring stations. Andalex has adhered to the locations shown on Figure IV-11 which is included in Andalex's operating plan.

c) Refer to Appendix E for specific drill hole lithologies as well as data on quality and chemical characteristics.

d) Crop lines and strikes and dips can be found on the coal thickness isopachs in Volume II, Plates 26, 27, and 28.

e) All old workings in the three coal seams to be mined are shown on Plates 29, 30, and 31. There are no old workings in the Centennial Seam.

f) All subsurface water on the permit area exists in perched aquifers. The Aberdeen sandstone is the lowest water bearing unit within the permit area and is discussed in Geology.
only water well drilled on the property which has been used with any frequency (well #1) has not depicted any seasonal variation. It is always a low producer.

g) There are no surface waters within the permit area. All drainages (natural) are shown on the topography on Plate 21. All constructed drainages are shown on Plates 6 and 7. There are no irrigation ditches. Appendix L, which is the Hydrologic Inventory, contains Figure 4 which clearly depicts the location of springs in the permit area and adjacent areas. This figure, along with Figures 5 and 6, depict the areal extent of the inventory.

h) N/A

i) Plate 6 shows the location of development waste stored in an area which was previously used as a sediment pond. Plate 6 now also shows the location of a new area above the Apex Mine which can be used for temporary and permanent storage of development waste such as sediment pond material. All dams and impoundments are shown on Plates 6 and 7, and detailed on Plates 11, 12, and 13. There are no other water treatment or air pollution control facilities on the permit area.

j) There are no oil or gas wells within the permit area. Three water wells are shown on Plate 6. Well number 1 is 220 feet deep; number 2 is 100 feet deep, and number 3 is 120 feet deep.

k) Plates 14 and 15 accurately depict the area currently affected by mining as well as the area to be affected. They show the slopes as they exist as well as after construction and upon final reclamation.

Operation Plan: Maps and Plans

1) Most of the maps and plans previously submitted as part of the approved Mining and Reclamation Plan, are applicable. Where necessary, the original maps have been revised to indicate the lease in Hoffman Creek and the revisions are included in this submittal in Volume II.

All necessary maps and plans to complete this section are found in Volume II of the submittal and also in the appendices of Volume I specifically,

a) Underground coal mining activities to be conducted and lands to be affected by surface facilities are shown on Plates 6, 29, 30, 31 and 41.

b-1) Buildings, utilities, and facilities are depicted on Plates 6 and Plate LF-1.

2) The area to be affected is shown on several plates, including
4, 5, 6, 29, 30, 31 and 41. These last four plates show the sequence of mining in the four seams over the five year term of the permit. Plate 30 has been revised to show immediate development in the Gilson Seam as soon as approval is achieved. Reclamation will not take place until after all four seams are mined out. This activity is depicted on Plates 15, 16, 17, and 20.

3) Plates 5 depict the entire disturbed area for which a performance bond is posted. The acreage is shown on Plate 5.

4) Coal storage and loading areas are shown on Plates 6. No cleaning takes place.

5) Plates 6 show a non-coal waste storage area as well as topsoil storage areas. Plates 36 and 37 show the topsoil piles in detail.

6) All water diversions and other water facilities are shown on Plates 6, 8, 9, 11, 12, and 13. Also, typical diversions for disturbed area and undisturbed areas are shown in the Sedimentation and Drainage Control Plan.

7) Diversion ditches as they exist are shown on Revised Plate 6. Topographic detail has been added to Plate 8 to allow determination of watershed slopes within the disturbed area.

8) Specific facilities are not used to protect or enhance
wildlife with the exception of the powerline which was built according to strict guidelines issued by the Division of Wildlife Resources and the U.S. Fish and Wildlife Service regarding raptor protection. The powerline design is included in Volume I as Appendix I (powerline design). Also, speed limits are posted within the permit area.

9) The two powder magazines are shown on Plates 6.

10) Plates 6, 8, and 9 show these facilities associated with protection of the hydrologic balance including sedimentation ponds and storage of non-coal waste. There are no permanent impoundments, or coal processing wastes. Underground development waste has been generated while putting in the Aberdeen portals, and has been used as stockpile pad material at the Aberdeen Minesite. The volume of this material is minimal.

11) Plates 16 and 17 show the final reclamation contours and configuration of the surface for Phases I and II respectively.

12) Subsidence monitoring points are shown on Plate 25. An additional station was added to Plate 25 to cover pillar extraction on the new Hoffman Creek Lease. Also a new station has been added over the Graves Lease. Water monitoring locations are shown on Figure IV-11. A new water monitoring station will be added over the Graves Lease, however and a new station has been added at the mouth of Alrad Canyon (12-1) for the AEP lease.

13) There will be no facilities left on the permit area permanently excepting possibly the road through the site. After the completion of underground mining, all facilities will be removed with the exception of one downstream sedimentation pond. This pond will be removed upon final reclamation.

c) Maps, plans, and cross sections required under b) (5), (6), (10), and (11) have been prepared under the direction of, and certified by a registered professional engineer. Assistance has come from a registered land surveyor.

1) Detailed maps, plans, and cross sections for our sediment ponds, Plates 11, 12, and 13 have been certified by a registered professional engineer.

2) Andalex has not used any excess spoil or underground development waste maps or cross sections. A map (uncertified) depicting the location of non-coal waste storage is included as Plate 6.

INTEGRATED

INTEGRATED

INTEGRATED

INTEGRATED

INTEGRATED

INTEGRATED

INTEGRATED

INTEGRATED

INTEGRATED
# Table of Contents

<table>
<thead>
<tr>
<th>Plate</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate 1</td>
<td>Centennial Project - General Location Map</td>
</tr>
<tr>
<td>Plate 1A</td>
<td>Centennial Project - Coal Leases and Acquisitions</td>
</tr>
<tr>
<td>Plate 2</td>
<td>Centennial Project - Surface Ownership</td>
</tr>
<tr>
<td>Plate 3</td>
<td>Centennial Project - Mineral Ownership Map</td>
</tr>
<tr>
<td>Plate 4</td>
<td>Centennial Project - Leases</td>
</tr>
<tr>
<td>Plate 5</td>
<td>Surface Area Boundary - Deadman Canyon</td>
</tr>
<tr>
<td>Plate 6</td>
<td>As Constructed Surface Facilities - Deadman Canyon</td>
</tr>
<tr>
<td>Plate 7</td>
<td>As Proposed Surface Facilities - Deadman Canyon</td>
</tr>
<tr>
<td>Plate 8</td>
<td>Support Facilities - Surface Area Drainage</td>
</tr>
<tr>
<td>Plate 9</td>
<td>Watershed &amp; Culvert Sizing &amp; Revegetation Reference Areas</td>
</tr>
<tr>
<td>Plate 10</td>
<td>Proposed Sediment Pond E - Post Mining</td>
</tr>
<tr>
<td>Plate 11</td>
<td>Catch Basin B</td>
</tr>
<tr>
<td>Plate 12</td>
<td>Sediment Pond C - As Constructed</td>
</tr>
<tr>
<td>Plate 13</td>
<td>Sediment Pond E - Proposed Aberdeen Surface</td>
</tr>
<tr>
<td>Plate 14</td>
<td>Cut &amp; Fill Cross Section Reference - Deadman Canyon</td>
</tr>
<tr>
<td>Plate 15</td>
<td>Cut &amp; Fill Cross Sections; Original Surface, As Constructed, As Reclaimed - Deadman Canyon (18 Sheets)</td>
</tr>
<tr>
<td>Plate 16</td>
<td>Post Mining Hydrology - Final Reclamation Plan - Deadman Canyon - Phase I</td>
</tr>
<tr>
<td>Plate 17</td>
<td>Final Mining Hydrology - Final Reclamation - Phase II - Deadman Canyon</td>
</tr>
<tr>
<td>Plate 17A</td>
<td>Reclamation Watershed Map</td>
</tr>
<tr>
<td>Plate 18</td>
<td>Soil Survey Map - Deadman Canyon</td>
</tr>
<tr>
<td>Plate 19</td>
<td>Vegetation Survey Map - Deadman Canyon</td>
</tr>
<tr>
<td>Plate 20</td>
<td>Revegetation Map - Deadman Canyon</td>
</tr>
<tr>
<td>Plate 21</td>
<td>Surface Geology of the Andalex Resources' Mine Plan Area</td>
</tr>
<tr>
<td>Plate 22</td>
<td>Centennial Project - Geologic Cross Section Reference and Drill Hole Location</td>
</tr>
<tr>
<td>Plate 23</td>
<td>Centennial Project - Cross Section A-A'</td>
</tr>
<tr>
<td>Plate 24</td>
<td>Centennial Project - Cross Section B-B'</td>
</tr>
<tr>
<td>Plate 25</td>
<td>Centennial Project - Subsidence Monitoring Stations</td>
</tr>
<tr>
<td>Plate 26</td>
<td>Lower Sunnyside Seam Isopach</td>
</tr>
<tr>
<td>Plate 27</td>
<td>Gilson Seam Isopach</td>
</tr>
<tr>
<td>Plate 28</td>
<td>Aberdeen Seam Isopach</td>
</tr>
<tr>
<td>Plate 29</td>
<td>Proposed Mine Plan Lower Sunnyside Seam</td>
</tr>
<tr>
<td>Plate 30</td>
<td>Proposed Mine Plan Gilson Seam</td>
</tr>
<tr>
<td>Plate 31</td>
<td>Proposed Mine Plan A Seam</td>
</tr>
<tr>
<td>Plate 32</td>
<td>Pinnacle Mine Current Mine Plan</td>
</tr>
<tr>
<td>Plate 33</td>
<td>Apex Mine Current Mine Plan</td>
</tr>
<tr>
<td>Plate 34</td>
<td>Centennial Project - Wildlife Distribution Map</td>
</tr>
<tr>
<td>Plate 35</td>
<td>Typical Road Cross Section</td>
</tr>
<tr>
<td>Plate 36</td>
<td>Top Soil Storage Pile &quot;G&quot;</td>
</tr>
<tr>
<td>Plate 37</td>
<td>Topsoil Piles - Deadman Canyon</td>
</tr>
<tr>
<td>Plate 38</td>
<td>Cross Sections and Volumes of Substitute Topsoil</td>
</tr>
</tbody>
</table>
R645-301-521.141. AFFECTED AREA

R645-301-521.142. UNDERGROUND WORKINGS AND SUBSIDENCE AREAS

See R645-301-510, Volume II.

R645-301-521.143. WASTE DISPOSAL SITES

See R645-301-510, Volume II.

R645-301-521.150. LAND SURFACE CONFIGURATION MAPS

See R645-301-510, Volume II.

R645-301-521.151. REQUIREMENTS

See R645-301-510, Volume II.

R645-301-521.152. PREVIOUSLY MINED AREAS

See R645-301-510, Volume II.

R645-301-521.160. MAPS OR CROSS SECTIONS OR PROPOSED FEATURES

See R645-301-510, Volume II.

R645-301-521.161. BUILDINGS, UTILITY CORRIDORS AND FACILITIES

See R645-301-510, Volume II.

R645-301-521.162. AREA AFFECTED ACCORDING TO SEQUENCE AND TIMING OF OPERATIONS

See R645-301-510, Volume II.

R645-301-521.163. BONDED AREA

See R645-301-510, Volume II.

R645-301-521.164. COAL HANDLING FACILITIES

See R645-301-510, Volume II.
R645-301-521.165. TOPSOIL AND WASTE STORAGE AREAS
See R645-301-510, Volume II.

R645-301-521.166. WASTE SOURCES AND DISPOSAL FACILITIES
See R645-301-510, Volume II.

R645-301-521.167. EXPLOSIVES STORAGE AND HANDLING FACILITIES
See R645-301-510, Volume II.

R645-301-521.168. AIR POLLUTION CONTROL FACILITIES
N/A

R645-301-521.169. COAL PROCESSING WASTE FACILITIES
N/A

R645-301-521.170. TRANSPORTATION FACILITIES MAPS
See R645-301-510, Volume II.

R645-301-521.180. OTHER INFORMATION
See R645-301-510, Volume II.

R645-301-521.200. SIGNS AND MARKERS SPECIFICATIONS
Signs of a uniform design, showing the company name, business address, and telephone number as well as the identification number of the current regulatory program permit authorizing the underground mining activities, have been placed at all access points to the permit area. These signs have been placed to be easily seen, are made of a durable material, and conform to local laws and regulations. The topsoil storage area is clearly marked.

As this is an underground mine, there will be no blasting conducted on the surface with the exception of highwall construction. When blasting for highwall construction does occur, conspicuous signs and flagging will be posted as required by 30 CFR Parts 817.11 (f) and 817.65 (e).

As there are no perennial streams or a stream with a biological community on the permit area, buffer zone markers will not be necessary. The perimeters of all areas affected by surface operations and facilities are clearly marked. These signs and markers shall be maintained during all activities and retained and
maintained until after the release of all bonds for the permit area.

R645-301-521.210. PLACEMENT AND REMOVAL
See R645-301-521.200.

R645-301-521.220. DESIGN
See R645-301-521.200.

R645-301-521.230. MAINTENANCE
See R645-301-521.200.

R645-301-521.240. MINE AND PERMIT IDENTIFICATION SIGNS
See R645-301-521.200.

R645-301-521.241. LOCATION, UNDERGROUND MINING
See R645-301-521.200.

R645-301-521.242. LOCATION, SURFACE MINING
N/A

R645-301-521.243. INFORMATION
See R645-301-521.200.

R645-301-521.244. REQUIREMENTS
See R645-301-521.200.

R645-301-521.250. PERIMETER MARKERS
See R645-301-521.200.

R645-301-521.251. SURFACE AFFECTED AREAS FOR UNDERGROUND MINING OPERATIONS
See R645-301-521.200.

R645-301-521.252. PERMIT AREA PERIMETER FOR SURFACE MINING OPERATIONS
N/A
They consist of orange "Tee" posts which are clearly visible from one marker to the next.

As there are four coal seams of minable thickness on the leases, a systematic plan of mining will be followed to assure maximum recovery of the coal reserves. When mining is progressing concurrently in two seams, the room and pillar design and layout will be columnized to assure maximum roof support. Over the life of mine, approximately 28 million tons of coal will be mined. We are currently mining at 0.8 million tpy. Of the 2.3 million tons in-place on the Incidental Boundary Change, much of the coal will be left as part of a barrier pillar according to our approved mining plan. The panel-barrier-panel mine design is the only feasible and approvable mine plan. The BLM and MSHA have agreed and the R2P2 reflects this design Appendix U contains ANDALEX’s approved R2P2 and the most recent modification. This Plan contains specific timing, sequence and method details for recovery of this resource. The panel-barrier design will minimize probability of subsidence.
MINING METHOD

The initial underground mining operation known as the Pinnacle Mine, located on the Zion's fee property, began production on October 3, 1980. It consisted of a single unit's production with an output projected to be approximately 200,000 tons per year and with 20 employees. The mine moved onto the federal leases and with the addition of the Apex Mine in 1982, the Centennial Project now has a production capacity of 1,800,000 tons per year. As there are four minable seams present, the Aberdeen, Gilson, Centennial, and Lower Sunnyside, in ascending order, mining plans call for simultaneous operation of a mine in each seam. The existing operations are in all four seams. The Centennial Seam has been accessed via rock tunnels from the existing Pinnacle Mines.

Mining will consist of the underground method of coal extraction using continuous miners, shuttle cars, roof bolters and feeders and longwall equipment consisting of a shearer, armored face conveyor and shield type roof supports. Room and pillar longwall panel development will be employed with final overall extraction estimated to be about 60 percent of the reserve. See plate 29 for cover isopachs.

Coal is presently being loaded into 40-ton coal trucks and hauled to Wildcat Jct. near Helper. All seams will be mined using continuous miners and longwall extraction.

SURFACE MINING OPERATIONS WITHIN 500 FEET OF AN UNDERGROUND MINE

N/A

EXCEPTIONS TO SURFACE MINING OPERATIONS WITHIN 500 FEET OF UNDERGROUND WORKINGS

N/A

RESOURCE RECOVERY OF ELIMINATION OF HAZARDS

N/A

APPROVAL BY DIVISION AND MSHA

Appendix B; Appendix J
All blasting performed underground will conform to both state and federal regulations governing explosives and blasting in underground coal mines. The rock tunnels to the Centennial Seam were constructed by professional hard rock mining company.

A powder magazine has been set up on one of the surface pads, located in a remote area. It is built to conform to all regulations, such as segregation, regarding such a structure (see plate 6). All blasting operations shall be conducted by experienced, trained, and competent persons who understand the hazards involved and who possess a valid certificate as required by Title 30 of the Code of Federal Regulations. If any additional surface blasting is required, powder magazines at that location will be in a remote site and will comply with all federal and state regulations.

If required, MSHA will be notified if surface blasting will be performed within 500 feet of an active coal mine. If necessary, joint approval will be obtained from the Division and MSHA.

Revised 9/12/95

R645-301-524.100. BLASTER CERTIFICATION

All blasting conducted on the surface will be performed by a DOGM-certified blaster.

R645-301-524.110. CERTIFIED BLASTER

See 301-524.100.

R645-301-524.120. BLASTING CERTIFICATES

Blasting certificates will be kept on site during blasting operations.

R645-301-524.130. FIRING OF A BLAST

A blaster and at least one other person will be present at the firing of the blast.

R645-301-524.140. RESPONSIBILITY

The certified blaster will be familiar with the blasting plan and performance standards, and will give on-the-job training to uncertified persons.
R645-301-524.200. BLAST DESIGN
A blast design will be submitted prior to blasting.

R645-301-524.210. ALL BLASTING OPERATIONS
See 301-524.200.

R645-301-524.211. BUILDINGS WITHIN 1000 FEET OUTSIDE THE PERMIT AREA
See 301-524.200.

R645-301-524.212. WITHIN 500 FEET OF UNDERGROUND MINE
See 301-524.200.

R645-301-524.220. BLAST DESIGN APPROVAL PRIOR TO BLAST
See 301-524.200.

R645-301-524.230. BLAST DESIGN CRITERIA
See 301-524.200. All blasts will meet the requirements of 301-524.600.

R645-301-524.240. CERTIFICATION
The blast design will be prepared and signed by a certified blaster.

R645-301-524.250. CHANGES TO BLAST DESIGN
All blasts will comply with requirements of the Division.

R645-301-524.300. PRE-BLASTING SURVEY
See 301-524.200

R645-301-524.310. NOTIFICATION OF RESIDENTS
See 301-524.200

R645-301-524.320. REQUESTS FOR PRE-BLASTING SURVEY
See 301-524.200
R645-301-524.330. ASSESSMENT OF FACILITIES
See 301-524.200

R645-301-524.340. REPORT OF SURVEY
See 301-524.200

R645-301-524.350. COMPLETION OF SURVEY PRIOR TO BLAST
See 301-524.200

R645-301-524.400. BLAST SCHEDULE
A schedule will be contained in the permit if required.

R645-301-524.410. UNSCHEDULED BLASTS
There will be no unscheduled blasts.

R645-301-524.420. TIME PERIODS FOR BLASTING
All blasting will be conducted between sunrise and sunset hours.

R645-301-524.430. BLASTING NOTICES FOR UNDERGROUND MINING OPERATIONS
See 301-524.200. Local governments will be notified that blasting may be conducted in the Left Hand Fork.

R645-301-524.450. BLASTING SCHEDULE PUBLICATION AND DISTRIBUTION
There will be one blast conducted in the Left Hand Fork between sunrise and sunset September 13, 1995.

R645-301-524.451. NEWSPAPER PUBLICATION
Appropriate publications will be made regarding surface blasting.

R645-301-524.452. DISTRIBUTION OF NOTICES
There are no requirements for distribution due the remote location (greater than ½ mile) of the blast. Local government will be notified.
Not applicable. This is a one-time blast and there will be no new requirements for distribution of notices.

R645-301-524.460. BLASTING SCHEDULE CONTENTS
See 301-524.200

R645-301-524.461. OPERATOR IDENTIFICATION
See 301-524.200

R645-301-524.462. BLASTING LOCATION
See 301-524.200

R645-301-524.463. DATES AND TIME PERIODS OF DETONATIONS
See 301-524.200

R645-301-524.464. ACCESS CONTROL METHODS
See 301-524.200

R645-301-524.465. WARNING SIGNALS
See 301-524.200

R645-301-524.500. DESCRIPTION OF BLASTING SAFEGUARDS
See 301-524.200

R645-301-524.510. BLASTING SIGNS
See 301-524.200

R645-301-524.511. CONSPICUOUSLY PLACED SIGNS
See 301-524.200

R645-301-524.512. ENTRANCES FROM PUBLIC ROADS OR HIGHWAYS
See 301-524.200

R645-301-524.520. WARNINGS
See 301-524.200

5-143
The blast planned in the Left Hand Fork is a one-time blast consisting of a pre-split shot and will be totally contained. The nature of this type of blast will contain both noise and particles. It will have no affect on underground mining, channels, surface or ground water outside the permit area. The location of this blast is a minimum of 7 miles from any public building, church or occupied dwelling.

See 301-524.600.

Air blasts will not exceed the maximum limits at the location of any dwelling, public building, school, church, or community or institutional building outside the permit area. The blast will be located in a remote steep-sided canyon and will not allow air blasts to affect any of the above items.

See 301-524.600. and 621.

Monitoring will be conducted if required by the Division.

Revised 9/12/95
R645-301-524.631. MEASUREMENTS AND LOCATIONS
See 301-524.630.
Revised 9/12/95

R645-301-524.632 MEASURING SYSTEMS
See 301-524.630.

R645-301-524.633. FLY ROCK
The blast is designed to contain all fly rock and cannot travel beyond the permit boundary.

R645-301-524.640. GROUND VIBRATION
Due to the location of the blast there is no potential for damage to any structure as the result of ground vibration.

R645-301-524.641. GENERAL
See 301-524.633.

R645-301-524.642. MAXIMUM PEAK-PARTICLE VELOCITY
See 301-524.633.

R645-301-524.643. SEISMOGRAPHIC RECORD
A seismographic record will be kept if required by the Division.

R645-301-524.650. ALLOWABLE CHARGE WEIGHT
See 301-524.643.

R645-301-524.652. MODIFIED SCALED-DISTANCE FACTOR
See 301-524.643.

R645-301-524.660. BLASTING-LEVEL CHART
See 301-524.643.

R645-301-524.661. GROUND VIBRATION LIMITS
See 301-524.643.
PARTICLE VELOCITY AND VIBRATION FREQUENCY LEVELS

See 301-524.643.
Revised 9/12/95

DAMAGE PROTECTION

See 301-524.643.

SEISMIC MONITORING

See 301-524.643.

STRUCTURES NOT SUBJECT TO AIR BLAST AND GROUND VIBRATION LIMITS

See 301-524.643.

RECORDS OF BLASTING OPERATIONS

Records will be kept of all blasting operations as required by the regulations.

RECORDS

See R645-301-524.700

OPERATOR IDENTIFICATION

See R645-301-524.700

BLAST LOCATION AND SCHEDULE

See R645-301-524.700

BLASTER CERTIFICATION

See R645-301-524.700

NEAREST DWELLING OR FACILITY OUTSIDE THE PERMIT AREA

See R645-301-524.700
WEATHER CONDITIONS

BLASTING RECORD

TYPE OF MATERIAL BLASTED

BLASTING PATTERN

DIAMETER AND DEPTH OF HOLES

TYPES OF EXPLOSIVES USED

TOTAL WEIGHT OF EXPLOSIVES USED PER HOLE

MAXIMUM WEIGHT OF EXPLOSIVES DETONATED IN AN EIGHT-MILLISECOND PERIOD

INITIATION SYSTEM

INCOMPANY

STEMMING

DIV OF OIL, GAS & MINING

MATS OR OTHER PROTECTIONS USED

5-147
R645-301-524.750. SEISMOGRAPHIC AND AIR BLAST INFORMATION
See R645-301-524.700

R645-301-524.751. INSTRUMENTATION
See R645-301-524.700

R645-301-524.752. LOCATION OF INSTRUMENTATION
See R645-301-524.700

R645-301-524.753. PERSONS COLLECTING DATA
See R645-301-524.700

R645-301-524.754. PERSONS ANALYZING DATA
See R645-301-524.700

R645-301-524.755. VIBRATION AND/OR AIR BLAST LEVEL RECORDED
See R645-301-524.700

R645-301-524.760. UNSCHEDULED BLASTS
See R645-301-524.700
Revised 9/12/95

R645-301-524.800. COMPLIANCE WITH OTHER APPROPRIATE REGULATIONS

Andalex Resources will comply with appropriate Utah and federal regulations in the use of explosives.
Survey of Structures and Renewable Resource Lands

There are no structures present other than those constructed for mining operations, on the permit area. The land is presently used for grazing and wildlife habitat which constitutes a renewable resource area. It should be noted that geographic areas above Andalex's 5 year mine plan do not include any area suitable for grazing, nor do they contribute significantly to the long-range productivity of water, food or fiber products. Andalex commits to mitigate all subsidence related damage to renewable resources including, but not limited to water, grazing, and wildlife habitat including raptor nests.

Mining Method

Mining will consist of the underground method of coal extraction using the longwall method, continuous miners on fringe areas, and conveyor haulage. Continuous miners will be employed for longwall development with longwall extraction completing the operation.

Geologic Factors

The Pinnacle Mine is located within the Blackhawk formation of the upper Cretaceous Mesa Verde Group. As is the case with all the active mines in the Book Cliffs coal field, the Pinnacle Mine drifts in from the outcrop and immediately the cover drastically increases as there are very steep sided canyons. Naturally, the same factors are present in the Lower Sunnyside, Aberdeen and the Centennial Seams. There are small areas of multiple seam extraction where a total thickness of up to 16 feet of coal could be removed. From a geologic standpoint, the following conclusion can be drawn: as mining progresses and the longwall panels are pulled the roof will cave in behind the shields as they advance. This is the normal scheme in this type of mining. In our longwall mining sequence, average cover over the coal seams is 2,700 feet or more. Use of longwall mining on the Andalex property will minimize the surface disturbance while enhancing safety underground.

Subsidence has not been detected at any monitoring location currently in place at Andalex, including two pillar extraction sections in close proximity to our initial longwall panel in the Gilson Seam. These pillar sections extracted 90% of the coal which is similar to longwall (See IBC PHC for additional comments on subsidence. The panel-barrier design will minimize the probability of subsidence.) extraction. This fact, in combination with research performed by the Bureau of Mines will justify Andalex using a maximum angle of draw on this property of 20°. The Bureau of Mines performed extensive research at Price River Coal Co. (AEP) in the early 1980's at the #5 and #3 Mines where longwall mining was taking place.

That mining property is in the Book Cliffs Coal field as is Andalex's and is within seven miles. The Bureau's data showed a
maximum draw angle over longwall extraction of (+) 15.2° and a minimum of (-) 7.4°. (See App. T.) The massive sandstones and geologic conditions above the Price River Coal mine are the same as those found above the Andalex permit area. Therefore, similar subsidence results will occur.

Preventive Measures
Subsidence due to mining on the Andalex property will not occur outside of the approved permit area. Stations have been set up as required for constant monitoring of subsidence movements. (See 6., Monitoring.) The only absolute preventive measure possible is to leave coal in place. This is in direct contrast to maximum economic coal recovery.

Resources on the lands above Andalex's mining plan consist only of wildlife habitat with very limited grazing access.

Subsidence monitoring stations will be established as necessary along the first proposed longwall mining. (See 6., Monitoring and Plate 28.) The results of this monitoring program will define monitoring and permitting needs in the future.

Mitigative Measures
If minor subsidence would occur, there would be no material damage or diminution of valuable or foreseeable use of lands including wildlife habitat. It should be noted that subsidence has been occurring in the Book Cliffs coal field for decades with no diminution of resources. The Bureau of Mines Subsidence Study over the #3 Mine longwall panels has substantiated this. (See App. T.) There are no man-made structures or hydrologic concerns located within the affected area of Andalex's mining plan. It has been demonstrated that broad areas of subsidence over longwall panels do not represent adverse impact, if they are even noticeable. Smaller cracks, should they occur, heal themselves quickly and thoroughly.

The one spring located in Hoffman Creek is located stratigraphically well below the lowest coal to be mined. Springs above the seams outside the permit area will not be affected due to their distance from mining activity. Andalex has committed to replacing water should it be proven that mining has disrupted water flow at any location.

In the event mining related subsidence should cause material damage to the land, Andalex Resources, Inc. will take appropriate steps to mitigate or repair such damage. Such repairs or mitigation may consist of one or more of the following steps:

1. Filling of hazardous subsidence cracks;
2. Leveling or regrading of subsidence damaged areas;
3. Reseeding of repaired areas;
4. Purchase of damaged site.

In the event mining related activities should be shown to adversely
affect State-appropriated water supplies, Andalex Resource, Inc. will attempt to repair and restore the affected supply; however, in the event, the supply cannot be restored, the loss may be mitigated by replacement of equivalent water rights from the 19 shares of primary water owned by Andalex Resources, Inc.

Methods to be used to repair damaged supplies may include installation of pipes and/or spring boxes, concreting or filling of cracks with impervious material, reconstructing ponds or damaged channels, or other methods of repair found to be acceptable and based on consultation with the Division and water right owner. It should be noted that any work performed on such hydrologic structures will be first permitted as necessary (i.e. Stream Alteration Permits, etc.).

Monitoring
There are no structures or surface features which could be affected adversely by subsidence. Monitoring stations, however, have been set up at the locations shown on Plate 25. Locations over the first longwall mining are also shown on Plate 28.

The purpose of the detailed monitoring program over the initial longwall mining is to establish baseline information which is useful in the long-term operation of the Andalex mines. This program will consist of surveyable monuments (nail, rebar, etc.) established on 100-foot centers (where possible) over the lines.
designated on Plate 28. Where 100-foot spacing is not possible due to topographic or other obstacles, spacing will be as near 100-foot as possible, particularly along potential tension areas above the panel. Distances between points within the compression area of the longwall panel may be increased up to 500-feet depending on accessibility. Also, Andalex will conduct visual inspections over the first panel prior to and subsequent to mining the panel.

In addition, Andalex is committed to establishing subsidence monitoring programs over successive longwall panels which will consist of up to two monuments per panel and will also include visual inspections annually on active panels.

R645-301-525.100. SUBSIDENCE CONTROL PLAN
See R645-301-525.

R645-301-525.110. MINING METHODS
See R645-301-525.

R645-301-525.120. LIKELIHOOD OF SUBSIDENCE
See R645-301-525.

R645-301-525.130. SUBSIDENCE CONTROL MEASURES
See R645-301-525.

R645-301-525.131. BACKSTOWING OR BACKFILLING OF VOIDS
N/A

R645-301-525.132. LEAVING SUPPORT PILLARS OF COAL
See R645-301-525.

R645-301-525.133. BARRIER PILLARS
See R645-301-525.

R645-301-525.134. MEASURES TO PREVENT DAMAGE
See R645-301-525.

R645-301-525.140. MONITORING
See R645-301-525.
R645-301-525.150. **ANTICIPATED EFFECTS OF PLANNED SUBSIDENCE**
See R645-301-525.

R645-301-525.160. **MITIGATION OR REMEDY OF SUBSIDENCE-RELATED DAMAGE**
See R645-301-525.

R645-301-525.170. **OTHER INFORMATION**

Upon completion of mining and following all required subsidence monitoring, subsidence monitoring stations (which consist of cemented rebar) will be removed.

R645-301-525.200. **SUBSIDENCE CONTROL**
See R645-301-525.

R645-301-525.210. **SUBSIDENCE DESIGN**
N/A

R645-301-525.220. **COMPLIANCE WITH SUBSIDENCE CONTROL PLAN**
See R645-301-525.

R645-301-525.230. **OPERATOR REQUIREMENTS**
See R645-301-525.

R645-301-525.231. **SUBSIDENCE MITIGATION**
See R645-301-525.

R645-301-525.232. **COMPENSATION**
N/A

R645-301-525.240. **RESTRICTED FACILITIES**
N/A

R645-301-525.241. **PUBLIC BUILDINGS AND FACILITIES**
N/A
R645-301-525.242. CHURCHES, SCHOOLS AND HOSPITALS
N/A

R645-301-525.243. IMPOUNDMENTS WITH A VOLUME OF 20 ACRE-FEET OR MORE
N/A

R645-301-525.244. SIGNIFICANT WATER SOURCE FOR ANY PUBLIC WATER SUPPLY SYSTEM
N/A

R645-301-525.250. SUSPENSION OF MINING TO MODIFY SUBSIDENCE CONTROL PLAN
N/A

R645-301-525.260. SUSPENSION OF MINING DUE TO IMMINENT DANGER
N/A

R645-301-525.270. DETAILED UNDERGROUND MINE PLANS

Underground Operation and Facilities

Mine Layout (Refer to Plates 26, 27, 28 and 29).

Multiple Seam Considerations

There are four economic seams present on the property. The uppermost seam is the Lower Sunnyside which varies from four to six feet thick. The second highest seam is the Centennial Seam which varies from four to eight feet thick. The third seam is the Gilson Seam which also varies from 4' to 8' thick. The lowermost seam is the Aberdeen which varies from four to thirteen feet in thickness. The bottom two seams are separated by a 200 foot interval which includes a massive sandstone. The Gilson and the Centennial Seams are separated by approximately 130' and the Centennial and Lower Sunnyside Seams are separated by 80' including a massive sandstone. It should be noted that the area in which the Centennial Seam is to mined does not contain any reserves in either the Lower Sunnyside nor the Gilson Seams. Only the Aberdeen Seam is present where the Centennial Seam is to be mined. The mine plans for each seam are shown on Plates 26, 27, 28 and 29.
Portals

Portals for the present mining operations in the Aberdeen, Gilson and Lower Sunnyside seams are located in Deadman Canyon as shown on Plate 6. The portal areas consist of a conveyor portal, two air intake portals, and an 88" fan portal.

Portals have been enlarged above the coal seam to facilitate men and equipment at the mine opening. Steel sets have been used to support mine roof in the portal areas. The Aberdeen portals have been constructed in a similar fashion, facilitating air intake, conveyor, and an exhaust fan.

The portals are generally 6' high and 20' wide in the Pinnacle and Aberdeen Mines and 4.5' high in the Apex Mine.

The portal mine pads consist of approximately one acre. Located on these pads are the fans, conveyor portals, air intake portals, and mine water storage tanks. It should be noted that the mining of the Centennial Seam did not require new portals on the surface. The Centennial Seam is accessed via rock tunnels from the existing Pinnacle Mine.

Mains, Submains, and Slopes

A five entry system is being used (two intake portals) and using a continuous miner, the entries are being driven to the property line. Generally, entries on 80 foot centers with crosscuts every 80 feet are being driven on the strike and dip of the coal seam. Development mining for the longwall panels are on 5th entry and 3rd entry systems. Refer to Plates 26 through 29. There exists only one return air portal on the surface, however, two exist underground making the five entry system.

Shafts and Interconnecting of Slopes

Mining plans called for rock tunnels to be constructed from the existing Pinnacle Mine up to the Centennial Seam mining area. These rock slopes are each approximately 500' in length. The three tunnels consist of an intake air tunnel, a return air tunnel, and a belt tunnel. Coal is transported via the belt tunnel and transferred on to the existing Pinnacle Mine conveyor belts. These tunnels were constructed in the Spring of 1990 and mining has commenced.

Longwall Panels

The mining sequence calls for the development of panels longwall using 2, 3 and 5 entry systems. These panels will be generally 650 to 800 feet in width and up to 8,000 feet in length.

Barrier Pillars

A barrier pillar will be left between the bleeders and the panels. A barrier will also be left wherever old mine workings are
skirted such as the Olsen Mine on the east side of Deadman Canyon in the Gilson Seam. The approved R2P2 also places barrier pillars between longwall panels to maintain safe working conditions. This was the only mine design approvable by ANDALEX and the BLM.

Bleeder System

A bleeder system will be maintained and pillars left to provide for ventilation, eventually extending around all mined out areas.

R645-301-525.300. PUBLIC NOTICE OF PROPOSED MINING

A copy of the newspaper advertisement of this Mining and Reclamation Plan and proof of publication of the advertisement is filed with the Division and made part of the complete application. Also, please refer to this chapter for the public notice and proof of publication for the newly acquired Sunedco Lease.

R645-301-526. MINE FACILITIES

Support Structures and Buildings

Support structures and buildings are shown on Plates 6 and 7.

Parking Areas

Parking areas have been covered with gravel and magnesium chloride and will be maintained. These are shown on Plate 6. The main office parking area is paved.

Storage Areas

There are several storage areas at the site. These include the Material Storage Area No. 1, Raw Coal Pile Area, Material Storage Area No. 2, and the Topsoil Storage Area. All areas are shown on Plate 6.

R645-301-526.100. MINE STRUCTURES AND FACILITIES

See Volume II.

R645-301-526.110. EXISTING STRUCTURES

Operation Plan: Existing Structures

Construction and Design of Surface Facilities

Existing Structures

It should be noted that there are no existing structures located in the Mathis Tract I.B.C. area or on adjacent proposed Federal and State Lease Applications shown on Plate I-A.
All existing structures are situated on the Zion's fee land, on federal lease SI-027304, or on right-of-way UTU-62045 and are shown on Plate 6. There are no structures existing as part as Andalex's facility which were constructed prior to 1980. Originally it was anticipated that all buildings and structures were to be completed during the first five year permit term. Obviously this is not the case since the Aberdeen Mine has only recently been completely finished to this date. Plate 6 depicts the Aberdeen Mine with the surface facilities completed in early 1990. No new structures on the surface will be required to mine the Centennial and Aberdeen Seams on any lease including the new AEP Lease. Underground rock tunnels access the Centennial Seam. See 1.1, 2.1-1, 2.1-4.

Existing structures include the following:

- Bathhouse (5)  14' x 60'
- Mine Water Storage Tanks (3)  12' x 16'
- Warehouse (1)  14' x 60'
- Lamphouse (2)  40' x 40'
- Substations (2)  60' x 100'
- Office Building  28' x 60'
- Mine Fans (4)  88'
- Portals (15)  6' x 20'
- Culinary Water Tanks (3)  12' x 10'
- Shop  80' x 120'
- Guard Shack  8' x 8'

The Aberdeen Mine surface facilities will include one additional bathhouse, and one lamphouse.

Upon completion of mining activities, the portals will be sealed according to existing state and federal regulations and all buildings and structures not being utilized as part of the reclamation sequence, will be removed.

**R645-301-526.111. LOCATION**

See R645-301-110.

**R645-301-526.112. PLANS OR PHOTOGRAPHS**

See R645-301-110.

**R645-301-526.113. DATES OF CONSTRUCTION OF EXISTING STRUCTURES**

See R645-301-110.

**R645-301-526.114. MONITORING DATA**

N/A

5-158

INCORPORATED

DEC 15 2008

Div. of Oil, Gas & Mining
Construction Schedule

All of the above structures have been completed. The earthwork for the Aberdeen Mine was completed in 1989. The surface facilities were in early 1990. Construction has been located and carried out so as to prevent and control erosion, siltation, water pollution, and damage to property. All facilities have been designed and constructed and will be maintained and used in a manner which prevents damage to wildlife and related environmental values. Any future construction will be conducted in a similar manner according to regulations regarding protection of the hydrologic system, etc. The rock tunnels for the Centennial Seam development were constructed in the spring of 1990 and completed late in 1990. As previously discussed this mining will require no new surface facilities.

General Requirements

Most of the maps and plans previously submitted as part of the approved Mining and Reclamation Plan, are applicable. Where necessary, the original maps have been revised to indicate the lease in Hoffman Creek and the revisions are included in this submittal as figures or as plates in Volume II.

All categories within this section have been addressed, primarily in Volume II of the MRP which contains most of the plates.

a) Surface and subsurface ownership of lands contiguous to the permit area are shown on Plates 2 and 3.

b) The leases for which we have the legal right of entry are shown on Plate 4.

c) At this time all plates and maps have been revised to include all new leases and beyond these leases Andalex does not anticipate making application for additional permits in this five year permit term with the possible exception of a breakout and fan installation on a newly acquired right-of-way in the left fork of Deadman Canyon. The sequence of mining for the next five year permit term as it relates to the entire permit area is shown on revised Plates 29, 30, 31, 41 to
include the Hoffman lease, the Graves Lease and the AEP Lease.

d) There are no buildings within 1,000 feet of the permit area except those used as part of the mining operation. They are shown on Plates 6 and 7.

e) There are no surface or subsurface man-made features within, passing through or passing over the permit area except the powerline, telephone cables, culverts, and etc., installed for the operation of this mine. See Plates 6 and 7 for their locations.

f) These reference areas are shown on Plate 9 as R-1, R-3 and R-4. They are each 200 feet square approximately.

g) The only user of surface water within this hydrologic area is Andalex. The intake location for this water into the mine is located on Plate 6. Disturbed area runoff is collected in a culvert and taken directly into the mine. Andalex controls this water right. If a discharge were to occur from any sediment pond (this has yet to occur), it would discharge into the Deadman Canyon drainage (Plate 21) which is ephemeral.

h) County Road 299 starts at highway 6 in Price and terminates at Andalex Resources' minesite (Plate 1).

i) There are no public parks nor any cultural or historical sites eligible for listing in the National Register in or adjacent to the mine plan area.

j) There are no cemeteries or burial grounds in or within 100 feet of the permit area.

k) There is no land which is within the boundaries of any units of the National System of Trails or the Wild and Scenic Rivers System including study rivers.

R645-301-526.115.4 MINIMIZING RISK OR HARM TO ENVIRONMENT, HEALTH OR PUBLIC SAFETY

R645-301-526.116. PROTECTION OF PUBLIC AND LANDOWNERS

See R645-301-525 and R645-301-510.

R645-301-526.116.1 MINING OPERATIONS WITHIN 100 FEET OF THE RIGHT-OF-WAY OF A PUBLIC ROAD

County Road 299 begins at Highway 6 in Price and terminates at the minesite.

INCORPORATED

OCT 07 2002

DIV OF OIL GAS & MINING
Appendices G & I

R645-301-526.220.
COMPLIANCE REQUIREMENTS
Appendices G & I

R645-301-526.221.
PROTECTION
Appendices G & I

R645-301-526.222.
MINIMIZATION OF ENVIRONMENTAL IMPACT AND COMPLIANCE WITH EFFLUENT LIMITATIONS
Appendices G & I

R645-301-526.300.
WATER POLLUTION CONTROL FACILITIES
See R645-301-512.240.

R645-301-526.400.
AIR POLLUTION CONTROL FACILITIES

Air Pollution Control Plan and Compliance with Air Quality Laws
Existing Environment

The permit area is located in a Class II air quality area.

Air Quality Impact Analysis

Please see the following section on Emission Estimates.

Emission Estimates

Emission estimates are included as Appendix F in the form of an emission inventory. This inventory has been reviewed and approved by the Utah Bureau of Air Quality and the E.P.A. It has been reapproved to increase our production restriction on the basis the haul road has been paved by Carbon County. Air quality permit in appendix F.
Proposed Controls

Since this is an underground operation, no air quality problems are anticipated. The only changes in air quality will be attributable to minor road dust and exhaust mine dust. Methods of control are spray systems, chemical treatment, enclosures, pavement, and other fugitive dust control practices outlined in 30 CFR 817.95.

There will be no additional fugitive emissions or air pollution associated with the newly acquired AEP Lease.

PSD Permit and Compliance with Air Quality

Laws
The Environmental Protection Agency has determined that this project does not need a PSD air quality permit. This is based on our fugitive and non fugitive dust emissions inventory which assumes facilities necessary for 1.5 mm tons per year production. Further, the mine is not subject to the PSD regulations because of the new definition of a major source. (Refer to letter dated March 21, 1980 in Appendix J). All applicable air quality laws will be complied with and fugitive dust control practices, as required under 30 CFR 817.95, will be followed.

Andalex has been issued a new approval order for the mines and the Wildcat Loadout for 1.5 million tons per year. These were inspected and met compliance during the summers of 1989-1992.

Since this is an underground operation, no air quality problems are anticipated. The only changes in air quality will be attributable to minor road dust and exhaust mine dust. Methods of control are spray systems, chemical treatment, enclosures, pavement, and other fugitive dust control practices outlined in 30 CFR 817.95.

There will be no additional fugitive emissions or air pollution associated with the newly acquired AEP Lease.

R645-301-527. TRANSPORTATION FACILITIES

Roads

All roads within the permit area are classified as "Primary Roads" in accordance with R614-301-527.100 or "Ancillary Roads" in accordance with R645-301-527.130. Roads on the site are of 2 typical designs:

1. Single-lane, gravel or asphalt surfaced roads approximately 12 - 15' wide; and

2. Double-lane, either gravel or asphalt surfaced roads, approximately 26' wide.
Although all roads on site are not used for coal hauling, each primary road is constructed to the respective typical design and dimensions shown on Plate 35.

All roads are shown on Plate 6 and Plate 8. Specifics about the road are described individually and include road widths, gradients and surfaces. Drainage ditches and drainage structures for each road (disturbed area ditches or culverts) can be found in Tables IV-2 through IV-8.

Because of the variance in road types, widths and lengths, the roads have been designated on Plate 6 with numbers (i.e. PR-1= Primary Road 1, Ar-1= Ancillary Road 1) to facilitate the description of each:

**Primary Road 1 (PR-1)** - This road connects Carbon County Road 199 to the two lane paved road which travels past the Aberdeen Mine facilities, past the office driveway and bath house drive ways and past the Pinnacle truck loadout. This is an asphalt surfaced road approximately 26 feet wide and 2700 feet long. The grade on PR-1 ranges from 4% to 8%. It is used for hauling coal and for men and material access to the mines.

**Primary Road 2 (PR-2)** - This road begins at the end of PR-1 and continues north past the shop/warehouse and ends at the eastern side of the Apex Mine stockpile. This is a two lane gravel surfaced road which is approximately 26 feet wide and 1400 feet long. It is treated annually with Magnesium Chloride. The grade on this stretch of road ranges from 5% to 9%. It is used for hauling coal and equipment as well as providing men and materials access to the mines.

**Primary Road 3 (PR-3)** - This road provides access to the Aberdeen Mine truck loadout. It is a single lane gravel surface road approximately 15 feet wide and 590 feet long. It is treated with Magnesium Chloride annually. The grade on this road ranges from 0% to 4%.

**Primary Road 4 (PR-4)** - This road provides access for the coal haul trucks to the Pinnacle Mine truck loadout. It is also crossed to access the bath house parking area. This is a single lane, paved surface road which is approximately 15 feet wide and 500 feet long. The grade on this loop ranges from 0% to 9%.

**Primary Road 5 (PR-5)** - This road provides access for the coal haul trucks coming off of PR-2 to the Apex Mine truck loadout. It is a single lane gravel surfaced road approximately 15 feet wide and 425 feet in length. The grade on this road ranges from 0% to 7%. It is treated annually with Magnesium Chloride. The three truck loadout roads are also accessed by front-end loaders for the purpose of cleaning up occasional coal spills.
Primary Road 6 (PR-6) - This is an access road which leads to the main office parking area. It is a single lane, paved surface road which is approximately 15 feet wide and 600 feet long. The average grade of this road is 5% to 7%.

Primary Road 7 (PR-7) - This is an access road for mining equipment. It provides heavy equipment access to and from the Aberdeen Mine. It begins at the south inlet to pond C and it ends at the bath house parking area. It is a gravel surfaced road and is approximately 12 feet wide and 450 feet long. It has grades which range from 4% to 14%. Magnesium Chloride is applied annually.

Primary Road 8 (PR-8) - This road leads from the fuel storage area at the Pinnacle Mine facility to the oil storage area near the upper Pinnacle portals. This is a single lane, gravel surface road approximately 15 feet wide and 325 feet long. The grade on this road has a range of 9% to 11%. It is treated with Magnesium Chloride annually.

Primary Road 9 (PR-9) - This road leads from PR-2 and turns west over the top of the Apex Mine conveyor belt. The road leads to the Apex Mine material storage area, adjacent to the mine fan. This is a single lane gravel surfaced road which is approximately 15 feet wide and 200 feet long and includes a steel deck bridge over the mine conveyor. The grade on this road ranges between 0% and 8%, and the gravel is treated with Magnesium Chloride.

Primary Road 10 (PR-10) - This is an access road which leads from the upper Aberdeen Mine material storage area down to the Aberdeen Mine stockpile pad. This is a short stretch of road which is approximately 12 feet wide and 150 feet long. It is a single lane road with an average grade of 12% to 15%.

Primary Road 11 (PR-11) - This is a very short access road which accesses the bath house pad from two directions; both from PR-1 and from PR-4. This road is approximately 12 feet wide and 150 feet long. It is a single lane road with a grade of 0% to 6%. This road is treated with magnesium chloride annually.

Ancillary Road 1 (AR-1) - This is an access road which leads from the south Aberdeen intake portal to the Aberdeen mine fan. It is a single lane road which has a surface of sandstone. The road is used primarily for access to the fan, water system and conveyor. This road is approximately 20 feet wide and 400 feet long. There is a steel deck bridge over the Aberdeen mine conveyor. The grade on this road ranges from 8% to 10%.

Ancillary Road 2 (AR-2) - This road leads from the upper Pinnacle Mine intake portals to the Pinnacle Mine fan. It is a single lane gravel surfaced road which has a steel deck bridge where the road crosses the Pinnacle Mine conveyor. Its primary use is to access the Pinnacle Mine fan. It is approximately 12 feet wide and 200 feet long. The grade on this road ranges from 0% to 12%.
Ancillary Road 3 (AR-3) - This road leads from PR-2 up to the Apex material storage area (Gun range). This is a single lane gravel surface road which is approximately 12 feet wide and 175 feet long. The grade on this road is on an average of 9%. It is treated with Magnesium Chloride annually. It is used primarily for access.

Ancillary Road 4 (AR-4) - This road is access from the upper Apex material storage area to the Powder Magazines. This road continues beyond the north end of our permit area but it becomes a private road beyond the permit area. This is a single lane dirt road which is approximately 12 feet wide and 150 feet long. The grade on this short stretch of road is 5% to 8%.

Ancillary Road 5 (AR-5) - This road is access from Carbon County Road 299 to the left hand fork installation. This existing road will be upgraded adequately for maintenance and emergency access only. It will be equipped with a locked gate. This is a single lane dirt road which is approximately 15 feet wide and 4000 feet long. There will be 3 or 4 locations specifically widened so that two vehicles may pass. The grade on this stretch of road ranges from 0% to 15%. This road will be reclaimed upon cessation of mining pending the approval of Mrs. Gladys Artman.

Andalex commits to repair roads damaged by a catastrophic event as soon as practical according to R645-301-527.240. According to R645-301-534.100 Andalex has located, designed, constructed, used and maintained Primary Roads so as to prevent or control damage to private and public property. Andalex has used non-acid or non-toxic forming materials in road surfacing. Roads have, at a minimum a static safety factor of 1.3 on embankments. Andalex has a schedule and plan to remove roads that will not be retained as part of the approved post mining land use. Ancillary roads will be traveled only by light vehicles for routine access. Occasionally, they will be traveled by larger equipment but probably only in emergency or repair situations, as 2 of the 4 Ancillary Roads lead to fan installations. All Primary Roads will meet the requirements of R645-301-358, R645-301.527.100, R645-301-527.230, R645-301-534.100, R645-301-534.200, R645-301-542.600 and R645-301-762. Primary Roads will be located in so far as practical on the most stable available surfaces. The roads are surfaced with rock, gravel or asphalt according to R645-301-534.320. They will be routinely maintained, and have culverts which are designed and installed as necessary according to the requirements of R645-301-534.340.

Railroad
There are no existing or proposed railroad spurs on the property.

Other Transportation Facilities
The conveyor structures at the minesite are very standard cross member, bent designs. The Pinnacle conveyor is 180 feet in length and uses a 42" conveyor belt. It is covered with galvanized corrugated sheeting. The Pinnacle Truck Loadout is an under pile gravity feed reclaim system in 8 foot diameter sectioned steel tunnel for 90 feet and surfaces on the typical bent, steel structure
for an additional 110 feet. The Apex truck loadout is identical to Pinnacle. The mine conveyor is also the same bent/cross member design with a 42" conveyor; however, it is 250 feet in length. The Aberdeen facility is equipped with conveyor facilities similar to that of Pinnacle with only slight variations in exact length anticipated or possible. These facilities will be completed in early 1990.

Transportation facilities such as roads have been addressed. The roads, Class II and I are to be removed upon cessation of mining by simple regrading and re-establishment of contours, unless surface owners request access through the mine area might remain.

Protection of the environment through the use of these facilities is achieved by speed controls (20 mph minesite). The conveyor structures as such do not impose environmental problems. Public safety obviously is a requirement of law including MSHA but also public safety is a requirement of Andalex Resources. Also the minesite is not frequented by any public outside of normal, weekly business hours.

R645-301-527.100. ROAD CLASSIFICATION
R645-301-527.110. DESIGNATION OF ALL ROADS
See R645-301-527.
R645-301-527.120. PRIMARY ROADS
See R645-301-527.
R645-301-527.122. FREQUENT USE OR FOR PERIODS IN EXCESS OF 6 MONTHS
See R645-301-527.
R645-301-527.123. RETAINED FOR POSTMINING LAND USE
See R645-301-527.
R645-301-527.130. ANCILLARY ROADS
See R645-301-527.
R645-301-527.200. TRANSPORTATION FACILITIES
Revised 8/8/95
R645-301-527.210. DESIGNS AND SPECIFICATIONS
See R645-301-527.
R645-301-528. HANDLING AND DISPOSAL OF COAL, OVERBURDEN, EXCESS SPOIL, AND COAL MINE WASTE

As raw coal is hauled from the permit area, there will be no processing waste and no return of processing waste to underground workings. If in the future it is decided that a processing facility is to be incorporated, waste or reject would taken to an approved refuse disposal site. Please note that underground development waste rock generated by the Centennial Seam rock tunnels was disposed of underground in the existing Pinnacle Mine workings. See R645-301-528.300.

R645-301-528.100. COAL REMOVAL, HANDLING, STORAGE, CLEANING, AND TRANSPORTATION AREAS AND STRUCTURES

Coal Handling Facilities

Stockpiles
Coal is discharged from the conveyor onto a coal stockpile in the Raw Coal Stockpile Area indicated as on Plate 6. This is a live stockpile as opposed to a storage pile. It should be noted that when the Centennial Seam is mined it is transferred underground to existing Pinnacle Mine conveyors and therefore, ends up in the Pinnacle Mine stockpile.

Loadout
Coal is loaded from the stockpile by an electronic automatic loadout into 40 ton coal trucks and hauled to Wildcat Jct. which is on the Utah Railroad.

Preparation Plant
A coal cleaning facility will not be used. However, by the new definition of a preparation plant, the Wildcat Loadout now comes
under the SMCRA and a plan has been approved under ACT 007/033.

Removal of Surface Structures

Upon completion of mining activities, all surface facilities will be removed. The coal pile area will be filled, the slope contoured, compacted, topsoil replaced, regraded, and revegetated. In the materials storage and building areas, all structures and foundations including the shop, office building, bathhouse, substation, and water storage tanks, will be removed, re-contoured, compacted, topsoil replaced and graded, and revegetated according to revegetation procedures described in this chapter.

R645-301-528.200. OVERBURDEN

R645-301-528.300. SPOIL, COAL PROCESSING WASTE, MINE DEVELOPMENT WASTE, AND NON-COAL WASTE REMOVAL

Underground Development Waste
There has been no development waste or excess spoil to date excepting sedimentation pond material.

Coal Waste

Coal Processing Waste
The only coal processing waste to date is rock material manually separated from Andalex Resources' lump coal product at Wildcat. This is currently placed in an approved area at Wildcat Loadout. This MRP contains an Appendix Q. Appendix Q references the plan for reclamation of the waste rock pile at the Wildcat Loadout and should not be confused with the Centennial Reclamation Plan. Disposal of sediment pond material (temporary and permanent) is shown on Plate 6. Sediment pond waste has already been tested in one case to be non toxic and non acid forming and is being used currently in the Aberdeen Mine fill areas. Other material which is generated will be placed in temporary storage above the Apex Mine as shown on Plate 6 and will be disposed of permanently as back fill in high walls upon final reclamation. This material will be tested prior to final reclamation if used for final reclamation purposes. Based on previous experience, Andalex estimates that up to 3,000 yards of material at most will be generated. This material is included in the earthwork estimates. Please note that the rock tunnels constructed to the Centennial coal seam generated significant amounts of waste rock. One hundred percent of this waste rock was disposed of underground in the existing Pinnacle Mine. None of the waste rock appeared at the surface.

Coal Refuse
Please refer to Plate 6 for location of disposal areas.
Acid and Toxic-Forming Materials

The only spoil material which has been developed from the minesite is sediment pond waste. It has been determined that this material is non-toxic or acid-forming and that it may be used in a fill situation (see Appendix H). Samples are currently being further analyzed to determine whether they are toxic or acid forming. These materials include mid seam, roof, and floor material. Appendices E and H currently contain the majority of the information necessary to determine whether roof, floor, or mid seam material is acid or toxic forming. If any roof rock from the Aberdeen Mine is developed, it will be disposed of underground or in one of the underground development waste storage areas depicted on Plate 6.

Some coal development waste has been used as a stockpile pad for the Aberdeen Mine. This material will be treated as coal mine development waste upon reclamation and back filled into our high wall areas.

Future pond accumulations for the entire mine site will be stored at least temporarily on the material storage site located above the Apex Mine or in the now defunct Pond A. depicted as "temporary excess spoil and mine development waste" and shown on plate 6. Please see Plate 6.

Andalex will analyze the mid-seam of all four coal seams in addition to the roof and floor material on an annual basis or more frequently if mining operations change which could result in a modification to the roof floor or the mid-seam. Andalex will use this monitoring program in conjunction with the new AAP Lease. Andalex will make an effort to sample the material in the vicinity of section corners which occur within our leases. Andalex agrees to monitor for acid or toxic forming materials according to Table 6, "Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining". These parameters will prove pH, Electrical Conductivity, Saturation Percentage, Particle Size Analysis, Soluble Ca, Mg and Na, Sodium Adsorption Ratio, Selenium, Total N, Nitrate-N, Boron, Maximum Acid Potential, Neutralization Potential, Organic Carbon, Exchangeable Sodium, Available Water Capacity, and Rock Fragments. These parameters will be measured by acceptable methods at a qualified commercial testing laboratory.

There is no equipment located within our permit area which contain any of the substances listed by the Toxic Substances and Control Act, particularly PCB's. All transformers and OCB's are relatively new and are PCB free.

The storage of petroleum products on site is done in such a manner that hazards from spillage are minimal. Andalex operates with an SPCC Plan approved by a registered professional engineer (Appendix S). It is inevitable that during the course of operations, small amounts of oil and fuel will be accidently spilled and soaked up by soils and gravels. Andalex proposes to designate a specific area within our disturbed area at which contaminated soils or gravels will be brought, spread out, and aerated using only solar heat. We propose this area to be south of the Aberdeen truck loadout. The area will be small, however, it will be bermed to avoid runoff while the aeration process is ongoing. Once the aeration process is
complete and the material is satisfactorily decontaminated, it will be used again as fill or hauled to our waste disposal area. Another possibility is the use of bioremediation. As this process is still being tested, Andalex does not propose to use this method at this time. However, should the method prove successful and acceptable, Andalex will consider using the process.

At the time of final reclamation, Andalex will need to treat or dispose of small quantities of soils and gravels which have been contaminated with oil and/or fuel. At final reclamation, Andalex will utilize the best available technology (BAT) to treat this quantity of soil and gravel in order that it is suitable for fill material. This would include methods for removing volatile matter and other contaminants. Should it prove at that time that best available technology is inadequate for decontamination, Andalex will dispose of this material at an approved disposal site (not within the permit area). This site would be approved by State Health and EPA for the disposal of this type of material.

Non-Coal Waste

Non-coal waste consists of lubricants, paints garbage, timber, and other waste generated during mining. Please refer to Plate 6 for the location of non-coal waste disposal (dumpsters).

Combustible Materials

No special measures are required. All combustibles (paper, etc.), are collected in trash containers and hauled to local city and land fill areas. Andalex currently operates under an SPCC Plan approved by a registered professional engineer. All materials such as oil and grease will be disposed of according to specific local requirements. All used motor oil is collected in 55 gallon drums and is recycled by local oil distributors. All used oils are recycled.

Contingency Plans to Prevent Sustained Combustion

All which could burn would be small in quantity and consist of mine trash. The trash facility is segregated and if ignited accidentally, could be extinguished using either water or fire extinguishers.

R645-301-528.310. EXCESS SPOIL

See R645-301-528.300.

R645-301-528.320. COAL MINE WASTE

See R645-301-528.300.
R645-301-528.321. RETURN OF COAL PROCESSING WASTE TO ABANDONED UNDERGROUND WORKINGS

See R645-301-528.300.

R645-301-528.322. REFUSE PILES

N/A

R645-301-528.323. BURNING AND BURNT WASTE UTILIZATION

N/A

R645-301-528.323.1 COAL MINE WASTE FIRES

In the unlikely event that any coal mine waste, including boney material or fine coal waste, were to ignite the fire would be extinguished in the same way that coal stockpile fires are extinguished. That is, the material will be dug out with front-end loaders, spread out on the ground inside the permit area, and be compacted. The material would then be returned to the waste storage area.

R645-301-528.323.2 BURNING OR BURNT COAL MINE WASTE REMOVAL PLAN

N/A

R645-301-528.330. NON-COAL MINE WASTE

See R645-301-528.300.

R645-301-528.331. DESIGNATION OF NON-COAL MINE WASTE MATERIALS

See R645-301-528.300.

R645-301-528.332. FINAL DISPOSAL OF NON-COAL MINE WASTES

See R645-301-528.300.

R645-301-528.333. RESTRICTIONS ON DISPOSAL ON NON-COAL MINE WASTE MATERIAL

See R645-301-528.300.

R645-301-528.334. HAZARDOUS WASTE MATERIALS
Introduction

Upon completion of mining activities, the portals will be sealed according to existing state and federal regulations. Conveyors will be removed and pads filled. The slope will be contoured, compacted, and topsoil replaced and graded.

The final sealing of mine openings will be accomplished by placing a recessed concrete block seal 25 to 50 feet from the mouth of the portal. Since a portion of the mine slopes towards the portals, and mine water is present, seals will be constructed with at least one drainage pipe in the lowest portal. This pipe shall be a schedule 80 - 4" PVC, with a U-tube water trap and a valve or cap on the end. The pipe will be extended beyond the portal backfill. The area from the seals to the mouth of the portals will be backfilled. The portal structures will be removed and the exposed coal seam, including portal area, will be covered during reclamation. Please note that the Centennial Seam Mine will not require any new portals on the surface.

If a discharge is found to occur after sealing, the water will be sampled quarterly for compliance with effluent standards of 817.42 and treated (if necessary) during the liability period. See Figures IV-1 and IV-2 for portal sealing details.
TYPICAL CONSTRUCTION

HIGHHALL

PORTAL

COAL SEAM

TYPICAL FOR RECLAMATION

LEDGE ROCK

BACKFILL

25' Min.

DRAINAGE PIPE (WHERE REQUIRED)

PORTALS SEALED AND BACKFILLED

SEAL

SEE FIG. 3 FOR DETAILS

FIGURE IV-1

TYPICAL PORTAL SEALING

DIV OF OIL, GAS & MINING

CCT 072222

5-171

DAN W. GUY

No. 154168

STATE OF UTAH

9/10/07
4" Sch. 80 PVC drainage pipe. U-Tube to keep water in pipe. Install in lower portal only. Extend beyond backfill and provide cap or valve on end.

Typical Portal Seal
Scale: 1"=4'0"
Figure IV-2
It is very unlikely that a mine discharge will occur from any of the permanently sealed mine portals, although each seal will be equipped with a drainage pipe described above. To date, Andalex has encountered dry mining conditions and all portals in all three mines drift into the mountain in a down dip direction. If a discharge were to occur, it would only be after the entire pillared out workings had filled first. Then only would the static head against the seal allow any discharge. There is no way of knowing or estimating the mine discharge rate.

As maintained above, Andalex will monitor any discharge. Andalex's existing NPDES allows for a certain volume of mine discharge. This permit will be maintained after cessation of mining for the liability period until the bond is released.

The blowing fan ventilation shaft will be sealed by completely backfilling it from bottom to top. This shaft is 370' deep by 16' diameter, and will require approximately 2,755 cubic yards of backfill material. This backfill material will be hauled in from an offsite commercial gravel pit. See Appendix Y for reclamation information regarding the Ventilation Shaft/Blowing Fan Installation.

**Temporary Cessation**

Whenever it is known that operations are to be temporarily ceased for more than 30 days, Andalex Resources will submit to the Division a notice of intention to cease or abandon the operations, in accordance with MSHA standards.

This notice will describe mitigation measures to be employed in accordance with the terms and conditions of the permit approval, such as a statement of the number of surface areas involved in the cessation, extent of sub-surface strata, prior reclamation efforts accomplished on the property, and identification of all backfilling, regrading, revegation, environmental monitoring, underground opening closures and water treatment activities that will continue during the temporary cessation.

Temporary closing of underground workings will be accomplished with chain link fence material as recommended by MSHA. This prevents access by unauthorized individuals during idle periods. It is not anticipated that once Andalex reaches its peak production that this will occur.

If underground openings are to remain inactive for a period greater than 90 days, such openings will be temporarily closed off from access. Such closures will consist of a chain link or other substantial wire mesh fabric fence placed over the portals to prevent public access while allowing for air flow. Locked gates may be installed in the portal to allow for mine inspection.

**Casing and Sealing of Drill Holes**

All exploratory drill holes have been sealed with cement and all water wells have been cased with steel casing and will be
After mining is completed, the water wells and monitoring wells will be sealed except in the event the state engineer allows them to remain opened for other purposes.

R645-301-529.200. UNDERGROUND MINING OPERATIONS

R645-301-529.210. TEMPORARILY INACTIVE OPERATIONS
See R645-301-515.300.

R645-301-529.220. RETURN UNDERGROUND DEVELOPMENT WASTE, COAL PROCESSING WASTE OR WATER TO UNDERGROUND WORKINGS
See R645-301-515.300.

R645-301-529.300. HOLES USED FOR BLASTING
N/A

R645-301-529.400. SURFACE MINING OPERATIONS
N/A

R645-301-530. OPERATIONAL DESIGN CRITERIA AND PLANS

Operation Plan: Existing Structures

Construction and Design of Surface Facilities

Existing Structures

All existing structures are situated on the Zion's fee land, on federal lease SL-027304, or on right-of-way UTU-62045 and are shown on Plate 6. There are no structures existing as part as Andalex's facility which were constructed prior to 1980. Plate 6 depicts the Aberdeen Mine with the surface facilities completed in early 1990. No new structures on the surface will be required to mine the Centennial and Aberdeen Seams on any lease including the new AEP Lease. Underground rock tunnels access the Centennial Seam. See 1.1, 2.1-1, 2.1-4. Existing structures include the following:

- Bathhouse (5) 14' x 60'
- Mine Water Storage Tanks (3) 12' x 16'
- Warehouse (1) 14' x 60'
- Lamphouse (2) 40' x 40'
- Substations (2) 60' x 100'
- Office Building 28' x 60'
- Mine Fans (4) 88''
- Portals (15) 6' x 20'
- Culinary Water Tanks (3) 12' x 10'
- Shop 80' x 120'

INTEGRATED

JAN 08 2007

Div. of Oil, Gas & Mining
A new blowing ventilation fan and a new substation is proposed as shown on Plate 6. The fan will be a forced air fan and shaft to the Aberdeen Seam below. The fan will be located very close to the existing edge of the disturbance as shown on Plate 6. Refer to Appendix Y for additional information regarding this installation. The new substation will be located near the Aberdeen Mine portals. See Plate 6.

Upon completion of mining activities, the portals will be sealed according to existing state and federal regulations and all buildings and structures not being utilized as part of the reclamation sequence, will be removed, according to the Reclamation Plan.

Construction Schedule

All of the above structures have been completed, except the proposed new ventilation fan for the Aberdeen Mine. The earthwork for the Aberdeen Mine was completed in 1989. The surface facilities were in early 1990. Construction has been located and carried out so as to prevent and control erosion, siltation, water pollution, and damage to property. All facilities have been designed and constructed and will be maintained and used in a manner which prevents damage to wildlife and related environmental values. Any future construction will be conducted in a similar manner according to regulations regarding protection of the hydrologic system, etc. The rock tunnels for the Centennial Seam development were constructed in the spring of 1990 and completed late in 1990. As previously discussed this mining will require no new surface facilities.

Construction Methods

Major Equipment

The portal and building sites were leveled using dozers, trucks, and loaders. At the building sites, the topsoil was removed and transported to a nearby area for storage.

All surface pads have been graveled and all other disturbed areas (pond embankments, etc.) have been reseeded.

R645-301-531. GENERAL

Schedule of Construction, Mine Development, Mining and Reclamation

All surface facilities have been constructed for the Pinnacle, Apex and Aberdeen Mines. Earthwork for the Aberdeen Mine was completed in 1989. The surface facilities for the Aberdeen Mine were completed in early 1990. No additional surface facilities are required for any new leases, however, as mentioned above, there is a proposed new ventilation fan for the Aberdeen Mine. There will be no additional construction activities or surface disturbance whatsoever in Hoffman Creek or Alrad Canyon.

However, Andalex does intend to add a fan installation in the left-hand fork of Deadman Canyon at some point in time. This
Installation will be according to measures outlined by the Bureau of Land Management as part of Right-of-Way U-64158. (Copy of Right-of-Way is included in Appendix B.) Andalex will submit detailed plans for this installation at the appropriate time. The location of this breakout is shown on Plate 29 (R.O.W.).

Mining in the Gilson seam began in October, 1980 with a single unit's production. As mining progresses, additional units will be added with three production units and the longwall scheduled to be operating by mid-1994. A systematic mining plan will be followed to assure maximum recovery. All planning and scheduled production, however, will be contingent upon the coal market. Upon the conclusion of mining activities in the area, the scheduled reclamation phase will begin immediately.

Andalex will fill, regrade and stabilize rills and gullies over 9 inches in depth. Further, Andalex has agreed to interim stabilization of all slopes and embankments within the disturbed area and has done so. One slope located at the bottom of the office driveway, has been attempted through hydroad seeding, fertilizing and mulching techniques on three separate occasions. No significant erosion problems have occurred, Andalex will notify the Division in the event of any slides or other damage immediately by telephone and in writing.

Andalex will cover acid or toxic forming materials if any are encountered.

Andalex will advise the Division in the event of a temporary shutdown, such as a letter sent to the Division when Andalex's Apex Mine was temporarily closed.

R645-301-532. SEDIMENT CONTROL

See R645-301-512.240.

R645-301-532.100. MINIMIZING DISTURBANCES

Surface disturbances are minimal due to the nature of the mining activities. The permit area has been previously impacted by mining. Surface disturbances will be limited to the existing facilities which have been constructed. The total existing surface area disturbed is 34.2 acres. Existing facilities are indicated on Plate 6 and 7.

The land affected by mining operations which shall be reclaimed, in compliance with the Mining and Reclamation Plan and all requirements of the Mined Land Reclamation Act and Rules and Regulations adopted in accordance therewith, can be described as follows:

34.2 acres located in T13S, R11E, S.L.B.&M., Carbon County, Utah and contained within,

- SE 1/4 SW 1/4 Section 7
- NE 1/4 SW 1/4 Section 7
- SW 1/4 SE 1/4 Section 7
- NW 1/4 SE 1/4 Section 7
- SW 1/4 NE 1/4 Section 7

INTEGRATED
JAN 08 2007
Div. of Oil, Gas & Mining
R645-301-532.200. STABILIZING BACKFILLED MATERIAL

Backfilling, Grading, and Soil Replacement and Stabilization

All disturbed areas will be backfilled and graded to as near as possible the approximate original contour, and to the most moderate slope possible. Slopes shall not exceed the angle of repose or such lesser slopes as required by the regulatory authority to maintain stability. Fill material will be compacted to assure stability.

Andalex has had a slope stability study performed on a fill pad with a slope greater than 2h:1v and it was determined, even prior to compaction, that the fill had an adequate safety factor. Refer to Appendix K for this study done at the Pinnacle Mine. Andalex has committed to five years of monitoring of this site or whatever amount of time is necessary to assure stability of slopes has been achieved. It should be noted that all highwalls on Andalex's minesite are in or will be in bedrock. This is a steep sided, narrow canyon and Andalex will not be relieved of liability until reasonable stability has been achieved through compaction and revegetation. Steep slopes will be reclaimed according to the approved plan shown on Plates 14 and 15.

Areas to be regraded include the portal site, surface facility site and roads. Because of the diversity of these areas, all regrading will conform to the specific site. Specific to high wall areas, some of the back filling will include excess spoil and underground development waste. We estimate this may be as much as 3000 yards of material. Please refer to Plate 15 addendum for a detailed drawing on the high wall areas. The Aberdeen Mine high wall has been redrawn and back fills recalculated. Where slopes are greater than 2 to 1, before final reclamation is completed, slope stability studies will be performed as necessary. All information for slope stability studies will be included as part of the final reclamation package.

Where possible, all final grading and placement of topsoil will be done along the contour to minimize erosion. In all cases, grading will be conducted in a manner which minimizes erosion and provides a stable surface for the placement of topsoils.

Topsoil existing on site will be spread using a grader. Where possible, the soil will be distributed along the contour. The thickness of the re-established soil will be consistent with soils in the vicinity and will be sufficient to support vegetation equal to or superior to pre-mining history, 6".

Andalex will rip the subsurface material to 6" using most likely a toothed motor grader or a disc, prior to soil redistribution.

Andalex will mix one ton of alfalfa per acre with its topsoil material to aid in aeration, microbiological community development, and water holding capacity.
Andalex will distribute topsoil to a minimum depth of 6" as previously stated.

Andalex has already committed to testing of redistributed soil and fill material and has committed to use proper additives if it is discovered necessary. Specifically, Andalex will test for organic matter, phosphorous, potassium, pH, conductivity, and texture. The samples will be taken at 0-6 inches, 6-12 inches, and 12-24 inches at least 90 days prior to final reclamation.

R645-301-533. IMPOUNDMENTS
See R645-301-512.240.

R645-301-533.100. STABILITY
See R645-301-512.240.

R645-301-533.200. FOUNDATION DESIGN
Appendix K

R645-301-533.210. STABILITY
Appendix K

R645-301-533.220. PREPARATION
Appendix K

R645-301-533.300. SLOPE PROTECTION
See R645-301-532.200.

R645-301-533.400. VEGETATION OF EMBANKMENTS
See R645-301-532.200.

R645-301-533.500. SUBMERGED HIGHWALLS
N/A

R645-301-533.600. MSHA IMPOUNDMENTS
N/A

R645-301-533.610. GEOTECHNICAL INVESTIGATIONS
N/A
ENGINEERING DESIGN

R645-301-533.620.
See R645-301-512.240.

R645-301-533.700.
NON-MSHA IMPOUNDMENTS DESIGN REQUIREMENTS
See R645-301-512.240.

R645-301-534.
ROADS
See R645-301-512.250.

R645-301-534.100.
DESIGN, USE AND RECLAMATION
See R645-301-512.250.

R645-301-534.110.
DAMAGE TO PUBLIC OR PRIVATE PROPERTY
See R645-301-512.250.

R645-301-534.120.
NON-ACID OR NONTOXIC FORMING SUBSTANCES IN ROAD SURFACING
No acid or toxic-forming substances will be used for road surfacing.

R645-301-534.130.
FACTOR OF SAFETY FOR ROAD EMBANKMENTS
See R645-301-512.250.

R645-301-534.200.
SAFETY AND ENVIRONMENTAL PROTECTION
See R645-301-512.250.

R645-301-534.300.
PRIMARY ROADS
See R645-301-512.250.

R645-301-534.310.
LOCATION
See R645-301-512.250.

R645-301-534.320.
SURFACING
See R645-301-512.250.

R645-301-534.330.
MAINTENANCE
See R645-301-512.250.
R645-301-534.340. CULVERT DESIGN
See R645-301-512.250.

R645-301-535. SPOIL
See R645-301-513.300.

R645-301-535.100. DISPOSAL OF EXCESS SPOIL
See R645-301-513.300.

R645-301-535.110. MINIMUM FACTOR OF SAFETY
N/A

R645-301-535.111. LOCATION
N/A

R645-301-535.112. FOUNDATION INVESTIGATIONS
N/A

R645-301-535.113. KEYWAY CUTS OR ROCK TOE BUTTRESSES
N/A

R645-301-535.120. EXCESS SPOIL DISPOSED OF IN UNDERGROUND MINE WORKINGS

Return of Coal Processing Waste to Abandoned Underground Workings

As raw coal is hauled from the permit area, there will be no processing waste and no return of processing waste to underground workings. If in the future it is decided that a processing facility is to be incorporated, waste or reject would taken to an approved refuse disposal site. Please note that underground development waste rock generated by the Centennial Seam rock tunnels was disposed of underground in the existing Pinnacle Mine workings.

R645-301-535.130. PLACEMENT OF EXCESS SPOIL

There has been no development waste or excess spoil to date excepting sedimentation pond material.

Coal Processing Waste

The only coal processing waste to date is rock material manually separated from Andalex Resources' lump coal product at Wildcat. This is currently placed in an approved area at Wildcat Loadout. This MRP contains an Appendix Q. Appendix Q references the plan for
reclamation of the waste rock pile at the Wildcat Loadout and should not be confused with the Centennial Reclamation Plan. Disposal of sediment pond material (temporary and permanent) is shown on Plate 6. Sediment pond waste has already been tested in one case to be non toxic and non acid forming and is being used currently in the Aberdeen Mine fill areas. Other material which is generated will be placed in temporary storage above the Apex Mine as shown on Plate 6 and will be disposed of permanently as back fill in high walls upon final reclamation. This material will be tested prior to final reclamation if used for final reclamation purposes. Based on previous experience, Andalex estimates that up to 3,000 yards of material at most will be generated. This material is included in the earthwork estimates. Please note that the rock tunnels constructed to the Centennial coal seam generated significant amounts of waste rock. One hundred percent of this waste rock was disposed of underground in the existing Pinnacle Mine. None of the waste rock appeared at the surface.

**Coal Refuse**

Please refer to Plate 6 for location of disposal areas.

- **R645-301-535.140.** SURFACE COAL OPERATIONS
  - N/A

- **R645-301-535.141.** GEOLOGIC CONDITIONS
  - N/A

- **R645-301-535.142.** SEEP AND SPRING SURVEY
  - N/A

- **R645-301-535.143.** EFFECTS FROM SUBSIDENCE
  - N/A

- **R645-301-535.144.** ROCK CHIMNEY CORES OR DRAINAGE BLANKETS
  - N/A

- **R645-301-535.145.** STABILITY ANALYSIS
  - N/A

- **R645-301-535.150.** SURFACE MINING OPERATIONS
  - N/A
R645-301-535.151. TEST BORINGS
N/A

R645-301-535.152. ENGINEERING SPECIFICATIONS FOR ROCK TOE BUTTRESS OR KEYWAY CUTS
N/A

R645-301-535.200. DISPOSAL OF EXCESS SPOIL: VALLEY FILLS / HEAD-OF-HOLLOW FILLS
N/A

R645-301-535.210. ROCK CORE CHIMNEY DRAINS
N/A

R645-301-535.220. DESIGN AND CONSTRUCTION OF THE FILL
N/A

R645-301-535.221. DESIGN REQUIREMENTS
N/A

R645-301-535.222. FILTER SYSTEM
N/A

R645-301-535.223. GRADING AND DRAINAGE
N/A

R645-301-535.300. DISPOSAL OF EXCESS SPOIL: DURABLE ROCK RILLS
N/A

R645-301-535.310. RESTRICTION
N/A

R645-301-535.320. REQUIREMENTS
N/A

R645-301-535.330. FACTOR OF SAFETY
N/A

5-182
All disturbed areas will be backfilled and graded to as near as possible the approximate original contour, and to the most moderate slope possible. Slopes shall not exceed the angle of repose or such lessor slopes as required by the regulatory authority to maintain stability. Fill material will be compacted to assure stability.

Andalex has had a slope stability study performed on a fill pad with a slope greater than 2:1v and it was determined, even prior to compaction, that the fill had an adequate safety factor. Refer to Appendix K for this study done at the Pinnacle Mine. Andalex has committed to five years of monitoring of this site or whatever amount of time is necessary to assure stability of slopes has been achieved. It should be noted that all highwalls on Andalex’s minesite are in or will be in bedrock. This is a steep sided, narrow canyon and Andalex will not be relieved of liability until reasonable stability has been achieved through compaction and revegetation.

Areas to be regraded include the portal site, surface facility site and roads. Because of the diversity of these areas, all regrading will conform to the specific site. Specific to high wall areas, some of the back filling will include excess spoil and underground development waste. We estimate this may be as much as 3000 yards of material. Please refer to Plate 15 addendum for a detailed drawing on the high wall areas. The Aberdeen Mine high wall has been redrawn and back fills recalculated. Where slopes are greater than 2 to 1, before final reclamation is completed, slope stability studies will be performed as necessary. All information for slope stability studies will be included as part of the final reclamation package.

Where possible, all final grading and placement of topsoil will be done along the contour to minimize erosion. In all cases, grading will be conducted in a manner which minimizes erosion and provides a stable surface for the placement of topsoils.

Topsoil existing on site will be spread using a grader. Where possible, the soil will be distributed along the contour. The thickness of the re-established soil will be consistent with soils in the vicinity and will be sufficient to support vegetation equal to or superior to pre-mining history, 6".

Andalex will rip the subsurface material to 6" using most likely a
toothed motor grader or a disc, prior to soil redistribution.

Andalex will mix one ton of alfalfa per acre with its topsoil material to aid in aeration, microbiological community development, and water holding capacity.

Andalex will distribute topsoil to a minimum depth of 6" as previously stated.

Andalex has already committed to testing of redistributed soil and fill material and has committed to use proper additives if it is discovered necessary. Specifically, Andalex will test for organic matter, phosphorous, potassium, pH, conductivity, and texture. The samples will be taken at 0-6 inches, 6-12 inches, and 12-24 inches at least 90 days prior to final reclamation.

R645-301-535.420. DESIGN

N/A

R645-301-535.430. GRADING AND HIGHWALL ELIMINATION

See R645-301-535.410.

R645-301-535.440. GRAVITY TRANSPORTATION

N/A

R645-301-535.441. HAZARDS

See R645-301-535.410.

R645-301-535.442. STABILITY

See R645-301-535.410.

R645-301-535.443. SAFETY BERMS

Appendix K

R645-301-535.444. FINAL DISPOSITION

See R645-301-535.410.

R645-301-535.500. FACEUP OPERATIONS

See R645-301-535.410.

R645-301-536. COAL MINE WASTE

See R645-301-528.300.
R645-301-536.100. DISPOSAL FACILITY
See R645-301-528.300.

R645-301-536.110. STABILITY
N/A

R645-301-536.120. FOUNDATION DESIGN
N/A

R645-301-536.200. PLACEMENT
See R645-301-528.300.

R645-301-536.210. CONSTRUCTION
See R645-301-528.300.

R645-301-536.220. PUBLIC HAZARDS
See R645-301-528.300.

R645-301-536.230. PREVENT COMBUSTION
See R645-301-528.300.

R645-301-536.300. COAL MINE WASTE DISPOSED OF IN EXCESS SPOIL FILLS
See R645-301-528.300.

R645-301-536.310. REQUIREMENTS
See R645-301-528.300.

R645-301-536.320. NONTOXIC AND NON-ACID FORMING
See R645-301-528.300.

R645-301-536.330. DESIGN STABILITY
See R645-301-528.300.

R645-301-536.400. OTHER REQUIREMENTS
See R645-301-528.300.
R645-301-536.410.  RESTRICTIONS
N/A

R645-301-536.420.  DESIGN PLAN
See R645-301-528.300.

R645-301-536.500.  DISPOSAL OF COAL MINE WASTE IN SPECIAL AREAS
N/A

R645-301-536.510.  OUTSIDE A PERMIT AREA
N/A

R645-301-536.520.  UNDERGROUND DISPOSAL
See R645-301-528.300.

R645-301-536.600.  UNDERGROUND DEVELOPMENT WASTE
See R645-301-528.300.

R645-301-536.700.  COAL PROCESSING WASTE
See R645-301-528.300.

R645-301-536.800.  COAL PROCESSING WASTE EMBANKMENTS
N/A

R645-301-536.810.  REQUIREMENTS
N/A

R645-301-536.820.  MSHA REQUIREMENTS
N/A

R645-301-821.  BORINGS AND TEST PITS
N/A

R645-301-536.822.  FOUNDATION DESIGN
N/A
R645-301-536.823. SEEP AND SPRING SURVEYS
N/A

R645-301-536.824. HAZARDS
N/A

R645-301-536.900. REFUSE PILES
N/A

R645-301-537. REGRADED SLOPES
See R645-532.200.

R645-301-537.100. GEOTECHNICAL ANALYSIS
See R645-532.200.

R645-301-537.200. REGRADING SETTLED AND REVEGETATED FILLS
See R645-532.200.

R645-301-537.210. RESTRICTIONS
N/A

R645-301-537.220. LOCATION
See R645-532.200.

R645-301-537.230. STABILITY
See R645-532.200.

R645-301-537.240. VEGETATION AND SURFACE RUNOFF CONTROL
See R645-532.200.

R645-301-537.250. HAZARDOUS CONDITIONS
See R645-532.200.

R645-301-540. RECLAMATION PLAN
See R645-532.240.

5-187
Post Mining Hydrology

Upon completion of mining activities, and following removal of surface structures, the earthwork portion of the reclamation plan will begin as described. The hydrologic portion of reclamation will take place in two phases:

1. The main and side drainage channels will be restored as shown in the Sedimentation and Drainage Control Plan, and on Plate 16. Loose rock check dams will be placed at each side drainage entrance onto the reclaimed area, and at approximately 500' intervals along the restored main channel RC-1. (Typical sections of the loose rock check dams are shown in the Sedimentation and Drainage Control Plan).

All disturbed diversions and sediment ponds "B" and "C" will also be removed at this time. Sediment Pond "E" will be enlarged, and the entire drainage above will flow into Pond "E-PM" through the restored channel RC-1.

It should be noted that the main road going through the minesite and continuing on will be left intact as part of the post-mining use.

2. Once revegetation and water quality standards are met, Pond "E-PM" will be removed, and the area reclaimed.

Surface water monitoring will continue during this time as described. Please see Figure IV-11.
R645-301-542.100.  TIMETABLE
See R645-301-240.

R645-301-542.200.  BACKFILLING AND GRADING PLAN
See R645-301-532.200.

R645-301-542.300.  FINAL SURFACE CONFIGURATION MAPS
Plates 16 & 17

R645-301-542.310.  CERTIFICATION REQUIREMENTS

Operation Plan: Maps and Plans

Most of the maps and plans previously submitted as part of the approved Mining and Reclamation Plan, are applicable. Where necessary, the original maps have been revised to indicate the lease in Hoffman Creek and the revisions are included in this submittal in Volume II.

All necessary maps and plans to complete this section are found in Volume II of the submittal and also in the appendices of Volume I specifically,

a) Underground coal mining activities to be conducted and lands to be affected by surface facilities are shown on Plates 6, 29, 30, 31 and 41.

b-1) Buildings, utilities, and facilities are depicted on Plates 6.

2) The area to be affected is shown on several plates, including 4, 5, 6, 29, 30, 31 and 41. These last four plates show the sequence of mining in the four seams over the five year term of the permit. Plate 30 has been revised to show immediate development in the Gilson Seam as soon as approval is achieved. Reclamation will not take place until after all four seams are mined out. This activity is depicted on Plates 15, 16, 17, and 20.

3) Plates 5 depict the entire disturbed area for which a performance bond is posted. The acreage is shown on Plate 5.

4) Coal storage and loading areas are shown on Plates 6. No cleaning takes place.

5) Plates 6 show a non-coal waste storage area as well as topsoil storage areas. Plates 36 and 37 show the topsoil piles in detail.

6) All water diversions and other water facilities are shown on Plates 6, 8, 9, 11, 12, and 13. Also, typical diversions for
disturbed area and undisturbed areas are shown in the Sedimentation and Drainage Control Plan.

Diversion ditches as they exist are shown on Revised Plate 6. Topographic detail has been added to Plate 8 to allow determination of watershed slopes within the disturbed area.

Diversions and other hydrologic controls are shown on Plates 6, 7, 8, 11, 12 and 13, for the Aberdeen Mine. Topographic detail has been added to Plate 8 to allow determination of watershed slopes within the disturbed area.

Plate 16 has been revised to show drainage during the reclamation period before and after removal of sediment ponds (Phase I).

Plate 17 shows final drainage details.
Plate 9 shows delineations of watershed areas.

The main culvert will be removed entirely during the reclamation/earthwork phase except under Pond "E". Pond "E" will be enlarged, and the entire drainage area above will flow into the restored channel RC-1 and through Pond "E-PM". Once revegetation and water quality standards have been met, Pond "E-PM" and the culvert will be removed and reclaimed.

7) There is no coal processing waste at the Centennial facility. There are no pollution control facilities other than sedimentation ponds on the permit area. Please note that waste rock generated by the Centennial Seam rock tunnels was disposed of underground in the existing Pinnacle Mine workings.

8) Specific facilities are not used to protect or enhance wildlife with the exception of the powerline which was built according to strict guidelines issued by the Division of Wildlife Resources and the U.S. Fish and Wildlife Service regarding raptor protection. The powerline design is included in Volume I as Appendix I (powerline design). Also, speed limits are posted within the permit area.

9) The two powder magazines are shown on Plates 6.

10) Plates 6, 8, and 9 show these facilities associated with protection of the hydrologic balance including sedimentation ponds and storage of non-coal waste. There are no permanent impoundments, or coal processing wastes. Underground development waste has been generated while putting in the Aberdeen portals, and has been used as stock pile pad material at the Aberdeen Minesite. The volume of this material is minimal.

11) Plates 16 and 17 show the final reclamation contours and configuration of the surface for Phases I and II respectively.
12) Subsidence monitoring points are shown on Plate 25. An additional station was added to Plate 25 to cover pillar extraction on the new Hoffman Creek Lease. Also a new station has been added over the Graves Lease. Water monitoring locations are shown on Figure IV-11. A new water monitoring station will be added over the Graves Lease, however and a new station has been added at the mouth of Alrad Canyon (12-1) for the AEP lease.

13) There will be no facilities left on the permit area permanently excepting possibly the road through the site. After the completion of underground mining, all facilities will be removed with the exception of one downstream sedimentation pond. This pond will be removed upon final reclamation.

c) Maps, plans, and cross sections required under b)(5),(6),(10), and (11) have been prepared under the direction of, and certified by a registered professional engineer. Assistance has come from a registered land surveyor.

1) Detailed maps, plans, and cross sections for our sediment ponds, Plates 11, 12, and 13 have been certified by a registered professional engineer.

2) Andalex has not used any excess spoil or underground development waste maps or cross sections. A map (uncertified) depicting the location of non-coal waste storage is included as Plate 6.
# VOLUME II

## Table of Contents

<table>
<thead>
<tr>
<th>Plate #</th>
<th>Plate Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>General Location Map</td>
</tr>
<tr>
<td>2.</td>
<td>Surface Ownership</td>
</tr>
<tr>
<td>3.</td>
<td>Book Cliffs Mineral Ownership Leases</td>
</tr>
<tr>
<td>4.</td>
<td>Surface Area Boundary</td>
</tr>
<tr>
<td>5.</td>
<td>As Constructed Surface Facilities - Deadman Canyon</td>
</tr>
<tr>
<td>6.</td>
<td>As Proposed Surface Facilities - Deadman Canyon</td>
</tr>
<tr>
<td>7.</td>
<td>Support Facilities - Surface Area Drainage</td>
</tr>
<tr>
<td>8.</td>
<td>Watershed &amp; Culvert Sizing &amp; REVEGATATION Reference Areas</td>
</tr>
<tr>
<td>9.</td>
<td>Sediment Pond E - Post Mining</td>
</tr>
<tr>
<td>10.</td>
<td>Sediment Pond B - As Constructed</td>
</tr>
<tr>
<td>11.</td>
<td>Sediment Pond C - As Constructed</td>
</tr>
<tr>
<td>12.</td>
<td>Sediment Pond E - Proposed Aberdeen Surface</td>
</tr>
<tr>
<td>13.</td>
<td>Cut &amp; Fill Cross Section Reference</td>
</tr>
<tr>
<td>14.</td>
<td>Cut &amp; Fill Cross Sections; As Constructed, As Proposed, Final Reclamation</td>
</tr>
<tr>
<td>15.</td>
<td>Post Mining Hydrology</td>
</tr>
<tr>
<td>16.</td>
<td>Final Reclamation Contours</td>
</tr>
<tr>
<td>17.</td>
<td>Soil Survey Map - Deadman Canyon</td>
</tr>
<tr>
<td>18.</td>
<td>Vegetation Survey Map - Deadman Canyon</td>
</tr>
<tr>
<td>19.</td>
<td>REVEGATATION Map</td>
</tr>
<tr>
<td>20.</td>
<td>Surface Geology of the Andalex Resources' Mine Plan Area</td>
</tr>
<tr>
<td>21.</td>
<td>Cross Section Reference (Geologic)</td>
</tr>
<tr>
<td>22.</td>
<td>Cross Section A-A'</td>
</tr>
<tr>
<td>23.</td>
<td>Cross Section B-B'</td>
</tr>
<tr>
<td>24.</td>
<td>Subsidence Monitoring Plan</td>
</tr>
<tr>
<td>25.</td>
<td>Lower Sunnyside Seam Isopach</td>
</tr>
<tr>
<td>26.</td>
<td>Gilson Seam Isopach</td>
</tr>
<tr>
<td>27.</td>
<td>Aberdeen Seam Isopach</td>
</tr>
<tr>
<td>28.</td>
<td>Proposed Mine Plan Lower Sunnyside Seam</td>
</tr>
<tr>
<td>29.</td>
<td>Proposed Mine Plan Gilson Seam</td>
</tr>
<tr>
<td>30.</td>
<td>Proposed Mine Plan A Seam</td>
</tr>
<tr>
<td>31.</td>
<td>Pinnacle Mine Current Mine Plan</td>
</tr>
<tr>
<td>32.</td>
<td>Apex Mine Current Mine Plan</td>
</tr>
<tr>
<td>33.</td>
<td>Wildlife Distribution Map</td>
</tr>
<tr>
<td>34.</td>
<td>Typical Road Cross Section</td>
</tr>
<tr>
<td>35.</td>
<td>Top Soil Storage Pile &quot;G&quot;</td>
</tr>
<tr>
<td>36.</td>
<td>Deadman Canyon Top Soil Storage Piles</td>
</tr>
<tr>
<td>37.</td>
<td>Cross Sections and Volumes of Substitute Topsoil</td>
</tr>
</tbody>
</table>

INCORPORATED
CCT 07 2002
DIV OF OIL GAS & MINING

5-192
Reclamation Cost and Bonding

Introduction

An estimate is provided in the Reclamation Cost Projection. Notably changed from the original bond estimate is the addition of the shop/warehouse complex, the removal of which will have to be added to the reclamation cost. The original estimate has also been revised to reflect current prices and wage estimate has also been revised to reflect current prices and wage schedules. Andalex frequently requires the use of dirt contractors and is therefore current on equipment rental costs, labor costs, and productivity, since we have a great deal of experience with construction projects. Andalex has used its experience in construction and earth moving projects to estimate the amount of time which will be required and the equipment needed for individual reclamation activities. Andalex has also been involved with several revegetation projects from which it drew estimates. Andalex has provided, as Plate 15, accurate as built versus reclaimed cross sections which show the mass balance for earthwork. The approximate original contours will be achieved using the material cut out to create the fill areas. No material will be hauled in. Maps depicting accurately the surface facilities including topsoil areas, structures and facilities are included in Volume II and also specific topsoil maps and cross sections are included. Andalex expects to return topsoil to a depth of up to 6" around the surface area of 34.2 acres.

Phase I of the reclamation will include, chronologically, structure removal including culverts, portal sealing, well sealing, regrading, recontouring, distribution of topsoil and revegetation. Additional sediment control during Phase I such as straw dikes and rock check dams will be implemented as shown on Plate 16. Once Phase I is adequately achieved, Phase II will commence which includes the removal of sediment structure E and revegetation of this area. This is followed by monitoring, noting that monitoring had begun during Phase I. See 5.8 re Monitoring. This section discusses the extended period of liability as being ten years if necessary. The entire permit area receives less than 26 inches of annual precipitation; therefore, it is generally accepted that Andalex is subject to an extended period of liability. Obviously if revegetation is deemed successful prior to this ten year period, Andalex will request bond release. Andalex has not proposed any selective husbandry practices.
Cost of Reclamation

Detailed Estimate

A detailed cost projection is included.

Calculations

Calculations of the estimate are included following this page. Calculations for cuts and fills were made and are summarized following the bond estimate. This summary shows the mass balance for the entire disturbed area including the Aberdeen site, as taken from Plates 14 and 15. Station numbers are referenced on Plate 14 and cross sections are shown on Plates 15-1, 2, and 3. Similarly, topsoil piles have been surveyed for the existing minesite and are summarized following the cut and fill summary. Because of deficits Andalex has committed to testing topsoil substitute areas.

Bond or Surety Arrangement

Andalex currently holds a bond, approved by UDOGM in the amount of $1,080,000.00 and it is included in this MRP in Appendix B.

Reclamation Plan (before bond estimate)

The productivity of equipment is somewhat difficult to predict, and therefore, Andalex feels that conservative estimates were in order. There are many variables which contribute to the productivity of a particular machine, including operator skill, type of material, and the condition of the material.

It is obvious that a front-end loader, for example, can move more topsoil from a pile than, for example, a bouldery conglomerate of highly compacted material.

However, for the purpose of this analysis, it should be assured that based on means cost data the following prices on earthwork can be used:

- Open Dozer grading: $2.25/yd
- Fill Placement: $1.16/yd
- Topsoil Placement: $1.16/yd
- Topsoil Hauling: $4.55/yd
- Compaction: $.21/yd

The following cost projection reflects hourly rates. An additional earthwork estimate can be found following the mass balance estimates.
1989
Reclamation Cost Projection
Centennial Project

Lower Sunnyside Mine

Restoration to pre-mining land use will require:

<table>
<thead>
<tr>
<th>Job Description</th>
<th>Equipment</th>
<th>Hours</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Coal Pile Storage Area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Seal portals, remove conveyor, etc.</td>
<td>Loader</td>
<td>8</td>
<td>$640</td>
</tr>
<tr>
<td>b. Fill pad</td>
<td>Loader</td>
<td>55</td>
<td>4,400</td>
</tr>
<tr>
<td>c. Contour slope including stream channel</td>
<td>D-7</td>
<td>50</td>
<td>4,000</td>
</tr>
<tr>
<td>d. Compact</td>
<td>Loader</td>
<td>15</td>
<td>1,200</td>
</tr>
<tr>
<td>e. Replace topsoil</td>
<td>Loader</td>
<td>23</td>
<td>1,840</td>
</tr>
<tr>
<td>f. Grade topsoil</td>
<td>Grader</td>
<td>15</td>
<td>1,050</td>
</tr>
<tr>
<td>g. Revegetate</td>
<td>Drill</td>
<td>7</td>
<td>350</td>
</tr>
<tr>
<td>h. Stake</td>
<td>Engineer</td>
<td>14</td>
<td>700</td>
</tr>
<tr>
<td><strong>Total Coal Pile Area:</strong></td>
<td></td>
<td></td>
<td>$14,180</td>
</tr>
<tr>
<td>2. Roads</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Recontour</td>
<td>D-7</td>
<td>5</td>
<td>$400</td>
</tr>
<tr>
<td>b. Compact</td>
<td>Loader</td>
<td>3</td>
<td>240</td>
</tr>
<tr>
<td>c. Replace topsoil</td>
<td>Loader</td>
<td>2</td>
<td>160</td>
</tr>
<tr>
<td>d. Grade topsoil</td>
<td>Grader</td>
<td>2</td>
<td>140</td>
</tr>
<tr>
<td>e. Revegetate</td>
<td>Drill</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td><strong>Total Roads:</strong></td>
<td></td>
<td></td>
<td>$990</td>
</tr>
<tr>
<td>3. Seal Wells (2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Fill, cement</td>
<td></td>
<td></td>
<td>$800</td>
</tr>
<tr>
<td><strong>Total Wells:</strong></td>
<td></td>
<td></td>
<td>$800</td>
</tr>
<tr>
<td>4. Material Storage Area (including topsoil pile)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Remove all structures</td>
<td>5 man crew</td>
<td>120</td>
<td>$9,000</td>
</tr>
<tr>
<td>b. Recontour including stream channel</td>
<td>D-7</td>
<td>30</td>
<td>2,400</td>
</tr>
<tr>
<td>c. Compact</td>
<td>Loader</td>
<td>4</td>
<td>320</td>
</tr>
<tr>
<td>d. Replace topsoil</td>
<td>Loader</td>
<td>8</td>
<td>640</td>
</tr>
<tr>
<td>e. Grade topsoil</td>
<td>Grader</td>
<td>4</td>
<td>280</td>
</tr>
<tr>
<td>f. Revegetate</td>
<td>Drill</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>g. Stake</td>
<td>Engineer</td>
<td>14</td>
<td>700</td>
</tr>
<tr>
<td><strong>Total Material Storage:</strong></td>
<td></td>
<td></td>
<td>$13,440</td>
</tr>
</tbody>
</table>
Gilson (Pinnacle Mine)

Restoration to the pre-mining land use will require:

<table>
<thead>
<tr>
<th>Job Description</th>
<th>Equipment</th>
<th>Hours</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mine Portal Area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Seal portals, remove conveyor, etc.</td>
<td>Loader</td>
<td>8</td>
<td>$640</td>
</tr>
<tr>
<td>b. Fill pad</td>
<td>Loader</td>
<td>12</td>
<td>$960</td>
</tr>
<tr>
<td>c. Contour slope</td>
<td>D-7</td>
<td>8</td>
<td>$640</td>
</tr>
<tr>
<td>d. Compact</td>
<td>Loader</td>
<td>4</td>
<td>$320</td>
</tr>
<tr>
<td>e. Replace topsoil</td>
<td>Loader</td>
<td>6</td>
<td>$480</td>
</tr>
<tr>
<td>f. Grade topsoil</td>
<td>Grader</td>
<td>4</td>
<td>$280</td>
</tr>
<tr>
<td>g. Revegetate</td>
<td>Drill</td>
<td>2</td>
<td>$100</td>
</tr>
<tr>
<td>h. Stake slope</td>
<td>Engineer</td>
<td>4</td>
<td>$200</td>
</tr>
<tr>
<td>Total Portal:</td>
<td></td>
<td></td>
<td>$3,620</td>
</tr>
<tr>
<td>2. Roads (1 mile)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Recontour</td>
<td>D-7</td>
<td>20</td>
<td>$1,600</td>
</tr>
<tr>
<td>b. Compact</td>
<td>Loader</td>
<td>10</td>
<td>$800</td>
</tr>
<tr>
<td>c. Topsoil</td>
<td>Loader</td>
<td>8</td>
<td>$640</td>
</tr>
<tr>
<td>d. Grade</td>
<td>Grader</td>
<td>8</td>
<td>$560</td>
</tr>
<tr>
<td>e. Revegetate</td>
<td>Drill</td>
<td>4</td>
<td>$200</td>
</tr>
<tr>
<td>Total Roads:</td>
<td></td>
<td></td>
<td>$3,800</td>
</tr>
<tr>
<td>3. Coal Pile Area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Fill pad</td>
<td>Loader</td>
<td>16</td>
<td>$1,280</td>
</tr>
<tr>
<td>b. Contour slope including stream channel</td>
<td>D-7</td>
<td>20</td>
<td>$1,600</td>
</tr>
<tr>
<td>c. Compact</td>
<td>Loader</td>
<td>4</td>
<td>$320</td>
</tr>
<tr>
<td>d. Topsoil</td>
<td>Loader</td>
<td>6</td>
<td>$480</td>
</tr>
<tr>
<td>e. Grade</td>
<td>Grader</td>
<td>4</td>
<td>$280</td>
</tr>
<tr>
<td>f. Revegetate</td>
<td>Drill</td>
<td>2</td>
<td>$100</td>
</tr>
<tr>
<td>g. Stake</td>
<td>Engineer</td>
<td>4</td>
<td>$200</td>
</tr>
<tr>
<td>Total Stockpile Area</td>
<td></td>
<td></td>
<td>$4,260</td>
</tr>
<tr>
<td>4. Seal Wells</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Fill, cement</td>
<td></td>
<td>8</td>
<td>$1,000</td>
</tr>
<tr>
<td>Total Wells:</td>
<td></td>
<td></td>
<td>$1,000</td>
</tr>
<tr>
<td>5. Material Storage &amp; Building Areas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Remove all structures (including shop/warehouse)</td>
<td>5 man crew</td>
<td>240</td>
<td>$27,000</td>
</tr>
<tr>
<td>b. Recontour including stream channel</td>
<td>D-7</td>
<td>30</td>
<td>$2,400</td>
</tr>
<tr>
<td>c. Compact</td>
<td>Loader</td>
<td>4</td>
<td>$320</td>
</tr>
<tr>
<td>d. Replace topsoil</td>
<td>Loader</td>
<td>8</td>
<td>$640</td>
</tr>
<tr>
<td>e. Grade</td>
<td>Grader</td>
<td>4</td>
<td>$280</td>
</tr>
<tr>
<td>f. Revegetate</td>
<td>Drill</td>
<td>2</td>
<td>$100</td>
</tr>
<tr>
<td>Total Material:</td>
<td></td>
<td></td>
<td>$30,740</td>
</tr>
</tbody>
</table>

DIV OF OIL GAS & MINING
Aberdeen Mine

Restoration to the pre-mining land use will require:

<table>
<thead>
<tr>
<th>Job Description</th>
<th>Equipment</th>
<th>Hours</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mine Portal Area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Seal portals, remove</td>
<td>Loader</td>
<td>8</td>
<td>$640</td>
</tr>
<tr>
<td>conveyor, etc.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Fill pad</td>
<td>Loader</td>
<td>24</td>
<td>$1,920</td>
</tr>
<tr>
<td>c. Contour slope</td>
<td>D-7</td>
<td>16</td>
<td>$1,280</td>
</tr>
<tr>
<td>d. Compact</td>
<td>Loader</td>
<td>8</td>
<td>$640</td>
</tr>
<tr>
<td>e. Replace topsoil</td>
<td>Loader</td>
<td>12</td>
<td>$960</td>
</tr>
<tr>
<td>f. Grade topsoil</td>
<td>Grader</td>
<td>8</td>
<td>$560</td>
</tr>
<tr>
<td>g. Revegetate</td>
<td>Drill</td>
<td>4</td>
<td>$200</td>
</tr>
<tr>
<td>h. Stake slope</td>
<td>Engineer</td>
<td>8</td>
<td>$400</td>
</tr>
<tr>
<td>Total Portal Area</td>
<td></td>
<td></td>
<td>$6,600</td>
</tr>
</tbody>
</table>

2. Coal Pile Area
(intervaling topsoil storage and sedimentation pond)

<table>
<thead>
<tr>
<th>Job Description</th>
<th>Equipment</th>
<th>Hours</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Fill pad</td>
<td>Loader</td>
<td>50</td>
<td>$4,000</td>
</tr>
<tr>
<td>b. Contour slope including stream channel</td>
<td>D-7</td>
<td>50</td>
<td>$4,000</td>
</tr>
<tr>
<td>c. Compact</td>
<td>Loader</td>
<td>15</td>
<td>$1,200</td>
</tr>
<tr>
<td>d. Replace topsoil</td>
<td>Loader</td>
<td>22</td>
<td>$1,760</td>
</tr>
<tr>
<td>e. Grade topsoil</td>
<td>Grader</td>
<td>15</td>
<td>$1,050</td>
</tr>
<tr>
<td>f. Revegetate</td>
<td>Drill</td>
<td>7</td>
<td>$350</td>
</tr>
<tr>
<td>g. Stake slope</td>
<td>Engineer</td>
<td>14</td>
<td>$700</td>
</tr>
<tr>
<td>Total Stockpile Area</td>
<td></td>
<td></td>
<td>$13,060</td>
</tr>
</tbody>
</table>

3) a. Seal Portals, fill cut slope | Loader    | 8     | $640  |
| b. Remove culvert                 | Backhoe   | 25    | $2,000|
| c. Contour stream channel         | D-7       | 16    | $1,280|
| d. Contour slope                  | D-7       | 16    | $1,280|
| e. Compance                       | Loader    | 8     | $640  |
| f. Replace topsoil                | Loader    | 16    | $1,200|
| g. REVEGETATION                   | Drill     | 2     | $100  |
| h. Stake slope                     | Engineer  | 8     | $400  |
| Total Stockpile Area              |           |       | $7,540|

INcorporated

Oct 07 2002

div of oil gas & mining

5-197
Office Site

Restoration to pre-mining land use will require:

<table>
<thead>
<tr>
<th>Job Description</th>
<th>Equipment</th>
<th>Hours</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Office Site</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Remove structures</td>
<td>5 man crew</td>
<td>50</td>
<td>$3,750</td>
</tr>
<tr>
<td>b. Recontour</td>
<td>D-7</td>
<td>8</td>
<td>640</td>
</tr>
<tr>
<td>c. Compact</td>
<td>Loader</td>
<td>4</td>
<td>320</td>
</tr>
<tr>
<td>d. Replace topsoil</td>
<td>Loader</td>
<td>4</td>
<td>320</td>
</tr>
<tr>
<td>e. Grade topsoil</td>
<td>Grader</td>
<td>4</td>
<td>280</td>
</tr>
<tr>
<td>f. Revegetate</td>
<td>Drill</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>g. Stake slope</td>
<td>Engineer</td>
<td>4</td>
<td>200</td>
</tr>
<tr>
<td><strong>Total Office Site:</strong></td>
<td></td>
<td></td>
<td><strong>$5,610</strong></td>
</tr>
<tr>
<td>2. Seal Well (1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Fill, cement</td>
<td></td>
<td>4</td>
<td>$400</td>
</tr>
<tr>
<td><strong>Total Well:</strong></td>
<td></td>
<td></td>
<td><strong>$400</strong></td>
</tr>
<tr>
<td>3. Roads 1/4 Mile</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Recontour</td>
<td>D-7</td>
<td>5</td>
<td>$400</td>
</tr>
<tr>
<td>b. Compact</td>
<td>Loader</td>
<td>3</td>
<td>240</td>
</tr>
<tr>
<td>c. Replace topsoil</td>
<td>Loader</td>
<td>2</td>
<td>160</td>
</tr>
<tr>
<td>d. Grade topsoil</td>
<td>Grader</td>
<td>2</td>
<td>140</td>
</tr>
<tr>
<td>e. Revegetate</td>
<td>Drill</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td><strong>Total Roads:</strong></td>
<td></td>
<td></td>
<td><strong>$990</strong></td>
</tr>
</tbody>
</table>

**Total Projected Reclamation Costs:**

- Lower Sunnyside Mine: $29,410
- Gilson (Pinnacle) Mine: $43,420
- Aberdeen Mine: $27,200
- Office Site: $7,000
- Monitoring (5 years): $10,000

**Total Reclamation, 1987**: $117,490

Contingency 10%: $11,740

**Grand Total**: $129,240

* Please note that as no reclamation is required for the Centennial Seam Mine no costs for reclamation are described above.
**MASS BALANCE SUMMARY**

<table>
<thead>
<tr>
<th>Station</th>
<th>CUT</th>
<th>FILL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ft²</td>
<td>yds³</td>
</tr>
<tr>
<td>-1 + 00</td>
<td>520</td>
<td>963</td>
</tr>
<tr>
<td>0 + 00</td>
<td>0</td>
<td>815</td>
</tr>
<tr>
<td>1 + 00</td>
<td>440</td>
<td>1000</td>
</tr>
<tr>
<td>2 + 00</td>
<td>100</td>
<td>1074</td>
</tr>
<tr>
<td>3 + 00</td>
<td>480</td>
<td>3333</td>
</tr>
<tr>
<td>4 + 00</td>
<td>1320</td>
<td>2593</td>
</tr>
<tr>
<td>5 + 00</td>
<td>80</td>
<td>2889</td>
</tr>
<tr>
<td>6 + 00</td>
<td>1480</td>
<td>6778</td>
</tr>
<tr>
<td>7 + 00</td>
<td>1736</td>
<td>6429</td>
</tr>
<tr>
<td>8 + 00</td>
<td>2572</td>
<td>4764</td>
</tr>
<tr>
<td>9 + 00</td>
<td>1696</td>
<td>6281</td>
</tr>
<tr>
<td>10 + 00</td>
<td>1480</td>
<td>6444</td>
</tr>
<tr>
<td>11 + 00</td>
<td>2000</td>
<td>6259</td>
</tr>
<tr>
<td>12 + 00</td>
<td>1380</td>
<td>9222</td>
</tr>
<tr>
<td>13 + 00</td>
<td>3600</td>
<td>7037</td>
</tr>
<tr>
<td>14 + 00</td>
<td>200</td>
<td>370</td>
</tr>
<tr>
<td>15 + 00</td>
<td>0</td>
<td>370</td>
</tr>
<tr>
<td>16 + 00</td>
<td>200</td>
<td>407</td>
</tr>
<tr>
<td>17 + 00</td>
<td>20</td>
<td>1889</td>
</tr>
<tr>
<td>18 + 00</td>
<td>1288</td>
<td>4720</td>
</tr>
<tr>
<td>19 + 00</td>
<td>1168</td>
<td>4325</td>
</tr>
<tr>
<td>20 + 00</td>
<td>536</td>
<td>1985</td>
</tr>
<tr>
<td>21 + 00</td>
<td>1736</td>
<td>6429</td>
</tr>
<tr>
<td>22 + 00</td>
<td>2748</td>
<td>5090</td>
</tr>
<tr>
<td>23 + 00</td>
<td>1544</td>
<td>2860</td>
</tr>
<tr>
<td>24 + 00</td>
<td>220</td>
<td>1148</td>
</tr>
<tr>
<td>25 + 00</td>
<td>400</td>
<td>926</td>
</tr>
<tr>
<td>26 + 00</td>
<td>100</td>
<td>2630</td>
</tr>
<tr>
<td>27 + 00</td>
<td>1320</td>
<td>4444</td>
</tr>
<tr>
<td>28 + 00</td>
<td>1080</td>
<td>3111</td>
</tr>
<tr>
<td>29 + 00</td>
<td>600</td>
<td>2222</td>
</tr>
<tr>
<td>30 + 00</td>
<td>600</td>
<td>2074</td>
</tr>
<tr>
<td>31 + 00</td>
<td>520</td>
<td>1889</td>
</tr>
<tr>
<td>32 + 00</td>
<td>500</td>
<td>1482</td>
</tr>
<tr>
<td>33 + 00</td>
<td>300</td>
<td>2037</td>
</tr>
<tr>
<td>34 + 00</td>
<td>800</td>
<td>3111</td>
</tr>
<tr>
<td>35 + 00</td>
<td>880</td>
<td>3485</td>
</tr>
<tr>
<td>36 + 00</td>
<td>840</td>
<td>1963</td>
</tr>
<tr>
<td>37 + 00</td>
<td>220</td>
<td>1741</td>
</tr>
<tr>
<td>38 + 00</td>
<td>720</td>
<td>2741</td>
</tr>
<tr>
<td>39 + 00</td>
<td>760</td>
<td>3000</td>
</tr>
<tr>
<td>40 + 00</td>
<td>860</td>
<td>2704</td>
</tr>
<tr>
<td>41 + 00</td>
<td>600</td>
<td>1444</td>
</tr>
<tr>
<td>42 + 00</td>
<td>180</td>
<td>482</td>
</tr>
<tr>
<td>43 + 00</td>
<td>80</td>
<td>148</td>
</tr>
</tbody>
</table>

* Total Cut = 136,858 yds³;  * Total Fill = 154,301 yds³
* Ratio of fill to cut = 1.11:1.00. This allows for an expansion factor of 1.11 or 11% on the cut material.

---

*INCORPORATED*

CUT O 7 2CE2

DIV OF OIL GAS & MINING

5-199
As Constructed Earthwork Volume (Aberdeen Mine and Left Fork Fan)

Cut 72,406 yds.³
Fill 76,925 yds.³
Topsoil 4,250 yds.³ (Piles H & J)

As Constructed Earthwork Volumes
(including Aberdeen Site)
Cut 117,273 yds.³
Fill 112,969 yds.³
Topsoil 8,500 yds.³

For purposes of reclamation costs for earthwork, the following estimates can be used. Please keep in mind that as built cross sections for the Aberdeen Mine will aid in the final earthwork estimates.

Open Grading (including 10% swell factor)
76,925 + 7693 = 84,618 @ $2.25
112,969 + 11,297 = 124,266 @ $2.25
208,884 @ $2.25 = $469,989

Topsoil Hauling and Placement
22,750 + 2275 = 25,025 @ $5.71 = $142,893

Compaction
158,294 @ $.21 = $33,242
Total Earthwork: $646,124

There is a 8,000 yd.³ topsoil deficit. The topsoil substitutes will make up this deficit.

The test plots previously discussed regarding the topsoil deficit is further discussed here.

Two test plot locations were decided upon based on certain known parameters. The 5,240 yard substitute material area chosen was once designated as substitute topsoil. Now that the shop building is in place, this should not have any impact on the suitability of the material. The second location depicted on Plate 6 near the Apex Truck Loadout is very similar, if not identical material, to the shop pad material (the rEVEGATATION test will ultimately prove this). To prove the materials suitability, Andalex has proposed to test the material using the approved seed mixture on the locations shown on Plate 6. The area of the test plots are both currently heavily vegetated indicating good potential. These test plots will be monitored for two years and evaluated for growth and species success. It is anticipated that these areas will succeed and solve the deficit problem.
Transportation

Roads

All roads within the permit area are classified as "Primary Roads" in accordance with R614-301-527.100 or "Ancillary Roads" in accordance with R645-301-527.130. Roads on the site are of 2 typical designs:

1. Single-lane, gravel or asphalt surfaced roads approximately 12 - 15' wide; and

2. Double-lane, either gravel or asphalt surfaced roads, approximately 26' wide.

Although all roads on site are not used for coal hauling, each primary road is constructed to the respective typical design and dimensions shown on Plate 35.

All roads are shown on Plate 6 and Plate 8. Specifics about the road are described individually and include road widths, gradients and surfaces. Drainage ditches and drainage structures for each road (disturbed area ditches or culverts) can be found in Tables IV-2 through IV-8.

Because of the variance in road types, widths and lengths, the roads have been designated on Plate 6 with numbers (i.e. PR-1= Primary Road 1, Ar-1= Ancillary Road 1) to facilitate the description of each:

**Primary Road 1 (PR-1)** - This road connects Carbon County Road 199 to the two lane paved road which travels past the Aberdeen Mine facilities, past the office driveway and bath house drive ways and past the Pinnacle truck loadout. This is an asphalt surfaced road approximately 26 feet wide and 2700 feet long. The grade on PR-1 ranges from 4% to 8%. It is used for hauling coal and for men and material access to the mines.

**Primary Road 2 (PR-2)** - This road begins at the end of PR-1 and continues north past the shop/warehouse and ends at the eastern side of the Apex Mine stockpile. This is a two lane gravel surfaced road which is approximately 26 feet wide and 1400 feet long. It is treated annually with Magnesium Chloride. The grade on this stretch of road ranges from 5% to 9%. It is used for hauling coal and equipment as well as providing men and materials access to the mines.

**Primary Road 3 (PR-3)** - This road provides access to the Aberdeen Mine truck loadout. It is a single lane gravel
surface road approximately 15 feet wide and 590 feet long. It is treated with Magnesium Chloride annually. The grade on this road ranges from 0% to 4%.

Primary Road 4 (PR-4) - This road provides access for the coal haul trucks to the Pinnacle Mine truck loadout. It is also crossed to access the bath house parking area. This is a single lane, paved surface road which is approximately 15 feet wide and 500 feet long. The grade on this loop ranges from 0% to 9%.

Primary Road 5 (PR-5) - This road provides access for the coal haul trucks coming off of PR-2 to the Apex Mine truck loadout. It is a single lane gravel surfaced road approximately 15 feet wide and 425 feet in length. The grade on this road ranges from 0% to 7%. It is treated annually with Magnesium Chloride. The three truck loadout roads are also accessed by front-end loaders for the purpose of cleaning up occasional coal spills.

Primary Road 6 (PR-6) - This is an access road which leads to the main office parking area. It is a single lane, paved surface road which is approximately 15 feet wide and 600 feet long. The average grade of this road is 5% to 7%.

Primary Road 7 (PR-7) - This is an access road for mining equipment. It provides heavy equipment access to and from the Aberdeen Mine. It begins at the south inlet to pond C and it ends at the bath house parking area. It is a gravel surfaced road and is approximately 12 feet wide and 450 feet long. It has grades which range from 4% to 14%. Magnesium Chloride is applied annually.

Primary Road 8 (PR-8) - This road leads from the fuel storage area at the Pinnacle Mine facility to the oil storage area near the upper Pinnacle portals. This is a single lane, gravel surface road approximately 15 feet wide and 325 feet long. The grade on this road has a range of 9% to 11%. It is treated with Magnesium Chloride annually.

Primary Road 9 (PR-9) - This road leads from PR-2 and turns west over the top of the Apex Mine conveyor belt. The road leads to the Apex Mine material storage area, adjacent to the mine fan. This is a single lane gravel surfaced road which is approximately 15 feet wide and 200 feet long and includes a steel deck bridge over the mine conveyor. The grade on this road ranges between 0% and 8%, and the gravel is treated with Magnesium Chloride.

Primary Road 10 (PR-10) - This is an access road which leads from the upper Aberdeen Mine material storage area down to the Aberdeen Mine stockpile pad. This is a short stretch of road which is approximately 12 feet wide and 150 feet long. It is a single lane road with an average grade of 12% to 15%.
Primary Road 11 (PR-11) - This is a very short access road which accesses the bath house pad from two directions; both from PR-1 and from PR-4. This road is approximately 12 feet wide and 150 feet long. It is a single lane road with a grade of 0% to 6%. This road is treated with magnesium chloride annually.

Ancillary Road 1 (AR-1) - This is an access road which leads from the south Aberdeen intake portal to the Aberdeen mine fan. It is a single lane road which has a surface of sandstone. The road is used primarily for access to the fan, water system and conveyer. This road is approximately 20 feet wide and 400 feet long. There is a steel deck bridge over the Aberdeen mine conveyor. The grade on this road ranges from 8% to 10%.

Ancillary Road 2 (AR-2) - This road leads from the upper Pinnacle Mine intake portals to the Pinnacle Mine fan. It is a single lane gravel surfaced road which has a steel deck bridge where the road crosses the Pinnacle Mine conveyor. Its primary use is to access the Pinnacle Mine fan. It is approximately 12 feet wide and 250 feet long. The grade on this road ranges from 0% to 12%.

Ancillary Road 3 (AR-3) - This road leads from PR-2 up to the Apex material storage area (Gun range). This is a single lane gravel surface road which is approximately 12 feet wide and 175 feet long. The grade on this road is on an average of 9%. It is treated with Magnesium Chloride annually. It is used primarily for access.

Ancillary Road 4 (AR-4) - This road is access from the upper Apex material storage area to the Powder Magazines. This road continues beyond the north end of our permit area but it becomes a private road beyond the permit area. This is a single lane dirt road which is approximately 12 feet wide and 150 feet long. The grade on this short stretch of road is 5% to 8%.

Ancillary Road 5 (AR-5) - This road is access from Carbon County Road 299 to the left hand fork installation. This existing road will be upgraded adequately for maintenance and emergency access only. It will be equipped with a locked gate. This is a single lane dirt road which is approximately 15 feet wide and 4000 feet long. There will be 3 or 4 locations specifically widened so that two vehicles may pass. The grade on this stretch of road ranges from 0% to 15%. This road will be reclaimed upon cessation of mining pending the approval of Mrs. Gladys Artman.

Andalex commits to repair roads damaged by a catastrophic event according to R645-301-527.240. According to R645-301-534.100 Andalex has located, designed, constructed, used and maintained Primary Roads so as to prevent or control damage to private and public property. Andalex has used non-acid or non-toxic forming
materials in road surfacing. Roads have, at a minimum a static safety factor of 1.3 on embankments. Andalex has a schedule and plan to remove roads that will not be retained as part of the approved post mining land use. Ancillary roads will be traveled only by light vehicles for routine access. Occasionally, they will be traveled by larger equipment but probably only in emergency or repair situations, as 2 of the 4 Ancillary Roads lead to fan installations. All Primary Roads will meet the requirements of R645-301-358, R645-301.527.100, R645-301-527.230, R645-301-534.100, R645-301-534.200, R645-301-542.600 and R645-301-762. Primary Roads will be located in so far as practical on the most stable available surfaces. The roads are surfaced with rock, gravel or asphalt according to R645-301-534.320. They will be routinely maintained, and have culverts which are designed and installed as necessary according to the requirements of R645-301-534.340.

**Railroad**

There are no existing or proposed railroad spurs on the property.

**Other Transportation Facilities**

The conveyor structures at the minesite are very standard cross member, bent designs. The Pinnacle conveyor is 180 feet in length and uses a 42" conveyor belt. It is covered with galvanized corrugated sheeting. The Pinnacle Truck Loadout is an under pile gravity feed reclaim system in 8 foot diameter sectioned steel tunnel for 90 feet and surfaces on the typical bent, steel structure for an additional 110 feet. The Apex truck loadout is identical to Pinnacle. The mine conveyor is also the same bent/cross member design with a 42" conveyor; however, it is 250 feet in length. The Aberdeen facility is equipped with conveyor facilities similar to that of Pinnacle with only slight variations in exact length anticipated or possible. These facilities will be completed in early 1990.

Transportation facilities such as roads have been addressed. The roads, Class II and I are to be removed upon cessation of mining by simple regrading and re-establishment of contours, unless surface owners request access through the mine area might remain.

Protection of the environment through the use of these facilities is achieved by speed controls (20 mph minesite). The conveyor structures as such do not impose environmental problems. Public safety obviously is a requirement of law including MSHA but also public safety is a requirement of Andalex Resources. Also the minesite is not frequented by any public outside of normal, weekly business hours.

R645-301-542.610. CLOSURE

See R645-301-240.
Post Mining Hydrology

Upon completion of mining activities, and following removal of surface structures, the earthwork portion of the reclamation plan will begin as described. The hydrologic portion of reclamation will take place in two phases including the left fork fan installation:

1. The main and side drainage channels will be restored as shown in the Sedimentation and Drainage Control Plan, and on Plate 16. Loose rock check dams will be placed at each side drainage entrance onto the reclaimed area, and at approximately 500' intervals along the restored main channel RC-1. (Typical sections of the loose rock check dams are shown in the Sedimentation and Drainage Control Plan).

All disturbed diversions and sediment ponds "B" and "C" will also be removed at this time. Sediment Pond "E" will be enlarged, and the entire drainage above will flow into Pond "E-PM" through the restored channel RC-1.

2. Once revegetation and water quality standards are met, Pond "E-PM" will be removed, and the area reclaimed.

Surface water monitoring will continue during this time as described. Please see Figure IV-11.

Topsoil Replacement and Stabilization

All disturbed areas will be backfilled and graded to as near as possible the approximate original contour, and to the most moderate slope possible. Slopes shall not exceed the angle of repose or such lesser slopes as required by the regulatory authority to maintain stability. Fill material will be compacted to assure stability.

Andalex has had a slope stability study performed on a fill pad with a slope greater than 2h:1v and it was determined, even prior to compaction, that the fill had an adequate safety factor. Refer to Appendix K for this study done at the Pinnacle Mine. Andalex has committed to five years of monitoring of this site or whatever amount of time is necessary to assure stability of slopes has been achieved. It should be noted that all highwalls on Andalex's minesite are in or will be in bedrock. This is a steep sided, narrow canyon and Andalex will not be relieved of liability until reasonable stability has been achieved through compaction and revegetation.

Areas to be regraded include the portal site, surface facility site and roads. Because of the diversity of these areas, all regrading will conform to the specific site. Specific to high wall areas,
development waste. We estimate this may be as much as 3000 yards of material. Please refer to Plate 15 addendum for a detailed drawing on the high wall areas. The Aberdeen Mine high wall has been redrawn and back fills recalculated. Where slopes are greater than 2 to 1, before final reclamation is completed, slope stability studies will be performed as necessary. All information for slope stability studies will be included as part of the final reclamation package.

Where possible, all final grading and placement of topsoil will be done along the contour to minimize erosion. In all cases, grading will be conducted in a manner which minimizes erosion and provides a stable surface for the placement of topsoils.

Topsoil existing on site will be spread using a grader. Where possible, the soil will be distributed along the contour. The thickness of the re-established soil will be consistent with soils in the vicinity and will be sufficient to support vegetation equal to or superior to pre-mining history, 6".

Andalex will rip the subsurface material to 6" using most likely a toothed motor grader or a disc, prior to soil redistribution.

Andalex will mix one ton of alfalfa per acre with its topsoil material to aid in aeration, microbiological community development, and water holding capacity.

Andalex will distribute topsoil to a minimum depth of 6" as previously stated.

Andalex has already committed to testing of redistributed soil and fill material and has committed to use proper additives if it is discovered necessary. Specifically, Andalex will test for organic matter, phosphorous, potassium, pH, conductivity, and texture. The samples will be taken at 0-6 inches, 6-12 inches, and 12-24 inches at least 90 days prior to final reclamation.

R645-301-542.700. FINAL ABANDONMENT OF MINE OPENINGS AND DISPOSAL AREAS

Plates 6, 16, 17, & Appendix Y.

R645-301-542.710. DESCRIPTION

See R645-301-515.300.

R645-301-542.720. DISPOSAL OF EXCESS SPOIL

See R645-301-513.300.
R645-301-542.730. DISPOSAL OF COAL MINE WASTE
See R645-301-513.300.

R645-301-542.740. DISPOSAL OF NON-COAL MINE WASTES
See R645-301-513.300.

R645-301-542.741. PLACEMENT AND STORAGE
See R645-301-513.300.

R645-301-542.742. FINAL DISPOSAL
See R645-301-513.300.

R645-301-542.800. RECLAMATION COST ESTIMATE
See R645-301-240.

R645-301-550. RECLAMATION DESIGN CRITERIA AND PLANS
See R645-301-240.

R645-301-551. CASING AND SEALING OF UNDERGROUND OPENINGS

Casing and Sealing of Drill Holes

All exploratory drill holes have been sealed with cement and all water wells have been cased with steel casing and will be maintained. After mining is completed, the water wells and monitoring wells will be sealed except in the event the state engineer allows them to remain opened for other purposes.

See R645-301-529.100.

R645-301-552. PERMANENT FEATURES
N/A

R645-301-552.100. SMALL DEPRESSIONS
Plates 16 & 17

R645-301-552.200. PERMANENT IMPOUNDMENTS
N/A

INCORPORATED
OCT 07 2002
DIV OF OIL GAS & MINING
Upon completion of Andalex Resources' mining operation, the land will continue to be used for grazing and hunting. The limited resources, both physical and scenic, will dictate no future change in the land status. The nature of an underground mine of this size requires minimal surface disturbance. All disturbed areas shall be restored in a timely manner to conditions that are capable of supporting the uses which they were capable of supporting before any mining including high priority wildlife habitat. Andalex is not proposing an alternate post-mining land use. Andalex is not requesting an approval for an alternate post-mining land use. The anticipated post-mining land use is likely to be achieved and does not present any actual or probable hazard to public health or safety or threat of water diminution or pollution. The post-mining land use is practical and can be implemented immediately following reclamation and will not result in any violation of federal, state, or local law.
R645-301-553.221. CLEARING AND GRUDDING
N/A

R645-301-553.222. TOPSOIL REMOVAL AND STORAGE
See R645-301-231, -234.

R645-301-553.223. BACKFILLING AND GRADING
See R645-301-532.200.

R645-301-553.230. FINAL SURFACE GRADING
See R645-301-532.200.

R645-301-553.240. FINAL CONFIGURATION
Plates 16 & 17

R645-301-553.250. REFUSE PILES
N/A

R645-301-553.251. FINAL CONFIGURATION
N/A

R645-301-553.252. COVER REQUIREMENTS
N/A

R645-301-553.260. DISPOSAL OF COAL PROCESSING WASTES IN MINED-OUT SURFACE AREAS
N/A

R645-301-553.300. RESTRICTIONS AND REQUIREMENTS
N/A

R645-301-553.400. CUT-AND-FILL TERRACES
N/A

R645-301-553.410. COMPATIBILITY
N/A
SPECIALIZED FACILITIES FOR IMPLEMENTING POSTMINING LAND USE

PREVIOUSLY MINED AREAS

RE-MINING AREAS CONTAINING HIGHWALLS

HIGHWALL ELIMINATION

SPOIL AVAILABILITY

Old coal pads will be used for backfilling highwalls.

BACKFILLING COMPATIBILITY

This is compatible with our refuse elimination plan.

HIGHWALL REMNANTS

SPOIL PLACEMENT

APPROXIMATE ORIGINAL CONTOUR

VARIANCE REQUIREMENTS

INCOMPLETE HIGHWALL ELIMINATION

MOUNTAINTOP APPROVAL

N/A
R645-301-553.640. SURFACE MINING OPERATIONS
N/A

R645-301-533.641. THIN OVERBURDEN
N/A

R645-301-533.642. THICK OVERBURDEN
N/A

R645-301-553.650. UNDERGROUND MINING OPERATIONS
See R645-301-511.100.

R645-301-553.651. RETAINED HIGHWALLS
See R645-301-532.200.

R645-301-553.652. COMPATIBILITY
See R645-301-532.200.

R645-301-553.653. GEOMORPHIC PROCESS
See R645-301-532.200.

R645-301-553.700. BACKFILLING AND GRADING: THIN OVERBURDEN
N/A

R645-301-553.710. AVAILABLE SPOIL MATERIALS
N/A

R645-301-553.720. REQUIREMENTS
N/A

R645-301-553.800. BACKFILLING AND GRADING: THICK OVERBURDEN
N/A

R645-301-553.810. FINAL GRADING
N/A
R645-301-553.820. REQUIREMENTS
N/A

R645-301-553.830. EXCESS SPOIL
N/A

R645-301-553.900. SETTLED AND REVEGETATED FILLS
N/A

R645-301-560. PERFORMANCE STANDARDS

See R645-301-511.100.
If settlement or rills occur at the well sites, they will be regraded and revegetated. Refer to Section 244.300.

560 PERFORMANCE STANDARDS

Performance of the well sites will be conducted in accordance with the approved permit and the requirements of R645-301-510 through R645-301-553. It should be noted that at such time as the wells are no longer in use they will be sealed at the well-head on the surface. This will coincide with the sealing of the respective underground longwall panels which the individual wells serviced.