PART D

OPERATION AND RECLAMATION PLAN

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1.0 INTRODUCTION

Exploration and development work on the Wishbone Hill Project has been in progress since 1983. In the western portion of the project area, exploration drilling has defined a reserve of high quality bituminous coal.

The proposed mine plan presented in this application includes 2 mine areas and associated processing facilities encompassing approximately 608 acres of disturbance. An access route of approximately 3 miles encompassing 22 acres of disturbance is also included in this application.

Part D of this application addresses the operations and reclamation plans for the Wishbone Hill Project including mine pits, coal processing facilities and hauling routes. Part D has been structured to meet the requirements of the Alaska Surface Coal Mining Control and Reclamation Act, AS 27.21 and the associated Regulations Governing Coal Mining in Alaska. Section 2.0 of Part D discusses existing structures at the mine site. The Life of Mine Plan is outlined in Section 3.0 and briefly discusses operations over the entire mine life. Subsequent sections address each aspect of the mining operations and facilities reclamation in detail.

Information compiled for Part C, Environmental Resource Information, has been used in development of Part D to ensure compliance with specific regulatory performance standards and to meet the intended objectives of the Moose Management Plan.

2.0 EXISTING OPERATIONS, STRUCTURES AND FACILITIES

There are no existing operations, structures, or facilities within the Wishbone Hill Project permit boundary that will be used in connection with the mining and reclamation plan presented in this application. Part C, Section XII discusses previous activities and structures within the permit boundary.

3.0 LIFE OF MINE PLAN

This section addresses, in general, the activities to occur over the life of the project. Following sections will describe in greater detail the project activities. The entire plan is presented in this section of the application for ease of review and understanding of the complete project. Plate 3-1 depicts the anticipated facilities for the entire project life. Table 3-1 is a tabulation of disturbance and reclamation for the first 5 year permit term and the remaining life of the mine.

3.1 Description of Reserve Area

The area to be mined lies at the western end of the Wishbone Hill coal district on the southwestern extent of Wishbone Hill. Wishbone Hill is a synclinal structure bisected by several major transverse and low angle thrust faults. Four main coal groups are proposed for mining. These groups are, in descending order, the Jonesville, Premier, Eska, and Burning Bed groups, with the majority of strippable coal located in the Premier group. An individual coal seam not associated with any of the coal groups, the Midway seam, lies between the Premier and Eska groups and is also planned for mining. The coal will be mined in two separate mine areas as depicted on Plate 3-1.

The four main coal groups and the individual Midway seam lie in the upper portion of the Tertiary age Chickaloon Formation. The Chickaloon Formation consists of sequences of claystone, shale, siltstone, sandstone, coal and thin beds of pebble conglomerate.

The coal groups found in the upper Chickaloon Formation are ranked as high-volatile, bituminous B coal. For a complete discussion of the project area geology see Part C, Chapter II, Geology.

3.2 Method of Mining

The mining method for the Wishbone Hill Project has been selected after careful consideration of the geologic conditions, climatic conditions, and mine plan for the Project. The overall mining method has been designed to allow for optimal equipment utilization and coal recovery to accomplish a continuous pattern from topsoil removal through reclamation while ensuring environmental protection.

Topsoil removal will be accomplished with the use of either dozers, scrapers, or trucks with an excavator or loader. Topsoil will be hauled for direct replacement, where possible, or stockpiled. Overburden and coal removal will be conducted with the use of a hydraulic excavator and/or shovel to dig and place the material into haul trucks. Direct haul back of the overburden/interburden will occur where possible. Because of the steeply dipping seams and the depth of mining, direct haul back of the overburden/interburden materials will not be possible during some of the mine life and these materials will be temporarily stockpiled in designated areas. Coal will be hauled to the coal wash plant for processing. Coarse coal refuse generated at the wash plant will be hauled back to the mine area for backfill in the pit. Fine coal refuse will be disposed in a slurry pond. The clean coal will be hauled off-site with road-legal trucks.

3.3 Mining Sequence and Disturbance Areas

The initial project disturbance will be construction of the mine access road. Once the access road is complete enough to be used to bring other construction equipment to the site, construction of the plant will begin. During construction of the plant area, topsoil and overburden removal operations will begin in Mine Area 1. The proposed sequence of topsoil removal is shown on Plate 3-2 for the first 5 year permit term. In all cases, runoff and drainage controls will be established prior to topsoil removal and construction of mining operations. These controls are discussed in detail in Section 11.

The proposed mining limits for the first 5 year permit term and the remaining life of mine, are shown on Plate 3-3. Table 3-1 outlines the projected disturbance by areas.

3.4 Topsoil Handling

The mining sequence will start with the removal of vegetative cover. Following this, topsoil will be removed using either dozers, scrapers, or trucks with an excavator or loader. Both of these operations will be conducted in advance of any site disturbances. A minimum 50 foot buffer of topsoil removal will be maintained at all times to allow for sufficient operating room without contamination of the topsoil resource. The topsoil will be either transported for direct redistribution on reclaimed areas or, if such areas are not available at the time of salvage, be placed in topsoil stockpiles strategically located away from active operations. Topsoil stockpiles will be located and constructed to ensure stability and to minimize wind and water erosion, unnecessary compaction, and contamination with other materials. Topsoil stockpiles will be graded with outslopes no steeper then 3H:1V and seeded with a mixture of grass species. Further information on topsoil handling and revegetation is contained in Sections 4 and 13, respectively.

During topsoil salvage operations, a qualified individual will observe the operations and make certain that all available topsoil is salvaged. The topsoil stockpiles will be clearly marked with signs designating the pile as a topsoil stockpile.

The volume of topsoil to be salvaged over the first 5 year permit term and the remaining life of mine is presented in Table 3-2. This Table provides acres of disturbance by area and volumes by soil type. Table 3-3 shows the destination for topsoil removed during the first 5 year permit term and the remaining life of mine (i.e., the volume to be stockpiled or the volume to be directly replaced). Table 3-4 provides the volume by soil type for the topsoil removed from the access road.

A complete description of the site soil resources is contained in Part C, Chapter XI, Soil Resources.

3.5 Overburden Handling

Once all topsoil has been salvaged from an area, overburden removal activities will begin. Initial overburden removal is not expected to require blasting, however, once the upper layer of glacial gravels has been removed blasting will be required to prepare the lower units of overburden for removal. Blasting plans and details are contained in Section 5.0. Overburden will be removed with the use of a hydraulic excavator or shovel and haul trucks.

The geologic information from the exploration drill holes was compiled and used to quantitatively assess the overburden and interburden material to be removed within the pit areas. Volumes of overburden/waste removed for the first 5 year permit term and the remaining life of mine for mine areas 1 and 2 were calculated and are presented on Table 3-5. The volumetric assessment of the overburden indicates that the average stripping ratio is 7 bank cubic yards of overburden to 1 metric ton of run of mine coal.

A complete discussion on the physical and geochemical characteristics of the overburden/interburden material is contained in Part C, Chapter III, Overburden and Interburden Assessment.

Where possible, overburden will be placed directly into areas of the mine pit ready for backfilling. During initial overburden excavation, no areas within the mine pit will be available for backfilling and the Initial Overburden Stockpile No. 1 will be constructed (see Plate 3-1). In portions of subsequent years, direct backfilling of all overburden material removed will not be possible. During these periods, Overburden Stockpile No. 1 will be enlarged and Overburden Stockpiles No. 2 and

No. 3 will be constructed. The locations of the overburden stockpiles are shown on Plate 3-1. The areas of overburden placement in the first 5 year permit term are shown on Plate 3-4. Initial Overburden Stockpile No. 1 will be constructed south of Mine Area 1 and eventually will extend over the backfilled limits of Mine Area 1. Overburden Stockpile No. 2 will be constructed over the southwestern portion of backfilled Mine Area 2. Overburden Stockpile No. 3 will be constructed southeast of Mine Area 2. The stockpiles will be constructed in a stable configuration with drainage controls in place prior to placement of overburden. The overburden stockpiles will be clearly marked with signs on all sides of the piles and segregated from any topsoil stockpiles. A complete discussion of overburden removal is contained in Section 5.

3.6 Coal Removal

Coal removal will occur following blasting of the coal seam. The coal will be removed using the same hydraulic excavator or shovel and haul trucks used for overburden removal. Care will be taken to separate, if possible, interburden or partings from the coal being loaded. The coal will be transported from the pit Area to the wash plant for stockpiling or direct feed into the wash plant. A maximum of 1.6 million metric tons of run of mine coal will be removed for processing during each year of operations. Section 7 contains complete details of the project coal removal activities and Section 8 contains details of the coal processing. Table 3-6 details the run of mine coal, clean coal, and coal refuse volumes for each area of operation.

3.7 Backfilling and Grading

After the initial box cut has been excavated, backfilling will occur concurrently with mining operations. Once all the minable coal has been removed from a pit area and sufficient room is available between the backfilling and active mining operations to ensure worker safety and adequate working space, the area will be backfilled with overburden from other areas of the mining operation and coarse coal refuse generated at the wash plant. The backfilled areas for the first 5 year permit term of the mining operation are shown on Plate 3-5. Backfilling operations during the last several years of the project will utilize the stockpiled overburden to achieve the final surface configuration. A small amount of overburden will be used in facilities area reclamation as described in Section 12.

Table 3-7 presents acreages of backfilling to occur in the first 5 year permit term and remaining life of mine and a material balance for the overburden removal and backfilling volumes. Section 12 contains a complete discussion of the pit backfilling and grading.

3.8 Reclamation

Reclamation will occur concurrently with mining and backfilling operations as much as possible but will be implemented in accordance with growing seasons and optimal planting times. Once backfilling of the pit has occurred, the backfilled areas will be graded and surveyed to ensure establishment of final contours and landforms. Topsoil will then be replaced, amended if necessary and prepared for seeding. The topsoiled areas will then be seeded with the appropriate reclamation seed mixture. Complete details of the site reclamation can be found in Section 13. Plate 3-6 shows the areas reclaimed during the first 5 year permit term.

3.9 Coal Production Statistics

The mine will operate at a maximum of 7 days per week utilizing three shifts per day. Table 3-8 presents the anticipated topsoil, overburden and coal volumes that will be removed during the first 5 year permit term and the remaining life of mine..

Coal processing will also occur at a maximum of 7 days per week utilizing three shifts per day. Processing will yield a maximum of 1.0 million metric tons of clean coal per year over the life of the project. The coal will be hauled with road-legal trucks from the mine site along the three mile access road to the Glenn Highway.

3.10 Equipment Utilized

The anticipated equipment list for routine operations at the Wishbone Hill mine is presented in Table 3-9. Additional or substitute equipment may be utilized from time to time due to unforseen circumstances, such as equipment breakdown.

3.11 Permit Terms

The permit term for this application is the first five years of operation. Operations for the life of mining are shown on Plate 3-1. Additional permit term information, along with a map depicting the 5 year permit term areas is presented in Part B, Section 5.0.

TABLES

TABLE 3-1
DISTURBANCE AND RECLAMATION

FIRST 5 YEAR TERM

	Disturbance (in acres)	Reclamation (in acres)
	150 - Mine Area 1 Pit and OB Stockpile No. 1	
	100 - Mine Area 2 Pit	
	137 - Facilities and TS Stockpile No. 1	
	22 - Access Road	
	22 - Haul Road, Buffalo Creek Pipeline	
	8 - Topsoil Stockpile No. 2	
	2 - Buffalo Creek Channel Relocation	
		2 - Buffalo Creek Relocation
		8 - Topsoil Stockpile No. 2
		7 - Upper Reach of Pipeline
		10 - Access Road
Subtotal	**441**	**27**

REMAINING LIFE OF MINE

	Disturbance (in acres)	Reclamation (in acres)
	166 - Mine Area 2 Pit	
	23 - OB Stockpile No. 3	
		251 - Mine Area 2 Rec.
		30 - OB Stockpile No. 3 Rec.
		147 - Mine Area 1 and OB Stockpile No. 1
		137 - Facilities Area and TS Stockpile No. 1
		20 - Mine Area 2 Haul Road
Subtotal	**189**	**585**
TOTAL	**630**	**612**

Approximately 12 acres of the site access road and 6 acres of the mine area roads will be left after reclamation to allow continued access to this area. Information used to develop this Table was taken from Plate 3-2 and Plate 3-5.

TABLE 3-2
ACRES OF DISTURBANCE AND SOIL TYPE VOLUMES
(Volumes Based on the Estimated Maximum Recoverable Amount)

FIRST 5 YEAR TERM

Facilities Area and Associated Roads

Soil Type	Depth (ft)	Area (ft^2)	Volume (BCY)
E1	1.5	3,314,000	184,000
F	3.25	394,000	47,000
G	1.09	562,000	23,000
I	3.8	555,000	78,000
		4,825,000	332,000

Overburden Stockpile No. 1

Soil Type	Depth (ft)	Area (ft^2)	Volume (BCY)
E1	1.5	1,117,000	62,000
F	3.25	122,000	15,000
I	3.8	1,245,000	175,000
		2,484,000	252,000

Buffalo Creek Channel Relocation

Soil Type	Depth (ft)	Area (ft^2)	Volume (BCY)
A	1.53	40,000	2,000
B	1.52	51,000	3,000
H	0.83	5,000	0
W	0	8,000	0
		104,000	5,000

Mine Roads and Diversion Structures

Soil Type	Depth (ft)	Area (ft^2)	Volume (BCY)
A	1.53	615,000	35,000
B	1.52	34,000	2,000
C	1.46	315,000	17,000
		964,000	54,000

Pit Area 1 Mine Area 1

Soil Type	Depth (ft)	Area (ft^2)	Volume (BCY)
B	1.52	784,000	44,000
DL	0	977,000	
E1	1.5	1,559,000	87,000
F	3.25	122,000	15,000
I	3.8	585,000	82,000
J	1.61	22,000	1,000
RO	0	5,000	
		4,054,000	229,000

Pit Area - Mine Area 2

Soil Type	Depth (ft)	Area (ft^2)	Volume (BCY)
A	1.53	1,234,000	70,000
B	1.52	2,457,000	138,000
C	1.46	168,000	9,000
E1	1.5	355,000	20,000
F	3.25	134,000	16,000
		4,348,000	253,000

REMAINING LIFE OF MINE

Pit Area - Mine Area 2

Soil Type	Depth (ft)	Area (ft^2)	Volume (BCY)
A	1.53	4,884,000	277,000
B	1.52	1,095,000	62,000
C	1.46	113,000	6,000
D	0	299,000	
DL	0	75,000	
H	0.83	4,000	
RO	0	44,000	
		6,514,000	345,000

Overburden Pile 2

Soil Type	Depth (ft)	Area (ft^2)	Volume (BCY)
A	1.53	21,000	1,000
B	1.52	1,645,000	93,000
C	1.46	45,000	2,000
DL	0	4,000	
I	3.8	9,000	1,000
		1,724,000	97,000

SUMMARY

Year	Removed Topsoil	Acres	Square Feet
First 5 Year Term	1,125,000	384	16,779,000
Remaining Life of Mine	442,000	190	8,238,000
TOTAL	1,567,000	574	25,017,000

Notes:

1. Area of topsoil replacement is 574 acres - 6 acres for permanent roads or 568 acres.
2. Total swelled topsoil is 1,567,000 x 1.1 - 1,723,700 LCY
3. 1,723,700 LCY x 27 cubic ft/cubic yard/24,742,080 square feet = 22 inches of topsoil replaced over the disturbed areas.
4. This excludes 34 acres for topsoil stockpiles since topsoil will not be removed from stockpile areas.

TABLE 3-3
TOPSOIL STOCKPILING AND REPLACEMENT BY TERM

	Stockpiled Volume (LCY)	Direct Replacement Volume (LCY)	Replacement from Stockpile (LCY)
First Five Year Term	1,238,000		27,000
Remaining Life of Mine	285,000	201,000	1,484,000
TOTAL	**1,523,000**	**201,000**	**1,511,000**

TABLE 3-4

ACCESS ROAD TOPSOIL REMOVAL

Soil Type	Depth (ft)	Area (ft^2)	Volume (BCY)
E1	1.5	157,000	10,000
E2	2.25	655,000	62,000
F	3.25	102,000	12,000
H	0.83	48,000	1,000
I	3.8	13,000	2,000
		975,000	87,000

Total volume of topsoil available = 87,000 BCY x 1.1 = 95,700 LCY
Total Area Reclaimed = 10 acres x 43,560 ft^2/acre = 435,600 ft^2
Replacement depth will be 2 feet.
Topsoil required is 435,600 ft^2 x 2 ft /27 ft^3/yd^3 = 32,267 LCY
Excess topsoil is 95,700 LCY - 32,267 LCY = 63,433 LCY
The excess topsoil material windrowed along the access road will be graded to blend with the existing topography.

TABLE 3-5
OVERBURDEN REMOVAL

Volume Removed (LCY)	Disposal Location
First Five Year Term	
20,922,000	Overburden Stockpile No. 1
18,329,000	Backfill in Mine Area 1
15,707,000	Backfill in Mine Area 2
54,958,000	**Sub Total**
Remaining Life of Mine	
5,236,000	Overburden Stockpile No. 1
5,492,000	Overburden Stockpile No. 2 and No. 3
67,801,000	Backfill in Mine Area 2
78,529,000	**Sub Total**
133,487,000	**TOTAL**

TABLE 3-6
COAL PROCESSING VOLUMES

Year	Run of Mine Coal (LCY)	Clean Coal (LCY)	Coarse Coal (LCY)	Fine Coal (LCY)
First Five Year Term	8,466,000	6,178,000	2,034,000	254,000
Remaining Life of Mine	9,682,000	6,876,000	2,516,000	290,000
TOTAL	**18,148,000**	**13,054,000**	**4,550,000**	**544,000**

TABLE 3-7
BACKFILLING SEQUENCE AND AMOUNTS

	Volume Backfilled (in loose cubic yards)	**Area Backfilled (in acres)**	**Area**
First Five Year Term	18,329,000	65	Mine Area 1 from pit
	15,707,000	13	Mine Area 2 from pit
	34,036,000	**78**	**Sub Total**
Remaining Life of Mine	67,801,000	215	Mine Area 2 from pit
	29,191,000	NA	Mine Area 2 from stockpile
	96,992,000	**215**	**Sub Total**
	131,028,000	**293**	**TOTAL**

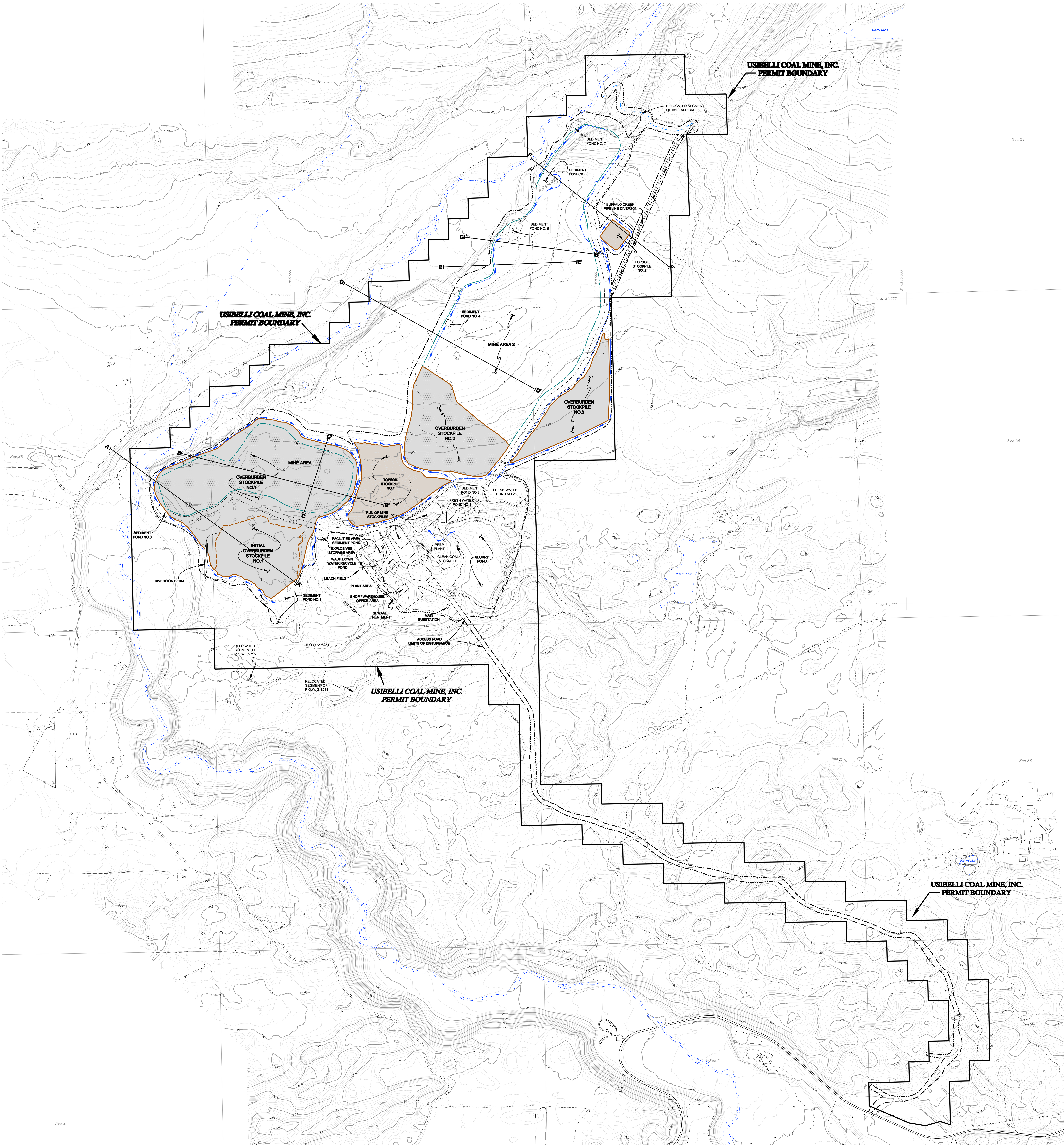
TABLE 3-8
TOPSOIL, OVERBURDEN, AND COAL REMOVAL

Year	Topsoil Volume (in LCY)	Overburden Volume (in LCY)	Run of Mine Coal Volume (in LCY)
First Five Year Term	1,238,000	54,958,000	8,466,000
Remaining Life of Mine	486,000	78,529,000	9,682,000
TOTAL	1,724,000	133,487,000	18,148,000

TABLE 3-9
PROPOSED MAJOR EQUIPMENT LIST FOR THE WISHBONE HILL PROJECT

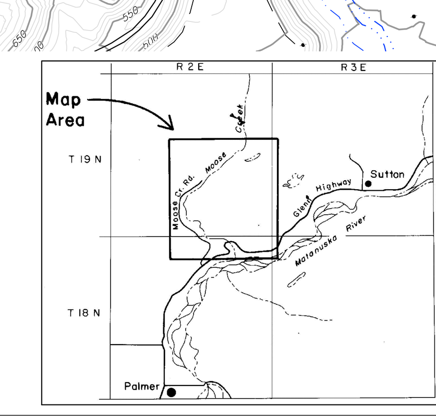
2 Crawler Dozers – D10R or equivalent
1 Hydraulic Shovel – 18-20 cubic yard capacity
1 Backhoe – 13-15 cubic yard capacity
1 Utility Backhoe – 385 or equivalent
1 Front End Loader – 993K or equivalent
1 Utility Loader – 980 or equivalent
4 Haul Trucks – 785D or equivalent
1 Crawler Drill
1 Powder Truck
1 Grader – 16G or equivalent
1 Water Truck
1 Sanding Truck
1 Field Fuel Truck
1 Field Maintenance Truck
1 Welding Truck
7 Pick-Up Trucks

PLATES



LEGEND

- PERMIT BOUNDARY
- DISTURBANCE BOUNDARY
- LIMITS OF MINING
- STOCKPILE LIMITS
- FACILITIES AREAS
- ROADS - UNPAVED
- ROADS - PAVED
- DIVERSION DITCHES
- PIPELINE
- SECTIONS LINES
- EXISTING CONTOURS
- MINE ROADWAYS
- TRAIL
- BUFFALO CREEK RELOCATION
- CROSS SECTIONS LOCATION
- FENCE
- TOPSOIL STOCKPILES
- OVERBURDEN STOCKPILES
- OVERBURDEN STOCKPILES CONSTRUCTED ON BACKILLLED PIT AREAS



NOTES:
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2. VERTICAL DATUM IS NAVD 88.
3. MAPPED FOR 1" = 200 FEET, 10 FOOT CONTOUR INTERVAL.
4. DATE OF PHOTOGRAPHY: 10–12–1997
5. THIS MAP CONFORMS TO ASPRS CLASS I MAP STANDARDS.
6. THE VERTICAL ACCURACY IS APPROXIMATELY ONE HALF OF THE CONTOUR INTERVAL SHOWN IN ANY GIVEN AREA ON THE MAP. CONTOURS IN VEGETATED AREAS MAY BE LESS ACCURATE, CONTOURS IN DENSE VEGETATION ARE LIKELY TO BE LESS ACCURATE.

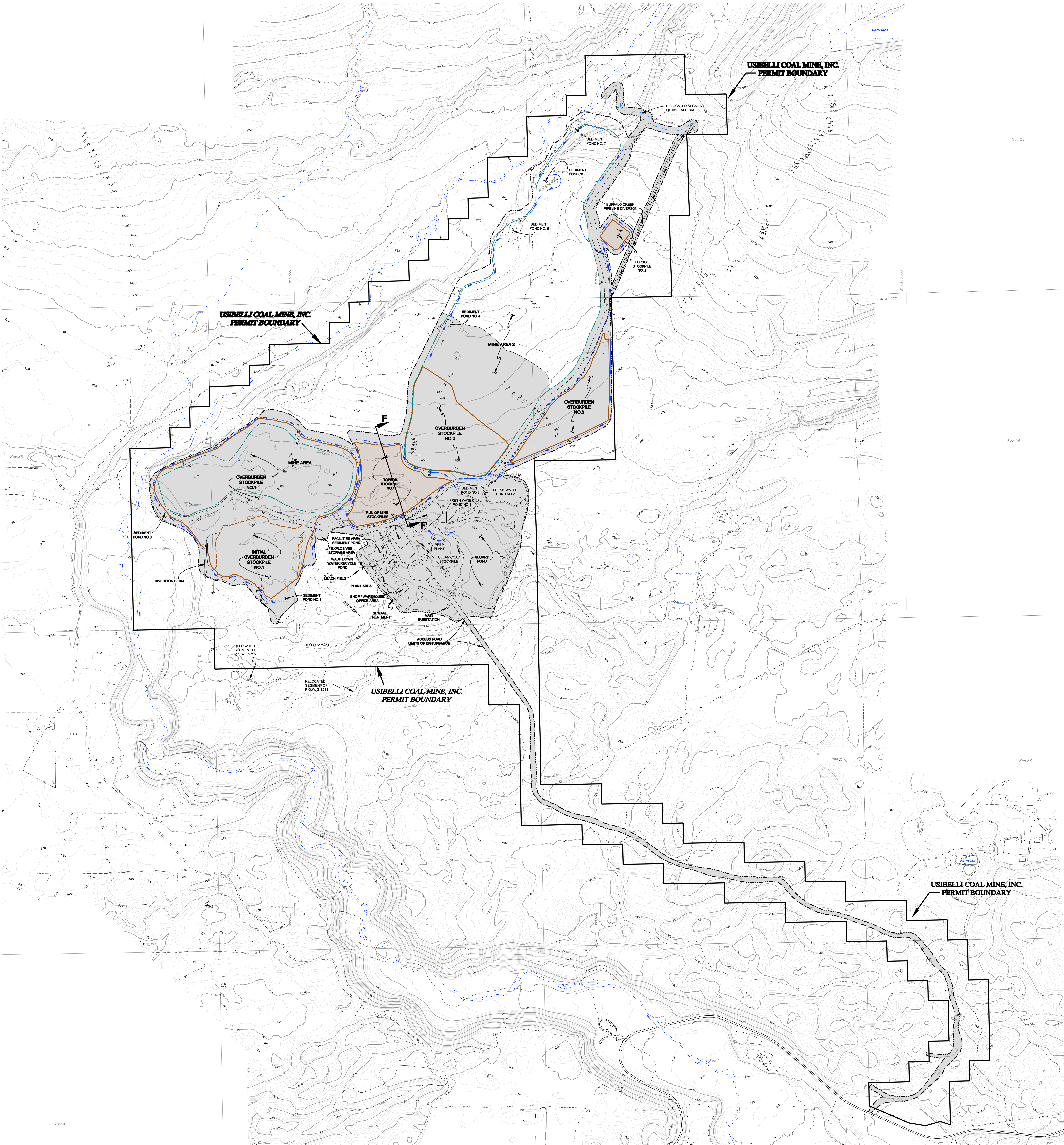
SUBJECT REVISIONS

REV.	DATE:	BY:	DESCRIPTION

DESIGN BY:	WISHBONE HILL MINE — USIBELLI COAL MINE INC. UCM — PERMIT NUMBER 01–89–796
DRAWN BY:	
CHECK BY:	MINE AREA 1 & 2 GENERAL FACILITIES ARRANGEMENT
DWG FILE:	
DATE DRAWN:	WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683–2226

PLATE No. 3–1 | SHEET No. 1 OF 1 | REV. 0



LEGEND

	PERMIT BOUNDARY		SECTIONS LINES
	DISTURBANCE BOUNDARY		EXISTING CONTOURS
	LIMITS OF MINING		MINE ROADWAYS
	STOCKPILE LIMITS		TRAIL
	FACILITIES AREAS		BUFFALO CREEK RELOCATION
	ROADS - UNPAVED		FENCE
	ROADS - PAVED		TOPSOIL STOCKPILES
	DIVERSION DITCHES		TOPSOIL REMOVAL LIMITS FIRST 5 YEAR PERMIT TERM
	PIPELINE		

SCALE
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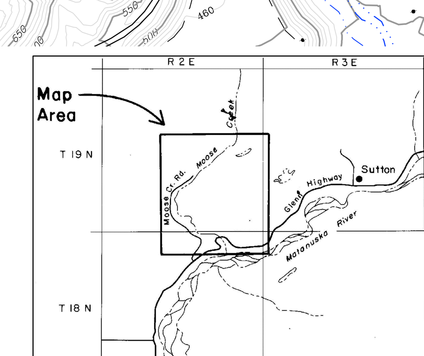
CONTOUR INTERVAL: 10FT.

STATE OF ALASKA
49th
ALAN E. RENSHAW
CE 9774
REGISTERED PROFESSIONAL ENGINEER



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SUBJECT REVISIONS

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CHECK BY:
DWG FILE:
DATE DRAWN:

WISHBONE HILL MINE — USIBELLI COAL MINE INC. UCM — PERMIT NUMBER 01-89-796

TOPSOIL REMOVAL
FIRST 5 YEAR PERMIT TERM

WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
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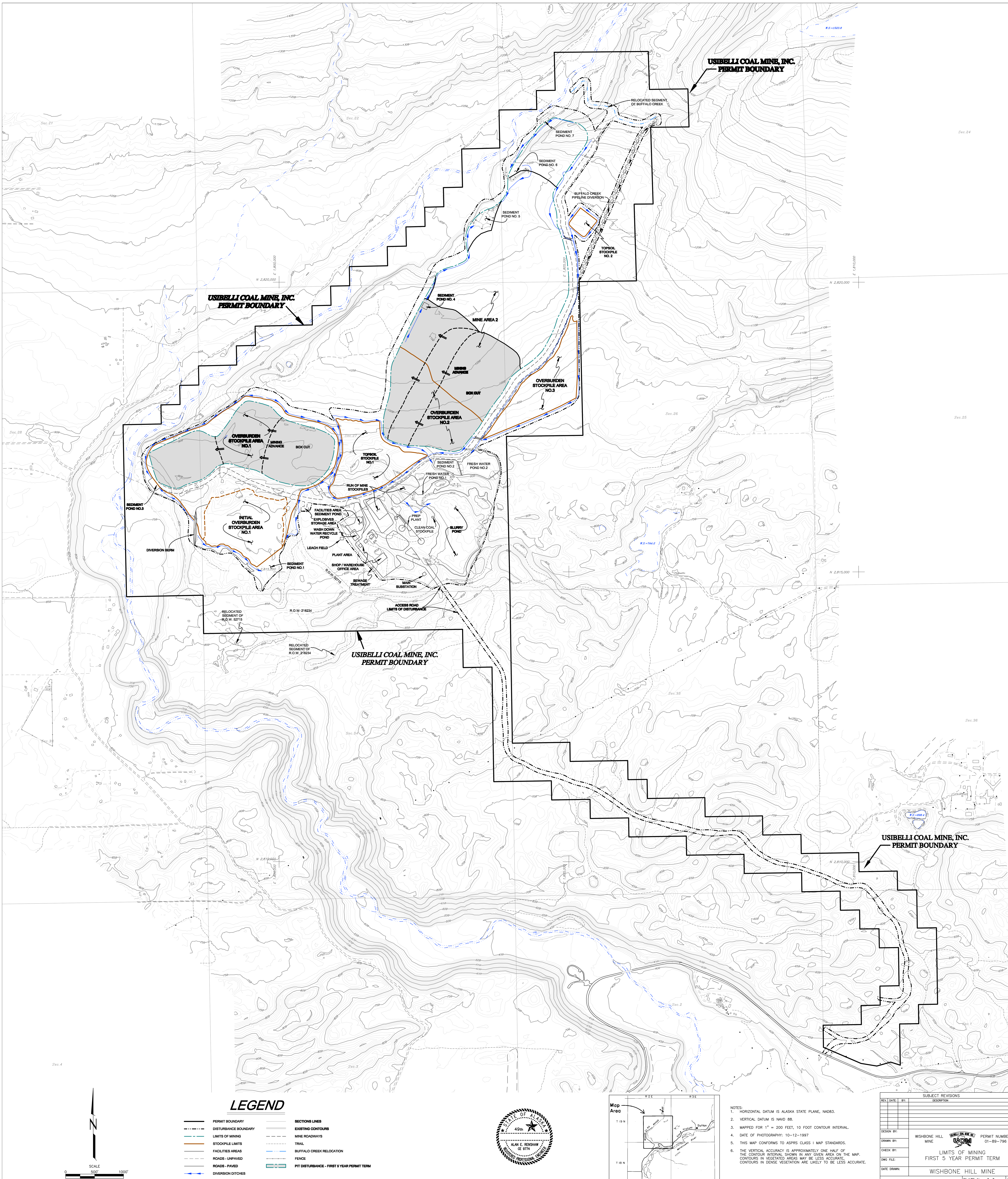
PLATE No. 3-2 | SHEET No. 1 OF 1 | REV. 0



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WISHBONE HILL MINE

PERMIT NUMBER 01-89-796

LIMITS OF MINING
FIRST 5 YEAR PERMIT TERM

WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
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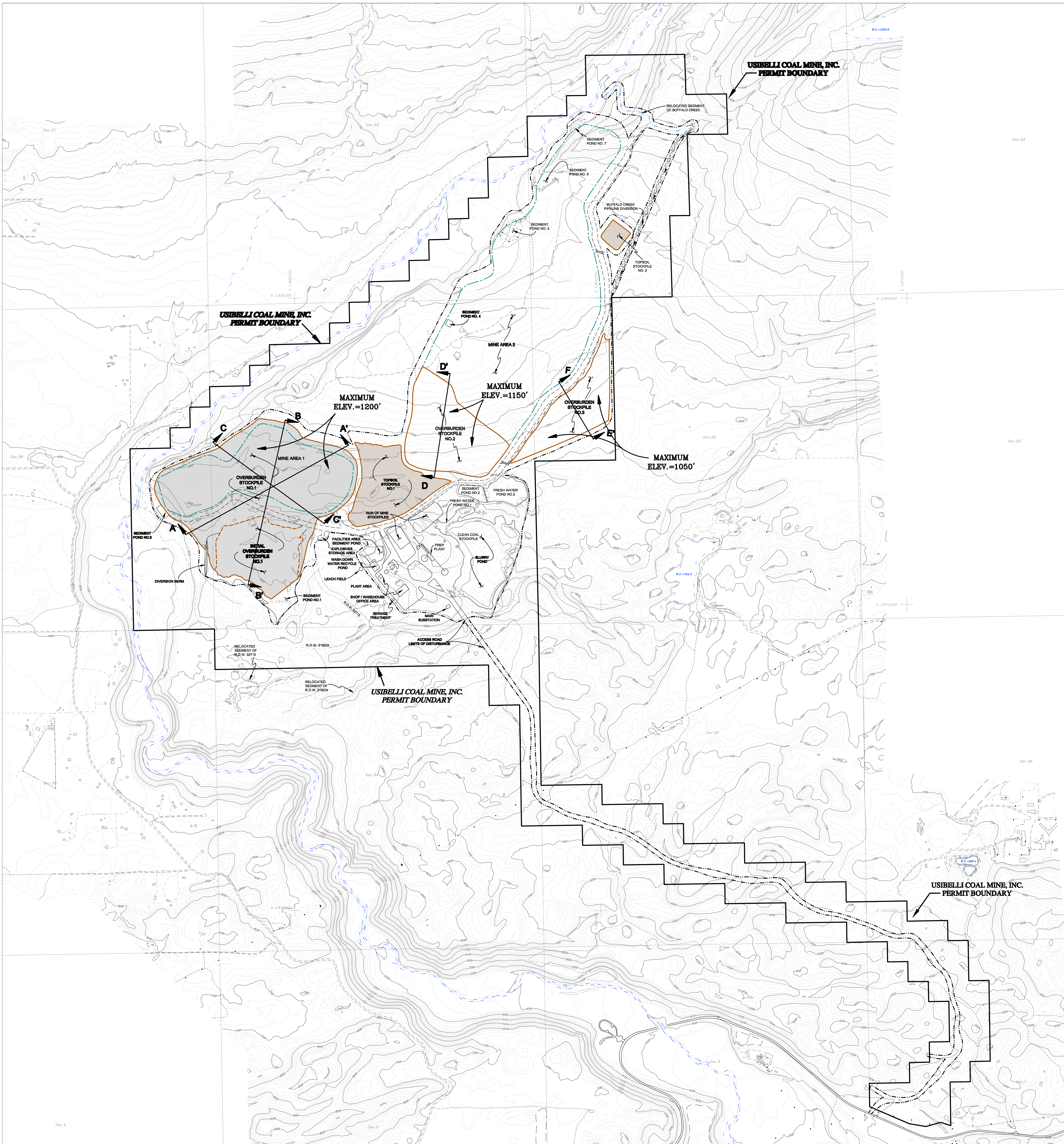
PLATE No. 3-3
SHEET No. 1 OF 1
REV. 0



LEGEND

	PERMIT BOUNDARY		EXISTING CONTOURS
	DISTURBANCE BOUNDARY		MINE ROADWAYS
	LIMITS OF MINING		TRAIL
	STOCKPILE LIMITS		BUFFALO CREEK RELOCATION
	FACILITIES AREAS		FENCE
	ROADS - UNPAVED		TOPSOIL STOCKPILES
	ROADS - PAVED		OVERBURDEN STOCKPILES FIRST 5 YEAR PERMIT TERM
	PIPELINE		OVERBURDEN STOCKPILES CONSTRUCTED ON BACKILLLED PIT AREAS
	SECTIONS LINES		

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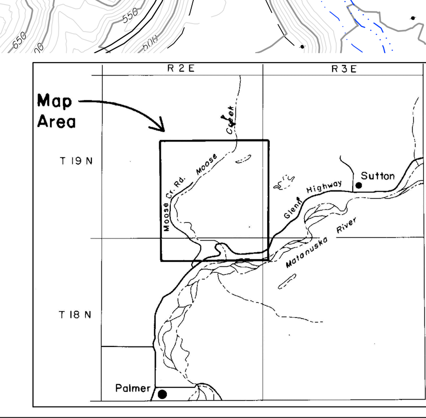

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6. THE VERTICAL ACCURACY IS APPROXIMATELY ONE HALF OF THE CONTOUR INTERVAL SHOWN IN ANY GIVEN AREA ON THE MAP. CONTOURS IN VEGETATED AREAS MAY BE LESS ACCURATE, CONTOURS IN DENSE VEGETATION ARE LIKELY TO BE LESS ACCURATE.

SUBJECT REVISIONS

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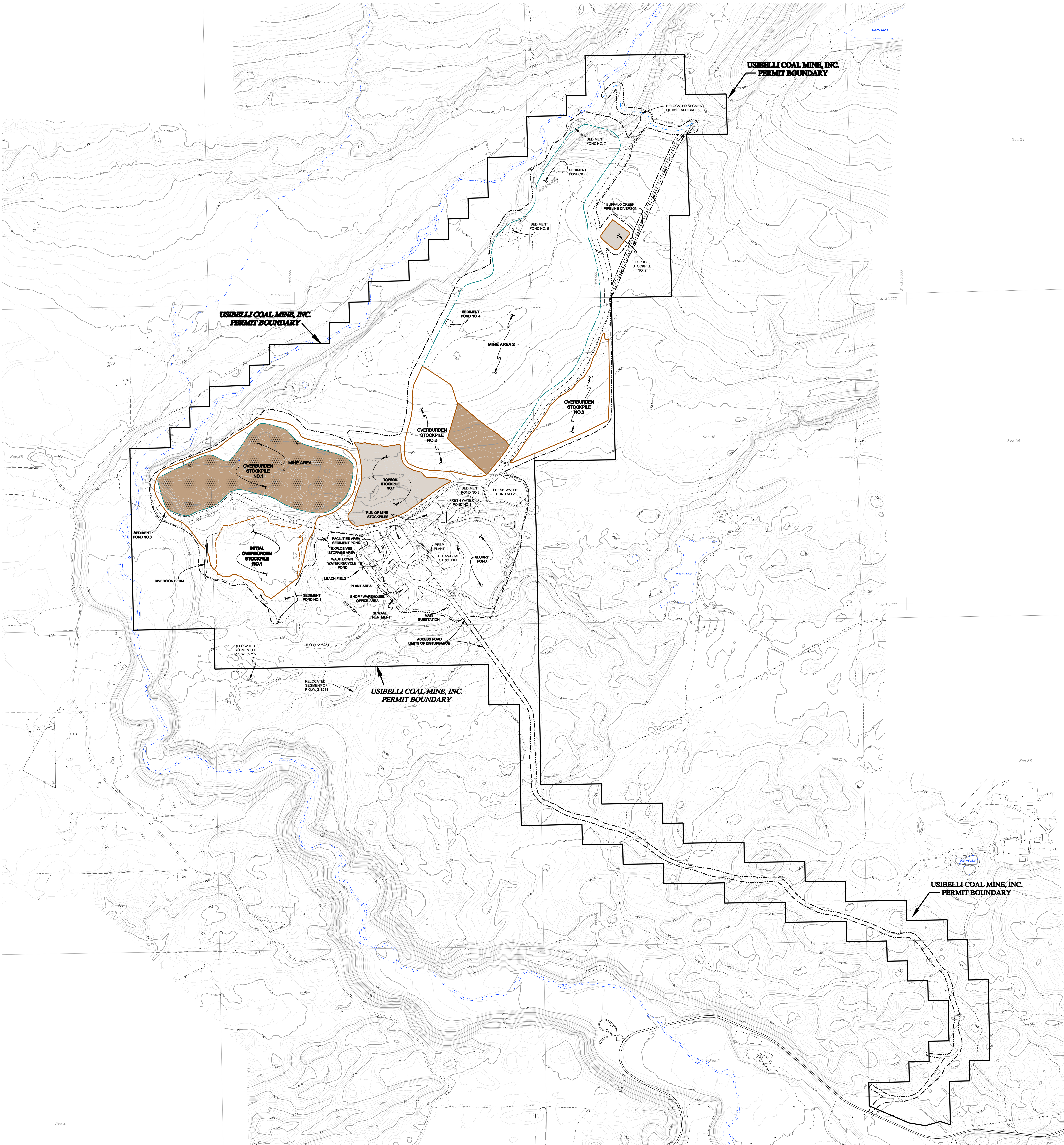
WISHBONE HILL MINE — USIBELLI COAL MINE INC. UCM — PERMIT NUMBER 01-89-796

OVERBURDEN STOCKPILE PLACEMENT FIRST 5 YEAR PERMIT TERM

WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. 3-4
SHEET No. 1 OF 1
REV. 0



N

SCALE
0 500' 1000'
CONTOUR INTERVAL: 10FT.

LEGEND

PERMIT BOUNDARY	EXISTING CONTOURS
DISTURBANCE BOUNDARY	MINE ROADWAYS
LIMITS OF MINING	TRAIL
STOCKPILE LIMITS	BUFFALO CREEK RELOCATION
FACILITIES AREAS	FENCE
ROADS - UNPAVED	TOPSOIL STOCKPILES
ROADS - PAVED	AREAS BACKFILLED FIRST 5 YEAR PERMIT TERM COVERED BY OVERBURDEN STOCKPILE
PIPELINE	AREAS BACKFILLED FIRST 5 YEAR PERMIT TERM
SECTIONS LINES	

STATE OF ALASKA 49th ALAN E. RENSHAW CE 6774 REGISTERED PROFESSIONAL ENGINEER

Map Area

NOTES:
1. HORIZONTAL DATUM IS ALASKA STATE PLANE, NAD83.
2. VERTICAL DATUM IS NAVD 88.
3. MAPPED FOR 1" = 200 FEET, 10 FOOT CONTOUR INTERVAL.
4. DATE OF PHOTOGRAPHY: 10-12-1997
5. THIS MAP CONFORMS TO ASPRS CLASS I MAP STANDARDS.
6. THE VERTICAL ACCURACY IS APPROXIMATELY ONE HALF OF THE CONTOUR INTERVAL SHOWN IN ANY GIVEN AREA ON THE MAP. CONTOURS IN VEGETATED AREAS MAY BE LESS ACCURATE, CONTOURS IN DENSE VEGETATION ARE LIKELY TO BE LESS ACCURATE.

SUBJECT REVISIONS

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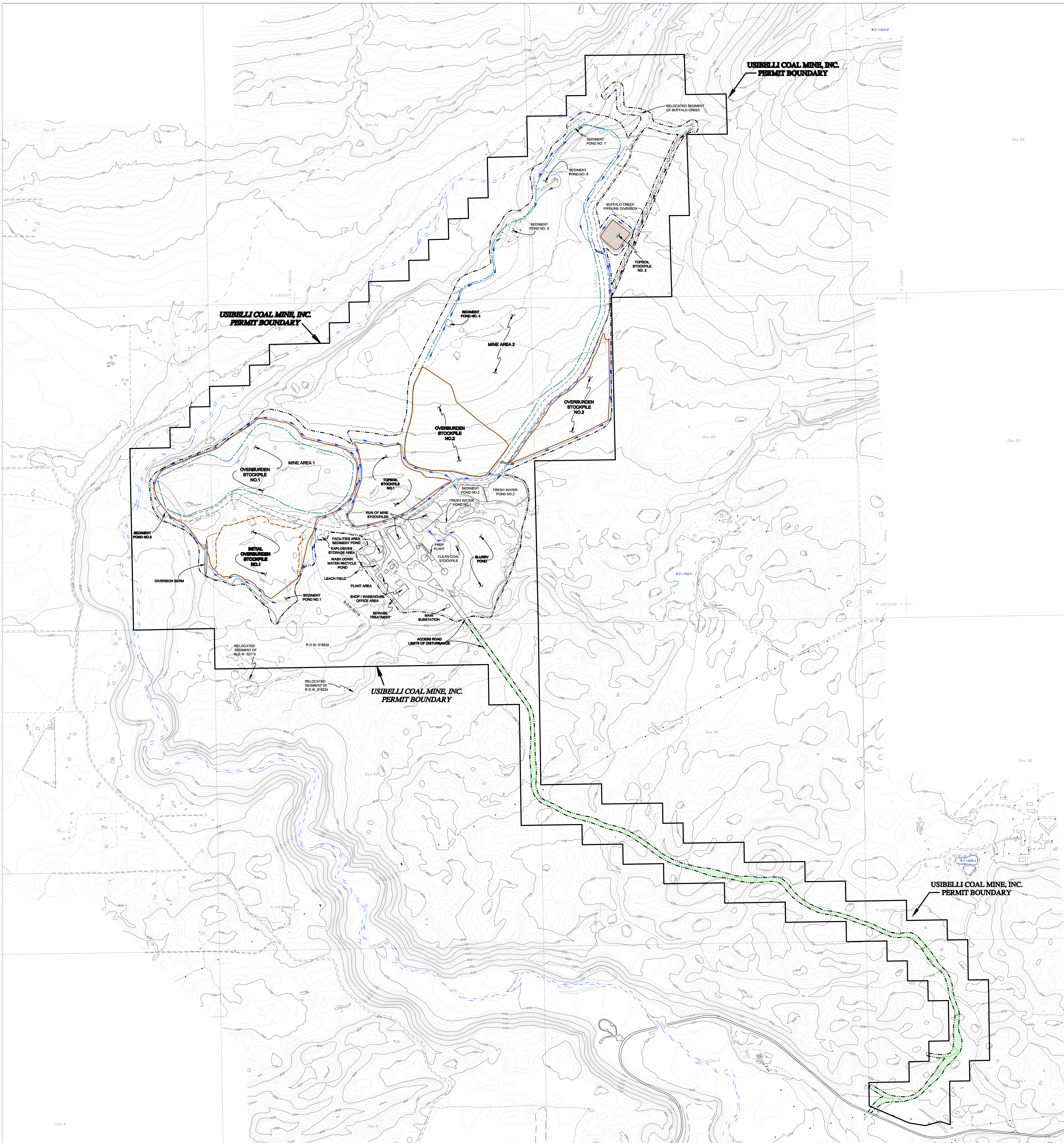
WISHBONE HILL MINE — USIBELLI COAL MINE INC. UCM — PERMIT NUMBER 01-89-796

BACKFILL SEQUENCE
FIRST 5 YEAR PERMIT TERM

WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. 3-5
SHEET No. 1 OF 1
REV. 0



LEGEND

PERMIT BOUNDARY	PIPELINE
DISTURBANCE BOUNDARY	SECTIONS LINES
LIMITS OF MINING	EXISTING CONTOURS
STOCKPILE LIMITS	MINE ROADWAYS
FACILITIES AREAS	TRAIL
ROADS - UNPAVED	BUFFALO CREEK RELOCATION
ROADS - PAVED	FENCE
DIVERSION DITCHES	RECLAIMED AREAS (CUT & FILL SLOPES OF ROAD)

SCALE
0 500' 1000'
CONTOUR INTERVAL: 10FT.

STATE OF ALASKA 49th ALAN E. RENSHAW CE 6774 REGISTERED PROFESSIONAL ENGINEER

Map Area
Sutton
Palmer

NOTES:
1. HORIZONTAL DATUM IS ALASKA STATE PLANE, NAD83.
2. VERTICAL DATUM IS NAVD 88.
3. MAPPED FOR 1" = 200 FEET, 10 FOOT CONTOUR INTERVAL.
4. DATE OF PHOTOGRAPHY: 10-12-1997
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SUBJECT REVISIONS

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DWG FILE:
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WISHBONE HILL MINE

PERMIT NUMBER 01-89-796

RECLAIMED AREAS
FIRST 5 YEAR PERMIT TERM

WISHBONE HILL MINE

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PLATE No. 3-6
SHEET No. 1 OF 1
REV. 0

4.0 TOPSOIL HANDLING

Vegetation and topsoil removal will be completed prior to any construction, drilling, blasting, mining or other surface disturbance. Whenever feasible, salvageable topsoil material will be removed and directly placed on backfilled and graded pit areas. If this is not possible, the topsoil and will be either stockpiled in the areas shown on Plate 3-1 or placed in windrows/berms with slash around the perimeter of disturbed areas. Salvage ability will be based on slope configuration and safety considerations. Topsoil stockpiles will be graded with outslopes at a maximum of 3H:1V and the outslopes will be immediately revegetated during the growing season to minimize erosion of the topsoil resource.

4.1 Removal Methods

Topsoil removal activities will begin with the cutting and stacking of useable timber in designated areas for disposal. Smaller vegetation and slash will be incorporated with the topsoil. This material will then be either stockpiled or placed in windrows/berms along the perimeter of disturbed areas. Within the pit areas, a minimum 50 foot buffer zone of topsoil stripped area will be maintained in advance of the mining operations. Removal operations will be performed with either dozers, scrapers, or trucks with an excavator or loader. A qualified individual will supervise topsoil removal activities to ensure that all salvageable material is removed.

4.2 Stripping Sequence

The estimated topsoil stripping areas for the first 5 year permit term are shown on Plate 3-2. Drainage and sediment controls will be constructed in all areas prior to implementation of stripping activities. Drainage and sediment controls are discussed in detail in Section 11.

The first area of topsoil stripping will be the access road.. Topsoil stripped from the road corridor will be windrowed adjacent to the road and immediately replaced on road outslopes as road construction is completed. Reclamation on the outslopes will commence after construction has been completed. Following stripping of the access road area, stripping will begin in the mine facilities area. Topsoil stripped from this area will be either stockpiled in Topsoil Stockpile No. 1 north of the facilities area (see Plate 3-1) or windrowed with slash around the perimeter of disturbance areas. At the completion of topsoil stripping in the mine facilities area, stripping will commence along the haul route to Mine Area 1. Topsoil removed from the haul road, Overburden Stockpile 1 and Mine Area 1 will also be stockpiled in Topsoil Stockpile No. 1 or windrowed with slash around the perimeter of disturbance areas. Stripping in Mine Area 2 is expected towards the end of the first 5-year term and will be completed in the same manner as Mine Area 1.

Topsoil salvaged from the upper reaches of the Buffalo Creek pipeline diversion and the Buffalo Creek channel relocation will be stockpiled in Topsoil Stockpile No. 2 located north of the pipeline diversion (see Plate 3-1) or windrowed with slash around the perimeter of disturbance areas. As will be discussed in Section 13, most of these areas will be reclaimed during the first 5-year term of the mining operations and all topsoil in Topsoil Stockpile No. 2 will be replaced.

4.3 Quantities and Characteristics

Table 3-2 presents topsoil quantities and characteristics for the first 5 year permit term and the remaining life of mine. Table 3-3 shows the maximum quantities to be stockpiled and to be directly replaced on backfilled areas. As discussed in Part C, Chapter XI, Soil Resources, topsoil depths over the entire Wishbone Hill Project area average 18 inches and all topsoil is suitable for reclamation.

4.4 Stockpiling and Replacement

As previously discussed, topsoil from active salvage areas will be directly placed on backfilled and graded areas whenever possible. When direct replacement is not feasible, the topsoil material will be either stockpiled or placed in windrows/berms, with any available slash, along the perimeter of disturbed areas. Topsoil that is stockpiled from most of the mine area will be stored in Topsoil Stockpile No. 1 located between Mine Area 1 and Mine Area 2. Topsoil Stockpile No. 2 will be located adjacent to the Buffalo Creek pipeline diversion to store topsoil salvaged from the diversion and from the Buffalo Creek channel relocation. As discussed in the previous section, Table 3-3 contains information on the maximum quantities of topsoil to be stockpiled and to be directly replaced on backfilled areas during the first 5-year permit term and for the remaining life of mine.

Topsoil Stockpile No. 1 will be constructed from the bottom of the slope upward. The stockpile will be constructed with slopes at a maximum of 3H:1V. Each slope will be broken every 80 feet in vertical height with a 20 foot wide bench. The top of the stockpile will be at an approximate elevation of 1030 feet above mean sea level. Plate 4-1 contains a cross section of Topsoil Stockpile No. 1. A stability analysis was performed for the topsoil stockpile and is presented in Appendix G.

Stockpiling will be continuous for the first five year mine permit term. Outslopes will be seeded with a quick growing cover crop as each bench is completed. The cover crop will serve to protect the pile from wind and water erosion. Section 13 contains a complete discussion of temporary and permanent reclamation seeding. As reclamation commences , topsoil will be either direct hauled from areas of removal or taken from the topsoil stockpile as needed for replacement on graded areas.

The Buffalo Creek diversion stockpile (Topsoil Stockpile No. 2) will be constructed in a similar manner and will have a maximum of 3H:1V outslopes..

Topsoil salvaged as part of construction of the mine access road will be windrowed adjacent to the road. Following road construction, topsoil will be immediately replaced on the road outslopes and the outslopes will be permanently reclaimed. A complete discussion of the access road reclamation can be found in Section 13.

The mine site drainage control, as discussed in Section 11, will control and contain any runoff from the stockpiles and prevent sediment from being carried offsite. Stockpiles have been located in stable areas away from any areas of drainage or disturbance. All topsoil stockpiles will be clearly marked on all sides with signs indicating that the material is topsoil and giving the stockpile designation for easy identification.

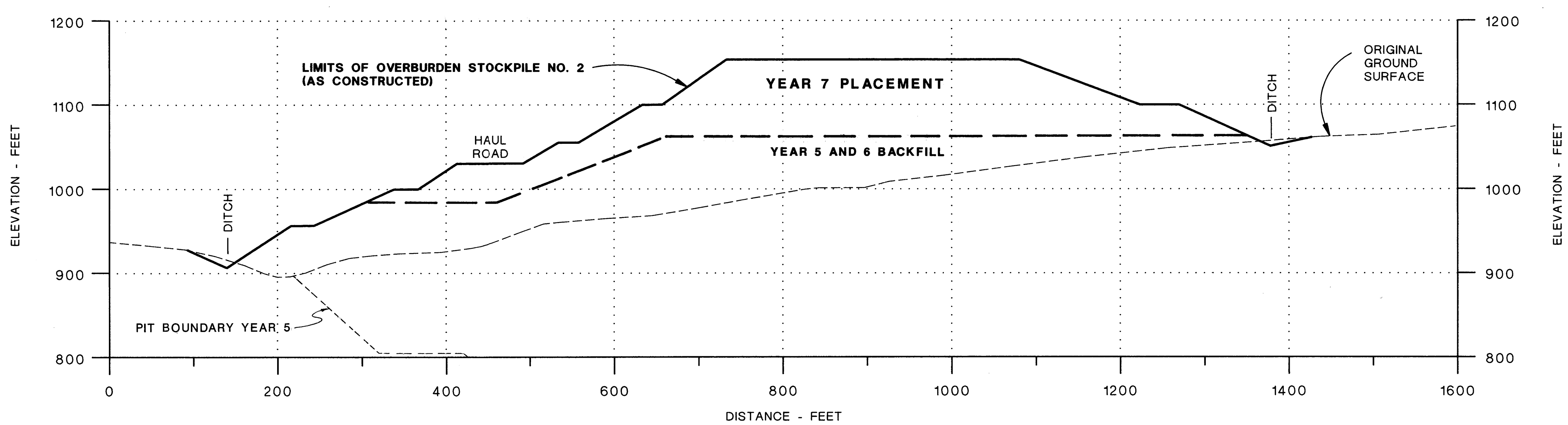
In areas of direct replacement, equipment will move the topsoil to backfilled and graded areas once these areas have been prepared for topsoil replacement by surveying in the final contours and lightly ripping or scarifying the final graded surface. Care will be taken during topsoil redistribution to ensure a uniform topsoil cover and minimize compaction. More details on topsoil replacement are contained in Section 13.0, Reclamation.

4.5 Topsoil Monitoring

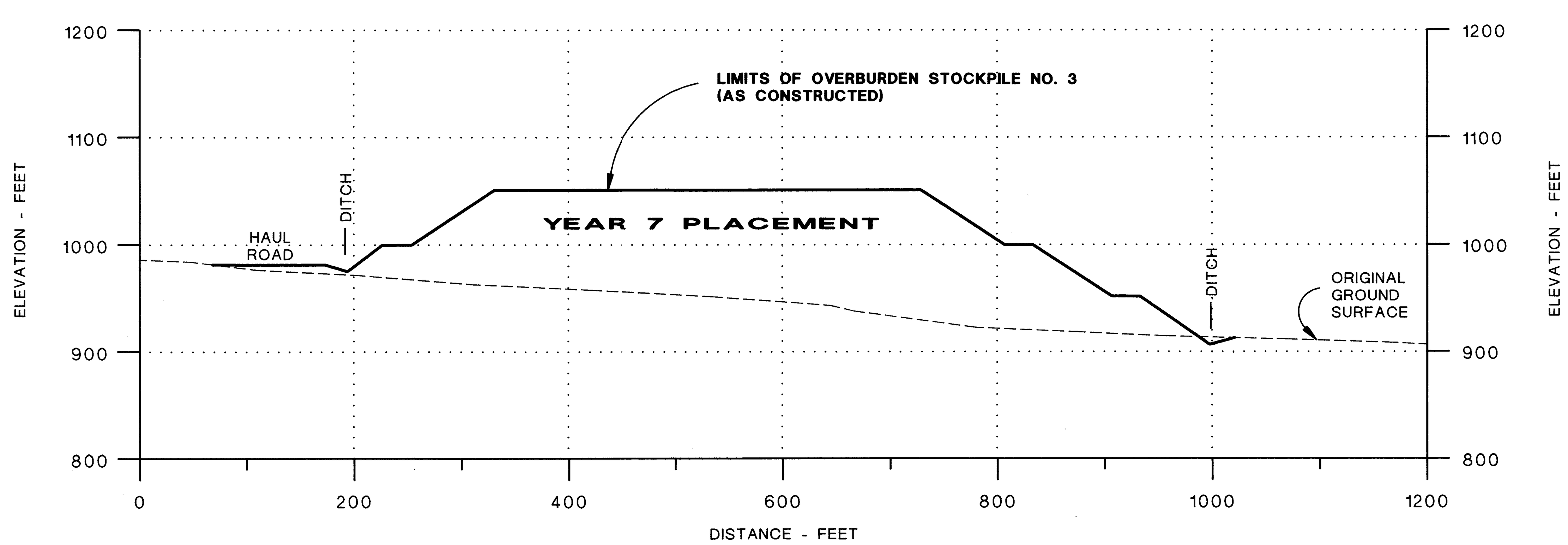
Topsoil salvage operations will be monitored by a qualified individual to ensure that all available and suitable topsoil is salvaged. Part C, Chapter XI, Soil Resources will be used as a guideline for determining suitable salvage depths for each area of the site.

Topsoil stockpiles will be visually monitored on a routine basis and following any large precipitation event to ensure that the integrity of the stockpiles is maintained. Any erosion of the stockpiles will be immediately repaired. Usibelli realizes the importance of adequate topsoil in achieving the postmining reclamation and revegetation and is committed to monitoring the topsoil handling to ensure that all topsoil is properly salvaged, stockpiled and replaced and protected from wind and water erosion during each phase.

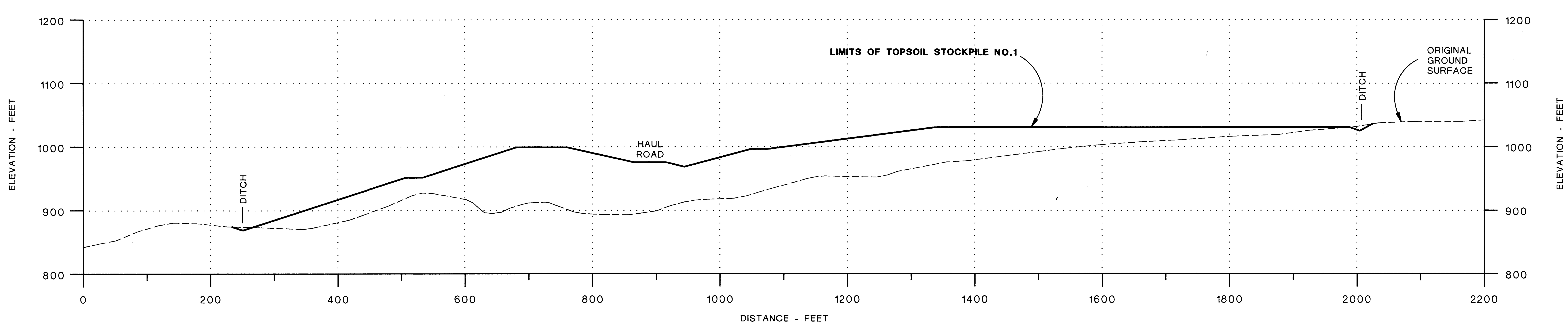
PLATES



SECTION D-D'
OVERBURDEN STOCKPILE NO. 2



SECTION E-E'
OVERBURDEN STOCKPILE NO. 3



SECTION F-F'
TOPSOIL STOCKPILE NO.1

NOTE:
SEE PLATE 3-4 FOR LOCATION OF SECTIONS D-D' AND E-E'.
SEE PLATE 3-2 FOR LOCATION OF SECTION F-F'.

STATE OF ALASKA
49th
IAN P. G. HUTCHISON
CE-6817
REGISTERED PROFESSIONAL ENGINEER

SCALE 1" = 100'

SUBJECT REVISIONS

REV.	DATE:	BY:	DESCRIPTION
A	8/89	HC	CHECK BY: HC APPRD BY: IH
1	2009	JDH	MINOR REVISIONS

DESIGN BY:
DRAWN BY: DB
CHECK BY: MMC
DWG FILE:
DATE DRAWN: 8/89

WISHBONE HILL MINE
PERMIT NUMBER 01-89-796
OVERBURDEN STOCKPILES NOs 2&3 & TOPSOIL STOCKPILE NO. 1 CROSS SECTIONS
WISHBONE HILL MINE
USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226
PLATE No. 4-1
SHEET No. 1 OF 1
REV. 1

5.0 PIT EXCAVATION

Pit excavation for the Wishbone Hill Project will commence following completion of initial topsoil removal in Mine Area 1. All overburden and interburden to be removed to recover the coal will be either transported to areas of the pit ready for backfilling (direct replacement) or stockpiled in one of several overburden stockpiles. The piles will be constructed to minimize and control wind and water erosion.

5.1 Overburden/Interburden Removal

Overburden removal will commence as soon as topsoil removal activities have been completed in a given area of the mine pit. As discussed in Part C, Chapter II, most of the mine area is overlain with a blanket of glacial gravel varying from zero to 100 feet in thickness. The glacial gravels will not require blasting and will be removed with the use of a hydraulic shovel or excavator. The shovel or excavator will load haul trucks with the glacial gravels for hauling to either the overburden stockpiles or to areas of the pit ready for backfilling. Removal of the glacial gravel will occur in approximately 30 foot benches. The overall slope angle for gravel will be the natural angle of repose which is approximately 37 degrees. A 15 foot wide catch bench will be placed at the glacial gravel and bed rock interface.

Once the glacial gravels have been removed, blasting will be necessary to prepare the remaining overburden/interburden for removal. Blasting is discussed in detail in Section 6.0. Following blasting, the overburden and interburden which can be separated between the major seam groups will be removed using the hydraulic shovel or excavator. The overburden will be blasted and removed in approximately 30 foot benches. The removal will proceed in the sequence shown on Plate 3-3. The overburden or interburden material will be loaded into the haul trucks for transport to either the overburden stockpile area or to areas of the pit ready for backfilling.

The ultimate pit limits for mining areas 1 and 2 are shown in plan view on Plates 5-1 through 5-3. Plates 5-4 through 5-10 show the pit configurations for both mining areas in cross sectional view. Locations for these cross sections are depicted on Plate 3-1. Quantities of overburden/interburden to be removed during the mining operation are presented in Table 3-7.

The pits will be mined in a typical open pit configuration. Mining will occur in approximately 30 foot benches with a 15 foot wide catch bench left in place on every third bench creating an approximate 90 foot highwall between catch benches. The pit configuration could vary slightly depending on the geological conditions encountered during mining. On average, the overall mine pit slopes, not including the haul roads, will vary between approximately 57 and 63 degrees. The cross sections on Plates 5-4 through 5-10 show the overall pit slope, catch benches and the location of the in-pit haul roads. Based on these cross sections, the maximum mining depth in Mine Area 1 will range between 180 feet to 290 feet. For Mine Area 2, the final mining depth will vary from 310 feet to 560 feet. In-pit haul roads will be designed to meet MSHA requirements.

The mining configuration has been designed to ensure pit stability and is primarily based on a geotechnical engineering study. The geotechnical engineering study was conducted to accurately quantify acceptable pit slopes and angles. This geotechnical investigation was performed in conjunction with geohydrological and surface water investigations. The study focused primarily on the collection, analysis, and evaluation of field geologic and geotechnical engineering data, supplemented by the review and evaluation of existing literature and data. The field data collection program included:

- Slope condition inventories and joint mapping of existing pit slopes at the site;
- Subsurface geologic and engineering investigations conducted through the drilling and sampling of a number of core holes;
- On-site testing of selected core samples; and
- Installation of pneumatic piezometers and the collection of groundwater data.

The information from the field program and literature review was used to characterize the geologic and geotechnical conditions at the site, from which design parameters were developed for use in stability analyses of various pit slope geometries. Acceptable pit slope configurations were developed from these analyses. During mining, company personnel will continually evaluate the pit configuration for changing geology and rock strength characteristics and will make minor modifications as necessary to ensure worker safety while maximizing resource recovery.

5.2 Overburden/Interburden Storage

Overburden/interburden from the box cut in mine area 1 will be placed in the initial overburden stockpile No. 1. Once the box cut is complete the overburden/interburden from the rest of mine area 1 will be placed in mined out pit areas.

Because of the depth of mining in Mine Area 2, most of the overburden/interburden mined during the first several years in this area will need to be stockpiled. The depth of pit floor necessitates that a greater area must remain open to allow access and safe working areas. During the first year of mining in this area, overburden will be used to complete backfilling of Mine Area 1 with a small amount placed in Overburden Stockpile No. 1. As mining advances, some of the overburden/interburden will be backfilled into the mined out portion of the pit and some will be placed in the extension area to Overburden Stockpile No. 1. The extension area will include the backfilled portion of Mine Area 1 as well as the initial Overburden Stockpile No. 1. As Mine Area 2 progresses, Overburden Stockpiles No. 2 and 3 will also need to be constructed. Overburden Stockpile No. 2 will be constructed over backfilled areas in the southwestern portion of Mine Area 2. Following completion of this stockpile, Overburden Stockpile No. 3 will be constructed just south of Mine Area 2. As will be discussed in Section 12, Backfilling and Grading, Overburden Stockpiles No. 2 and No. 3 will be in place for a very short time before being removed for use as backfill; however, Overburden Stockpile No. 1 will remain in place for a longer period. Table 3-7 shows the volume and sequence of backfilled material.

Overburden Stockpile No. 1 and the extension will be constructed during the first 5-year permit term and have been designed to contain approximately 20,922,000 loose cubic yards of material. The design includes a bench that will collect runoff and be graded to drain to a ditch located along the overburden stockpile haul road. The runoff control is discussed in detail in Section 11. Cross sections of this stockpile are contained on Plate 5-11. Outslopes for the stockpile will be graded to 3H:1V and the pile will be temporarily revegetated to minimize wind and water erosion (see Section 13).

Most of the initial overburden removed in Mine Area 2 will be used to complete backfilling of Mine Area 1. Excess overburden will be placed in the Overburden Stockpile No. 1 Extension. The stockpile extension will be constructed to a maximum elevation of approximately 1200 feet msl. Side slopes on the north, south, and west sides of the stockpile will be graded to 3H:1V and revegetated to stabilize the pile and protect against wind and water erosion. The east side of the stockpile will be used for access and will be the active side of the stockpile. Side slopes on the east side will be placed at angle of repose. Since the overburden stockpile will be accessed from the east side, actual slopes will, in most cases, be shallower than the angle of repose. Benching will also be used on the stockpile extension to collect runoff. Benches will be sloped inward and graded to drain to a ditch located along the stockpile access road. This ditch will continue along the east side of the pile to Sediment Pond No. 1. Due to the active nature of this side of the stockpile, no seeding is planned. Wind and water erosion will be monitored and, if necessary, appropriate steps will be taken to stabilize the stockpile. Removal of the stockpile for use in pit backfilling will commence at the end of mine life. Cross sections of the Overburden Stockpile No. 1 Extension are shown on Plate 5-11.

Overburden Stockpile No. 2 has been designed to contain approximately 2.5 million loose cubic yard of overburden. The stockpile will be a maximum of approximately 250 feet in vertical height with the top of the pile at an approximate elevation of 1150 feet msl. The pile will be constructed with side slopes at the angle of repose. Benching will be used to collect runoff and graded inward towards the stockpile toe so that water can be conveyed by ditch to Sediment Pond No. 2. Cross sections of this stockpile are contained on Plate 4-1. Because this stockpile will be in place for a limited time, the pile outslopes will be at the angle of repose and no attempt will be made to establish a temporary vegetative cover. The material in Overburden Stockpile No. 2 will be used as backfill.

The final overburden stockpile, designated as Overburden Stockpile No. 3, will be located southeast of Mine Area 2. Overburden Stockpile No. 3 has been designed to contain approximately 2.5 million loose cubic yards of overburden. The pile will be constructed to a maximum height of approximately 130 feet. The pile will be constructed at the angle of repose with benching. A ditch system, similar to the one discussed for Overburden Stockpile No. 1, will be used to control runoff. Plate 4-1 presents cross sections for this stockpile.

The stockpiles will have drainage controls constructed around the piles prior to disposal of any overburden. The drainage controls will route all runoff from the piles to one of several sediment control basins within the project area. A complete discussion of the project sediment control is contained in Section 11. In addition, during pile construction the piles will be graded with a dozer which will compact the surface and help to minimize wind and water erosion.

All three overburden stockpiles have been analyzed for stability under both static and pseudostatic conditions. The results of these analyses are presented and explained in Appendix G. The results indicate that the stockpiles will be stable under accepted static and pseudostatic factors of safety.

5.3 Swell Factor and Excess Spoils

Based on experience with similar mine materials and a review of available literature, a swell factor of 10% for the bedrock overburden and a 5% swell factor for the glacial gravels have been predicted for the overburden and interburden at the Wishbone Hill Project after final reclamation. These numbers are based on the net swell in either a long term backfill or stockpile condition and have been used in the material balance calculations presented in Section 5.6. For determining equipment needs, an initial swell of 25% was used on the materials being moved. The overburden/interburden will be monitored during the active mining operations to verify that the swell factor used is appropriate.

Over the life of the project it will be necessary to temporarily stockpile the overburden/interburden in one of three stockpiles designated for that purpose. Based on the materials balance presented in Section 5.6, all stockpiled overburden will be used during pit backfilling and site reclamation to achieve the approximate premining land forms and drainage patterns. The post mining configuration is discussed in detail in Section 12.

5.4 Overburden/Interburden Monitoring

Material from overburden and interburden to be mined and in the zone directly below mining was tested for suitability for reclamation and any acid or toxic producing materials. Information on this testing program is explained in detail in Part C, Chapter III. Test results demonstrated that the overburden and interburden at the Wishbone Hill Project is suitable for reclamation and no additional geochemical monitoring is proposed.

5.5 Overburden Special Handling Plan

As discussed in the previous section, material from overburden and interburden to be mined and in the zone directly below mining was tested for any acid or toxic producing materials.

No acid or toxic producing materials were found in the 13 drill holes tested except for the ten foot interval from 70.0 to 80.0 feet in drill hole PB-69A. This interval showed an acid base potential of -10.22. The high neutralization capacity of the other overburden/interburden materials which will be mixed with this material during overburden removal and disposal operations will be more than sufficient to neutralize any acid production from this one interval and no special handling is required.

High sodium absorption ratio (SAR) and pH values were observed in some overburden/interburden materials. The high values in themselves are not considered indicative of toxic materials and, as discussed in Part C, Chapter III the high values will not impact reclamation.

Based on the geochemical test results as discussed in Part C Chapter III, no special handling of any overburden materials at the Wishbone Hill Project will be necessary. For a complete discussion of the overburden/interburden characteristics see Part C, Chapter III.

5.6 Materials Balance

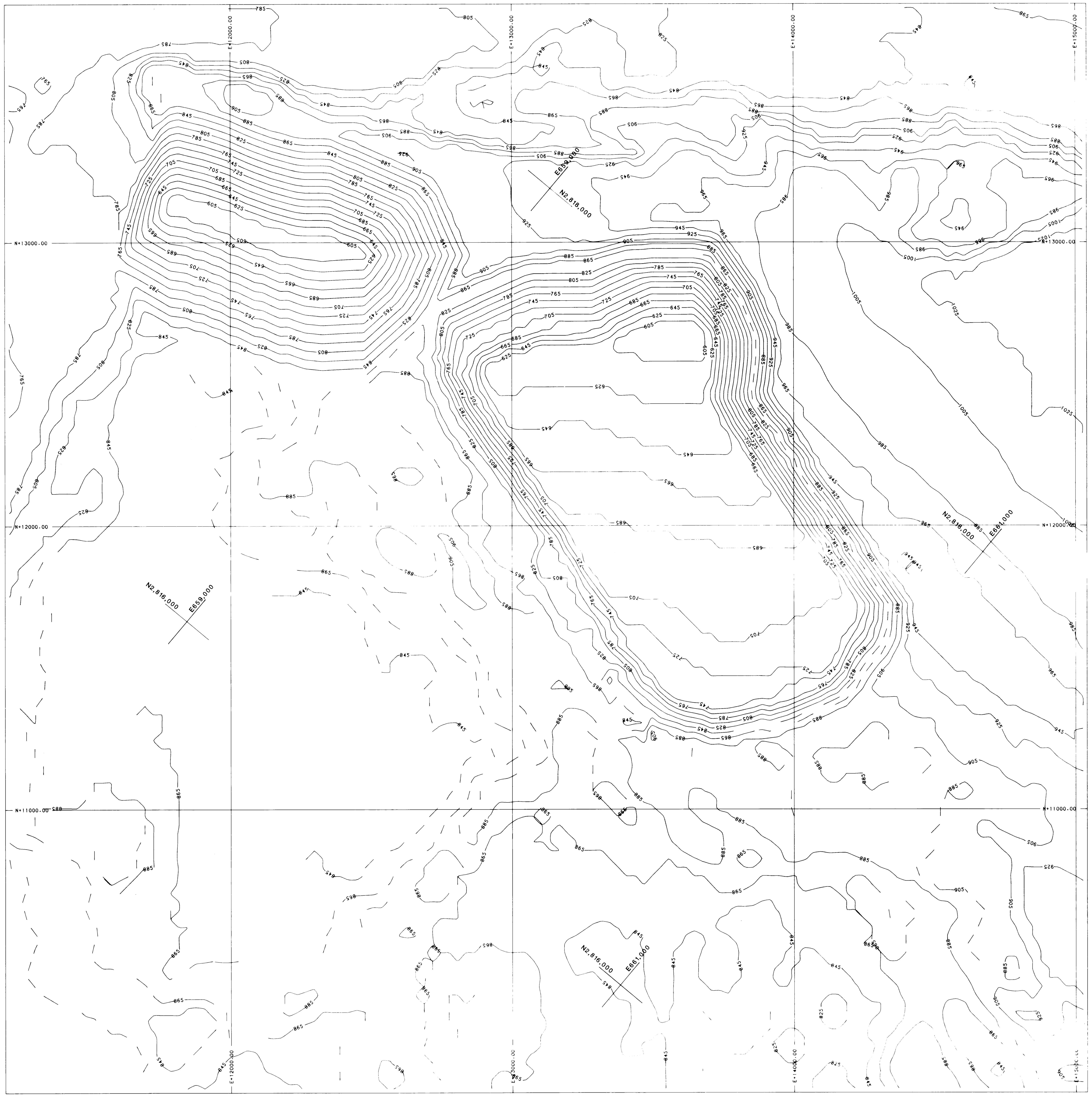
The total materials balance for the life of the Wishbone Hill Project is presented in Table 5-1. As shown on the Table, all stockpiled overburden will be used during pit backfilling and site reclamation to reconstruct the approximate premining topography. The post mining topography will generally approximate premining topography and slopes, slope aspects, and drainage patterns. The backfilling and grading plan presented in Section 12 provides further details on the post mining topography.

TABLES

TABLE 5-1
MATERIAL BALANCE

	Volume (LCY)	Volume (BCY)
Total Coal Mined	18,148,000	16,498,182
Total Overburden/Interburden Mined	133,487,000	121,351,818
Total Volume Removed		137,850,000
Total Overburden/Interburden	133,487,000	
Total Coarse Refuse	4,550,000	
Total Backfill	138,037,000	
Difference	187,000	
% Difference	0.1%	

PLATES



LEGEND

ALASKA STATE PLANE SYSTEM

200 100 0 200 400
SCALE IN FEET

SUBJECT REVISIONS			
REV.	DATE:	BY:	DESCRIPTION
1	2009	JEH	MIONR REVISIONS

DESIGN BY:

DRAWN BY: GCD

CHECK BY: GCD

DWG FILE:

DATE DRAWN: 1/24/90

WISHBONE HILL MINE

USIBELLI COAL MINE INC.

PERMIT NUMBER 01-89-796

PERMIT CASE PLAN VIEW
PIT LIMITS MINE AREA 1
COMPUTER MODEL A

WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
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PLATE No. 5-1

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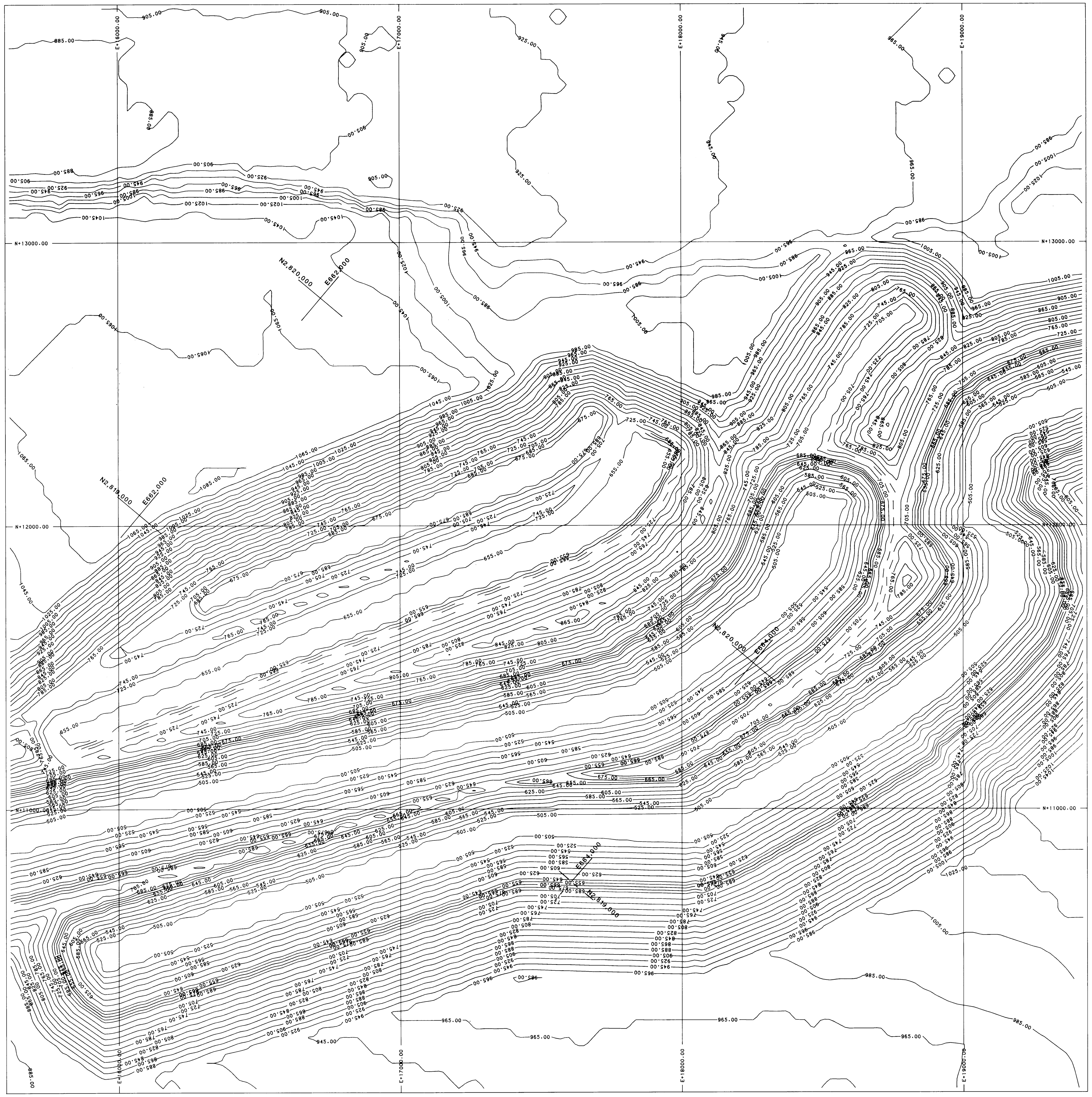

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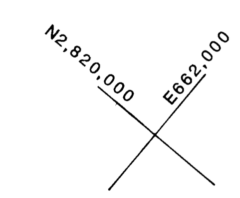
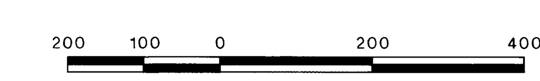


ALASKA STATE PLANE SYSTEM



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1	2009	JEH	MINOR REVISIONS

DESIGN BY:

DRAWN BY: GCD

CHECK BY: GCD

DWG FILE:

DATE DRAWN: 1/24/90

WISHBONE HILL MINE

PERMIT NUMBER 01-89-796

PERMIT CASE PLAN VIEW
PIT LIMITS MINE AREA 2
COMPUTER MODEL B

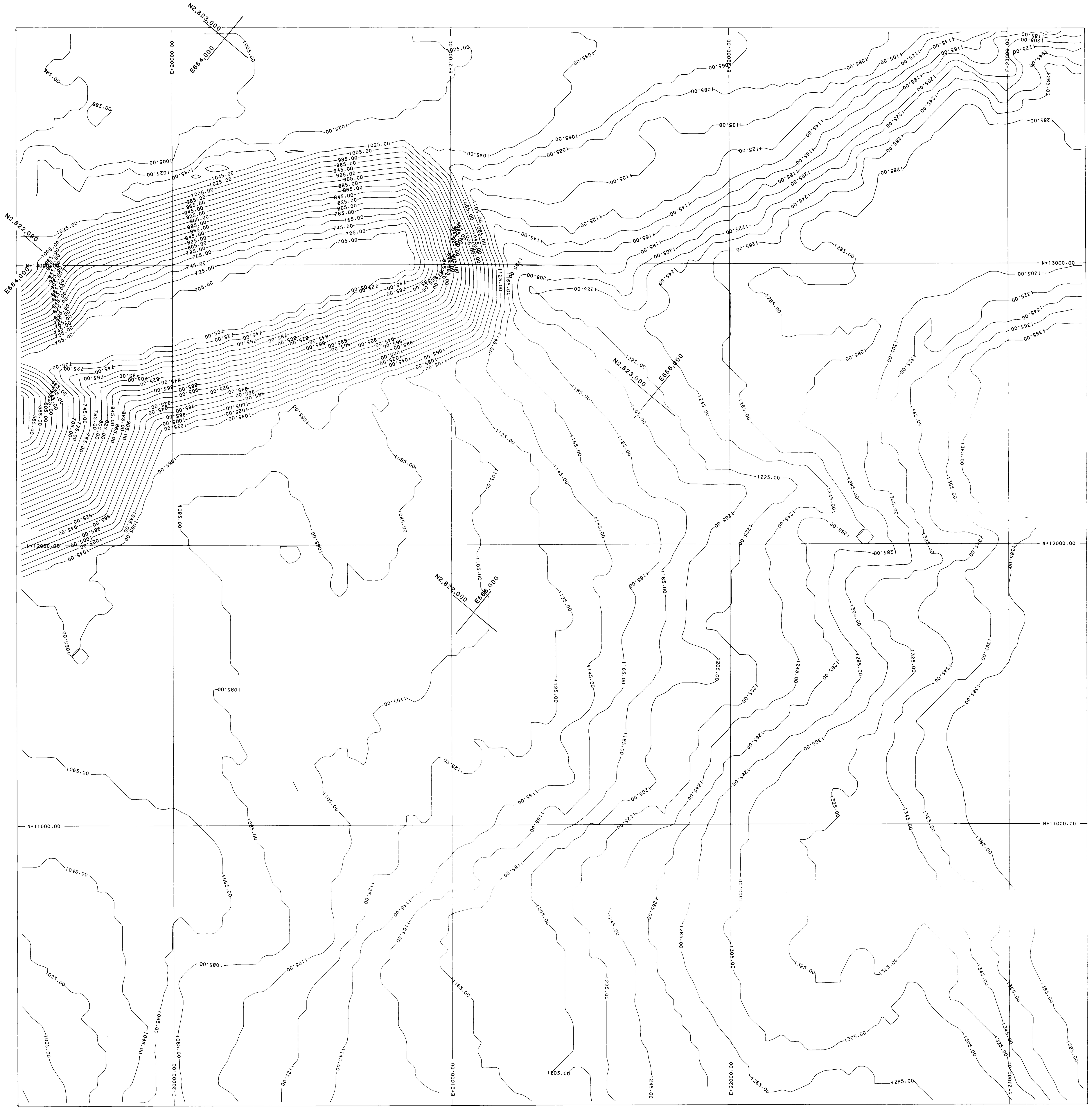
WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

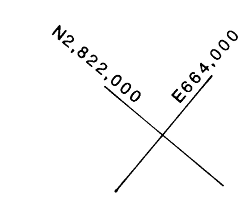
PLATE No. 5-2

SHEET No. 1 OF 1

REV. 1



LEGEND



ALASKA STATE PLANE SYSTEM

SCALE IN FEET (200 100 0 200 400)

SUBJECT REVISIONS			
REV.	DATE:	BY:	DESCRIPTION
			MINOR REVISIONS

DESIGN BY:	WISHBONE HILL MINE	PERMIT NUMBER 01-89-796
DRAWN BY: GCD		
CHECK BY: GCD	PERMIT CASE PLAN VIEW PIT LIMITS MINE AREA 2 COMPUTER MODEL C	
DWG FILE:		
DATE DRAWN: 1/24/90	WISHBONE HILL MINE	
USIBELLI COAL MINE, INC. P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226	PLATE No. 5-3 SHEET No. 1 OF 1	REV. 1

LEGEND

UPPER CHICKALOON FM. Coal

Shale

Siltstone

Interbedded Shale, Siltstone, Sandstone

Sandstone

WISHBONE & TSADAKA FM. Sandstone & Conglomerates

GLACIAL GRAVEL

NOTE: SEE FIGURE 3-1 FOR SECTION LOCATIONS.

CERTIFICATE

I hereby certify that this drawing has been prepared under my direction and is correct to the best of my knowledge and belief.

David E. Germer

SUBJECT REVISIONS		
REV.	DATE:	BY:	DESCRIPTION

DESIGN BY:

DRAWN BY:

CHECK BY:

DWG FILE:

DATE DRAWN:

WISHBONE HILL MINE

PERMIT NUMBER 01-89-796

CROSS SECTION A – A'

WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. 5-4

SHEET No. 1 OF 1

REV. 1

LEGEND

UPPER CHICKALOON FM. — Coal
Shale
Siltstone
Sandstone
Interbedded Siltstone, Sandstone & Shale
WISHBONE FM. — Sandstone & Conglomerates
GLACIAL GRAVEL

Scale: 100' (vertical), 0, 100' (horizontal)

NOTE: SEE FIGURE 3-1 FOR SECTION LOCATIONS.

CERTIFICATE

I hereby certify that this drawing has been prepared under my direction and is correct to the best of my knowledge and belief.

David E. Germer

SUBJECT REVISIONS			
REV.	DATE:	BY:	DESCRIPTION
1	2009	JEH	MINOR REVISIONS

DESIGN BY:
DRAWN BY:
CHECK BY:
DWG FILE:
DATE DRAWN:

WISHBONE HILL MINE

USIBELLI COAL MINE INC. UCM

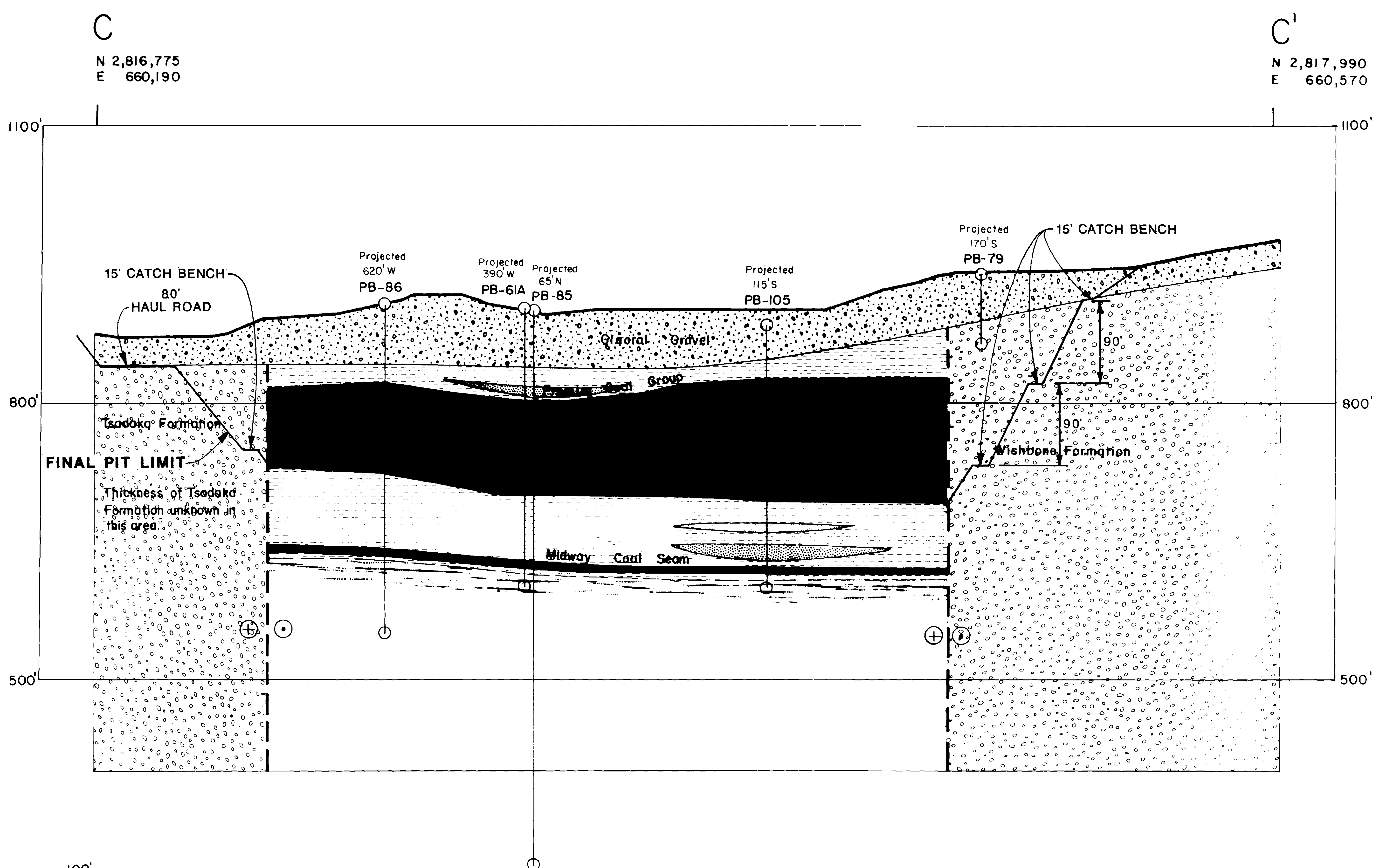
PERMIT NUMBER 01-89-796

CROSS SECTION B – B'

WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. 5-5
SHEET No. 1 OF 1
REV. 1



LEGEND

UPPER CHICKALOON FM.
- Coal
- Shale
- Siltstone
- Sandstone
- Interbedded Sandstone, Shale, Siltstone

WISHBONE & TSADAKA FM. — Sandstone & Conglomerates

GLACIAL GRAVEL

CERTIFICATE

I hereby certify that this drawing has been prepared under my direction and is correct to the best of my knowledge and belief.

David E. Germer

SUBJECT REVISIONS			
REV.	DATE:	BY:	DESCRIPTION
1	2009	JEH	MINOR REVISIONS

DESIGN BY:	WISHBONE HILL MINE — PERMIT NUMBER 01-89-796
DRAWN BY:	
CHECK BY:	CROSS SECTION C – C'
DWG FILE:	
DATE DRAWN:	WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. 5-6 | SHEET No. 1 OF 1 | REV. 1

LEGEND

UPPER CHICKALOON FM.
- Coal
- Shale
- Siltstone
- Sandstone
- Interbedded Sandstone, Shale, Siltstone

WISHBONE & TSADAKA FM.
- Sandstone & Conglomerates

GLACIAL GRAVEL

100'
0 100'
Scale

NOTE: SEE FIGURE 3-1 FOR SECTION LOCATIONS.

CERTIFICATE

I hereby certify that this drawing has been prepared under my direction and is correct to the best of my knowledge and belief.

David E. Gormes

SUBJECT REVISIONS			
REV.	DATE:	BY:	DESCRIPTION
1	2009	JEH	MINOR REVISIONS

DESIGN BY:

DRAWN BY:

CHECK BY:

DWG FILE:

DATE DRAWN:

WISHBONE HILL MINE

USIBELLI COAL MINE INC. UCM

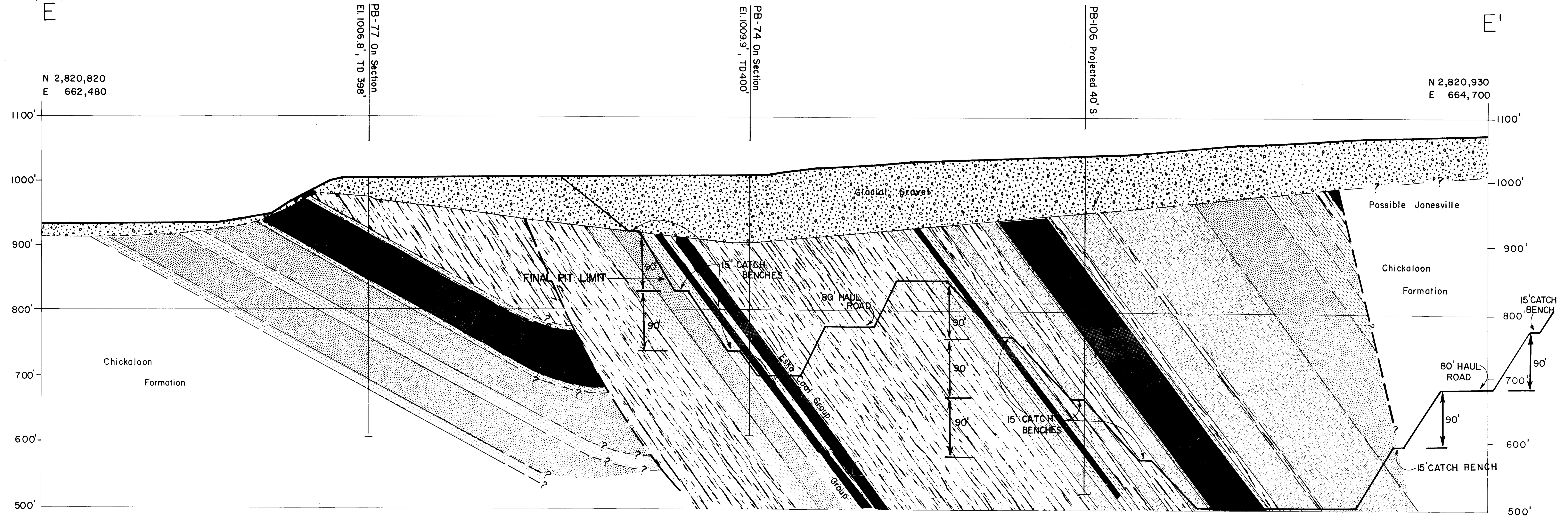
PERMIT NUMBER 01-89-796

CROSS SECTION D – D'

WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. 5-7
SHEET No. 1 OF 1
REV. 1



Note: See Plate 3-1 for Section Locations

LEGEND

CHICKALOON FM.

- Coal
- Shale
- Sandstone
- Siltstone
- Interbedded Sandstone Siltstone, Shale

- Glacial Gravel

Scale: 0 – 100' (horizontal), 100' (vertical)

CERTIFICATE

I hereby certify that this drawing has been prepared under my direction and is correct to the best of my knowledge and belief.

David E. Germer

SUBJECT REVISIONS		
REV. DATE:	BY:	DESCRIPTION
2003	JEH	MINOR REVISIONS

DESIGN BY:
DRAWN BY:
CHECK BY:
DWG FILE:
DATE DRAWN:

WISHBONE HILL MINE

PERMIT NUMBER 01-89-796

CROSS SECTION E – E'

WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. 5-8
SHEET No. 1 OF 1
REV. 1

LEGEND

UPPER CHICKALOON FM.
- Coal
- Shale
- Siltstone
- Interbedded Sandstone, Shale, Siltstone
- Sandstone

WISHBONE & TSADAKA FM. — Sandstone & Conglomerates

GLACIAL GRAVEL

NOTE: SEE FIGURE 3-1 FOR SECTION LOCATIONS.

100'

0 — Scale — 100'

CERTIFICATE

I hereby certify that this drawing has been prepared under my direction and is correct to the best of my knowledge and belief.

SUBJECT REVISIONS			
REV.	DATE:	BY:	DESCRIPTION
1	2009	JEH	MINOR REVISIONS

DESIGN BY:

DRAWN BY:

CHECK BY:

DWG FILE:

DATE DRAWN:

WISHBONE HILL MINE

PERMIT NUMBER 01-89-796

CROSS SECTION F – F'

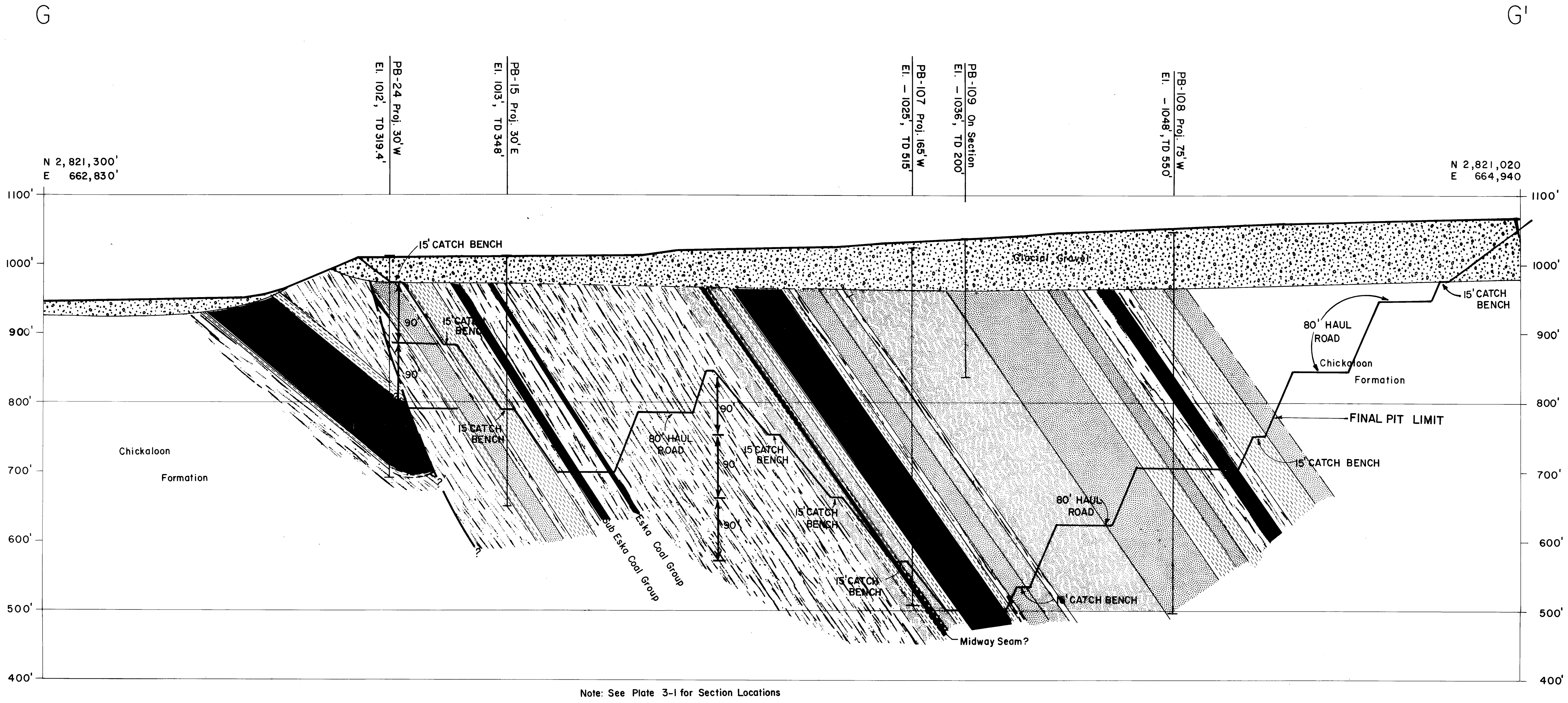
WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. 5-9

SHEET No. 1 OF 1

REV. 1



LEGEND

CHICKALOON FM.

- Coal
- Shale
- Siltstone
- Sandstone
- Interbedded Shale, Siltstone, Sandstone

- Glacial Gravel

100'
0 100'

CERTIFICATE

I hereby certify that this drawing has been prepared under my direction and is correct to the best of my knowledge and belief.

David E. Germer

SUBJECT REVISIONS			
REV.	DATE:	BY:	DESCRIPTION
1	2009	JEH	MINOR REVISIONS

DESIGN BY:
DRAWN BY:
CHECK BY:
DWG FILE:
DATE DRAWN:

WISHBONE HILL MINE

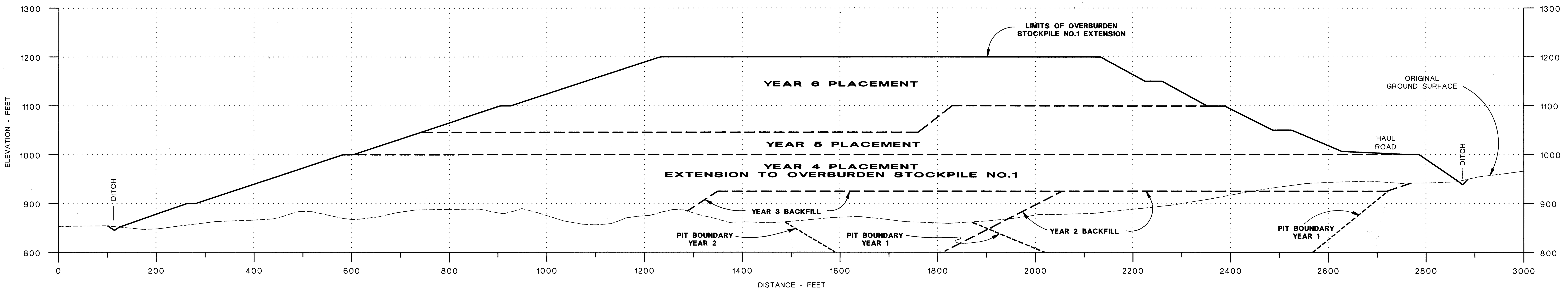
PERMIT NUMBER 01-89-796

CROSS SECTION G – G'

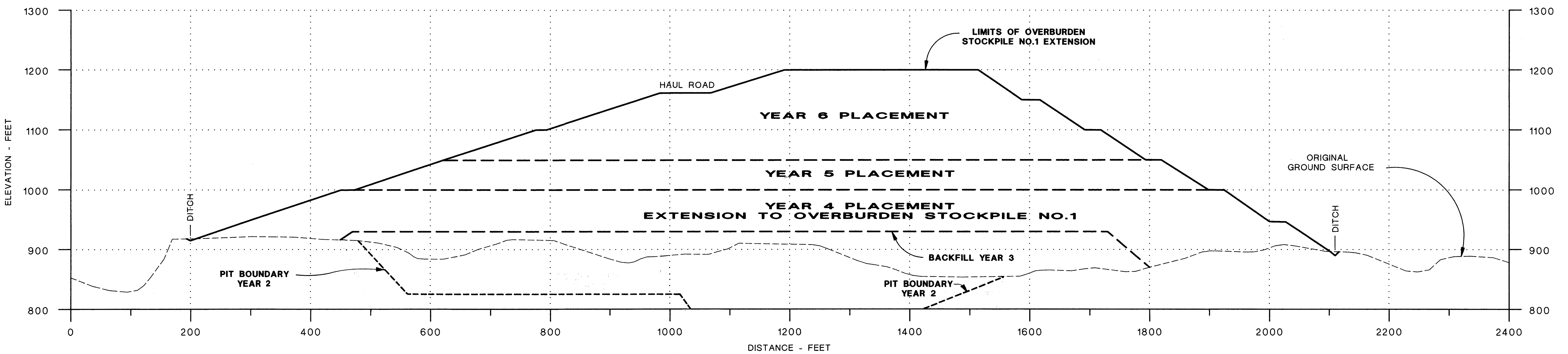
WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

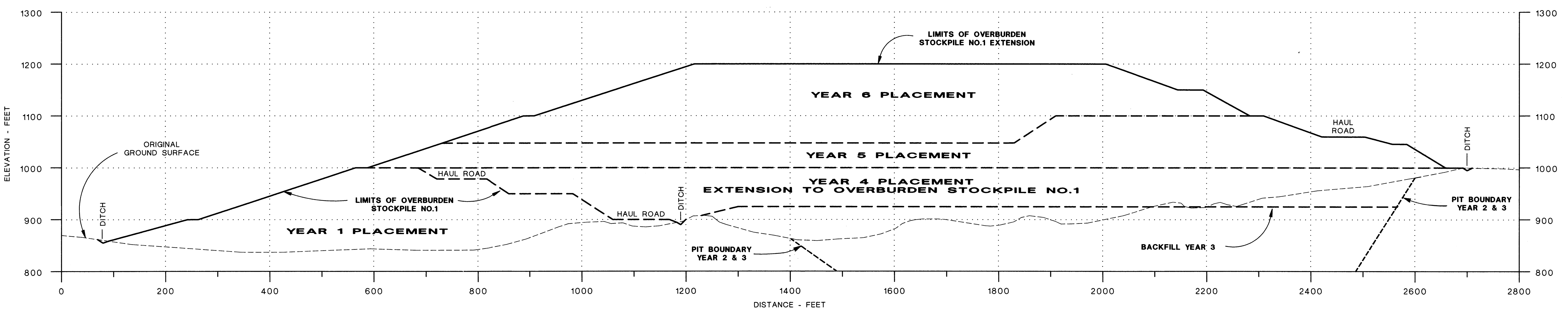
PLATE No. 5-10
SHEET No. 1 OF 1
REV. 1



SECTION A-A'

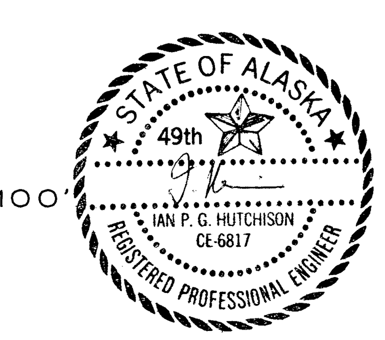


SECTION C-C'



SECTION B-B'

SCALE 1" = 100'



NOTE:

1. YEAR 2 AND 3 OVERBURDEN USED TO BACKFILL PITS 1, 2 AND 3. FOR A COMPLETE DESCRIPTION OF OVERBURDEN PLACEMENT BY YEAR SEE TABLE 3-4.
2. SEE PLATE 3-4 FOR LOCATIONS OF OVERBURDEN STOCKPILE NO. 1 CROSS-SECTIONS.

SUBJECT REVISIONS

REV.	DATE:	BY:	DESCRIPTION
A	8/89	HC	CHECK BY: HC APPROVED BY: IH
1	2009	JEH	MINOR REVISIONS

DESIGN BY:
DRAWN BY: DB
CHECK BY: MMC
DWG FILE:
DATE DRAWN: 8/89

WISHBONE HILL MINE — PERMIT NUMBER 01-89-796

OVERBURDEN STOCKPILE NO. 1 & OVERBURDEN STOCKPILE NO. 1 EXTENSION CROSS SECTIONS

WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. 5-11 | SHEET No. 1 OF 1 | REV. 1

6.0 BLASTING PLAN

The following section describes the general blasting procedures and methods that will be used at the Wishbone Hill Project. These procedures will be used throughout the mine life for blasting associated with overburden, interburden and coal removal.

6.1 Description of Blasting Operation

Removal of the glacial gravels, the first overburden encountered, will not require blasting. Once the gravels have been removed, blasting will be necessary to remove lower overburden and interburden units and to remove the coal. All blasting on the Wishbone Hill Project will comply with local, state and federal blasting regulations. A blaster certified under 30 CFR Part 850 will supervise all blasting activities associated with the Wishbone Hill Project. Several areas of abandoned underground workings will be mined through as part of the Wishbone Hill Project. These areas are discussed in Part C, Chapter XII, and the blasting plan for these areas is contained in Section 6.7.

6.1.1 Overburden Blasting

Overburden drilling will be performed with a rotary drill. The overburden will be blasted in benches approximately 30 feet in depth. Overburden holes will be drilled to a depth of 32 feet for floor control. Both vertical and angle holes will be drilled.

Once drilling is completed, the holes will be loaded with ANFO or slurry. Figure 6-1 shows a typical overburden blast cross section. The typical overburden blast pattern is also shown on Figure 6-1. This pattern produces maximum fragmentation of the overburden without generating excessive amounts of flyrock. The blast delay design will be developed based on the geologic conditions to conform to required air blast standards. Because of the geologic structure of the mine area, the length of the blast pattern will vary. The final blast design will be developed to suit the specific conditions and will conform to regulations 11 AAC 90.371 and 90.379.

6.1.2 Coal Blasting

Coal and coal group interburden will be drilled using a crawler mounted drill. Most of the holes will be angle holes. The coal holes will be shot using a ANFO or slurry. Figure 6-2 shows a typical coal/interburden blast cross section. Figure 6-2 also shows a typical coal/interburden blast pattern.

6.2 Explosives Storage and Handling Facilities

Explosives to be used at the Wishbone Hill Project will be stored in the explosive storage area denoted on Plate 3-1. The explosive storage area is located away from other areas of disturbance and active blasting. Explosives will be kept safe in ATF approved storage.

6.3 Blasting Control

Air blasts at any structure not owned by the operator will not exceed the values specified in Table 6-1. With the exception of the powerline that crosses the mine access road, there are no other utilities that cross the permit area. The support structures associated with the powerline are located approximately one mile from the closest point of the mining area and will not be affected by the blasting operations. Periodic monitoring will be conducted by Usibelli to ensure compliance with the standards in Table 6-1. The monitoring system used will have a flat frequency response of at least 200 Hz at the upper end.

Flyrock will be minimized through the use of the previously described blasting patterns. Blasting at Wishbone Hill has been designed as several small blasts rather than one larger blast. Flyrock, including blasted material traveling along the ground, will not be cast beyond the permit boundary or more than half the distance to the nearest occupied structure, whichever is closer to the blasting area. All blasting at the Wishbone Hill Project will be conducted to prevent injury to persons, damage to public or private property outside the permit area, adverse impacts on any active underground mine, and change in the course, channel, or availability of ground or surface waters outside the permit area.

Blasting will conform to the maximum weight, in pounds, of explosives (W) allowable in an eight millisecond period for a distance (D) in feet to the nearest structure not owned by Usibelli as determined by the following formula:

$$W = (D/60)^2$$

If it is necessary to exceed the maximum allowable weight (W), the ground motion will be monitored with a seismograph at the nearest structure not owned by the company. Blasting conducted in accordance with the above formula is expected to conform to the maximum peak particle velocity. Velocities will be measured in three mutually perpendicular directions. The maximum peak particle velocity will be the largest of any of the three measurements.

6.4 Blasting Schedule and Public Notice

All blasting at the Wishbone Hill Project will be conducted in accordance with the blasting schedule as approved and presented in public notice, unless safety controls require that an unscheduled blast be conducted. Blasts will be small area blasts creating less disturbance but requiring more frequent blasting. Blasting will most often occur during regular work day hours in an effort to minimize noise disturbance to residents. Blasting signs and warnings to be used are discussed in the following section.

At least 30 days before the beginning of blasting, all residents or owners of structures or dwellings within one half mile of the permit area will be notified in writing of the proposed blasting and the procedures to follow in requesting a preblast survey. Preblast surveys on any structure will be promptly conducted. Signed written reports will be sent to both the commissioner and the person requesting the survey. If any survey is requested more than ten days in advance of the planned start of blasting, the survey will be completed and made available as prescribed before the blasting program begins. If a preblast survey is requested, it will be conducted in accordance with 11 AAC 90.373.

The blasting schedule for the Wishbone Hill Project will be distributed to local governments, public utilities, each person who regularly works within one-half mile of the permit area and each residence within one half mile of the permit area at least ten days but no more than 30 days prior to commencement of blasting. Copies sent to residences will be accompanied by information advising how to request a preblast survey. The schedule will also be published in a newspaper of general circulation. The schedule will be redistributed at least once every 12 months or if the schedule is revised prior to the end of a 12 month period a new schedule will be redistributed at least 10 days prior to initiation of blasting under the new schedule. Figure 6-3 is an example of the typical blasting notice to be sent for the Wishbone Hill Project.

While not currently anticipated, unscheduled blasts may be necessary from time to time to ensure worker safety. If an unscheduled blast is necessary, all residents within one half mile will be notified and the reason for the blast will be documented and immediately submitted to the Division of Mining, Land & Water.

6.5 Blasting Signs, Warnings and Access Control

Signs reading "BLASTING AREA" will be conspicuously displayed along the edge of any blasting area that comes within 50 feet of any road within the permit area or within 100 feet of any public road right-of-way. The charged holes within the blasting area will be flagged or posted. Signs which read "WARNING !!! EXPLOSIVES IN USE," and clearly explain the blast warning and all clear signals that are in use and the marking of blast areas and charged holes within the permit area, will be posted at the entrance to the access road and at the main gate.

At 10 minutes before a blast the area will be cleared, if not already clear, and then checked to assure clearance of all people and livestock. The access to the area will be guarded by mine personnel until the all-clear signal is given. At five minutes and one minute prior to a blast, a warbling siren, audible within a range of one half mile from the point of the blast will be sounded for 15 seconds. Following the blast, the blast area will be inspected for safety by the certified blaster or pit foreman and a steady siren, audible within a range of one half mile from the point of the blast, will be sounded for 15 seconds.

6.6 Records of Blasting

A record of each blast, including seismograph reports, when taken, will be prepared and signed by the certified blaster and retained at the mine site for at least three years. These records will be available for inspection by the appropriate regulatory agencies and the public upon request. Table 6-3 contains a listing of the information which will be required for the blasting record.

6.7 Special Blasting Considerations

As discussed in Part C, Chapter XII, there are currently twelve existing structures located within 1,000 feet of the permit boundary. As shown on Plate XII-1, the actual distance from the mining activities is considerably greater.

Mining will also occur through the abandoned underground workings previously discussed in Part C, Chapter XII. Prior to conducting blasting within 500 feet of any abandoned underground working, a blast design prepared and signed by a certified blaster will be submitted for approval. The plan will provide details on the existing structures or abandoned workings and will describe the type and amount of explosives to be used as well as contain sketches of the drill pattern, delay periods, and decking. The plan will describe how the blasting details were developed and specify how the plan will protect the existing structures and meet the applicable standards of 11 AAC 90.379.

TABLES

TABLE 6-1

MAXIMUM AIR BLAST LIMITATIONS

Lower Frequency Limit of Measuring System, Hz(+ 3dB)	Maximum Level in dB
2Hz or Lower - Flat Response	132 peak
6 Hz or Lower - Flat Response	129 peak

(TABLE 6-2 was deleted under Rev. 2.)

TABLE 6-3

BLASTING RECORD INFORMATION

1. Name of operator conducting the blast.
2. Location, date and time of the blast.
3. Name, signature and license number of the certified blaster in charge.
4. Direction and distance to the nearest building not owned or leased by UCM
5. Weather conditions, including temperature, wind direction and approximate velocity.
6. Type of material blasted.
7. Sketches of the blast pattern, including number of holes, burden, spacing, decks, and delay pattern.
8. Diameter and depth of holes.
9. Types of explosives used.
10. Total weight of explosives used and weight per hole.
11. Maximum weight of explosives detonated within any 8-millisecond period.
12. Maximum number of holes detonated within any 8-millisecond period.
13. Initiation system.
14. Type and length of stemming.
15. Mats or other protection used.
16. Type of delay detonator and delay period.
17. Sketch of delay pattern.
18. Number of persons in the blasting crew.
19. Other comments or considerations.
20. Seismographic records will be attached if necessary and will include the following information:
    - a. Calibration signal of the gain setting.
    - b. Seismograph reading.
    - c. Seismograph exact location and distance from the blast.
    - d. Name of the person taking the seismograph reading.

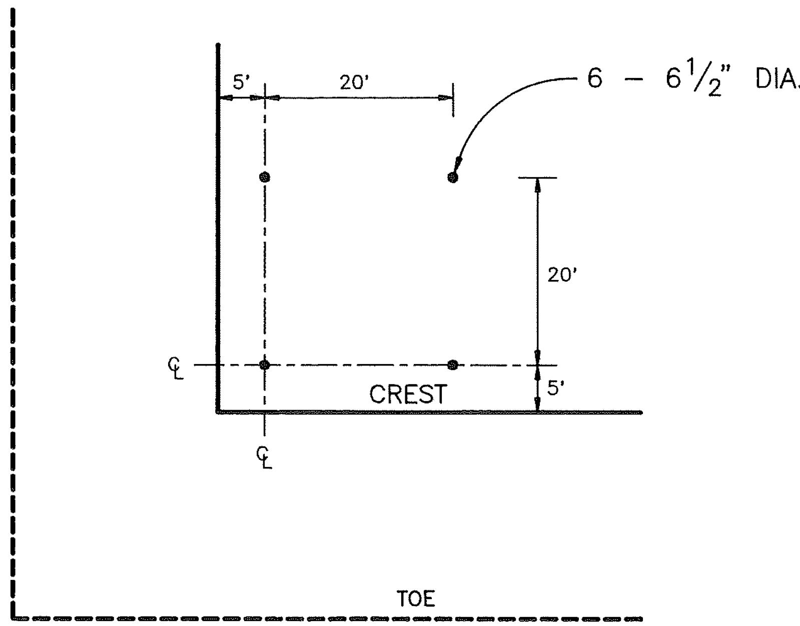
e. Name of the person and firm analyzing the seismograph reading.

f. Type of instrument.

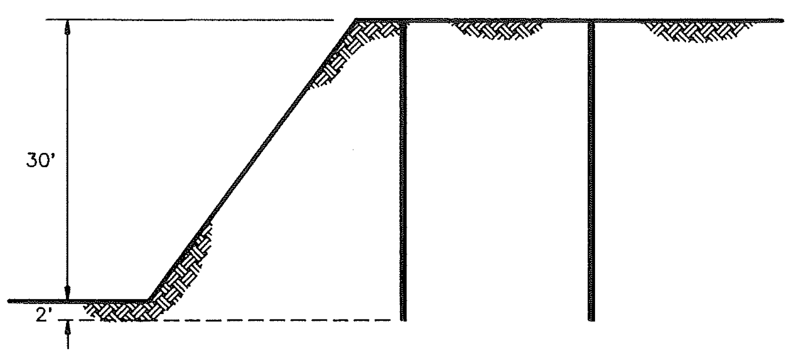
g. Sensitivity

h. Vibration or airblast level recorded.

FIGURES



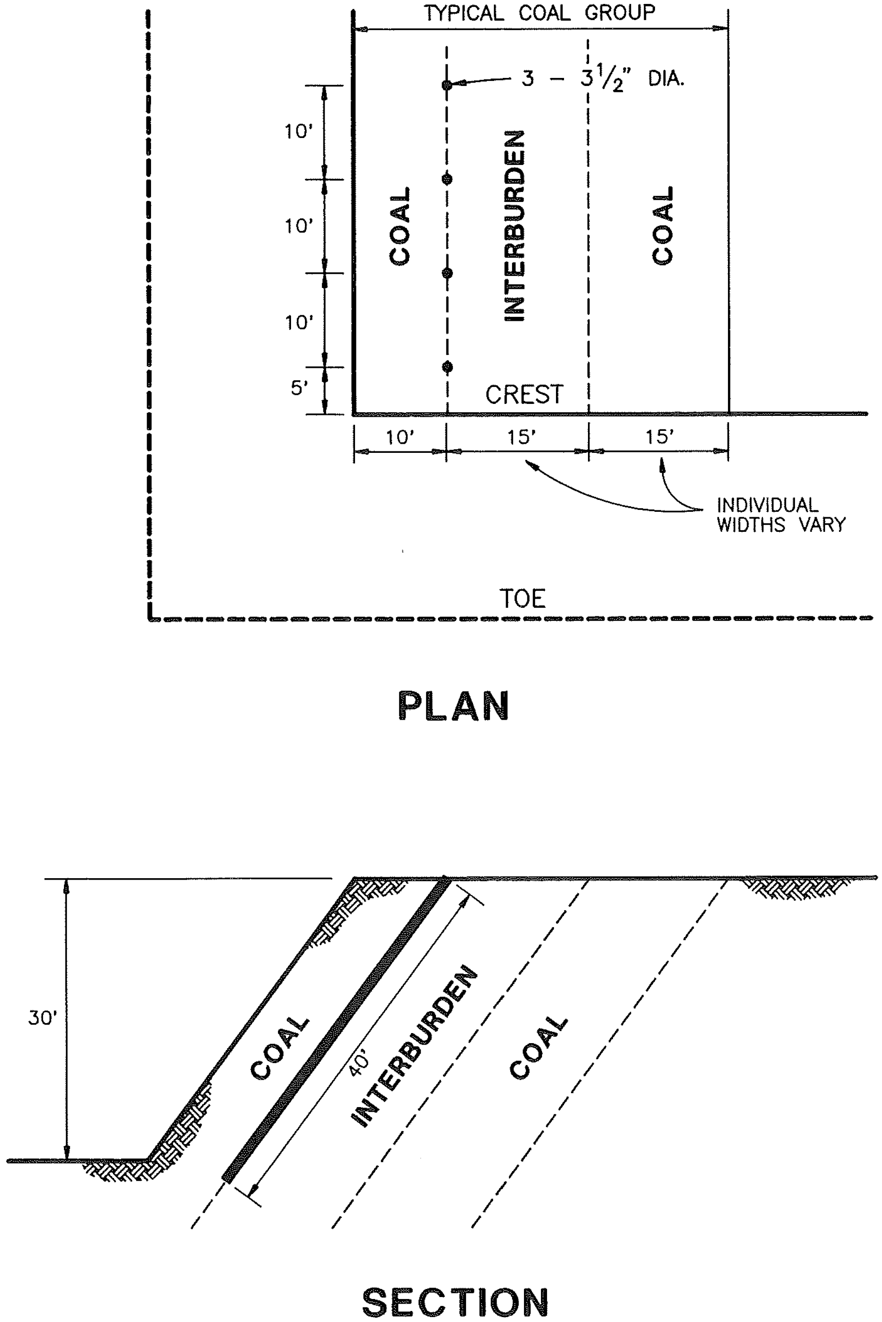
PLAN



SECTION

SCALE 1" = 20"

DESIGN BY:	TYPICAL PATTERN OVERBURDEN DRILLING	WISHBONE HILL MINE	PERMIT No. 01-89-796
DRAWN BY:			
CHECK BY:		FIGURE No. 6-1	REV. 0
DWG FILE:	USIBELLI COAL MINE, INC. P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226	SCALE:	
DATE DRAWN: 8/89			



SCALE 1" = 20"

DESIGN BY: DRAWN BY: CHECK BY: DWG FILE: **DATE DRAWN:** 8/89	TYPICAL PATTERN INTERBURDEN AND COAL DRILLING USIBELLI COAL MINE, INC. P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226	WISHBONE HILL MINE — PERMIT No. 01-89-796 FIGURE No. 6-2 — REV. 0 SCALE:

FIGURE 6-3

TYPICAL BLASTING NOTICE

Public Notice

Usibelli Coal Mine, Inc., owners and operators of the Wishbone Hill Coal Mine, hereby give notice of the blasting schedule for the year commencing in ________________ and running through ____________________. During this time period blasting will be occurring in ____. Blasting will be conducted each day between the hours of 8:00 AM and 5:00 PM. Blasting will normally occur two times per day. Ten minutes prior to any blast the specific area will be checked to ensure clearance by all people and livestock. All entrances to the blasting area will be guarded by mine personnel and the roads will be barricaded to prevent entry during blasting. At five minutes and one minute prior to blasting, a warbling siren audible for 1/2 mile will be sounded for 15 seconds. At completion of the blast a steady siren audible for 1/2 mile will be sounded for 15 seconds. Please contact Usibelli Coal Mine, Inc. 634 South Bailey Street, Suite 204, Palmer, Alaska 99645, (907)745-6028 with any questions.

7.0 COAL REMOVAL

Coal removal at the Wishbone Hill Project will be accomplished in much the same way as the overburden removal described in Section 5.0. Following overburden removal, the coal will be blasted and removed for transport to the coal wash plant for cleaning prior to shipment.

7.1 Removal Process

Overburden/interburden will be removed down to the next coal seam to be recovered. Care will be taken to clean all overburden from above the coal seam prior to blasting and removal of the coal. The coal will be blasted separately from the overburden as described in Section 6.0. Once blasting has prepared the coal for removal, the hydraulic excavator will be used to move and load the coal into the same haul trucks used for overburden transport. The loaded haul trucks will carry the run of mine coal from the pit area to the wash plant. The amount of run of mine coal to be transported during the first 5 year permit term and the remaining life of mine is shown on Table 3-6. At the wash plant, the coal will either be direct loaded into the run of mine hopper or stockpiled for washing. The wash plant process is described in Section 8.0.

7.2 Coal Conservation Measures

Every effort has been made to maximize coal recovery at the Wishbone Hill Project through the mine planning process, coal washing operations, and coal removal operations. Mining plans are based on recovering 85 to 90% of the economically minable in-place coal within the controlled reserve area. On seams that are dipping less than 30 degrees, best efforts will be made to recover coal down to a 2 foot true thickness. For seams that exceed 30 degrees, a 4 foot recovery factor will be used. Approximately 65 to 70% of the run-of-mine feed into the coal wash plant will be recovered. The coal removal and washing techniques proposed for the Wishbone Hill Project will allow maximum coal recovery while ensuring that environmental protection is maintained.

7.3 Handling, Preparation and Shipping

Run of mine coal will be loaded directly into the run of mine hopper or stored in run of mine stockpiles adjacent to the wash plant (see Plate 3-1). The run of mine stockpile area has been designed to store a maximum of 100,000 tons of coal. Coal processing is discussed in detail in Section 8.0.

After washing, the clean coal will be loaded into highway trailers for hauling to the Glenn Highway or will be stockpiled in the clean coal stockpile area. The clean coal stockpile area has been designed to store a maximum of 75,000 tons of clean coal.

The coal will be sampled and weighed during the loadout procedure to ensure that quality and quantity are within contract specifications.

8.0 COAL PROCESSING, COAL STORAGE AND WASTE STREAMS

Coal processing facilities are required to remove interburden and partings from the mined coal prior to shipment. The following section describes the coal processing requirements for the Wishbone Hill Project including the wash plant, coal storage areas and disposal areas for the refuse product separated from the coal during the cleaning process.

8.1 Overview of Processing Requirements

The coal to be mined as part of the Wishbone Hill Project is not clean enough to meet utility steam coal specifications and will require washing prior to shipment. Required cleaning of the coal is not extensive and can be easily accomplished through simple washing and separation techniques without the use of chemicals. A flocculent will be added to the fine coal refuse slurry just prior to disposal to enhance settling of the fines.

The coal will be cleaned to meet the specifications for utility steam coals. To meet these specifications over the project life the coal will be cleaned to an average of 15% ash, 0.4% sulfur, and 11,710 Btu/lb (6,660 kcal/kg), all on an air-dried basis. The clean coal will have an approximately 2.8% residual moisture content after air-drying.

8.2 Coal Wash Plant

The coal wash plant facilities are depicted on Plate 8-1. The main facilities consist of a run of mine stockpile area, the run of mine hopper, the crushing and screening plant, the preparation plant and the clean coal stockpile area. All structures will be constructed of steel and have been designed to be as low as possible.

The coal will be transported to the wash plant from the pit area in haul trucks. At the wash plant, the run of mine coal will be either stockpiled or direct loaded into the run of mine hopper for processing through the wash plant. The run of mine stockpile area has a capacity of 100,000 tons to allow continued plant operation during any unexpected lapses in haulage from the pit area. A front end loader will be used to load the stockpiled coal into the hopper for processing.

The hopper will feed coal to a grizzly for sizing, then onto a feed breaker to further reduce the material size to a maximum of 8 inches. This feed will proceed to the crushing and screening plant where it will be sized at 3 inch and 3/8 inch. The material falling between 3 inch and 3/8 inch will form the feed for the preparation plant. Plus 3 inch material will pass through a grizzly to be crushed to a maximum 3 inch size. These two streams will be recombined prior to entering the preparation plant. The minus 3/8 inch material will be separated at this point and either be blended into the plant feed for washing or blended back with the clean coal leaving the plant. The 3 inch to 3/8 inch material will proceed through the wash plant which will consist of either heavy media cyclones and spirals to separate the coal from the parting material or a water jig. The coal product will be crushed to a final sizing of minus 2 inches. The final step will be to centrifuge the fine clean coal to reduce moisture content.

Figure 8-1 is a schematic drawing of a typical heavy media wash plant showing the maximum design capacity for the Wishbone Hill project. With this design, the plant could process approximately 350 tons per hour, with recovery of approximately 210 tons of coal and disposal of approximately 130 tons of coarse coal waste and 10 tons of fine coal waste. No chemicals, other than an inert flocculent used to settle the fine coal waste, will be used in the washing process. Drying will be by means of a centrifuge and there will be no thermal drying of the washed coal.

Wash water for the plant will come from the Fresh Water Pond No. 1. Water will be pumped to the plant through a pipeline as shown on Plate 8-2. The maximum make-up water required for the plant on a continuous basis is estimated at approximately 180 gallons per minute.

8.3 Plant Waste Handling

Under the maximum design specifications shown on Figure 8-1, coarse coal refuse will be generated at a rate of approximately 130 tons per hour. The coarse coal refuse will be loaded from the refuse bin into the same trucks used to haul coal to the plant and transported back to the mine pit. The refuse will be directly placed in areas of current backfilling and will be buried a minimum of 4 feet below the regraded surface of the overburden material. During initial mine development, when no areas of the pit are ready for backfilling, coarse coal refuse will be stockpiled in a portion of the overburden stockpile area. As discussed in Part C, Chapter III the coarse coal refuse to be generated at the Wishbone Hill Project does not contain any chemical characteristics that are acid or toxic forming or would result in degradation of surface water or groundwater quality.

Fine coal waste will be slurried through a pipeline for disposal in a natural depression located to the south of the plant area. An inert flocculent, used to enhance settling of the fines, will be added to the slurry prior to leaving the plant. A specification sheet for a typical flocculent is included in Appendix A. Section 11 discusses the slurry pond in detail.

8.4 Disposal of Hazardous Coal Processing Waste

Because the process used to wash the coal for the Wishbone Hill Project does not use any chemicals, no hazardous coal processing waste will be produced. The coal refuse, both coarse and fine, has been geochemically tested for any potential hazardous substances or elements that may degrade ground or surface waters. Test results demonstrate that the coal refuse does not contain any potentially hazardous substances and that the refuse will not degrade ground or surface water. The results of this testing program are presented and discussed in Part C, Chapter III.

8.5 Slurry Pond

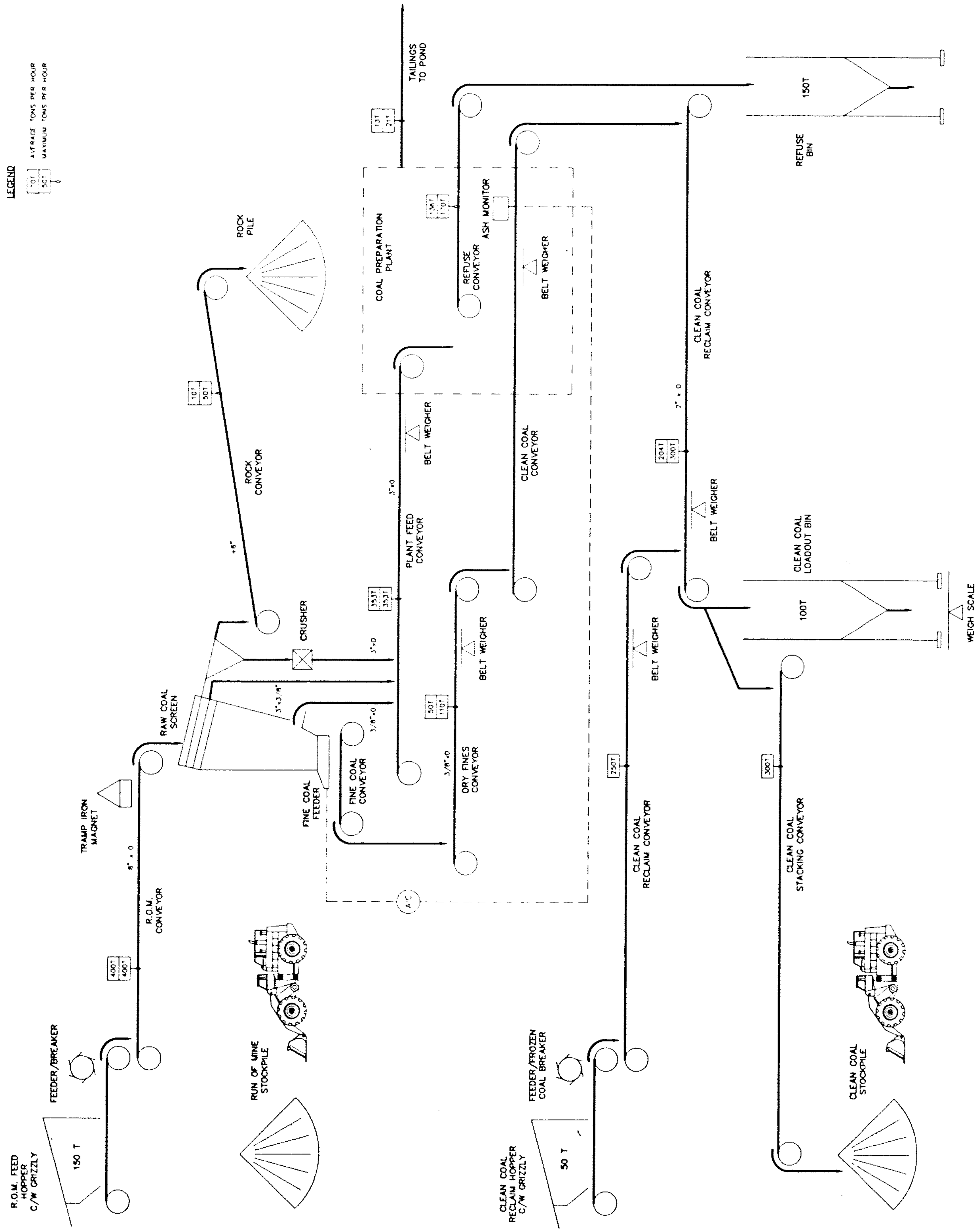
A slurry pond will be constructed in a natural depression adjacent to and south of the plant site for disposal of the fine coal refuse (see Plate 8-1). Slurry from the plant will be piped to the slurry pond at a maximum rate of 10 tons per hour. The slurry may be treated with a flocculent to enhance settling of the fine coal refuse. In addition to containing slurry, the pond will also function to contain and control runoff from part of the Topsoil Stockpile No. 1 area.

The pond has been designed to contain the fine coal refuse, slurry water discharged at a rate of 180 gallons per minute (120 gpm in the slurry and 60 gpm from the coarse coal wash circuit), the runoff and sediment volume generated from a 100 year 24 hour design storm as well as the life of mine sediment yield from runoff into the pond. The slurry pond design is discussed in detail in Section 11.

8.6 Onsite Coal Storage

Onsite coal storage facilities will be located adjacent to the wash plant building as shown on Plate 8-1 . Two types of onsite coal storage are anticipated, a stockpile of run of mine (unwashed) coal to allow continued plant operations during times when hauling from the pits is not possible and a stockpile of clean coal awaiting truck transport to the Glenn Highway. The run of mine coal stockpile will have a maximum capacity of 100,000 tons. Onsite storage of washed coal will have a capacity of approximately 75,000 tons of coal. The coal will be stockpiled in separate piles to allow for blending of different coal seams and wash products to achieve the optimal quality for shipment.

FIGURES



DESIGN BY: ALC/DN	COAL & REFUSE HANDLING PLANT STIE – FLOWSHEET	WISHBONE HILL MINE	PERMIT No. 01-89-796
DRAWN BY: DT			
CHECK BY: DN			
DWG FILE:	USIBELLI COAL MINE, INC. P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226	FIGURE No. 8-1	REV. 2
DATE DRAWN: 11/23/88		**SCALE:** NTS	

PLATES

LEGEND OF SYMBOLS

OVERHEAD POWER LINE	
UNDERGROUND POWER DUCT	—E——E——E—
PROCESS WATER	——PW——PW——
SLURRY LINE	—SL——SL—
FIRE PROTECTION WATER LINE	—FP——FP—
WASH DOWN WATER	—WDW——WDW—
SANITARY SEWER	—SAN——SAN—
FIRE HYDRANT	F.H

NOTES

1. FOR COMPLETE DETAILS OF THE FACILITIES AREA PONDS SEE PLATES 11-1 THROUGH 11-7
2. FOR THE FACILITIES AREA PLOT PLAN SEE PLATE 8-2.
3. PROCESS AREA FACILITIES DESIGNED AND LOCATED BY ASSOCIATED MINING CONSULTANTS LTD. ROADS, PONDS, MINE AREAS AND STOCKPILE AREAS DESIGNED BY SRK.
4. SEE PLATE 11-8 FOR TOPSOIL STOCKPILE No. 1 DRAINAGE CONTROL.

SUBJECT REVISIONS

REV.	DATE:	BY:	DESCRIPTION
1	2009	JEH	MINOR REVISIONS

DESIGN BY:
DRAWN BY:
CHECK BY:
DWG FILE:
DATE DRAWN: 6/12/90

WISHBONE HILL MINE

PERMIT NUMBER 01-89-796

FACILITIES AREA SERVICE PLAN

WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. 8-1
SHEET No. 1 OF 1
REV. 1

NOTES

1. FOR COMPLETE DETAILS OF THE FACILITIES AREA PONDS SEE PLATES 11-1 THROUGH 11-7
2. FOR THE FACILITIES AREA SERVICE PLAN SEE PLATE 8-1.
3. PROCESS AREA FACILITIES DESIGNED AND LOCATED BY ASSOCIATED MINING CONSULTANTS LTD. ROADS, PONDS, MINE AREAS AND STOCKPILE AREAS DESIGNED BY SRK.
4. SEE PLATE 11-8 FOR TOPSOIL STOCKPILE No. 1 DRAINAGE CONTROL.

REV.	DATE:	BY:	SUBJECT REVISIONS DESCRIPTION
1	2009	JEH	MINOR REVISIONS

DESIGN BY:
DRAWN BY:
CHECK BY:
DWG FILE:
DATE DRAWN: 6/12/90

WISHBONE HILL MINE

PERMIT NUMBER 01-89-796

FACILITIES AREA PLOT PLAN

WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. 8-2
SHEET No. 1 OF 1
REV. 1

9.0 ROADS AND COAL TRANSPORT SYSTEMS

The mine area road system will consist of two main haul roads, numerous in-pit roads, small construction roads and a site access road. The following sections describe the mine Area road system.

9.1 Roads

9.1.1 Mine area Haul Road Complex

The mine area road complex is shown on Plate 3-1. There are two main haul roads outside of the pit areas. These haul roads provide a route from each mine area to the wash plant and office and maintenance areas. These haul roads are designed for two way traffic and have an 80 foot wide running surface. The maximum grade on the haul roads will be 10%. The roads will be surfaced with run of mine gravel. Drainage from these roads will be directed to either Sediment Pond No. 2 or the slurry pond. Section 11 contains a complete discussion of drainage controls on the mine haul roads.

The pit area haul roads for both overburden and coal removal will be constructed in the pit highwall, spoils, and on the pit floor. The in-pit road system will be contained within the disturbance associated with the active mine areas and will move as mining progresses in each mine area. These roads are designed using an average 10% grade and 80 foot width, including berms. In some cases, the grade will exceed 10 percent. All runoff from the in-pit roads will be collected and contained within the pit.

Other roads will be constructed to access the overburden stockpiles, topsoil stockpiles, explosives storage area, sediment ponds, and the Buffalo Creek pipeline diversion and channel relocation. These roads are shown on Plate 3-1.

Roads to be used for maintenance of the sediment ponds, the Buffalo Creek pipeline and the Buffalo Creek channel relocation will be small, unimproved, dirt roads fifteen to twenty five feet in width.

Roads to be used by mine haul trucks or scrapers, such as roads accessing the overburden and topsoil stockpiles, will be constructed in the same manner as the main haul roads described above.

9.1.2 Access Road

The access road for the Wishbone Hill Project will consist of an approximately three mile segment of road which will connect the mine site with the Glenn Highway. The access road has been designed for year round use. Haulage will occur using highway legal tractors each equipped with two trailers. The road has been designed using prudent engineering practices to minimize the disturbance associated with road construction and to balance the amount of cut and fill required, while ensuring safe curves and grades. A longitudinal profile for the access road is shown on Plate 9-1 and the access road location is shown on Plate 9-2.

The access road will be surfaced with a layer of crushed gravel or pit-run gravel and may be treated with a dust suppressant and/or water as needed. The entrance at the intersection with the Glenn Highway will have an asphalt surface. The drainage control system has been designed to maintain the natural drainage patterns of the area as much as possible. Ditches will intercept upland flow on the upslope side of the access road and carry the flow to culverts located in areas of existing drainages or topographic low spots.

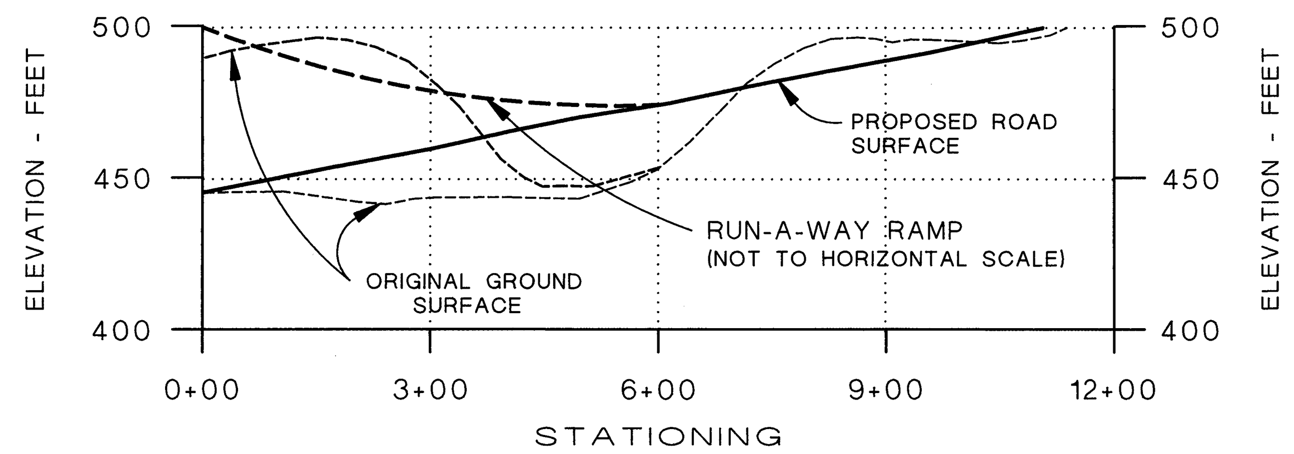
Based on design criteria, the maximum grade of the road will be 6 percent. Because of the steepness in certain sections, two runaway ramps have been incorporated into the design. The runaway ramps are designed to run uphill at 6 to 10% for a minimum length of 400 feet.

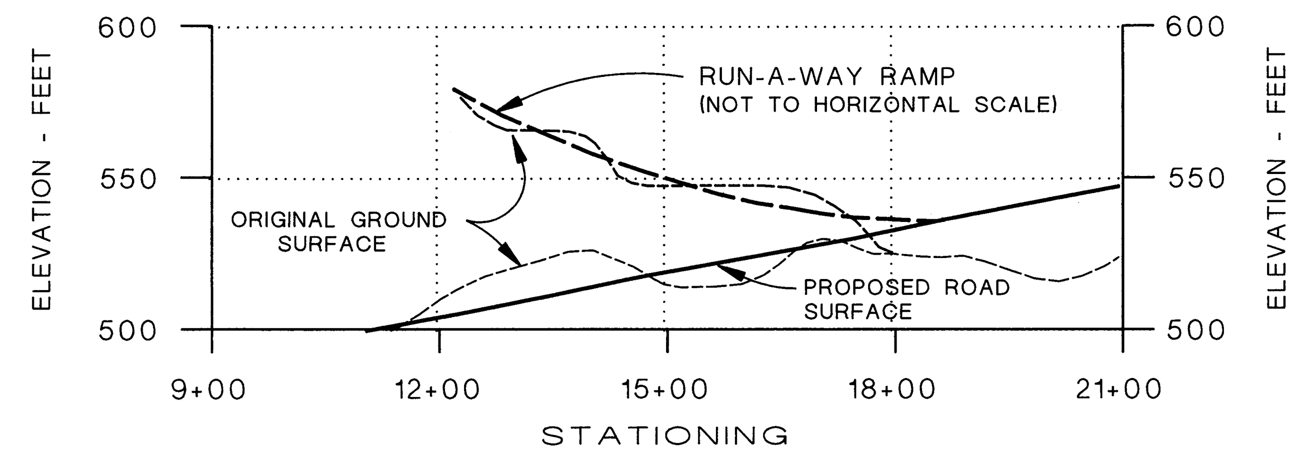
9.2 Truck Haul Operation

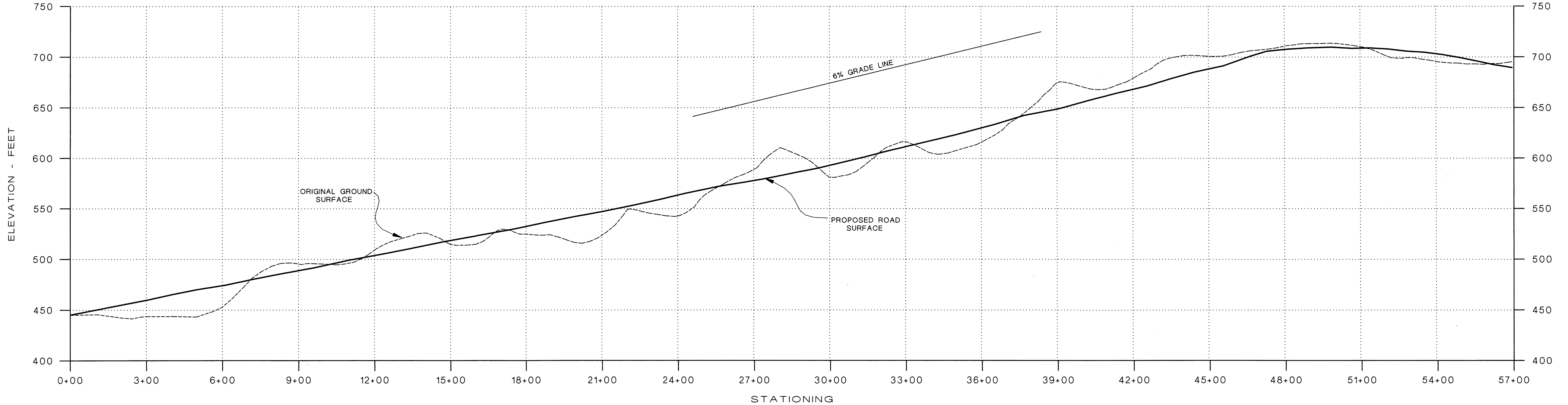
Clean coal from the wash plant will be hauled to the Glenn Highway along the mine access road using highway-type tractors with doulble trailers. Each truck unit will be equipped with a residential exhaust system and have covered trailers capable of hauling 45 to 50 tons per load.

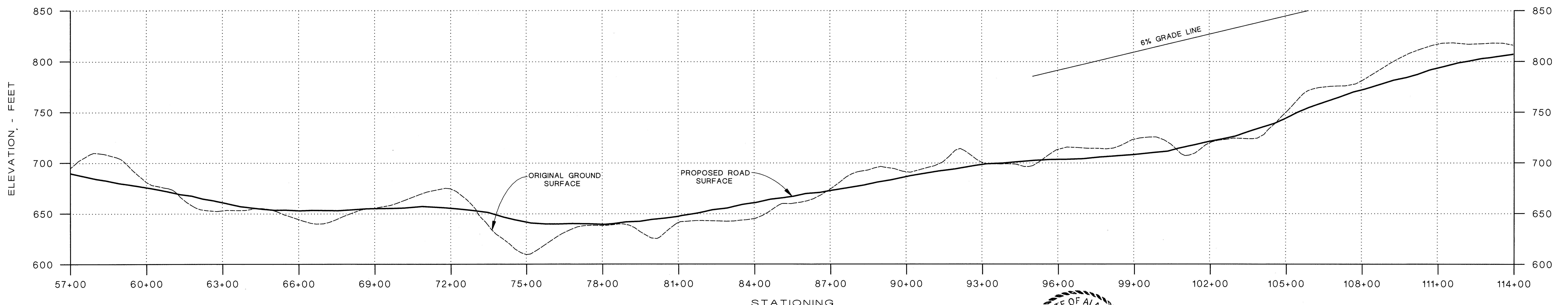
The coal transportation route will be along the approximate 3 mile mine access road to the intersection with the Glenn Highway. The Alaskan Department of Transportation and Public Facilities (DOT/PF) will review and approve the design plans for the intersection at the Glenn Highway under a Driveway Permit.

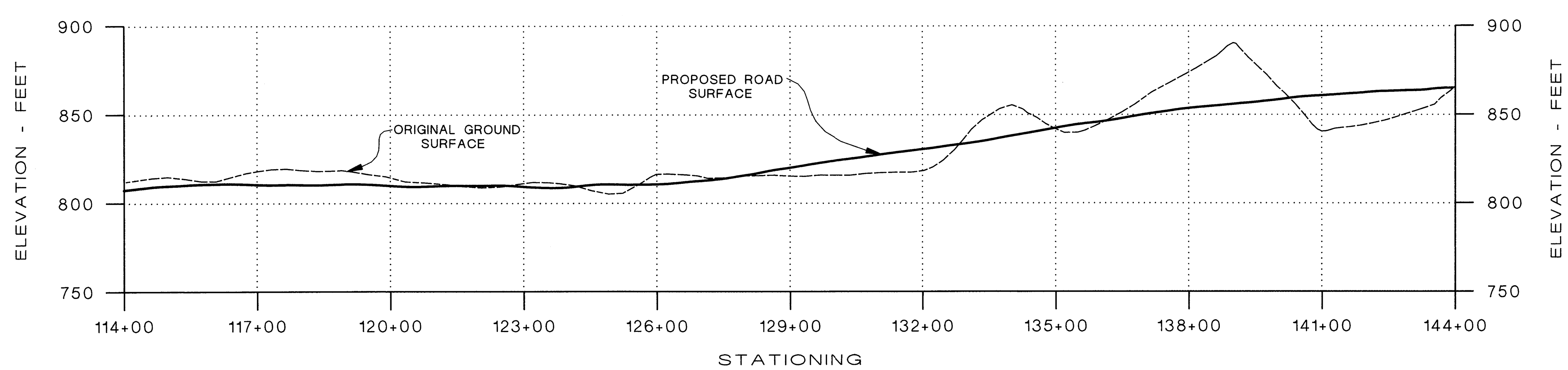
PLATES











STATE OF ALASKA 49th
P. G. HUTCHISON CE-6817
REGISTERED PROFESSIONAL ENGINEER

SCALES

HORIZONTAL 1" = 200'
VERTICAL 1" = 50'

NOTES:

1. FIELD SURVEY IS REQUIRED TO VERIFY AND FINALIZE LOCATION.
2. FIELD SOIL TESTING IS REQUIRED TO FINALIZE GRADES AND DESIGN SECTION.
3. SEE PLATES 9-2 AND 8-1 FOR PLAN VIEW OF ACCESS ROAD.

SUBJECT REVISIONS

REV.	DATE:	BY:	DESCRIPTION
A	8/89	BZ	CHECK BY: BZ, APPROVED BY: IH

DESIGN BY:

DRAWN BY: DB

CHECK BY: MMC

DWG FILE:

DATE DRAWN: 8/89

WISHBONE HILL MINE

USIBELLI COAL MINE INC. UCM

PERMIT N
X-XX

PROPOSED ACCESS ROA
ORIGINAL GROUND AND
ROAD PROFILE

WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
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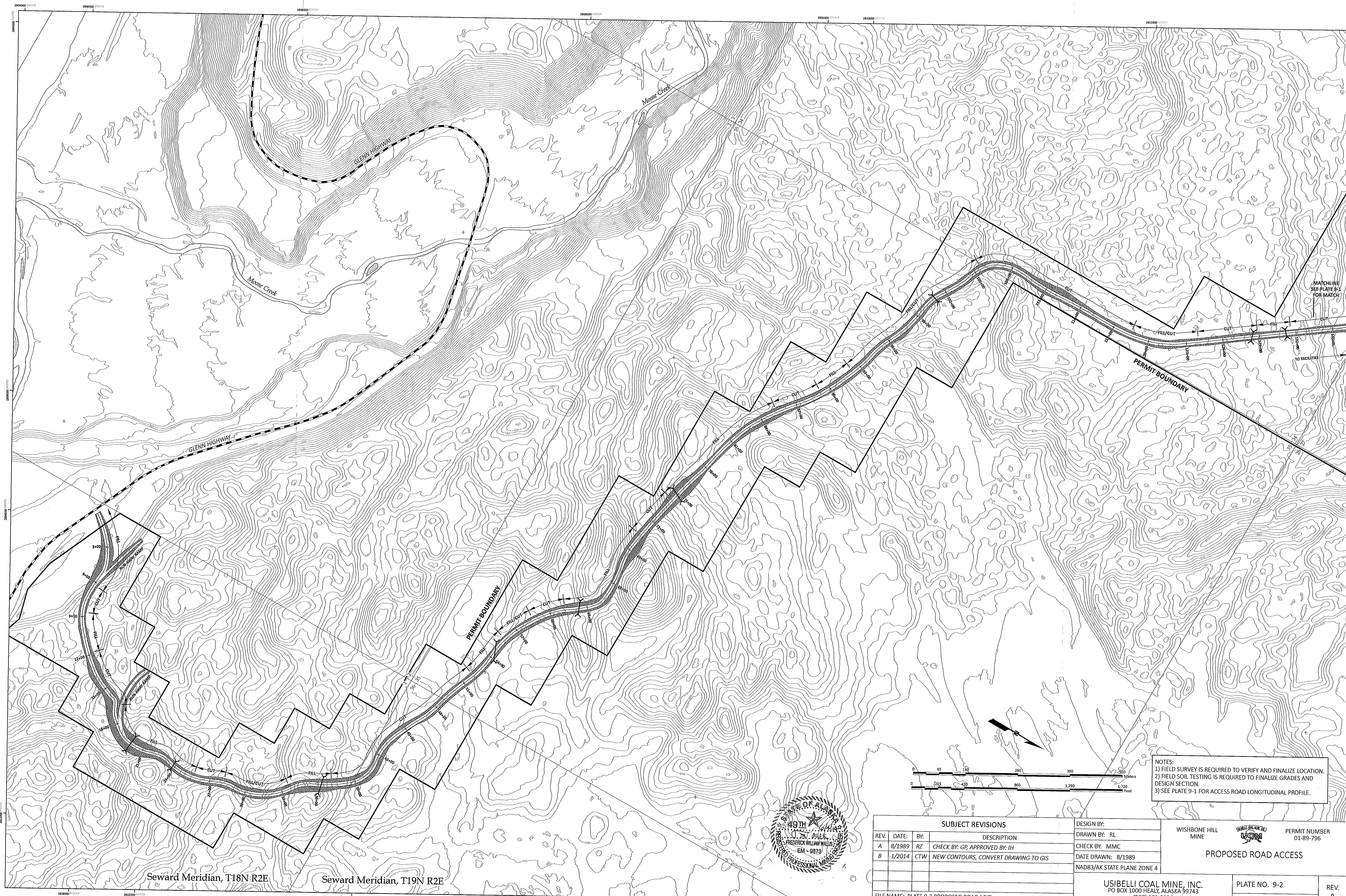
PLATE No. 9-1

SHEET No. 1 OF 1



NOTES:
1) FIELD SURVEY IS REQUIRED TO VERIFY AND FINALIZE LOCATION.
2) FIELD SOIL TESTING IS REQUIRED TO FINALIZE GRADES AND DESIGN SECTION.
3) SEE PLATE 9-1 FOR ACCESS ROAD LONGITUDINAL PROFILE.

SUBJECT REVISIONS

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A	8/1989	RZ	CHECK BY: GP, APPROVED BY: IH
B	1/2014	CTW	NEW CONTOURS, CONVERT DRAWING TO GIS

FILE NAME: PLATE 9-2 PROPOSED ROAD.MXD

DESIGN BY:
DRAWN BY: RL
CHECK BY: MMC
DATE DRAWN: 8/1989
NAD83/AK STATE PLANE ZONE 4

WISHBONE HILL MINE

PERMIT NUMBER 01-89-796

PROPOSED ROAD ACCESS

USIBELLI COAL MINE, INC.
PO BOX 1000 HEALY, ALASKA 99743
(907) 683-2226

PLATE NO. 9-2
SCALE: 1:3,750
REV. B

10.0 MINE FACILITIES

This section discusses mine support facilities at the Wishbone Hill Project. Coal preparation facilities have been previously discussed in Section 8.0 therefore this section addresses those support facilities not directly associated with the coal wash plant. These facilities include the mine offices, maintenance workshop, warehouse, bathhouse, process water supply system, potable water supply system, parking areas, effluent/sewage treatment system, fuel storage, and the electrical transmission. Plate 8-1 shows the location of these facilities.

10.1 Buildings and Structures

In addition to the coal wash plant, there will be two other main buildings at the project. A one story office building, constructed of prefabricated steel modular units, will be located southwest of the coal wash plant. This building will include offices, a meeting room, a first aid room, a small storage area and washroom facilities. Adjacent to the office building will be an employee and visitor parking area.

The second main building will be a maintenance complex which will house the maintenance workshop, warehouse and bathhouse facilities. This complex will be situated near the office building and has been designed to be interconnected to allow year round operations while minimizing the time that employees are exposed to the weather.

10.2 Utility Corridors and Facilities

The electrical power for the project will be supplied by the Matanuska Electric Association (MEA). An overhead and/or underground line will carry the required 3 phase power from an existing transmission line to the facilities area. A typical electrical distribution system for the facilities is depicted on Plate 8-2.

10.3 Solid and Sanitary Waste Disposal

All trash and refuse will be collected in containers placed throughout the project facilities. The waste material will be periodically hauled off site and placed in an approved landfill.

Sewage treatment facilities will be properly designed to handle the mine work force. and permitted through the Department of Environmental Conservation. The location for the planned sewage treatment system is located on Plate 8-1.

10.4 Fuel Storage

An above ground fuel storage area will be located between the maintenance complex and the wash plant as shown on Plate 8-1. The storage area will be properly sized to handle the mine's fuel requirements and will be equipped with line heaters and fast fuel devices. The area will be bermed to ensure fuel containment in the unlikely event of a fuel spill. In addition to the berm, the area will be lined with a 60-mil HDPE liner to provide further protection. The bermed containment area will be designed to contain approximately 110% of the total tank capacity.

10.5 Process and Potable Water Supply System

Initial make-up water for the wash plant will be pumped from Fresh Water Pond No. 1. Potable water will be obtained from either Fresh Water Pond No. 1 or a well. During continuous wash plant operations, water will be added only as needed. A water balance delineating expected make-up water requirements is discussed in Section 11.0 and presented in Appendix C. Electrically run pump stations will be placed at the edge of the slurry pond and Fresh Water Pond No. 1 as shown on Plate 8-2.

10.6 Wash Down Water Treatment and Disposal

Wash down water, primarily from truck washing, will be collected at the wash stations and piped to the wash down water recycle pond. At the wash water collection point a skimmer will be utilized to skim any oil or grease from the surface of the water before conveying to the pond. Oil collected from the skimmer will be periodically hauled off-site for recycling. Sorbent booms will be placed at the pipe outlet to collect any remaining oil, grease or solvents. Water in the pond will be continually recycled. A more complete discussion of the wash down water recycle pond is contained in Section 11.

10.7 Signs and Markers

Signs and markers will be posted in appropriate locations to identify the mine permit boundary, buffer zones, blasting areas, and topsoil stockpiles. Easily readable mine and permit identification signs will be placed at the mine access road entrance from the Glenn Highway and at the mine office. These signs will identify the name, business address and telephone number of UCM and contain the current permit number. Perimeter signs will be placed wherever trails or roads cross the permit boundary. Perimeter markers will also be located so that a clear line of sight is maintained from marker to marker around the permit boundary.

If any disturbance occurs within 200 feet of Moose Creek, those areas will have the 100 foot buffer zone marked as required by 11 AAC 90.301 (e). This will include the area near the reconstructed Buffalo Creek outfall, the area near sediment pond 7, and the area adjacent to the disturbance.

Blasting signs warning of the use of explosives and identifying blasting times and signals will be posted at all entrances to blasting areas and at the mine entrance.

10.8 Access Control Features

Access to the Wishbone Hill Project will be closely controlled. An automated gate will be located along the access road at the mine entrance. All vehicles entering or exiting the property will be required to stop at the office to sign in or out.

As shown on Plate 3-1, fencing will be constructed around the facilities area. Fencing will also be provided at the west end of Mine Area 1 near the existing public access to the area. Fences will be approximately 8 feet high and will be constructed with woven wire. Fences will be periodically marked with identification signs.

The existing public right-of-way 52715 will cross the mine access road south of the facilities area (see Plate 3-1). Controlled access will be maintained at this point with either 4 way stop signs or a large diameter culvert under the access road. A more complete discussion on the relocated public right-of-way is present in Section 18.0.

11.0 HYDROLOGIC STRUCTURES, DRAINAGE CONTROL AND IMPOUNDMENTS

Hydrologic controls will play an important role at the Wishbone Hill Project. The hydrologic controls have been designed to maintain project water requirements while preventing potential pollution to the surrounding water resources. Drainage from undisturbed areas will be diverted away from areas of disturbance to maintain the existing undisturbed drainage water quality.

Drainage from all disturbed areas will be diverted to sediment basins located throughout the mine area. The sediment basins will primarily make use of the numerous natural depressions present on site and will not substantially change the surface water runoff patterns existing prior to mining. The sediment control concept for the Wishbone Hill Project is a nondischarging concept. The sediment basins will allow any sediment to settle out and the runoff water to infiltrate into the surrounding glacial gravels, thereby maintaining and preserving existing water quality. As discussed in the following sections, each sediment control structure has been designed to contain inflows of both water and sediment generated from a 100-year 24-hour storm as well as an annual sediment yield. In addition, an emergency spillway has been designed for each sediment pond except the facilities area sediment pond because of the topography. The overall sediment control plan has been conservatively designed to preserve and protect existing site water resources.

In addition to the sediment and drainage controls, hydrologic controls will be used in Buffalo Creek to allow water to be diverted as needed for use in the mining operations. The creek channel will be permanently relocated during the second 5 year term to allow mining to progress through the existing Buffalo Creek channel.

Final design documentation for each hydraulic structure will be provided for Division of Mining approval following the rough grading of the structure and final determination of subsoil conditions, and prior to placing the structure in use. Final design documentation will include final design drawings showing all information necessary to verify the hydraulic adequacy of the structure, and a detailed discussion of design methodology, including hydrology, hydraulic capacity, erosion protection, riprap sizing and durability, filter criteria, inlet/outlet control at culverts, and flow depth and velocity calculations. Within 90 days of the completion of the construction of a hydraulic structure, certified as-built drawings will be provided to the Division of Mining.

11.1 Methods of Drainage Control Design

As described in the following sections, standard methods were used to calculate the peak flows, runoffs and sediment generated for the design of the sediment and runoff control structures to be constructed and used for the Wishbone Hill Project. In addition, stability calculations were performed on any embankment meeting the requirements for necessitating a stability analysis under the Alaska Surface Coal Mining Control and Reclamation Act, the proposed Alaska Dam Safety Regulations, or Federal Mine Safety and Health Administration Regulations (MSHA).

11.1.1 Climatological Data

Data on precipitation, evaporation, and runoff were obtained for the project site through interpretation of data from nearby areas available from the Soil Conservation Service (SCS) and the National Weather Service. Mean annual precipitation data for the site was derived using data from Palmer, Alaska and extrapolating the data to Wishbone Hill using an elevation adjustment. Site runoff was derived using SCS data from the Little Susitna River and regional atlases of Alaska and Canada. Storm recurrence intervals were derived using SCS precipitation data for Palmer. Mean annual evaporation was derived using data from the Matanuska Agricultural and Forestry Experiment Station, Palmer, and regional information obtained from the National Weather Service. Appendix B contains the climatological data derived for the site.

During the permit renewal for the Wishbone Hill Mine, the Alaska Department of Natural Resources Division of Mining, Land and Water (DNR) requested that the design hydrology be updated. The previous design storm event for the 100-year 24-hour event at the site was 3.6 inches. The National Oceanographic and Atmospheric Administration (NOAA) has updated Atlas 14 Volume 7 to provide Precipitation Frequency Estimates for the state of Alaska, and based on this updated data a design storm event of 3.81 inches was selected for the project site. This updated data superceeds Technical Paper No. 47, Probable Maximum Precipitation and Rainfall-Frequency Data for Alaska for Areas to 400 Square Miles, Durations to 24 Hours, and Return Periods from 1 to 100 Years (Miller, 1963), which was previously used to develop hydrologic design criteria for the Wishbone Hill permit application.

11.1.2 Water Balance Calculations

The project water balance calculations for each of the process related facilities were developed using data obtained from the wash plant design and potable water systems as well as precipitation, evaporation, and seepage data developed for the project area. The project water balance calculations were derived using spreadsheets with additions and subtractions as necessary for inflows and outflows to determine make-up water requirements and water storage requirements for the Fresh Water Pond No. 1, Fresh Water Pond No. 2, Slurry Pond, and all sediment control ponds. Water balance calculations are contained in Appendix C.

11.1.3 Peak Flow/Runoff and Sediment Generation Calculations for Sediment Ponds

Design storm runoff and sediment generation for the project drainage control facilities were calculated using SEDCAD4. SEDCAD4 is an adaptation of SEDIMOT developed by the University of Kentucky, Agricultural Engineering Department for determining sediment generation on disturbed lands. SEDCAD4 is an accepted standard for coal mine sediment pond design.

Input parameters for SEDCAD4 include catchment area, length of slope, SCS curve number, storm type, storm precipitation, soil characteristics, and Muskingum routing parameters. The program calculates runoff and sediment load information for the design storm including runoff volume, peak discharge and sediment yield. An updated CP factor was used for permit renewal. Based on the Guidelines for the Use of the Revised Soil Loss Equation(RUSLE) on Mined Lands, Construction Sites and Reclaimed Lands, a CP of 0.95 was used for fill areas(i.e., stockpiles) and 0.45 was used for cut areas(i.e., pits).

Average annual sediment calculations were done using the Universal Soil Loss Equation (USLE) (Barfield, Warner, and Haan, 1981).

Emergency overflow channel design calculations are based on the broad-crested weir formula with peak flows determined from the storm runoff hydrograph. Reservoir routing was not considered in the peak flow calculations. Sediment control ditch sizing utilized the Bentely FLOWMASTER program. The calculation program employs Manning's equation to determine channel design.

Appendix D contains all sediment pond design calculations. Appendix F contains height-capacity curves for each pond.

11.1.4 Peak Flow/Runoff Calculations for the Buffalo Creek Channel Relocation

Peak flow and runoff for the design storm for the Buffalo Creek channel relocation were calculated using the SEDCAD4 computer model. . Input parameters include catchment areas and lengths, slope, SCS runoff curve numbers, storm event and storm duration. All input parameters and hydrographs developed by SEDCAD4 are included in Appendix E.

11.1.5 Stability Calculations

Slope stability analyses were performed in accordance with the Alaska Surface Coal Mining Control and Reclamation Regulations, Mine Safety and Health Administration (MSHA) requirements and proposed State of Alaska Dam Safety requirements. The most conservative combination of these regulations required that a stability analysis be performed on any structure impounding more than 20 acre feet of water or having an embankment height of 20 feet or greater as measured from the embankment centerline to either the upstream or downstream toe, whichever provides the greater height. Structures that were analyzed for stability under these criteria included the slurry pond, Sediment Pond No. 1, Fresh Water Pond No. 1, and Fresh Water Pond No. 2/Sediment Pond No. 2. The stability of each berm on the respective structures was evaluated at the maximum cross-section utilizing two-dimensional force-equilibrium techniques. Conditions that were considered in the stability analyses included static and pseudostatic loading, rapid drawdown from a maximum pool elevation, and critical pool elevations which could potentially adversely influence the stability of upstream and downstream embankment slopes. These structures may require review and approval under MSHA and/or the Alaska Dam Safety Program. Approvals will be obtained prior to construction of the respective facilities.

The stability analyses results are summarized and presented in Appendix G.

11.1.6 Field Program and Infiltration Rate Testing

A field testing program was undertaken in June of 1989 to assess site subsoils for suitability as construction materials and to determine permeability and infiltration rates for the native soils in the pond areas. The program included a total of 20 backhoe pits and infiltration testing of seven locations within the project area. Results of this program are included as Appendix J.

The backhoe test pits were excavated using a Caterpillar 416 backhoe and a Case 450 bulldozer.

The test pits were excavated to a depth of 8 to 11 feet and logged by an SRK engineer. Samples were retrieved from the test pits and shipped to SRK's geotechnical laboratory for further classification and testing. The test pit location map and test pit logs are contained in Appendix H. Laboratory test results for the test pit soils are contained in Appendix I.

11.2 Support Facilities Complex

The support facilities complex includes the wash plant area, the coal stockpile areas, the office area, the maintenance complex, the slurry pond, the fresh water ponds, the facilities area sediment pond, and the wash down water recycle pond. The support facilities complex is shown on Plate 8-1.

11.2.1 Drainage and Sediment Control

Most of the support facilities area currently drains into natural depression areas which are proposed as the facility area sediment pond, slurry pond, or Sediment Pond No. 2. Drainage and sediment control for the support facilities complex can be facilitated with some minor grading and berming to ensure that all areas continue to drain to these proposed pond areas. The final grading plan for the support facilities area will ensure that these drainage flows are contained. Each pond has been designed to handle the runoff and sediment generated from the design storm (100 year 24 hour) as well as the annual sediment volume. The slurry pond has also been designed to handle the inflows due to the processing requirements. The pond design for the slurry pond is discussed in Section 11.2.3, the facilities area sediment pond design is discussed in Section 11.4.3 and the design for Sediment Pond No. 2 is discussed in Section 11.5.

11.2.2 Fresh Water Ponds

The fresh water ponds are located as shown on Plate 3-1, with more detailed plan views shown on Plate 11-1. Plate 11-2 shows cross sections through both ponds. Two fresh water ponds are needed to maintain the supply necessary to ensure continued wash plant operations. Water from Buffalo Creek will be diverted as needed to provide fresh or make-up water for the coal wash plant, water for the bathhouse facilities and water for dust suppression activities on the roads, if needed. A water balance for the entire project life on a month by month basis for normal water years is presented in Appendix C. A water balance which includes a wet water year and a water balance which includes a dry water year are also presented in Appendix C for comparison. The conveyance of water from Buffalo Creek to Fresh Water Pond No. 2 is explained in detail in Section 11.6.

Fresh Water Pond No. 1 is located in an existing natural depression directly north of the wash plant. The pond has been designed to store approximately 24 acre feet or 7.8 million gallons of water with two feet of freeboard. The height-capacity curve for Fresh Water Pond No. 1 is shown on Figure F-1 in Appendix F.

Because of the high permeability of the underlying soil, as determined through the infiltration testing described in Appendix I, the pond will need to be lined to ensure that the water remains in the pond and does not infiltrate into the underlying glacial gravels. The lining material will be a 60-mil high density polyethylene (HDPE). The liner may be covered with a one foot thick layer of selected native soils to protect the liner during winter conditions. Pond inside slopes must be graded to a maximum 3 horizontal to 1 vertical (3H:1V) following topsoil removal to allow for liner placement and sealing. Plate 11-4 contains the liner details.

Two berms will be necessary to provide total containment of the pond design volume. One berm will separate the pond from the run of mine coal stockpile area, while the second berm will prevent the pond from draining into the slurry pond. Details of these embankments are contained on Plate 11-3. Both embankments will have combined upstream and downstream side slopes of 5H:1V with no slopes steeper than 2H:1V. The top width of each embankment is 10 feet. A stability analysis was performed on each embankment as described in Section 11.1.5. Stability analyses for these berms are contained in Appendix G, Figures G-1 and G-2, and demonstrate that the embankments meet the accepted criteria for static, pseudostatic, and drawdown conditions.

An emergency overflow spillway will allow inflows from Sediment Pond No. 2 to be diverted into Fresh Water Pond No. 1 in the event of a storm greater than the 100 year 24 hour storm. An emergency overflow spillway has also been designed for the discharge from the Fresh Water Pond No. 1 in the event of a storm greater than the 100 year 24 hour design storm. The Fresh Water Pond No. 1 emergency overflow spillway will outlet to the Slurry Pond and has been designed to pass the peak flow from a 100 year 24 hour storm event. Emergency spillway designs are contained in Appendix D.

Fresh Water Pond No. 2 will be the pond into which the Buffalo Creek pipeline diversion outlets. Water will be pumped from Pond No. 2 to Pond No. 1 as needed to ensure adequate water availability for project requirements. Fresh Water Pond No. 2 has a capacity of 81 acre feet or 26.4 million gallons with 2 feet of freeboard. The pond volume and associated elevations are shown on the height-capacity curve presented in Appendix F as Figure F-2.

Fresh Water Pond No. 2 will also require lining to minimize water losses through infiltration. Lining for Pond No. 2 will be the same as previously described for Pond No. 1. The pond will be graded so that no inside slope is steeper than 3H:1V to allow for liner placement. Plate 11-4 contains liner details.

Three embankments will be constructed at Fresh Water Pond No. 2. One embankment will separate the pond from the Mine Area 2 haul road and is part of the road fill, the second embankment will separate Fresh Water Pond No. 2 from Sediment Pond No. 2, and the third embankment will ensure containment on the southeast corner of the pond. The embankment located between Fresh Water Pond No. 2 and Sediment Pond No. 2 will be constructed with a silt core. The core material will consist of selected site materials placed in lifts of 12 inches and compacted to 95% standard proctor prior to placement of the next lift. The core will promote vertical seepage At Sediment Pond No. 2 thus preventing horizontal seepage under the Fresh Water Pond No. 2 liner.

The latter two embankments are large enough to meet the requirements for a stability analysis. The results of the stability analyses on these two embankments are included in Appendix G, Figures G-3 and G-4. The results demonstrate that the embankments meet the accepted factors of safety for static, pseudostatic, and drawdown conditions. Embankment cross sections for the two larger embankments are shown on Plate 11-3. The embankments have been designed with overall combined side slopes of 5H:1V and embankment top widths of 12 feet.

An emergency overflow spillway has been designed for the discharge from the Fresh Water Pond No. 2 in the event of a storm greater than the 100 year 24 hour design storm. The Fresh Water Pond No. 2 emergency overflow spillway will outlet to Sediment Pond No. 2. The emergency spillway has been designed to handle the peak flow from a 100 year 24 hour storm event. Emergency spillway designs are contained in Appendix D.

11.2.3 Slurry Pond

A slurry pond, for the disposal of fine coal refuse from the wash plant, will be constructed in an existing natural depression southeast of the plant site as shown in plan view on Plate 11-5 and in cross sectional view on Plate 11-6. Slurry from the plant will be piped to the slurry pond at a maximum rate of 10 tons per hour. The slurry will be treated with a flocculent to enhance settling of the fine coal refuse prior to pumping to the slurry pond. In addition to containing slurry, the pond will also function to contain and control runoff from approximately 72 acres of area, which includes the pond surface itself and a portion of Topsoil Stockpile No. 1. The slurry pond volume is 701 acre feet with 2 feet of freeboard for a total available storage of 759 acre feet.

The slurry pond water balance is contained in Appendix C. The water balance was developed on a monthly basis for normal precipitation years for the entire project life. In addition, a water balance assuming a wet year in Year 5 and a water balance assuming a dry year in Year 5 were developed and are also included in Appendix C. The estimated amount of fine coal refuse to be generated for the project life is 869,000 cubic yards or 538.5 acre feet. This number includes both the fines material and any water which will be trapped in the voids as the slurry settles. Of the maximum average of 180 gallons per minute (gpm) total water use for the coal processing, 120 gpm are discharged to the slurry pond while the other 60 gpm are contained in the coarse coal refuse which is destined for mine backfill. Although approximately 120 gpm of water will be discharged with the slurry only 104 gpm will be discharged as "free water" available for infiltration. The 104 gpm is calculated by subtracting 16 gpm of water which has been determined to be entrained in the voids of the coal fines based on laboratory testing of the slurry. The test results are contained in Appendix K. The infiltration test results for natural soils in the area of the slurry pond indicated permeability for the pond area of 10^{-2} cm/sec as discussed in Appendix I. The laboratory testing of the slurry indicated a permeability rate of 10^{-3} cm/sec. The more conservative coal slurry infiltration rate was used in the water balance calculations for the slurry pond design after the first year, however, even this more conservative number indicated that the permeability rate was greater than the rate at which flows would be pumped to the pond. As a result, free standing water in the slurry pond is not expected to occur.

The calculations for sediment generated from a 100 year 24 hour storm are contained in Appendix D. Runoff from the 100 year 24 hour storm is estimated as 22.9 acre feet assuming no infiltration (3.81 inches x 72 acres), while sediment generated from the 100 year 24 hour storm will be 0.6 acre feet. The annual sediment yield for the project life is estimated at 2.6 acre feet/year or 34 acre feet over the 13 year life of the slurry pond. These calculations are contained in Appendix D. The maximum slurry pond design requirements of approximately 600 acre feet are easily contained in the total designed slurry pond volume of 701 acre feet with freeboard in excess of 2 feet. The slurry pond height-capacity curve is shown on Figure F-3 of Appendix F.

The slurry pond will be constructed making use of a natural depression at that site. The natural depression will be modified with the addition of four embankments. The embankments will be constructed of locally available material. Each embankment will be constructed as shown on Plate 11-3. Three of the four embankments will require construction of a silt core. The core will be constructed of selected local material. The material will be placed in 12 inch lifts with each lift compacted to 95% standard proctor prior to placement of the next lift. Each embankment will be constructed so that the combination of side slopes is greater than or equal to 5H:1V. Embankment top widths will vary between 10 and 20 feet.

All of the embankments meet the criteria for requiring a stability analysis. The stability analyses indicate that all embankments meet the accepted factors of safety for static, pseudostatic, and drawdown conditions. Stability analyses are contained in Appendix G.

11.2.4 Wash Down Water Recycle Pond

A wash down water recycle pond will be located adjacent to the facilities area sediment pond, northwest of the plant site as shown on Plate 3-1 with a more detailed plan view shown on Plate 11-7. A cross sectional view is shown on Plate 11-2. The wash down water recycle pond will collect equipment washing water from the maintenance area. The wash down water will first be collected in a sump in the maintenance building where a skimmer will be used to remove oil, grease and solvents from the water. The water will then be piped to the wash down water recycle pond. Sorbent booms will be placed at the pipe outlet to collect any remaining oil or grease prior to discharge into the wash down water pond.

The pond is designed to contain up to 1.5 acre feet of water under normal operating conditions. Water will be continually recycled through the wash down area.

The wash down water recycle pond will be lined with 60 mil HDPE liner to prevent seepage of the wash down water into the underlying gravels and allow recycling of the water. A one foot thick layer of compacted native soils will be placed over the liner to protect the liner during winter conditions. Plate 11-4 contains liner details.

11.3 Roads

Roads will be designed with drainage control systems to minimize erosion and control sediment in road runoff. The mine area road complex is designed with ditches which discharge road runoff to sediment control structures. The mine access road drainage control system is designed to control both the road runoff and runoff from undisturbed areas along the upslope side of the road.

11.3.1 Haul Roads

The mine area road system will contain ditches at the edge of the road surface. Periodic breaks in the road berms will allow these ditches to discharge to the sediment control structures or ditches within the mine area. The road drainage controls are discussed in Sections 11.4 and 11.5 which detail sediment and drainage controls for Mine Area 1 and Mine Area 2, respectively. In pit haul roads will direct road runoff into the bottom of the pits.

11.3.2 Access Road

The access road drainage control system has been designed to maintain the natural drainage patterns of the area as much as possible. Ditches will intercept upland flow on the upslope side of the road and carry the flow to culverts located in areas of existing drainages or topographic low spots. The berm along the access road will be broken periodically to allow discharge of flows on the road. These flows will be discharged into the ditch system. Culverts will be located at periodic intervals to carry this flow under the roads to discharge to existing drainages or depressions. Periodic hay bales and/or small catch basins will be used to control any sediment generated in the access road ditch system.

11.4 Mine Area 1 Drainage Controls

All surface water and groundwater flows in Mine Area 1 will be controlled to minimize the effects of mining on the prevailing hydrologic balance. The following sections provide specific details on the hydrologic structures, drainage controls and impoundments necessary to ensure that water quality and quantity are not affected by the mining activities in Mine Area 1. Post mining drainage controls for Mine Area 1 are discussed in Section 13.

The runoff control plan for Mine Area 1 includes the use of ditches, one constructed sediment control structure and two natural depressions within the disturbed areas to capture all disturbed area runoff. These ditches and sediment control structures are shown on Plate 11-8. The settling areas will not be lined but will allow runoff to infiltrate into the underlying glacial gravels. Infiltration rates, based on the results of field testing as contained in Appendix I, are rapid enough to allow the basins to dewater naturally even when using the most conservative test value observed, a rate of 2×10^{-4} cm/sec. By making use of the natural infiltration, the sediment control system has been conservatively designed to be a non-discharging system. The settling areas are designed to store all flows and sediment which would be carried to that area during a 100 year 24 hour storm event plus the normal annual sediment yield. All ponds and corresponding ditches have been designed for worst case conditions with regard to combined runoff and sediment volume. Worst case is represented by total concurrent mine pit disturbance coupled with maximum stockpile development. This situation will not exist during the mine life but has been modeled for the design case for the purpose of conservatism. Appendix D contains the design calculations for each ditch and sediment control structure.

Runoff control structures, that are needed in the mining area, will be constructed prior to any disturbance. During and after topsoil removal and prior to opening of the mine pits, flows will be directed to the sediment control ponds. Once overburden removal activities have begun, flows from the pit areas will be directed into the active pits. These flows will be collected in a sumped area of the pit floor. Ditching will be provided around the perimeter of the pit areas to collect any disturbed area runoff which does not drain into the active pit areas and divert this runoff into the existing sediment basins. The following sections provide brief summaries of the design characteristics of the sediment control structures for active operations in Mine Area 1. Section 13 discusses post mining drainage controls for Mine Area 1.

11.4.1 Sediment Pond No. 1

Sediment Pond No. 1 has been designed, making use of an existing natural depression, to collect all flows from Overburden Stockpile No. 1 and Mine Area 1 except for a small Area in the northwest corner of the mine area. The pond catchment area has been estimated at 114 acres. The pond design is based on the worst case runoff and sediment generation for the life of the project, i.e., 100% of the mine pit area disturbed with maximum development of all stockpiles (overburden and topsoil). The worst case was determined to be when the Overburden Stockpile No. 1 Extension was at its maximum height and, therefore, Plate 11-8 shows the stockpile rather than an active mine area. Plate 11-9 shows a plan view of Sediment Pond No.1. Plate 11-10 shows the pond in cross section.

Drainage from the stockpile will be collected on benches which will be graded to drain to the stockpile access roads. The benches will act as ditches, providing some reduction in storm flow and thus reducing sediment loads to the sediment pond. The presence of these ditches has been accounted for in the sediment loading calculations. From the SEDCAD calculations contained in Appendix D.1, the 100 year 24 hour storm runoff was determined to be 14.31 acre feet. The 100 year 24 hour storm sediment loading was determined to be 4.69 acre feet. The average annual sediment yield was determined to be 14.5 acre feet using USLE. Based on these numbers the total required storage assuming an annual cleanout is 33.5 acre feet. As shown on the height-capacity curve, Figure F-5 in Appendix F, the maximum storage prior to flow in the overflow spillway is 48 acre feet.

Infiltration test 1, as described in Appendix I, was conducted in the area of Sediment Pond No. 1. The coefficient of permeability for subsoils in this pond was measured at less than 2 x 10^{-3} cm/sec. Since the testing was localized, the worst case infiltration rate observed during testing of approximately 10^{-4} cm/sec or 2.3 acre feet per day was used in determining the Pond 1 infiltration rate.

An overflow spillway has been designed for Sediment Pond No. 1. The spillway will discharge flows to an adjacent small depression area. The spillway has been designed to pass the peak flow from a 100 year 24 hour storm event. Spillway designs are contained in Appendix D.

An embankment will need to be constructed at the upstream end of the pond to ensure that all flows are directed and contained in the pond. The embankment cross section is shown on Plate 11-3. Combined embankment side slopes have been designed to be 5H:1V. The embankment top width is 10 feet. The embankment will be constructed with a silt core to promote vertical seepage and restrict horizontal flows. The silt core will be constructed of selected, locally available materials placed in 12 inch lifts and compacted to 95% of the standard proctor density. The embankment met the requirements for performing a stability analysis. Appendix G, Figure G-8 contains the results of the stability analysis. As shown on this Figure, the factors of safety for static, pseudostatic, and drawdown conditions exceed the acceptable minimal standards.

11.4.2 Sediment Pond No. 3

Sediment Pond No. 3 will collect a small area of drainage from the northwest corner of Mine Area 1. The pond will be a constructed sediment pond which will be built during the first 5-year term to control drainage from mining operations. The pond will have a catchment area of 13 acres. Pond design is for the worst case disturbance condition. Based on the SEDCAD modeling approximately 1.28 acre foot of runoff and 0.36 acre feet of sediment is expected from the 100 year 24 hour storm. From the USLE calculations, the approximate annual sediment yield is 1.6 acre feet. The pond has been designed to contain the total design storage of 3.24 acre feet below the elevation of the emergency spillway.

Sediment Pond No. 3 will be constructed primarily by excavation, thus no large embankments have been designed. The pond will have a spillway which has been designed to pass the peak flows from a 100 year 24 hour storm event. Spillway designs are contained in Appendix D.

11.4.3 Facilities area Sediment Pond

The Facilities area Sediment Pond will collect drainage from the facilities area and the run of mine stockpile area. The pond will be located in an existing natural depression which will be supplemented by some excavation and fill placement to provide sufficient storage and freeboard. The pond will be constructed during the initial phases of project construction. The pond will have a catchment area of 33.5 acres. Pond design is for the worst case disturbance condition. Based on the SEDCAD modeling, approximately 3.6 acre ft of runoff and 1.2 acre ft of sediment is expected from the 100 year 24 hour storm. From the USLE calculations, the approximate annual sediment yield is 1.0 acre ft. The pond has been designed to contain the total design storage of 5.8 acre ft below the pond crest with 2 ft of freeboard.

11.4.4 Slurry Pond

As shown on Plate 11-8, flows from a portion of Topsoil Stockpile No. 1 will be directed to the slurry pond. Flows from the stockpile will be routed on benches and access roads from the stockpile. The flows will be collected, along with flows from a portion of the Mine Area 2 haul road, and conveyed by culvert under the haul road and run of mine coal stockpile. The culvert will empty into a ditch which will carry the flows to the slurry pond. The culvert and ditch have been designed to carry the expected peak flows from a 100 year 24 hour storm event. The culvert and ditch designs are contained in Appendix D.

A complete discussion of the slurry pond design is contained in Section 11.2.3.

11.4.5 Mine Area 1 Ditch System

Ditching will be necessary to route flows from disturbed areas to the Mine Area 1 sediment control structures. Ditches for Mine Area 1 have been designed for worst case conditions and are designated on Plate 11-8. Ditch designs are contained in Appendix D. Ditches have been placed in one of several type categories as shown on Plate 11-8. Ditch type details are contained on Plate 11-4.

11.5 Mine Area 2 Drainage Controls

All surface water and groundwater flows in Mine Area 2 will be controlled in a manner similar to Mine Area 1 to minimize the effects of mining on the prevailing hydrologic balance. The following sections provide specific details on the hydrologic structures, drainage controls and impoundments necessary to ensure that water quality and quantity are not affected by the mining activities in Mine Area 2. Post mining drainage controls for Mine Area 2 are discussed in Section 13.

The runoff control plan for Mine Area 2 includes the use of ditches, one natural depression and four constructed sediment control ponds throughout the disturbed areas to capture all disturbed area runoff. These ditches and sediment control structures are shown on Plate 11-11. The settling areas have been designed to be non-discharging by allowing the runoff to infiltrate into the surrounding glacial gravels. Infiltration rates, based on field testing as discussed in Section 11.1.6, are rapid enough to allow the basins to dewater naturally even when using the most conservative test value observed, a rate of 2×10^{-4} cm/sec. The settling areas are designed to store all flows and sediment which would be carried to that area during a 100 year 24 hour storm event plus the normal annual sediment yield. All ponds and corresponding ditches have been designed for worst case conditions with regard to combined runoff and sediment volume. Worst case is represented by total concurrent mine pit disturbance coupled with maximum stockpile development. This situation will not exist during the mine life, but has been modeled for the design case for the purpose of conservatism. Appendix D contains the design calculations for each ditch and sediment control structure.

The runoff control structures for Mine Area 2 will function in much the same manner as those described for Mine Area 1. Runoff control structures will be constructed prior to disturbance in all areas of the mining operation. During and after topsoil removal and prior to opening of the mine pits, flows will be directed to the sediment control ponds. Once overburden removal activities have begun, flows from the pit areas will be directed into the active pits. These flows will be collected in a sumped area of the pit floor. Ditching will be provided around the pit perimeter areas to collect any disturbed area runoff which does not drain into the active pit areas and divert this runoff into the existing sediment basins. The following sections provide brief summaries of the design characteristics of the sediment control structures for active operations in Mine Area 2. Section 13 discusses post mining drainage controls for Mine Area 2.

11.5.1 Sediment Pond No. 2

Sediment Pond No. 2 has been designed to collect and contain most of the runoff from the southwestern end of Mine Area 2, the Mine Area 2 haul road, Overburden Stockpile No. 3, Topsoil Stockpile No. 1, and a small area of the support facilities immediately adjacent to the pond, for a total catchment area of 175 acres. The pond has been designed making use of an existing natural depression. Sediment Pond No. 2 will be in place at the beginning of mining operations although it will not be fully utilized until later years. Plate 11-1 shows a plan view of this pond and Plate 11-2 show a cross-sectional view.

The pond has been designed with a maximum capacity of 43.5 acre feet prior to flow through the emergency spillway. Figure F-6 in Appendix F contains the height-capacity curve for Sediment Pond No. 2. Pond design is for the worst case disturbance condition. Based on SEDCAD modeling, the 100 year 24 hour storm flow for the catchment area is approximately 18.04 acre feet. The 100 year 24 hour storm sediment generation is 2.28 acre feet and the annual sediment yield is 10 acre feet. These calculations can be found in Appendix D. The required pond capacity is 30.32 acre feet.

One infiltration test, Test No. 5, as described in Section 11.1.6 and contained in Appendix I, indicated that the subsoils in Sediment Pond No. 2 have a permeability on the order of 2×10^{-2} cm/sec or 397 acre feet per day over the entire pond area. Using the most conservative infiltration rate as tested of 1×10^{-4} cm/sec still results in a seepage rate of 2 acre feet per day.

The pond will require construction of one embankment to separate the pond from Fresh Water Pond No. 2. This embankment has been previously described in Section 11.2.2. Plate 11-3 provides a maximum embankment cross-section. The embankment side slopes will vary from 2.5H:1V on the Sediment Pond No. 2 side to 3H:1V on the Fresh Water Pond No. 2 side. The embankment top width is 12 feet. A stability analysis was performed on the embankment and the results are presented in Appendix G, Figure G-4.

An emergency spillway will allow flows from Fresh Water Pond No. 2 to enter Sediment Pond No. 2 during a storm event larger than the 100 year 24 hour storm. An emergency spillway will also be constructed in Sediment Pond No. 2 to discharge flows from a storm event larger than the design storm to the slurry pond. Emergency spillway designs are contained in Appendix D.

11.5.2 Sediment Pond No. 4

Sediment Pond No. 4 has been designed to control a small area of drainage in the mine pit area during the first 5 year term. The catchment area for Pond No. 4 is 5 acres. Pond No. 4 is shown in plan view on Plate 11-9 and in cross-sectional view on Plate 11-10. Pond design is for the worst case disturbance condition. The 100 year 24 hour storm runoff for this catchment is calculated to be 0.37 acre feet. The sediment generated from this storm is almost negligible and is

0.005 acre feet. The annual sediment yield is 0.02 acre feet. These calculations are contained in Appendix D. The total storage requirements are 0.40 acre feet. The pond has been designed to store 0.48 acre feet prior to discharging through the emergency spillway. The total pond capacity is 0.84 acre feet as shown on Figure F-8 in Appendix F.

The pond design is non-discharging and assumes an infiltration rate based on the least permeable rate determined during the infiltration testing as presented in Appendix I. This rate of approximately 10^{-4} cm/sec or 103 feet/year corresponds to a rate of infiltration for Pond 4 of 0.06 acre feet per day.

Sediment Pond No. 4 is approximately four feet deep and will be constructed by excavation. No embankment will be constructed. An emergency spillway will provide a controlled discharge for flows in the event of a storm event larger than the 100 year 24 hour storm. Designs for the Sediment Pond No. 4 emergency spillway are contained in Appendix D.

11.5.3 Sediment Pond No. 5

Sediment Pond No. 5 will collect runoff from disturbance created from topsoil removal and mining operations in Mine Area 2. The total catchment area for Sediment Pond No. 5 is 105 acres. Plate 11-12 illustrates a plan view of Sediment Pond No. 5. Plate 11-10 contains a cross-sectional view of the pond.

Pond design is for the worst case disturbance condition. The 100 year 24 hour design storm runoff for Sediment Pond No. 5 is estimated to be 9.06 acre feet. The 100 year 24 hour storm sediment loading is estimated at 0.80 acre feet. The annual sediment load was calculated at 1.6 acre feet. These calculations are contained in Appendix D. The total required capacity, based on these calculations is 11.47 acre feet. The total design capacity below the elevation of the emergency spillway is 16 acre feet. Figure F-9 in Appendix F presents a height-capacity curve for this pond.

The infiltration rate for this pond, based on the most conservative value observed during the field testing program presented in Appendix I, is 0.45 acre feet per day.

The pond will be an excavated pond requiring an average of 35 feet of excavation. This excavation will keep the pond and pond drainage above the steep bluffs and floodplain areas of Moose Creek. No embankments will be constructed.

The pond location necessitates that a small diversion berm be constructed south of the pond to ensure that flow from this area of lower topography is directed to the pond. The diversion berm will allow flows to back up until entering a constructed channel which will divert the flows into Sediment Pond No. 5. Buffalo Creek flows just north of the pond. A constructed ditch will intercept any runoff which might flow in the then abandoned Buffalo Creek channel and divert these flows into Sediment Pond No. 5.

An emergency spillway will be constructed to allow a controlled outlet for flows from a design storm greater than the 100 year 24 hour storm event. The emergency spillway design is contained in Appendix D.

11.5.4 Sediment Pond No. 6

Sediment Pond No. 6 will be constructed to collect some of the disturbed area runoff from Mine Area 2. The total catchment for Sediment Pond No. 6 is 6 acres. Plate 11-12 shows a plan view of this pond.

Pond design is for the worst case disturbance condition. The 100 year 24 hour storm runoff for the catchment area is calculated as 0.63 acre feet. The 100 year 24 hour storm sediment loading is calculated as 0.47 acre feet. The annual sediment loading is calculated to be 0.8 acre feet. These calculations can be found in Appendix D. The total storage requirement for the runoff and sediment is 1.89 acre feet. As shown on Figure F-10 in Appendix F, the total capacity of the pond below the level of the emergency spillway is 4.6 acre feet.

The pond has been designed as a combination of excavation and embankment fill. A diversion ditch has been designed to divert runoff from the year's previous mining activity which is above the pond to Sediment Pond No. 5 and the Sediment Pond No. 6 emergency spillway will outlet into this ditch as well. Approximately 7 feet of excavation will be required. The maximum embankment height will be 12 feet as measured from the downstream toe. A maximum embankment cross-section is shown on Plate 11-3. The embankment will have combined side slopes of 5H:1V and a top width of 10 feet. The embankment does not meet either the height or capacity criteria for requiring that a stability analysis be performed.

An emergency spillway has been designed located in the northeast corner of the pond. The spillway has been designed to carry peak flows from a 100 year 24 hour storm event into a diversion ditch which will route the flows to Sediment Pond No. 5. Spillway designs are contained in Appendix D.

11.5.5 Sediment Pond No. 7

Sediment Pond No. 7 has been designed to collect flows from a small steep area in the northernmost mining area. This pond will be constructed prior to topsoil stripping in the northern portion of Mine Area 2. Sediment Pond No. 7 is shown in plan view on Plate 11-12.

The total catchment for Sediment Pond No. 7 is 1 acre. Pond design is for worst case disturbance condition. The 100 year 24 storm runoff for this area has been calculated to be 0.05 acre feet. The design storm sediment load has been calculated as 0.04 acre feet. The average annual sediment load has been calculated as 0.1 acre feet. These calculations are contained in Appendix D. The total required capacity is 0.19 acre feet. The capacity of the pond up to the emergency spillway as shown on Figure F-11 in Appendix F has been designed at 0.57 acre feet.

The infiltration rate for this pond, as calculated based on the most conservative infiltration rate observed during the field test program as presented in Appendix I, is 0.13 acre feet per day.

The pond will be partially excavated and partially embanked. The maximum embankment cross-section is shown on Plate 11-3. The maximum depth of excavation is approximately 7 feet. The maximum embankment height is 3 feet. The embankment has been designed with total combined outslopes of 5H:1V. The embankment top width is 10 feet. The embankment does not meet the criteria for requiring that a stability analysis be performed.

An emergency spillway has been designed to allow a controlled discharge in the event of a storm greater than the 100 year 24 hour storm. The spillway channel has been designed to pass the peak flows from a 100 year 24 hour storm. Spillway designs are contained in Appendix D.

11.5.6 Mine Area 2 Ditch System

Ditching will be necessary to route flows from disturbed areas to the Mine Area 2 sediment control structures. Ditches for Mine Area 2 have been designed for worst case conditions and are designated on Plate 11-11. Ditch designs are contained in Appendix D. Ditches have been placed in one of several type categories as shown on Plate 11-11. Ditch type details are contained on Plate 11-4.

11.6 Drainage and Sediment Control Structures Dewatering and Maintenance Procedures

Geotechnical testing of the infiltration rate of the expected subsoils for the sediment control ponds was performed during a field testing program in June of 1989. The testing was necessary to ensure that the sediment control structures could be successfully dewatered through natural infiltration in a sufficiently short period of time to allow use of infiltration rather than a controlled discharge. The test results are presented in Appendix I. The results show a maximum infiltration rate of 1×10^{-2} cm/sec and a minimum infiltration rate of 2×10^{-4} cm/sec. Each pond was evaluated for dewatering time for the design storm based on the maximum and minimum rates. The results are presented in Table 11-1. Although the worst case maximum time calculated in the field testing was presented in the sediment pond discussions in Sections 11.4 and 11.5, the actual rate is expected to vary and lies somewhere in between the maximum and minimum rates presented in the Table.

An operational monitoring program will be maintained for the 8 sediment ponds and the coal slurry pond. For the sediment ponds, the monitoring program will ensure that there is always sufficient volume available to contain the runoff generated by the 10-year 24-hour precipitation event, while maintaining one foot of freeboard. Monitoring for the slurry pond will ensure that there is always sufficient volume available to contain the runoff generated by the probable maximum 24-hour precipitation event, while maintaining one foot of freeboard. Water quality monitoring in both the slurry and sediment ponds will utilize the same parameters as those monitored in the groundwater wells. Monitoring records, acceptable to the Division of Mining, will be maintained on-site and made available to the Division of Mining as requested.

The pond design assumes yearly clean out of sediment for all sediment control ponds except the slurry pond. Accumulated sediment will be removed in the fall or winter, and at other times of the year when deemed necessary. The pond sediment will be placed as backfill in the mine pits. In addition to annual sediment pond clean out, all site ditches and culverts, including access road culverts, will be inspected in the spring and early summer and cleaned out as necessary. Excessive erosion at ditch outlets will be repaired and additional erosion protection will be provided, if necessary.

All other hydrologic structures, including the Buffalo Creek Diversion Pipeline, Wash Down Water Pond, Fresh Water Ponds Numbers 1 and 2, and the Slurry Pond, will be inspected annually and maintained on an as-needed basis subsequent to inspection. Annual inspections will be conducted under the supervision of a professional engineer registered in the State of Alaska.

11.7 Erosion Control

Erosion control practices will also be implemented to aid in sediment control in disturbed areas of the mine site both during active mining operations and during reclamation. The main erosion control method to be used at the Wishbone Hill Project is the mine and reclamation planning. The mining and reclamation activities for the project are designed to disturb and leave unreclaimed the smallest practical area at any time, minimizing the areas subject to erosion. Another erosion control practice to be implemented is the establishment of vegetation on topsoil stockpiles, temporary overburden stockpiles, impoundment slopes, drainage ditches, and backfilled areas. As depicted on Plates 11-8 and 11-11 rock riprap will be placed in many of the ditch systems to further protect the disturbed areas from excessive erosion. Table 11-2 outlines the criteria which are proposed for determining the need for erosion protection in all ditches based on design flow velocities and exposed material type. Regrading of backfilled pit areas will be done on contour, where possible, to aid in erosion control. Areas of the mine pit will be backfilled, graded, topsoil replaced and revegetated as quickly as possible to minimize the amount of disturbed areas subject to erosion. In areas where erosion occurs, measures such as hay bales, silt fences, regrading, erosion matting, protective mulches and other proven erosion control measures will be installed.

11.8 Pond Construction and Inspection

All ponds and drainage control structures will be constructed in accordance with the Alaska Surface Coal Mining and Reclamation Act (AS 27.21). The sediment control structures will be constructed prior to any disturbance of the area from which runoff will be controlled. All ponds have been designed to handle flows and sediment generated from a 100 year 24 hour storm event as well as expected annual sediment loading. The ponds have been designed using natural infiltration as a dewatering device for the runoff into the ponds. An emergency spillway has been designed for each pond which will allow at least one foot of freeboard when flowing at design capacity.

Prior to pond construction, the pond area will be stripped of vegetation and all topsoil in the pond and embankment areas will be salvaged. In ponds which require construction of an embankment structure, the fill will consist of locally available material. The material will be free of vegetative debris, large rocks, frozen soil and other potentially deleterious material. Embankment construction will occur in lifts not to exceed 2 feet. The silt core to be constructed for some of the embankments will be constructed using selected site materials which will be placed in lifts approximately 12 inches thick and compacted to a minimum of 95% of standard proctor. The combined side slopes of each embankment will not exceed 5H:1V and no slope will be steeper than 2H:1V. The constructed height of the sediment pond embankments will be increased 5% over the design height to allow for settling.

The design of each pond has been supervised by a registered professional engineer in the State of Alaska. The ponds will be constructed under the supervision of a registered professional engineer who will submit certified as-built drawings to the State upon completion of construction. Ponds will be inspected annually by a registered professional engineer for erosion, cracking or other potential problems.

Pond embankment outslopes will be revegetated in accordance with the procedures outlined in Section 13.

11.9 Buffalo Creek Channel Relocation

The Mine Area 2 topsoil removal activities will intercept Buffalo Creek requiring relocation of the Buffalo Creek channel. The relocated channel construction will occur during the first 5 year term of the mining operations concurrently with the construction of the Buffalo Creek diversion structure. By relocating the channel early in the mining operations, some of the first site reclamation work will concentrate on stabilizing and revegetating the channel to allow monitoring over the entire mine life. Flow routing will be controlled through the channel to observe channel behavior and correct any unexpected problems to ensure that impacts to Moose Creek are minimized.

The Buffalo Creek channel will be permanently relocated to the north of the existing channel within the permit boundary but away from Mine Area 2 and other mining related disturbance. The channel location is shown on Plate 11-13 with a channel profile shown on Plate 11-14. Three different channel types are planned based on the slope of the relocated channel. These channel types can also be found on Plate 11-14. In shallow slope areas along the upper reaches of the relocated channel a grass lined channel will be constructed. The channel will be riprapped beginning in the steeper middle reach of the relocation and continuing to the outlet of the channel. The outlet has been located to discharge into an existing drainage channel prior to flow into Moose Creek. The relocated channel has been designed to handle the flows from a 100 year 24 hour storm event. Channel designs are contained in Appendix E.

11.10 Buffalo Creek Pipeline Diversion

Water will be conveyed from the existing Buffalo Creek channel for plant startup and as makeup and potable water for the wash plant and bathhouse facilities. A diversion structure will be constructed in the creek to allow diversion of the flows as needed. The diversion will be accomplished by means of a small basin and berm structure constructed in the creek channel with a manually controlled inlet valve. The flows will be routed by gravity through an eight inch diameter pipeline which will be buried a minimum 5 to 12 feet deep. The pipeline will outlet into Fresh Water Pond No. 2. The pipeline location is shown on Plate 3-1 with a profile of the pipeline shown on Plate 11-15. Typical illustrations of the basin and berm structure and diversion intake structure are shown on Plate 11-14. The diversion has been designed to allow year round use. Calculations for the pipeline design and depth of burial to prevent freezing are contained in Appendix E.

The makeup water requirements will vary according to the site conditions and season of the year. Table C-1 in Appendix C presents estimated fresh water requirements for the life of the project. The fresh water requirements will be met primarily by diverting flows from Buffalo Creek. As discussed in Section 11.11, if groundwater inflows are significant, they will be pumped from the pit area for use as fresh water thereby reducing the amount of flow diverted from Buffalo Creek.

11.11 Groundwater Drainage/Pit Inflow

11.11.1 Mine Inflow from Bedrock and Glacial Sediments

The proposed mine excavations will penetrate saturated glacial deposits and sedimentary bedrock resulting in groundwater inflow to the open pits. The pit in Mine Area 1 will be excavated to a maximum depth of approximately 380 feet below ground surface to elevation 605 feet. The Mine Area 1 pit is expected to penetrate up to approximately 300 feet of saturated material (i.e., glacial sediments and bedrock). The pit in Mine Area 2 will be excavated to a maximum depth of approximately 550 feet below ground surface to elevation 505 feet and is expected to penetrate up to approximately 450 feet of saturated material.

The open pits are not expected to intersect saturated alluvial materials. Based on borehole and seismic survey data (see Part C, Chapter IV) the alluvial deposits are confined to an area within several hundred feet or less of the Moose Creek channel and are generally less than 20 feet thick. Alluvial deposits will be separated from the pit slopes by bedrock and glacial deposits that have a relatively low permeability (see Part C, Chapter IV). Therefore, it is not expected that the mine excavation will induce flows of groundwater from the shallow alluvium or cause increased losses of surface water from Moose Creek into the alluvium.

11.11.1.1 Physical Model

Approximate groundwater inflow rates to the two mine areas were calculated based on the proposed pit configurations and mining sequence as presented in Part D, Section 3. Figure 11-1 shows the simplified mining sequence that was used for the inflow computations. A conceptualized diagram of a pit wall and one of the analytical models used to calculate inflow are shown in Figure 11-2. For each portion of the pit slope, the saturated thickness of glacial sediments and bedrock was determined from the hydrogeologic cross-sections (Figures 4-3 to 4-7) and water table contour map (Figure 4-9) presented in Part C, Chapter IV. The maximum drawdown in water level in the bedrock was set at the elevation of the pit floor. The maximum drawdown in the glacial sediments was set at the contact between the glacial sediments and the bedrock.

Pits that are to be developed during any given year were assumed to open instantaneously at the beginning of that year and then stay open during the remaining life of the mine area. In reality, the mine excavation will be backfilled sequentially. However, the backfill will be several of orders of magnitude more permeable than the in-situ bedrock and glacial sediments and, therefore, will not significantly impede inflow to the remaining open areas of the pit. Depending on the bottom profile of the backfilled areas, inflow may tend to pond beneath the backfill in low areas thus reducing the actual inflow into the open areas of the pit. Under such conditions, the resulting inflow into the open (i.e., not backfilled) areas of the pit would be less than that estimated below.

The contribution of pit inflow from the glacial sediments and the bedrock was calculated separately. Because the bedrock is generally one to two orders of magnitude lower in hydraulic conductivity than the overlying glacial sediments (see Part C, Chapter IV) and will have a different storage coefficient, each of these major hydrogeologic units will have a different hydraulic response to the excavation. It is expected that the unconfined groundwater in the glacial sediments will flow laterally towards the open pit on top of the bedrock contact. The groundwater in the bedrock is expected to flow towards the pit under confined conditions except adjacent to the excavation where it may become unconfined as portions of the bedrock desaturate. Total pit inflow is the sum of the separately calculated inflows from the glacial sediments and the bedrock formations.

Representative values for hydraulic conductivity were determined from aquifer pump tests and slug tests described in Part C, Chapter IV. The values used for the mine inflow estimates are listed below.

Unit	Best Estimate (ft/day)	Hydraulic Conductivity Low (ft/day)	High (ft/day)
Bedrock			
Flat Strata	0.024	0.0076	0.076
Dipping Strata	0.006	0.0019	0.019
Glacial Sediments	0.400	0.1260	1.260

Two "best estimate" values of hydraulic conductivity were used for the bedrock. For relatively flat-lying bedrock, a hydraulic conductivity value of 0.024 ft/day determined from the H88-15 pump test was used. This test was conducted in relatively flat-lying strata in Mine Area 1. For steeply dipping bedrock a value of 0.006 ft/day determined from the H88-16 pump test was used. This pump test was conducted in steeply-dipping strata in Mine Area 2. As discussed in Part C, Chapter IV, the steeply dipping strata is expected to have a lower horizontal hydraulic conductivity than the relatively flat-lying strata because flow will occur across bedding. Inflow from pit walls in flat-lying strata (i.e., portions of Mine Area 1) was calculated using the higher value of hydraulic conductivity and inflow from pit walls in steeply-dipping strata (i.e., portions of Mine Area 1 and all of Mine Area 2) was calculated using the lower value of hydraulic conductivity.

A representative "best estimate" value for hydraulic conductivity for the glacial sediments of 0.4 ft/day was calculated as the geometric mean of the slug tests performed in seven monitoring wells installed in the glacial sediments (see Part C, Chapter IV).

To account for variability in groundwater parameters, a range of inflows was computed using a one-order-of-magnitude envelope about the representative values of hydraulic conductivity. The low and high values of hydraulic conductivity used for the inflow estimates are shown above.

Since pit inflow will vary with time, values for storage coefficient were needed to calculate transient effects. In bedrock, inflow is expected to occur under primarily confined aquifer conditions and the storage coefficient was set equal to the measured specific storage of the bedrock times the thickness of the bedrock over which inflow is assumed to occur. Bedrock specific storage values measured from the pump test in well H88-15 are approximately 2×10^{-7} and 4×10^{-7} ft^{-1} as presented in Part C, Chapter IV. An average value of 3×10^{-7} ft^{-1} was used for the mine inflow calculations for both flat-lying and dipping bedrock. Since specific storage is primarily a function of aquifer compressibility and porosity, there is not expected to be a difference in specific storage between the flat-lying and steeply-dipping strata and it is appropriate to use one value for both. Flow in the glacial sediments will occur under unconfined conditions. Therefore a value of specific yield was used for the transient inflow calculations. Based on the material type a specific yield of 0.15 (see Part C, Chapter IV) was used for the glacial sediments.

11.11.1.2 Analytical Methods

Three analytical methods were used to estimate the quantity of mine inflow from the bedrock and glacial sediments. Different methods were used to account for a range of possible inflow conditions and as a cross-check. Each of the methods required idealization of the hydrogeology at the site and the resulting inflow numbers should be considered as approximate. As discussed above, a range of parameter values was used to account for the natural variability of the rock.

The first analytical method is based on confined one-dimensional transient inflow to an open excavation. The solution is given by Glover (1974) and is shown in Figure 11-2. This solution assumes that horizontal flow will occur from a confined aquifer of infinite areal extent and no recharge. Although this solution is strictly applicable only to confined conditions, unconfined flow conditions in the glacial deposits were approximated by reducing the effective saturated thickness in the sediments to one half of the total saturated thickness. This reduction compensates for dewatering of the sediments and the associated reduction in transmissivity that will occur near the pit wall. Because this solution assumes no recharge either from vertical leakage or hydrologic boundaries, it represents a minimum estimate of pit inflow for a given set of parameters.

The procedure included solving for inflow from the glacial sediments and bedrock formations separately in one-year intervals for the duration of the mining. Inflows from each formation were then summed by year. A computer program used to run the analytical model is presented in Appendix L. This Appendix also provides the parameter values used for each calculation and summary tables of inflow from bedrock and glacial sediments to the various pits during each year.

A second analytical method used to estimate inflows is based on one-dimensional steady-state unconfined flow into an excavation from a boundary at which the head is held constant. This method described by McWhorter (1977) is illustrated in Figure 11-3. The assumed constant head boundary could be maintained by a stream (e.g., Moose Creek), by vertical infiltration or by a lateral change to a more permeable hydrogeologic unit (e.g., from bedrock to alluvium). It represents a reasonable maximum estimate of inflow for a given set of parameters. Inflow from both bedrock and glacial units was estimated using this method. The calculations are presented in Appendix L.

A third analytical method was used as an additional check on inflows. This method used the standard Theis solution for confined radial flow to a well (Lohman, 1972) and is illustrated in Figure 11-4. The maximum area of the open pit excavation in each of the two mine areas was idealized as a large diameter well in an aquifer of infinite areal extent. Diameters were calculated based on a large well with the same equivalent area as the pits in each mine area. This method was used only to calculate inflow under confined conditions from the bedrock. The solution is not appropriate to use for a large diameter excavation in an unconfined aquifer (i.e., glacial deposits). Calculations of inflow using this method are presented in Appendix L.

11.11.1.3 Results

The estimated mine inflows to Mine Areas 1 and 2 over the proposed mine life are plotted in Figure 11-5. For any given point in time a range of inflows is shown. The range reflects the uncertainty in hydrogeologic parameters (reflected by an order of magnitude variation in hydraulic conductivity) and boundary conditions (reflected by the three different analytical methods) that will influence actual inflows into the pits. As shown in Figure 11-5 inflow is expected to be in the range of approximately 20 to 180 gpm in Mine Area 1 and 30 to 200 gpm in Mine Area 2.

These estimated inflows are relatively small for a large open pit mine. The low permeability of the units comprising the pit slopes limits the amount of inflow that will occur. Observed inflows to the pits may be smaller than those calculated due to evaporation of inflow as it enters the pit.

It is possible that inflows higher than these ranges could be experienced if permeable faults or fractures are encountered during pit excavation. Such permeable features were not detected in the mine areas during the hydrogeological characterization program but cannot be ruled out. It is likely that if such features are encountered during excavation, they would contribute higher inflows over several days to weeks and then flows would decrease as these features drain.

11.11.2 Inflow from Underground Workings

The proposed bottom of the excavation in Mine Area 1 will be at an elevation of about 605 feet. The open pit excavation will intersect the old underground workings of the Premier Mine based on the mapped location of these workings (see Part C, Chapter XII). Information obtained from monitoring wells penetrating the old workings indicates that they are saturated up to approximately elevation 710 feet or about 100 feet above the base of the proposed pit (see Part C, Chapter IV). Therefore, dewatering of the old workings will be conducted before the open pit penetrates below elevation 710 feet to avoid sudden inrushes of water from the old workings into the pit.

A pump test conducted in well H89-29 (see Part C, Chapter IV) indicates that the saturated mine voids behave like a reservoir rather than a porous media. The volume of water contained in the old mine voids was estimated by taking the approximate area of the underground mine perpendicular to dip of the coal (13.6 acres) times the estimated thickness of the unit mined (10 ft) times an estimated extraction ratio of 50%. The entire area of the underground workings on both sides of Moose Creek was considered to be interconnected based on the similarity in water levels in the old workings on either side of Moose Creek measured in H89-29 and H89-30 (see Part C, Chapter IV). The location and area at the old workings was taken from the map contained in Part C, Chapter XII. The resulting water volume contained in the workings from elevation 710 feet to elevation 600 feet is approximately 68 acre-ft. This water volume could be removed by pumping at a rate of 100 gpm for a period of about 150 days assuming no recharge to the old workings.

Groundwater recharge to the old underground workings would have to be pumped in addition to the water currently contained in the mine voids. Direct measurements of recharge to the old workings are not available. An indirect estimate of recharge to the portion of the old workings affected by pumping in well H89-30 is presented in Part C, Chapter IV. A recharge rate of approximately 5 gpm was indicated by the recovery rate in H89-30 after pumping was stopped. Barnes and Payne (1956) reported that in 1933, the removal of pillars in a weakened area of the Premier Mine caused flooding of the lower workings. The depth of the flooding was not reported. However, it is possible that dewatering of the old underground workings could require the pumping of large quantities of water if renewed flooding in the old workings above the 600 foot level occurs during proposed dewatering operations.

11.11.3 Mine Dewatering Requirements

Inflow to the open pits from glacial sediments and bedrock is expected to be relatively low as described in the preceding section. Much of this inflow will evaporate as it enters the pit and will therefore not require any special handling. Groundwater inflow and surface precipitation that does not evaporate will be collected in sumps and pumped out of the pit for use as process water.

It is possible that the pits may encounter localized zones of inflow that are higher than predicted in Section 11.11.1.3. Such zones in the bedrock could result from open fractures, faults or other features. Increased inflow from the glacial deposits could result from buried stream channels or other localized zones of increased permeability. In general, it is anticipated that higher inflows in such zones will decrease within several days to several weeks as the localized features drain. If sustained higher inflows are encountered, additional sumps in the pit, horizontal drains, or in extreme cases, dewatering wells may be needed to control inflow.

As described in Section 11.11.2 above, the pits in Mine Area 1 will encounter old underground workings from the Premier Mine. These workings are currently saturated to approximately elevation 710 feet, well above the bottom pit elevation of 605 feet.

Therefore, dewatering of the old workings will be required before excavating the western portion of Mine Area 1 below the 710 foot elevation. Dewatering of the old workings will be accomplished by wells completed into the mine voids. Groundwater will be pumped from the old workings and conveyed via a temporary pipeline along the mine road system to Freshwater Pond No. 1 where it will ultimately be used as process water.

11.11.4 Quality of Mine Inflow

The chemical quality of groundwater inflow to the open pit mines will be the same as that measured in bedrock and glacial monitoring wells. The average chemical content of mine water will reflect a combination of groundwater from glacial sediments and bedrock units. The chemical characteristics of groundwater inflow to the mine will be similar to the average characteristics provided in Table 4-1 in Part C, Chapter IV. The quality of mine inflow is anticipated to be sufficient for use as process water.

The quality of water in the flooded underground workings is represented by the data from wells H89-29 and 30 in Table 3-2, Part C, Chapter IV. It is very similar in chemical composition to other bedrock waters sampled in wells and is anticipated to be of sufficient quality for use as process water.

TABLES

TABLE 11-1

MAXIMUM AND MINIMUM INFILTRATION RATES

Pond	Surface Area (acres)	100 Yr Storm (acre-feet)	Minimum Rate(days)	Maximum Rate (hrs)
1	8	10.2	4.5	1
2	7	15.6	8	2
3	1	1.1	4	1
4	0.2	0.4	7	2
5	1.6	9.3	20.6	5
6	1.1	0.5	1.6	0.5
7	0.5	0.04	0.3	0.07

Rates based on maximum and minimum permeabilities as measured during field testing. Test results are contained in Appendix I. Test results indicate a maximum infiltration rate of 28.345 ft/day and a minimum infiltration rate of 0.28 ft/day.

TABLE 11-2

MAXIMUM PERMISSIBLE VELOCITIES FOR
DIVERSION DITCHES AND POND SPILLWAYS*

PART A - UNLINED CHANNELS

Material	Manning n	Clear Water Permissible Velocity (fps)
Fine sand, colloidal	0.020	1.50
Sandy loam, noncolloidal	0.020	1.75
Silt loam, noncolloidal	0.020	2.00
Alluvial silts, noncolloidal	0.020	2.00
Ordinary firm loam	0.020	2.50
Stiff clay, very colloidal	0.025	3.75
Alluvial silts, collodial	0.025	3.75
Shales and hardpans	0.025	6.00
Fine gravel	0.020	2.50
Graded loam to cobbles when noncolloidal	0.030	3.75
Graded silts to cobbles when colloidal	0.030	4.00
Coarse gravel, noncolloidal	0.025	4.00
Cobbles and shingles	0.035	5.00

TABLE 11-2 (CON'T)

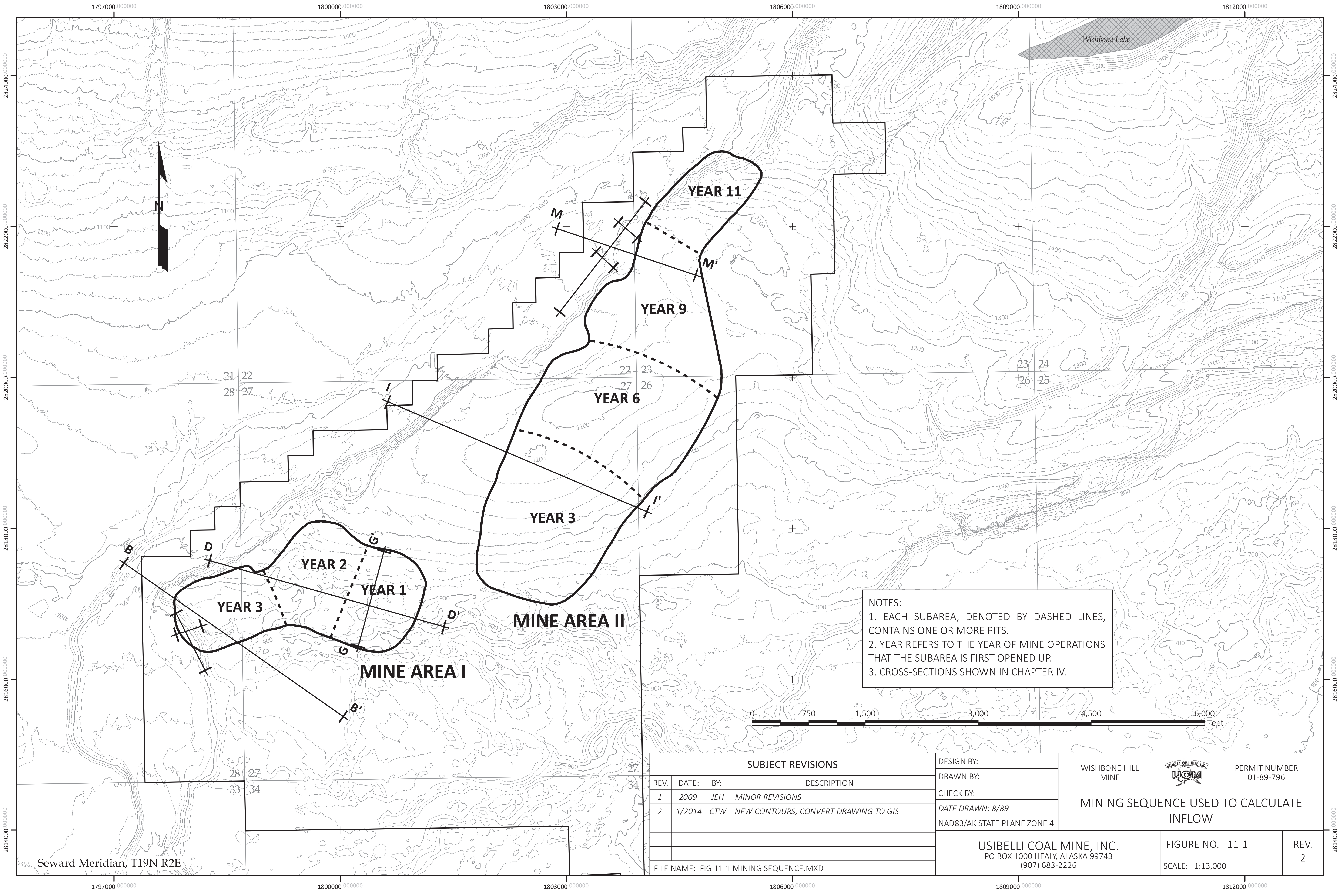
MAXIMUM PERMISSIBLE VELOCITIES FOR DIVERSION DITCHES AND POND SPILLWAYS*

PART B - VEGETATION-LINED CHANNELS

Cover	Slope Range %	Permissible Velocity, fps: Erosion-Resistant Soils	Permissible Velocity, fps: Easily eroded Soils
Bermuda grass	0-5	8	6
	5-10	7	5
	>10	6	4
Buffalo grass, Kentucky bluegrass, smooth brome, blue grama	0-5	7	5
	5-10	6	4
	>10	5	3
Grass mixture	0-5	5	4
	5-10	4	3
	Do not use on slopes steeper than 10%		
Lespedeza sericea, weeping love grass, ischaemum (yellow bluestem), kudzu, alfalfa, crabgrass	0-5	3.5	2.5
	Do not use on slopes steeper than 5% except for side slopes in a combination channel		
Annuals - used on mild slopes or as temporary protection until permanent covers are established, common lespedeza, Sudan grass	0-5	3.5	2.5
	Use on slopes steeper than 5% is not recommended		

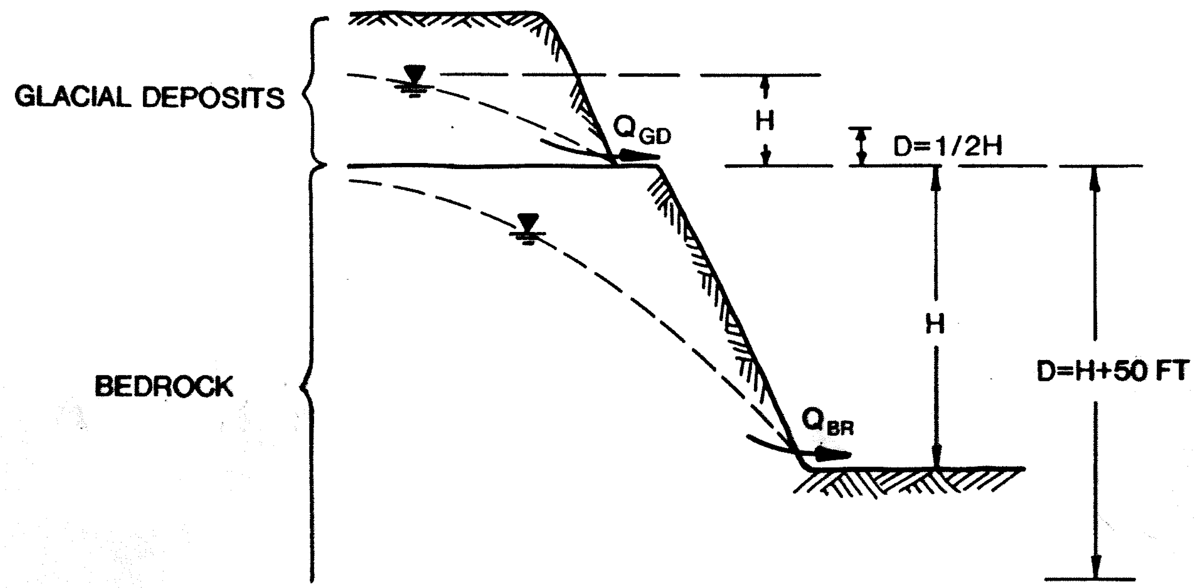
*<u>Reference</u> - Chow, V.T.: "Open-channel Hydraulics," McGraw Hill Book Company, Inc., N.Y., 1959

FIGURES



Wishbone Lake
N
YEAR 11
YEAR 9
YEAR 6
YEAR 3
YEAR 2
YEAR 1
YEAR 3
MINE AREA I
MINE AREA II
M
M'
I
I'
B
B'
D
D'
G
G'
NOTES:
1. EACH SUBAREA, DENOTED BY DASHED LINES, CONTAINS ONE OR MORE PITS.
2. YEAR REFERS TO THE YEAR OF MINE OPERATIONS THAT THE SUBAREA IS FIRST OPENED UP.
3. CROSS-SECTIONS SHOWN IN CHAPTER IV.
0 750 1,500 3,000 4,500 6,000 Feet
Seward Meridian, T19N R2E
SUBJECT REVISIONS
REV. DATE: BY: DESCRIPTION
1 2009 JEH MINOR REVISIONS
2 1/2014 CTW NEW CONTOURS, CONVERT DRAWING TO GIS
FILE NAME: FIG 11-1 MINING SEQUENCE.MXD
DESIGN BY:
DRAWN BY:
CHECK BY:
DATE DRAWN: 8/89
NAD83/AK STATE PLANE ZONE 4
WISHBONE HILL MINE
PERMIT NUMBER 01-89-796
MINING SEQUENCE USED TO CALCULATE INFLOW
USIBELLI COAL MINE, INC.
PO BOX 1000 HEALY, ALASKA 99743
(907) 683-2226
FIGURE NO. 11-1
SCALE: 1:13,000
REV. 2

TYPICAL SECTION THROUGH PIT WALL

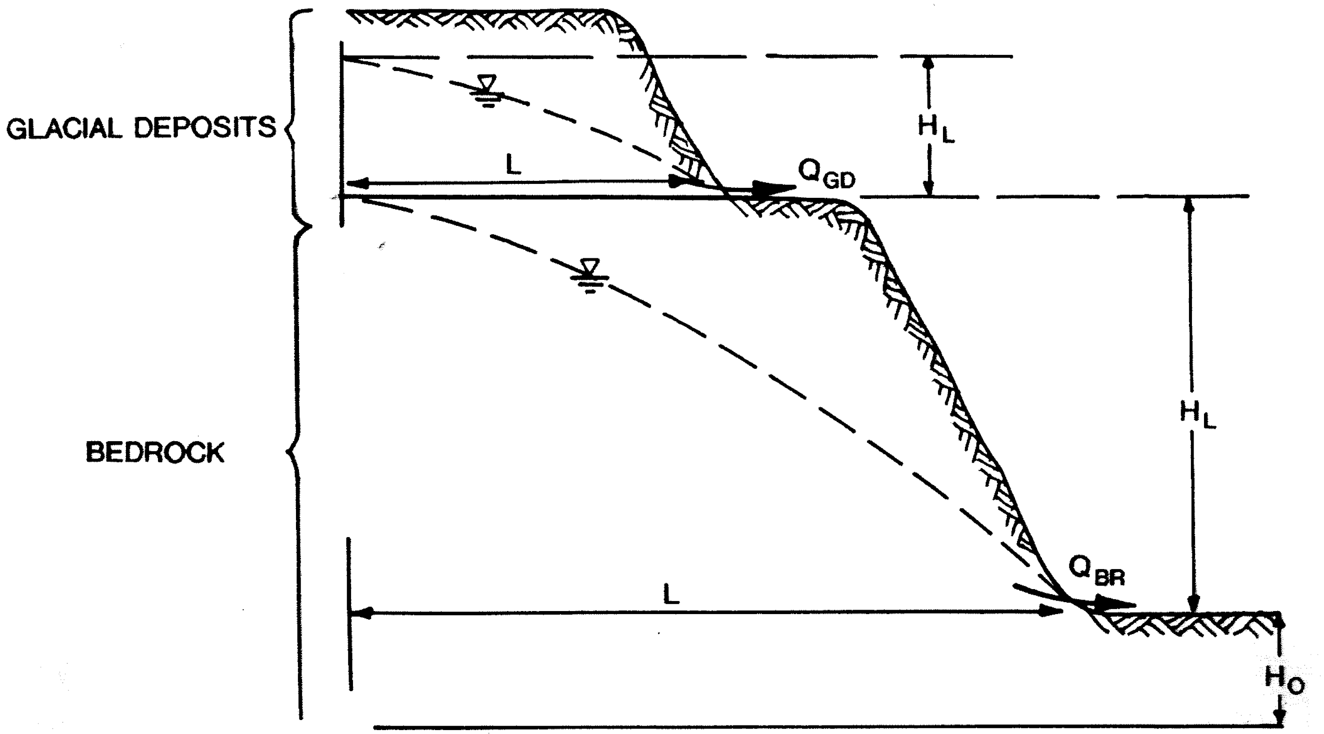


$$Q_{GD,BR} = \frac{2H\ KD}{\sqrt{\frac{4\pi KDt}{S}}} \qquad Q_T = Q_{GD}(W_{GD}) + Q_{BR}(W_{BR})$$

H= DRAWNDOWN AT PIT [L]
D= ASSUMED EFFECTIVE THICKNESS OF AQUIFER [L]
K= HYDRAULIC CONDUCTIVITY [L/T]
S= STORAGE COEFFICIENT
t= ELAPSED TIME SINCE PIT FIRST OPENED [T]
W_{GD}= LENGTH OF GLACIAL TILL PIT WALL [L]
W_{BR}= LENGTH OF BEDROCK FORMATION PIT WALL [L]
Q_{GD}= INFLOW PER UNIT LENGTH FROM GLACIAL TILL [L^3/T/L]
Q_{BR} = INFLOW PER UNIT LENGTH FROM BEDROCK [L^3/T/L]
Q_T = TOTAL PIT INFLOW [L^3/T]

DESIGN BY:	CONCEPTUAL MODEL TO APPLY TRANSIENT 1-DIMENSIONAL SOLUTION FOR PIT INFLOW	WISHBONE HILL MINE	PERMIT No. 01-89-796
DRAWN BY:			
CHECK BY:			
DWG FILE:	USIBELLI COAL MINE, INC. P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226	FIGURE No. 11-2	REV. 0
DATE DRAWN: 8/89		SCALE:	

TYPICAL SECTION THROUGH PIT WALL



$$Q_{GD,BR} = \frac{K}{2L}\,(H_L^2 - H_O^2)$$

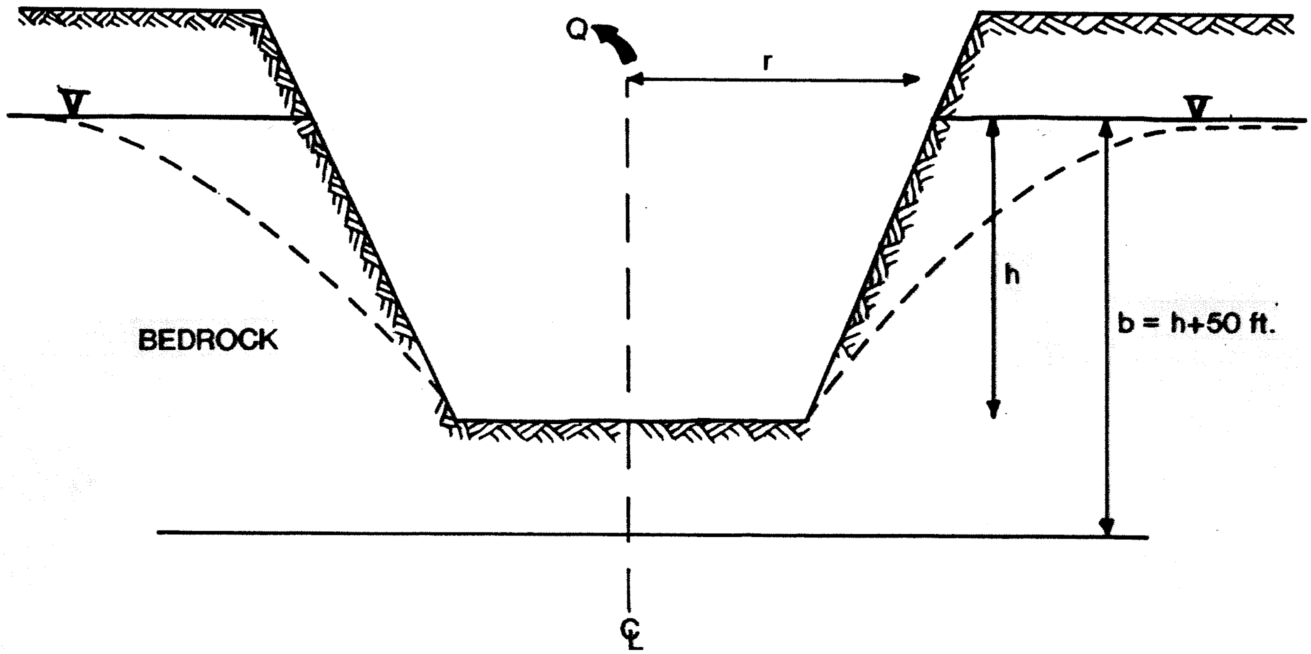
$$Q_T = Q_{GD}(W_{GD}) + Q_{BR}(W_{BR})$$

H_O = ASSUMED AQUIFER THICKNESS AT TOE OF PIT SLOPE [L]
H_L = ASSUMED AQUIFER THICKNESS AT DISTANCE L FROM PIT WALL [L]
L = DISTANCES FROM PIT WALL TO CONSTANT HEAD BOUNDARY
K = HYDRAULIC CONDUCTIVITY [L/T]
$Q_{GD,BR}$ = DISCHARGE PER UNIT LENGTH OF PIT [L^3/T/L]
Q_T = TOTAL FLOW INTO PIT [L^3/T]
W_{GD} = LENGTH OF GLACIAL DEPOSITS PIT WALL [L]
W_{BR} = LENGTH OF BEDROCK PIT WALL [L]

NOTE: FOR GLACIAL DEPOSITS H_O = 0, FOR BEDROCK H_O =50 FT

DESIGN BY: DRAWN BY: CHECK BY: DWG FILE:	CONCEPTUAL MODEL TO APPLY STEADY STATE 1–DIMENSIONAL SOLUTION FOR PIT FLOW	WISHBONE HILL MINE	PERMIT No. 01-89-796
DATE DRAWN: 8/89	USIBELLI COAL MINE, INC. P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226	FIGURE No. 11-3 SCALE:	REV. 0

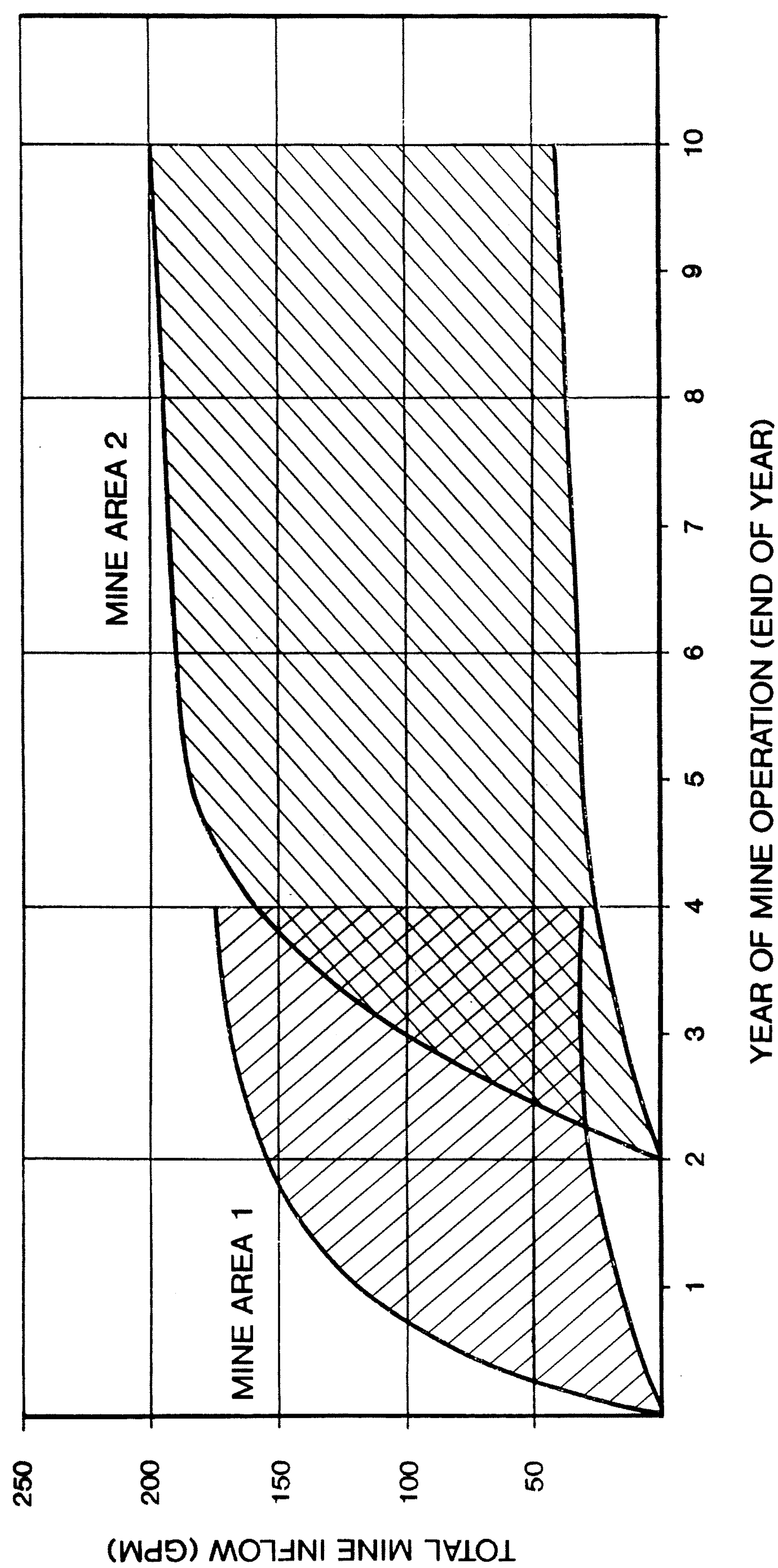
TYPICAL SECTION THROUGH MINE AREA



$$Q = \frac{4\pi Kbh}{W(u)} \qquad u = \frac{r^2 Ss}{4Kt}$$

r = EFFECTIVE RADIUS OF MINE AREA (L)
Ss = SPECIFIC STORAGE (1/L)
K = HYDRAULIC CONDUCTIVITY (L/T)
t = ELAPSED TIME FROM INITIAL PIT OPENING (T)
b = THICKNESS OF AQUIFER (L)
h = DRAWDOWN (L)
W(u) = WELL FUNCTION

DESIGN BY:	CONCEPTUAL MODEL TO APPLY TRANSIENT RADIAL SOLUTION FOR PIT FLOW	WISHBONE HILL MINE — PERMIT No. 01-89-796
DRAWN BY:		
CHECK BY:		
DWG FILE:	USIBELLI COAL MINE, INC. P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226	FIGURE No. 11-4 — REV. 0
DATE DRAWN: 8/89		SCALE:



DESIGN BY: DRAWN BY: CHECK BY:	ESTIMATED RANGE OF GROUNDWATER INFLOWS TO THE OPEN PITS	WISHBONE HILL MINE — PERMIT No. 01-89-796
DWG FILE: **DATE DRAWN:** 8/89	USIBELLI COAL MINE, INC. P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226	FIGURE No. 11-5 — REV. 0 SCALE: AS SHOWN

PLATES

NOTES:

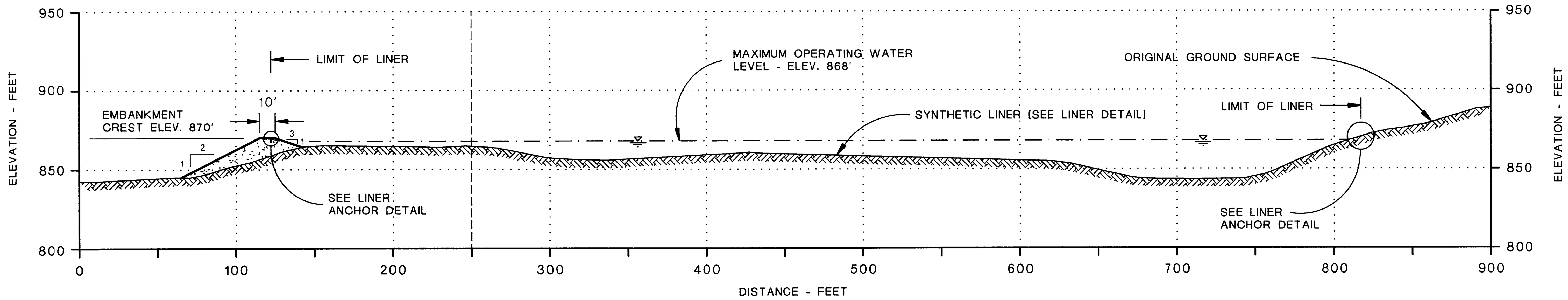
1. FOR FRESH WATER PONDS, CONTOURS SHOWN INDICATE ORIGINAL GROUND SURFACE PRIOR TO TOPSOIL STRIPPING, REGRADING AND LINER AND COVER INSTALLATION.
2. FOR SEDIMENT POND 2 AND SLURRY POND, CONTOURS INDICATE ORIGINAL GROUND SURFACE PRIOR TO STRIPPING.
3. AFTER STRIPPING FRESH WATER PONDS TO BE REGRADED WHERE APPROPRIATE TO NOT STEEPER THAN 3:1 FOR SYNTHETIC LINER INSTALLATION.
4. SEE PLATE 11-2 FOR POND SECTIONS C-C' & D-D'.
5. SEE PLATE 11-4 FOR MAXIMUM EMBANKMENT CROSS-SECTIONS.

50 25 0 50 100
SCALE IN FEET

SUBJECT REVISIONS			
REV.	DATE:	BY:	DESCRIPTION
A	8/89	RF	CHECK BY: JJ, APPROVED BY: IH
B	6/90	GM	CHECK BY: JJ, APPROVED BY: IH
1	2009	JEH	MINOR REVISIONS

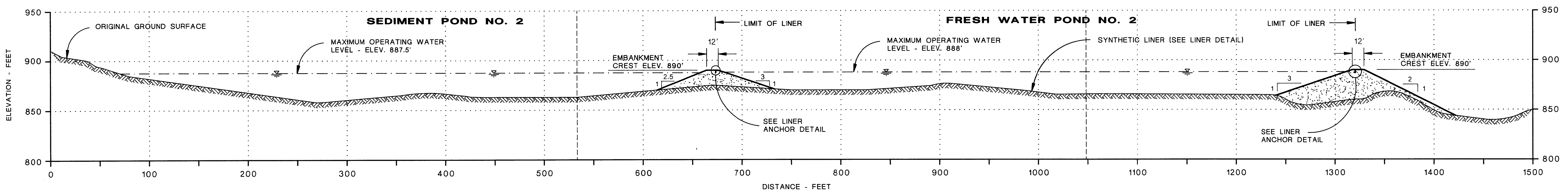
DESIGN BY:	WISHBONE HILL MINE — USIBELLI COAL MINE INC. UCM — PERMIT NUMBER 01-89-796
DRAWN BY: SRB	
CHECK BY:	FRESH WATER PONDS NO.S 1 & 2 AND EQUIPMENT POND NO. 2
DWG FILE:	
DATE DRAWN: 8/89	WISHBONE HILL MINE

USIBELLI COAL MINE, INC. P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226	PLATE No. 11-1 SHEET No. 1 OF 1	REV. 1



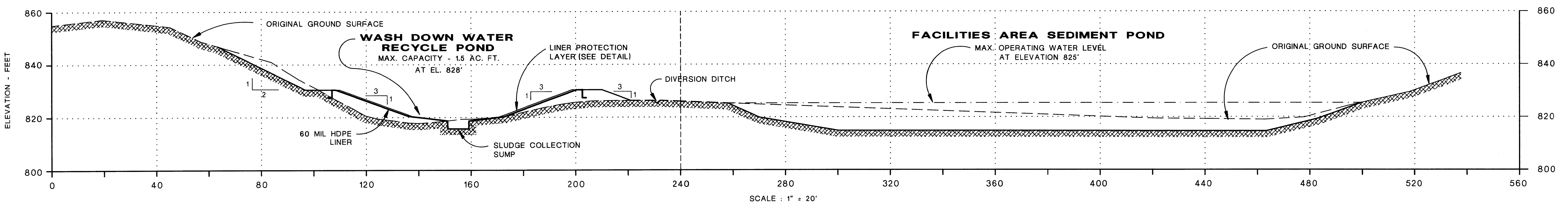
SECTION C-C'

FRESH WATER POND No. 1



SECTION D-D'

SEDIMENT POND No. 2 AND FRESH WATER POND No. 2



SECTION E-E'

WASH DOWN WATER RECYCLE POND AND FACILITIES AREA SEDIMENT POND

NOTES:

1. GROUND LEVEL SHOWN INDICATES ORIGINAL GROUND SURFACE PRIOR TO TOPSOIL STRIPPING, REGRADING OF SLOPES TO NOT STEEPER THAN 3:1, AND LINER AND LINER COVER INSTALLATION.
2. SEE PLATES 11-1 AND 11-7 FOR LOCATIONS OF POND SECTIONS.
3. SEE PLATE 11-4 FOR LINER DETAILS.

STATE OF ALASKA
49th
IAN P. G. HUTCHISON
CE-6817
REGISTERED PROFESSIONAL ENGINEER

SUBJECT REVISIONS			
REV.	DATE:	BY:	DESCRIPTION
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B	6/90	GM	CHECK BY: JJ, APPROVED BY: IH
1	2009	JEH	MINOR REVISIONS

DESIGN BY:

DRAWN BY: DB

CHECK BY:

DWG FILE:

DATE DRAWN: 8/89

WISHBONE HILL MINE

USIBELLI COAL MINE INC. UCM

PERMIT NUMBER 01-89-796

CROSS SECTIONS
FRESH WATER PONDS No's 1 & 2,
SEDIMENT POND No 2, AND
WASH DOWN WATER POND

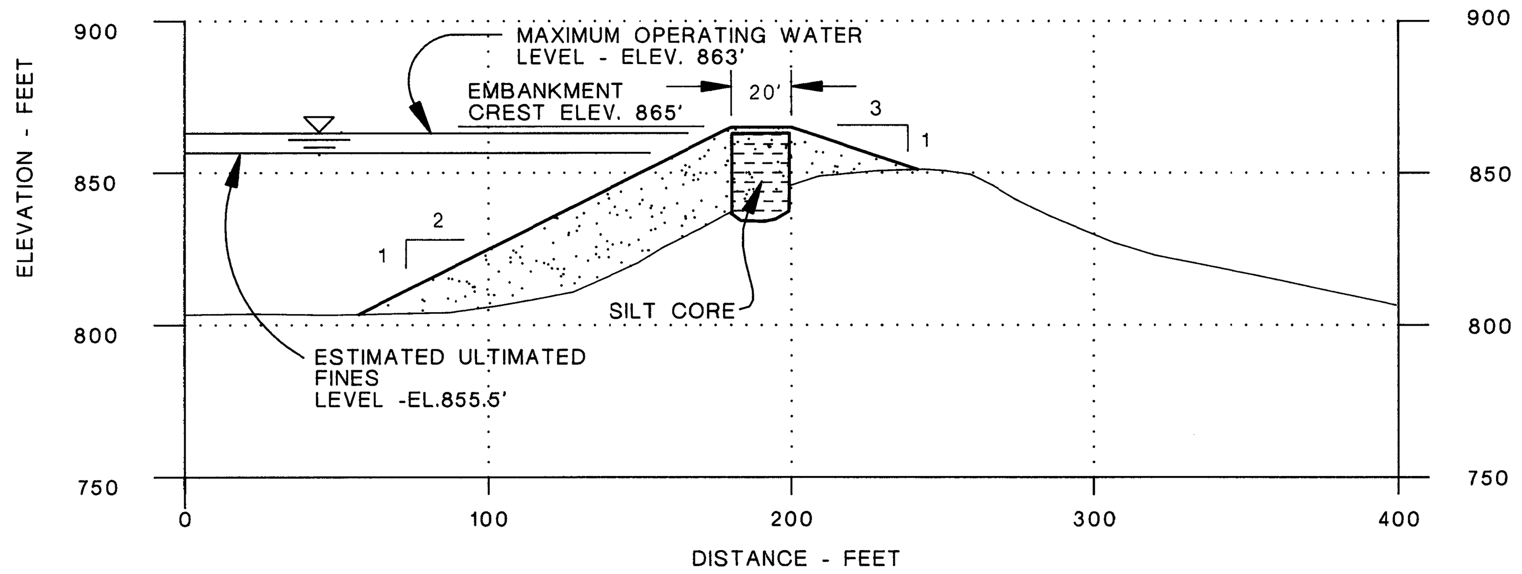
WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

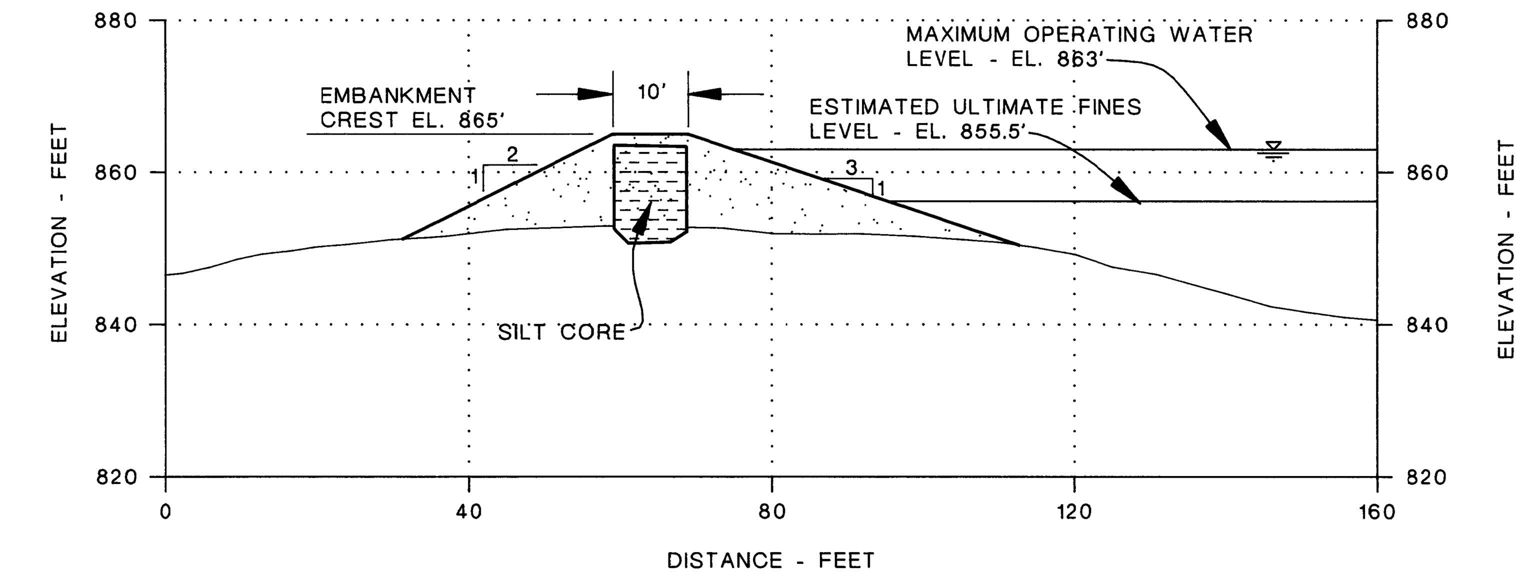
PLATE No. 11-2

SHEET No. 1 OF 1

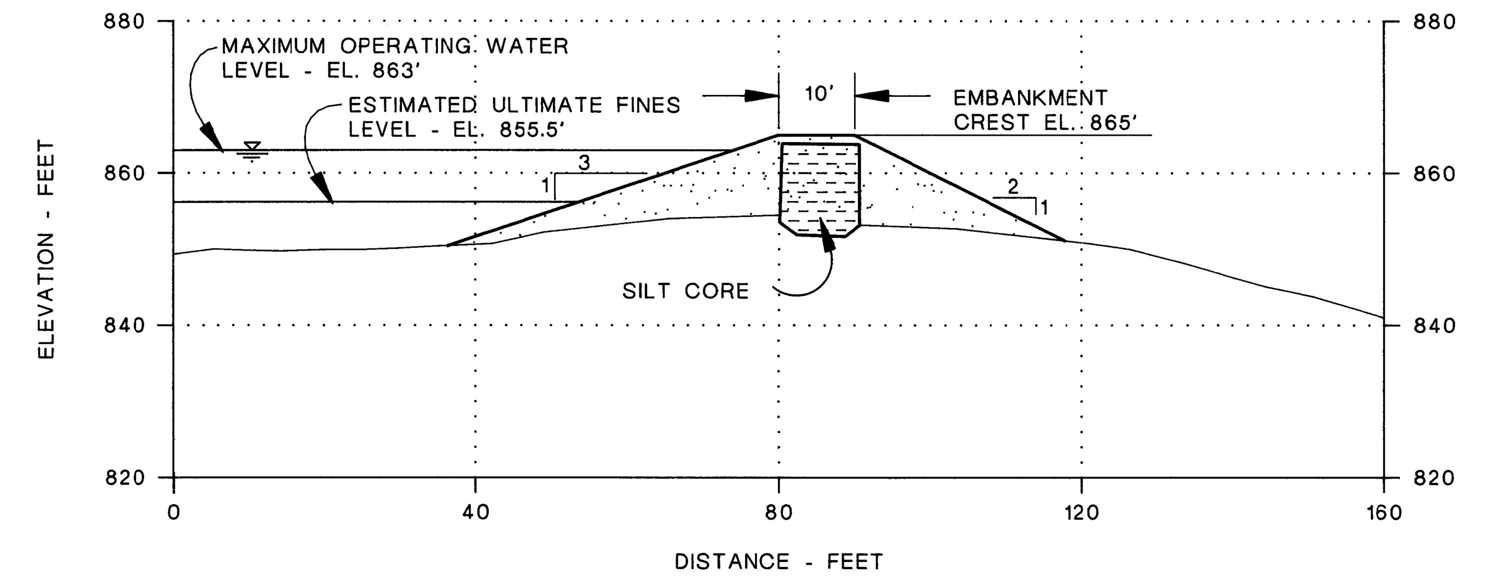
REV. 1



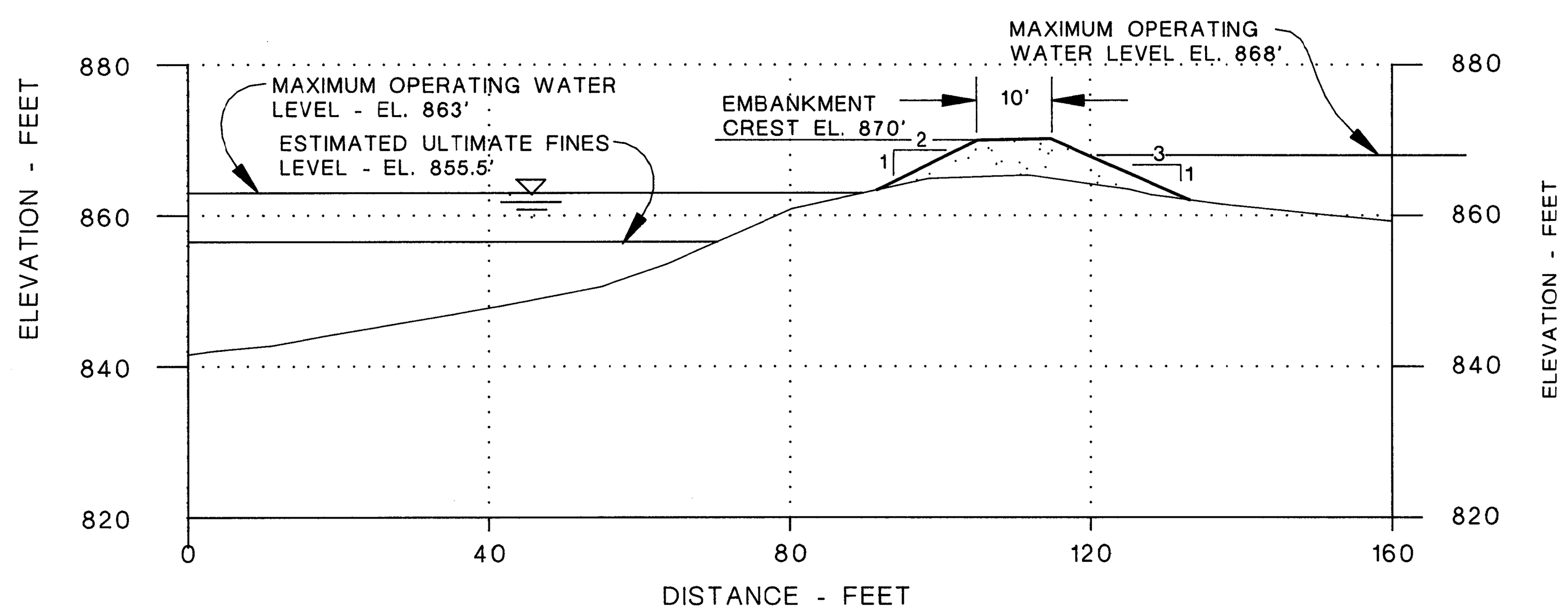
S1 - SLURRY POND



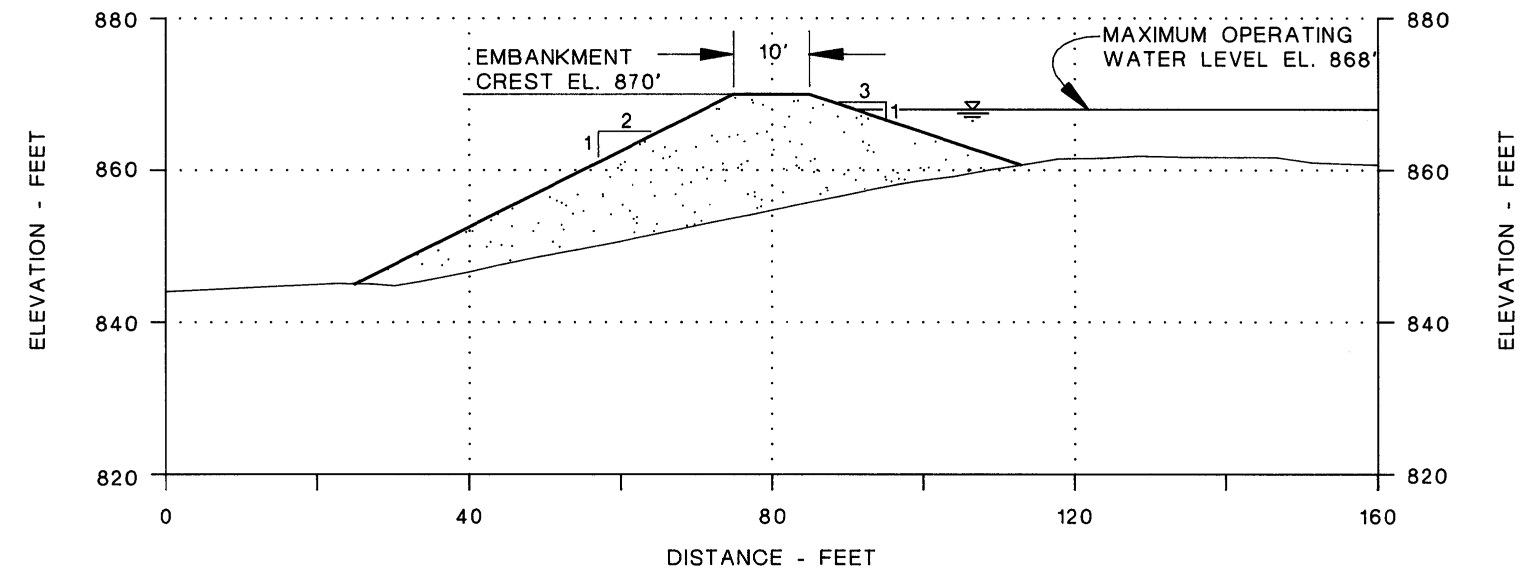
S2 - SLURRY POND



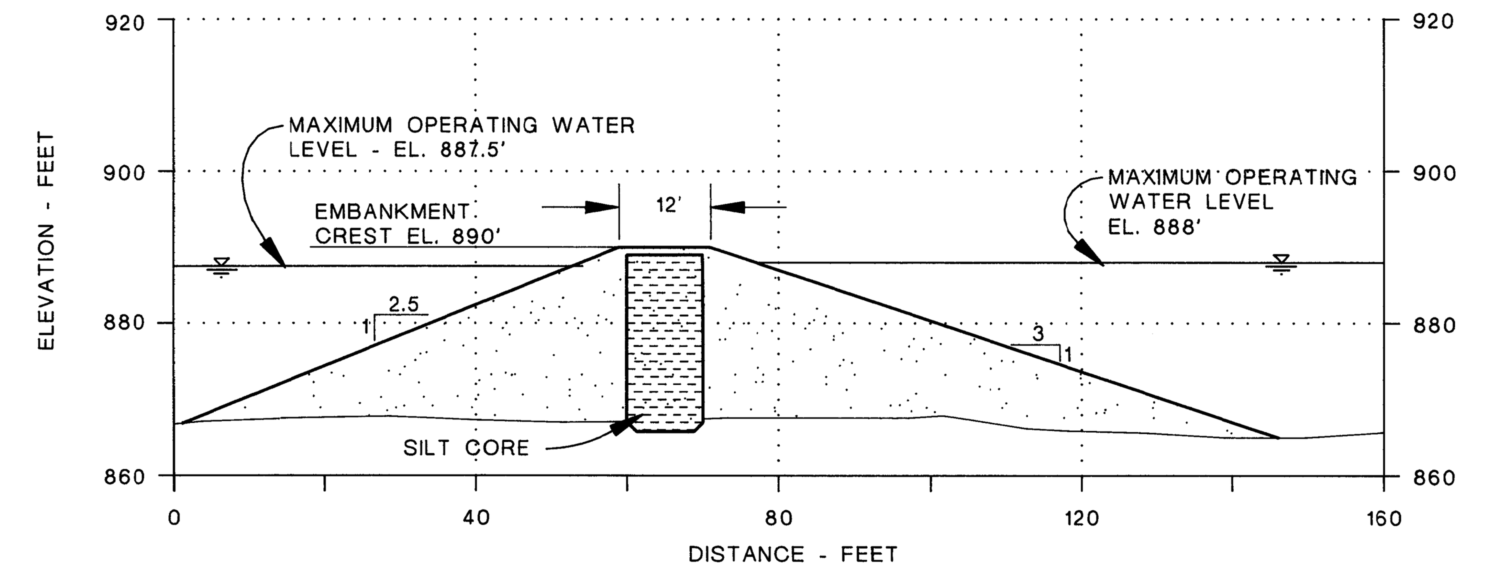
S3 - SLURRY POND



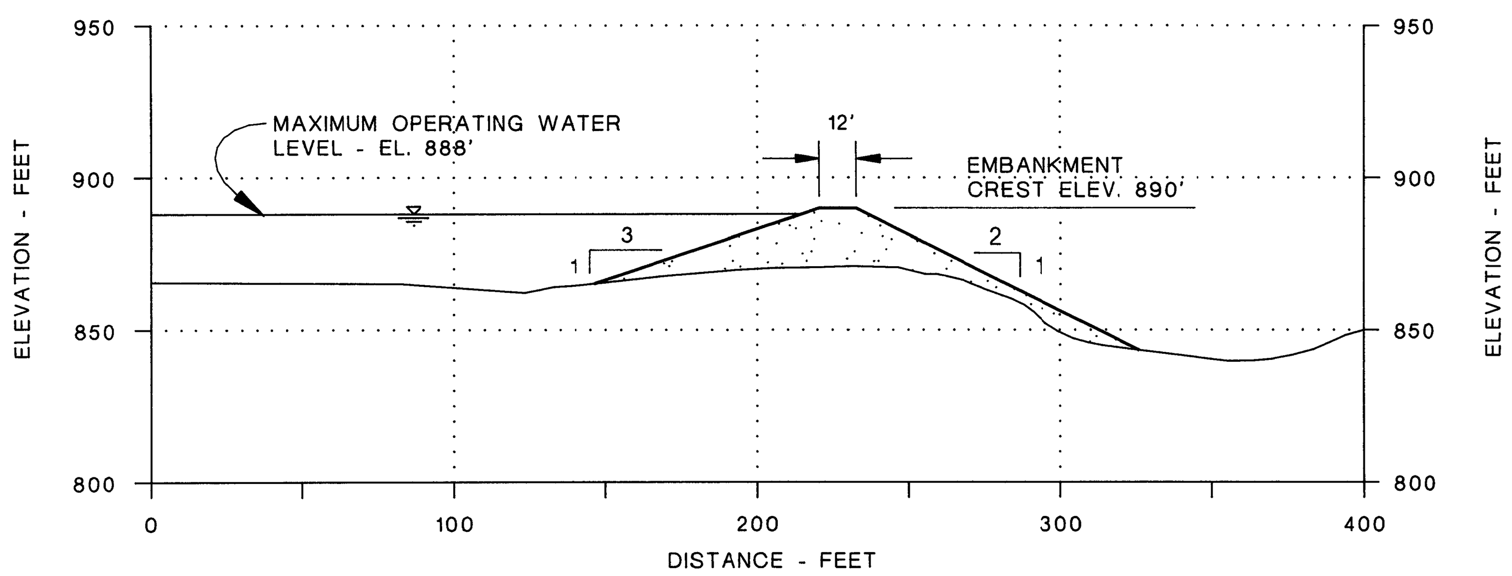
S4 - SLURRY POND AND FRESH WATER POND No. 1



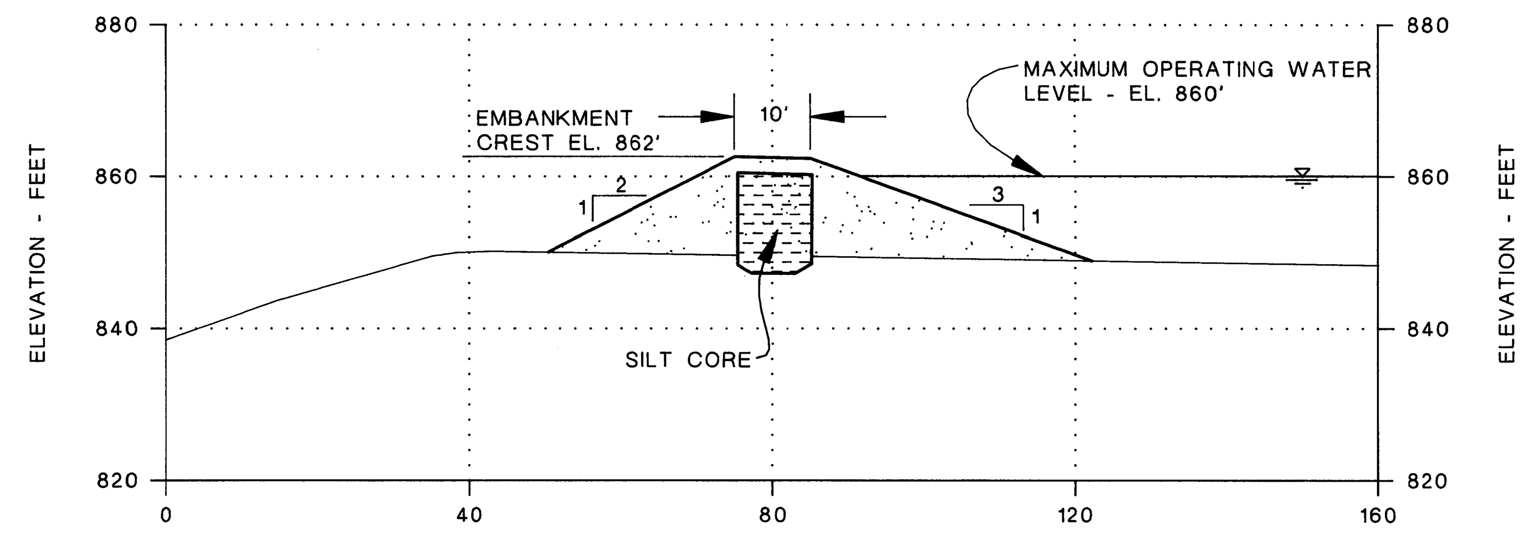
S5 - FRESH WATER POND No. 1



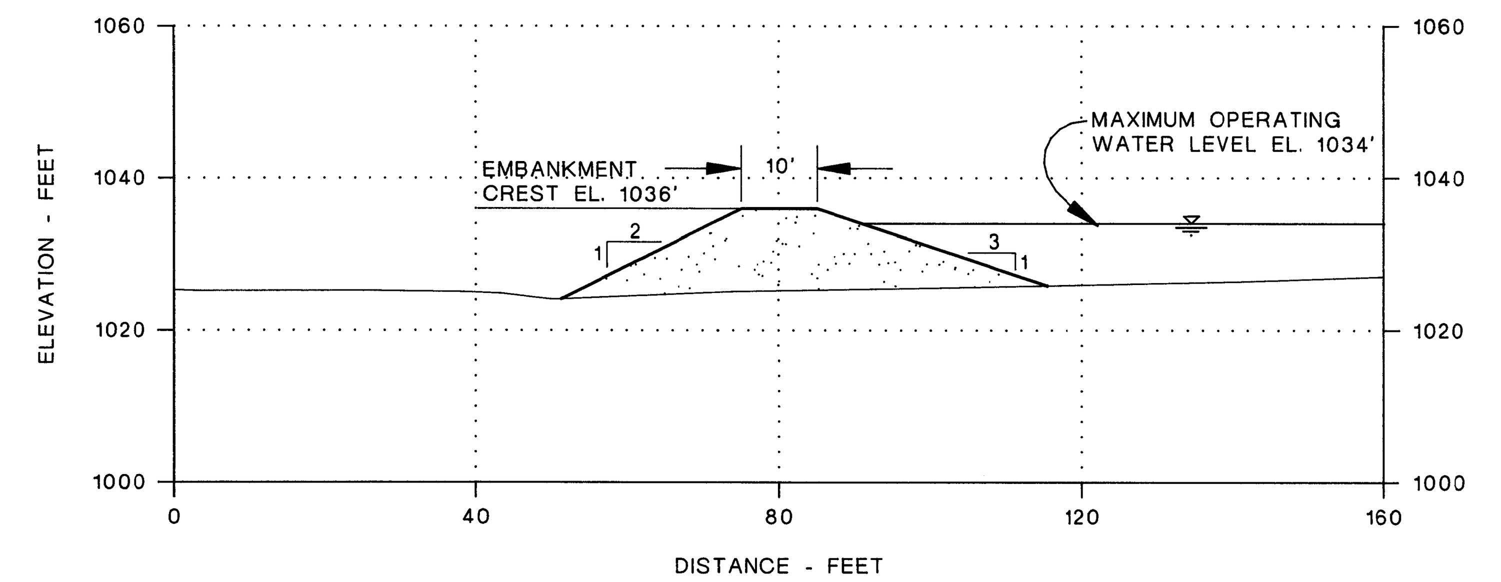
S6 - SEDIMENT POND No. 2 AND FRESH WATER POND No. 2



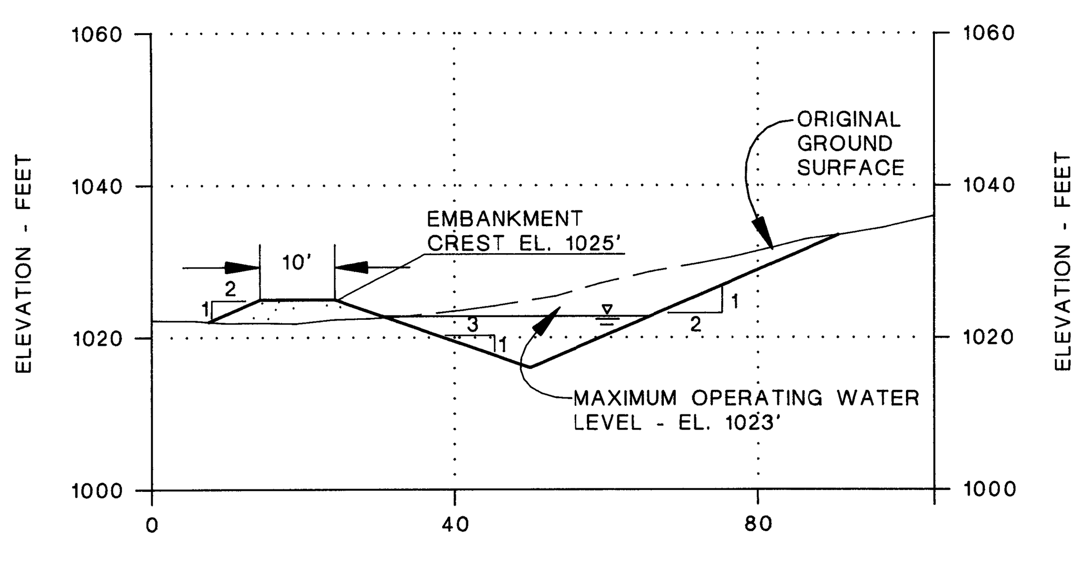
S7 - FRESH WATER POND No. 2



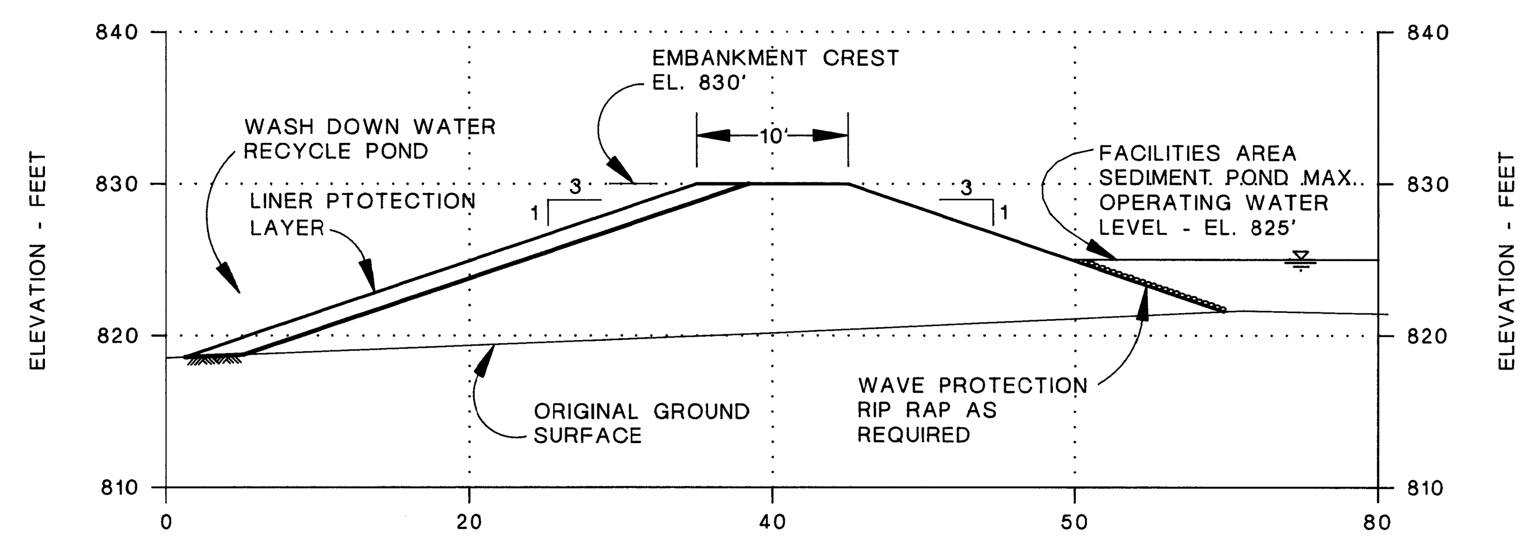
S8 - SEDIMENT POND No. 1



S9 - SEDIMENT POND No. 6

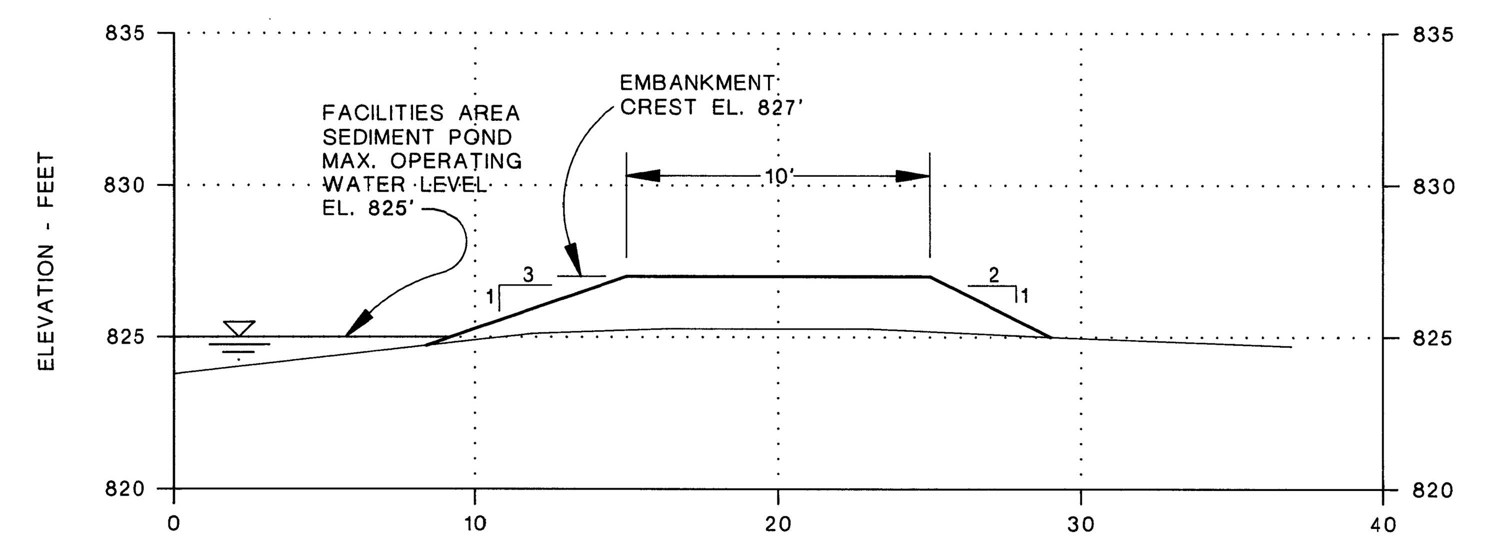


S10 - SEDIMENT POND No. 7



SCALE : 1" = 10'

S11 - WASH DOWN WATER RECYCLE POND AND FACILITIES AREA SEDIMENT POND



SCALE : 1" = 5'

S12 - FACILITIES AREA SEDIMENT POND EMBANKMENT

STATE OF ALASKA 49th IAN P. G. HUTCHISON CE-6817 REGISTERED PROFESSIONAL ENGINEER

NOTE:
REFER TO POND PLAN VIEW FOR SECTION LOCATION.

SUBJECT REVISIONS

REV.	DATE:	BY:	DESCRIPTION

DESIGN BY:
DRAWN BY:
CHECK BY:
DWG FILE:
DATE DRAWN:

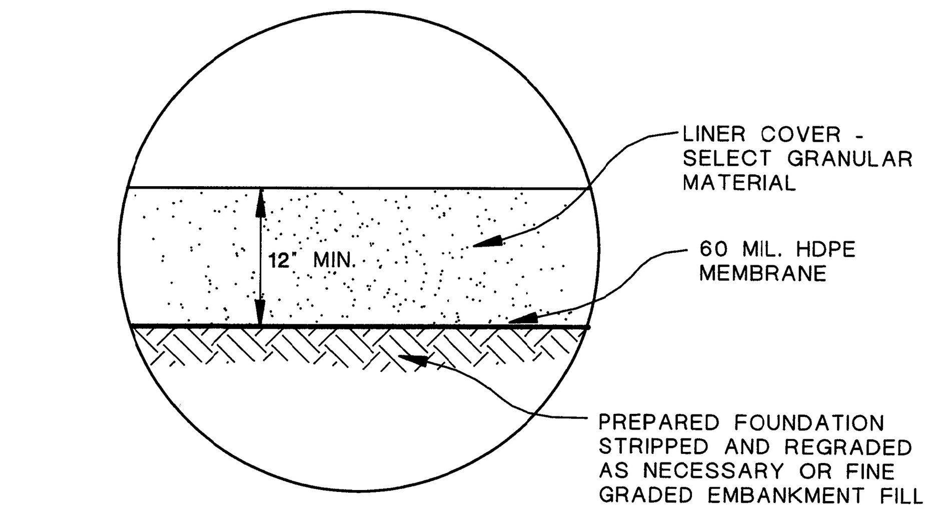
WISHBONE HILL MINE — UCM — PERMIT NUMBER 01-89-796

MAXIMUM EMBANKMENT CROSS-SECTION

WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

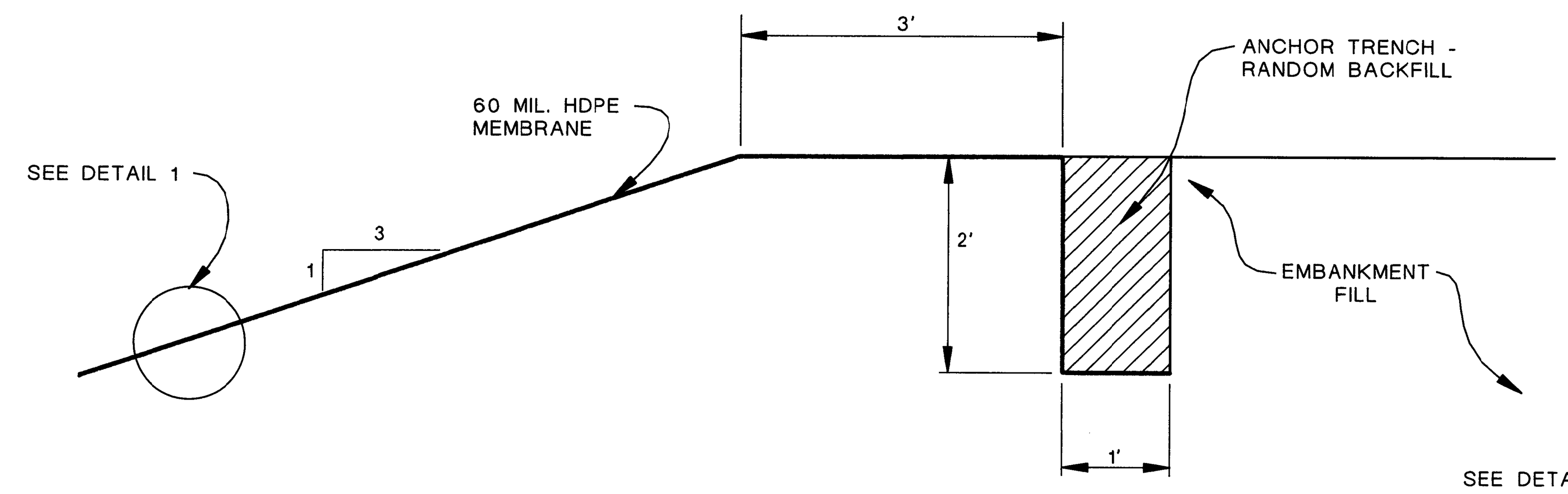
PLATE No. 11-3
SHEET No. 1 OF 1
REV. 1



DETAIL 1

SYNTHETIC LINER INSTALLATION DETAIL

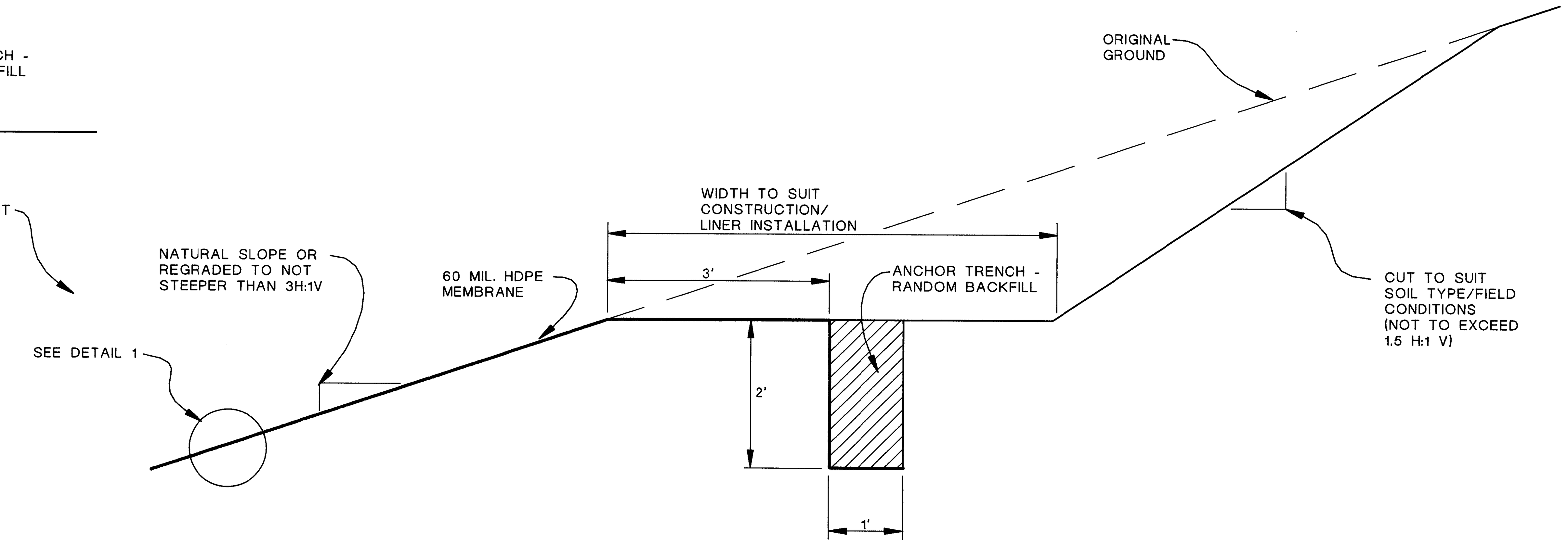
NOT TO SCALE



DETAIL 2

LINER ANCHOR DETAIL - EMBANKMENT CREST

NOT TO SCALE

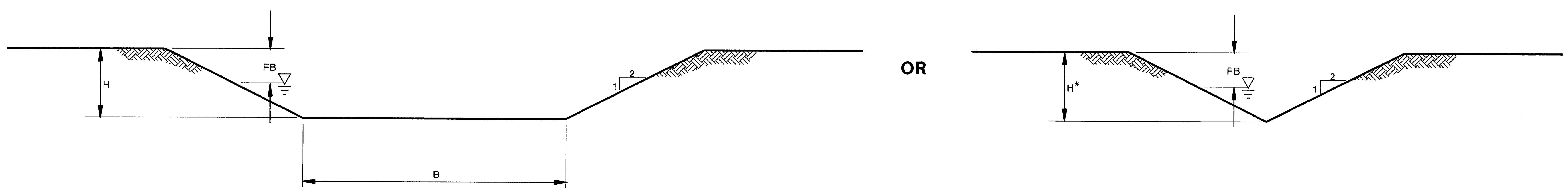


DETAIL 3

LINER ANCHOR DETAIL - POND PERIMETER

NOT TO SCALE

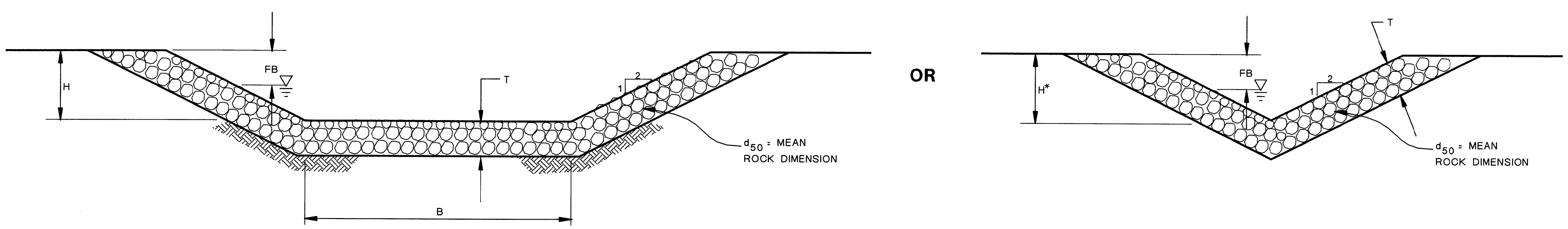
SEDIMENT CONTROL DITCH CROSS-SECTIONS



DETAIL 4

TYPICAL SECTION - DITCH WITHOUT RIPRAP

NOT TO SCALE



DETAIL 5

TYPICAL SECTION - DITCH WITH RIPRAP

NOT TO SCALE

DITCH TYPE	(B) BASE WIDTH (FT.)	(H) DITCH DEPTH (FT.)	(H)* DITCH DEPTH (FT.)	(F.B.) MIN. FREE-BOARD (FT.)	DESIGN FLOW (CFS)	FLOW VELOCITY (FPS)	FLOW VELOCITY* (FPS)	GRADIENT (%)	d_{50} RIPRAP (IN.)	(T) THICKNESS (IN.)	SECTION DETAIL
4	10	1.5	2.0	1	1-5	1-3	1-4	<8	NONE	NONE	DETAIL 4
5	10	1.1	1.8	1	1-5	3-5	5-7	12-16	6"	12"	DETAIL 5
6	10	1.7	3.2	1	16-24	3-4	3-5	<5	NONE	NONE	DETAIL 4
7	10	1.4	2.3	1	<24	<6	8	10	6"	12"	DETAIL 5

* VALUE FOR V-DITCH ALTERNATIVE

SUBJECT REVISIONS			
REV.	DATE:	BY:	DESCRIPTION
A	8/89	RF	CHECK BY: JJ, APPROVED BY: IH
B	6/90	GM	CHECK BY: JJ, APPROVED BY: IH
1	2009	JEH	MINOR REVISIONS

DESIGN BY:

DRAWN BY: SRB

CHECK BY: MMC

DWG FILE:

DATE DRAWN: 8/89

WISHBONE HILL MINE

USIBELLI COAL MINE INC. UCM

PERMIT NUMBER 01-89-796

MISCELLANEOUS POND & SEDIMENT CONTROL DITCH DETAILS

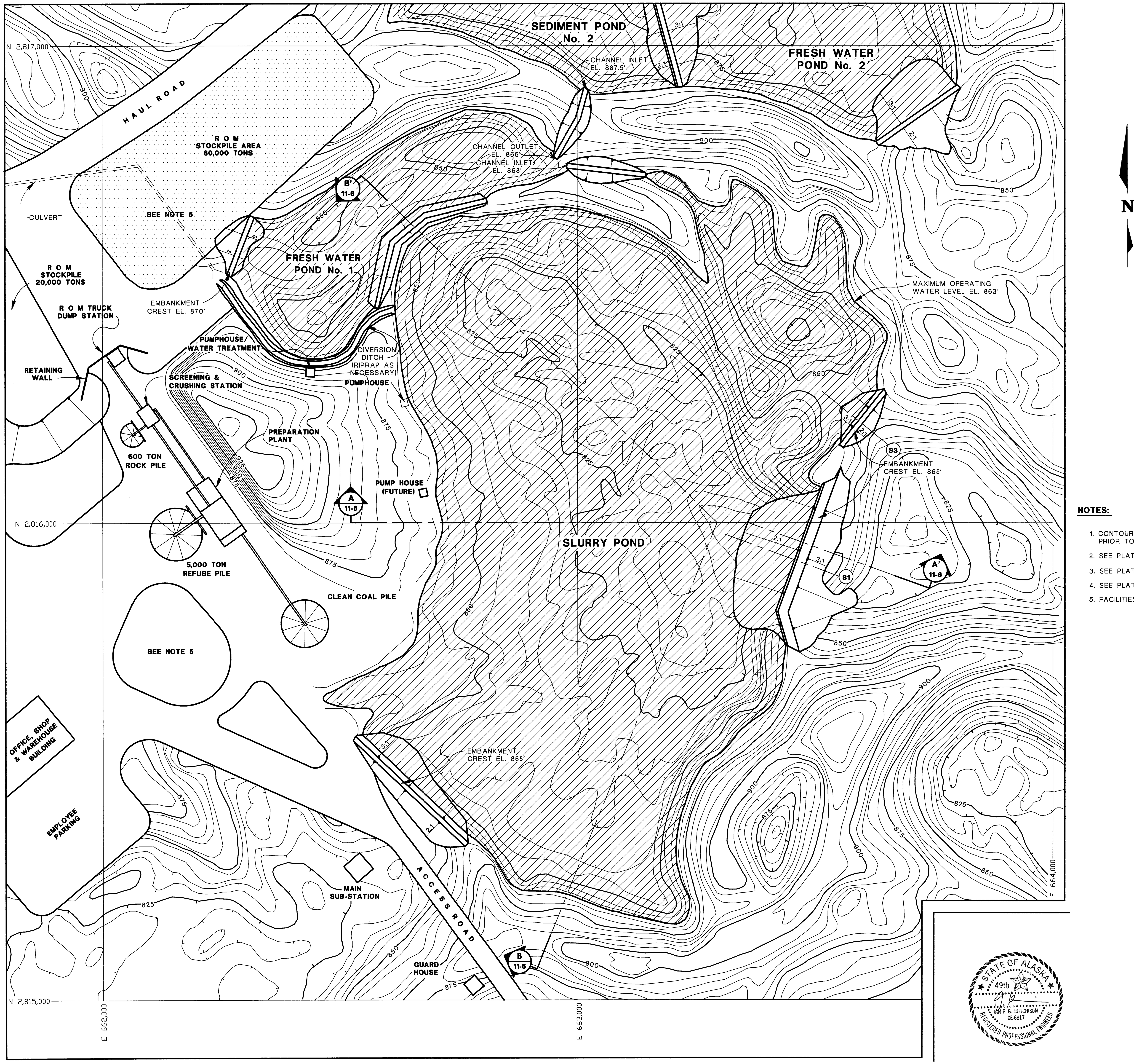
WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. 11-4

SHEET No. 1 OF 1

REV. 1



NOTES:

1. CONTOURS INDICATE ORIGINAL GROUND SURFACE PRIOR TO TOPSOIL STRIPPING.
2. SEE PLATE 11-1 FOR FRESH WATER POND AREA PLAN.
3. SEE PLATE 11-6 FOR POND SECTIONS A-A' AND B-B'.
4. SEE PLATE 11-3 FOR MAXIMUM EMBANKMENT CROSS-SECTIONS.
5. FACILITIES AREA LAYOUT PROVIDED BY ROBERTS & SCHAEFER CO.

100 50 0 100 200
SCALE IN FEET

STATE OF ALASKA 49th IAN P. G. HUTCHISON CE-6817 REGISTERED PROFESSIONAL ENGINEER

SUBJECT REVISIONS

REV.	DATE:	BY:	DESCRIPTION
A	8/89	RF	CHECK BY: JJ, APPRD BY: IA
B	6/90	GM	CHECK BY: JJ, APPRD BY: IA
1	2009	JEH	MINOR REVISIONS

DESIGN BY:
DRAWN BY: SRB
CHECK BY:
DWG FILE:
DATE DRAWN: 8/89

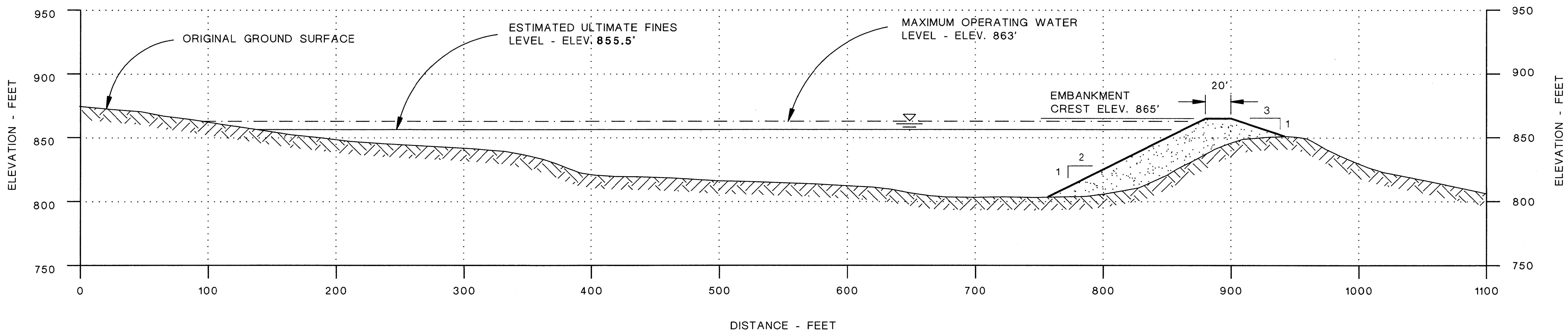
WISHBONE HILL MINE — PERMIT NUMBER 01-89-796

SLURRY POND

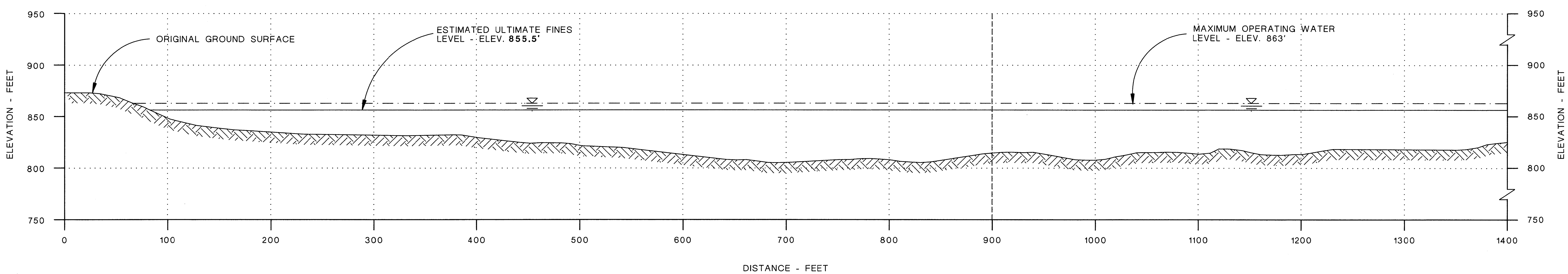
WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

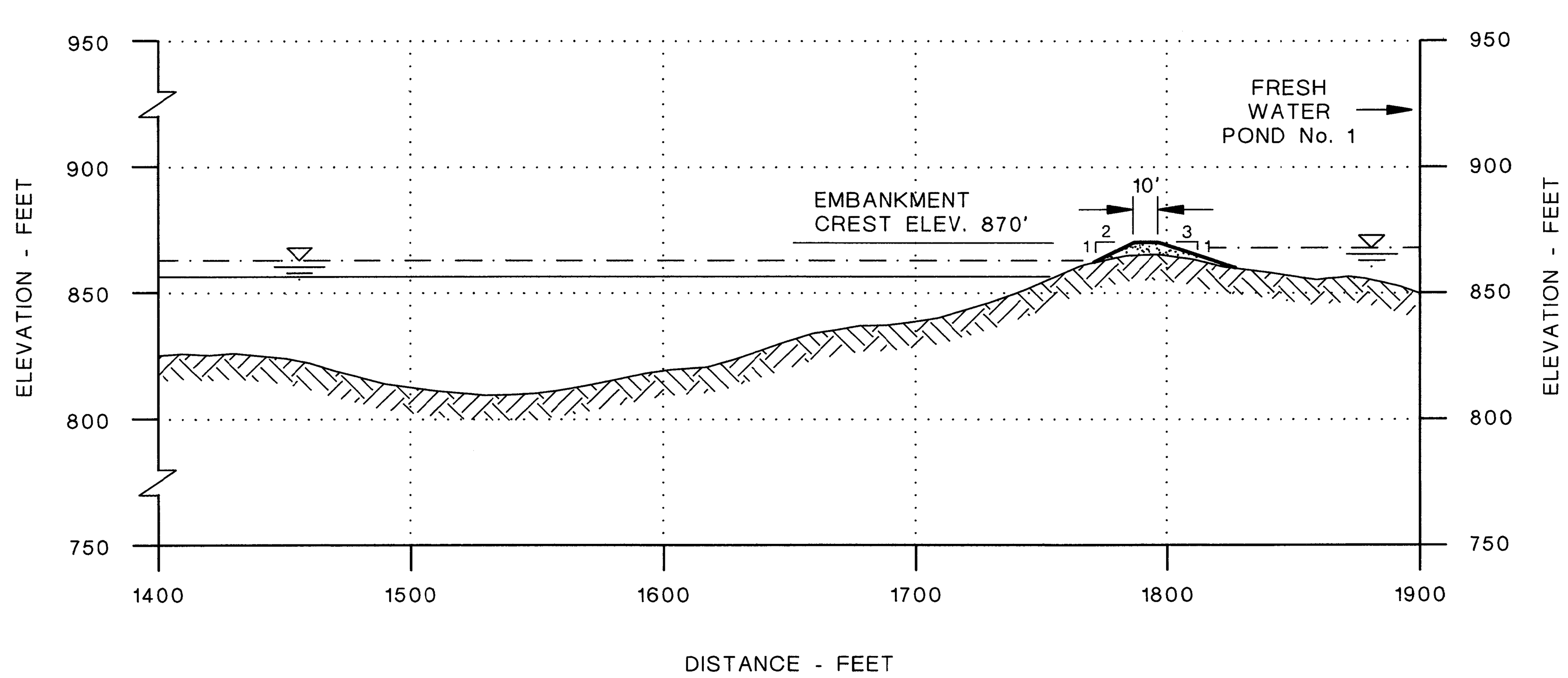
PLATE No. 11-5 | SHEET No. 1 OF 1 | REV. 1



SECTION A-A'



SECTION B-B'



SECTION B-B'

NOTES:

1. GROUND LEVEL SHOWN INDICATES ORIGINAL GROUND SURFACE PRIOR TO TOPSOIL STRIPPING.
2. SEE PLATE 11-5 FOR LOCATIONS OF POND SECTIONS.

STATE OF ALASKA
49th
IAN P. G. HUTCHISON
CE-6817
REGISTERED PROFESSIONAL ENGINEER

SUBJECT REVISIONS			
REV.	DATE:	BY:	DESCRIPTION
A	8/89	RF	CHECK BY: JJ, APPROVED BY: IH
1	2009	JEH	MINOR REVISIONS

DESIGN BY:

DRAWN BY: SRB

CHECK BY: MMC

DWG FILE:

DATE DRAWN: 8/89

WISHBONE HILL MINE

USIBELLI COAL MINE INC. UCM

PERMIT NUMBER 01-89-796

CROSS-SECTION SLURRY POND

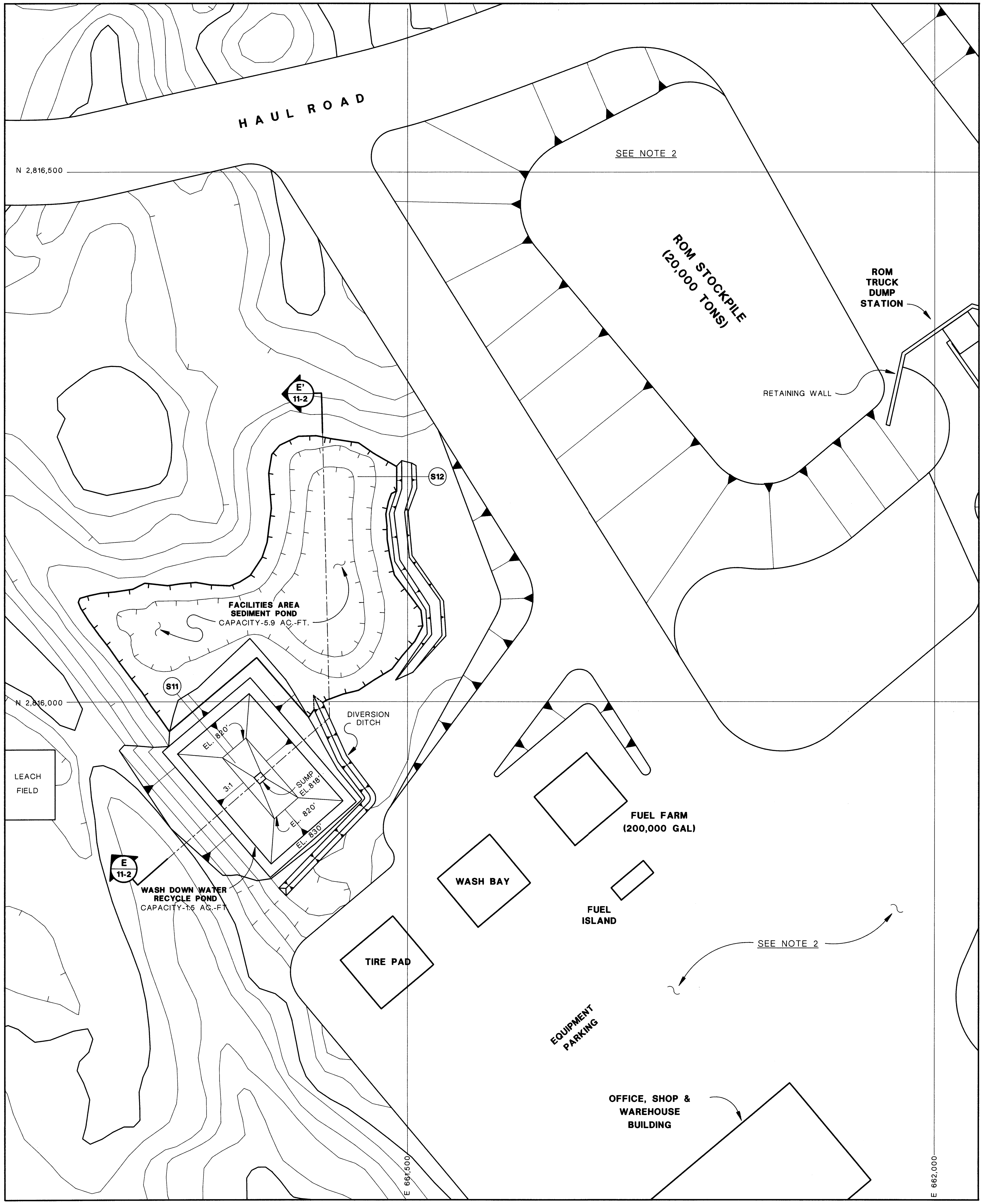
WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. 11-6

SHEET No. 1 OF 1

REV. 1



NOTES:

1. SEE PLATE 11-2 FOR POND SECTION E-E'
2. FACILITIES AREA LAYOUT PROVIDED BY ROBERTS & SCHAEFER COMPANY

N

50 25 0 50 100
SCALE IN FEET

STATE OF ALASKA
49th
IAN P. G. HUTCHISON
CE-6617
REGISTERED PROFESSIONAL ENGINEER

SUBJECT REVISIONS

REV.	DATE:	BY:	DESCRIPTION
A	8/89	RF	CHECK BY: JJ, APPROVED BY: IH
B	6/90	GM	CHECK BY: JJ, APPROVED BY: IH
1	2009	JEH	MINOR REVISIONS

DESIGN BY:

DRAWN BY: SRB

CHECK BY: MMC

DWG FILE:

DATE DRAWN: 8/89

WISHBONE HILL MINE

USIBELLI COAL MINE INC. UCM

PERMIT NUMBER 01-89-796

CROSS-SECTION
SLURRY POND

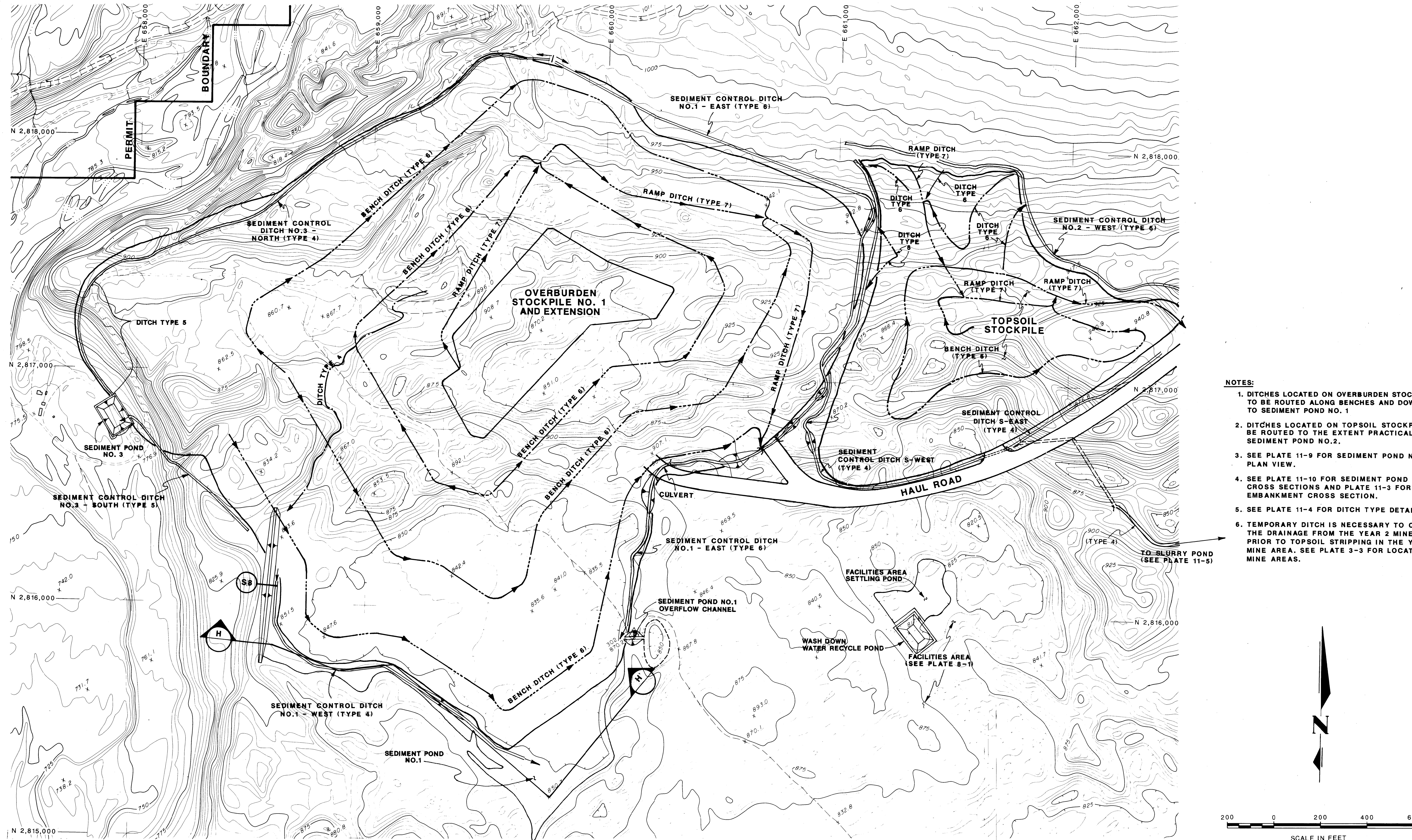
WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. 11-7

SHEET No. 1 OF 1

REV. 1



NOTES:

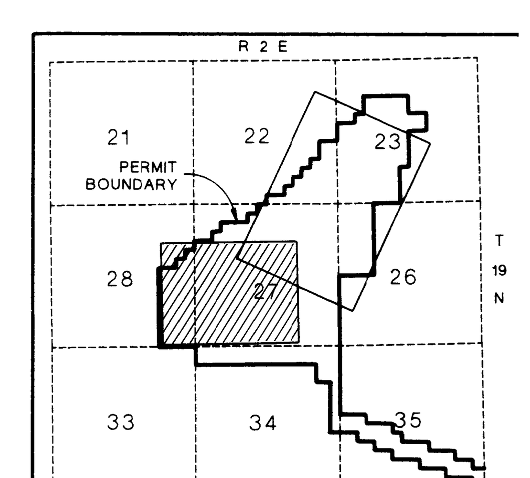
1. DITCHES LOCATED ON OVERBURDEN STOCKPILE TO BE ROUTED ALONG BENCHES AND DOWN RAMP TO SEDIMENT POND NO. 1
2. DITCHES LOCATED ON TOPSOIL STOCKPILE TO BE ROUTED TO THE EXTENT PRACTICAL TO SEDIMENT POND NO.2.
3. SEE PLATE 11-9 FOR SEDIMENT POND NO.1 PLAN VIEW.
4. SEE PLATE 11-10 FOR SEDIMENT POND NO.1 CROSS SECTIONS AND PLATE 11-3 FOR MAXIMUM EMBANKMENT CROSS SECTION.
5. SEE PLATE 11-4 FOR DITCH TYPE DETAILS.
6. TEMPORARY DITCH IS NECESSARY TO CONTROL THE DRAINAGE FROM THE YEAR 2 MINE AREA PRIOR TO TOPSOIL STRIPPING IN THE YEAR 3 MINE AREA. SEE PLATE 3-3 FOR LOCATION OF MINE AREAS.

LEGEND

TEMPORARY DITCH

DITCH LOCATED ON BENCH OR ACCESS RAMP AT OVERBURDEN OR TOPSOIL STOCKPILE (TEMPORARY)

PERMANENT PERIMETER DITCH



KEY MAP

SUBJECT REVISIONS			
REV.	DATE:	BY:	DESCRIPTION

DESIGN BY:	WISHBONE HILL MINE	USIBELLI COAL MINE INC. UCM	PERMIT NUMBER 01-89-796
DRAWN BY:			
CHECK BY:	MINE AREA 1 SEDIMENT CONTROL PLAN		
DWG FILE:			
DATE DRAWN:	WISHBONE HILL MINE		
USIBELLI COAL MINE, INC. P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226	PLATE No. 11-8	SHEET No. 1 OF 1	REV. 1

NOTES:

1. SEE PLATE 11-8 FOR SEDIMENT POND No. 1 OVERALL PLAN VIEW.
2. SEE PLATE 11-10 FOR SEDIMENT POND CROSS-SECTIONS.

STATE OF ALASKA 49th ... GARY E. HUTCHISON CE-8617 REGISTERED PROFESSIONAL ENGINEER

SUBJECT REVISIONS			
REV.	DATE:	BY:	DESCRIPTION
A	8/89	RF	CHECK BY: JJ, APPROVED BY: IH
1	2009	JEH	MINOR REVISIONS

DESIGN BY:

DRAWN BY: SRB

CHECK BY: MMC

DWG FILE:

DATE DRAWN: 8/89

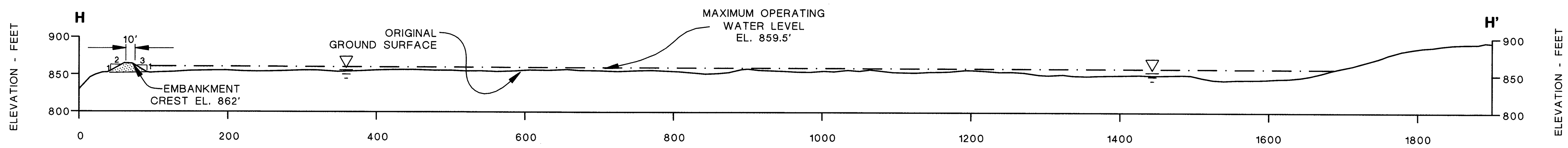
WISHBONE HILL MINE — USIBELLI COAL MINE INC. UCM — PERMIT NUMBER 01-89-796

SEDIMENT PONDS No's 1, 3 AND 4

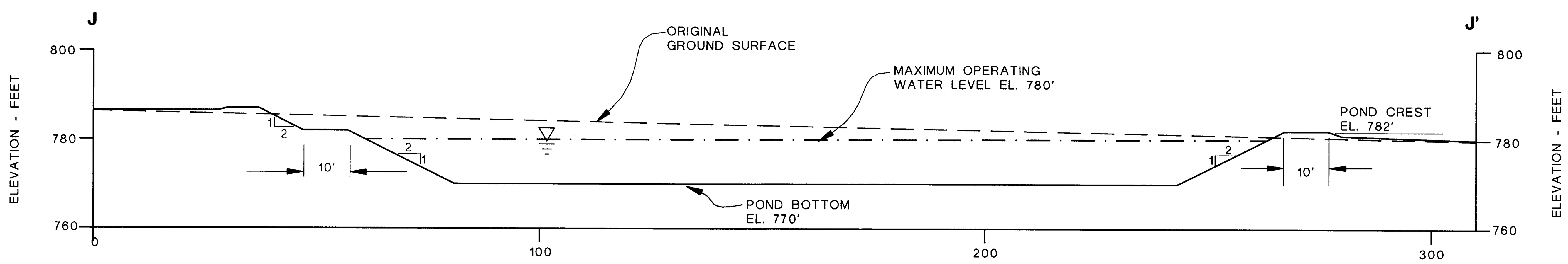
WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

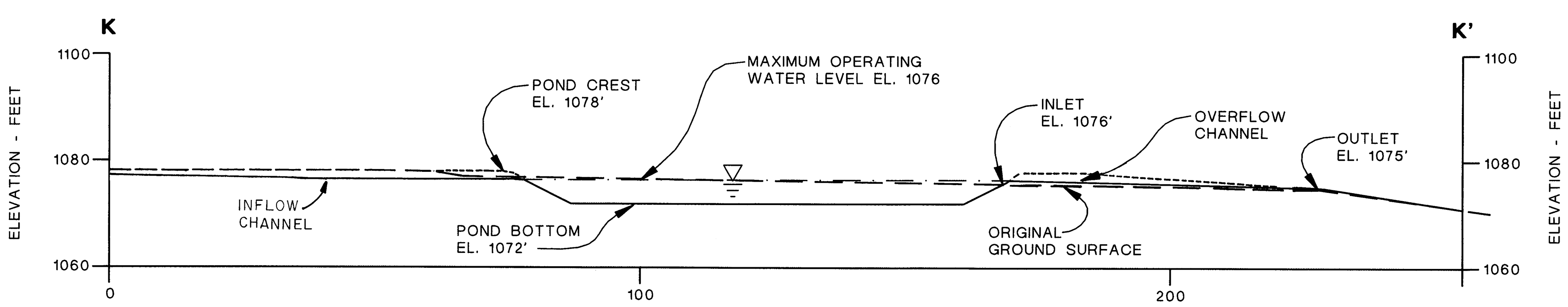
PLATE No. 11-9 | SHEET No. 1 OF 1 | REV. 1



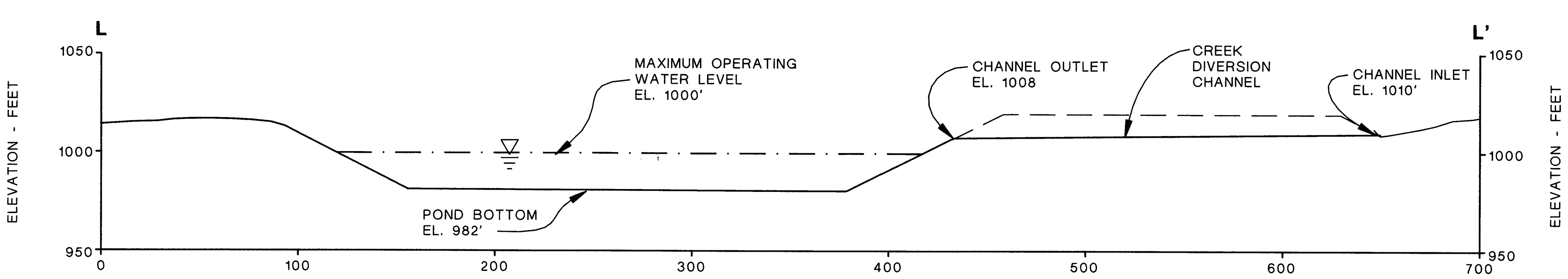
CROSS-SECTION H-H'
SEDIMENT POND No. 1



CROSS-SECTION J-J'
SEDIMENT POND No. 3



CROSS-SECTION K-K'
SEDIMENT POND No. 4



CROSS-SECTION L-L'
SEDIMENT POND No. 5

NOTES:

1. GROUND LEVEL SHOWN INDICATES ORIGINAL GROUND SURFACE PRIOR TO TOPSOIL STRIPPING.
2. SEE PLATES 11-9 AND 11-12 FOR CROSS-SECTION LOCATIONS.

STATE OF ALASKA
49th
IAN P. G. HUTCHISON
CE-6817
REGISTERED PROFESSIONAL ENGINEER

SUBJECT REVISIONS			
REV.	DATE:	BY:	DESCRIPTION
A	8/89	RF	CHECK BY: JJ, APPROVED BY: IH
1	2009	JEH	MINOR REVISIONS

DESIGN BY:
DRAWN BY: SRB
CHECK BY: MMC
DWG FILE:
DATE DRAWN: 8/89

WISHBONE HILL MINE
USIBELLI COAL MINE INC. UCM
PERMIT NUMBER 01-89-796

CROSS-SECTIONS
SEDIMENT PONDS No's
1, 3, 4 AND 5

WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

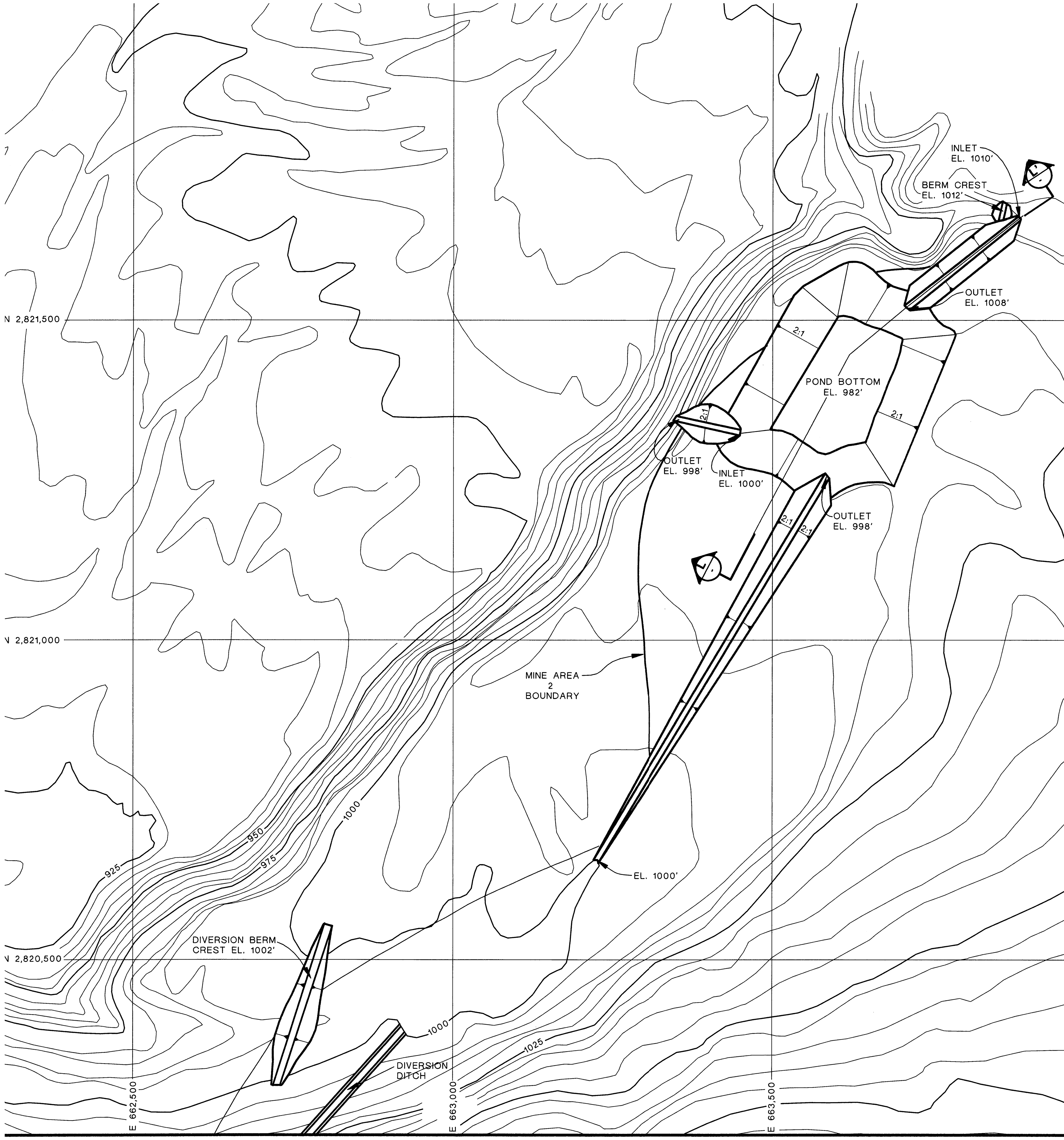
PLATE No. 11-10
SHEET No. 1 OF 1
REV. 1

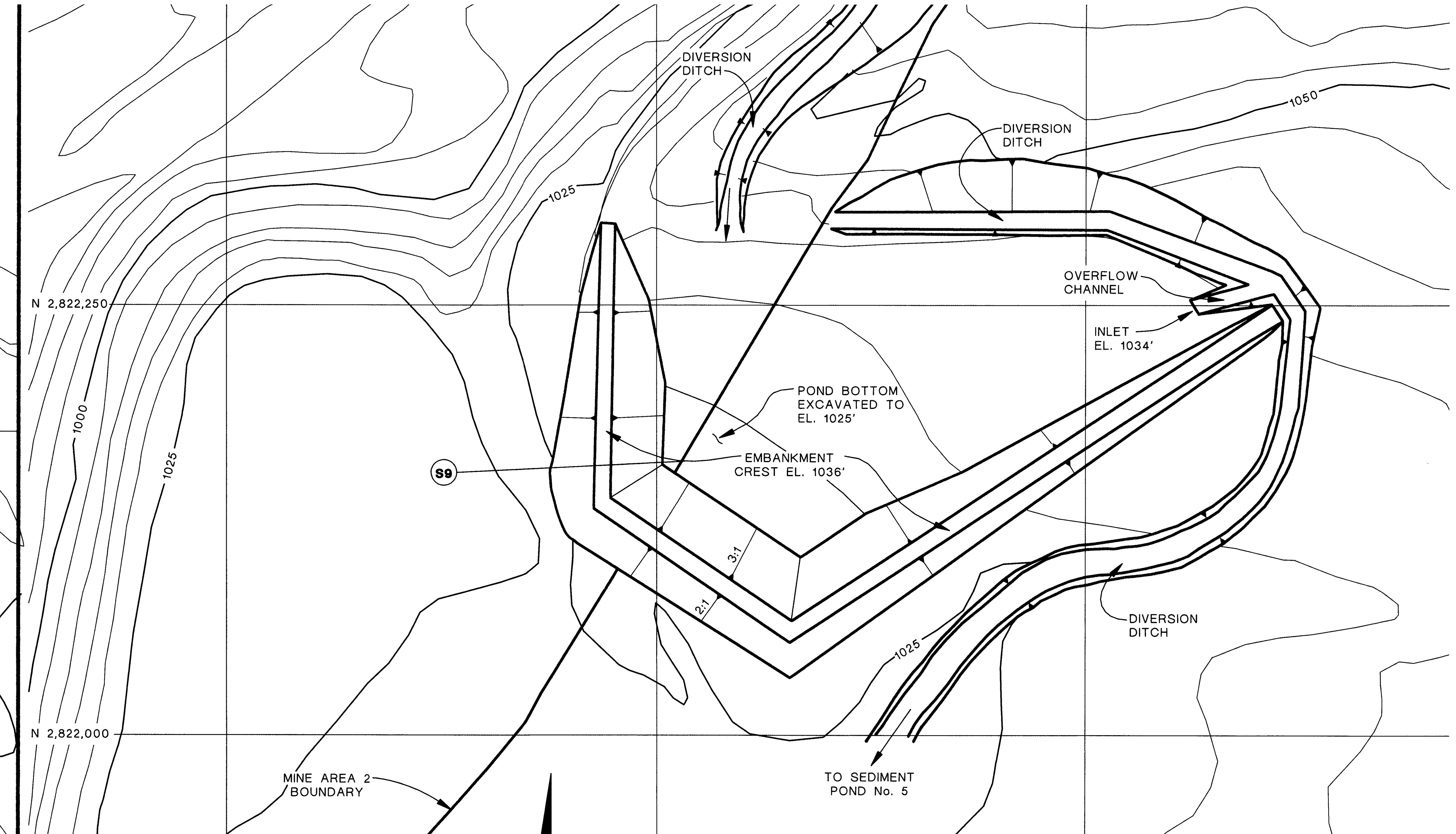
NOTES:

1. SEE PLATES 11-9 AND 11-12 FOR SEDIMENT POND PLANS.
2. SEE PLATE 11-4 FOR DITCH TYPE DETAILS.

SUBJECT REVISIONS		
REV. DATE:	BY:	DESCRIPTION
2009	JDY	MINOR REVISIONS

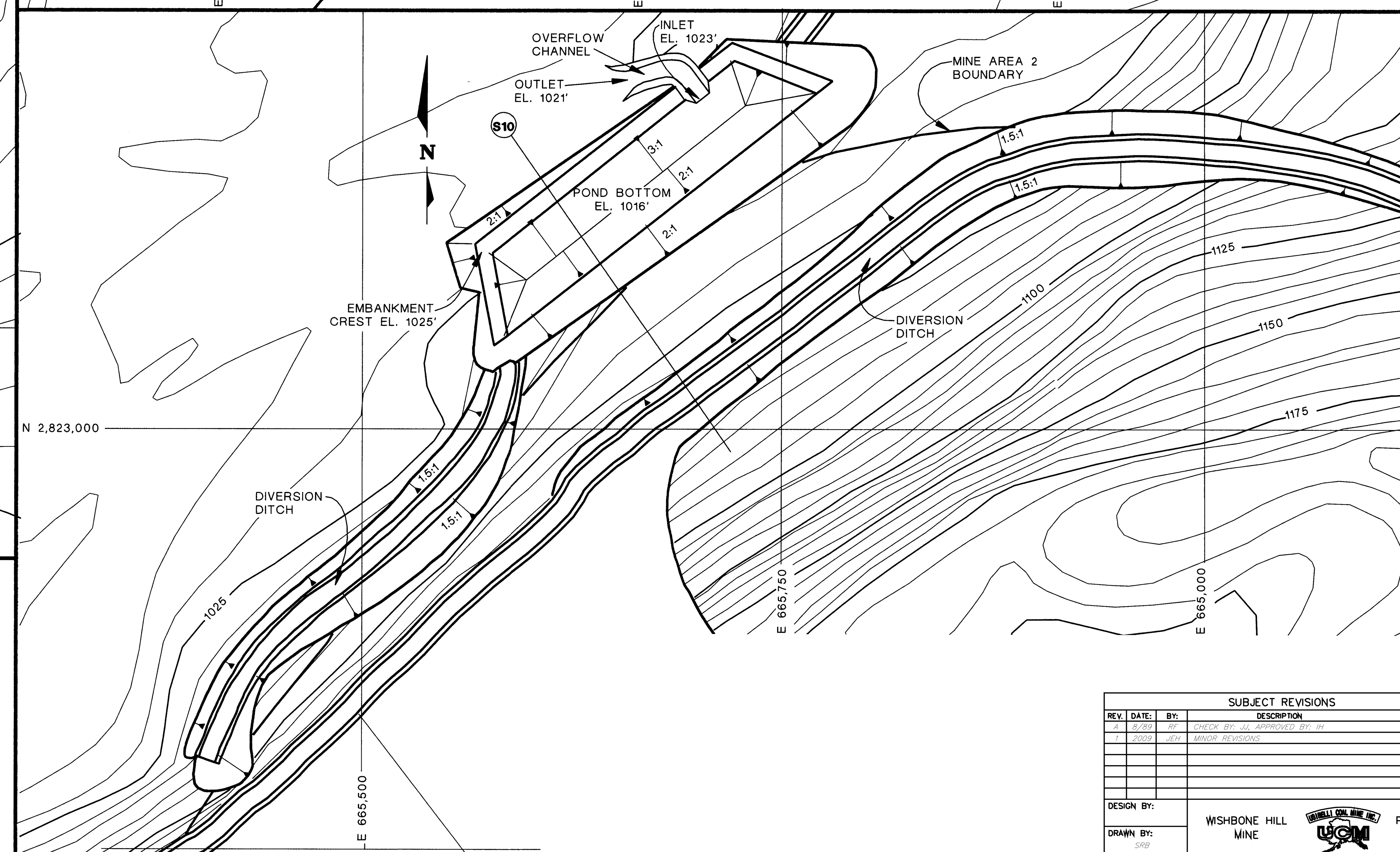
DESIGN BY:	WISHBONE HILL MINE	UCM	PERMIT NUMBER 01-89-796
DRAWN BY:			
CHECK BY:	MINE AREA 2 SEDIMENT CONTROL PLAN		
DWG FILE:			
DATE DRAWN:	WISHBONE HILL MINE		
USIBELLI COAL MINE, INC. P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226	PLATE No. 11-11	REV. 1	
	SHEET No. 1 OF 1		





SEDIMENT POND No. 6

50 25 0 50 100
SCALE IN FEET



SEDIMENT POND No. 7

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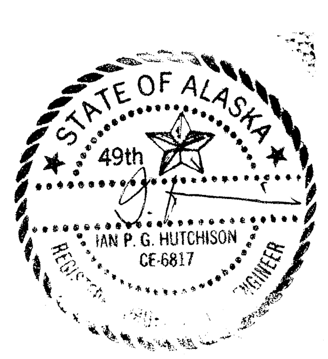
SCALE IN FEET



SEDIMENT POND No. 5

100 50 0 100 200
SCALE IN FEET

NOTES:

1. SEE PLATE 11-10 FOR SEDIMENT POND CROSS-SECTION L-L'.
2. SEE PLATE 11-3 FOR EMBANKMENT CROSS-SECTION S9.
3. SEDIMENT POND EMERGENCY OVERFLOW CHANNELS TO BE RIPRAPED AS NECESSARY.

SUBJECT REVISIONS

REV.	DATE:	BY:	DESCRIPTION
A	8/89	RF	CHECK BY: JJ, APPROVED BY: IH
1	2009	JEH	MINOR REVISIONS

DESIGN BY:

DRAWN BY: SRB

CHECK BY: MMC

DWG FILE:

DATE DRAWN: 8/89

WISHBONE HILL MINE

PERMIT NUMBER 01-89-796

SEDIMENT PONDS No's 5, 6 AND 7

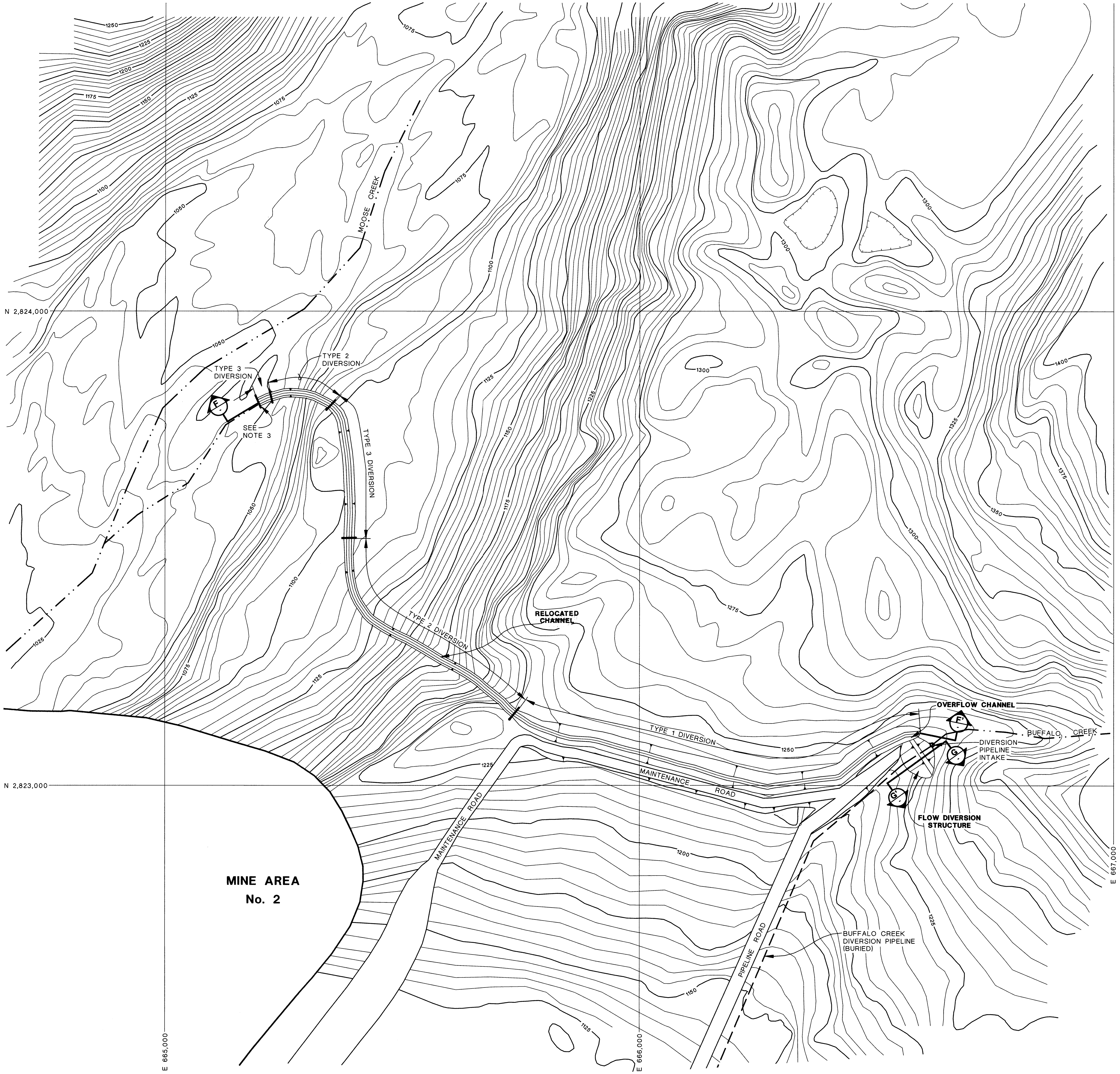
WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. 11-12

SHEET No. 1 OF 1

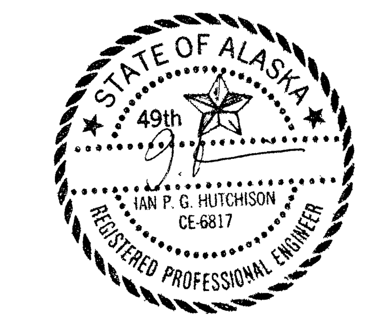
REV. 1



N

NOTES:

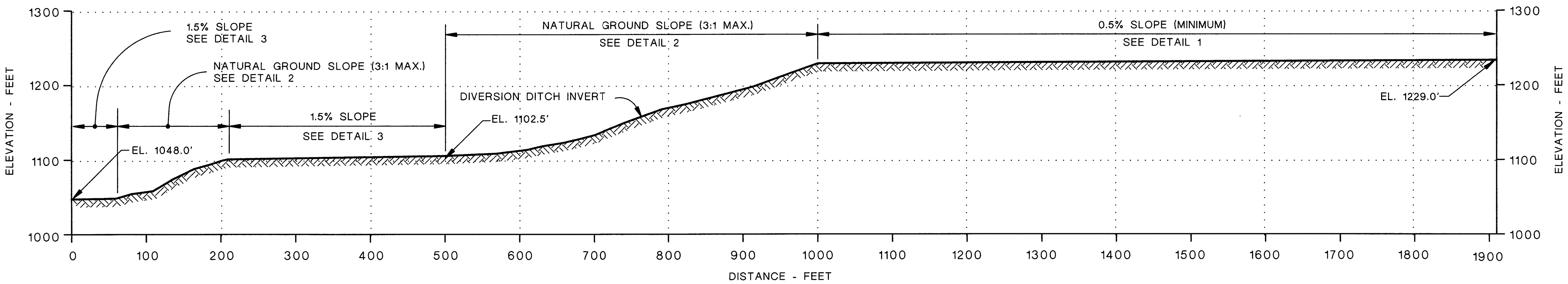
1. SEE PLATE 11-14 FOR DITCH PROFILE, SECTIONS AND DIVERSION DETAILS.
2. SEE PLATE 11-15 FOR DIVERSION PIPELINE PROFILE.
3. MATCH END OF DIVERSION TO EXISTING GROUND - I.E. FLARE END OF CHANNEL TO DISPERSE FLOW.



100 50 0 100 200
SCALE IN FEET

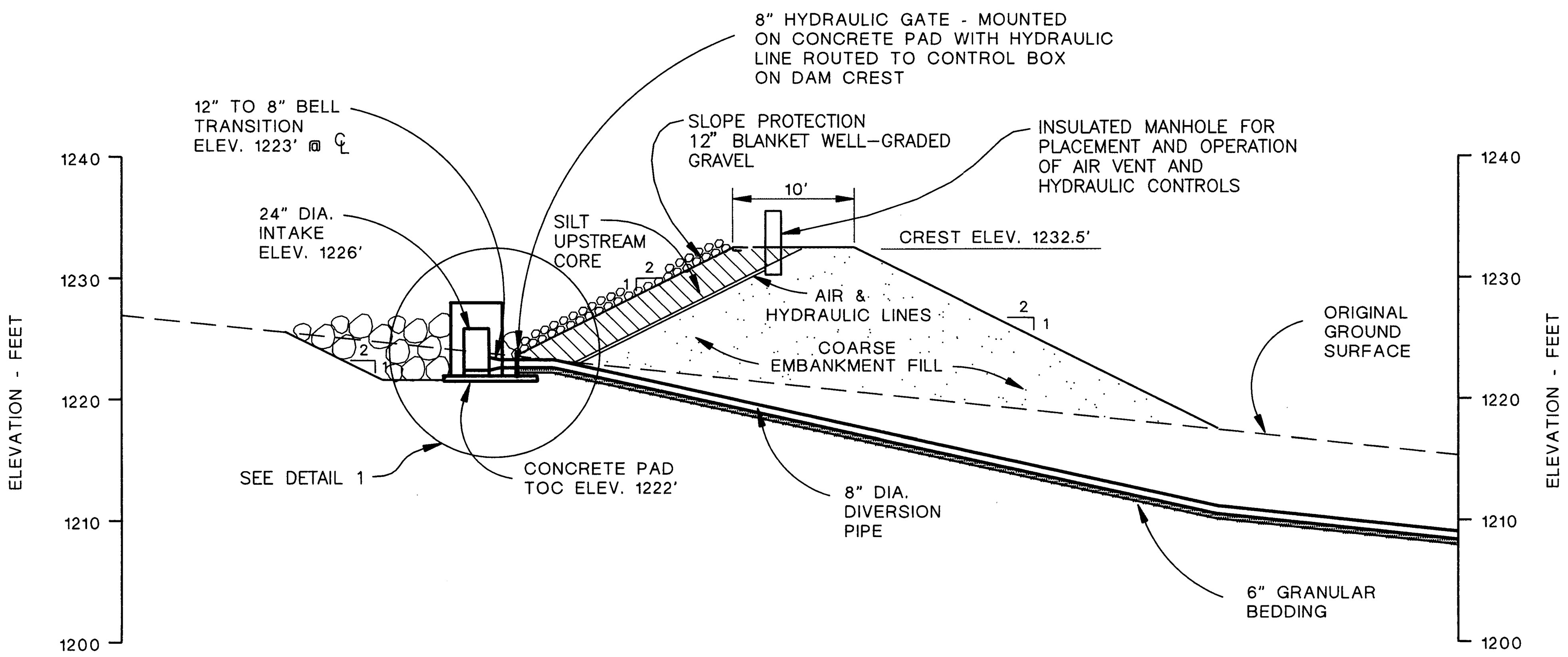
SUBJECT REVISIONS			
REV.	DATE:	BY:	DESCRIPTION
A	8/89	RF	CHECK BY: JJ, APPROVED BY: IH
1	2009	JEH	MINOR REVISIONS

DESIGN BY:	WISHBONE HILL MINE	PERMIT NUMBER 01-89-796
DRAWN BY: SRB		
CHECK BY: MMC	RELOCATED SEGMENT OF BUFFALO CREEK	
DWG FILE:		
DATE DRAWN: 8/89	WISHBONE HILL MINE	
USIBELLI COAL MINE, INC. P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226	PLATE No. 11-13 SHEET No. 1 OF 1	REV. 1



SECTION F-F'

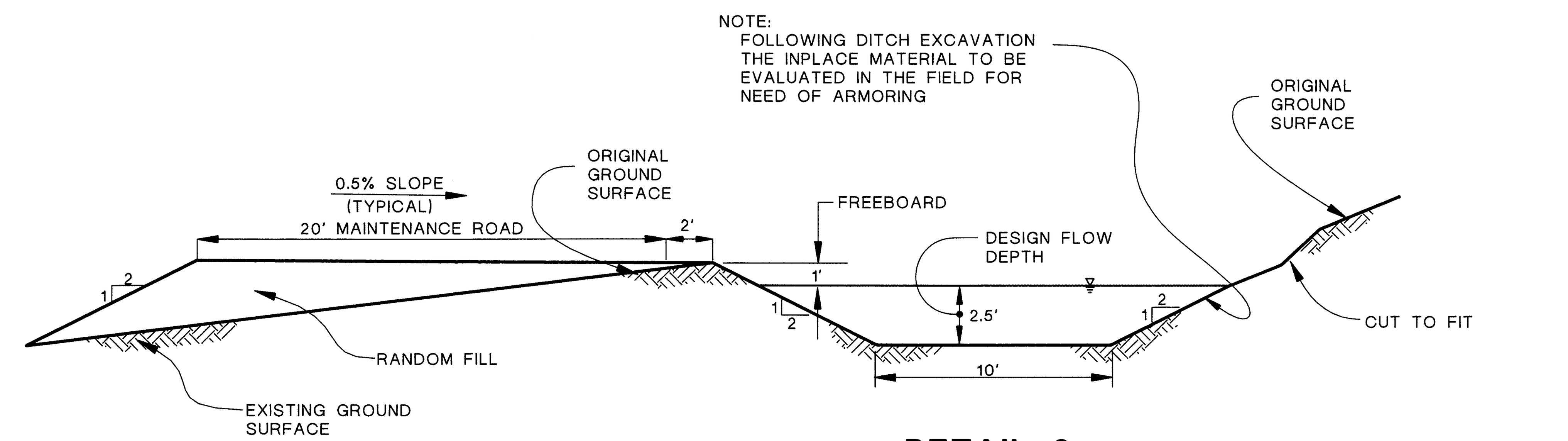
RELOCATED CHANNEL PROFILE



SECTION G-G'

FLOW DIVERSION STRUCTURE

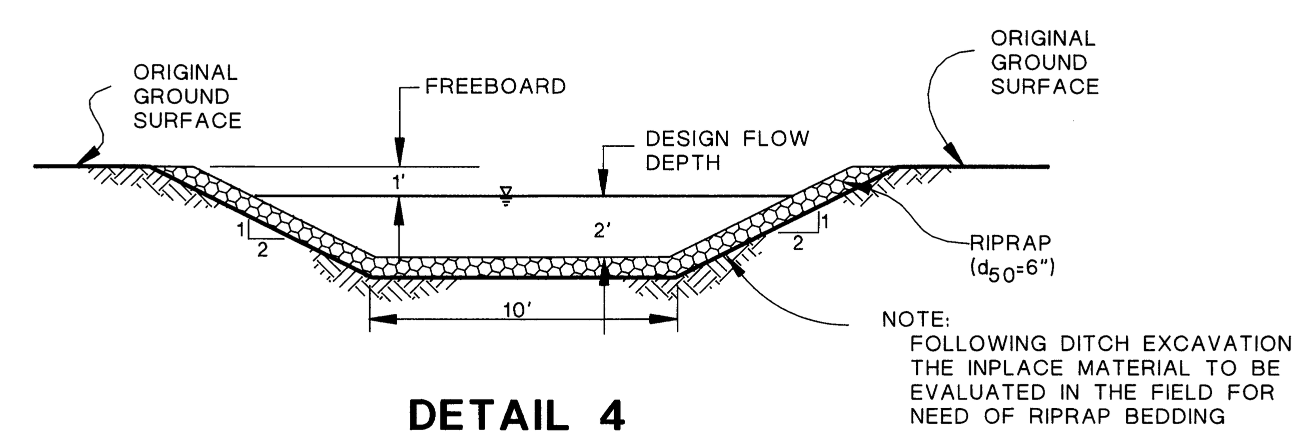
SCALE 1" = 10'



DETAIL 2

TYPE 1 DIVERSION DITCH CROSS-SECTION

NOT TO SCALE

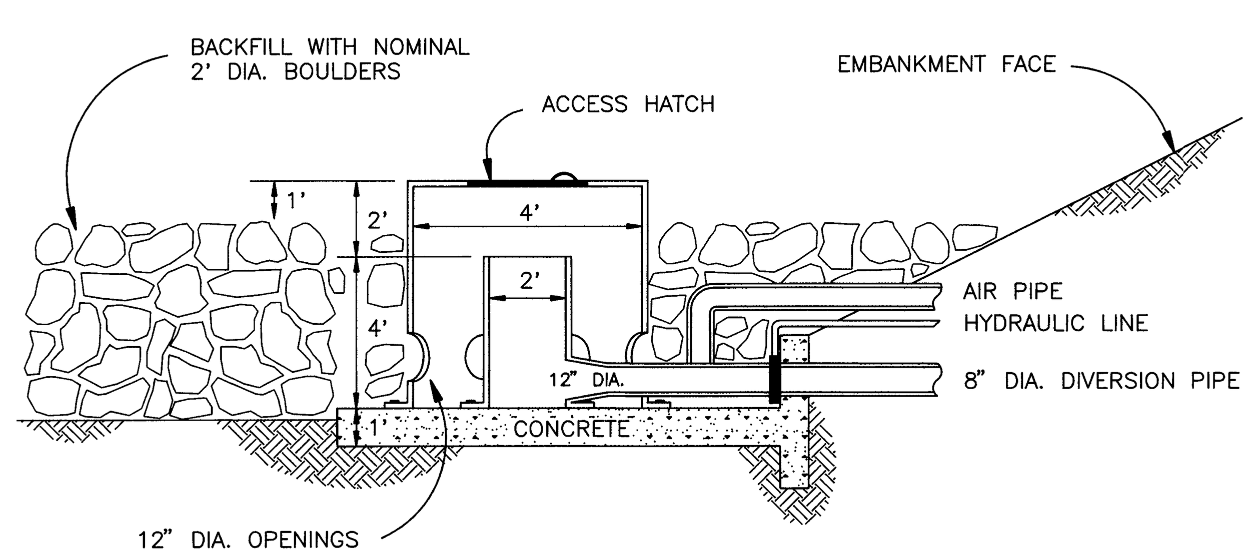


DETAIL 4

TYPE 3 DIVERSION DITCH CROSS-SECTION

NOT TO SCALE

SCALE AS SHOWN

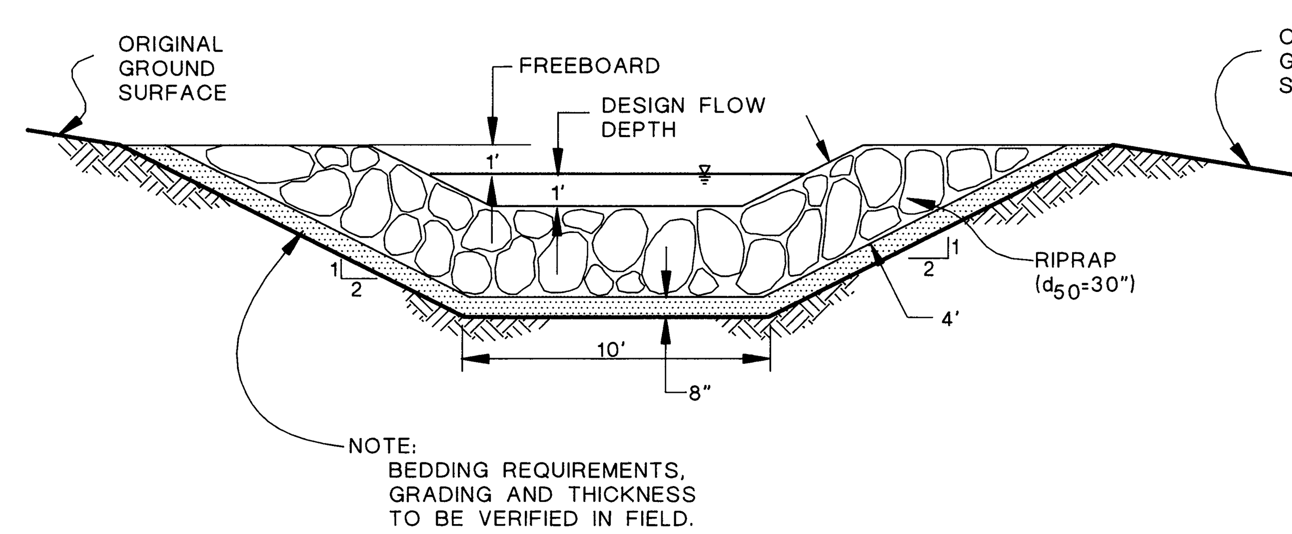


NOTE:
NO STEEL SHOULD BE USED FOR INLET PIPE CONSTRUCTION. ACCEPTABLE MATERIALS INCLUDE WOOD, CONCRETE AND PLASTIC.

DETAIL 1

DIVERSION INTAKE STRUCTURE

NOT TO SCALE



DETAIL 3

TYPE 2 DIVERSION DITCH CROSS-SECTION

NOT TO SCALE

STATE OF ALASKA
49th
IAN P. G. HUTCHISON
CE-6817
REGISTERED PROFESSIONAL ENGINEER

SUBJECT REVISIONS			
REV.	DATE:	BY:	DESCRIPTION
A	8/89	RF	CHECK BY: JJ, APPROVED BY: IH
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DESIGN BY:
DRAWN BY: DB
CHECK BY: MMC
DWG FILE:
DATE DRAWN: 8/89

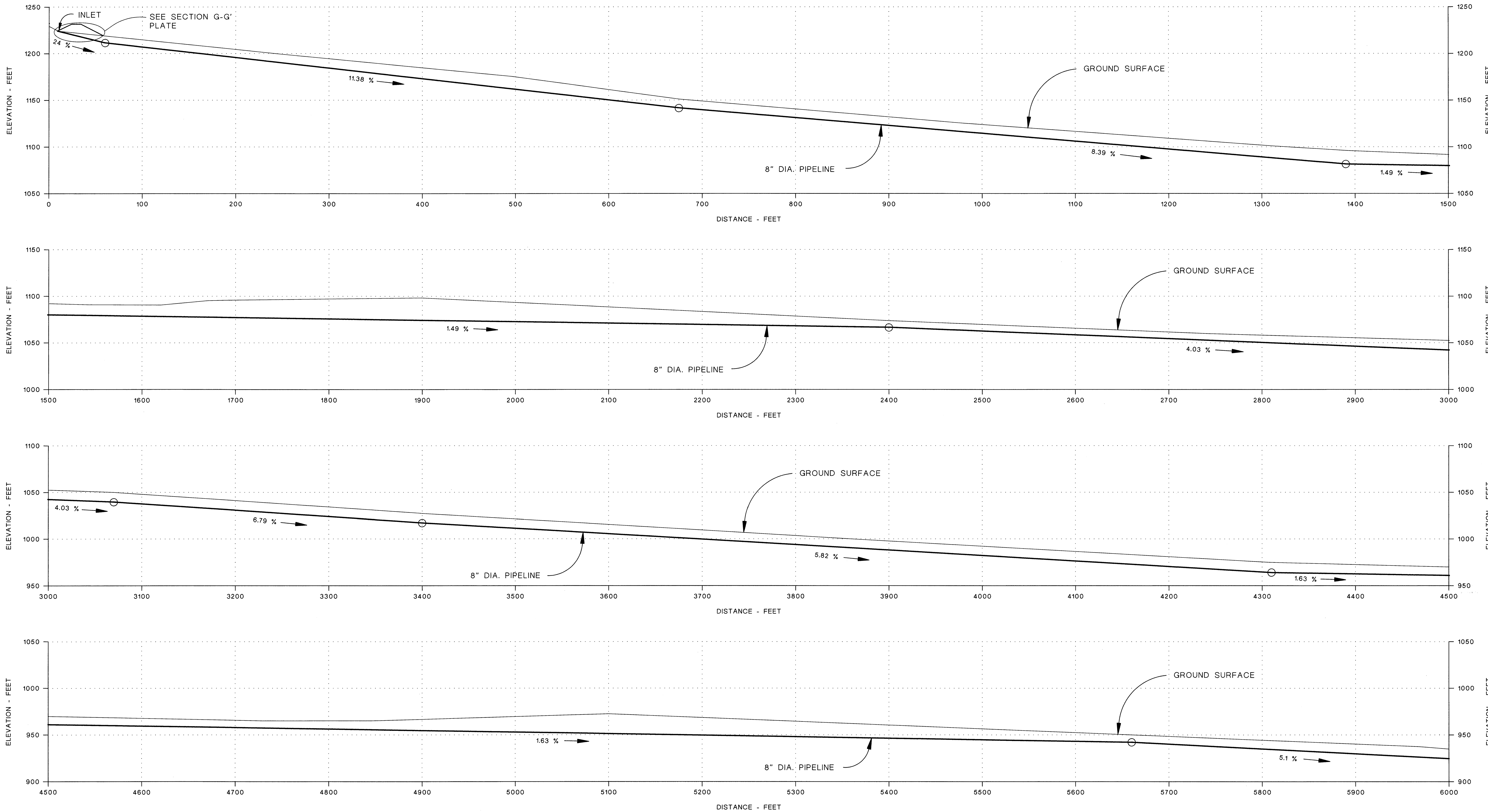
WISHBONE HILL MINE
PERMIT NUMBER 01-89-796

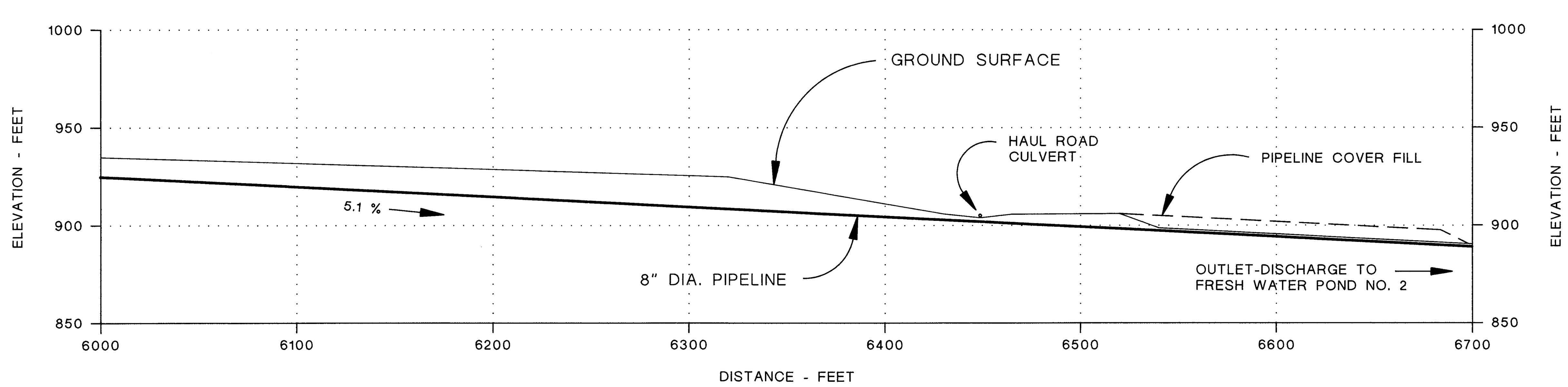
BUFFALO CREEK DIVERSION STRUCTURE & RELOCATED SEGMENTS SECTIONS AND DETAILS

WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. 11-14
SHEET No. 1 OF 1
REV. 1





NOTE:

MINIMUM DEPTH OF COVER OVER PIPE TO RANGE FROM 5 FT. TO 12 FT. DEPENDING ON THE NATURE OF THE BACKFILL MATERIAL. SILTY MATERIAL REQUIRES 5 FT. THICKNESS WHILE SAND AND COARSER MATERIAL REQUIRES 12 FT. THICKNESS.

SUBJECT REVISIONS

REV.	DATE:	BY:	DESCRIPTION
A	8/89	RF	CHECK BY: JJ, APPROVED BY: IH
1	2009	JEH	MINOR REVISIONS

DESIGN BY:
DRAWN BY: DB
CHECK BY: MMC
DWG FILE:
DATE DRAWN: 8/89

WISHBONE HILL MINE — PERMIT NUMBER 01-89-796

BUFFALO CREEK
PIPELINE DIVERSION PROFILE

WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. 11-15 | SHEET No. 1 OF 1 | REV. 1

12.0 BACKFILLING AND GRADING PLAN

The backfilling and grading operations have been designed to provide positive drainage on all disturbed areas and surrounding adjacent lands; reestablish the natural drainage patterns and drainage areas which existed prior to mining; reconstruct a topography similar to the premining topography; and reconstruct slopes approximately equal to the premining slopes in the disturbed areas.

Backfilling and grading of the completed pit areas will occur concurrently with mining operations. Once enough area has been established to ensure adequate working space and worker safety during mining and backfilling operations, backfilling will commence. Overburden/interburden removed from the active mine areas and coarse coal refuse from the wash plant will be used to backfill the pits. The pits will be backfilled to the approximate premining contour. Following backfilling, the backfilled areas will be graded in preparation for topsoil replacement and revegetation.

12.1 Backfilling Operations

Backfilling will be accomplished using overburden, interburden and coarse coal refuse. Haul trucks will carry the material from overburden removal operations in active mine areas, from the overburden stockpiles or, in the case of the coarse coal refuse, from the wash plant. The haul trucks will end dump the overburden starting in the pit bottom and gradually working upward to the approximate original ground surface. While the haul trucks are dumping the material, a dozer will be grading out the end dumped piles and providing some compaction of the regraded overburden. This cycle of dumping and dozing will continue until the overburden has reached the approximate elevation of the adjacent areas or the approximate premining topography.

The backfilling will eliminate the major highwalls and spoil piles. The sequence of backfilling is shown on Plate 3-5. The corresponding Table 3-7 delineates backfill volumes and acreages for the first 5 year permit term and the remaining life of mine.

12.2 Backfilling Plan for Hazardous Materials

A complete overburden analysis was conducted on the overburden for the Wishbone Hill Project. The results of this analysis are presented in Part C, Chapter III, Overburden and Interburden Assessment. The test results indicate that no hazardous materials will be encountered or generated as part of this project. In addition, the wash plant will use no chemicals, except an inert flocculent for the coal slurry. The refuse generated as part of the coal washing was also tested as part of the overburden characterization program presented in Part C, Chapter III and found to be acceptable. The overburden, interburden, and coal waste is not combustible, physically unstable, or acid or toxic producing, and therefore no backfilling of potentially hazardous materials will occur as part of this operation.

12.3 Grading

Grading operations will be ongoing during backfilling. Once backfilling to near the approximate original contour is completed, grading will be accomplished using dozers to approximate the original contour and to create a condition acceptable for topsoil replacement. Wherever possible, final grading will be performed on contour to make use of the crawler and/or wheel tracks for erosion control. The final graded topography will then be surveyed to make certain that the desired landform has been established. Following surveying, if no additional grading is necessary, the surface may be lightly ripped or scarified with either a dozer or a grader to provide a suitable subsoil rooting zone in preparation for topsoil replacement and seeding.

Overburden will be graded to slopes approximating the original site conditions. In most cases, these slopes will average 4H:1V. The regraded slopes will average significantly less then 4H:1V with some areas steeper to blend with the surrounding topography and induce microtopographic diversity. Long slopes will be broken with small undulations and/or small terraces to minimize erosion and associated sediment generation and to enhance revegetation. The final topography is discussed in detail in Section 13.

12.4 Monitoring of Regraded Spoils

If topsoil replacement and revegetation cannot occur immediately after completion of final grading of the replaced overburden, the graded slopes will be closely monitored to ensure that erosion or gullying is not occurring. Slopes will be visually examined on a routine basis and after large precipitation events. If erosion or gullying is observed, those areas will be immediately repaired. In some cases, the gullying may be indicative of a natural drainage area formation. If such a case is observed, the gully will be armored or otherwise enhanced as a small post mining drainage feature.

As described in Part C, Chapter III a number of overburden materials were tested. No acid or toxic producing materials were found in the 13 drill holes tested except for the 70.0 to 80.0 foot interval in Hole PB-69A. This interval showed an acid base potential of -10.22. The high neutralization capacity of the other overburden/interburden materials which will be mixed with this material during overburden removal and disposal operations will be more than sufficient to neutralize any acid production from this one interval and no special handling is required.

High sodium absorption ratio (SAR) and pH values were observed in some overburden/interburden materials. The high values in themselves are not considered indicative of toxic materials and, as discussed in Part C, Chapter III the high values will not impact reclamation.

Based on the geochemical test results as discussed in Part C, Chapter III, no geochemical monitoring of the regraded spoil on the Wishbone Hill Project will be necessary.

12.5 Post Mining Topography

The backfilling and grading plan will be accomplished to approximate the post mining topography in preparation for topsoil replacement. Based on the materials balance presented in Section 5.6, all stockpiled overburden will be used during pit backfilling and site reclamation to achieve the approximate premining land forms and drainage patterns. The general shape and aspect of the topography will remain much the same as the premining condition.

Backfilling at the northernmost end of Mine Area 2 and the southernmost end of Mine Area 1 will be completed to slopes approximating 3H:1V – 4H:1V. These areas will be the steepest slope areas of the post mining topography. The premining slopes in these areas more closely approximate 2H:1V, however, to ensure successful revegetation and long term stability of the reclaimed topography, the shallower slopes will be established. Section 13 contains a complete discussion of the reclaimed topography.

13.0 RECLAMATION

13.1 Introduction

The intent of reclamation is to return disturbed areas to a condition which is at least as productive and useful as the pre-mining condition. The Alaska Surface Coal Mining Control and Reclamation Act requires that applications for surface coal mining permits include a detailed description of the steps to be taken to achieve reclamation and to assure compliance with the various performance standards. This section describes the reclamation plan for the Wishbone Hill Coal Project.

The Matanuska Moose Range Management Plan (ADNR 1986) prescribes the range of appropriate uses for the area (including coal development) and prescribes post-mining land use and reclamation goals. General reclamation goals have followed the guidelines of the plan.

13.2 Proposed Post-mining Land Use

The management plan for the Matanuska Valley Moose Range indicates that post-mining land reclamation should be directed toward reestablishment of wildlife habitat with emphasis on maintenance and enhancement of moose habitat. At the same time, the Moose Range is a multiple use area with a significant recreational component. Moose Range guidelines address the need to maintain scenic qualities and other environmental values.

Therefore, the primary post-mining land use for the Wishbone Hill Coal Project is proposed as wildlife habitat with moose as the key habitat evaluation species. Secondary land use is proposed as general recreation as long as it is not inconsistent with the primary use.

The Matanuska Valley Moose Range Management Plan has been adopted by the Matanuska-Susitna Borough as well as by cooperating state agencies such as the Alaska Department of Fish and Game. The proposed post-mining land use is consistent with all known land use plans or policies.

As discussed in Part A, Exhibit A, there are no private lands within the permit area other than Usibelli Coal Mine Inc.'s (UCM) fee title holdings. It is UCM's desire to return the land to its original premining condition. Therefore, the post-mining land use on these lands will be consistent with the Matanuska Valley Moose Range Management Plan.

13.3 Contouring Plan

Contouring to achieve the post-mining topography for the Wishbone Hill Project will be accomplished upon completion of backfilling in the mine areas. Contouring will be achieved through grading in combination with surveying to ensure that the proposed post-mining topography is achieved. Backfilled slopes will first be surveyed to ensure that backfilling has occurred to the approximate post-mining configuration. A dozer and/or grader will then be used to accomplish final grading and smoothing prior to topsoil replacement. Final grading will include blending the backfilled configuration with the surrounding topography. Final grading will be accomplished along contour to allow the small depressions created by the tracks to act as an aid in erosion control and moisture retention. The approximate post-mining slopes are shown on Plate 13-1.

The post-mining topography for the mine areas will approximate the premining topography in slope, aspect and drainage patterns. Based on a 5% swell factor for the glacial gravels and a 10% swell factor for the bedrock materials being mined as discussed in Section 5.0, the predicted final elevation on the backfilled areas will generally approximate original contours. On average, the final post mine topography will be on the negative side and represents a slight underfill on the backfilled areas. Pre and post-mining topography are shown in plan view on Plate 13-1 and in cross sectional view on Plates 13-2 and 13-2a.

The premining slopes in the northernmost portion of Mine Area 2 and the westernmost portion of Mine Area 1 were as steep as 2H:1V in places. Reclaimed areas would not be stable at such a steep slope and these areas will be flattened slightly upon reclamation to a maximum slope in the range of 3H:1V – 4H:1V. As shown on Plate 13-1 these areas are the steepest portions of the reclaimed topography.

Drainage control structures to control runoff and sediment from reclaimed areas will remain in place and continue to catch runoff from the disturbed areas until the revegetation requirements have been met and the drainage entering the ponds meets the applicable State and Federal water quality regulations. The post-mining sediment control plan is discussed in Section 13.4.

13.3.1 Premining vs. Post-mining Slopes

A survey of premining and post-mining slopes was conducted to evaluate the reclamation configuration for the Wishbone Hill Project. The reclaimed configuration was developed to closely approximate the premining topography. The main difference is the change in the location of the

Buffalo Creek channel. In addition, several small portions of the mine areas have been flattened slightly from their very steep premining configuration to ensure long term stability.

For Mine Area 1, the premining configuration reflects the effects of glaciation. Numerous depressions are present in the southeastern portion of the mine area. A steep slope is present where Moose Creek has down cut into the bedrock in the extreme southwest corner of the mine area. The reclaimed configuration approximates the premining configuration however the depressions have been filled and eliminated. The average pre and post-mining slopes are almost identical with the exception of the extreme southwest corner of the mine area. In this area, the post-mining slopes are almost identical with the exception of the extreme southwest corner of the mine area. In this area, the post-mining land will be flattened to maximum slopes in the range of 3H:1V – 4H:1V to ensure long-term stability. The aspect of the pre- and post-mining topography is approximately the same and swings from southeast in the eastern portion to due south in the central portion to southwest and finally west in the western portion of the mine area. No drainage channels will be disturbed by mining activities in Mine Area 1 and therefore, none are planned for replacement.

For the southern half of Mine Area 2 the average premining slope varies between 8 and 10% on the southeast side of the ridge and between 10 and 20% on the northwest side of the ridge. The average post-mining slope varies between 8 and 11% on the southeast side and between 10 and 20% on the northwest side. The aspect of the topography is gently sloping to the southeast on one side and the northwest on the other side in both the pre and post-mining conditions. No drainage channels will be intercepted during mining and none are planned as part of the post-mining configuration.

In the northern half of Mine Area 2 the average premining slope varies greatly. For most of the area the slope varies between 12% and 17% but for the northwest corner just above Sediment Pond No. 7 the slope is as steep as 75% in places. The average post-mining slope for most of the reclaimed areas in the northern half will be between 10% and 15%. The steep northwest corner will be flattened to a maximum slope in the range of 3H:1V – 4H:1V to ensure long term stability. The general aspect of the premining and post-mining topography is the same. The Buffalo Creek channel lies in the northern half of Mine Area 2. This channel will be disturbed by mining and the channel will be permanently relocated to the north of the mine areas as described in Section 11. Section 13.4 discusses the drainage reestablishment including relocation of the Buffalo Creek channel.

13.3.2 Erosion Control Practices

A combination of control measures will be used to minimize erosion potential and prevent any contribution of sediment to stream flow or to runoff outside the permit area. All of the sedimentation ponds and storage impoundments for the project have been designed to be non-discharging structures. Drainage from undisturbed areas will be diverted away from areas of disturbance to maintain the existing undisturbed drainage water quality. Drainage from all disturbed areas will be routed to natural closed depressions capable of retaining inflows of both run off and sediment generated from a 100-year, 24-hour storm event as well as the annual sediment yield.

Through progressive backfilling, grading, topsoiling and prompt revegetation, the amount of disturbed area potentially subject to erosion will be minimized. To further limit the amount of area subject to disturbance, active overburden material will be placed on previously mined out areas as opposed to stockpiling the material on adjacent undisturbed areas. All of the regrading operations will be done on contour to aid in controlling erosion. The slope and slope angles on stockpiles and reclaimed areas have been designed to create the least practical amount of sediment from runoff. As discussed in the Revegetation Plan (Section 13.6) various planting methods will be employed to encourage the rapid establishment of vegetative cover on exposed areas. These will include hydroseeding select areas, applying fertilizer to stimulate growth, establishing temporary vegetative cover on stockpiles, transplanting mats of native vegetation, hand planting cuttings and seedlings and utilizing special designed mixes of grass species to achieve the optimal growth patterns. Seeding and planting of disturbed areas will be conducted during the first normal period for favorable planting conditions after replacement of the topsoil material.

As discussed in Section 13.6.7.4, stockpiled topsoil and reclaimed surfaces will be closely monitored following revegetation work. If any rills and gullies which are disruptive to the post-mining land use begin to form in areas, measures will be implemented to stabilize the erosive conditions. In addition to regrading and reseeding the select areas, additional temporary erosion methods may be used, such as ripping on the contour, shortening slope length, lessening slope steepness or mulching. Data from the test plots discussed in Sections 13.6.2 and 13.6.7.4 will be used to help evaluate erosion potential and applicable mitigation measures on the reclaimed slopes.

13.4 Post-Mining Drainage Control

Post-mining drainage control practices will be identical to the drainage control practices during ongoing mining operations. The same sediment controls existing during active mining operations will be used to control drainage and sediment from backfilled and reclaimed areas until revegetation has been deemed successful and the drainage entering the ponds meets all applicable State and Federal water quality regulations. In areas where ditches and sediment control ponds have been mined through as a result of the active operations, these structures will be reestablished in the same configuration as part of the backfilling and grading operations. Post-mining drainage controls for Mine Area 1 are shown on Plate 13-3 and post-mining drainage controls for Mine Area 2 are shown on Plate 13-4.

The Buffalo Creek channel will be mined through as part of the mining operations in Mine Area 2 (see Section 11.9). Although topsoil removal activities do not intercept the Buffalo Creek channel until later in the mine life, the new channel will be constructed and revegetated during the first 5-year term and allowed to stabilize for at least five years prior to use. By allowing a minimum of five years for channel stabilization, sediment loading to Moose Creek will be minimized when the relocated channel is put into use.

Upon successful revegetation and demonstration that the post-mining drainage into the sediment ponds meets all applicable State and Federal water quality standards, the sediment control ponds will be reclaimed by backfilling those excavated ponds, removing embankment structures, replacing topsoil and revegetating. Upon removal of the sediment control structures the post-mining drainage patterns, with the exception of the relocated Buffalo Creek channel, will be approximately the same as the premining configuration.

13.5 Topsoil Replacement

Topsoil replacement will occur following backfilling and grading operations. The regraded surface will be prepared for topsoil replacement by walking the surface along contour to allow the tracks to create small furrows to aid in moisture retention and erosion control. The surface will then be lightly ripped or scarified in preparation for topsoil replacement activities.

13.5.1 Methods of Replacement

Topsoil replacement will occur in much the same manner as topsoil salvaging operations. Dozers, scrapers, or trucks with an excavator or loader will be used to remove the topsoil from either the topsoil stockpiles or areas of active stripping and transport it to areas ready for topsoil replacement and reclamation. Once deposited, a dozer or grader will be used to grade the topsoil to the approximate post-mining depth.

13.5.2 Schedule of Replacement

The topsoil replacement by volume for the life of the mine project is shown on Table 3-3. The topsoil from Topsoil Stockpile No. 2 will be replaced on the relocated channel of Buffalo Creek and the upper reaches of the Buffalo Creek pipeline diversion during the first 5 year term of the mining operation. Also occurring will be the replacement of topsoil windrowed along the access road. Additional topsoil in the windrows will be graded to blend with the surrounding topography. Whenever possible, topsoil removed from active mine areas will be placed directly on backfilled and graded areas without being stockpiled and continuing through to completion of topsoil replacement, topsoil will be removed from Topsoil Stockpile No. 1 for replacement on backfilled and graded areas. Table 3-3 lists the maximum volumes of topsoil to be direct hauled or taken from the stockpiles for replacement.

13.5.3 Depth of Topsoil

Table 3-2 provides details on the amount of topsoil to be salvaged from each of the disturbance areas for the Wishbone Hill Project. No special handling of any of the topsoil types for the project is anticipated. All of the salvageable topsoil will be either stockpiled in the designated areas shown on Plate 3-1 or windrowed with slash around the perimeter of the disturbance areas. As shown on Table 3-2, the maximum total topsoil salvaged for all disturbed areas, except the access road, is estimated to be 1,567,000 bank cubic yards (BCY). Using a swell factor of 10% the total maximum amount of topsoil available for replacement is 1,723,700 loose cubic yards (LCY).

Topsoil will be removed from 574 acres during the life of the mining operation, however, topsoil will be replaced on only 568 acres. Six acres of roads will be left unreclaimed for public access. The following calculation was used to determine the topsoil replacement depth.

1,723,700 LCY x 27 ft3/1 yd^3 = 46,539,900 ft^3
568 acres x 43,560 ft^2/acre = 24,742,080 ft^2
46,539,900 ft^3/24,742,080 ft^2 = 1.9 ft or 22.6 inches

The estimated maximum topsoil replacement depth for the Wishbone Hill Project will be approximately 22 inches for all disturbed areas except the access road.

The calculations for available topsoil to be salvaged from the access road are shown on Table 3-4. The total topsoil available is 87,000 BCY or 95,700 LCY. The access road will remain upon completion of mining to allow improved public access to the area. The outslopes of the road, comprising approximately ten acres of the entire 22 acres of access road disturbance, will be reclaimed during the first 5 year term of the mining operation. Approximately 32,270 LCY will be replaced on the access road outslopes. The excess topsoil (63,430 LCY) which will be windrowed adjacent to the access road will be graded to blend with the surrounding topography.

13.6 Revegetation Plan

13.6.1 Objectives

The objectives of the revegetation program will be to return the land to a stable state usable for moose habitat and recreation. Specifically, this entails creating several habitat types interspersed among each other (landscape diversity) composed of a variety of plant species (species diversity). Habitat type construction will consider primarily moose browse and thermal and hiding cover but will also consider habitat for other small mammals and birds.. The goal is to construct a mosaic of several vegetation successional stages which will mature at different times. This will contrast with the expanses of old-growth birch -spruce forest currently found in the project area and surrounding areas.

Revegetation of the Wishbone Hill mine area will be much more than simple replacement of vegetative cover. Species selection, planting techniques, and planting rates have been specifically designed to restore and enhance ecological diversity while providing habitat requirements for key species. For example, plant community selection has been heavily weighted toward replacement and enhancement of moose feeding habitat including calculations of moose browse production on restored habitats. At the same time, other wildlife habitat requirements, such as hiding cover, have been considered.

Browse will be provided by several shrub species including willow (Salix spp.) and rose (Rosa acicularis) and two tree species (balsam poplar, Populus balsamifera, and paper birch, Betula papyrifera). Thermal cover and wind protection will be provided primarily by the evergreen tree species white spruce (Picea glauca). Hiding cover will be provided by high stem densities in the winter or dense foliage in the summer. Stem densities in some deciduous stands at selected locations will be increased to improve hiding cover.

Optimization of edge effect for wildlife habitat as required by 11AAC 90.423(e) will be accomplished in several ways. As discussed in detail below, revegetation will emphasize the creation of a mosaic of community types and community growth forms, both through variation in community composition and variation in successional stage. The three primary habitat types (spruce - birch forest, deciduous forest, and herbaceous communities) will be positioned based on post-mining environmental characteristics (such as topography, soil moisture, aspect, and wind exposure), rather than artificial boundaries. This method will mimic natural irregular vegetation boundaries (edges) that are important for wildlife and diversity. Community types selected represent varying successional stages, which will enhance the patchiness of the restored area.

The plan will strive to meet the above requirements using current technology as well as technology that is developed over the course of the mine life. Local materials from the permit area will be used as much as possible. Plant materials will be collected and / or grown using Alaskan commercial producers or local organizations where possible. Herbaceous species (mostly grasses) will be regenerated from seed obtained from Alaskan sources, using certified seed where available. Other plant materials will include woody plant seeds and cuttings as well as young plants from such materials. The mine will collaborate or partner with local organizations where possible. Approximately 70% of the disturbed sites will be planted with woody species (usually 1700 to 2500 stems/ha or 690 to 1012 stems/acre), while 30% will be grassland containing some shrubs. This is about 1.5 to 2.2 times the survival density required by Alaska Forest Resources & Practices Regulations (June 2007). This is partly to ensure adequate survival but also to focus on moose browse production in the Matanuska Valley Moose Range, whereas forestry practices usually emphasize commercial timber.

13.6.2 Revegetation Trials

Initial revegetation trials on the project area were initiated in 1983 by the Plant Materials Center (PMC) at the request of Hawley Resources near the Premier Mine site (State of Alaska 1987) in the current project area. One site was at the exploration camp site on highly compacted gravel while the other was on a new drill pad. Soils here were compacted loamy soils. Seed mixes were planted on recontoured overburden along Moose Creek during 1984. Cover by species in these tests by 1988 are summarized in the vegetation baseline section (Part C, Chapter VIII). Initial results were reported in PMC's 1987 report (State of Alaska 1987). Dormant bundles of four species of willow including feltleaf willow (Salix alaxensis), barren-ground willow (Salix brachycarpa), barclay willow (Salix barclayi), and scouler willow (Salix scouleriana) were tested along an embankment by Moose Creek. Results of these trials plus additional recommendations by the PMC were used to develop the initial revegetation plans presented in this section.

To further enhance techniques for establishing woody browse species on mined lands, three rather extensive test plots were established on the Wishbone Hill project site during the summer of 1989. The first plot was situated in a birch - spruce vegetation community and was 24 meters by 46 meters in size. A second plot, located in a lowland meadow, was 25 meters by 34 meters in size. The third plot was 12 meters by 34 meters and was positioned in an upland meadow type.

Site preparation included the removal of existing vegetation followed by stripping of topsoil down to the overburden materials. On sites one and three all of the stripped topsoil was then replaced on the overburden; however, on site two approximately half of the plot was not topsoilled to further determine the benefits of the topsoil resource. Finally, sites one and two were enclosed with eight foot high fence consisting of woven wire with support posts on 10 foot centers.

Designs for the revegetation test plots were based on prior studies, additional PMC recommendations, and general observations elsewhere. Information on individual species responses were combined with ecological principles to determine what combinations of species would be tested to establish ecological communities in the long term. These test plots go beyond the earlier studies in addressing the following new goals:

- Establishment of plants on topsoil.
- Production of moose browse on upland soils.
- Reduction of herbaceous competition with woody species.
- Improvement of diversity in grass seed mixes.

Topsoils have different biological properties depending upon the plant communities growing on them. These properties include buried propagule (seeds, rhizomes) banks for plant propagation and mycorrhizae for improved plant growth. Mycorrhizae are symbioses between fungi and plant roots whereby the fungus enhances nutrient absorption, especially P absorption, by the plant and the plant provides the fungus with carbon (energy). Most plants are associated with mycorrhizae but vary in their dependence on the association. Spruce are usually obligately dependent on mycorrhizae while willows are less dependent. Past observations on successional sites – both natural and mined land – indicates that many individuals will become colonized by mycorrhizal fungi either from soil sources or distribution by wind or animals.

Results of the plot trials at 10 year indicate the following:

- Planted woody seedlings and rooted cuttings can grow well in many of these sites, even with the presence of seeded grasses or local herbaceous species.
- Local woody plants can colonize these disturbances. While the colonization was least on the plots with best grass cover, especially if fertilized, there were still the equivalent of over 4000 stems/acre (at least 10 stems of any size in a 10-m^2 plot) with other treatments having at least that many stems.
- Grass cover and surface erosion control were improved when plots were fertilized.
- Ground cover of colonizing plants was increased with fertilization, but the density of woody plants was decreased, but still generally above 4000 stems/acre. Growth and community development over the long term would be expected to reduce number of stems to a more natural density.
- Seeded grasses can compete with the undesirable local colonizers such as bluejoint reedgrass.

Casual observation of the plots over the following years showed continued tree growth and understory development. Heavy browsing on some unfenced plants, some of the only willows around, did affect their vigor over time; however, when large numbers are planted over an area, this browsing pressure is significantly reduced.

Deciduous trees in the birch-spruce plots (fenced) were up to 20 feet tall after 10 years, when measurements were discontinued. Growth was less in other plots, partly because of the cooler location, poorer drainage, and later snow cover in a small basin. Girdling was only a problem on one site that had less sun exposure and more snow later in the season.

13.6.3 Species Selection

An underlying assumption for species selection is that the pH of the topsoil will be < 5.5 unless mixed with overburden or limed. The pH of overburden will probably be > 7 or 8. Liming is not considered desirable since appropriate species are available for soils with pH in this range, and lime could slow reestablishment of ecosystem function.

13.6.3.1 Grasses

The grass seed mix will consist initially of:

'Arctared' red fescue	Festuca rubra
'Nortran' tufted hairgrass	Deschampsia caespitosa
or 'Norcoast' Bering hairgrass	Deschampsia beringensis
'Gruening' alpine bluegrass	Poa alpina

The red fescue and hairgrass cultivars provided excellent short-term ground cover until natural colonization by desirable species occurred. Woody cuttings were still able to grow above these grasses. A mix of Nortran and Arctared provided the most stable surface cover, but colonization did occur on those plots also. Modifications of the mix will be considered as more experience is obtained during the mine life and when new cultivars become available. UCM intends to take advantage of new developments, when they become available.

The following species descriptions are based on trials by the PMC (State of Alaska 1987) on higher pH sites within the permit area, the revegetation test plots initiated in 1989 specifically for the Wishbone Hill Coal Project, and general observations at other sites. Community descriptions of the PMC trials are located in the vegetation baseline report (Part C, Chapter VIII).

Arctared has been a very successful conservation species in many boreal revegetation projects and is readily available from commercial sources now. It establishes fairly rapidly from seed, grows on acid soils, and is tolerant of low nutrient and moisture regimes. It has dominated most reclamation plantings using it in the past. Arctared will be seeded at a lower ratio than in past projects to improve cover ratios of the other species and the resultant diversity. It will be seeded normally on steeper slopes to improve soil stabilization. It does not normally grow as tall as bluejoint so will not be as competitive with woody regeneration. However, it may (as will all grasses) still provide hiding cover for voles which girdle the woody stems.

Gruening alpine bluegrass was not tested in the PMC trials in 1983 and 1984 (State of Alaska 1987), but will be available for use during the mine operation. It is expected to perform well and was tested on the test plots described in 13.6.2.

The two species of hairgrass have been good grasses in monocultures in revegetation trials. They were released in the 1980s and have been used in a number of revegetation projects in the Matanuska Valley as well as in Healy. Seedling vigor can be very high (W.W. Mitchell, pers. comm.). Hairgrasses are palatable grasses and will generally leave some spaces for local species to colonize. Nortran performed well in monoculture and in grass mix tests initiated in 1989 (13.6.2). A mix of equal ratios of Nortran and Arctared was one of the best mixes tested. Norcoast apparently has a greater moisture requirement for initial establishment. Nortran may be an excellent selection for inclusion in mixes on the more southerly and drier slopes.

13.6.3.2 Forbs

Forbs are expected to colonize from the soil seedbanks as well as aerial dispersal from adjacent vegetation. Commercial seed of a few species may be considered on small areas. Early results from the test plots initiated in 1989 (Section 13.6.2) indicate the following species may propagate from fresh topsoil obtained from birch-spruce or upland meadow communities in the first year: fireweed (Epilobium angustifolium), sanguisorba (Sanguisorba stipulata), horsetail (Equisetum), and oak-fern (Gymnocarpium dryopteris). These are the types of soils most available for direct haulback or mat transplants. Additional herbaceous species that may be obtained from mat transplants include bunchberry (Cornus canadensis) and bluebell (Mertensia paniculata). Since most topsoil will be stockpiled for several years, it is expected that this seedbank may not be important on large areas of the reclamation.

13.6.3.3 Woody Species

The following woody species are proposed for use in reclamation:

Low Shrubs

Feltleaf willow	Salix alaxensis	Dormant or rooted cutting
Barclay willow	Salix barclayi	Dormant or rooted cutting
Bebb willow	Salix bebbiana	Rooted cutting
Rose	Rosa acicularis	Topsoil source

Tall Shrubs		
Alder	Alnus spp.	Seedlings
Trees		
Poplar	Populus balsamifera	Dormant or rooted cuttings
Birch	Betula papyrifera	Seedlings
White spruce	Picea glauca	Seedlings

The indicated willow and poplar species, especially feltleaf willow, are all suitable for moose browse. Feltleaf willow and balsam poplar can be successfully established from dormant cuttings under suitable conditions. Barclay willow can be established from dormant cuttings also, but not as successfully as feltleaf. Bebb willow will require rooted cuttings. It is not suitable for dormant cuttings since it usually requires warm soils (heating pad under sand bed) for rooting. It is the dominant upland willow in the project area. Feltleaf willow is a highly palatable willow but may grow better on moister sites and a higher pH than the topsoil in the project area.

Rose can be a very aggressive vegetative spreader, and rhizomes in live topsoil may sprout. Seeds may also be present in the seedbank or may be dispersed to the area. It has sprouted during the first year of the revegetation trial plots (13.6.2). It is browsed by large and small mammals. Other shrub species may also colonize either from soil sources or wind or animal dispersal.

Alder seed will be collected on site. Some might be seeded in desired local sites, but most will be raised into seedlings by producers. Alder thickets are useful for hares and as hiding cover for moose.

Birch is the most common tree species on the site. It can be established from locally-grown seedlings or regenerate from the soil seed banks or wind- or animal-dispersed seeds, especially along the edges. Plant establishment from distant dispersal is expected to be insignificant although birch seed may disperse great distances. Birch invasion near established stands could contribute to overall cover of the area. Birch does colonize scarified and other disturbed sites in the Matanuska Valley Moose Range as well as many agricultural developments.

White spruce planting methods will be similar to those of paper birch. However, spruce are usually dependent on mycorrhizae for normal growth, but they will likely be colonized from propagules in the soil or spores dispersed by wind or animals. The materials balance for the topsoil indicates that there is sufficient spruce - birch soil available from direct haulback and that only small quantities of spruce will need to be established on soils that had been stockpiled. White spruce is currently the only evergreen tree species in the permit area and will be used in the revegetation program to provide thermal cover for wildlife.

Some aspen (Populus tremuloides) regeneration may be tried in very localized sites as existing plant materials (uprooted trees) provide opportunities.

13.6.4 Communities

Three primary habitat types will be revegetated in areas to be disturbed by the proposed Wishbone Hill Coal Project: spruce-birch forest, deciduous forest or scrub, and an herbaceous community. The spruce-birch forest is one of the dominant vegetation types prior to mining, however, it is dominated by birch trees with relatively few spruce. The existing community provides little thermal cover. Spruce - birch forest represents the most advanced successional stage to be revegetated. The existing deciduous forest or scrub communities are represented by closed birch - aspen or closed or open birch communities. The closed communities have low diversities and little browse. The open communities have some young birch trees which have been hedged into a shrub growth form. Instead of replacing these communities, communities higher in wildlife values (browse) such as poplar and willow types will be planted. Most existing herbaceous communities are dominated by bluejoint. Planted herbaceous communities will consist of seeded grasses with a greater diversity than most bluejoint stands.

The planted individuals on topsoil are expected to facilitate vegetation establishment and succession. The direction and rate of expansion will be determined by natural processes. Some of the test plots went through two stages of development and at least one went through three changes in the 10 years they were monitored.

13.6.4.1 White spruce - Paper birch

The paper birch - white spruce vegetation type (mixed forest) is one of the most common vegetation types present in the Wishbone Hill Area before disturbance and in southcentral Alaska. It is an advanced successional vegetation type. Its main uses are for thermal and hiding cover (evergreen trees) with some browse in the understory. Much of this browse consists of young birch trees, rose, and highbush cranberry. This type is very common in the Matanuska Valley Moose Range, but with birch the dominant tree species. More spruce will be planted in the postmining spruce - birch communities for improved thermal cover. Creation of diversity and patchiness is another important goal that will be accomplished during revegetation with the spruce - birch community. At least two variations on establishing birch - spruce communities will be considered:

- Transplanting seedlings of paper birch and white spruce.
- Scattering seed of paper birch and white spruce.

Seedlings will be grown by a commercial producer from Alaskan-adapted species, then transplanted in selected locations. These will be planted in a matrix of grass seed selected for light erosion control and minimum competition with woody regeneration. These communities will be established near existing vegetation and on the more stable sites where erosion would be a relatively minor concern. Propagules from established vegetation can then disperse to some of these areas fairly easily. Natural seed dispersal may enhance the plantings but are not being depended on for browse production.

Understory species are expected to regenerate from topsoil seed banks, which would also include the appropriate microbiota for those plants. This contrasts with the redistribution of soil organisms that occurs with topsoil disturbance. Species that are expected to regenerate from the topsoil seed banks include rose, highbush cranberry, bunchberry, lowbush cranberries, some bluejoint and fireweed, and oak-fern.

Most existing spruce - birch communities occur on level or gentle slopes. Spruce is lost from the mixture on steeper slopes, although the understory frequently remains the same. Spruce also requires a fair amount of moisture. Criteria for placement of spruce - birch communities will be flat or gentle slopes with favorable moisture conditions. Vegetative mats will be located to favor their use as a means of promoting seed dispersal and establishing immediate cover. Planted stands will be located to favor reception of mycorrhizal propagules (near existing spruce - birch communities). Both types will be interspersed to provide thermal and hiding cover.

13.6.4.2 Deciduous

The deciduous habitat type will contain various mixes of willows, poplar, and alder. These types are common on floodplains and on other disturbed sites. Their main objective in the revegetation plan will be production of moose browse. Denser stands containing alder will also function as hiding cover. The alder is intended for its nitrogen-fixing symbiosis, hiding cover, and hare habitat. It will be used sparingly. Poplar and willow will be established from cuttings, either rooted or dormant, depending on the species and potential erosion hazard or perhaps from seedlings grown from seeds collected on site. Rooted cuttings will enable the plants to help control erosion very quickly.

Dormant cuttings will suffer greater mortality and effective erosion control may be delayed. Bundles will be used on steeper slopes to provide a physical barrier to soil movement until the roots form a biological barrier. Willow species will be varied among sites or several species planted on one site. Alder will be established by outplanting seedlings or dispersing seed if it can be readily collected or obtained commercially.

Overall densities of woody plants will be similar in all communities, but the percentage of each species will vary. Spatial arrangements of individuals will be varied to derive benefits from shading out grass competition. If several stems are planted closely together, some twigs may be protected from moose browse. Additionally, potential problems associated with voles girdling stems will be reduced by limiting the amount of hiding cover. Woody species will be planted to simulate the patchy arrangement of natural clumps of plants where possible.

Different mixes of the deciduous species would also represent different stages of succession. The hope is to replace some of the relatively uniform stands of pre-mining vegetation with a mosaic of younger vegetation with more moose browse.

Alder is expected to grow faster than willow or poplar initially. However, the poplar eventually overtops the alder (about 20 years or less) and produces a poplar forest in normal succession (Helm et al. 1985). The understories resulting from a poplar/willow planting compared with a poplar/alder/willow planting would be expected to differ because of the initial shading by the alder and the latter benefits of N additions to the soil from the alder component.

13.6.4.3 Herbaceous

Grassland will be seeded in the areas with the most severe erosion potential either because of length of slope or degree of slope or soil materials. The mix will be applied at greater effective rates than on other sites. It will also be dominated by more vigorous species such as Arctared and Nortran. Willow and poplar bundles may be used near the toes of steeper slopes for physical barriers which then develop into biological barriers. These multiple stems may prove more resistant to vole girdling than individual stems.

13.6.5 Methods

13.6.5.1 Contouring

Pits will be backfilled and graded to the approximate original contour. Benches or furrows may be used on steeper slopes to reduce runoff and to accumulate moisture, fertilizer, and dispersed propagules and organics. If benches are used, willows will be planted at the base of slopes to take advantage of the moisture and to provide added site stability.

13.6.5.2 Topsoil

Dozers, scrapers, or trucks and an excavator/loader will be used to move the topsoil from temporary storage to the regraded area or directly from new areas to the regraded area. Direct haulback will be used whenever possible.

Portions of topsoils underlying spruce - birch communities will be used for direct haulback when possible . These soils are expected to provide propagule banks for understory species and soil microbiota, especially mycorrhizae needed for growth by some plant species such as spruce. Any soil to be used with spruce plantings will come from plant communities with spruce trees growing and will be as fresh as possible. Ectomycorrhizal propagules are dispersed by wind, but plantings may be too far from a source for sufficient quantities for inoculation. An alternative will be to locate any spruce plantings near existing spruce sites or use seedlings inoculated with proper mycorrhizae.

13.6.5.3 Application of Seed, Cuttings, Fertilizer

Fertilizer will be applied before any seed is spread. The seed will be spread at a rate of approximately 20 pounds per acre (PLS) during May through July. Steeper slopes may be hydroseeded using a light mulch as a tracer. Mulch will be avoided in most places not hydroseeded as it decreases soil temperature and some types do not decompose well. Litter buildup becomes a problem with grasses after the first two years, and mulching would contribute to the problem.

Herbaceous species will be seeded first then woody species outplanted to prevent damage to the woody plants. All areas will be seeded for erosion control but lower rates will be used in the woody communities to reduce herbaceous competition with shrub establishment. If cuttings or bundles are to be located on slopes to be hydroseeded, they will be planted first, then the area will be hydroseeded to reduce trampling of the seed and other disturbances. Based on the results of the monitoring program discussed in Section 13.6.7.4, appropriate maintenance procedures will be implemented to make certain the reclamation objectives are achieved.

Cuttings and seedlings will be planted by machine or by hand, depending on slope, soil stability, and other considerations during May through July, as weather and soil conditions permit. The individual cutting or seedling will be planted to the same depth to which it was planted in its original growing medium. They will be planted in the grass-free strips where possible. The starting of woody plants from cuttings and seedlings will provide an advantage for woody plants over grasses.

Grass seed ratios and rates will be varied somewhat according to the desired result. More seed and a greater percentage of robust species such as Arctared and Nortran will be used on steeper slopes. Soil stabilization will be the main goal here. A medium seed rate will be used in deciduous communities to cover most of the ground and control erosion, but not dense enough to compete with woody species. Hiding cover for voles will also be kept to a minimum to reduce potential girdling damage. An attempt will be made to achieve as much diversity as possible with the seed mix where reasonable. Some species may require longer than others to develop. These species will be seeded at a greater ratio on areas where diversity is a consideration than they would on steep slopes. Some slow-developing species may not be included on steep slope sites since they may not be capable of surviving.

Fertilizer strategies will be considered to achieve desired results. The soil fertility status of the topsoil will be tested after the topsoil has been replaced and redressed prior to seeding. At that time, macro-nutrient and micro-nutrient status will be evaluated. The soils will then be fertilized based on this testing.

Grasses usually require high N for best performance. Hence higher N levels will be used in areas where establishment of grass is important. The N level will be reduced in areas where grass competition with woody species is a consideration. More P also encourages root growth and could encourage mycorrhizal development, depending upon nutrient base levels. Levels, especially of P, that are too high may suppress soil microbiota. Initial flushes of growth might be obtained, but long-term establishment of the community may be slowed. These plans will make use of experience and research results as they become available. Initial trials described in 13.6.2 are using 20-20-20 at 300 lb/acre with grasses and no fertilizer with the shrubs.

13.6.5.4 Roads

As indicated on Plate 13-1, the access road and a portion of the main haul road system will be left in place for recreational access to the area. Road embankments will be seeded but no woody species will be planted here. Willow and poplar naturally invade these narrow corridors to create additional moose browse. No attempt will be made to encourage browse along roads where moose could be a safety hazard.

13.6.5.5 Shrub Protection

Woody species may benefit from some protection from cold and moose browsing during the establishment years by creating microsites where feasible. Windbreaks will produce snow drifts in the winter.

Clustering of individuals will be used to improve accumulation of snow and other windborne materials such as seeds and organics. Planting shrubs in clusters may reduce browsing on at least some twigs and also limit girdling caused by voles. Clustering may also reduce grass cover under the canopy thus reducing competition and hiding cover for the voles.

The facilities area will contain depressions where willows are expected to perform well and will be one of the larger plantings of willows. Some browsing by moose after establishment may actually improve plant growth, but overbrowsing could slow the reestablishment of woody species, as is evidenced by the hedged paper birch trees in the permit area. For safety reasons, portions of the project area will be fenced, which will provide some protection from moose overbrowsing in establishment years (see Monitoring section).

13.6.5.6 Temporary Cover

Topsoil and overburden stockpiles will be seeded with a mix of Arctared, timothy, and brome. This seed mixture will produce effective cover for erosion control. To encourage growth performance and rapid establishment, fertilizer will be applied at the time of seeding. The application rate will be determined from on-site soil test results.

13.6.6 Revegetation Schedule

The reclaimed mine area is depicted on Plate 13-1. As indicated, the embankments along the Buffalo Creek diversion channel as well as the northern end of the pipeline arm will be reclaimed during the first 5 year term. Also in the first 5 year term, the disturbed areas along the access road will be permanently reclaimed. Following the end of the mine operation , the other portions of the mine and facilities area will be reclaimed using the methods outlined above.

The woody plants will be planted in post-mine conditions (slope, aspect, wind exposure, moisture conditions) suitable for those species. That is, willows would likely be planted in swales while paper birch might be on drier sites. Some white spruce would be planted in clusters to provide hiding and thermal cover for moose. Some alder will be planted adjacent to poplar stands for hiding cover. Direct haul back will be used for much of the spruce - birch community to be planted to ensure a collection of seeds, rhizomes, and microbiota. Woody plants will be planted in the most suitable locations, and grass will be planted elsewhere.

On locations dominated by steep slopes ranging from south to northwest-facing, grass will be hydroseeded (steep). Willows, possibly including bundles, may be planted on some slopes to assist with soil surface stability.

At the end of reclamation several depressions will remain, including several backfilled ponds which are similar to the existing topography. These ponds were initially established in natural depressions during the mine operation but will be depressions after mining. Willows will be emphasized in these sites including the slurry pond and plant area.

13.6.7 Standards

All proposed standards are technical standards, some of which are partly derived from baseline data. Existing vegetation has taken decades to become established. Most species are not commercially available hence natural processes are needed for the ultimate completion of these communities. Standards have been proposed that should ensure a viable plant community with cover for erosion control, diversity, and shrubs for moose browse, but still allow space for natural succession. The standards need to be met by year 10 after planting, but the communities will continue to develop ecologically by natural processes in the following decades.

13.6.7.1 Erosion Control Standard

Ground cover shall cover at least 70% of the proposed bond-release area. This includes live vegetation (e.g. vascular plants, mosses, lichens), vegetative mat, incidental woody debris, litter, and stones and gravel that will resist erosion. This should provide sufficient live cover to have a viable plant community, but allow space for native colonization over time. This cover should balance the need for short-term surface protection and longer-term woody species regeneration.

13.6.7.2 Woody Vegetation Density Standard

An average of 600 woody stems per acre must be achieved on at least two-thirds of any area proposed for bond release. To be counted, each stem must be at least 8 inches tall. This is about 33% greater than the 450 stems per acre required by Division of Forestry Reforestation Standard for Region II (Interior spruce / hardwood, south of the Alaska Range), primarily because the goal is moose browse rather than merchantable timber. It is anticipated that this number of stems will help initiate the processes to form vegetation types suitable for moose habitat but not crowd out natural colonization. Observations on other mined sites as well as revegetation plot trials indicate that these succession processes will occur, especially if facilitated by initial seedings and plantings. Data suggest that in 15-20 years, this number of stems would produce similar levels of browse relative to what is out there now. Planting greater densities could result in less productive communities. The average age of many of the browsed plants before mining was 15-18 years.

13.6.7.3 Woody Species Diversity

In two-thirds of each area requested for bond release, at least three woody species must be present with at least 20% of the density (stems / acre) being made up of at least two species. An exception might be a small area that was intended to contain only one woody species, like a spruce community. It is anticipated that there will be multiple communities establish within a bond-release area, so the overall diversity will be greater than the smaller areas.

13.6.8 Monitoring

Vegetation development will be monitored at recurring intervals to ensure that ground cover and woody plants are being established as planned. Sampling units will likely be located in a systematic grid of hexagons, in which all points are equal distance from neighbors. This is patterned after US Forest Service Forest Inventory and Forest Health Monitoring plots for sampling vegetation over decades, but on a smaller spatial scale (maybe 100-150m apart). The grid can be setup with GIS, then download the grid points to a GPS receiver and use this to locate points in the field.

At each point a 20-m transect will be extended in a random direction. Cover data will be obtained by recording vegetation hits every 50 cm along the transect edge. Woody stems will be counted in a 2-m wide belt transect along the edge. For bond release, the stems must be 8 inches tall for most species, but only 4 inches tall for white spruce. Long thin sampling units maximize the amount of variability, potentially reducing costs of relocating plots.

The advantages of systematically spaced sampling units include ensuring dispersal of units across the entire area, ease of relocation for monitoring purposes, and documenting community expansion. Random samples tend to cluster in some areas. This type approach works better than stratified random sampling within plant communities where sampling units are located within homogeneous areas and the edge effect, so important for wildlife habitat, is neglected. It also lends itself to periodic photographs of the area.

Monitoring can vary from just observational in the first few years after revegetation to ensure that ground cover and woody plants are becoming established. It is anticipated that some quantitative data would be taken by year 4 to ensure adequate progress toward community development and to document woody plants in place 6 years prior to bond release application. Photographs in years 3, then 5 or 6, then 9 and 10 would be recommended to document the revegetation progress. Years 1 and 2 are the establishment years, and year 3 is the first to really give an idea of long-term survival after initial fertilizer effects wear off. In the last two years before applying for bond release, monitoring would be detailed to meet the bond-release criteria. If more sampling units are needed for adequate sampling, then additional units would be added as needed.

All woody plants needed on a site will be planted during the reclamation year for that site. If high mortality occurs, then areas will be replanted the following year. It is expected that all shrubs to be counted will be in place by the end of the first 5 year term at a particular site. These shrubs should be much older and larger than later invaders. Hence, the planted shrubs should be readily identifiable.

13.6.9 Bond Release Procedures

The following bond release methodology will apply to any request for final bond release unless another methodology is mutually agreed by UCM and the Department of Natural Resources:

Outline the boundary of a bond release area. UCM will, as much as practical, request bond release for logical units. Examples might include a completed out-of-pit spoil pile, or all reclaimed areas within a 100 acre area or within a five year permit term. Because exact areas cannot be specified in advance(i.e., at the time of their permit application), UCM will jointly agree on bond release areas with the Department before bond release is requested.

Outline 2/3 of the acreage to which the woody shrub and the diversity standards apply. The woody shrub standard applies to 2/3 of any area on which final bond release is requested. The 1/3 of the area that is outside this standard may be outlined any time up to the time that final bond release is requested. The 1/3 area on which the standard does not apply may be in one part of the bond release unit, or be broken up into smaller areas spread throughout the unit. Distributing the non-woody shrub areas will serve to help spread out the edge effect and diversity for which the standard was devised.

Site Visit By the Department. After the two steps above have been completed, representatives of UCM and the Department will walk the area proposed for bond release.

Establish sampling units for the erosion control standard (i.e., to measure ground cover) throughout the area proposed for bond release. This sampling grid will be established early in the revegetation monitoring program, but may be subsampled or extra samples, depending upon how many needed. Sampling units will likely be located in a systematic grid of hexagons, in which all points are equal distance from neighbors. This is patterned after US Forest Service Forest Inventory and Forest Health Monitoring plots for sampling vegetation over decades, but on a smaller spatial scale. Cover will be measured using the method referenced for foliage cover in *Premining Vegetation Inventory, Hoseanna Creek Basin, Usibelli Coal Mine; November 1, 1992. Dot Helm (p 8-9),* or any similar and generally accepted method of measuring ground cover. Long thin sampling units maximize the amount of variability, potentially reducing costs of relocating plots.

Establish sampling units to measure the number and type of and woody stems in the 2/3 of the acreage to which the woody shrub and diversity standards apply. Sampling units for woody stems will be belt transects 2m x 20m along edge of the cover transects. If the trees are particularly well developed by that time, it might be more appropriate to use 4m x 20m belt transects to accommodate the larger scale of pattern. Within randomly established plots of a standard size, all woody stems greater than eight inches (and spruce greater than four inches) will be counted and characterized by species. All stems growing from a single “clump” will be counted as a single stem.

With respect to the erosion control standard, measurements will be made on at least 10 sampling units to determine whether ground cover meets the erosion control standard. Measurements will also be made on at least 10 sampling units for woody density and diversity standards. Because the erosion control standard applies to the entire area requested for bond release, and woody vegetation and diversity standards apply to only two-thirds of the area, all sampling units may not be the same.

The following tests will be used to determine whether the criteria have been met.

Number of Sampling Units – For these tests, the minimum number of sampling units to be sampled will be determined according to the formula below:

$n_{min} = t^2 s^2/(dx_{ave})^2$

Where n_{min} = Minimum number of sampling units in the bond release request;

t = t-value for a one-tailed t-test for 90% confidence and n-1 degrees of freedom
s = standard deviation of the observations from each sampling init (cover, number of stems)
x_{ave} = arithmetic mean of the observations from each sampling unit (cover, number of stems)
d = percentage of mean required for adequacy of sampling = 10% (0.1) for cover and 20% (0.2) for stocking

Comparison against the standards (ground cover, number of woody stems) – The t value calculated from the data is

$$t_{calc} = \frac{x_{ave} - x_{std}}{s/\sqrt{n}}$$

x_{ave} = arithmetic mean of the individual sampling units (cover,number of stems)
x_{std} = 11 AAC 90.457(b) provides that success is achieved at 90% of the cover and stocking standards; therefore:
x_{std} for the number of woody stems is 90% of 600 or 540 stems/acre
x_{std} for ground cover is 90% of 70% or 63% (.63)
s = standard deviation of the sampling units.
n = the number of sampling units

The calculated t is compared with t , which is a one-tailed t-test with a .1 alpha error and n-1 degrees of freedom.

If, for each standard, the number of sampling units is greater than or equal to n_{nmin} as calculated above, and the calculated t-value is less than or equal to the standard value as indicated above, the appropriate standard (erosion control or woody vegetation density) will be considered to be achieved.

The diversity standard is tested directly comparing the total woody stem counts by species with the diversity standard. The test either passes or fails, and no more elaborate statistics are necessary.

13.7 Reclamation of Support Facilities

13.7.1 Post-Mining Removal of Mine Facilities

Upon completion of coal processing during the third year term of the mining operation, reclamation of the processing and support facilities will commence. The first step in reclamation will be to dismantle the wash plant and other buildings and equipment. These structures will be hauled offsite for resale or salvage. Once all the buildings and equipment have been removed, any concrete foundations will be broken up and disposed in the slurry pond. The lining in the fuel storage area will be removed and properly disposed. Fencing in the support facilities area will also be removed as part of the support facilities reclamation.

With the exception of the slurry pond, as discussed in the following section, the support facilities area will require only minor grading. Grading will be conducted to maintain a small parking area for post-mining recreational users of the property. In conjunction with the minor grading, a dozer will be used to rip the compacted surfaces and prepare these surfaces for topsoil replacement. Once the surface has been loosened, topsoil will be replaced and the area will be planted.

13.7.2 Process Ponds

Fresh Water Ponds No. 1 and No. 2 as well as the Wash Down Water Pond will be regraded as part of the support facilities final grading. All embankments constructed to ensure containment of the necessary storage will be removed and the native soil embankment materials will be placed in the pond and surrounding area and regraded.

The slurry pond is also located in a natural depression. The depression will be partially filled with slurry upon completion of the mining operation. As a part of the reclamation activities, the natural depression will be backfilled with overburden material to the approximate surrounding topography to eliminate the existing depression and create positive drainage of surface runoff away from this area. The amount of overburden required to fill the depression will be determined based on the actual amounts of slurry and sediment present in the pond immediately prior to final reclamation. At a minimum four feet of overburden will be material will be placed on the slurry pond area. Upon completion of overburden placement and grading, topsoil will be replaced on the slurry pond area and the area will be revegetated.

A small part of the slurry pond will be left unreclaimed to continue to function in sediment control until the site revegetation standards have been met and drainage into this area meets applicable State and Federal water quality regulations. Once these requirements have been met, this area will also be backfilled with overburden followed by topsoil replacement and revegetation.

13.7.3 Roads

All roads constructed as part of the Wishbone Hill Project will be reclaimed upon completion of use except those roads which will be retained to allow public access to the area for recreational use. The roads to be left unreclaimed are shown on Plate 13-1 and include the mine site access road, the main Mine Area 1 haul road and the main Mine Area 2 haul road. The latter two roads will be downgraded to 20 foot wide dirt trails as part of the reclamation effort; the mine access road will be left at its full width of 40 ft. The combined length of the unreclaimed Mine Area 1 and 2 haul roads will be about 2.5 miles accounting for about 6 acres of unreclaimed area. About 12 acres of unreclaimed mine access road will be left in place.

The access road outslopes will be reclaimed during the first 5 year term of the operation. No additional reclamation work is planned for this road. At the end of mining, the main haul road to Mine Area 1 will be downgraded from the approximate 80 foot wide mine haul road to a 20 foot wide dirt road. Topsoil will be replaced on cut and fill slopes needed for the reclaimed road as well as the disturbance from the operations haul road and these areas will be revegetated. Also at the end of mining, the main haul road to Mine Area 2 will be reclaimed in the same manner.

All other mine roads needed to access the various mine facilities will be reclaimed upon completion of use of the facility. The road reclamation will occur in conjunction with the associated facility reclamation.

13.7.4 Utilities

The two utilities located at the site will be power facilities and telephone facilities. Both utilities will be brought onto the site through underground lines. Upon completion of mining activities these utilities will be disconnected leaving the underground lines in place.

13.8 Reclamation Timetable

Reclamation will occur as contemporaneously as practicable with the mining operation; however, it will be limited in the first 5 year term do to the DMLW's request to minimize the amount of disturbance within the permit area. The placement of overburden stockpile 1 and 2 on the previously mined and backfilled pit areas will minimize the amount of disturbance required for the mining operations but will also limit contemporaneous reclamation in the first 5 year term.. Reclamation will run concurrently with the mining operation once overburden stockpile 2 is complete and will continue through the mine life...

13.9 Reclamation Costs

Surface coal mining operations, as defined in AS 27.21.998(17), began under mining permit numbers 01-89-796 and 02-89-796 in June 2010. A bond in the amount of $29,910 is currently posted with the Division of Mine, Land and Water (DMLW) to cover the predevelopment work that was completed in 2010. Pursuant to the provisions of 11 AAC 90.205 a new detailed reclamation cost estimated has been developed for the first five years of mining using current rates and price quotes. This estimate assumes the cost for a third party to reclaim the maximum yearly disturbance as described in the previous sections of this Operation and Reclamation Plan. The detailed estimate includes all supporting calculations and background information including the type of equipment (including cost to operate and maintain), volumes in LCY, material haul distances, push distances for backfilling and grading, cost for revegetation work, and personnel cost. In addition to the direct costs list above, the following indirect costs were also assumed:

- Mobilization/Demobilization at 4%
- Contingencies at 5%
- Engineering Redesign Fee at 4%
- Contractor Profit & Overhead at 15%
- Project Management Fee at 2%

All of the backup materials, assumptions, and cost estimations have been filed with the DMLW and are contained in their offices in Anchorage. The following table provides a summary of the projected reclamation costs for the first five years of mining.

Year	Amount
0 (Predevelopment)	$34,800
1	$7,940,616
2	$8,100,576
3	$11,292,940
4	$38,395,702
5	$55,575,994

Summary of Wishbone Hill incremental Reclamation Bond Costs

Review Date: 16-Jul-14

Direct Cost Items

Year		0	1	2	3	4	5
Earthmoving		$ 24,749	$ 5,708,316	$ 5,815,743	$ 8,211,057	$ 29,040,165	$ 42,238,735
Revegetation (seed bed prep)		$ 300	$ 15,540	$ 16,860	$ 21,960	$ 23,580	$ 25,020
Aerial Seeding & Fertilizing		$ 1,720	$ 168,350	$ 182,650	$ 237,900	$ 255,450	$ 271,050
Facility Removal		$ -	$ 215,960	$ 215,960	$ 215,960	$ 215,960	$ 215,960
Subtotal Direct Costs		$ 26,769	**$ 6,108,166**	**$ 6,231,213**	**$ 8,686,877**	**$ 29,535,155**	**$ 42,750,765**

Indirect Cost Items

	(percent)						
Mobilization & Demobilization	4.0	$ 1,071	$ 244,327	$ 249,249	$ 347,475	$ 1,181,406	$ 1,710,031
Contingency Allowance	5.0	$ 1,338	$ 305,408	$ 311,561	$ 434,344	$ 1,476,758	$ 2,137,538
Engineering Redesign Fee	4.0	$ 1,071	$ 244,327	$ 249,249	$ 347,475	$ 1,181,406	$ 1,710,031
Contracor Profit & Overhead	15.0	$ 4,015	$ 916,225	$ 934,682	$ 1,303,032	$ 4,430,273	$ 6,412,615
Reclamation Management Fee	2.0	$ 535	$ 122,163	$ 124,624	$ 173,738	$ 590,703	$ 855,015
Subtotal Indirect Costs		**$ 8,031**	**$ 1,832,450**	**$ 1,869,364**	**$ 2,606,063**	**$ 8,860,547**	**$ 12,825,229**

Grand Totals	**$ 34,800**	**$ 7,940,616**	**$ 8,100,576**	**$ 11,292,940**	**$ 38,395,702**	**$ 55,575,994**

Summary of Wishbone Hill Reclamation Bond Costs Year 1

Review Date: 16-Jul-14

Direct Cost Items			
Earthmoving		$	24,749
Revegetation (seed bed prep)		$	300
Aerial Seeding & Fertilizing		$	1,720
Facility Removal		$	-
Subtotal Direct Costs		**$**	**26,769**
Indirect Cost Items			
	(percent)		
Mobilization & Demobilization	**4.0**	$	1,071
Contingency Allowance	**5.0**	$	1,338
Engineering Redesign Fee	**4.0**	$	1,071
Contracor Profit & Overhead	**15.0**	$	4,015
Reclamation Management Fee	**2.0**	$	535
Subtotal Indirect Costs		**$**	**8,031**
Grand Totals		**$**	**34,800**

Wishbone Hill Year 1 Summary Calculation of Earthmoving Costs

Task	Equipment	Operating Costs	Labor Costs	Unit Cost	Total Hours	Quantity BCY	Sub Total
Back Fill	992 Loader	$420.10	$59.73		0	0	$0
	2-777 Truck	$576.78	$119.46		0		$0
	G14 Grader	$160.60	$59.73		0		$0
	Water Truck	$81.55	$59.73		0		$0
	D9R Dozer	$208.90	$59.73		0		$0
Topsoil Respread				$1.75		5,000	$8,750
Roads	D8R Bulldozer	140.259	$59.73		80		$15,999
Drainage Construction	D8R Bulldozer	$156.22	$59.73		0		$0
	966 Loader	$91.57	$59.73		0		$0
	15 CY Truck	$73.06	$59.73		0		$0
	Riprap Screened			$8.00		0	$0
	Labor Tasks		$51.77		0		$0
	Geocloth			$1.75		0	$0
					TOTAL		**$24,749**

Equipment Costs (input by DNR)

Dataquest Guide

	Dataquest	AK factor	subtotal	Fuel (g/hr)	$/gal	Fuel ($/hr)	**TOTAL**
992 Loader	$ 230.65	1.337	$ 308.38	28	$3.99	$ 111.72	**$420.10**
777 Truck	$ 159.78	1.293	$ 206.60	20.5	$3.99	$ 81.80	**$288.39**
G14 Grader	$ 63.42	1.337	$ 84.79	19	$3.99	$ 75.81	**$160.60**
Water Truck	$ 43.01	1.293	$ 55.61	6.5	$3.99	$ 25.94	**$81.55**
D9R Bulldozer (w/EROPS*)	$ 111.48	1.337	$ 149.05	15	$3.99	$ 59.85	**$208.90**
D8R Bulldozer (w/EROPS)	$ 87.00	1.337	$ 116.32	10	$3.99	$ 39.90	**$156.22**
Cat D6 Bulldozer (w/EROPS)	$ 87.00	1.337	$ 116.32	6	$3.99	$ 23.94	**$140.26**
966F Loader	$ 46.11	1.337	$ 61.65	7.5	$3.99	$ 29.93	**$91.57**
15 cy Truck	$ 35.52	1.293	$ 45.93	6.8	$3.99	$ 27.13	**$73.06**

Wishbone Hill Drain Costs Year 1

Cut Terrace Drain, Lay Geocloth, Screen and Haul and Spread Riprap

	Amount	Rate (units per hr)	Rip-Rap BCY	Cloth	Labor	D8N	Loader	Truck
Cut Drain								
	0 LF	125				0		
Lay Cloth	Assume coverage of 2 sq. yd. Per ft of ditch							
	0 LF	325		0 sq. yd.	0			
Rip-Rap	Assume an average coverage rate of 0.75 BCY per LF ditch							
	0 LF	30	0			0	0	0
	**See UCM Backup Calculation for Riprap Support production cost of $8 per BCY							
	***See Morrison-Knudsen Riprap Caluclation (Backup Data)							
	Haul 3720 CY of Riprap With 15 CY Truck							
	Assume a Production Rate of 30 CY/Hr. with 966 Loader and 15 CY truck							
	Spread Riprap With D8N Dozer Hours							
Pond Regrade	Settling Pond Regrade (only include removal of decants)							
	0	40 hr per unit			0	0		
Totals			**0**	**0 sq. yd.**	**0**	**0**	**0**	**0**

Drainage subcalcs (back-calculate to find 2002 assumptions)

Given:

LF Ditch	8200
D8 Hrs	238
BCY Rip-Rap	3720
LF Cloth	5,000
Loader Hours	124
Truck Hours	124

Calculated Assumptions:	**2002**	**Use in 2004**
Dozer rate (LF/Hr)	34.5	125.0
Rip-Rap Req'd (BCY/ft)	0.5	0.75
Loader/Truck/Spread Rate (BCY/Hr)	30.0	30.0
Geocloth (Sq. Yd. per LF ditch)	0.6	2

Wishbone Hill Revegetation Costs Year 1		
Total Disturbed Area (Acres)		5
Subcontract Costs		
Seeding & Fertilizing	$344 /acre	$1,720
Direct Cost		
Seedbed Preparation	$60 /acre	$300
Total Costs		$2,020

Wishbone Hill Facilities Removal Year 1				
Powerline Removal				
Ft		**0**		
$ per ft	**$**	**6.00**	$	-
Substation				
Remove skid mounted equipment			$	-
Plant, shop and Misc. Buildings				
Number of Days		-		
Daily Demolision Crew Cost	$	7,022		-
Powder Magazine - Structure Removal			$	-
Total Costs			$	-

Means 2010

**Acreage under facilities included in revegetation calculations elsewhere

Year 1 Wisebone Hill Regrade Volumetrics, Topsoil Volumes, and Drainage Construction Volumes

	Task	Backfill Volume (lcy)	Avg Distance	Effective Grade	Travel Time Loaded (min)	Travel Time Empty (min)	Load Time (min)	Dump Time (min)	Total Cycle Time (min)	Truck Capacity (cy)	**Number of Truck**	**Fleet Production (cy/hr)**	**Fleet Avalability**	**Fleet Utilazation**	**Ajusted Fleet Production (cy/hr)**	**Equipment**	**Hours**
Pit Backfill																	
	Mine Area 1	-	1500	5	0.8	0.6	3.2	1.2	5.8	66	2	1,366	0.9	0.83	1020	992 Loader	0
																2-777 Trucks	0
																Moter Grader	0
																Water truck	*0*
																D9R	0

Topsoil Redistribution	**Area (ac)**	**Depth (ft)**	**Quantity (BCY)**	**Drainage Length**	**Equipment**	**Acres**
Mine Roads and Divertions	5	0.6	5,000		Truck/Loader/Dozer	
					Truck/Loader/Dozer	
Subtotal	*5*		*5,000*			
Drain Construction	**See Drain Cost Sheet for details**					
	Length (ft)	Production ft/hr	Hours			
Roads/Trails (Rip road surface)	**10000**	**1000**	80		D8H	
Area Topsoiled						5
Topsoil Pile Areas						34
Furrow-Seed-Fertilize						39

Summary of Wishbone Hill Reclamation Bond Costs Year 1

Review Date: 16-Jul-14

Direct Cost Items			
Earthmoving		$	5,708,316
Revegetation (seed bed prep)		$	15,540
Aerial Seeding & Fertilizing		$	168,350
Facility Removal		$	215,960
Subtotal Direct Costs		**$**	**6,108,166**
Indirect Cost Items			
	(percent)		
Mobilization & Demobilization	**4.0**	$	244,327
Contingency Allowance	**5.0**	$	305,408
Engineering Redesign Fee	**4.0**	$	244,327
Contracor Profit & Overhead	**15.0**	$	916,225
Reclamation Management Fee	**2.0**	$	122,163
Subtotal Indirect Costs		**$**	**1,832,450**
Grand Totals		**$**	**7,940,616**

Wishbone Hill Year 1 Summary Calculation of Earthmoving Costs

Task	Equipment	Operating Costs	Labor Costs	Unit Cost	Total Hours	Quantity BCY	Sub Total
Back Fill	992 Loader	$420.10	$59.73		2,941	3,000,000	$1,411,205
	2-777 Truck	$576.78	$119.46		2,941		$2,047,685
	G14 Grader	$160.60	$59.73		294		$64,801
	Water Truck	$81.55	$59.73		294		$41,550
	D9R Dozer	$208.90	$59.73		2,941		$790,053
Topsoil Respread				$1.75		733,000	$1,282,750
Roads	D8R Bulldozer	156.219	$59.73		144		$31,097
Drainage Construction	D8R Bulldozer	$156.22	$59.73		54		$11,687
	966 Loader	$91.57	$59.73		41		$6,203
	15 CY Truck	$73.06	$59.73		41		$5,444
	Riprap Screened			$8.00		1230	$9,840
	Labor Tasks		$51.77		5		$261
	Geocloth			$1.75		3,280	$5,740
					TOTAL		**$5,708,316**

Equipment Costs (input by DNR)

Dataquest Guide

	Dataquest	AK factor	subtotal	Fuel (g/hr)	$/gal	Fuel ($/hr)	**TOTAL**
992 Loader	$ 230.65	1.337	$ 308.38	28	$3.99	$ 111.72	**$420.10**
777 Truck	$ 159.78	1.293	$ 206.60	20.5	$3.99	$ 81.80	**$288.39**
G14 Grader	$ 63.42	1.337	$ 84.79	19	$3.99	$ 75.81	**$160.60**
Water Truck	$ 43.01	1.293	$ 55.61	6.5	$3.99	$ 25.94	**$81.55**
D9R Bulldozer (w/EROPS*)	$ 111.48	1.337	$ 149.05	15	$3.99	$ 59.85	**$208.90**
D8R Bulldozer (w/EROPS)	$ 87.00	1.337	$ 116.32	10	$3.99	$ 39.90	**$156.22**
966F Loader	$ 46.11	1.337	$ 61.65	7.5	$3.99	$ 29.93	**$91.57**
15 cy Truck	$ 35.52	1.293	$ 45.93	6.8	$3.99	$ 27.13	**$73.06**

Wishbone Hill Drain Costs Year 1

Cut Terrace Drain, Lay Geocloth, Screen and Haul and Spread Riprap

	Amount	Rate (units per hr)	Rip-Rap BCY	Cloth	Labor	D8N	Loader	Truck
Cut Drain								
	1,640 LF	125				13.12		
Lay Cloth	Assume coverage of 2 sq. yd. Per ft of ditch							
	1,640 LF	325		3,280 sq. yd.	5			
Rip-Rap	Assume an average coverage rate of 0.75 BCY per LF ditch							
	1,640 LF	30	1,230			41	41	41
	**See UCM Backup Calculation for Riprap Support production cost of $8 per BCY							
	***See Morrison-Knudsen Riprap Caluclation (Backup Data)							
	Haul 3720 CY of Riprap With 15 CY Truck							
	Assume a Production Rate of 30 CY/Hr. with 966 Loader and 15 CY truck							
	Spread Riprap With D8N Dozer Hours							
Pond Regrade	Settling Pond Regrade (only include removal of decants)							
	0	40 hr per unit			0	0		
Totals			**1230**	**3,280 sq. yd.**	**5**	**54**	**41**	**41**

Drainage subcalcs (back-calculate to find 2002 assumptions)

Given:

LF Ditch	8200
D8 Hrs	238
BCY Rip-Rap	3720
LF Cloth	5,000
Loader Hours	124
Truck Hours	124

Calculated Assumptions:	**2002**	**Use in 2004**
Dozer rate (LF/Hr)	34.5	125.0
Rip-Rap Req'd (BCY/ft)	0.5	0.75
Loader/Truck/Spread Rate (BCY/Hr)	30.0	30.0
Geocloth (Sq. Yd. per LF ditch)	0.6	2

Wishbone Hill Revegetation Costs Year 1		
Total Disturbed Area (Acres)		259
Subcontract Costs		
Aerial Seeding & Fertilizing	$650 /acre	$168,350
Direct Cost		
Seedbed Preparation	$60 /acre	$15,540
Total Costs		$183,890

Wishbone Hill Facilities Removal Year 1				
Powerline Removal				
Ft	**0**			
$ per ft	**$ 6.00**		$ -	
Substation				
Remove skid mounted equipment			$ 3,700.00	
Plant, shop and Misc. Buildings				
Number of Days		30		
Daily Demolision Crew Cost		$ 7,022	210,660	Means 2010
Powder Magazine - Structure Removal			$ 1,600.00	
Total Costs			$ 215,960.00	

**Acreage under facilities included in revegetation calculations elsewhere

Year 1 Wisebone Hill Regrade Volumetrics, Topsoil Volumes, and Drainage Construction Volumes

	Task	Backfill Volume (lcy)	Avg Distance	Effective Grade	Travel Time Loaded (min)	Travel Time Empty (min)	Load Time (min)	Dump Time (min)	Total Cycle Time (min)	Truck Capacity (cy)	**Number of Truck**	**Fleet Production (cy/hr)**	**Fleet Avalability**	**Fleet Utilazation**	**Ajusted Fleet Production (cy/hr)**	**Equipment**	**Hours**
Pit Backfill																	
	Mine Area 1	3,000,000	1500	5	0.8	0.6	3.2	1.2	5.8	66	2	1,366	0.9	0.83	1020	992 Loader	2941
																2-777 Trucks	2941
																Moter Grader	294
																Water truck	*294*
																D9R	2941

Topsoil Redistribution	**Area (ac)**	**Depth (ft)**	**Quantity (BCY)**	**Drainage Length**	**Equipment**	**Acres**
Facilities- Assoc. Roads	111	1.9	332,000		Truck/Loader/Dozer	
Overburden Stockpile 1	57	2.7	252,000			
Pit Area	33	1.7	90,000			
Buffalo Creek Divertion	2	1.5	5,000			
Mine Roads and Divertions	22	1.5	54,000			
					Truck/Loader/Dozer	
Subtotal	*225*		*733,000*			
Drain Construction	**See Drain Cost Sheet for details**					
	Length	Production ft/hr	Hours			
Roads (Rip half the road)	**144000**	**1000**	144		D8H	
Area Topsoiled						225
Topsoil Pile Areas						34
Furrow-Seed-Fertilize						259

Summary of Wishbone Hill Reclamation Bond Costs Year 2

Review Date: 16-Jul-14

Direct Cost Items			
Earthmoving		$	5,815,743
Revegetation (seed bed prep)		$	16,860
Aerial Seeding & Fertilizing		$	182,650
Facility Removal		$	215,960
Subtotal Direct Costs		**$**	**6,231,213**
Indirect Cost Items			
	(percent)		
Mobilization & Demobilization	**4.0**	$	249,249
Contingency Allowance	**5.0**	$	311,561
Engineering Redesign Fee	**4.0**	$	249,249
Contracor Profit & Overhead	**15.0**	$	934,682
Reclamation Management Fee	**2.0**	$	124,624
Subtotal Indirect Costs		**$**	**1,869,364**
Grand Totals		**$**	**8,100,576**

Wishbone Hill Year 2 Summary Calculation of Earthmoving Costs

Task	Equipment	Operating Costs	Labor Costs	Unit Cost	Total Hours	Quantity BCY	Sub Total
Back Fill	992 Loader	$420.10	$59.73		2,941	3,000,000	$1,411,205
	2-777 Truck	$576.78	$119.46		2,941		$2,047,685
	G14 Grader	$160.60	$59.73		294		$64,801
	Water Truck	$81.55	$59.73		294		$41,550
	D9R Dozer	$208.90	$59.73		2,941		$790,053
Topsoil Respread				$1.75		772,000	$1,351,000
Roads	D8R Bulldozer	156.219	$59.73		144		$31,097
Drainage Construction	D8R Bulldozer	$156.22	$59.73		108		$23,374
	966 Loader	$91.57	$59.73		82		$12,407
	15 CY Truck	$73.06	$59.73		82		$10,889
	Riprap Screened			$8.00		2460	$19,680
	Labor Tasks		$51.77		10		$522
	Geocloth			$1.75		6,560	$11,480
					TOTAL		**$5,815,743**

Equipment Costs (input by DNR)

Dataquest Guide

	Dataquest	AK factor	subtotal	Fuel (g/hr)	$/gal	Fuel ($/hr)	**TOTAL**
992 Loader	$ 230.65	1.337	$ 308.38	28	$3.99	$ 111.72	**$420.10**
777 Truck	$ 159.78	1.293	$ 206.60	20.5	$3.99	$ 81.80	**$288.39**
G14 Grader	$ 63.42	1.337	$ 84.79	19	$3.99	$ 75.81	**$160.60**
Water Truck	$ 43.01	1.293	$ 55.61	6.5	$3.99	$ 25.94	**$81.55**
D9R Bulldozer (w/EROPS*)	$ 111.48	1.337	$ 149.05	15	$3.99	$ 59.85	**$208.90**
D8R Bulldozer (w/EROPS)	$ 87.00	1.337	$ 116.32	10	$3.99	$ 39.90	**$156.22**
966F Loader	$ 46.11	1.337	$ 61.65	7.5	$3.99	$ 29.93	**$91.57**
15 cy Truck	$ 35.52	1.293	$ 45.93	6.8	$3.99	$ 27.13	**$73.06**

Wishbone HIll Drain Costs Year 2

Cut Terrace Drain, Lay Geocloth, Screen and Haul and Spread Riprap

Cut Drain	**Amount**	**Rate (units per hr)**	**Rip-Rap BCY**	**Cloth**	**Labor**	**D8N**	**Loader**	**Truck**
	3,280 LF	125				26.24		
Lay Cloth	Assume coverage of 2 sq. yd. Per ft of ditch							
	3,280 LF	325		6,560 sq. yd.	10			
Rip-Rap	Assume an average coverage rate of 0.75 BCY per LF ditch							
	3,280 LF	30	2,460			82	82	82
	**See UCM Backup Calculation for Riprap Support production cost of $8 per BCY							
	***See Morrison-Knudsen Riprap Caluclation (Backup Data)							
	Haul 3720 CY of Riprap With 15 CY Truck							
	Assume a Production Rate of 30 CY/Hr. with 966 Loader and 15 CY truck							
	Spread Riprap With D8N Dozer Hours							
Pond Regrade	Settling Pond Regrade (only include removal of decants)							
	0	40 hr per unit			0	0		
Totals			**2460**	**6,560 sq. yd.**	**10**	**108**	**82**	**82**

Drainage subcalcs (back-calculate to find 2002 assumptions)

Given:

LF Ditch	8200	
D8 Hrs	238	
BCY Rip-Rap	3720	
LF Cloth	5,000	
Loader Hours	124	
Truck Hours	124	
Calculated Assumptions:	**2002**	**Use in 2004**
Dozer rate (LF/Hr)	34.5	125.0
Rip-Rap Req'd (BCY/ft)	0.5	0.75
Loader/Truck/Spread Rate (BCY/Hr)	30.0	30.0
Geocloth (Sq. Yd. per LF ditch)	0.6	2

Wishbone Hill Revegetation Costs Year 2		
Total Disturbed Area (Acres)		281
Subcontract Costs		
Aerial Seeding & Fertilizing	$650 /acre	$182,650
Direct Cost		
Seedbed Preparation	$60 /acre	$16,860
Total Costs		$199,510

Wishbone Hill Facilities Removal Year 2				
Powerline Removal				
Ft		**0**		
$ per ft	**$**	**6.00**	$	-
Substation				
Remove skid mounted equipment			$	3,700.00
Plant, shop and Misc. Buildings				
Number of Days		30		
Daily Demolision Crew Cost	$	7,022		210,660	Means 2010
Powder Magazine - Structure Removal			$	1,600.00
Total Costs			$	215,960.00

**Acreage under facilities included in revegetation calculations elsewhere

Year 2 Wisebone Hill Regrade Volumetrics, Topsoil Volumes, and Drainage Construction Volumes

	Task	Backfill Volume (lcy)	Avg Distance	Effective Grade	Travel Time Loaded (min)	Travel Time Empty (min)	Load Time (min)	Dump Time (min)	Total Cycle Time (min)	Truck Capacity (cy)	**Number of Truck**	**Fleet Production (cy/hr)**	**Fleet Avalability**	**Fleet Utilazation**	**Ajusted Fleet Production (cy/hr)**	**Equipment**	**Hours**
Pit Backfill																	
	Mine Area 1	3,000,000	1500	5	0.8	0.6	3.2	1.2	5.8	66	2	1,366	0.9	0.83	1020	992 Loader	2941
																2-777 Trucks	2941
																Moter Grader	294
																Water truck	*294*
																D9R	2941

Topsoil Redistribution	**Area (ac)**	**Depth (ft)**	**Quantity (BCY)**	**Drainage Length**	**Equipment**	**Acres**
Facilities- Assoc. Roads	111	1.9	332,000		Truck/Loader/Dozer	
Overburden Stockpile 1	57	2.7	252,000			
Pit Area	57	1.4	129,000			
Buffalo Creek Divertion	0		5,000			
Mine Roads and Divertions	22	1.5	54,000			
					Truck/Loader/Dozer	
Subtotal	*247*		*772,000*			
Drain Construction	**See Drain Cost Sheet for details**					
	Length	Production ft/hr	Hours			
Roads (Rip half the road)	**144000**	**1000**	144		D8H	
Area Topsoiled						247
Topsoil Pile Areas						34
Furrow-Seed-Fertilize						281

Summary of Wishbone Hill Reclamation Bond Costs Year 3

Review Date: 16-Jul-14

Direct Cost Items			
Earthmoving		$	8,211,057
Revegetation (seed bed prep)		$	21,960
Aerial Seeding & Fertilizing		$	237,900
Facility Removal		$	215,960
Subtotal Direct Costs		**$**	**8,686,877**
Indirect Cost Items			
	(percent)		
Mobilization & Demobilization	**4.0**	$	347,475
Contingency Allowance	**5.0**	$	434,344
Engineering Redesign Fee	**4.0**	$	347,475
Contracor Profit & Overhead	**15.0**	$	1,303,032
Reclamation Management Fee	**2.0**	$	173,738
Subtotal Indirect Costs		**$**	**2,606,063**
	30.0		
Grand Totals		**$**	**11,292,940**

Wishbone Hill Year 3 Summary Calculation of Earthmoving Costs

Task	Equipment	Operating Costs	Labor Costs	Unit Cost	Total Hours	Quantity BCY	Sub Total
Back Fill	992 Loader	$420.10	$59.73		3,570	3,300,000	$1,712,910
	3-777 Truck	$865.17	$119.46		3,570		$3,514,972
	G14 Grader	$160.60	$59.73		357		$78,655
	Water Truck	$81.55	$59.73		357		$50,434
	D9R Dozer	$208.90	$59.73		3,570		$958,960
Topsoil Respread				$1.75		998,000	$1,746,500
Roads	D8R Bulldozer	156.219	$59.73		144		$31,097
Drainage Construction	D8R Bulldozer	$156.22	$59.73		162		$35,061
	966 Loader	$91.57	$59.73		123		$18,610
	15 CY Truck	$73.06	$59.73		123		$16,333
	Riprap Screened			$8.00		3690	$29,520
	Labor Tasks		$51.77		15		$784
	Geocloth			$1.75		9,840	$17,220
					TOTAL		**$8,211,057**

Equipment Costs (input by DNR)

Dataquest Guide

	Dataquest Total cost	Ownership Cost	Operating Cost	AK factor	subtotal	Fuel (g/hr)	$/gal	Fuel ($/hr)	**TOTAL**
992 Loader	$ 230.65	$ 152.29	$ 78.36	1.337	$ 308.38	28	$3.99	$ 111.72	**$420.10**
777 Truck	$ 159.78	$ 107.35	$ 52.43	1.293	$ 206.60	20.5	$3.99	$ 81.80	**$288.39**
G14 Grader	$ 63.42	$ 10.30	$ 53.12	1.337	$ 84.79	19	$3.99	$ 75.81	**$160.60**
Water Truck	$ 43.01	$ 14.70	$ 28.31	1.293	$ 55.61	6.5	$3.99	$ 25.94	**$81.55**
D9R Bulldozer (w/EROPS*)	$ 111.48	$ 68.50	$ 42.98	1.337	$ 149.05	15	$3.99	$ 59.85	**$208.90**
D8R Bulldozer (w/EROPS)	$ 87.00	$ 55.22	$ 31.59	1.337	$ 116.32	10	$3.99	$ 39.90	**$156.22**
966F Loader	$ 46.11	$ 29.79	$ 16.32	1.337	$ 61.65	7.5	$3.99	$ 29.93	**$91.57**
15 cy Truck	$ 35.52	$ 20.32	$ 15.20	1.293	$ 45.93	6.8	$3.99	$ 27.13	**$73.06**

Wishbone Hill Drain Costs Year 3

Cut Terrace Drain, Lay Geocloth, Screen and Haul and Spread Riprap

Cut Drain	Amount	Rate (units per hr)	Rip-Rap BCY	Cloth	Labor	D8N	Loader	Truck
	4,920 LF	125				39.36		
Lay Cloth	Assume coverage of 2 sq. yd. Per ft of ditch							
	4,920 LF	325		9,840 sq. yd.	15			
Rip-Rap	Assume an average coverage rate of 0.75 BCY per LF ditch							
	4,920 LF	30	3,690			123	123	123
	**See UCM Backup Calculation for Riprap Support production cost of $8 per BCY							
	***See Morrison-Knudsen Riprap Caluclation (Backup Data)							
	Haul 3720 CY of Riprap With 15 CY Truck							
	Assume a Production Rate of 30 CY/Hr. with 966 Loader and 15 CY truck							
	Spread Riprap With D8N Dozer Hours							
Pond Regrade	Settling Pond Regrade (only include removal of decants)							
	0	40 hr per unit			0	0		
Totals			**3690**	**9,840 sq. yd.**	**15**	**162**	**123**	**123**

Drainage subcalcs (back-calculate to find 2002 assumptions)

Given:

LF Ditch	8200
D8 Hrs	238
BCY Rip-Rap	3720
LF Cloth	5,000
Loader Hours	124
Truck Hours	124

Calculated Assumptions:	2002	Use in 2004
Dozer rate (LF/Hr)	34.5	125.0
Rip-Rap Req'd (BCY/ft)	0.5	0.75
Loader/Truck/Spread Rate (BCY/Hr)	30.0	30.0
Geocloth (Sq. Yd. per LF ditch)	0.6	2

Wishbone Hill Revegetation Costs Year 3		
Total Disturbed Area (Acres)		366
Subcontract Costs		
Aerial Seeding & Fertilizing	$650 /acre	$237,900
Direct Cost		
Seedbed Preparation	$60 /acre	$21,960
Total Costs		$259,860

Wishbone Hill Facilities Removal Year 3						
Powerline Removal						
	Ft		**0**			
	$ per ft	**$**	**6.00**		$	-
Substation						
	Remove skid mounted equipment				$	3,700.00
Plant, shop and Misc. Buildings						
Number of Days			30			
Daily Demolision Crew Cost		$	7,022			210,660
Powder Magazine - Structure Removal					$	1,600.00
Total Costs					$	215,960.00

Means 2010

**Acreage under facilities included in revegetation calculations elsewhere

Year 3 Wisebone Hill Regrade Volumetrics, Topsoil Volumes, and Drainage Construction Volumes

Task	Backfill Volume (lcy)	Avg Distance	Effective Grade	Travel Time Loaded (min)	Travel Time Empty (min)	Load Time (min)	Dump Time (min)	Total Cycle Time (min)	Truck Capacity (cy)	Number of Truck	Fleet Production (cy/hr)	Fleet Avalability	Fleet Utilazation	Ajusted Fleet Production (cy/hr)	Equipment	Hours
Pit Backfill																
Mine Area 2	3,300,000	4500	6	3.8	1.4	3.2	1.2	9.6	66	3	1,238	0.9	0.83	924	992 Loader	3570
															3-777 Trucks	3570
															Moter Grader	357
															Water truck	*357*
															D9R	3570

Topsoil Redistribution	Area (ac)	Depth (ft)	Quantity (BCY)	Drainage Length	Equipment	Acres
Facilities- Assoc. Roads	111	1.9	332,000		Truck/Loader/Dozer	
Overburden Stockpile 1	57	2.7	252,000			
Pit Area	142	1.5	355,000			
Buffalo Creek Divertion	0		5,000			
Mine Roads and Divertions	22	1.5	54,000			
					Truck/Loader/Dozer	
Subtotal	*332*		*998,000*			
Drain Construction	**See Drain Cost Sheet for details**					
	Length	Production ft/hr	Hours			
Roads (Rip half the road)	**144000**	**1000**	144		D8H	
Area Topsoiled						332
Topsoil Pile Areas						34
Furrow-Seed-Fertilize						366

Summary of Wishbone Hill Reclamation Bond Costs Year 4

		Review Date:	16-Jul-14
Direct Cost Items			
Earthmoving		$ 29,040,165	
Revegetation (seed bed prep)		$ 23,580	
Aerial Seeding & Fertilizing		$ 255,450	
Facility Removal		$ 215,960	
Subtotal Direct Costs		**$ 29,535,155**	
Indirect Cost Items			
	(percent)		
Mobilization & Demobilization	**4.0**	$ 1,181,406	
Contingency Allowance	**5.0**	$ 1,476,758	
Engineering Redesign Fee	**4.0**	$ 1,181,406	
Contracor Profit & Overhead	**15.0**	$ 4,430,273	
Reclamation Management Fee	**2.0**	$ 590,703	
Subtotal Indirect Costs		**$ 8,860,547**	
Grand Totals		**$ 38,395,702**	

Wishbone Hill Year 4 Summary Calculation of Earthmoving Costs

Task	Equipment	Operating Costs	Labor Costs	Unit Cost	Total Hours	Quantity BCY	Sub Total
Back Fill	992 Loader	$420.10	$59.77		15,253	14,100,000	$7,319,409
	3-777 Truck	$865.17	$119.46		15,253		$15,018,518
	G14 Grader	$160.60	$59.73		1,525		$336,072
	Water Truck	$81.55	$59.73		1,525		$215,489
	D9R Dozer	$208.90	$59.73		15,253		$4,097,376
Topsoil Respread				$1.75		1,066,000	$1,865,500
Roads	D8R Bulldozer	156.219	$59.73		144		$31,097
Drainage Construction	D8R Bulldozer	$156.22	$59.73		216		$46,749
	966 Loader	$91.57	$59.73		164		$24,814
	15 CY Truck	$73.06	$59.73		164		$21,777
	Riprap Screened			$8.00		4920	$39,360
	Labor Tasks		$51.77		20		$1,045
	Geocloth			$1.75		13,120	$22,960
					TOTAL		**$29,040,165**

Equipment Costs (input by DNR)

Dataquest Guide

	Dataquest	AK factor	subtotal	Fuel (g/hr)	$/gal	Fuel ($/hr)	**TOTAL**
992 Loader	$ 230.65	1.337	$ 308.38	28	$3.99	$ 111.72	**$420.10**
777 Truck	$ 159.78	1.293	$ 206.60	20.5	$3.99	$ 81.80	**$288.39**
G14 Grader	$ 63.42	1.337	$ 84.79	19	$3.99	$ 75.81	**$160.60**
Water Truck	$ 43.01	1.293	$ 55.61	6.5	$3.99	$ 25.94	**$81.55**
D9R Bulldozer (w/EROPS*)	$ 111.48	1.337	$ 149.05	15	$3.99	$ 59.85	**$208.90**
D8R Bulldozer (w/EROPS)	$ 87.00	1.337	$ 116.32	10	$3.99	$ 39.90	**$156.22**
966F Loader	$ 46.11	1.337	$ 61.65	7.5	$3.99	$ 29.93	**$91.57**
15 cy Truck	$ 35.52	1.293	$ 45.93	6.8	$3.99	$ 27.13	**$73.06**

Wishbone Hill Drain Costs Year 4

Cut Terrace Drain, Lay Geocloth, Screen and Haul and Spread Riprap

	Amount	Rate (units per hr)	Rip-Rap BCY	Cloth	Labor	D8N	Loader	Truck
Cut Drain								
	6,560 LF	125				52.48		
Lay Cloth	Assume coverage of 2 sq. yd. Per ft of ditch							
	6,560 LF	325		13,120 sq. yd.	20			
Rip-Rap	Assume an average coverage rate of 0.75 BCY per LF ditch							
	6,560 LF	30	4,920			164	164	164
	**See UCM Backup Calculation for Riprap Support production cost of $8 per BCY							
	***See Morrison-Knudsen Riprap Caluclation (Backup Data)							
	Haul 3720 CY of Riprap With 15 CY Truck							
	Assume a Production Rate of 30 CY/Hr. with 966 Loader and 15 CY truck							
	Spread Riprap With D8N Dozer Hours							
Pond Regrade	Settling Pond Regrade (only include removal of decants)							
	0	40 hr per unit			0	0		
Totals			**4920**	**13,120 sq. yd.**	**20**	**216**	**164**	**164**

Drainage subcalcs (back-calculate to find 2002 assumptions)

Given:

LF Ditch	8200
D8 Hrs	238
BCY Rip-Rap	3720
LF Cloth	5,000
Loader Hours	124
Truck Hours	124

Calculated Assumptions:	**2002**	**Use in 2004**
Dozer rate (LF/Hr)	34.5	125.0
Rip-Rap Req'd (BCY/ft)	0.5	0.75
Loader/Truck/Spread Rate (BCY/Hr)	30.0	30.0
Geocloth (Sq. Yd. per LF ditch)	0.6	2

Wishbone Hill Revegetation Costs Year 4		
Total Disturbed Area (Acres)		393
Subcontract Costs		
Aerial Seeding & Fertilizing	$650 /acre	$255,450
Direct Cost		
Seedbed Preparation	$60 /acre	$23,580
Total Costs		$279,030

Wishbone Hill Facilities Removal Year 4				
Powerline Removal				
Ft		**0**		
$ per ft	**$**	**6.00**	$	-
Substation				
Remove skid mounted equipment			$	3,700.00
Plant, shop and Misc. Buildings				
Number of Days		30		
Daily Demolision Crew Cost	$	7,022		210,660
Powder Magazine - Structure Removal			$	1,600.00
Total Costs			$	215,960.00

Means 2010

**Acreage under facilities included in revegetation calculations elsewhere

Year 4 Wisebone Hill Regrade Volumetrics, Topsoil Volumes, and Drainage Construction Volumes

Task	Backfill Volume (lcy)	Avg Distance	Effective Grade	Travel Time Loaded (min)	Travel Time Empty (min)	Load Time (min)	Dump Time (min)	Total Cycle Time (min)	Truck Capacity (cy)	**Number of Truck**	**Fleet Production (cy/hr)**	**Fleet Avalability**	**Fleet Utilazation**	**Ajusted Fleet Production (cy/hr)**	**Equipment**	**Hours**
Pit Backfill																
Mine Area 2	14,100,000	4500	6	3.8	1.4	3.2	1.2	9.6	66	3	1,238	0.9	0.83	924	992 Loader	15253
															3-777 Trucks	15253
															Moter Grader	1525
															Water truck	*1525*
															D9R	15253

Topsoil Redistribution	**Area (ac)**	**Depth (ft)**	**Quantity (BCY)**	**Drainage Length**	**Equipment**	**Acres**
Facilities- Assoc. Roads	111	1.9	332,000		Truck/Loader/Dozer	
Overburden Stockpile 1	57	2.7	252,000			
Pit Area	169	1.6	423,000			
Buffalo Creek Divertion	0		5,000			
Mine Roads and Divertions	22	1.5	54,000			
					Truck/Loader/Dozer	
Subtotal	*359*		*1,066,000*			
Drain Construction	**See Drain Cost Sheet for details**					
	Length	Production ft/hr	Hours			
Roads (Rip half the road)	**144000**	**1000**	144		D8H	
Area Topsoiled						359
Topsoil Pile Areas						34
Furrow-Seed-Fertilize						393

Summary of Wishbone Hill Reclamation Bond Costs Year 5

	Review Date:		16-Jul-14
Direct Cost Items			
Earthmoving		$	42,238,735
Revegetation (seed bed prep)		$	25,020
Aerial Seeding & Fertilizing		$	271,050
Facility Removal		$	215,960
Subtotal Direct Costs		**$**	**42,750,765**
Indirect Cost Items			
	(percent)		
Mobilization & Demobilization	**4.0**	$	1,710,031
Contingency Allowance	**5.0**	$	2,137,538
Engineering Redesign Fee	**4.0**	$	1,710,031
Contracor Profit & Overhead	**15.0**	$	6,412,615
Reclamation Management Fee	**2.0**	$	855,015
Subtotal Indirect Costs		**$**	**12,825,229**
Grand Totals		**$**	**55,575,994**

Wishbone Hill Year 5 Summary Calculation of Earthmoving Costs

Task	Equipment	Operating Costs	Labor Costs	Unit Cost	Total Hours	Quantity BCY	Sub Total
Back Fill	992 Loader	$420.10	$59.73		22,633	20,922,000	$10,859,852
	3-777 Truck	$865.17	$119.46		22,633		$22,284,924
	G14 Grader	$160.60	$59.73		2,263		$498,673
	Water Truck	$81.55	$59.73		2,263		$319,749
	D9R Dozer	$208.90	$59.73		22,633		$6,079,808
Topsoil Respread				$1.75		1,125,000	$1,968,750
Roads	D8R Bulldozer	156.219	$59.73		144		$31,097
Drainage Construction	D8R Bulldozer	$156.22	$59.73		271		$58,436
	966 Loader	$91.57	$59.73		205		$31,017
	15 CY Truck	$73.06	$59.73		205		$27,222
	Riprap Screened			$8.00		6150	$49,200
	Labor Tasks		$51.77		25		$1,306
	Geocloth			$1.75		16,400	$28,700
					TOTAL		**$42,238,735**

Equipment Costs (input by DNR)

Dataquest Guide

	Dataquest	AK factor	subtotal	Fuel (g/hr)	$/gal	Fuel ($/hr)	**TOTAL**
992 Loader	$ 230.65	1.337	$ 308.38	28	$3.99	$ 111.72	**$420.10**
777 Truck	$ 159.78	1.293	$ 206.60	20.5	$3.99	$ 81.80	**$288.39**
G14 Grader	$ 63.42	1.337	$ 84.79	19	$3.99	$ 75.81	**$160.60**
Water Truck	$ 43.01	1.293	$ 55.61	6.5	$3.99	$ 25.94	**$81.55**
D9R Bulldozer (w/EROPS*)	$ 111.48	1.337	$ 149.05	15	$3.99	$ 59.85	**$208.90**
D8R Bulldozer (w/EROPS)	$ 87.00	1.337	$ 116.32	10	$3.99	$ 39.90	**$156.22**
966F Loader	$ 46.11	1.337	$ 61.65	7.5	$3.99	$ 29.93	**$91.57**
15 cy Truck	$ 35.52	1.293	$ 45.93	6.8	$3.99	$ 27.13	**$73.06**

Wishbone Hill Drain Costs Year 5

Cut Terrace Drain, Lay Geocloth, Screen and Haul and Spread Riprap

	Amount	Rate (units per hr)	Rip-Rap BCY	Cloth	Labor	D8N	Loader	Truck
Cut Drain	8,200 LF	125				65.6		
Lay Cloth	Assume coverage of 2 sq. yd. Per ft of ditch							
	8,200 LF	325		16,400 sq. yd.	25			
Rip-Rap	Assume an average coverage rate of 0.75 BCY per LF ditch							
	8,200 LF	30	6,150			205	205	205
	**See UCM Backup Calculation for Riprap Support production cost of $8 per BCY							
	***See Morrison-Knudsen Riprap Caluclation (Backup Data)							
	Haul 3720 CY of Riprap With 15 CY Truck							
	Assume a Production Rate of 30 CY/Hr. with 966 Loader and 15 CY truck							
	Spread Riprap With D8N Dozer Hours							
Pond Regrade	Settling Pond Regrade (only include removal of decants)							
	0	40 hr per unit			0	0		
Totals			**6150**	**16,400 sq. yd.**	**25**	**271**	**205**	**205**

Drainage subcalcs (back-calculate to find 2002 assumptions)

Given:

LF Ditch	8200
D8 Hrs	238
BCY Rip-Rap	3720
LF Cloth	5,000
Loader Hours	124
Truck Hours	124

Calculated Assumptions:	**2002**	**Use in 2004**
Dozer rate (LF/Hr)	34.5	125.0
Rip-Rap Req'd (BCY/ft)	0.5	0.75
Loader/Truck/Spread Rate (BCY/Hr)	30.0	30.0
Geocloth (Sq. Yd. per LF ditch)	0.6	2

Wishbone Hill Revegetation Costs Year5		
Total Disturbed Area (Acres)		417
Subcontract Costs		
Aerial Seeding & Fertilizing	$650 /acre	$271,050
Direct Cost		
Seedbed Preparation	$60 /acre	$25,020
Total Costs		$296,070

Wishbone Hill Facilities Removal Year 5				
Powerline Removal				
Ft		**0**		
$ per ft	**$**	**6.00**	$	-
Substation				
Remove skid mounted equipment			$	3,700.00
Plant, shop and Misc. Buildings				
Number of Days		30		
Daily Demolision Crew Cost	$	7,022		210,660
Powder Magazine - Structure Removal			$	1,600.00
Total Costs			$	215,960.00

Means 2010

**Acreage under facilities included in revegetation calculations elsewhere

Year 5 Wisebone Hill Regrade Volumetrics, Topsoil Volumes, and Drainage Construction Volumes

Task	Backfill Volume (lcy)	Avg Distance	Effective Grade	Travel Time Loaded (min)	Travel Time Empty (min)	Load Time (min)	Dump Time (min)	Total Cycle Time (min)	Truck Capacity (cy)	**Number of Truck**	**Fleet Production (cy/hr)**	**Fleet Avalability**	**Fleet Utilazation**	**Ajusted Fleet Production (cy/hr)**	**Equipment**	**Hours**
Pit Backfill																
Mine Area 2	20,922,000	4500	6	3.8	1.4	3.2	1.2	9.6	66	3	1,238	0.9	0.83	924	992 Loader	22633
															3-777 Trucks	22633
															Moter Grader	2263
															Water truck	*2263*
															D9R	22633

Topsoil Redistribution	**Area (ac)**	**Depth (ft)**	**Quantity (BCY)**	**Drainage Length**	**Equipment**	**Acres**
Facilities- Assoc. Roads	111	1.9	332,000		Truck/Loader/Dozer	
Overburden Stockpile 1	57	2.7	252,000			
Pit Area	193	1.5	482,000			
Buffalo Creek Divertion	0		5,000			
Mine Roads and Divertions	22	1.5	54,000			
					Truck/Loader/Dozer	
Subtotal	*383*		*1,125,000*			
Drain Construction	**See Drain Cost Sheet for details**					
	Length	Production ft/hr	Hours			
Roads (Rip half the road)	**144000**	**1000**	144		D8H	
Area Topsoiled						383
Topsoil Pile Areas						34
Furrow-Seed-Fertilize						417

Editors Note:

Pages D-94 through D-97 have been deleted from this document. The next section, 14.0 fish and Wildlife Protection Plan, starts on page D-98

TABLES

TABLE 13-1

Areas to be disturbed and quantity of browse per area within existing communities that will be lost to disturbance.

Habitat Type	Area Disturbed		Bepa[1]	Salix	Vied	Roac	Total Browse	Ttl Brws Lost
	ha	pct	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg
Closed Deciduous	81	32%	1.62	0.00	61.73	49.29	113	9166
Young birch (open)	51	20%	32.01	12.99	22.81	24.82	93	4688
Birch-Spruce	60	23%	39.07	32.04	63.18	31.20	165	9849
Herbaceous	61	24%	47.89	61.95	7.31	19.77	137	8315
Misc	3	1%					0	0
Total	255	100%						32018

1 Bepa = Betula papyrifera
Vied = Viburnum edule
Roac = Rosa acicularis

Habitat Type	Area Disturbed		Bepa	Salix	Vied	Roac	Total Browse	Ttl Brws Lost
	acre	pct	lb/acre	lb/acre	lb/acre	lb/acre	lb/acre	lb
Closed Deciduous	201	32%	1	0	55	44	101	20212
Young birch (open)	125	20%	29	12	20	22	83	10336
Birch-Spruce	147	23%	35	29	56	28	148	21717
Herbaceous	150	24%	43	55	7	18	122	18335
Misc	7	1%	0	0	0	0	0.00	0
Total	630	100%						70600

TABLE 13-2

Assumptions concerning plant growth and survival for browse production calculations on reclaimed sites.

Assumption	Bepa	Pigl	Poba	Salix	Alder	Roac+Vied
Browse/stem (kg)	0.078	0.000	0.090	0.118	0.000	0.021
Browse/stem (g)	78.1	0.0	90.0	118.0	0.0	21.4
Survival	0.5	0.5	0.7	0.7	0.8	1.0
Growth Fraction	0.8	0.6	0.8	0.8	0.8	1.0

Browse / stem is the mean quantity of browse per individual for each species indicated on the baseline inventory. It is based on premining vegetation baseline data.

Survival is the fraction of planted individuals expected to live until bond release (year 10). It is based on observations of first couple years of shrub growth in reclamation plantings.

Growth fraction is the fraction of normal growth that is expected on plants on reclaimed sites. In some cases it has been assumed that natural invasion will occur during this time and contribute to the effective growth per planted individual. No Roac or Vied are planned for planting except on mats and from regeneration from live topsoil. However, these plants regenerate quickly and have relatively short life expectancies so plants alive in year 10 may be 2nd or 3rd generation from original plants. Hence an effective growthand survival rate of 1 are being used.

[1] Bepa = Betula papyrifera
Pigl = Picea glauca
Poba = Populus balsamifera
Vied = Viburnum edule
Roac = Rosa acicularis

TABLE 13-3

Densities of woody individuals to be planted.

Vegetation Type	Method	Bepa	Pigl	Pobe	Salix	Alder	Roac+Vied	Total [2]
				plants/ha				
Grass	Drill Hydroseed			300	200			500
Willow	Plant	0	0		2500			2500
Poplar/willow	Plant			900	1300			2200
Poplar/alder/willow	Plant			800	1100	300		2200
Poplar	Plant			1700				1700
Spruce-birch	Plant	700	1300		300		300	2600
	Mat							0
Total [2]		700	1300	3700	5400	300	300	

Vegetation Type	Method	Bepa	Pigl	Pobe	Salix	Alder	Roac+Vied	Total [2]
				plants/acre				
Grass	Drill	0	0	121	81	0	0	202
	Hydroseed	0	0	0	0	0	0	0
Willow	Plant	0	0	0	1012	0	0	1012
Poplar/willow	Plant	0	0	364	526	0	0	891
Poplar/alder/willow	Plant	0	0	324	445	121	0	891
Poplar	Plant	0	0	688	0	0	0	688
Spruce-birch	Plant	283	526	0	121	0	121	1053
	Mat	0	0	0	0	0	0	0
Total [2]		283	526	1498	2186	121	121	4737

[1] Bepa = Betula papyrifera
Pigl = Picea glauca
Pobe = Populus balsamifera
Vied = Viburnum edule
Roac = Rosa acicularis

[2] Because of rounding errors, the totals do not always exactly equal the sum of the parts.

TABLE 13-4
AREA (ACRES) PLANNED TO BE RECLAIMED TO EACH HABITAT TYPE DURING EACH TERM OF OPERATION

Vegetation Type	Method	First Five Year Term	Remaining Life of Mine	Total[1]	Percent
Grass	Drill	17	147	164	27%
	Hydroseed	0	12	12	2%
Willow	Plant	6	138	144	24%
Poplar/willow	Plant	4	134	138	23%
Poplar/alder/willow	Plant	0	31	31	5%
Poplar	Plant	0	48	48	8%
Spruce-birch	Plant	0.4	72	72	12%
	Mat	0	3	3	0%
TOTAL		**27.4**	**585**	**612**	**100%**
Woody (acre)		10	426	436	
Herb (acre)		17	159	176	
Woody (%)		37%	73%	71%	
Herb (%)		63%	27%	29%	

[1]Because of rounding errors, the totals do not always exactly equal the sum of the parts.

TABLE 13-5

Quantity of browse (mass/area and total in project) resulting from assumptions of Table 13-2, densities of Table 13-3, and areas of Table 13-4.

Vegetation Type	Method	Bepa	Pigl	Poba	Salix	Alsi	Roac+Vied	Total	Planned	Total Species Area
Browse ha kg				kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha
Grass	Drill	0	0	15	13	0	0	28	66	1881
	Hydroseed	0	0	0	0	0	0	0	5	0
Willow	Plant	0	0	0	165	0	0	165	58	9631
Poplar/willow	Plant	0	0	45	86	0	0	131	56	7334
Poplar/alder/willow	Plant	0	0	40	73	0	0	113	13	1418
Poplar	Plant	0	0	86	0	0	0	86	19	1665
Spruce-birch	Plant	22	0	0	20	0	6	48	29	1402
	Mat	0	0	0	0	0	0		0	0
Total		22	0	186	357	0	6	572	248	23331
						Existing browse (kg)				32018
						Pct of existing browse				73%
						Browse based on 10 vs 15 yrs				21345
						Pct of 10/15 goal				109%

Vegetation Type	Method	Bepa	Pigl	Poba	Salix	Alder	Roac+Vied	Total	Planned Species	Total Area
Browse lb			lb/ac	lb/ac	lb/ac	lb/ac	lb/ac	lb/ac	lb/ac	acre
Grass	Drill	0	0	13	12	0	0	25	164	4756
	Hydroseed	0	0	0	0	0	0	0	12	0
		0	0	0	0	0	0	0	0	0
Willow	Plant	0	0	0	147	0	0	147	144	21237
Poplar/willow	Plant	0	0	40	77	0	0	117	138	16171
Poplar/alder/willow	Plant	0	0	36	65	0	0	101	31	3127
Poplar	Plant	0	0	76	0	0	0	76	48	3748
Spruce-birch	Plant	20	0	0	18	0	6	43	72	3092
	Mat	0	0	0	0	0	0		3	0
Total		20	0	166	319	0	6	510	612	51447
						Existing browse (lb)				70600
						Pct of existing browse				73%
						Browse based on 10 vs 15 yrs				47066
						Pct of 10/15 goal				109%

Total browse is the amount expected by summing production for each reclamation area (by year of mine operation) at year 10 for each site. That is, areas revegetated in Year 8 of mine operation are up for bond release in Year 18 of mine operation (mine will be closed at that point, but it is year 10 into this reclamation area's life). Production on Year 8 sites is measured in Year 18, Year 9 in Year 19, and so on. These are summed to attain the projected browse estimates **(23331 kg or 51447 lb)** being replaced.

TABLE 13-6

Density standards for bond release.[1]

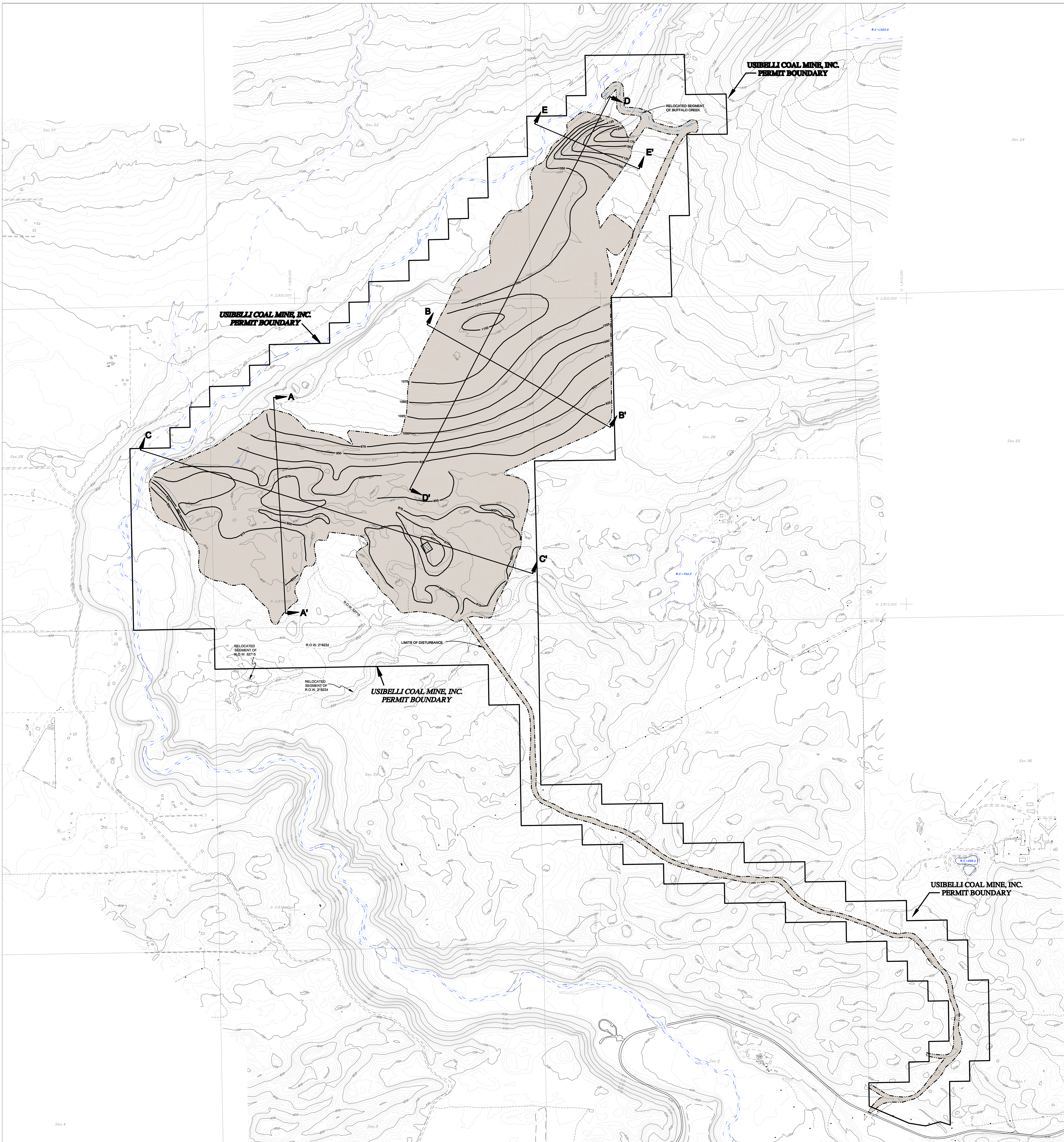
Vegetation Type	Method	Bepa	Pigl	Poba	Salix	Alder	Roac+Vied	Total
				plants / ha				
Grass	Drill	0	0	210	140	0	0	350
	Hydroseed	0	0	0	0	0	0	0
Willow	Plant	0	0	0	1750	0	0	1750
Poplar/willow	Plant	0	0	630	910	0	0	1540
Poplar/alder willow	Plant	0	0	560	770	240	0	1570
Poplar	Plant	0	0	1190	0	0	0	1190
Spruce birch	Plant	350	650	0	210	0	300	1510
	Mat	0	0	0	0	0	0	0
Total								

Vegetation Type	Method	Bepa	Pigl	Poba	Salix	Alder	Roac+Vied	Total
				plants / acre				
Grass	Drill	0	0	85	57	0	0	142
	Hydroseed	0	0	0	0	0	0	0
Willow	Plant	0	0	0	709	0	0	709
Poplar/willow	Plant	0	0	255	368	0	0	623
Poplar/alder/willow	Plant	0	0	227	312	97	0	636
Poplar	Plant	0	0	482	0	0	0	482
Spruce-birch	Plant	142	263	0	85	0	121	611
	Mat	0	0	0	0	0	0	0

1 This many plants per area must be present for bond release. At least 80% of them must be present for at least 6 years according to ADOM (1988).

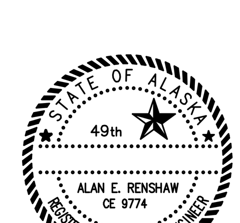
2 Bepa = Betula papyrifera
Pigl = Picea glauca
Poba = Populus balsamifera
Vied = Viburnum edule
Roac = Rosa acicularis

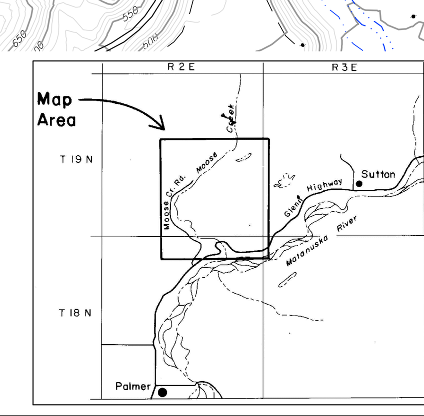
PLATES



LEGEND

PERMIT BOUNDARY	FENCE
DISTURBANCE BOUNDARY	SECTIONS LINES
ROADS - UNPAVED	EXISTING CONTOURS
ROADS - PAVED	POST MINE CONTOURS
TRAIL	BUFFALO CREEK RELOCATION
TRAIL	PROPOSED RECREATIONAL PARKING AREA



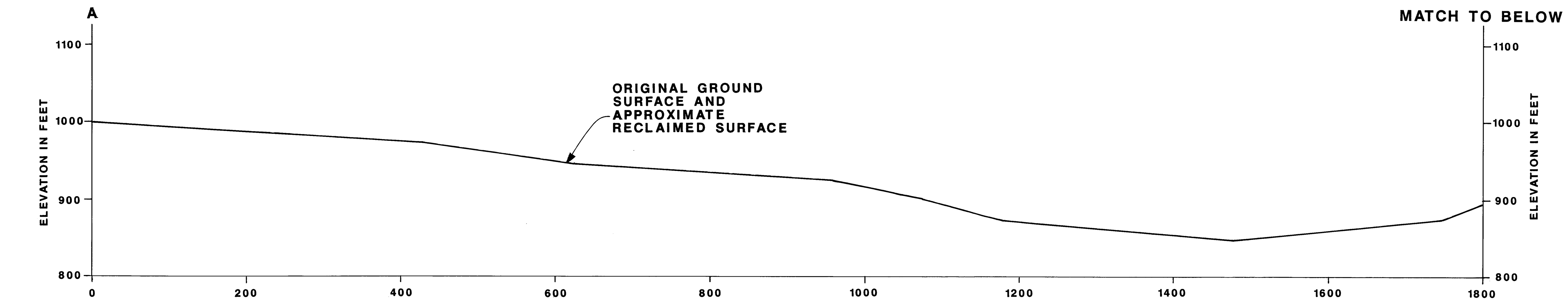


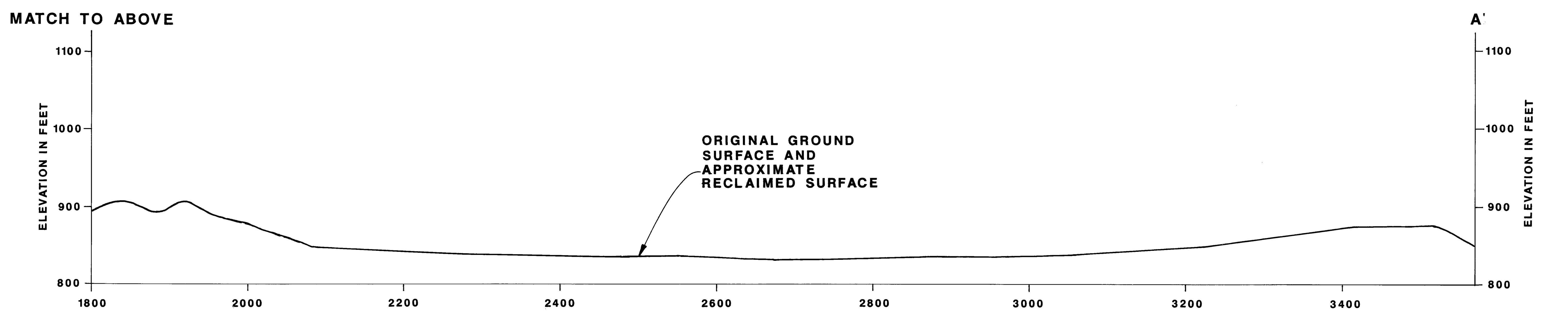
NOTES:
1. HORIZONTAL DATUM IS ALASKA STATE PLANE, NAD83.
2. VERTICAL DATUM IS NAVD 88.
3. MAPPED FOR 1" = 200 FEET, 10 FOOT CONTOUR INTERVAL.
4. DATE OF PHOTOGRAPHY: 10-12-1997
5. THIS MAP CONFORMS TO ASPRS CLASS I MAP STANDARDS.
6. THE VERTICAL ACCURACY IS APPROXIMATELY ONE HALF OF THE CONTOUR INTERVAL SHOWN IN ANY GIVEN AREA ON THE MAP. CONTOURS IN VEGETATED AREAS MAY BE LESS ACCURATE, CONTOURS IN DENSE VEGETATION ARE LIKELY TO BE LESS ACCURATE.
7. FOR CROSS SECTIONS, SEE PLATE 13-2.

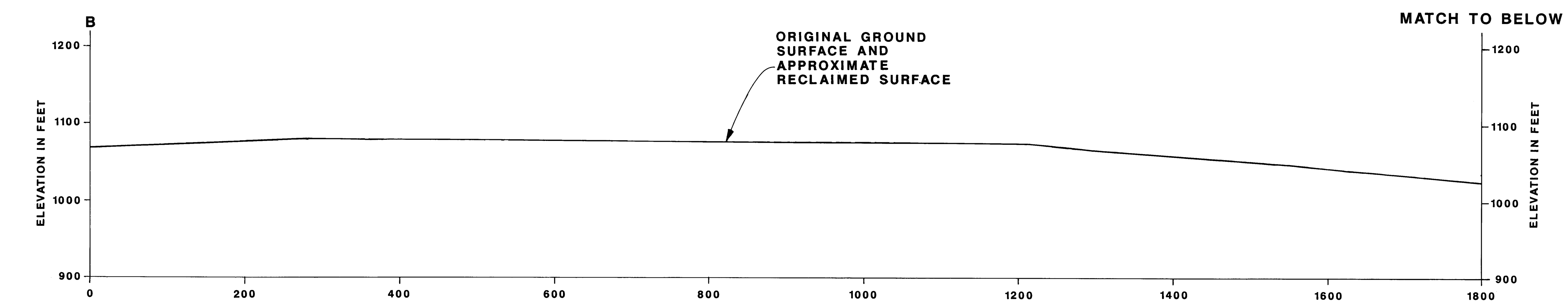
SUBJECT REVISIONS			
REV.	DATE:	BY:	DESCRIPTION

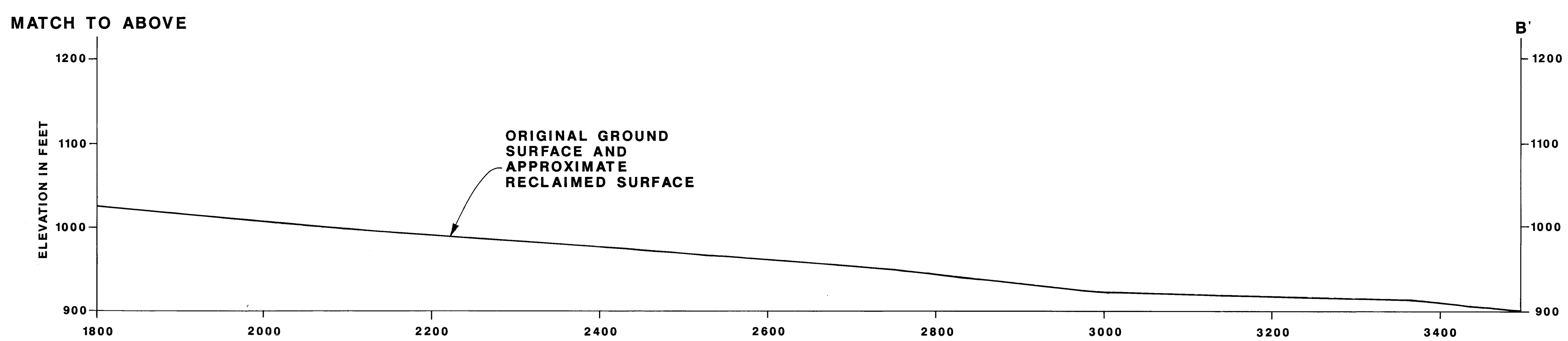
DESIGN BY:	WISHBONE HILL MINE — USIBELLI COAL MINE INC. UCM — PERMIT NUMBER 01-89-796
DRAWN BY:	
CHECK BY:	APPROXIMATE FINAL RECLAMATION CONTOURS
DWG FILE:	
DATE DRAWN:	WISHBONE HILL MINE

USIBELLI COAL MINE, INC. P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226	PLATE No. 13-1 SHEET No. 1 OF 1	REV. 0









NOTE:
The total mine area will be slightly underfilled. To bring the area back to its original contour, an additional 1,169,000 cy of material would be required. This volume of material over the entire mine area only represents approximately 1.5 feet and can not be shown on this scale map.

NOTE:

FOR CROSS-SECTION LOCATIONS SEE PLATE 13-1.

SCALE : VERTICAL AND HORIZONTAL - 1" = 100'

SUBJECT REVISIONS

REV.	DATE:	BY:	DESCRIPTION
A	8/89	RF	CHECK BY: AB, APPROVED BY: IH
B	1/90	RWZ	CHECK BY: RF, APPROVED BY: IH
1	2009	JEH	MINOR REVISIONS

DESIGN BY:

DRAWN BY: EB

CHECK BY: MMC

DWG FILE:

DATE DRAWN: 8/89

WISHBONE HILL MINE

PERMIT NUMBER 01-89-796

PRE & POST MINING TOPOGRAPHY
SECTION A-A' & SECTION B-B'

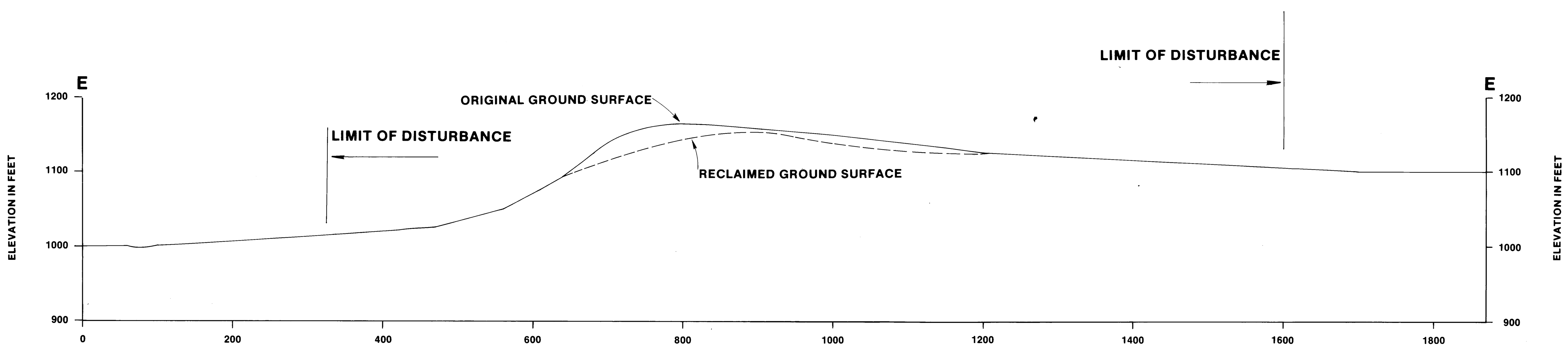
WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. 13-2

SHEET No. 1 OF 1

REV. 1



EXPLANATION:

——— Original Topography

– – – Reclamation Topography

NOTE:
The total mine area will be slightly underfilled. To bring the area back to its original contour, an additional 1,169,000 cy of material would be required. This volume of material over the entire mine area only represents approximately 1.5 feet and can not be shown on this scale map.

NOTE: FOR CROSS SECTION LOCATIONS SEE PLATE 13-1

SCALE: VERTICAL & HORIZONTAL - 1" = 100'

CERTIFICATE

I hereby certify that this drawing has been prepared under my direction and is correct to the best of my knowledge and belief.

David E. Germer

SUBJECT REVISIONS			
REV.	DATE:	BY:	DESCRIPTION
1	2009	JEH	MINOR REVISIONS

DESIGN BY:

DRAWN BY:

CHECK BY:

DWG FILE:

DATE DRAWN:

WISHBONE HILL MINE

PERMIT NUMBER 01-89-796

PRE & POST MINING TOPOGRAPHY SECTIONS C-C', D-D' & E-E'

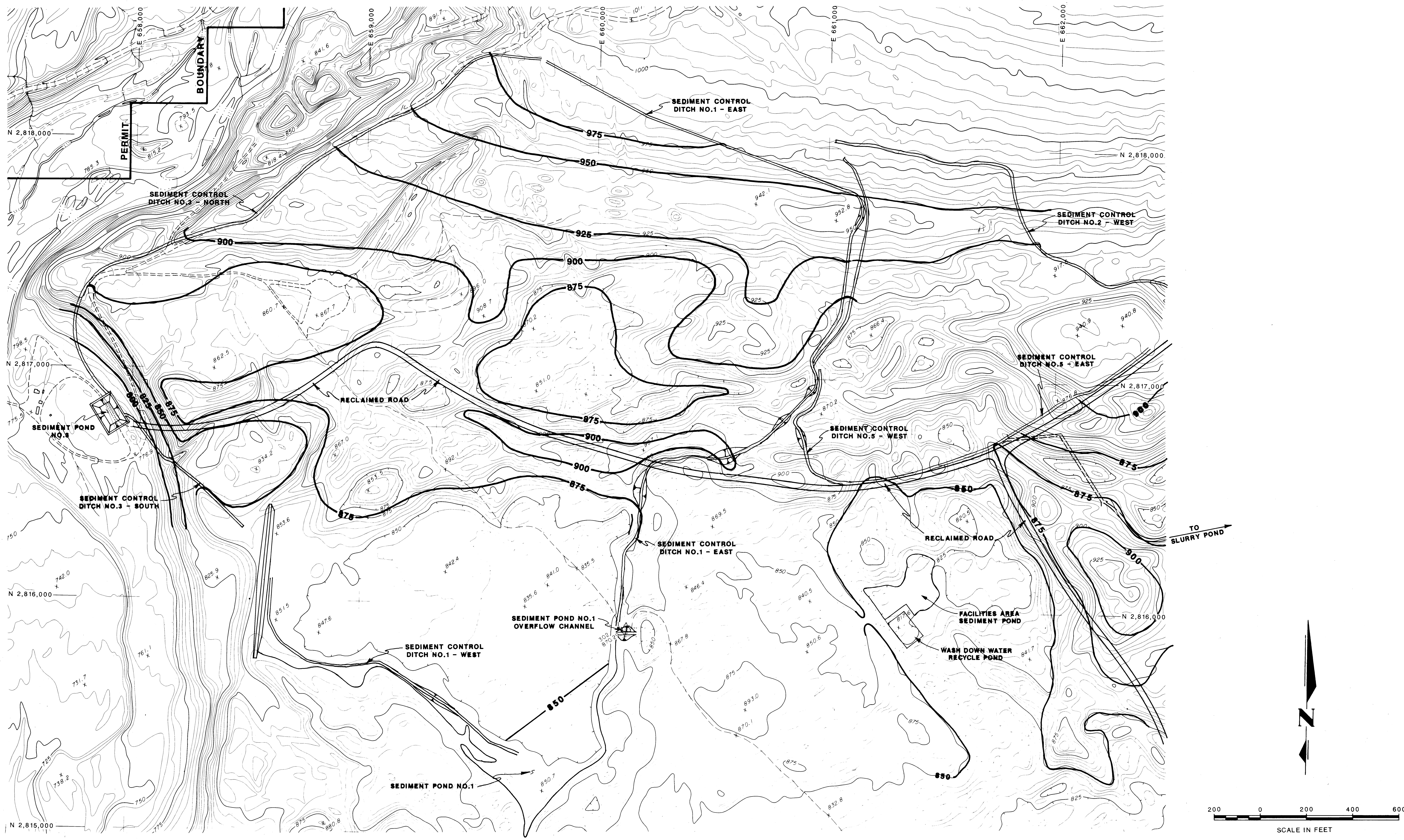
WISHBONE HILL MINE

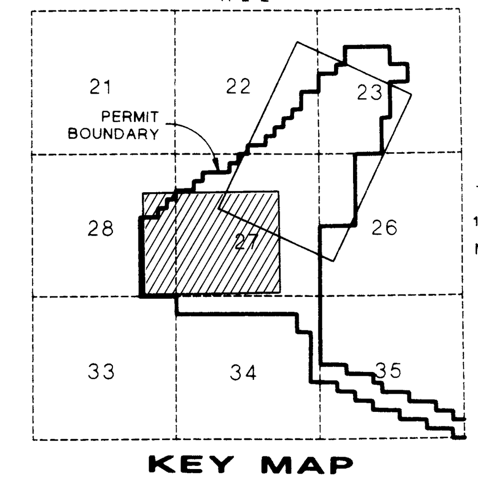
USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. 13-2A

SHEET No. 1 OF 1

REV. 1





KEY MAP

SUBJECT REVISIONS			
REV.	DATE:	BY:	DESCRIPTION
A	8/89	RF	CHECK BY: JJ, APPROVED BY: IH
B	1/90	RWZ	CHECK BY: RF, APPROVED BY: IH
C	6/90	GM	CHECK BY: JJ, APPROVED BY: IH
1	2009	JEH	MINOR REVISIONS

DESIGN BY:

DRAWN BY: DB

CHECK BY: MMC

DWG FILE:

DATE DRAWN: 8/89

WISHBONE HILL MINE

PERMIT NUMBER 01-89-796

MINE AREA 1
POST MINING SEDIMENT
CONTROL PLAN

WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. 13-3
SHEET No. 1 OF 1
REV. 1

SUBJECT REVISIONS

REV.	DATE:	BY:	DESCRIPTION
A	8/89	RF	CHECK BY: JJ, APPROVED BY: IH
B	1/90	RWZ	CHECK BY: RF, APPROVED BY: IH
C	6/90	GM	CHECK BY: JJ, APPROVED BY: IH
1	2009	JEH	MINOR REVISIONS
2	1/2014	CTW	ADD NEW CONTOURS, CONVERT TO GIS

FILE NAME: PLATE 13-3 POSTMINING SEDIMENT.MXD

DESIGN BY:
DRAWN BY: DB
CHECK BY: MMC
DATE DRAWN: 8/89
NAD83/AK STATE PLANE ZONE 4

WISHBONE HILL MINE

PERMIT NUMBER 01-89-796

MINE AREA 1
POST MINING SEDIMENT CONTROL PLAN

USIBELLI COAL MINE, INC.
PO BOX 1000 HEALY, ALASKA 99743
(907) 683-2226

PLATE NO. 13-3a

SCALE: 1:2,100

REV. 2

SUBJECT REVISIONS

REV.	DATE:	BY:	DESCRIPTION
A	8/89	RF	CHECK BY: JJ, APPROVED BY: IH
B	1/90	RWZ	CHECK BY: RF, APPROVED BY: IH
1	2009	JEH	MINOR REVISIONS

DESIGN BY:
DRAWN BY: DB
CHECK BY: MMC
DWG FILE:
DATE DRAWN: 8/89

WISHBONE HILL MINE

PERMIT NUMBER 01-89-796

MINE AREA 2
POST MINING SEDIMENT
CONTROL PLAN

WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. 13-4
SHEET No. 1 OF 1
REV. 1

14.0 FISH AND WILDLIFE PROTECTION PLAN

14.1 Introduction

The Alaska Surface Coal Mining Program regulations require that each application include a plan to minimize or prevent disturbance and adverse impact to fish and wildlife resources (11AAC 90.081). This plan addresses that requirement with emphasis on protection of important species and important habitats.

14.2 Protection of Fish Resources

14.2.1 Summary of Important Resources

The aquatic baseline study for the Wishbone Hill Coal Project (Part C, Chapter IX) as well as long term salmon escapement monitoring by the Alaska Department of Fish and Game (ADF&G) have determined that Moose Creek provides spawning habitat for chinook and coho salmon. Resident Dolly Varden inhabit all portions of Moose Creek at low density.

Buffalo Creek, a small tributary to Moose Creek, flows through Mine Area 2. The creek has little or no flow in the winter and has only minor value to fish. Small numbers of Dolly Varden and rainbow trout have been observed at the lower end of the stream. The remainder of Buffalo Creek is marginal fish habitat with several possible barriers to fish passage because of waterfalls or cascades. Wishbone Lake, the source of Buffalo Creek, is located northeast of the mine permit area. It has been stocked with rainbow trout in recent years and is currently being developed into a trophy fish area by the imposition of regulations in 1989 requiring anglers to return all fish alive to the lake after capture and to use only single hooks. The intent is to provide a high quality fishing experience to a specific segment of the angling population (fly fishermen).

14.2.2 Summary of Potential Impacts

Based on the results of the hydrogeologic investigations presented in Part C, Chapter IV and Section 15 of this Part D, hydrological impacts will be small and are unlikely to cause a significant effect relative to the habitat requirements of fish or aquatic organisms. Moose Creek and its floodplain will not be directly disturbed by the mining operation and the creek will not receive any water from coal mining activities or disturbed area drainage. At those few limited locations where a portion of the mine pits are in closest proximity to Moose Creek, blasting could create ground vibrations that transfer to the creek. In these instances, the current ADF&G's Blasting Standards for the Protection of Fish may be used to mitigate potential impacts by maintaining an instantaneous pressure change of no more than 7.3 pounds per square inch where fish are present, with the peak particle velocities in spawning gravels limited to no more than 2.0 in/sec. during the early stages of embryo incubation before epiboly is complete.

The ADF&G's method for calculating setbacks may be used to maintain compliance with the blasting standards for the protection of fish and embryos contained in ADF&G's *Habitat Publication No. 13-03, Alaska Blasting Standard for the Proper Protection of Fish, November 2013*.

> *"Hydrophones used to monitor pressures and geophones used to monitor vibrations will be placed in the appropriate habitats in Moose Creek as close to the point of detonation as possible without damaging the equipment. The instantaneous pressure rise in the water column in rearing habitat and migration corridors is limited to no more than* 7.3 pounds per square inch *where fish are present. Peak particle velocities in spawning gravels are limited to no more than 2.0 in/s during the early stages of embryo incubation before epiboly is complete."*

The ADF&G Blasting standard for the prevention of injury to fish is no less restrictive and is consistent with the Blasting Standard at *11 AAC 90.379(g) Control of Adverse Effects of Blasting*. However, the most restrictive standard (ADF&G Habitat Publication No. 13-03, or 11 AAC 90.379) that poses the least risk of harm to fish will be used.

Buffalo Creek will be permanently diverted to allow mining through a portion of the creek. Since Buffalo Creek is not utilized by significant numbers of fish and is not accessible to anadromous fish, the loss of minor amounts of fish habitat associated with Buffalo Creek should not significantly impact the fisheries resource. A short-term input of sediment could occur at the time that the Buffalo Creek channel diversion is first opened for flow; however, this potential impact will be mitigated by constructing the channel at the outset of the project and allowing it to fully stabilize before water is diverted into it.

14.2.3 General Fish Protection Strategy

Protection of aquatic resources began with the baseline study programs which delineated the fish use and habitat value of Moose and Buffalo Creeks. The value of Moose Creek was recognized early in the planning process and the configuration of the mining operations and locations of facilities were designed to avoid direct and indirect impacts to Moose Creek.

It was also recognized that conflicts with Buffalo Creek were unavoidable because of the creek's location in relation to mineable coal reserves. Discussions with representatives of ADF&G Habitat and Sport Fish Divisions indicated that mitigation emphasis should concentrate on protection of Moose Creek and enhancement of the Wishbone Lake fishery rather than protection and restoration of Buffalo Creek. Compensation for the small loss of fish habitat in Buffalo Creek will be accomplished by providing improved access to the Wishbone Lake fishery and other recreational areas after mining and by creating parking facilities in the area occupied by the coal wash plant.

14.2.4 Protection of Threatened and Endangered Species

There are no threatened or endangered aquatic species in the Wishbone Hill area and no special protective measures are needed.

14.2.5 Protection of Moose Creek Integrity

The Wishbone Hill Coal Project has been designed to prevent direct impact to Moose Creek. No physical alteration of the creek bed or encroachment onto the 100 year floodplain will occur. Measures that will be taken to mitigate the effects of blasting were previously discussed in Section 14.2.2. The potential for hydrologic impact to Moose Creek through alteration of ground or surface water regimes is discussed in Section 15.13. As indicated in the analysis of hydrologic consequences, the annual flow of Moose Creek will not be significantly affected. Any alterations that do occur will be insignificant relative to the natural annual variation in flow. Furthermore, the least impact is likely to occur in the winter when minimum flows are most critical to fish and incubating fish eggs.

14.2.6 Protection of the Wishbone Lake Fishery

Prior to the commencement of any alteration to the flow or physical configuration of Buffalo Creek, a screened weir will be constructed in Buffalo Creek a short distance downstream from Wishbone Lake. This weir will prevent stocked and resident rainbow trout in Wishbone Lake from entering Buffalo Creek and becoming lost to the Wishbone Lake fishery. The weir will also prevent Wishbone Lake fish from becoming harmed by entering downstream portions of Buffalo Creek that may be subject to water withdrawal, reduced flow, and altered channel characteristics during and after mining.

The weir will be designed to prevent the passage of 3-inch and larger rainbow trout and will be designed for easy maintenance. Initial conceptual design calls for a flat, 3/8 inch mesh screen mounted on an axle within a box structure so that it can be rotated 180 degrees for self cleaning. Rotation will either be by hand or by a battery-operated electric motor, depending on the rotation interval required to prevent debris clogging. A trash rack will be placed in Buffalo Creek upstream of the weir to prevent large pieces of debris from damaging the screen. A spillway will also be constructed to allow relief in the event of exceptionally high flow. Periodic maintenance will be performed and will include removal of the weir prior to freeze-up in the fall and replacement in the spring.

Other weir designs that were considered included self-cleaning rotating drum type screens. However, the flow in Buffalo Creek is too small to provide adequate water power to rotate the screen and there is no electric power available at the site. Therefore, continuously rotating drum screens were judged to be not feasible under the conditions at Wishbone Lake.

Observations of flow, ice conditions, and snow cover will be conducted at the weir site prior to final design to assure that the structure will function under the conditions at the site. The final design of the weir will be submitted to the ADF&G and the Division of Mining for review. Installation of the weir will not occur until approval has been granted.

After the completion of mining, access to Wishbone Lake will be substantially improved. The mine access road and other selected roadways within the mine area will be left for public use and parking facilities will be provided in the area occupied by the coal wash plant.

14.2.7 Buffalo Creek Diversion

As discussed in Part D, Section 11.10, a portion of the Buffalo Creek flow will be diverted via a diversion gate and a pipeline to provide a supply of water for the coal processing facilities at the onset of mining and throughout the life of the mine. Water demand will be greatest during the initial period when the fresh water pond is being filled. At this time it is likely that the flow in the natural channel of Buffalo Creek will be significantly diminished and it is possible that fish present in the creek could become stranded because of low water. Buffalo Creek will be monitored at the time when the creek is initially diverted for mine use, and any stranded fish will be rescued and placed in either Moose Creek or Wishbone Lake depending on the species. Because of the weir at Wishbone Lake, it is unlikely that fish will re-invade Buffalo Creek after the initial diversion except at the extreme lower end near the confluence with Moose Creek.

Early in the mine life, a permanent diversion channel for Buffalo Creek will be constructed north of the proposed mine pit (see Part D, Section 11.9). The new channel, however, will not be utilized until later in the mine life when the system has become fully stabilized. As discussed in Part D, Section 11.9, the channel has been designed to avoid the transport of sediment to Moose Creek.

This stream channel will not be suitable as fish habitat because of the gradient except possibly at the extreme lower end within the Moose Creek floodplain. The use of a permanent diversion channel, as opposed to temporary diversion followed by restoration of Buffalo Creek to its original channel after mining, was considered to be preferable because of the marginal value of Buffalo Creek habitat to fish, risk of water quality impacts to Moose Creek during the restoration of Buffalo Creek, and difficulty in assuring a successful stream restoration on unconsolidated (backfilled) soils.

The segment of Buffalo Creek upstream from the water diversion structure will remain in natural condition. This stream reach flows through a small canyon and gradient is too steep to provide fish habitat. It was recommended by ADF&G that fish be prevented from entering this area. For that reason, the fish weir was located just below Wishbone Lake to prevent Wishbone Lake fish from entering any portion of Buffalo Creek.

The extreme lower portion of the Buffalo Creek diversion utilizes an overflow channel of Moose Creek. This very short segment within the Moose Creek floodplain has the potential to provide some fish habitat and may be colonized by fish from Moose Creek. However, flow in the Buffalo Creek diversion will be variable depending on water needs at the wash plant. This fluctuating water level suggests that habitat enhancement in this area would not be effective or desirable.

14.2.8 Water Quality Protection

Water quality compliance and monitoring are thoroughly discussed in Section 15.0. The project was designed for zero surface discharge, thus eliminating the potential water quality problems associated with discharges to surface waters and, consequently, potential water quality impacts to fish and other aquatic resources.

As previously discussed, the Buffalo Creek diversion will be constructed at the beginning of the project but will not be utilized until the later years of mining. Potential water quality impacts associated with the diversion will be minimized by lining the channel with clean coarse material and by protecting the channel with rip rap in areas of high gradient. Vegetation will be used to stabilize areas adjacent to the stream channel and will be fully established prior to use of the channel system.

14.2.9 Aquatic Resource Monitoring

Water quality and quantity monitoring in Moose Creek, as described in Section 15.9, will detect any changes in physical habitat characteristics that may occur within Moose Creek during mining, reclamation, and post-reclamation. No significant impacts to fish resources are anticipated and extensive monitoring of fish utilization is not planned for Moose Creek. The Alaska Department of Fish and Game will continue to conduct annual surveys of chinook salmon spawners. If the hydrological monitoring indicates that unexpected impacts to stream habitats are occurring, then additional monitoring of fish resources or physical habitat characteristics will be initiated to further define the problem.

Monitoring of the stability of the Buffalo Creek diversion channel will continue until stability is assured. Repairs to the channel will be accomplished as needed.

14.2.10 Synopsis of Fisheries Protection Measures

Fisheries resources will be protected from direct impact due to mine facility placement primarily by locating mine facilities as far from important water bodies (e.g., Moose Creek) as possible. No facilities will be placed on the active flood plain of Moose Creek. The unavoidable disruption of Buffalo Creek has been compensated by measures to protect the fishery at Wishbone Lake and by enhancing access to fisherman as discussed in Section 14.2.6 and 14.2.7.

Protection from water quality impacts has been accomplished by designing the sedimentation control structures and other facilities to achieve a zero discharge to surface waters and by controlling surface runoff as described in Section 15.

Protection from hydrological impacts has been achieved by locating mine areas away from Moose Creek. No adverse effects on stream flows are predicted based on hydrological study programs as described in Section 15.

Protection of fisheries resources from siltation is accomplished by controlling surface runoff from all disturbed areas and routing it to specially designed non-discharging sedimentation basins as described in Sections 11 and 15. Erosion of the Buffalo Creek diversion channel will be minimized through special design features and also by allowing the channel to stabilize for a number of years before diverting flow into it.

Protection of fish resources from blasting effects will be accomplished by adhereing to the ADF&G's blasting standards.

While sport fishing may be increased as a result of improved access, ADF&G considers improved access to Wishbone Lake, the primary fishery, to be desirable. The lake fishery is already limited to catch and release fishing. Therefore, increased fishing pressure will have little effect.

14.3 Protection of Wildlife Resources

14.3.1 Summary of Important Resources

The wildlife baseline study (Part C, Chapter X) indicates that the Wishbone Hill area is typical of upland habitats in the vicinity, providing habitat for moose, bear, furbearers and songbirds. For the most part, wildlife abundance and habitat values are not exceptional. However, the area is used heavily by moose in the winter and has value as moose winter range. Winter food species are currently over-utilized as indicated by the heavily browsed shrubs. The management plan for the Matanuska Valley Moose Range recognized this situation and emphasizes enhancement of moose habitat as a primary goal. The designated post-mining land use applied to potential coal development in the Moose Range is wildlife habitat with moose as the key species. Clearly, moose is the most important wildlife species and moose winter range the most important habitat consideration.

14.3.2 Summary of Potential Impacts

The major impact of mining will be the unavoidable destruction of wildlife habitats in areas disturbed by mining, by mine facility placement, and by road construction. The affected habitat types are listed below along with the surface area of each that lies within the area of direct disturbance:

Habitat Type		Acreage
Open Mixed Forest		159
Closed Deciduous Forest		202
Tall Shrub (Alder)		3
Tall Shrub (Willow)		0
Tall Shrub (Young Birch)		113
Lowland Meadow		56
Upland Meadow		94
Wet Low Shrub		0
Riverine		0
Barren		3
	Total	630

The 630 acres of habitat shown above will be disturbed over the life of the project. On average, after the first year of mining, a maximum of 39 acres will be disturbed per year. During the second 5 year term, reclamation work will begin and will help to further reduce the amount of habitat lost on an annual basis.

Open mixed forest and closed deciduous forest are the most common habitat types which will be disturbed by the project. These types along with the less common tall shrub and meadow types provide winter habitat for moose as well as habitat for small mammals and song birds. Mobile animals including most mammals and birds will be displaced to other habitats in the area.

Some additional disturbance of animals as a result of noise and activity will also occur during the life of the mine. Sensitive mammals such as brown bears and furbearers will avoid the area of activity and, consequently, will be displaced from an area which is larger than the zone of direct habitat alteration. Other species, such as moose and most song birds, will adapt to the noise and will probably not be greatly affected.

14.3.3 General Wildlife Protection Strategy

The primary protection strategy will be to limit the amount of surface disturbance and restore disturbed areas to productive habitat as soon as possible following disturbance with emphasis on reclamation and enhancement of moose habitat. In addition, disturbance to wildlife during the life of the mine will be minimized through facility design measures and education of employees.

14.3.4 Protection of Threatened and Endangered Species

There are no threatened or endangered plant or animal species that are resident in the Wishbone Hill area. Endangered peregrine falcons may enter the area occasionally during spring and fall migrations; however, special protection measures are not appropriate under these circumstances.

The American bald eagle is not threatened or endangered but is protected by special federal law. Bald eagles may be present in the area occasionally. There are no known bald eagle nest sites in the vicinity and no special protective measures are needed for this species (see Part C, ChapterX).

14.3.5 Wildlife Protection during the Life of the Mine

The mine facilities have been designed to achieve maximum consolidation and to avoid unnecessary disturbance to vegetated terrain. Additionally, some facilities have been specifically designed to minimize impacts to wildlife. The mine facilities area, including the waste water pond and the slurry pond will be fenced to prevent wildlife from entering. Any above ground power lines will be properly designed to mitigate impacts to large birds.

All Wishbone Hill mine employees will receive training which will include orientation to the wildlife and ecological values of the area with emphasis on preventing unnecessary disturbance to wildlife. Company policies will prevent harassment of wildlife and the use of firearms in the permit area. Workers will be instructed regarding the proper disposal of food waste which can attract wildlife. The proposed mine facilities will not include sleeping or cooking facilities; therefore, food sources will be limited to sack lunches brought to the site by shift workers. All putrescible waste will be placed in animal-proof containers until it can be buried in an approved landfill site. Company policies regarding improper disposal of waste items will be strictly enforced.

Operation of coal haul trucks in areas frequented by moose presents the potential for increased road encounters. Several steps will be taken to minimize any such impacts: 1) the employee environmental training program will address the topic of wildlife conflict with truck traffic and will instruct truck drivers and other equipment operators to watch for moose and drive at acceptable speeds; 2) speed limits on mine roads that consider the safety of both humans and wildlife will be established and enforced; and 3) wildlife (especially moose) abundance and location in relation to major travel routes will be monitored and drivers will be informed regarding the areas where moose are most likely to cross roadways.

14.3.6 Wildlife Habitat Restoration

The primary wildlife protection measure to be employed during and after mining is the reclamation of productive wildlife habitat. This reclamation effort will be performed as contemporaneously as practicable with the mining operation. The reclamation plan and its rationale are described in detail in Section 13.0.

To obtain the desired post-mining land use, revegetation efforts will emphasize the creation of several habitat types (landscape diversity) composed of a variety of plant species (species diversity). Habitat type construction will consider primarily moose browse and thermal/hiding cover with additional consideration given to creating habitat desirable for song birds and small mammals. The aim will be to construct a mosaic of various successional stages so that all the communities do not mature at the same time and, thus, avoid contributing to the expanse of old-growth birch-spruce forest in the area. Species selection and planting density have been designed such that the productivity of moose browse will be at least as high as that which now exists. The success of reclamation in providing suitable wildlife habitat will be monitored on an ongoing basis.

14.3.7 Wildlife Monitoring and Reporting

Five years of site specific baseline moose monitoring data have been collected within and adjacent to the permit area (see Part C, Chapter X). Once mine construction is initiated, this data will be used to develop an operational moose monitoring program. The operational monitoring will provide general information on animal abundance, location, and habitat use and also provide for comparison of moose utilization of the project area before, during, and after mining. The utilization data will also allow an evaluation of the effectiveness of reclamation in restoring and enhancing moose habitat.

15.0 PROTECTION OF THE HYDROLOGIC BALANCE AND WATER QUALITY

15.1 Overview of Surface Water and Groundwater Protection

15.1.1 Protection Goals

The Wishbone Hill Project has been designed to minimize the effects of mining on the hydrologic balance and to restore the mine site ground and surface water resources to their approximate premining condition. Protection standards relating to surface water and groundwater resources are established in 11 AAC 90 Sections 321, 323, 329, 339, 343 and 345 of the Alaska Coal Mining Program. These regulations establish standards to protect the quantity and quality of ground and surface water during mining and to reestablish the approximate premining conditions at the completion of mining. The standards also require that the mining operation comply with all applicable State and Federal water quality regulations.

This section provides information relating to the procedures to be followed to ensure protection of surface water and groundwater resources in and near the proposed permit area during mining and the reestablishment of the approximate premining conditions following completion of mining.

15.1.2 Water Quality Standards

Water quality criteria for the State of Alaska are promulgated in the Alaska Water Quality Standards, 18 AAC 70. The water quality criteria are combined with the water use designation to determine the water quality standards for a particular water body. Alaska Water Quality Standards incorporate by reference Federal Primary and Secondary Drinking Water Standards in addition to numerical criteria for other constituents not covered under Federal Standards. Additional information on groundwater quality standards and existing baseline groundwater quality is provided in Part C, Chapter IV.

15.2 Mine Facilities

15.2.1 Slurry Pond

A slurry pond will be constructed for disposal of fine coal refuse. The pond is approximately 26 acres in surface area and will be unlined. The pond has been designed to have zero surface discharge, therefore no impacts to the surface water system under normal operations are expected.

Vertical leakage out of the pond into the shallow groundwater present in this area will occur. The rate of leakage will depend mainly on the degree of sealing provided by the fine coal refuse. Initially, leakage rates will probably be high until the fine coal refuse settles out and reduces the permeability of the bottom of the pond. A localized groundwater mound may form under and around the slurry pond as a result of leakage. This localized mound should not affect the general regional direction of groundwater flow in the glacial sediments and will not cause any significant adverse impacts to the groundwater regime.

The chemical quality of water leaking from the slurry pond is not expected to result in degradation of groundwater. Based on information in Part C, Chapter III the fine coal waste does not have any geochemical characteristics that are acid or toxic forming or would result in water quality degradation.

15.2.2 Wash Down Water Recycle Pond

The wash down water recycle pond will be fully lined and will have zero discharge. Therefore, no impacts to surface water or groundwater are expected during normal operation of the wash down water recycle pond.

15.2.3 Fresh Water Ponds

The fresh water ponds will be lined to prevent leakage and minimize the amount of makeup water required for the mine. The ponds have been designed to be zero discharging. Therefore, no impacts to surface water or groundwater are expected during normal operation of the fresh water ponds. Leakage from the ponds would not cause any surface water or groundwater quality degradation since only fresh water is stored in the ponds.

15.2.4 Topsoil Stockpiles

Precipitation falling on the topsoil stockpile may eventually runoff as surface water or infiltrate to the groundwater Table. All surface water runoff will be collected and routed to a sediment control structure. The sediment control structures have been designed to be nondischarging at the surface and will allow infiltration of the water which may eventually reach the groundwater Table. No degradation of groundwater quality is anticipated since the topsoil resource does not contain acid or toxic forming substances. Since topsoil stockpiles are temporary, it is likely that during the period they are in operation a significant proportion of available moisture which does not runoff as surface water will be stored in the stockpile as soil moisture rather than percolating through the stockpile into the underlying soils and eventually to the shallow groundwater.

15.2.5 Overburden Stockpiles

Precipitation falling on the overburden stockpile may eventually runoff as surface water or infiltrate to the groundwater Table. All surface water runoff will be routed to a sediment control pond. The ponds have been designed to be nondischarging at the surface and will allow infiltration which could eventually reach the groundwater Table. As discussed in Part C, Chapter III the overburden does not have any geochemical characteristics that are acid or toxic forming or would cause degradation of water quality. Since stockpiles are temporary, it is likely that during the period they are in operation a significant proportion of available moisture which does not runoff as surface water will be stored in the stockpile as soil moisture rather than percolating through the stockpile into the underlying soils and eventually to the groundwater system.

15.2.6 Mine Service Area

Facilities associated with the mine service area and coal washing plant are not expected to cause significant groundwater impacts under normal operating conditions. Equipment maintenance activities will be conducted in a facility with a concrete foundation, therefore minimizing the potential for oils, fuels and degreasers to affect soil and groundwater. No chemicals other than a flocculent will be used in the coal washing process.

Fuel storage will be above ground, therefore allowing early detection of any leaks or spills. The area will be bermed and lined to prevent offsite movement in the unlikely event of a spill.

15.2.7 Septic System

Sewage treatment will include a septic tank, a subsurface drainage system, and a leach field. The glacial sediments present on the site should be amenable to leach field operation. Degradation of groundwater quality as a result of leach field operation is not anticipated.

15.3 Drainage and Sediment Control

Drainage and sediment controls for the proposed project will be implemented to minimize the effects of the mining operation on the prevailing hydrologic balance by controlling and collecting disturbed area runoff. Drainage from undisturbed areas will be diverted away from areas of disturbance to maintain the existing undisturbed drainage water quality. Drainage from disturbed areas will be collected and conveyed to drainage control structures located throughout the project area. Drainage controls to collect and contain runoff from disturbed land within the project Area will be implemented prior to any disturbance in an area.

The drainage control plan has been developed to make the best use of existing drainage patterns and the numerous natural depressions present on site. The drainage and sediment control system will make use of ditches and berms to promote drainage to sediment control structures. There are seven sediment control ponds to be constructed over the life of the project. In addition, the sediment control plan will make use of the slurry pond and wash down water pond to control drainage in the area of the coal washing facilities.. The open mine pits will be used to collect runoff in the mine areas. Drainage from all disturbed areas will be diverted to one of these sediment control structures.

The drainage control system for the Wishbone Hill Project has been conservatively designed to be non surface discharging in rainfall events up to and including the 100 year 24 hour storm. The sediment control structures have been designed to handle flows and sediment generated from a 100 year 24 hour storm event, plus the expected annual sediment yield without overtopping. The sediment basins will allow any sediment to settle out and the runoff water to infiltrate into the underlying glacial gravels in a reasonably short period of time. In addition, an emergency spillway has been designed for each sediment pond.

Runoff control structures will be constructed prior to disturbance in all areas of the mining operation. The coal washing facilities area will be graded prior to building construction to promote drainage to either the slurry pond, the wash down water pond or Sediment Pond No. 2 (see Section 11.0). After topsoil removal and prior to opening of the mine pits, the natural drainage patterns in the mine areas will be enhanced through the use of ditches and berms to promote drainage to the sediment control ponds in the pit areas. Once overburden removal activities have begun, most of the flows from the pit areas will topographically flow into the active pits. These flows will be collected in an area of the pit floor. Ditching will be provided around the perimeter of the pit areas to collect any disturbed area runoff which does not drain into the active pit areas and divert this runoff into the existing sediment basins. During backfilling, any ponds which have been mined out will be reconstructed and the approximate pre-mining drainage control patterns will be reestablished. Drainage controls will remain in place until the revegetation effort has been determined successful by the Division of Mining, Land & Water and the drainage entering the ponds meets the applicable State and Federal water quality laws and regulations.

Since no surface water discharge is anticipated from the drainage control structures for the Wishbone Hill Project, no surface water impacts are expected. The chemical quality of water infiltrating from all ponds is not expected to result in degradation of groundwater. Based on information in Part C, Chapter III the fine coal waste does not have any geochemical characteristics that are acid or toxic forming or would result in groundwater quality degradation. Surface runoff in the mine area will contain sediment from roads, overburden stockpiles, coal stockpiles and other sources. Based on the information provided in Part C, Chapter III potential sources of sediments including overburden and coal do not have any geochemical characteristics that are acid or toxic forming or would degrade the quality of groundwater.

15.4 Sediment Pond Maintenance

The sediment control ponds for the proposed project have been designed to store one year's accumulation of the expected annual sediment load. The ponds will be maintained and the collected sediment removed on a yearly basis to ensure continued containment of the design storm and continued infiltration of the storm flows. Ponds and ditches will be inspected each spring. Material removed from the ponds or ditches will be used as backfill in the mine pits.

15.5 Surface Water and Groundwater Treatment Facilities

With the exception of treatment of the potable water there will be no active facilities for surface water or groundwater treatment. As described above there are no acid, toxic or hazardous substances to be exposed as part of the mining operation or used as part of the coal processing. Passive treatment for sediment control will be accomplished through routing of all disturbed area flows to the sediment control structures as described in Section 15.3.

15.6 Stream Channel Diversions/Relocations

The Buffalo Creek channel will be permanently relocated as part of the mining operation. Early in the mine life, the relocated channel for Buffalo Creek will be constructed north of the proposed mine pit (see Part D, Section 11.9). The new channel, will not be utilized until topsoil removal activities associated with mining begin in the area of the existing Buffalo Creek channel. The time between construction of the channel and diversion of the flows into the channel will allow stabilization and monitoring of the channel.

As discussed in Part D, Section 11.9, the channel has been designed to avoid the transport of sediment to Moose Creek. The channel will be stabilized in the upper, shallower reaches with a vegetative cover. Beginning at the steeper middle reach of the relocated channel and continuing to the outlet of the channel, the stream will be riprapped with a clean rock material (see Section 11.9). By constructing the channel early in the mine life and allowing the channel to stabilize prior to use the potential for erosion and sediment loading to Moose Creek will be minimized.

15.7 Mine Water Usage

15.7.1 Coal Washing Make-Up Water

Flows in Buffalo Creek will be diverted as needed to serve as make-up water in the coal washing operations for the mining project. Water in the storage ponds could also include some groundwater from inflows from the pit area, if inflows are significant enough to warrant pumping. Appendix C provides information on the maximum expected processing water requirements and the amount of water which will be diverted to meet processing water requirements on a monthly basis during the life of the mining operation. Based on the flow information for Moose Creek presented in Part C, Chapter V, diversion of Buffalo Creek will not significantly affect flows in Moose Creek. The withdrawal from Buffalo Creek will represent less than 1% of the Moose Creek flows. Any alterations that do occur will be insignificant relative to the natural annual variation in flow. The least amount of flow diversion will occur in the winter when Buffalo Creek has little or no flow. During that period water stored in the fresh water ponds will be used for coal washing.

15.7.2 Potable Water

The mining operation will use either a well or water from Fresh Water Pond No. 1 for potable water. Potable water requirements have been determined to be 5,330 gallons per day or approximately 4 gpm. The water balance for wash plant requirements is contained in Appendix C, and includeds the potable water quantities that will be needed.. As discussed in 15.7.1 above, the use of Buffalo Creek water for coal washing and potable water will not materially affect surface water or groundwater quality or quantity.

15.7.3 Dust Control

Water from the wash down water pond will be used for dust control on mine haul roads and the access road as needed during the drier summer months. A conservative estimate of the amount of water needed for dust control (14 gpm) has been used in the water balance for the wash down water pond presented in Appendix C. As shown in the water balance Table in Appendix C, this volume can be maintained through the use of runoff water which flows into the wash down water pond. No additional water source is believed necessary. The wash down water pond makes use of a natural depression which under premining conditions would contain surrounding area drainage and allow that drainage to infiltrate into the underlying gravels. Therefore, collection of this water will not materially change the premining surface water runoff quantity. The wash down water will be treated to remove oil and grease prior to disposal in the pond. The use of this water for dust control will not materially affect the quantity or quality of groundwater.

15.8 Pit Inflows

A complete discussion of the expected pit inflows is contained in Section 11.11 of Part D. As this section indicates, pit inflows are not expected to be significant and most of the expected inflow will evaporate as it enters the pit. Any pit inflows that are encountered during mining will be temporarily stored in a sump area in the bottom of the pit. The inflows will then be pumped from the pit, if necessary, to Fresh Water Pond No. 1 for incorporation into the wash plant circuit. No degradation of surface water or groundwater quality as a result of the discharge of mine inflow is anticipated.

15.9 Monitoring of Surface Water Quality and Quantity

15.9.1 Premining Monitoring Program

Premining surface water monitoring has been conducted as part of the baseline hydrologic characterization activities described in Part C, Chapter V. Seven surface water monitoring stations were established to monitor water quantity and quality. Table 15-1 provides a list of the premining monitoring stations. The location of these stations is shown in Figure 15-1.

Four continuous stream flow monitoring stations were established for monitoring premining surface water conditions. Two of the four stations (Stations 1 and 5) monitored flows in Moose Creek with a pressure transducer and electronic data logging system. The other two continuous flow monitoring stations were on Buffalo Creek (Stations 3 and 4) and measured flows with a Parshall flume and stilling well. Instantaneous flow measurements were also taken at Stations 2, 3, 6 and 7 at the time of the monthly sampling.

Water quality samples were collected monthly at the four continuous recorder sites as well as one additional site, located on Premier Creek (Station 2). These samples were analyzed for a comprehensive suite of parameters. Two additional sites on Moose Creek (Stations 6 and 7) were also sampled monthly for field parameters and sediment loading.

The suite of chemical parameters analyzed in surface water samples during the premining monitoring is listed in Table 15-2.

15.9.2 Monitoring During Mining

Operational surface water monitoring will commence upon startup of mining activities at the site. Monitoring will be conducted to determine the effect of the mining activities on surface water quantity and quality during the active mining period. Table 15-3 lists the operational monitoring stations. Locations of these stations are also shown on Figure 15-1.

Continuous flow measurements will continue at Stations 1 and 5 on Moose Creek and at Station 3 on Buffalo Creek. Continuous flow measurements will be discontinued at Station 4 on Buffalo Creek since the creek will be partially diverted to meet coal wash water requirements and the flow measurements will no longer represent actual flow values. Continuous flow recorders will not be active during the winter months (November through March) due to problems with ice buildup and the ability to obtain accurate readings, as experienced in the premining monitoring. In addition to the continuous recorders, staff gage readings will be taken once a month during April through October at Stations 1, 3, and 5. Flow rates at Stations 2 and 4 will be manually measured once a month during April through October.

Water quality samples will be obtained quarterly from the continuous recorder stations as well as Stations 2 and 4. When Buffalo Creek flow is permanently diverted into the relocated channel, the water quality monitoring site at Station 4 will be relocated to the outlet of the relocated channel. Pending ice conditions and flow, the field parameters shown on Table 15-2 will be analyzed monthly at all five stations. Sampling at Stations 6 and 7 on Moose Creek will be discontinued. Water quality parameters to be analyzed are the same as those measured during premining and are shown on Table 15-2. As additional data becomes available on water quality this list may be modified.

The results of the operational surface water monitoring program will be submitted to the Division of Mining, Land & Water in UCM's annual report.

15.9.3 Post-Mining Monitoring Program

Post-mining surface water monitoring will commence upon completion of the active mining operations and startup of final mine reclamation. Post-mining surface water monitoring will be conducted to evaluate the reestablishment of the hydrogeologic regime in the project area. The monitoring stations will be the same as those listed for operational monitoring in Table 15-3. Figure 15-1 depicts the location of these five stations.

Post-mining monitoring will consist of monitoring water quantity and quality on a quarterly basis at Stations 1, 2, 3, 4, and 5. The continuous flow measurements at Stations 1, 3 and 5 will be discontinued, however, water quantity will continue to be monitored by taking instantaneous flow measurements at the time of quarterly sampling. Water quality samples will be obtained quarterly for field and laboratory analysis for the same parameters outlined for the operational monitoring period (see Table 15-2).

Results of the post-mining water monitoring program will be submitted on an annual basis to the Division of Mining, Land & Water.

15.10 Monitoring of Groundwater Quality and Quantity

15.10.1 Premining Monitoring Program

Premining groundwater monitoring has been conducted as part of the baseline hydrogeological characterization activities described in Part C, Chapter IV. Table 15-4 provides a list of the premining monitoring installations which include both monitoring wells and pneumatic piezometers. The location of these facilities is shown in Figure 15-2. The suite of chemical parameters analyzed in groundwater samples during the premining monitoring is listed in Table 15-5.

15.10.2 Monitoring During Mining

Operational groundwater monitoring will commence upon startup of mining activities at the site. Monitoring will be conducted to determine the potential effects of mining activities on groundwater levels and water quality and will include the additional requirements contained in the stipulations of the surface mining permit

A number of the baseline monitoring facilities that are located within the two mine areas will be destroyed by mining. These include wells H88-11, 12, 15, and 16 and essentially all of the pneumatic piezometers. Monthly monitoring of water levels during April through October and January will continue in these facilities until they are destroyed.

In addition to the wells located in the mine areas, three other existing wells are located in areas that will be affected by mine facilities. Well H88-21 will be in an overburden stockpile area, well H88-23 will be in the area of one of the fresh water ponds, and well H88-24A may be covered by an embankment for the slurry pond. These wells will be decommissioned in accordance with the DMLW's well abandonment procedures prior to construction of these facilities.

The wells that will be used for operational groundwater monitoring are listed in Table 15-6. Locations are shown in Figure 15-3. They include eleven existing wells and nine new wells. New well H-31 will be located on the southeast side of the slurry pond and monitor potential impacts of the slurry pond. It will replace well H88-24A which will be decommissioned as described above. New well DNR 1a will be located down-gradient of the plant area and will be used to monitor groundwater quality near this facility.

All wells used for operational monitoring will be measured once a month during April through October and again in January to determine water levels. Seven wells will be sampled semi-annually (two times a year) in the spring and fall for water quality. The wells selected for water quality sampling are indicated in Table 15-6 and include wells adjacent to Moose Creek (H88-10, 14A, 17, and 19), wells H88-25 and H-31 around the slurry pond.

The chemical parameters that will be analyzed in groundwater samples during operational monitoring are the same as those analyzed in the premining monitoring program and are listed in Table 15-5. As additional data becomes available on groundwater quality, this list may be modified. The results of monitoring activities will be reported on an annual basis to the Division of Mining, Land & Water.

15.10.3 Post-Mining Monitoring Program

Post-mining groundwater monitoring will commence upon termination of mining activities and startup of final mine reclamation. Monitoring will be conducted to evaluate the re-establishment of the hydrogeologic regime in the mine area and will include the additional requirements contained in the stipulations of the surface mining permit. Data on water level recovery in the reclaimed pits as well as the quality of groundwater in the pits and adjacent down-gradient areas will be used to assess the postmining groundwater system.

The wells that will be used for post-mining monitoring are shown in Figure 15-4 and listed in Table 15-7. They include a number of wells that will be used for pre-mining and operational monitoring plus several new wells. Well H88-10 will be used to monitor bedrock on the west side of Mine Area 1. Wells H88-14A, 17 and 19 will be used to monitor stream alluvium along Moose Creek. Wells H88-25 and H-31 will be used to monitor glacial sediments adjacent to the slurry pond area. Four wells, H-33 to 36, will be installed into the backfilled pits and be used to monitor the water levels and water quality in the backfill.

All other wells that were used for operational monitoring will be decommissioned in accordance with the DMLW's well abandonment procedures..

Water levels in the post-mining groundwater monitoring wells shown in Table 15-7 will be measured quarterly and water samples will be collected and analyzed annually in twelve of the wells, with water levels measured semi-annually (two times a year) in eight of the wells. The suite of chemical parameters that will be analyzed is the same as the suite to be analyzed during operational monitoring and is included in Table 15-5. Results of post-mining monitoring will be reported annually to the DMLW.

15.11 Plan for Restoration of Recharge Capacity

15.11.1 Aquifer Restoration

The open pits will be sequentially backfilled with overburden and coarse coal refuse during the active life of the mine. The backfill material will be significantly more permeable and have a higher porosity than the in-situ bedrock. Therefore, when re-saturated with groundwater, the backfill will comprise a more permeable hydrogeologic unit than the in-situ bedrock. This is not considered to be a significant adverse impact.

Resaturation of mine backfill will occur as a result of lateral inflow of groundwater from the pit walls plus vertical infiltration from precipitation. Based on information presented in Section 11, lateral inflows of groundwater are expected to range from 20 to 180 gpm in Mine Area 1 and from 30 to 200 gpm in Mine Area 2.

The amount of infiltration from precipitation on the backfill will depend on a number of factors including slope, vegetation and thickness of topsoil. As an estimate of infiltration, it is assumed that 20% of the average 15 inches of precipitation infiltrates into the backfill. This results in 3 inches per year of infiltration which yields approximately 10 gpm of inflow over the 65 acres comprising Mine Area 1 and approximately 35 gpm of inflow over the 220 acres comprising Mine Area 2.

Adding infiltration to groundwater inflow results in a total inflow to Mine Area 1 of 30 to 190 gpm and an inflow to Mine Area 2 of 65-235 gpm. It is assumed that these inflow rates occur until the backfill is resaturated. In reality, groundwater inflow will decrease as the water levels in the backfill rise (i.e. as a result of lower gradients). Therefore, the resaturation times estimated by assuming constant inflow rates are minimum times.

The volume of backfill in Mine Areas 1 and 2 are approximately 25 and 125 MCY (million cubic yards), respectively. Assuming a 40% porosity in the backfill, the total void volume to resaturate is 10 MCY and 50 MCY in Mine Areas 1 and 2, respectively. At the inflow rates presented above, it will take 20 to 130 years to resaturate the backfill in Mine Area 1 and 80 to 300 years in Mine Area 2. These times should be considered as order of magnitude estimates. However, they indicate that a relatively long time period may be required to resaturate the backfill and restore groundwater levels to pre-mining conditions.

15.11.2 Recharge Water Quality

Geochemical information discussed in Part C, Chapter III indicates that the overburden and course coal refuse do not contain acid or toxic-forming materials. Therefore, vertical infiltration through and resaturation of the mine backfill is not expected to degrade post-mining groundwater quality.

It is likely that moderate increases in the total dissolved solids (TDS) content of groundwater in the mine backfill will occur as a result of oxidation of backfill materials and subsequent leaching by infiltrating waters. Water in bedrock wells ranged in TDS from 142 to 834 mg/l based on data presented in Part C, Chapter IV. An estimate of the amount of increase in TDS was obtained by developing a relationship between electrical conductivity (EC) and TDS and then using this relationship to estimate TDS content from the overburden geochemistry information presented in Part C, Chapter III. The following data from the first two groundwater sampling rounds (see Part C, Chapter IV) in bedrock wells were used to develop a relationship between TDS and EC.

Well No.	EC (lab) umhos/cm	TDS mg/l
H88-10	301	188
	278	182
H88-11	1200	738
	964	782
H88-12	1180	728
	1085	736
H88-13	4285	2750
	2560	1984
H88-15	255	172
	245	154
H88-16	273	192
	234	164

A linear regression in the form of:

$$TDS = A \times EC + B$$

where A and B are the slope and intercept of the regression line yielded the equation:

$$TDS = 0.67EC + 13.5$$

with a coefficient of correlation, r, equal to 0.99. Ignoring the intercept (which has negligible effect for the range of EC values being considered) yields the equation:

$$TDS = 0.67EC$$

which is in the form TDS = A x EC suggested by Hem (1970). Hem reports that the coefficient A usually lies between 0.55 and 0.75 for natural waters. The calculated coefficient of 0.67 falls in approximately the middle of this range.

Overburden geochemistry data presented in Part C, Chapter III indicate that the following measured EC values are representative of overburden/interburden material:

Unit	EC (umhos/cm)
Tsadaka Conglomerate	1,000
Wishbone conglomerate	1,300
Shale	1,600
Sandstone	1,500
Siltstone	1,500
Jonesville	700
Premier	1,300
Midway	1,500
Eska	1,800
Sub Eska	2,300
Burning Bed	1,400

The range is from 700 to 2,300 umhos/cm with most values falling between 1,300 to 1,800 umhos/cm. Using equation 4-3 presented above to convert the latter range of EC values to TDS yields expected TDS concentrations in saturated overburden of 870 to 1210 mg/l. These expected ranges of TDS do not constitute a significant groundwater quality impact and are within the range of TDS values acceptable for livestock and agricultural uses.

Minor increases in the TDS content of groundwater baseflow from the mine Area to Moose Creek may occur. However, as discussed in Part C, Chapter IV the groundwater baseflow from the mine Area is small and potential increases in TDS caused by the mine are not anticipated to degrade the water quality in Moose Creek.

15.12 Measures to Manage Exploration Holes and Wells

Exploration holes and monitoring wells will be actively managed to minimize the potential for contamination of the groundwater resource. When no longer needed, these openings will be abandoned in accordance with the DMLW's hole abandonment procedures.

15.13 Hydrologic Consequences of the Operation

15.13.1 Surface Water Impacts

Based on the information presented in this section, no significant and long-term effects to the surface water regime are expected from the mining operations.

Surface water quality will not be affected since runoff from disturbed areas will be completely retained within the disturbance area and not discharged to the existing surface water. All disturbed area runoff will be collected and routed to either the open pits or a sediment control structure. All mine sediment control ponds as well as the mine processing water and slurry ponds have been designed to be nondischarging under the design storm (100 year 24 hour). The Buffalo Creek channel relocation has been designed to minimize erosion and sediment loading to Moose Creek. The channel will be constructed several years prior to when the creek will be rerouted to allow channel stabilization prior to use. By implementing these controls potential impacts to the surface water quality in the project area and vicinity will be minimized.

Surface water quantity will not be materially affected during the life of the mining operations and should approximate premining conditions at the completion of reclamation. The mine will use water diverted from Buffalo Creek for coal washing and possibly potable water.

The diversion of flows from the creek will be insignificant in relation to the total flows in Moose Creek. In addition, Buffalo Creek is not a significant fisheries resource and diversion of flows will not have a great effect on the Moose Creek fisheries resource. The mine sediment control plan makes use of the existing drainage patterns and natural depressions. The runoff which currently flows to a depression and infiltrates into the groundwater system will continue to do so. Surface flows which would normally reach Moose or Buffalo Creek and which during mining will be diverted to sediment control structures are minimal and will not affect Moose Creek. Surface drainage patterns existing prior to mining will be reestablished during reclamation. Surface water quantity for the project area and vicinity will not be materially affected by the active mining operations and should return to their approximate premining condition upon completion of reclamation.

15.13.2 Groundwater Impacts

Based on the information presented in this section, no significant and long-term effects to the groundwater system are expected from the mining operations.

All runoff from disturbed area will be diverted to sediment control basins which will allow the water to infiltrate into the subsoils potentially reaching the groundwater table. The runoff could carry sediment from topsoil, overburden, coal or coal slurry. Based on the information contained in Part C, Chapter III the coal, overburden and fine coal waste do not have any geochemical characteristics that are acid or toxic forming or would result in groundwater quality degradation. The topsoil resource also does not contain acid or toxic forming substances. Therefore, infiltration from the drainage control structures will not affect groundwater quality.

No water quality impacts are expected from the processing facilities at the Wishbone Hill Project. No chemicals other than an inert flocculent will be used in the coal washing process. The fuel storage area will be bermed and lined to contain any spills. Oil and grease will be removed from the wash down water prior to disposal. The glacial sediments present on the site will be amenable to sewage disposal through a leach field operation. Degradation of groundwater quality as a result of leach field operation is not anticipated.

Regional groundwater flow regimes will not be affected by the mining operations, although some localized effects may be seen. As discussed in Section 11.11 some water is expected to be encountered during the mining operations. Pit inflows are expected to be insignificant and it is expected that a portion of the inflow water will evaporate as it enters the pit. Excess water will be collected in the pit floor and pumped for use in the processing circuit. Once backfilling has occurred in an area of the pit, the groundwater regime will be reestablished in the approximate premining condition in a relatively short period of time.

15.13.3 Impacts to Existing Water Uses

As discussed in Part C, Chapter VI there are no known surface water supply intakes within or adjacent to the permit area.

Groundwater rights and uses in and near the proposed permit area are also described in Part C, Chapter VI. Four permitted wells and four permitted springs are located more than 1 mile from the proposed mining pits.. Three of the wells and two of the springs are located south of the mine area in the vicinity of the Matanuska River. The fourth well is located approximately 2 miles east of the mining area while the other two springs are located more than a mile to the north or to the west of the proposed mining operation.

The springs and wells located south of the mine area will not have their yields or water levels affected by the mining activities based on the following considerations:

- These wells and springs are located approximately two miles from the mine area and are separated from the mine area by numerous topographic divides. Based on the water level and flow system information presented in Volume 3, Part C, Chapter IV, Section 4 these wells are not in the same groundwater flow regime as the mine area. Groundwater from the mine area discharges to Moose Creek above Tsadaka Canyon whereas the wells are located below the canyon.
- All but one of these southern wells are located within several hundred feet of Moose Creek or the Matanuska River, both of which would provide recharge to the groundwater if drawdowns at the wells extended below the level of the streams.
- The springs are located on the opposite side of Moose Creek from the mine area, thus Moose Creek would act as a hydrologic boundary.
- Analysis of the area around the open pits that will experience water level drawdowns (see Appendix L.4) indicates that the maximum distances from the pits that drawdowns are likely to occur are on the order of 2000 to 5000 feet based on conservative assumptions. This is less than half the distance to the wells and springs located at the south.

The permitted springs that are located approximately one mile north or to the west of the mine area lie on the opposite side of Moose Creek from the mine at an elevation of approximately 200 to 400 feet above Moose Creek. Their source of recharge is the area located north of Moose Creek. Moose Creek will act as a hydrologic boundary between the mine area and the area to the north as described in Volume 3, Part C, Chapter IV, Section 4. There is no possible mechanism for drawdowns in the mine area to affect these springs. The well located approximately two miles east of the mining operation is separated by topographic divides and beyond the zone of influence for the mining pits.

No permitted or other groundwater users were identified within the proposed permit area. Therefore, no impacts of mining on existing groundwater users in the area are anticipated.

Coal wash water supplies will be obtained from pit inflow, diversion of surface water from Buffalo Creek, and potentially from dewatering of the old underground workings of the Premier Mine.

Development of well fields in glacial or alluvial deposits is not anticipated. Therefore, no significant groundwater impacts are anticipated as a result of mine water supply.

15.14 Compliance with the Clean Water Act

Operations at the Wishbone Hill Mine will comply with the requirements of the federal Clean Water Act and all State of Alaska water quality statutes. The site operations and drainage controls have been designed to be non discharging to the surface and will not require a National Pollution Discharge and Elimination (NPDES) Permit.

TABLES

TABLE 15-1
PREMINING SURFACE WATER MONITORING

DESIGNATION	STREAM MONITORED	FLOW	SAMPLING FREQUENCY	PARAMETERS*
Station 1	Moose Creek	Continuous	Monthly	Full Suite
Station 2	Premier Creek	Monthly	Monthly	Full Suite
Station 3	Buffalo Creek	Monthly	Monthly	Full Suite
Station 4	Buffalo Creek	Continuous	Monthly	Full Suite
Station 5	Moose Creek	Continuous	Monthly	Full Suite
Station 6	Moose Creek	Monthly	Monthly	Sed Load
Station 7	Moose Creek	Monthly	Monthly	Sed Load

Instantaneous flow measurements taken at the time of water quality sampling.

* Water quality also tested for field parameters at time of sampling (see Table 15-2 for field parameters tested).

TABLE 15-2

PARAMETERS FOR PREMINING, OPERATIONAL AND POST-MINING SURFACE WATER MONITORING

FIELD PARAMETERS

- Instantaneous Flow
- Specific Conductance
- Temperature
- Alkalinity
- pH
- Total Dissolved Oxygen
- Turbidity

LABORATORY PARAMETERS

Lab pH	Chloride
Lab Specific Conductance	Nitrate as N
Total Dissolved Solids (180)	Nitrite as N
Total Dissolved Solids (Calc.)	Sulfate
Boron	Calcium
Flouride	Magnesium
Ammonia Nitrogen as N	Potassium
Total Kjeldahl Nitrogen	Sodium
Ortho Phosphorus	Aluminum
Total Organic Phosphorus as P	Arsenic
Total Phosphorus as P	Barium
Total Alkalinity	Cadmium
Total Acidity as $CaCO_3$	Copper
Total Hardness as $CaCO_3$	Chromium
Sodium Absorption Ratio	Iron
Color	Lead
Total Suspended Solids	Manganese
Settleable Solids	Mercury
Bicarbonate as CaO_3	Selenium
Carbonate as CO_3	Zinc

TABLE 15-3

OPERATIONAL SURFACE WATER MONITORING

DESIGNATION	STREAM MONITORED	FLOW	SAMPLING FREQUENCY	PARAMETERS*
Station 1	Moose Creek	Continuous	Quarterly	Full Suite
Station 2	Premier Creek	Monthly	Quarterly	Full Suite
Station 3	Buffalo Creek	Continuous	Quarterly	Full Suite
Station 4	Buffalo Creek	Monthly	Quarterly	Full Suite
Station 5	Moose Creek	Continuous	Quarterly	Full Suite

Water quality will also be sampled for field parameters listed in Table 15-2 at the time of sampling.

TABLE 15-4
PRE-MINING GROUNDWATER MONITORING

DESIGNATION	TYPE	UNIT MONITORED	WATER LEVELS	WATER SAMPLES
H88-10	2" Well	Bedrock	Monthly	Quarterly
H88-11	2" Well	Bedrock	Monthly	Quarterly
H88-12	2" Well	Bedrock	Monthly	Quarterly
H88-13	2" Well	Bedrock	Monthly	Quarterly
H88-14	5" Well	Glacial Sediments	Monthly	Quarterly
H88-14A	2" Well	Stream Alluvium	Monthly	Quarterly
H88-15	5" Well	Bedrock	Monthly	Quarterly
H88-16	5" Well	Bedrock	Monthly	Quarterly
H88-17	2" Well	Steam Alluvium	Monthly	Quarterly
H88-19	2" Well	Steam Alluvium	Monthly	Quarterly
H99-21	2" Well	Glacial Sediments	Monthly	Quarterly
H88-22	2" Well	Glacial Sediments	Monthly	Quarterly
H88-23	2" Well	Glacial Sediments	Monthly	Quarterly
H88-24A	2" Well	Glacial Sediments	Monthly	Quarterly
H88-25	2" Well	Glacial Sediments	Monthly	Quarterly
H88-27	2" Well	Glacial Sediments	Monthly	Quarterly
H88-28	2" Well	Glacial Sediments	Monthly	Quarterly
H89-29*	5" Well	Mine Voids	Monthly	Quarterly
H89-30*	2" Well	Bedrock	Monthly	Quarterly
PB-7	Piezometers	Bedrock	Monthly	----
PB-8	Piezometers	Bedrock	Monthly	----
PB-12	Piezometers	Bedrock	Monthly	----
PB-13	Piezometers	Bedrock	Monthly	----
PB-60	Piezometers	Bedrock	Monthly	----
PB-88	Piezometers	Bedrock	Monthly	----
PB-92	Piezometers	Bedrock	Monthly	----
PB-100	Piezometers	Bedrock	Monthly	----
PB-101	Piezometers	Bedrock	Monthly	----
PB-102	Piezometers	Bedrock	Monthly	----
PB-103	Piezometers	Bedrock	Monthly	----
PB-104	Piezometers	Bedrock	Monthly	----
PB-105	Piezometers	Bedrock	Monthly	----

* Wells installed July 1989

TABLE 15-5

PARAMETERS FOR PREMINING, OPERATIONAL AND POST-MINING GROUNDWATER MONITORING

FIELD PARAMETERS

Water Level
Specific Conductance
Temperature
Alkalinity
pH

LABORATORY PARAMETERS

Lab pH	Sulfate
Lab Specific Conductance	Calcium
Total Dissolved Solids (180)	Magnesium
Total Dissolved Solids (Calc.)	Potassium
Boron	Sodium
Fluoride	Aluminum
Ammonia Nitrogen as N	Arsenic
Total Kjeldahl Nitrogen	Barium
Ortho Phosphorus	Cadmium
Total Organic Phosphorus as P	Copper
Total Phosphorus as P	Chromium
Total Alkalinity	Iron
Total Acidity as $CaCO_3$	Lead
Total Hardness as $CaCO_3$	Manganese
Sodium Absorption Ratio	Mercury
Bicarbonate as HCO_3	Selenium
Carbonate as CO_3	Zinc
Chloride	
Nitrate as N	
Nitrite as N	

TABLE 15-6
OPERATIONAL GROUNDWATER MONITORING

DESIGNATION	TYPE	UNIT MONITORED	WATER LEVELS	WATER SAMPLES
H88-10	2" Well	Bedrock	Monthly	Semi·annually*
H88-13	2" Well	Bedrock	Monthly	none
H88·14A	2" Well	Stream Alluvium	Monthly	Semi-annually*
H88-17	2" Well	Stream Alluvium	Monthly	Semi-annually*
H88-19	2" Well	Stream Alluvium	Monthly	Semi-annually*
H88-22	2" Well	Glacial Sediments	Monthly	none
H88-25	2" Well	Glacial Sediments	Monthly	Semi-annually*
H88-27	2" Well	Glacial Sediments	Monthly	none
H88-28	2" Well	Glacial Sediments	Monthly	none
H89-29	5" Well	Mine Voids	Monthly	none
H89-30	2" Well	Bedrock	Monthly	none
H-31*	2" Well	Glacial Sediments	Monthly	Semi-annually*

* New well to be installed

OPERATIONAL GROUNDWATER MONITORING.
NEW WELLS REQUIRED BY APPENDIX A
OF DNR LETTER DATED AUGUST 2, 2012.

DESIGNATION	TYPE	UNIT MONITORED	WATER LEVELS	WATER SAMPLES
DNR 1a	2”	Glacial Sediments.	Monthly	Semi-annually*
DNR 1b-1	2”	Glacial Sediments, Bedrock	Monthly	Semi-annually*
DNR 1b-2	2”	“	Monthly	Semi-annually*
DNR 1b-3	2”	“	Monthly	Semi-annually*
DNR 1b-4	2”	“	Monthly	Semi-annually*
DNR 1c	2”	Glacial Sediments, Bedrock	Monthly	Semi-annually*
DNR 1d-1	2”	Glacial Sediments, Bedrock	Monthly	Semi-annually*
DNR 1d-2	2”	“	Monthly	Semi-annually*

* Semi-annually means two times a year.

TABLE 15-7
POST-MINING GROUNDWATER MONITORING

DESIGNATION	TYPE	UNIT MONITORED	WATER LEVELS	WATER SAMPLES
H88-10	2" Well	Bedrock	Quarterly	Annually
H88-14A	2" Well	Stream Alluvium	Quarterly	Annually
H88-17	2" Well	Stream Alluvium	Quarterly	Annually
H88-19	2" Well	Stream Alluvium	Quarterly	Annually
H88-22	2" Well	Glacial Sediments	Quarterly	Annually
H88-25	2" Well	Glacial Sediments	Quarterly	Annually
H88-27	2" Well	Glacial Sediments	Quarterly	Annually
H-31	2" Well	Glacial Sediments	Quarterly	Annually
H-33*	2" Well	Pit Backfill	Quarterly	Annually
H-34*	2" Well	Pit Backfill	Quarterly	Annually
H-35*	2" Well	Pit Backfill	Quarterly	Annually
H-36*	2" Well	Pit Backfill	Quarterly	Annually

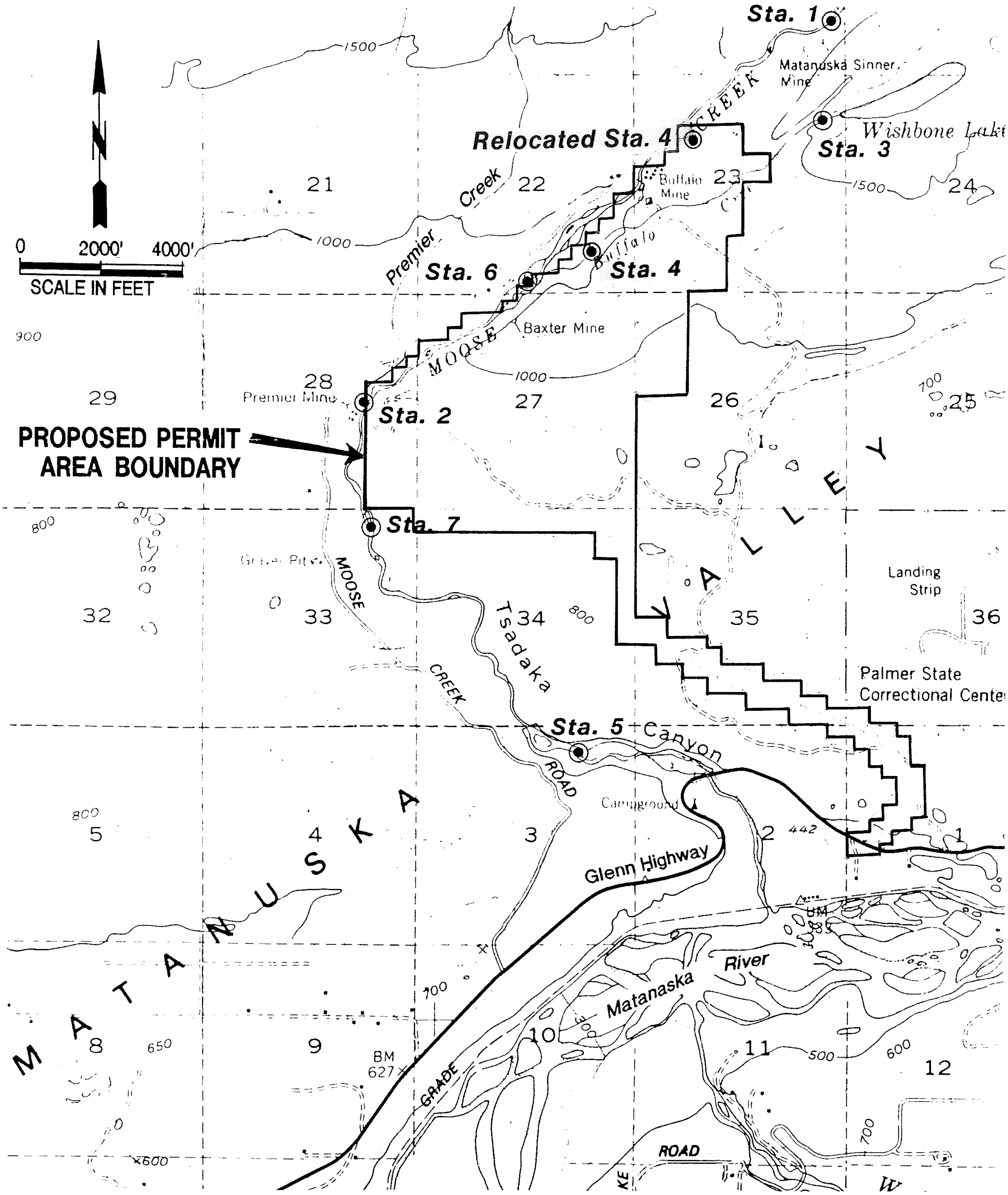
* New well to be installed

POST-MINING GROUNDWATER MONITORING.
NEW WELLS REQUIRED BY APPENDIX A
OF DNR LETTER DATED AUGUST 2, 2012.

DESIGNATION	TYPE	UNIT MONITORED	WATER LEVELS	WATER SAMPLES
DNR 1a	2”	Glacial Sediments.	Monthly	Semi-annually*
DNR 1b-1	2”	Glacial Sediments, Bedrock	Monthly	Semi-annually*
DNR 1b-2	2”	“	Monthly	Semi-annually*
DNR 1b-3	2”	“	Monthly	Semi-annually*
DNR 1b-4	2”	“	Monthly	Semi-annually*
DNR 1c	2”	Glacial Sediments, Bedrock	Monthly	Semi-annually*
DNR 1d-1	2”	Glacial Sediments, Bedrock	Monthly	Semi-annually*
DNR 1d-2	2”	“	Monthly	Semi-annually*

* Semi-annually means two times a year.

FIGURES

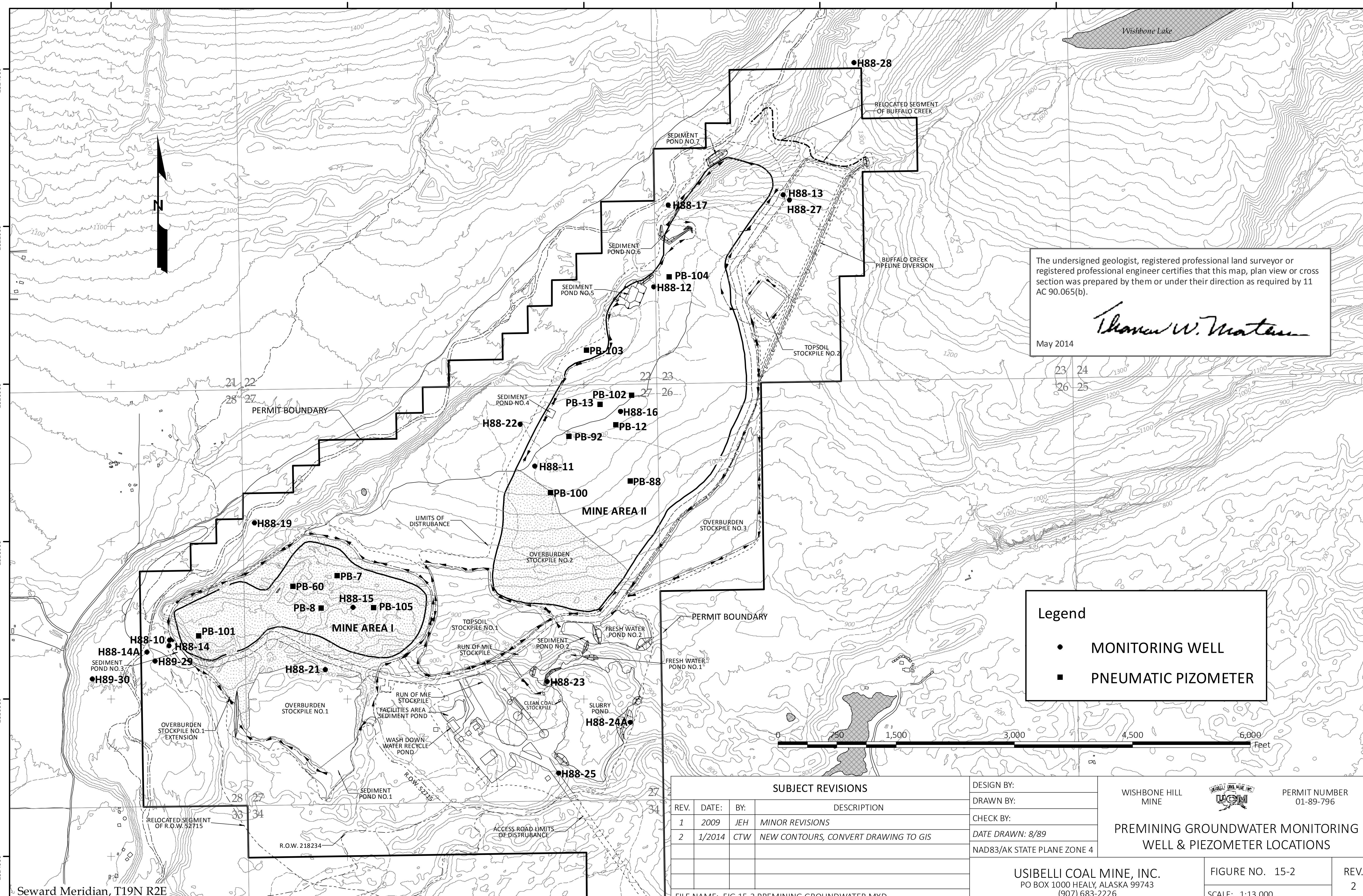


DESIGN BY:	LOCATION OF SURFACE WATER MONITORING STATIONS
DRAWN BY:	
CHECK BY:	
DWG FILE:	USIBELLI COAL MINE, INC.
DATE DRAWN: 8/89	P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226

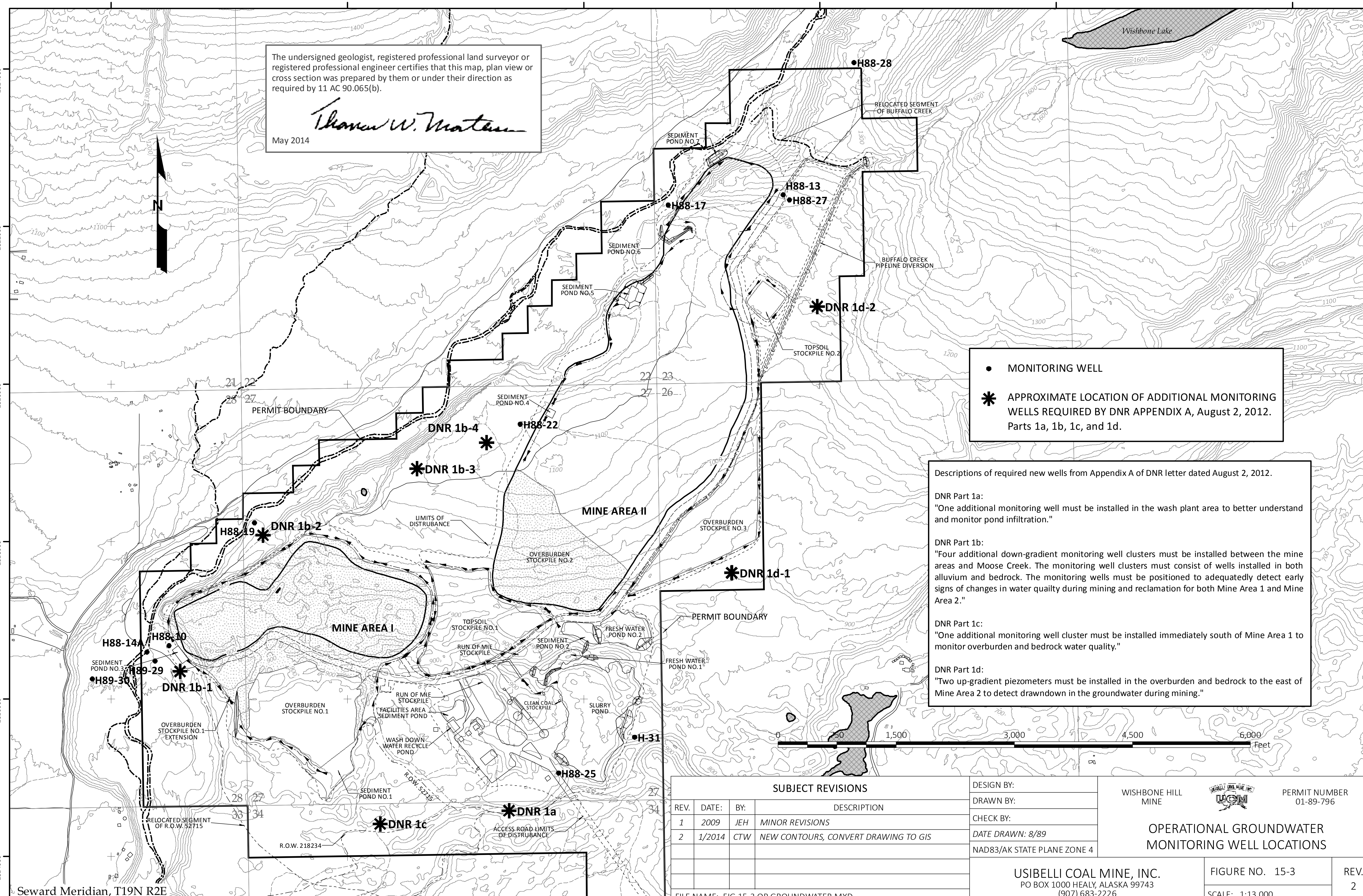
WISHBONE HILL MINE — PERMIT No. 01-89-796

FIGURE No. 15-1 — REV. 0

SCALE: AS SHOWN



Wishbone Lake
N
H88-28
RELOCATED SEGMENT OF BUFFALO CREEK
SEDIMENT POND NO.7
H88-13
H88-27
H88-17
SEDIMENT POND NO.6
BUFFALO CREEK PIPELINE DIVERSION
PB-104
H88-12
SEDIMENT POND NO.5
TOPSOIL STOCKPILE NO.2
PB-103
The undersigned geologist, registered professional land surveyor or registered professional engineer certifies that this map, plan view or cross section was prepared by them or under their direction as required by 11 AC 90.065(b).
May 2014
PERMIT BOUNDARY
SEDIMENT POND NO.4
PB-102
PB-13
H88-16
H88-22
PB-12
PB-92
H88-11
PB-88
PB-100
MINE AREA II
LIMITS OF DISTRUBANCE
H88-19
OVERBURDEN STOCKPILE NO.3
OVERBURDEN STOCKPILE NO.2
PB-7
PB-60
H88-15
PB-8
PB-105
MINE AREA I
PB-101
H88-10
H88-14A
H88-14
SEDIMENT POND NO.3
H89-29
H89-30
H88-21
TOPSOIL STOCKPILE NO.1
RUN OF MIE STOCKPILE
SEDIMENT POND NO.2
FRESH WATER POND NO.2
FRESH WATER POND NO.1
PERMIT BOUNDARY
H88-23
CLEAN COAL STOCKPILE
SLURRY POND
H88-24A
OVERBURDEN STOCKPILE NO.1
RUN OF MIE STOCKPILE
FACILITIES AREA SEDIMENT POND
WASH DOWN WATER RECYCLE POND
OVERBURDEN STOCKPILE NO.1 EXTENSION
SEDIMENT POND NO.1
R.O.W. 52715
H88-25
RELOCATED SEGMENT OF R.O.W. 52715
ACCESS ROAD LIMITS OF DISTRUBANCE
R.O.W. 218234
Seward Meridian, T19N R2E
Legend
MONITORING WELL
PNEUMATIC PIZOMETER
0 750 1,500 3,000 4,500 6,000 Feet
SUBJECT REVISIONS
REV. | DATE: | BY: | DESCRIPTION
1 | 2009 | JEH | MINOR REVISIONS
2 | 1/2014 | CTW | NEW CONTOURS, CONVERT DRAWING TO GIS
DESIGN BY:
DRAWN BY:
CHECK BY:
DATE DRAWN: 8/89
NAD83/AK STATE PLANE ZONE 4
WISHBONE HILL MINE
PERMIT NUMBER 01-89-796
PREMINING GROUNDWATER MONITORING WELL & PIEZOMETER LOCATIONS
USIBELLI COAL MINE, INC.
PO BOX 1000 HEALY, ALASKA 99743
(907) 683-2226
FIGURE NO. 15-2
REV. 2
SCALE: 1:13,000
FILE NAME: FIG 15-2 PREMINING GROUNDWATER.MXD



The undersigned geologist, registered professional land surveyor or registered professional engineer certifies that this map, plan view or cross section was prepared by them or under their direction as required by 11 AC 90.065(b).

Thomas W. Matson

May 2014

● MONITORING WELL

✱ APPROXIMATE LOCATION OF ADDITIONAL MONITORING WELLS REQUIRED BY DNR APPENDIX A, August 2, 2012. Parts 1a, 1b, 1c, and 1d.

Descriptions of required new wells from Appendix A of DNR letter dated August 2, 2012.

DNR Part 1a:
"One additional monitoring well must be installed in the wash plant area to better understand and monitor pond infiltration."

DNR Part 1b:
"Four additional down-gradient monitoring well clusters must be installed between the mine areas and Moose Creek. The monitoring well clusters must consist of wells installed in both alluvium and bedrock. The monitoring wells must be positioned to adequatedly detect early signs of changes in water quailty during mining and reclamation for both Mine Area 1 and Mine Area 2."

DNR Part 1c:
"One additional monitoring well cluster must be installed immediately south of Mine Area 1 to monitor overburden and bedrock water quality."

DNR Part 1d:
"Two up-gradient piezometers must be installed in the overburden and bedrock to the east of Mine Area 2 to detect drawdown in the groundwater during mining."

SUBJECT REVISIONS

REV.	DATE:	BY:	DESCRIPTION
1	2009	JEH	MINOR REVISIONS
2	1/2014	CTW	NEW CONTOURS, CONVERT DRAWING TO GIS

FILE NAME: FIG 15-3 OP GROUNDWATER.MXD

DESIGN BY:
DRAWN BY:
CHECK BY:
DATE DRAWN: 8/89
NAD83/AK STATE PLANE ZONE 4

WISHBONE HILL MINE

PERMIT NUMBER 01-89-796

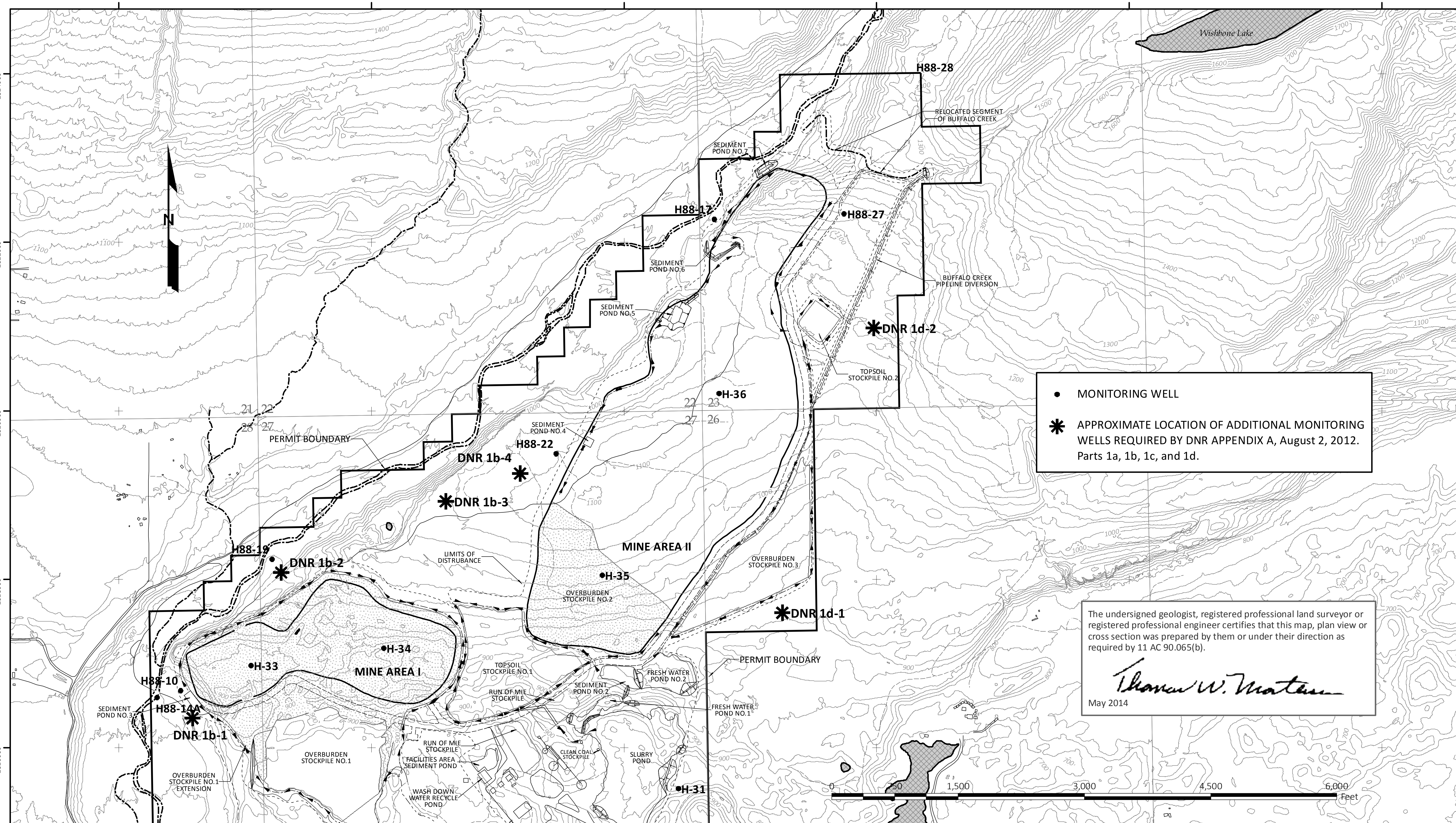
OPERATIONAL GROUNDWATER MONITORING WELL LOCATIONS

USIBELLI COAL MINE, INC.
PO BOX 1000 HEALY, ALASKA 99743
(907) 683-2226

FIGURE NO. 15-3

SCALE: 1:13,000

REV. 2



REV.	DATE:	BY:	DESCRIPTION
1	2009	JEH	MINOR REVISIONS
2	1/2014	CTW	NEW CONTOURS, CONVERT DRAWING TO GIS

SUBJECT REVISIONS

FILE NAME: FIG 15-4 POST GROUNDWATER.MXD

DESIGN BY:
DRAWN BY:
CHECK BY:
DATE DRAWN: 8/89
NAD83/AK STATE PLANE ZONE 4

WISHBONE HILL MINE

PERMIT NUMBER 01-89-796

POST-MINING GROUNDWATER MONITORING WELL LOCATIONS

USIBELLI COAL MINE, INC.
PO BOX 1000 HEALY, ALASKA 99743
(907) 683-2226

FIGURE NO. 15-4

SCALE: 1:13,000

REV. 2

16.0 AIR POLLUTION CONTROL PLAN

16.1 Introduction

The Alaska Department of Environmental Conservation (ADEC) has determined that a minor stationary source permit will be required for the coal processing and wash plant that was previously discussed in Section 8.0 of this Plan. Although the minor permit is only required for the coal processing facility, the compliance review process required a demonstration that all emissions associated with the planned mining activities (including fugitive dust) will not interfere with maintenance of the Alaska Ambient Air Quality Standards (AAAQS). This demonstration of compliance with AAAQS was completed using dispersion modeling techniques and approved models, including the EPA-approved AERMOD model (version 07026) along with the suite of associated programs (AERMET and AERMAP) to model the planned mining activities. The activities included mining, processing, and hauling operations which are supported by both fixed and mobile emission units that emit products of combustion and/or generate fugitive dust emissions. To account for all of the mining activities, an overall emission unit inventory was developed using emission factors approved by EPA. The results of the modeling demonstrated that pollutant emissions from the mining operations would not cause an exceedance of the AAAQS at or beyond the mine ambient air quality boundary.

In conjunction with the ADEC's permitting process, specific air quality control procedures will be implemented to further assure compliance with the National Ambient Air Quality Standards. The following sections address the implementation of specific air pollution control measures for the proposed mining operation and include a discussion relative to ongoing monitoring.

16.2 Dust Control Plan

16.2.1 Active Controls for Fugitive Emissions

Total emission rates associated with the mining operations are predominantly fugitive derived particulate matter (PM10) emissions. The bulk of these emissions are associated with:
Wind erosion from the exposed mine area,
Topsoil removal operations, and
Roads.

To mitigate the production of fugitive emissions from the exposed mine area, the mining and reclamation plan has been specifically designed to limit the amount of pre-stripping that is done in advance of the active operations. Only the minimum amount of area required to maintain the active pit will be exposed at any given time. In addition, the truck/shovel mining method will utilize an immediate haul back system that will promote contemporaneous reclamation and minimize the size of the active disturbance area. Through progressive backfilling, grading, topsoiling and prompt revegetation, the amount of disturbed area potentially subject to wind erosion will be minimized. The majority of active overburden material will be placed on previously mined out areas as opposed to stockpiling the material on adjacent undisturbed areas. Topsoil will be immediately placed on the regraded areas and various planting methods will be employed to encourage the rapid establishment of vegetative cover on exposed areas. These methods will include hydroseeding select areas, applying fertilizer to stimulate growth, establishing temporary vegetative cover on stockpiles, transplanting mats of native vegetation, hand planting cuttings and seedlings and utilizing special designed mixes of grass species to achieve the optimal growth patterns. Seeding and planting of disturbed areas will be conducted during the first normal period for favorable planting conditions after replacement of the topsoil material.

The primary control for topsoil stripping will be timing and immediate stabilization. Advanced mine planning will be done to allow stripping operations to be completed as early as possible in the growing season and thus take advantage of the higher soil moisture content. In addition to reducing fugitive dust emissions, early timing will facilitate revegetation work and the stabilization of the topsoil stockpiles and reclaimed areas.

For the modeled compliance demonstration with the AAAQS, watering was the only control factor that was applied to roads. However, enhanced techniques may be used for the control of particulate matter emissions from the mine access road and all permanent mine roads. These techniques may include the use of Alaska Department of Environmental Conservation (ADEC) approved dust palliatives such as calcium chloride, or a similar dust control agent, along with water. Each calendar year, as soon as road and weather conditions allow, but in no case later than June 15, the dust palliative will be applied in accordance with the manufacturer's specifications. The ongoing maintenance work required to maintain the effectiveness of the product will also follow the manufacturer's recommendations. In addition to above procedures, the roads will be reassessed before freeze-up each year and any required maintenance needed to maintain the roads through the winter months will be performed.

16.2.2 Clean Coal Hauling

All clean coal haul trucks will be covered to prevent the release of dust either while on the mine access road or while on the Glenn Highway. Dust will be suppressed on the mine access road through the use of chemical dust suppressants and/or water application.

16.3 Compliance With the Clean Air Act

Operations at the Wishbone Hill Mine will comply with the requirements of the federal Clean Air Act and all State of Alaska air quality statutes under an Air Quality Control Permit to Operate from the ADEC, permit number AQ1227MSS04.

The ADEC Air Quality Control Permit to Operate number AQ1227MSS04 requires public access control measures in compliance with the designated Ambient Air Quality Boundary (AAQB). The required public access control measures include the construction of a vehicle gate located on the access road from the Glenn Highway, and a length of fencing constructed along a segment of the re-located public right of way easement ADL 52715 southwest of Mine Area 1. Both the vehicle gate and the length of fencing are shown in the ADEC Air Quality Control Permit to Operate on Plate 1, Mine Area 1 & 2 Ambient Air Quality Boundary, which is incorporated into this DNR permit by reference.

The operation and reclamation plan and bonding of this DNR permit will be revised as applicable to include the length of fencing and access road gate as required by the ADEC Air Quality Control Permit.

17.0 PROTECTION OF PUBLIC PARKS AND HISTORIC PLACES

17.1 Public Use and Historic Areas In the Mine Vicinity

No specific public use sites are located in or adjacent to the project area. As described in Chapter XII, most of the permit area is located on public land and open to diffuse public use.

There are no known historic or archeological sites within the potential zone of influence from the proposed project (see Part C, Chapter I). The State Historic Preservation Officer has cleared the project area for development as indicated in the letter on the following page.

17.2 Measures To Minimize Impacts

No specific mitigation measures will be needed to protect public use areas. Mandatory employee training will address the possibility of encountering a site containing items of archeological or historic value. Employees will be instructed regarding the recognition of artifacts or archeological sites and regarding notification procedures if sites are found. In the unlikely event that potential sites are found during mining or facilities construction, disturbance to the area will be stopped until the site is cleared by the State Historic Preservation Officer.

LETTER FROM THE STATE HISTORIC PRESERVATION OFFICER

RECEIVED AUG 9 1989

STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF PARKS AND OUTDOOR RECREATION

STEVE COWPER, GOVERNOR

3601 C STREET
ANCHORAGE, ALASKA 99503
PHONE: (907) 561-2020

MAILING ADDRESS:
P.O. Box 107001
ANCHORAGE, ALASKA 99510-7001

August 7, 1989

Re: 3130-2R (DOM)

Subject: Wishbone Hill Project
Cultural Resource Site Survey

James E. Helling
McKinley Mining Consultants, Inc.
634 South Bailey Street, Suite 205
Palmer, Alaska 99645

Dear Mr. Helling:

We have received the March 1989 cultural resource site survey report by Edwin S. Hall, Jr., and John E. Lobdell for the proposed Wishbone Hill surface coal mining project. We concur with their findings that the previously identified Buffalo Mine, Premier Mine and Baxter Mine sites, located adjacent to the proposed mining activities, no longer appear to possess data significant to the understanding of the area's history. Additionally, since no previously unknown sites were found in the project area, we also concur with their assessment that the proposed mining project should be cleared to proceed at this point.

Sincerely,

Neil C. Johannsen
Director

Judith E. Bittner

By: Judith E. Bittner
State Historic Preservation Officer

cc: Sam Dunaway, DOM, Anchorage

GD:clk

18.0 PROTECTION OF OTHER RESOURCES, STRUCTURES AND FACILITIES

18.1 Other Structures

The proposed mine access road will cross the existing Matanuska Electric Association power transmission line (see Plate 9-1). The height of the power line and the planned elevation of the road will allow the safe passage of coal trucks and other mine traffic with no special modification to the power transmission structure.

18.2 Access Considerations

Existing roads and trails are illustrated on Plate 3-1 and legal rights-of-way are shown on Plate XII-1. In order to provide continuing public access along the existing right-of-way system, those portions of rights-of-way within the active mine and facilities area will be relocated to the south of the mine area as shown in Plate 3-1. The relocated segment will pass south of all active mine facilities, and rejoin the existing right-of-way south of the proposed wash plant area. Users of the public right-of-way will have to cross the mine access road but otherwise will not interact with mine operations. A controlled crossing, consisting of either 4 way stop signs or a large diameter culvert installed under the access road, will be placed at the intersection of the proposed mine access road and the existing public right-of-way to help prevent potential safety problems related to conflicts between the public and mine traffic..

As discussed in Section 13, the mine access road will be opened to the public after the completion of mining and reclamation, and additional access will be developed to the north of the mine area using the remnants of mine roads. Access to recreation areas such as Wishbone Lake will be substantially improved after mining relative to the existing condition.

19.0 ABANDONED UNDERGROUND MINE WORKINGS

19.1 Location of Underground Mine Openings

There is no active underground mining occurring within or adjacent to the proposed project. Part C, Chapters I and XII contain information relating to previous mining activities in or immediately adjacent to the proposed permit area. As discussed in these baseline chapters, all underground workings have been either subsequently mined through as a result of later surface mining operations or have been sealed and/or flooded. No abandoned underground mine openings exist within or adjacent to the proposed permit area.

The current abandoned underground workings do not pose a threat to the safety of the general public since all openings have been sealed. Furthermore, the quality of water in the workings, as discussed in Part C, Chapter IV, is good. The information indicates that the workings are not currently, nor are they expected to be in the future, a source of water pollution or a hazard to public health.

19.2 Proposed Protection of the Underground Workings

Mining in Mine Area 1 will intercept the abandoned Premier Mine workings. As discussed in Section 11, water will be encountered in these workings and pumped from the pit for use as coal wash water. Potential subsidence resulting from the dewatering activities is not expected to occur either on or off of the permit area. The old underground workings are saturated up to approximately elevation 710 feet or approximately 100 feet above the proposed bottom of the pit. Old workings above elevation 710 feet are expected to be unsaturated. The mine water is not under confining pressures since the water table intersects the old workings. Subsidence is not expected because the workings are excavated in competent rock which should not be subject to further consolidation. It is possible that localized pillar failure could occur as a result of dewatering. However, these localized failures would not be expected to cause general subsidence.

Blasting will occur within 500 feet of theses abandoned workings. All blasting will occur in accordance with 11 AAC 90.371. A plan for blasting in the area of the abandoned underground workings will be prepared under the direction of a certified blaster and will be submitted for approval prior to any blasting in this area.

20.0 CESSATION OF OPERATIONS

20.1 Notice of Intent

As required by 11 AAC 90.471, a notice of intention to stop operations will be submitted to the commissioner a minimum of 30 days in advance of a temporary cessation of operations or as soon as it is known that a temporary cessation will extend beyond 30 days. The notice will include a summary of the acres affected, acres reclaimed, and other information required by the regulation.

20.2 Security Procedures

During any temporary cessation of operations, security procedures will be implemented to assure the continuing safety of the public and to prevent damage to mine facilities. The controlled access at the entrance to the mine facilities area will continue to be maintained during shutdown periods to prevent unauthorized entry to the mine area. Regular security patrols will monitor the perimeter of the mine area to further minimize the potential for unauthorized entry. Signs will be maintained to inform the public of hazards connected with the mine facilities. Closed gates will prevent access to fenced areas.

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22.0 RESPONSIBLE PARTIES

The preparation of Part D, Mine and Reclamation Plan, of this permit application was an integrated effort involving input from many individuals. The principal participants and their input is as follows:

1) McKinley Mining Consultants, Inc.
634 S. Bailey St.
Palmer, Alaska

McKinley Mining Consultants, as the management contractor for the design and permitting effort, provided technical input and overall coordination of the permit application effort. Persons contributing to this permit application were as follows:

David Germer	Project Manager/Senior Geologist
Fred Mrkonjich	Engineering Manager
James Helling	Environmental/Permitting Manager
John Morsell	Permit Coordinator

2) Steffen, Robertson and Kirsten (SRK)
3232 S. Vance Street, Suite 210
Lakewood, Colorado 80227

SRK was the primary engineering contractor involved with development of the mine and reclamation plans. A major portion of Part D was prepared by SRK. Principal persons involved with the permit application effort included:

Mine Planning	
Gary Doolittle	Mining Division Head
Robert Zeindler	Mining System Specialist
Henry Cooke	Mining Engineer
Peter Clark	Senior Mining Engineer

Hydrology	
Ian Hutchison	Senior Technical Reviewer
James Johnson	Project Manager
Rick Frechette	Project Engineer
Permitting	
Anne Baldrige	Permit Coordinator/Technical Editor

3) Golder Associates, Inc.
200 Union Boulevard, Suite 100
Lakewood, Colorado 80228

Golder Associates contributed to the analysis of hydrological consequences and prepared portions of the hydrologic protection plan. Golder also provided technical input relating to hydrogeology and surface water hydrology which was utilized in the design of sediment control structures. Principal persons involved with the permit application effort included:

Jerry Rowe, P.E.	Associate
Greg Davis	Project Geochemist
Larry Cope	Project Hydrogeologist
Ed Pottorff	Staff Hydrogeologist