BOND AMOUNT COMPUTATION

Applicant: _____

Permit Number: _____ **Permitted Acreage:** _____

Bonding Scheme (permit area, incremental, cumulative): _____

If Incremental:

Increment Number: _____

Increment Acreage: _____

If Cumulative:

Acres previously authorized for disturbance: _____

New acres proposed for disturbance: _____

Type of Operation: _____

Location: _____

Prepared by: _____

Date: _____

Total Bond Amount: $ _____

Project: _____
Date: _____
Prepared by: _____

WORKSHEET 1
DESCRIPTION OF THE WORST-CASE RECLAMATION SCENARIO

Assumptions:

Data Source(s):

Project: _____
Date: _____
Prepared by: _____

WORKSHEET 2
STRUCTURE DEMOLITION AND DISPOSAL COSTS

Structures to be demolished:

Item	Construction Material	Volume (cubic feet)	Unit Cost Basis ($)	Demolition Cost ($)
Subtotal				

Other items to be demolished (paved roads, conveyors, utility poles, rail spurs, etc.):

Subtotal = $ _____

Debris Handling and Disposal Costs:

Subtotal = $ _____

TOTAL DEMOLITION AND DISPOSAL = $ _____

Data Source(s):

Project: _____
Date: _____
Prepared by: _____

WORKSHEET 3
MATERIAL HANDLING PLAN SUMMARY

Earthmoving Activity	Volume (LCY)	Origin	Destination	Haul Distance (ft)	Grade * (%)	Equipment To Be Used

* Record grade resistance (% grade) here.

Project: _____
Date: _____
Prepared by: _____

WORKSHEET 4A
EARTHWORK QUANTITY

Cross-Section/ Station	Distance Between Stations (ft)	End Area (ft^2)	Volume (yd^3)*	Adjust-ment Factor * (%)	Adjusted Volume (LCY)
TOTALS					

* See discussion of material volume estimates in Chapter 2, Step 2, Part II. B. of the Handbook. Select adjustment factor based on the state of the material to be moved.

Data Source(s):

Project: _____
Date: _____
Prepared by: _____

WORKSHEET 4B
EARTHWORK QUANTITY

Data Source(s):

Project: _____
Date: _____
Prepared by: _____

WORKSHEET 5
PRODUCTIVITY AND HOURS REQUIRED FOR DOZER USE

Earthmoving Activity:

Characterization of Dozer Used (type, size, etc.):

Description of Dozer Use (origin, destination, grade, haul distance, material, etc.):

Productivity Calculations:

Operating Adjustment Factor = _____ (operator factor) x _____ (material factor) x _____ (efficiency factor) x _____ (grade factor)

x _____ (weight correction factor) x _____ (production method/blade factor) x _____ (visibility factor) x _____ (elevation factor) = _____

Net Hourly Production = _____ (normal hourly production) LCY/hr x _____ (operating adjustment factor) = _____ LCY/hr

Hours Required = _____ (volume to be moved) LCY ÷ _____ (net hourly production) LCY/hr = _____ hr

Data Source(s):

Project: _____
Date: _____
Prepared by: _____

WORKSHEET 6
PRODUCTIVITY AND HOURS REQUIRED FOR DOZER USE--GRADING

Earthmoving Activity:

Characterization of Dozer Used (type, size, etc.):

Description of Dozer Use (% grade, effective blade width, operating speed, etc.):

Productivity Calculations:

Operating Adjustment Factor = _____ (operator factor) x _____ (material factor) x _____ (efficiency factor) x _____ (grade factor)

x _____ (weight correction factor) x _____ (production method/blade factor) x _____ (visibility factor) x _____ (elevation factor) = _____

Hourly Production = _____ (average speed) mi/hr x _____ (effective blade width) ft x 5,280 ft/mi x 1 ac/43,560 ft²

= _____ ac/hr

Net Hourly Production = _____ (hourly production) ac/hr x _____ (operating adjustment factor) = _____ ac/hr

Hours Required = _____ (area to be graded) ac ÷ _____ (net hourly production) ac/hr = _____ hr

Data Source(s):

Project: _____
Date: _____
Prepared by: _____

WORKSHEET 7
PRODUCTIVITY AND HOURS REQUIRED FOR RIPPER-EQUIPPED DOZER USE

Ripping Activity:

Characterization of Dozer and Ripper Use:

Description of Ripping (ripping depth, cut spacing, cut length, and material to be ripped):

Productivity Calculation:

Cycle Time = (_____ ft ÷ 88 ft/min) + _____ min = _____ min/pass
(cut length; [speed]; fixed turn time *)

Passes/Hour = 60 min/hr ÷ _____ min/pass X _____ = _____ passes/hr
(cycle time; efficiency factor)

Volume Cut/Pass = (_____ ft X _____ ft X _____ ft) ÷ 27 ft^3/yd^3
(tool penetration; cut spacing; cut length)

= _____ BCY/pass

Hourly Production = _____ BCY/pass X _____ passes/hr = _____ BCY/hr

Hours Required = _____ BCY ÷ _____ BCY/hr = _____ hr
(bank volume to be ripped **; hourly production)

* Fixed turn time depends upon dozer used. 0.25 min/turn is normal.

** Remember to use the swell factor to convert from bank cubic yards to loose cubic yards when applying these data to *Worksheet 5*. Calculate separate dozer hauling of ripped material for each lift on that worksheet.

Data Source(s):

Project: _____
Date: _____
Prepared by: _____

WORKSHEET 8
PRODUCTIVITY AND HOURS REQUIRED FOR LOADER USE

Earthmoving Activity:

Characterization of Loader Use (type, size, etc.):

Description of Loader Use (origin, destination, grade, haul distance, etc.):

Productivity Calculations:

Cycle time = _____ min (haul time (loaded)) + _____ min (return time (empty)) + _____ min (basic cycle time) = _____ min

Net Bucket Capacity = _____ LCY (heaped bucket capacity) x _____ (bucket fill factor *) = _____ LCY

Hourly Production = _____ LCY (net bucket capacity) ÷ _____ min (cycle time) x _____ (efficiency factor) x 60 min/hr = _____ LCY/hr

Hours Required = _____ LCY (volume to be moved) ÷ _____ LCY/hr (hourly production) = _____ hr

* See loader section of equipment manual.

Data Source(s):

Project: _____
Date: _____
Prepared by: _____

WORKSHEET 9
PRODUCTIVITY AND HOURS REQUIRED FOR TRUCK USE

Earthmoving Activity:

Characterization of Truck Use (type, size, etc.):

Description of Truck Use (origin, destination, grade, haul distance, capacity, etc.):

Productivity Calculations:

No. Loader Passes/Truck = _____ (truck capacity *) LCY ÷ _____ (loader bucket net capacity) LCY = _____ (round down to nearest whole number) passes

Net Truck Capacity = _____ (loader bucket net capacity) LCY X _____ (no. loader passes/truck) = _____ LCY

Loading Time/Truck = _____ (loader cycle time (from *Worksheet 8* or *10*)) min X _____ (no. loader passes/truck) = _____ min

Truck Cycle Time = _____ (haul time) min + _____ (return time) min + _____ (loading time) min + _____ (dump and maneuver time) min = _____ min

No. Trucks Required = _____ (truck cycle time) min ÷ _____ (total loading time) min = _____ trucks

Production Rate = _____ (net truck capacity) LCY X _____ (no. trucks) ÷ _____ (truck cycle time) min = _____ LCY/min

Hourly Production = _____ (production rate) LCY/min X 60 min/hr X _____ (efficiency factor) = _____ LCY/hr

Hours Required = _____ (volume to be moved) LCY ÷ _____ (hourly production) LCY/hr = _____ hr

* Use the average of the struck and heaped capacities.

Data Source(s):

Project: _____
Date: _____
Prepared by: _____

WORKSHEET 10
PRODUCTIVITY FOR HYDRAULIC EXCAVATOR USE (BACKHOE OR POWER SHOVEL)

Earthmoving Activities:

Characterization of the Excavator Used (type, size, etc.):

Description of Excavator Used (loading geometry, materials, etc.):

Productivity Calculations:

Net Bucket Capacity = _____ LCY (heaped bucket capacity) x _____ (bucket fill factor *) = _____ LCY

Hourly Production = _____ LCY (net bucket capacity) x 60 min/hr ÷ _____ min (cycle time **) x _____ (efficiency factor) = _____ LCY/hr

Hours Required = _____ LCY (volume to be handled) ÷ _____ LCY/hr (net hourly production) = _____ hr

* See loader section of the equipment manual.
** See excavator section of equipment manual.

Data Source(s):

Project: _____
Date: _____
Prepared by: _____

WORKSHEET 11A
PRODUCTIVITY OF PUSH-PULL OR SELF-LOADING SCRAPER USE

Earthmoving Activity:

Characterization of Scraper Used (type, capacity, etc.):

Description of Scraper Use (origin, destination, grade, haul distance, capacity, etc.):

Productivity Calculations:

Cycle Time = _____ min (load time (push-pull is per pair)) + _____ min (loaded trip time) + _____ min (maneuver and spread time) + _____ min (return trip time) = _____ min (push-pull is per pair)

Hourly Production = _____ LCY (capacity *) x 60 min/hr ÷ _____ min (cycle time) x _____ (efficiency factor) = _____ LCY/hr (push-pull is per pair)

Hours Required = _____ LCY (volume to be handled) ÷ _____ LCY/hr (net hourly production) = _____ hr

* The average of the struck and heaped capacities; use total for two scrapers for push-pull.

Data Source(s):

Project: _____
Date: _____
Prepared by: _____

WORKSHEET 11B
PRODUCTIVITY OF DOZER PUSH-LOADED SCRAPER USE

Earthmoving Activity:

Characterization of Scraper Used (type, capacity, etc.):

Description of Scraper Use (origin, destination, grade, haul distance, capacity, etc.):

List Pusher Tractor(s) Used:

Describe Push Tractor Loading Method (see figure on next page):

Scraper Productivity Calculations:

Cycle Time = _____ (load time) min + _____ (loaded trip time) min + _____ (maneuver and spread time) min + _____ (return trip time) min = _____ min

Hourly Production = _____ (capacity *) LCY x 60 min/hr ÷ _____ (cycle time) min x _____ (efficiency factor) = _____ LCY/hr

Hours Required = _____ (volume to be handled) LCY ÷ _____ (hourly production) LCY/hr = _____ hr

* Use the average of the struck and heaped capacities.

Push Tractor Productivity Calculations:

Pusher Cycle Time = _____ (scraper load time) min x _____ (pusher factor) = _____ min

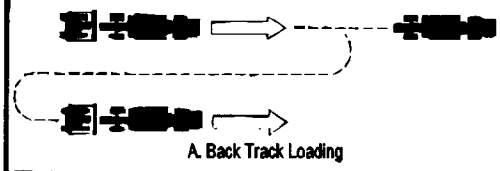
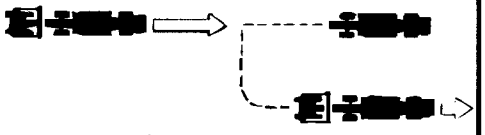
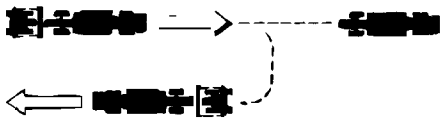
Scrapers/Pusher = _____ (scraper cycle time) min ÷ _____ (pusher cycle time) min = _____ scrapers

Pusher Hours Required = _____ (scraper hours) hr ÷ _____ (scrapers per pusher) = _____ (round up) hr

Data Source(s):

Project: _____
Date: _____
Prepared by: _____

WORKSHEET 11B (continued)
PRODUCTIVITY OF DOZER PUSH-LOADED SCRAPER USE

PUSHER FACTORS	Single Push	Tandem Push
 A. Back Track Loading	1.5	2.0
 B. Chain Loading	1.3	1.5
 C. Shuttle Loading	1.3	1.5

Modified from Terex, 1981.

The following disclaimer pertains to the above illustration from Terex, "Production and Cost Estimating of Material Movement and Earthmoving Equipment."

This manual is a fundamental text on estimating the production and cost of moving materials. It is intended for people associated with the construction industry who prepare job estimates or who evaluate the performance of earthmoving equipment and related costs.

The manual can be used as a supplementary text in those schools and colleges offering formal training in earthmoving techniques. A metric version of this manual is also available.

It will also serve as a reference for those professional consulting engineers who prepare complete job analyses, of which the earthmoving fundamentals covered in this text are only one element.

Estimating the production and costs of earthmoving equipment is not an exact science. While this manual outlines the basic factors or parameters on which estimates can be made, the user must make judgements, and must apply his own experience and know-how to temper the estimate.

This manual, prepared by TEREX, deals with rubber-tired and track-laying equipment, and does not attempt to deal with other forms of earthmoving or production. While the formulas and other guides in this manual are entirely satisfactory for most earthmoving jobs, the reader should note that more sophisticated haulage analyses can be quickly accomplished through the use of a computer.

While efforts have been made to utilize percentages, formulas, and other notations in this manual which reflect actual on-the-job conditions, none of the statements in this manual, or the illustrative figures given for machine life, or the costs for owning and operating earthmoving equipment, or the production of such earthmoving equipment should be construed as any form of guarantee that these machines will have any such specific service life, or production capabilities, or that costs related to their ownership and operation will be as indicated.

Data Source(s): TEREX AMERICAS, Tulsa, OK 74107, (918) 445-5802.

Project: _____
Date: _____
Prepared by: _____

WORKSHEET 12
PRODUCTIVITY AND HOURS REQUIRED FOR MOTORGRADER USE

Earthmoving Activity:

Characterization of Grader Used (type, size capacity, etc.):

Description of Grader Route (push distance, grade, effective blade width, operating speed, etc.):

Productivity Calculations:

Grading

Hourly Production = _____ (average speed) mi/hr x _____ (effective blade width) ft x 5,280 ft/mi x 1 ac/43,560 ft²

x _____ (efficiency factor) = _____ ac/hr

Hours Required = _____ (area to be graded) ac ÷ _____ (hourly production) ac/hr = _____ hr

Scarification

Hourly Production = _____ (average speed) mi/hr x _____ (scarifier width) ft x 5,280 ft/mi x 1 ac/43,560 ft²

x _____ (efficiency factor) = _____ ac/hr

Hours Required = _____ (area to be scarified) ac ÷ _____ (hourly production) ac/hr = _____ hr

Total Hours Required

Total Hours = _____ (grading hours required) + _____ (scarification hours required) = _____ hr

Data Source(s):

Project: _____
Date: _____
Prepared by: _____

WORKSHEET 13
SUMMARY CALCULATION OF EARTHMOVING COSTS

Equipment *	Ownership & Operation Cost ($/hr)	Labor Cost ($/hr)	Total Hours Required **	Total Cost *** ($)
			Grand Total	

* Include all necessary attachments and accessories for each item of equipment. Also, add support equipment such as water wagons and graders to match total project time as appropriate.

** Account for multiple units in truck and/or scraper teams.

*** To compute Total Cost: Add Ownership & Operation Cost and Labor Cost columns then multiply by Total Hours Required column.

Data Source(s):

Project: _____
Date: _____
Prepared by: _____

WORKSHEET 14
REVEGETATION COSTS

Name and Description of Area To Be Revegetated:

Description of Revegetation Activities:

Cost Calculation for Individual Revegetation Activities:

Initial Seeding

_____ ac x ($_____/ac + $_____/ac) = $_____
area to be seeded | seedbed preparation | seeding, fertilizing & mulching

Planting Trees and Shrubs

_____ ac x ($_____/ac + $_____/ac) = $_____
area to be planted | planting | herbicide treatment

Reseeding

_____ ac x _____ x ($_____/ac + $_____/ac) = $_____
area to be seeded & unreleased disturbed areas | failure rate* | seedbed preparation | seeding, fertilizing & mulching

Replanting Trees and Shrubs

_____ ac x _____ x ($_____/ac + $_____/ac) = $_____
area to be planted & unreleased disturbed areas | failure rate* | planting | herbicide treatment

Other Necessary Revegetation Activities

(Examples of other activities that may be necessary include soil sampling, irrigation, and rill and gully repair. Describe each activity and provide a cost estimate with documentation. Use additional worksheets if necessary.)

Other Costs = $_____

TOTAL REVEGETATION COST = $_____

* Identify failure rate and basis. If anticipated failure rates vary within the area proposed for disturbance, use a separate worksheet for the area subject to each failure rate.

Data Source(s):

Project: _____
Date: _____
Prepared by: _____

WORKSHEET 15
OTHER RECLAMATION ACTIVITY COSTS

(Subsidence damage repair costs, water supply replacement costs, funds required to support long-term treatment of unanticipated acid or ferruginous mine drainage, etc.)

Description of Reclamation, Repair or Pollution Abatement Activity:

Assumptions:

Cost Estimate Calculations:

TOTAL COSTS = $_____

Other Documentation or Notes:

(Include additional sheets, maps, calculations, etc., as necessary to document estimate.)

Data Source(s):

Project: _____
Date: _____
Prepared by: _____

WORKSHEET 16
RECLAMATION BOND SUMMARY SHEET

1.	Total Facility and Structure Removal Costs	$_____	
2.	Total Earthmoving Costs	$_____	
3.	Total Revegetation Costs	$_____	
4.	Total Other Reclamation Activities Costs	$_____	
5.	Total Direct Costs (sum of Lines 1 through 4)	$_____	
6.	*Inflated Total Direct Costs* (Line 5 x inflation factor *)		$_____
7.	Mobilization/Demobilization (___% of Line 6) (1% to 10% of Line 6)	$_____	
8.	Contingencies (_____% of Line 6) (3% to 5% of Line 6)	$_____	
9.	Engineering Redesign Fee (____% of Line 6) (2.5% to 6% of Line 6)	$_____	
10.	Contractor Profit/ Overhead (___% of Line 6) (see Graph 1)	$_____	
11.	Project Management Fee (_____% of Line 6) (see Graph 2)	$_____	
12.	*Total Indirect Costs* (sum of Lines 7 through 11)		$_____
13.	GRAND TOTAL BOND AMOUNT (sum of Lines 6 and 12)		$_____

---

* Inflation factor = $\frac{\text{ENR Construction Cost Index (CCI) for current mo/yr}}{\text{ENR CCI for mo/yr 5 years prior to current mo/yr}}$ = _____ = _____

Identify current month/year used in formula above: _____
Identify prior month/year used in formula above: _____

ENR = *Engineering News Record*, McGraw-Hill Construction Information Group, New York, NY; http://www.enr.com.

Formula assumes permit term or time until next bond adequacy evaluation is 5 years. Adjust timeframe as necessary.

Project: _____
Date: _____
Prepared by: _____

WORKSHEET 17
SUMMARY SHEET FOR DETERMINING AMOUNT OF BOND TO RETAIN AT PHASE I RELEASE

1.	Remaining Structure Removal Costs	$_____	
2.	Remaining Earthmoving Costs	$_____	
3.	Remaining Revegetation Costs	$_____	
4.	Remaining Other Reclamation Activities Costs	$_____	
5.	Remaining Total Direct Costs (sum of Lines 1 through 4)	$_____	
6.	***Remaining Inflated Total Direct Costs*** (Line 5 x inflation factor *)		$_____
7.	Mobilization/ Demobilization (___% of Line 6) (1% to 10% of Line 6)	$_____	
8.	Contingencies (_____% of Line 6) (3% to 5% of Line 6)	$_____	
9.	Engineering Redesign Fee (_____% of Line 6) (2.5% to 6% of Line 6)	$_____	
10.	Contractor Profit and Overhead (___% of Line 6) (see Graph 1)	$_____	
11.	Project Management Fee (_____% of Line 6) (see Graph 2)	$_____	
12.	***Total Indirect Costs*** (sum of Lines 7 through 11)		$_____
13.	AMOUNT OF BOND TO RETAIN AFTER PHASE I RELEASE (sum of Lines 6 and 12)		$_____

---

* Inflation factor = $\frac{\text{ENR Construction Cost Index (CCI) for current mo/yr}}{\text{ENR CCI for mo/yr } x \text{ years prior to current mo/yr}}$ = _____ = _____

Identify current month/year used in formula above: _____
Identify prior month/year used in formula above: _____

ENR = *Engineering News Record*, McGraw-Hill Construction Information Group, New York, NY; http://www.enr.com.

x years = minimum revegetation responsibility period for site.

Project: _____
Date: _____
Prepared by: _____

WORKSHEET 17 (continued)
SUMMARY SHEET FOR DETERMINING
AMOUNT OF BOND TO RETAIN AT PHASE I RELEASE

14.	**Amount of Bond Required at Time of Application for Release (original bond amount as modified by any adjustments)**	$_____
15.	**Minimum Amount of Bond That Must Be Retained by Law ** (0.4 x Line 14)**	$_____
16.	**AMOUNT OF BOND TO RETAIN AFTER PHASE I RELEASE (enter Line 13 or Line 15, whichever is greater)**	$_____
17.	**PHASE I RELEASE AMOUNT (subtract Line 16 from Line 14)**	$_____

** **Section 519(c)(1) of SMCRA limits Phase I bond release to no more than 60 percent of the amount of bond posted for the site. Therefore, we must retain at least 40 percent of the amount of bond required under 30 CFR 800.14, as modified by any adjustments under 30 CFR 800.15.**

Project: _____
Date: _____
Prepared by: _____

WORKSHEET 18
SUMMARY SHEET FOR DETERMINING AMOUNT OF BOND TO RETAIN AT PHASE II RELEASE

1.	Remaining Revegetation Costs	$_____	
2.	Remaining Other Reclamation Activities Costs	$_____	
3.	Remaining Total Direct Costs (sum of Lines 1 and 2)	$_____	
4.	***Remaining Inflated Total Direct Costs*** (Line 3 x inflation factor *)		$_____
5.	Mobilization/ Demobilization (_____of Line 4) (1% to 10% of Line 4)	$_____	
6.	Contingencies (_____% of Line 4) (3% to 5% of Line 4)	$_____	
7.	Engineering Redesign Fee (____% of Line 4) (2.5% to 6% of Line 4)	$_____	
8.	Contractor Profit and Overhead (___% of Line 4) (see Graph 1)	$_____	
9.	Project Management Fee (_____% of Line 4) (see Graph 2)	$_____	
10.	***Total Indirect Costs*** (sum of Lines 5 through 9)		$_____
11.	AMOUNT OF BOND TO RETAIN AFTER PHASE II RELEASE (sum of Lines 4 and 10)		$_____
12.	Amount of Bond Remaining After Phase I Release		$_____
13.	PHASE II RELEASE AMOUNT (subtract Line 11 from Line 12)		$_____

---

* Inflation factor = $\frac{\text{ENR Construction Cost Index (CCI) for current mo/yr}}{\text{ENR CCI for mo/yr } x \text{ years prior to current mo/yr}}$ = _____ = _____

Identify current month/year used in formula above: _____
Identify prior month/year used in formula above: _____

ENR = *Engineering News Record*, McGraw-Hill Construction Information Group, New York, NY; http://www.enr.com.

x years = minimum revegetation responsibility period for site.

Note: Attach a separate sheet describing and documenting costs associated with any special or unusual conditions (such as prime farmland restoration) not already discussed on one of the other worksheets.

B. Examples

APPENDIX B

EXAMPLES

The examples do not represent active operations today. They are presented to show the application of the Handbook methodology to various types of operations.

BOND AMOUNT COMPUTATION

Applicant: Underground Example

Permit Number: Example No. 1 **Permitted Acreage:** 20

Bonding Scheme (permit area, incremental, cumulative): permit area

If Incremental:

Increment Number: _____

Increment Acreage: _____

If Cumulative:

Acres previously authorized for disturbance: _____

New acres proposed for disturbance: _____

Type of Operation: Underground

Location: USA

Prepared by: R. R. Bond

Date: December 2, 1999

Total Bond Amount: $ 904,000

Project: Underground Example
Date: 12/02/99
Prepared by: R.R. Bond

WORKSHEET 1
DESCRIPTION OF THE WORST-CASE RECLAMATION SCENARIO

The worst-case situation for forfeiture would be after all the improvements have been built. This would require the third-party contractor the greatest time and dollars to reclaim.

The mine plan outlines the proposed development sequence for the underground operation, starting with the installation of a sedimentation pond near the lower boundary of the site. Following the installation of the sediment pond, the applicant plans to install all the site culverts, diversion ditches, roads, benches, and topsoil stockpiles. Next, the applicant proposes to install the coal processing equipment. Concurrently, the operator plans to start three underground entries for the manway, materials/conveyor, and ventilation. Each entry will receive corrugated arches for about 50 feet into the mountainside. In addition, a series of highwalls must be constructed to form benches due to the steep slopes of the mountain in this area. These manmade benches provide the needed work space to access the mine.

Most of these improvements are required for the life of the coal mine. An administration/change facility and a shop/warehouse facility will be constructed during the first 3 years of operations. During the construction period, portable units will house these early facilities.

The following discussion will present the tasks needed to be performed for returning the mine site to the original premining condition. (See Figures B-I through B-3 at end of worksheets.)

1. <u>Structure Demolition</u>

When returning the site to the postmining land use, most surface mine-related structures and facilities will be removed. This includes all buildings and other manmade items not identified for postmining land use.

Buildings and Facilities

a. A two-story administration building, sized 60'x60'x18', will be constructed of concrete block on a poured thin, reinforced concrete slab floor. The second floor will be of plywood floor over wood floor joists. The cost of demolition includes the cost of removing the thin slab.

b. One shop building, sized 60'x120'x18', will be constructed of insulated sheet metal, high enough to accommodate the mine and haul equipment. The 6-inch thick concrete floor is designed of 4,000 psi concrete, reinforced with No. 5 rebar @ 12 inches o.c., e.w. Two reinforced concrete aprons of 60'x50'x6" thick are planned at each end of the building. The demolition size will be: building-- 60'x120'xl8'; floor -- 60'x220'x6" thick.

c. Two explosive magazines are planned. These steel MSHA-approved buildings will be set on a thin concrete slab and must be removed to meet the postmining land use. Two steel buildings: 10'x10'x8' high. The demolition cost includes removal of the slab.

WORKSHEET 1 (continued)
DESCRIPTION OF THE WORST-CASE RECLAMATION SCENARIO

d. Four structures are included for coal primary and secondary processing, storage, and loadout. Each of these structures will be connected with a conveyor belt. This system transmits the coal from the mine to the loadout structure some 1300 feet from the mine mouth. The items that need to be removed are:

- 300' conveyor belt from the mine to the primary processing structure
- Primary processing structure = 35'x40'x60' high
- 480' conveyor belt from primary processing structure to the stacker

  Stacker = 15' diameter x 90'
  15' diameter x 100'

- 290' conveyor from the stacker to the secondary-processing structure
- Secondary-processing structure = 30'x35'x40' high
- 230' conveyor belt from the secondary-processing structure to the loadout structure

  Loadout structure = 20'x20'x60' high

e. The applicant proposes a 2.3-mile powerline to a substation within the mine site. The primary entry lines consist of four wires sized 2/0 and attached to overhead poles spaced at 250 feet.

f. The water supply includes a 20'x30'x8' treatment building constructed of insulated sheet metal on a thin, reinforced concrete slab. The cost of demolition includes the cost of removing the thin slab.

g. The applicant proposes three corrugated metal pipe (CMP) culverts sized to handle the on-site drainage. The various riprap sections can remain as channel protection. The on-site culverts to be removed will be:

18" cmp - I 32 LF
48" cmp - 307 LF
84" cmp - 3029 LF

2. Earthmoving Activities

During the mine development, the applicant plans to create several benches on the mountainside to create work platforms. Each of these benches will be eliminated when returning the site to the approximate original contour (AOC). Much of the earthwork associated with bench elimination will be by scrapers and bulldozers to create pre-mining slopes. In addition, the bench/stockpile areas, the sedimentation pond, and the diversion-ditch area must be backfilled and graded prior to topsoiling and revegetation. The attached

WORKSHEET 1 (continued)
DESCRIPTION OF THE WORST-CASE RECLAMATION SCENARIO

mine plan map shows the contours and cross-sections that give the various locations and grades of the proposed development. The earthwork activities will include backfilling and grading the site and preparing the site (ripping) for topsoil placement.

The dugout sedimentation pond includes all appurtenances necessary to make the pond function. The excavated materials will be stockpiled nearby. Removal of all piping and riprap will be necessary prior to backfilling and grading. Most appurtenances can be bull dozed into the pit and covered with backfill. The sediment pond is less than 20 acre feet in volume and less than 20 feet deep. The sediment pond area covers about I acre in size (32,300 cubic yards).

The applicant plans to rebuild 2 miles of old logging road and about 0.5 miles on the mine site. The half-mile onsite road will be eliminated with the backfilling and grading portion on the reclamation. The mine plan states that 20 percent swell can be expected on the earth material.

3. Topsoil Replacement

The topsoil stockpile is located about 500 feet below the sediment pond. The mine plan requires 6 inches of topsoil removed and stockpiled before mine development could begin. The topsoil stockpile will be adequate to return a depth of 6 inches to the mine area. Topsoil volume is 16,133 cubic yards.

4. Revegetation

The entire area will need seedbed preparation, fertilization, seeding, and mulching. Because of the short growing season, the contractor will only have a few months per year when revegetation has a chance to survive. Local experience indicates a 50 percent failure on the revegetation due to this short growing season.

5. Other Reclamation Activities

Three underground entries need to be closed. Each entry has a corrugated arch support that extends about 50 feet into the mine. The ventilation access measures 10 feet in diameter, the material access is 12 feet in diameter, and the manway access is 25 feet on diameter. A masonry wall will be erected to seal the entries prior to the covering with backfill materials.

NOTE: *Worksheets 8, 9, 10, 11A, 17* and *18* are not applicable to this example.

Data Source(s): Mine plan.

Project: Underground Example
Date: 12/02/99
Prepared by: R.R. Bond

WORKSHEET 2A
STRUCTURE DEMOLITION AND DISPOSAL COSTS

Structures to be demolished:

Item	Construction Material	Volume (cubic feet)	Unit Cost Basis ($)	Demolition Cost ($)
1. Admin. Building	Masonry Block	64,800	0.18*	11,664
2. Shop Building	Metal	129,600	0.18*	23,328
3. Explosives Magazine	Metal	1,600	0.18*	288
4. Water System Bldg.	Metal	4,800	0.18*	864
5. Primary Processing	Metal	84,000	0.18*	15,120
			Subtotal	$51,264

Other items to be demolished (paved roads, conveyors, utility poles, rail spurs, etc.):

Item	Construction Material	Volume	Unit Cost Basis ($)	Demolition Cost ($)
1. Conveyor system**	Metal	1,300 LF	38/LF	49,400
2. Power line***, 2.3 mi	4-wire	48,576 LF	3/LF	145,728
3. Power poles***, 50	Wood	50	250/ea	12,500
4. Shop slab	Reinforced Concrete	13,200 SF	7.60/SF*	100,320
			Subtotal	$307,948

Debris Handling and Disposal Costs:

* Demolition includes disposal with up to 20 mi. haul.

** Cost breakdown:

Removal of belt cover and pan =	$19.30/LF
Belt removal =	$10.93/LF
Idler pully removal =	$ 3.19/LF
Tower and concrete removal and site grading =	$ 4.58/LF
Total conveyor removal costs =	$38.00/LF

*** Personal communication, 1985, David Radesevich, Electrical Engineer, Western Power Administrator, P.O. Box 3403, Golden, CO 80401.

Continued on next page

Project: Underground Example
Date: 12/02/99
Prepared by: R.R. Bond

WORKSHEET 2B
STRUCTURE DEMOLITION AND DISPOSAL COSTS

Structures to be demolished:

Item	Construction Material	Volume (cubic feet)	Unit Cost Basis ($/cf)	Demolition Cost ($)
1. Secondary Processing	Metal	42,000	0.18*	7,560
2. Stacker	Concrete	33,575	0.26*	8,730
3. Load Out	Metal	24,000	0.18*	4,320
			Subtotal	$20,610

Other items to be demolished (paved roads, conveyors, utility poles, rail spurs, etc.):

Item	Construction Material	Volume	Unit Cost Basis ($)	Demolition Cost ($)
1. 18" Culvert**	Metal	132 LF	2.50/LF*	330
2. 48" Culvert**	Metal	307 LF	2.50/LF*	768
3. 84" Culvert**	Metal	3,029 LF	2.50/LF*	7,573
			Subtotal	$8,671

Debris Handling and Disposal Costs:

* Demolition includes disposal with up to a 20 miles haul.

** Cost breakdown from Mine Plan.

TOTAL DEMOLITION AND DISPOSAL (from Worksheets 2A and 2B) = $ 388,493

Data Source(s): Means *Site Work and Landscape Cost Data*, 1998; Mine plan.

Project: Underground Example
Date: 12/02/99
Prepared by: R.R. Bond

WORKSHEET 3
MATERIAL HANDLING PLAN SUMMARY

Earthmoving Activity	Volume (LCY)	Origin	Destination	Haul Distance (ft)	Grade * (%)	Equipment To Be Used
1. Site Grading**	41,110	Benches	General Contouring	500 average	10	627F scraper with D8N push tractor
2. Site Grading**	20,555	Benches	General Contouring	500 average	8	D9R-SU dozer
3. Sedimentation Pond**	25,814	Embankment	Pond Area	500 average	10	627F scraper with D8N push tractor
4. Sedimentation Pond**	12,907	Embankment	Pond Area	500 average	8	D9R-SU dozer
5. Topsoil	16,133	Stockpile	Disturbed Area	1,100	10	627F scraper with D8N push tractor
6. Ripping	64,533		Disturbed Area			D7R-SU dozer with 3-shank ripper
7. Haul Road Maintenance			Disturbed Area			14G grader

* Record grade resistance here. (% grade)
** Scraper and Dozer (D9R-SU) work concurrently.

Project: Underground Example
Date: 12/02/99
Prepared by: R.R. Bond

WORKSHEET 4A
EARTHWORK QUANTITY

CROSS-SECTION/ STATION	DISTANCE BETWEEN STATIONS (ft)	END AREA (ft^2)	VOLUME (yd^3)*	ADJUST-MENT FACTOR (%)**	ADJUSTED VOLUME (LCY)
0		0			
	400		7,777	20	9,332
B/D		1,050			
	450		20,833	20	25,000
C/D		1,450			
	400		18,148	20	21,778
D/D		1,000			
	250		4,630	20	5,556
Boundary		0			
TOTALS			51,388		61,666

* Volume is BCY or LCY as appropriate.
** Select adjustment factor based on the state of material being moved.

Data Source(s): Mine plan.

Project: Underground Example
Date: 12/02/99
Prepared by: R.R. Bond

WORKSHEET 4B
EARTHWORK QUANTITY

Site Grading

Bench Cut Earthwork Volume = 61,666 LCY (see Worksheet 4A)

Estimate 1/3rd moved by scraper and the remainder by dozer:

Scraper Volume = 2/3 X 61,666 LCY = 41,111 LCY

Dozer Volume = 61,666 LCY - 41,111 LCY = 20,555 LCY

Sediment Pond Regrade

Embankment Cut Volume = 32,267 BCY (from mine plan)
Swell = 20%

Earthwork Volume = 32,267 BCY X 1.2 = 38,720 LCY

Estimate 1/3rd moved by scraper and the remainder by dozer:

Scraper Volume = 2/3 X 38,720 LCY = 25,814 LCY

Dozer Volume = 38,720 LCY - 25,814 LCY = 12,906 LCY

Topsoil Replacement

Cover depth for 20 ac. disturbed area = 0.5 ft. (from mine plan)

Earthwork Volume = (20 ac. X 43560 SF /ac. X 0.5 ft) / 27 CY/CF = 16,133 LCY

Ripping

Ripping depth for 20 ac. disturbed area = 2.0 ft. (from mine plan)

Volume = (20 ac. X 43560 SF /ac. X 2 ft) / 27 CY/CF = 64,533 BCY

Data Source(s): Mine plan.

Project: Underground Example
Date: 12/02/99
Prepared by: R.R. Bond

WORKSHEET 5A
PRODUCTIVITY AND HOURS REQUIRED FOR DOZER USE

Earthmoving Activity:
1) Backfill and rough grade sediment pond; 2) rough grade bench site.

NOTE: Since these two tasks have similar characteristics in push distance and grade, the yardage are combined and the total hours required determined. Site located 8000 feet above sea level.
TOTAL YARDAGE = 20,555 CY + 12,906 CY (from *Worksheet 4B*)

Characterization of Dozer Used (type, size, etc.):
D9R dozer with "Semi-U or SU" Blade = 250 cy/hr.

Description of Dozer Use (origin, destination, grade, haul distance, material, etc.):
500 LF push distance at 10% effective grade; some material is blasted rock; however, the majority is assumed to be average.

Productivity Calculations:

Operating Adjustment Factor = .75 (operator factor) x .95 (material factor) x .83 (efficiency factor) x .85 (grade factor)

x 2,550 / 2,500 (weight correction factor) x 1.0 (production method/blade factor) x 1.0 (visibility factor) x 1.0 (elevation factor) = .51

Net Hourly Production = 250 (normal hourly production) LCY/hr x .51 (operating adjustment factor) = 128 LCY/hr

Hours Required = 33,462 (volume to be moved) LCY ÷ 128 (net hourly production) LCY/hr = 261 hr

Data Source(s): Caterpillar Performance Handbook, Edition 28.

Project: Underground Example
Date: 12/02/99
Prepared by: R.R. Bond

WORKSHEET 5B
PRODUCTIVITY AND HOURS REQUIRED FOR DOZER USE

Earthmoving Activity:
Push tractor to assist loading scrapers.

Characterization of Dozer Used (type, size, etc.):
D8N dozer with a "SU" Blade.

Description of Dozer Use (origin, destination, grade, haul distance, material, etc.):
Scrapers loaded with Back-track Loading Method; equipment working @ 8000 feet, msl.

Productivity Calculations:

Operating Adjustment Factor = _____ (operator factor) x _____ (material factor) x _____ (efficiency factor) x _____ (grade factor)

x _____ (weight correction factor) x _____ (production method/blade factor) x _____ (visibility factor) x _____ (elevation factor) = _____

Net Hourly Production = _____ (normal hourly production) LCY/hr x _____ (operating adjustment factor) = _____ LCY/hr

Hours Required = _____ (volume to be moved) LCY ÷ _____ (net hourly production) LCY/hr = **116*** hr

***See *Worksheets 11B-1* and *11B-2*. (86 hr + 30 hr = 116 hr)**

Data Source(s): Caterpillar Performance Handbook, Edition 28.

Project: Underground Example
Date: 12/02/99
Prepared by: R.R. Bond

WORKSHEET 6
PRODUCTIVITY AND HOURS REQUIRED FOR DOZER USE--GRADING

Earthmoving Activity:
Final (contour) grading.

Characterization of Dozer Used (type, size, etc.):
D6R w/ an 11-foot wide "Straight or S"-blade.

Description of Dozer Use (% grade, effective blade width, operating speed, etc.):
Operates along contour at 0% average grade, 8,000-foot elevation.

Productivity Calculations:

Operating Adjustment Factor = .75 (operator factor) x 1.0 (material factor) x .83 (efficiency factor) x 1.0 (grade factor)

x 1.0 (weight correction factor) x 1.0 (production method/blade factor) x 1.0 (visibility factor) x 1.0 (elevation factor) = .62

Hourly Production = 3.0 (average speed) mi/hr x 11 (effective blade width) ft x 5,280 ft/mi x 1 ac/43,560 ft²

= 4.0 ac/hr

Net Hourly Production = 4.0 (hourly production) ac/hr x .62 (operating adjustment factor) = 2.5 ac/hr

Hours Required = 20 (area to be graded) ac ÷ 2.5 (net hourly production) ac/hr = 8.0 hr

Data Source(s): Caterpillar Performance Handbook, Edition 28.

Project: Underground Example
Date: 12/02/99
Prepared by: R.R. Bond

WORKSHEET 7
PRODUCTIVITY AND HOURS REQUIRED FOR RIPPER-EQUIPPED DOZER USE

Ripping Activity: **This unit will be used for ripping the site prior to topsoil placement as well as additional miscellaneous site maintenance activities for the life of the reclamation contract. The ripping activity will involve 20 acres.**

Characterization of Dozer and Ripper Use:
D7R w/ SU blade and 3-shank adjustable parallelogram ripper; ripper has a 39 inch (3.25-foot) pocket spacing

Description of Ripping (ripping depth, cut spacing, cut length, and material to be ripped):

Ripping depth = 2 feet
Ripping effective width = 3.25 feet X 3 = 9.75 feet

Productivity Calculation:

Cycle Time = (1,000 ft ÷ 88 ft/min) + 0.3 min = 11.66 min/pass
(1,000: cut length; 88 ft/min: [speed]; 0.3: fixed turn time *)

Passes/Hour = 60 min/hr ÷ 11.66 min/pass X .83 = 4.27 passes/hr
(11.66: cycle time; .83: efficiency factor)

Volume Cut/Pass = (2.0 ft X 9.75 ft X 1,000 ft) ÷ 27 ft^3/yd^3
(2.0: tool penetration; 9.75: cut spacing; 1,000: cut length)

= 722.2 BCY/pass

Hourly Production = 722.2 BCY/pass X 4.27 passes/hr = 3,083.8 BCY/hr **

Hours Required = 64,533 BCY ÷ 3,083.8 BCY/hr = 20.9 hr
(64,533: bank volume to be ripped; 3,083.8: hourly production)
Use 231 hours***

* Fixed turn time depends upon dozer used. 0.25 min/turn is normal.

** Remember to use the swell factor to convert from bank cubic yards to loose cubic yards when applying these data to *Worksheet 5.* Calculate separate dozer hauling of ripped material for each lift on that worksheet.

*** The D7R bulldozer is to be for miscellaneous tasks during the life of the project (see *Worksheet 13*).

Data Source(s): **Caterpillar Performance Handbook, Edition 28.**

Project: Underground Example
Date: 12/02/99
Prepared by: R.R. Bond

WORKSHEET 11B-1
PRODUCTIVITY OF DOZER PUSH-LOADED SCRAPER USE

Earthmoving Activity: 1) Backfill and grade benches and 2) backfill sediment pond.
NOTE: Since these two tasks have similar grade and haul distances, the yardage can be added together and hours required determined. Total yardage = 41,111 cy + 25,814 cy (from Worksheet 4B). Site located 8,000 feet above sea level.

Characterization of Scraper Used (type, capacity, etc.):
Cat 627F Non-push pull 14 cy (struck) + 20 cy (heaped) = 17 cy avg. capacity
Description of Scraper Route:
500' haul @ 10% effective grade; 500' return @ (-)4% effective grade

List Pusher Tractor(s) Used: D8N dozer will assist the scraper in loading.

Describe Push Tractor Loading Method (see figure): Back-track loading method with 1 push tractor.

Scraper Productivity Calculations:

Cycle Time = .5 (load time) min + .55 (loaded trip time) min + .6 (maneuver and spread time) min + .3 (return trip time) min = 1.95 min

Hourly Production = 17 (capacity *) LCY x 60 min/hr ÷ 1.95 (cycle time) min x .75 (efficiency factor) = 392 LCY/hr

Hours Required = 66,925 (volume to be handled) LCY ÷ 392 (hourly production) LCY/hr = 171 hr

* Use the average of the struck and heaped capacities.

Push Tractor Productivity Calculations:

Pusher Cycle Time = .5 (scraper load time) min x 1.5 (pusher factor) = .75 min

Scrapers/Pusher = 1.95 (scraper cycle time) min ÷ .75 (pusher cycle time) min = 2.6 scrapers (Use 2)

Pusher Hours Required = 171 (scraper hours) hr ÷ 2 (scrapers per pusher) = 86 (round up) hr

Data Source(s): Caterpillar Performance Handbook, Edition 28.

Project: Underground Example
Date: 12/02/99
Prepared by: R.R. Bond

WORKSHEET 11B-2
PRODUCTIVITY OF DOZER PUSH-LOADED SCRAPER USE

Earthmoving Activity: Haul and spread topsoil; 16,133 cy; (from *Worksheet 4B*).

Characterization of Scraper Used (type, capacity, etc.): Cat 627F Non-push pull 14 cy (struck) + 20 cy (heaped) = 17 cy avg. capacity.

Description of Scraper Route: 1,100' haul @ 10% effective grade; 1,100' return @ (-)4% effective grade, site is located 8,000 feet above sea level.

List Pusher Tractor(s) Used: D8N dozer will assist the scraper in loading.

Describe Push Tractor Loading Method (see figure below): Back-track loading method with 1 push tractor.

Scraper Productivity Calculations:

Cycle Time = .5 (load time) min + 1.25 (loaded trip time) min + .6 (maneuver and spread time) min + .5 (return trip time) min = 2.85 min

Hourly Production = 17 (capacity *) LCY x 60 min/hr ÷ 2.85 (cycle time) min x .75 (efficiency factor) = 268 LCY/hr

Hours Required = 16,133 (volume to be handled) LCY ÷ 268 (hourly production) LCY/hr = 60 hr

* Use the average of the struck and heaped capacities.

Push Tractor Productivity Calculations:

Pusher Cycle Time = .5 (scraper load time) min x 1.5 (pusher factor) = .75 min

Scrapers/Pusher = 2.85 (scraper cycle time) min ÷ .75 (pusher cycle time) min = 3.8 scrapers

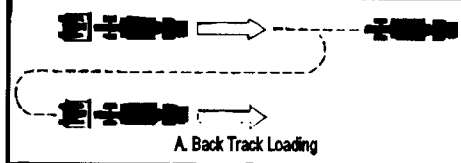
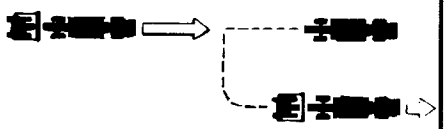
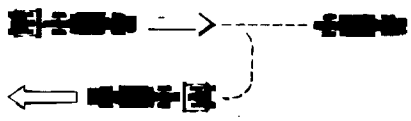
Pusher Hours Required = 60 (scraper hours) hr ÷ 2** (scrapers per pusher) = 30 (round up) hr

** Two scrapers used to match *Worksheet 11B-1*.

Data Source(s): Caterpillar Performance Handbook, Edition 28.

Project: Underground Example
Date: 12/02/99
Prepared by: R.R. Bond

WORKSHEET 11B (continued)
PRODUCTIVITY OF DOZER PUSH-LOADED SCRAPER USE

PUSHER FACTORS	Single Push	Tandem Push
 A. Back Track Loading	1.5	2.0
 B. Chain Loading	1.3	1.5
 C. Shuttle Loading	1.3	1.5

Modified from Terex,1981

Data Source(s): Illustration from "Production and Cost Estimating of Material Movement and Earthmoving Equipment," TEREX AMERICAS, Tulsa, OK 74107, (918) 445-5802. See disclaimer in Appendix A, *Worksheet 11B*.

Project: Underground Example
Date: 12/02/99
Prepared by: R.R. Bond

WORKSHEET 12
PRODUCTIVITY AND HOURS REQUIRED FOR MOTORGRADER USE

Earthmoving Activity: The motorgrader will be used for maintaining haul roads, to assist in final grading prior to topsoil placement, final grading of topsoil prior to seeding, clean-up, and maintenance work around the site. The motorgrader, along with the D7R bulldozer/ripper will be used for the life of the reclamation contract (131 hours). This unit will be working at 8,000 feet, msl.

Characterization of Grader Used (type, size capacity, etc.): Caterpillar 14G, 215 horsepower, equipped with EROPS and scarifier.

Description of Grader Route (push distance, grade, effective blade width, operating speed, etc.):

Productivity Calculations:

Grading

Hourly Production = _____ (average speed) mi/hr x _____ (effective blade width) ft x 5,280 ft/mi x 1 ac/43,560 ft²

x _____ (efficiency factor) = _____ ac/hr

Hours Required = _____ (area to be graded) ac ÷ _____ (hourly production) ac/hr = _____ hr

Scarification

Hourly Production = _____ (average speed) mi/hr x _____ (scarifier width) ft x 5,280 ft/mi x 1 ac/43,560 ft²

x _____ (efficiency factor) = _____ ac/hr

Hours Required = _____ (area to be scarified) ac ÷ _____ (hourly production) ac/hr = _____ hr

Total Hours Required

Total Hours = _____ (grading hours required) + _____ (scarification hours required) = 231* hr

* Motorgrader is to be used for the project life of the reclamation contract (see *Worksheet 13*).

Data Source(s): Caterpillar Performance Handbook, Edition 28.

Project: Underground Example
Date: 12/02/99
Prepared by: R.R. Bond

WORKSHEET 13
SUMMARY CALCULATION OF EARTHMOVING COSTS

Equipment *	Ownership & Operation Cost ($/hr)	Labor Cost ($/hr)	Total Hours Required **	Total Cost *** ($)
627F Scraper	115.72	24.61	171+60 = 231	32,416
D8N-SU Push Tractor	80.54	24.61	116	12,197
D6R-S Dozer	45.79	24.61	8	563
D7R-SU Dozer	76.62	24.61	231	23,384
D9R-SU Dozer	113.22	24.61	261	35,974
14G Grader	59.20	24.61	231	19,360
6,000 gal Water Tanker	69.98	18.50	231	20,439
			Grand Total	$144,333

* Include all necessary attachments and accessories for each item of equipment. Also, add support equipment such as water wagons and graders to match total project time as appropriate. (Total scraper time.)

** Account for multiple units in truck and/or scraper teams.

*** To compute Total Cost: Add Ownership & Operation Cost and Labor Cost columns then multiply by Total Hours Required column.

Data Source(s): PRIMEDIA Information, Inc., Cost Reference Guide for Construction Equipment.

Project: Underground Example
Date: 12/02/99
Prepared by: R.R. Bond

WORKSHEET 14
REVEGETATION COSTS

Name and Description of Area To Be Revegetated: Total disturbed area = 20 acres.

Description of Revegetation Activities: The local NRCS office provided a cost of $425 per acre for seeding, fertilizing, and mulching.

Cost Calculation for Individual Revegetation Activities:

Initial Seeding

20 ac (area to be seeded) x ($ _____ /ac (seedbed preparation) + $ 425 /ac (seeding, fertilizing & mulching)) = $ 8,500

Planting Trees and Shrubs

_____ ac (area to be planted) x ($ _____ /ac (planting) + $ _____ /ac (herbicide treatment)) = $ _____

Reseeding

20 ac (area to be seeded) x .50 (failure rate*) x ($ ** /ac (seedbed preparation) + $ 425 /ac (seeding, fertilizing & mulching)) = $ 4,250

Replanting Trees and Shrubs

_____ ac (area to be planted) x _____ (failure rate*) x ($ _____ /ac (planting) + $ _____ /ac (herbicide treatment)) = $ _____

Other Necessary Revegetation Activities

(Examples of other activities that may be necessary include soil sampling, irrigation, and rill and gully repair. Describe each activity and provide a cost estimate with documentation. Use additional worksheets if necessary.)

Other Costs = $ _____

TOTAL REVEGETATION COST = $ 12,750

* A failure rate of 50 percent is assumed based on other reclamation in the area (see *Worksheet 1*). Assuming that no seedbed preparation is needed for reseeding effort.

** Cost included with earthmoving expense in initial seeding and not needed for reseeding.

Data Source(s): Mine plan; the local NRCS office.

Project: Underground Example
Date: 12/02/99
Prepared by: R.R. Bond

WORKSHEET 15
OTHER RECLAMATION ACTIVITY COSTS

(Subsidence damage repair costs, water supply replacement costs, funds required to support long-term treatment of unanticipated acid or ferruginous mine drainage, etc.)

Description of Reclamation, Repair or Pollution Abatement Activity:

Sealing three mine entries: ventilation, manway, and material. The sealing will be as follows: 1) each entryway will be pneumatically filled for 50 feet and 2) a masonry wall will be installed at the entrance.

Assumptions:

	Backfill	Masonry Wall
1. Ventilation	1,964	39
2. Manway	12,272	245
3. Materials	2,827	57
	17,063 CF	341 SF

Cost Estimate Calculations:

Pneumatically filled materials	17,063 CF X $1.11/CF = $ 18,940
Masonry walls	341 SF X $4.36 /SF = $ 1,487
	TOTAL = $ 20,427

Other Documentation or Notes:
(Include additional sheets, maps, calculations, etc., as necessary to document estimate.)

Data Source(s): Local AML contract figures.

Project: Underground Example
Date: 12/02/99
Prepared by: R.R. Bond

WORKSHEET 16
RECLAMATION BOND SUMMARY SHEET

1.	Total Facility and Structure Removal Costs	$ 388,157	
2.	Total Earthmoving Costs	$ 144,333	
3.	Total Revegetation Costs	$ 12,750	
4.	Total Other Reclamation Activities Costs	$ 20,427	
5.	Total Direct Costs (sum of Lines 1 through 4)	$ 565,667	
6.	*Inflated Total Direct Costs* (Line 5 x inflation factor *)		$ 629,022
7.	Mobilization/Demobilization (5 % of Line 6) (1% to 10% of Line 6)	$ 31,451	
8.	Contingencies (5 % of Line 6) (3% to 5% of Line 6)	$ 31,451	
9.	Engineering Redesign Fee (5 % of Line 6) (2.5% to 6% of Line 6)	$ 31,451	
10.	Contractor Profit/ Overhead (24 % of Line 6) (see Graph 1)	$ 150,965	
11.	Project Management Fee (4.7 % of Line 6) (see Graph 2)	$ 29,564	
12.	*Total Indirect Costs* (sum of Lines 7 through 11)		$ 274,882
13.	GRAND TOTAL BOND AMOUNT (sum of Lines 6 and 12)		$ 903,904 (round to $ 904,000)

---

* Inflation factor = ENR Construction Cost Index (CCI) for current mo/yr / ENR CCI for mo/yr 5 years prior to current mo/yr = 6008 / 5405 = 1.112.

Identify Month/Year used in formula above: current 4/99
prior 4/94

ENR = Engineering News Record, McGraw-Hill Construction Information Group, New York, NY; http://www.enr.com.

Formula assumes permit term or time until next bond adequacy evaluation is 5 years. Adjust timeframe as necessary.

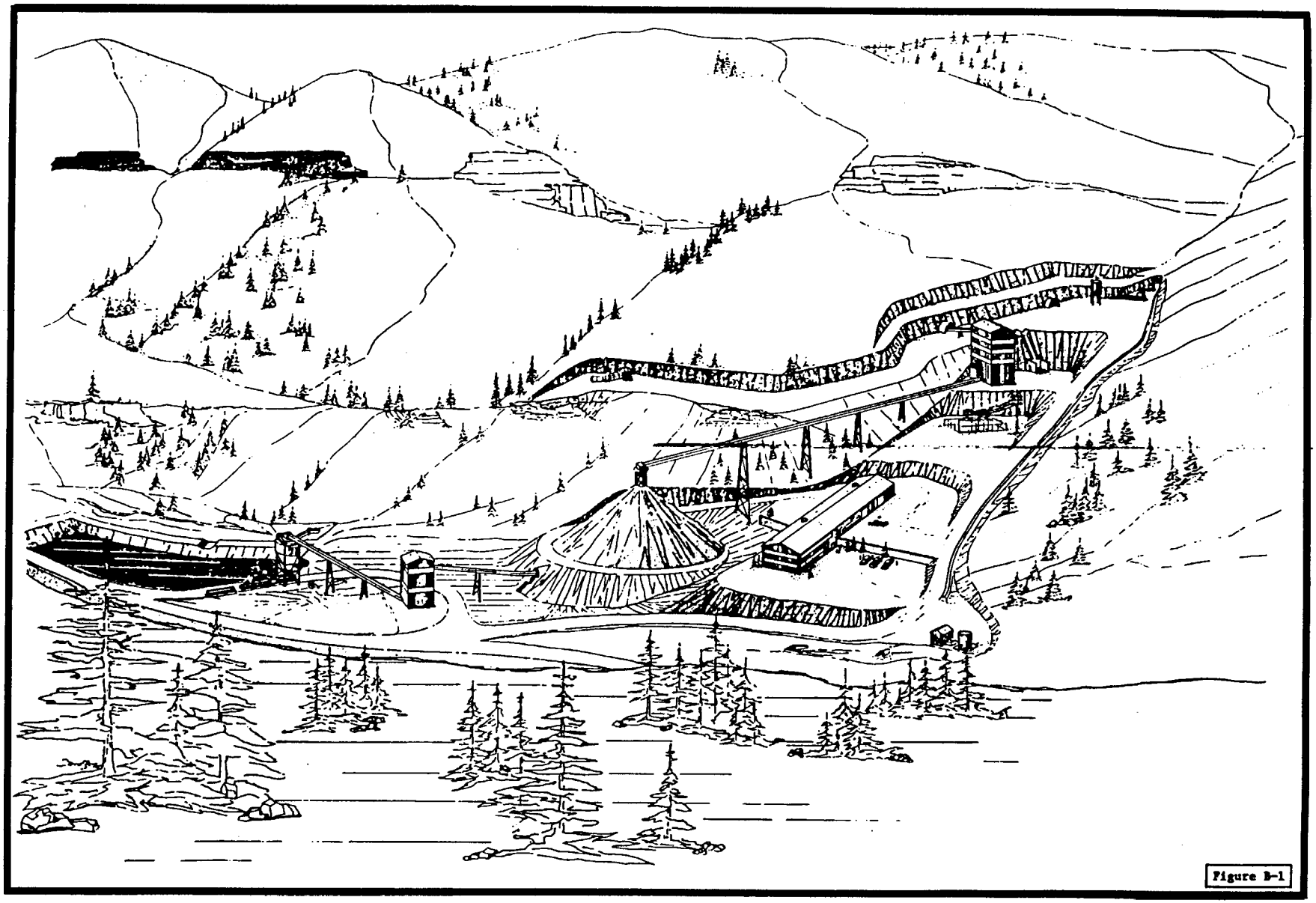


Figure B-1

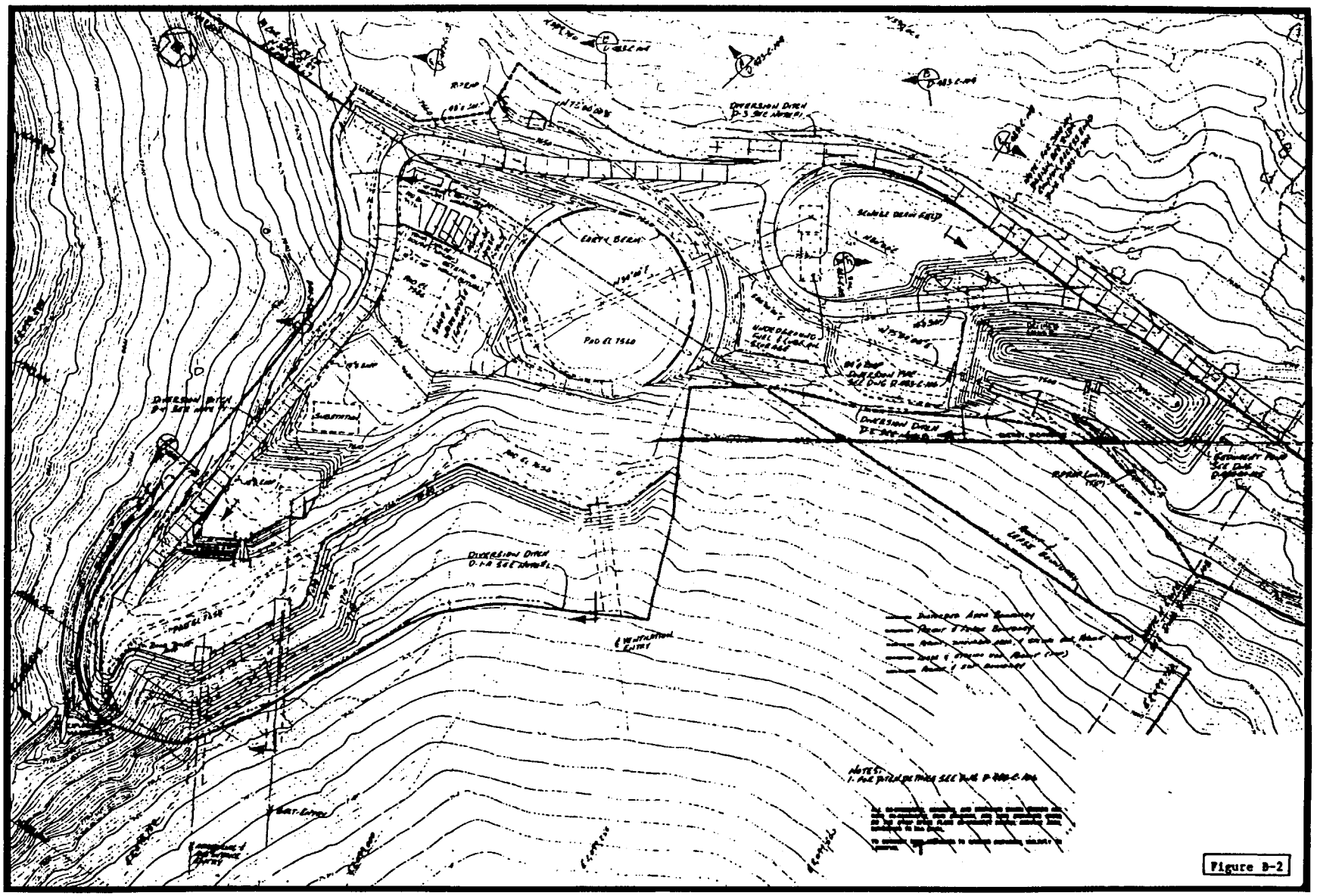


Figure B-2

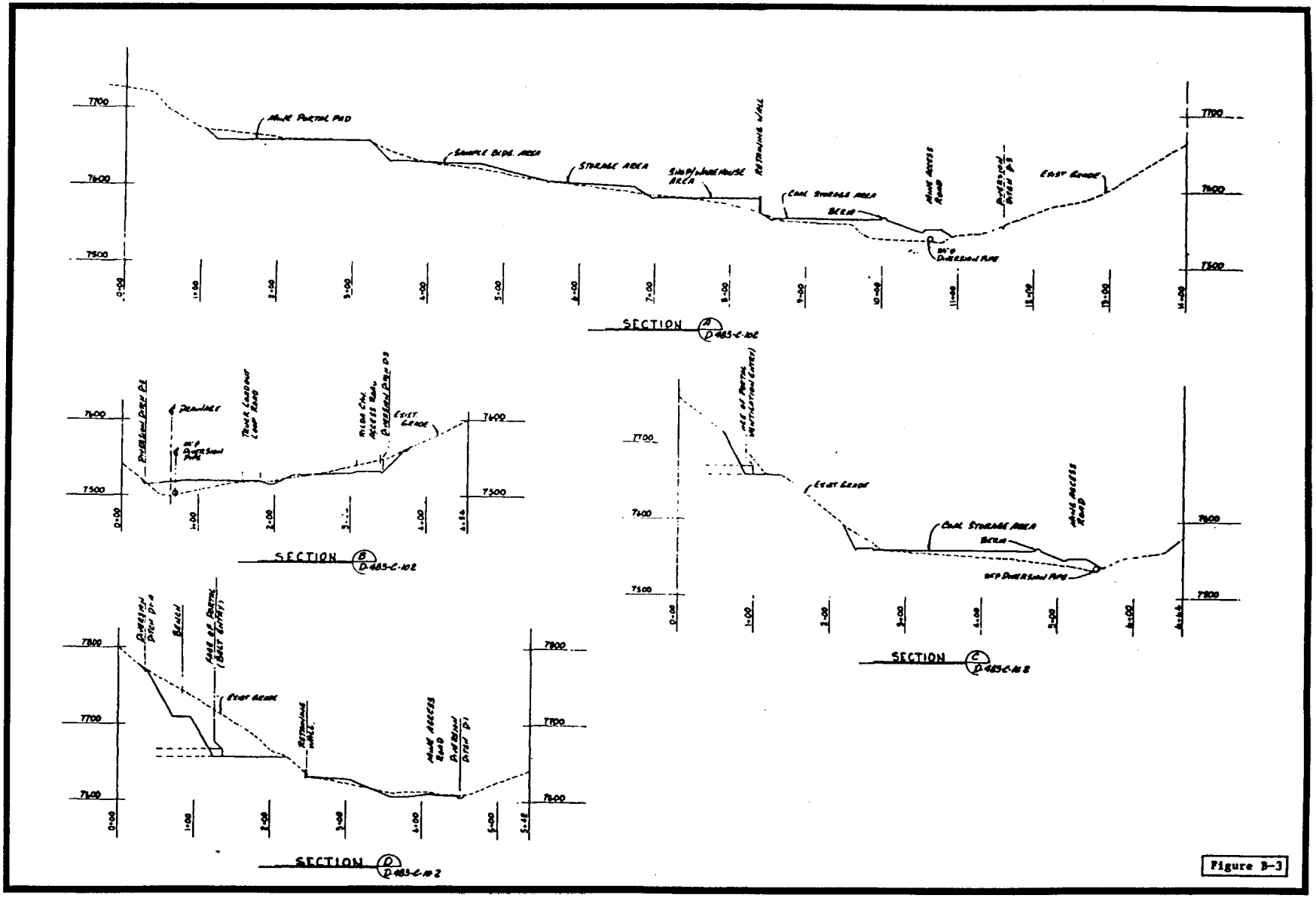

SECTION A D-485-C-102
SECTION B D-485-C-102
SECTION C D-485-C-102
SECTION D D-485-C-102

Figure B-3

BOND AMOUNT COMPUTATION

Applicant: Area Mining - Dragline Example

Permit Number: Example No. 2 **Permitted Acreage:** 115.1

Bonding Scheme (permit area, incremental, cumulative): permit area

If Incremental:

Increment Number: _____

Increment Acreage: _____

If Cumulative:

Acres previously authorized for disturbance: _____

New acres proposed for disturbance: _____

Type of Operation: Area-type surface (dragline)

Location: U.S.A.

Prepared by: K. G. Bond

Date: 01/05/00

Total Bond Amount: $ 961,000