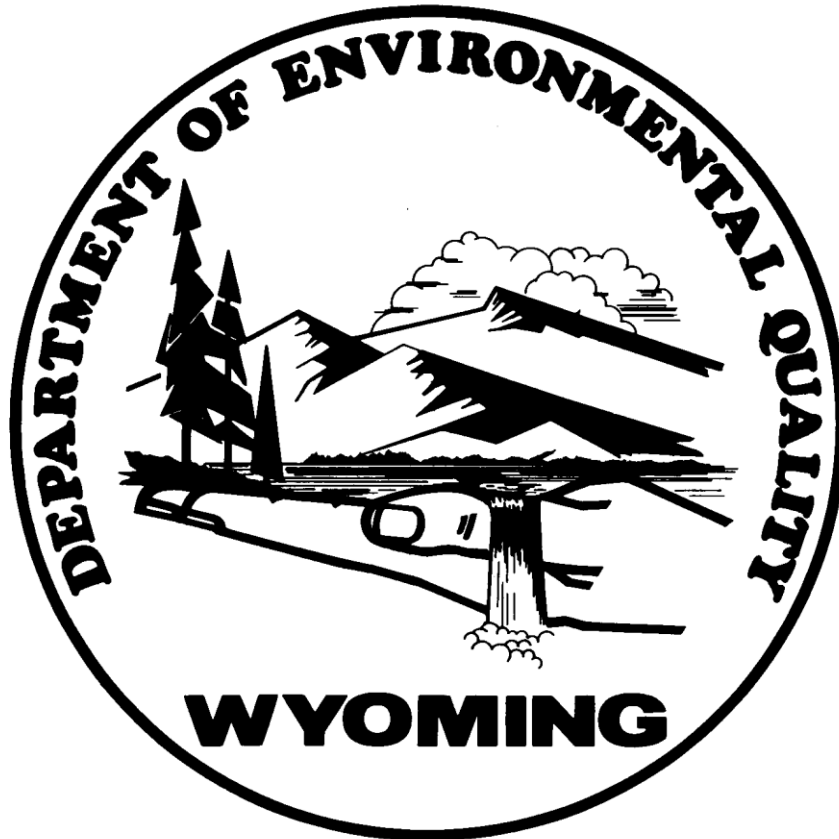


**DEPARTMENT OF ENVIRONMENTAL QUALITY
LAND QUALITY DIVISION**



GUIDELINE NO. 12

**STANDARDIZED RECLAMATION
PERFORMANCE BOND FORMAT AND COST
CALCULATION METHODS**

Revised February 2017 using \$1.90/gal. diesel & 70% of EQ Hourly Rates

DEQ Exhibit 33

DEQ 33-001

TABLE OF CONTENTS

INTRODUCTION..... iv

APPLICABLE STATUTES AND RULES AND REGULATIONS..... iv

I. COST EXPLANATION FOR ITEMS USED IN STANDARDIZED RECLAMATION BOND COSTS 1

Table D-1. Operating Costs and Adjusted Costs (\$/Hour w/o Operator) For Equipment in This Standardized Bond Format.....2

Table D-1a. Purchase Price, Lease Cost, and Operating Costs for 58 CY Electric Shovel and 793F Trucks 3

Table D-1b. Shovel Leasing Option.....4

Table D-2 Abbreviations Used in This Standardized Bond Format 5

II. STANDARDIZED RECLAMATION BOND FORMAT 5

A. Area Bond 5

1. Introduction..... 5

2. Backfill..... 5

3. Rough Grade Backfill 6

4. Final Grade Backfill..... 6

B. Incremental Bond..... 6

1. Introduction..... 6

2. Native Topsoil Removal From Borrow and/or Backslope Areas 7

3. Native Overburden Removal From Borrow and/or Backslope Areas..... 7

4. Miscellaneous Overburden Redistribution 7

5. Demolition 7

6. Removal of Monitoring Structures and Other Miscellaneous Items..... 8

7. Scarification or Ripping of All Compacted Surfaces..... 8

8. Topsoil Redistribution on All Disturbed Areas 8

9. Revegetation of All Disturbed Areas..... 8

10. Reclamation Status and Bond Liability Status of All Lands Within the Permit Area 9

a. Land Status Categories..... 9

b. Line Item Bond Costs 10

11. Coal Drilling 13

12. Miscellaneous Items..... 13

13. Unknown Costs..... 14

14. References..... 15

15. Maps..... 15

III. APPENDICES 15

Appendix A - Front end loader & truck fleet..... 16

Appendix B - 657 scraper fleet 19

Appendix C - 637 scraper fleet	22
Appendix D - 58 CY Electric shovel & truck fleet.....	25
Appendix D1 - 80 CY Electric shovel & truck fleet.....	27
Appendix E - D9 dozer push.....	29
Appendix F - D11 dozer push.....	31
Appendix F1 - D11 CD dozer push	33
Appendix G - 16M blade grading	35
Appendix H - Fencing & powerlines	36
Appendix I - Asphalt ripping	37
Appendix I1 - D10 ripping overburden.....	38
Appendix J - Culvert removal.....	39
Appendix K - Demolition	40
Appendix L - Drill holes & monitor wells.....	41
Appendix M - Grading backfill.....	42
Appendix N - Surface water monitoring stations.....	43
Appendix O - Air quality monitoring stations	43
Appendix P - Scarification.....	44
Appendix Q - Revegetation	45
Appendix R - Project management	46
Appendix S – Non-coal miscellaneous (contingency) costs.....	47

INTRODUCTION

This document is a Guideline only. Its contents are not to be interpreted by the applicant/permittee or Wyoming Department of Environmental Quality (WDEQ) staff as mandatory. This Guideline intends to assist applicants/permittees in understanding and attaining the requirements of the Wyoming Environmental Quality Act (ACT) and Land Quality Division (LQD) Rules and Regulations addressing bonding topics.

This Guideline was developed as a joint project of the Wyoming Mining Association (WMA) Reclamation Subcommittee, WMA Bond-subcommittee and the LQD. The LQD has and intends to selectively and periodically publish updated versions of the Cost Calculation Methods as contained in the various Appendices.

APPLICABLE WEQA STATUTES AND LQD RULES AND REGULATIONS

This is a general summary of items from the ACT.

WS §35-11-417:

Outlines some general provisions applying to initial bond and renewal bond values. This statute outlines the concept of Partial Bond Release.

WS §35-11-418:

Outlines acceptable bond vehicles.

WS §35-11-423:

Outlines procedures for bond release for coal and other mineral permittees.

WS §35-11-411(d):

Authorizes the WDEQ Director to establish the bond amount based upon information submitted in the annual report, an inspection and other materials.

These items in LQD Rules and Regulations apply to bonding.

Coal Rules and Regulations, Chapter 1, Section 2(k) and Noncoal Rules and Regulations, Chapter 1, Section 2(i) defines bond.

Coal Rules and Regulations, Chapter 2, Section 3(b)(xxi) requires that shared structures be cross-referenced in the bonds of applicable coal permittees.

Coal Rules and Regulations, Chapter 4, Section 2(d)(ix) establishes a minimum ten (10) year bond period for coal permittees.

Coal Rules and Regulations, Chapter 11 and Noncoal Rules and Regulations, Chapter 6 outlines definitions and procedures for the self-bond program.

Coal Rules and Regulations, Chapter 12 applies exclusively to coal permittees. Section 2(a) defines the Area and Incremental Bonds. Section 2(b) elaborates further bond data requirements. Section 2(d) explains the liability areas and periods for the Area and Incremental Bonds. Section 2(e) distinguishes among and establishes procedures for bond adjustments versus bond reductions versus partial bond releases. Sections 2(f) through (h) address requirements for specific bond vehicles.

Coal Rules and Regulations, Chapter 14, Section 4 and Noncoal Rules and Regulations, Chapter 8, Section 3 require a bond for exploration by drilling.

Coal Rules and Regulations, Chapter 15 outlines procedures for partial or complete release of coal permittee bonds.

Noncoal Rules and Regulations, Chapter 9, Section 2 discusses bond requirements for conversion of a non-coal Small Mine Permit to a Regular Mine Permit.

Coal Rules and Regulations, Chapter 20 and Noncoal Rules and Regulations, Chapter 12 details information on Letters of Credit used as a bond vehicle.

I. COST EXPLANATION FOR ITEMS USED IN STANDARDIZED RECLAMATION BOND COSTS

Equipment sizes (loaders, trucks, scrapers, motor graders, etc.) were selected and agreed upon by the WMA Committee and LQD based on the usual types of equipment contractors normally have available for use. Costs for other equipment may be calculated by using methodologies as shown in this package.

Owning and operating costs were determined, except where noted, by using EquipmentWatch (formerly DataQuest). The owning and operating costs were regionally adjusted to 70% since many factors including digging conditions are favorable which justify the reduction.

Costs for the electric shovel and the trucks associated with the shovel were determined from the InfoMine USA, Inc.; Mine and Mill Equipment Costs Estimators Guide (2016). The costs were regionally adjusted to 70% of the InfoMine costs based on favorable conditions.

A standard efficiency factor of 0.83 is incorporated into all production calculations. The factor accounts for a fifty-minute work hour as recommended by many cost references.

Labor and benefit costs were obtained from the 2016 WMA cost compilation and averaged for several categories.

Supervision costs were determined by adding \$5.00 per hour to the highest operators scale. In most cases, only a portion of a supervisor's costs is applied to each task. Theoretically, this allows one supervisor the flexibility to oversee many jobs or pieces of equipment at the same time.

The supervisor's transportation is also divided among tasks. For example, where one-half of a supervisor's time is allotted, the same amount of time is used in calculating his transportation costs.

Where only a portion of support equipment are used in a calculation (i.e., one-half water truck), it is assumed that the equipment in question services more than one area.

Operators Hourly Costs

Shovel Op. = \$49.11/hr.

Dozer Op. = \$44.57/hr.

Blade Op. = \$43.36/hr.

Scraper Op. = \$42.26/hr.

Truck Driver = \$43.00/hr.

FEL Op. = \$42.33/hr.

Excavator Op. = \$47.00/ hr.

General Laborer = \$43.00/hr.

Farm Tractor = \$35.00/hr.

Supervisor = \$54.11.hr.

Table D-1. Operating Costs and Adjusted Costs (\$/Hour w/o Operator) For Equipment in This Standardized Bond Format

Equipment Type	Equipment Name	70% Equipment Watch Book Cost (w/o Operator) (\$)	Date
Dozer	Caterpillar D9T (SU)	135.04	2/2017
Blade	Caterpillar 16M	93.61	2/2017
Scraper	Caterpillar 657G P-P	268.27	2/2017
Truck (95 ton)	Caterpillar 777F	196.56	2/2017
Loader (13.5 CY)	Caterpillar 992K	231.91	2/2017
Loader (5.25 CY)	Caterpillar 980H	73.32	2/2017
Dozer	Caterpillar D10T (SU)	168.55	2/2017
Dozer	Caterpillar D11T (U)	294.40	2/2017
Dozer	Caterpillar D11R-CD	283.22	2/2017
Backhoe Loader	Caterpillar 430E(4WD)	23.12	2/2017
Water Truck	14,000 Gallon	132.65	2/2017
Dump Truck	10-12 CY	43.56	2/2017
Pickup Truck	Crew 4x4 1T (Gas)	N/A	N/A
Pickup Truck	Crew 4x4 1T (Diesel)	14.86	2/2017
Tractor	Case 580 48 H.P.	6.38	2/2017
Towed Mower	Flail 7 ft	1.72	2/2017
Rubber Tired Dozer	Caterpillar 854G	239.98	2/2017
Scraper	Caterpillar 637G P-P	225.24	2/2017
Scraper	Caterpillar 651E	178.12	
Scraper	Caterpillar 627G P-P	158.53	
Blade	Caterpillar 140M	49.25	
Dozer	Caterpillar D6T-XL SU	63.77	

Caterpillar 24H blade: \$50.37/hr. to lease and \$101.49/hr. operating cost (from InfoMine USA, Inc.) for total of \$151.86/hr. This blade is used in the truck/shovel appendices (D & D1) only.

Table D-1a. Purchase Price, Lease Cost, and Operating Costs for 58 CY Electric Shovel and 793C Trucks

Operators that use the truck/shovel appendix must show a regrading plan that is suitable for a large shovel/truck operation. Many backfill operations are not suited for this type operation because the cuts are not thick enough to allow the shovel optimum digging depths, highwall reduction with dozers takes up a large percentage of the required backfill, and there is insufficient backfill to justify this large shovel/truck fleet.

Operators using the shovel/truck appendix should submit suitable cut and fill isopachs that support the choice of this backfill method.

This method is not to be used for topsoil movement from native areas or from stockpiles. Topsoil movement from stockpiles should have the production rate at 85% (see page 7, item 8.).

The \$22,959,100.00 purchase price of the 58 CY shovel must be added to the bond costs. There is no profit or other contingency items added to this cost so it can be added to the bond cost after all the line items and add-ons have been totaled. No salvage value is allowed at the end of the project.

58 CY Electric Shovel

Purchase Price \$22,959,100 (InfoMine)

Productivity - 58 CY x 1 pass/35 sec. x 3,600 sec./hr. x 0.968 bucket fill factor = 5,774

5,774 CY/hr. x 0.8696 BCY/LCY (15% swell of BCY) = 5,021 BCY/hr.

5,021 BCY/hr. x 0.8333 (operating efficiency) = 4,184 BCY/hr.

58 CY Shovel Hourly Costs (WME)

Overhaul <u>Parts</u>	Overhaul <u>Labor</u>	Maint. <u>Parts</u>	Maint. <u>Labor</u>	<u>Power</u>	<u>Lube</u>	Wear <u>Parts</u>	<u>Total</u>
\$49.52	\$49.16	\$74.28	\$73.75	\$55.55	\$45.92	\$17.61	\$365.79

(Note: if mine uses an 80 CY shovel the purchase price will be \$24,529,400 & \$366.76/hr. w/o ownership cost)

Caterpillar 793D Trucks (240 Ton)

Purchase Price \$3,849,100 (InfoMine)

Monthly Lease (@600 hr./month) \$60,548.00

Hourly Lease Cost \$100.91

[Cat 797F Trucks (380T) @ \$164.52/hr. to lease & \$412.37/hr. operating cost = \$576.89/hr.]

793 Truck Hourly Costs (WME)

Overhaul <u>Parts</u>	Overhaul <u>Labor</u>	Maint. <u>Parts</u>	Maint. <u>Labor</u>	<u>Fuel</u>	<u>Lube</u>	<u>Tires</u>	<u>Total</u>
\$8.55	\$7.28	\$15.89	\$13.52	\$90.72	\$30.92	\$76.24	\$243.12

Table D-1b. Shovel Leasing Option

The Wyoming Department of Environmental Quality, with assistance of counsel, has determined that the use of a lease option for a shovel can be substituted for the purchase of a shovel for the Guideline 12 bond calculation. The minimum requirements for the use of this option are as follows:

- 1) A determination of the life of the project and length of the lease is to be submitted to LQD for review and approval;
- 2) The lease valuation must be provided by an independent third party such as Caterpillar (BE) or Joy Global (P&H) and updated on an annual basis;
- 3) A copy of the lease arrangement must include, mobilization and assembly, maintenance and preventative costs and general upkeep for the duration of the project, and disassembly and demobilization;
- 4) If the shovel is to be shared between two operations owned by the same company, the life of the lease must include the required time to complete both projects and take into account the additional costs of disassembly, moving and reassembly as well as lost production time for the duration of the move; and
- 5) LQD will review the lease terms and cost prior to acceptance and inclusion into the bond calculation.

Table D-2. Abbreviations Used in This Standardized Bond Format

CPH -	Caterpillar Performance Handbook (Edition No. specified where appropriate)
EQW -	Equipment Watch Guide (date of data indicated)
WYDOT-WDD -	Wyoming Department of Transportation - Wage Determination Decision (2015 Version)
IM -	InfoMine, USA, Inc. (2015 Estimating Guide)
BCY -	Bank Cubic Yard
LCY -	Loose Cubic Yard
MPH -	Miles Per Hour
BHB -	Black Hills Bentonite Corporation
AML -	DEQ Abandoned Mine Land Reclamation Program

II. STANDARDIZED RECLAMATION BOND FORMAT

Individual items may be expanded as necessary or noted as not applicable based upon the specific reclamation practices approved in each permit.

This guideline refers to “area bond” and “incremental bond” which are terms that are associated with bond estimates for coal mines. In general terms, the area bond is the pit backfill cost and the incremental bond is the cost of completing the reclamation after backfilling is completed. These terms are not applicable for non-coal mines, but the costs are estimated in the same manner.

A. Area Bond

The Area Bond covers the costs of backfilling and rough grading (and special reconstruction techniques when specifically approved) according to procedures and postmining topography approved in the current term permit.

1. Introduction

Present a general discussion of assumptions, including time frames, backup calculations, procedures, methods, etc. for summarizing or documenting the basis for all calculations. The reclamation cost estimate should be based upon completing the reclamation of the site in a timely and efficient manner consistent with the approved reclamation plan. The time frame for completion must be clearly stated in order to support the calculations.

2. Backfill

Describe equipment, procedures, volumes, and costs for bringing all pits to an interim/bond topography with reference to a quality, current map of the project site. **The interim/bond topography must come as close as possible to the approved final topography, acknowledging that the current mine site differs from the final configuration.**

The operator should submit a map showing the interim/bond topography based on 5(H):1(V) slopes that will be constructed if the mine were to cease operations during the next Annual Report period. Cut and fill isopachs may also need to be submitted to adequately show the backfill work.

LQD realizes that the interim/bond topography will not exactly match the approved PMT because the mine life will not be the same. The operator must do more than simply regrade the highwalls and spoil piles to 5(H):1(V) slopes, topsoil and seed. There has to be some diversity built into the slopes and adequate, non-erosive through drainage. LQD will not accept long, straight slopes that match the dragline or truck/shovel highwall from the current pit.

Appendices A through F detail equipment fleets and costs for this reclamation activity.

Operators should clearly show cut and fill areas and the associated haul distances and grades on a map.

This section should clearly list overburden Drilling and Blasting cost at \$0.19/BCY when applicable. If the operator intends to cast blast some material then that should be calculated at \$0.25/BCY. Drill and blast costs in small mines and quarries are considerably higher and the cost should be figured at \$0.35/BCY, or on a case by case basis depending on the location, topography, rock type, etc.

3. Rough Grade Backfill

Describe procedures and costs for shaping interim/bond topography with reference to a quality map. NOTE: Depending upon permit approved backfill practices, rough grading may not be a necessary line item bond cost.

Appendices G and M detail equipment and costs for this reclamation activity.

4. Final Grade Backfill

Describe equipment, procedures, and costs for specific site tasks (e.g., drainage reconstruction or permit-specific postmining features).

Appendix G details equipment and costs for this reclamation activity.

B. Incremental Bond

1. Introduction

The Incremental Bond covers all other costs beyond those detailed in the Area Bond.

Present a general discussion of assumptions, including time frames, backup calculations, procedures, methods, etc. for summarizing or documenting the basis for all calculations. The reclamation cost estimate should be based upon completing the reclamation of the site

in a timely and efficient manner consistent with the approved reclamation plan. The time frame for completion must be clearly stated in order to support the calculations.

2. Native Topsoil Removal From Borrow and/or Backslope Areas

If applicable, describe equipment, volumes, haul routes, and costs with reference to a quality, current map of the project site.

Appendices A, B, C, E, F and G detail potential equipment and costs for this reclamation activity.

3. Native Overburden Removal From Borrow and/or Backslope Areas

If applicable, describe equipment, haul routes, volumes, and costs with reference to a quality, current map of the project site.

Appendices A through G detail potential equipment and costs for this reclamation activity.

4. Miscellaneous Overburden Redistribution

Describe equipment, haul routes, volumes, and costs (with reference to a quality map) for backfilling structures, such as:

- scoria or shale pit(s)
- diversion ditches
- access/haul road cut or fill
- railroad cuts/embankments
- sediment ponds
- sewage lagoons
- culverts
- other

Appendices A through G (excluding D) detail potential equipment and costs for this reclamation activity.

5. Demolition

Equipment, procedures, and costs for demolition and disposal of each individual structure should be described in terms of size, type of construction, etc. so that appropriate demolition costs can be estimated, such as:

- fences
- power lines, transformers
- hard-surfaced roads
- bridges
- abandoned equipment (i.e., draglines, shovels, drills and pieces of same)
- culverts
- railroads (rails, ties, ballast, scales, etc.)
- facility buildings (shops, warehouse, offices, etc.)
- mineral handling facilities (truck dumps, conveyors, silos, scales, etc.)

- support facilities (ready line, fuel tanks, water tanks, equipment yards, explosive storage sites, electrical substations)

Appendices H through K contain costs for these reclamation and demolition practices. LQD accepts no salvage value for any facilities, equipment, or other infrastructure.

6. Removal of Monitoring Structures and Other Miscellaneous Items

Describe the procedures, equipment, and costs required to properly abandon or remove and disposal of items, such as:

- groundwater monitor wells
- all other operator-owned wells within the permit area
- surface water monitoring stations
- all other experimental study sites within the permit area
- meteorological/air quality monitoring sites

Appendices L through O detail equipment and costs for these reclamation practices.

7. Scarification or Ripping of All Compacted Surfaces

Describe equipment, procedures, and costs (preferably on a per acre basis) with reference to a quality, current map of the project site.

Appendices I and P detail costs for this reclamation practice.

8. Topsoil Redistribution on All Disturbed Areas

Describe equipment, procedures, and costs with reference to a quality, current map of the project site. The map should show haul distances and grades.

Appendices B and C detail equipment and costs for this reclamation activity. Topsoil haul from stockpiles with shovel or loader and trucks is not as productive as conventional drilled and shot material. LQD assumes the cost for this topsoil at 115% of the cost in the truck/shovel and loader/truck appendices.

9. Revegetation of All Disturbed Areas

Describe equipment, practices, and costs (preferably on a per acre basis), including:

- seedbed preparation
- mulch (purchase and application)
- seed (purchase and application)
- fertilizer (if required, purchase and application)

- post-seeding maintenance over the minimum bonding period (e.g., weed control, mowing, interseeding). Operators suggest that a ten percent line item should cover this issue for the entire bonding period.

Appendix Q outlines a cost calculation process for this reclamation activity. The costs must be calculated using the specific seed mixes and practices from the approved term permit.

10. Reclamation Status and Bond Liability Status of All Lands Within the Permit Area

a. Land Status Categories

The bond calculation should describe the status of all lands within the permit area. Each land status category should be clearly identified on a quality map and cross-referenced to specific reclamation cost for each category. The LQD also prefers a tabular summary of the acreage for each category.

LANDS THAT HAVE BEEN TOPSOILED AND SEEDED BUT HAVE NO BOND RELEASE MUST BE BONDED FOR RETOPSOILING, SCARIFICATION, AND REVEGETATION. [see Section 10.b.(2)(b)i)e) on page 10]

The following is a summary of generic land status categories. Section 10.(2) below details the information and calculations necessary for each of these categories.

- (1) Native lands undisturbed at the time of this specific bond calculation and which will remain undisturbed under this bond calculation (e.g., no borrow areas necessary).
- (2) Lands disturbed and requiring backfilling, regrading and revegetation at the time of this specific bond calculation.
 - (a) Lands requiring assessment of Area Bond costs
 - (b) Lands requiring assessment of full or Incremental Bond costs
 - (c) Lands requiring assessment of partial Incremental Bond costs
 - i) Lands permanently reclaimed prior to December 31, 1982
 - ii) Lands permanently reclaimed after December 31, 1982
 - a) Lands with no approved Partial or Full Bond Release
 - b) Lands with approved 60 percent Partial Release of the Incremental Bond

- c) Lands with approved larger percent Partial Release of the Incremental Bond
- d) Lands with approved Full Release of Area and Incremental Bonds

b. Line Item Bond Costs

- (1) The bond covers lands currently disturbed by mining and associated activities and those lands to be disturbed in the next 12-month period.
- (2) The bond should include costs for the Area Bond (through backfill, rough and final grading) for all open pits, impoundments, sediment ponds, diversions, etc.
 - (a) Section II.A of this Guideline and its associated appendices detail procedures and costs for the Area Bond. The bond calculation should detail costs for the operations listed in Section II.A Parts 2, 3 and 4.
 - (b) Section II.B of this Guideline and its associated appendices detail general categories and procedures for the Incremental Bond. Overall, the bond calculation should detail costs for the operations listed in Section II B Parts 2 through 9.
 - i) The bond calculation should assess the full suite of Incremental Bond tasks and costs for all disturbed lands which have not formally approved partial or full release of the Incremental Bond.

Historic LQD policy, LQD Coal Rules and Regulations Chapter 15 and WS§35-11-417(e) establish three (3) distinct categories of Partial Bond Release for permanently reclaimed lands.

- (a) Lands Permanently Reclaimed Prior to December 31, 1982

Prior to this date and prior to approval of the Wyoming State Coal Program, the LQD granted defacto Partial Bond Release for permanently reclaimed lands.

The LQD did not specifically approve or otherwise record this Partial Bond Release category, so there is generally no written approval letter.

The bond should specifically identify this Partial Bond Release category if it exists.

The bond should include a carry-over cost assessment for interseeding an appropriate, permit-approved seed mixture on these lands. These carry-over costs should include seed purchase and seed implantation.

(b) 60 Percent Partial Bond Release

LQD Coal Rules and Regulations Chapter 15, Section 5(a)(i) allows for release of 60 percent of the Incremental Bond when the permittee has completed backfilling, regrading, topsoil replacement, and drainage control according to the approved term permit procedures.

This category of Partial Bond Release requires formal, written approval by the DEQ Director. If this release category exists for your specific permit, the bond calculation should include the date of the Director's approval letter.

The bond calculation should specifically identify this category and show the appropriate units on a quality map.

The bond calculation should specifically tabulate the residual 40 percent Incremental Bond costs (preferably on a per acre basis) as the appropriate carry-over cost assessment. As noted above, the Incremental Bond includes all term permit approved Reclamation Plan practices beyond rough grading of the backfill. The tabulation of the 40 percent Incremental Bond carry-over costs should detail all approved reclamation practices.

(c) Larger Percentage of Partial Bond Release

LQD Coal Rules and Regulations Chapter 15, Section 5(a)(ii)(A) allows more than 60 percent release of the Incremental Bond as determined by the LQD Administrator and DEQ Director.

WS §35-11-423(d) mandates development of specific rules and regulations for release of coal bonds. These rules are controlling not withstanding other provisions of WS§35-11-417 and §35-11-423 to the contrary.

LQD Coal Rules and Regulations, Chapter 15 is that formulation.

Coal Chapter 15 governs partial and 100 percent release of the Incremental Bond. For partial release, the amount remaining cannot be less than the cost of reseedling.

This category of Partial Bond Release requires formal, written approval by the DEQ Director. If this release category exists for your specific

permit, the bond calculation should identify the date of the Director's approval letter.

The bond calculation should specifically tabulate the residual percentage Incremental Bond costs (preferably on a per acre basis) as the appropriate carry-over cost assessment. As previously noted, the Incremental Bond includes all term permit approved Reclamation Plan practices beyond rough grading of the backfill. The tabulation of the percentage Incremental Bond carry-over costs should detail all approved reclamation practices.

NOTE: The percentages of partial release of the Incremental Bond vary for Noncoal Permittees. A Noncoal Permittee seeking partial release should consult with the LQD.

(d) Full Bond Release of the Area and Incremental Bonds

This category includes all land permanently reclaimed and formally released under provisions of the 1973 ACT and LQD RR Chapter 15.

Full Bond Release requires formal, written approval by the DEQ Director. If this category exists for your specific permit, the bond calculation should list the date of the DEQ Director's Full Bond Release decision.

(e) Lands Permanently Reclaimed After December 31, 1982

This category includes all land permanently reclaimed that has no bond release.

These reclaimed lands must be bonded to scarify, retopsoil, and reseed. There are no provisions made for where the topsoil would come from. It is assumed that topsoil would be spread at the same average depth on these lands as it is on the rest of the areas requiring topsoil. Topsoil haul distance and grade used would be the weighted average used for the rest of the reclamation. Scarification and reseed costs would be the same per acre as those used on other lands requiring reclamation.

NOTE: The LQD continues development of a DRAFT Guideline on Full and Partial Bond Release Procedures. Please consult with the LQD concerning the status of that Guideline, should you consider bond release for permanently reclaimed lands.

11. Coal Drilling

Describe the approximate number, depth, diameter, and location (show on inclusive map, if

possible) of all holes drilled into or through coal during the current and next annual report period. A tabular format with reference to map locations may be an efficient presentation. This description should distinguish between coal drill holes which will be or have been removed by the pit advance within the annual report period versus those coal drill holes which will not be mined out in a report cycle. The operator may distinguish between abandonment/plugging procedures for the coal drill holes mined out in the report cycle versus the longer term abandoned holes. Each category should have a total line item cost entry in the bond. The LQD prefers that all coal drill hole reclamation costs be estimated according to Appendices L and M.

12. Miscellaneous Items

The following tasks are mostly for the surface coal mine bonds. Miscellaneous bond costs for other mines, which are typically much smaller than coal mines, will be different. Mobilization, de-mobilization, and profit will likely be higher for small, remote projects, and other tasks will also vary. LQD feels that the miscellaneous costs on other mines should range from 25% on projects in excess of \$500,000.00, to 35% on projects of \$250,000.00, and 45% on projects of \$50,000 and less. See Appendix S, page 46.

Each individual operator should identify these items as a line item or include each in some specific bond category. Otherwise, the LQD will enter the item as an addition to total dollar value of the Area and Incremental Bonds.

- a. COSTS FOR AN INDEPENDENT FIRM TO DESIGN THE FINAL RECLAMATION PROJECT: LQD and WMA agreed on a flat \$250,000 for project design regardless of project size.
- b. CONTRACTOR PROFIT, OVERHEAD, MOBILIZATION AND DEMOBILIZATION COSTS: The Dataquest Cost Reference Guides used to construct the appendices do not include these costs. If an operator uses these appendices in bond calculations, there is still a need for this distinct line item cost in the bond. Assorted references place these items from 8 to 15 percent of the total bond cost. Presently LQD is using 13.5 percent.
- c. PRECONSTRUCTION INVESTIGATION AND STABILIZATION: This item addresses all field work necessary to document and mitigate dangerous and/or quickly deteriorating conditions, such as slumping highwalls or drainage problems. Any assessment under this item will be based upon the LQD's knowledge of specific site conditions and the length of time between cessation/forfeiture and initiation of the final reclamation project. When necessary, reference sources place this cost at 1 to 2 percent. LQD is using 1.5 percent.
- d. COSTS FOR AN INDEPENDENT FIRM TO MANAGE THE FINAL RECLAMATION PROJECT: LQD and the WMA agreed that the Office of Surface Mining's sliding scale would be used for this item. A copy of that is attached as Appendix R.

- e. COSTS FOR ON SITE MONITORING PROGRAMS FOR TEN YEARS AFTER COMPLETION OF THE FINAL RECLAMATION PROJECT (INCLUDES SUCH ITEMS AS UTILITIES AND GROUNDWATER SAMPLING): Costs of this item will vary depending upon specific permit commitments. The LQD uses a range of 1/2 to 2 percent. Usually LQD uses 1.0 percent.
- f. COSTS FOR SITE SECURITY DURING THE FINAL RECLAMATION PROJECT AND LIABILITY INSURANCE COST DURING THE FINAL RECLAMATION PROJECT AND OVER THE FULL BONDING PERIOD: LQD and the WMA agreed that \$250,000 per year of project life would be adequate.
- g. LONG-TERM ADMINISTRATION AND ACCOUNTING COSTS: LQD and the WMA agreed to a range of \$315,000 to \$505,000 based on the project size.
- h. ANY OTHER SITE-SPECIFIC PERMIT COMMITMENTS SHOULD ALSO BE INCLUDED HERE: Costs will vary according to specific permit commitments and standard pre-feasibility, feasibility and construction requirements for large scale projects..

The LQD has historically used the following sources to establish the range of percentages list in the Miscellaneous Items.

- * Means Heavy Construction Cost Data (current edition), published by R. S. Means Company, Inc., Kingston, MA
- * Means Site Work Cost Data (current edition), published by R. S. Means Company, Inc., Kingston, MA
- * Building Construction Cost Data (current edition), published by R. S. Means Company, Inc., Kingston, MA
- * Handbook for Calculation of Reclamation Bond Costs, 1987, Department of Interior, Office of Surface Mining Reclamation and Enforcement, Washington, D.C.
- * Wyoming DEQ Abandoned Mine Land Program contracting and reclamation practices and cumulative experience

13. Unknown Costs

The items under L) represent the usual contingency items applied to bonds. If these items are included as line items in the bond, the only remaining category could be unknown as per WS §35-11-417(c)(ii). References place this cost at 2 to 5 percent of the total bond cost. Under normal circumstances LQD is using 5.0 percent.

14. References

List sources of information, procedures, costs, etc. which were used in the bond calculations.

15. Maps

This Guideline requests that the various tasks, operations, disturbed areas, reclamation areas, etc., be illustrated on or referenced to a **QUALITY, CURRENT MAP**. Several of the tasks may be illustrated on the same map. All maps presented in support of the bond calculations must be clear and legible contour maps or recent (with date) aerial photographs. **The preferred scale is 1"=500'**, unless it is necessary to directly compare (e.g., overlay) a bond map to an existing permit map. In this case the scales should be identical. Each map should be of a reasonable size, generally no larger than 48" on a side.

Each map must have a complete title block, including:

- Map title
- Name and address of permittee
- Permit number and term designation
- Annual report period
- Scale, north arrow, contour interval, date of photography or date of preparation

All maps must show and clearly label:

- Legal subdivisions with section, township, and range lines
- Permit area boundary and term boundary

III. APPENDICES

The following appendices are intended for use in this standardized bond calculation package. Any references to specific equipment should not be interpreted as a recommendation of any kind by any person, company or agency for the use of specific brand-name equipment.

Appendix A
Calculations for Moving Materials With a Caterpillar 992K Loader and Caterpillar 777F Truck Fleet

NOTE: THESE COSTS ARE FOR EXCAVATION ONLY. MATERIAL REQUIRING BLASTING SHOULD HAVE AN ADDITIONAL \$0.19/BCY ADDED FOR DRILLING AND BLASTING COSTS.

Material Movement By Loader-Truck Combination

1) Caterpillar 992K Loader	13.2 BCY	CPH 40
2) Caterpillar 777F Trucks (85 ton)	66.0 BCY	CPH 40
3) Material Density	2,850.0 LB/BCY	CPH 40
4) Operating Efficiency Factor (50 Min/Hr)	0.83	CPH 40
5) Rolling Resistance Factor	4.00 %	CPH 40
6) 777F Truck Operating Costs	\$196.56 Per Hour	70% of E-W
7) 992K Loader Operating Costs	\$231.91 Per Hour	70% of E-W
8) Labor Costs	See Pg. 1	
9) 1/2 of 1 - 14,000 Gal. Water Trucks + 1 Operator	\$87.83 Per Hour	1/2 of 70% E-W
10) 1 - 16M Blade for Road Work + 1 Operator	\$136.97 Per Hour	70% E-W + Operator
11) 1 - D9T for Misc. Work + 1 Operator	\$179.61 Per Hour	70% E-W + Operator
12) Supervision Labor Costs	\$27.06 Per Hour	1/2 of Hourly Rate
13) Supervisor Transportation	<u>\$7.43 Per Hour</u>	1/2 of 70% E-W
14) Total Fleet Hourly Costs (Except Trucks)	\$713.14	

TO USE TABLE: Locate your approximate grade by reference to case number. Determine cost per BCY by using distance column that approximates your distance. No calculations are necessary.

Case #1: Level Ground			Loaded (0% grade + 4% rolling = 4% total resistance)					Empty (0% grade + 4% total resistance)				
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Loader Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	3.50	0.70	0.282	1.10	0.15	5.732	10.47	66	575	942	1.64	\$1.174
1000	3.50	0.70	0.564	1.10	0.30	6.164	9.734	66	535	942	1.76	\$1.205
1500	3.50	0.70	0.846	1.10	0.45	6.596	9.10	66	500	942	1.88	\$1.235
2000	3.50	0.70	1.129	1.10	0.60	7.029	8.536	66	469	942	2.01	\$1.268
2500	3.50	0.70	1.411	1.10	0.75	7.461	8.042	66	442	942	2.13	\$1.299
3000	3.50	0.70	1.693	1.10	0.90	7.893	7.602	66	418	942	2.25	\$1.329
3500	3.50	0.70	1.975	1.10	1.05	8.325	7.207	66	396	942	2.38	\$1.362
4000	3.50	0.70	2.257	1.10	1.20	8.757	6.852	66	377	942	2.50	\$1.393
4500	3.50	0.70	2.539	1.10	1.35	9.189	6.53	66	359	942	2.62	\$1.423
5000	3.50	0.70	2.821	1.10	1.50	9.621	6.24	66	343	942	2.75	\$1.456
5500	3.50	0.70	3.104	1.10	1.65	10.054	5.97	66	328	942	2.87	\$1.487
6000	3.50	0.70	3.386	1.10	1.80	10.486	5.72	66	315	942	2.99	\$1.517
6500	3.50	0.70	3.668	1.10	1.95	10.918	5.50	66	302	942	3.12	\$1.551
7000	3.50	0.70	3.950	1.10	2.10	11.35	5.29	66	291	942	3.24	\$1.581

Operating Costs = ((# Trucks x (Truck costs + Labor costs)) + Total Fleet costs)/Loader Productivity)

Appendix A (Continued)
Calculations for Moving Materials With a Caterpillar 992K Loader and Caterpillar 777F Truck Fleet

Material Movement By Loader-Truck Combination

Case #2: 5% Assisting Grade			Loaded (-5% grade + 4% rolling = -1% total)				Empty (5% grade + 4% rolling = 9% total)					
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Loader Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	3.50	0.70	0.139	1.10	0.279	5.718	10.49	66	577	942	1.63	\$1.172
1000	3.50	0.70	0.279	1.10	0.557	6.136	9.78	66	538	942	1.75	\$1.202
1500	3.50	0.70	0.418	1.10	0.836	6.554	9.15	66	503	942	1.87	\$1.233
2000	3.50	0.70	0.557	1.10	1.114	6.971	8.61	66	473	942	1.99	\$1.263
2500	3.50	0.70	0.696	1.10	1.393	7.389	8.12	66	446	942	2.11	\$1.294
3000	3.50	0.70	0.836	1.10	1.671	7.807	7.69	66	423	942	2.23	\$1.324
3500	3.50	0.70	0.975	1.10	1.950	8.225	7.29	66	401	942	2.35	\$1.355
4000	3.50	0.70	1.114	1.10	2.229	8.643	6.94	66	381	942	2.46	\$1.383
4500	3.50	0.70	1.254	1.10	2.507	9.061	6.62	66	364	942	2.59	\$1.416
5000	3.50	0.70	1.393	1.10	2.786	9.479	6.33	66	348	942	2.71	\$1.446
5500	3.50	0.70	1.532	1.10	3.064	9.896	6.06	66	333	942	2.83	\$1.477
6000	3.50	0.70	1.671	1.10	3.343	10.314	5.82	66	320	942	2.95	\$1.507
6500	3.50	0.70	1.811	1.10	3.621	10.732	5.59	66	307	942	3.06	\$1.535
7000	3.50	0.70	1.950	1.10	3.900	11.15	5.38	66	296	942	3.18	\$1.566

Case #3: 10% Assisting Grade			Loaded (-10% grade + 4% rolling = -6% total)				Empty (10% grade + 4% rolling = 14% total)					
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Loader Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	3.50	0.70	0.139	1.10	0.436	5.875	10.21	66	561	942	1.68	\$1.184
1000	3.50	0.70	0.279	1.10	0.871	6.45	9.30	66	511	942	1.84	\$1.225
1500	3.50	0.70	0.418	1.10	1.307	7.025	8.54	66	470	942	2.01	\$1.268
2000	3.50	0.70	0.557	1.10	1.743	7.60	7.89	66	434	942	2.17	\$1.309
2500	3.50	0.70	0.696	1.10	2.179	8.175	7.34	66	404	942	2.33	\$1.350
3000	3.50	0.70	0.836	1.10	2.614	8.75	6.86	66	377	942	2.50	\$1.393
3500	3.50	0.70	0.975	1.10	3.050	9.325	6.45	66	354	942	2.66	\$1.434
4000	3.50	0.70	1.114	1.10	3.35	9.90	6.06	66	333	942	2.83	\$1.477
4500	3.50	0.70	1.254	1.10	3.921	10.475	5.73	66	315	942	2.99	\$1.517
5000	3.50	0.70	1.393	1.10	4.357	11.05	5.43	66	299	942	3.16	\$1.561
5500	3.50	0.70	1.532	1.10	4.793	11.625	5.16	66	284	942	3.32	\$1.601
6000	3.50	0.70	1.671	1.10	5.229	12.22	4.91	66	270	942	3.49	\$1.645
6500	3.50	0.70	1.811	1.10	5.664	12.775	4.70	66	258	942	3.65	\$1.685
7000	3.50	0.70	1.950	1.10	6.10	13.35	4.49	66	247	942	3.81	\$1.726

Appendix A (Continued)
Calculations for Moving Materials With a Caterpillar 992K Loader and Caterpillar 777F Truck Fleet

Material Movement by Loader-Truck Combination

Case #4: 5% Resisting Grade			Loaded (5% grade + 4% rolling = 9% total)					Empty (-5% grade + 4% rolling = -1% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Loader Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	3.50	0.70	0.621	1.10	0.143	6.064	9.89	66	544	942	1.73	\$1.197
1000	3.50	0.70	1.243	1.10	0.286	6.829	8.79	66	483	942	1.95	\$1.253
1500	3.50	0.70	1.864	1.10	0.429	7.593	7.90	66	434	942	2.17	\$1.309
2000	3.50	0.70	2.486	1.10	0.571	8.357	7.18	66	395	942	2.39	\$1.365
2500	3.50	0.70	3.107	1.10	0.714	9.121	6.58	66	362	942	2.61	\$1.421
3000	3.50	0.70	3.729	1.10	0.857	9.886	6.07	66	334	942	2.82	\$1.474
3500	3.50	0.70	4.35	1.10	1.00	10.65	5.6	66	310	942	3.04	\$1.530
4000	3.50	0.70	4.971	1.10	1.143	11.414	5.26	66	289	942	3.26	\$1.586
4500	3.50	0.70	5.593	1.10	1.286	12.179	4.93	66	271	942	3.48	\$1.642
5000	3.50	0.70	6.214	1.10	1.429	12.943	4.64	66	255	942	3.70	\$1.698
5500	3.50	0.70	6.836	1.10	1.571	13.707	4.38	66	241	942	3.91	\$1.751
6000	3.50	0.70	7.457	1.10	1.714	14.471	4.15	66	228	942	4.13	\$1.807
6500	3.50	0.70	8.079	1.10	1.857	15.236	3.94	66	217	942	4.35	\$1.863
7000	3.50	0.70	8.70	1.10	2.00	16.00	3.75	66	206	942	4.57	\$1.919

Case #5: 10% Resisting Grade			Loaded (10% grade + 4% rolling = 14% total)					Empty (-10% grade + 4% rolling = -6% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Loader Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	3.50	0.70	0.989	1.10	0.143	6.432	9.33	66	513	942	1.84	\$1.225
1000	3.50	0.70	1.979	1.10	0.286	7.565	7.93	66	436	942	2.16	\$1.306
1500	3.50	0.70	2.969	1.10	0.429	8.697	6.90	66	379	942	2.48	\$1.388
2000	3.50	0.70	3.957	1.10	0.571	9.828	6.11	66	336	942	2.81	\$1.472
2500	3.50	0.70	4.946	1.10	0.714	10.96	5.47	66	301	942	3.13	\$1.553
3000	3.50	0.70	5.936	1.10	0.857	12.093	4.96	66	273	942	3.45	\$1.634
3500	3.50	0.70	6.925	1.10	1.00	13.225	4.54	66	249	942	3.78	\$1.718
4000	3.50	0.70	7.914	1.10	1.143	14.357	4.18	66	230	942	4.10	\$1.800
4500	3.50	0.70	8.964	1.10	1.286	15.49	3.87	66	213	942	4.42	\$1.881
5000	3.50	0.70	9.893	1.10	1.429	16.622	3.61	66	198	942	4.75	\$1.965
5500	3.50	0.70	10.882	1.10	1.571	17.753	3.38	66	862	942	5.07	\$2.046
6000	3.50	0.70	11.871	1.10	1.714	18.885	3.18	66	175	942	5.39	\$2.128
6500	3.50	0.70	12.861	1.10	1.857	20.018	3.00	66	165	942	5.72	\$2.212
7000	3.50	0.70	13.85	1.10	2.00	21.15	2.84	66	156	942	6.04	\$2.293

Appendix B
Calculations for Moving Materials With a Caterpillar 657G Push-Pull Scraper Fleet

NOTE: DRILLING AND BLASTING COSTS ARE NOT INCLUDED IN THESE CALCULATIONS. THE LQD DOES NOT CONSIDER DRILLING AND BLASTING COSTS NECESSARY WHEN USING APPENDIX B.

Material Movement By Scrapers

1) Caterpillar 657G Push-Pull Scraper		
2) Material Density	2,850. LB/BCY	CPH 40
3) Payload	104,000. LB	CPH 40
	35.0 BCY	
4) Maximum Vehicle Speed Loaded	33.0 MPH	CPH 40
5) Operating Efficiency Factor (50 Min./Hr.)	0.83	CPH 40
6) 657G PP Operating Costs	\$268.27 Per Hour	70% E-W
7) Labor Costs	See Pg. 1	
8) Supervision Labor Costs	\$6.76 Per Hour	1/8 of Hourly Rate
9) Supervisor Transportation	\$1.86 Per Hour	1/8 of 70% E-W
10) 1/8 of 1 - 14,000 Gal. Water Trucks + 1 Operator	\$21.96 Per Hour	1/8 of 70% E-W
11) 1/8 of 1 - 16M Blade for Road Work + 1 Operator	\$17.12 Per Hour	1/8 of 70% E-W
12) - - D9T for Ripping Ovb. and Misc. Work + 1 Operator	<u>\$89.81 Per Hour</u>	. of 70% E-W
13) Total Hourly Costs	\$448.04	

TO USE TABLE: Locate your approximate grade by reference to case number. Determine cost per BCY by using distance column that approximates your distance. No calculations are necessary.

Case #1: Level Ground	Loaded (0% grade + 4% rolling = 4% total)					Empty (0% grade + 4% rolling = 4% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.10	0.42	0.60	0.36	2.48	24.2	35.0	0.83	706	\$0.635
1000	1.10	0.68	0.60	0.57	2.95	20.3	35.0	0.83	593	\$0.756
1500	1.10	0.92	0.60	0.75	3.37	17.8	35.0	0.83	519	\$0.863
2000	1.10	1.15	0.60	0.92	3.77	15.9	35.0	0.83	464	\$0.966
2500	1.10	1.37	0.60	1.09	4.16	14.4	35.0	0.83	421	\$1.064
3000	1.10	1.59	0.60	1.26	4.55	13.2	35.0	0.83	385	\$1.164
3500	1.10	1.81	0.60	1.44	4.95	12.1	35.0	0.83	354	\$1.266
4000	1.10	2.02	0.60	1.61	5.33	11.3	35.0	0.83	328	\$1.366
4500	1.10	2.22	0.60	1.78	5.70	10.5	35.0	0.83	307	\$1.460
5000	1.10	2.43	0.60	1.95	6.08	9.9	35.0	0.83	288	\$1.556
5500	1.10	2.64	0.60	2.13	6.47	9.3	35.0	0.83	270	\$1.660
6000	1.10	2.85	0.60	2.30	6.85	8.8	35.0	0.83	255	\$1.757
6500	1.10	3.05	0.60	2.47	7.22	8.3	35.0	0.83	242	\$1.851
7000	1.10	3.26	0.60	2.64	7.60	7.9	35.0	0.83	230	\$1.948

Appendix B (Continued)
Calculations for Moving Materials With a Caterpillar 657G Push-Pull Scraper Fleet

Material Movement By Scrapers

Case #2: 5% Assisting Grade		Loaded (-5% grade + 4% rolling = -1% total)				Empty (5% grade + 4% rolling = 9% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.10	0.36	0.60	0.42	2.48	24.2	35.0	0.83	706	\$0.635
1000	1.10	0.54	0.60	0.71	2.95	20.3	35.0	0.83	593	\$0.756
1500	1.10	0.71	0.60	0.98	3.39	17.7	35.0	0.83	516	\$0.868
2000	1.10	0.87	0.60	1.25	3.82	15.7	35.0	0.83	458	\$0.978
2500	1.10	1.03	0.60	1.51	4.24	14.2	35.0	0.83	413	\$1.085
3000	1.10	1.19	0.60	1.78	4.67	12.8	35.0	0.83	375	\$1.195
3500	1.10	1.36	0.60	2.05	5.11	11.7	35.0	0.83	342	\$1.310
4000	1.10	1.52	0.60	2.32	5.54	10.8	35.0	0.83	316	\$1.418
4500	1.10	1.68	0.60	2.59	5.97	10.1	35.0	0.83	293	\$1.529
5000	1.10	1.85	0.60	2.86	6.41	9.4	35.0	0.83	273	\$1.641
5500	1.10	2.01	0.60	3.12	6.83	8.8	35.0	0.83	256	\$1.750
6000	1.10	2.17	0.60	3.39	7.26	8.3	35.0	0.83	241	\$1.859
6500	1.10	2.33	0.60	3.66	7.69	7.8	35.0	0.83	228	\$1.965
7000	1.10	2.50	0.60	3.93	8.13	7.4	35.0	0.83	215	\$2.084

Case #3: 10% Assisting Grade		Loaded (-10% grade + 4% rolling = -6% total)				Empty (10% grade + 4% rolling = 14% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.10	0.34	0.60	0.51	2.55	23.5	35.0	0.83	686	\$0.653
1000	1.10	0.51	0.60	0.96	3.17	18.9	35.0	0.83	552	\$0.812
1500	1.10	0.67	0.60	1.41	3.78	15.9	35.0	0.83	463	\$0.968
2000	1.10	0.83	0.60	1.85	4.38	13.7	35.0	0.83	400	\$1.120
2500	1.10	0.99	0.60	2.30	4.99	12.0	35.0	0.83	351	\$1.277
3000	1.10	1.16	0.60	2.74	5.60	10.7	35.0	0.83	313	\$1.431
3500	1.10	1.32	0.60	3.19	6.21	9.7	35.0	0.83	282	\$1.589
4000	1.10	1.48	0.60	3.63	6.81	8.8	35.0	0.83	257	\$1.743
4500	1.10	1.64	0.60	4.08	7.42	8.1	35.0	0.83	236	\$1.899
5000	1.10	1.81	0.60	4.52	8.03	7.5	35.0	0.83	218	\$2.055
5500	1.10	1.97	0.60	4.97	8.64	6.9	35.0	0.83	203	\$2.207
6000	1.10	2.13	0.60	5.41	9.24	6.5	35.0	0.83	189	\$2.371
6500	1.10	2.30	0.60	5.86	9.86	6.1	35.0	0.83	177	\$2.531
7000	1.10	2.46	0.60	6.30	10.46	5.7	35.0	0.83	167	\$2.683

Appendix B (Continued)
Calculations for Moving Materials With a Caterpillar 657G Push-Pull Scraper Fleet

Material Movement By Scrapers

Case #4: 5% Resisting Grade		Loaded (5% grade + 4% rolling = 9% total)					Empty (-5% grade + 4% rolling = -1% total)			
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.10	0.55	0.60	0.33	2.58	23.3	35.0	0.83	678	\$0.661
1000	1.10	1.01	0.60	0.50	3.21	18.7	35.0	0.83	545	\$0.822
1500	1.10	1.46	0.60	0.66	3.82	15.7	35.0	0.83	458	\$0.978
2000	1.10	1.92	0.60	0.83	4.45	13.5	35.0	0.83	393	\$1.140
2500	1.10	2.38	0.60	0.99	5.07	11.8	35.0	0.83	345	\$1.299
3000	1.10	2.83	0.60	1.15	5.68	10.6	35.0	0.83	308	\$1.455
3500	1.10	3.29	0.60	1.31	6.30	9.5	35.0	0.83	278	\$1.612
4000	1.10	3.75	0.60	1.48	6.93	8.7	35.0	0.83	253	\$1.771
4500	1.10	4.21	0.60	1.64	7.55	7.9	35.0	0.83	232	\$1.931
5000	1.10	4.66	0.60	1.80	8.16	7.4	35.0	0.83	214	\$2.094
5500	1.10	5.12	0.60	1.96	8.78	6.8	35.0	0.83	199	\$2.252
6000	1.10	5.58	0.60	2.13	9.41	6.4	35.0	0.83	186	\$2.409
6500	1.10	6.04	0.60	2.29	10.03	6.0	35.0	0.83	174	\$2.575
7000	1.10	6.49	0.60	2.45	10.64	5.6	35.0	0.83	164	\$2.732

Case #5: 10% Resisting Grade		Loaded (10% grade + 4% rolling = 14% total)					Empty (-10% grade + 4% rolling = -6% total)			
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.10	0.75	0.60	0.32	2.77	21.7	35.0	0.83	632	\$0.709
1000	1.10	1.43	0.60	0.49	3.62	16.6	35.0	0.83	483	\$0.928
1500	1.10	2.12	0.60	0.65	4.47	13.4	35.0	0.83	391	\$1.146
2000	1.10	2.81	0.60	0.81	5.32	11.3	35.0	0.83	329	\$1.362
2500	1.10	3.49	0.60	0.98	6.17	9.7	35.0	0.83	284	\$1.578
3000	1.10	4.18	0.60	1.14	7.02	8.5	35.0	0.83	249	\$1.800
3500	1.10	4.87	0.60	1.30	7.87	7.6	35.0	0.83	222	\$2.018
4000	1.10	5.56	0.60	1.46	8.72	6.9	35.0	0.83	201	\$2.229
4500	1.10	6.24	0.60	1.63	9.57	6.3	35.0	0.83	183	\$2.448
5000	1.10	6.93	0.60	1.79	10.42	5.8	35.0	0.83	168	\$2.670
5500	1.10	7.62	0.60	1.95	11.27	5.3	35.0	0.83	155	\$2.891
6000	1.10	8.31	0.60	2.12	12.13	4.9	35.0	0.83	144	\$3.111
6500	1.10	8.99	0.60	2.28	12.97	4.6	35.0	0.83	135	\$3.319
7000	1.10	9.68	0.60	2.44	13.82	4.3	35.0	0.83	127	\$3.530

Appendix C
Calculations for Moving Materials With a Caterpillar 637G Push-Pull Scraper Fleet

NOTE: DRILLING AND BLASTING COSTS ARE NOT INCLUDED IN THESE CALCULATIONS. THE LQD DOES NOT CONSIDER DRILLING AND BLASTING COSTS NECESSARY WHEN USING APPENDIX C.

Material Movement By Scrapers

1) Caterpillar 637E Push-Pull Scraper		
2) Material Density	2,850. LB/BCY	CPH 40
3) Payload	75,000. LB	CPH 40
	25.0 BCY	
4) Maximum Vehicle Speed Loaded	33.0 MPH	CPH 40
5) Operating Efficiency Factor (50 Min./Hr.)	0.83	CPH 40
6) 637G PP Operating Costs	\$225.24 Per Hour	70% E-W
7) Labor Costs	See Pg. 1	
8) Supervision Labor Costs	\$6.76 Per Hour	1/8 of Hourly Rate
9) Supervisor Transportation	\$1.86 Per Hour	1/8 of 70% E-W
10) 1/8 of 1 - 14,000 Gal. Water Trucks + 1 Operator	\$21.96 Per Hour	1/8 of 70% E-W
11) 1/8 of 1 - 16M Blade for Road Work + 1 Operator	\$17.12 Per Hour	1/8 of 70% E-W
12) - - D9T for Ripping Ovb. and Misc. Work + 1 Operator	<u>\$89.81 Per Hour</u>	- of 70% E-W
13) Total Hourly Costs	\$405.01	

TO USE TABLE: Locate your approximate grade by reference to case number. Determine cost per BCY by using distance column that approximates your distance. No calculations are necessary.

Case #1: Level Ground		Loaded (0% grade + 4% rolling = 4% total)				Empty (0% grade + 4% rolling = 4% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.0	0.42	0.60	0.36	2.38	25.2	25.0	0.83	523	\$0.774
1000	1.0	0.68	0.60	0.57	2.85	21.1	25.0	0.83	438	\$0.925
1500	1.0	0.92	0.60	0.75	3.27	18.4	25.0	0.83	382	\$1.060
2000	1.0	1.15	0.60	0.92	3.67	16.3	25.0	0.83	338	\$1.198
2500	1.0	1.37	0.60	1.09	4.06	14.8	25.0	0.83	307	\$1.319
3000	1.0	1.59	0.60	1.26	4.45	13.5	25.0	0.83	280	\$1.447
3500	1.0	1.81	0.60	1.44	4.85	12.4	25.0	0.83	257	\$1.576
4000	1.0	2.02	0.60	1.61	5.23	11.5	25.0	0.83	239	\$1.695
4500	1.0	2.22	0.60	1.78	5.60	10.7	25.0	0.83	222	\$1.824
5000	1.0	2.43	0.60	1.95	5.98	10.0	25.0	0.83	208	\$1.947
5500	1.0	2.64	0.60	2.13	6.37	9.4	25.0	0.83	195	\$2.077
6000	1.0	2.85	0.60	2.30	6.75	8.9	25.0	0.83	185	\$2.189
6500	1.0	3.05	0.60	2.47	7.12	8.4	25.0	0.83	174	\$2.328
7000	1.0	3.26	0.60	2.64	7.50	8.0	25.0	0.83	166	\$2.440

Appendix C (Continued)
Calculations for Moving Materials With a Caterpillar 637G Push-Pull Scraper Fleet

Material Movement By Scrapers

Case #2: 5% Assisting Grade		Loaded (-5% grade + 4% rolling = -1% total)				Empty (5% grade + 4% rolling = 9% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.0	0.36	0.60	0.42	2.38	25.2	25.0	0.83	523	\$0.774
1000	1.0	0.54	0.60	0.71	2.85	21.0	25.0	0.83	436	\$0.929
1500	1.0	0.71	0.60	0.98	3.29	18.2	25.0	0.83	378	\$1.072
2000	1.0	0.87	0.60	1.25	3.72	16.1	25.0	0.83	334	\$1.213
2500	1.0	1.03	0.60	1.51	4.14	14.5	25.0	0.83	301	\$1.346
3000	1.0	1.19	0.60	1.78	4.57	13.1	25.0	0.83	272	\$1.489
3500	1.0	1.36	0.60	2.05	5.01	12.0	25.0	0.83	249	\$1.627
4000	1.0	1.52	0.60	2.32	5.44	11.0	25.0	0.83	228	\$1.776
4500	1.0	1.68	0.60	2.59	5.87	10.2	25.0	0.83	212	\$1.910
5000	1.0	1.85	0.60	2.86	6.31	9.5	25.0	0.83	197	\$2.056
5500	1.0	2.01	0.60	3.12	6.73	8.9	25.0	0.83	185	\$2.189
6000	1.0	2.17	0.60	3.39	7.16	8.4	25.0	0.83	174	\$2.328
6500	1.0	2.33	0.60	3.66	7.59	7.9	25.0	0.83	164	\$2.470
7000	1.0	2.50	0.60	3.93	8.03	7.5	25.0	0.83	156	\$2.596

Case #3: 10% Assisting Grade		Loaded (-10% grade + 4% rolling = -6% total)				Empty (10% grade + 4% rolling = 14% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.0	0.34	0.60	0.51	2.45	24.5	25.0	0.83	508	\$0.797
1000	1.0	0.51	0.60	0.96	3.07	19.5	25.0	0.83	405	\$1.000
1500	1.0	0.67	0.60	1.41	3.68	16.3	25.0	0.83	338	\$1.198
2000	1.0	0.83	0.60	1.85	4.28	14.0	25.0	0.83	291	\$1.392
2500	1.0	0.99	0.60	2.30	4.89	12.3	25.0	0.83	255	\$1.588
3000	1.0	1.16	0.60	2.74	5.50	10.9	25.0	0.83	226	\$1.792
3500	1.0	1.32	0.60	3.19	6.11	9.8	25.0	0.83	203	\$1.995
4000	1.0	1.48	0.60	3.63	6.71	8.9	25.0	0.83	185	\$2.189
4500	1.0	1.64	0.60	4.08	7.32	8.2	25.0	0.83	170	\$2.382
5000	1.0	1.81	0.60	4.52	7.93	7.6	25.0	0.83	158	\$2.563
5500	1.0	1.97	0.60	4.97	8.54	7.0	25.0	0.83	145	\$2.793
6000	1.0	2.13	0.60	5.41	9.14	6.5	25.0	0.83	135	\$3.000
6500	1.0	2.30	0.60	5.86	9.76	6.2	25.0	0.83	129	\$3.140
7000	1.0	2.46	0.60	6.30	10.36	5.8	25.0	0.83	120	\$3.375

Appendix C (Continued)
Calculations for Moving Materials With a Caterpillar 637G Push-Pull Scraper Fleet

Material Movement By Scrapers

Case #4: 5% Resisting Grade		Loaded (5% grade + 4% rolling = 9% total)					Empty (-5% grade + 4% rolling = -1% total)			
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.0	0.55	0.60	0.33	2.48	24.2	25.0	0.83	502	\$0.807
1000	1.0	1.01	0.60	0.50	3.11	19.3	25.0	0.83	400	\$1.013
1500	1.0	1.46	0.60	0.66	3.72	16.1	25.0	0.83	334	\$1.213
2000	1.0	1.92	0.60	0.83	4.35	13.8	25.0	0.83	286	\$1.416
2500	1.0	2.38	0.60	0.99	4.97	12.1	25.0	0.83	251	\$1.614
3000	1.0	2.83	0.60	1.15	5.58	10.8	25.0	0.83	224	\$1.808
3500	1.0	3.29	0.60	1.31	6.20	9.7	25.0	0.83	201	\$2.015
4000	1.0	3.75	0.60	1.48	6.83	8.8	25.0	0.83	183	\$2.213
4500	1.0	4.21	0.60	1.64	7.45	8.1	25.0	0.83	168	\$2.411
5000	1.0	4.66	0.60	1.80	8.06	7.4	25.0	0.83	154	\$2.630
5500	1.0	5.12	0.60	1.96	8.68	6.9	25.0	0.83	143	\$2.832
6000	1.0	5.58	0.60	2.13	9.31	6.4	25.0	0.83	133	\$3.045
6500	1.0	6.04	0.60	2.29	9.93	6.0	25.0	0.83	125	\$3.240
7000	1.0	6.49	0.60	2.45	10.54	5.7	25.0	0.83	118	\$3.432

Case #5: 10% Resisting Grade		Loaded (10% grade + 4% rolling = 14% total)					Empty (-10% grade + 4% rolling = -6% total)			
One-Way Distance (Ft.)	Load Time (Min.)	Travel Time Loaded (Min.)	Maneuver & Spread Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Efficiency Factor (50 min/hr)	Adjusted Productivity (BCY/Hr)	Operating Costs (\$/BCY)
500	1.0	0.75	0.60	0.32	2.67	22.5	25.0	0.83	467	\$0.867
1000	1.0	1.43	0.60	0.49	3.52	17.0	25.0	0.83	353	\$1.147
1500	1.0	2.12	0.60	0.65	4.37	13.7	25.0	0.83	284	\$1.426
2000	1.0	2.81	0.60	0.81	5.22	11.5	25.0	0.83	238	\$1.702
2500	1.0	3.49	0.60	0.98	6.07	9.9	25.0	0.83	205	\$1.976
3000	1.0	4.18	0.60	1.14	6.92	8.7	25.0	0.83	181	\$2.238
3500	1.0	4.87	0.60	1.30	7.77	7.7	25.0	0.83	160	\$2.531
4000	1.0	5.56	0.60	1.46	8.62	7.0	25.0	0.83	145	\$2.793
4500	1.0	6.24	0.60	1.63	9.47	6.3	25.0	0.83	131	\$3.092
5000	1.0	6.93	0.60	1.79	10.32	5.8	25.0	0.83	120	\$3.375
5500	1.0	7.62	0.60	1.95	11.17	5.4	25.0	0.83	112	\$3.616
6000	1.0	8.31	0.60	2.12	12.03	4.9	25.0	0.83	102	\$3.971
6500	1.0	8.99	0.60	2.28	12.87	4.7	25.0	0.83	98	\$4.133
7000	1.0	9.68	0.60	2.44	13.72	4.4	25.0	0.83	91	\$4.451

Appendix D
Calculations for Moving Materials With a 58 CY Electric Cable Shovel and Caterpillar 240T (793F) Trucks

NOTE: THESE COSTS ARE FOR EXCAVATION ONLY. MATERIAL REQUIRING BLASTING SHOULD HAVE AN ADDITIONAL \$0.19/BCY ADDED FOR DRILLING AND BLASTING COSTS.

Material Movement By Shovel-Truck Combination

1) 58 CY Shovel	58.0 LCY Heaped	
2) Caterpillar 793F - 240-Ton End Dumps	193.0 LCY/156.8 BCY	
3) Material Density	2,850.0 LB/BCY	CPH 40
4) Operating Efficiency Factor	0.83	CPH 40
5) Rolling Resistance Factor	4.00 %	CPH 40
6) 58 CY Shovel Operating Costs (No Ownership Cost)	\$365.79	70% of IM
7) 793F Lease + Operating Costs	\$344.03	70% of IM
8) Labor Costs	See Pg. 1	
9) - of 1 - 14,000 Gal. Water Truck + 1 Operator	\$87.83 Per Hour	- of 70% E-W + Operator
10) 1 - 24H Blade + 1 Operator	\$195.22 Per Hour	70% of IM
11) 1 - D9T + 1 Operator	\$179.61 Per Hour	70% E-W + Operator
12) 1 854G Rubber Tired Dozer + 1 Operator	\$284.55 Per Hour	70% E-W + Operator
13) Supervision Labor Costs	\$27.06 Per Hour	- of Hourly Rate
14) Supervisor Transportation	<u>\$7.43 Per Hour</u>	- of 70% E-W
15) Total Fleet Hourly Costs (Except Trucks)	\$1,196.60 Per Hour	

TO USE TABLE: Locate your approximate grade by reference to case number. Determine cost per BCY by using distance column that approximates your distance. No calculations are necessary.

Case #1: Level Ground		Loaded (0% grade + 4% rolling = 4% total resistance)						Empty (0% grade + 4% = 4% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Shovel Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	1.70	0.60	0.25	1.20	0.2	3.95	15.2	156.8	1985	4184	2.11	\$0.481
1000	1.70	0.60	0.5	1.20	0.35	4.35	13.8	156.8	1802	4184	2.32	\$0.501
1500	1.70	0.60	0.75	1.20	0.6	4.85	12.4	156.8	1620	4184	2.58	\$0.525
2000	1.70	0.60	1.0	1.20	0.7	5.20	11.5	156.8	1502	4184	2.79	\$0.544
2500	1.70	0.60	1.25	1.20	0.86	5.61	10.69	156.8	1396	4184	3.00	\$0.564
3000	1.70	0.60	1.5	1.20	1.03	6.03	9.95	156.8	1300	4184	3.22	\$0.584
3500	1.70	0.60	1.75	1.20	1.21	6.46	9.29	156.8	1213	4184	3.45	\$0.605
4000	1.70	0.60	2.0	1.20	1.38	6.88	8.72	156.8	1139	4184	3.67	\$0.626
4500	1.70	0.60	2.25	1.20	1.55	7.3	8.22	156.8	1074	4184	3.90	\$0.647
5000	1.70	0.60	2.5	1.20	1.72	7.72	7.77	156.8	1015	4184	4.12	\$0.667
5500	1.70	0.60	2.75	1.20	1.89	8.14	7.37	156.8	962	4184	4.35	\$0.688
6000	1.70	0.60	3.0	1.20	2.07	8.57	7.0	156.8	914	4184	4.58	\$0.710
6500	1.70	0.60	3.25	1.20	2.24	8.99	6.67	156.8	871	4184	4.80	\$0.730
7000	1.70	0.60	3.5	1.20	2.41	9.41	6.3	156.8	833	4184	5.02	\$0.750

Operating Costs = ((# Trucks x (Truck costs + Labor costs)) + Total Fleet costs)/Shovel Productivity

Appendix D (Continued)
Calculations for Moving Materials With a 58 CY Electric Cable Shovel and Caterpillar 240T (793F) Trucks

Material Movement By Shovel-Truck Combination

Case #2: 5% Resisting Grade			Loaded (5% grade + 4% rolling = 9% total resistance)					Empty (-5% grade + 4% rolling = -1% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Shovel Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	1.70	0.60	0.56	1.20	0.17	4.23	14.18	156.8	1853	4184	2.26	\$0.495
1000	1.70	0.60	1.12	1.20	0.34	4.96	12.1	156.8	1580	4184	2.65	\$0.531
1500	1.70	0.60	1.68	1.20	0.5	5.68	10.5	156.8	1380	4184	3.03	\$0.566
2000	1.70	0.60	2.24	1.20	0.67	6.41	9.36	156.8	1223	4184	3.42	\$0.602
2500	1.70	0.60	2.8	1.20	0.84	7.14	8.40	156.8	1098	4184	3.81	\$0.638
3000	1.70	0.60	3.36	1.20	1.01	7.87	7.62	156.8	996	4184	4.20	\$0.675
3500	1.70	0.60	3.93	1.20	1.18	8.61	6.97	156.8	910	4184	4.60	\$0.712
4000	1.70	0.60	4.49	1.20	1.34	9.33	6.43	156.8	840	4184	4.98	\$0.747
4500	1.70	0.60	5.05	1.20	1.51	10.06	5.96	156.8	779	4184	5.37	\$0.783
5000	1.70	0.60	5.61	1.20	1.68	10.79	5.56	156.8	726	4184	5.76	\$0.819
5500	1.70	0.60	6.17	1.20	1.85	11.52	5.21	156.8	680	4184	6.15	\$0.855
6000	1.70	0.60	6.73	1.20	2.01	12.24	4.90	156.8	640	4184	6.54	\$0.891
6500	1.70	0.60	7.29	1.20	2.18	12.97	4.62	156.8	604	4184	6.93	\$0.927
7000	1.70	0.60	7.85	1.20	2.35	13.7	4.38	156.8	572	4184	7.31	\$0.962

Case #3: 5% Assisting Grade			Loaded (-5% grade + 4% rolling = -1% total resistance)					Empty (5% grade + 4% = 9% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Shovel Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	1.70	0.60	0.17	1.20	0.23	3.9	15.38	156.8	2009	4184	2.08	\$0.478
1000	1.70	0.60	0.34	1.20	0.45	4.29	13.99	156.8	1827	4184	2.29	\$0.498
1500	1.70	0.60	0.5	1.20	0.68	4.68	12.82	156.8	1675	4184	2.50	\$0.517
2000	1.70	0.60	0.67	1.20	0.9	5.07	11.83	156.8	1546	4184	2.71	\$0.537
2500	1.70	0.60	0.84	1.20	1.13	5.47	10.97	156.8	1433	4184	2.92	\$0.556
3000	1.70	0.60	1.01	1.20	1.35	5.86	10.24	156.8	1337	4184	3.13	\$0.576
3500	1.70	0.60	1.18	1.20	1.58	6.26	9.58	156.8	1252	4184	3.34	\$0.595
4000	1.70	0.60	1.34	1.20	1.8	6.64	9.04	156.8	1180	4184	3.55	\$0.614
4500	1.70	0.60	1.51	1.20	2.03	7.04	8.52	156.8	1113	4184	3.76	\$0.634
5000	1.70	0.60	1.68	1.20	2.25	7.43	8.06	156.8	1055	4184	3.97	\$0.653
5500	1.70	0.60	1.85	1.20	2.48	7.83	7.66	156.8	1001	4184	4.18	\$0.673
6000	1.70	0.60	2.01	1.20	2.7	8.21	7.31	156.8	955	4184	4.38	\$0.691
6500	1.70	0.60	2.18	1.20	2.93	8.61	6.97	156.8	910	4184	4.60	\$0.712
7000	1.70	0.60	2.35	1.20	3.15	9.00	6.67	156.8	871	4184	4.80	\$0.730

Appendix D1
Calculations for Moving Materials With an 80 CY Electric Cable Shovel and Caterpillar 380T (797F) Trucks

NOTE: THESE COSTS ARE FOR EXCAVATION ONLY. MATERIAL REQUIRING BLASTING SHOULD HAVE AN ADDITIONAL \$0.19/BCY ADDED FOR DRILLING AND BLASTING COSTS.

Material Movement By Shovel-Truck Combination

1) 80 CY Shovel	80.0 LCY Heaped	
2) Caterpillar 797F - 360-Ton End Dumps	316.3 LCY/275.8 BCY	
3) Material Density	2,850.0 LB/BCY	CPH 40
4) Operating Efficiency Factor	0.83	CPH 40
5) Rolling Resistance Factor	4.00 %	CPH 40
6) 80 CY Shovel Operating Costs (No Ownership Cost)	\$366.76	70% of IM
7) 797F Lease + Operating Costs	\$576.89	70% of IM
8) Labor Costs	See Pg. 1	
9) - of 1 - 14,000 Gal. Water Truck + 1 Operator	\$87.83 Per Hour	- of 70% E-W + Operator
10) 1 - 24H Blade + 1 Operator	\$195.22 Per Hour	IM
11) 1 - D9T + 1 Operator	\$179.61 Per Hour	70% E-W + Operator
12) 1 854G Rubber Tired Dozer + 1 Operator	\$284.55 Per Hour	70% E-W + Operator
13) Supervision Labor Costs	\$27.06 Per Hour	- of Hourly Rate
14) Supervisor Transportation	<u>\$7.43 Per Hour</u>	- of 70% E-W
15) Total Fleet Hourly Costs (Except Trucks)	\$1,197.57 Per Hour	

TO USE TABLE: Locate your approximate grade by reference to case number. Determine cost per BCY by using distance column that approximates your distance. No calculations are necessary.

Case #1: Level Ground		Loaded (0% grade + 4% rolling = 4% total resistance)						Empty (0% grade + 4% = 4% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Shovel Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	2.00	0.60	0.26	1.20	0.14	4.2	14.29	275.8	3282	5865	1.79	\$0.393
1000	2.00	0.60	0.52	1.20	0.27	4.59	13.07	275.8	3003	5865	1.95	\$0.410
1500	2.00	0.60	0.79	1.20	0.41	5.0	12.0	275.8	2757	5865	2.13	\$0.429
2000	2.00	0.60	1.05	1.20	0.55	5.4	11.11	275.8	2553	5865	2.30	\$0.447
2500	2.00	0.60	1.31	1.20	0.69	5.8	10.34	275.8	2377	5865	2.47	\$0.465
3000	2.00	0.60	1.57	1.20	0.82	6.19	9.69	275.8	2227	5865	2.63	\$0.482
3500	2.00	0.60	1.84	1.20	0.96	6.6	9.09	275.8	2089	5865	2.81	\$0.501
4000	2.00	0.60	2.1	1.20	1.1	7.0	8.57	275.8	1969	5865	2.98	\$0.519
4500	2.00	0.60	2.36	1.20	1.23	7.39	8.12	275.8	1865	5865	3.14	\$0.536
5000	2.00	0.60	2.62	1.20	1.37	7.79	7.70	275.8	1770	5865	3.31	\$0.554
5500	2.00	0.60	2.88	1.20	1.51	8.19	7.33	275.8	1683	5865	3.48	\$0.572
6000	2.00	0.60	3.15	1.20	1.65	8.6	6.98	275.8	1603	5865	3.66	\$0.591
6500	2.00	0.60	3.41	1.20	1.78	8.99	6.67	275.8	1533	5865	3.83	\$0.609
7000	2.00	0.60	3.67	1.20	1.92	9.39	6.39	275.8	1468	5865	4.00	\$0.627

Operating Costs = (((# Trucks x (Truck costs + Labor costs)) + Total Fleet costs)/Shovel Productivity)

Appendix D1 (Continued)
Calculations for Moving Materials With an 80 CY Electric Cable Shovel and Caterpillar 360T (797F) Trucks

Material Movement By Shovel-Truck Combination

Case #2: 5% Resisting Grade			Loaded (5% grade + 4% rolling = 9% total resistance)					Empty (-5% grade + 4% rolling = -1% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Shovel Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	2.00	0.60	0.57	1.20	0.13	4.5	13.33	275.8	3063	5865	1.91	\$0.406
1000	2.00	0.60	1.13	1.20	0.27	5.2	11.54	275.8	2651	5865	2.21	\$0.438
1500	2.00	0.60	1.7	1.20	0.4	5.9	10.17	275.8	2336	5865	2.51	\$0.470
2000	2.00	0.60	2.26	1.20	0.54	6.6	9.09	275.8	2089	5865	2.81	\$0.501
2500	2.00	0.60	2.83	1.20	0.67	7.3	8.22	275.8	1888	5865	3.11	\$0.533
3000	2.00	0.60	3.39	1.20	0.81	8.0	7.5	275.8	1723	5865	3.40	\$0.564
3500	2.00	0.60	3.96	1.20	0.94	8.7	6.90	275.8	1584	5865	3.70	\$0.595
4000	2.00	0.60	4.52	1.20	1.07	9.39	6.39	275.8	1468	5865	4.00	\$0.627
4500	2.00	0.60	5.09	1.20	1.21	10.1	5.94	275.8	1365	5865	4.30	\$0.659
5000	2.00	0.60	5.65	1.20	1.34	10.79	5.56	275.8	1278	5865	4.59	\$0.689
5500	2.00	0.60	6.22	1.20	1.48	11.5	5.22	275.8	1199	5865	4.89	\$0.721
6000	2.00	0.60	6.78	1.20	1.61	12.19	4.92	275.8	1131	5865	5.19	\$0.753
6500	2.00	0.60	7.35	1.20	1.75	12.9	4.65	275.8	1069	5865	5.49	\$0.784
7000	2.00	0.60	7.91	1.20	1.88	13.59	4.42	275.8	1014	5865	5.78	\$0.815

Case #3: 5% Assisting Grade			Loaded (-5% grade + 4% rolling = -1% total resistance)					Empty (5% grade + 4% = 9% total)				
One-Way Distance (Ft.)	Load Time (Min.)	Maneuver Time (Min.)	Travel Time Loaded (Min.)	Dump Time (Min.)	Travel Time Empty (Min.)	Total Cycle Time (Min.)	Trips Per Hour	Payload (BCY)	Adjusted Truck Productivity (BCY/Hr)	Adjusted Shovel Productivity (BCY/Hr)	Number of Trucks Required	Operating Costs (\$/BCY)
500	2.00	0.60	0.14	1.20	0.24	4.18	14.35	275.8	3298	5865	1.78	\$0.392
1000	2.00	0.60	0.27	1.20	0.47	4.54	13.22	275.8	3036	5865	1.93	\$0.408
1500	2.00	0.60	0.41	1.20	0.71	4.92	12.20	275.8	2802	5865	2.09	\$0.425
2000	2.00	0.60	0.54	1.20	0.94	5.28	11.36	275.8	2611	5865	2.25	\$0.442
2500	2.00	0.60	0.68	1.20	1.18	5.66	10.6	275.8	2435	5865	2.41	\$0.459
3000	2.00	0.60	0.81	1.20	1.41	6.02	9.97	275.8	2290	5865	2.56	\$0.475
3500	2.00	0.60	0.95	1.20	1.65	6.4	9.38	275.8	2154	5865	2.72	\$0.492
4000	2.00	0.60	1.09	1.20	1.88	6.77	8.86	275.8	2036	5865	2.88	\$0.509
4500	2.00	0.60	1.22	1.20	2.12	7.14	8.4	275.8	1930	5865	3.04	\$0.526
5000	2.00	0.60	1.36	1.20	2.35	7.51	7.99	275.8	1835	5865	3.20	\$0.542
5500	2.00	0.60	1.49	1.20	2.59	7.88	7.61	275.8	1749	5865	3.35	\$0.558
6000	2.00	0.60	1.63	1.20	2.82	8.25	7.27	275.8	1671	5865	3.51	\$0.575
6500	2.00	0.60	1.76	1.20	3.06	8.62	6.96	275.8	1599	5865	3.67	\$0.592
7000	2.00	0.60	1.90	1.20	3.29	8.99	6.67	275.8	1533	5865	3.83	\$0.609

Appendix E
Calculations for Moving Material With a Caterpillar D9T Dozer

These costs are for dozing only. Material requiring drilling and blasting should have an additional \$0.19/BCY added for D&B. If cast blasting will be used the D&B cost should be \$0.25/BCY.

Material Movement By Dozing

1) Caterpillar D9T Dozer With U Blade		
2) Operating Costs	\$135.04 Per Hour	70% of E-W
3) Labor Costs	\$44.57 Per Hour	see Page 1
4) Supervisor Labor Costs	\$6.76 Per Hour	1/8 of Hourly Rate
5) Supervisor Transportation	<u>\$1.86 Per Hour</u>	1/8 of 70% E-W
6) Total Hourly Costs	\$188.23 Per Hour	

TO USE TABLE: Locate your approximate grade by referencing "Grade" column. Determine cost per LCY by using the distance that best approximates your distance.

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors ¹				Grade (0%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	2200	1.0	1.0	0.90	0.83	1.00	1649	\$0.114
100	1300	1.0	1.0	0.90	0.83	1.00	975	\$0.193
150	1000	1.0	1.0	0.90	0.83	1.00	750	\$0.251
200	750	1.0	1.0	0.90	0.83	1.00	562	\$0.335
250	570	1.0	1.0	0.90	0.83	1.00	427	\$0.441
300	480	1.0	1.0	0.90	0.83	1.00	360	\$0.523
350	390	1.0	1.0	0.90	0.83	1.00	292	\$0.645
400	330	1.0	1.0	0.90	0.83	1.00	247	\$0.762
450	290	1.0	1.0	0.90	0.83	1.00	217	\$0.867
500	250	1.0	1.0	0.90	0.83	1.00	187	\$1.007

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors ¹				Grade (-10%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	2200	1.0	1.0	0.90	0.83	1.20	1979	\$0.095
100	1300	1.0	1.0	0.90	0.83	1.20	1170	\$0.161
150	1000	1.0	1.0	0.90	0.83	1.20	900	\$0.209
200	750	1.0	1.0	0.90	0.83	1.20	675	\$0.279
250	570	1.0	1.0	0.90	0.83	1.20	513	\$0.367
300	480	1.0	1.0	0.90	0.83	1.20	432	\$0.436
350	390	1.0	1.0	0.90	0.83	1.20	351	\$0.536
400	330	1.0	1.0	0.90	0.83	1.20	297	\$0.634
450	290	1.0	1.0	0.90	0.83	1.20	261	\$0.721
500	250	1.0	1.0	0.90	0.83	1.20	225	\$0.837

¹ Job Correction Factors:

Operator	Excellent	= 1.00
Material	Good	= 1.00
Visibility	Fair	= 0.90
Efficiency	50 min/hr	= 0.83

Appendix E (Continued)
Calculations for Moving Material With a Caterpillar D9T Dozer

These costs are for dozing only. Material requiring drilling and blasting should have an additional \$0.19/BCY added for D&B. If cast blasting will be used the D&B cost should be \$0.25/BCY.

Material Movement By Dozing

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors ¹				Grade (-20%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	2200	1.0	1.0	0.90	0.83	1.40	2309	\$0.082
100	1300	1.0	1.0	0.90	0.83	1.40	1365	\$0.138
150	1000	1.0	1.0	0.90	0.83	1.40	1050	\$0.179
200	750	1.0	1.0	0.90	0.83	1.40	787	\$0.239
250	570	1.0	1.0	0.90	0.83	1.40	599	\$0.314
300	480	1.0	1.0	0.90	0.83	1.40	504	\$0.374
350	390	1.0	1.0	0.90	0.83	1.40	409	\$0.460
400	330	1.0	1.0	0.90	0.83	1.40	346	\$0.544
450	290	1.0	1.0	0.90	0.83	1.40	304	\$0.619
500	250	1.0	1.0	0.90	0.83	1.40	262	\$0.718

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors ¹				Grade (10%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	2200	1.0	1.0	0.90	0.83	0.75	1237	\$0.152
100	1300	1.0	1.0	0.90	0.83	0.75	731	\$0.258
150	1000	1.0	1.0	0.90	0.83	0.75	562	\$0.335
200	750	1.0	1.0	0.90	0.83	0.75	422	\$0.446
250	570	1.0	1.0	0.90	0.83	0.75	321	\$0.586
300	480	1.0	1.0	0.90	0.83	0.75	270	\$0.697
350	390	1.0	1.0	0.90	0.83	0.75	219	\$0.860
400	330	1.0	1.0	0.90	0.83	0.75	186	\$1.012
450	290	1.0	1.0	0.90	0.83	0.75	163	\$1.155
500	250	1.0	1.0	0.90	0.83	0.75	141	\$1.335

¹ Job Correction Factors:

Operator	Excellent	= 1.00
Material	Good	= 1.00
Visibility	Fair	= 0.90
Efficiency	50 min/hr	= 0.83

Appendix F

Calculations For Moving Material With a Caterpillar D11T Dozer

These costs are for dozing only. Material requiring drilling and blasting should have an additional \$0.19/BCY added for D&B. If cast blasting will be used the D&B cost should be \$0.25/BCY.

Material Movement By Dozing With D11T

1) Caterpillar D11R Dozer With U Blade		
2) Operating Costs	\$294.40 Per Hour	70% E-W
3) Labor Costs	\$44.57 Per Hour	see Page 1
4) Supervisor Labor Costs	\$6.76 Per Hour	1/8 of Hourly Rate
5) Supervisor Transportation	<u>\$1.86 Per Hour</u>	1/8 of 70% E-W
6) Total Hourly Costs	\$347.59 Per Hour	

TO USE TABLE: Locate your approximate grade by referencing "Grade" column. Determine cost per LCY by using the distance that best approximates your distance.

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors ¹				Grade (0%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	4500	1.0	1.0	0.90	0.83	1.00	3374	\$0.103
100	3000	1.0	1.0	0.90	0.83	1.00	2249	\$0.155
150	2000	1.0	1.0	0.90	0.83	1.00	1499	\$0.232
200	1550	1.0	1.0	0.90	0.83	1.00	1162	\$0.299
250	1250	1.0	1.0	0.90	0.83	1.00	937	\$0.371
300	1080	1.0	1.0	0.90	0.83	1.00	810	\$0.429
350	900	1.0	1.0	0.90	0.83	1.00	675	\$0.515
400	800	1.0	1.0	0.90	0.83	1.00	600	\$0.579
450	720	1.0	1.0	0.90	0.83	1.00	540	\$0.644
500	650	1.0	1.0	0.90	0.83	1.00	487	\$0.714

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors ¹				Grade (-10%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	4500	1.0	1.0	0.90	0.83	1.20	4048	\$0.086
100	3000	1.0	1.0	0.90	0.83	1.20	2699	\$0.129
150	2000	1.0	1.0	0.90	0.83	1.20	1799	\$0.193
200	1550	1.0	1.0	0.90	0.83	1.20	1394	\$0.249
250	1250	1.0	1.0	0.90	0.83	1.20	1125	\$0.309
300	1080	1.0	1.0	0.90	0.83	1.20	972	\$0.358
350	900	1.0	1.0	0.90	0.83	1.20	810	\$0.429
400	800	1.0	1.0	0.90	0.83	1.20	720	\$0.483
450	720	1.0	1.0	0.90	0.83	1.20	648	\$0.536
500	650	1.0	1.0	0.90	0.83	1.20	585	\$0.594

¹ Job Correction Factors:

Operator	Excellent	= 1.00
Material	Good	= 1.00
Visibility	Fair	= 0.90
Efficiency	50 min/hr	= 0.83

Appendix F (Continued)
Calculations For Moving Material With a Caterpillar D11T Dozer

These costs are for dozing only. Material requiring drilling and blasting should have an additional \$0.19/BCY added for D&B. If cast blasting will be used the D&B cost should be \$0.25/BCY.

Material Movement By Dozing With D11T

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors ¹				Grade (-20%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	4500	1.0	1.0	0.90	0.83	1.40	4723	\$0.074
100	3000	1.0	1.0	0.90	0.83	1.40	3149	\$0.110
150	2000	1.0	1.0	0.90	0.83	1.40	2099	\$0.166
200	1550	1.0	1.0	0.90	0.83	1.40	1627	\$0.214
250	1250	1.0	1.0	0.90	0.83	1.40	1312	\$0.265
300	1080	1.0	1.0	0.90	0.83	1.40	1134	\$0.307
350	900	1.0	1.0	0.90	0.83	1.40	945	\$0.368
400	800	1.0	1.0	0.90	0.83	1.40	840	\$0.414
450	720	1.0	1.0	0.90	0.83	1.40	756	\$0.460
500	650	1.0	1.0	0.90	0.83	1.40	682	\$0.510

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors ¹				Grade (10%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	4500	1.0	1.0	0.90	0.83	0.75	2530	\$0.137
100	3000	1.0	1.0	0.90	0.83	0.75	1687	\$0.206
150	2000	1.0	1.0	0.90	0.83	0.75	1125	\$0.309
200	1550	1.0	1.0	0.90	0.83	0.75	872	\$0.399
250	1250	1.0	1.0	0.90	0.83	0.75	703	\$0.494
300	1080	1.0	1.0	0.90	0.83	0.75	607	\$0.573
350	900	1.0	1.0	0.90	0.83	0.75	506	\$0.687
400	800	1.0	1.0	0.90	0.83	0.75	450	\$0.772
450	720	1.0	1.0	0.90	0.83	0.75	405	\$0.858
500	650	1.0	1.0	0.90	0.83	0.75	365	\$0.952

¹ Job Correction Factors:

Operator	Excellent	= 1.00
Material	Good	= 1.00
Visibility	Fair	= 0.90
Efficiency	50 min/hr	= 0.83

Appendix F1

Calculations For Moving Material With a Caterpillar D11R Carry Dozer

These costs are for dozing only. Material requiring drilling and blasting should have an additional \$0.19/BCY added for D&B. If cast blasting will be used the D&B cost should be \$0.25/BCY.

Material Movement By Dozing With D11R-CD

1) Caterpillar D11R Carry Dozer		
2) Operating Costs	\$283.22 Per Hour	70% E-W
3) Labor Costs	\$44.57 Per Hour	see Page 1
4) Supervisor Labor Costs	\$6.76 Per Hour	1/8 of Hourly Rate
5) Supervisor Transportation	<u>\$1.86 Per Hour</u>	1/8 of 70% E-W
6) Total Hourly Costs	\$336.41 Per Hour	

TO USE TABLE: Locate your approximate grade by referencing "Grade" column. Determine cost per LCY by using the distance that best approximates your distance.

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors ¹				Grade (0%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	4300	1.0	1.0	0.90	0.83	1.00	3224	\$0.104
100	3000	1.0	1.0	0.90	0.83	1.00	2249	\$0.150
150	2200	1.0	1.0	0.90	0.83	1.00	1649	\$0.204
200	1700	1.0	1.0	0.90	0.83	1.00	1274	\$0.264
250	1350	1.0	1.0	0.90	0.83	1.00	1012	\$0.332
300	1180	1.0	1.0	0.90	0.83	1.00	885	\$0.380
350	1000	1.0	1.0	0.90	0.83	1.00	750	\$0.449
400	900	1.0	1.0	0.90	0.83	1.00	675	\$0.498
450	800	1.0	1.0	0.90	0.83	1.00	600	\$0.561
500	750	1.0	1.0	0.90	0.83	1.00	562	\$0.600

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors ¹				Grade (-10%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	4300	1.0	1.0	0.90	0.83	1.20	3868	\$0.087
100	3000	1.0	1.0	0.90	0.83	1.20	2699	\$0.125
150	2200	1.0	1.0	0.90	0.83	1.20	1979	\$0.170
200	1700	1.0	1.0	0.90	0.83	1.20	1529	\$0.220
250	1350	1.0	1.0	0.90	0.83	1.20	1215	\$0.277
300	1180	1.0	1.0	0.90	0.83	1.20	1062	\$0.317
350	1000	1.0	1.0	0.90	0.83	1.20	900	\$0.374
400	900	1.0	1.0	0.90	0.83	1.20	809	\$0.416
450	800	1.0	1.0	0.90	0.83	1.20	720	\$0.467
500	750	1.0	1.0	0.90	0.83	1.20	675	\$0.498

¹ Job Correction Factors:
 Operator Excellent = 1.00
 Material Good = 1.00
 Visibility Fair = 0.90
 Efficiency 50 min/hr = 0.83

Appendix F1 (Continued)
Calculations For Moving Material With a Caterpillar D11R Carry Dozer

These costs are for dozing only. Material requiring drilling and blasting should have an additional \$0.19/BCY added for D&B. If cast blasting will be used the D&B cost should be \$0.25/BCY.

Material Movement By Dozing With D11R-CD

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors ¹				Grade (-20%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	4300	1.0	1.0	0.90	0.83	1.40	4513	\$0.075
100	3000	1.0	1.0	0.90	0.83	1.40	3149	\$0.107
150	2200	1.0	1.0	0.90	0.83	1.40	2309	\$0.146
200	1700	1.0	1.0	0.90	0.83	1.40	1784	\$0.189
250	1350	1.0	1.0	0.90	0.83	1.40	1417	\$0.237
300	1180	1.0	1.0	0.90	0.83	1.40	1239	\$0.272
350	1000	1.0	1.0	0.90	0.83	1.40	1050	\$0.320
400	900	1.0	1.0	0.90	0.83	1.40	945	\$0.356
450	800	1.0	1.0	0.90	0.83	1.40	840	\$0.401
500	750	1.0	1.0	0.90	0.83	1.40	787	\$0.428

Distance (Ft.)	Productivity (LCY/Hr.)	Job Correction Factors ¹				Grade (10%)	Adjusted Productivity (LCY/Hr.)	Costs (\$/LCY)
		Operator	Material	Visibility	Efficiency			
50	4300	1.0	1.0	0.90	0.83	0.75	2418	\$0.139
100	3000	1.0	1.0	0.90	0.83	0.75	1687	\$0.199
150	2200	1.0	1.0	0.90	0.83	0.75	1237	\$0.272
200	1700	1.0	1.0	0.90	0.83	0.75	956	\$0.352
250	1350	1.0	1.0	0.90	0.83	0.75	759	\$0.443
300	1180	1.0	1.0	0.90	0.83	0.75	663	\$0.507
350	1000	1.0	1.0	0.90	0.83	0.75	562	\$0.599
400	900	1.0	1.0	0.90	0.83	0.75	506	\$0.665
450	800	1.0	1.0	0.90	0.83	0.75	450	\$0.748
500	750	1.0	1.0	0.90	0.83	0.75	422	\$0.798

¹ Job Correction Factors:

Operator	Excellent	= 1.00
Material	Good	= 1.00
Visibility	Fair	= 0.90
Efficiency	50 min/hr	= 0.83

Appendix G
Calculations for Final Grading With a Caterpillar 16M Motor Grader

Final Grading

	INPUT, UNIT AS INDICATED	COMMENT/ SOURCE
Caterpillar 16M Motor Grader		
Speed in Miles Per Hour (Second Gear)	3.3 Miles/Hour	CPH 40
Width of Grading Per Pass	8 Feet	CPH 40
Feet Per Mile	5,280 Feet	
Square Feet Per Acre	43,560 Sq. Ft.	
Operating Efficiency Factor 50 Min./Hr.	0.83	CPH 40
Operating Costs	\$93.61 Per Hour	70% of E-W
Labor Costs	\$43.36 Per Hour	See Page 1
Supervision Labor Costs	\$6.76 Per Hour	1/8 of Hourly Rate
Supervisor Transportation	\$1.86 Per Hour	1/8 of 70% of E-W
Total Hourly Costs	\$145.59	
Grading Rate		
$(3.3 \text{ Miles/Hour}) \times (5,280 \text{ Ft./Mile}) \times (8 \text{ Ft./Pass})$	139,392 Ft ² /Hour	
$(139,392 \text{ Ft}^2/\text{Hour}) / (43,560 \text{ Ft}^2/\text{Acre})$	3.2 Acres/Hour	
$(3.2 \text{ Acres/Hour}) \times (0.83 \text{ Efficiency Factor})$	2.66 Acres/Hour	
Operating Costs		
$(\$145.59/\text{Hour}) / (2.66 \text{ Acres/Hour})$	\$54.73 Per Acre	

Appendix H
 Cost Estimates for Handling Wire Fencing and Electrical Power Lines

FENCING		SOURCES
Construction 4-Strand Barbed	Overall Average - \$1.91/LF	Wyoming Highway Department Weighted Average Bid Prices, 2015
6' chain link with b/w top	\$17.10/LF	WYDOT 2015 Bid Prices
Removal	Overall Average - \$0.31/LF	Wyoming Highway Department, Average Bid Prices, 2015
	Power Line Removal	
Distribution Lines:	No Charge	From: Tri-County Electric
Transmission Lines:	No Charge	From: Tri-County Electric

Note: Cost estimates for power line removal are based on phone contact with Tri-County Electric. Distribution lines are owned by Tri-County Electric and would be removed upon request at no charge by Tri-County Electric. Transmission lines (lines which go from the main metering point to various electrical substations and are not owned by Tri-County Electric) would be removed by Tri-County Electric at no cost for their salvage value.

Appendix I
Cost Estimate for Ripping Asphalt Using a Caterpillar D9T Dozer

Asphalt Ripping (3"-4" Mat)

	INPUT, UNIT AS INDICATED	COMMENT/ SOURCE
Caterpillar D9T Dozer With 3 Shank Ripper		
Speed in Miles Per Hour	1 Mile/Hour	CPH 40
Width of Ripping Pass	3 Feet	CPH 40
Feet Per Mile	5,280 Feet	
Square Feet Per Acre	43,560 Sq. Ft.	
Operating Efficiency Factor 50 Min./Hr.	0.83	CPH 40
Operating Costs	\$135.04 Per Hour	70% of E-W
Labor Costs	\$44.57 Per Hour	See Page 1
Supervision Labor Costs	\$6.76 Per Hour	1/8 of Hourly Rate
Supervisor Transportation	\$1.86 Per Hour	1/8 of 70% of E-W
Total Hourly Costs	\$188.23	
Ripper Productivity		
(1.0 Mile/Hour)x(5,280 Ft./Mile)x(3 Ft./Pass)	15,840 Ft ² /Hour	
(15,840 Ft ² /Hour)/(43,560 Ft ² /Acre)	0.36 Acres/Hour	
(0.36 Acres/Hour)x(0.83 Efficiency Factor)	0.299 Acres/Hour	
Operating Costs		
(\$188.23/Hour)/(0.299 Acres/Hour)	\$629.53 Per Acre	

Appendix II
 Cost Estimate for Ripping Overburden Using a Caterpillar D10T Dozer

Overburden Ripping

	INPUT, UNIT AS INDICATED	COMMENT/ SOURCE
Caterpillar D10T Dozer With Single Shank Ripper		
Speed in Miles Per Hour	1 Mile/Hour	CPH 40
Width of Ripping Pass	3 Feet	CPH 40
Feet Per Mile	5,280 Feet	
Square Feet Per Acre	43,560 Sq. Ft.	
Operating Efficiency Factor 50 Min./Hr. (adjusted) ¹	0.75	CPH 40
Rip Depth	2 Feet	CPH 40
Operating Costs	\$168.55 Per Hour	70% of E-W
Labor Costs	\$44.57 Per Hour	See Page 1
Supervision Labor Costs	\$6.76 Per Hour	1/8 of Hourly Rate
Supervisor Transportation	\$1.86 Per Hour	1/8 of 70% of E-W
Total Hourly Costs	\$221.74	
Ripper Productivity		
(1.0 Mile/Hour)x(5,280 Ft./Mile)x(3 Ft./Pass)	15,840 Ft ² /Hour	
(15,840 Ft ² /Hour)/(43,560 Ft ² /Acre)	0.36 Acre/Hour	
(0.36 Acre/Hour)x(0.75 Efficiency Factor)	0.27 Acre/Hour	
Operating Costs		
(\$221.74/Hour)/(0.27 Acre/Hour)	\$821.26 Per Acre	

¹Note: A 75 percent Efficiency Factor was used to account for slowing, raising ripper, maneuvering and turn time.

Appendix J
Cost Estimate for Culvert Removal

Culvert Removal

	INPUT, UNIT AS INDICATED	COMMENT/ SOURCE
Average Length of CMP Section	20 Feet	
Assumed Culvert Diameter	48 Inches	
Time to Cut One Band	10 Minutes	
Time to Load One 20' Section (2 People)	20 Minutes	
Average Haul, Dump and Return Time	30 Minutes	
Number of Sections of CMP Per Load	2	
Operating Efficiency Factor 50 Min./Hr.	0.83	
Labor	\$43.00 Per Hour	See Page 1
Dump Truck (10-12 yd ³)	\$43.56 Per Hour	70% of E-W
Caterpillar 980G Front-End Loader	\$73.32 Per Hour	70% of E-W
Cost to Remove One 20' Section of CMP		
Labor Cost x Time to Cut One Band	\$7.17	
+ ((Labor Cost x 2) + FEL Cost) x Time to Load 1 Section	\$53.05	
+ (Labor Cost + Truck Cost) x Haul Time	\$43.28	
Cost to Remove One 20' Section of CMP (not including dirt removal)	\$103.50	

Note: Culverts may be smashed and buried in place when feasible.

Appendix K
 Cost Estimates for Demolition and Removal of Railroad Spurs and Facilities Buildings

TASK	COST PER UNIT (\$)	REGIONAL COST ADJUSTMENT ¹	ADJUSTED COST PER UNIT (\$)
Track Removal	9.34/lin. ft.	96.2%	8.99/lin. ft.
Ballast Removal	4.71/cy	96.2%	4.53/cy
Building Demolition and Disposal^{1, 2, 3}			
Mixture of Types	0.31/ft ³	96.2%	0.298/ft ³
Explosive Demolition, Concrete or Steel	0.30/ft ³	96.2%	0.289/ft ³
Disposal (Average)	10.50/cy	96.2%	10.10/cy
City Landfill Dump Charges	\$74.00/ton	96.2%	\$71.19/ton
Concrete Footings and Foundations			
6" Thick With Rebar	0.81sq. ft.	96.2%	0.779/sq. ft.
Footings - 2' Thick, 3' Wide	16.60/lin. ft.	96.2%	15.97/lin. ft.
Concrete Disposal On-Site	9.15/cy	96.2%	8.80/cy

Note: Operators may also provide a verifiable cost estimate from a qualified contractor for these demolition tasks. This estimate may be used for one to three consecutive years, assuming few substantial changes in mine facilities.

¹ Costs From: 2017 Means Heavy Construction Cost Data & Building Construction Cost Data

² Based on Total Volume of Building, does not include disposal cost

³ Based on Concrete Structures Volume Only, does not include disposal cost

Appendix L
Abandonment of Drill Holes and Wells

Drill Hole Abandonment Costs^{2,3}	Cost	Unit
Shallow dry holes (≤ 50 feet deep)	\$10.00	Hole
Shallow wet holes (≤ 50 feet deep)	\$50.00	Hole
Delineation holes (w/in 500' of the pit highwall)	\$50.00	Hole
Dry Exploration holes	\$2.00	Ft.
Wet Exploration holes (≤ 25 holes)	\$4.00	Ft.
Wet Exploration holes (> 25 holes)	\$3.00	Ft.
Artesian or Gassy Holes	\$10.00	Ft.
Well Abandonment Costs		
Monitor, production, and injection wells w/in an active ISR facility	\$2.50	Ft.
Scattered wells (≤ 25 wells)	\$4.00	Ft.
Scattered wells (> 25 wells)	\$3.00	Ft.
Artesian or Gassy Wells	\$10.00	Ft.
Incidental Costs		
Small site grading and seeding ($\leq 1,000$ ft ²)	\$50.00	Site
Large site / access road grading and seeding ⁴	\$3,000.00	Ac.
Capping using a pre-cast concrete cap	\$10.00	Each
Location fee	\$10.00	Hole
Remove pump, wiring, and drop pipe	\$0.40	Ft.
Removal and disposal of top few feet casing	\$30.00	Well
Monitoring well concrete pedestal disposal	\$100.00	Each
Mobilization ¹	\$1,000.00	Prj.

Notes

¹ Mobilization cost maybe adjusted upward due to the remoteness of the activity / project.

² Costs in the table do not include directional drilling. The applicant should contact the appropriate WYDEQ/LQD District office to reach agreement on an appropriate abandonment cost.

³ Costs assume a diameter of 5½ inches or less. For larger diameter holes the applicant should contact the appropriate WYDEQ/LQD District office to reach agreement on an appropriate abandonment cost.

⁴ Cost does not include reclamation of major cut and fill road construction. Calculation of these costs should be performed independently on a volumetric basis.

⁵ For Drilling Notifications and Coal Notifications a Contingency Fee of 22% shall be applied to the Reclamation Bond estimate.

⁶ Once subsurface reclamation is complete, the bonding level maybe reduced to the grading and seeding cost plus mobilization and contingency. If the revegetation is observed the first growing season, the surface reclamation bond can be reduced by 60% and held at this level until final bond release.

Appendix M
 Cost Estimate for Rough Grading Backfill Using
 Caterpillar D9R Dozer or Caterpillar 854G

ITEMS	CATERPILLAR D9T DOZER	CATERPILLAR 854G RUBBER TIRED DOZER	COMMENT/SOURCE
Speed in Miles Per Hour (First Gear)	2.0 Miles/Hour	4.0 Miles/Hour	CPH 40
Width of Dozer Pass	14 Feet	14 Feet	CPH 40
Feet Per Mile	5,280 Feet	5,280 Feet	
Square Feet Per Acre	43,560 Sq. Ft.	43,560 Sq. Ft.	
Operating Efficiency Factor 50 Min./Hr.	0.83	0.83	CPH 40
Operating Costs	\$135.04 Per Hour	\$239.98 Per Hour	70% of E-W
Labor Costs	\$44.57 Per Hour	\$44.57 Per Hour	See Page 1
Supervision Labor Costs	\$6.76 Per Hour	\$6.76 Per Hour	1/8 of Hourly Rate
Supervisor Transportation	\$1.86 Per Hour	\$1.86 Per Hour	1/8 of 70% of E-W
Total Hourly Costs	\$188.23	\$293.17	
SCARIFICATION RATE			
(2.0 Miles/Hour)x(5,280 Ft./Mile)x(14 Ft./Pass) ¹ (4.0 Miles/Hour)x(5,280 Ft./Mile)x(14 Ft./Pass) ²	147,840 Ft ² /Hour	295,680 Ft ² /Hour	
(147,890 Ft ² /Hour)/(43,560 Ft ² /Acre) ¹ (295,680 Ft ² /Hour)/(43,560 Ft ² /Acre) ²	3.39 Acres/Hour	6.79 Acres/Hour	
(3.39 Acres/Hour)x(0.83 Efficiency Factor) ¹ (6.79 Acres/Hour)x(0.83 Efficiency Factor) ²	2.82 Acres/Hour	5.66 Acres/Hour	
OPERATING COSTS			
(\$188.23/Hour)/(2.82 Acres/Hour) ¹ (\$293.17/Hour)/(5.66 Acres/Hour) ²	\$66.75 Per Acre	\$51.80 Per Acre	

¹ Caterpillar D9T Dozer

² Caterpillar 854G Rubber Tired Dozer

Appendix N
 Cost Estimates for Demolition and Removal of One "Standard" Surface Water Monitoring Station

	INPUT, UNIT AS INDICATED	COMMENT/ SOURCE
Assumed Time to Remove One Station	8 Hours	
Labor	\$43.00 Per Hour	See Page 1
Dump Truck (10-12 yd ³)	\$43.56 Per Hour	70% of E-W
Caterpillar 980H Front-End Loader	\$73.32 Per Hour	70% of E-W
Cost to Remove One Surface Water Station = (Labor Cost x Time to Remove Station)	\$344.00	
+ (Labor Cost + Truck Cost) x Time to Remove Station	\$692.48	
+ (Labor Cost + Loader Cost) x Time to Remove Station	\$930.56	
Cost to Remove One Surface Water Station =	\$1,967.04	

Appendix O
 Cost Estimates for Demolition and Removal of One
 "Standard" Meteorological or Air Quality Monitoring Site

	INPUT, UNIT AS INDICATED	COMMENT/ SOURCE
Assumed Time to Remove One Station	4 Hours	
Labor	\$43.00 Per Hour	See Page 1
Dump Truck (10-12 yd ³)	\$43.56 Per Hour	70% of E-W
Caterpillar 430D (4WD) Backhoe Loader	\$23.12 Per Hour	70% of E-W
Cost to Remove One Meteorological or Air Quality Station = (Labor Cost x Time to Remove Station)	\$172.00	
+ (Labor Cost + Truck Cost) x Time to Remove Station	\$346.24	
+ (Labor Cost + Loader Cost) x Time to Remove Station	\$264.48	
Cost to Remove One Meteorological or Air Quality Station =	\$782.72	

Appendix P
 Cost Estimate for Scarification of Compacted Surfaces with a Cat 16M

	INPUT, UNIT AS INDICATED	COMMENT/ SOURCE
CATERPILLAR 16M MOTOR GRADER		
Speed in Miles Per Hour (First Gear)	2.4 Miles/Hour	CPH 40
Width of Scarifying Pass	12 Feet	CPH 40
Feet Per Mile	5,280 Feet	
Square Feet Per Acre	43,560 Sq. Ft.	
Operating Efficiency Factor 50 Min./Hr.	0.83	CPH 40
Operating Costs	\$93.61 Per Hour	70% of E-W
Labor Costs	\$43.36 Per Hour	See Page 1
Supervision Labor Costs	\$6.76 Per Hour	1/8 of Hourly Rate
Supervisor Transportation	\$1.86 Per Hour	1/8 of 100% of E-W
Total Hourly Costs	\$145.59	
SCARIFICATION RATE		
$(2.4 \text{ Miles/Hour}) \times (5,280 \text{ Ft./Mile}) \times (12 \text{ Ft./Pass})$	152,064 Ft ² /Hour	
$(152,064 \text{ Ft}^2/\text{Hour}) / (43,560 \text{ Ft}^2/\text{Acre})$	3.49 Acres/Hour	
$(3.49 \text{ Acres/Hour}) \times (0.83 \text{ Efficiency Factor})$	2.90 Acres/Hour	
OPERATING COSTS		
$(\$145.59/\text{Hour}) / (2.90 \text{ Acres/Hour})$	\$50.20 Per Acre	

Appendix Q Revegetation Tasks and Costs

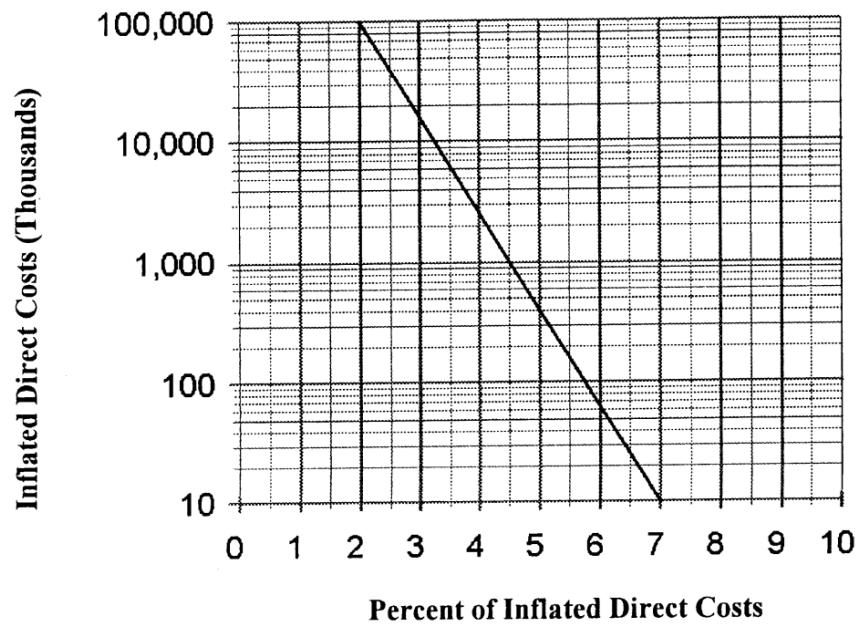
The permittee should fill in the cost per acre for each mine-specific Revegetation Activity as listed in the approved permit document. If a permittee does not use a specific Revegetation Activity, there should be no cost entry. The permittee should add these costs together to obtain a total cost per acre for revegetation. A flat estimate per acre for revegetation costs is not acceptable. The LQD may request verification of submitted revegetation costs (WS • 35-11-417(c)(i)).

General Revegetation Activity	Calculate According To Specific Permit Commitments
1) Seedbed Preparation	
Ripping	\$
Chisel Plowing	\$
Disking	\$
Harrowing or Cultipacking	\$
2) Drill Seed Stubble Mulch Mix	
Seed Costs	\$
Drill Seeding	\$
Mowing Prior to Planting Permanent Seed Mix	\$
3) Seeding Permanent Mixes: Detail for each seed mix, if different seed mixes will be applied. The costs/acre for each individual mix should then be proportioned on the basis of acreage per parcels to derive a single weighted average cost/acre.	
Drill Seeding	\$
Broadcast Seeding	\$
Seed Costs	\$
4) Mulching	
Mulch Purchase	\$
Hydromulch Application	\$
Straw Mulch Placement and Crimping	\$
5) Fertilizer	
Fertilizer Purchase by Defined Composition	\$
Application	\$
6) Fencing	
Construction	\$
Removal	\$
Subtotal	\$
7) Maintenance Operations at 10% of Total Revegetation Costs: This cost addresses standard husbandry practices applied over the minimum 10-year bonding period, such as remedial seeding, mowing, selective weed treatment, etc. The 10 percent figure is derived from historical operator experience for the Powder River Basin.	\$
Total Revegetation Cost Per Acre	\$

Appendix R
Reclamation Management Costs

Project Management Fee

Graph 2



Graphical extension of
Reference lines 010 000 016 0050 and 0300
From Means 1998 *Building Construction Cost Data*,
Copyright R.S. Means Co., Inc., Kingston, MA,
781-585-7880, all rights reserved.

Appendix S

Non-Coal Miscellaneous Costs

