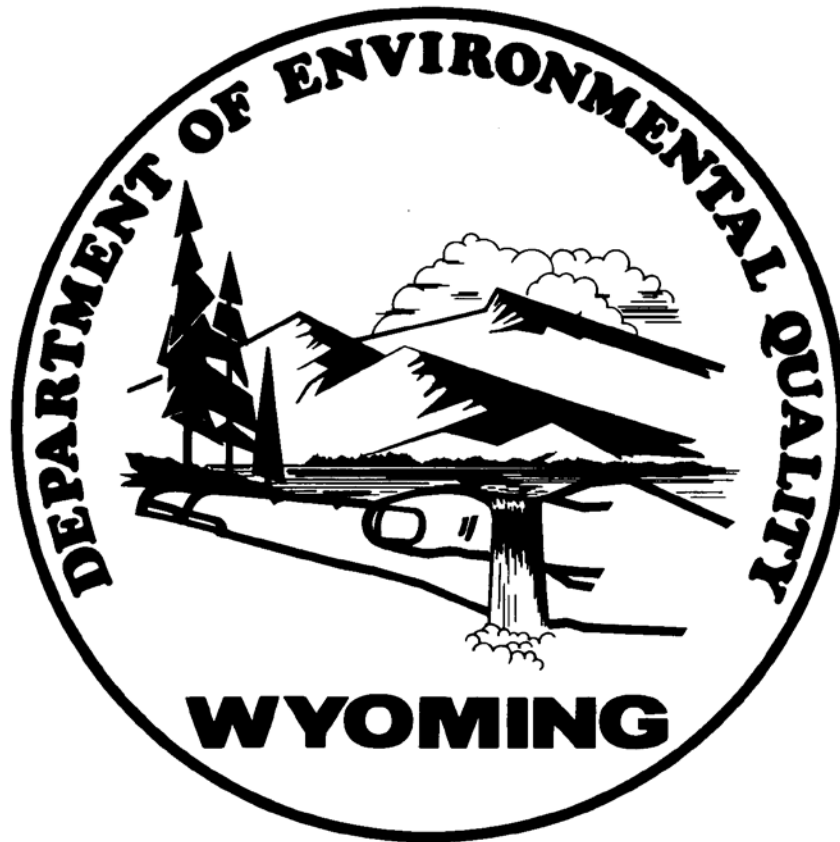


**DEPARTMENT OF ENVIRONMENTAL QUALITY
LAND QUALITY DIVISION**



GUIDELINE NO. 12

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

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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 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 are no longer regionally adjusted to 90% since actual costs in Wyoming no longer reflect that.

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 (2011). There was no adjustment factors used for these costs since they are based on actual costs at mining operations in the United States.

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 2011 State Building Construction Prevailing Wages (February 2011).

Supervision costs were determined by adding \$5.00 per hour to labor costs and also include the same percentage add-on for benefits that the labor costs had. 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.

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

Equipment Type	Equipment Name	100% Equipment Watch Book Cost (\$)	Date
Dozer	Caterpillar D9T (SU)	209.31	11/2011
Blade	Caterpillar 16M	146.21	11/2011
Scraper	Caterpillar 657G P-P	405.76	11/2011
Truck (95 ton)	Caterpillar 777F	306.57	11/2011
Loader (13.5 CY)	Caterpillar 992K	368.71	11/2011
Loader (5.25 CY)	Caterpillar 980H	116.22	11/2011
Dozer	Caterpillar D10T (SU)	272.70	11/2011
Dozer	Caterpillar D11R (U)	391.56	11/2011
Dozer	Caterpillar D11R-CD	366.06	11/2011
Backhoe Loader	Caterpillar 430E(4WD)	36.33	11/2011
Water Truck	14,000 Gallon	214.47	11/2011
Dump Truck	10-12 CY	77.62	11/2011
Pickup Truck	Crew 4x4 1T (Gas)	32.35	11/2011
Pickup Truck	Crew 4x4 1T (Diesel)	27.30	11/2011
Tractor	New Holland 545D 4WD 63 H.P.	16.08	11/2011
Towed Mower	Flail 7 ft	2.43	11/2011
Rubber Tired Dozer	Caterpillar 834G	159.73	11/2011
Scraper	Caterpillar 637G P-P	327.40	11/2011
Scraper	Caterpillar 651E	250.63	
Scraper	Caterpillar 627G P-P	243.15	
Blade	Caterpillar 140M	73.73	
Dozer	Caterpillar D6T-XL SU	92.40	

Caterpillar 24H blade: \$66.51/hr. to lease and \$159.38/hr. operating cost (from InfoMine USA, Inc.) for a total of \$225.89/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.

The \$15,183,000.00 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 \$15,183,000 (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.

Hourly Costs (WME)

<u>Overhaul Parts</u>	<u>Overhaul Labor</u>	<u>Maint. Parts</u>	<u>Maint. Labor</u>	<u>Power</u>	<u>Lube</u>	<u>Wear Parts</u>	<u>Total</u>
\$46.78	\$53.95	\$70.17	\$80.93	\$80.12	\$43.38	\$19.94	\$395.27

(Note: if mine uses an 80 CY shovel the purchase price will be \$20,428,000 & \$477.32/hr. w/o ownership cost)

Caterpillar 793D Trucks (240 Ton)

Purchase Price \$3,912,000 (InfoMine)

Monthly Lease (@600 hr./month) \$87,900.00

Hourly Lease Cost \$146.50

[Cat 797F Trucks (360T) @ \$171.88/hr. to lease & \$605.87/hr. operating cost = \$777.75/hr.]

Hourly Costs (WME)

<u>Overhaul Parts</u>	<u>Overhaul Labor</u>	<u>Maint. Parts</u>	<u>Maint. Labor</u>	<u>Fuel</u>	<u>Lube</u>	<u>Tires</u>	<u>Total</u>
\$12.42	\$12.28	\$23.07	\$22.80	\$189.09	\$30.14	\$90.59	\$380.39

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 (2011 Version)
IM -	InfoMine, USA, Inc. (2011 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 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 \$0.259/BCY when applicable. If the operator intends to cast blast some material then that should be calculated at \$0.400/BCY. Drill and blast costs in small mines and quarries are considerably higher and the cost should be figured at \$0.859/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 I1 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 should be at 85% of the productivity from the 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 reseeding.

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 reseeding 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 \$200,000 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 10 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 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 0.5 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 \$200,000 per year of project life would be adequate.
- g. LONG-TERM ADMINISTRATION AND ACCOUNTING COSTS: LQD and the WMA agreed to a range of \$250,000 to \$400,000 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.

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 4 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 \$0.259/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	\$306.57 Per Hour	100% of E-W
7) 992K Loader Operating Costs	\$368.71 Per Hour	100% of E-W
8) Labor Costs	\$40.92 Per Hour	WYDOT-WDD
9) 1/2 of 1 - 14,000 Gal. Water Trucks + 1 Operator	\$127.70 Per Hour	1/2 of 100% E-W
10) 1 - 16M Blade for Road Work + 1 Operator	\$187.13 Per Hour	100% E-W + Operator
11) 1 - D9T for Misc. Work + 1 Operator	\$250.23 Per Hour	100% E-W + Operator
12) Supervision Labor Costs	\$22.96 Per Hour	1/2 of WYDOT-WDD
13) Supervisor Transportation	<u>\$13.65 Per Hour</u>	1/2 of 100% E-W
14) Total Fleet Hourly Costs (Except Trucks)	\$1,011.30	

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	0.47	1.10	0.36	6.13	9.8	66	539	942	1.75	\$1.719
1000	3.50	0.70	0.78	1.10	0.56	6.64	9.0	66	495	942	1.90	\$1.774
1500	3.50	0.70	1.06	1.10	0.74	7.10	8.5	66	467	942	2.02	\$1.819
2000	3.50	0.70	1.34	1.10	0.90	7.54	8.0	66	440	942	2.15	\$1.867
2500	3.50	0.70	1.60	1.10	1.06	7.96	7.5	66	412	942	2.29	\$1.918
3000	3.50	0.70	1.86	1.10	1.22	8.38	7.2	66	396	942	2.38	\$1.952
3500	3.50	0.70	2.11	1.10	1.39	8.80	6.8	66	374	942	2.52	\$2.000
4000	3.50	0.70	2.37	1.10	1.55	9.22	6.5	66	357	942	2.64	\$2.047
4500	3.50	0.70	2.63	1.10	1.71	9.64	6.2	66	341	942	2.77	\$2.095
5000	3.50	0.70	2.89	1.10	1.88	10.07	6.0	66	330	942	2.86	\$2.129
5500	3.50	0.70	3.15	1.10	2.04	10.49	5.7	66	313	942	3.00	\$2.180
6000	3.50	0.70	3.41	1.10	2.21	10.92	5.5	66	302	942	3.12	\$2.225
6500	3.50	0.70	3.66	1.10	2.37	11.33	5.3	66	291	942	3.24	\$2.269
7000	3.50	0.70	3.92	1.10	2.53	11.75	5.1	66	280	942	3.36	\$2.313

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	0.38	1.10	0.41	6.09	9.9	66	544	942	1.73	\$1.712
1000	3.50	0.70	0.58	1.10	0.68	6.56	9.1	66	500	942	1.88	\$1.767
1500	3.50	0.70	0.74	1.10	0.94	6.98	8.6	66	473	942	1.99	\$1.808
2000	3.50	0.70	0.89	1.10	1.18	7.37	8.1	66	445	942	2.12	\$1.856
2500	3.50	0.70	1.05	1.10	1.43	7.78	7.7	66	423	942	2.23	\$1.896
3000	3.50	0.70	1.20	1.10	1.68	8.18	7.3	66	401	942	2.35	\$1.940
3500	3.50	0.70	1.35	1.10	1.92	8.57	7.0	66	385	942	2.45	\$1.977
4000	3.50	0.70	1.50	1.10	2.17	8.97	6.7	66	368	942	2.56	\$2.018
4500	3.50	0.70	1.66	1.10	2.42	9.38	6.4	66	352	942	2.68	2.062
5000	3.50	0.70	1.81	1.10	2.66	9.77	6.1	66	335	942	2.81	\$2.110
5500	3.50	0.70	1.96	1.10	2.91	10.17	5.9	66	324	942	2.91	\$2.147
6000	3.50	0.70	2.11	1.10	3.16	10.57	5.7	66	313	942	3.01	\$2.184
6500	3.50	0.70	2.27	1.10	3.40	10.97	5.5	66	302	942	3.12	\$2.225
7000	3.50	0.70	2.42	1.10	3.65	11.37	5.3	66	291	942	3.24	\$2.269

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	0.35	1.10	0.49	6.14	9.8	66	539	942	1.75	\$1.719
1000	3.50	0.70	0.52	1.10	0.90	6.72	8.9	66	489	942	1.93	\$1.786
1500	3.50	0.70	0.67	1.10	1.31	7.28	8.2	66	451	942	2.09	\$1.845
2000	3.50	0.70	0.82	1.10	1.72	7.84	7.7	66	423	942	2.23	\$1.896
2500	3.50	0.70	0.97	1.10	2.13	8.40	7.1	66	390	942	2.42	\$1.966
3000	3.50	0.70	1.13	1.10	2.54	8.97	6.7	66	368	942	2.56	\$2.018
3500	3.50	0.70	1.28	1.10	2.94	9.52	6.3	66	346	942	2.72	\$2.077
4000	3.50	0.70	1.43	1.10	3.35	10.08	6.0	66	330	942	2.85	\$2.125
4500	3.50	0.70	1.59	1.10	3.76	10.65	5.6	66	308	942	3.06	\$2.202
5000	3.50	0.70	1.74	1.10	4.17	11.21	5.4	66	297	942	3.17	\$2.243
5500	3.50	0.70	1.89	1.10	4.58	11.77	5.1	66	280	942	3.36	\$2.313
6000	3.50	0.70	2.04	1.10	4.99	12.33	4.9	66	269	942	3.50	\$2.365
6500	3.50	0.70	2.20	1.10	5.40	12.90	4.7	66	258	942	3.65	\$2.420
7000	3.50	0.70	2.35	1.10	5.80	13.45	4.5	66	247	942	3.81	\$2.479

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	0.66	1.10	0.33	6.29	9.5	66	522	942	1.80	\$1.738
1000	3.50	0.70	1.23	1.10	0.50	7.03	8.5	66	467	942	2.02	\$1.819
1500	3.50	0.70	1.81	1.10	0.65	7.76	7.7	66	423	942	2.23	\$1.896
2000	3.50	0.70	2.38	1.10	0.81	8.49	7.1	66	390	942	2.42	\$1.966
2500	3.50	0.70	2.95	1.10	0.96	9.21	6.5	66	357	942	2.64	\$2.047
3000	3.50	0.70	3.53	1.10	1.11	9.94	6.0	66	330	942	2.85	\$2.125
3500	3.50	0.70	4.10	1.10	1.26	10.66	5.6	66	308	942	3.06	\$2.202
4000	3.50	0.70	4.68	1.10	1.42	11.40	5.3	66	291	942	3.24	\$2.269
4500	3.50	0.70	5.25	1.10	1.57	12.12	5.0	66	275	942	3.43	\$2.339
5000	3.50	0.70	5.82	1.10	1.72	12.84	4.7	66	258	942	3.65	\$2.420
5500	3.50	0.70	6.40	1.10	1.87	13.57	4.4	66	242	942	3.89	\$2.509
6000	3.50	0.70	6.97	1.10	2.03	14.30	4.2	66	231	942	4.08	\$2.579
6500	3.50	0.70	7.54	1.10	2.18	15.02	4.0	66	220	942	4.28	\$2.652
7000	3.50	0.70	8.12	1.10	2.33	15.75	3.8	66	209	942	4.51	\$2.737

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	0.94	1.10	0.33	6.57	9.1	66	500	942	1.88	\$1.767
1000	3.50	0.70	1.83	1.10	0.49	7.62	7.9	66	434	942	2.17	\$1.874
1500	3.50	0.70	2.72	1.10	0.64	8.66	6.9	66	379	942	2.49	\$1.992
2000	3.50	0.70	3.60	1.10	0.79	9.69	6.2	66	341	942	2.76	\$2.092
2500	3.50	0.70	4.49	1.10	0.94	10.73	5.6	66	308	942	3.06	\$2.202
3000	3.50	0.70	5.38	1.10	1.10	11.78	5.1	66	280	942	3.36	\$2.313
3500	3.50	0.70	6.26	1.10	1.25	12.81	4.7	66	258	942	3.65	\$2.420
4000	3.50	0.70	7.15	1.10	1.40	13.85	4.3	66	236	942	3.99	\$2.545
4500	3.50	0.70	8.04	1.10	1.55	14.89	4.0	66	220	942	4.28	\$2.652
5000	3.50	0.70	8.94	1.10	1.71	15.94	3.8	66	209	942	4.51	\$2.737
5500	3.50	0.70	9.81	1.10	1.86	16.97	3.5	66	192	942	4.91	\$2.885
6000	3.50	0.70	10.70	1.10	2.01	18.01	3.3	66	181	942	5.20	\$2.992
6500	3.50	0.70	11.59	1.10	2.16	19.05	3.1	66	170	942	5.54	\$3.117
7000	3.50	0.70	12.48	1.10	2.32	20.10	3.0	66	165	942	5.71	\$3.180

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	\$405.76 Per Hour	100% E-W
7) Labor Costs	\$40.92 Per Hour	WYDOT-WDD
8) Supervision Labor Costs	\$5.74 Per Hour	1/8 of WYDOT-WDD
9) Supervisor Transportation	\$3.41 Per Hour	1/8 of 100% E-W
10) 1/8 of 1 - 14,000 Gal. Water Trucks + 1 Operator	\$31.92 Per Hour	1/8 of 100%E-W
11) 1/8 of 1 - 16M Blade for Road Work + 1 Operator	\$23.39 Per Hour	1/8 of 100% E-W
12) - - D9T for Ripping Ovb. and Misc. Work + 1 Operator	<u>\$125.12 Per Hour</u>	. of 100% E-W
13) Total Hourly Costs	\$636.26	

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	\$0.901
1000	1.10	0.68	0.60	0.57	2.95	20.3	35.0	0.83	593	\$1.073
1500	1.10	0.92	0.60	0.75	3.37	17.8	35.0	0.83	519	\$1.226
2000	1.10	1.15	0.60	0.92	3.77	15.9	35.0	0.83	464	\$1.371
2500	1.10	1.37	0.60	1.09	4.16	14.4	35.0	0.83	421	\$1.511
3000	1.10	1.59	0.60	1.26	4.55	13.2	35.0	0.83	385	\$1.653
3500	1.10	1.81	0.60	1.44	4.95	12.1	35.0	0.83	354	\$1.797
4000	1.10	2.02	0.60	1.61	5.33	11.3	35.0	0.83	328	\$1.940
4500	1.10	2.22	0.60	1.78	5.70	10.5	35.0	0.83	307	\$2.073
5000	1.10	2.43	0.60	1.95	6.08	9.9	35.0	0.83	288	\$2.209
5500	1.10	2.64	0.60	2.13	6.47	9.3	35.0	0.83	270	\$2.357
6000	1.10	2.85	0.60	2.30	6.85	8.8	35.0	0.83	255	\$2.495
6500	1.10	3.05	0.60	2.47	7.22	8.3	35.0	0.83	242	\$2.629
7000	1.10	3.26	0.60	2.64	7.60	7.9	35.0	0.83	230	\$2.766

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	\$0.901
1000	1.10	0.54	0.60	0.71	2.95	20.3	35.0	0.83	593	\$1.073
1500	1.10	0.71	0.60	0.98	3.39	17.7	35.0	0.83	516	\$1.233
2000	1.10	0.87	0.60	1.25	3.82	15.7	35.0	0.83	458	\$1.389
2500	1.10	1.03	0.60	1.51	4.24	14.2	35.0	0.83	413	\$1.541
3000	1.10	1.19	0.60	1.78	4.67	12.8	35.0	0.83	375	\$1.697
3500	1.10	1.36	0.60	2.05	5.11	11.7	35.0	0.83	342	\$1.860
4000	1.10	1.52	0.60	2.32	5.54	10.8	35.0	0.83	316	\$2.014
4500	1.10	1.68	0.60	2.59	5.97	10.1	35.0	0.83	293	\$2.172
5000	1.10	1.85	0.60	2.86	6.41	9.4	35.0	0.83	273	\$2.331
5500	1.10	2.01	0.60	3.12	6.83	8.8	35.0	0.83	256	\$2.485
6000	1.10	2.17	0.60	3.39	7.26	8.3	35.0	0.83	241	\$2.640
6500	1.10	2.33	0.60	3.66	7.69	7.8	35.0	0.83	228	\$2.791
7000	1.10	2.50	0.60	3.93	8.13	7.4	35.0	0.83	215	\$2.960

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	\$0.928
1000	1.10	0.51	0.60	0.96	3.17	18.9	35.0	0.83	552	\$1.153
1500	1.10	0.67	0.60	1.41	3.78	15.9	35.0	0.83	463	\$1.374
2000	1.10	0.83	0.60	1.85	4.38	13.7	35.0	0.83	400	\$1.591
2500	1.10	0.99	0.60	2.30	4.99	12.0	35.0	0.83	351	\$1.813
3000	1.10	1.16	0.60	2.74	5.60	10.7	35.0	0.83	313	\$2.033
3500	1.10	1.32	0.60	3.19	6.21	9.7	35.0	0.83	282	\$2.256
4000	1.10	1.48	0.60	3.63	6.81	8.8	35.0	0.83	257	\$2.476
4500	1.10	1.64	0.60	4.08	7.42	8.1	35.0	0.83	236	\$2.696
5000	1.10	1.81	0.60	4.52	8.03	7.5	35.0	0.83	218	\$2.919
5500	1.10	1.97	0.60	4.97	8.64	6.9	35.0	0.83	203	\$3.134
6000	1.10	2.13	0.60	5.41	9.24	6.5	35.0	0.83	189	\$3.367
6500	1.10	2.30	0.60	5.86	9.86	6.1	35.0	0.83	177	\$3.595
7000	1.10	2.46	0.60	6.30	10.46	5.7	35.0	0.83	167	\$3.810

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	\$0.938
1000	1.10	1.01	0.60	0.50	3.21	18.7	35.0	0.83	545	\$1.167
1500	1.10	1.46	0.60	0.66	3.82	15.7	35.0	0.83	458	\$1.390
2000	1.10	1.92	0.60	0.83	4.45	13.5	35.0	0.83	393	\$1.619
2500	1.10	2.38	0.60	0.99	5.07	11.8	35.0	0.83	345	\$1.844
3000	1.10	2.83	0.60	1.15	5.68	10.6	35.0	0.83	308	\$2.066
3500	1.10	3.29	0.60	1.31	6.30	9.5	35.0	0.83	278	\$2.289
4000	1.10	3.75	0.60	1.48	6.93	8.7	35.0	0.83	253	\$2.515
4500	1.10	4.21	0.60	1.64	7.55	7.9	35.0	0.83	232	\$2.743
5000	1.10	4.66	0.60	1.80	8.16	7.4	35.0	0.83	214	\$2.973
5500	1.10	5.12	0.60	1.96	8.78	6.8	35.0	0.83	199	\$3.197
6000	1.10	5.58	0.60	2.13	9.41	6.4	35.0	0.83	186	\$3.421
6500	1.10	6.04	0.60	2.29	10.03	6.0	35.0	0.83	174	\$3.657
7000	1.10	6.49	0.60	2.45	10.64	5.6	35.0	0.83	164	\$3.880

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	\$1.007
1000	1.10	1.43	0.60	0.49	3.62	16.6	35.0	0.83	483	\$1.317
1500	1.10	2.12	0.60	0.65	4.47	13.4	35.0	0.83	391	\$1.627
2000	1.10	2.81	0.60	0.81	5.32	11.3	35.0	0.83	329	\$1.934
2500	1.10	3.49	0.60	0.98	6.17	9.7	35.0	0.83	284	\$2.240
3000	1.10	4.18	0.60	1.14	7.02	8.5	35.0	0.83	249	\$2.555
3500	1.10	4.87	0.60	1.30	7.87	7.6	35.0	0.83	222	\$2.866
4000	1.10	5.56	0.60	1.46	8.72	6.9	35.0	0.83	201	\$3.166
4500	1.10	6.24	0.60	1.63	9.57	6.3	35.0	0.83	183	\$3.477
5000	1.10	6.93	0.60	1.79	10.42	5.8	35.0	0.83	168	\$3.787
5500	1.10	7.62	0.60	1.95	11.27	5.3	35.0	0.83	155	\$4.105
6000	1.10	8.31	0.60	2.12	12.13	4.9	35.0	0.83	144	\$4.419
6500	1.10	8.99	0.60	2.28	12.97	4.6	35.0	0.83	135	\$4.713
7000	1.10	9.68	0.60	2.44	13.82	4.3	35.0	0.83	127	\$5.010

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	\$327.40 Per Hour	100% E-W
7) Labor Costs	\$40.92 Per Hour	WYDOT-WDD
8) Supervision Labor Costs	\$5.74 Per Hour	1/8 of WYDOT-WDD
9) Supervisor Transportation	\$3.41 Per Hour	1/8 of 100% E-W
10) 1/8 of 1 - 14,000 Gal. Water Trucks + 1 Operator	\$31.92 Per Hour	1/8 of 100% E-W
11) 1/8 of 1 - 16M Blade for Road Work + 1 Operator	\$23.39 Per Hour	1/8 of 100% E-W
12) - - D9T for Ripping Ovb. and Misc. Work + 1 Operator	<u>\$125.12</u> Per Hour	. of 100% E-W
13) Total Hourly Costs	\$557.90	

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	\$1.067
1000	1.0	0.68	0.60	0.57	2.85	21.1	25.0	0.83	438	\$1.274
1500	1.0	0.92	0.60	0.75	3.27	18.4	25.0	0.83	382	\$1.461
2000	1.0	1.15	0.60	0.92	3.67	16.3	25.0	0.83	338	\$1.651
2500	1.0	1.37	0.60	1.09	4.06	14.8	25.0	0.83	307	\$1.817
3000	1.0	1.59	0.60	1.26	4.45	13.5	25.0	0.83	280	\$1.993
3500	1.0	1.81	0.60	1.44	4.85	12.4	25.0	0.83	257	\$2.171
4000	1.0	2.02	0.60	1.61	5.23	11.5	25.0	0.83	239	\$2.334
4500	1.0	2.22	0.60	1.78	5.60	10.7	25.0	0.83	222	\$2.513
5000	1.0	2.43	0.60	1.95	5.98	10.0	25.0	0.83	208	\$2.682
5500	1.0	2.64	0.60	2.13	6.37	9.4	25.0	0.83	195	\$2.861
6000	1.0	2.85	0.60	2.30	6.75	8.9	25.0	0.83	185	\$3.016
6500	1.0	3.05	0.60	2.47	7.12	8.4	25.0	0.83	174	\$3.207
7000	1.0	3.26	0.60	2.64	7.50	8.0	25.0	0.83	166	\$3.361

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	\$1.067
1000	1.0	0.54	0.60	0.71	2.85	21.0	25.0	0.83	436	\$1.280
1500	1.0	0.71	0.60	0.98	3.29	18.2	25.0	0.83	378	\$1.476
2000	1.0	0.87	0.60	1.25	3.72	16.1	25.0	0.83	334	\$1.670
2500	1.0	1.03	0.60	1.51	4.14	14.5	25.0	0.83	301	\$1.854
3000	1.0	1.19	0.60	1.78	4.57	13.1	25.0	0.83	272	\$2.051
3500	1.0	1.36	0.60	2.05	5.01	12.0	25.0	0.83	249	\$2.241
4000	1.0	1.52	0.60	2.32	5.44	11.0	25.0	0.83	228	\$2.447
4500	1.0	1.68	0.60	2.59	5.87	10.2	25.0	0.83	212	\$2.632
5000	1.0	1.85	0.60	2.86	6.31	9.5	25.0	0.83	197	\$2.832
5500	1.0	2.01	0.60	3.12	6.73	8.9	25.0	0.83	185	\$3.016
6000	1.0	2.17	0.60	3.39	7.16	8.4	25.0	0.83	174	\$3.206
6500	1.0	2.33	0.60	3.66	7.59	7.9	25.0	0.83	164	\$3.402
7000	1.0	2.50	0.60	3.93	8.03	7.5	25.0	0.83	156	\$3.576

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	\$1.098
1000	1.0	0.51	0.60	0.96	3.07	19.5	25.0	0.83	405	\$1.378
1500	1.0	0.67	0.60	1.41	3.68	16.3	25.0	0.83	338	\$1.651
2000	1.0	0.83	0.60	1.85	4.28	14.0	25.0	0.83	291	\$1.917
2500	1.0	0.99	0.60	2.30	4.89	12.3	25.0	0.83	255	\$2.188
3000	1.0	1.16	0.60	2.74	5.50	10.9	25.0	0.83	226	\$2.469
3500	1.0	1.32	0.60	3.19	6.11	9.8	25.0	0.83	203	\$2.748
4000	1.0	1.48	0.60	3.63	6.71	8.9	25.0	0.83	185	\$3.016
4500	1.0	1.64	0.60	4.08	7.32	8.2	25.0	0.83	170	\$3.282
5000	1.0	1.81	0.60	4.52	7.93	7.6	25.0	0.83	158	\$3.531
5500	1.0	1.97	0.60	4.97	8.54	7.0	25.0	0.83	145	\$3.848
6000	1.0	2.13	0.60	5.41	9.14	6.5	25.0	0.83	135	\$4.133
6500	1.0	2.30	0.60	5.86	9.76	6.2	25.0	0.83	129	\$4.325
7000	1.0	2.46	0.60	6.30	10.36	5.8	25.0	0.83	120	\$4.649

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	\$1.111
1000	1.0	1.01	0.60	0.50	3.11	19.3	25.0	0.83	400	\$1.395
1500	1.0	1.46	0.60	0.66	3.72	16.1	25.0	0.83	334	\$1.670
2000	1.0	1.92	0.60	0.83	4.35	13.8	25.0	0.83	286	\$1.951
2500	1.0	2.38	0.60	0.99	4.97	12.1	25.0	0.83	251	\$2.223
3000	1.0	2.83	0.60	1.15	5.58	10.8	25.0	0.83	224	\$2.491
3500	1.0	3.29	0.60	1.31	6.20	9.7	25.0	0.83	201	\$2.776
4000	1.0	3.75	0.60	1.48	6.83	8.8	25.0	0.83	183	\$3.049
4500	1.0	4.21	0.60	1.64	7.45	8.1	25.0	0.83	168	\$3.321
5000	1.0	4.66	0.60	1.80	8.06	7.4	25.0	0.83	154	\$3.623
5500	1.0	5.12	0.60	1.96	8.68	6.9	25.0	0.83	143	\$3.901
6000	1.0	5.58	0.60	2.13	9.31	6.4	25.0	0.83	133	\$4.195
6500	1.0	6.04	0.60	2.29	9.93	6.0	25.0	0.83	125	\$4.463
7000	1.0	6.49	0.60	2.45	10.54	5.7	25.0	0.83	118	\$4.728

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	\$1.195
1000	1.0	1.43	0.60	0.49	3.52	17.0	25.0	0.83	353	\$1.581
1500	1.0	2.12	0.60	0.65	4.37	13.7	25.0	0.83	284	\$1.964
2000	1.0	2.81	0.60	0.81	5.22	11.5	25.0	0.83	238	\$2.344
2500	1.0	3.49	0.60	0.98	6.07	9.9	25.0	0.83	205	\$2.722
3000	1.0	4.18	0.60	1.14	6.92	8.7	25.0	0.83	181	\$3.082
3500	1.0	4.87	0.60	1.30	7.77	7.7	25.0	0.83	160	\$3.487
4000	1.0	5.56	0.60	1.46	8.62	7.0	25.0	0.83	145	\$3.848
4500	1.0	6.24	0.60	1.63	9.47	6.3	25.0	0.83	131	\$4.259
5000	1.0	6.93	0.60	1.79	10.32	5.8	25.0	0.83	120	\$4.648
5500	1.0	7.62	0.60	1.95	11.17	5.4	25.0	0.83	112	\$4.981
6000	1.0	8.31	0.60	2.12	12.03	4.9	25.0	0.83	102	\$5.470
6500	1.0	8.99	0.60	2.28	12.87	4.7	25.0	0.83	98	\$5.693
7000	1.0	9.68	0.60	2.44	13.72	4.4	25.0	0.83	91	\$6.131

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 \$0.259/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)	\$395.27	IM
7) 793F Lease + Operating Costs	\$526.89	IM
8) Labor Costs	\$40.92 Per Hour	WYDOT-WDD
9) - of 1 - 14,000 Gal. Water Truck + 1 Operator	\$132.23 Per Hour	- of 100% E-W + Operator
10) 1 - 24H Blade + 1 Operator	\$266.81 Per Hour	IM
11) 1 - D9T + 1 Operator	\$250.23 Per Hour	100% E-W + Operator
12) 1 834G Rubber Tired Dozer + 1 Operator	\$200.65 Per Hour	100% E-W + Operator
13) Supervision Labor Costs	\$22.96 Per Hour	- of WYDOT-WDD
14) Supervisor Transportation	<u>\$13.65</u> Per Hour	- of 100% E-W
15) Total Fleet Hourly Costs (Except Trucks)	\$1,322.72 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	\$0.603
1000	1.70	0.60	0.5	1.20	0.35	4.35	13.8	156.8	1802	4184	2.32	\$0.631
1500	1.70	0.60	0.75	1.20	0.6	4.85	12.4	156.8	1620	4184	2.58	\$0.666
2000	1.70	0.60	1.0	1.20	0.7	5.20	11.5	156.8	1502	4184	2.79	\$0.695
2500	1.70	0.60	1.3	1.20	0.8	5.60	10.7	156.8	1398	4184	2.99	\$0.722
3000	1.70	0.60	1.5	1.20	1.0	6.0	10.0	156.8	1306	4184	3.20	\$0.750
3500	1.70	0.60	1.7	1.20	1.2	6.4	9.4	156.8	1228	4184	3.41	\$0.779
4000	1.70	0.60	2.0	1.20	1.4	6.9	8.7	156.8	1136	4184	3.68	\$0.816
4500	1.70	0.60	2.2	1.20	1.5	7.2	8.3	156.8	1084	4184	3.86	\$0.840
5000	1.70	0.60	2.5	1.20	1.7	7.7	7.8	156.8	1019	4184	4.11	\$0.874
5500	1.70	0.60	2.7	1.20	1.9	8.10	7.4	156.8	967	4184	4.33	\$0.904
6000	1.70	0.60	3.0	1.20	2.1	8.60	7.0	156.8	914	4184	4.58	\$0.938
6500	1.70	0.60	3.2	1.20	2.3	9.0	6.7	156.8	875	4184	4.78	\$0.965
7000	1.70	0.60	3.5	1.20	2.5	9.5	6.3	156.8	823	4184	5.08	\$1.006

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	0.5	1.20	0.2	4.2	14.3	156.8	1866	4184	2.24	\$0.620
1000	1.70	0.60	1.2	1.20	0.3	5.0	12.0	156.8	1567	4184	2.67	\$0.679
1500	1.70	0.60	1.8	1.20	0.5	5.8	10.3	156.8	1351	4184	3.10	\$0.737
2000	1.70	0.60	2.2	1.20	0.6	6.3	9.52	156.8	1244	4184	3.36	\$0.772
2500	1.70	0.60	2.7	1.20	0.8	7.0	8.57	156.8	1120	4184	3.74	\$0.824
3000	1.70	0.60	3.3	1.20	1.0	7.8	7.69	156.8	1005	4184	4.16	\$0.881
3500	1.70	0.60	3.8	1.20	1.1	8.4	7.14	156.8	933	4184	4.48	\$0.924
4000	1.70	0.60	4.4	1.20	1.2	9.1	6.59	156.8	861	4184	4.86	\$0.976
4500	1.70	0.60	5.0	1.20	1.3	9.8	6.12	156.8	800	4184	5.23	\$1.026
5000	1.70	0.60	5.6	1.20	1.5	10.6	5.66	156.8	739	4184	5.66	\$1.084
5500	1.70	0.60	6.1	1.20	1.7	11.3	5.31	156.8	694	4184	6.03	\$1.135
6000	1.70	0.60	6.9	1.20	1.9	12.3	4.88	156.8	637	4184	6.57	\$1.208
6500	1.70	0.60	7.3	1.20	2.0	12.8	4.69	156.8	612	4184	6.84	\$1.244
7000	1.70	0.60	7.8	1.20	2.2	13.5	4.44	156.8	581	4184	7.20	\$1.293

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	0.3	1.20	0.4	4.2	14.29	156.8	1866	4184	2.24	\$0.620
1000	1.70	0.60	0.4	1.20	0.5	4.4	13.64	156.8	1781	4184	2.35	\$0.635
1500	1.70	0.60	0.5	1.20	0.7	4.7	12.77	156.8	1667	4184	2.51	\$0.657
2000	1.70	0.60	0.7	1.20	0.9	5.1	11.76	156.8	1537	4184	2.72	\$0.685
2500	1.70	0.60	0.9	1.20	1.2	5.6	10.71	156.8	1399	4184	2.99	\$0.722
3000	1.70	0.60	1.0	1.20	1.4	5.9	10.17	156.8	1328	4184	3.15	\$0.744
3500	1.70	0.60	1.1	1.20	1.6	6.2	9.68	156.8	1264	4184	3.31	\$0.765
4000	1.70	0.60	1.2	1.20	1.8	6.5	9.23	156.8	1206	4184	3.47	\$0.787
4500	1.70	0.60	1.4	1.20	2.1	7.0	8.57	156.8	1120	4184	3.74	\$0.824
5000	1.70	0.60	1.6	1.20	2.3	7.4	8.11	156.8	1059	4184	3.95	\$0.852
5500	1.70	0.60	1.8	1.20	2.6	7.9	7.59	156.8	992	4184	4.22	\$0.889
6000	1.70	0.60	1.9	1.20	2.8	8.2	7.32	156.8	956	4184	4.38	\$0.911
6500	1.70	0.60	2.1	1.20	2.9	8.5	7.06	156.8	922	4184	4.54	\$0.932
7000	1.70	0.60	2.3	1.20	3.1	8.9	6.74	156.8	881	4184	4.75	\$0.961

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

NOTE: THESE COSTS ARE FOR EXCAVATION ONLY. MATERIAL REQUIRING BLASTING SHOULD HAVE AN ADDITIONAL \$0.259/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)	\$477.32	IM
7) 797B Lease + Operating Costs	\$777.75	IM
8) Labor Costs	\$40.92 Per Hour	WYDOT-WDD
9) - of 1 - 14,000 Gal. Water Truck + 1 Operator	\$132.23 Per Hour	- of 100% E-W + Operator
10) 1 - 24H Blade + 1 Operator	\$266.81 Per Hour	IM
11) 1 - D9T + 1 Operator	\$250.23 Per Hour	100% E-W + Operator
12) 1 834G Rubber Tired Dozer + 1 Operator	\$200.65 Per Hour	100% E-W + Operator
13) Supervision Labor Costs	\$22.96 Per Hour	- of WYDOT-WDD
14) Supervisor Transportation	<u>\$13.65</u> Per Hour	- of 100% E-W
15) Total Fleet Hourly Costs (Except Trucks)	\$1,404.77 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	0.4	1.20	0.2	4.4	13.64	275.8	3133	5865	1.87	\$0.501
1000	2.00	0.60	0.5	1.20	0.3	4.7	12.77	275.8	2933	5865	2.00	\$0.519
1500	2.00	0.60	0.8	1.20	0.5	5.1	11.76	275.8	2703	5865	2.17	\$0.542
2000	2.00	0.60	1.1	1.20	0.6	5.5	10.9	275.8	2506	5865	2.34	\$0.566
2500	2.00	0.60	1.4	1.20	0.7	5.9	10.17	275.8	2336	5865	2.51	\$0.590
3000	2.00	0.60	1.6	1.20	0.8	6.2	9.68	275.8	2223	5865	2.64	\$0.608
3500	2.00	0.60	1.8	1.20	1.0	6.6	9.09	275.8	2089	5865	2.81	\$0.632
4000	2.00	0.60	2.1	1.20	1.2	7.1	8.45	275.8	1941	5865	3.02	\$0.661
4500	2.00	0.60	2.4	1.20	1.3	7.5	8.0	275.8	1838	5865	3.19	\$0.685
5000	2.00	0.60	2.6	1.20	1.4	7.8	7.69	275.8	1767	5865	3.32	\$0.703
5500	2.00	0.60	2.8	1.20	1.5	8.1	7.41	275.8	1702	5865	3.45	\$0.722
6000	2.00	0.60	3.2	1.20	1.7	8.9	6.9	275.8	1584	5865	3.70	\$0.756
6500	2.00	0.60	3.4	1.20	1.9	9.1	6.59	275.8	1515	5865	3.87	\$0.780
7000	2.00	0.60	3.8	1.20	2.0	9.6	6.25	275.8	1436	5865	4.08	\$0.809

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	0.5	1.20	0.2	4.5	13.33	275.8	3063	5865	1.91	\$0.507
1000	2.00	0.60	1.0	1.20	0.3	5.1	11.76	275.8	2703	5865	2.17	\$0.542
1500	2.00	0.60	1.5	1.20	0.4	5.7	10.53	275.8	2418	5865	2.43	\$0.578
2000	2.00	0.60	2.2	1.20	0.5	6.5	9.23	275.8	2121	5865	2.77	\$0.626
2500	2.00	0.60	3.0	1.20	0.6	7.4	8.11	275.8	1863	5865	3.15	\$0.679
3000	2.00	0.60	3.3	1.20	0.8	7.9	7.59	275.8	1745	5865	3.36	\$0.709
3500	2.00	0.60	4.0	1.20	0.9	8.7	6.90	275.8	1584	5865	3.70	\$0.756
4000	2.00	0.60	4.5	1.20	1.1	9.4	6.38	275.8	1466	5865	4.00	\$0.798
4500	2.00	0.60	5.0	1.20	1.3	10.1	5.94	275.8	1365	5865	4.30	\$0.839
5000	2.00	0.60	5.5	1.20	1.4	10.7	5.61	275.8	1288	5865	4.55	\$0.875
5500	2.00	0.60	6.2	1.20	1.6	11.6	5.17	275.8	1188	5865	4.94	\$0.928
6000	2.00	0.60	6.8	1.20	1.7	12.3	4.88	275.8	1121	5865	5.23	\$0.970
6500	2.00	0.60	7.2	1.20	1.8	12.8	4.69	275.8	1077	5865	5.45	\$1.000
7000	2.00	0.60	7.8	1.20	2.0	13.6	4.41	275.8	1014	5865	5.79	\$1.047

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	0.2	1.20	0.3	4.3	13.95	275.8	3206	5865	1.83	\$0.495
1000	2.00	0.60	0.3	1.20	0.5	4.6	13.04	275.8	2997	5865	1.96	\$0.513
1500	2.00	0.60	0.4	1.20	0.8	5.0	12.00	275.8	2757	5865	2.13	\$0.537
2000	2.00	0.60	0.6	1.20	1.0	5.4	11.11	275.8	2553	5865	2.30	\$0.560
2500	2.00	0.60	0.7	1.20	1.2	5.7	10.53	275.8	2418	5865	2.43	\$0.578
3000	2.00	0.60	0.9	1.20	1.4	6.1	9.84	275.8	2260	5865	2.60	\$0.602
3500	2.00	0.60	1.0	1.20	1.7	6.5	9.23	275.8	2121	5865	2.77	\$0.626
4000	2.00	0.60	1.1	1.20	1.9	6.8	8.82	275.8	2027	5865	2.89	\$0.643
4500	2.00	0.60	1.3	1.20	2.2	7.3	8.22	275.8	1888	5865	3.11	\$0.673
5000	2.00	0.60	1.4	1.20	2.5	7.7	7.79	275.8	1790	5865	3.28	\$0.697
5500	2.00	0.60	1.6	1.20	2.6	8.0	7.50	275.8	1723	5865	3.40	\$0.715
6000	2.00	0.60	1.7	1.20	2.8	8.3	7.23	275.8	1661	5865	3.53	\$0.733
6500	2.00	0.60	1.8	1.20	3.0	8.6	6.98	275.8	1603	5865	3.66	\$0.750
7000	2.00	0.60	2.0	1.20	3.2	9.0	6.67	275.8	1532	5865	3.83	\$0.774

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 \$0.259/BCY added for D&B. If cast blasting will be used the D&B cost should be \$0.400/BCY.

Material Movement By Dozing

1) Caterpillar D9T Dozer With U Blade		
2) Operating Costs	\$209.31 Per Hour	100% ofE-W
3) Labor Costs	\$40.92 Per Hour	WYDOT-WDD
4) Supervisor Labor Costs	\$5.74 Per Hour	1/8 of WYDOT-WDD
5) Supervisor Transportation	<u>\$3.41 Per Hour</u>	1/8 of 100% E-W
6) Total Hourly Costs	\$259.38 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	\$0.157
100	1300	1.0	1.0	0.90	0.83	1.00	975	\$0.266
150	1000	1.0	1.0	0.90	0.83	1.00	750	\$0.346
200	750	1.0	1.0	0.90	0.83	1.00	562	\$0.461
250	570	1.0	1.0	0.90	0.83	1.00	427	\$0.607
300	480	1.0	1.0	0.90	0.83	1.00	360	\$0.721
350	390	1.0	1.0	0.90	0.83	1.00	292	\$0.887
400	330	1.0	1.0	0.90	0.83	1.00	247	\$1.048
450	290	1.0	1.0	0.90	0.83	1.00	217	\$1.193
500	250	1.0	1.0	0.90	0.83	1.00	187	\$1.384

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	\$0.131
100	1300	1.0	1.0	0.90	0.83	1.20	1170	\$0.222
150	1000	1.0	1.0	0.90	0.83	1.20	900	\$0.288
200	750	1.0	1.0	0.90	0.83	1.20	675	\$0.384
250	570	1.0	1.0	0.90	0.83	1.20	513	\$0.506
300	480	1.0	1.0	0.90	0.83	1.20	432	\$0.600
350	390	1.0	1.0	0.90	0.83	1.20	351	\$0.739
400	330	1.0	1.0	0.90	0.83	1.20	297	\$0.874
450	290	1.0	1.0	0.90	0.83	1.20	261	\$0.994
500	250	1.0	1.0	0.90	0.83	1.20	225	\$1.153

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 \$0.259BCY added for D&B. If cast blasting will be used the D&B cost should be \$0.400/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	\$0.112
100	1300	1.0	1.0	0.90	0.83	1.40	1365	\$0.190
150	1000	1.0	1.0	0.90	0.83	1.40	1050	\$0.247
200	750	1.0	1.0	0.90	0.83	1.40	787	\$0.330
250	570	1.0	1.0	0.90	0.83	1.40	599	\$0.433
300	480	1.0	1.0	0.90	0.83	1.40	504	\$0.515
350	390	1.0	1.0	0.90	0.83	1.40	409	\$0.634
400	330	1.0	1.0	0.90	0.83	1.40	346	\$0.749
450	290	1.0	1.0	0.90	0.83	1.40	304	\$0.852
500	250	1.0	1.0	0.90	0.83	1.40	262	\$0.990

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	\$0.210
100	1300	1.0	1.0	0.90	0.83	0.75	731	\$0.355
150	1000	1.0	1.0	0.90	0.83	0.75	562	\$0.461
200	750	1.0	1.0	0.90	0.83	0.75	422	\$0.615
250	570	1.0	1.0	0.90	0.83	0.75	321	\$0.808
300	480	1.0	1.0	0.90	0.83	0.75	270	\$0.961
350	390	1.0	1.0	0.90	0.83	0.75	219	\$1.183
400	330	1.0	1.0	0.90	0.83	0.75	186	\$1.400
450	290	1.0	1.0	0.90	0.83	0.75	163	\$1.591
500	250	1.0	1.0	0.90	0.83	0.75	141	\$1.845

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 D11R Dozer

These costs are for dozing only. Material requiring drilling and blasting should have an additional \$0.259BCY added for D&B. If cast blasting will be used the D&B cost should be \$0.400/BCY.

Material Movement By Dozing With D11R

1) Caterpillar D11R Dozer With U Blade		
2) Operating Costs	\$391.56 Per Hour	100% E-W
3) Labor Costs	\$40.92 Per Hour	WYDOT-WDD
4) Supervisor Labor Costs	\$5.74 Per Hour	1/8 of WYDOR-WDD
5) Supervisor Transportation	<u>\$3.41 Per Hour</u>	1/8 of 100% E-W
6) Total Hourly Costs	\$441.63 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	\$0.131
100	3000	1.0	1.0	0.90	0.83	1.00	2249	\$0.196
150	2000	1.0	1.0	0.90	0.83	1.00	1499	\$0.295
200	1550	1.0	1.0	0.90	0.83	1.00	1162	\$0.380
250	1250	1.0	1.0	0.90	0.83	1.00	937	\$0.471
300	1080	1.0	1.0	0.90	0.83	1.00	810	\$0.595
350	900	1.0	1.0	0.90	0.83	1.00	675	\$0.655
400	800	1.0	1.0	0.90	0.83	1.00	600	\$0.736
450	720	1.0	1.0	0.90	0.83	1.00	540	\$0.818
500	650	1.0	1.0	0.90	0.83	1.00	487	\$0.906

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	\$0.109
100	3000	1.0	1.0	0.90	0.83	1.20	2699	\$0.164
150	2000	1.0	1.0	0.90	0.83	1.20	1799	\$0.245
200	1550	1.0	1.0	0.90	0.83	1.20	1394	\$0.317
250	1250	1.0	1.0	0.90	0.83	1.20	1125	\$0.393
300	1080	1.0	1.0	0.90	0.83	1.20	972	\$0.455
350	900	1.0	1.0	0.90	0.83	1.20	810	\$0.545
400	800	1.0	1.0	0.90	0.83	1.20	720	\$0.614
450	720	1.0	1.0	0.90	0.83	1.20	648	\$0.682
500	650	1.0	1.0	0.90	0.83	1.20	585	\$0.755

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 D11R Dozer

These costs are for dozing only. Material requiring drilling and blasting should have an additional \$0.259/BCY added for D&B. If cast blasting will be used the D&B cost should be \$0.400/BCY.

Material Movement By Dozing With D11R

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	\$0.094
100	3000	1.0	1.0	0.90	0.83	1.40	3149	\$0.140
150	2000	1.0	1.0	0.90	0.83	1.40	2099	\$0.210
200	1550	1.0	1.0	0.90	0.83	1.40	1627	\$0.272
250	1250	1.0	1.0	0.90	0.83	1.40	1312	\$0.337
300	1080	1.0	1.0	0.90	0.83	1.40	1134	\$0.390
350	900	1.0	1.0	0.90	0.83	1.40	945	\$0.468
400	800	1.0	1.0	0.90	0.83	1.40	840	\$0.526
450	720	1.0	1.0	0.90	0.83	1.40	756	\$0.584
500	650	1.0	1.0	0.90	0.83	1.40	682	\$0.647

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	\$0.175
100	3000	1.0	1.0	0.90	0.83	0.75	1687	\$0.262
150	2000	1.0	1.0	0.90	0.83	0.75	1125	\$0.393
200	1550	1.0	1.0	0.90	0.83	0.75	872	\$0.507
250	1250	1.0	1.0	0.90	0.83	0.75	703	\$0.628
300	1080	1.0	1.0	0.90	0.83	0.75	607	\$0.727
350	900	1.0	1.0	0.90	0.83	0.75	506	\$0.873
400	800	1.0	1.0	0.90	0.83	0.75	450	\$0.982
450	720	1.0	1.0	0.90	0.83	0.75	405	\$1.090
500	650	1.0	1.0	0.90	0.83	0.75	365	\$1.208

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 \$0.259/BCY added for D&B. If cast blasting will be used the D&B cost should be \$0.400/BCY.

Material Movement By Dozing With D11R

1) Caterpillar D11R Carry Dozer		
2) Operating Costs	\$366.06 Per Hour	100% E-W
3) Labor Costs	\$40.92 Per Hour	WYDOT-WDD
4) Supervisor Labor Costs	\$5.74 Per Hour	1/8 of WYDOT-WDD
5) Supervisor Transportation	<u>\$3.41 Per Hour</u>	1/8 of 100% E-W
6) Total Hourly Costs	\$416.13 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	\$0.129
100	3000	1.0	1.0	0.90	0.83	1.00	2249	\$0.185
150	2200	1.0	1.0	0.90	0.83	1.00	1649	\$0.252
200	1700	1.0	1.0	0.90	0.83	1.00	1274	\$0.327
250	1350	1.0	1.0	0.90	0.83	1.00	1012	\$0.411
300	1180	1.0	1.0	0.90	0.83	1.00	885	\$0.470
350	1000	1.0	1.0	0.90	0.83	1.00	750	\$0.555
400	900	1.0	1.0	0.90	0.83	1.00	675	\$0.617
450	800	1.0	1.0	0.90	0.83	1.00	600	\$0.694
500	750	1.0	1.0	0.90	0.83	1.00	562	\$0.740

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	\$0.108
100	3000	1.0	1.0	0.90	0.83	1.20	2699	\$0.154
150	2200	1.0	1.0	0.90	0.83	1.20	1979	\$0.210
200	1700	1.0	1.0	0.90	0.83	1.20	1529	\$0.272
250	1350	1.0	1.0	0.90	0.83	1.20	1215	\$0.343
300	1180	1.0	1.0	0.90	0.83	1.20	1062	\$0.392
350	1000	1.0	1.0	0.90	0.83	1.20	900	\$0.463
400	900	1.0	1.0	0.90	0.83	1.20	809	\$0.514
450	800	1.0	1.0	0.90	0.83	1.20	720	\$0.578
500	750	1.0	1.0	0.90	0.83	1.20	675	\$0.617

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 \$0.259/BCY added for D&B. If cast blasting will be used the D&B cost should be \$0.400/BCY.

Material Movement By Dozing With D11R

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	\$0.092
100	3000	1.0	1.0	0.90	0.83	1.40	3149	\$0.132
150	2200	1.0	1.0	0.90	0.83	1.40	2309	\$0.180
200	1700	1.0	1.0	0.90	0.83	1.40	1784	\$0.233
250	1350	1.0	1.0	0.90	0.83	1.40	1417	\$0.294
300	1180	1.0	1.0	0.90	0.83	1.40	1239	\$0.336
350	1000	1.0	1.0	0.90	0.83	1.40	1050	\$0.397
400	900	1.0	1.0	0.90	0.83	1.40	945	\$0.441
450	800	1.0	1.0	0.90	0.83	1.40	840	\$0.496
500	750	1.0	1.0	0.90	0.83	1.40	787	\$0.529

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	\$0.172
100	3000	1.0	1.0	0.90	0.83	0.75	1687	\$0.247
150	2200	1.0	1.0	0.90	0.83	0.75	1237	\$0.336
200	1700	1.0	1.0	0.90	0.83	0.75	956	\$0.435
250	1350	1.0	1.0	0.90	0.83	0.75	759	\$0.548
300	1180	1.0	1.0	0.90	0.83	0.75	663	\$0.627
350	1000	1.0	1.0	0.90	0.83	0.75	562	\$0.740
400	900	1.0	1.0	0.90	0.83	0.75	506	\$0.822
450	800	1.0	1.0	0.90	0.83	0.75	450	\$0.925
500	750	1.0	1.0	0.90	0.83	0.75	422	\$0.987

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	\$146.21 Per Hour	100% of E-W
Labor Costs	\$40.92 Per Hour	WYDOT-WDD
Supervision Labor Costs	\$5.74 Per Hour	1/8 of WYDOT-WDD
Supervisor Transportation	\$3.41 Per Hour	1/8 of 100% of E-W
Total Hourly Costs	\$196.28	
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		
$(\$196.28/\text{Hour}) / (2.66 \text{ Acres/Hour})$	\$73.79 Per Acre	

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

FENCING		SOURCES
Construction 4-Strand Barbed	Overall Average - \$1.46/LF	Wyoming Highway Department Weighted Average Bid Prices, 2010
Removal	Overall Average - \$0.34/LF	Wyoming Highway Department, Average Bid Prices, 2010
	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	\$209.31 Per Hour	100% of E-W
Labor Costs	\$40.92 Per Hour	WYDOT-WDD
Supervision Labor Costs	\$5.74 Per Hour	1/8 of WYDOT-WDD
Supervisor Transportation	\$3.41 Per Hour	1/8 of 100% of E-W
Total Hourly Costs	\$259.38	
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		
(\$259.38/Hour)/(0.299 Acres/Hour)	\$867.49 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.	0.75 %	CPH 40
Rip Depth	2 Feet	CPH 40
Operating Costs	\$272.70 Per Hour	100% of E-W
Labor Costs	\$40.92 Per Hour	WYDOT-WDD
Supervision Labor Costs	\$5.74 Per Hour	1/8 of WYDOT-WDD
Supervisor Transportation	\$3.41 Per Hour	1/8 of 100% of E-W
Total Hourly Costs	\$322.77	
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		
(\$322.77/Hour)/(0.27 Acre/Hour)	\$1,195.44 Per Acre	

Note: 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	\$40.92 Per Hour	WYDOT-WDD
Dump Truck (10-12 yd ³)	\$77.62 Per Hour	100% of E-W
Caterpillar 980G Front-End Loader	\$116.22 Per Hour	100% of E-W
Cost to Remove One 20' Section of CMP		
Labor Cost x Time to Cut One Band	\$6.82	
+ ((Labor Cost x 2) + FEL Cost) x Time to Load 1 Section	\$65.36	
+ (Labor Cost + Truck Cost) x Haul Time	\$59.27	
Cost to Remove One 20' Section of CMP (not including dirt removal)	\$131.45	

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	8.56/lin. ft.	97.0%	8.30/lin. ft.
Ballast Removal	4.23/cy	97.0%	4.10/cy
Building Demolition and Disposal ^{1, 2, 3}			
Mixture of Types	0.27/ft ³	97.0%	0.262/ft ³
Explosive Demolition, Concrete or Steel	0.27/ft ³	97.0%	0.262/ft ³
Disposal (Average)	9.14/cy	97.0%	8.87/cy
City Landfill Dump Charges	\$82.00/ton	97.0%	\$79.54/ton
Concrete Footings and Foundations			
6" Thick With Rebar	5.43sq. ft.	97.0%	5.27/sq. ft.
Footings - 2' Thick, 3' Wide	19.85/lin. ft.	97.0%	19.25/lin. ft.
Concrete Disposal On-Site	8.17/cy	97.0%	7.92/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: 2012 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 and Sealing of Drill Holes and Monitor Wells

TASKS	UNIT COST	UNITS	TOTAL COST
DRILL HOLE RECLAMATION COSTS			
Site Locating	\$10.00/site		
Sealing Using High-Solids Bentonite Grout ^{1,2} # 500' deep # 1,000' deep	\$4.00/lin. ft. \$6.28/lin. ft.		
Capping Using a Pre-cast Concrete Cap (if needed)	\$7.50/hole		
Site Grading	\$30.00/site		
Seeding - Small Site (15' x 25')	\$1.00/site		
Contouring & Seeding - Large Sites (100' x 100')	\$250.00/site		
MONITORING WELL RECLAMATION COSTS			
Site Locating	\$10.00/site		
Removal of Top Few Feet of Casing (Backhoe & Welder)	\$15.00/well		
Sealing Using High-Solids Bentonite Grout ^{1,2} # 500' deep # 1,000' deep	\$4.00/lin. ft. \$6.28/lin. ft.		
Site Smoothing (Hand Work) & Seeding	\$5.00/site		

Costs based on industry sources.

¹ Assumes a hole/well size of 5" diameter.

² Gassy or artesian wells would require class G neat cement plugging @ \$6.46/ft. for wells up to 500' deep and \$7.64/ft. for holes over 500' deep.

Appendix M
 Cost Estimate for Rough Grading Backfill Using
 Caterpillar D9R Dozer or Caterpillar 834G

ITEMS	CATERPILLAR D9R DOZER	CATERPILLAR 834G 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	\$209.31 Per Hour	\$159.73 Per Hour	100% of E-W
Labor Costs	\$40.92 Per Hour	\$40.92 Per Hour	WYDOT-WDD
Supervision Labor Costs	\$5.74 Per Hour	\$5.74 Per Hour	1/8 of WYDOT-WDD
Supervisor Transportation	\$3.41 Per Hour	\$3.41 Per Hour	1/8 of 100% of E-W
Total Hourly Costs	\$259.38	\$209.80	
SCARIFICATION RATE			
(2.0 Miles/Hour)x(5,280 Ft./Mile)x(14 Ft./Pass) ¹	147,840 Ft ² /Hour	295,680 Ft ² /Hour	
(4.0 Miles/Hour)x(5,280 Ft./Mile)x(14 Ft./Pass) ²			
(147,890 Ft ² /Hour)/(43,560 Ft ² /Acre) ¹	3.39 Acres/Hour	6.79 Acres/Hour	
(295,680 Ft ² /Hour)/(43,560 Ft ² /Acre) ²			
(3.39 Acres/Hour)x(0.83 Efficiency Factor) ¹	2.82 Acres/Hour	5.66 Acres/Hour	
(6.79 Acres/Hour)x(0.83 Efficiency Factor) ²			
OPERATING COSTS			
(\$259.38/Hour)/(2.82 Acres/Hour) ¹	\$91.98 Per Acre	\$37.07 Per Acre	
(\$209.80/Hour)/(5.66 Acres/Hour) ²			

¹ Caterpillar D9T Dozer

² Caterpillar 834G 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	\$40.92 Per Hour	WYDOT-WDD
Dump Truck (10-12 yd ³)	\$77.62 Per Hour	100% of E-W
Caterpillar 980H Front-End Loader	\$116.22 Per Hour	100% of E-W
Cost to Remove One Surface Water Station = (Labor Cost x Time to Remove Station)	\$327.36	
+ (Labor Cost + Truck Cost) x Time to Remove Station	\$948.32	
+ (Labor Cost + Loader Cost) x Time to Remove Station	\$1,257.12	
Cost to Remove One Surface Water Station =	\$2,532.80	

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	\$40.92 Per Hour	WYDOT-WDD
Dump Truck (10-12 yd ³)	\$77.62 Per Hour	100% of E-W
Caterpillar 430D (4WD) Backhoe Loader	\$36.33 Per Hour	100% of E-W
Cost to Remove One Meteorological or Air Quality Station = (Labor Cost x Time to Remove Station)	\$163.68	
+ (Labor Cost + Truck Cost) x Time to Remove Station	\$474.16	
+ (Labor Cost + Loader Cost) x Time to Remove Station	\$309.00	
Cost to Remove One Meteorological or Air Quality Station =	\$946.84	

Appendix P
 Cost Estimate for Scarification of Compacted Surfaces

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	\$146.21 Per Hour 100% of E-W
Labor Costs	\$40.92 Per Hour WYDOT-WDD
Supervision Labor Costs	\$5.74 Per Hour 1/8 of WYDOT-WDD
Supervisor Transportation	\$3.41 Per Hour 1/8 of 100% of E-W
Total Hourly Costs	\$196.28
SCARIFICATION RATE	
(2.4 Miles/Hour)x(5,280 Ft./Mile)x(12 Ft./Pass)	152,064 Ft ² /Hour
(152,064 Ft ² /Hour)/(43,560 Ft ² /Acre)	3.49 Acres/Hour
(3.49 Acres/Hour)x(0.83 Efficiency Factor)	2.90 Acres/Hour
OPERATING COSTS	
(\$196.28/Hour)/(2.90 Acres/Hour)	\$67.68 Per Acre

Appendix Q Revegetation Tasks and Costs

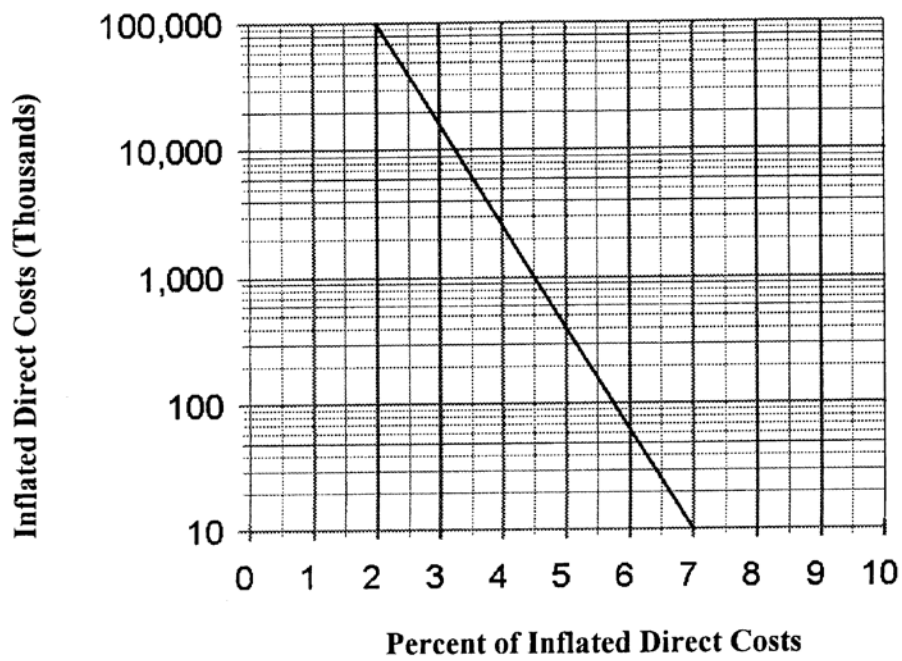
The permittee should fill in the cost per acre for each mine-specific Revegetation Activity as listed in the approved permit document. If a permittee does not use a specific Revegetation Activity, there should be no cost entry. The permittee should add these costs together to obtain a total cost per 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
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Appendix S

Non-Coal Miscellaneous Costs

