DEPARTMENT OF ENVIRONMENTAL QUALITY
LAND QUALITY DIVISION

GUIDELINE NO. 12

STANDARDIZED RECLAMATION PERFORMANCE BOND FORMAT AND COST CALCULATION METHODS

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∗Diesel fuel cost used in this version = $3.98/gal. & gas = $3.51/gal.

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 (2014). 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 2014 State Building Construction Prevailing Wages (February 2014).

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 (w/o Operator) ($)	Date
Dozer	Caterpillar D9T (SU)	205.87	10/2014
Blade	Caterpillar 16M	151.77	10/2014
Scraper	Caterpillar 657G P-P	419.32	10/2014
Truck (95 ton)	Caterpillar 777F	308.40	10/2014
Loader (13.5 CY)	Caterpillar 992K	361.20	10/2014
Loader (5.25 CY)	Caterpillar 980H	117.64	10/2014
Dozer	Caterpillar D10T (SU)	284.28	10/2014
Dozer	Caterpillar D11R (U)	457.68	10/2014
Dozer	Caterpillar D11R-CD	427.86	10/2014
Backhoe Loader	Caterpillar 430E(4WD)	35.73	10/2014
Water Truck	14,000 Gallon	210.69	10/2014
Dump Truck	10-12 CY	77.10	10/2014
Pickup Truck	Crew 4x4 1T (Gas)	30.35	10/2014
Pickup Truck	Crew 4x4 1T (Diesel)	26.79	10/2014
Tractor	New Holland 545D 4WD 63 H.P.	16.48	10/2014
Towed Mower	Flail 7 ft	2.43	10/2014
Rubber Tired Dozer	Caterpillar 854G	346.86	10/2014
Scraper	Caterpillar 637G P-P	337.52	10/2014
Scraper	Caterpillar 651E	256.82	
Scraper	Caterpillar 627G P-P	249.49	
Blade	Caterpillar 140M	75.75	
Dozer	Caterpillar D6T-XL SU	93.10	
Scraper	Caterpillar 631G	239.72	

Caterpillar 24H blade: $69.66/hr. to lease and $146.86/hr. operating cost (from InfoMine USA, Inc.) for total of $216.52/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 $22,650,000.00 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 $22,650,000 (InfoMine)

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

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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 Parts	Overhaul Labor	Maint. Parts	Maint. Labor	Power	Lube	Wear Parts	Total
$69.79	$68.80	104.68	$103.21	$80.12	$64.71	$24.96	$516.28

(Note: if mine uses an 80 CY shovel the purchase price will be $24,200,000 & $517.86/hr. w/o ownership cost)

Caterpillar 793D Trucks (240 Ton)

Purchase Price $4,129,000 (InfoMine)
Monthly Lease (@600 hr./month) $92,787.00
Hourly Lease Cost $154.64
[Cat 797F Trucks (380T) @ $244.08/hr. to lease & $628.41/hr. operating cost = $872.49/hr.]

793 Truck Hourly Costs (WME)

Overhaul Parts	Overhaul Labor	Maint. Parts	Maint. Labor	Fuel	Lube	Tires	Total
$13.11	$11.08	$24.35	$20.58	$144.44	$34.26	$106.85	$354.66

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 (2014 Version)
IM -	InfoMine, USA, Inc. (2014 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 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 appendicies.

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 <u>all</u> 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.

<u>LANDS THAT HAVE BEEN TOPSOILED AND SEEDED BUT HAVE NO BOND RELEASE MUST BE BONDED FOR RETOPSOILING, SCARIFICATION, AND REVEGETATION.</u> [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 <u>permanently reclaimed</u> 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 <u>defacto</u> 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 $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.

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 $0.259/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	$308.40 per Hour	100% of E-W
7)	992K Loader Operating Costs	$361.20 per Hour	100% of E-W
8)	Labor Costs	$44.97 per Hour	WYDOT-WDD
9)	1/2 of 1 - 14,000 Gal. Water Trucks + 1 Operator	$127.83 per Hour	1/2 of 100% E-W
10)	1 – 16M Blade for Road Work + 1 Operator	$196.74 per Hour	100% E-W + Operator
11)	1 - D9T for Misc. Work + 1 Operator	$250.84 per Hour	100% E-W + Operator
12)	Supervision Labor Costs	$24.99 per Hour	1/2 of WYDOT-WDD
13)	Supervisor Transportation	$13.40 per Hour	1/2 of 100% E-W
14)	Total Fleet Hourly Costs (Except Trucks)	$1,019.97	

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	$1.698
1000	3.50	0.70	0.564	1.10	0.30	6.164	9.734	66	535	942	1.76	$1.743
1500	3.50	0.70	0.846	1.10	0.45	6.596	9.10	66	500	942	1.88	$1.788
2000	3.50	0.70	1.129	1.10	0.60	7.029	8.536	66	469	942	2.01	$1.837
2500	3.50	0.70	1.411	1.10	0.75	7.461	8.042	66	442	942	2.13	$1.882
3000	3.50	0.70	1.693	1.10	0.90	7.893	7.602	66	418	942	2.25	$1.927
3500	3.50	0.70	1.975	1.10	1.05	8.325	7.207	66	396	942	2.38	$1.976
4000	3.50	0.70	2.257	1.10	1.20	8.757	6.852	66	377	942	2.50	$2.021
4500	3.50	0.70	2.539	1.10	1.35	9.189	6.53	66	359	942	2.62	$2.066
5000	3.50	0.70	2.821	1.10	1.50	9.621	6.24	66	343	942	2.75	$2.114
5500	3.50	0.70	3.104	1.10	1.65	10.054	5.97	66	328	942	2.87	$2.159
6000	3.50	0.70	3.386	1.10	1.80	10.486	5.72	66	315	942	2.99	$2.204
6500	3.50	0.70	3.668	1.10	1.95	10.918	5.50	66	302	942	3.12	$2.253
7000	3.50	0.70	3.950	1.10	2.10	11.35	5.29	66	291	942	3.24	$2.298

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

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	$1.694
1000	3.50	0.70	0.279	1.10	0.557	6.136	9.78	66	538	942	1.75	$1.739
1500	3.50	0.70	0.418	1.10	0.836	6.554	9.15	66	503	942	1.87	$1.784
2000	3.50	0.70	0.557	1.10	1.114	6.971	8.61	66	473	942	1.99	$1.829
2500	3.50	0.70	0.696	1.10	1.393	7.389	8.12	66	446	942	2.11	$1.874
3000	3.50	0.70	0.836	1.10	1.671	7.807	7.69	66	423	942	2.23	$1.919
3500	3.50	0.70	0.975	1.10	1.950	8.225	7.29	66	401	942	2.35	$1.964
4000	3.50	0.70	1.114	1.10	2.229	8.643	6.94	66	381	942	2.46	$2.006
4500	3.50	0.70	1.254	1.10	2.507	9.061	6.62	66	364	942	2.59	$2.054
5000	3.50	0.70	1.393	1.10	2.786	9.479	6.33	66	348	942	2.71	$2.099
5500	3.50	0.70	1.532	1.10	3.064	9.896	6.06	66	333	942	2.83	$2.144
6000	3.50	0.70	1.671	1.10	3.343	10.314	5.82	66	320	942	2.95	$2.189
6500	3.50	0.70	1.811	1.10	3.621	10.732	5.59	66	307	942	3.06	$2.231
7000	3.50	0.70	1.950	1.10	3.900	11.15	5.38	66	296	942	3.18	$2.276

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	$1.713
1000	3.50	0.70	0.279	1.10	0.871	6.45	9.30	66	511	942	1.84	$1.773
1500	3.50	0.70	0.418	1.10	1.307	7.025	8.54	66	470	942	2.01	$1.837
2000	3.50	0.70	0.557	1.10	1.743	7.60	7.89	66	434	942	2.17	$1.897
2500	3.50	0.70	0.696	1.10	2.179	8.175	7.34	66	404	942	2.33	$1.957
3000	3.50	0.70	0.836	1.10	2.614	8.75	6.86	66	377	942	2.50	$2.021
3500	3.50	0.70	0.975	1.10	3.050	9.325	6.45	66	354	942	2.66	$2.081
4000	3.50	0.70	1.114	1.10	3.35	9.90	6.06	66	333	942	2.83	$2.144
4500	3.50	0.70	1.254	1.10	3.921	10.475	5.73	66	315	942	2.99	$2.204
5000	3.50	0.70	1.393	1.10	4.357	11.05	5.43	66	299	942	3.16	$2.268
5500	3.50	0.70	1.532	1.10	4.793	11.625	5.16	66	284	942	3.32	$2.328
6000	3.50	0.70	1.671	1.10	5.229	12.22	4.91	66	270	942	3.49	$2.392
6500	3.50	0.70	1.811	1.10	5.664	12.775	4.70	66	258	942	3.65	$2.452
7000	3.50	0.70	1.950	1.10	6.10	13.35	4.49	66	247	942	3.81	$2.512

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	$1.732
1000	3.50	0.70	1.243	1.10	0.286	6.829	8.79	66	483	942	1.95	$1.814
1500	3.50	0.70	1.864	1.10	0.429	7.593	7.90	66	434	942	2.17	$1.897
2000	3.50	0.70	2.486	1.10	0.571	8.357	7.18	66	395	942	2.39	$1.979
2500	3.50	0.70	3.107	1.10	0.714	9.121	6.58	66	362	942	2.61	$2.062
3000	3.50	0.70	3.729	1.10	0.857	9.886	6.07	66	334	942	2.82	$2.141
3500	3.50	0.70	4.35	1.10	1.00	10.65	5.6	66	310	942	3.04	$2.223
4000	3.50	0.70	4.971	1.10	1.143	11.414	5.26	66	289	942	3.26	$2.306
4500	3.50	0.70	5.593	1.10	1.286	12.179	4.93	66	271	942	3.48	$2.388
5000	3.50	0.70	6.214	1.10	1.429	12.943	4.64	66	255	942	3.70	$2.471
5500	3.50	0.70	6.836	1.10	1.571	13.707	4.38	66	241	942	3.91	$2.550
6000	3.50	0.70	7.457	1.10	1.714	14.471	4.15	66	228	942	4.13	$2.632
6500	3.50	0.70	8.079	1.10	1.857	15.236	3.94	66	217	942	4.35	$2.715
7000	3.50	0.70	8.70	1.10	2.00	16.00	3.75	66	206	942	4.57	$2.797

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	$1.773
1000	3.50	0.70	1.979	1.10	0.286	7.565	7.93	66	436	942	2.16	$1.893
1500	3.50	0.70	2.969	1.10	0.429	8.697	6.90	66	379	942	2.48	$2.013
2000	3.50	0.70	3.957	1.10	0.571	9.828	6.11	66	336	942	2.81	$2.137
2500	3.50	0.70	4.946	1.10	0.714	10.96	5.47	66	301	942	3.13	$2.257
3000	3.50	0.70	5.936	1.10	0.857	12.093	4.96	66	273	942	3.45	$2.377
3500	3.50	0.70	6.925	1.10	1.00	13.225	4.54	66	249	942	3.78	$2.501
4000	3.50	0.70	7.914	1.10	1.143	14.357	4.18	66	230	942	4.10	$2.621
4500	3.50	0.70	8.964	1.10	1.286	15.49	3.87	66	213	942	4.42	$2.741
5000	3.50	0.70	9.893	1.10	1.429	16.622	3.61	66	198	942	4.75	$2.865
5500	3.50	0.70	10.882	1.10	1.571	17.753	3.38	66	862	942	5.07	$2.985
6000	3.50	0.70	11.871	1.10	1.714	18.885	3.18	66	175	942	5.39	$3.105
6500	3.50	0.70	12.861	1.10	1.857	20.018	3.00	66	165	942	5.72	$3.229
7000	3.50	0.70	13.85	1.10	2.00	21.15	2.84	66	156	942	6.04	$3.349

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 35.0 BCY	CPH 40
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	$419.32 per Hour	100% E-W
7) Labor Costs	$44.97 per Hour	WYDOT-WDD
8) Supervision Labor Costs	$6.25 per Hour	1/8 of WYDOT-WDD
9) Supervisor Transportation	$3.35 per Hour	1/8 of 100% E-W
10) 1/8 of 1 - 14,000 Gal. Water Trucks + 1 Operator	$31.96 per Hour	1/8 of 100%E-W
11) 1/8 of 1 – 16M Blade for Road Work + 1 Operator	$24.59 per Hour	1/8 of 100% E-W
12) . - D9T for Ripping Orb. and Misc. Work + 1 Operator	$125.42 per Hour	. of 100% E-W
13) Total Hourly Costs	$655.86	

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	$0.929
1000	1.10	0.68	0.60	0.57	2.95	20.3	35.0	0.83	593	$1.106
1500	1.10	0.92	0.60	0.75	3.37	17.8	35.0	0.83	519	$1.264
2000	1.10	1.15	0.60	0.92	3.77	15.9	35.0	0.83	464	$1.413
2500	1.10	1.37	0.60	1.09	4.16	14.4	35.0	0.83	421	$1.558
3000	1.10	1.59	0.60	1.26	4.55	13.2	35.0	0.83	385	$1.703
3500	1.10	1.81	0.60	1.44	4.95	12.1	35.0	0.83	354	$1.853
4000	1.10	2.02	0.60	1.61	5.33	11.3	35.0	0.83	328	$1.999
4500	1.10	2.22	0.60	1.78	5.70	10.5	35.0	0.83	307	$2.136
5000	1.10	2.43	0.60	1.95	6.08	9.9	35.0	0.83	288	$2.277
5500	1.10	2.64	0.60	2.13	6.47	9.3	35.0	0.83	270	$2.429
6000	1.10	2.85	0.60	2.30	6.85	8.8	35.0	0.83	255	$2.572
6500	1.10	3.05	0.60	2.47	7.22	8.3	35.0	0.83	242	$2.710
7000	1.10	3.26	0.60	2.64	7.60	7.9	35.0	0.83	230	$2.852

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	$0.929
1000	1.10	0.54	0.60	0.71	2.95	20.3	35.0	0.83	593	$1.106
1500	1.10	0.71	0.60	0.98	3.39	17.7	35.0	0.83	516	$1.271
2000	1.10	0.87	0.60	1.25	3.82	15.7	35.0	0.83	458	$1.432
2500	1.10	1.03	0.60	1.51	4.24	14.2	35.0	0.83	413	$1.588
3000	1.10	1.19	0.60	1.78	4.67	12.8	35.0	0.83	375	$1.749
3500	1.10	1.36	0.60	2.05	5.11	11.7	35.0	0.83	342	$1.918
4000	1.10	1.52	0.60	2.32	5.54	10.8	35.0	0.83	316	$2.075
4500	1.10	1.68	0.60	2.59	5.97	10.1	35.0	0.83	293	$2.238
5000	1.10	1.85	0.60	2.86	6.41	9.4	35.0	0.83	273	$2.402
5500	1.10	2.01	0.60	3.12	6.83	8.8	35.0	0.83	256	$2.562
6000	1.10	2.17	0.60	3.39	7.26	8.3	35.0	0.83	241	$2.721
6500	1.10	2.33	0.60	3.66	7.69	7.8	35.0	0.83	228	$2.877
7000	1.10	2.50	0.60	3.93	8.13	7.4	35.0	0.83	215	$3.051

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	$0.956
1000	1.10	0.51	0.60	0.96	3.17	18.9	35.0	0.83	552	$1.188
1500	1.10	0.67	0.60	1.41	3.78	15.9	35.0	0.83	463	$1.416
2000	1.10	0.83	0.60	1.85	4.38	13.7	35.0	0.83	400	$1.640
2500	1.10	0.99	0.60	2.30	4.99	12.0	35.0	0.83	351	$1.868
3000	1.10	1.16	0.60	2.74	5.60	10.7	35.0	0.83	313	$2.095
3500	1.10	1.32	0.60	3.19	6.21	9.7	35.0	0.83	282	$2.326
4000	1.10	1.48	0.60	3.63	6.81	8.8	35.0	0.83	257	$2.552
4500	1.10	1.64	0.60	4.08	7.42	8.1	35.0	0.83	236	$2.779
5000	1.10	1.81	0.60	4.52	8.03	7.5	35.0	0.83	218	$3.009
5500	1.10	1.97	0.60	4.97	8.64	6.9	35.0	0.83	203	$3.231
6000	1.10	2.13	0.60	5.41	9.24	6.5	35.0	0.83	189	$3.470
6500	1.10	2.30	0.60	5.86	9.86	6.1	35.0	0.83	177	$3.705
7000	1.10	2.46	0.60	6.30	10.46	5.7	35.0	0.83	167	$3.927

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	$0.967
1000	1.10	1.01	0.60	0.50	3.21	18.7	35.0	0.83	545	$1.203
1500	1.10	1.46	0.60	0.66	3.82	15.7	35.0	0.83	458	$1.432
2000	1.10	1.92	0.60	0.83	4.45	13.5	35.0	0.83	393	$1.669
2500	1.10	2.38	0.60	0.99	5.07	11.8	35.0	0.83	345	$1.901
3000	1.10	2.83	0.60	1.15	5.68	10.6	35.0	0.83	308	$2.129
3500	1.10	3.29	0.60	1.31	6.30	9.5	35.0	0.83	278	$2.359
4000	1.10	3.75	0.60	1.48	6.93	8.7	35.0	0.83	253	$2.592
4500	1.10	4.21	0.60	1.64	7.55	7.9	35.0	0.83	232	$2.827
5000	1.10	4.66	0.60	1.80	8.16	7.4	35.0	0.83	214	$3.065
5500	1.10	5.12	0.60	1.96	8.78	6.8	35.0	0.83	199	$3.296
6000	1.10	5.58	0.60	2.13	9.41	6.4	35.0	0.83	186	$3.526
6500	1.10	6.04	0.60	2.29	10.03	6.0	35.0	0.83	174	$3.769
7000	1.10	6.49	0.60	2.45	10.64	5.6	35.0	0.83	164	$3.999

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	$1.038
1000	1.10	1.43	0.60	0.49	3.62	16.6	35.0	0.83	483	$1.358
1500	1.10	2.12	0.60	0.65	4.47	13.4	35.0	0.83	391	$1.677
2000	1.10	2.81	0.60	0.81	5.32	11.3	35.0	0.83	329	$1.994
2500	1.10	3.49	0.60	0.98	6.17	9.7	35.0	0.83	284	$2.309
3000	1.10	4.18	0.60	1.14	7.02	8.5	35.0	0.83	249	$2.634
3500	1.10	4.87	0.60	1.30	7.87	7.6	35.0	0.83	222	$2.954
4000	1.10	5.56	0.60	1.46	8.72	6.9	35.0	0.83	201	$3.263
4500	1.10	6.24	0.60	1.63	9.57	6.3	35.0	0.83	183	$3.584
5000	1.10	6.93	0.60	1.79	10.42	5.8	35.0	0.83	168	$3.904
5500	1.10	7.62	0.60	1.95	11.27	5.3	35.0	0.83	155	$4.231
6000	1.10	8.31	0.60	2.12	12.13	4.9	35.0	0.83	144	$4.555
6500	1.10	8.99	0.60	2.28	12.97	4.6	35.0	0.83	135	$4.858
7000	1.10	9.68	0.60	2.44	13.82	4.3	35.0	0.83	127	$5.164

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	$337.52 per Hour	100% E-W
7) Labor Costs	$44.97 per Hour	WYDOT-WDD
8) Supervision Labor Costs	$6.25 per Hour	1/8 of WYDOT-WDD
9) Supervisor Transportation	$3.35 per Hour	1/8 of 100% E-W
10) 1/8 of 1 - 14,000 Gal. Water Trucks + 1 Operator	$31.96 per Hour	1/8 of 100% E-W
11) 1/8 of 1 – 16M Blade for Road Work + 1 Operator	$24.59 per Hour	1/8 of 100% E-W
12) . - D9T for Ripping Ovb. and Misc. Work + 1 Operator	$125.42 per Hour	. of 100% E-W
13) Total Hourly Costs	$574.06	

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	$1.098
1000	1.0	0.68	0.60	0.57	2.85	21.1	25.0	0.83	438	$1.311
1500	1.0	0.92	0.60	0.75	3.27	18.4	25.0	0.83	382	$1.503
2000	1.0	1.15	0.60	0.92	3.67	16.3	25.0	0.83	338	$1.698
2500	1.0	1.37	0.60	1.09	4.06	14.8	25.0	0.83	307	$1.870
3000	1.0	1.59	0.60	1.26	4.45	13.5	25.0	0.83	280	$2.050
3500	1.0	1.81	0.60	1.44	4.85	12.4	25.0	0.83	257	$2.234
4000	1.0	2.02	0.60	1.61	5.23	11.5	25.0	0.83	239	$2.402
4500	1.0	2.22	0.60	1.78	5.60	10.7	25.0	0.83	222	$2.586
5000	1.0	2.43	0.60	1.95	5.98	10.0	25.0	0.83	208	$2.760
5500	1.0	2.64	0.60	2.13	6.37	9.4	25.0	0.83	195	$2.944
6000	1.0	2.85	0.60	2.30	6.75	8.9	25.0	0.83	185	$3.103
6500	1.0	3.05	0.60	2.47	7.12	8.4	25.0	0.83	174	$3.299
7000	1.0	3.26	0.60	2.64	7.50	8.0	25.0	0.83	166	$3.458

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	$1.098
1000	1.0	0.54	0.60	0.71	2.85	21.0	25.0	0.83	436	$1.317
1500	1.0	0.71	0.60	0.98	3.29	18.2	25.0	0.83	378	$1.519
2000	1.0	0.87	0.60	1.25	3.72	16.1	25.0	0.83	334	$1.719
2500	1.0	1.03	0.60	1.51	4.14	14.5	25.0	0.83	301	$1.907
3000	1.0	1.19	0.60	1.78	4.57	13.1	25.0	0.83	272	$2.111
3500	1.0	1.36	0.60	2.05	5.01	12.0	25.0	0.83	249	$2.306
4000	1.0	1.52	0.60	2.32	5.44	11.0	25.0	0.83	228	$2.518
4500	1.0	1.68	0.60	2.59	5.87	10.2	25.0	0.83	212	$2.708
5000	1.0	1.85	0.60	2.86	6.31	9.5	25.0	0.83	197	$2.914
5500	1.0	2.01	0.60	3.12	6.73	8.9	25.0	0.83	185	$3.103
6000	1.0	2.17	0.60	3.39	7.16	8.4	25.0	0.83	174	$3.300
6500	1.0	2.33	0.60	3.66	7.59	7.9	25.0	0.83	164	$3.500
7000	1.0	2.50	0.60	3.93	8.03	7.5	25.0	0.83	156	$3.680

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	$1.130
1000	1.0	0.51	0.60	0.96	3.07	19.5	25.0	0.83	405	$1.417
1500	1.0	0.67	0.60	1.41	3.68	16.3	25.0	0.83	338	$1.698
2000	1.0	0.83	0.60	1.85	4.28	14.0	25.0	0.83	291	$1.973
2500	1.0	0.99	0.60	2.30	4.89	12.3	25.0	0.83	255	$2.251
3000	1.0	1.16	0.60	2.74	5.50	10.9	25.0	0.83	226	$2.540
3500	1.0	1.32	0.60	3.19	6.11	9.8	25.0	0.83	203	$2.828
4000	1.0	1.48	0.60	3.63	6.71	8.9	25.0	0.83	185	$3.103
4500	1.0	1.64	0.60	4.08	7.32	8.2	25.0	0.83	170	$3.377
5000	1.0	1.81	0.60	4.52	7.93	7.6	25.0	0.83	158	$3.633
5500	1.0	1.97	0.60	4.97	8.54	7.0	25.0	0.83	145	$3.959
6000	1.0	2.13	0.60	5.41	9.14	6.5	25.0	0.83	135	$4.252
6500	1.0	2.30	0.60	5.86	9.76	6.2	25.0	0.83	129	$4.450
7000	1.0	2.46	0.60	6.30	10.36	5.8	25.0	0.83	120	$4.784

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	$1.144
1000	1.0	1.01	0.60	0.50	3.11	19.3	25.0	0.83	400	$1.435
1500	1.0	1.46	0.60	0.66	3.72	16.1	25.0	0.83	334	$1.719
2000	1.0	1.92	0.60	0.83	4.35	13.8	25.0	0.83	286	$2.007
2500	1.0	2.38	0.60	0.99	4.97	12.1	25.0	0.83	251	$2.287
3000	1.0	2.83	0.60	1.15	5.58	10.8	25.0	0.83	224	$2.563
3500	1.0	3.29	0.60	1.31	6.20	9.7	25.0	0.83	201	$2.856
4000	1.0	3.75	0.60	1.48	6.83	8.8	25.0	0.83	183	$3.137
4500	1.0	4.21	0.60	1.64	7.45	8.1	25.0	0.83	168	$3.417
5000	1.0	4.66	0.60	1.80	8.06	7.4	25.0	0.83	154	$3.728
5500	1.0	5.12	0.60	1.96	8.68	6.9	25.0	0.83	143	$4.014
6000	1.0	5.58	0.60	2.13	9.31	6.4	25.0	0.83	133	$4.316
6500	1.0	6.04	0.60	2.29	9.93	6.0	25.0	0.83	125	$4.593
7000	1.0	6.49	0.60	2.45	10.54	5.7	25.0	0.83	118	$4.865

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	$1.229
1000	1.0	1.43	0.60	0.49	3.52	17.0	25.0	0.83	353	$1.626
1500	1.0	2.12	0.60	0.65	4.37	13.7	25.0	0.83	284	$2.021
2000	1.0	2.81	0.60	0.81	5.22	11.5	25.0	0.83	238	$2.412
2500	1.0	3.49	0.60	0.98	6.07	9.9	25.0	0.83	205	$2.800
3000	1.0	4.18	0.60	1.14	6.92	8.7	25.0	0.83	181	$3.172
3500	1.0	4.87	0.60	1.30	7.77	7.7	25.0	0.83	160	$3.588
4000	1.0	5.56	0.60	1.46	8.62	7.0	25.0	0.83	145	$3.959
4500	1.0	6.24	0.60	1.63	9.47	6.3	25.0	0.83	131	$4.382
5000	1.0	6.93	0.60	1.79	10.32	5.8	25.0	0.83	120	$4.784
5500	1.0	7.62	0.60	1.95	11.17	5.4	25.0	0.83	112	$5.125
6000	1.0	8.31	0.60	2.12	12.03	4.9	25.0	0.83	102	$5.628
6500	1.0	8.99	0.60	2.28	12.87	4.7	25.0	0.83	98	$5.858
7000	1.0	9.68	0.60	2.44	13.72	4.4	25.0	0.83	91	$6.308

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)	$516.28	IM
7) 793F Lease + Operating Costs	$509.30	IM
8) Labor Costs	$44.97 per Hour	WYDOT-WDD
9) ₋ of 1 - 14,000 Gal. Water Truck + 1 Operator	$127.83 per Hour	₋ of 100% E-W + Operator
10) 1 - 24H Blade + 1 Operator	$261.49 per Hour	IM
11) 1 - D9T + 1 Operator	$250.84 per Hour	100% E-W + Operator
12) 1 854G Rubber Tired Dozer + 1 Operator	$391.83 per Hour	100% E-W + Operator
13) Supervision Labor Costs	$24.99 per Hour	₋ of WYDOT-WDD
14) Supervisor Transportation	$13.40 per Hour	₋ of 100% E-W
15) Total Fleet Hourly Costs (Except Trucks)	$1,631.63 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	$0.670
1000	1.70	0.60	0.5	1.20	0.35	4.35	13.8	156.8	1802	4184	2.32	$0.697
1500	1.70	0.60	0.75	1.20	0.6	4.85	12.4	156.8	1620	4184	2.58	$0.732
2000	1.70	0.60	1.0	1.20	0.7	5.20	11.5	156.8	1502	4184	2.79	$0.760
2500	1.70	0.60	1.25	1.20	0.86	5.61	10.69	156.8	1396	4184	3.00	$0.787
3000	1.70	0.60	1.5	1.20	1.03	6.03	9.95	156.8	1300	4184	3.22	$0.817
3500	1.70	0.60	1.75	1.20	1.21	6.46	9.29	156.8	1213	4184	3.45	$0.847
4000	1.70	0.60	2.0	1.20	1.38	6.88	8.72	156.8	1139	4184	3.67	$0.876
4500	1.70	0.60	2.25	1.20	1.55	7.3	8.22	156.8	1074	4184	3.90	$0.907
5000	1.70	0.60	2.5	1.20	1.72	7.72	7.77	156.8	1015	4184	4.12	$0.936
5500	1.70	0.60	2.75	1.20	1.89	8.14	7.37	156.8	962	4184	4.35	$0.966
6000	1.70	0.60	3.0	1.20	2.07	8.57	7.0	156.8	914	4184	4.58	$0.997
6500	1.70	0.60	3.25	1.20	2.24	8.99	6.67	156.8	871	4184	4.80	$1.026
7000	1.70	0.60	3.5	1.20	2.41	9.41	6.3	156.8	833	4184	5.02	$1.055

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

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	$0.689
1000	1.70	0.60	1.12	1.20	0.34	4.96	12.1	156.8	1580	4184	2.65	$0.741
1500	1.70	0.60	1.68	1.20	0.5	5.68	10.5	156.8	1380	4184	3.03	$0.791
2000	1.70	0.60	2.24	1.20	0.67	6.41	9.36	156.8	1223	4184	3.42	$0.843
2500	1.70	0.60	2.8	1.20	0.84	7.14	8.40	156.8	1098	4184	3.81	$0.895
3000	1.70	0.60	3.36	1.20	1.01	7.87	7.62	156.8	996	4184	4.20	$0.946
3500	1.70	0.60	3.93	1.20	1.18	8.61	6.97	156.8	910	4184	4.60	$0.999
4000	1.70	0.60	4.49	1.20	1.34	9.33	6.43	156.8	840	4184	4.98	$1.050
4500	1.70	0.60	5.05	1.20	1.51	10.06	5.96	156.8	779	4184	5.37	$1.101
5000	1.70	0.60	5.61	1.20	1.68	10.79	5.56	156.8	726	4184	5.76	$1.153
5500	1.70	0.60	6.17	1.20	1.85	11.52	5.21	156.8	680	4184	6.15	$1.205
6000	1.70	0.60	6.73	1.20	2.01	12.24	4.90	156.8	640	4184	6.54	$1.256
6500	1.70	0.60	7.29	1.20	2.18	12.97	4.62	156.8	604	4184	6.93	$1.308
7000	1.70	0.60	7.85	1.20	2.35	13.7	4.38	156.8	572	4184	7.31	$1.358

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	$0.666
1000	1.70	0.60	0.34	1.20	0.45	4.29	13.99	156.8	1827	4184	2.29	$0.693
1500	1.70	0.60	0.5	1.20	0.68	4.68	12.82	156.8	1675	4184	2.50	$0.721
2000	1.70	0.60	0.67	1.20	0.9	5.07	11.83	156.8	1546	4184	2.71	$0.749
2500	1.70	0.60	0.84	1.20	1.13	5.47	10.97	156.8	1433	4184	2.92	$0.777
3000	1.70	0.60	1.01	1.20	1.35	5.86	10.24	156.8	1337	4184	3.13	$0.805
3500	1.70	0.60	1.18	1.20	1.58	6.26	9.58	156.8	1252	4184	3.34	$0.832
4000	1.70	0.60	1.34	1.20	1.8	6.64	9.04	156.8	1180	4184	3.55	$0.860
4500	1.70	0.60	1.51	1.20	2.03	7.04	8.52	156.8	1113	4184	3.76	$0.888
5000	1.70	0.60	1.68	1.20	2.25	7.43	8.06	156.8	1055	4184	3.97	$0.916
5500	1.70	0.60	1.85	1.20	2.48	7.83	7.66	156.8	1001	4184	4.18	$0.944
6000	1.70	0.60	2.01	1.20	2.7	8.21	7.31	156.8	955	4184	4.38	$0.970
6500	1.70	0.60	2.18	1.20	2.93	8.61	6.97	156.8	910	4184	4.60	$0.999
7000	1.70	0.60	2.35	1.20	3.15	9.00	6.67	156.8	871	4184	4.80	$1.026

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 $0.259/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)	$517.86	IM
7) 797F Lease + Operating Costs	$872.49	IM
8) Labor Costs	$44.97 per Hour	WYDOT-WDD
9) . of 1 - 14,000 Gal. Water Truck + 1 Operator	$127.83 per Hour	. of 100% E-W + Operator
10) 1 - 24H Blade + 1 Operator	$261.49 per Hour	IM
11) 1 - D9T + 1 Operator	$250.84 per Hour	100% E-W + Operator
12) 1 854G Rubber Tired Dozer + 1 Operator	$391.83 per Hour	100% E-W + Operator
13) Supervision Labor Costs	$24.99 per Hour	. of WYDOT-WDD
14) Supervisor Transportation	$13.40 per Hour	. of 100% E-W
15) Total Fleet Hourly Costs (Except Trucks)	$1,633.21 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	$0.559
1000	2.00	0.60	0.52	1.20	0.27	4.59	13.07	275.8	3003	5865	1.95	$0.584
1500	2.00	0.60	0.79	1.20	0.41	5.0	12.0	275.8	2757	5865	2.13	$0.612
2000	2.00	0.60	1.05	1.20	0.55	5.4	11.11	275.8	2553	5865	2.30	$0.638
2500	2.00	0.60	1.31	1.20	0.69	5.8	10.34	275.8	2377	5865	2.47	$0.665
3000	2.00	0.60	1.57	1.20	0.82	6.19	9.69	275.8	2227	5865	2.63	$0.690
3500	2.00	0.60	1.84	1.20	0.96	6.6	9.09	275.8	2089	5865	2.81	$0.718
4000	2.00	0.60	2.1	1.20	1.1	7.0	8.57	275.8	1969	5865	2.98	$0.745
4500	2.00	0.60	2.36	1.20	1.23	7.39	8.12	275.8	1865	5865	3.14	$0.770
5000	2.00	0.60	2.62	1.20	1.37	7.79	7.70	275.8	1770	5865	3.31	$0.796
5500	2.00	0.60	2.88	1.20	1.51	8.19	7.33	275.8	1683	5865	3.48	$0.823
6000	2.00	0.60	3.15	1.20	1.65	8.6	6.98	275.8	1603	5865	3.66	$0.851
6500	2.00	0.60	3.41	1.20	1.78	8.99	6.67	275.8	1533	5865	3.83	$0.878
7000	2.00	0.60	3.67	1.20	1.92	9.39	6.39	275.8	1468	5865	4.00	$0.904

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

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	$0.577
1000	2.00	0.60	1.13	1.20	0.27	5.2	11.54	275.8	2651	5865	2.21	$0.624
1500	2.00	0.60	1.7	1.20	0.4	5.9	10.17	275.8	2336	5865	2.51	$0.671
2000	2.00	0.60	2.26	1.20	0.54	6.6	9.09	275.8	2089	5865	2.81	$0.718
2500	2.00	0.60	2.83	1.20	0.67	7.3	8.22	275.8	1888	5865	3.11	$0.765
3000	2.00	0.60	3.39	1.20	0.81	8.0	7.5	275.8	1723	5865	3.40	$0.810
3500	2.00	0.60	3.96	1.20	0.94	8.7	6.90	275.8	1584	5865	3.70	$0.857
4000	2.00	0.60	4.52	1.20	1.07	9.39	6.39	275.8	1468	5865	4.00	$0.904
4500	2.00	0.60	5.09	1.20	1.21	10.1	5.94	275.8	1365	5865	4.30	$0.951
5000	2.00	0.60	5.65	1.20	1.34	10.79	5.56	275.8	1278	5865	4.59	$0.997
5500	2.00	0.60	6.22	1.20	1.48	11.5	5.22	275.8	1199	5865	4.89	$1.043
6000	2.00	0.60	6.78	1.20	1.61	12.19	4.92	275.8	1131	5865	5.19	$1.090
6500	2.00	0.60	7.35	1.20	1.75	12.9	4.65	275.8	1069	5865	5.49	$1.137
7000	2.00	0.60	7.91	1.20	1.88	13.59	4.42	275.8	1014	5865	5.78	$1.183

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	$0.557
1000	2.00	0.60	0.27	1.20	0.47	4.54	13.22	275.8	3036	5865	1.93	$0.580
1500	2.00	0.60	0.41	1.20	0.71	4.92	12.20	275.8	2802	5865	2.09	$0.605
2000	2.00	0.60	0.54	1.20	0.94	5.28	11.36	275.8	2611	5865	2.25	$0.630
2500	2.00	0.60	0.68	1.20	1.18	5.66	10.6	275.8	2435	5865	2.41	$0.656
3000	2.00	0.60	0.81	1.20	1.41	6.02	9.97	275.8	2290	5865	2.56	$0.679
3500	2.00	0.60	0.95	1.20	1.65	6.4	9.38	2758	2154	5865	2.72	$0.704
4000	2.00	0.60	1.09	1.20	1.88	6.77	8.86	275.8	2036	5865	2.88	$0.729
4500	2.00	0.60	1.22	1.20	2.12	7.14	8.4	275.8	1930	5865	3.04	$0.754
5000	2.00	0.60	1.36	1.20	2.35	7.51	7.99	275.8	1835	5865	3.20	$0.779
5500	2.00	0.60	1.49	1.20	2.59	7.88	7.61	275.8	1749	5865	3.35	$0.803
6000	2.00	0.60	1.63	1.20	2.82	8.25	7.27	275.8	1671	5865	3.51	$0.828
6500	2.00	0.60	1.76	1.20	3.06	8.62	6.96	275.8	1599	5865	3.67	$0.853
7000	2.00	0.60	1.90	1.20	3.29	8.99	6.67	275.8	1533	5865	3.83	$0.878

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	$205.87 Per Hour	100% ofE-W
3) Labor Costs	$44.97 per Hour	WYDOT-WDD
4) Supervisor Labor Costs	$6.25 per Hour	1/8 of WYDOT-WDD
5) Supervisor Transportation	$3.35 per Hour	1/8 of 100% E-W
6) Total Hourly Costs	$260.44 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	$0.158
100	1300	1.0	1.0	0.90	0.83	1.00	975	$0.267
150	1000	1.0	1.0	0.90	0.83	1.00	750	$0.347
200	750	1.0	1.0	0.90	0.83	1.00	562	$0.463
250	570	1.0	1.0	0.90	0.83	1.00	427	$0.610
300	480	1.0	1.0	0.90	0.83	1.00	360	$0.723
350	390	1.0	1.0	0.90	0.83	1.00	292	$0.892
400	330	1.0	1.0	0.90	0.83	1.00	247	$1.054
450	290	1.0	1.0	0.90	0.83	1.00	217	$1.200
500	250	1.0	1.0	0.90	0.83	1.00	187	$1.393

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	$0.132
100	1300	1.0	1.0	0.90	0.83	1.20	1170	$0.223
150	1000	1.0	1.0	0.90	0.83	1.20	900	$0.289
200	750	1.0	1.0	0.90	0.83	1.20	675	$0.386
250	570	1.0	1.0	0.90	0.83	1.20	513	$0.508
300	480	1.0	1.0	0.90	0.83	1.20	432	$0.603
350	390	1.0	1.0	0.90	0.83	1.20	351	$0.742
400	330	1.0	1.0	0.90	0.83	1.20	297	$0.877
450	290	1.0	1.0	0.90	0.83	1.20	261	$0.998
500	250	1.0	1.0	0.90	0.83	1.20	225	$1.158

[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	$0.113
100	1300	1.0	1.0	0.90	0.83	1.40	1365	$0.191
150	1000	1.0	1.0	0.90	0.83	1.40	1050	$0.248
200	750	1.0	1.0	0.90	0.83	1.40	787	$0.331
250	570	1.0	1.0	0.90	0.83	1.40	599	$0.435
300	480	1.0	1.0	0.90	0.83	1.40	504	$0.517
350	390	1.0	1.0	0.90	0.83	1.40	409	$0.637
400	330	1.0	1.0	0.90	0.83	1.40	346	$0.753
450	290	1.0	1.0	0.90	0.83	1.40	304	$0.857
500	250	1.0	1.0	0.90	0.83	1.40	262	$0.994

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	$0.211
100	1300	1.0	1.0	0.90	0.83	0.75	731	$0.356
150	1000	1.0	1.0	0.90	0.83	0.75	562	$0.463
200	750	1.0	1.0	0.90	0.83	0.75	422	$0.617
250	570	1.0	1.0	0.90	0.83	0.75	321	$0.811
300	480	1.0	1.0	0.90	0.83	0.75	270	$0.965
350	390	1.0	1.0	0.90	0.83	0.75	219	$1.189
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	$1.598
500	250	1.0	1.0	0.90	0.83	0.75	141	$1.847

[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	$457.68 per Hour	100% E-W
3) Labor Costs	$44.97 per Hour	WYDOT-WDD
4) Supervisor Labor Costs	$6.25 per Hour	1/8 of WYDOR-WDD
5) Supervisor Transportation	$3.35 per Hour	1/8 of 100% E-W
6) Total Hourly Costs	$512.25 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	$0.152
100	3000	1.0	1.0	0.90	0.83	1.00	2249	$0.228
150	2000	1.0	1.0	0.90	0.83	1.00	1499	$0.342
200	1550	1.0	1.0	0.90	0.83	1.00	1162	$0.441
250	1250	1.0	1.0	0.90	0.83	1.00	937	$0.547
300	1080	1.0	1.0	0.90	0.83	1.00	810	$0.633
350	900	1.0	1.0	0.90	0.83	1.00	675	$0.759
400	800	1.0	1.0	0.90	0.83	1.00	600	$0.854
450	720	1.0	1.0	0.90	0.83	1.00	540	$0.949
500	650	1.0	1.0	0.90	0.83	1.00	487	$1.052

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	$0.127
100	3000	1.0	1.0	0.90	0.83	1.20	2699	$0.190
150	2000	1.0	1.0	0.90	0.83	1.20	1799	$0.285
200	1550	1.0	1.0	0.90	0.83	1.20	1394	$0.368
250	1250	1.0	1.0	0.90	0.83	1.20	1125	$0.455
300	1080	1.0	1.0	0.90	0.83	1.20	972	$0.527
350	900	1.0	1.0	0.90	0.83	1.20	810	$0.632
400	800	1.0	1.0	0.90	0.83	1.20	720	$0.712
450	720	1.0	1.0	0.90	0.83	1.20	648	$0.791
500	650	1.0	1.0	0.90	0.83	1.20	585	$0.876

[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	$0.109
100	3000	1.0	1.0	0.90	0.83	1.40	3149	$0.163
150	2000	1.0	1.0	0.90	0.83	1.40	2099	$0.244
200	1550	1.0	1.0	0.90	0.83	1.40	1627	$0.315
250	1250	1.0	1.0	0.90	0.83	1.40	1312	$0.390
300	1080	1.0	1.0	0.90	0.83	1.40	1134	$0.452
350	900	1.0	1.0	0.90	0.83	1.40	945	$0.542
400	800	1.0	1.0	0.90	0.83	1.40	840	$0.610
450	720	1.0	1.0	0.90	0.83	1.40	756	$0.678
500	650	1.0	1.0	0.90	0.83	1.40	682	$0.751

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	$0.203
100	3000	1.0	1.0	0.90	0.83	0.75	1687	$0.304
150	2000	1.0	1.0	0.90	0.83	0.75	1125	$0.455
200	1550	1.0	1.0	0.90	0.83	0.75	872	$0.587
250	1250	1.0	1.0	0.90	0.83	0.75	703	$0.729
300	1080	1.0	1.0	0.90	0.83	0.75	607	$0.844
350	900	1.0	1.0	0.90	0.83	0.75	506	$1.012
400	800	1.0	1.0	0.90	0.83	0.75	450	$1.138
450	720	1.0	1.0	0.90	0.83	0.75	405	$1.265
500	650	1.0	1.0	0.90	0.83	0.75	365	$1.403

[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	$427.86 per Hour	100% E-W
3) Labor Costs	$44.97 per Hour	WYDOT-WDD
4) Supervisor Labor Costs	$6.25 per Hour	1/8 of WYDOT-WDD
5) Supervisor Transportation	$3.35 per Hour	1/8 of 100% E-W
6) Total Hourly Costs	$482.43 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	$0.150
100	3000	1.0	1.0	0.90	0.83	1.00	2249	$0.215
150	2200	1.0	1.0	0.90	0.83	1.00	1649	$0.293
200	1700	1.0	1.0	0.90	0.83	1.00	1274	$0.379
250	1350	1.0	1.0	0.90	0.83	1.00	1012	$0.477
300	1180	1.0	1.0	0.90	0.83	1.00	885	$0.545
350	1000	1.0	1.0	0.90	0.83	1.00	750	$0.645
400	900	1.0	1.0	0.90	0.83	1.00	675	$0.715
450	800	1.0	1.0	0.90	0.83	1.00	600	$0.804
500	750	1.0	1.0	0.90	0.83	1.00	562	$0.858

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	$0.125
100	3000	1.0	1.0	0.90	0.83	1.20	2699	$0.179
150	2200	1.0	1.0	0.90	0.83	1.20	1979	$0.244
200	1700	1.0	1.0	0.90	0.83	1.20	1529	$0.316
250	1350	1.0	1.0	0.90	0.83	1.20	1215	$0.397
300	1180	1.0	1.0	0.90	0.83	1.20	1062	$0.454
350	1000	1.0	1.0	0.90	0.83	1.20	900	$0.536
400	900	1.0	1.0	0.90	0.83	1.20	809	$0.596
450	800	1.0	1.0	0.90	0.83	1.20	720	$0.670
500	750	1.0	1.0	0.90	0.83	1.20	675	$0.715

[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	$0.107
100	3000	1.0	1.0	0.90	0.83	1.40	3149	$0.153
150	2200	1.0	1.0	0.90	0.83	1.40	2309	$0.209
200	1700	1.0	1.0	0.90	0.83	1.40	1784	$0.270
250	1350	1.0	1.0	0.90	0.83	1.40	1417	$0.341
300	1180	1.0	1.0	0.90	0.83	1.40	1239	$0.389
350	1000	1.0	1.0	0.90	0.83	1.40	1050	$0.460
400	900	1.0	1.0	0.90	0.83	1.40	945	$0.511
450	800	1.0	1.0	0.90	0.83	1.40	840	$0.574
500	750	1.0	1.0	0.90	0.83	1.40	787	$0.613

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	$0.200
100	3000	1.0	1.0	0.90	0.83	0.75	1687	$0.286
150	2200	1.0	1.0	0.90	0.83	0.75	1237	$0.390
200	1700	1.0	1.0	0.90	0.83	0.75	956	$0.505
250	1350	1.0	1.0	0.90	0.83	0.75	759	$0.636
300	1180	1.0	1.0	0.90	0.83	0.75	663	$0.728
350	1000	1.0	1.0	0.90	0.83	0.75	562	$0.858
400	900	1.0	1.0	0.90	0.83	0.75	506	$0.953
450	800	1.0	1.0	0.90	0.83	0.75	450	$1.072
500	750	1.0	1.0	0.90	0.83	0.75	422	$1.143

[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	$151.77 Per Hour	100% of E-W
Labor Costs	$44.97 Per Hour	WYDOT-WDD
Supervision Labor Costs	$6.25 Per Hour	1/8 of WYDOT-WDD
Supervisor Transportation	$3.35 Per Hour	1/8 of 100% of E-W
Total Hourly Costs	$206.34	
Grading Rate		
(3.3 Miles/Hour)x(5,280 Ft./Mile)x(8 Ft./Pass)	139,392 Ft^2/Hour	
(139,392 Ft^2/Hour)/(43,560 Ft^2/Acre)	3.2 Acres/Hour	
(3.2 Acres/Hour)x(0.83 Efficiency Factor)	2.66 Acres/Hour	
Operating Costs		
($206.34/Hour)/(2.66 Acres/Hour)	$77.57 Per Acre	

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

FENCING		SOURCES
Construction 4-Strand Barbed	Overall Average - $2.01/LF	Wyoming Highway Department Weighted Average Bid Prices, 2013
Removal	Overall Average - $0.38/LF	Wyoming Highway Department, Average Bid Prices, 2013
	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	$205.87 Per Hour	100% of E-W
Labor Costs	$44.97 Per Hour	WYDOT-WDD
Supervision Labor Costs	$6.25 Per Hour	1/8 of WYDOT-WDD
Supervisor Transportation	$3.35 Per Hour	1/8 of 100% of E-W
Total Hourly Costs	$260.44	
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		
($260.44/Hour)/(0.299 Acres/Hour)	$871.04 Per Acre	

Appendix I1
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)[l]	0.75	CPH 40
Rip Depth	2 Feet	CPH 40
Operating Costs	$284.28 Per Hour	100% of E-W
Labor Costs	$44.97 Per Hour	WYDOT-WDD
Supervision Labor Costs	$6.25 Per Hour	1/8 of WYDOT-WDD
Supervisor Transportation	$3.35 Per Hour	1/8 of 100% of E-W
Total Hourly Costs	$338.85	
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		
($338.85/Hour)/(0.27 Acre/Hour)	$1,255.00 Per Acre	

[l]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	$44.97 Per Hour	WYDOT-WDD
Dump Truck (10-12 yd^3)	$77.10 Per Hour	100% of E-W
Caterpillar 980G Front-End Loader	$117.64 Per Hour	100% of E-W
Cost to Remove One 20' Section of CMP		
Labor Cost x Time to Cut One Band	$7.50	
+ ((Labor Cost x 2) + FEL Cost) x Time to Load 1 Section	$69.12	
+ (Labor Cost + Truck Cost) x Haul Time	$61.04	
Cost to Remove One 20' Section of CMP (not including dirt removal)	$137.66	

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	9.18/lin. ft.	95.6%	8.78/lin. ft.
Ballast Removal	4.55/cy	95.6%	4.35/cy
Building Demolition and Disposal[1, 2, 3]			
Mixture of Types	0.30/ft^3	95.6%	0.287/ft^3
Explosive Demolition, Concrete or Steel	0.30/ft^3	95.6%	0.287/ft^3
Disposal (Average)	10.21/cy	95.6%	9.76/cy
City Landfill Dump Charges	$74.00/ton	95.6%	$70.74/ton
Concrete Footings and Foundations			
6" Thick With Rebar	5.80sq. ft.	95.6%	5.55/sq. ft.
Footings - 2' Thick, 3' Wide	21.40/lin. ft.	95.6%	20.46/lin. ft.
Concrete Disposal On-Site	9.04/cy	95.6%	8.64/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: 2015 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 (≤ 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	$205.87 Per Hour	$346.86 Per Hour	100% of E-W
Labor Costs	$44.97 Per Hour	$44.97 Per Hour	WYDOT-WDD
Supervision Labor Costs	$6.25 Per Hour	$6.25 Per Hour	1/8 of WYDOT-WDD
Supervisor Transportation	$3.35 Per Hour	$3.35 Per Hour	1/8 of 100% of E-W
Total Hourly Costs	$260.44	$401.43	
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			
($260.44/Hour)/(2.82 Acres/Hour)[1] ($401.43/Hour)/(5.66 Acres/Hour)[2]	$92.35 Per Acre	$70.92 Per Acre	

[1] Caterpillar D9T Dozer

[2] Caterpillar 854G Rubber Tired Dozer

DE 10/2014

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	$44.97 Per Hour	WYDOT-WDD
Dump Truck (10-12 yd^3)	$77.10 Per Hour	100% of E-W
Caterpillar 980H Front-End Loader	$117.64 Per Hour	100% of E-W
Cost to Remove One Surface Water Station = (Labor Cost x Time to Remove Station) + (Labor Cost + Truck Cost) x Time to Remove Station + (Labor Cost + Loader Cost) x Time to Remove Station	 $359.76 $976.56 $1,300.88	
Cost to Remove One Surface Water Station =	$2,637.20	

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	$44.97 Per Hour	WYDOT-WDD
Dump Truck (10-12 yd^3)	$77.10 Per Hour	100% of E-W
Caterpillar 430D (4WD) Backhoe Loader	$35.80 Per Hour	100% of E-W
Cost to Remove One Meteorological or Air Quality Station = (Labor Cost x Time to Remove Station) + (Labor Cost + Truck Cost) x Time to Remove Station + (Labor Cost + Loader Cost) x Time to Remove Station	 $179.88 $488.28 $323.08	
Cost to Remove One Meteorological or Air Quality Station =	$991.24	

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	$151.77 Per Hour	100% of E-W
Labor Costs	$44.97 Per Hour	WYDOT-WDD
Supervision Labor Costs	$6.25 Per Hour	1/8 of WYDOT-WDD
Supervisor Transportation	$3.35 Per Hour	1/8 of 100% of E-W
Total Hourly Costs	$206.34	
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		
($206.34/Hour)/(2.90 Acres/Hour)	$71.15 Per Acre	

Appendix Q
Revegetation Tasks and Costs

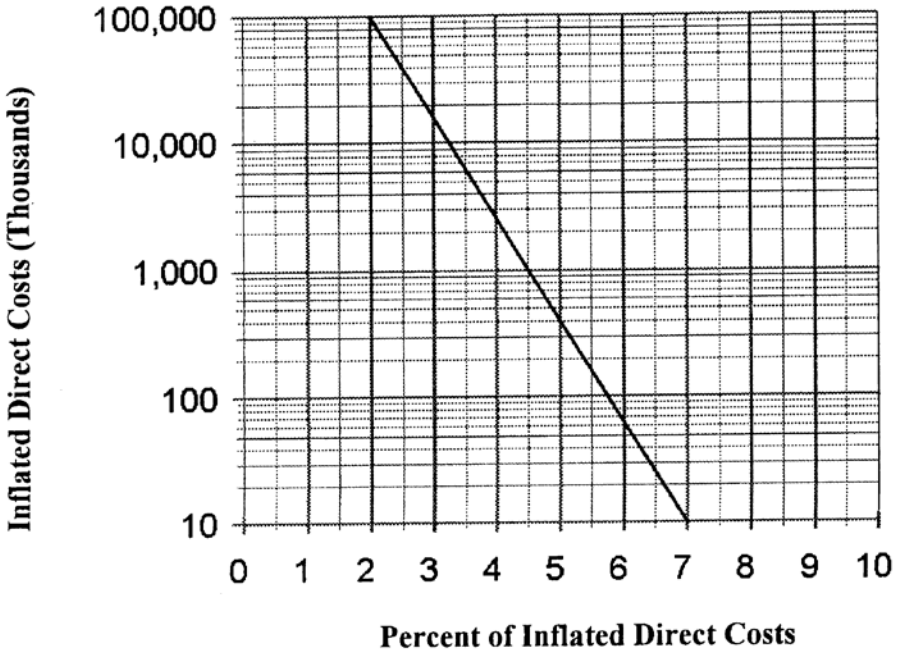
The permittee should fill in the cost per acre for each mine-specific Revegetation Activity as listed in the approved permit document. If a permittee does not use a specific Revegetation Activity, there should be no cost entry. The permittee should add these costs together to obtain a total cost per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

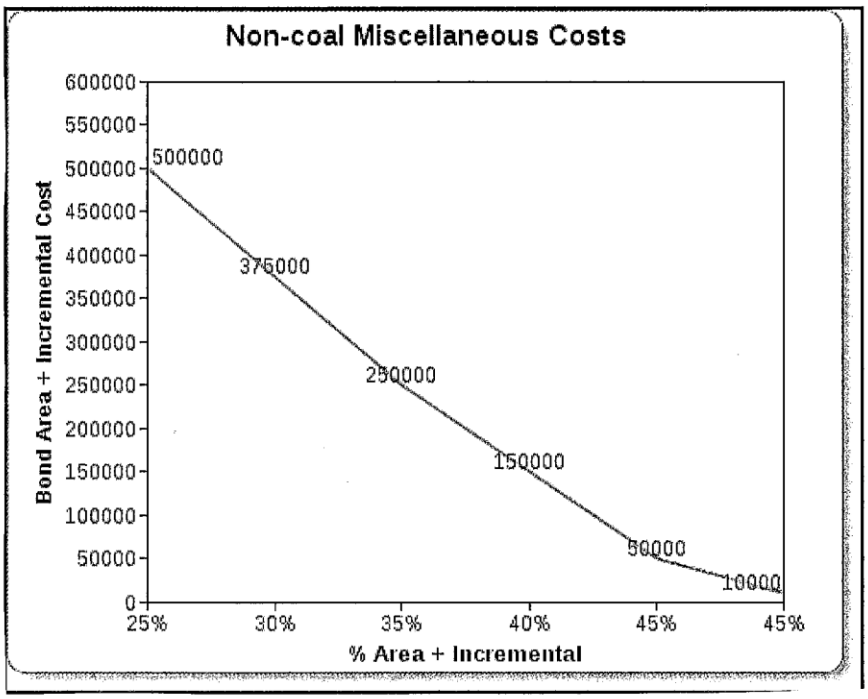
Graph 2



Graphical extension of
Reference lines 010 000 016 0050 and 0300
From Means 1998 *Building Construction Cost Data*,

Appendix S

Non-Coal Miscellaneous Costs



DE 11/2011

DEPARTMENT OF ENVIRONMENTAL QUALITY
LAND QUALITY DIVISION
GUIDELINE NO. 12A

STANDARDIZED RECLAMATION PERFORMANCE BOND
COST CALCULATION METHODS
for
NonCOAL SMALL SCALE MINING OPERATIONS

INTRODUCTION

This document is a Guideline only. Its contents are not to be interpreted by the applicant/operator or Wyoming Department of Environmental Quality (WDEQ) staff as mandatory. This Guideline intends to assist applicants/operators in understanding and attaining the requirements of the Wyoming Environmental Quality Act (ACT) and Land Quality Division (WDEQ/LQD) Rules and Regulations addressing bonding topics. The WDEQ/LQD will selectively and periodically publish updated versions of the Cost Calculation Methods.

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 and establishes a minimum five (5) year bond period for 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 WDEQ/LQD Rules and Regulations apply to bonding.

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

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

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

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.

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 based on types of equipment contractors typically use during reclamation. Ownership and operation costs were determined by using EquipmentWatch (formerly DataQuest). A standard efficiency factor of 0.83 is incorporated into all production calculations, with the exception of scarification calculations where the efficiency factor used was 0.75. The general efficiency factor accounts for a fifty-minute work hour as recommended by many cost references. Labor and benefit costs were obtained from the 2014 State Building Construction Prevailing Wages (February 2014).

II. SITE RECLAMATION TASKS

A. Topsoil / Overburden respread using Cat 627 Push-Pull Scraper. The capacity of the box is assumed to be 17 cubic yards, operating on a nearly level surface, and an operator efficiency of 83%. To determine a volume in cubic yards using replacement depth commitments, the following formula is used:

Volume = {(Replacement Depth in Inches / 12) x (# of acres x 43,560)} / 27

Average One-Way Travel Distance	Cost per cubic yard
500 feet	$0.82
750 feet	$0.90
1,000 feet	$0.99
1,250 feet	$1.06
1,500 feet	$1.14
1,750 feet	$1.21
2,000 feet	$1.28
2,250 feet	$1.35
2,500 feet	$1.42
2,750 feet	$1.49
3,000 feet	$1.56

B. Material Movement with a Dozer

Push Distance	Cat D6 (175 hp) - $/yd^3		Cat D8 (305 hp) - $/yd^3	
	Flat (0% Gr.)	Downslope (-10% Gr.)	Flat (0% Gr.)	Downslope (-10% Gr.)
50	$0.26	$0.22	$0.21	$0.17
100	$0.36	$0.30	$0.33	$0.27
150	$0.46	$0.39	$0.45	$0.38
200	$0.58	$0.48	$0.58	$0.48
250	$0.66	$0.55	$0.80	$0.67
300	$0.82	$0.65	$0.96	$0.80
350			$1.20	$1.00
400			$1.53	$1.28

C. Highwall Reduction with a Dozer

Highwall height in ft.	Cat D6 (175 HP) - $/ft. of HW	Cat D8 (305 HP) - $/ft. of HW
5	$0.13	$0.10
10	$0.51	$0.40
15	$1.15	$0.90
20	$2.04	$1.59
25	$3.19	$2.49
30	$4.60	$3.59

- Quarries operations should include blasting costs of $0.859/BCY for slope reduction.

D. Material Movement with a Loader (Cat 980) and Truck (Cat 725) Fleet

Average One-Way Travel Distance	Cost per cubic yard
500 feet	$1.25
1,000 feet	$1.32
1,500 feet	$1.41
2,000 feet	$1.50
2,500 feet	$1.59
3,000 feet	$1.68
3,500 feet	$1.77
4,000 feet	$1.86
4,500 feet	$1.95
5,000 feet	$2.05
6,000 feet	$2.23

E. Ripping of a pit floor with a Dozer

These costs are based on an assumption that a dozer will be equipped with a three-shank ripper with a three-foot shank spacing. The average pass would result in an equivalent width of nine feet, assuming a three-foot shank spacing is maintained.

a. CAT D6, $170.06 per acre

b. CAT D8, $265.06 per acre

F. Final Grading of the Reclaimed Surface using a Cat 140 Motor Grader

Final grading costs are calculated based on the grader operating in 2nd gear and finish grade being attained at one-half the blade width. The unit cost for this operation equates to $71.62 per acre.

G. Scarification of a compacted surface using a Cat 140 Motor Grader

The cost is based on the assumption that a grader will be operated in 1st gear and is equipped with a five-shank ripper with a 21-inch shank spacing. The average pass would result in an equivalent width of 9.33 feet, assuming the 21-inch spacing is maintained between passes. The unit cost for this operation equates to $62.80 per acre.

H. Culvert Removal including fill material.

This task assumes excavation using a common backhoe/loader combination hauling a distance of roughly 1000 feet to dispose of fill material. Fill volume estimate is assumed to be two (2) cubic yards per foot of culvert. Culvert removal cost equates to $13.20 foot.

I. Seeding Costs (seed plus application)

Seeding costs are estimated at $300.00 per acre (based on a generic seed mix of shrubs, grasses, and forbs). This cost should be used in calculations unless the landowner has a specific seed mix for the area that will reduce or increase the cost of reclamation. Under such conditions, the seed cost would be added to an application cost of $100.00 per acre to derive the total seeding cost.

J. Miscellaneous Equipment Costs and Capabilities.

a. Case 590 / Cat 430 with a 1.1 cubic-yard loader bucket and 0.33 cubic-yard backhoe bucket - $89.74 / hour. Backhoe production is approximately 19 cubic-yards per hour, which equates to $4.72 / cubic-yard.

b. Cat 980 Front-End Loader with a 5.25 cubic yard bucket - $171.58 / hour. When using the loader to spread stockpiled material, the estimated costs are:

One-Way Travel Distance (feet)	Unit Cost ($ / cubic-yard)
100	$0.35
200	$0.44
300	$0.50
400	$0.58

K. Pioneer (Cut/Fill Perpendicular to the Slope) Road Reclamation
Reclamation is assumed to be performed with a Cat 330 excavator. The estimated cost per foot of road is $1.70 and includes smoothing of the replaced material.

L. Well and Drill Hole Abandonment

The operator should see Guideline 12, Appendix L as a guide to estimate costs associated with this task.

III. Minimum Bonding Costs

If the estimated cost of a reclamation task, with the exception of those falling under Items II (H) and (L) is less than $200.00, then a lump sum fee of $200.00 should applied to the task rather than the calculated estimated cost.

IV. Bond Release

The minimum period between completion of reclamation and application for bond release on reclaimed areas is five (5) years (growing seasons. Early bond release is possible after two full growing seasons provided the Operator has obtained a “Statement of Satisfactory Reclamation” from the Landowner and the operator adequately demonstrates to the

WDEQ/LQD that vegetation is self-renewing. This demonstration of self-renewing vegetation may require vegetation sampling as required under Guideline 2.

Once an area has been seeded, the Operator is eligible for up to 75% release of the bond required for the affected land. However, the overall bond for the operation should not be less than $10,000.00. Unit area reclamation costs are highly variable and for simplicity the WDEQ/LQD will assume the unit area reclamation costs of $2,000.00 per acre associated with Limited Mining Operations is applicable. Therefore, the minimum reclamation maintenance level after partial bond release is **$500.00 per acre**.

V. Contingency Fees

Miscellaneous bond costs, such as mobilization, de-mobilization, and profit will likely be higher for small, remote projects. The WDEQ/LQD feels that the miscellaneous costs on these small operations 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. The table below has been developed to assist in the estimate of a Contingency Fee.

Site Cost Reclamation Estimate ($)	Contingency Fee (%)
≤ 50,000	45
100,000	42
150,000	40
200,000	37
250,000	35
300,000	33
350,000	31
400,000	29
450,000	27
≥ 500,000	25

VI. Maps

This Guideline requests that acreages Reclamation Performance Bond estimates be tied to a map at a scale that adequately illustrates the location of various features (e.g., stockpiles) and the land surface status (i.e., reclaimed, topsoiled, disturbed, etc.). The map should be titled, identify the Permit Number, Operator address, have a north arrow, scale identified, show legal subdivisions and the Permit Area Boundary.

Please also see WDEQ/LQD Guideline #6, Page 14, Section V (Maps and Aerial Photos)