APPENDIX D

ESTIMATING COST OF TREATMENTS, STRUCTURES AND MATERIALS

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Cost Estimation

The cost of implementing erosion control practices is variable depending on the region, site conditions, eg. slope, aspect and soil, size of the area, proximity of materials, labor rates, and timing of installment. More importantly, cost will be highly dependent on whether erosion control work is done concurrently with or closely following the mining operation and if mining equipment and labor are utilized. Therefore, it is difficult to generalize regionally or nationwide on a year-round basis.

With this in mind, realistic approximations of cost data have been collected and summarized in Table D.1. Additional sources of information are: state highway departments, mining companies, and SCS.

Cost data are organized into the following categories: surface protection measures, mechanical treatments, and diversion, conveyance, detention and filtering systems. Surface protection measures (Table D.1a) include mulches, chemical stabilizers, nets, blankets, mats, tackifiers, revegetation measures (seed and fertilizer) and combined treatments. The cost of liming, soil testing or gypsum application which may be required before implementing surface protection measures are not included. The costs incurred during topsoiling are included under revegetation. Associated costs not included are temporarily stabilizing a topsoil stockpile and final reclamation of the area disturbed by the stockpile. The mechanical treatments included in Table D.1b are only those described and specified in Chapter IV. Cost data for the four practices - diversion, conveyance, detention and filtering - are combined in Table D.1c. Items from this table can be combined or used singularly when analyzing costs of designing these erosion control measures.

The unit cost data are usually expressed as the pay item unit cited in the standard specifications for each particular treatment or structure (Chapters IV to VII). Cost data represent the range of costs incurred to contractors for materials, equipment operation, and installation unless otherwise specified. Maintenance costs which are extremely variable and dependent on climate and site-specific conditions, are not included in the cost estimates unless specified. Unit costs for mechanical treatments have been divided into two parts depending on whether equipment is owned or rented (contracted).

To assist in assessing total costs of each erosion control practice (or combined practices) a worksheet is provided in Table D.2. Although not specified for each particular erosion practice, cost of renting or buying equipment to construct or emplace structures or treatments is an important item for consideration. Unless contracted, these costs include rental or purchase amount, taxes, insurance, fuel, maintenance, and depreciation. Many types of equipment may already be available on site at a mining operation, eg. dozers, crawlers, trucks, scrapers and front end loaders. Other implements may be purchased or rented from farm or rangeland dealers in the area, eg. seeders, plows, and disks. Irrigation equipment may also be needed to maintain a seeded and mulched area for one or several growing seasons.

Labor costs will vary widely, depending on the type or combinations of treatments or structures required on the site. Some of the costs of labor are included in "total cost" estimates in Table D.1. Initial work required to prepare a site before actually implementing a control practice may be incorporated into the mining and postmining work, eg. leveling and grading spoil material. Hence, the overall cost of a treatment may be minimized by premine planning and coordination with the active mining operation.

Most treatments and structures require a substantial amount of labor in achieving the most cost-effective result. If properly designed, implemented, and monitored during the early stages of reclamation, overall cost will be minimized because periodic maintenance costs will be greatly reduced.

Installation of any of the erosion control practices involves supervision and sometimes design costs. When incurred, the costs will depend on the complexity of the treatment or structure and on whether the company or a contractor does the work. Utilization of mining company personnel, mining and postmining overburden manipulation, and mining equipment can greatly decrease the price of implementing a control measure.

The cost-effectiveness of an erosion control practice is an essential piece of information for final appraisal of a total control design plan. As suggested earlier, cost (and cost-effectivness) is a function of site-specific conditions, climate and design objective for reduction in sediment yield. The cost-effectivess of a particular design should be compared to that of another design only when both designs fulfill the same sediment reduction objective. The cost analysis can then be used to determine the most cost-effective design

to achieve the required sediment reduction at a site.

Several different practices and combinations of methods and materials should be evaluated using Tables D.1 and D.2 before a final design is accepted. For example, if mulching is selected, several alternative materials are available. The least expensive choice will take advantage of material and equipment available on site, such as wood chips from the clearing operation or gravel from the overburden.

In summary, overall costs are highly variable and must be assessed critically at a site before finalizing a design. The costs given in Table D.1 are realistic approximations (not maximums or minimums) and provide a means of estimating relative costs associated with a particular erosion control structure or measure.

References

Brown, L.F. 1982, in press. A Definition of Mined-Land Reclamation and Its Relationship With the Use of Topsoil as an Amendment to Aid Revegetation, Am. Mining Congress (mtg. in Denver, Colorado, 1981).

Table D.1. Cost Data for Erosion Control Practices.

D.1a. Surface Protection Measures

Surface Protection Measures	Unit Cost (includes materials only unless specified)
Mulch	
Conwed Wood Fiber	$.20/lb - $400/ton
Silva Wood Fiber	$.10/lb - $200/ton
Stone and Gravel	$5.60/ton (Total Cost)
Straw (mechanically crimped)	$100-200/ton (Total Cost)
Woodchips	$42.30/ton (Total Cost)
Turifiber	$.12/lb - $244/ton
Wood Fiber	$.11/lb - $222/ton
Hydro Mulch (grass seed/ cellulose fiber)	$615/ton (Total Cost)
Chemical Stabilizer	
Aero Spray	$3.40/gal
Terratack	$6.20/lb
Genequa	$3.90/gal
Asphalt (Tackifier)	$1.20/gal
Nets, Blankets, Mats	
Holdgro (paper and nylon)	$2,130/acre
Excelsior (curlex)	$1,500/acre
Jute Mesh	$2,800-6,000/acre
Enkamat	$16,553-24,200/acre
Mulch with Chemical Stabilizer and Tackifier	
Straw/Asphalt	$288/gal
	$480/gal applied (Total Cost)
Wood Fiber/Terratack	$123/package (100 lb)
Wood Fibert/Aerospray	$304/500 lb/45 gal
Wood Fiber/Genequa 743	$277/500 lb/45 gal
Wood Fiber/Petroset SB	$252/500 lb/45 gal
Straw/Curasol AK	$371/1.5 ton/40 gal
Wood Fiber/Dow Mulch Binder	$198/500 lb/45 gal
Straw/Terratack	$291/1.5 ton/45 lb
Straw/Dow Mulch Binder	$286/1.5 ton/45 lb

Table D.1. (continued).

D.1a. Surface Protection Measures (continued)

Surface Protection Measures	Unit Cost (includes materials only unless specified)
Revegetation Measures	
Seeds - Average Total Cost of Seeds (grass, clover, etc.) and Seeding Cost (rate varies with soil and seed type)	$11/lb
Seeds - Weeping Lovegrass	$2/lb
Crimson Clover	$1/lb
Tall Fescue	$.50/lb
Kentucky Bluegrass	$2/lb
Redtop	$4/lb
Crown Vetch	$10/lb
Red Clover	$1.50/lb
Flat Pea	$6/lb
Fertilizer - Nitrogen	$.65/lb
Seed and Mulch - Hydromulch (seed/ cellulose fiber)	$615/ton (Total Cost)
Basic Regrading and Reseeding	$1,500/acre
Maintenance (purchase and application of maintenance fertilizer)	$50/acre
Respreading Topsoil Without Stockpiling	$500/acre
Stockpiling and One Move of Topsoil (may require more than 1 move)	$2,800/acre
Total Cost (average over 4-6 years)[1]	$1,700-7,150/acre

[1]From Brown, 1982 (in press)

Table D.1. (continued).

D.1b. Mechanical Treatments

Mechanical Treatment	Unit Cost (Total Cost) Hired Contractor	Own Equipment
Contour Furrowing	$20-50/acre	~$15/acre
Pitting	$20-50/acre	~$15/acre
Ripping	$60-120/acre	~$50/acre
Land Imprinting	-----	~$10-20/acre

D.1c. Diversions, Conveyance, Detention and Filter Systems

Diversion, Conveyance, Detention, Filtering	Unit Cost (includes materials, equipment operation, emplacement)
Diversion, Lined	$5-10/lin ft
Diversion Unlined	$1.50-4.50/lin ft
Perimeter Berm	$1-2/cu yd
Silt Fence	$3-6/lin ft
Straw Bale Barrier	$3-7.50/lin ft $9-22.50/bale
Brush Barrier	$5-10/sq yd
Rock Outlet	
Riprap	$25-35/cu yd
Aggregate	$20-30/cu yd
Plastic Filter Fabric	$1-3 sq yd

Table D.1. (continued).

D.1c. Diversions, Conveyance, Detention and Filter Systems (continued)

Diversion, Conveyance, Detention, Filtering	Unit Cost (Total Cost)
Check Dam - Riprap	$25-35 cu yd
Waterways	
Grass-Lined, Seeded	$2-5/sq yd
Grass-Line, Sodded	$7-10/sq yd
Riprap	$25-35/cu yd
Miscellaneous Treatment	
Excavation	$5-15/cu yd
Raking	$40-45/acre
Hauling	$.20-.30/ton/mi
Scarification (about 1 ft deep)	$40/acre

Table D.2. Worksheet for Calculating Total Cost of Installing an Erosion Control Measure.

Equipment		
Rental		_____
Purchase		_____
Company Owned		_____
	Subtotal	_____
Labor		
Outside Labor		_____
In-House Labor Force		_____
	Subtotal	_____
Material		
On-Site Material		_____
Other Material		_____
	Subtotal	_____
Miscellaneous		
Soil Preparation		_____
Maintenance		_____
Topsoil Stockpile Stabilization and Reclamation		_____
	Subtotal	_____
Supervision, Design, Contingencies		
	Subtotal	_____
	TOTAL	_____