APPENDIX C
COST ANALYSIS OF
EROSION AND SEDIMENT CONTROL PRACTICES

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COST ANALYSIS OF EROSION AND SEDIMENT CONTROL PRACTICES

Analyzing Benefits and Costs

Benefit-Cost analysis is a technique used to determine whether a measure will result in more benefits than it will cost.

For the purposes of making a benefit-cost analysis for erosion and sediment control, the time period associated with erosion and sedimentation is considered to extend from the first disturbance of the land to the time of establishing effective erosion control.

Ascribing Effects to Treatment Measures

The generally accepted basis for attributing effects of treatment measures on a comparable basis is the "with" and "without" approach. This approach compares the expected difference in damages between what is expected if no control is used and what is expected if a measure is installed. The total difference in expected damage is the estimated benefit of the measure.

Sediment damages may be related to (1) deposition of eroded materials on flood plains, in channels, reservoirs, residences, utilities, and other properties that require the removal and disposition of materials, and the repairing of damaged facilities and (2) swamping damage which adversely affects existing features or limits potential improvement of land caused by a rise in the ground water table or by impairing surface drainage.

Sediment resulting from construction sites can be deposited along a stream and cause individual landowners to pay for its removal. Sediment can also destroy aesthetic values of a stream (clean water vs. turbid water) and adversely impact stream fisheries and micro-organisms.

In municipal and industrial uses where water is pumped directly from a river or reservoir, slugs of sediment associated with excessive rainfall may pose sever water quality problems. Turbidity may be increased, necessitating increased treatment, which raises the cost of operations. Sediment may also be deposited in storm drains, reducing their ability to control flooding. This increases flood damage and requires the cleanout of sediment from the storm drain systems.

Pricing Treatment Measures and Benefits

Prices applied should reflect values expected to prevail at the time of occurrence. Current prices are used for installation costs of treatment measures. Projected normalized prices (based on past prices and trends) should be used for estimating future values (benefits, operations and maintenance costs and replacement costs) for permanent type measures only.

Period of Analysis and Evaluation

The period of analysis in years should equal the economic life (need for a measure) or the physical life of treatment measures, whichever is less. The benefits considered over the evaluation period include those accruing over the period.

The annual costs of permanent measures chargeable to the evaluation period include the amortized installation cost and the future annual operation, maintenance, and replacement cost necessary to provide the benefits over the evaluation period. The amortization rate should be based on prevailing local interest rates at the time of installation.

Appraisal of Damages and Treatment Costs

Many people are affected by the damages resulting from erosion and sedimentation. Also, communities and individuals benefit from its prevention, reduction, or mitigation.

Costs will be incurred to: (1) install remedial treatment measures; or (2) correct damages; or (3) a combination of the two.

Treatment Measures

Treatment measures on developing sites are frequently temporary—generally lasting up to one or two construction seasons. Benefits and cost for temporary measures can be compared directly using current prices.

Permanent measures are planned to trap sediment and control erosion and runoff during and beyond the construction period. The prevention of sediment damages can be accomplished by either, or both of, two methods:

1. Stabilizing sediment source areas by applying conservation erosion control measures.

2. Trapping sediment before it leaves the construction area (sediment control)

Erosion control is almost always more effective than sediment control at preventing sediment damage.
Some of the potential benefits from preventing downstream sediment transport and deposition include:

1. Prevention or reduction in cost of removal and disposition of sediment from properties.

2. Prevention or reduction in damage to property.

3. Prevention of water quality impairment.

Some permanent measures may be retained to provide long-term benefits.

For example, a sediment basin may be cleaned out after construction is finished and utilized for aesthetics, recreation, fish, or stormwater management.

Benefits and costs for permanent measures need to be converted by discounting and amortizing to average annual figures for comparison.

Benefit-Cost Analysis

A simple equation for determining the benefits of controlling sediment is:

B = (SxY) - [C + (SxY)(1.00-P)]

Where: B = Benefits in dollars.

S = Cubic yards of sediment expected to move off the site if no control measures are applied. (See Section 3).

Y = Cost in dollars per yard to recover and dispose of sediment that has moved off the site.

C = Estimated cost of temporary measures to be installed. (See Cost Tables).

P = Estimated effectiveness of proposed measures expressed as a decimal.

Example

This example illustrates the methodology of a benefit-cost analysis:

Given: A construction site of 78 acres, which without erosion or sediment control measures will yield about 5 acre feet or 8,000 cubic yards of sediment (S) to the lower end of the site. There is a channel with several culverts located below the site and it is assumed all the sediment would be deposited in it. It would be necessary to remove all the additional sediment in order to maintain the capacity of the channel and avoid increased hazard to flooding. The cost of removing and disposing the sediment is estimated at $2.00 per cubic yard (Y).
With temporary erosion and sediment control measures, including a sediment basin, in place during the one year construction period, sediment delivered to the channel will be reduced 90 percent (P). The cost of the measures would be as follows, (no amortization is required since costs and benefits are incurred in a similar one year period):

1. Land grading measures…….$2,000
2. Temporary sediment basin……$3,000

    a. Construction……$1,500
    b. Maintenance……$1,000
    c. Restoration……...$500

Total Cost (C)……...…….$5,000

The "without treatment" condition reveals damages in the form of costs to remove sediment. Benefit (costs saved) are derived by subtracting the sediment removal costs under the "with treatment" condition.

1. Without treatment condition

    8,000 cu.yd. (S) x $2.00/cu.yd. (Y) = $16,000 (SxY)

2. With treatment condition

    a. Costs (C) described above = ……...$5,000
    b. Removal costs for the 10% of sediment that passes through the control measure (measure is 90% effective)

        (SxY)(1.00-P) = (16,000)(1.00 - .90) …$1,600

    c. Total Cost = $5,000 + $1,600 =……. .$6,600

3. Benefits

    $16,000—$6,600 = ……..$9,400 (B)
    ($9,400 is money saved by installing sediment treatment)

Using the formula directly, the computations show the same results:

B = (SxY)-[c + (SxY)(1.00-P)]

B = ($8,000 x 2.00)-[($5,000 + (8,000 x 2.00)(1.00-0.90)]

B = ($16,000)-($5,000 + 1,600)

B = ($16,000)-($6,600)

B = $9,400

In this example, the more economical approach would be to install treatment measures rather than correct damages at a later date. A third alternative would be "do nothing" which would result in a higher flood damage hazard that would need evaluation under a more sophisticated analytical model. **Also, in this simple example, water quality issues (such as habitat loss) were not included even though society, in general, does place a value on such issues.**

Table C.1—Cost Table of Selected Practices

The cost of implementing erosion and sediment control practices is highly variable and dependent upon many factors including availability and proximity of materials, time of year, prevailing wage rates, and regional cost trends to name a few. It is therefore difficult to develop cost estimates that are applicable statewide and year-round. The cost data contained in this chapter is based on actual bid prices from county and state highway construction projects, and suppliers for the year 2013. The following cost figures for selected practices, are provided to aid project planners in estimating erosion and sediment cost for feasibility studies. Values have been rounded to nearest dollar. **The actual dollar amounts are not recommended for use in estimating and bidding construction contracts.** It is advisable to check with local suppliers and contractors for this purpose.

Erosion and Sediment Control Measures	$ Low	$ High	$ Median
VEGETATIVE MEASURES			
Temporary Seeding	750/ac.	1,950/ac.	1,050/ac.
Permanent Seeding	2,850/ac.	5,000/ac.	3,800/ac.
Straw Mulch	1,250/ac.	1,900ac.	1,400/ac.
Wood Mulch	-	32,000/ac.	32,000/ac.
Topsoil Stripping	-	-	3/cu.yd.
Topsoil Spreading	-	-	38/cu.yd.
Sodding	-	-	23/sq.yd.
RECP Netting	8/sq.yd.	10/sq.yd.	9/ sq.yd.
Tree Protection	-	-	10/ln.ft.
BIOTECHNICAL MEASURES			
Willow Wattles	-	-	19/ln.ft.
Live Stakes	5.85	9.00	7/ea.
Brush Layering	-	-	15/ln.ft.
RUNOFF CONTROL MEASURES			
Temporary Swale	4/ln.ft.	6/ln.ft.	5/ln.ft.
Rock Check Dam	248/ea.	860/ea.	500/ea.
Diversion or Grass Channel	12/ln.ft.	23/ln.ft.	19/ln.ft.
Riprap Channel	70/cu.yd.	105/cu.yd.	86/cu.yd.
Flow Spreader/Diffuser	-	-	48/ln.ft.
Rock Outlet Structure	-	-	1,900/ea.
Turf Reinforcement Mats			25/ sq.yd

Table C.1 (cont'd)
Cost Table for Selected Practices

Erosion and Sediment Control Measures	$ Low	$ High	$ Median
SEDIMENT CONTROL MEASURES			
Silt Fence	4ln.ft.	10/ln.ft.	6/ln.ft.
Straw Bale Dike	6/ln.ft.	10/ln.ft.	8/ln.ft.
Stabilized Construction Access	-	-	57/cu.yd.
Temporary Sediment Basin	-	-	96/cu.yd.
Temporary Sediment Trap	1,100/ea.	3,800/ea.	2,900/ea.
Temporary Sediment Dike	-	-	23/ln.ft.
Turbidity Curtain	8/sq.yd.	105/sq.yd.	60/sq.yd.
Filter Fabric Inlet Protection	-	-	190/ea.
Excavated Drop Inlet Protection	-	-	950/ea.
Temporary Sediment Tank	-	-	5,000/ea.
Block & Gravel Inlet Protection	-	-	1,000/ea.
Compost Filter Sock			50/ln.ft.
Geotextile Filter Bag			700/ea.
Sediment Basin Skimmer			1,200/ea.
Concrete Truck Washout Facility			1,500/ea.

Table C.2
Maintenance Cost As Percentage of Installation Cost

Item	Percentage (%)
Seeding	20
Mulch	2
Silt Fence	100
Sediment Trap	30
Sediment Basin	25
Inlet Protection	60
Stabilized Construction Entrance	100
Rock Riprap	10
Grass Channel	10
Temporary Swale	50
Flow Spreader	50
Tree Protection	30
Rock Outlet Structure	20

References

1. Soil Conservation Service, USDA. Oct. 1977. National Handbook for Conservation Practices, U.S. Government Printing Office, Washington, D.C.

2. Soil Conservation Service, USDA. July 1984. Engineering Field Manual of Conservation Practices, 4th Printing, U.S. Government Printing Office, Washington, D.C.

3. Soil Conservation Service, USDA. Sept. 1987. Drainage Guide for New York State, Syracuse, N.Y.