LOAD REDUCTION ESTIMATION GUIDE

A Guide for Estimating Pollutant Load Reductions Achieved Through Implementation of Best Management Practices

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WQPBWPSTD-013

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ACRONYMS

Acronym	Definition
BEHI	Bank Erosion Hazard Index
BMP	Best Management Practice
CWA	Clean Water Act
DEQ	Department of Environmental Quality (MT)
EPA	Environmental Protection Agency (US)
FS WEPP	Forest Service Water Erosion Prediction Project
GIS	Geographic Information System
GRTS	Grant Reporting and Tracking System
MSU	Montana State University
N	Nitrogen
NRCS	Natural Resources Conservation Service (USDA)
NRIS	Natural Resource Information System
P	Phosphorus
RUSLE2	Revised Universal Soil Loss Equation, Version 2
SOP	Standard Operating Procedure
STEPL	Spreadsheet Tool for Estimating Pollutant Load
TMDL	Total Maximum Daily Load
USDA	United States Department of Agriculture
USLE	Universal Soil Loss Equation
WQ	Water Quality
WSS	Web Soil Survey (USDA)

INTRODUCTION

The Load Reduction Estimation Guide (Guide) is primarily designed to help recipients of Clean Water Act (CWA) 319 funding comply with the US Environmental Protection Agency's (EPA) requirement to report the annual nitrogen, phosphorus and sediment load reductions achieved through implementation of on-the-ground best management practices (BMPs). However, others may also find it helpful as they attempt to evaluate the impact of their efforts to reduce nonpoint source pollution.

The Guide is not designed to be an exhaustive list of all reasonable methods for estimating pollutant load reductions. 319 fund recipients should not feel constrained to using only the methods contained in this Guide. The Watershed Protection Section encourages 319 project sponsors to contact Section staff with any questions you might have regarding selection of load reduction estimation methodology.

The Guide is **not intended for** the following purposes:

- Calculation of nutrient reductions in support of a nutrient trading program
- Evaluation of Total Maximum Daily Load (TMDL) targets
- Evaluation of water quality standards
- Assessment of a stream or lake's ability to support beneficial uses

The Guide will be updated from time to time as new methods are discovered. If you are aware of methods not contained in the Guide, please share them with the Department of Environmental Quality's (DEQ) Watershed Protection Section.

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Updates to the Guide will be made available through the DEQ Nonpoint Source Program website, http://deq.mt.gov/wqinfo/nonpoint/NonpointSourceProgram.mcpx

INSTRUCTIONS

Section 1 – Method Summary Tables
Table 1-1 – Method Characteristics
Use this table to quickly identify an estimation method or set of methods based on the following factors:

- Pollutants of concern
- Data requirements
- Desired level of accuracy
- Availability and skill of method users

Table 2-1 through **2-8** – Applicable Best Management Practices
Use these tables to determine which estimation methods are appropriate for your particular best management practices (BMPs). The BMPs are listed according to the following categories:

- Agriculture

- Forestry
- Hydromodification
- Mining and Industry
- Recreation
- Restoration
- Transportation
- Urban and Suburban

Section 2 – Method Descriptions
This appendix contains a one to two page description of each load reduction estimation method. The descriptions include the following information:

- Method name
- Applicable pollutants
- Applicable BMPs (broadly categorized)
- Names of other versions of the same method
- Links to downloadable programs, databases, and other resources
- List of required expertise, equipment, software, and data
- Instructions for how to use the method

Some of the **individual method descriptions contain web links that must be accessed in order to fully evaluate and use the method**. If you encounter broken links or other issues with any of the methods, please contact the DEQ Watershed Protection Section (see contact info above).

A few of the methods require you to have or download software. Generally speaking, you should not need to purchase any additional software beyond the Microsoft Office suite of programs (Word, Excel, PowerPoint, Access). Some of the methods require the use of Geographic Information System (GIS) software. Depending upon the GIS software you choose, there may be a cost associated. However, there are numerous, free or “open source” GIS software packages available on the web.

SECTION 1 – METHOD SUMMARY TABLES

Table 1-1. Method Characteristics

Method Name	Nitrogen	Phosphorus	Sediment	Pre-construction Field Data Required?	Accuracy (estimate)	Time to Learn and Apply (relative)	Skill Level
BEHI	N	N	Y	Y	M	M	M
FS WEPP	N	N	Y	Y	M	M	M
Livestock Deposition Model	Y	Y	N	N	L	L	L
Mass Balance Equation	Y	Y	Y	Y	M	L	L
Pour Point Monitoring	Y	Y	Y	Y	H	L	L
Region 5 Model	Y	Y	Y	N	M	H	H
RUSLE2	N	N	Y	N	M	H	H
STEPL	Y	Y	Y	N	M	H	H
Y = yes, N = no							
L = low, M = medium, H = high							

SECTION 2 - APPLICABLE BEST MANAGEMENT PRACTICES

Table 2-1. Agriculture

Best Management Practice	BEHI (S)	FS WEPP (S)	Livestock Deposition Model (N,P)	Mass Balance Equation (N,P,S)	Pour Point Monitoring (N,P,S)	RUSLE2 (S)	STEPL (N)	STEPL (P)	STEPL (S)	Region 5 Model (N)	Region 5 Model (P)	Region 5 Model (S)
Alley Cropping					Y	Y						
Animal Trails and Walkways		Y	Y									
Animal Waste System			Y									
Buffer Strip			Y	Y	Y	Y						
Canal Fencing			Y									
Clean Water Diversion					Y							
Composting												
Conservation Cover					Y	Y						
Conservation Crop Rotation - ag fields					Y	Y				Y	Y	Y
Conservation Easements										Y	Y	Y

Table 2-1. Agriculture

Best Management Practice	BEHI (S)	FS WEPP (S)	Livestock Deposition Model (N,P)	Mass Balance Equation (N,P,S)	Pour Point Monitoring (N,P,S)	RUSLE2 (S)	STEPL (N)	STEPL (P)	STEPL (S)	Region 5 Model (N)	Region 5 Model (P)	Region 5 Model (S)
Conservation Tillage					Y	Y						
Constructed Wetland					Y							
Contour Farming / Cropping					Y	Y	Y	Y	Y			
Corral Relocation			Y									
Cover Crop (Conservation Cover) - ag fields										Y	Y	Y
Cover Crop and Green Manure					Y	Y				Y	Y	Y
Critical Area Planting - ag fields				Y	Y	Y				Y	Y	Y
Critical Area Treatment (critical area planting in areas with gullies)										Y	Y	Y
Diversion - cropland							Y	Y	Y			
Diversion - feedlot										Y	Y	
Filter strip - cropland			Y		Y		Y	Y	Y			
Filter strip - feedlot			Y		Y			Y			Y	
Filter Strips - which may further reduce sediment by 65%, phosphorous by 75% - ag fields			Y		Y					Y	Y	Y
Flood to Pivot Conversion					Y							
Grade Stabilization Structure - gully stabilization	Y			Y						Y	Y	Y
Grassed Waterway - gully stabilization										Y	Y	Y
Hardened Stream Crossing	Y	Y		Y								
Heavy Use Area Protection			Y			Y						
Irrigation Canal Seepage Reduction												

Table 2-1. Agriculture

Best Management Practice	BEHI (S)	FS WEPP (S)	Livestock Deposition Model (N,P)	Mass Balance Equation (N,P,S)	Pour Point Monitoring (N,P,S)	RUSLE2 (S)	STEPL (N)	STEPL (P)	STEPL (S)	Region 5 Model (N)	Region 5 Model (P)	Region 5 Model (S)
Irrigation Diversion Improvement												
Irrigation Tailwater Control	Y			Y	Y							
Irrigation Wasteway Rehabilitation	Y			Y	Y							
Mineral Supplement Relocation			Y									
Minimum-Till					Y	Y						
No-Till					Y	Y						
Nutrient Management Planning			Y		Y							
Off-Stream Watering / Water Gap	Y		Y	Y								
Perennial Forage Establishment					Y	Y						
Prescribed Grazing - ag fields			Y		Y	Y				Y	Y	Y
Raingutters					Y							
Range/Pasture Improvement Practices					Y	Y						
Recreational Access Site Stabilization (Animal trails and walkways) - bank stabilization										Y	Y	Y
Reduced Tillage Systems					Y	Y	Y	Y	Y			
Residue Management, Mulch Till - ag fields					Y	Y				Y	Y	Y
Revegetation				Y	Y	Y						
Riparian Fencing			Y		Y	Y						
Rotational Grazing			Y		Y	Y						
Runoff Mgmt System - feedlot								Y			Y	

Table 2-1. Agriculture

Best Management Practice	BEHI (S)	FS WEPP (S)	Livestock Deposition Model (N,P)	Mass Balance Equation (N,P,S)	Pour Point Monitoring (N,P,S)	RUSLE2 (S)	STEPL (N)	STEPL (P)	STEPL (S)	Region 5 Model (N)	Region 5 Model (P)	Region 5 Model (S)
Salinity and Sodic Soil Management					Y							
Sediment basins (water and sediment control basins) - gully stabilization					Y					Y	Y	Y
Settling Basin					Y							
Solids Separation Basin - feedlot							Y	Y		Y	Y	
Solids Separation Basin w/Infilt Bed - feedlot								Y			Y	
Streambank Stabilization (Streambank Protection) - bank stabilization										Y	Y	Y
Streambank stabilization and fencing - cropland							Y	Y	Y			
Stream-crossing Replacement/Upgrade	Y	Y		Y								
Stripcropping, Contour - ag fields					Y	Y				Y	Y	Y
Stripcropping, Field - ag fields					Y	Y				Y	Y	Y
Swamp "un-busting"												
Terrace - cropland							Y	Y	Y			
Terrace - feedlot							Y	Y		Y	Y	
Waste Mgmt System - feedlot							Y	Y		Y	Y	
Waste Storage Facility - feedlot							Y	Y		Y	Y	
Water Gap	Y		Y	Y								
Wetland Detention					Y							
Windbreak			Y			Y						

Table 2-2. Forestry

Best Management Practice	BEHI (S)	FS WEPP (S)	Livestock Deposition Model (N,P)	Mass Balance Equation (N,P,S)	Pour Point Monitoring (N,P,S)	RUSLE2 (S)	STEPL (N)	STEPL (P)	STEPL (S)	Region 5 Model (N)	Region 5 Model (P)	Region 5 Model (S)
Animal Trails and Walkways		Y	Y									
Beaver Reintroduction												
Conservation Easements										Y	Y	Y
Critical Area Planting				Y	Y	Y						
Critical Area Treatment (critical area planting in areas with gullies)										Y	Y	Y
Filter Strip					Y							
Grade Stabilization Structure - gully stabilization	Y			Y						Y	Y	Y
Grassed Waterway - gully stabilization										Y	Y	Y
Infiltration Basin					Y							
Infiltration Trench					Y							
Reforestation				Y	Y	Y						
Road Decommissioning		Y										
Road dry seeding - forest					Y	Y			Y			
Road Grading		Y			Y							
Road grass and legume seeding - forest					Y	Y			Y			
Road hydro mulch - forest					Y	Y			Y			
Road Maintenance		Y			Y							
Road Paving		Y			Y							
Road Sanding Management					Y							
Road Storage		Y										
Road straw mulch - forest					Y				Y			
Road tree planting - forest									Y			
Sediment basins (water and sediment control basins) - gully stabilization					Y					Y	Y	Y
Settling Basin					Y							
Site preparation/ hydro mulch/ seed/ fertilizer - forest						Y			Y			

Table 2-2. Forestry

Best Management Practice	BEHI (S)	FS WEPP (S)	Livestock Deposition Model (N,P)	Mass Balance Equation (N,P,S)	Pour Point Monitoring (N,P,S)	RUSLE2 (S)	STEPL (N)	STEPL (P)	STEPL (S)	Region 5 Model (N)	Region 5 Model (P)	Region 5 Model (S)
Site preparation/ hydro mulch /seed/ fertilizer/ transplants - forest						Y			Y			
Site preparation/ steep slope seeder/ transplant - forest						Y			Y			
Site preparation/ straw/ crimp seed/ fertilizer/ transplant - forest						Y			Y			
Site preparation/ straw/ crimp/ net - forest						Y			Y			
Site preparation/ straw/ net/ seed/ fertilizer/ transplant - forest						Y			Y			
Site preparation/ straw/ polymer/ seed/ fertilizer/ transplant - forest						Y			Y			
Stream-crossing Replacement/ Upgrade	Y	Y		Y								
Water and Sediment Control Basins					Y							
Water Bar					Y							
Wetland Detention					Y							

Table 2-3. Hydromodification

Best Management Practice	BEHI (S)	FS WEPP (S)	Livestock Deposition Model (N,P)	Mass Balance Equation (N,P,S)	Pour Point Monitoring (N,P,S)	RUSLE2 (S)	STEPL (N)	STEPL (P)	STEPL (S)	Region 5 Model (N)	Region 5 Model (P)	Region 5 Model (S)
Beaver Reintroduction												
Bioretention facility - urban					Y		Y	Y		Y	Y	Y
Critical Area Planting				Y	Y	Y						
Extended Wet Detention - urban					Y		Y	Y	Y	Y	Y	Y
Flood to Pivot Conversion					Y							
Floodplain Reconnection												
Grade Stabilization Structure - gully stabilization	Y			Y						Y	Y	Y

Table 2-3. Hydromodification

Best Management Practice	BEHI (S)	FS WEPP (S)	Livestock Deposition Model (N,P)	Mass Balance Equation (N,P,S)	Pour Point Monitoring (N,P,S)	RUSLE2 (S)	STEPL (N)	STEPL (P)	STEPL (S)	Region 5 Model (N)	Region 5 Model (P)	Region 5 Model (S)
Impervious Surface Runoff Reduction					Y							
Infiltration Basin					Y							
Infiltration Devices					Y							
Infiltration Trench					Y							
Irrigation Canal Seepage Reduction												
Irrigation Diversion Improvement												
Irrigation Tailwater Control	Y			Y	Y							
Irrigation Wasteway Rehabilitation	Y			Y	Y							
Porous Pavement - urban					Y		Y	Y	Y	Y	Y	Y
Settling Basin					Y							
Stormwater Retention					Y							
Stream Channel Stabilization	Y			Y								
Streambank Protection	Y			Y								
Streamflow Alterations	Y			Y								
Water and Sediment Control Basins					Y							
Wetland Detention					Y							

Table 2-4. Mining and Industry

Best Management Practice	BEHI (S)	FS WEPP (S)	Livestock Deposition Model (N,P)	Mass Balance Equation (N,P,S)	Pour Point Monitoring (N,P,S)	RUSLE2 (S)	STEPL (N)	STEPL (P)	STEPL (S)	Region 5 Model (N)	Region 5 Model (P)	Region 5 Model (S)
Bioretention facility - urban					Y		Y	Y		Y	Y	Y
Clean Water Diversion					Y							
Conservation Easements										Y	Y	Y
Critical Area Planting				Y	Y	Y						
Critical Area Treatment (critical area planting in areas with gullies)										Y	Y	Y
Filter Strip					Y							

Table 2-4. Mining and Industry

Best Management Practice	BEHI (S)	FS WEPP (S)	Livestock Deposition Model (N,P)	Mass Balance Equation (N,P,S)	Pour Point Monitoring (N,P,S)	RUSLE2 (S)	STEPL (N)	STEPL (P)	STEPL (S)	Region 5 Model (N)	Region 5 Model (P)	Region 5 Model (S)
Grade Stabilization Structure - gully stabilization	Y			Y						Y	Y	Y
Grassed Waterway - gully stabilization										Y	Y	Y
Infiltration Basin					Y							
Infiltration Trench					Y							
Mine Tailings Removal/ Stabilization				Y		Y						
Revegetation				Y	Y	Y						
Road Decommissioning		Y										
Road dry seeding - forest					Y	Y			Y			
Road Grading		Y			Y							
Road grass and legume seeding - forest					Y	Y			Y			
Road hydro mulch - forest					Y	Y			Y			
Road Maintenance		Y			Y							
Road Paving		Y			Y							
Road Storage		Y										
Road straw mulch - forest					Y				Y			
Road tree planting - forest									Y			
Sand Filters					Y							
Sediment basins (water and sediment control basins) - gully stabilization					Y					Y	Y	Y
Settling Basin					Y							
Site preparation/ hydro mulch/ seed/ fertilizer - forest						Y			Y			
Site preparation/ hydro mulch/ seed/ fertilizer/ transplants - forest						Y			Y			
Site preparation/ steep slope seeder/ transplant - forest						Y			Y			

Table 2-4. Mining and Industry

Best Management Practice	BEHI (S)	FS WEPP (S)	Livestock Deposition Model (N,P)	Mass Balance Equation (N,P,S)	Pour Point Monitoring (N,P,S)	RUSLE2 (S)	STEPL (N)	STEPL (P)	STEPL (S)	Region 5 Model (N)	Region 5 Model (P)	Region 5 Model (S)
Site preparation/ straw/ crimp seed/ fertilizer/ transplant - forest						Y			Y			
Site preparation/ straw/ crimp/ net - forest						Y			Y			
Site preparation/ straw/ net/ seed/ fertilizer/ transplant - forest						Y			Y			
Site preparation/ straw/ polymer/ seed/ fertilizer/ transplant - forest						Y			Y			
Stormwater Retention					Y							
Stream Channel Stabilization	Y			Y								
Streambank Protection	Y			Y								
Stream-crossing Replacement/Upgrade	Y	Y		Y								
Water and Sediment Control Basins					Y							
Water Bar					Y							
Wetland Detention					Y							

Table 2-5. Recreation

Best Management Practice	BEHI (S)	FS WEPP (S)	Livestock Deposition Model (N,P)	Mass Balance Equation (N,P,S)	Pour Point Monitoring (N,P,S)	RUSLE2 (S)	STEPL (N)	STEPL (P)	STEPL (S)	Region 5 Model (N)	Region 5 Model (P)	Region 5 Model (S)
Animal Trails and Walkways		Y	Y									
Bioretention facility - urban					Y		Y	Y		Y	Y	Y
Boat Ramp Rehabilitation		Y				Y						
Concrete Grid Pavement - urban					Y		Y	Y	Y	Y	Y	Y
Conservation Easements										Y	Y	Y
Critical Area Planting				Y	Y	Y						
Filter Strip					Y							
Grass Swale - urban							Y	Y	Y	Y	Y	Y
Infiltration Basin					Y							

Table 2-5. Recreation

Best Management Practice	BEHI (S)	FS WEPP (S)	Livestock Deposition Model (N,P)	Mass Balance Equation (N,P,S)	Pour Point Monitoring (N,P,S)	RUSLE2 (S)	STEPL (N)	STEPL (P)	STEPL (S)	Region 5 Model (N)	Region 5 Model (P)	Region 5 Model (S)
Infiltration Trench					Y							
No-Wake Zone				Y								
Off-Highway Vehicle (OHV) Management		Y			Y							
Pet Waste Pollution Prevention			Y		Y							
Porous Pavement - urban					Y		Y	Y	Y	Y	Y	Y
Road Decommissioning		Y										
Road dry seeding - forest					Y	Y			Y			
Road Grading		Y			Y							
Road grass and legume seeding - forest					Y	Y			Y			
Road hydro mulch - forest					Y	Y			Y			
Road Maintenance		Y			Y							
Road Paving		Y			Y							
Road Relocation		Y										
Road Storage		Y										
Road straw mulch - forest					Y				Y			
Road tree planting - forest									Y			
Site preparation/ hydro mulch/ seed/ fertilizer - forest						Y			Y			
Site preparation/ hydro mulch/ seed/ fertilizer/ transplants - forest						Y			Y			
Site preparation/ steep slope seeder/ transplant - forest						Y			Y			
Site preparation/straw/crimp seed/fertilizer/transplant - forest						Y			Y			
Site preparation/ straw/ crimp/ net - forest						Y			Y			
Site preparation/ straw/ net/ seed/ fertilizer/ transplant - forest						Y			Y			

Table 2-5. Recreation

Best Management Practice	BEHI (S)	FS WEPP (S)	Livestock Deposition Model (N,P)	Mass Balance Equation (N,P,S)	Pour Point Monitoring (N,P,S)	RUSLE2 (S)	STEPL (N)	STEPL (P)	STEPL (S)	Region 5 Model (N)	Region 5 Model (P)	Region 5 Model (S)
Site preparation/ straw/ polymer/ seed/ fertilizer/ transplant - forest						Y			Y			
Streambank Protection	Y			Y								
Stream-crossing Replacement/ Upgrade	Y	Y		Y								
Trail Maintenance		Y										
Trail Relocation		Y										
Trail Removal		Y										
Water Bar					Y							
Wetland Detention					Y							

Table 2-6. Restoration

Best Management Practice	BEHI (S)	FS WEPP (S)	Livestock Deposition Model (N,P)	Mass Balance Equation (N,P,S)	Pour Point Monitoring (N,P,S)	RUSLE2 (S)	STEPL (N)	STEPL (P)	STEPL (S)	Region 5 Model (N)	Region 5 Model (P)	Region 5 Model (S)
Beaver Reintroduction												
Conservation Easements										Y	Y	Y
Critical Area Planting				Y	Y	Y						
Critical Area Treatment (critical area planting in areas with gullies)										Y	Y	Y
Culvert Removal or Replacement	Y			Y								
Filter Strip					Y							
Floodplain Reestablishment												
Floodplain Roughening												
Grade Stabilization Structure - gully stabilization	Y			Y						Y	Y	Y
Grassed Waterway - gully stabilization										Y	Y	Y

Table 2-6. Restoration

Best Management Practice	BEHI (S)	FS WEPP (S)	Livestock Deposition Model (N,P)	Mass Balance Equation (N,P,S)	Pour Point Monitoring (N,P,S)	RUSLE2 (S)	STEPL (N)	STEPL (P)	STEPL (S)	Region 5 Model (N)	Region 5 Model (P)	Region 5 Model (S)
Reforestation				Y	Y	Y						
Revegetation				Y	Y	Y						
Riparian Planting				Y	Y	Y						
Rip-rap Replacement - Bio-engineering	Y											
Road dry seeding - forest					Y	Y			Y			
Road grass and legume seeding - forest					Y	Y			Y			
Road hydro mulch - forest					Y	Y			Y			
Road Removal		Y										
Road straw mulch - forest					Y				Y			
Road tree planting - forest									Y			
Sediment basins (water and sediment control basins) - gully stabilization					Y	Y				Y	Y	Y
Site preparation/ hydro mulch/ seed/ fertilizer - forest						Y			Y			
Site preparation/ hydro mulch/ seed/ fertilizer/ transplants - forest						Y			Y			
Site preparation/ steep slope seeder/ transplant - forest						Y			Y			
Site preparation/ straw/ crimp seed/ fertilizer/ transplant - forest						Y			Y			
Site preparation/ straw/ crimp/ net - forest						Y			Y			
Site preparation/ straw/ net/ seed/ fertilizer/ transplant - forest						Y			Y			
Site preparation/ straw/ polymer/ seed/ fertilizer/ transplant - forest						Y			Y			
Stream Channel Reconstruction	Y											

Table 2-6. Restoration

Best Management Practice	BEHI (S)	FS WEPP (S)	Livestock Deposition Model (N,P)	Mass Balance Equation (N,P,S)	Pour Point Monitoring (N,P,S)	RUSLE2 (S)	STEPL (N)	STEPL (P)	STEPL (S)	Region 5 Model (N)	Region 5 Model (P)	Region 5 Model (S)
Stream Channel Stabilization	Y			Y								
Stream Crossing Removal	Y	Y		Y								
Streambank Stabilization	Y			Y								
Trail Removal		Y										
Wetland Detention					Y							
Wetland Restoration												
Willow Soil Lift	Y			Y								

Table 2-7. Transportation

Best Management Practice	BEHI (S)	FS WEPP (S)	Livestock Deposition Model (N,P)	Mass Balance Equation (N,P,S)	Pour Point Monitorin g (N,P,S)	RUSLE2 (S)	STEPL (N)	STEPL (P)	STEPL (S)	Region 5 Model (N)	Region 5 Model (P)	Region 5 Model (S)
Animal Trails and Walkways		Y	Y									
Bioretention facility - urban					Y		Y	Y		Y	Y	Y
Concrete Grid Pavement - urban					Y		Y	Y	Y	Y	Y	Y
Critical Area Treatment (critical area planting in areas with gullies)										Y	Y	Y
Dry Detention - urban							Y	Y	Y	Y	Y	Y
Extended Wet Detention - urban					Y		Y	Y	Y	Y	Y	Y
Filter Strip-Agricultural - urban					Y		Y	Y	Y			
Grade Stabilization Structure - gully stabilization	Y			Y						Y	Y	Y
Grassed Waterway - gully stabilization										Y	Y	Y
Grass Swale - urban							Y	Y	Y	Y	Y	Y
Infiltration Basin - urban					Y		Y	Y	Y	Y	Y	Y
Infiltration Devices - urban					Y			Y	Y		Y	Y
Infiltration Trench - urban					Y		Y	Y	Y	Y	Y	Y

Table 2-7. Transportation

Best Management Practice	BEHI (S)	FS WEPP (S)	Livestock Deposition Model (N,P)	Mass Balance Equation (N,P,S)	Pour Point Monitoring (N,P,S)	RUSLE2 (S)	STEPL (N)	STEPL (P)	STEPL (S)	Region 5 Model (N)	Region 5 Model (P)	Region 5 Model (S)
Off-Highway Vehicle (OHV) Management		Y			Y							
Oil/Grit Separator - urban					Y		Y	Y	Y	Y	Y	Y
Porous Pavement - urban					Y		Y	Y	Y	Y	Y	Y
Road Decommissioning		Y										
Road dry seeding - forest					Y	Y			Y			
Road Grading		Y			Y							
Road grass and legume seeding - forest					Y	Y			Y			
Road hydro mulch - forest					Y	Y			Y			
Road Maintenance		Y			Y							
Road Paving		Y			Y							
Road Relocation		Y										
Road Sanding Management					Y							
Road Storage		Y										
Road straw mulch - forest					Y				Y			
Road tree planting - forest									Y			
Sand Filter/Infiltration Basin - urban							Y	Y	Y	Y	Y	Y
Sand Filters - urban					Y			Y	Y		Y	Y
Sediment basins (water and sediment control basins) - gully stabilization					Y					Y	Y	Y
Sediment Trap					Y							
Settling Basin					Y							
Settling Basin - urban					Y			Y	Y		Y	Y
Site preparation/ hydro mulch/ seed/ fertilizer - forest						Y			Y			
Site preparation/ hydro mulch/ seed/ fertilizer/ transplants - forest						Y			Y			
Site preparation/ steep slope seeder/ transplant - forest						Y			Y			

Table 2-7. Transportation

Best Management Practice	BEHI (S)	FS WEPP (S)	Livestock Deposition Model (N,P)	Mass Balance Equation (N,P,S)	Pour Point Monitoring (N,P,S)	RUSLE2 (S)	STEPL (N)	STEPL (P)	STEPL (S)	Region 5 Model (N)	Region 5 Model (P)	Region 5 Model (S)
Site preparation/ straw/ crimp seed/ fertilizer/ transplant - forest						Y			Y			
Site preparation/ straw/ crimp/ net - forest						Y			Y			
Site preparation/ straw/ net/ seed/ fertilizer/ transplant - forest						Y			Y			
Site preparation/ straw/ polymer/ seed/ fertilizer/ transplant - forest						Y			Y			
Storm Drain Inlet Protection												
Stormwater Retention					Y							
Stormwater Reuse												
Stream Crossing Removal	Y	Y		Y								
Stream-crossing Replacement/Upgrade	Y	Y		Y								
Streambank Protection	Y			Y								
Street Sweeping					Y							
Vegetated Filter Strips - urban							Y	Y	Y	Y	Y	Y
Water and Sediment Control Basins					Y							
Water Bar					Y							
Weekly Street Sweeping - urban								Y	Y		Y	Y
Wet Pond - urban							Y	Y	Y	Y	Y	Y
Wetland Detention					Y							
Wetland Detention - urban					Y		Y	Y	Y	Y	Y	Y
WQ Inlet w/ Sand Filter - urban							Y		Y	Y		Y
WQ Inlets - urban							Y	Y	Y	Y	Y	Y

Table 2-8. Urban and Suburban

Best Management Practice	BEHI (S)	FS WEPP (S)	Livestock Deposition Model (N,P)	Mass Balance Equation (N,P,S)	Pour Point Monitoring (N,P,S)	RUSLE2 (S)	STEPL (N)	STEPL (P)	STEPL (S)	Region 5 Model (N)	Region 5 Model (P)	Region 5 Model (S)
Alum Treatment - urban							Y	Y	Y			
Animal Trails and Walkways		Y	Y									
Bioretention facility - urban					Y		Y	Y		Y	Y	Y
Buffer Strip			Y	Y	Y	Y						
Composting												
Concrete Grid Pavement - urban					Y		Y	Y	Y	Y	Y	Y
Conservation Easements										Y	Y	Y
Constructed Wetland					Y							
Construction Stormwater Control					Y	Y						
Critical Area Planting				Y	Y	Y						
Critical Area Treatment (critical area planting in areas with gullies)										Y	Y	Y
Dry Detention - urban							Y	Y	Y	Y	Y	Y
Extended Wet Detention - urban					Y		Y	Y	Y	Y	Y	Y
Filter Strip-Agricultural - urban			Y		Y		Y	Y	Y			
Grade Stabilization Structure - gully stabilization	Y			Y						Y	Y	Y
Grass Swales - urban							Y	Y	Y	Y	Y	Y
Grassed Waterway - gully stabilization										Y	Y	Y
Green Roofs										Y	Y	Y
Infiltration Basin - urban					Y		Y	Y	Y	Y	Y	Y
Infiltration Devices - urban					Y			Y	Y		Y	Y
Infiltration Trench - urban					Y		Y	Y	Y	Y	Y	Y
Irrigation Water Management												
Lawn and Garden Fertilizer Management					Y							

Table 2-8. Urban and Suburban

Best Management Practice	BEHI (S)	FS WEPP (S)	Livestock Deposition Model (N,P)	Mass Balance Equation (N,P,S)	Pour Point Monitoring (N,P,S)	RUSLE2 (S)	STEPL (N)	STEPL (P)	STEPL (S)	Region 5 Model (N)	Region 5 Model (P)	Region 5 Model (S)
Low Impact Development /Bioretention - urban							Y	Y				
Low Impact Development /Dry Well - urban							Y	Y	Y			
Low Impact Development /Filter/Buffer Strip - urban							Y	Y	Y			
Low Impact Development /Infiltration Swale - urban							Y	Y	Y			
Low Impact Development /Infiltration Trench - urban							Y	Y	Y			
Low Impact Development /Vegetated Swale - urban							Y	Y	Y			
Low Impact Development /Wet Swale - urban							Y	Y	Y			
Oil/Grit Separator - urban					Y		Y	Y	Y	Y	Y	Y
Permeable Landscape					Y							
Pet Waste Pollution Prevention			Y		Y							
Porous Pavement - urban					Y		Y	Y	Y	Y	Y	Y
Revegetation				Y	Y	Y						
Road Grading		Y			Y							
Road Maintenance		Y			Y							
Road Paving		Y			Y							
Road Sanding Management					Y							
Sand Filter/ Infiltration Basin - urban							Y	Y	Y	Y	Y	Y
Sand Filters - urban					Y			Y	Y		Y	Y
Sediment basins (water and sediment control basins) - gully stabilization					Y					Y	Y	Y
Sediment Trap					Y							

Table 2-8. Urban and Suburban

Best Management Practice	BEHI (S)	FS WEPP (S)	Livestock Deposition Model (N,P)	Mass Balance Equation (N,P,S)	Pour Point Monitoring (N,P,S)	RUSLE2 (S)	STEPL (N)	STEPL (P)	STEPL (S)	Region 5 Model (N)	Region 5 Model (P)	Region 5 Model (S)
Septic Hook-ups to Treatment Facility												
Septic System Maintenance												
Settling Basin - urban					Y			Y	Y		Y	Y
Storm Drain Inlet Protection												
Stormwater Retention					Y							
Stream Channel Stabilization	Y			Y								
Streambank Protection	Y			Y								
Stream-crossing Replacement/Upgrade	Y	Y		Y								
Street Sweeping					Y							
Vegetated Filter Strips - urban							Y	Y	Y	Y	Y	Y
Water and Sediment Control Basins					Y							
Weekly Street Sweeping - urban								Y	Y		Y	Y
Wet Pond - urban							Y	Y	Y	Y	Y	Y
Wetland Detention - urban					Y		Y	Y	Y	Y	Y	Y
WQ Inlet w/Sand Filter - urban							Y		Y	Y		Y
WQ Inlets - urban							Y	Y	Y	Y	Y	Y

SECTION 3 – METHOD DESCRIPTIONS

BANK ASSESSMENT FOR NON-POINT SOURCE CONSEQUENCES OF SEDIMENT (BANCS)

Bank Erosion Hazard Index (BEHI) and Near Bank Stress (NBS)

Applicable Pollutants: Sediment
Applicable BMPs: Streambank erosion reduction BMPs, channel reconstruction

Brief Description: The BANCS method was developed by Dave Rosgen (2001) to predict stream bank erosion rates using two distinct tools: BEHI and NBS. BEHI is a bank erodibility estimation tool that assesses streambank erosion condition and potential. NBS is a tool to evaluate flow distributions that can affect erosion. The relationship between BEHI and NBS is used to estimate the bank erosion rate on established indices of field measured streambank erosion rates. The estimated bank erosion rate is then multiplied by the measured height and length of an eroding streambank to calculate a load estimate in tons of eroding sediment/year. BEHI and NBS methods are described in more detail below.

More information: EPA website -
https://owpubauthor.epa.gov/scitech/datait/tools/warsss/pla_box08.cfm
Montana Department of Environmental Quality -

Requirements

Minimum Level of Expertise: Trained Volunteer to Professional
Equipment and Software: Measuring rod, clinometer, camera, worksheets, field and desk calculations
Data Needs: Field observations and data, established indices for streambank erosion rates

How to Use the Method

Field data collection is required to measure the length and height of eroding banks and collect BEHI and NBS criteria on each of them. EPA's website (link above) provides a detailed, step-by-step approach to the streambank erodibility and flow distribution criteria for calculating a BEHI and NBS rating. These methods are summarized below. BEHI and NBS ratings are used to estimate sediment erosion rates from an established index. Two commonly used indices developed by Rosgen (1996, 2001) can be found in Figures 115 and 166 on the EPA website listed above. Sediment erosion rates are multiplied by eroding bank height and length to calculate erosion in tons/year. Worksheet 23 on the EPA website contains the calculations necessary to convert the BEHI and NBS values to an erosion rate in tons/year.

BEHI

This approach requires appropriate experience in assessing bankfull height and identification of other key streambank and stream features. There are five main metrics in the complete BEHI procedure:

1) Ratio of bank height to bankfull height
2) Ratio of root depth to bank height
3) Root density, in percent
4) Bank angle, in degrees
5) Surface protection, in percent

These metrics can be recorded on Worksheet 20 (BEHI variable worksheet) from the EPA website (above) or similar field forms. The value range for these metrics corresponds to an index score range (see Worksheet 21 on the EPA Website). The sum of the index scores is calculated and adjusted based on bank material composition and stratification. The adjusted score corresponds to the BEHI rating, which ranges from very low to extreme. The BEHI rating can be combined with NBS values to estimate streambank erosion rates.

Near Bank Stress
Calculating a NBS rating for streambanks can be done using several field methods, which are listed in worksheet 22A on the EPA website above. Montana DEQ uses a detailed prediction method of calculating the ratio between near-bank maximum depth and mean depth (d_{nb}/d). This ratio is then converted to a NBS rating from very low to extreme.

Rosgen, D.L., 1996. *Applied river morphology* (Vol. 1481). Pagosa Springs, Colorado: Wildland Hydrology.

Rosgen, D.L., 2001, March. A practical method of computing streambank erosion rate. In *Proceedings of the Seventh Federal Interagency Sedimentation Conference* (Vol. 2, No. 2, pp. 9-15).

Forest Service Water Erosion Prediction Project (FS WEPP)

Applicable Pollutants: Sediment
Applicable BMPs: Road and crossing improvements, road decommissioning
Other Names and Versions: WEPP, WEPP:Road

Brief Description: WEPP is a physically based erosion model that can be used to estimate sediment delivery from roads, cropland, rangeland, and forest lands. The US Forest Service has developed a suite of WEPP Internet interfaces (called FS WEPP), specific to forest management practices that stakeholders and the general public can use to quickly predict erosion and sediment delivery potential from unpaved roads.

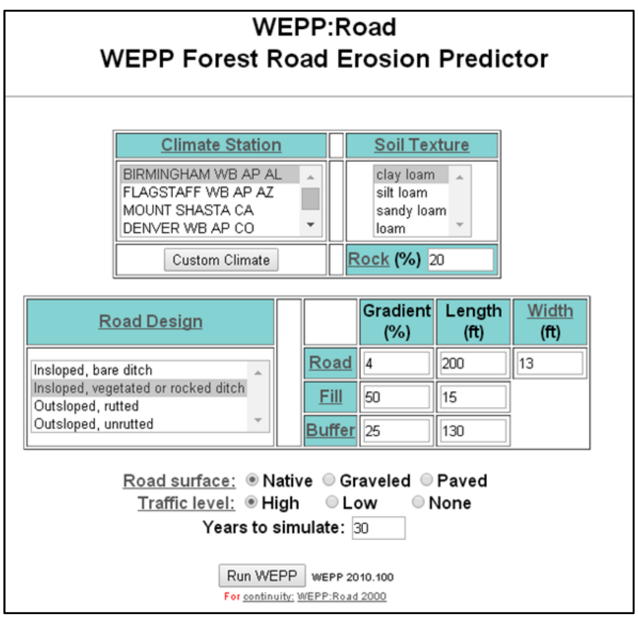
More information: http://forest.moscowfsl.wsu.edu/fswepp/

Requirements

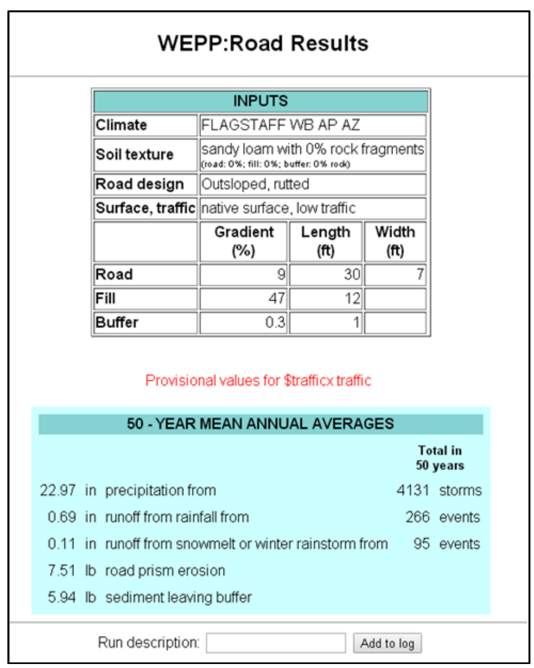
Minimum Level of Expertise: Professional
Equipment and Software: Microsoft Windows, Internet
Data Needs: Field observations, climate station data (available at: http://www.wrcc.dri.edu)

How to Use the Method

The specific FS WEPP interface used to predict erosion from roads is WEPP:Road, and can be accessed at http://forest.moscowfsl.wsu.edu/fswepp/. The WEPP model inputs and outputs are shown in the two figures below. The WEPP:Road output includes two results: average annual sediment leaving the road prism and average annual sediment leaving the buffer. Note that WEPP results are given in lb/year, and will need to be converted to tons/year for entry into EPA's Grants Reporting and Tracking System (GRTS).



Input form for WEPP:Road model. Descriptions for each input are available on the website by clicking on the underlined text.



Results form for WEPP:Road model. The last two rows in the blue box are the average annual sediment (in lbs) leaving the road prism and buffer, respectively.

LIVESTOCK DEPOSITION MODEL

Applicable Pollutants: Nitrogen (N), Phosphorus (P)
Applicable BMPs: Livestock grazing BMPs
Other Names and Versions: None identified

Brief Description: This model uses riparian grazing practice information (e.g. stocking density, animal types, duration of access), "book values" for manure nutrient concentrations, and several broad assumptions to profile possible changes in nitrogen and phosphorus loading to streams under different livestock grazing systems. This model is best suited to riparian pastures.

More information: This model assumes that none of the manure deposited in the pasture is subsequently removed and hauled away. For this reason, this model may not be appropriate for estimating nutrient load reductions achieved through removal of corrals from floodplains.

Requirements

Minimum Level of Expertise: Student
Equipment and Software: Calculator; detailed map or simple GIS tool
Data Needs: Number of livestock, type of livestock, and duration on pasture under both pre-project and post-project management systems; surface area of pasture contributing runoff to the stream system.

How to Use the Method

Step 1 - Gather the following information for both pre and post-project conditions:

- Type of livestock on pasture (e.g. beef cattle, dairy cattle, horses, sheep, goats, hogs)
- Number of livestock on pasture
- Number of days within a calendar year in which the animals are on pasture

Step 2 - Determine the fraction of the pasture that contributes surface runoff to the waterbody. Count all of the riparian area within the pasture, as well as any uplands that slope steeply into the riparian area. For example, if you have a 100 acre pasture, containing 20 acres of riparian area and 5 acres of uplands that slope steeply into the riparian area, you would determine that ¼ of the pasture contributes runoff to the stream system.

Step 3 - Determine the daily nitrogen and phosphorus production, per animal, from the table below (adapted from Tables 4-5 through 4-14 of Chapter 4 of the United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) Ag Waste Management Field Handbook, March 2008, ftp://ftp.wcc.nrcs.usda.gov/wntsc/AWM/handbook/ch4.pdf).

Animal Type	Daily N Production	Daily P Production
Beef Cow (in confinement)	0.42 lb/day	0.097 lb/day
Calf (450 lb -750 lb, confined)	0.29 lb/day	0.055 lb/day
Dairy Cow (lactating; 75 lb/day milk production)	0.97 lb/day	0.17 lb/day
Dry Cow	0.50 lb/day	0.07 lb/day
Heifer	0.26 lb/day	0.04 lb/day
Horse (sedentary)	0.20 lb/day	0.029 lb/day
Horse (exercised)	0.34 lb/day	0.073 lb/day
Sheep (90 lb animal)	0.041 lb/day	0.0063 lb/day
Sow (gestating)	0.071 lb/day	0.020 lb/day
Sow (lactating)	0.19 lb/day	0.055 lb/day
Boar	0.061 lb/day	0.021 lb/day

Step 4 - Use the following calculations to estimate the annual nitrogen and phosphorus contributions from livestock on pasture under pre and post-project conditions:

Nitrogen Loading Equation

(number of animals)x(days on pasture)x(daily N production)x(contributing fraction of pasture)x(0.15*)

**conversion factor to account for nitrogen volatilization, decomposition, and plant uptake*

Phosphorus Loading Equation

(number of animals)x(days on pasture)x(daily P production)x(contributing fraction of pasture)x(0.85**)

***conversion factor to account for phosphorus uptake and immobilization*

Step 5 - Subtract the post-project nitrogen and phosphorus load contributions from the pre-project load contributions to obtain an estimate of the annual load reductions.

(pre-project nitrogen load) – (post-project nitrogen load) = annual nitrogen load reduction

MASS BALANCE EQUATION

Applicable Pollutants: N, P, Sediment
Applicable BMPs: Bank stabilization BMPs
Other Names and Versions: Bank Retreat Estimation

Brief Description: The mass balance equation uses bank height, bank length and an estimate of the annual, horizontal erosion rate to generate the volume of material entering the stream. A soil bulk density estimate is then combined with the volume in an equation that produces an annual sediment erosion rate in tons/year. Estimates or soil sample analyses are used to determine the concentration of nitrogen and phosphorus (lbs/ton) within one ton of soil. The concentration of nitrogen is multiplied by the annual sediment erosion rate to estimate the annual nitrogen load in lbs/year. A similar procedure is used to calculate a phosphorus load. This method rests on the assumption that the installed project will completely halt further lateral bank erosion. If greater accuracy is desired, annual loads can be calculated for both pre-project conditions and post-project conditions, with the difference between the two representing the load reduction achieved by the project.

More information: Please contact the Montana DEQ Watershed Protection Section staff for assistance in employing this method.

- United States Department of Agriculture's (USDA)Web Soil Survey (WSS) may be able to provide some of the soil characteristics data necessary for the equation (http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm).
- Google Earth may be downloaded from http://www.google.com/earth/.
- ArcExplorer (another free GIS viewer, similar to Google Earth but map layers may need to be added individually) may be downloaded from http://www.esri.com/software/arcgis/explorer-desktop.
- Aerial photos of different vintages may be downloaded from the Montana State Library's Montana Natural Resource Information System (NRIS) at http://nris.mt.gov/. When you access the site, click on the link labeled "Montana GIS Data List". From there you can conduct a keyword search to identify aerial photos to suit your needs.
- Montana State University (MSU) Extension Service guidance for soil sampling can be found at http://store.msuextension.org/Products/Soil-Sampling-Strategies__MT200803AG.aspx

Requirements

Minimum Level of Expertise: Student
Equipment and Software: Calculator; Google Earth or similar GIS tool; bank pins (optional); soil test kit; measuring stick or tape measurer
Data Needs: Bank height; bank length; annual, lateral bank erosion rate; nitrogen and phosphorus concentration in soil; soil bulk density

How to Use the Method

To estimate annual sediment load reductions:
Assumption: On-the-ground project completion will prevent all future soil erosion at the project site.

Step 1 - Obtain two aerial photographs of the project site. The photos should be at the same scale and preferably at the same resolution. Photo dates should be at least 5 years apart, but preferably longer.

Step 2 - Using GIS software, draw a series of dots or a solid line tracing the eroding streambank in each of the two photos.

Step 3 - Overlay the two sets of dots or lines, and connect them to form a polygon. This polygon represents the surface area lost to erosion during the time between photo dates. Using the GIS software, determine the area of this polygon in square feet. Divide this area by the number of years between photographs to estimate an annual surface area loss rate.

Step 4 - Visit the project site. With a transect level and stadia rod, measuring stick or tape measurer, measure the height of the eroding streambank in several locations. Use these measurements to estimate the average height of the eroding bank, in feet.

Step 5 - Multiply the annual surface area loss rate from Step 3 by the average bank height from Step 4 to obtain an estimate of the annual volume of soil lost from the project area.

Step 6 - Using USDA's Web Soil Survey tool, estimate the average bulk density of the soil within the project area.

Step 7 - Using the annual soil volume loss rate from Step 5 and the estimated soil bulk density from Step 6, calculate the annual sediment loss (load) rate for the project area, in tons/year.

To calculate Phosphorus and Nitrogen load reductions:
Prerequisite: The ton/year reduction in sediment loading achieved by the project.

Step 1 - Using United States Department of Agriculture's Web Soil Survey tool, identify major soil types within the project area.

Step 2 - Obtain a composite soil sample from the land within ten feet of the streambank for each of the major soil types. Follow the directions provided by MSU Extension service for soil sampling strategies.

Step 3 - Submit the sample to a qualified lab and have it analyzed according to the parameters and methods identified in Table 3-1.

Table 3-1. Laboratory Analysis Methods for Mass Balance Equation Method

Parameter	Extraction Method	Analysis Method	Reporting Units
Total Kjeldahl Nitogen (TKN)	ASA Monograph #9, Part 2, Method 31-3.1	A 4500 N org	mg/kg
Nitrate as N	ASA Monograph #9, Part 2, Method 33-8.1	E353.2	mg/kg
Phosphorus (Olsen P)	ASA Monograph #9, Part 2, Method 24-5.4	E365.1	mg/kg

Step 4 - Add the result from the Total Kjeldahl Nitrogen (TKN) test to the result from the Nitrate as N test, then multiply by ".002" to calculate the lb N/ton of soil. Multiply the Olsen P test results by ".002" to calculate the lb P/ton of soil.

Step 5 - Multiply the lb N/ton of soil by the ton/year of streambank sediment reduction to calculate the lb N/year nitrogen reduction. Multiply the lb P/ton by the ton/year streambank sediment reduction to calculate the lb P/year phosphorus reduction.

Pour Point Monitoring

Applicable Pollutants: N, P, Sediment
Applicable BMPs: Crop field BMPs, urban stormwater collection, vegetated treatment areas, road improvements, upland revegetation work, some logging BMPs, animal feeding operation BMPs.
Other Names and Versions: Natural Resources Conservation Service (NRCS) Edge-of-Field Monitoring; Catchment Basin Monitoring

Brief Description: Pour point monitoring uses a direct measurement of the volume and pollutant concentration of runoff from a defined project area to calculate a pollutant load. This method is applicable to situations in which most or all pollutant loading can be attributed to surface flow. In the case of sediment load measurements, it may be possible to simply collect and measure the entire sediment load over the course of a year. This method may be used to help calibrate models or evaluate their applicability for specific situations. When used to estimate nitrogen and phosphorus load reductions, this method typically calls for obtaining water samples and sending them to a lab for analysis

More information: United States Department of Agriculture's NRCS guidance for edge-of-field monitoring can be downloaded at http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/water/quality/?&cid=stelprdb1044782

Requirements

Minimum Level of Expertise: Trained Volunteer to Professional
Equipment and Software: Lab analyses; catchment basins; flow monitoring devices
Data Needs: Surface runoff volume and pollutant concentration

How to Use the Method

To calculate sediment load reductions:
Monitor for one year before project implementation, and then one year after. Each year, follow steps 1 through 7 below. Once post-project monitoring has been completed, subtract the post-project load from the pre-project load to determine the load reduction achieved as a result of the project.

Step 1 - Find the point or points at which surface runoff leaves the project area. At each point, construct a sediment settling basin of known volume. The basin should be sized to retain, for 24 hours, all of the surface runoff from a 25-year, 24-hour storm event.

Step 2 - For one year, measure the volume of sediment that accumulates in the settling basin. Periodically clean out the basin to maintain adequate storage volume and retention time.

Step 3 - Using a straight-walled container of known volume, obtain a full container sample of the collected sediment. Spread the sediment sample on a tray and allow it to air-dry.

Step 4 - Once the sample is dry, collect it and weigh it.

Step 5 - Divide the weight of the dried sample by the volume of the sample container, and record the figure and the units of measurement (e.g. "20 lb/ft^3). This figure is the approximate bulk density of the sediment leaving the project area.

Step 6 - Repeat steps 3 through 5 several times throughout the sampling year. At the end of the sampling year, calculate the average bulk density for the year.
Step 7 - At the end of the sampling year, multiply the average bulk density by the total volume of sediment collected (be sure to use the same units of measurement for volume). Convert the resulting weight to tons. This is the amount of sediment leaving the project area, in tons/year.

To calculate nitrogen and phosphorus load reductions
Monitor for one year before project implementation, and then one year after. Each year, follow steps 1 through 7 below. Once the post-project monitoring has been completed, subtract the post-project load from the pre-project load to determine the load reduction achieved as a result of the project.

Step 1 - Find the point or points at which surface runoff leaves the project area. At each point, construct a weir, impervious catchment basin, or other structure for measuring the volume of surface runoff leaving the project areas. For one year, measure and record the volume of surface runoff.

Step 2 - At least twice during the year, obtain a sample of the runoff water and submit it to a qualified lab for analysis. Follow the instructions provided by the lab for sample handling and documentation. Request that the lab analyze the sample for total persulfate nitrogen and total phosphorus. Ask the lab to report results in mg/L.

Step 3 - At the end of the sampling year, multiply the nitrogen concentration by the total volume of runoff. Do the same for phosphorus concentration. In both instances, make sure to use the same units of measurement in the equations. Convert the resulting weights to pounds. These are the weights of nitrogen and phosphorus leaving the project area annually, in lb/year.

REGION 5 MODEL

Applicable Pollutants: N, P, Sediment
Applicable BMPs: Agricultural and urban BMPs; bank and gully stabilization. The tables within the Region 5 spreadsheet contain a full list of applicable BMPs.
Other Names and Versions: Ohio has developed a similar model based on the Region 5 Model, found at: http://www.in.gov/idem/nps/files/nps_compendium_ohio_septic_sheet.xls

Brief Description: Region 5 Model is an Excel workbook that provides a coarse estimate of sediment and nutrient load reductions from the implementation of agricultural and urban BMPs at the source level. Despite the name, the Region 5 Model is not limited to Region 5. The algorithms for non-urban BMPs are based on the "Pollutants controlled: Calculation and Documentation for Section 319 Watersheds Training Manual" (Michigan Department of Environmental Quality, June 1999). The algorithms for urban BMPs are based on the data and calculations developed by Illinois EPA. Region 5 Model does not estimate pollutant load reductions for dissolved constituents. Region 5 Model can be downloaded from http://it.tetratech-ffx.com/steplweb/STEPLmain_files/Region%205%20model_112309.zip

More information:

- Region 5 Load Estimation Model User's Manual: http://it.tetratech-ffx.com/steplweb/STEPLmain_files/Region%205%20manual05.pdf
- Region 5 Load Estimation Model Field Data Entry Sheets: http://it.tetratech-ffx.com/steplweb/STEPLmain_files/R5%20Load%20Estimation%20Model%20Field%20Data%20Entry%20Sheets.pdf
- Tutorial presentations: http://projects.glc.org/tributary/documents/SedReductionWebinar/TD_Sediment_Davenport.pdf
- http://it.tetratech-ffx.com/steplweb/STEPLmain_files/Model_ppt400.zip

Requirements

Minimum Level of Expertise: Professional. Users will need: a basic understanding of hydrology, soils, erosion, and pollutant loading processes; knowledge of spreadsheet applications such as Microsoft Excel and formulas; and some knowledge of the use and limitations of input data, such as land use and BMP efficiencies.

Equipment and Software: Model can be downloaded at http://it.tetratech-ffx.com/steplweb/STEPLmain_files/Sample.zip. Tape measure for field measurements

Data Needs: Field data requirements will be based on land use and BMPs. Field data sheets detailing the needed data inputs can be found at http://it.tetratech-ffx.com/steplweb/STEPLmain_files/R5%20Load%20Estimation%20Model%20Field%20Data%20Entry%20Sheets.pdf.

How to Use the Method

Once the Region 5 Model spreadsheet is open, users can select the appropriate tab with the associated source and BMP category, such as gully stabilization, bank stabilization, ag fields and filter strips, feedlots, and urban runoff. The data sources in each worksheet are independent of one another. Once all data parameters are entered for appropriate source(s), the model provides an estimate of load reductions attributable to BMP implementation. Detailed instruction on using the Region 5 Model can be found at the websites provided above.

REVISED UNIVERSAL SOIL LOSS EQUATION, VERSION 2 (RUSLE2)

Applicable Pollutants: Sediment
Applicable BMPs: Cover crops, no-till/reduced tillage, contour cropping, filter strips at the edge of crop fields, other cropping BMPs
Other Names and Versions: USLE, RUSLE

Brief Description: RUSLE2 is a computer model containing both empirical and process-based science in a Windows environment that predicts rill and inter-rill erosion by rainfall and runoff. RUSLE2 was developed primarily to guide conservation planning, inventory erosion rates and estimate sediment delivery. The calculated results from RUSLE2 are on a daily basis. Improved cover-management subfactor relationships are used in RUSLE2, a new ridge subfactor has been added, and the deposition equations have been extended to consider sediment characteristics and how deposition changes these characteristics. RUSLE2 also includes new relationships for handling residue, including resurfacing of residue by implements like field cultivators.

More information: The official RUSLE2 website for the United States Department of Agriculture Natural Resources Conservation Service is http://fargo.nserl.purdue.edu/rusle2_dataweb/RUSLE2_Index.htm. RUSLE2 applies exclusively to agricultural cropping BMPs. RUSLE2 requires some knowledge of farming practices, soil science, and climate data.

Requirements

Minimum Level of Expertise: Professional
Equipment and Software: RUSLE2 software (free download from http://fargo.nserl.purdue.edu/rusle2_dataweb/RUSLE2_Index.htm)
Data Needs: Soils data, climate info, length of slope (field), percent slope (field), cropping practices

How to Use the Method

Go to the official RUSLE2 website for United States Department of Agriculture, Natural Resources Conservation Service (NRCS) http://fargo.nserl.purdue.edu/rusle2_dataweb/RUSLE2_Index.htm . Click on the appropriate links to download the RUSLE2 program, data sets and training materials. It is helpful to review the download instructions for each set of files, prior to trying to download. Once all files have been downloaded, read the “RUSLE2 – Instructions and User Guide” and complete the Tutorial. These two resources are probably sufficient to enable full use of the model for the purpose of calculating sediment load reductions. It is probably *not* necessary to read the draft “RUSLE2 Technology User’s Guide”.

SPREADSHEET TOOL FOR ESTIMATING POLLUTANT LOAD (STEPL)

Applicable Pollutants: N, P, Sediment
Applicable BMPs: Various cropland, pastureland, forest, feedlot, and urban BMPs. A full list is available within the user guide (http://it.tetratech-ffx.com/steplweb/STEPLmain_files/STEPLGuide401.pdf). Additional BMPs can be added to the model if pollutant removal efficiency data is available.
Other Names and Versions: STEPL 4.0, 4.1, 4.2

Brief Description: STEPL is an Excel spreadsheet based application used to estimate load reductions for sediment and nutrients (nitrogen, phosphorous) by land use type from the application of BMPs. Its primary utility is in the application of agricultural and urban BMPs, but can also be used for some forestry related activities. Users may also add BMPs if load reduction efficiencies are known. The model is primarily composed of four worksheets—Input, BMPs, Total Load, and Graphs—all designed for user interaction. Additional worksheets can be displayed and modified based on the level of known/existing data for parameters such as septic loading, sediment loading, and BMP efficiency.

More information: STEPL is a useful model but can be somewhat intimidating for inexperienced users. Please feel free to contact the Montana DEQ Watershed Protection Section staff for assistance in employing this method. There are also some useful online guides listed below.

- User's Guide: http://it.tetratech-ffx.com/steplweb/STEPLmain_files/STEPLGuide401.pdf
- Tutorial presentation of STEPL and Region 5 models: http://projects.glc.org/tributary/documents/SedReductionWebinar/TD_Sediment_Davenport.pdf

Requirements

Minimum Level of Expertise: Professional. Users will need: a good understanding of hydrology, erosion, and pollutant loading processes; knowledge of spreadsheet applications such as Microsoft Excel and formulas; and some knowledge of the use and limitations of input data, such as land use and BMP efficiencies.
Equipment and Software: STEPL can be downloaded at http://it.tetratech-ffx.com/steplweb
Data Needs: Input data for watershed and land use from http://it.tetratech-ffx.com/steplweb/steplweb.html. Users will also need information on the types of BMPs applied and percentage of area that the BMP is applied to (e.g. 25% of cropland has applied filter strips). Accuracy of load reduction estimates will depend on these inputs.

How to Use the Method

The complete user guide, with step by step instructions, is recommended for full use. It can be downloaded at http://it.tetratech-ffx.com/steplweb/STEPLmain_files/STEPLGuide401.pdf. Download and installation of STEPL will include several additional data and system files for input and usability.

Prior to opening a new STEPL spreadsheet/model, users must select the number of subwatersheds, the number of special sediment sources in the watershed including gully formations and impaired streambanks, and land use options. The spreadsheet will then open with tables created based on input data. The values displayed in red font are required input to the model. Black values are calculated by the model based on input values and should not be changed. Data for the watershed can be acquired from the STEPL model input data server (http://it.tetratech-ffx.com/steplweb/steplweb.html); open the website, select the state, county, and watershed of interest, and download the data to an Excel spreadsheet. This data will help populate the required STEPL model inputs. Input data into the STEPL model for: watershed location (state and county); land use area and precipitation; number of agricultural animals and number of months of manure application; septic system data; and universal soil loss equation (USLE) parameters. Location information will automatically populate some of the parameters, such as USLE, but users may modify these if more precise values are available. The model will provide a total load from land use types in the Total Load and Graphs tabs.

BMP data can then be entered in the BMPs tab of the STEPL model. BMPS are separated into six categories: cropland; pastureland; forest; feedlots; urban; and user-defined, which allows the user to add a BMP not included in the existing list, provided the user knows the BMP’s pollutant removal efficiency (percent reduction of pollutant load expected from this BMP). Users need to select the applicable BMP and the percent of the watershed area it is applied to. The Total Load and Graphs tabs will then update with load reductions.

To open additional data and reference tabs, click on all or one of the STEPL add-ins (from a dropdown menu at the top of the spreadsheet) including: precipitation and runoff data; USLE parameters; a list of BMPs and efficiencies; precipitation correction factors; and soil nitrogen and phosphorous concentration maps. Additional data tabs are not necessary but can provide useful information for creating the model and calculating reductions.