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Sediment Delivery Inventory and Monitoring

A Method for Water Quality Management in Rangeland Watersheds

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For most landowners, production incentives and the economics of soil loss require accurate assessment and control not only of soil erosion but also of the amount and nature of sediment delivered to watercourses. In addition, protecting the beneficial uses of water has become a principal goal of resource management, requiring landowners to adapt their management to comply with water quality regulations. An example is the ongoing development and implementation of water quality standards for sediment developed by the U. S. Environmental Protection Agency (U.S. EPA) and the California Regional Water Quality Control Board (CRWQCB) in the form of the total maximum daily load (TMDL).

The sediment delivery inventory and monitoring worksheet and the photograph record presented in this publication (appendix A) are responses to these management and regulatory needs. The worksheet and record provide landowners with the necessary tools–including prioritization, planning, and documentation of control measures–to inventory and monitor sites that have potentially deliverable sediment. Using the worksheet and record also assists landowners in documenting the effects of climate, soil conditions, and off-property factors that cause sediment delivery beyond their control. This publication also contains a glossary of terms to assist in using the worksheet and record and in understanding water quality standards and regulations.

The monitoring objectives for using the worksheet and photograph record:

- Ease of use by private agricultural landowners. The worksheet and photograph record method assumes that landowners are the most knowledgeable people regarding their property and the sites of potential sediment delivery. For this reason, the worksheet and record are designed to be effective and efficient for landowner use.
- Water quality regulation compliance, including baseline, implementation, and effectiveness monitoring.
- Incorporation of terminology from the Natural Resource Conservation Service's (NRCS) *Field Office Technical Guide, Section 4: Conservation Practices*. The NRCS is an important technical resource for the design and implementation of sediment delivery control measures. Familiarity with their terminology makes it easier for the landowner to interact with the NRCS.

The worksheet and photograph record were developed in collaboration with agricultural landowners, CRWQCB staff, NRCS staff, and University of California Cooperative Extension (UCCE) advisors and specialists. These groups tested and

revised the worksheet and record method on agricultural lands, ensuring that the method is accessible to landowners, compliant with water quality regulations, and integrated with NRCS terminology.

It is important to note that the worksheet and photograph record method is not intended to monitor instream sediment. Linking soil erosion and management to delivered sediment is confounded by the temporal and spatial variability of sediment transport and storage (Walling 1983). In addition, field sampling and water sample analysis for this kind of monitoring require financial outlays perhaps better utilized for installing and maintaining control measures. Because of this, the worksheet and record were developed to allow the landowner to develop a prioritized list of erosion control projects in a cost-effective manner.

USING THE WORKSHEET AND PHOTOGRAPHIC RECORD

Site Selection

The first step in inventorying and monitoring sediment delivery sites is selecting the sites to be monitored. Site selection should be based on the landowner's knowledge of the property. Any site that has the potential to erode, is presently eroding, or has eroded in the past should be considered for inventory and monitoring. Landowners should account for erosion influenced by off-site and natural factors, as well as by management.

Because the influences and quantities of sediment delivery are site-specific, sites should be screened using four criteria:

1. Potentially deliverable sediment that is actually delivered to a watercourse
2. Potential sediment delivery that is management induced
3. Potential sediment delivery that is reasonably responsive to mitigation
4. Potentially deliverable sediment that is greater than an established volume threshold

These four site selection criteria are contained in the worksheet (see appendix A).

1. **Deliverable sediment.** Soil erosion can take place without delivery of sediment to a surface watercourse. When selecting sites for monitoring water quality for sediment, identify sites where sediment is delivered to a watercourse and where that delivery impacts the watercourse's beneficial uses. Careful assessment of the drainage setting and hydrological connectivity above and below the site in question can determine the potential for sediment delivery. In addition, the slope of the site and its distance to the watercourse are important considerations.
2. **Management-induced erosion.** Distinguishing between sites that have management-induced sediment delivery and sites that have natural sediment delivery is the second important criterion for site selection. We recommend that both types of sites be inventoried and monitored. This distinction is useful in determining sites that can be addressed and controlled by management actions.
3. **Mitigation potential.** Soil erosion and sediment delivery can be controlled by many methods that require varying levels of inputs and engineering. Discerning whether sediment delivery at a site would reasonably respond to mitigation can help landowners evaluate the cost-effectiveness of control measures. At one end of this spectrum is a site where sediment delivery can be controlled only with a large and costly engineering project. Such a site does not reasonably respond to mitigation. This site should still be included in an inventory and monitoring program as an "unstable area" (see below) and could possibly be addressed through a grant program in a watershed-scale restoration project. The opposite

end of the spectrum is a site where sediment delivery can be controlled with materials and knowledge that are readily available. Placing a hay bale or gravel, cobbles, and boulders in a small gully or rill to stop erosion is one example; increasing the size of a culvert in a road stream crossing is another. Between these extremes are a great number of sites with varying control measure responses. Determining if these sites would reasonably respond to mitigation is ultimately a field judgement, calling upon the landowner to carefully assess the resources available to address a site and the severity of possible sediment delivery from that site.

4. **Volume threshold.** Only sites with potentially deliverable sediment that is above the volume threshold should be included in an inventory. The rationale for the volume threshold stems from the concept of "critical erosion sites" discussed by Lewis and Rice (1989). In their study of sediment delivery from timber harvesting, sites with greater than 13 cubic yards of potentially deliverable sediment comprised over 80 percent of the total potentially deliverable sediment. Selecting a volume threshold should be based on site-specific climate, soils, and vegetative conditions, as well as relevant regulatory requirements. Recommended threshold values range between 10 and 50 cubic yards.

Unstable areas. Sites that exceed the volume threshold but do not receive "yes" responses to the first three criteria are termed "unstable areas." Unstable areas should be inventoried and monitored with photographs but they are not sites where sediment delivery can be addressed and controlled (see fig. 1 and appendix B). Unstable areas have active and potential sediment delivery, including known shallow and deep-seated landslides, debris flows, earth flows, inner gorges, and unstable soils. They also include all known active or potentially active gullies and streambank erosion sites, as appropriate, but should not include identified source sites.

Source sites. Sites that receive "yes" responses to all four criteria are termed "source sites." These are sites with sediment delivery that can be addressed and controlled (see fig. 2 and appendix C).

Figure 1.
Site 1—Unstable area.

Site Characterization

Once sites are selected the next step is to characterize them using the worksheet. This step generates the information needed for baseline monitoring, which is an inventory of sediment delivery from unstable areas and source sites. Site characterization also collects information used to prioritize control measure implementation. To demonstrate how site characterization is done, two examples of sediment delivery sites have been included (figs. 1 and 2), with completed worksheets and records (appendixes B and C). Below are explanations of the worksheet questions, in the order that they appear on the worksheet.

Site #. The number assigned to site. In a systematic fashion, assign an identifying number to each site.

Location description. Can include a legal description or a site description based on the name of a pasture or road. Again, the purpose is to facilitate site location.

Figure 2.
Site 2—Source site.

Site selection criteria. Criteria used to select and differentiate sites for baseline monitoring. To be a source site, the potential sediment from a site must be (1) deliverable to a surface watercourse, (2) management induced, (3) reasonably responsive to mitigation, and (4) greater than the volume threshold.

Eroded volume estimate. Estimate of the sediment volume that has been eroded. Using a staff gauge and pacing off distances, record estimated height (H), width (W), and length (L) of the erosional feature and indicate units (feet or yards). If in yards, multiply H times W times L to calculate the volume in cubic yards. If measured in feet, multiply H times W times L and divide by 27 cubic feet/cubic yard to calculate the volume in cubic yards.

Potential volume estimate. Estimate of the potential sediment volume that can be delivered to a watercourse. This is used as a criterion for site inventory selection and in monitoring and prioritization. Using a staff gauge or pacing off distances, record estimated height (H), width (W), and length (L) in yards. Calculate the volume as in "Eroded volume estimate," above.

% Deliverable. Estimate of the percentage of potentially eroded sediment that enters the watercourse. This percentage should be estimated to the nearest of these four ranges: 0–30%, 30–60%, 60–90%, 90–100%. Consider soil type, slope, distance to watercourse, hydrologic connectivity, and vegetation in making this determination. For example, sediment delivery

from streambank cutting would be 90–100% deliverable, while sediment delivery from hillslope sites not in the watercourse would be lower. Likewise, a site that is well vegetated and covered with dry vegetative matter will have a lower percentage deliverable than bare soil.

Unstable area. A site at which the potentially deliverable sediment exceeds the volume threshold but the site does not meet all of the other three site selection criteria. Indicate on the record whether the unstable area is to be monitored with photopoints.

Category. One of three land-use categories: (1) road; (2) riparian; or (3) hillslope/upland. Check only one.

Process. The erosion process occurring at the site. Check only one.

Influence. Contributing influences to soil erosion and sediment delivery occurring at a site. Check all that apply.

Control measure. Measures that can be taken to address conditions at a site. If only monitoring will be conducted at a site, that should be indicated on the worksheet.

Prioritization. If a control measure is selected, the worksheet can assist in estimating the cost and assigning priority to control measures. In addition, space is provided to record dates and final costs for control measures that are implemented. However, this priority mechanism is only a suggestion and is presented as an example. Priority setting and decision making with regard to allocation of time and resources is highly operation-specific. Using the method contained in the worksheet (appendix A), scores are assigned and recorded for the following categories: assistance needed; estimated time; estimated cost ($); potential volume; and % deliverable. Use the points for the various categories from table 1 and from the bottom of the worksheet (appendix A). These categories balance the resource manager's need to consider the costs and time required by control measures with the sediment delivery potential at a given site. Control measures requiring the least costs and time as well as sites with the highest sediment delivery potential receive the highest scores. After the category scores are recorded, the "priority score" is calculated as their sum. Compare individual site priority scores with other site scores to establish a list of short- and long-term control measures at various sites. For example, the priority score for Site 1 is 17 (fig. 1 and appendix B) while that for Site 2 is 19 (fig. 2 and appendix C).

Table 1. Scores used to calculate individual site priority scores. Corresponding category points are recorded on the worksheet and totaled.

ASSISTANCE NEEDED

Points	Description
1	Engineering, equipment funding, permitting
2	Majority of project requires materials and assistance not readily available
3	Minimal assistance and materials that are readily available
4	None

ESTIMATED TIME

Points	Description
1	More than one week
2	One week
3	One day
4	Less than one day

ESTIMATED COST

Points	Description
1	More than $10,000
2	$1,000–$10,000
3	$100–$1,000
4	Less than $100

POTENTIAL VOLUME

Points	Description
2	10–100 yd^3
4	100–500 yd^3
6	500–1,000 yd^3
8	More than 1,000 yd^3

% DELIVERABLE

Points	Description
2	0–30%
4	30–60%
6	60–90%
8	90–100%

Photopoint Monitoring

Photopoint monitoring (taking a series of photographs from the same point) is recommended for monitoring sediment delivery because it captures a complete inventory or baseline of the landscape through a relatively quick and easy process. Successive photographic documentation can also be used to monitor the implementation and effectiveness of control measures. The summary of photopoint monitoring that follows is adapted from the detailed description in *"How To" Monitor Rangeland Resources; Monitoring Primer for Rangeland Watersheds* (Bedell and Buckhouse 1994), and *Monitoring Protocols to Evaluate Water Quality Effects of Grazing Management on Western Streams* (Bauer and Burton 1993) (see bibliography).

Photopoints should be permanently marked with a fence post, ground marker, or some other suitable object. The marker should be made of durable material that can withstand climatic conditions over a long period of time. Consideration should also be made to ensure that markers withstand livestock disturbance and do not harm livestock or damage equipment. After the markers are established, record their locations and the dates photographs are made using the photographic record (see appendix A) described below.

Monitoring site location & map. The description of the location should include any general information about marker location on the property. A compass heading from the photopoint should be used to give the direction in which to photograph. Noticeable landmarks should also be recorded, including witness points (a point from which a photopoint can be seen). Record the same information for second and third photopoints if needed for the site. Notes about these locations can be made in the provided map space.

Photograph documentation. Record detailed information on each photograph taken, including date/time, photographer, photopoint #, camera/lens/film speed, film roll #/frame #, and other observations of details specific to that particular year or condition, such as changes in weather conditions and management practices.

Effective photopoint monitoring requires consistency in taking photographs from year to year. This consistency can be maintained by adhering to the following suggestions.

1. Use a date-back camera that records at least the date on the photograph. Be familiar with where the date is positioned so the date can be put in a darker area of the photograph.
2. When taking the photographs, carefully follow the information provided for each photopoint. This includes using a similar camera, lens, and film.
3. Take the photographs during the same season every year and at same time of day.
4. Use a staff gauge to provide scale in the photograph. The staff gauge should be at least 6 feet long and have 1-foot increments visibly marked. It can be made from PVC, wood, or other materials on hand (see figs. 1 and 2).

Document Storage

The worksheet, photograph record, and photographs should be stored with other important landowner records. Each successive year's photograph(s) can be documented and filed with the appropriate worksheet and record.

GLOSSARY

assistance needed. Specific materials, machinery, and technical assistance without which control measures cannot be implemented.

controllable. Erosion that would reasonably respond to cost-effective mitigation.

crop agriculture. Sediment delivery influenced by agricultural cropping practices such as tilling or irrigation.

dams and spillways. Sediment delivery influenced by the concentration and direction of water from dams and dam spillways.

deliverable. Sediment that is delivered to a watercourse; as percentage deliverable, the percentage estimated (to the nearest 30%) of the potential volume that is received by the watercourse.

diversion potential. Road stream crossing that has the potential to divert flow out of the established channel with the risk of causing soil erosion and sediment delivery.

erosion. The detachment, transport, and deposition of soil or soil particles by wind, raindrop impact, or flowing water.

eroded volume. Estimated volume of sediment that has eroded from a site.

grade stabilization. A structure used to control the vertical and horizontal cutting in natural or artificial channels.

grazing management. Sediment delivery influenced by livestock, including hoof impacts and livestock presence in stream channels.

gully. An erosion channel formed by concentrated surface runoff; larger then 1 square foot in cross-sectional area (larger than 1 foot deep by 1 foot wide).

hillslope/uplands. Sediment erosion site associated with areas above the riparian management zone.

historical influence. Sediment delivery that has a decades-long history.

hydrological connectivity. Degree to which water from a source site or unstable area is conveyed to the network of the natural watercourse of concern.

landslide treatment. Treating in place material such as mine spoils, mine waste, or overburden to reduce downslope movement of sediment.

management induced. Sediment delivery traced to land management and use.

mass wasting. Downslope movement of soil mass under force of gravity; often used synonymously with "landslide."

natural. Sediment delivery resulting from natural influences only.

off-property road sediment. Sediment delivery resulting from roads not on the landowner's property.

photopoint. Established point used to conduct photographic monitoring.

potential volume. Estimated volume of sediment that is potentially deliverable.

reasonably responsive to mitigation. Sites with sediment delivery that can be addressed and controlled by readily available resources and methods.

rill. An erosion channel formed by concentrated surface runoff; less than 1 square foot in cross-sectional area (less than 1 foot deep by 1 foot wide).

riparian. Site of potential sediment delivery related to the bank of a natural watercourse.

road cut failure. Sediment delivery influenced by the failure of the slope left after a hillside is cut to make a road.

road drainage design. Sediment delivery influenced by the concentration and channeling of runoff from a road.

road fill failure. Sediment delivery influenced by the failure of materials built up to form a road.

road improvement. Measures to reduce road-associated erosion, including culvert improvement, road grading, and road surfacing.

sediment. Material transported and deposited by water or air.

sheet erosion. The loss of thin layers of soil across a large surface area.

site selection criteria. Criteria used to classify sediment delivery sites, including sediment that is deliverable, management induced, reasonably responsive to mitigation, and above an established volume threshold.

source site. Location that meets all four site selection criteria.

stream channelization. Stream channel alteration, including removal of sinuosity.

streambank protection. Stabilization and protection of streambanks, lakes, estuaries, or excavated channels against erosion.

surface treatment. Efforts such as mulching used to control erosion on exposed, disturbed, or bare soils.

TMDL (total maximum daily load). The assessment of problems, sources, and control actions to restore and protect water quality in individual bodies of water.

unstable area. Site in which the potentially deliverable sediment exceeds the volume threshold but the site does not meet the other three site selection criteria.

upstream sediment. Sediment and erosion resulting from sources upstream of the property.

volume threshold. Established volume of potentially deliverable sediment.

witness point. Established point used to locate photopoints.

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Sediment Delivery Inventory and Monitoring Worksheet

Site #:_____ **Location Description:**_____

Site Selection Criteria *("y" or "n")*

___ Deliverable to surface watercourse? ___ Reasonably responsive to mitigation?

___ Management induced? ___ Greater than volume threshold (VT =_____)?

Sediment Volume *(yards³)*

Eroded volume: H=_____ L=_____ W=_____ Volume (H X L X W)=_____

Potential volume: H=_____ L=_____ W=_____ Volume (H X L X W)=_____

% Deliverable *(check one)*: ☐ 0-30% ☐ 30-60% ☐ 60-90% ☐ 90-100%

Unstable Areas *(sediment delivery sites not meeting source site criteria)*

☐ Photopoint monitoring ☐ No monitoring

Category *(check only one)*

☐ Road ☐ Riparian ☐ Hillslope/uplands

Process *(check only one)*

☐ Streambank cutting ☐ Sheet erosion ☐ Rill ☐ Gully ☐ Mass wasting

Influence *(check all that apply)*

☐ Road drainage design ☐ Road fill failure ☐ Grazing ☐ Off-property road sediment ☐ Upstream sediment
☐ Culvert design ☐ Road cut failure ☐ Livestock trail ☐ Stream channelization ☐ Historical
☐ Diversion potential ☐ Crop agriculture ☐ Concentration area ☐ Dams and spillways ☐ Natural

Potential Control Measure *(check all that apply)*

☐ Road improvement ☐ Grade stabilization ☐ Grazing management ☐ Landslide treatment
☐ Surface treatment ☐ Streambank protection ☐ Monitoring only

Prioritization *(points provided below, see **Table 1** in user guide for further detail)*

	Description	**Points**
Assistance needed:		
Estimated time:		
Estimated cost ($):		
Potential volume:	(copy from Sediment Volume section above)	
% Deliverable:	(copy from Sediment Volume section above)	

Total Priority Score = _____

Total Project Cost =$ _____

Date Completed = _____

Assistance Needed	Pts.	Time	Pts.	Costs	Pts.	Potential Volume	Pts.	% Deliverable	Pts.
Technical & Permits	1	> Week	1	> $10,000	1	10-100 yd³	2	0-30%	2
Some	2	One Week	2	$1,000-10,000	2	100-500 yd³	4	30-60%	4
Minimal	3	One Day	3	$100-1,000	3	500-1,000 yd³	6	60-90%	6
None	4	< Day	4	<$100	4	>1,000 yd³	8	90-100%	8

Sediment Delivery Photopoint Monitoring Record

Monitoring Site Location (indicate on map):

	Location Description	Compass Heading	Landmarks
Witness Point			
Photopoint 1			
Photopoint 2			
Photopoint 3			

Witness and Photopoint Map

Photograph Record

Date/ Time	Photographer	Photo-point #	Camera/Lens/ Film speed	Roll #/ Frame #	Observations

Sediment Delivery Inventory and Monitoring Worksheet

Site #: 1 **Location Description:** Streambank cutting in Lambing Pasture

Site Selection Criteria *("y" or "n")*

Y Deliverable to surface watercourse? N Reasonably responsive to mitigation?
N Management induced? Y Greater than volume threshold (VT = 10)?

Sediment Volume *(yards³)*

Eroded volume: H= 3 L= 27 W= 7 Volume (H X L X W)= 567
Potential volume: H= 4 L= 31 W= 5 Volume (H X L X W)= 620
% Deliverable *(check one)*: ☐ 0-30% ☐ 30-60% ☐ 60-90% ☑ 90-100%

Unstable Areas *(sediment delivery sites not meeting source site criteria)*

☑ Photopoint monitoring ☐ No monitoring

Category *(check only one)*

☐ Road ☑ Riparian ☐ Hillslope/uplands

Process *(check only one)*

☑ Streambank cutting ☐ Sheet erosion ☐ Rill ☐ Gully ☐ Mass wasting

Influence *(check all that apply)*

☐ Road drainage design	☐ Road fill failure	☐ Grazing	☐ Off-property road sediment	☑ Upstream sediment
☐ Culvert design	☐ Road cut failure	☐ Livestock trail	☐ Stream channelization	☑ Historical
☐ Diversion potential	☐ Crop agriculture	☐ Concentration area	☐ Dams and spillways	☑ Natural

Potential Control Measure *(check all that apply)*

☐ Road improvement	☐ Grade stabilization	☐ Grazing management	☐ Landslide treatment
☐ Surface treatment	☐ Streambank protection	☐ Monitoring only	

Prioritization *(points provided below, see **Table 1** in user guide for further detail)*

	Description	Points
Assistance needed:	Check permit needs, bank armor design	1
Estimated time:	> 1 week	1
Estimated cost ($):	> $10,000	1
Potential volume:	(copy from Sediment Volume section above) 620 yards³	6
% Deliverable:	(copy from Sediment Volume section above) 90-100	8

Total Priority Score = 17

Total Project Cost = $

Date Completed =

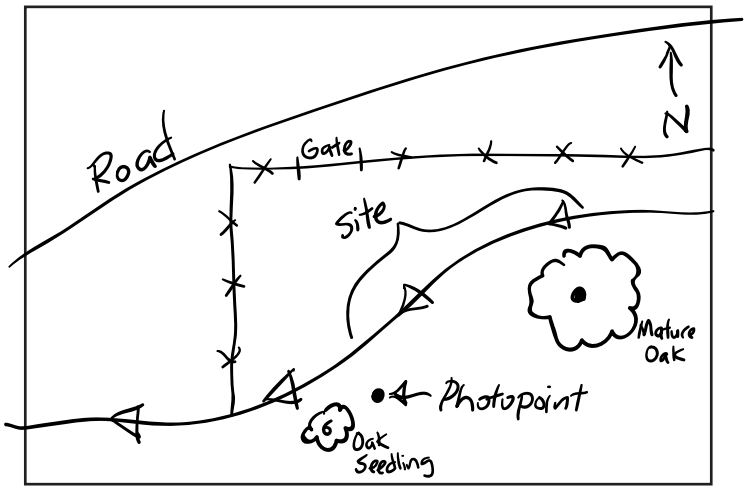
Assistance Needed	Pts.	Time	Pts.	Costs	Pts.	Potential Volume	Pts.	% Deliverable	Pts.
Technical & Permits	1	> Week	1	> $10,000	1	10-100 yd³	2	0-30%	2
Some	2	One Week	2	$1,000-10,000	2	100-500 yd³	4	30-60%	4
Minimal	3	One Day	3	$100-1,000	3	500-1,000 yd³	6	60-90%	6
None	4	< Day	4	<$100	4	>1,000 yd³	8	90-100%	8

Sediment Delivery Photopoint Monitoring Record

Monitoring Site Location (indicate on map):

	Location Description	Compass Heading	Landmarks
Witness Point			
Photopoint 1	On southside of creek	52°NE	Road and fence above site
Photopoint 2			
Photopoint 3			

Witness and Photopoint Map



Photograph Record

Date/ Time	Photographer	Photo-point #	Camera/Lens/ Film speed	Roll #/ Frame #	Observations
5/12/99 945	David Lewis	1	35/35/100	2/14	Streambank cutting

Sediment Delivery Inventory and Monitoring Worksheet

Site #: 2 **Location Description:** North Pasture Culvert #1

Site Selection Criteria *("y" or "n")*

Y Deliverable to surface watercourse? Y Reasonably responsive to mitigation?

Y Management induced? Y Greater than volume threshold (VT = 10)?

Sediment Volume *(yards³)*

Eroded volume: H= 1 L= 80 W= 1 Volume (H X L X W)= 80

Potential volume: H= 1 L= 80 W= 2 Volume (H X L X W)= 160

% Deliverable *(check one)*: ☐ 0-30% ☐ 30-60% ☑ 60-90% ☐ 90-100%

Unstable Areas *(sediment delivery sites not meeting source site criteria)*

☐ Photopoint monitoring ☐ No monitoring

Category *(check only one)*

☑ Road ☐ Riparian ☐ Hillslope/uplands

Process *(check only one)*

☐ Streambank cutting ☐ Sheet erosion ☐ Rill ☑ Gully ☐ Mass wasting

Influence *(check all that apply)*

☑ Road drainage design	☐ Road fill failure	☐ Grazing	☐ Off-property road sediment	☐ Upstream sediment
☑ Culvert design	☐ Road cut failure	☐ Livestock trail	☐ Stream channelization	☐ Historical
☐ Diversion potential	☐ Crop agriculture	☐ Concentration area	☐ Dams and spillways	☐ Natural

Potential Control Measure *(check all that apply)*

☑ Road improvement	☑ Grade stabilization	☐ Grazing management	☐ Landslide treatment
☐ Surface treatment	☐ Streambank protection	☐ Monitoring only	

Prioritization *(points provided below, see **Table 1** in user guide for further detail)*

	Description	Points
Assistance needed:	Minimal	3
Estimated time:	One day	3
Estimated cost ($):	$100-1,000	3
Potential volume:	(copy from Sediment Volume section above) 160 yards³	4
% Deliverable:	(copy from Sediment Volume section above) 60-90%	6

Total Priority Score = 19

Total Project Cost = $

Date Completed =

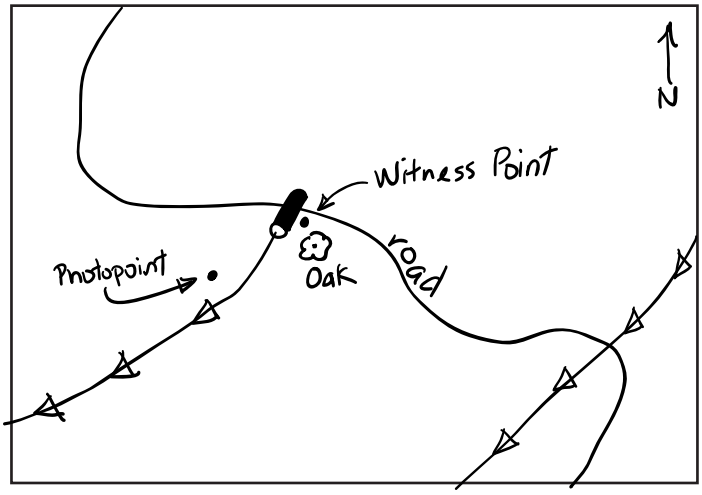
Assistance Needed	Pts.	Time	Pts.	Costs	Pts.	Potential Volume	Pts.	% Deliverable	Pts.
Technical & Permits	1	> Week	1	> $10,000	1	10-100 yd³	2	0-30%	2
Some	2	One Week	2	$1,000-10,000	2	100-500 yd³	4	30-60%	4
Minimal	3	One Day	3	$100-1,000	3	500-1,000 yd³	6	60-90%	6
None	4	< Day	4	<$100	4	>1,000 yd³	8	90-100%	8

Sediment Delivery Photopoint Monitoring Record

Monitoring Site Location (indicate on map):

	Location Description	Compass Heading	Landmarks
Witness Point	South of Culvert between road and Oak tree		
Photopoint 1	Below road on north side of drainage	146° SE	Culvert and road above gulley
Photopoint 2			
Photopoint 3			

Witness and Photopoint Map



Photograph Record

Date/ Time	Photographer	Photo-point #	Camera/Lens/ Film speed	Roll #/ Frame #	Observations
5/12/99 930	David Lewis	1	35/35/100	1/6	Culvert draining inboard ditch. Inboard ditch stable but downcutting taking place below culvert.