

FREP Water Quality Effectiveness Evaluation Field Tables

Table 1. Site Type: Requiring Evaluation within Sampling Area

Road Related
All road stream crossing (bridge and culvert)
Inter-drainage culverts. Road segments located within 20 meters of stream or lake.
Road generated slope failure. Any mass failure either immediately above or below road. (These will not generally be known until the field visit)
Harvesting Related
Harvesting / yarding within or adjacent to riparian zone (windthrow)
Skidder/ mechanized harvester trails in proximity to riparian zone
Harvesting generated slope failure (all new failures within or below cutblock)
Other forestry harvesting disturbances resulting in bare, unvegetated soil
Livestock Related
Livestock presence noted within riparian zone and stream channel. When livestock presence is noted, and domestic water intakes occur downstream will require further evaluation using Range Checklist Indicator Sheet. (Form 3)

Table 2. (for Column 1) Individual Components of Sampled Sites.

Possible components found within sample site (note abbreviations used)
Road surface (RS)
Road ditch (RD)
Road cutbank (RC)
Road Fill or sidecast (F)
Gullies or rills generated by artificially concentrated storm flow (G)
Landslides generated by forest harvesting and road related activities.(L)
Upturned root wads (URW)
Livestock Disturbance Noted (LDN)
Other Disturbed Areas (ODA)

Other descriptors:

Left (L) (Facing downstream from crossing)

Right (R) (Facing downstream from crossing)

Upslope (u)

Downslope (d)

Example: RRC (u) Right road cutbank on upstream side

Table 3 (for Column 2) Estimating Connectivity

Estimated Connectivity	Typical example	Actual Range	Connectivity Value used in Column 2
none	Ditch-blocked interceptor culvert draining 70m of road discharging onto long, hummocky forested slope	(<0.1)	0
A little	Landslide with majority of failed material captured by alluvial terrace below	(0.1-0.3)	0.2
About half	A small area of disturbed cutbank (50 m ²) with 2 meters of forest floor separation from stream	(0.3-0.7)	0.5
A lot	Ditch-blocked interceptor culvert draining 200 m of road discharging onto a steep forested slope within 10 m of stream	(0.7-0.9)	0.8
all	Ditch drainage running directly into stream or road surface drainage running off road bridge	(>0.9)	1

Table 4. (for Column 2). Estimating Connectivity (portion of disturbed drainage area to distance over forest floor to stream)

Distance over forest floor between ditch outlet and wetted width of stream (m)	Approximate area of disturbed drainage area upslope of storm drainage outfall (m ²)							
	< 10	10-50	50-100	100-250	250-500	500-1000	1000-2000	>2000
0.5-1	0.5	0.8	1	1	1	1	1	1
1-2	0.2	0.5	0.8	1	1	1	1	1
2-5	0	0.2	0.5	0.8	1	1	1	1
5-10	0	0	0.2	0.5	0.8	1	1	1
10-20	0	0	0	0.2	0.5	0.8	1	1
20-30	0	0	0	0	0.2	0.5	0.8	0.8
>30	0	0	0	0	0	0	0	0.5

Table 4 that considers the relationship between the size of the drainage area generating storm flow for an individual component and the distance traveled over vegetated ground between disturbed site and stream.

Table 5. (for Column 3) Estimating Fine Sediment Component

Estimate of portion of fine sand, silt and clay in eroded/ erodible material (excluding active road surfaces)	Actual range	Value used in Column 3
None	< 0.1	0
A little	0.1-0.3	0.2
About half	0.3-0.7	0.5
A lot	0.7-0.9	0.8
All	< 0.9	1

Note: Active road surfaces are always assigned a fine sediment portion of 1.

Estimating surface erosion on roads

Table 6a (For Column 9) showing predicted depths of surface erosion from road surface of <2% slope gradient under differing conditions

Road Use	Road Surfacing Quality			
	Paved or Coarse Ballast	Good	Average	Poor
<2% slope				
Heavy use , all season road	0	0.001	0.002	0.005
Moderate use, all season road	0	0.0005	0.001	0.002
Light use (4 x4)	0	0.0002	0.0005	0.001
Deactivated (and unused)	0	0.0001	0.0002	0.0005

Table 6b (For Column 9) showing predicted depths of surface erosion from road surface of 2-10% slope gradient under differing conditions

Road Use	Road Surfacing Quality			
	Paved or Coarse Ballast	Good	Average	Poor
2-10% slope				
Heavy use , all season road	0	0.002	0.005	0.01
Moderate use, all season road	0	0.001	0.002	0.005
Light seasonal use (4 x4 and occasional logging truck)	0	0.0005	0.001	0.002
Deactivated (and unused)	0	0.0002	0.0005	0.001

Table 6c (For Column 9) showing predicted depths of surface erosion from road surface of >10% slope gradient under differing conditions

Road Use	Road Surfacing Quality			
	Paved or Coarse Ballast	Good	Average	Poor
>10% slope				
Heavy use , all season road	0	0.005	0.01	0.02
Moderate use, all season road	0	0.002	0.005	0.01
Light use (4 x4)	0	0.001	0.002	0.005
Deactivated (and unused)	0	0.0005	0.001	0.002

1 If evaluator is not experienced with estimating road surface quality, always revert to average values.

Table 7. (for Column 9). Annual surface erosion expected on surfaces commonly associated with mini-catchments.

Note: Applied only to portion of surface with bare unprotected soil. Net down to account for self armoring and/ or revegetation (0, 0.2, 0.5,.0.8, 1.0).

Typical surface (other than road surfaces) within mini-catchments draining forestry-disturbed sites.	Estimated annual depth of surface erosion expected under existing conditions (m) (1mm= 0.001 m)
Forest floor, cutbanks, sidecast, fill slopes or ditch lines with algae sheen, moss, grass or litter cover or naturally or artificially armoured (Generally associated with well established roads)	0
Bedrock outcrop, Colluvial/ morainal, fluvial stone rubble in any location	0
Disturbed forest floor, newly opened cutbanks, recent sidecast, fill slopes or ditch lines with bare, unvegetated, unarmoured unconsolidated surface material. Also older surfaces with on-going needle ice formation	0.01
Natural or artificial surface with heavy livestock use and presence of compacted bare soil and cow pies present	0.01
Cutbanks, sidecast, fill slopes and ditches with no vegetation cover on stone- free very fine sandy and silty lacustrine	0.02

Converting fine sediment volume to water quality degradation

Table 8. Degree of Water Quality Degradation
(Based on volume of fine sediment generated from inspected site)

Total volumes of fine sediment reaching stream from Sample Site Grand Total from Form 2 Side 2.	Sediment Generating Potential Classes	General Level of management
<0.2 m ³	Very Low	Good
0.2- 1 m ³	Low	↑ ↓ Sites with moderate or higher class require assessment of management practices (Table 9)
1-5 m ³	Moderate	
5-20 m ³	High	
>20 m ³	Very High	Poor

Note: Table 9 and 10 not required for WQEE protocol in 2009

Table 11 Checklist of Possible Solutions to Reduce Fine Sediment Generation

Activity of concern	Possible means to reduce stream sedimentation
Location of road (To be considered in future road alignments)	1. Locate road away from stream. 2. Avoid steep, unstable slopes or ensure adequate engineering of alignment 3. Avoid stream crossing where lay of land requires road approaches with long gradients flowing towards stream.
Design of road and cutblock (To be considered in future road drainage and cutblock boundary design)	4. Avoid deeply dug ditches in proximity to streams. (possibly use rock ballast to raise road) 5. Plan for sufficient number of strategically located culverts to avoid excess drainage water concentration. 6. Design bridge deck to be slightly higher than road grade, with gentle slope away from bridge. 7. Design narrower road that follows natural breaks in topography to channel surface water safely off road away from natural drainages 8. Ensure that remaining trees left within riparian zone are wind firm.
Construction of road/ harvesting of cutblock (To be considered during construction of road and harvesting of cutblock)	9. Avoid soil disturbance wherever possible. 10. Armour, seed or spread out logging debris over disturbed area to protect soil. 11. Avoid wet areas or use brush mats to avoid compaction and incision of skid trails. 12. Use good quality road sub grade and capping materials. 13. Place rock armouring over areas of concentrated flow. 14. Construct sediment basin capable of handling coarse sediment expected from new road construction.
Management/ Maintenance (To be considered during ongoing management and maintenance of road and cutblock)	15. Ensure good quality road fill and surfacing used and grader produces crowned road. 16. Remove grader berms. 17. Reduce or prevent vehicular traffic during wet weather or just after spring thaw. 18. Reduce or prevent vehicular traffic on road. 19. Fall away, yard away or clean stream to former conditions. 20. Improve Range Management by reducing livestock damage within riparian zone
Deactivation (Seasonally or permanently)	21. Install strategically placed cross ditches, water bars and ditch blocks. 22. Pull back and end haul unstable road fill to safe location. 23. Pull culverts and armour crossing.
Other	24. Other recommendations (Comments on Form 2, Side2)

