

FREP 101: Water Quality Effectiveness Evaluation

Forest and Range Evaluation Program
Victoria, BC
March 8, 2022

by:

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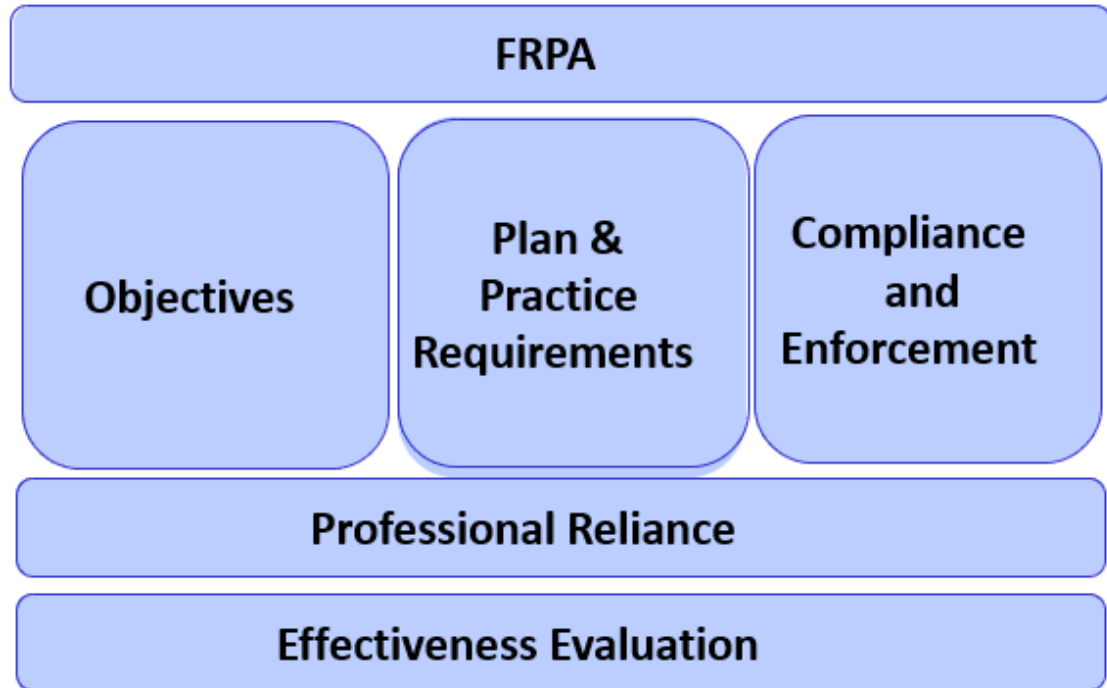


Outline – Water Quality

- Why are we monitoring?
- What is being monitored & why
 - Monitoring question
 - Resource roads & crossings
 - Indicators
 - Sample design & approach
 - Scoring
- What have we learned to date
 - Provincial results
 - Key issues / causal factors
 - Management recommendations
- How have the results been used
 - Provincial & district reporting
 - Engineering manual
 - ABCFP article
 - Forest Practice Board reports



Why: Forest and Range Practices Act



Forest and Range Practices Act was introduced in November 2002. This results-based regime is expected to reduce government and industry costs, increase opportunities for flexibility and innovation without reducing the province's high environmental standards.

Key goals:

- reduce transactional and operating costs to industry;
- reduce the code's complexity;
- provide forest industry "freedom to manage" in delivery of defined results;
- **maintain the code's high environmental standards;**
- continue to balance social, environmental and economic interests;
- maintain and enhance the level of public acceptance of forest management;
- be consistent with the reduced resource capacity of government; and,
- strengthen the compliance and enforcement regime.



FREP
Forest & Range
Evaluation Program

Effectiveness Evaluations



Purpose:

- EE are part of the FRPA construct (2004)
- A science-based feedback loop into policy and legislation
- Determine if government (FPPR) objectives are being delivered
- Evaluate operational outcomes where licensees are in compliance with approved results or strategies
- Use adaptive management principles to conduct timely, credible and appropriate evaluations – by district staff/contractors
- Make recommendations to DDM's, land managers, legislation and policies
- Manage information and data
- Communicate results and recommendations to stakeholders in a timely and appropriate manner
- Supports indigenous reconciliation, integrated monitoring and decision making

Why monitoring?

Provincial / Federal Legislation, Regulations regarding fish & water protection

Provincial – FRPA

Forest Planning and Practices Regulation (FPPR)

8.0 Objectives set by government for water, fish, wildlife and biodiversity within riparian areas

- ...to conserve, at the landscape level, the water quality, ...associated with those riparian areas.

8.1 Objectives set by government for fish habitat in fisheries sensitive watersheds

- ..to prevent ...cumulative hydrological effects of primary forest activities ...from resulting in a material adverse impact on the habitat of the fish species.

8.2 Objectives set by government for water in community watersheds

- to prevent ... the cumulative hydrological effects of primary forest activities from resulting in a material adverse impact on the quantity, quality or the timing of the flow of the water to the waterworks

Provincial - FPPR

Stream crossing

- **55** (1) An authorized person ... protect the stream channel and stream bank immediately above and below the stream crossing, and (b) mitigates.

Protection of fish and fish habitat

- **57** An authorized person who carries out a primary forest activity must conduct the primary forest activity at a time and in a manner that is unlikely to harm fish or destroy, damage or harmfully alter fish habitat.

Protecting water quality

- **59** must ensure that the primary forest activity does not cause material that is harmful to human health to be deposited in, or transported to, water that is diverted for human consumption by a licensed waterworks.

Licensed waterworks

- **60** (1) An authorized person who carries out a primary forest activity must ensure that the primary forest activity does not damage a licensed waterworks.

Excavated or bladed trails

- **61** ... must ensure that doing so does not cause sediment that is harmful to human health to enter a stream, wetland or lake from which water is being diverted for human consumption by a licensed waterworks.

- **Others – DWPA, WSA, WLPPR, RPPR,**

- **Federal Fisheries Act**

- **Fish and Fish Habitat Protection and Pollution Prevention**

- 34 (1) deleterious substance means

- (a) any substance that, if added to any water, would degrade or alter or form part of a process of degradation or alteration of the quality of that water so that it is rendered or is likely to be rendered deleterious to fish or fish habitat or to the use by man of fish that frequent that water, or

34.3 (1) necessary to ensure the free passage of fish or the protection of fish or fish habitat, the owner or person who has the charge, management or control of an obstruction or any other thing that is detrimental to fish or fish habitat shall, on the Minister's request and within the period specified by him or her, conduct studies, analyses, samplings and evaluations, and provide the Minister with any document and other information relating to them, to the obstruction or thing or to the fish or fish habitat that is or is likely to be affected by the obstruction or thing.

34.4 (1) No person shall carry on any work, undertaking or activity, other than fishing, that results in the death of fish.

Harmful alteration, disruption or destruction of fish habitat (HADD)

35 (1) No person shall carry on any work, undertaking or activity that results in the harmful alteration, disruption or destruction of fish habitat.

FREP Water Quality question

To gauge the effectiveness of FRPA:

- Are forest practices effective in protecting water quality?
- Are forest and range practices increasing the risk of drinking water health hazards?

To be completed by:

- **Routine** level assessment, conducted by district staff
- Repeatable
- Fast (<1/2 hour per site)
- Provides a means to communicate sediment and water quality information
- Identifies an order of magnitude estimate of water quality impacts
- Identifies options for site improvement (remediation)
- **Routine evaluations** are low intensity, overview evaluations that use relatively simple qualitative indicators that can be obtained at most sites, such as visual estimates (length/width/% cover etc.) and/or yes/no answers.



Summary of WQEE protocol

- Focus – fine sediments (resource roads / in block landslides)
- Randomly selected cutblocks
- Assess exposed mineral soil, soil texture, amount of traffic, slope, road construction materials, connectivity (0, a little, half, most, all), stream characteristics, fecal coliforms
- Estimate volume of fines erodible (score=m3)
- Estimate bankful discharge
- Identify severity of ill effects (score=NTU's/Mg/L)
- Provide recommendations for remediation if necessary



WQEE scoring

Volume based scoring

Total Volume of Fine Sediment generated at site (WQ Index)	Site Sediment Generation Potential Classes (based on consensus of field practitioners)	Associated General Level of Management of Site
<0.2 m ³	Very Low	<div>Good</div> <div>↑</div> <div>↓</div> <div>Poor</div>
0.2-1 m ³	Low	
1-5 m ³	Moderate	
5-20 m ³	High	
>20 m ³	Very High	

Severity of ill effects – based on estimated levels of turbidity over 10 days on sensitive fish (salmon and trout - Newcombe).

Effect on Sensitive Fish	Sediment duration of 10 days
Not impaired (<i>Impact Class 0</i>)	< 10 mg/l (<5 ntu)
Slightly Impaired Minor Physiological stress (<i>Impact Class 1,2,3</i>)	10-40 mg/l (5-20 ntu)
Moderately impaired (<i>Impact class 4,5,6,7, 8</i>)	20- 400 mg/l (20- 200 ntu)
Severely Impaired (<i>Impact class 9,10,11,12</i>)	>400 mg/l (> 200 ntu)

Results: By Area (2008-2020)

Score	North (%)	South (%)	Coast (%)	Province (%)
VL	26	25	29	27
L	36	44	47	43
M	27	26	21	24
H	9	5	2	5
VH	2	1	1	1
Sample size	2159	2908	3541	8608

Results: By Year (2021), by Feature

Count of District	Column Labels						
Row Labels	Very Low	Low	Moderate	High	Very High	Grand Total	Mod.+ %
DCC	31	40	25	2		98	28
DCK	13	16	8	1		38	24
DCR	1	2	1			4	25
DCS	27	29	18	4		78	15
DKA	7	15	9	2	1	34	35
DKM	6	5	5			16	31
DMH	7	14	10	1		32	34
DMK	3	3	8	5		19	68
DND	4	4	4			12	33
DNI	13	24	14			51	28
DOS	5	15	12			32	38
DPC		1	4			5	80
DPG	4	5	1			10	10
DRM	38	15	8	1		62	15
DSE	6	6	1			13	8
DSI	7	26	10		1	44	23
DSN	4	8	4			16	25
DSQ	7	22	12			41	29
DSS	12	14	2	5	1	34	24
(blank)							
Grand Total	195	264	156	21	3	639	28
DFN						0	
DQU						0	
DSC						0	
DQC						0	

Count of Road Use	Column Labels						
Row Labels	Very Low	Low	Moderate	High	Very High	(blank)	Grand Total
Deactivated	36	42	11	1			90
Light	66	119	58	5	3		251
Moderate	25	68	43	3	3		142
Heavy	7	13	13	7	1		41
(blank)							
Grand Total	134	242	125	16	7		524

Count of Stream class	Column Labels					
Row Labels	No Effect	Slightly impaired	Moderately impaired	Severely Impacted	Undefined (blank)	Grand Total
<1.5	66	8	4	4	246	328
1.5-5	78	4	4	2	88	176
5-20	37				9	46
>20	8				2	10
(blank)						
Grand Total	189	12	8	6	345	560

Results: 2008 – 2020 Recommendations for Improvement

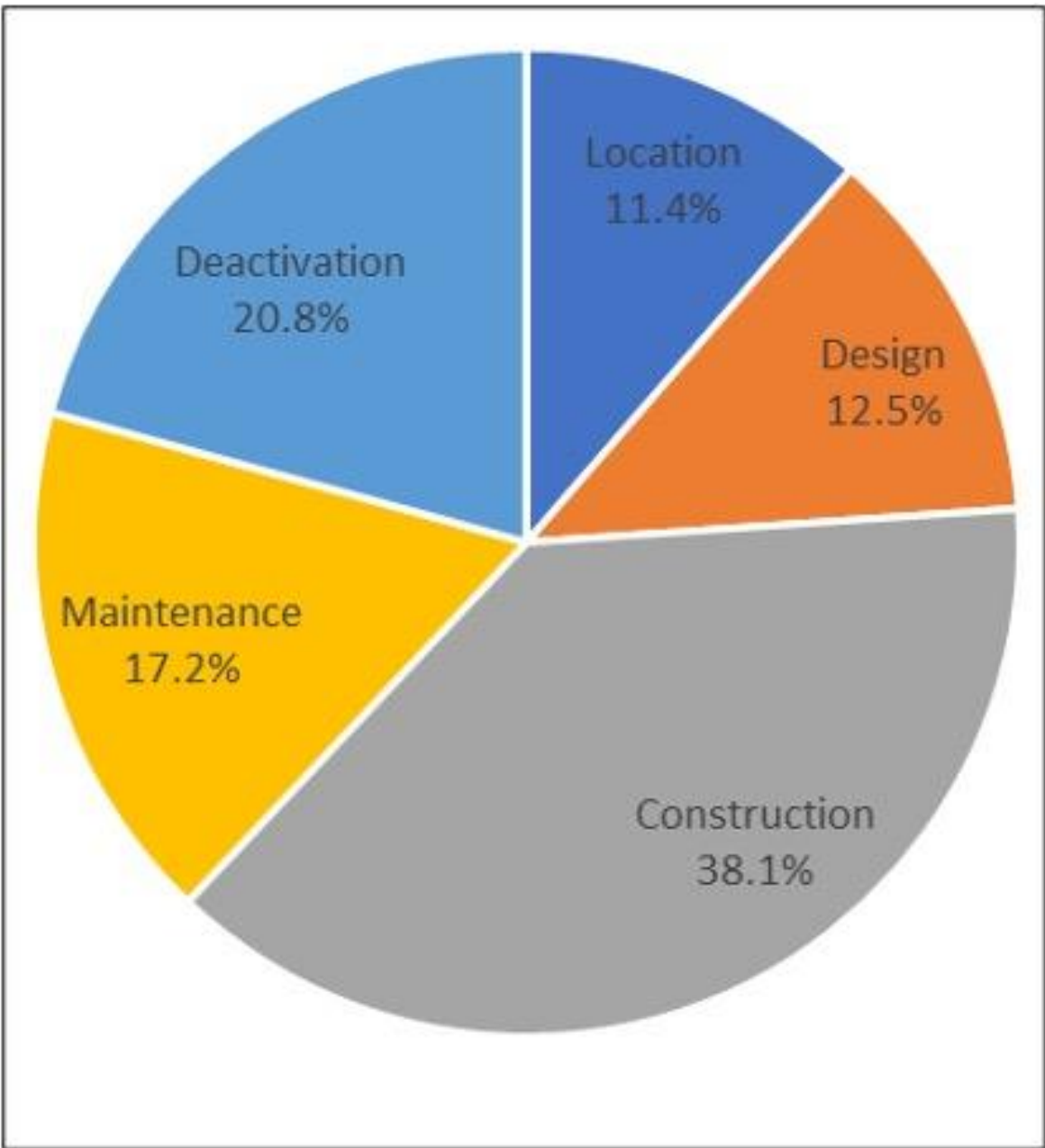
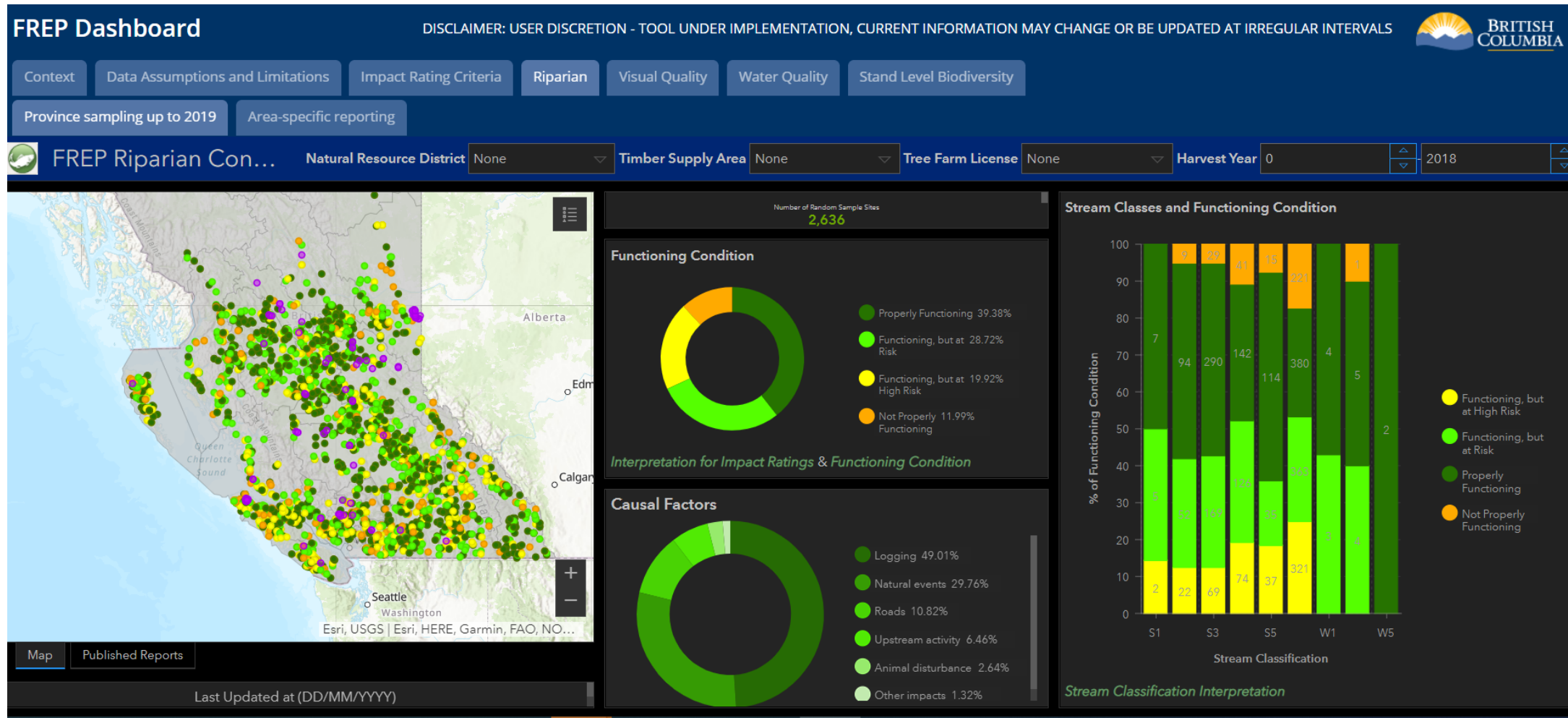


Table 13. Summary of management recommendations during the five stages of a road's life (2008-2020)

Stage in road life	Specific recommendation for site	# of times observed out of 8028 sites evaluated between 2008-2020	Total # and %
Location	Locate road away from stream	89	
	Avoid steep unstable slopes	77	
	Avoid stream crossing	406	
	Recommendations related to location		572 (11.4%)
Design	Avoid deeply dug ditches	196	
	Plan for sufficient number of culverts	196	
	Design bridge deck higher than road grade	154	
	Design narrower road	81	
	Recommendations related to design		627 (12.5%)
Construction	Ensure that remaining trees are wind firm	20	
	Avoid soil disturbance wherever possible	107	
	Spread out logging debris	663	
	Avoid compaction of skid trails	7	
	Use good quality road materials	278	
	Place rock armouring over areas of concentrated flow	136	
	Construct sediment basin	206	
	Ensure good quality road fill	495	
	Recommendations related to construction		1912 (38.1%)
Maintenance	Manage grader berms	646	
	Reduce vehicular traffic during wet weather	119	
	Reduce vehicular traffic on road	22	
	Clean stream to former conditions	9	
	Improve range management	66	
	Recommendations related to maintenance		862 (17.2%)
Deactivation	Install strategically placed cross ditches	915	
	Move unstable road fill to safe location	50	
	Pull culverts armour crossing	76	
	Recommendations related to deactivation		1041 (20.8%)

Application of Results: FREP Dashboard – Find monitoring results



FREP Website (or Google FREP dashboard)

<https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/integrated-resource-monitoring/forest-range-evaluation-program>

Application of results: District reporting

A FREP water quality assessment was conducted in WFP's Jeune Landing Operation on the Cygl road system and Marine Drive (RO6897) starting in Cutblock 33507.



The FREP Water Quality Effectiveness Evaluation (WQEE) protocol evaluates the potential of forestry disturbed sites (ie roads, landslides) to generate and transport fine sediment to natural water bodies, including fish streams and (or) drinking water sources.

Nine sample locations were assessed. Sample locations and ratings are provided in the attached KML file. Of the 9 sample locations, 8 sample sites were rated as **Low** or **Very Low** and 1 sample site was rated as **Moderate**. One sample site (Sample Site 3) was rated as **Low** but could easily have become a **High**. A rating of **Low** or **Very Low** indicates good water quality management at the time of sampling and that no action is required. A rating of **Moderate** or **High** indicates some concerns and will have recommendations for improvement. Definitions of the ratings are provided in Table 11 below.

Findings

Sample Site 2-Moderate



Photo 2-1

The **Moderate** rating at Sample Site 2 is due to the 100m long section of road and the adjacent unstable cutbank that transport sediment towards the stream. The rating would change to **Low** by:

- Installing effective waterbars and/or cross-ditches and ditch blocks at strategic locations
- Stabilizing the erodible portions of the cutbank (armoring, grass-seeding, bio-engineering, spreading logging slash over exposed soil).

Reports can be:

- End of to day to report an emergency situation
- Mini report / end of season – as above
- Data to server requiring reviewed/certified data

Application of Results



Chapter 9: Forest Resource Road and Crossing Erosion and Sediment Management

Forest resource roads and crossings are sources of sediment. This chapter provides general guidance for considerations for forest resource road erosion and sediment management for those involved with Forest Service Roads.

Roads and associated crossings should be designed, constructed, inspected, maintained, and deactivated recognizing that they are sources of sediment that can detrimentally impact upon other forest resources such as water quality, fish streams and fish habitat.

Consideration for management of sediment should be made through the life-cycle phases of forest resource roads and crossings. Each phase impacts sediment development and mobilization. It is more effective and efficient to integrate sediment management in road activities than to deal with it in a reactive manner. Plan all activities to minimize the potential for sediment development and movement.

FLNRORD Engineering Manual - engineering roads policy, procedures, guidance manual for engineering activities associated with forest and resource roads

Chapter 9: Forest Resource Road and Crossing Erosion and Sediment Management

[9.1 Road and Crossing Life Cycle Phases and Sediment](#)

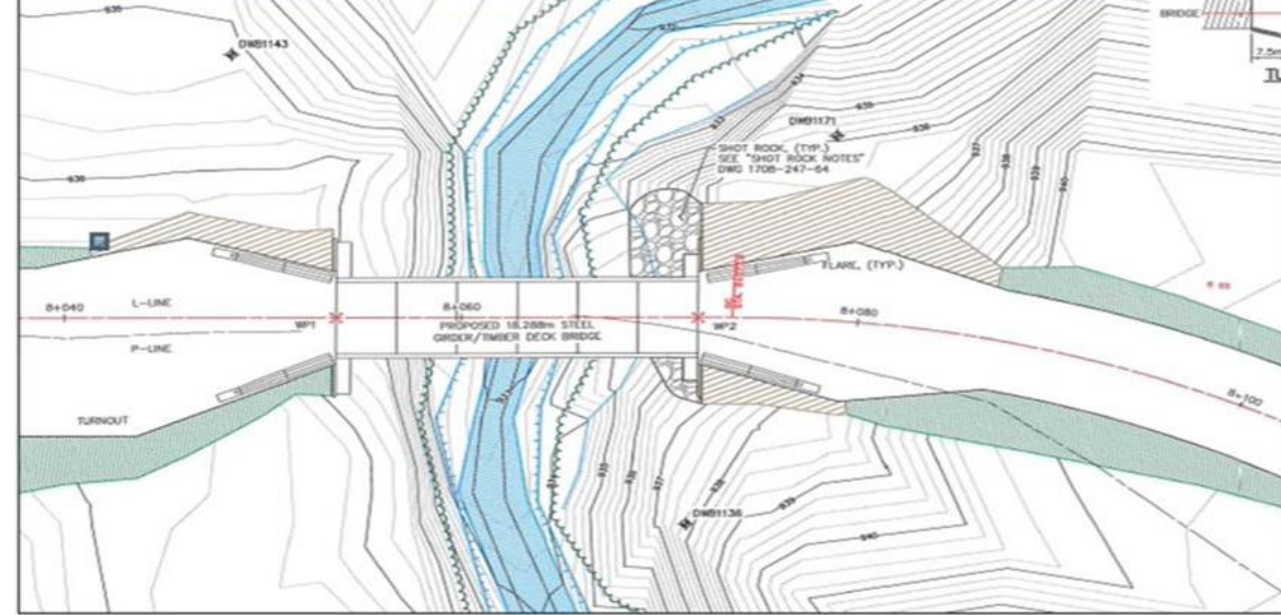
- [9.1.1 Planning and design](#)
- [9.1.2 Construction](#)
- [9.1.3 Inspection](#)
- [9.1.4 Maintenance](#)
- [9.1.5 Deactivation](#)

[9.2 Resources](#)

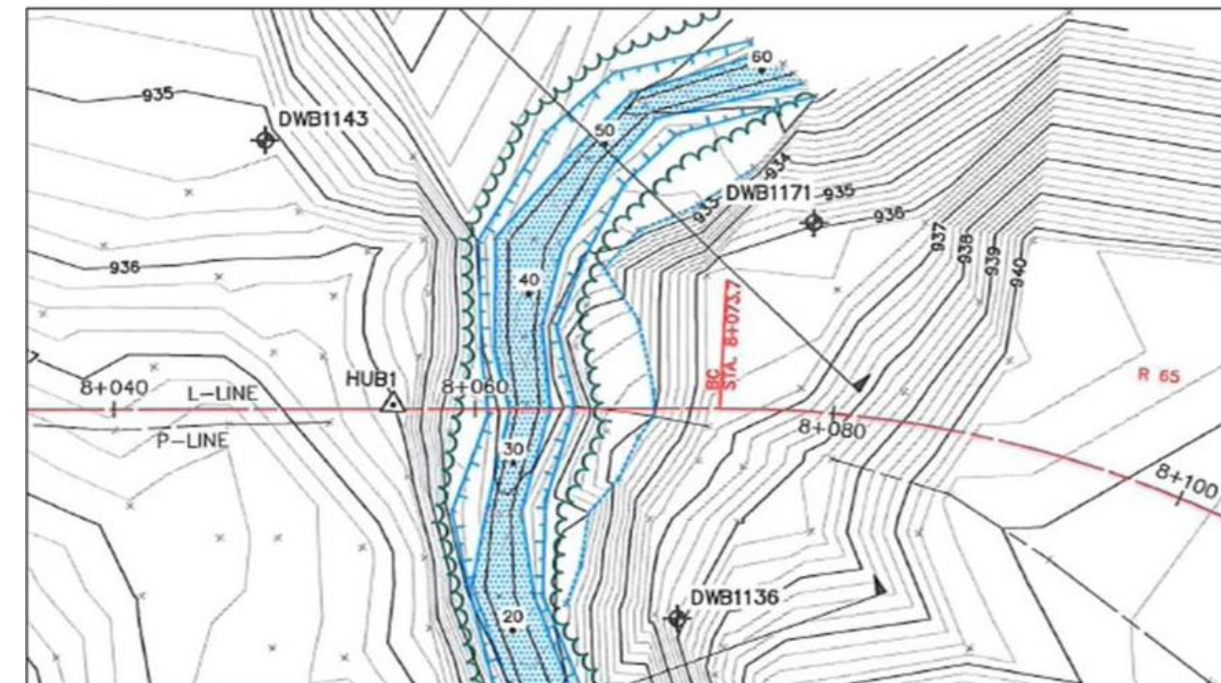
https://www2.gov.bc.ca/gov/content/industry/natural-resource-use/resource-roads/engineering-publications-permits/engineering-manual/resource-road-and-crossing-erosion-and-sediment-management#life_cycle_phases

Application of Results: Industry partners

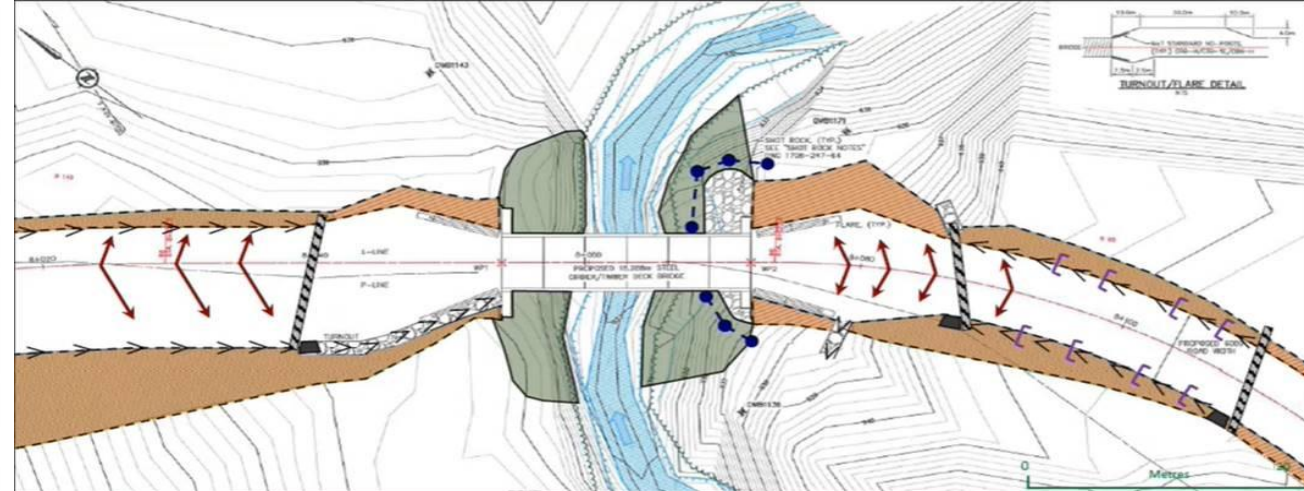
- Awareness of fine sediment as an issue
- Be prepared to manage sediment for all road life stages
- Grader course mandatory
- Communication between resource managers
- FREP WQEE assessment information
- Engineering Manual
- Monitor
- Know what is happening on the ground in your district
- FREP WQEE
- Knowledge / remediation
- use FREP WQEE data (Moderates/Highs), what can be impacted, and what can be done to remediate the site
- On-site training - FPIinnovations, FREP WQEE, BCTS, licensees



Erosion and sediment control plan



Courtesy of DWB Consulting Services Ltd.



SEDIMENT FENCE		DUFF / VEGETATION RETENTION	
WATER BAR		STRAW / WOOD MULCH	
WING DITCH		SURFACE ROUGHENING / SEED	
DITCH BLOCK		COIR MATTING	
COIR LOG		SOIL RETAINING BERM	
WATTLE		CULVERT	
CHECK DAM		CROWN ROAD SURFACE	
SEDIMENT TRAP		BENCH MARK	
WOODY DEBRIS BERM			
SCATTER WOODY DEBRIS ON SLOPE			

Courtesy of DWB Consulting Services Ltd.

Application of Results:Reporting: FREP Reports & Publications

- Sustainable Forest Management Practices
- Timber Supply Review & Allowable Annual Cut
- Forest Inventory
- Forest Health
- Soil Conservation
- Forest Stewardship Plans
- Silviculture
- Wildfire Management
- Tree Seed
- Visual Resource Management
- ▼ Integrated Resource Monitoring
 - Integrated Monitoring Reports
- ▼ Forest & Range Evaluation Program
 - FREP Monitoring Protocols
 - FREP Multiple Resource Value Assessments
 - FREP Reports & Publications**
- Managed Resource Features

FREP Reports & Publications

The Forest & Range Evaluation Program (FREP) produces a variety of publications such as scientific reports, annual reports and newsletters. Click on the drop-down arrows below for more information and to view the individual publications.

Expand All | Collapse All

- FREP Assistant Deputy Minister's Reports** ▼
- FREP Multiple Resource Value Assessment (MRVA) Reports** ▼
- FREP Reports** ▼
- FREP Extension Notes** ▼
- FREP Technical Guidance** ▼
- Watershed Status Evaluation Reports** ▼
- FREP Newsletters** ▼
- Strategic Plans** ▼
- Annual Reports** ▼

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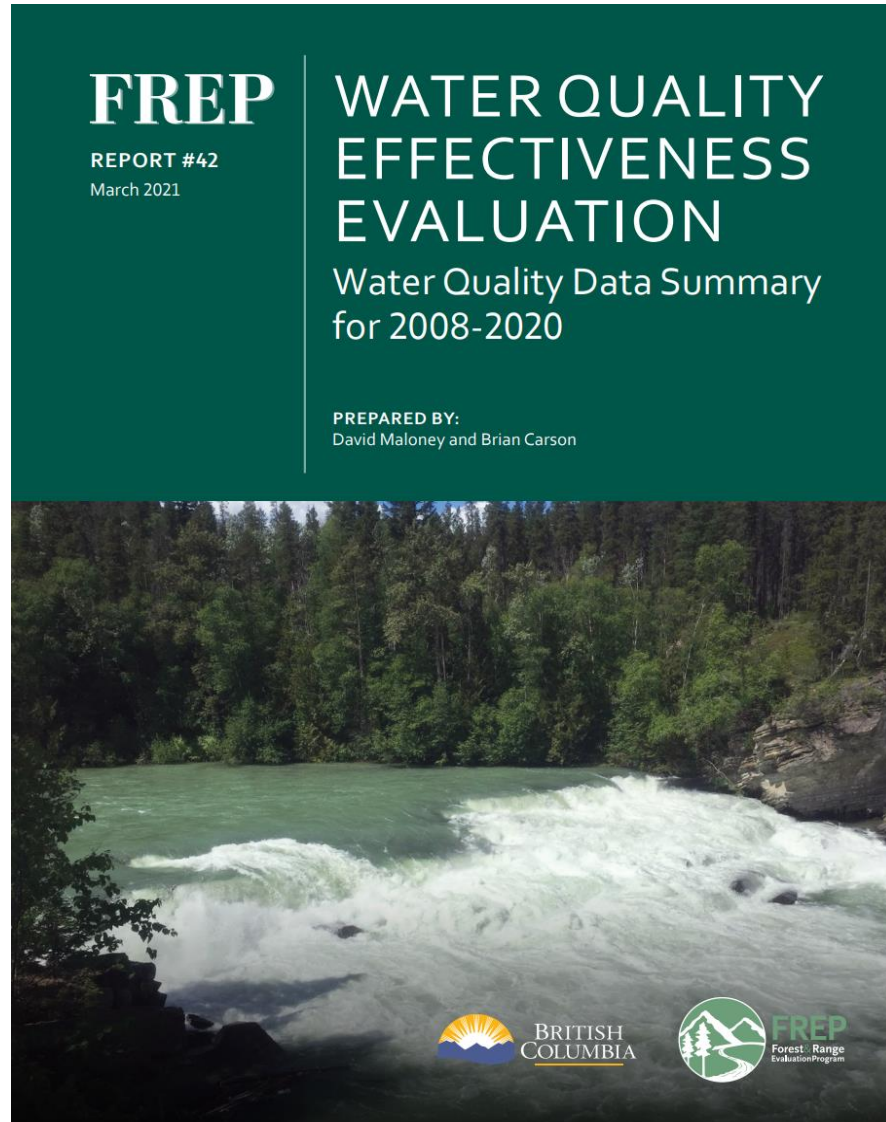
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Contact Information

For more information about the program:

- FREP@gov.bc.ca

Application of Results: FREP reporting



Links to FREP extension notes and reports:

- [FREP Extension Note #7 \(PDF, 1.4MB\)](#): Why the Forest and Range Evaluation Program is Important to You as a Forest Manager and Decision Maker
- [FREP Extension Note #12 \(PDF, 2.3MB\)](#): What is a Water Quality Effectiveness Evaluation?
- [FREP Extension Note #22 \(PDF, 1.2MB\)](#): Summary of Provincial Water Quality Effectiveness Evaluation Results (2008-2010)
- [FREP Extension Note #29 \(PDF\)](#): Water Quality Effectiveness Evaluation Results (2008-2012): Results and Opportunities For Continued Improvement
- [FREP Extension Note #31 \(PDF\)](#): Potential Uses of the FREP Water Quality Effectiveness Evaluation Procedure
- [FREP Report #42 \(PDF, 7 MB\)](#): Water Quality Effectiveness Evaluation: Water Quality Data Summary for 2008-2020
- The FREP WQ app is available to everyone (free)
- FREP WQ app protocol at:
https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/protocol-documents/2018_wqee_protocol.pdf

Thank you