



# Multiple Resource Value Assessment (MRVA)

Arrow and Boundary Timber Supply Areas

December 2013

## FOREWORD

Forest management in British Columbia is governed by a hierarchy of legislation, plans and resource management objectives. For example, federal and provincial acts and regulations, Land Use and Forest Stewardship plans, and protected areas and reserves collectively contribute to achieving balanced environmental, social and economic objectives. Sustainable forest management is key to achieving this balance and a central component of forest management certification programs. The purpose of the Multiple Resource Value Assessment (MRVA) report is to provide resource professionals and decision makers with information about the environmental component of this 'balance' so that they can assess the consistency of actual outcomes with their expectations.

The Forest and Range Practices Act (FRPA) lists 11 resource values essential to sustainable forest management in the province; biodiversity, cultural heritage, fish/riparian and watershed, forage and associated plant communities, recreation, resource features, soils, timber, visual quality, water, and wildlife. The MRVA report is a summary of the available field-based assessments of the conditions of these values. Field assessments are generally conducted on or near recently harvested cut blocks and therefore are only evaluating the impact of industrial activity and not the condition of the value overall (e.g. they don't take into account protected areas and reserves). Most of the information is focused on the ecological state of the values and provides useful information to resource managers and professionals on the outcomes of their plans and practices. This information is also valuable for communicating resource management outcomes to stakeholders, First Nations and the public, and as a foundation for refining government's expectations for sustainable resource management in specific areas of the province.

I encourage readers to review the full report and direct any questions or comments to the appropriate district office.

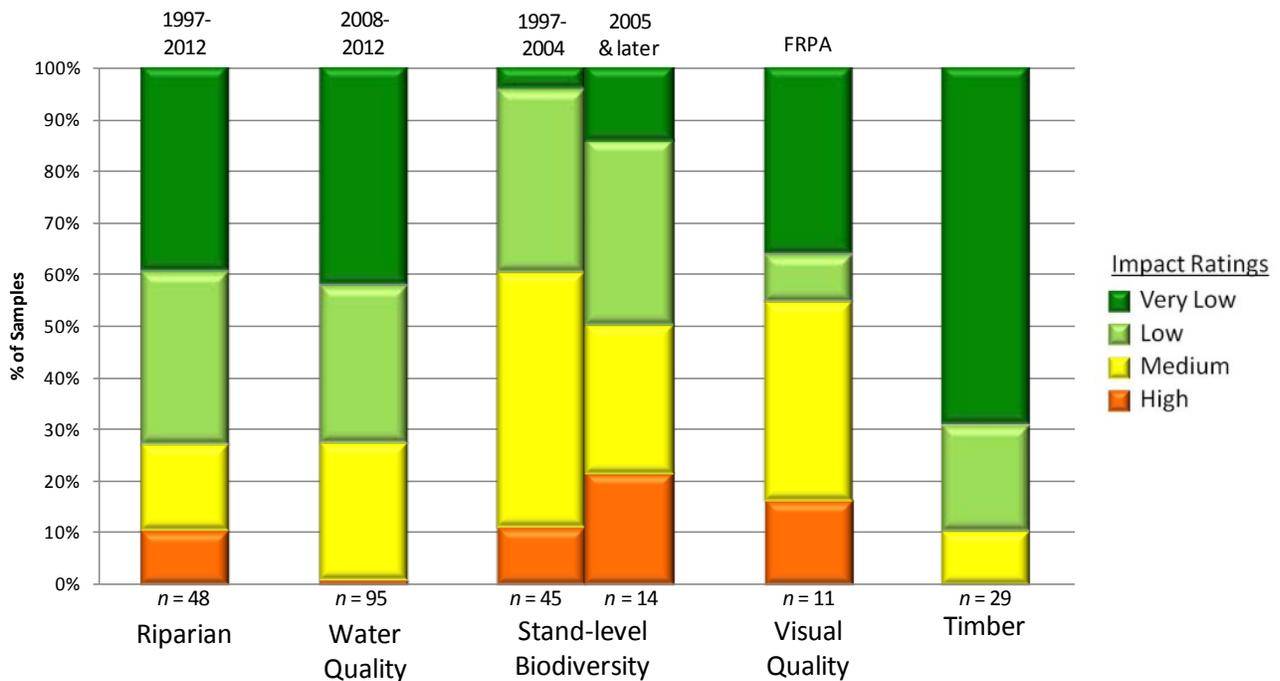
A handwritten signature in black ink, appearing to read 'Tom Ethier', is positioned above the printed name.

Tom Ethier  
Assistant Deputy Minister  
Resource Stewardship Division  
Ministry of Forests, Lands and Natural Resource Operations

## MULTIPLE RESOURCE VALUE ASSESSMENTS—IN BRIEF

Multiple resource value assessments show the results of stand and landscape-level monitoring carried out under the Forest and Range Evaluation Program (FREP). This report summarizes results for riparian, water quality (sediment), biodiversity, visual quality and timber (stand development) monitoring conducted in the Arrow and Boundary Timber Supply Areas and includes a district manager commentary of key strengths and weaknesses. Through MRVA reports, decision makers communicate expectations for sustainable resource management of public resources and identify opportunities for continued improvement.

**Figure 1: Arrow and Boundary Timber Supply Areas site-level resource development impact rating by resource value with trend (Riparian, stand-level biodiversity and visual quality by harvest year/era. Water quality trends by evaluation year. Timber samples are all post-free growing).**



### Important Context for Understanding this Assessment

The extraction and development of natural resources, along with natural factors (e.g., insects, wind, floods), influence and impact ecological condition. The goal of effectiveness evaluations is to assess these impacts on the state of public natural resource values (status, trends, and causal factors); such evaluations *do not assess compliance with legal requirements*. These evaluations help resource managers:

- assess whether the impacts of resource development result in sustainable resource management
- provide transparency and accountability for the management of public resources
- support the decision-making balance between environmental, social, and economic factors
- inform the ongoing improvement of resource management practices, policies, and legislation.

The resource development impact ratings contained in this report are based on assessments conducted within the areas where resource extraction takes place and do not reflect the ecological contributions of parks, protected areas, or other conservancy areas.

Although this report focuses on forestry-related activities, FREP monitoring protocols have also been applied to other resource sector activities, including mining (roads) and linear developments (hydro and pipelines). Procedures are being adapted to expand monitoring into these resource sectors over time.

## INTRODUCTION

The development of the *Forest and Range Practices Act (FRPA)* had several key objectives, including:

- simplifying the forest management legal framework
- reducing operational costs to both industry and government
- allowing “freedom to manage”
- maintaining the high environmental standards of the *Forest Practices Code of British Columbia Act (FPC)*.

As part of the results-based *FRPA* framework, the provincial government committed to conducting effectiveness evaluations and publically reporting the monitoring results. The science-based information provided by these evaluations will be used to determine whether *FRPA* is achieving the government’s objectives of maintaining high environmental standards and ensuring sustainable management of public resources. If those objectives are not being met the monitoring results will be used to help inform the necessary adjustments to practices, policies, and legislation. Government is delivering its effectiveness evaluation commitment through the Forest and Range Evaluation Program (FREP; for details, see <http://www.for.gov.bc.ca/hfp/frep/>). The 11 *FRPA* resource values monitored under FREP include: biodiversity, cultural heritage, fish/ riparian & watershed, forage and associated plant communities, recreation, resource features, soils, timber, visual quality, water and wildlife.

Multiple Resource Value Assessments (MRVAs) reflect the results of stand- and landscape-level monitoring carried out under FREP. The program’s stand-level monitoring is generally conducted on forestry cutblocks, resource roads, or other areas of industrial activity. As such, these evaluations provide a stewardship assessment of resource development practices. Landscape-level monitoring of biodiversity, visual quality, and wildlife resource values is more broadly an assessment of the overall landscape. Reports on MRVAs are designed to inform decision making related to on-the-ground management practices, statutory decision-maker approvals, and data for the assessment of cumulative effects.

This report summarizes FREP monitoring results for the Arrow and Boundary Timber Supply Areas. MRVA reports clarify resource stewardship expectations, and promote the open and transparent discussion needed to achieve short- and long-term sustainable resource management in British Columbia.

MRVA reports are intended for those interested in the status and trends of resource values at the timber supply area (TSA) or natural resource district scale, such as natural resource managers and professionals, government decision makers, and First Nations. These reports are also useful in communicating resource management outcomes to the public.

**Government managers and decision makers** are encouraged to consider this information when:

- discussing district or TSA-level resource stewardship with staff, licenced stakeholders, tenure holders and First Nations
- clarifying expectations for sustainable resource management of public land
- integrating social and economic considerations into balanced decision making
- reviewing and approving forest stewardship plans
- developing silviculture strategies for TSAs
- assessing Timber Supply Reviews and their supporting rationale
- informing decision making at multiple scales.

**Natural resource professionals** are encouraged to consider this information, along with other FREP information such as reports, extension notes, protocols, and monitoring data to:

- maintain current knowledge of the resources they manage
- inform professional recommendations and decisions, particularly when balancing environmental, social, and economic values
- enhance resource management, consultation, and treaty rights discussions between First Nations, government, and licensees.

Published FREP reports and extension notes contain detailed findings for each resource value. These documents are available on the FREP website at: <http://www.for.gov.bc.ca/hfp/frep/publications/reports.htm>. Licensees can request data collected on their operating areas. FREP staff will assist licensees with the analysis of their data and the preparation of licensee-specific MRVA reports.

Although this MRVA report documents monitoring results at the district or TSA level, the MRVA concept is scalable. Reports for individual licensees, treaty settlement areas, or landscape units can be produced when sufficient monitoring data is available. Reports can also be prepared at the regional or provincial levels. This report provides site-level resource value assessments and trends through comparisons of cutblocks harvested before 2005 with those harvested in 2005 or later (where data is sufficient). FREP's site assessment monitoring results on each resource value are categorized by impact (very low, low, medium, or high). This classification reflects how well site-level practices achieve government's overall goal of sustainable resource management. Site-level practices that result in "very low" or "low" impact are consistent with sustainable management objectives. Practices resulting in "high" impact are seen as inconsistent with government's sustainability objectives. For a description of the MRVA methodology see Appendix 1.

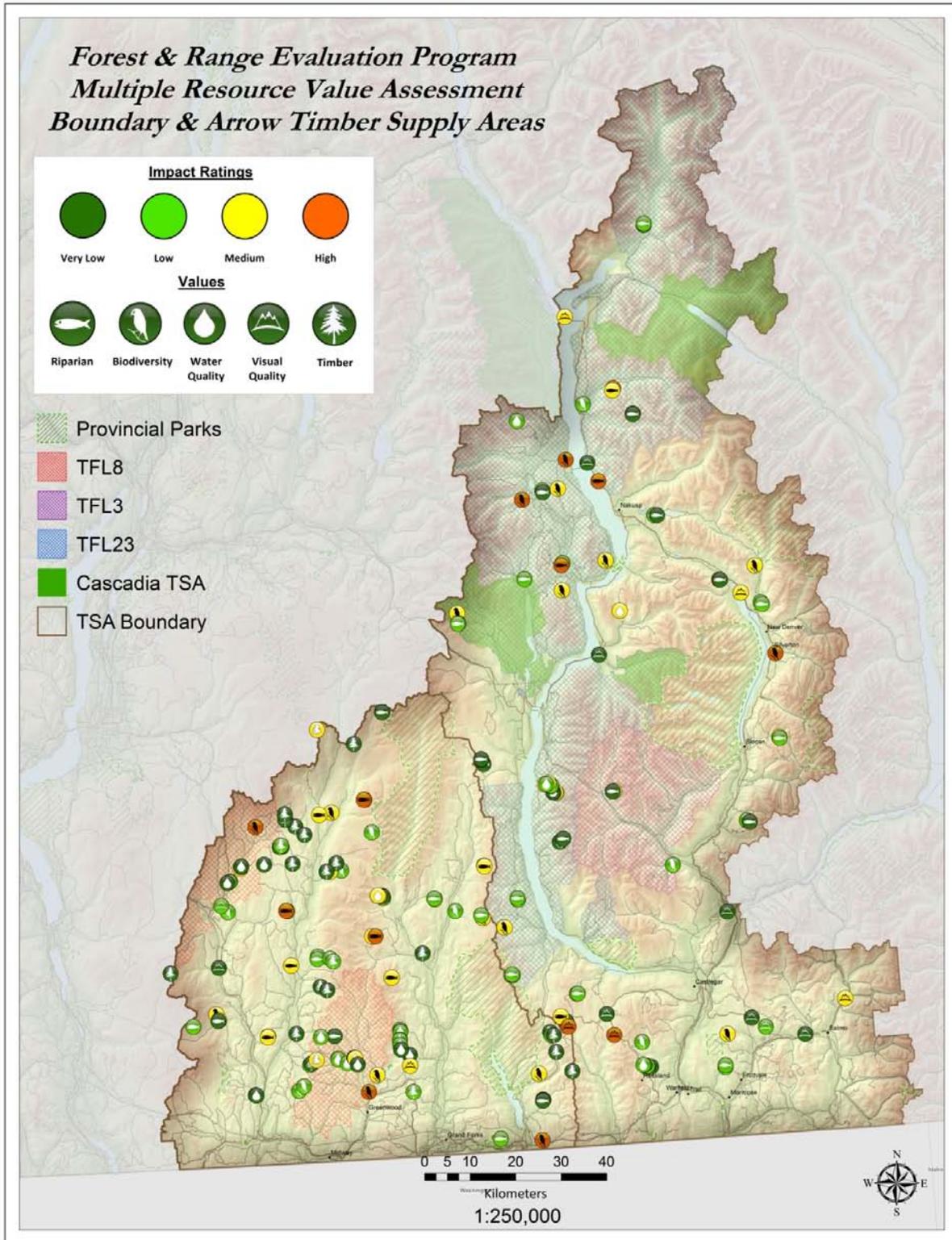
## ARROW AND BOUNDARY TIMBER SUPPLY AREAS – ENVIRONMENTAL AND STEWARDSHIP CONTEXT

This report covers the geographical areas encompassed by the Arrow and Boundary TSAs, a portion of the Cascadia TSA, and Tree Farm Licences 3, 8 and 23 (figure 2). The area is bounded by the Okanagan Highland Range of the Monashee Mountains to the west, Kootenay Lake Natural Resource District to the east, and the Canada-US border to the south. This area covers approximately 1.8 million hectares. Provincial parks include Valhalla Provincial Park, Granby Provincial Park, Gladstone Provincial Park, and a large portion of Goat Range Provincial Park. The Ktunaxa Kinbasket, Shuswap and Okanagan Nations have asserted traditional territories within this geographic area.



The Boundary TSA covers 580 000 hectares (ha) with about 288 000 ha (49% of the TSA) available for timber harvesting. The Arrow TSA covers 741 000 hectares with about 202 000 ha (27% of the TSA) available for timber harvesting. The Boundary TSA is dominated by lodgepole pine, larch and Douglas-fir species with spruce and subalpine fir (balsam) as secondary species. Within the Arrow TSA, most of the forests are dominated by Douglas-fir/larch species mix with lodgepole pine, balsam, spruce and hemlock species found as a secondary species. Biogeoclimatic zones include Interior Cedar Hemlock (ICH), Engelmann Spruce-Subalpine Fir (ESSF), Montane Spruce (MS), and Interior Douglas-fir (IDF). The Ponderosa Pine (PP) biogeoclimatic zone is found primarily in the Boundary TSA. Important non-timber values include domestic and community watersheds, controlled forest recreation, visuals, caribou, ungulate winter range, and grizzly bear habitat. Bark beetles and defoliators active in the area that are considered significant include mountain pine beetle, Douglas-fir beetle, Douglas-fir tussock moth and spruce budworm. Many communities within the Arrow and Boundary TSAs face significant fire interface issues with houses and other infrastructure located within or adjacent to forested areas. Reducing the fire hazard (fuel loading) is a priority for both the ministry and municipalities. Fuel reduction programs such as the Fire Smart program have been initiated in several areas to minimize the fire interface. Protection of grasslands is also a priority for the district and a considerable amount of work has been done in both the Gilpin and Midway areas. Forage assessments, reduction of animal unit months (AUMs), rotation changes, fencing, signage and patrols for ATV use, weed control and seeking reports from independent sources are some of the actions taken by the Ministry of Forests, Lands and Natural Resource Operations thus far. Water is a primary and fundamental resource of the Arrow and Boundary TSAs. Whether occurring as surface or groundwater, it is a crucial component of the ecosystems found in the area. The range industry, recreational fisheries, community and domestic watersheds are important resources in both TSAs.

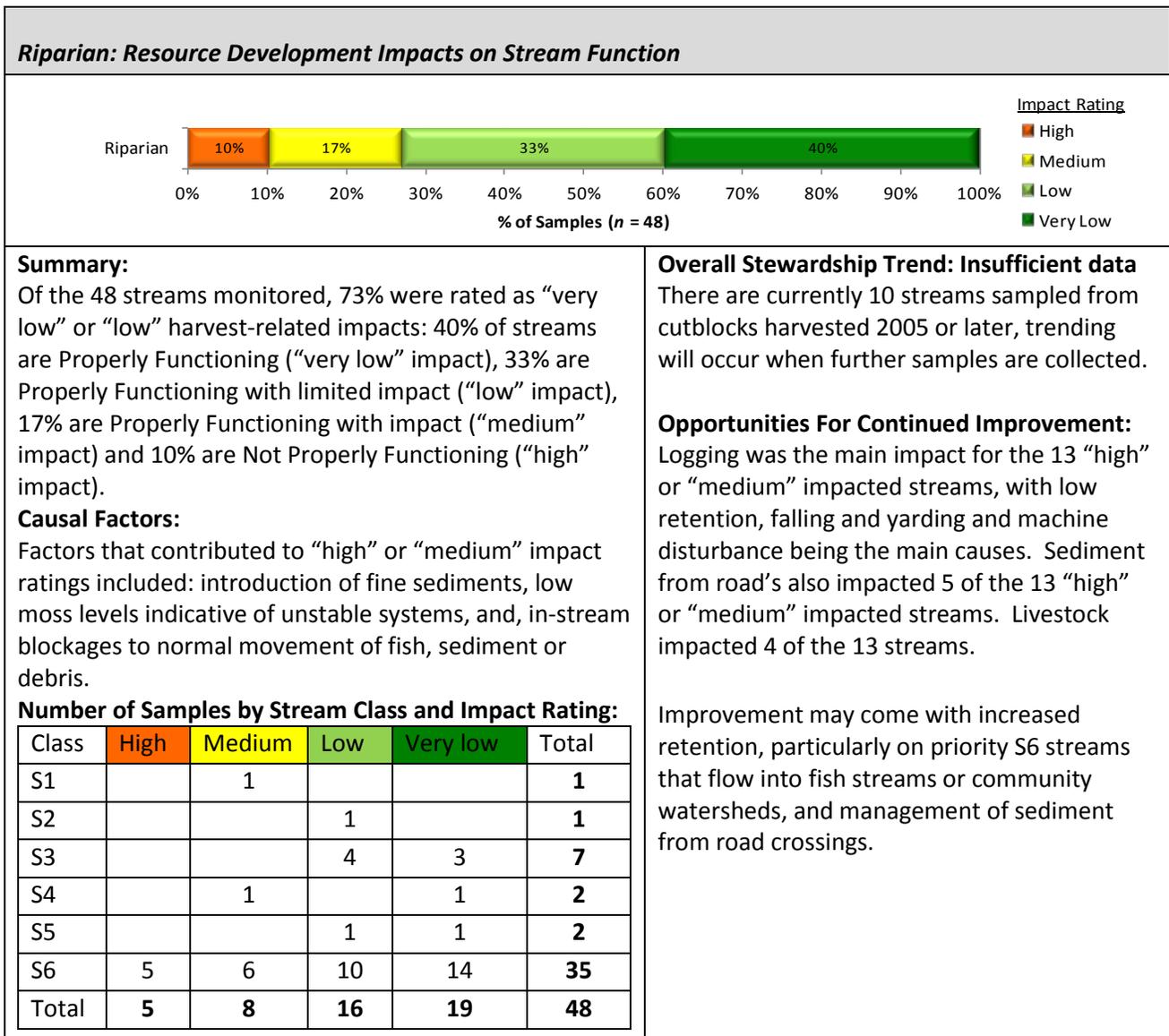
Figure 2: Arrow and Boundary TSAs, showing FREP sample locations and results (see <http://www.for.gov.bc.ca/hfp/frep/publications/mrva.htm> for a high-resolution version of this map).



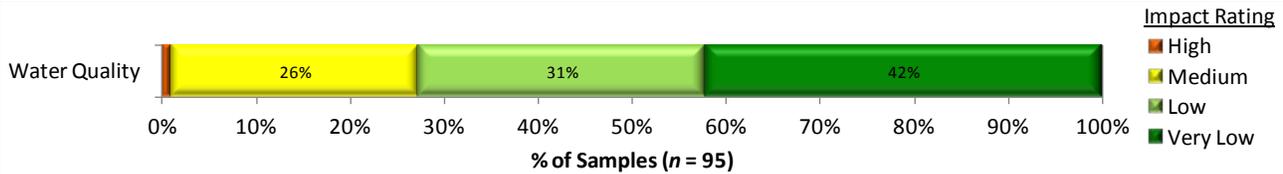
## KEY RESULTS BY RESOURCE VALUE AND OPPORTUNITIES FOR CONTINUED IMPROVEMENT

Table 1 shows the resource values assessed, and includes a summary of key findings, causal factors, trends, and opportunities for continued improvement. Data are presented for *FPC*-era samples at sites harvested before 2005 and *FRPA*-era samples at sites harvested in 2005 or later. This approximates the *Forest and Range Practices Act* (*FRPA*) era, and allows for a comparison between earlier and later stewardship practices. The impact rating indicates the effect of resource development on the resource value, from “very low” to “high” impact.

**Table 1: Resource development impact rating, key findings, and opportunities for improvement by resource value for the Arrow and Boundary Timber Supply Areas.**



**Water Quality (fine sediment): Resource Development Impacts on Water Quality**



**Summary:**

Of the 95 road segments assessed, 73% were rated as “very low” or “low” road-related impact.

Site assessments show the range for potential sediment generation as 42% “very low” (“very low” impact), 31% “low” (“low” impact), 26% “moderate” (“medium” impact), 1% “high” or “very high” (“high” impact).

**Causal Factors:**

See opportunities for improvement for “medium” or “high” impacted road segments. Some opportunities will apply to ongoing maintenance issues, while others would mainly apply to new road construction.

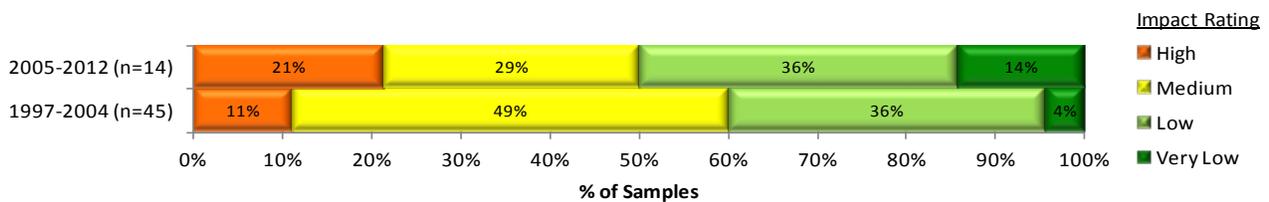
**Overall Stewardship Trend: *Insufficient data***

Trending for water quality is based on survey years, to capture impact of road traffic and maintenance. The majority of the data comes from 2008 evaluation year, with insufficient in later years to allow for trending.

**Opportunities For Improvement:**

The most frequent suggested maintenance issues are: to increase the number of strategically located culverts; and, use cross ditches and kickouts.

**Stand-level Biodiversity: Resource Development Impacts on Stand-Level Biodiversity**



**Summary:**

Of 59 cutblocks sampled (combined *FPC* and *FRPA*-eras), 42% of sites were rated as “very low” or “low” harvest-related impact.

Considering total retention, retention quality, and coarse woody debris quantity and quality, 7% sites are rated as “very low” impact on biodiversity, 36% as “low”, 44% as “medium” and 14% as “high”.

**Causal Factors:**

78% of all blocks had more than 3.5% tree retention. Average retention is 8.9%. Large snag density has increased in the *FRPA*-era, while large diameter tree ( $\geq 40$  or  $\geq 50$  cm dependent on ecosystem) density has decreased.

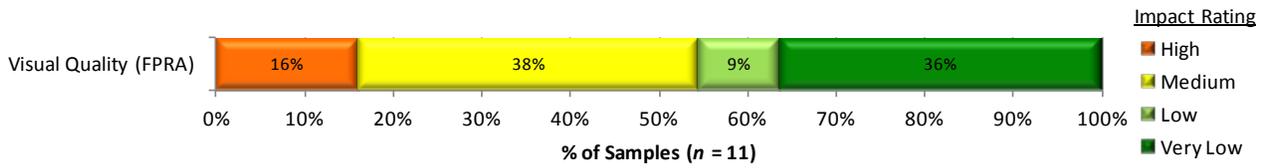
**Overall Stewardship Trend: *Neutral***

There is little overall change between data from *FPC*-era to *FRPA*-era. The average retention has not changed, though there is slight indication of increasing retention quality, particularly in terms of snag density and numbers of tree species retained. The sample size is small in the *FRPA*-era so caution should be taken with any extrapolation of this data.

**Opportunities For Continued Improvement:**

Leave at least low levels of retention on every cutblock. Increase retention quality by retaining large trees in densities similar to pre-harvest conditions.

**Visual Quality: Resource Development Impacts on Achievement of Visual Quality Objectives (VQO)**



**Summary:**

Of the 16 landforms assessed (5 FPC and 11 FRPA cutblocks), 63% were rated with as “very low” or “low” harvest-related impacts on achieving the Visual Quality Objectives. Of the 5 Code samples, 4 were rated “very low” and 1 was “low”.

VQOs were “well met” (“very low” impact on achieving the VQO) on 50% of landforms, “met” (“low” impact) on 13%, “borderline” (“medium” impact) on 25%, “not met” on 6%, and “clearly not met” (“high” impact) on 6%.

**Causal Factors:**

13% of the openings contained visually effective levels of tree retention (> 22% by volume or stem count) and 50% of landforms sampled had good visual quality design (cutblock shaping).

**Number of Samples by VQO and Impact Rating:**

VQO <sup>1</sup>	High	Medium	Low	Very Low	Total
M		2	1	3	6
PR	2	2	1	4	9
R				1	1
<b>Total</b>	<b>2</b>	<b>4</b>	<b>2</b>	<b>8</b>	<b>16</b>

<sup>1</sup> M = modification, PR = partial retention, R = retention

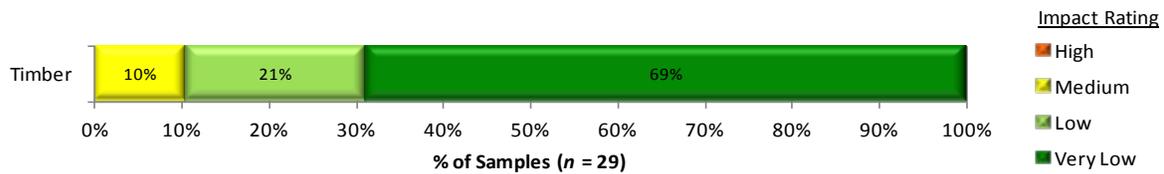
**Overall Stewardship Trend: *Insufficient data***

There are only 6 landforms assessed for the FPC. Future trending analysis will use year of assessment.

**Opportunities For Improvement:**

Use existing visual design techniques to create more natural-looking openings and better achieve VQOs. Use partial cutting to retain higher levels of volume/stems. Reduce opening size in retention and partial retention VQO areas.

**Timber Resource Value: Resource development impacts on the overall health and stocking of managed 20-40 year stands**



**Summary:**

Of the 29 polygons sampled (2009, 2010, 2011) the weighted average well-spaced density over the four biogeoclimatic ecosystem classification (BEC) zones achieved 90% of target stocking standard (TSS).

**Percent of target stocking standard by BEC**

BEC	ICH	ESSF	MS	IDF	Ave
TSS	88%	94%	90%	90%	90%

90% of the polygons were rated “very low” or “low” impact to health and stocking; 10% “medium” and 0% “high”. The “medium” impact rated polygons were a result of low total and/or well-spaced stems/ha at the time of the stand-development monitoring survey. It must be noted, however, that these same polygons had very low levels (less than 5%) presence of forest health factors (FHF).

The DRAFT Stand-Development Monitoring TSA Data summary report (based on data from 29 polygons collected in 2009, 2010 and 2011) noted the top four FHF were: Western Gall Rust (DSG), tree competition (VT), unknown (U), and snow press (NY).

FHF	DSG	VT	U	NY
290 plots	76/290	49/290	49/290	46/290

The average total stems/ha (all BECs) at the time of stand-development monitoring was 4384 stems/ha with well-spaced stands at 1124 stems/ha. There was no change in leading species in 82% of the polygons sampled (23 of 28 polygons).

**Causal Factors:**

The major contributing factor to the three polygons rated “medium” was low total and well-spaced stems/ha. It is unclear whether these stands were spaced. If these low densities are attributed to spacing their productivity will be re-evaluated. Of the polygons assessed to-date, the stands appear to be very healthy and productive.

**Overall Stewardship Trend:**

No trend can be established at this time

**Opportunities For Continued Improvement:**

A closer investigation is needed of the “medium” impact rated stands to see if they were spaced.

NOTE: Completing the polygon cover sheet will provide a clearer picture why some stands have such low stocking at declaration.

**Soils: Resource Development Impacts on Soil Productivity and Hydrologic Function**

There are currently only eight soils samples in the Arrow-Boundary Resource District. Analysis will be completed in subsequent years when more samples are available.

**Landscape-level Biodiversity: Is the forested matrix at the landscape-level providing the range of habitat understood as necessary for maintaining ecosystem function and old and mature forest dependant species?**

In development. The three primary landscape-level biodiversity indicators are: (1) site index by leading species (ecosystem representativeness); (2) percent of TSA by age class (young, mid-, mature, and old forest); and (3) percent interior habitat of old forest. Each indicator is categorized by percent in non-commercial land base, timber harvesting land base, and protected areas. Data for these indicators is derived from Hectares BC and other spatial databases.

## RESOURCE VALUE STEWARDSHIP RESULTS COMPARISON

Tables 2 provides ratings of stewardship effectiveness at varying scales. Effectiveness is determined by the percentage of samples with a “very low” or “low” resource development impact rating. Appendix 2 shows results by resource value for the North, South and Coast Areas and the province as a whole.

**Table 2: Stewardship effectiveness within the Kootenay Boundary Region as determined by resource development impact rating (ID = Insufficient Data; sample sizes in brackets).**

Resource Value	Effectiveness of Practices in Achieving Resource Stewardship Objectives: % Very low + Low Resource Development Impact Rating (sample size in brackets)						
	Kootenay Boundary Region Comparison						Kootenay Boundary Region <sup>5</sup>
	Arrow & Boundary TSAs	Invermere TSA	Golden TSA	Revelstoke TSA	Cranbrook TSA	Kootenay Lake TSA	
Riparian – all data	<b>73%</b> (48)	<b>92%</b> (25)	<b>54%</b> (35)	<b>37%</b> (35)	<b>72%</b> (25)	<b>86%</b> (14)	<b>66%</b> (182)
FRPA-era data	ID (10)	ID (4)	39% (18)	ID (13)	ID (9)	ID (8)	61% (62)
FPC-era data	71% (38)	90% (21)	71% (17)	36% (22)	69% (16)	ID (6)	68% (120)
Water quality – all data	<b>73%</b> (95)	<b>77%</b> (71)	<b>60%</b> (88)	<b>64%</b> (59)	<b>78%</b> (132)	<b>ID</b> (48)	<b>73%</b> (493)
2010–2012 samples	ID (8)	ID (52)	ID (35)	ID (28)	ID (51)		78% (222)
2008–2009 samples	76% (87)	ID (19)	ID (53)	ID (31)	74% (81)		68% (271)
Stand-level biodiversity –all data	<b>42%</b> (59)	<b>31%</b> (39)	<b>66%</b> (38)	<b>45%</b> (31)	<b>55%</b> (31)	<b>36%</b> (42)	<b>45%</b> (240)
FRPA-era data	50% (14)	25% (20)	88% (16)	29% (17)	69% (16)	50% (16)	52% (99)
FPC-era data	40% (45)	37%(19)	50% (22)	64% (14)	40% (15)	27% (26)	41% (141)
Visual Quality							
FRPA	<b>45%</b> (11)	<b>ID</b> (4)	<b>ID</b> (3)	<b>ID</b> (2)	<b>20%</b> (19)	<b>ID</b> (1)	<b>39%</b> (36)
FPC	<b>ID</b> (5)	<b>ID</b> (0)	<b>ID</b> (8)	<b>82%</b> (11)	<b>ID</b> (0)	<b>62%</b> (26)	<b>68%</b> (50)
Timber (stand development monitoring)	<b>90%</b> (29)	<b>ID</b> (0)	<b>73%</b> (30)	<b>ID</b> (7)	<b>82%</b> (28)	<b>ID</b> (0)	<b>81%</b> <sup>b</sup> (87)

<sup>a</sup> Arrow, Boundary, Invermere, Golden, Revelstoke, Cranbrook and Kootenay Timber Supply Areas

<sup>b</sup> Does not include Revelstoke TSA

## DISTRICT MANAGER COMMENTARY<sup>1</sup>

The evaluation criteria in this report is based upon stewardship objectives (e.g., sustainable resource management practices) and do not always correspond with the minimum standards set in legislation. A rating of “high” impact to stewardship does not necessarily mean that a practice has not met the legislation or the results and strategies contained within a forest licensees’ forest stewardship plan (FSP). The monitoring results reported in this document contain a mix of stewardship ratings; a number of the resource values still need more samples before a conclusion can be drawn. Assessments in the Arrow and Boundary TSAs have been combined and are not separated by TSA. Additional assessments for stand-level biodiversity, riparian, water quality and visual quality are needed to assess trends by TSA individually.

Stand-level biodiversity assessments show a neutral trend between the data from the *FPC* to the *FRPA*-era. The average retention has not changed, though there is a slight indication of increasing retention quality in terms of snag density and numbers of tree species retained.

Riparian assessments potentially assess the cumulative effects of forestry and range practices and natural impacts. From the streams sampled to date, the trend shows the majority of riparian assessments as having a “very low” or “low” impact rating. Increasing retention along stream buffers and being cognizant of machine disturbance around streams will further improve results.

Water quality assessments also are predominantly rated as “very low” or “low” impact. Opportunities for improvement relate to new construction and maintenance, avoid road use when wet or thawing, amour, seed and protect bare soil and increase the number of strategically located culverts and cross ditches.

Visual quality assessments were predominantly rated as “medium” impact, or “borderline” regarding meeting the visual quality objective. Of the samples assessed so far only 45% have met the visual quality objectives. More assessments are needed to properly form a conclusion.

Timber as assessed through the stand development monitoring (SDM) protocol, 29 samples from the Boundary TSA have been summarized in this report. No conclusion can be established at this time as further information is needed on the few “medium” impact samples. Of the polygons assessed to-date the stands appear to be very healthy and productive.

District staff should continue to monitor practices for all values with an emphasis on those related to stand-level biodiversity, riparian, water quality and visual quality. More assessments are needed for each value to determine the trends by TSA.

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<sup>1</sup> Commentary supplied by Selkirk Natural Resource District Manager, Garth Wiggill.

## APPENDIX 1: SUMMARY DESCRIPTION OF RESOURCE DEVELOPMENT IMPACT RATING CRITERIA

Table A1.1 shows the criteria used to determine the resource development impact ratings for each resource value. Detailed rating criteria, methodology, and definition of terms used are described in the companion document *FREP Technical Note #6: Methodologies for Converting FREP Monitoring Results to Multiple Resource Value Assessment (MRVA) Resource Development Impact Ratings* ([http://www.for.gov.bc.ca/ftp/HFP/external!/publish/frep/technical/FREP\\_Technical\\_Note\\_06.pdf](http://www.for.gov.bc.ca/ftp/HFP/external!/publish/frep/technical/FREP_Technical_Note_06.pdf)). The ratings of “very low”, “low”, “medium” and “high” are “technical ratings” based on best available science.

**Table A1.1: Criteria for determining resource development impact rating outcomes for each resource value.**

Resource Value	FREP Evaluation Question	Indicators	Resource Development Impact Rating Criteria	Very low	Low	Medium	High
Riparian	Are riparian forestry and range practices effective in maintaining the proper functioning of riparian areas?	Fifteen key questions (e.g., intact channel banks, fine sediments, riparian vegetation)	Number of “no” answers on assessment questions of channel and riparian conditions	0–2	3–4	5–6	> 6
Stand-level Biodiversity	Is stand-level retention providing the range of habitat and attributes understood as necessary for maintaining species dependant on wildlife trees and coarse woody debris?	Percent retention, retention quality from nine key attributes (e.g., big patches, density of large diameter trees), coarse woody debris volume, coarse woody debris quality from two key attributes (e.g., density of pieces $\geq$ 10 m and 20 cm, and volume of large diameter pieces)	Cumulative score. A 60/40 weighting is used for tree retention versus coarse woody debris, recognizing the longer-term ecological value of standing retention.	> 70%	55–70%	40–55%	< 40%
Water Quality (sediment)	Are forest practices effective in protecting water quality?	Fine sediment potential	Fine sediment ( $m^3$ ) due to expected surface erosion or past mass wasting	< 0.1	< 1	1–5	> 5
Soils	Are forest practices preventing site disturbance that is detrimental to soil productivity and hydrologic function?	Amount of access, restoration of natural drainage patterns, road side work area soil disturbance, amount of mature forest and coarse woody debris and restoration of natural drainage patterns	Overall assessment of practices on cutblock to maintain soil productivity and hydrologic function	Well	Moderately		Poor
Cultural Heritage	Are cultural heritage resources being conserved and where necessary protected for First Nations cultural and traditional activities?	Evidence and extent of damage to features, operational limitations, management strategies and type and extent of features	Combined overall cutblock assessment results with consideration of individual feature assessment results	See methodology report			
Timber: Stand Development Monitoring	What is the overall health and productivity of managed 20-40 year stands?	Impacts of forest health factors on stand stocking (ratio of total and well spaced)	Forest health damaging agent (% level of incidence) and level of stocking (well spaced stems per hectare)	$\geq$ 1.7	0.8–1.69	0.3–0.79	0–0.29
Landscape-level Biodiversity	Is the forested matrix at the landscape-level providing the range of habitat understood as necessary for maintaining ecosystem function and old and mature forest dependant species?	Ecosystem representativeness, age class and interior old	Overall ranking: within protected and non-protected areas	Ranking under development			
Visual Quality	How are we managing views in scenic areas and achieving visual quality objectives?	Visual evaluation of block, design of block, percent of landform altered, impact of roads, tree retention and view point importance	Basic visual quality class (determined using the VQC definitions) is compared with the Adjusted VQC (derived using percent alteration measurements and adjustment factors) to determine if VQO is achieved.	VQO achieved, and % alteration low or mid-range	VQO achieved, but % alteration for one or both close to alteration limit	Only one method indicates VQO achieved	Both methods indicate VQO not achieved

## APPENDIX 2: COMPARATIVE FREP RESULTS BY RESOURCE VALUE FOR OTHER AREAS

Table 2, in the main body of the document, describes overall ratings for the Arrow and Boundary Timber Supply Areas as compared to adjacent TSAs or districts. Table A2.1 below describes the same results but by the North, South and Coast areas and the province as a whole. The three operational areas represent combined natural resource regions.

**Table A2.1: FREP monitoring results by resource value for the North, South and Coast Areas and the province as a whole compared to the Arrow and Boundary Timber Supply Areas.**

Resource Value	Effectiveness of Practices in Achieving Resource Stewardship Objectives: % Very low + low resource development impact rating (sample size in brackets)				
	Arrow & Boundary TSAs	Forests, Lands and Natural Resource Operations Areas			Province
		North	South	Coast	
Riparian – all data	<b>73%</b> (48)	<b>71%</b> (654)	<b>69%</b> (678)	<b>58%</b> (451)	<b>67%</b> (1783)
FRPA-era data	ID (10)	71% (257)	68% (277)	62% (198)	67% (732)
FPC-era data	71% (38)	71% (394)	70% (401)	55% (253)	67% (1048)
Water quality – all data	<b>73%</b> (95)	<b>66%</b> (992)	<b>70%</b> (1515)	<b>76%</b> (1526)	<b>71%</b> (4033)
2010–2012 samples	ID (8)	67% (505)	70% (823)	79% (1021)	73%(2349)
2008–2009 samples	76% (87)	64% (487)	70% (692)	70% (505)	68% (1684)
Stand-level biodiversity - all data	<b>42%</b> (59)	<b>42%</b> (655)	<b>54%</b> (780)	<b>77%</b> (455)	<b>56%</b> (1890)
FRPA-era data	50% (14)	49% (270)	61% (347)	84% (201)	63% (818)
FPC-era data	40% (45)	38% (385)	49% (433)	72% (254)	50% (1072)
Visual Quality					
FRPA	<b>45%</b> (11)	<b>73%</b> (122)	<b>54%</b> (136)	<b>78%</b> (153)	<b>69%</b> (411)
FPC	ID (5)	<b>56%</b> (96)	<b>65%</b> (85)	<b>62%</b> (68)	<b>61%</b> (249)