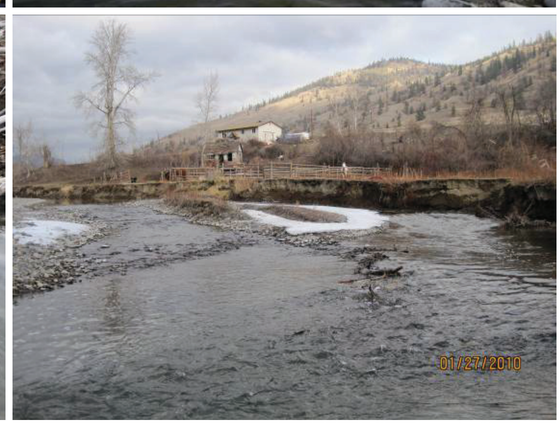
DEADMAN RIVER SENSITIVE HABITAT INVENTORY AND MAPPING (SHIM) – 2009-2011

Inventory Summary Report

A Comprehensive Watercourse Catalogue



Prepared For:
Skeetchestn Indian Band

Prepared By:
Ecoscape Environmental Consultants Ltd.

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Inventory Summary Report

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March 2012
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INFORMATION DISCLAIMER

The results contained in this report are based upon data collected during a single inventory period spanning November 2009 - 2011. Biological systems respond differently both in space and time. For this reason, the assumptions contained within the text are based upon field results, previously published material on the subject, and airphoto interpretation. The material in this report attempts to account for some of the variability between years and in space by using safe assumptions and a conservative approach. Data in this assessment was not analyzed statistically and no inferences about statistical significance are made if the word significant is used. Use of or reliance upon biological conclusions made in this report is the responsibility of the party using the information. Neither Ecoscape Environmental Consultants Ltd., nor the authors of this report, or the Skeetchestn Indian Band, is liable for accidental mistakes, omissions, or errors made in preparation of this report because best attempts were made to verify the accuracy and completeness of data collected, analyzed, and presented.

EXECUTIVE SUMMARY

As resource development and human populations increase in British Columbia, pressures for all resources and services have accelerated. Rapid growth has often overwhelmed the ability of local planners to manage land and preserve sensitive habitats (Mason and Knight, 2001). This has resulted in the loss or degradation of aquatic and riparian habitats that are critical for fish and a diverse wildlife assemblage. Sensitive Habitat Inventory and Mapping (SHIM) is a standard for fish and aquatic habitat mapping in urban and rural watersheds in British Columbia. SHIM attempts to ensure the collection and mapping of reliable, high quality, current, and spatially accurate information about local freshwater habitats, watercourses, and associated riparian communities.

Ecoscape Environmental Consultants Ltd. (Ecoscape) was retained by the Skeetchestn Indian Band to provide training and subsequent QA/QC of field data and to subsequently process and analyze data and prepare an inventory summary report for SHIM of the Deadman River.

The Deadman River is a tributary of the Thompson River. It originates on the Bonaparte Plateau south of Bonaparte Lake from which it flows south approximately 70 kilometers to the Thompson River just west of Kamloops Lake. The watershed has an area of approximately 1509 km^2, has 12 sub-basins. The once abundant and diverse fish, wildlife and flora of the Deadman River valley have been put at risk by forest, mining, tourism, urban and agricultural development practices (Moore 2001).

The total length of river surveyed was about 43km. The river was broken into 57 segments over this distance extending through the Skeetchestn Indian Band Lands and upstream beyond to the private land boundary (Segment 57). Over this 43 km length, about 48% (20.5 km) of the river has experienced disturbance and modification to streamside communities from rural and agricultural landuse. The remaining 52% of the surveyed river length is still natural both instream and along its banks.

A 50-m band was delineated along both the left and right banks of the river. All vegetation communities were digitized within this band and the relative level of disturbance was estimated from digital orthophotos. Based on this interpretation, natural plant communities still predominate the 50-m band. Cottonwood ecosystems predominate mid bench floodplains while upland sites are predominated by grassland/shrub-steppe ecosystems and ponderosa pine savanna (on warmer aspects), and pine-fir woodlands (cooler aspect sites and lower slope areas). However, the spatial extents (area) of rural, agricultural area, and roads combined to account for close to 19% of the 50 m band inclusive of both the left and right bank.

Total and relative instream cover is a field estimate of the type and amount of in-channel cover available to fish. Total cover represents the total percentage of the wetted area of respective segments occupied by cover. The relative abundance (%) of cover types (e.g., deep pool, large woody debris etc.) is an estimate of the distribution (of respective cover types) within the total cover estimate.

From this estimate, boulder substrates and deep pools/glides are providing the greatest proportion of instream cover at about 9% and 8 % of the river channel respectively. Instream cover was

relatively high in Segment 11 (cascade pool), and Segments 44, 48, 51, and 57. However, the majority of the lower 43 km of surveyed river had low relative cover estimated at <15%. Based on this observation, deep pools and holding areas become increasingly critical for fish. Large woody debris was estimated to be providing cover to less than 1% of the river. The total spatial coverage of all habitat features recorded was 24267 m^2. The cumulative measure of deep pools accounted for an area of over 11,000 m^2 habitat in the lower 43 km of the Deadman River. Deeper glides, not classified as pools, which provide known and potential holding areas (other) for migrating salmonids account for an area of over 10,000 m^2. Deep pool and holding areas combined, accounted for close to 80% of all habitat recorded during the inventory. Large woody debris was measured to provide only about 720 m^2 of habitat in the lower 43 km of the Deadman River.

Bank instability and erosion was prevalent over the 43 km surveyed river length. In total bank erosion was measured and recorded to combine for over 7.8 km of river bank. Of this about 4 km (9.5%) of the left bank and 3.2 km (7.5%) of the right bank were eroding.

Skeetchestn's salmon and steelhead restoration programs include habitat recovery and hatchery-based conservation programs as part of broader resource management programming. The community's fishery on wild salmon and steelhead in Deadman Creek has been severely restricted since 1985 due to insufficient returning spawners (Moore 2001).

Stream channel instability has been cited as an ongoing concern since the 1990 flood which caused wide spread channel disturbance. However, stream bank stability problems were cited along the channel in the 1980's long before the flood event, and may have exacerbated its impact. Riparian restoration programming led by the band has included replanting of indigenous vegetation, management of cattle impacts through fencing and stabilization of access points, and prescribed habitat treatments. In addition, the band has worked with valley residents to address the impact of roads, pollution, natural resource and urban development (Moore 2001).

The SHIM survey of Deadman River revealed that approximately 48% of the total surveyed stream length, has been modified to some degree along its banks. Previous restoration efforts by the Skeetchestn, in partnership with Fisheries and Oceans included: bank stabilization using a combination of rip rap, tree revetments, and setback fencing. To date the success of many of these efforts were evident in the field inventory, where setback fencing is promoting the reestablishment of riparian vegetation and livestock have restricted access to the river channel for watering.

However, bank instability and persistent erosion continues to be a concern along this watercourse. There continue to be numerous opportunities for bank stabilization, setback fencing and riparian restoration along the Deadman River. To assist in the prioritization of sites, where rehabilitative efforts would realize the greatest potential net benefits in habitat and potential water quality improvements, key areas were extracted using the SHIM data. Recognizing that erosion is the prevalent symptom of stream channel and habitat impairment (i.e., encroachment and riparian removal etc.), key problem areas were identified according to the frequency and severity of erosion within segments. Based on this, Segments 42, 46, 52, 53, 55, and 56 are identified as priority segments.

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1.0 INTRODUCTION

Ecoscape Environmental Consultants Ltd. (Ecoscape) was retained by the Skeetchestn Indian Band to provide training and subsequent QA/QC of field data and to subsequently process and analyze data and prepare an inventory summary report for Sensitive Habitat Inventory and Mapping (SHIM) of the Deadman River. The following report summarizes the inventory findings, which have been provided to the Skeetchestn Indian Band, the Department of Fisheries and Oceans Canada, and the Community Mapping Network (http://www.cmnbc.ca/) in digital GIS format.

1.1 Project Background

As resource development and human populations increase in British Columbia, pressures for all resources and services have accelerated. Rapid growth has often overwhelmed the ability of local planners to manage land and preserve sensitive habitats (Mason and Knight, 2001). This has resulted in the loss or degradation of aquatic and riparian habitats that are critical for fish and a diverse wildlife assemblage. Accordingly, there is an urgent need to develop stronger tools and better methods to conserve, protect, and reclaim these habitats.

Sensitive Habitat Inventory and Mapping (SHIM) is a standard for fish and aquatic habitat mapping in urban and rural watersheds in British Columbia. SHIM attempts to ensure the collection and mapping of reliable, high quality, current, and spatially accurate information about local freshwater habitats, watercourses, and associated riparian communities.

SHIM is designed as a land-planning, computer-generated, interactive GIS tool that identifies sensitive aquatic and terrestrial habitats. It is intended to provide community, stewardship groups, individuals, regional districts and municipalities with an effective, low-cost delivery system for information on these local habitats and associated current land uses.

SHIM has numerous applications and can:

- Provide current information not previously available to urban planners, to allow more informed planning decisions and provide inventory information for integration into Official Community Plans;
- Identify and map areas of significant impairment (e.g., erosion, channelization, habitat degradation) and potential point sources of pollution;
- Assist in the design of stormwater/runoff management plans;
- Monitor for changes in habitat resulting from known disturbance;
- Help guide management decisions and priorities with respect to habitat restoration and enhancement projects;
- Assist in determining setbacks and fish/wildlife-sensitive zones;

- Identify sensitive habitats for fish and wildlife along watercourses;
- Provide a means of highlighting areas that may have problems with channel stability or water quality that require more detailed study;
- Provide baseline mapping data for future monitoring activities; and,
- Map and identify the extent of riparian vegetation available and used by wildlife and fisheries resources.

1.2 Project Objectives

The objectives of the project were to:

- Inventory and map the extents of the Deadman River and associated riparian habitats, and important watercourse and fisheries habitat features;
- Provide the basis for accurately mapped baseline data that can be integrated into local mapping and planning initiatives; and,
- Augment and potentially enhance local land use planning maps and/or specific site or detailed planning surveys.

The primary functions of SHIM are to:

- Identify sensitive habitats and resources within local communities;
- Integrate property boundaries, land parcels, and road networks with locations of sensitive resources to facilitate Official Community Plans and Development Permit applications;
- Work within an interactive Geographical Information System (GIS) to provide useful map products for analysis and effective communication;
- Facilitate updating and exchange of information; and,
- Establish partnerships with provincial and municipal governments, stakeholders, and the public, to protect and manage aquatic habitats and associated functions (i.e. riparian communities and linear corridors etc.).

By combining resource information from a variety of sources, the goal is that SHIM will provide a robust baseline inventory (cataloguing the stream and all natural and anthropogenic features occurring within and along it) for improving integrated resource management and planning along the Deadman River.

2.0 SCOPE OF WORK

Field inventory methods and data processing and management were to conform to SHIM Standards and Methodology. At the completion of the project, standard SHIM deliverables are to be provided to the Skeetchestn Indian Band and subsequently to the Community Mapping Network (CMN) for publication in the SHIM atlas.

3.0 METHODOLOGY

Ecoscape Environmental Consultants Ltd. (Ecoscape) provided training and technical support to the Skeetchestn First Nation (SFN) for the Deadman River Watershed Mapping Project at the beginning of the project in November 2009. The objective of services was in support of the Community Economic Development Program (CEDP).

The overarching intent was to provide mentoring in Sensitive Habitat Inventory and Mapping (SHIM) data collection, data processing, and mapping techniques for the Deadman River Watershed Mapping Project. In doing so, Ecoscape satisfied the following Objectives:

1. Environmental Scientist / GIS Analyst, Robert Wagner, created a GIS based map grid and template for the Deadman River and one tributary (identified by SFN at a contractor meeting October 19, 2009). The index sheet has been included in this report with the full map grid template being provided digitally. Mr. Wagner worked with the SFN Forest Technologist / GIS Analyst (Avon Isnadry) on the collection of the required background data, creation of a GIS based map grid and template of the Deadman River and one tributary (identified by SFC at a contractor meeting October 19, 2009).

2. Ecoscape Senior Resource Inventory Specialist, Kyle Hawes, created a modified SHIM data dictionary, which included other data points desired to be collected by SFN and DFO such as location of restorations sites, water intakes, and ground water sources. This refined data dictionary was provided and uploaded to the SFN hand held computer (Trimble GPS data logger). A print-out of this dictionary is attached and a digital (.ddf) file has been included with this report delivery.

   Ecoscape subsequently provided two days (November 18-19, 2009) of in-field instruction relating the GPS setup and operation, and SHIM data collection methods. For this training, Ecoscape provided two Trimble hand-held GPS units such that each member of the field crew was able to operate the hardware for the full training session – maximizing exposure to the data dictionary and collection methods while Ecoscape (Mr. Hawes) was onsite.

   At the end of each of the two field training days, Mr. Hawes reviewed data collected and worked with the SFN Forest Technologist / GIS Analyst on file folder setup for effective data management, data transfer, differential correction, and post processing methods.

Ecoscape has since reviewed raw and processed data that was collected subsequent to the two days of field instruction. With these Quality Assurance checks of the SFN data collection, Ecoscape provided further advice on collection methods and data management.

3. To assist the SFN in creating habitat summary maps and reporting on SHIM results, Ecoscape provided the SFN Forest Technologist / GIS Analyst with example map templates and symbology as well as an Inventory Summary Report template.

Field inventory, data processing and data deliverables conformed to the SHIM Standards (Mason and Knight, 2001), which can be reviewed in full at:

http://www.shim.bc.ca/methods/SHIM_Methods.html

Principle surveyors were: Avon Isnardy and Don Ignace, with the assistance of Bob Hewitt, Darvey Hewitt, Tina Donald. SHIM training was provided by Kyle Hawes, and Robert Wagner. Data processing and management was completed by Avon Isnardy, Kyle Hawes, and Robert Wagner. Data review and quality assurance and control were completed by Kyle Hawes.

3.1 Centerline Survey

The river centerline was mapped along the center of the bankfull (not floodplain) width. The river was stratified into a series of successive sections (segments), each possessing and being characterized by different attributes or biophysical characteristics (i.e. hydraulic class, channel characteristics, substrates composition, and riparian class, etc.). The river segmentation and associated attributes was the fundamental unit of the centerline survey with point features providing a more quantitative measure of relative disturbance/modification and aquatic habitat quality/complexity (i.e. area abundance of deep pools, spawning substrates, large woody debris, bank erosion, etc.).

Table 1 provides a complete list of features and corresponding attributes that were recorded using the Trimble Geo Explorer (GPS) XT and SHIM Data Dictionary.

Table 1. Overview of watercourse and habitat attributes to be collected using the SHIM Data Dictionary (Module 3, Mason and Knight, 2001). The complete data dictionary can be found in Appendix B.

Survey Component	Main Attribute	Detailed Feature Collected
Stream Centre Line	Stream Reference Information	Name; Watershed Code; Date; Time; Survey Conditions; Surveyors
	Stream Segment Points	Start; Stop; Reach Break; Elevation; Representative Photographs
	Stream Segment Class	Stream Section; State of Section (i.e. natural/modified/channelized); Dominant Hydraulic Type
	Segment Characteristics	Section Gradient; Fish Spawning; Canopy; Access; Gravel
	Segment Substrate Attributes	Dominant Substrate Type; Compaction
	Segment Channel Attributes	Widths (wetted, bankfull), Depths (wetted, bankfull)
	Segment Instream Cover	% Total Cover; % by Feature/Cover Type (large woody debris/deep pool/over stream vegetation etc.)
	Segment Riparian Attributes	Left and Right Bank Riparian Class (vegetation association; structural stage; bank slope; material etc.)
		Segment Summary Description
	Level of Impairment	Score 0 (Severely impaired) – 6 (Natural); Rationale
	Enhancement Opportunity Rating	0 (Nil) – 4 (Very High); Rationale
Watercourse and Habitat Features	Culvert Attributes	Type-Material; Condition; Barrier; Size; Baffles
	Obstruction Attributes	Type-Material; Barrier; Size; Photo
	Stream Discharge Attributes	Point of Discharge; Type-material; Size
	Erosion Feature	Type of Erosion; severity; exposure; material
	Fish Habitat Attributes	Type of Habitat (Spawning/rearing/cover); Size; Slope; Photo
	Enhancement Areas	Type of Enhancement; Potential or existing enhancement
	Wildlife Observations	Type of Observation; Wildlife species; Photo
	Wildlife Tree Attributes	Type of Tree; Size; Location
	Near Waterbody Attributes	Type of Waterbody (spring/side channel/pond etc.); Size
	Wetland Attributes (Polygon feature)	Wetland Type-Class; Photo
	Photograph Location	Location; Direction.

3.2 Level of Impact/Condition Scoring

Ecoscape developed and appended a Level of Impact rating to the data dictionary (Appendix B). This rating system was designed with the intent of providing a more measurable parameter in evaluating the watercourse condition and monitoring and evaluating habitat changes on local watercourses and associated riparian and floodplain communities. Individual reach scores will be assigned based on the criteria outlined in Table 2.

Table 2. Level of Impact rating criteria for Deadman River Inventory and Mapping.

River Bank Impact Criteria[1]	Combined Segment Score
Nil-Nil (*Nil impacts on both banks*)	6
Nil-Low	5
Nil-Mod	4
Nil-High	3
Low-Low	4
Low-Mod	3
Low-High	2
Mod-Mod	2
Mod-High	1
High-High (*Impact on both banks is high*)	0

1. Numeric Bank Impact Scores: Nil=3 Low=2 Mod=1 High=0

The raw data and rationale for respective stream segment scores can be found in Appendix A within the Stream line data. Weighted scores for respective impact ratings were obtained by dividing the cumulative length of segments receiving the same SHIM impact rating by the total SHIM stream length to obtain a fractional abundance (% of SHIM stream length). This value was then multiplied by the respective SHIM Score (0-6) equaling the weighted score. A zero (0) to six (6) rating system was developed to evaluate respective stream segments in terms of their degree of disturbance, where a stream segment not being recently modified (natural) received a score of 6 (nil), and a stream segment being highly modified on both banks/channelized/ditched, etc. received a score of 0 (both banks high). The sum of weighted scores was then divided by the maximum attainable score (6)[1] and transformed into a percentage value to yield the condition score.

3.3 Data Logging and Processing

GPS settings were in accordance with Resource Inventory Committee Standards to ensure the collection of spatially accurate data. The coordinate system used was North American Datum 83, UTM Zone 10 North.

Field (GPS) data were post processed (differentially corrected) in the office using base stations situated both in Penticton (SOPAC, Dominion Radio Astrophysical Observatory), and Kettle Falls, Washington (USFS, Colville National Forest).

Data dictionary tools designed for ARC View 3.x were employed to process the data and to export the data into ESRI shapefiles. Final mapping deliverables were produced in ArcGIS 10.1.

3.4 Quality Assurance and Quality Control

The Resource Inventory Committee and SHIM Methodology (Mason and Knight, 2001) provide specific requirements for quality assurance and quality control. These standards such as GPS settings/precision, logging intervals, and data management and deliverables were followed throughout the project. Data review and quality assurance and control were provided by Kyle Hawes, R.P.Bio. – Senior resource inventory biologist.

[1] A combined weighted score of 6 would be attained if all segments were natural with no discernable human disturbance on either the right or left bank. Note this evaluation does not factor in impacts upstream of the District of Coldstream municipal boundary limit, which could still impact on water quality and habitat values.

4.0 RESULTS

The following section summarizes the morphological and biophysical character of each of the Deadman River. Refer to the attached segment summary pages (complete with representative photos) and corresponding maps included at the end of this report. The processed data from the centerline survey (Stream_line) and feature data has been included in Appendix A. In addition, this data can be found in digital format accompanying the complete inventory catalogue, which includes all point features, attributes, and representative photos (intended for use in an ESRI GIS platform). Furthermore, the reader is encouraged to refer to the Community Mapping Network, SHIM atlas (http://cmnbc.ca/).

The Deadman River (Watershed Code: 120-714600), also known as the Deadman's River, Deadman Creek or Deadman's Creek, is a tributary of the Thompson River. It originates on the Bonaparte Plateau south of Bonaparte Lake from which it flows south approximately 70 kilometers to the Thompson River just west of Kamloops Lake. The watershed has an area of approximately 1509 km^2 , has 12 sub-basins. The once abundant and diverse fish, wildlife and flora of the Deadman River valley have been put at risk by forest, mining, tourism, urban and agricultural development practices (Moore 2001).

4.1 Stream Primary Character

The total length of river surveyed was about 43km. The river was broken into 57 segments over this distance extending through the Skeetchestn Indian Band Lands and upstream beyond to the private land boundary (Segment 57). Over this 43 km length, about 48% (20.5 km) of the river has experienced disturbance and modifications to streamside communities from rural and agricultural landuse. The remaining 52% of the surveyed river length is still natural both instream and along its banks.

4.2 Stream Channel and Hydraulic Character

From its confluence with the Thompson River close to 40 kilometers of the River is predominantly riffle with about 3 km more strongly riffle-pool, and only 174 m being steeped cascade (Segment 10). Although variable, the mean bankfull width over this length was about 15 m and the bankfull depth was around 0.7 m.

Figure 1 illustrates the change in substrate composition; where boulder and larger cobble-sized material predominate the channel bed up to about Segment 19. From Segment 20 progressing upstream, boulders comprise a small component of the channel bed substrates as gravels and fines become more prevalent.

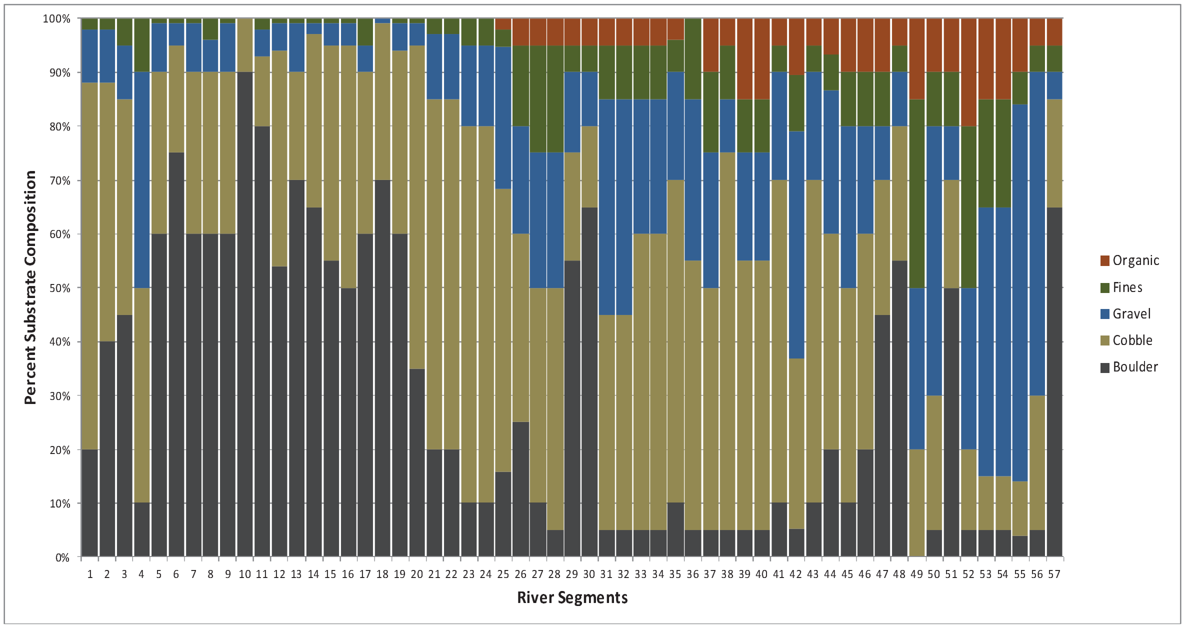

Figure 1. Substrate composition of segments.

4.3 Riparian Band

A 50-m band was delineated along both the left and right banks of the river. All vegetation communities were digitized within this band and the relative level of disturbance was estimated from digital orthophotos. Broad community types were established by grouping ecosystems described by the biogeoclimatic zones with similar vegetation structure. The site series classes and corresponding broad community types used in this mapping exercise are presented in Table 3.

Table 3. Ecosystems and broad community groups assigned to polygons delineated within 50m of the Deadman River channel.

Biogeoclimatic Code	Site Series	Ecosystem Code	Site Series Name	Deadman Map Codes	Broad Community Groups
BGxh2	07	CD	Act - Snowberry - Dogwood	CD	Cottonwood Mid Flood bench riparian
BGxh2	07	CW	Act - Water birch		
BGxh2	02	WS	Bluebunch wheatgrass - Selaginella	GR	Grassland
BGxh2	06	FW	Fescue - Bluebunch wheatgrass(Rough fescue)		
IDFxh2	00	WJ	Bluebunch wheatgrass - Junegrass		
IDFxh2	00	WJ	Bluebunch wheatgrass - Junegrass		
BGxh2	03	PT	Py - Red three-awn	SA	Pine Savanna
BGxh2	04	PW	Py - Bluebunch wheatgrass		
PPxh2	01	PF	Py - Bluebunch wheatgrass - Fescue		
PPxh2	03	PW	Py - Bluebunch wheatgrass		
PPxh2	04	PS	Py - Big sage - Bluebunch wheatgrass		
BGxh2	01	SW	Big sagebrush - Bluebunch wheatgrass	SH	Shrub Steppe
BGxh2	05	SN	Big sage - Needle-and-thread grass		
PPxh2	05	SF	Big sage - Bluebunch wheatgrass (-Fescue)		
IDFxh2	01	DP	FdPy - Pinegrass - Feathermoss	T	Pine/Fir Woodland and Mixed Forest
IDFxh2	02	WR	FdPy - Bluebunch wheatgrass - Rough fescue		
IDFxh2	03	PB	FdPy - Bluebunch wheatgrass - Balsamroot		
IDFxh2	04	DW	FdPy - Bluebunch wheatgrass - Pinegrass		
IDFxh2	05	PP	FdPy - Pinegrass		
IDFxh2	06	DF	Fd - Feathermoss		
IDFxh2	07	RD	CwFd - Dogwood		
IDFxh2	08	SH	Sxw - Horsetail		
PPxh2	02	DS	FdPy - Bluebunch wheatgrass - Selaginella		
PPxh2	06	SS	FdPy - Snowberry - Saskatoon		
				CB	Cut Bank
				CF	Cultivated Field
				ES	Exposed Soil
				LS	Riparian Low Shrub
				RU	Rural
				RZ	Road
				TA	Talus
				TS	Riparian Tall Shrub
				WM	Marsh

Figure 2 illustrates the composition of the 50m band that flanks the right and left banks of the Deadman River. Natural plant communities still predominate this band with cottonwood ecosystems predominating mid bench floodplains while upland sites are still predominated by grassland and shrub steppe ecosystems in the warmer aspects, ponderosa pine savanna, and pine-fir woodlands in cooler aspect sites and lower slope area. However, the spatial extents (area) of rural, agricultural area, and roads combined to account for close to 19% of the 50 m band inclusive of both the left and right bank. This is subsequently illustrated in Figure 3. In this figure, cultivated fields and rural developed properties and associated roads represent High Disturbance areas, which account for 19% of the area within 50 m of the banks of the Deadman River.

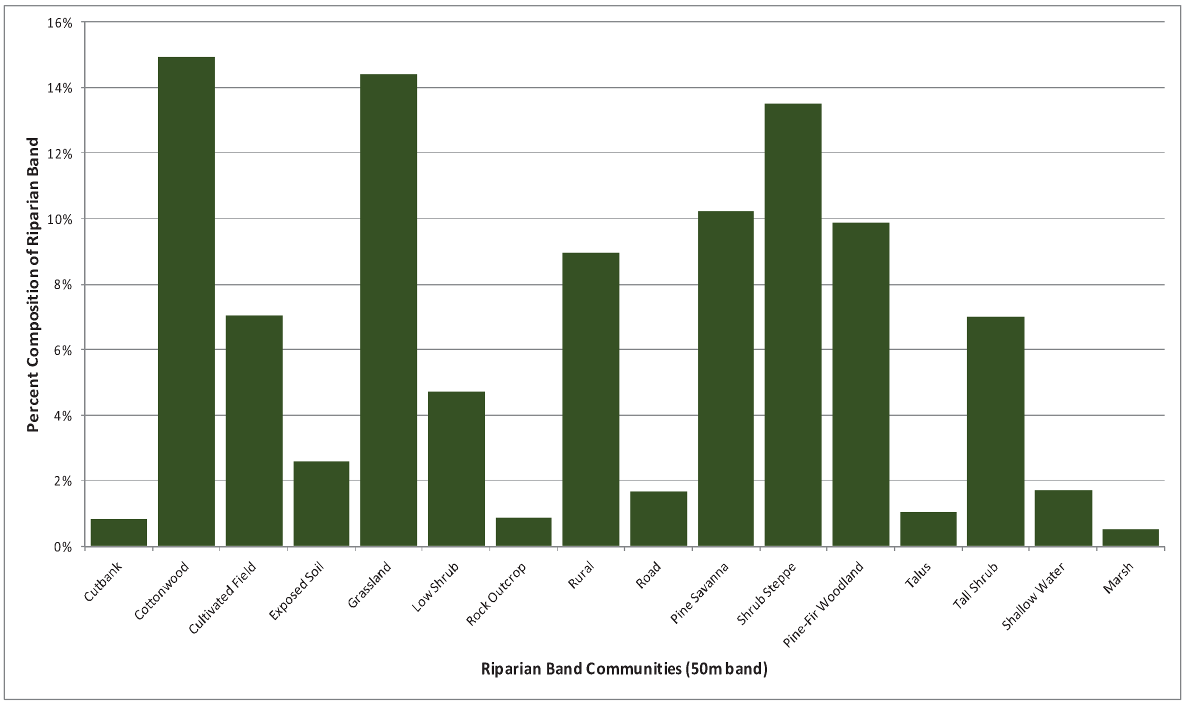

Figure 2. Relative abundance of vegetation communities and anthropogenic areas within 50m of the Deadman River (left and right banks).

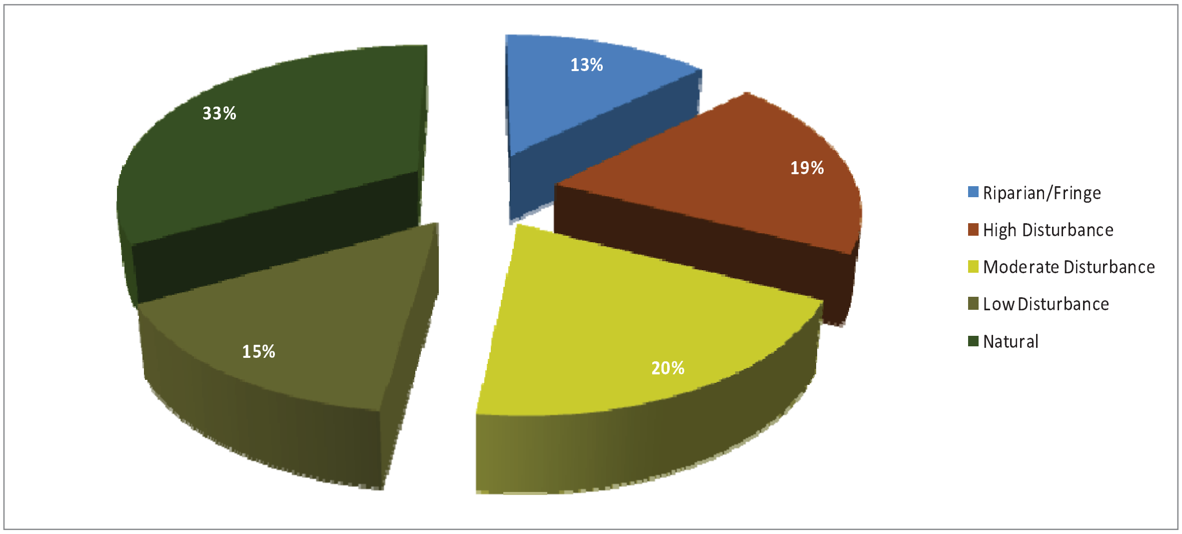

Figure 3. Relative condition of vegetation communities/polygons delineated within 50 m of the Deadman River channel (inclusive of left and right banks) over the 43 km SHIM survey length.

Figure 4 divides the data, summarized in Figure 3, by segment to illustrate the relative condition of vegetation communities/polygons occurring within 50 m of the Deadman River channel by individual river segments.

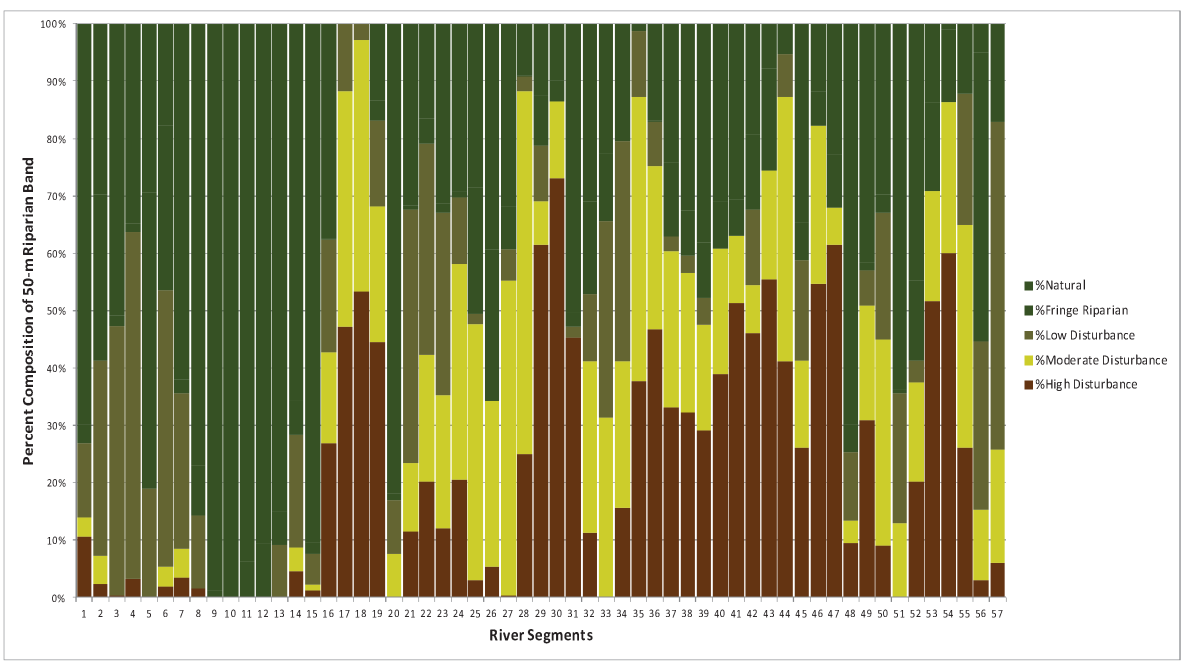

Figure 4. Relative condition of vegetation communities/polygons delineated within 50 m of the Deadman River channel (inclusive of left and right banks) by river segment.

4.4 Instream Habitat Cover/Complexity

Total and relative instream cover is a field estimate of the type and amount of in-channel cover available to fish. Total cover represents the total percentage of the wetted area of respective segments occupied by cover. The relative abundance (%) of cover types (e.g., deep pool, large woody debris etc.) is an estimate of the distribution (of respective cover types) within the total cover estimate. Figure 5 illustrates the estimates of total cover for each of the 57 segments. Total cover values (%) were then broken down by the relative abundance estimates of cover types (Figure 6). From this estimate, boulder substrates and deep pools/glides are providing the greatest proportion of instream cover at about 9% and 8 % of the river channel respectively.

Instream cover was relatively high in Segment 11 (cascade pool), and Segments 44, 48, 51, and 57. However, the majority of the lower 43 km of surveyed river had low relative cover estimated at <15%. Based on this observation, deep pools and holding areas become increasingly critical for fish. Large woody debris was estimated to be providing cover to less than 1% of the river. Historic flood events, which assist to wash LWD from the river, accompanied by the removal or riparian vegetation (i.e., creation of field), which reduces the recruitment of new large woody debris may be two contributing factors for low instream cover values.

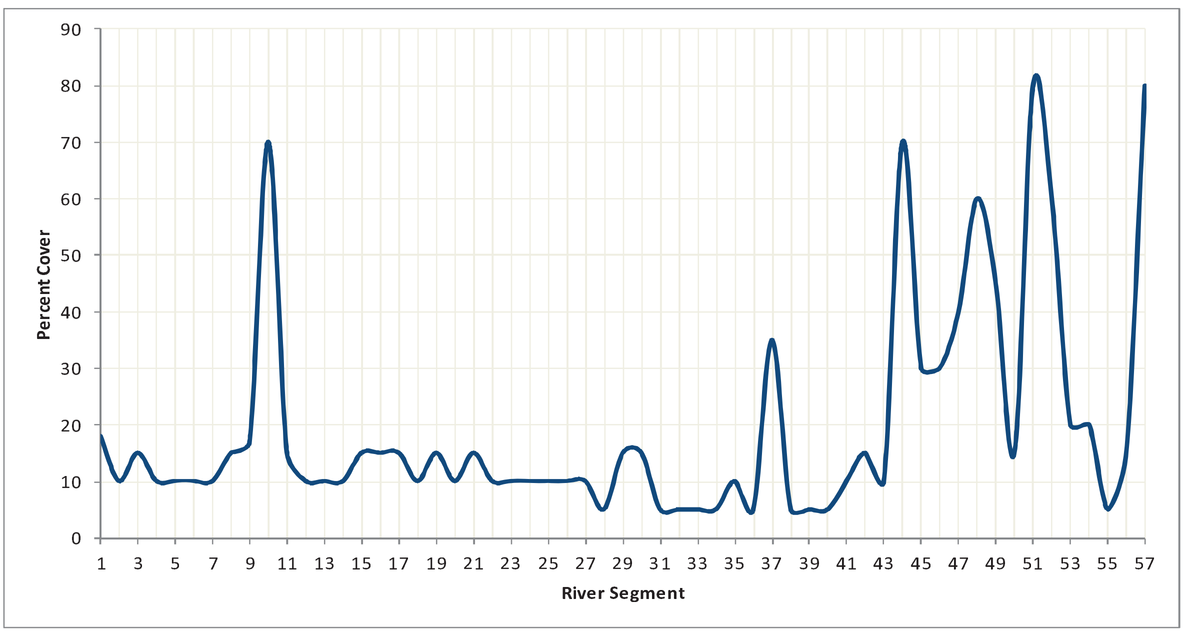

Figure 5. Percent cover recorded for each segment of the 43km survey length. Segment 1 occurs at the downstream end of the Deadman River at the confluence with the Thompson River.

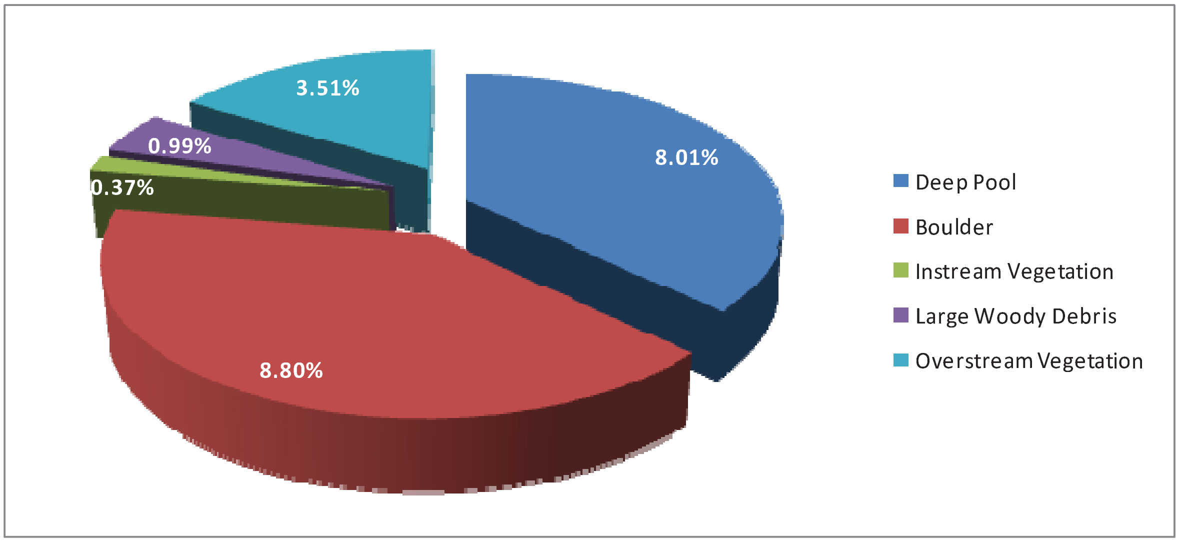

Figure 6. Distribution of percent instream cover according to cover types in the 43 km SHIM survey length of the Deadman River.

4.5 Watercourse and Habitat Features

The following section summarizes feature data collected and nested within the line segments. All features are measured and recorded individually and provide a more robust and quantitative measure of watercourse impairment and habitat quality.

4.5.1 Modifications

While disturbance to areas within 50m of the river was common (i.e., rural development and agriculture), detrimental modifications recorded in the river channel were more limited over the 43 km survey length. In total, there were 19 bridges, an old concrete dam/weir, 5 recorded incidents of garbage/debris (auto wreckage), 18 water withdrawals, and 55 incidents where the river banks had been stabilized with rip rap. All feature locations are indicated in the attached map set. Rip rap armouring was measured on over 3280 m of creek bank, which accounts for about 7.63% of the surveyed stream length. In the majority of cases, the placement of rip rap was mitigation for bank erosion. Previous bank stabilization works are reviewed in greater detail in Section 4.7.

4.5.2 Bank Stability and Erosion

Bank instability and erosion was prevalent over the 43 km surveyed river length. In total bank erosion was measured and recorded to combine for over 7.8 km of river bank. Of this about 4 km (9.5%) of the left bank and 3.2 km (7.5%) of the right bank were eroding. While some of these features were natural cutbanks and scarps, the majority of moderate and high severity sites were associated with rural and agricultural disturbance to the riparian band and resulting lack of riparian vegetation.

Table 4 lists all the moderate to extreme severity sites that were recorded during the 2009-2011 inventories of the lower 43 km of the Deadman River. The order of sites has been sorted according to the segment in which they occur. Segments were then reviewed according to their primary class (i.e., Natural vrs Modified) to distinguish natural bank erosion from that which may be influenced by adjacent landuse activities such as land clearing and cultivated fields. In doing so, priority segments and sites were identified (shaded cells in Table 4).

Table 4. Summary of moderate to extreme severity erosion sites along the Deadman River. Segments shaded gray represent those where streamside modifications have occurred and may be a factor in the erosion versus natural eroding banks.

Bank	Severity	Length (m)	Height (m)	Feature ID	Segment	Bank	Severity	Length (m)	Height (m)	Feature ID	Segment
Left	High	85	3	92	2	Left	Moderate	70	3	49	42
Left	High	80	4	97		Left	Moderate	45	3	50	
Right	Moderate	45	2	87		Right	High	75	3	52	43
Left	Moderate	90	3	88		Left	Moderate	15	2	51	
Left	Moderate	60	5	90		Right	Extreme	50	3	57	46
Right	Moderate	40	4	93		Left	High	40	1	58	
Right	Extreme	50	2	100	3	Left	Moderate	32	1	53	
Left	High	220	8	107	13	Left	Moderate	70	1	54	
Right	Moderate	58	2	81	15	Right	Moderate	33	1	55	
Left	High	30	4	122	16	Right	Moderate	30	1	56	
Left	Moderate	30	3	120		Left	Moderate	65	1	59	
Right	High	43	3	116	19	Left	Moderate	35	3	28	47
Right	High	110	4	119		Right	Moderate	20	1	27	49
Both	Moderate	217	2	124	21	Right	Moderate	80	5	28	
Left	High	150	2	110	22	Left	Moderate	50	1	31	50
Right	High	82	2	111		Left	Moderate	45	1	32	
Right	High	283	2	112		Right	Moderate	60	5	33	
Right	High	55	2	113		Left	Moderate	50	2	36	
Left	High	50	2	126		Right	Moderate	32	3	37	
Right	Moderate	109	2	109		Right	Moderate	45	2	38	
Both	Moderate	228	3	115	23	Right	Moderate	55	2	16	52
Left	Moderate	12	2	62	26	Right	Moderate	45	2	17	
Left	High	53	1	65	28	Left	Moderate	35	2	18	
Left	Moderate	75	3	63		Right	Moderate	52	2	19	
Right	Moderate	30	2	66		Right	Moderate	40	2	20	
Left	Moderate	75	1	67	30	Right	Moderate	40	3	21	
Right	Moderate	7	3	68		Right	Moderate	25	2	22	
Left	Moderate	28	2	69		Right	Moderate	85	2	23	
Left	Moderate	200	1	70	32	Right	Moderate	80	2	25	
Right	Moderate	118	1	71		Left	Moderate	20	1	13	53
Left	Moderate	100	2	72		Right	Moderate	25	1	14	
Right	Moderate	150	2	73		Left	Moderate	65	2	15	54
Left	Moderate	32	2	74		Left	Moderate	75	2	39	55
Left	High	94	2	76	33	Right	Moderate	16	2	40	
Right	Moderate	40	2	78	35	Left	Moderate	80	1	41	
Left	High	35	17	1	36	Right	Moderate	11	2	42	
Right	Moderate	15	2	2		Left	Moderate	120	2	44	56
Right	Moderate	53	3	4		Right	Moderate	85	2	45	
Left	Moderate	30	3	6	40	Left	Moderate	90	2	46	
Left	Moderate	20	2	11	42	Left	Moderate	40	4	47	
Left	Moderate	110	3	48							

4.5.3 Fish Habitat

Section 4.4, presented the estimated total cover that was present in each segment and subsequently estimated the relative abundance of cover types. From this estimate, boulder substrates and deep pools/glides were found to be providing the greatest proportion of instream cover at about 9% and 8 % of the river channel respectively. In addition to cover estimates, key habitat features were measured and recorded as individual features occurring along the River.

The total spatial coverage of all habitat features recorded was 24267 m^2. The cumulative measure of deep pools accounted for an area of over 11,000 m^2 habitat in the lower 43 km of the Deadman River. Deeper glides, not classified as pools, which provide known and potential holding areas (other) for migrating salmonids account for an area of over 10,000 m^2. Deep pool and holding areas combined, accounted for close to 80% of all habitat recorded during the inventory (Figure 7). Large woody debris was measured to provide only about 720 m^2 of habitat in the lower 43 km of the Deadman River.

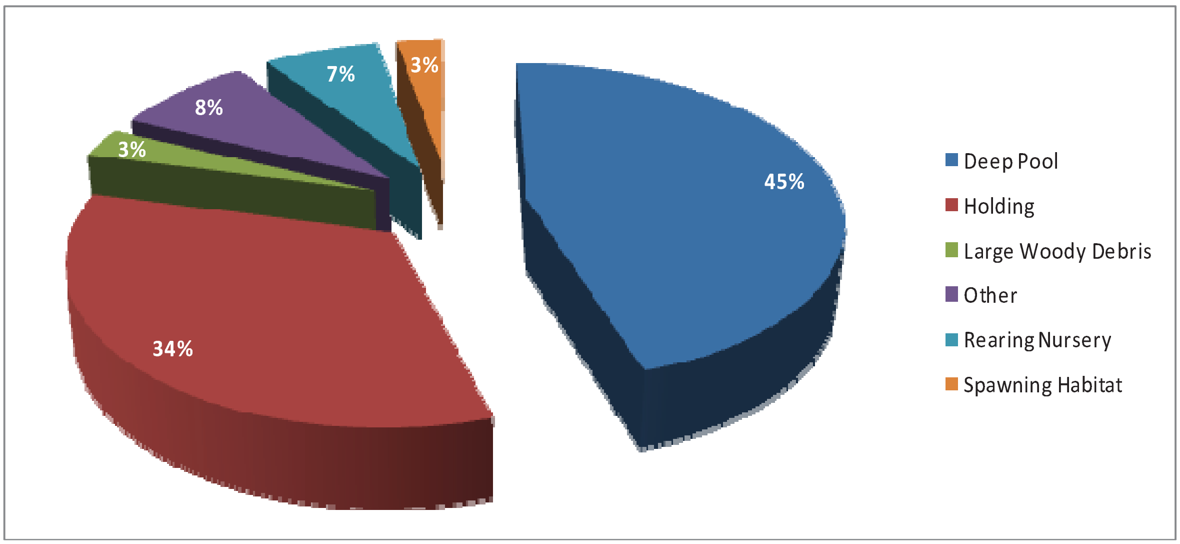

Figure 7. Relative distribution of spatial coverage of habitat features recorded during the SHIM field inventory. The total spatial coverage of all habitat features recorded was 24267 m^2.

4.5.4 Obstructions / Barriers

Beaver dams were the only potential upstream migration barrier recorded during the field inventory. While six beaver dams were recorded over the nearly 43 km of surveyed river, one was recorded as a potential barrier. However with seasonal monitoring and maintenance of these structures (i.e., partial dismantling) fish migration access may remain unobstructed. Table 5 lists the dams and their current distance upstream from the confluence of the Deadman River with the Thompson River.

Table 5. Beaver dams (recorded during 2009 – 2011 survey period) and potential upstream migration barriers.

Dist. Upstream from Thompson R. (km)	UTM (10 North)	
	Easting	Northing
3.7	647258	5626212
18.2	643460	5635525
23.2	642450	5639183
30.2	641704	5644431
32.7	641696	5646125
39.4	644429	5649233

4.6 Stream Impact Summary

About 48% (20.5 km) of the lower 43km of the Deadman River has experienced disturbance and modifications to streamside communities from rural and agricultural landuse. Although physical alterations to the river channel itself were more limited, the impacts of landuse adjacent to the river were apparent with the prevalent erosion, and channel aggradation that was observed in lower segments. The sum of weighted SHIM scores equaled 3.97 (out of 6) receiving a stream grade of 0.66 (Table 6). With continued efforts aimed at restoring riparian communities, assisted with setback riparian fencing, and bank stabilization, the satisfactory score may be increased as impacts are removed/setback from the banks of the river.

Table 6. Level of Impact/Condition Summary for the Deadman River (lower 43km).

	Impact/Condition Score						
	1	2	3	4	5	6	
Segments	31	17,46,53, 55	16,42,50, 54,56	2,18,20,21,22,23,24,25,26,27,28, 29,30,32,33,34,36,37,38,41,43,44 ,45, 47,48,49,52,57	3,4,15,35,39,51	5,6,7,8,9,10 ,11,12,14,1 9,40,	
Combined Segment Length (m)	189	4136	8135	20780	3783	5942	
Percent SHIM	0.44	9.63	18.93	48.37	8.81	13.83	
Weighted Score	0.00 4	0.19	0.57	1.93	0.44	0.83	3.97
						Score (/1)	**0.66**

4.7 Past Riparian and Channel Restoration

Skeetchestn's salmon and steelhead restoration programs include habitat recovery and hatchery-based conservation programs as part of broader resource management programming. The community's fishery on wild salmon and steelhead in Deadman Creek has been severely restricted since 1985 due to insufficient returning spawners (Moore 2001).

Stream channel instability has been cited as an ongoing concern since the 1990 flood which caused wide spread channel disturbance. However, stream bank stability problems were cited along the channel in the 1980's long before the flood event, and may have exacerbated its impact. Riparian restoration programming led by the band has included replanting of indigenous vegetation, management of cattle impacts through fencing and stabilization of access points, and prescribed habitat treatments. In addition, the band has worked with valley residents to address the impact of roads, pollution, natural resource and urban development (Moore 2001).

Past restoration works on the Deadman River have involved bank armouring using a combination of rip rap and tree revetments, installation of riparian setback fencing, and riparian area planting. Based on GIS data provided by Fisheries and Oceans and SHIM inventory information, close to 3.3 km of river bank have been armoured with rip rap where erosion and property loss was identified as a concern. In general all these sites continue to function properly. The only sites where the works are no longer functioning occur along the left bank of Segment 53, the left bank at the downstream end of Segment 43, and left bank of Segment 42. At each of these sites, the river channel has migrated/avulsed.

Table 7. Summary of existing bank armouring/stabilization.

Segment	Armoured bank length (m)		Segment	Armoured bank length (m)
1	52		42	70
6	81		43	120
16	45		45	210
17	53		46	262
19	42		50	170
22	60		51	35
24	15		52	120
25	28		53	120
34	120		55	221
35	418		56	674
37	195		57	9
38	160			

Efforts to restore the riparian communities along the lower 43 km of the Deadman River are clearing evident when considering the extent of riparian fencing that has been installed. Based on Fisheries and Oceans GIS data, riparian fencing extends almost 19 km along the Deadman River. Table 8 lists the extents of riparian fencing that has been installed along the Deadman River according to SHIM segments. Riparian planting was carried out in conjunction with some of the fencing projects with a total planting area of about 5200 m^2.

Table 8. Summary of existing riparian fencing.	
Segment (s)	**Length of Fencing (m)**
19	1169
27	355
21-22	2695
34-36	3889
43	350
50	1792
52-56	8727

4.8 Prioritization of Restoration

The SHIM survey of Deadman River revealed that approximately 48% of the total surveyed stream length, has been modified to some degree along its banks. Previous restoration efforts by the Skeetchestn, in partnership with Fisheries and Oceans included: bank stabilization using a combination of rip rap, tree revetments, and setback fencing. To date the success of many of these efforts were evident in the field inventory, where setback fencing is promoting the reestablishment of riparian vegetation and livestock have restricted access to the river channel for watering.

However, bank instability and persistent erosion continues to be a concern along this watercourse. There continue to be numerous opportunities for bank stabilization, setback fencing and riparian restoration along the Deadman River. There are several areas where the stream flows through fields where channel migration continues to erode the fine-textured bed material (eg. segment 42). Consistent with past efforts, these banks should be stabilized using a combination of rip rap armouring, large woody debris placement and tree revetments, to mitigate property loss. Concurrently riparian vegetation should be planted along these sites to help promote increased bank stability.

Fencing should be located such that it allows for a wider riparian band between adjacent landuse and Deadman River to provide a vegetated buffer to help mitigate for runoff from fields.

Many of the disturbed and modified stream segments, riverine wetlands, and riparian associations along Deadman River have a high capability to regenerate in conjunction with remedial efforts such as bank stabilization and riparian planting.

To assist in the prioritization of sites, where rehabilitative efforts would realize the greatest potential net benefits in habitat and potential water quality improvements, key areas were extracted using the SHIM data. Recognizing that erosion is the prevalent symptom of stream channel and habitat impairment (i.e., encroachment and riparian removal etc.), key problem areas were identified according to the frequency and severity of erosion within segments as identified in Table 4 (Section 4.5.3).

Based on this Segments 42, 46, 52, 53, 55, and 56 are identified as priority segments. Accordingly, the following sites are recommended as priorities for continued restoration works.

Table 9. List of prioritized sites/segments for bank stabilization and riparian restoration.

Bank	Feature ID (see attached maps)	Segment
Left	49	42
Left	50	
Right	57	46
Left	58	
Left	53	
Left	54	
Right	55	
Right	56	
Left	59	
Left	28	47
Right	16	52
Right	17	
Left	18	
Right	19	
Right	20	
Right	21	
Right	22	
Right	23	
Right	25	
Left	13	53
Right	14	
Left	39	55
Right	40	
Left	41	
Right	42	
Left	44	56
Right	45	
Left	46	
Left	47	

5.0 CLOSURE

This report has summarized detailed field inventory data collected during 2009-2011 SHIM surveys of the Deadman River. The collection and management of data conformed to the SHIM methodology, which is a standard for fish and aquatic habitat mapping in urban and rural watersheds in British Columbia.

The Deadman River inventory has resulted in the development of an up-to-date catalogue of watercourse and habitat features, which has numerous applications and can be used by the Skeetchestn Bank, Fisheries and Oceans, stewardship groups, and individuals. In maintaining the integrity of this SHIM database, periodic field inspections should be carried out to update watercourse and habitat feature mapping.

The inventory that has been summarized within this report was commissioned by and prepared for the Skeetchestn Indian Band. The collection, processing, and management of data have conformed to SHIM standards. No other warranty is made, either expressed or implied.

Questions or inquires pertaining to SHIM methodology, data, and this summary report should be directed to the undersigned.

Respectfully Submitted,
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