



Technical Data Report

Surface Water and Sediment Quality

ENBRIDGE NORTHERN GATEWAY PROJECT

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Abbreviations

AENV	Alberta Environment
AMEC	AMEC Earth & Environmental
ASWQG	Alberta Surface Water Quality Guidelines
BC MWLAP	British Columbia Ministry of Water, Land and Air Protection
BCAWQG	British Columbia Approved Water Quality Guidelines (Criteria)
BCSQG	British Columbia Working Sediment Quality Guidelines
BCWQGD	British Columbia Water Quality Guidelines for Drinking and Recreational Water Uses
BCWWQG	British Columbia Working Water Quality Guidelines
CCME	Canadian Council of Ministers of the Environment
CEQG	Canadian Environmental Quality Guidelines
COD	chemical oxygen demand
CSQG	Canadian Sediment Quality Guidelines
DO	dissolved oxygen
DOC	dissolved organic carbon
EMS-WR	Environmental Monitoring System Water Resources
ESA	environmental and socio-economic assessment
GCDWQ	Guidelines for Canadian Drinking Water Quality
GPS	global positioning system
ISQG	interim sediment quality guidelines
KP	kilometre post
LWBC	Land & Water British Columbia Inc.
MEMPR	(British Columbia) Ministry of Energy, Mines and Petroleum Resources
PEL	probable effect levels
QA and QC	quality assurance and quality control
RGS	(British Columbia) Regional Geochemistry Survey
RoW	right-of-way
SLC	screening level concentration
TDS	total dissolved solids
the Project	Enbridge Northern Gateway Project
TKN	total Kjeldahl nitrogen
TOC	total organic carbon
TP	total phosphorus
TPH	total petroleum hydrocarbons
TSS	total suspended solids
USGS	United States Geological Survey

1 Introduction

1.1 Objectives

The purpose of this document is to describe the baseline characteristics of surface water and sediment quality, which will be assessed in the environmental and socio-economic assessment (ESA). This information will be used to identify construction and operational measures that will be needed to limit or avoid environmental effects on these biophysical elements. It will also be used as a basis against which environmental effects on surface water quality will be assessed.

The Enbridge Northern Gateway Project (the Project) water quality database was developed using surface water and sediment quality data from different sources and data collected during the 2005 field survey.

This baseline technical data report includes:

- sources for water and sediment quality information
- field programs and data collection methods
- an overview of the water quality within major basins and hydrological zones, based on available historical information
- surface water and sediment quality along the route at watercourse crossings, where applicable
- a comparison and analysis of compliance with applicable Alberta, British Columbia and federal water and sediment quality guidelines

1.2 Environmental Setting

The North Saskatchewan, Athabasca and Peace River basins have similar drainage patterns and climatic conditions but variable land uses. The watersheds are characterized by rolling hills, watercourses with low slope gradients, low mean annual precipitation and long cold winters.

The North Saskatchewan River basin, which encompasses areas between the Rocky Mountains and the confluence of the South Saskatchewan River, is part of the Nelson River drainage system, which drains most freshwater from the Prairie Provinces into Hudson Bay. The portion of this basin to be crossed by the RoW extends from near Bruderheim, Alberta to Glenford (Barrhead County), Alberta and includes mainly cultivated lands near the RoW and some sloughs.

The pipeline route will cross the Athabasca River basin between Glenford, Alberta to about 50 km west of Whitecourt, Alberta. The headwaters of this basin are found in the Rocky Mountains. Water from this basin drains into the MacKenzie River drainage system and the Beaufort Sea via the Peace–Athabasca Delta. The portion of this basin crossed by the RoW is characterized as a zone of transition between cultivated land in the east and boreal forests in the west.

The Peace River basin drains most of northwest Alberta and northeast British Columbia through the Peace – Athabasca Delta. The pipeline route will extend approximately 40 km through a forested area in this basin. The highest slope gradients can be found near Foxy Creek.

Industrial operations, such as pulp and paper mills, are found in Whitecourt, but agriculture is the main activity. Most areas are uninhabited. However, there are several operational oil and gas leases west of Foxy Creek near Smoky River and in the Simonette, Latournell and Wapiti River watersheds. Logging operations are identified along the Redwillow River watershed and Kinuseo Creek and Murray River watersheds south of Tumbler River, British Columbia. Generally, most areas near the RoW are undisturbed.

Further in the mountains, major rivers, including the Stuart, Necoslie and Endako occur. Generally, climatic conditions vary little with low to moderate mean annual precipitation, warm short summers and cool winters. Most watercourses have drainage areas less than 50 km². Stream slope gradients vary, with the lowest gradients found in the interior area, extending from the Crooked River watershed to the Endako River watershed. High stream slope gradients are observed in the Rocky Mountain trench area (Monkman Pass to the Crooked River watershed) and in the Coastal Mountains (Endako River watershed to the Morice River watershed).

Farther to the east, the RoW crosses western portions of the Peace River basin (Monkman Pass to Bear Lake, British Columbia) and headwater areas of the Fraser River basin (Muskeg and Salmon River watersheds).

Central portions of this area traverse the headwaters of several subwatersheds of the Nechako River basin and the Muskeg and Salmon River watersheds from areas south of Davie Lake to Burns Lake, British Columbia. The pipeline route will also cross the headwaters of Parrott Creek, a subwatershed west of Burns Lake, which is also part of the Nechako River sub-basin.

The Nechako River sub-basin and the Muskeg and Salmon River watersheds drain water south and east into the Fraser River drainage system, which extends from the Yellowhead Pass (Rocky Mountains) to the lower mainland (south coast) where water drains into Georgia Strait (Pacific Ocean).

The portion of the pipeline route west of Burns Lake and areas between Sutherland River and Burns Lake will cross headwaters of several subwatersheds in the Skeena River basin. Water drains north and west from the region where the pipeline route crosses to Hecate Strait (Pacific Ocean), south of Prince Rupert.

Logging areas are identified in all major river basins along the RoW. Burns Lake and Bear Lake are the only settlements in this zone near the RoW.

The Kitimat River basin drains into the Kitimat Arm of the Douglas Channel (Hecate Strait) and has a small drainage area compared to the other basins along the RoW. Most of the areas are undisturbed subalpine habitat with steep stream flow gradients. High mean annual precipitation, cool temperatures at high elevations and more moderate temperatures in valleys characterize the climate. This basin consists of mountainous regions in upstream areas and an alluvial plain in downstream areas. The RoW will follow the Kitimat River along a valley in upstream locations and then will follow the western Coast Mountain Range to its end point at Kitimat Arm. The climate near the Kitimat Terminal is wet and temperate, with very high mean annual precipitation and above-freezing temperatures for most of the year.

Some logging areas were identified in the Skeena River basin. The RoW will cross mainly natural habitats along the alluvial plain of the Kitimat Valley. Portions of the RoW will be upstream of the Town of Kitimat, a pulp and paper mill and an aluminum smelter.

2 Methods

2.1 Study Area Boundaries

The pipelines will extend approximately 1,170 km from near Bruderheim, Alberta to Kitimat, British Columbia. The pipeline right-of-way (RoW) will cross several distinct hydrological zones, each with differing hydrological, geochemical, water quality, climatic and ecological conditions.

Hydrological zones were delineated based on hydrologic conditions, including stream characteristics and flows, climate (e.g., runoff regimes, temperature fluctuations), geomorphology (e.g., watercourse slope gradients, soil and geological formations), ecological conditions and land uses. The six hydrological zones crossed by the RoW are:

- Prairies (initiating station near Bruderheim to approximately KP 81)
- Foothills (KP 81 to KP 485)
- Rocky Mountains (KP 485 to KP 714)
- Central Interior (KP 714 to KP 915)
- Central Mountains (KP 915 to KP 1054)
- Coastal Mountains (KP 1054 to the Kitimat Terminal)

It is assumed that baseline water quality is largely dependent on land use patterns and hydrological conditions. Surface water and sediment quality data are collected and presented by hydrological zone.

The Prairies hydrological zone extends from near Bruderheim, in the North Saskatchewan River Basin, through to the edge of the Athabasca River Basin. This hydrological zone receives less precipitation than the other zones crossed by the RoW. The terrain of this zone is generally quite flat and land use is predominantly agricultural.

The Foothills hydrological zone extends from the Athabasca River Basin just east of the Athabasca River to the eastern portions of the Peace River Basin. This hydrological zone has higher elevations and a slightly higher annual total precipitation than the Prairies hydrological zone.

The Rocky Mountains hydrological zone extends through the Peace River Basin from slightly east of the Alberta–British Columbia border to Davie Lake, north of Prince George. Annual total precipitation is quite high in this hydrological zone, surpassed only by the Coastal Mountains zone.

The Central Interior hydrological zone extends through the western portion of the Peace River Basin. Watercourses of the Fraser River Basin, including the Nechako River Sub-basin and the Skeena River Basin are also found within this zone. The hydrological zone extends through several headwater watersheds from Davie Lake, north of Prince George, to the Tintagel Creek watershed, east of Burns Lake. The terrain in this zone is similar to that of the Prairies hydrological zone and similar land use (agriculture) exists.

The Central Mountains hydrological zone extends through several headwater watersheds in the Nechako River Sub-basin and the Skeena River Basin. The hydrological zone extends from the Stearns Creek watershed, east of Burns Lake to Gosnell Creek watershed, on the eastern side of the Coastal Mountains. This hydrological zone receives much less precipitation than the Coastal Mountains hydrological zone to the west.

The Coastal Mountains hydrological zone extends through several headwater watersheds in the Skeena River Basin and Kitimat River Basin. Several lowland watersheds in the Kitimat Valley are also in this zone. The hydrological zone extends from Gosnell Creek watershed, on the eastern side of the Coastal Mountains, to the Kitimat Terminal, located near the outlet of the Kitimat River into the Kitimat Arm of the Pacific Ocean. This hydrological zone receives more precipitation than any other hydrological zone along the RoW.

2.1.1 Study Area for Existing Data Review

The study area used for the review of existing data was determined differently for surface water and sediment quality data. The size of the study area for existing baseline data was standardized for all hydrological zones (see Figures 2-1 and 2-2). The categories of data used to establish the study area are:

- historical surface water quality data
- historical sediment data

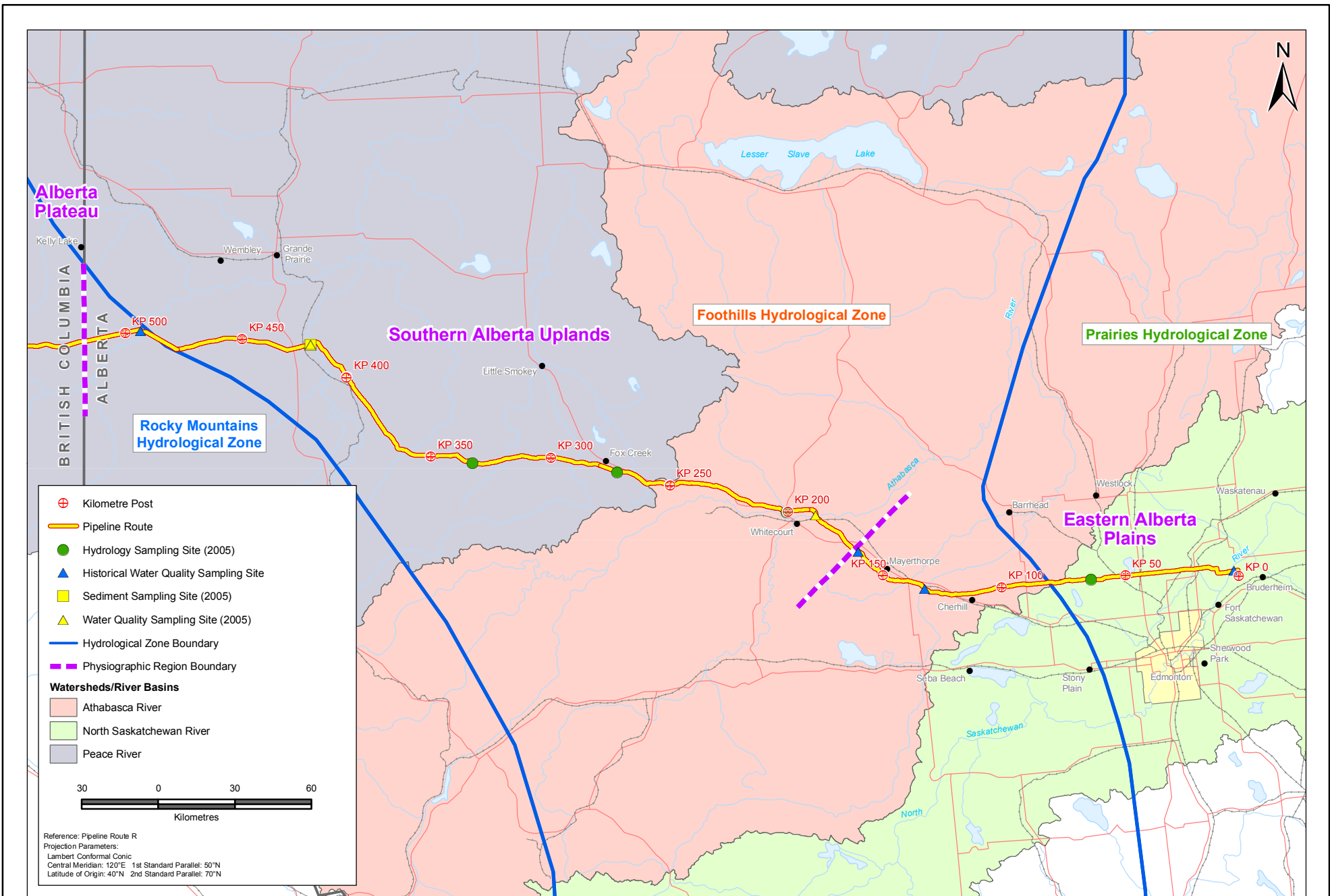
A baseline study corridor of 15 km on either side of the pipeline RoW was established to capture any relevant existing data that could enable the characterization of baseline conditions at watercourse crossings along the RoW. All available data found within the corridor were acquired for the different categories of data.

Historical surface water quality data used to assess baseline conditions were considered if found within 15 km downstream or 1 km upstream of the pipeline RoW. The use of water quality data found more than 1 km upstream were excluded, as the drainage area at the sampled location was considered smaller and could not be used to characterize water quality properly. Many tributaries join the watercourse mainstem downstream of the sampling location, potentially altering the water quality and resulting in samples from the watercourse crossing being unrepresentative.

Using data downstream of the watercourse crossing over a longer distance yields results that can be viewed as more conservative, as the water quality at the crossing is included in the downstream sample. Furthermore, locations sampled downstream of the watercourse crossing can characterize the sum of the water quality conditions of several watercourse crossings that eventually join at the sampling location.

Historical sediment data used to assess baseline conditions were considered if found within 1 km upstream or downstream of the RoW. Unlike water, sediment tends to be stationary and its geochemistry typically reflects that of its immediate environment.

For the locations of the sediment and water quality historical sampling sites, see Figure 2-1 and Figure 2-2.



REFERENCES: AB SRD, Enbridge, ESRI, Spatial Data Warehouse Ltd. Watershed boundaries reproduced and distributed with permission of Agriculture and Agri-Food Canada

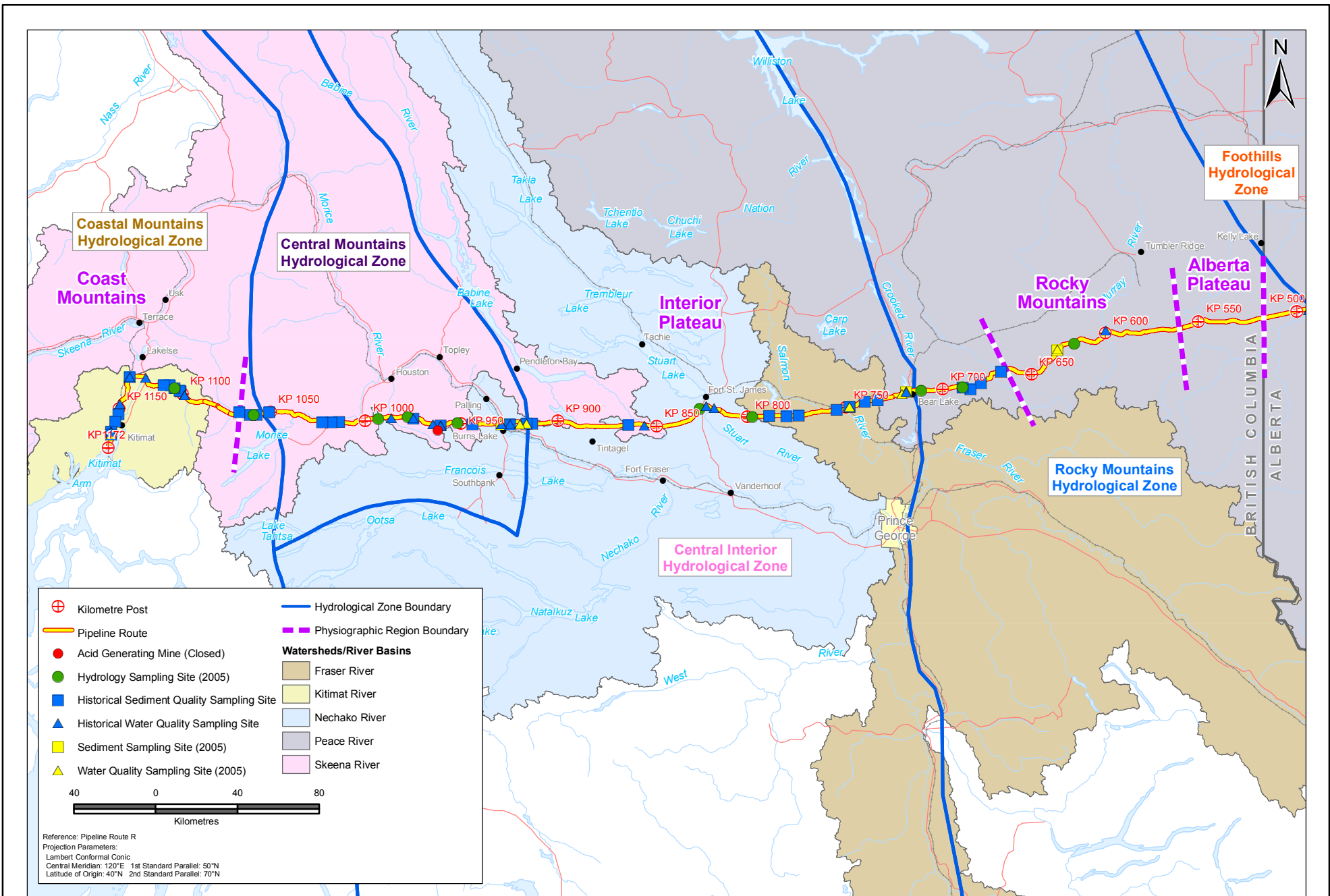
CONTRACTOR: AMEC	
PREPARED BY:	PREPARED FOR:

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Baseline Surface Water and Sediment Quality Sampling Locations in Alberta


FIGURE NUMBER: 2-1		DATE: 20090929
SCALE: 1:2,000,000	AUTHOR: JNB	APPROVED BY: ST
PROJECTION: LCC	DATUM: NAD 83	


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REFERENCES: BC_MOE, Enbridge, ESRI, Spatial Data Warehouse Ltd.

CONTRACTOR:
AMEC

PREPARED BY: 

PREPARED FOR: 

ENBRIDGE NORTHERN GATEWAY PROJECT

Baseline Surface Water and Sediment Quality Sampling Locations in British Columbia

FIGURE NUMBER: 2-2	DATE: 20090929
SCALE: 1:2,500,000	APPROVED BY: ST
PROJECTION: LCC	DATUM: NAD 83

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2.1.2 Study Area for Field Surveys

Surface water quality and sediment samples were taken at RoW watercourse crossings or at the closest accessible location downstream of the RoW. The study area for field surveys was determined with the following considerations:

- accessibility by road or helicopter
- relative locations of towns and industrial activities, such as mines, gas plants, pulp and paper mills and smelters
- relative locations of water intake structures and water licences

Sampling focused on locations where upstream industrial activity or downstream water consumption were identified within 5 km (see Figures 2-1 and 2-2). Watercourses with industrial activities were sampled to capture baseline conditions. Watercourses with downstream water intakes were also sampled to gauge potential changes from the Project on baseline water quality conditions.

2.2 Review of Existing Data Sources

Existing data for surface water and sediment quality were obtained from several government sources, as the RoW will cross two provincial jurisdictions.

In Alberta, existing water quality data were obtained from Alberta Environment (AENV 2008); no relevant sediment data were available.

In British Columbia, existing water quality data were obtained from the Environmental Monitoring System Water Resources Database (EMS-WR), which is a compendium of historical data from both government and industry sources made available through the Ministry of Environment (2008, Internet site). Sediment data were obtained from the Regional Geochemistry Survey (RGS), an initiative by the Ministry of Energy, Mines and Petroleum Resources (MEMPR) to collect sediment data throughout British Columbia (MEMPR 2008, Internet site).

Surface water quality data for 1995 to 2008 were used. Older data were excluded because they were deemed irrelevant, as land uses in the affected watersheds have changed over time. Sediment data from 1995 to present were used. Data from the RGS were analyzed for metals in many small-unnamed tributaries (MEMPR 2008, Internet site).

Qualitative sediment composition data were also presented in the RGS data. These data are not quantitatively accurate and can be used only as a sediment composition guide to infer an approximate quantity of fine particles (i.e., silt and clay fractions) and total organic carbon (TOC) from the data. Percentages that were assigned based on approximations used by MEMPR (2008, Internet site) were:

- absent – 0%
- minor – less than 33%
- medium – 33 to 67%
- major – greater than 67%

All relevant data taken from government sources were compiled into a database and assessed both temporally and spatially.

2.3 Field Surveys

Surface water quality and sediment samples were taken at RoW watercourse crossings or at the closest location downstream of the RoW. Areas for field surveys were determined by considering:

- relative locations of industrial areas, such as mines, gas plants, pulp and paper mills and smelters
- relative locations of water intake structures and water licences (AENV 2005; LWBC 2005, Internet site)
- relative locations of inhabited areas
- accessibility by road or helicopter

Sampling focused on locations where upstream industrial activity or downstream water consumption was identified within a 5-km boundary (see Figures 2-1 and 2-2). Watercourses with industrial activities were sampled to capture baseline conditions with the potential effects of industrial activities. Watercourses with downstream water intakes were also sampled to gauge potential changes from the Project on baseline water quality conditions. Surface water and sediment samples were obtained during a fall 2005 field survey.

Twelve survey locations along the RoW were sampled during a fall 2005 water quality field survey based on the presence of upstream industrial activity and/or downstream consumption, and a lack of historical data. These locations were determined using data from land use maps and governmental sources, such as Minfile, a mineral inventory released by the Ministry of Energy, Mines and Petroleum Resources in British Columbia (MEMPR 2005, Internet site). Twenty water samples for total suspended solids (TSS) were obtained in conjunction with the fall 2005 hydrology field program.

2.3.1 Baseline Water Quality and Sediment Sampling Locations

For a summary of the historical and baseline field survey sampling locations by hydrological zone, see Table 2-1. Source identification numbers are provided for the historical data. Baseline data collected by the Project’s environmental team are denoted as either “Water Quality Baseline” or “Hydrology Baseline”. Data from Alberta Environment is denoted by AENV. Data from the British Columbia Ministry of Environment is denoted as BC MoE. Data from the British Columbia Ministry of Energy, Mines and Petroleum Resources is denoted as MEMPR.

Table 2-1 Historical and Baseline Field Survey Sampling Locations

Location	Crossing Number	Source	Data Collected		
			Water Sample	TSS Sample	Bottom Sediments Sample
Prairies Hydrological Zone					
North Saskatchewan River	1	AENV: AB05EB0595	X		
Rivière Qui Barre	3005	Hydrology Baseline		X	

Table 2-1 Historical and Baseline Field Survey Sampling Locations (cont'd)

Location	Crossing Number	Source	Data Collected		
			Water Sample	TSS Sample	Bottom Sediments Sample
Foothills Hydrological Zone					
Pembina River	75	AENV: AB07BB0030	X		
Little Paddle River	100	AENV: AB07BB0050	X		
Athabasca River	1975	Water Quality Baseline	X		
Sakwatamau River	120	Hydrology Baseline		X	
Unnamed Foxy Creek Tributary	157	Hydrology Baseline		X	
Unnamed Washkahigan Creek Tributary	1602	Hydrology Baseline		X	
Smoky River	3174	Water Quality Baseline	X		X
Rocky Mountains Hydrological Zone					
Wapiti River	3038	AENV: AB07GC0020	X		
Murray River	3051	BC MoE: E206322	X		
Unnamed Imperial Creek Tributary	446	Hydrology Baseline		X	
Missinka River	480	Water Quality Baseline	X		X
Unnamed Missinka River Tributary	579	MEMPR: 93J853113			X
Unnamed Wichcika Creek Tributary	592	MEMPR: 93J851409			X
Unnamed Chuchinka Creek Tributary	599	MEMPR: 93J851413			X
Unnamed Chuchinka Creek Tributary	619	Hydrology Baseline / MEMPR: 93J851414		X	X
Angusmac Creek	665	Hydrology Baseline		X	
Central Interior Hydrological Zone					
Hart Lake (Crooked River)	677	BC MoE: E227432 / E227430	X		
Crooked River	677	Water Quality Baseline	X		X
Unnamed Davie Lake Tributary	679	Water Quality Baseline	X		
Unnamed Merton Creek Tributary	700	MEMPR: 93J851355			X
Unnamed Slender Lake Tributary	710	MEMPR: 93J851310			X
Muskeg River	720	AMEC Water Quality Baseline / MEMPR: 93J851819	X		X
Unnamed Mossvale Lake Tributary	732	MEMPR: 93J851492			X

Table 2-1 Historical and Baseline Field Survey Sampling Locations (cont'd)

Location	Crossing Number	Source	Data Collected		
			Water Sample	TSS Sample	Bottom Sediments Sample
Central Interior Hydrological Zone (cont'd)					
Unnamed Great Beaver Lake Tributary	759	MEMPR: 93J853176			X
Unnamed Great Beaver Lake Tributary	765	MEMPR: 93J851052			X
Unnamed Great Beaver Lake Tributary	782	MEMPR: 93J853182			X
Unnamed Necoslie River Tributary	793	Hydrology Baseline		X	
Unnamed Necoslie River Tributary	826	MEMPR: 93K081434			X
Necoslie River	5003	BC MoE: 400801	X		
Stuart River	3076	BC MoE: 400488 / 920101	X		
Pitka Creek	3077	Hydrology Baseline		X	
Sutherland River	888	BC MoE: E268330	X		
Duncan Creek	907	MEMPR: 93K071365			X
Sheraton Creek	981	MEMPR: 93K051248			X
Tintagel Creek	6000	Water Quality Baseline / MEMPR: 93K051249	X		X
Stearns Creek	6004	Water Quality Baseline	X		
Unnamed Kager Lake Tributary	6013	BC MoE: E208132 / MEMPR: 93K041102	X		X
Endako River (Burns Lake)	1001	Water Quality Baseline / BC MoE 400375 / 400379	X		X
Unnamed Maxan Creek Tributary	1017	MEMPR: 93K041053			X
Unnamed Maxan Creek Tributary	1024	Hydrology Baseline		X	
Foxy Creek (Downstream Reach)	1923	Water Quality Baseline / BC MoE 700108 / MEMPR: 93L861710	X		X
Foxy Creek (Upstream Reach)	1032	BC MoE 400763 / 400764	X		
Klo Creek	3090	BC MoE: E228337 / MEMPR: 93L861938	X		X
Unnamed Klo Creek Tributary	1041	Hydrology Baseline		X	
Buck Creek	5018	BC MoE: E228317	X		
Parrott Creek	1052	Hydrology Baseline		X	
24.5 Mile Creek	2046	MEMPR: 93L861939			X

Table 2-1 Historical and Baseline Field Survey Sampling Locations (cont'd)

Location	Crossing Number	Source	Data Collected		
			Water Sample	TSS Sample	Bottom Sediments Sample
Central Interior Hydrological Zone (cont'd)					
Unnamed Morice River Tributary	1946	MEMPR: 93L861644			X
Unnamed Morice River Tributary	1949	MEMPR: 93L861645			X
Unnamed Gosnell Creek Tributary	1095	MEMPR: 93L861540			X
Unnamed Gosnell Creek Tributary	1110	MEMPR: 93L861806			X
Gosnell Creek	1111	Hydrology Baseline		X	
Unnamed Gosnell Creek Tributary	1112	MEMPR: 93L861536			X
Unnamed Burnie River Tributary	1124	MEMPR: 103I787714			X
Hunter Creek	3197	BC MoE: E256659	X		
Unnamed Kitimat River Tributary	1181	MEMPR: 103I787714			X
Unnamed Kitimat River Tributary	1182	MEMPR: 103I787713			X
Unnamed Kitimat River Tributary	1191	Hydrology Baseline		X	
Unnamed Kitimat River Tributary	1195	MEMPR: 103I787720			X
Unnamed Kitimat River Tributary	1205	MEMPR: 103I787725			X
Chist Creek	1222	BC MoE: E256660 / E256662	X		
Cecil Creek	1223	BC MoE: E239479 / MEMPR: 103I781055	X		X
Trout Creek	3130	BC MoE: E256654	X		
Unnamed Kitimat River Tributary	3136	MEMPR: 103I781014			X
Duck Creek	3140	MEMPR: 103I781014			X
Anderson Creek	1274	Water Quality Baseline / BC MoE E216322	X		
Moore Creek	3141	Water Quality Baseline	X		

2.3.2 Sampling Procedures and Methods

Most sampling locations were accessed by helicopter, using a handheld GPS (global positioning system) unit to identify the RoW watercourse crossing location. For the Alberta sites that were accessed by roads, sampling was performed at the nearest accessible location to the RoW watercourse crossing location.

Sampling techniques for water quality followed protocols developed by the United States Geological Survey (USGS), as well as codes of practice developed by the British Columbia Ministry of Environment (USGS 1998, 1999; BC MoE 1997). Bulk water samples were collected in a large clean plastic container. Water samples were poured into individual glass and plastic bottles and some subsamples were preserved with acid preservative (e.g., sulphuric or nitric acid). Samples were placed in a cooler before being shipped to the AMEC laboratory in Edmonton.

Sediment samples were taken from the same locations as the water samples when possible. Sediment samples were not taken from the smaller streams where substrates were dominated by coarse materials such as gravel and cobbles. An Ekman dredge was used in watercourses where substrates were dominated by fine-textured particles. These sediment samples were mixed together in a clean aluminium pan before being transferred into two clean plastic freezer bags. The bags were sealed and placed in a cooler before being shipped to the AMEC laboratory in Edmonton.

For a summary of the water and sediment samples analysis parameters, see Table 2-2.

Table 2-2 Water and Sediment Quality Parameters Analyzed

Sample Type	Parameter		
Water	Field	<ul style="list-style-type: none"> • pH • dissolved oxygen (DO) 	<ul style="list-style-type: none"> • temperature • specific conductivity
	Conventional parameters and major ions	<ul style="list-style-type: none"> • pH • specific conductivity • total alkalinity • total dissolved solids (TDS) • total hardness • total suspended solids (TSS) • turbidity 	<ul style="list-style-type: none"> • bicarbonate • calcium • carbonate • chloride • magnesium • potassium • sodium • sulphate
	Nutrients	<ul style="list-style-type: none"> • ammonia as N • nitrate as N • nitrite as N 	<ul style="list-style-type: none"> • total Kjeldahl nitrogen (TKN) • total phosphorus (TP)
	Organics	<ul style="list-style-type: none"> • chemical oxygen demand (COD) • oil and grease • phenol 	<ul style="list-style-type: none"> • dissolved organic carbon (DOC) • total organic carbon (TOC) • total petroleum hydrocarbons (TPH)

Table 2-2 Water and Sediment Quality Parameters Analyzed (cont'd)

Sample Type	Parameter		
Water (cont'd)	Total and dissolved metals	<ul style="list-style-type: none"> • aluminum • antimony • arsenic • barium • beryllium • boron • cadmium • chromium • cobalt • copper • iron • lead 	<ul style="list-style-type: none"> • manganese • mercury • molybdenum • nickel • phosphorus • selenium • silicon • silver • thallium • uranium • vanadium • zinc
Sediment	Conventional parameters and organics	<ul style="list-style-type: none"> • texture: sand, silt, clay • total organic carbon (TOC) 	
	Total metals	<ul style="list-style-type: none"> • aluminum • arsenic • barium • cadmium • calcium • chromium • cobalt • copper • iron • lead • magnesium 	<ul style="list-style-type: none"> • manganese • mercury • molybdenum • nickel • phosphorus • potassium • selenium • silver • sodium • thallium • vanadium • zinc

The following quality assurance (QA) and quality control (QC) methods were used to obtain accurate and reliable data:

- Field blanks were used to detect sample contamination during the collection, shipping and analysis of samples.
- Trip blanks were used to detect sample contamination during transport.
- Duplicate laboratory samples were used to assess the reproducibility of the laboratory results (i.e., lab methodology and analyses). At least 10% of the samples submitted to the laboratory were analyzed as duplicates.
- The laboratory used standard QA and QC methods (including method blanks and the use of spike samples), for accuracy and to avoid contaminated equipment.

2.3.3 Applicable Guidelines

Specific federal and provincial guidelines were used to detect exceedances in water and sediment quality parameters under baseline conditions. As baseline studies were done in both Alberta and British Columbia, the application of water quality guidelines was dependant on the jurisdiction. The guidelines used to assess baseline water and sediment quality were:

- Canadian Council of the Ministers of the Environment (CCME) *Canadian Environmental Quality Guidelines (CEQG) for the Protection of Aquatic Life*, applicable in both jurisdictions (CCME 2007)
- *Alberta Surface Water Quality Guidelines (ASWQG) for the Protection of Aquatic Life*, applicable in Alberta (AENV 1999)
- *British Columbia Approved Water Quality Guidelines (BCAWQG) for the Protection of Aquatic Life*, applicable in British Columbia (BC MWLAP 2006a)
- *Guidelines for Canadian Drinking Water Quality (GCDWQ)*, applicable in both Alberta and British Columbia (Health Canada 2008)
- *British Columbia Water Quality Guidelines for Drinking and Recreational Uses (BCWQGD)*, applicable in British Columbia (BC MWLAP 2006b)
- CCME *Canadian Sediment Quality Guidelines (CSQG)*, applicable in both jurisdictions (CCME 2002)
- *Working Sediment Quality Guidelines for British Columbia (BCSQG)*, applicable in British Columbia (BC MWLAP 2006b)

For a list of parameters and their corresponding guidelines, see Table 2-3.

Table 2-3 Federal and Provincial Water Quality Guidelines used in Baseline Studies

Parameter (Water Quality)	Units	Protection of Aquatic Life			Human Consumption	
		Canadian Environmental Quality Guidelines (CEQG)	Alberta Surface Water Quality Guidelines (ASWQG)	British Columbia Approved Water Quality Guidelines (BCAWQG)	Guidelines for Canadian Drinking Water Quality (GCDWQ)	British Columbia Water Quality Guidelines for Drinking and Recreational Water Uses (BCWQGD)
		CCME 2007	AENV 1999	BC MWLAP 2006a	Health Canada 2008	BC MWLAP 2006a
Field Measured						
pH	pH Units	6.5 to 9.0	6.5 to 8.5 ^{b1}	6.5 to 9 ^{c1}	6.5 to 8.5 ^{d1}	6.5 to 8.5 ^{e1}
Conductivity	µS/cm	-	-	-	-	-
Conductivity, Specific	µS/cm	-	-	-	-	700
Dissolved Oxygen (DO)	mg/L (ppm)	6.5 to 9.5 ^{a1}	5	5 - 9 ^{c2}	-	-
Dissolved Oxygen, saturation	%	-	-	-	-	-
Temperature	°C	-	b2	c3	≤15 ^{d1}	15 ^{e1}
Conventional Parameters and Major Ions						
pH	pH Units	6.5 to 9.0	6.5 to 8.5 ^{b1}	6.5 to 9 ^{c1}	6.5 to 8.5 ^{d1}	6.5 to 8.5 ^{e1}
Conductivity, Specific	µS/cm	-	-	-	-	700
Total Dissolved Solids (TDS)	mg/L (ppm)	-	-	-	≤500 ^{d1}	≤500 ^{e1}
Alkalinity, Total	mg/L (ppm)	-	-	<10 ^{c4, c5}	-	-
Hardness, Total	mg/L (ppm)	-	-	-	-	100 ^{e2}

Table 2-3 Federal and Provincial Water Quality Guidelines used in Baseline Studies (cont'd)

Parameter (Water Quality)	Units	Protection of Aquatic Life			Human Consumption	
		Canadian Environmental Quality Guidelines (CEQG)	Alberta Surface Water Quality Guidelines (ASWQG)	British Columbia Approved Water Quality Guidelines (BCAWQG)	Guidelines for Canadian Drinking Water Quality (GCDWQ)	British Columbia Water Quality Guidelines for Drinking and Recreational Water Uses (BCWQGD)
		CCME 2007	AENV 1999	BC MWLAP 2006a	Health Canada 2008	BC MWLAP 2006a
Conventional Parameters and Major Ions (cont'd)						
Total Suspended Solids (TSS)	mg/L (ppm)	-	<i>b3</i>	25 ^{c6}	-	-
Turbidity	NTU	-	-	8 ^{c7}	1 ^{d2}	1 ^{e3}
Bicarbonate	mg/L (ppm)	-	-	-	-	-
Calcium	mg/L (ppm)	-	-	4 ^{c5, c8}	-	-
Carbonate	mg/L (ppm)	-	-	-	-	-
Chloride	mg/L (ppm)	-	-	-	≤250 ^{d1}	≤250 ^{e5}
Fluoride	mg/L (ppm)	-	-	0.2 (0.3) ^{c9}	1.5 ^{d3}	1.5
Magnesium	mg/L (ppm)	-	-	-	-	100 ^{e4}
Potassium	mg/L (ppm)	-	-	-	-	-
Sodium	mg/L (ppm)	-	-	-	≤200 ^{d1}	≤200 ^{e5}
Sulphate	mg/L (ppm)	-	-	100 ^{c10}	≤500 ^{d1}	≤500 ^{e1}
Nutrients						
Chlorophyll <i>a</i>	mg/L (ppm)	-	-	100 ^{c11}	-	0.0025
Ammonia	mg/L (ppm)	7.0 - 48.3 ^{a2}	1.3 - 32.6 ^{b4}	0.7 - 28.3 ^{c12}	-	-
Nitrate + Nitrite	mg/L (ppm)	-	-	-	-	-
Nitrate	mg/L (ppm)	-	-	200	45 ^{d4}	45 ^{e6}

Table 2-3 Federal and Provincial Water Quality Guidelines used in Baseline Studies (cont'd)

Parameter (Water Quality)	Units	Protection of Aquatic Life			Human Consumption	
		Canadian Environmental Quality Guidelines (CEQG)	Alberta Surface Water Quality Guidelines (ASWQG)	British Columbia Approved Water Quality Guidelines (BCAWQG)	Guidelines for Canadian Drinking Water Quality (GCDWQ)	British Columbia Water Quality Guidelines for Drinking and Recreational Water Uses (BCWQGD)
		CCME 2007	AENV 1999	BC MWLAP 2006a	Health Canada 2008	BC MWLAP 2006a
Nutrients (cont'd)						
Nitrite	mg/L (ppm)	0.06	-	0.06 - 0.6 ^{c13}	3.2 ^{d4}	-
Nitrogen, Total Kjeldahl (TKN)	mg/L (ppm)	-	1	-	-	-
Phosphorus, Dissolved	mg/L (ppm)	-	-	-	-	-
Phosphorus, Total	mg/L (ppm)	a3	0.05	0.0015 ^{c14}	-	0.01 ^{e7}
Organic Carbon, Dissolved (DOC)	mg/L (ppm)	-	-	c15	-	-
Organic Carbon, Total (TOC)	mg/L (ppm)	-	-	c15	-	4 ^{e9}
Total Metals						
Aluminum (Al)	µg/L (ppb)	5 or 100 ^{a4}	-	c16	100 ^{d5}	e10
Antimony (Sb)	µg/L (ppb)	-	-	20 ^{c5, c17}	6 ^{d2}	6 ^{e11}
Arsenic (As)	µg/L (ppb)	5	-	5	10 ^{d2}	25 ^{e11}
Barium (Ba)	µg/L (ppb)	-	-	5000 ^{c5, c18}	1,000 ^{d2}	1000 ^{e8}
Beryllium (Be)	µg/L (ppb)	-	-	5.3 ^{c5, c19}	-	e8
Boron (B)	µg/L (ppb)	-	-	-	5,000 ^{d2}	5000 ^{e8}
Cadmium (Cd)	µg/L (ppb)	0.017 ^{a5}	-	0.01 ^{c5, c18, c20}	5 ^{d1}	5 ^{e8}

Table 2-3 Federal and Provincial Water Quality Guidelines used in Baseline Studies (cont'd)

Parameter (Water Quality)	Units	Protection of Aquatic Life			Human Consumption	
		Canadian Environmental Quality Guidelines (CEQG)	Alberta Surface Water Quality Guidelines (ASWQG)	British Columbia Approved Water Quality Guidelines (BCAWQG)	Guidelines for Canadian Drinking Water Quality (GCDWQ)	British Columbia Water Quality Guidelines for Drinking and Recreational Water Uses (BCWQGD)
		CCME 2007	AENV 1999	BC MWLAP 2006a	Health Canada 2008	BC MWLAP 2006a
Total Metals (cont'd)						
Chromium (Cr)	µg/L (ppb)	1 ^{a6}	-	1 ^{c5, c21}	50 ^{d1}	50 ^{e8}
Cobalt (Co)	µg/L (ppb)	-	-	0.9 ^{c5, c22}	-	-
Copper (Cu)	µg/L (ppb)	2 ^{a7}	8.1 - 47 ^{b5}	6.7 ^{c23}	≤1,000 ^{d1}	≤1,000 ^{e1}
Iron (Fe)	µg/L (ppb)	300	-	300 ^{c5}	≤300 ^{d1}	≤300 ^{e1, e8}
Lead (Pb)	µg/L (ppb)	1 ^{a8}	-	3 ^{c24}	10	10
Manganese (Mn)	µg/L (ppb)	-	-	800 ^{c25}	≤50 ^{d1}	≤50 ^{e1}
Mercury (Hg)	µg/L (ppb)	0.004 ^{a9}	0.013 ^{b6}	0.1	1 ^{d2}	1
Molybdenum (Mo)	µg/L (ppb)	73	-	2,000	-	250
Nickel (Ni)	µg/L (ppb)	25 ^{a10}	-	25 ^{c5, c26}	-	-
Selenium (Se)	µg/L (ppb)	1	-	2	10 ^{d2}	10
Silicon (Si)	µg/L (ppb)	-	-	-	-	-
Silver (Ag)	µg/L (ppb)	0.1	-	0.1 (3.0) ^{c27}	-	-
Strontium (Sr)	µg/L (ppb)	-	-	-	-	-
Thallium (Tl)	µg/L (ppb)	0.8	-	0.3 ^{c5, c28}	-	0.5 ^{e12, e13}
Uranium (U)	µg/L (ppb)	-	-	300 ^{c5}	20 ^{d2}	100
Vanadium (V)	µg/L (ppb)	-	-	-	-	100 ^{e12}
Zinc (Zn)	µg/L (ppb)	30	-	33 ^{c29}	≤5,000 ^{d1}	≤5,000 ^{e1}

Table 2-3 Federal and Provincial Water Quality Guidelines used in Baseline Studies (cont'd)

Parameter (Sediment Quality)	Units	Protection of Aquatic Life			
		CCME Guidelines		British Columbia	
		CCME 2002		BC MWLAP 2006b	
		Interim Sediment Quality Guidelines (ISQG)	Probable Effect Levels (PEL)	Screening Level Concentration (SLC)	Probable Effect Levels (PEL)
Texture and Organic Content					
Texture - Sand	%	-	-	-	-
Texture - Silt	%	-	-	-	-
Texture - Clay	%	-	-	-	-
Organic Carbon, Total (TOC)	µg/g (ppm)	-	-	-	-
Total Metals					
Aluminum (Al)	µg/g (ppm)	-	-	-	-
Arsenic (As)	µg/g (ppm)	5.9	17.0	-	17
Barium (Ba)	µg/g (ppm)	-	-	-	-
Cadmium (Cd)	µg/g (ppm)	0.6	3.5	-	3.5
Calcium (Ca)	µg/g (ppm)	-	-	-	-
Chromium (Cr)	µg/g (ppm)	37.3	90.0	-	90
Cobalt (Co)	µg/g (ppm)	-	-	-	-
Copper (Cu)	µg/g (ppm)	35.7	197	-	197
Iron (Fe)	µg/g (ppm)	-	-	21200 ^{f1}	-
Lead (Pb)	µg/g (ppm)	35.0	91.3	-	91
Magnesium (Mg)	µg/g (ppm)	-	-	-	-
Manganese (Mn)	µg/g (ppm)	-	-	-	-

Table 2-3 Federal and Provincial Water Quality Guidelines used in Baseline Studies (cont'd)

Parameter (Sediment Quality)	Units	Protection of Aquatic Life			
		CCME Guidelines		British Columbia	
		CCME 2002		BC MWLAP 2006b	
		Interim Sediment Quality Guidelines (ISQG)	Probable Effect Levels (PEL)	Screening Level Concentration (SLC)	Probable Effect Levels (PEL)
Total Metals (cont'd)					
Mercury (Hg)	µg/g (ppm)	0.17	0.486	-	0.486
Molybdenum (Mo)	µg/g (ppm)	-	-	-	-
Nickel (Ni)	µg/g (ppm)	-	-	16 ^{f1}	-
Phosphorus (P)	µg/g (ppm)	-	-	-	-
Potassium (K)	µg/g (ppm)	-	-	-	-
Selenium (Se)	µg/g (ppm)	-	-	-	5
Silver (Ag)	µg/g (ppm)	-	-	-	0.5 ^{f2}
Sodium (Na)	µg/g (ppm)	-	-	-	-
Thallium (Tl)	µg/g (ppm)	-	-	-	-
Vanadium (V)	µg/g (ppm)	-	-	-	-
Zinc (Zn)	µg/g (ppm)	123	315	-	315
<p>NOTES:</p> <p>PART 1. WATER QUALITY GUIDELINES FOR THE PROTECTION OF AQUATIC LIFE</p> <p>Canadian Environmental Quality Guidelines (CEQG) (CCME 2007)</p> <p>a1 = Guideline is based on temperature of biota. In this case, the cold water biota guidelines for both early life (9.5 mg/L) and other life stages (6.5 mg/L) are shown.</p> <p>a2 = Guideline depends on temperature and pH. The value ranges between 6.98 mg/L (pH= 7.0, temperature= 15°C) and 48.3 mg/L (pH= 6.5, temperature= 5°C).</p> <p>a3 = The trophic status of lakes is assessed using the total phosphorus concentrations. The Canadian Trigger Ranges are as follows: ultra-oligotrophic - <0.004 mg/L; oligotrophic - 0.004 to 0.01 mg/L; mesotrophic - 0.01 to 0.02 mg/L; eutrophic - 0.035 to 0.1 mg/L</p>					

Table 2-3 Federal and Provincial Water Quality Guidelines used in Baseline Studies (cont'd)

NOTES: (cont'd)

Canadian Environmental Quality Guidelines (CEQG) (CCME 2007) (cont'd)

a4 = Guideline = 5 µg/L at pH < 6.5, [Ca²⁺] < 4 mg/L and DOC < 2 mg/L; Guideline = 100 µg/L at pH ≥ 6.5, [Ca²⁺] ≥ 4 mg/L and DOC ≥ 2 mg/L.

a5 = Cadmium guideline = 10[0.86 [log(hardness)] - 3.2].

a6 = Guideline is for hexavalent chromium (CrVI) because its guideline is more stringent than the trivalent chromium (CrIII) guideline of 8.9 µg/L.

a7 = Copper guideline depends on [CaCO₃]. Guideline shown is for when [CaCO₃] is 0-120 mg/L. At 120-180 mg/L of CaCO₃, guideline = 3 µg/L; and at >180 mg/L CaCO₃, guideline = 4 µg/L.

a8 = Lead guideline depends on [CaCO₃]. Guideline shown is for CaCO₃ at 0-60 mg/L. At 60-120 mg/L CaCO₃, guideline = 2 µg/L; at 120-180 mg/L CaCO₃, guideline = 4 µg/L; and at >180 mg/L CaCO₃, guideline = 7 µg/L.

a9 = Guideline for methyl-mercury provided. The guideline for total inorganic mercury is 0.1 µg/L.

a10 = Nickel guideline depends on [CaCO₃]. Guideline shown is for CaCO₃ at 0-60 mg/L. At 60-120 mg/L CaCO₃, guideline = 65 µg/L; at 120-180 mg/L CaCO₃, guideline = 110 µg/L; and at >180 mg/L CaCO₃, guideline = 150 µg/L.

Alberta Surface Water Quality Guidelines (ASWQG) (AENV 1999a)

b1 = The pH is to be in the range of 6.5 to 8.5 but not altered by more than 0.5 pH units from background values.

b2 = Not to be increased by more than 3°C above ambient water temperature.

b3 = Not to be increased by more than 10 mg/L over background value.

b4 = Acute values based on one-hour average concentration of total ammonia-nitrogen (mg nitrogen/L). The guideline depends on pH and the presence of salmonids, ranging from 0.88 mg/L (pH = 9.0; salmonids present) to 48.8 mg/L (pH = 6.5; no salmonids)

b5 = Guideline depends on hardness and applies to acid-extractable copper concentrations governed by the following equation: [Max] = e[0.979123 * ln(hardness) - 8.64497]. The copper guideline ranges from 8.1 µg/L (hardness = 50 mg/L) to 47 µg/L (hardness = 300 mg/L).

b6 = Aesthetic objective.

British Columbia Approved Water Quality Guidelines (BCAWQG) (BC MWLAP 2006a)

c1 = The criteria should be used cautiously if changes in dissolved carbon dioxide concentrations due to changes in pH decrease below 10 µmol/L or increase beyond 1,360 µmol/L.

c2 = Dependant on the life stage where the instantaneous minimum concentration of 5 mg/L refers to all stages except buried embryos / alevins, which have an instantaneous minimum concentration of 9 mg/L.

Table 2-3 Federal and Provincial Water Quality Guidelines used in Baseline Studies (cont'd)

NOTES: (cont'd)

British Columbia Approved Water Quality Guidelines (BCAWQG) (BC MWLAP 2006a) (cont'd)

- c3 = Generally $\pm 1^{\circ}\text{C}$ above background temperature. In waterbodies or streams with rearing bull trout and / or Dolly Varden, the temperature needed for rearing must not exceed 15°C , spawning temperature must not exceed 10°C , and incubation temperatures must not exceed 10°C and must not decrease below 2°C .
- c4 = This guideline serves as a classification guide to rivers and streams, where concentrations (as CaCO_3) of less than 10 mg/L means the water is highly sensitive to acid inputs; 10-20 mg/L is viewed as moderately sensitive; and, >20 mg/L generally has low sensitivity to acid inputs.
- c5 = Not yet an approved criteria. Used in BC as a working guideline until it is approved and incorporated into the official list.
- c6 = 25 mg/L in 24 hours when the background level is less than 25 mg/L. Mean of 5 mg/L over 30 days when background concentration is less than 25 mg/L.
- c7 = 8 NTU in 24 hours when the background level is less than 8 NTU. Mean of 2 NTU over 30 days when background concentration is less than 8 NTU.
- c8 = When calcium concentrations are less than 4 mg/L, water is highly sensitive to acid inputs. The more restrictive guideline between calcium and alkalinity applies.
- c9 = A guideline of 0.2 mg/L applies when hardness is < 50 mg/L as CaCO_3 . The guideline increases to 0.3 mg/L at higher hardness concentrations.
- c10 = At a concentration exceeding 50 mg/L, the health of aquatic mosses should be monitored occasionally.
- c11 = In units of mg/m². This guideline only applies to natural periphytic algae growing in streams.
- c12 = The ammonia guideline varies as a function of temperature and pH, where the most stringent guideline of 0.681 applies when $T = 6.0^{\circ}\text{C}$ and $\text{pH} = 9.0$, while the least stringent guideline of 28.3 applies when $T = 1.0^{\circ}\text{C}$ and $\text{pH} = 6.5$.
- c13 = Dependent on the concentration of chloride. <2 mg/L of chloride results in a nitrite guideline of 0.06 mg/L, while >10 mg/L of chloride results in a nitrite guideline of 0.6 mg/L.
- c14 = Total phosphorous in lakes is either the spring overturn concentration, if the residence time of the epilimnetic water is greater than 6 months, or the mean epilimnetic growing season concentration, if the residence time of the epilimnetic water is less than 6 months.
- c15 = 30-day median $\pm 20\%$ of the median background concentration.
- c16 = Guideline only exists for dissolved fraction of this metal.
- c17 = Based on proposed Ontario guideline.
- c18 = Under Ministry review.
- c19 = Chronic criterion.
- c20 = Cadmium guideline depends on hardness where the given value of 0.01 $\mu\text{g/L}$ is at a hardness concentration of 30 mg/L as CaCO_3 . This guideline can be calculated using the following equation: $[\text{Max}] = 10(0.86[\log\{\text{hardness}\}]-3.2)$.
- c21 = Based on the more stringent guideline for hexavalent chromium (CrVI). Guideline for trivalent chromium (CrIII) is 9 $\mu\text{g/L}$.

Table 2-3 Federal and Provincial Water Quality Guidelines used in Baseline Studies (cont'd)

NOTES: (cont'd)

British Columbia Approved Water Quality Guidelines (BCAWQG) (BC MWLAP 2006a) (cont'd)

c22 = Based on Ontario water quality objective.

c23 = Guideline based on a hardness concentration ≤ 50 mg/L as CaCO₃. The guideline value can be calculated using the equation: $[\text{Max}] = (0.094 * (\text{hardness}) + 2)$.

c24 = The guideline is equal to 3 µg/L when hardness is ≤ 8 mg/L as CaCO₃. When hardness is > 8 mg/L as CaCO₃, the guideline is calculated using the equation: $[\text{Max}] = e(1.273 \ln [\text{hardness}] - 1.460)$.

c25 = The guideline is equal to 0.8 mg/L (800 µg/L) when hardness is 25 mg/L as CaCO₃. The guideline is calculated using the equation: $[\text{Max}] = 0.01102 * [\text{hardness}] + 0.54$.

c26 = The guideline is 25 µg/L within a hardness range of 0 to 60 mg/L as CaCO₃; 65 µg/L within a hardness range of 60 to 120 mg/L as CaCO₃; 110 µg/L within a hardness range of 120 to 180 mg/L as CaCO₃; and, 150 µg/L when hardness is greater than 180 mg/L.

c27 = The guideline is 0.1 µg/L when hardness is ≤ 100 mg/L as CaCO₃ and 3 µg/L when hardness is > 100 mg/L as CaCO₃.

c28 = The guideline is 33 µg/L when hardness is ≤ 90 mg/L as CaCO₃. When hardness is > 90 mg/L as CaCO₃, the guideline is calculated using the equation: $[\text{Max}] = 33 + (0.75 * ([\text{hardness}] - 100))$.

c29 = The guideline applies when the pH is ≥ 6.5 . If the pH is < 6.5 , use the following equation: $[\text{Max}] = e(1.209 - 2.426 \text{ pH} + 0.286 \text{ K})$, where $\text{K} = \text{pH} - 2$.

PART 2. WATER QUALITY GUIDELINES FOR HUMAN CONSUMPTION

Guidelines for Canadian Drinking Water Quality (GCDWQ) (Health Canada 2008)

d1 = Aesthetic objective.

d2 = Maximum allowable concentration (MAC).

d3 = It is recommended that the concentration be adjusted to 0.8 to 1.0 mg/L, which is the optimum range for the control of dental cavities.

d4 = Equivalent to 10 mg/L as nitrate-nitrogen. Where nitrate and nitrite are determined separately, levels of nitrite should not exceed 3.2 mg/L.

d5 = A health-based guideline for aluminum in drinking water has not been established. Operational guidance values of less than 100 µg/L total aluminum for conventional treatment plants and less than 200 µg/L total aluminum for other types of treatments.

British Columbia Water Quality Guidelines for Drinking and Recreational Water Uses (BCWQGD) (BC MWLAP 2006a)

e1 = Aesthetic objective.

e2 = A guideline of 80 mg/L to 100 mg/L as CaCO₃ is acceptable; Over 200 mg/L as CaCO₃ is poor but can be tolerated; Concentrations over 500 mg/L as CaCO₃ are normally not tolerated.

Table 2-3 Federal and Provincial Water Quality Guidelines used in Baseline Studies (cont'd)

NOTES: (cont'd)

British Columbia Water Quality Guidelines for Drinking and Recreational Water Uses (BCWQGD) (BC MWLAP 2006a) (cont'd)

e3 = 1 NTU is the maximum and less than or equal to 5 NTU is the aesthetic objective.

e4 = 100 mg/L is the taste threshold for sensitive people; 500 mg/L is the taste threshold for average people; A concentration over 700 mg/L has a laxative effect for everyone.

e5 = Aesthetic objective. The drinking water guideline for people with sodium restricted diets is 20 mg/L.

e6 = A maximum concentration of 10 mg/L of nitrate-nitrogen is used if nitrogen compounds are determined separately.

e7 = Drinking water guideline is specific for lakes.

e8 = The guideline for this parameter is currently under review and may be updated in the near future.

e9 = The guideline is for source water that has been treated by chlorination.

e10 = Guideline only exists for dissolved fraction of this metal.

e11 = Proposed interim maximum.

e12 = Not yet an approved criteria. Used in British Columbia as a working guideline until it is approved and incorporated into the official list.

e13 = Maximum contaminant level goal.

PART 3. SEDIMENT QUALITY GUIDELINES FOR THE PROTECTION OF AQUATIC LIFE

BCSQWG (BC MWLAP 2006b)

Explanation

f1 = Lowest effect level based on SLC.

f2 = Based on the Ontario Sediment Quality Guideline.

3 Results of Baseline Investigations

The results of the baseline investigations – both historical and field survey data – are listed in the following (see also tables in Appendix A and Appendix B).

3.1.1 Water Quality

Prairies Hydrological Zone

The Prairies hydrological zone extends from near Bruderheim, in the North Saskatchewan River Basin, through to the edge of the Athabasca River Basin. Water quality conditions are described for the North Saskatchewan River (Crossing 1) and the Rivière Qui Barre (Crossing 3005). Watercourse drainage areas in this hydrological zone range between 1 and 31,230 km².

The median dissolved oxygen (DO) concentration of 10.9 mg/L in the North Saskatchewan River indicates that the river is well oxygenated (see Table A-1). The median water pH value was 8.1. The total dissolved solids (TDS) median concentration was 220 mg/L.

The nutrient concentrations in the North Saskatchewan River were generally low or slightly elevated. The median ammonia and nitrate plus nitrite concentrations were 0.1 mg/L and 0.2 mg/L, respectively. The median total phosphorus concentration (0.05 mg/L) exceeded the ASWQG of 0.05 mg/L.

The median total suspended solids (TSS) concentration was 18 mg/L in the North Saskatchewan River (see Table A-2). A TSS concentration of 105 mg/L was measured during the 2005 fall hydrology field program in the Rivière Qui Barre.

Total metals were measured in the North Saskatchewan River throughout 2002 (see Table A-3). The median concentration of most metals was below guidelines. Guideline exceedances of the CEQG or GCDWQ were measured for the following parameters:

- The median total aluminum concentration of 996 µg/L exceeded the CEQG and GCDWQ of 100 µg/L.
- The median total cadmium concentration of 0.03 µg/L exceeded the CEQG of 0.017 µg/L.
- The median total iron concentration of 549 µg/L exceeded the CEQG of 300 µg/L.

Foothills Hydrological Zone

The Foothills hydrological zone extends from the Athabasca River Basin just east of the Athabasca River to the eastern portions of the Peace River Basin. Baseline water quality conditions are described for seven representative watercourses, including detailed descriptions for the Athabasca (Crossing 1975), Pembina (Crossing 75), Little Paddle (Crossing 100) and Smoky Rivers (Crossing 3174).

Watercourse drainage areas in this hydrological zone range between 0.3 and 31,250 km². The surveyed watercourses have drainage areas ranging from 10.2 km² for an unnamed Washkahigan Creek tributary (Crossing 1602) to 31,250 km² for the Athabasca River.

The baseline DO concentrations were similar at all locations being within 11.0 and 11.3 mg/L (see Table A-4). These measurements, taken in fall, indicate that the larger rivers within this hydrological zone are well oxygenated. The pH ranged between 7.8 and 8.5. Field measured pH levels in the Pembina and Athabasca Rivers were equivalent to the ASWQG of 8.5.

Specific conductivity ranged from 303 to 342 $\mu\text{S}/\text{cm}$ and TDS ranged from 156 to 196 mg/L. The surveyed watercourses were adequately buffered to acid deposition as the alkalinity concentration ranged between 126 and 172 mg/L. The water hardness was also high, with concentrations ranging between 153 and 165 mg/L.

Bicarbonate (153 to 210 mg/L) and calcium (42 to 45 mg/L) were the dominant ions measured.

All these parameters did not change between watersheds and showed similar major ions content and physical characteristics of water quality.

Nutrient concentrations were generally low. Nitrite was measured in all surveyed watercourses, while most other parameters were only measured in the Pembina and Little Paddle Rivers. The median ammonia concentration (0.06 mg/L) in the Little Paddle River was higher than the concentration recorded in the Pembina River (0.004 mg/L). Nitrite was only detected in the Little Paddle River with a median concentration 0.003 mg/L.

The median concentrations of total Kjeldahl nitrogen (TKN) (1.2 mg/L) and total phosphorus (0.2 mg/L) in the Little Paddle River exceeded the ASWQG of 1 and 0.05 mg/L, respectively. These parameters were measured below guidelines concentrations in the Pembina River.

A median TSS concentration of 39 mg/L was measured in the Little Paddle River between 1995 and 1997 (see Table A-5). A historical measurement of TSS (4 mg/L) was also completed in the Pembina River in fall 2002. Five crossings were sampled for TSS during the 2005 baseline field surveys. The TSS concentration ranged from less than 2 mg/L in the Sakwatamau River (Crossing 120) to 9 mg/L in the Smoky River.

Total and dissolved metals were measured in the Smoky River (see Table A-6). Total iron was also measured in the Pembina and Athabasca Rivers. The median concentration of most metals was below guidelines. Guideline exceedances of the CEQG were measured for the following parameters:

- A total aluminum concentration (115 $\mu\text{g}/\text{L}$) in the Smoky River exceeded the CEQG and GCDWQ of 100 $\mu\text{g}/\text{L}$.
- The median total iron concentration (1,005 $\mu\text{g}/\text{L}$) in the Little Paddle River exceeded the CEQG of 300 $\mu\text{g}/\text{L}$.

Generally, a lower concentration of the dissolved metals compared to total metals was measured.

Rocky Mountains Hydrological Zone

The Rocky Mountains hydrological zone extends through the Peace River Basin from slightly east of the Alberta-British Columbia border to Davie Lake, north of Prince George. Baseline water quality conditions are described for six watercourses, including detailed descriptions for the Wapiti (Crossing 3038), Murray (Crossing 3051) and Missinka Rivers (Crossing 480).

Watercourse drainage areas in this hydrological zone range between 1 and 5,770 km². The surveyed watercourses have drainage areas ranging from 2.53 km² for an unnamed Chuchinka Creek tributary (Crossing 619) to 5,770 km² for the Wapiti River.

The baseline DO concentration ranged between 10.4 and 11.9 mg/L (see Table A-7). These measurements indicate that watercourses within this hydrological zone are well oxygenated. The pH ranged between 7.8 and 8.4. No guideline exceedances were measured for DO or pH.

Specific conductivity ranged from 120 to 303 µS/cm and TDS ranged from 76 to 172 mg/L. The surveyed watercourses were adequately buffered to acid deposition as the alkalinity concentration ranged between 62 and 138 mg/L. The water hardness was also moderate to high, with concentrations ranging between 81 and 155 mg/L. The concentrations for TDS, alkalinity and hardness in upland watercourses were substantially lower than concentrations measured in the Wapiti River, a lowland river.

Bicarbonate (76 to 164 mg/L) and calcium (16 to 45 mg/L) were the dominant ions measured.

Nutrient concentrations were generally low and no guideline exceedances were measured. A median ammonia concentration of 0.004 mg/L was measured in the Wapiti River, while the concentration was below detection in the Missinka River. A nitrate concentration of 0.2 mg/L was measured in the Missinka River.

A median TKN concentration of 0.07 mg/L was measured in the Wapiti River. Total phosphorus was not detected in the Murray or Missinka Rivers, while the median concentration in the Wapiti River was 0.007 mg/L.

A median TSS concentration of 7 mg/L was measured in the Wapiti River between 1997 and 1998 (see Table A-8). Four crossings were sampled for TSS during the 2005 baseline field surveys. TSS was not detected with the concentration remaining below 2 mg/L.

Total and dissolved metals were measured in the Wapiti, Murray and Missinka Rivers (see Table A-9). The concentration of most metals was below guidelines. Guideline exceedances were measured for the following parameters:

- The total aluminum concentration in the Wapiti (median = 131 µg/L) and Murray Rivers (138 µg/L) exceeded the CEQG and GCDWQ of 100 µg/L.
- The median total iron concentration (380 µg/L) in the Murray River exceeded the CEQG, GCDWQ, BCAWQG and the BCWQGD of 300 µg/L.

Generally, a lower concentration of the dissolved metals compared to total metals was measured.

Central Interior Hydrological Zone

The Central Interior hydrological zone extends through the western portion of the Peace River Basin. Watercourses of the Fraser River Basin, including the Nechako River Sub-basin and the Skeena River Basin are also found within this zone. The hydrological zone extends through several headwater watersheds from Davie Lake, north of Prince George, to the Tintagel Creek watershed, east of Burns Lake.

Baseline water quality conditions are described for eight watercourses, including detailed descriptions for the Crooked (Crossing 677) and Muskeg (Crossing 720) Rivers, an unnamed Davie Lake tributary (Crossing 679) and Tintagel Creek (Crossing 6000).

Watercourse drainage areas in this hydrological zone range between 1 and 14,600 km². The surveyed watercourses have drainage areas ranging from 1 km² for an unnamed Necoslie River tributary (Crossing 793) to 14,600 km² for the Stuart River.

The baseline DO concentration ranged from 4.1 to 11.4 mg/L (see Table A-10). Generally, the watercourses are well oxygenated. The exception was the measurement taken from an Unnamed Davie Lake Tributary (Crossing 679) of 4.1 mg/L, which is below the CEQG (6.5 to 9.5 mg/L) and BCAWQG (5 to 9 mg/L) guidelines.

The pH ranged between 7.0 and 8.3. No guideline exceedances were measured for pH.

Specific conductivity ranged from 30 to 369 µS/cm and TDS ranged from 32 to 172 mg/L. The surveyed watercourses were adequately buffered to acid deposition as the alkalinity concentration ranged between 18 and 98 mg/L. The water hardness was also low to moderate, with concentrations ranging between 17 and 128 mg/L. The concentrations for TDS, alkalinity and hardness in upland headwater watercourses (i.e., Tintagel Creek) were substantially lower than concentrations measured in the lowland watercourses.

Bicarbonate (22 to 119 mg/L) and calcium (5 to 38 mg/L) were generally the dominant ions measured. The sulphate concentration (0.7 to 66 mg/L), resulting mainly from groundwater inputs, was measured in low concentration in most surveyed watercourses. Sulphate (66 mg/L) was a dominant anion in an unnamed Davie Lake tributary (Crossing 679), with its concentration being similar to that of bicarbonate (74 mg/L).

Nutrient concentrations were generally low, although a few guideline exceedances were measured. The median chlorophyll a concentration in the Crooked River (0.006 mg/L) exceeded the BCWQGD of 0.0025 mg/L. Ammonia-nitrogen was not detected in three watercourses and low median concentrations were reported in the Necoslie River (1.1 mg/L) and Stuart River (0.1 mg/L).

Nitrite was not detected in any watercourse and the only detected nitrate concentration of 0.06 mg/L was measured in the Muskeg River.

Total phosphorus was below detection limit in the Crooked and Muskeg Rivers. The concentration (0.02 to 0.2 mg/L) exceeded the BCAWQG (0.0015 mg/L) and BCWQGD (0.01 mg/L) in four other watercourses.

Seven crossings were sampled for TSS between 2005 and 2007 (see Table A-11). The TSS concentration was below the detection limit of 2 mg/L in an unnamed Davie Lake tributary (Crossing 679), as well as in the Crooked and Muskeg Rivers. The TSS concentration in the other watercourses ranged from 2 mg/L in Tintagel Creek to 7 mg/L in an unnamed Necoslie River tributary (Crossing 793).

Total and dissolved metals were measured in the Crooked and Muskeg Rivers, an unnamed Davie Lake tributary (Crossing 679) and Tintagel Creek (see Table A-12). The concentration of most metals was below guidelines. Guideline exceedances were measured for the following parameters:

- A total aluminum concentration (197 µg/L) in Tintagel Creek exceeded the CEQG and GCDWQ of 100 µg/L.
- The total copper concentration in the Crooked River (2 µg/L) and an unnamed Davie Lake tributary (4 µg/L) exceeded the CEQG of 2 µg/L.
- A total iron concentration (400 µg/L) in Tintagel Creek exceeded the CEQG, GCDWQ, BCAWQG and BCWQGD of 300 µg/L.
- A dissolved aluminum concentration (181 µg/L) in Tintagel Creek exceeded the BCAWQG of 100 µg/L.

Generally, a lower concentration of the dissolved metals compared to total metals was measured.

Central Mountains Hydrological Zone

The Central Mountains hydrological zone extends through several headwater watersheds in the Nechako River Sub-basin and the Skeena River Basin. The hydrological zone extends from the Stearns Creek watershed, east of Burns Lake to Gosnell Creek watershed, on the eastern side of the Coastal Mountains.

Baseline water quality conditions are described for nine watercourses, including detailed descriptions for the Endako River (Crossing 1001), Stearns (Crossing 6004), Foxy (Crossings 1923 and 1032), Klo (Crossing 3090) and Buck (Crossing 5018) Creeks.

Watercourse drainage areas in this hydrological zone range between 1 and 1,982 km². The surveyed watercourses have drainage areas ranging from 4 km² for an unnamed Maxan Creek tributary (Crossing 1024) to 1,070 km² for the Endako River.

The baseline DO concentration ranged from 7.8 to 11.5 mg/L (see Table A-13). The pH ranged from 7.3 to 7.8. No guideline exceedances were measured for either DO or pH.

Specific conductivity ranged from 65 to 246 µS/cm and TDS ranged from 40 to 164 mg/L. The surveyed watercourses were adequately buffered to acid deposition as the alkalinity concentration ranged between 31 and 91 mg/L. The water hardness was also low to moderate, with concentrations ranging between 22 and 126 mg/L. The concentrations for TDS, alkalinity and hardness were highest in Foxy Creek, downstream of the Equity Mine site and in the Endako River.

Bicarbonate (37 to 110 mg/L) and calcium (11 to 37 mg/L) were generally the dominant ions measured. The sulphate concentration (less than 0.5 to 66 mg/L), resulting mainly from groundwater inputs, was measured in low concentration in most surveyed watercourses. Sulphate (66 mg/L) was a dominant anion at both Foxy Creek crossings. The sulphate concentration at the downstream reach of Foxy was similar to that of bicarbonate (75 mg/L).

Nutrient concentrations were generally low, although a few guideline exceedances were measured. The median chlorophyll a concentration in the Endako River (0.008 mg/L) exceeded the BCWQGD of 0.0025 mg/L. The BCWQGD for chlorophyll a was also exceeded in Klo Creek (0.2 mg/L).

Ammonia was not detected in three watercourses. A low concentration of 0.007 mg/L was measured in the upstream reach of Foxy Creek. Nitrate and nitrite ranged from below detection in Klo and Buck Creeks to a median concentration 0.04 mg/L in the Endako River.

The total phosphorus concentration exceeded the BCAWQG (0.0015 mg/L) and BCWQGD (0.01 mg/L) in most surveyed watercourses. The concentration ranged from 0.03 mg/L in Stearns Creek and the upstream reach of Foxy Creek to a median concentration of 0.09 mg/L in the Endako River.

Six crossings were sampled for TSS during the 2005 baseline field surveys and historical data were also available for four watercourses (see Table A-14). The TSS concentration was below the detection limit of 2 mg/L (baseline data) or 5 mg/L (historical data) in six watercourses. The TSS concentration in the other watercourses ranged from 2 mg/L in Foxy Creek (Crossings 1032 and 1923) to a median concentration of 3 mg/L in the Endako River (Crossing 1001).

Total and dissolved metals were measured in the Sutherland River, Stearns Creek, the Endako River and both reaches of Foxy Creek (see Table A-15). The concentration of most metals was below guidelines. Guideline exceedances were measured for the following parameters:

- The total aluminum concentration in Stearns Creek (154 µg/L) and in the upstream reach of Foxy Creek (269 µg/L) exceeded the CEQG and GCDWQ of 100 µg/L.
- The total copper concentration in Stearns Creek (2 µg/L) and the upstream reach of Foxy Creek (median = 3 µg/L) exceeded the CEQG of 2 µg/L.
- A total iron concentration (443 µg/L) in Foxy Creek exceeded the CEQG, GCDWQ, BCAWQG and BCWQGD of 300 µg/L.

Generally, a lower concentration of the dissolved metals compared to total metals was measured.

Coastal Mountains Hydrological Zone

The Coastal Mountains hydrological zone extends through several headwater watersheds in the Skeena River Basin and Kitimat River Basin. Several lowland watersheds located in the Kitimat Valley are also located in this zone. The hydrological zone extends from Gosnell Creek watershed, on the eastern side of the Coastal Mountains, to the Kitimat Terminal, located near the outlet of the Kitimat River into the Kitimat Arm of the Pacific Ocean.

Baseline water quality conditions are described for six watercourses, including detailed descriptions for Hunter Creek (Crossing 3197) and Chist (Crossing 1222), Cecil (Crossing 1223), Trout (Crossing 3130), Anderson (Crossing 1274) and Moore (Crossing 3141) Creeks.

Watercourse drainage areas in this hydrological zone range between 1 and 293 km². The surveyed watercourses have drainage areas ranging from 5 km² for Hunter Creek (Crossing 3197) to 161 km² for Chist Creek.

The baseline DO concentration ranged from 11.8 to 12.3 mg/L (see Table A-16). The surveyed streams were well oxygenated and no guideline exceedances were measured. The pH ranged from 6.4 to 7.9. The pH level in Cecil Creek was below the acceptable CEQG and BCAWQG range.

Specific conductivity ranged from 22 to 75 $\mu\text{S}/\text{cm}$ and TDS ranged from 10 to 54 mg/L. The surveyed watercourses generally had a low buffering capacity to acid deposition as the alkalinity concentration ranged between 3 and 36 mg/L. The alkalinity concentration was below the BCAWQG of 10 mg/L in Chist Creek (3 mg/L) and Hunter Creek (Crossing 3197) (9 mg/L). The water hardness was also low, with concentrations ranging from 7 to 35 mg/L.

Bicarbonate and calcium were generally the dominant ions measured. The sulphate concentration (1 to 6 mg/L), resulting mainly from groundwater inputs, was also a dominant ion. The calcium concentration in Moore Creek (4 mg/L) was equivalent the BCAWQG indicating that the water was sensitive to acid inputs.

Nutrient concentrations were generally low, although a few guideline exceedances were measured. Ammonia was not detected in three watercourses. A low concentration was measured in Hunter Creek (Crossing 3197) (0.006 mg/L) and in Chist Creek (median = 0.1 mg/L). Nitrate and nitrite ranged from 0.008 mg/L in Hunter Creek (Crossing 3197) to 0.04 mg/L in Trout Creek. TKN was not measured in this hydrological zone.

The total phosphorus concentration was below detection in four watercourses. The concentration exceeded the BCAWQG (0.0015 mg/L) and BCWQGD (0.01 mg/L) in Hunter Creek (Crossing 3197) (0.2 mg/L) and in Chist Creek (0.04 mg/L).

Four crossings were sampled for TSS during the 2005 baseline field surveys and historical data were also available for four watercourses (see Table A-17). The TSS concentration was below the detection limit of 2 mg/L (baseline data) or 4 mg/L (historical data) in six watercourses. The median TSS concentration in Chist Creek was 9 mg/L. The TSS concentration in Hunter Creek (Crossing 3197) was 36 mg/L.

Total and dissolved metals were measured in the Cecil, Anderson and Moore Creeks. Total metals were also analyzed in Hunter Creek (Crossing 3197) and Chist and Trout Creeks (see Table A-18). The concentration of most metals was below guidelines. Guideline exceedances were measured for the following parameters:

- The total aluminum concentration in Hunter Creek (Crossing 3197) (394 $\mu\text{g}/\text{L}$), Chist Creek (median = 609 $\mu\text{g}/\text{L}$) and Cecil Creek (310 $\mu\text{g}/\text{L}$) exceeded the CEQG and GCDWQ of 100 $\mu\text{g}/\text{L}$.
- A total chromium concentration in Cecil Creek (10 $\mu\text{g}/\text{L}$) exceeded the CEQG and BCAWQG of 1 $\mu\text{g}/\text{L}$.
- A total copper concentration in Hunter Creek (Crossing 3197) (4 $\mu\text{g}/\text{L}$) exceeded the CEQG of 2 $\mu\text{g}/\text{L}$.
- The total iron concentration in an unnamed Kitimat River tributary (2,150 $\mu\text{g}/\text{L}$), Chist Creek (2,060 $\mu\text{g}/\text{L}$) and Trout Creek (310 $\mu\text{g}/\text{L}$) exceeded the CEQG, GCDWQ, BCAWQG and BCWQGD of 300 $\mu\text{g}/\text{L}$.
- A total manganese concentration in Cecil Creek (65 $\mu\text{g}/\text{L}$) exceeded the GCDWQ and BCWQGD of 50 $\mu\text{g}/\text{L}$.
- A dissolved aluminum concentration in Cecil Creek (240 $\mu\text{g}/\text{L}$) exceeded the BCAWQG of 100 $\mu\text{g}/\text{L}$.

Generally, a lower concentration of the dissolved metals compared to total metals was measured.

3.1.2 Sediment Quality

The investigation into baseline conditions has been divided into hydrological zones, following the principles highlighted in previous sections. The use of qualitative and quantitative data is provided in this summary.

Prairies Hydrological Zone

Sediment samples from this zone were not included in the 2005 fall field sampling program and no data were available from governmental sources.

Prairies and Foothills Hydrological Zone

The percentage of fine textured particles in the Prairies and Foothills Hydrological Zone was about one third of overall sediment weight and consists of silt (27%) as per results obtained mostly from Smoky River. Organic matter content as represented by TOC was low (less than 2%). No CSQG exceedances were detected for metals.

The median TSS concentration 18 mg/L was found in the Prairies was calculated at 18 mg/L in the North Saskatchewan River. The higher level at 105 mg/L was measured during the 2005 fall hydrology field program in the Rivière Qui Barre.

Total suspended sediment concentrations were usually low in the Foothills and within less than 2 mg/L and 9 mg/L during 2005 field survey and historical data analysis. A median TSS concentration of 39 mg/L was calculated from historical records between 1995 and 1997 in the Little Paddle River.

Historical sediment data near the pipeline RoW were not available in this zone. A sediment sample was collected from the Smoky River (Crossing 3174) during the 2005 fall water quality field program.

The sediments in the Smoky River were predominately consisted of sand (66%) and silt (27%) with small amount of clay (7%) (see Table B-1). Total organic carbon content was low (1.4%). No CSQG exceedances were measured in the sample. Iron (21,500 µg/g) and calcium (50,400 µg/g) were the dominant metals.

Rocky Mountains Hydrological Zone

Historical sediment data were collected from four locations within this zone. A sediment sample was also collected during the 2005 fall water quality field program in the Missinka River (Crossing 480).

The range in percentage of fine textured particles was variable in the historical data (see Table B-2). The fine textured particle content of the sediment in an unnamed Missinka River tributary (Crossing 579) was more than 67%. An unnamed Wichcika Creek tributary (Crossing 592) and an unnamed Chuchinka Creek tributary (Crossing 599) had a fine textured particle content ranging between 33% and 67%. An unnamed Chuchinka Creek tributary (Crossing 619) had a low content of less than 33%.

The sediment texture in the Missinka River contained 98% sand, 2% silt, while clay was not detected. There was no measurable total organic carbon content at the in the other surveyed watercourses. A total organic content of 0.7% was reported in the Missinka River.

The total metal content was measured in all sediment samples. Iron (18,000 µg/g) and aluminum (7,000 µg/g) were the dominant metals in an unnamed Missinka River tributary (Crossing 579). Iron (17,100 to 29,500 µg/g) and calcium (13,400 to 43,200 µg/g) were the dominant metals in the watercourses.

The only CCME guideline exceedance was measured for arsenic (5.9 µg/g) where a concentration of 6.5 µg/g was reported in the Missinka River sample. Exceedances of the BCSQG (21,500 µg/g) were measured for iron in an unnamed Wichcika Creek tributary (Crossing 592) (29,500 µg/g) and in the Missinka River (24,800 µg/g). Nickel exceeded the BCSQG of 16 µg/g in an unnamed Wichcika Creek tributary (Crossing 592), two unnamed Chuchinka Creek tributaries (Crossings 599 and 619) and the Missinka River with concentrations ranging between 16 and 28 µg/g.

Central Interior Hydrological Zone

Historical sediment data were collected from eleven locations within this zone. Sediment samples were also collected during the 2005 fall water quality field program in the Crooked River (Crossing 677) and in the Muskeg River (Crossing 720).

The range in percentage of fine textured particles was variable in the historical data (see Table B-3). The fine textured particle content of the sediment in an unnamed Great Beaver Lake tributary (Crossing 782) was more than 67%. An unnamed Mossvale Lake tributary (Crossing 732), an unnamed Necoslie River tributary (Crossing 826) and Duncan Creek (Crossing 907) had a fine textured particle content ranging between 33% and 67%. The remaining surveyed creeks had a fine textured particle content of less than 33%.

The sediment texture in the Crooked and Muskeg Rivers contained respective sand contents of 97% and 93%. The silt content was 5% and 2%, respectively. The clay content in both watercourses was 2% and 1%, respectively.

The total organic carbon content was 0% in most watercourses. Observations of less than 33% were recorded for an unnamed Mossvale Lake tributary (Crossing 732) and an unnamed Great Beaver Lake tributary (Crossing 782). A content of more than 67% was reported in two unnamed Great Beaver Lake tributaries (Crossings 759 and 765). The Crooked and Muskeg Rivers had a total organic carbon content of 0.2% to 0.3%.

The total metal content was measured in all sediment samples. Iron, with a concentration ranging between 15,100 and 54,600 µg/g, was a dominant metal at all sites. Aluminum (3,660 to 39,100 µg/g) was also a dominant metal in most sediment samples. Calcium (1,820 to 12,500 µg/g) and magnesium (3,030 to 9,900 µg/g) were measured in variable concentrations.

Generally sodium (25 to 24,200 µg/g) was measured in low concentration. However, this metal was dominant in the sediment samples collected from an unnamed Necoslie River tributary (Crossing 826), Duncan Creek (Crossing 907) and Sheraton Creek (Crossing 981).

Guideline exceedances in sediment were measured for the following metal parameters:

- The arsenic concentration in five watercourses (6 to 14 µg/g) exceeded the CCME guideline of 5.9 µg/g.
- The cadmium concentration in four watercourses (0.7 to 3 µg/g) exceeded both the CCME and BCSQG guidelines of 0.6 µg/g.
- The chromium concentration in 11 watercourses (41 to 230 µg/g) exceeded the BCSQG of 37.3 µg/g.
- A copper concentration of 57 µg/g measured in an Unnamed Great Beaver Lake tributary (Crossing 765) exceeded the CCME guideline of 35.7 µg/g.
- The iron concentration in four watercourses (25,200 to 54,600 µg/g) exceeded the BCSQG of 21,200 µg/g.
- The mercury concentration in three watercourses (0.2 µg/g) slightly exceeded the CCME guideline of 0.17 µg/g.
- The nickel concentration in 12 watercourses (18 to 89 µg/g) exceeded the BCSQG of 16 µg/g.
- A silver concentration of 0.6 µg/g measured in Tintagel Creek (Crossing 6000) exceeded the BCSQG of 0.5 µg/g.
- The zinc concentration in two watercourses (153 to 160 µg/g) exceeded the CCME guideline of 123 µg/g.

Less than four guideline exceedances for metal parameters were measured in most watercourses.

Guideline exceedances were most common at the following locations:

- Tintagel Creek had guideline exceedances for seven metal parameters.
- An unnamed Great Beaver Lake tributary (Crossing 759) had guideline exceedances for six metal parameters.
- An unnamed Great Beaver Lake tributary (Crossing 765), an unnamed Necoslie River tributary (Crossing 826) and Sheraton Creek had guideline exceedances for four metal parameters.

Central Mountains Hydrological Zone

Historical sediment data were collected from eight locations within this zone. Sediment samples were also collected during the 2005 fall water quality field program in the Endako River (Crossing 1001).

The range in percentage of fine textured particles was variable in the historical data (see Table B-4). The fine textured particle content of the sediment in an unnamed Kager Lake tributary (Crossing 6013), an unnamed Maxan Creek tributary (Crossing 1017) and an unnamed Gosnell Creek tributary (Crossing 1095) was more than 67%. Four watercourses had a fine textured particle content ranging between 33% and 67%. The 24.5 Mile Creek (Crossing 2046) had a fine textured particle content of less than 33%.

The sediment texture in the Endako River contained a sand content of 48%. The silt and clay content was 42% and 10%, respectively.

The total organic carbon content was 0% in two unnamed Morice River tributaries (Crossings 1946 and 1949) and in an unnamed Gosnell Creek tributary (Crossing 1095). Observations of less than 33% were recorded in five watercourses. The Endako River had a total organic carbon content of 7.2%.

The total metal content was measured for all major parameters three watercourses, while a partial list was analyzed in the other watercourses. Iron, with a concentration ranging between 8,420 and 39,200 $\mu\text{g/g}$, was a dominant metal at all sites. Aluminum (2,770 to 16,800 $\mu\text{g/g}$) was also a dominant metal in an unnamed Kager Lake tributary (Crossing 6013), an unnamed Maxan Creek tributary (Crossing 1017) and the Endako River. Sodium (19,000 to 21,900 $\mu\text{g/g}$) was also dominant in an unnamed Kager Lake tributary (Crossing 6013) and an unnamed Maxan Creek tributary (Crossing 1017).

Guideline exceedances in sediment were measured for the following metal parameters:

- The arsenic concentration in three watercourses (7 to 12 $\mu\text{g/g}$) exceeded the CCME guideline of 5.9 $\mu\text{g/g}$.
- The chromium concentration in two watercourses (100 to 110 $\mu\text{g/g}$) exceeded the BCSQG of 37.3 $\mu\text{g/g}$.
- The iron concentration in eight watercourses (24,400 to 39,200 $\mu\text{g/g}$) exceeded the BCSQG of 21,200 $\mu\text{g/g}$.
- The nickel concentration in eight watercourses (16 to 41 $\mu\text{g/g}$) exceeded the BCSQG of 16 $\mu\text{g/g}$.

Guidelines exceedances were common for at least two parameters in all watercourses, with the exception of the Endako River. No guideline exceedances were measured in the Endako River.

Coastal Mountains Hydrological Zone

Historical sediment data were collected from 13 locations within this zone. No sediment samples were collected during the 2005 fall water quality field program because no data gaps were observed within the historical data.

The range in percentage of fine textured particles was variable in the historical data (see Table B-5). The fine textured particle content of the sediment in an unnamed Burnie River tributary (Crossing 1124), Duck Creek (Crossing 3140) and Cecil Creek (Crossing 1223) was more than 67%. Seven watercourses had a fine textured particle content ranging between 33 and 67%. Three unnamed Kitimat River tributaries (Crossings 1182, 1195 and 1205) had a fine textured particle content of less than 33%.

The total organic carbon content was 0% in most watercourses. Observations of less than 33% were recorded for two unnamed Gosnell Creek tributaries (Crossings 1110 and 1115) and Anderson Creek (Crossing 1274). A content of 33% to 67% was reported in an unnamed Kitimat River tributary (Crossings 3136).

The total metal content was measured for selected parameters in the studied watercourses. Several metal parameters, including aluminum, calcium, magnesium, potassium and sodium, were not measured in any of the sediment samples. Iron, with a concentration ranging between 7,000 and 36,000 $\mu\text{g/g}$, was the dominant analyzed metal at all sites.

Guideline exceedances in sediment were measured for the following metal parameters:

- A cadmium concentration of 0.6 µg/g in an unnamed Gosnell Creek tributary was equivalent to both the CCME and BCSQG guidelines.
- The chromium concentration in 10 watercourses (43 to 130 µg/g) exceeded the BCSQG of 37.3 µg/g.
- The copper concentration in seven watercourses (36 to 84 µg/g) exceeded the CCME guideline of 35.7 µg/g.
- The iron concentration in nine watercourses (26,000 to 36,000 µg/g) exceeded the BCSQG of 21200 µg/g.
- The lead concentration in two watercourses (46 to 60 µg/g) exceeded the CCME guideline of 35 µg/g.
- The nickel concentration in seven watercourses (16 to 28 µg/g) exceeded the BCSQG of 16 µg/g.
- A silver concentration of 0.6 µg/g measured in an unnamed Kitimat River tributary (Crossing 1205) exceeded the BCSQG of 0.5 µg/g.
- The zinc concentration in three watercourses (128 to 367 µg/g) exceeded the CCME guideline of 123 µg/g.

Less than four guideline exceedances for metal parameters were measured in most watercourses.

Guideline exceedances were most common at the following locations:

- An unnamed Kitimat River tributary (Crossing 1205) had guideline exceedances for seven metal parameters.
- Four unnamed Kitimat River tributaries (Crossings 1181, 1182, 1191 and 1195) had guideline exceedances for four metal parameters.

Contaminated Sediments

A special sampling program was implemented in the fall of 2005 to determine the potential risk of such environmental effects downstream of existing or abandoned mines or pulp and paper facilities. No contaminants were observed. Some exceedances were noted at other sites based on historical data sources as discussed above. The elevated concentrations were determined to be of natural origin.

4 Conclusion

Baseline environmental surface water quality and sediment data were presented from sampling events and from historical (mostly governmental) sources. Historical data for both British Columbia and Alberta were downloaded from appropriate governmental sources and data gaps were identified. Water samples were taken at locations along the pipeline RoW that were identified as having experienced possible environmental effects from upstream industry or where downstream water intakes for domestic consumption exist.

There were no temporal or distinct spatial patterns observed with the data. Generally, higher TSS was observed in the Prairies where most of the land is cultivated, while sub-alpine areas in the other zones tended to have the lowest concentrations. Most watercourses were well oxygenated and pH was within compliance at sampled locations. The concentration of nitrogenous compounds was near or below detection in most areas, while total phosphorus often exceeded guidelines throughout all hydrological zones. Colour exceeded guidelines in many watercourses along the route; however, organic compounds were usually observed at concentrations below guidelines. Aluminum and iron exceedances were common in all areas. Copper and lead exceedances were common in the Coastal Mountains hydrological zone, while copper and zinc exceeded guidelines sporadically at some other locations.

Sediments collected as part of field programs as well as historical data displayed variable substrates along the route. Most common guideline exceedances were observed for aluminum, chromium, copper, iron and nickel.

The results presented herein were used in the surface water resources section of the ESA to assess the surface water quality effects.

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Appendix A Water Quality Tables

Table A-1 Baseline Water Quality Conditions for Physical, Conventional, and Nutrient Parameters in the Prairies Hydrological Zone

Parameter	Units	North Saskatchewan River Basin	
		North Saskatchewan River	
		Crossing 1	
		AENV: AB05EB0595	
		2002	
		n =	Result
Field Measured			
pH	pH Units	15	8.1
Conductivity	µS/cm	-	-
Conductivity, Specific	µS/cm	15	344
Dissolved Oxygen (DO)	mg/L (ppm)	15	10.9
Dissolved Oxygen, saturation	%	-	-
Conventional Parameters and Major Ions			
pH	pH Units	-	-
Conductivity, Specific	µS/cm	-	-
Total Dissolved Solids (TDS)	mg/L (ppm)	1	220
Alkalinity, Total	mg/L (ppm)	1	146
Hardness, Total	mg/L (ppm)	-	-
Turbidity	NTU	-	-
Bicarbonate	mg/L (ppm)	-	-
Calcium	mg/L (ppm)	11	44
Carbonate	mg/L (ppm)	-	-
Chloride	mg/L (ppm)	1	4
Fluoride	mg/L (ppm)	-	-
Magnesium	mg/L (ppm)	1	15
Potassium	mg/L (ppm)	1	1.3
Sodium	mg/L (ppm)	1	9.6
Sulphate	mg/L (ppm)	1	19
Nutrients			
Chlorophyll <i>a</i>	mg/L (ppm)	-	-
Ammonia	mg/L (ppm)	11	0.11
Nitrate + Nitrite	mg/L (ppm)	11	0.18
Nitrate	mg/L (ppm)	-	-
Nitrite	mg/L (ppm)	-	-

Table A-1 Baseline Water Quality Conditions for Physical, Conventional, and Nutrient Parameters in the Prairies Hydrological Zone (cont'd)

Parameter	Units	North Saskatchewan River Basin	
		North Saskatchewan River	
		Crossing 1	
		AENV: AB05EB0595	
		2002	
		n =	Result
Nutrients (cont'd)			
Nitrogen, Total Kjeldahl (TKN)	mg/L (ppm)	11	0.31
Phosphorus, Dissolved	mg/L (ppm)	11	0.025
Phosphorus, Total	mg/L (ppm)	11	0.05²
Organic Carbon, Dissolved (DOC)	mg/L (ppm)	1	2
Organic Carbon, Total (TOC)	mg/L (ppm)	11	4
NOTES: Bolded numbers indicate either a guideline equivalency or exceedance. 1 = Exceedance of the Canadian Environmental Quality Guideline (CEQG) for the Protection of Aquatic Life (CCME 2007). See Table 2-3 for guideline concentration and explanation. 2 = Exceedance of the Alberta Surface Water Quality Guideline (ASWQG) for the Protection of Aquatic Life (AENV 1999). See Table 2-3 for guideline concentration and explanation. 3 = Exceedance of the British Columbia Approved Water Quality Guidelines for the Protection of Aquatic Life (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation. 4 = Exceedance of the Health Canada Guideline for Canadian Drinking Water Quality (GCDWQ) (Health Canada 2008). See Table 2-3 for guideline concentration and explanation. 5 = Exceedance of the British Columbia Working Water Quality Guideline (BCWWQG) for Drinking Water (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.			

Table A-2 Baseline Total Suspended Solids Results for the Prairies Hydrological Zone

Parameter	Units	North Saskatchewan River Basin			
		North Saskatchewan River		Rivière Qui Barre	
		Crossing 1		Crossing 3005	
		AENV: AB05EB0595		AMEC: Hydrology	
		2002		12-Oct-05	
		n =	Result	n =	Result
Total Suspended Solids (TSS)	mg/L (ppm)	11	18	1	105
<p>NOTES:</p> <p>Bolded numbers indicate either a guideline equivalency or exceedance.</p> <p>1 = Exceedance of the Canadian Environmental Quality Guideline (CEQG) for the Protection of Aquatic Life (CCME 2007). See Table 2-3 for guideline concentration and explanation.</p> <p>2 = Exceedance of the Alberta Surface Water Quality Guideline (ASWQG) for the Protection of Aquatic Life (AENV 1999). See Table 2-3 for guideline concentration and explanation.</p> <p>3 = Exceedance of the British Columbia Approved Water Quality Guidelines for the Protection of Aquatic Life (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.</p> <p>4 = Exceedance of the Health Canada Guideline for Canadian Drinking Water Quality (GCDWQ) (Health Canada 2008). See Table 2-3 for guideline concentration and explanation.</p> <p>5 = Exceedance of the British Columbia Working Water Quality Guideline (BCWWQG) for Drinking Water (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.</p>					

Table A-3 Baseline Water Quality Conditions for Metal Parameters in the Prairies Hydrological Zone

Parameter	Units	North Saskatchewan River Basin	
		North Saskatchewan River	
		Crossing 1	
		AENV: AB05EB0595	
		2002	
		n =	Result
Total Metals			
Aluminum (Al)	µg/L (ppb)	11	996 ¹
Antimony (Sb)	µg/L (ppb)	11	0.08
Arsenic (As)	µg/L (ppb)	11	0.47
Barium (Ba)	µg/L (ppb)	11	72
Beryllium (Be)	µg/L (ppb)	11	0.09
Boron (B)	µg/L (ppb)	11	17
Cadmium (Cd)	µg/L (ppb)	11	0.03 ¹
Chromium (Cr)	µg/L (ppb)	9	1.16
Cobalt (Co)	µg/L (ppb)	11	0.28
Copper (Cu)	µg/L (ppb)	10	1.37
Iron (Fe)	µg/L (ppb)	11	549 ¹
Lead (Pb)	µg/L (ppb)	11	0.49
Manganese (Mn)	µg/L (ppb)	11	16.2
Mercury (Hg)	µg/L (ppb)	1	<0.04
Molybdenum (Mo)	µg/L (ppb)	11	1.06
Nickel (Ni)	µg/L (ppb)	6	2.18
Selenium (Se)	µg/L (ppb)	9	0.37
Silicon (Si)	µg/L (ppb)	1	2.42
Silver (Ag)	µg/L (ppb)	11	0.02
Strontium (Sr)	µg/L (ppb)	11	397
Thallium (Tl)	µg/L (ppb)	11	0.02
Uranium (U)	µg/L (ppb)	11	0.48
Vanadium (V)	µg/L (ppb)	11	2.53
Zinc (Zn)	µg/L (ppb)	11	5.14

Table A-3 Baseline Water Quality Conditions for Metal Parameters in the Prairies Hydrological Zone (cont'd)

Parameter	Units	North Saskatchewan River Basin	
		North Saskatchewan River	
		Crossing 1	
		AENV: AB05EB0595	
		2002	
		n =	Result
Dissolved Metals			
Aluminum (Al)	µg/L (ppb)	-	-
Antimony (Sb)	µg/L (ppb)	-	-
Arsenic (As)	µg/L (ppb)	-	-
Barium (Ba)	µg/L (ppb)	-	-
Beryllium (Be)	µg/L (ppb)	-	-
Boron (B)	µg/L (ppb)	-	-
Cadmium (Cd)	µg/L (ppb)	-	-
Chromium (Cr)	µg/L (ppb)	-	-
Cobalt (Co)	µg/L (ppb)	-	-
Copper (Cu)	µg/L (ppb)	-	-
Iron (Fe)	µg/L (ppb)	-	-
Lead (Pb)	µg/L (ppb)	-	-
Manganese (Mn)	µg/L (ppb)	-	-
Mercury (Hg)	µg/L (ppb)	-	-
Molybdenum (Mo)	µg/L (ppb)	-	-
Nickel (Ni)	µg/L (ppb)	-	-
Selenium (Se)	µg/L (ppb)	-	-
Silicon (Si)	µg/L (ppb)	-	-
Silver (Ag)	µg/L (ppb)	-	-
Strontium (Sr)	µg/L (ppb)	-	-
Thallium (Tl)	µg/L (ppb)	-	-
Uranium (U)	µg/L (ppb)	-	-



Table A-3 Baseline Water Quality Conditions for Metal Parameters in the Prairies Hydrological Zone (cont'd)

Parameter	Units	North Saskatchewan River Basin	
		North Saskatchewan River	
		Crossing 1	
		AENV: AB05EB0595	
		2002	
		n =	Result
Dissolved Metals (cont'd)			
Vanadium (V)	µg/L (ppb)	-	-
Zinc (Zn)	µg/L (ppb)	-	-
NOTES: Bolded numbers indicate either a guideline equivalency or exceedance. 1 = Exceedance of the Canadian Environmental Quality Guideline (CEQG) for the Protection of Aquatic Life (CCME 2007). See Table 2-3 for guideline concentration and explanation. 2 = Exceedance of the Alberta Surface Water Quality Guideline (ASWQG) for the Protection of Aquatic Life (AENV 1999). See Table 2-3 for guideline concentration and explanation. 3 = Exceedance of the British Columbia Approved Water Quality Guidelines for the Protection of Aquatic Life (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation. 4 = Exceedance of the Health Canada Guideline for Canadian Drinking Water Quality (GCDWQ) (Health Canada 2008). See Table 2-3 for guideline concentration and explanation. 5 = Exceedance of the British Columbia Working Water Quality Guideline (BCWWQG) for Drinking Water (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.			

Table A-4 Baseline Water Quality Conditions for Physical, Conventional, and Nutrient Parameters in the Foothills Hydrological Zone

Parameter	Units	Athabasca River Basin						Peace River Basin	
		Pembina River		Little Paddle River		Athabasca River		Smoky River	
		Crossing 75		Crossing 100		Crossing 1975		Crossing 3174	
		AENV: AB07BB0030		AENV: AB07BB0050		AMEC: Water Quality		AMEC: Water Quality	
		24-Sep-02		1995 - 1997		30-Sep-05		30-Sep-05	
		n =	Result	n =	Result	n =	Result	n =	Result
Field Measured									
pH	pH Units	1	8.5	-	-	1	8.5	1	8.4
Conductivity	µS/cm	-	-	-	-	1	214	1	205
Conductivity, Specific	µS/cm	1	322	-	-	1	315	1	298
Dissolved Oxygen (DO)	mg/L (ppm)	1	11.2	-	-	1	11.3	1	11.0
Dissolved Oxygen, saturation	%	-	-	-	-	1	97	1	94
Conventional Parameters and Major Ions									
pH	pH Units	1	8.4	56	7.8	1	8.4	1	8.3
Conductivity, Specific	µS/cm	1	342	4	334	1	317	1	303
Total Dissolved Solids (TDS)	mg/L (ppm)	1	196	4	186	1	156	1	168
Alkalinity, Total	mg/L (ppm)	1	172	4	172	1	132	1	126
Hardness, Total	mg/L (ppm)	1	153	4	158	1	165	1	154
Turbidity	NTU	1	4 ⁴	-	-	1	3 ⁴	1	10 ⁴
Bicarbonate	mg/L (ppm)	1	202	4	210	1	157	1	153
Calcium	mg/L (ppm)	-	-	3	45	1	45	1	42

Table A-4 Baseline Water Quality Conditions for Physical, Conventional, and Nutrient Parameters in the Foothills Hydrological Zone (cont'd)

Parameter	Units	Athabasca River Basin						Peace River Basin	
		Pembina River		Little Paddle River		Athabasca River		Smoky River	
		Crossing 75		Crossing 100		Crossing 1975		Crossing 3174	
		AENV: AB07BB0030		AENV: AB07BB0050		AMEC: Water Quality		AMEC: Water Quality	
		24-Sep-02		1995 - 1997		30-Sep-05		30-Sep-05	
		n =	Result	n =	Result	n =	Result	n =	Result
Conventional Parameters and Major Ions (cont'd)									
Carbonate	mg/L (ppm)	1	4	-	-	1	2	1	< 1
Chloride	mg/L (ppm)	1	5	4	4	1	1	1	0.4
Fluoride	mg/L (ppm)	1	0.1	4	0.1	1	0.1	1	0.09
Magnesium	mg/L (ppm)	-	-	3	11	1	13	1	12
Potassium	mg/L (ppm)	1	1	4	2	1	0.5	1	< 0.5
Sodium	mg/L (ppm)	1	18	4	15	1	5.9	1	3
Sulphate	mg/L (ppm)	1	15	4	6	1	33	1	33
Nutrients									
Chlorophyll a	mg/L (ppm)	-	-	-	-	-	-	-	-
Ammonia	mg/L (ppm)	1	0.004	70	0.06	-	-	-	-
Nitrate + Nitrite	mg/L (ppm)	1	<0.005	70	0.04	-	-	-	-
Nitrate	mg/L (ppm)	-	-	-	-	1	< 0.05	1	< 0.05
Nitrite	mg/L (ppm)	1	<0.001	4	0.003	1	< 0.05	1	< 0.05
Nitrogen, Total Kjeldahl (TKN)	mg/L (ppm)	1	0.2	70	1.2 2	-	-	-	-

Table A-4 Baseline Water Quality Conditions for Physical, Conventional, and Nutrient Parameters in the Foothills Hydrological Zone (cont'd)

Parameter	Units	Athabasca River Basin						Peace River Basin	
		Pembina River		Little Paddle River		Athabasca River		Smoky River	
		Crossing 75		Crossing 100		Crossing 1975		Crossing 3174	
		AENV: AB07BB0030		AENV: AB07BB0050		AMEC: Water Quality		AMEC: Water Quality	
		24-Sep-02		1995 - 1997		30-Sep-05		30-Sep-05	
		n =	Result	n =	Result	n =	Result	n =	Result
Nutrients (cont'd)									
Phosphorus, Dissolved	mg/L (ppm)	-	-	-	-	-	-	-	-
Phosphorus, Total	mg/L (ppm)	1	0.009	70	0.2 ²	-	-	-	-
Organic Carbon, Dissolved (DOC)	mg/L (ppm)	-	-	-	-	-	-	-	-
Organic Carbon, Total (TOC)	mg/L (ppm)	1	5.2	-	-	1	4	-	-
<p>NOTES:</p> <p>Bolded numbers indicate either a guideline equivalency or exceedance.</p> <p>1 = Exceedance of the Canadian Environmental Quality Guideline (CEQG) for the Protection of Aquatic Life (CCME 2007). See Table 2-3 for guideline concentration and explanation.</p> <p>2 = Exceedance of the Alberta Surface Water Quality Guideline (ASWQG) for the Protection of Aquatic Life (AENV 1999). See Table 2-3 for guideline concentration and explanation.</p> <p>3 = Exceedance of the British Columbia Approved Water Quality Guidelines for the Protection of Aquatic Life (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.</p> <p>4 = Exceedance of the Health Canada Guideline for Canadian Drinking Water Quality (GCDWQ) (Health Canada 2008). See Table 2-3 for guideline concentration and explanation.</p> <p>5 = Exceedance of the British Columbia Working Water Quality Guideline (BCWWQG) for Drinking Water (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.</p>									

Table A-5 Baseline Total Suspended Solids Results for the Foothills Hydrological Zone

Parameter	Units	Athabasca River Basin								Peace River Basin					
		Pembina River		Little Paddle River		Athabasca River		Sakwatamau River		Unnamed Foxy Creek Tributary		Unnamed Waskahigan Creek Tributary		Smoky River	
		Crossing 75		Crossing 100		Crossing 1975		Crossing 120		Crossing 157		Crossing 1602		Crossing 3174	
		AENV: AB07BB0030		AENV: AB07BB0050		AMEC: Water Quality		AMEC: Hydrology		AMEC: Hydrology		AMEC: Hydrology		AMEC: Water Quality	
		24-Sep-02		1995 - 1997		30-Sep-05		12-Oct-05		12-Oct-05		12-Oct-05		30-Sep-05	
n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result		
Total Suspended Solids (TSS)	mg/L (ppm)	1	4	70	39	1	2	1	<2	1	3	1	6	1	9

NOTES:
Bolded numbers indicate either a guideline equivalency or exceedance.
 1 =Exceedance of the Canadian Environmental Quality Guideline (CEQG) for the Protection of Aquatic Life (CCME 2007). See Table 2-3 for guideline concentration and explanation.
 2 =Exceedance of the Alberta Surface Water Quality Guideline (ASWQG) for the Protection of Aquatic Life (AENV 1999). See Table 2-3 for guideline concentration and explanation.
 3 =Exceedance of the British Columbia Approved Water Quality Guidelines for the Protection of Aquatic Life (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.
 4 =Exceedance of the Health Canada Guideline for Canadian Drinking Water Quality (GCDWQ) (Health Canada 2008). See Table 2-3 for guideline concentration and explanation.
 5 =Exceedance of the British Columbia Working Water Quality Guideline (BCWWQG) for Drinking Water (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.

Table A-6 Baseline Water Quality Conditions for Metal Parameters in the Foothills Hydrological Zone

Parameter	Units	Athabasca River Basin				Peace River Basin	
		Pembina River		Little Paddle River		Smoky River	
		Crossing 75		Crossing 100		Crossing 3174	
		AENV: AB07BB0030		AENV: AB07BB0050		AMEC: Water Quality	
		24-Sep-02		1995 - 1997		30-Sep-05	
		n =	Result	n =	Result	n =	Result
Total Metals							
Aluminum (Al)	µg/L (ppb)	-	-	-	-	1	115 ¹
Antimony (Sb)	µg/L (ppb)	-	-	-	-	1	3
Arsenic (As)	µg/L (ppb)	-	-	-	-	1	< 0.4
Barium (Ba)	µg/L (ppb)	-	-	-	-	1	82
Beryllium (Be)	µg/L (ppb)	-	-	-	-	1	< 0.5
Boron (B)	µg/L (ppb)	-	-	-	-	1	< 10
Cadmium (Cd)	µg/L (ppb)	-	-	-	-	1	< 0.1
Chromium (Cr)	µg/L (ppb)	-	-	-	-	1	< 0.9
Cobalt (Co)	µg/L (ppb)	-	-	-	-	1	0.2
Copper (Cu)	µg/L (ppb)	-	-	-	-	1	< 1.0
Iron (Fe)	µg/L (ppb)	1	116	4	1005 ^{1,4}	1	150
Lead (Pb)	µg/L (ppb)	-	-	-	-	1	0.1
Manganese (Mn)	µg/L (ppb)	-	-	-	-	1	7
Mercury (Hg)	µg/L (ppb)	-	-	-	-	1	< 0.1
Molybdenum (Mo)	µg/L (ppb)	-	-	-	-	1	< 0.5

Table A-6 Baseline Water Quality Conditions for Metal Parameters in the Foothills Hydrological Zone (cont'd)

Parameter	Units	Athabasca River Basin				Peace River Basin	
		Pembina River		Little Paddle River		Smoky River	
		Crossing 75		Crossing 100		Crossing 3174	
		AENV: AB07BB0030		AENV: AB07BB0050		AMEC: Water Quality	
		24-Sep-02		1995 - 1997		30-Sep-05	
		n =	Result	n =	Result	n =	Result
Total Metals (cont'd)							
Nickel (Ni)	µg/L (ppb)	-	-	-	-	1	< 0.6
Phosphorus (P)	µg/L (ppb)	-	-	-	-	1	< 50
Selenium (Se)	µg/L (ppb)	-	-	-	-	1	< 0.8
Silicon (Si)	µg/L (ppb)	-	-	-	-	1	17,600
Silver (Ag)	µg/L (ppb)	-	-	-	-	1	< 0.2
Strontium (Sr)	µg/L (ppb)	-	-	-	-	-	-
Thallium (Tl)	µg/L (ppb)	-	-	-	-	1	< 0.05
Uranium (U)	µg/L (ppb)	-	-	-	-	1	0.4
Vanadium (V)	µg/L (ppb)	-	-	-	-	1	2
Zinc (Zn)	µg/L (ppb)	-	-	-	-	1	3
Dissolved Metals							
Aluminum (Al)	µg/L (ppb)	-	-	-	-	1	3
Antimony (Sb)	µg/L (ppb)	-	-	-	-	1	< 0.1
Arsenic (As)	µg/L (ppb)	-	-	-	-	1	0.2

Table A-6 Baseline Water Quality Conditions for Metal Parameters in the Foothills Hydrological Zone (cont'd)

Parameter	Units	Athabasca River Basin				Peace River Basin	
		Pembina River		Little Paddle River		Smoky River	
		Crossing 75		Crossing 100		Crossing 3174	
		AENV: AB07BB0030		AENV: AB07BB0050		AMEC: Water Quality	
		24-Sep-02		1995 - 1997		30-Sep-05	
		n =	Result	n =	Result	n =	Result
Dissolved Metals (cont'd)							
Barium (Ba)	µg/L (ppb)	-	-	-	-	1	81
Beryllium (Be)	µg/L (ppb)	-	-	-	-	1	< 0.1
Boron (B)	µg/L (ppb)	-	-	-	-	1	8
Cadmium (Cd)	µg/L (ppb)	-	-	-	-	1	< 0.05
Chromium (Cr)	µg/L (ppb)	-	-	-	-	1	0.8
Cobalt (Co)	µg/L (ppb)	-	-	-	-	1	0.16
Copper (Cu)	µg/L (ppb)	-	-	-	-	1	< 1.0
Iron (Fe)	µg/L (ppb)	-	-	-	-	1	<10
Lead (Pb)	µg/L (ppb)	-	-	-	-	1	< 0.05
Manganese (Mn)	µg/L (ppb)	-	-	-	-	1	2
Mercury (Hg)	µg/L (ppb)	-	-	-	-	1	< 0.1
Molybdenum (Mo)	µg/L (ppb)	-	-	-	-	1	0.5
Nickel (Ni)	µg/L (ppb)	-	-	-	-	1	0.4

Table A-6 Baseline Water Quality Conditions for Metal Parameters in the Foothills Hydrological Zone (cont'd)

Parameter	Units	Athabasca River Basin				Peace River Basin	
		Pembina River		Little Paddle River		Smoky River	
		Crossing 75		Crossing 100		Crossing 3174	
		AENV: AB07BB0030		AENV: AB07BB0050		AMEC: Water Quality	
		24-Sep-02		1995 - 1997		30-Sep-05	
		n =	Result	n =	Result	n =	Result
Dissolved Metals (cont'd)							
Phosphorus (P)	µg/L (ppb)	-	-	-	-	1	< 5
Selenium (Se)	µg/L (ppb)	-	-	-	-	1	< 0.4
Silicon (Si)	µg/L (ppb)	-	-	-	-	1	1,520
Silver (Ag)	µg/L (ppb)	-	-	-	-	1	< 0.05
Strontium (Sr)	µg/L (ppb)	-	-	-	-	-	-
Thallium (Tl)	µg/L (ppb)	-	-	-	-	1	< 0.02
Uranium (U)	µg/L (ppb)	-	-	-	-	1	0.37

Table A-6 Baseline Water Quality Conditions for Metal Parameters in the Foothills Hydrological Zone (cont'd)

Parameter	Units	Athabasca River Basin				Peace River Basin	
		Pembina River		Little Paddle River		Smoky River	
		Crossing 75		Crossing 100		Crossing 3174	
		AENV: AB07BB0030		AENV: AB07BB0050		AMEC: Water Quality	
		24-Sep-02		1995 - 1997		30-Sep-05	
		n =	Result	n =	Result	n =	Result
Dissolved Metals (cont'd)							
Vanadium (V)	µg/L (ppb)	-	-	-	-	1	1.1
Zinc (Zn)	µg/L (ppb)	-	-	-	-	1	3
NOTES: Bolded numbers indicate either a guideline equivalency or exceedance. 1 = Exceedance of the Canadian Environmental Quality Guideline (CEQG) for the Protection of Aquatic Life (CCME 2007). See Table 2-3 for guideline concentration and explanation. 2 = Exceedance of the Alberta Surface Water Quality Guideline (ASWQG) for the Protection of Aquatic Life (AENV 1999). See Table 2-3 for guideline concentration and explanation. 3 = Exceedance of the British Columbia Approved Water Quality Guidelines for the Protection of Aquatic Life (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation. 4 = Exceedance of the Health Canada Guideline for Canadian Drinking Water Quality (GCDWQ) (Health Canada 2008). See Table 2-3 for guideline concentration and explanation. 5 = Exceedance of the British Columbia Working Water Quality Guideline (BCWWQG) for Drinking Water (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.							

Table A-7 Baseline Water Quality Conditions for Physical, Conventional, and Nutrient Parameters in the Rocky Mountains Hydrological Zone

Parameter	Units	Peace River Basin					
		Wapiti River		Murray River		Missinka River	
		Crossing 3038		Crossing 3051		Crossing 480	
		AENV: AB07GC0020		BC EMS: E206322		AMEC: Water Quality	
		Fall 1997 / 1998		29-Jun-00		01-Oct-05	
		n =	Result	n =	Result	n =	Result
Field Measured							
pH	pH Units	3	8.3	1	8.4	1	8.2
Conductivity	µS/cm	-	-	-	-	1	74
Conductivity, Specific	µS/cm	3	303	1	150	1	120
Dissolved Oxygen (DO)	mg/L (ppm)	3	10.4	1	11.2	1	11.9
Dissolved Oxygen, saturation	%	-	-	-	-	1	93
Conventional Parameters and Major Ions							
pH	pH Units	3	8.4	-	-	1	7.8
Conductivity, Specific	µS/cm	3	257	-	-	1	121
Total Dissolved Solids (TDS)	mg/L (ppm)	3	172	-	-	1	76
Alkalinity, Total	mg/L (ppm)	3	138	-	-	1	62
Hardness, Total	mg/L (ppm)	3	155	1	81	-	-
Turbidity	NTU	3	5 ⁴	1	8 ^{3,4,5}	1	1 ^{4,5}
Bicarbonate	mg/L (ppm)	3	164	-	-	1	76

Table A-7 Baseline Water Quality Conditions for Physical, Conventional, and Nutrient Parameters in the Rocky Mountains Hydrological Zone (cont'd)

Parameter	Units	Peace River Basin					
		Wapiti River		Murray River		Missinka River	
		Crossing 3038		Crossing 3051		Crossing 480	
		AENV: AB07GC0020		BC EMS: E206322		AMEC: Water Quality	
		Fall 1997 / 1998		29-Jun-00		01-Oct-05	
		n =	Result	n =	Result	n =	Result
Conventional Parameters and Major Ions (cont'd)							
Calcium	mg/L (ppm)	-	45	-	-	1	16
Carbonate	mg/L (ppm)	-	4	-	-	1	< 1
Chloride	mg/L (ppm)	-	2	-	-	1	< 0.1
Fluoride	mg/L (ppm)	-	0.1	-	-	1	0.04
Magnesium	mg/L (ppm)	-	10	-	-	1	6
Potassium	mg/L (ppm)	-	0.6	-	-	1	< 0.5
Sodium	mg/L (ppm)	-	4.8	-	-	1	< 0.5
Sulphate	mg/L (ppm)	-	27	-	-	1	5
Nutrients							
Chlorophyll <i>a</i>	mg/L (ppm)	-	-	-	-	-	-
Ammonia	mg/L (ppm)	-	0.004	-	-	1	< 0.1
Nitrate + Nitrite	mg/L (ppm)	-	<0.006	-	-	-	-

Table A-7 Baseline Water Quality Conditions for Physical, Conventional, and Nutrient Parameters in the Rocky Mountains Hydrological Zone (cont'd)

Parameter	Units	Peace River Basin					
		Wapiti River		Murray River		Missinka River	
		Crossing 3038		Crossing 3051		Crossing 480	
		AENV: AB07GC0020		BC EMS: E206322		AMEC: Water Quality	
		Fall 1997 / 1998		29-Jun-00		01-Oct-05	
		n =	Result	n =	Result	n =	Result
Nutrients (cont'd)							
Nitrate	mg/L (ppm)	-	-	-	-	1	0.2
Nitrite	mg/L (ppm)	-	-	-	-	1	< 0.05
Organic Carbon, Dissolved (DOC)	mg/L (ppm)	-	-	-	-	1	2
Organic Carbon, Total (TOC)	mg/L (ppm)	-	3	-	-	1	3
<p>NOTES:</p> <p>Bolded numbers indicate either a guideline equivalency or exceedance.</p> <p>1 = Exceedance of the Canadian Environmental Quality Guideline (CEQG) for the Protection of Aquatic Life (CCME 2007). See Table 2-3 for guideline concentration and explanation.</p> <p>2 = Exceedance of the Alberta Surface Water Quality Guideline (ASWQG) for the Protection of Aquatic Life (AENV 1999). See Table 2-3 for guideline concentration and explanation.</p> <p>3 = Exceedance of the British Columbia Approved Water Quality Guidelines for the Protection of Aquatic Life (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.</p> <p>4 = Exceedance of the Health Canada Guideline for Canadian Drinking Water Quality (GCDWQ) (Health Canada 2008). See Table 2-3 for guideline concentration and explanation.</p> <p>5 = Exceedance of the British Columbia Working Water Quality Guideline (BCWWQG) for Drinking Water (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.</p>							

Table A-8 Baseline Total Suspended Solids Results for the Rocky Mountains Hydrological Zone

Parameter	Units	Peace River Basin									
		Wapiti River		Unnamed Imperial Creek Tributary		Missinka River		Unnamed Chuchinka Creek Tributary		Angusmac Creek	
		Crossing 3038		Crossing 446		Crossing 480		Crossing 619		Crossing 665	
		AENV: AB07GC0020		AMEC: Hydrology		AMEC: Water Quality		AMEC: Hydrology		AMEC: Hydrology	
		Fall 1997 / 1998		29-Sep-05		01-Oct-05		29-Sep-05		29-Sep-05	
n =	Result	n =	Result	n =	Result	n =	Result	n =	Result		
Total Suspended Solids (TSS)	mg/L (ppm)	3	7	1	< 2	1	< 2	1	<2	1	<2

NOTES:

Bolded numbers indicate either a guideline equivalency or exceedance.

- 1 = Exceedance of the Canadian Environmental Quality Guideline (CEQG) for the Protection of Aquatic Life (CCME 2007). See Table 2-3 for guideline concentration and explanation.
- 2 = Exceedance of the Alberta Surface Water Quality Guideline (ASWQG) for the Protection of Aquatic Life (AENV 1999). See Table 2-3 for guideline concentration and explanation.
- 3 = Exceedance of the British Columbia Approved Water Quality Guidelines for the Protection of Aquatic Life (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.
- 4 = Exceedance of the Health Canada Guideline for Canadian Drinking Water Quality (GCDWQ) (Health Canada 2008). See Table 2-3 for guideline concentration and explanation.
- 5 = Exceedance of the British Columbia Working Water Quality Guideline (BCWWQG) for Drinking Water (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.

Table A-9 Baseline Water Quality Conditions for Metal Parameters in the Rocky Mountains Hydrological Zone

Parameter	Units	Peace River Basin					
		Wapiti River		Murray River		Missinka River	
		Crossing 3038		Crossing 3051		Crossing 480	
		AENV: AB07GC0020		BC EMS: E206322		AMEC: Water Quality	
		Fall 1997 / 1998		29-Jun-00		01-Oct-05	
		n =	Result	n =	Result	n =	Result
Total Metals							
Aluminum (Al)	µg/L (ppb)	2	131 ^{1,4}	1	138 ^{1,4}	1	28
Antimony (Sb)	µg/L (ppb)	2	<0.4	-	-	1	< 0.1
Arsenic (As)	µg/L (ppb)	2	<0.4	1	0.2	1	< 0.4
Barium (Ba)	µg/L (ppb)	2	101	1	25	1	< 5
Beryllium (Be)	µg/L (ppb)	2	<0.5	-	-	1	< 0.5
Boron (B)	µg/L (ppb)	1	20	1	2	1	< 10
Cadmium (Cd)	µg/L (ppb)	-	-	-	-	1	< 0.1
Chromium (Cr)	µg/L (ppb)	2	<0.4	1	0.2	1	< 0.9
Cobalt (Co)	µg/L (ppb)	2	0.2	1	0.2	1	< 0.1
Copper (Cu)	µg/L (ppb)	2	1	1	1	1	< 1
Iron (Fe)	µg/L (ppb)	2	60	1	380 ^{1,3,4,5}	1	60
Lead (Pb)	µg/L (ppb)	2	0.2	1	0.2	1	< 0.1
Manganese (Mn)	µg/L (ppb)	2	6	1	10	1	<2
Mercury (Hg)	µg/L (ppb)	3	<40	-	-	1	< 0.1

Table A-9 Baseline Water Quality Conditions for Metal Parameters in the Rocky Mountains Hydrological Zone (cont'd)

Parameter	Units	Peace River Basin					
		Wapiti River		Murray River		Missinka River	
		Crossing 3038		Crossing 3051		Crossing 480	
		AENV: AB07GC0020		BC EMS: E206322		AMEC: Water Quality	
		Fall 1997 / 1998		29-Jun-00		01-Oct-05	
		n =	Result	n =	Result	n =	Result
Total Metals (cont'd)							
Molybdenum (Mo)	µg/L (ppb)	2	0.7	1	0.2	1	< 0.5
Nickel (Ni)	µg/L (ppb)	2	0.5	1	2	1	< 0.6
Phosphorus (P)	µg/L (ppb)	-	-	-	-	1	< 50
Selenium (Se)	µg/L (ppb)	2	0.4	1	<0.2	1	< 0.8
Silicon (Si)	µg/L (ppb)	-	-	1	1,290	1	1,140
Silver (Ag)	µg/L (ppb)	2	<0.2	-	-	1	< 0.2
Strontium (Sr)	µg/L (ppb)	2	183	1	48	-	-
Thallium (Tl)	µg/L (ppb)	-	-	-	-	1	< 0.05
Uranium (U)	µg/L (ppb)	-	-	1	0.1	1	0.1
Vanadium (V)	µg/L (ppb)	2	0.5	1	0.8	1	1
Zinc (Zn)	µg/L (ppb)	2	6	1	2	1	< 2
Dissolved Metals							
Aluminum (Al)	µg/L (ppb)	1	110	1	12	1	21
Antimony (Sb)	µg/L (ppb)	-	-	-	-	1	< 0.1

Table A-9 Baseline Water Quality Conditions for Metal Parameters in the Rocky Mountains Hydrological Zone (cont'd)

Parameter	Units	Peace River Basin					
		Wapiti River		Murray River		Missinka River	
		Crossing 3038		Crossing 3051		Crossing 480	
		AENV: AB07GC0020		BC EMS: E206322		AMEC: Water Quality	
		Fall 1997 / 1998		29-Jun-00		01-Oct-05	
		n =	Result	n =	Result	n =	Result
Dissolved Metals (cont'd)							
Arsenic (As)	µg/L (ppb)	-	-	1	0.2	1	< 0.1
Barium (Ba)	µg/L (ppb)	1	105	1	23	1	5
Beryllium (Be)	µg/L (ppb)	-	-	-	-	1	< 0.1
Boron (B)	µg/L (ppb)	1	9	1	3	1	< 4
Cadmium (Cd)	µg/L (ppb)	1	<0.1	-	-	1	< 0.05
Chromium (Cr)	µg/L (ppb)	1	2	1	<0.2	1	< 0.4
Cobalt (Co)	µg/L (ppb)	-	-	1	0.1	1	0.07
Copper (Cu)	µg/L (ppb)	1	1	1	0.2	1	< 1
Iron (Fe)	µg/L (ppb)	1	231	1	16	1	<10
Lead (Pb)	µg/L (ppb)	1	<5	-	-	1	< 0.05
Manganese (Mn)	µg/L (ppb)	1	7	1	2	1	<1
Mercury (Hg)	µg/L (ppb)	-	-	-	-	1	< 0.1
Molybdenum (Mo)	µg/L (ppb)	1	<2	1	0.3	1	< 0.3
Nickel (Ni)	µg/L (ppb)	1	<2	1	1	1	0.4

Table A-9 Baseline Water Quality Conditions for Metal Parameters in the Rocky Mountains Hydrological Zone (cont'd)

Parameter	Units	Peace River Basin					
		Wapiti River		Murray River		Missinka River	
		Crossing 3038		Crossing 3051		Crossing 480	
		AENV: AB07GC0020		BC EMS: E206322		AMEC: Water Quality	
		Fall 1997 / 1998		29-Jun-00		01-Oct-05	
		n =	Result	n =	Result	n =	Result
Dissolved Metals (cont'd)							
Phosphorus (P)	µg/L (ppb)	-	-	-	-	1	< 5
Selenium (Se)	µg/L (ppb)	-	-	1	<0.2	1	< 0.4
Silicon (Si)	µg/L (ppb)	-	-	1	740	1	1,170
Silver (Ag)	µg/L (ppb)	-	-	-	-	1	< 0.05
Strontium (Sr)	µg/L (ppb)	-	-	1	44	-	-
Thallium (Tl)	µg/L (ppb)	-	-	-	-	1	< 0.02
Uranium (U)	µg/L (ppb)	-	-	1	0.1	1	0.1

Table A-9 Baseline Water Quality Conditions for Metal Parameters in the Rocky Mountains Hydrological Zone (cont'd)

Parameter	Units	Peace River Basin					
		Wapiti River		Murray River		Missinka River	
		Crossing 3038		Crossing 3051		Crossing 480	
		AENV: AB07GC0020		BC EMS: E206322		AMEC: Water Quality	
		Fall 1997 / 1998		29-Jun-00		01-Oct-05	
		n =	Result	n =	Result	n =	Result
Dissolved Metals (cont'd)							
Vanadium (V)	µg/L (ppb)	1	1	1	0.2	1	< 0.5
Zinc (Zn)	µg/L (ppb)	1	2	1	0.5	1	< 2
NOTES: Bolded numbers indicate either a guideline equivalency or exceedance. 1 = Exceedance of the Canadian Environmental Quality Guideline (CEQG) for the Protection of Aquatic Life (CCME 2007). See Table 2-3 for guideline concentration and explanation. 2 = Exceedance of the Alberta Surface Water Quality Guideline (ASWQG) for the Protection of Aquatic Life (AENV 1999). See Table 2-3 for guideline concentration and explanation. 3 = Exceedance of the British Columbia Approved Water Quality Guidelines for the Protection of Aquatic Life (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation. 4 = Exceedance of the Health Canada Guideline for Canadian Drinking Water Quality (GCDWQ) (Health Canada 2008). See Table 2-3 for guideline concentration and explanation. 5 = Exceedance of the British Columbia Working Water Quality Guideline (BCWWQG) for Drinking Water (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.							

Table A-10 Baseline Water Quality Conditions for Physical, Conventional, and Nutrient Parameters in the Central Interior Hydrological Zone

Parameter	Units	Peace River Basin						Fraser River Basin		Nechako River Sub-basin							
		Hart Lake		Crooked River		Unnamed Davie Lake Tributary		Muskeg River		Necoslie River		Stuart River		Unnamed Kager Lake Tributary		Tintagel Creek	
		Crossing 677		Crossing 677		Crossing 679		Crossing 720		Crossing 5003		Crossing 3076		Crossing 6013		Crossing 6000	
		BC EMS: E227432 / E227430		AMEC: Water Quality		AMEC: Water Quality		AMEC: Water Quality		BC EMS: 400801		BC EMS: 400488 / 920101		BC EMS: E208132		AMEC: Water Quality	
		26-Jul-97		01-Oct-05		01-Oct-05		01-Oct-05		Winter 1995		Winter 1995		20-May-05		02-Oct-05	
n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result		
Field Measured																	
pH	pH Units	-	-	1	7.9	1	7.7	1	7.9	-	-	-	-	-	-	1	8.3
Conductivity	µS/cm	-	-	1	107	1	152	1	115	-	-	-	-	-	-	1	19
Conductivity, Specific	µS/cm	-	-	1	157	1	235	1	173	-	-	-	-	-	-	1	31
Dissolved Oxygen (DO)	mg/L (ppm)	-	-	1	11.0	1	4.1 ^{1,3}	1	10.5	-	-	5	11.4	-	-	1	11.1
Dissolved Oxygen, saturation	%	-	-	1	93	1	34	1	88	-	-	-	-	-	-	1	86
Conventional Parameters and Major Ions																	
pH	pH Units	2	8.3	1	8.0	1	7.8	1	8.0	5	7.7	5	7.8	-	-	1	7.0
Conductivity, Specific	µS/cm	-	-	1	157	1	249	1	171	5	369	10	122	-	-	1	30
Total Dissolved Solids (TDS)	mg/L (ppm)	-	-	1	92	1	172	1	104	-	-	-	-	-	-	1	32
Alkalinity, Total	mg/L (ppm)	2	77	1	89	1	61	1	98	-	-	-	-	-	-	1	18
Hardness, Total	mg/L (ppm)	-	-	1	83	1	128	1	94	-	-	-	-	-	-	1	17
Turbidity	NTU	-	-	1	2 ^{4,5}	1	3 ^{4,5}	1	2 ^{4,5}	-	-	-	-	-	-	1	4 ^{4,5}
Bicarbonate	mg/L (ppm)	-	-	1	108	1	74	1	119	-	-	-	-	-	-	1	22
Calcium	mg/L (ppm)	-	-	1	26	1	38	1	25	-	-	-	-	-	-	1	5
Carbonate	mg/L (ppm)	-	-	1	< 1	1	< 1	1	< 1	-	-	-	-	-	-	1	< 1
Chloride	mg/L (ppm)	1	0.4	1	0.6	1	0.5	1	< 0.1	3	7	-	-	-	-	1	0.4
Fluoride	mg/L (ppm)	1	0.02	1	0.05	1	0.1	1	0.07	-	-	-	-	-	-	1	0.04
Magnesium	mg/L (ppm)	-	-	1	4	1	8	1	8	-	-	-	-	-	-	1	0.7
Potassium	mg/L (ppm)	-	-	1	< 0.5	1	0.6	1	< 0.5	-	-	-	-	-	-	1	< 0.5
Sodium	mg/L (ppm)	-	-	1	2	1	3	1	2	-	-	-	-	-	-	1	1
Sulphate	mg/L (ppm)	-	-	1	0.7	1	66	1	1	-	-	-	-	-	-	1	2
Nutrients																	
Chlorophyll a	mg/L (ppm)	2	0.006 ⁵	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ammonia	mg/L (ppm)	-	-	1	< 0.1	-	-	1	< 0.1	5	1.1	10	0.1	-	-	1	< 0.1
Nitrate + Nitrite	mg/L (ppm)	-	-	-	-	-	-	-	-	5	0.1	11	0.04	-	-	-	-
Nitrate	mg/L (ppm)	2	< 0.002	1	< 0.05	1	< 0.05	1	0.06	-	-	-	-	-	-	1	< 0.05

Table A-10 Baseline Water Quality Conditions for Physical, Conventional, and Nutrient Parameters in the Central Interior Hydrological Zone (cont'd)

Parameter	Units	Peace River Basin						Fraser River Basin		Nechako River Sub-basin							
		Hart Lake		Crooked River		Unnamed Davie Lake Tributary		Muskeg River		Necoslie River		Stuart River		Unnamed Kager Lake Tributary		Tintagel Creek	
		Crossing 677		Crossing 677		Crossing 679		Crossing 720		Crossing 5003		Crossing 3076		Crossing 6013		Crossing 6000	
		BC EMS: E227432 / E227430		AMEC: Water Quality		AMEC: Water Quality		AMEC: Water Quality		BC EMS: 400801		BC EMS: 400488 / 920101		BC EMS: E208132		AMEC: Water Quality	
		26-Jul-97		01-Oct-05		01-Oct-05		01-Oct-05		Winter 1995		Winter 1995		20-May-05		02-Oct-05	
n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result		
Nutrients (cont'd)																	
Nitrite	mg/L (ppm)	2	<0.005	1	< 0.05	1	< 0.05	1	< 0.05	5	<0.005	10	<0.001	-	-	1	< 0.05
Nitrogen, Total Kjeldahl (TKN)	mg/L (ppm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosphorus, Dissolved	mg/L (ppm)	2	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosphorus, Total	mg/L (ppm)	2	0.02 ^{3,5}	1	< 0.02	-	-	1	< 0.02	5	0.2 ^{3,5}	10	0.02 ^{3,5}	1	0.009	1	0.03 ⁵
Organic Carbon, Dissolved (DOC)	mg/L (ppm)	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Organic Carbon, Total (TOC)	mg/L (ppm)	2	21	1	3	1	15	1	7	-	-	-	-	-	-	1	17

NOTES:
Bolded numbers indicate either a guideline equivalency or exceedance.
 1 = Exceedance of the Canadian Environmental Quality Guideline (CEQG) for the Protection of Aquatic Life (CCME 2007). See Table 2-3 for guideline concentration and explanation.
 2 = Exceedance of the Alberta Surface Water Quality Guideline (ASWQG) for the Protection of Aquatic Life (AENV 1999). See Table 2-3 for guideline concentration and explanation.
 3 = Exceedance of the British Columbia Approved Water Quality Guidelines for the Protection of Aquatic Life (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.
 4 = Exceedance of the Health Canada Guideline for Canadian Drinking Water Quality (GCDWQ) (Health Canada 2008). See Table 2-3 for guideline concentration and explanation.
 5 = Exceedance of the British Columbia Working Water Quality Guideline (BCWWQG) for Drinking Water (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.

Table A-11 Baseline Total Suspended Solids Results for the Central Interior Hydrological Zone

Parameter	Units	Peace River Basin				Fraser River Basin		Nechako River Sub-basin					
		Crooked River		Unnamed Davie Lake Tributary		Muskeg River		Unnamed Nicoslie River Tributary		Pitka Creek		Tintagel Creek	
		Crossing 677		Crossing 679		Crossing 720		Crossing 793		Crossing 3077		Crossing 6000	
		AMEC: Water Quality		AMEC: Water Quality		AMEC: Water Quality		AMEC: Hydrology		AMEC: Hydrology		AMEC: Water Quality	
		01-Oct-05		01-Oct-05		01-Oct-05		29-Sep-05		29-Sep-05		02-Oct-05	
		n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result
Total Suspended Solids (TSS)	mg/L (ppm)	1	< 2	1	< 2	1	< 2	1	7	1	4	1	2

NOTES:
Bolded numbers indicate either a guideline equivalency or exceedance.
 1 = Exceedance of the Canadian Environmental Quality Guideline (CEQG) for the Protection of Aquatic Life (CCME 2007). See Table 2-3 for guideline concentration and explanation.
 2 = Exceedance of the Alberta Surface Water Quality Guideline (ASWQG) for the Protection of Aquatic Life (AENV 1999). See Table 2-3 for guideline concentration and explanation.
 3 = Exceedance of the British Columbia Approved Water Quality Guidelines for the Protection of Aquatic Life (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.
 4 = Exceedance of the Health Canada Guideline for Canadian Drinking Water Quality (GCDWQ) (Health Canada 2008). See Table 2-3 for guideline concentration and explanation.
 5 = Exceedance of the British Columbia Working Water Quality Guideline (BCWWQG) for Drinking Water (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.

Table A-12 Baseline Water Quality Conditions for Metal Parameters in the Central Interior Hydrological Zone

Parameter	Units	Peace River Basin				Fraser River Basin		Nechako River Sub-basin	
		Crooked River		Unnamed Davie Lake Tributary		Muskeg River		Tintagel Creek	
		Crossing 677		Crossing 679		Crossing 720		Crossing 6000	
		AMEC: Water Quality		AMEC: Water Quality		AMEC: Water Quality		AMEC: Water Quality	
		01-Oct-05		01-Oct-05		01-Oct-05		02-Oct-05	
		n =	Result	n =	Result	n =	Result	n =	Result
Total Metals									
Aluminum (Al)	µg/L (ppb)	1	19	1	88	1	6	1	197 ^{1,4}
Antimony (Sb)	µg/L (ppb)	1	2	1	0.8	1	< 0.1	1	< 0.1
Arsenic (As)	µg/L (ppb)	1	< 0.4	1	1.3	1	0.6	1	< 0.4
Barium (Ba)	µg/L (ppb)	1	37	1	58	1	61	1	9
Beryllium (Be)	µg/L (ppb)	1	< 0.5	1	< 0.5	1	< 0.5	1	< 0.5
Boron (B)	µg/L (ppb)	1	< 10	1	< 10	1	< 10	1	< 10
Cadmium (Cd)	µg/L (ppb)	1	< 0.1	1	< 0.1	1	< 0.1	1	< 0.1
Chromium (Cr)	µg/L (ppb)	1	< 0.9	1	< 0.9	1	< 0.9	1	< 0.9
Cobalt (Co)	µg/L (ppb)	1	< 0.1	1	0.1	1	< 0.1	1	< 0.1
Copper (Cu)	µg/L (ppb)	1	2 ¹	1	4 ¹	1	< 1	1	1
Iron (Fe)	µg/L (ppb)	1	230	1	170	1	280	1	400 ^{1,3,4,5}
Lead (Pb)	µg/L (ppb)	1	< 0.1	1	0.2	1	< 0.1	1	< 0.1
Manganese (Mn)	µg/L (ppb)	1	15	1	13	1	31	1	35
Mercury (Hg)	µg/L (ppb)	1	< 0.1	1	< 0.1	1	< 0.1	1	< 0.1
Molybdenum (Mo)	µg/L (ppb)	1	< 0.5	1	0.6	1	0.7	1	< 0.5
Nickel (Ni)	µg/L (ppb)	1	2	1	3	1	2	1	0.8

Table A-12 Baseline Water Quality Conditions for Metal Parameters in the Central Interior Hydrological Zone (cont'd)

Parameter	Units	Peace River Basin				Fraser River Basin		Nechako River Sub-basin	
		Crooked River		Unnamed Davie Lake Tributary		Muskeg River		Tintagel Creek	
		Crossing 677		Crossing 679		Crossing 720		Crossing 6000	
		AMEC: Water Quality		AMEC: Water Quality		AMEC: Water Quality		AMEC: Water Quality	
		01-Oct-05		01-Oct-05		01-Oct-05		02-Oct-05	
		n =	Result	n =	Result	n =	Result	n =	Result
Total Metals (cont'd)									
Phosphorus (P)	µg/L (ppb)	1	< 50	1	< 50	1	< 50	1	< 50
Selenium (Se)	µg/L (ppb)	1	< 0.8	1	< 0.8	1	< 0.8	1	< 0.8
Silicon (Si)	µg/L (ppb)	1	3,980	1	4,120	1	3,090	1	3,230
Silver (Ag)	µg/L (ppb)	1	< 0.2	1	< 0.2	1	< 0.2	1	< 0.2
Strontium (Sr)	µg/L (ppb)	-	-	-	-	-	-	-	-
Thallium (Tl)	µg/L (ppb)	1	< 0.05	1	< 0.05	1	< 0.05	1	< 0.05
Uranium (U)	µg/L (ppb)	1	0.1	1	0.3	1	0.1	1	0.3
Vanadium (V)	µg/L (ppb)	1	1	1	1	1	2	1	0.7
Zinc (Zn)	µg/L (ppb)	1	3	1	4	1	< 2	1	3
Dissolved Metals									
Aluminum (Al)	µg/L (ppb)	1	< 2	1	25	1	< 2	1	181 ³
Antimony (Sb)	µg/L (ppb)	1	< 0.1	1	0.8	1	< 0.1	1	< 0.1
Arsenic (As)	µg/L (ppb)	1	< 0.1	1	0.8	1	0.5	1	< 0.1
Barium (Ba)	µg/L (ppb)	1	36	1	54	1	61	1	9
Beryllium (Be)	µg/L (ppb)	1	< 0.1	1	< 0.1	1	< 0.1	1	< 0.1
Boron (B)	µg/L (ppb)	1	< 4	1	< 4	1	< 4	1	< 4



Table A-12 Baseline Water Quality Conditions for Metal Parameters in the Central Interior Hydrological Zone (cont'd)

Parameter	Units	Peace River Basin				Fraser River Basin		Nechako River Sub-basin	
		Crooked River		Unnamed Davie Lake Tributary		Muskeg River		Tintagel Creek	
		Crossing 677		Crossing 679		Crossing 720		Crossing 6000	
		AMEC: Water Quality		AMEC: Water Quality		AMEC: Water Quality		AMEC: Water Quality	
		01-Oct-05		01-Oct-05		01-Oct-05		02-Oct-05	
		n =	Result	n =	Result	n =	Result	n =	Result
Dissolved Metals (cont'd)									
Cadmium (Cd)	µg/L (ppb)	1	< 0.05	1	< 0.05	1	< 0.05	1	< 0.05
Chromium (Cr)	µg/L (ppb)	1	0.8	1	< 0.4	1	0.6	1	< 0.4
Cobalt (Co)	µg/L (ppb)	1	0.1	1	0.1	1	0.1	1	0.06
Copper (Cu)	µg/L (ppb)	1	< 1	1	4	1	< 1.0	1	1
Iron (Fe)	µg/L (ppb)	1	120	1	50	1	170	1	260
Lead (Pb)	µg/L (ppb)	1	< 0.05	1	< 0.05	1	< 0.05	1	< 0.05
Manganese (Mn)	µg/L (ppb)	1	11	1	11	1	20	1	15
Mercury (Hg)	µg/L (ppb)	1	< 0.1	1	< 0.1	1	< 0.1	1	< 0.1
Molybdenum (Mo)	µg/L (ppb)	1	< 0.3	1	0.6	1	0.7	1	< 0.3
Nickel (Ni)	µg/L (ppb)	1	1	1	< 0.1	1	2	1	< 0.1
Phosphorus (P)	µg/L (ppb)	1	< 5	1	< 5	1	< 5	1	< 5
Selenium (Se)	µg/L (ppb)	1	< 0.4	1	< 0.4	1	< 0.4	1	< 0.4
Silicon (Si)	µg/L (ppb)	1	4,080	1	3,900	1	3,190	1	3,160
Silver (Ag)	µg/L (ppb)	1	< 0.05	1	< 0.05	1	< 0.05	1	< 0.05
Strontium (Sr)	µg/L (ppb)	-	-	-	-	-	-	-	-
Thallium (Tl)	µg/L (ppb)	1	< 0.02	1	< 0.02	1	< 0.02	1	< 0.02

Table A-12 Baseline Water Quality Conditions for Metal Parameters in the Central Interior Hydrological Zone (cont'd)

Parameter	Units	Peace River Basin				Fraser River Basin		Nechako River Sub-basin	
		Crooked River		Unnamed Davie Lake Tributary		Muskeg River		Tintagel Creek	
		Crossing 677		Crossing 679		Crossing 720		Crossing 6000	
		AMEC: Water Quality		AMEC: Water Quality		AMEC: Water Quality		AMEC: Water Quality	
		01-Oct-05		01-Oct-05		01-Oct-05		02-Oct-05	
		n =	Result	n =	Result	n =	Result	n =	Result
Dissolved Metals (cont'd)									
Uranium (U)	µg/L (ppb)	1	0.1	1	0.2	1	0.1	1	0.29
Vanadium (V)	µg/L (ppb)	1	1	1	1	1	1	1	< 0.5
Zinc (Zn)	µg/L (ppb)	1	2	1	4	1	< 2	1	< 2
<p>NOTES:</p> <p>Bolded numbers indicate either a guideline equivalency or exceedance.</p> <p>1 = Exceedance of the Canadian Environmental Quality Guideline (CEQG) for the Protection of Aquatic Life (CCME 2007). See Table 2-3 for guideline concentration and explanation.</p> <p>2 = Exceedance of the Alberta Surface Water Quality Guideline (ASWQG) for the Protection of Aquatic Life (AENV 1999). See Table 2-3 for guideline concentration and explanation.</p> <p>3 = Exceedance of the British Columbia Approved Water Quality Guidelines for the Protection of Aquatic Life (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.</p> <p>4 = Exceedance of the Health Canada Guideline for Canadian Drinking Water Quality (GCDWQ) (Health Canada 2008). See Table 2-3 for guideline concentration and explanation.</p> <p>5 = Exceedance of the British Columbia Working Water Quality Guideline (BCWWQG) for Drinking Water (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.</p>									

Table A-13 Baseline Water Quality Conditions for Physical, Conventional, and Nutrient Parameters in the Central Mountains Hydrological Zone

Parameter	Units	Skeena River Basin		Nechako River Sub-basin				Skeena River Basin							
		Sutherland River		Stearns Creek		Endako River		Foxy Creek (Downstream)		Foxy Creek (Upstream)		Klo Creek		Buck Creek	
		Crossing 888		Crossing 6004		Crossing 1001		Crossing 1923		Crossing 1032		Crossing 3090		Crossing 5018	
		BC EMS: E268330		AMEC: Water Quality		AMEC: Water Quality / BC EMS: 400375 / 400379		AMEC: Water Quality / BC EMS: 700108		BC EMS: 400763 / 400764		BC EMS: E228337		BC EMS: E228317	
		13-Sep-07		02-Oct-05		2002 - 2005		1995 / 2005		1995 / 2004		22-Sep-97		22-Sep-97	
		n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result
Field Measured															
pH	pH Units	-	-	1	7.8	49	7.7	7	7.3	-	-	-	-	-	-
Conductivity	µS/cm	-	-	1	39	1	78	-	-	-	-	-	-	-	-
Conductivity, Specific	µS/cm	-	-	1	64	1	112	-	-	-	-	-	-	-	-
Dissolved Oxygen (DO)	mg/L (ppm)	-	-	1	11.5	1	7.8 ^{1,3}	1	11.5	-	-	-	-	-	-
Dissolved Oxygen, saturation	%	-	-	1	89	1	68	1	87	-	-	-	-	-	-
Conventional Parameters and Major Ions															
pH	pH Units	-	-	1	7.4	1	7.7	1	7.8	24	7.3	-	-	-	-
Conductivity, Specific	µS/cm	-	-	1	65	48	111	1	246	-	-	-	-	-	-
Total Dissolved Solids (TDS)	mg/L (ppm)	-	-	1	44	15	93	1	164	1	40	-	-	-	-
Alkalinity, Total	mg/L (ppm)	1	91	1	31	15	52	7	52	25	31	1	36	1	44
Hardness, Total	mg/L (ppm)	1	97	1	33	27	50	1	126	1	22	-	-	-	-
Turbidity	NTU	1	0.8	1	3 ^{4,5}	48	4 ^{4,5}	1	4 ^{4,5}	1	5 ^{4,5}	-	-	-	-
Bicarbonate	mg/L (ppm)	1	110	1	37	1	71	1	75	-	-	-	-	-	-
Calcium	mg/L (ppm)	1	25	1	11	1	14	1	37	-	-	-	-	-	-
Carbonate	mg/L (ppm)	1	<0.5	1	<1	1	<1	1	<1	-	-	-	-	-	-
Chloride	mg/L (ppm)	1	<0.5	1	0.3	15	3	1	0.5	1	0.6	-	-	-	-
Fluoride	mg/L (ppm)	-	-	1	0.08	15	0.06	1	0.1	-	-	-	-	-	-
Magnesium	mg/L (ppm)	1	8	1	2	1	5	1	8	-	-	-	-	-	-
Potassium	mg/L (ppm)	1	3	1	<0.5	1	1	1	0.6	-	-	-	-	-	-
Sodium	mg/L (ppm)	1	3	1	1	1	3	1	3	-	-	-	-	-	-
Sulphate	mg/L (ppm)	1	3	1	3	15	1	1	66	25	19	1	<0.5	1	2
Nutrients															
Chlorophyll a	mg/L (ppm)	-	-	-	-	12	0.008 ⁵	-	-	-	-	1	0.2 ⁵	-	-
Ammonia	mg/L (ppm)	1	<0.005	1	<0.1		<0.1	-	-	1	0.007	-	-	-	-
Nitrate + Nitrite	mg/L (ppm)	1	0.01	-	-	48	0.04	-	-	1	0.002	1	<0.002	1	<0.002
Nitrate	mg/L (ppm)	1	0.01	1	<0.05	43	0.07	1	<0.05	-	-	-	-	-	-

Table A-13 Baseline Water Quality Conditions for Physical, Conventional, and Nutrient Parameters in the Central Mountains Hydrological Zone (cont'd)

Parameter	Units	Skeena River Basin		Nechako River Sub-basin				Skeena River Basin							
		Sutherland River		Stearns Creek		Endako River		Foxy Creek (Downstream)		Foxy Creek (Upstream)		Klo Creek		Buck Creek	
		Crossing 888		Crossing 6004		Crossing 1001		Crossing 1923		Crossing 1032		Crossing 3090		Crossing 5018	
		BC EMS: E268330		AMEC: Water Quality		AMEC: Water Quality / BC EMS: 400375 / 400379		AMEC: Water Quality / BC EMS: 700108		BC EMS: 400763 / 400764		BC EMS: E228337		BC EMS: E228317	
		13-Sep-07		02-Oct-05		2002 - 2005		1995 / 2005		1995 / 2004		22-Sep-97		22-Sep-97	
		n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result
Nutrients (cont'd)															
Nitrite	mg/L (ppm)	-	-	1	< 0.05	48	0.002	1	< 0.05	-	-	-	-	-	-
Nitrogen, Total Kjeldahl (TKN)	mg/L (ppm)	1	0.3	-	-	-	-	-	-	-	-	-	-	-	-
Phosphorus, Dissolved	mg/L (ppm)	-	-	-	-	48	0.01	-	-	-	-	-	-	-	-
Phosphorus, Total	mg/L (ppm)	1	0.007	1	0.03 ⁵	48	0.09 ⁵	-	-	2	0.03 ^{3,5}	1	0.06 ^{3,5}	1	0.06 ^{3,5}
Organic Carbon, Dissolved (DOC)	mg/L (ppm)	-	-	1	13	1	17	-	-	1	9.3	1	6.7	1	6.4
Organic Carbon, Total (TOC)	mg/L (ppm)	1	10	1	14	23	14	-	-	-	-	-	-	-	-

NOTES:
Bolded numbers indicate either a guideline equivalency or exceedance.
 1 = Exceedance of the Canadian Environmental Quality Guideline (CEQG) for the Protection of Aquatic Life (CCME 2007). See Table 2-3 for guideline concentration and explanation.
 2 = Exceedance of the Alberta Surface Water Quality Guideline (ASWQG) for the Protection of Aquatic Life (AENV 1999). See Table 2-3 for guideline concentration and explanation.
 3 = Exceedance of the British Columbia Approved Water Quality Guidelines for the Protection of Aquatic Life (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.
 4 = Exceedance of the Health Canada Guideline for Canadian Drinking Water Quality (GCDWQ) (Health Canada 2008). See Table 2-3 for guideline concentration and explanation.
 5 = Exceedance of the British Columbia Working Water Quality Guideline (BCWWQG) for Drinking Water (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.

Table A-14 Baseline Total Suspended Solids Results for the Central Mountains Hydrological Zone

Parameter	Units	Skeena River Basin		Nechako River Sub-basin				Skeena River Basin										Nechako River Sub-basin			
		Sutherland River		Stearns Creek		Endako River		Unnamed Maxam Creek Tributary		Foxy Creek (Downstream)		Foxy Creek (Upstream)		Klo Creek		Unnamed Klo Creek Tributary		Buck Creek		Parrott Creek	
		Crossing 888		Crossing 6004		Crossing 1001		Crossing 1024		Crossing 1923		Crossing 1032		Crossing 3090		Crossing 1041		Crossing 5018		Crossing 1052	
		BC EMS: E268330		AMEC: Water Quality		AMEC: Water Quality		AMEC: Hydrology		AMEC: Water Quality / BC EMS: 700108		BC EMS: 400763 / 400764		BC EMS: E228337		AMEC: Hydrology		BC EMS: E228317		AMEC: Hydrology	
		13-Sep-07		02-Oct-05		03-Oct-05		29-Sep-05		1995 / 2005		1995 / 2004		22-Sep-97		29-Sep-05		22-Sep-97		29-Sep-05	
		n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result
Total Suspended Solids (TSS)	mg/L (ppm)	1	4	1	< 2	1	3	1	< 2	7	2	26	2	1	< 5	1	< 2	1	< 5	1	< 2

NOTES:
Bolded numbers indicate either a guideline equivalency or exceedance.
 1 = Exceedance of the Canadian Environmental Quality Guideline (CEQG) for the Protection of Aquatic Life (CCME 2007). See Table 2-3 for guideline concentration and explanation.
 2 = Exceedance of the Alberta Surface Water Quality Guideline (ASWQG) for the Protection of Aquatic Life (AENV 1999). See Table 2-3 for guideline concentration and explanation.
 3 = Exceedance of the British Columbia Approved Water Quality Guidelines for the Protection of Aquatic Life (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.
 4 = Exceedance of the Health Canada Guideline for Canadian Drinking Water Quality (GCDWQ) (Health Canada 2008). See Table 2-3 for guideline concentration and explanation.
 5 = Exceedance of the British Columbia Working Water Quality Guideline (BCWWQG) for Drinking Water (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.

Table A-15 Baseline Water Quality Conditions for Metal Parameters in the Central Mountains Hydrological Zone

Parameter	Units	Skeena River Basin		Nechako River Sub-basin				Skeena River Basin			
		Sutherland River		Stearns Creek		Endako River		Foxy Creek (Downstream)		Foxy Creek (Upstream)	
		Crossing 888		Crossing 6004		Crossing 1001		Crossing 1923		Crossing 1032	
		BC EMS: E268330		AMEC: Water Quality		AMEC: Water Quality		AMEC: Water Quality / BC EMS: 700108		BC EMS: 400763 / 400764	
		13-Sep-07		02-Oct-05		03-Oct-05		1995 / 2005		1995 / 2004	
		n =	Result	n =	Result	n =	Result	n =	Result	n =	Result
Total Metals											
Aluminum (Al)	µg/L (ppb)	1	26	1	154 ^{1,4}	1	< 5	1	88	1	269 ^{1,3}
Antimony (Sb)	µg/L (ppb)	1	0.1	1	< 0.1	1	0.1	1	0.9	1	0.4
Arsenic (As)	µg/L (ppb)	1	0.3	1	< 0.4	1	1	1	1	1	0.4
Barium (Ba)	µg/L (ppb)	1	38	1	18	1	28	1	55	1	11
Beryllium (Be)	µg/L (ppb)	-	-	1	< 0.5	1	< 0.5	1	< 0.5	-	-
Boron (B)	µg/L (ppb)	1	8	1	< 10	1	< 10	1	< 10	1	<8
Cadmium (Cd)	µg/L (ppb)	-	-	1	< 0.1	1	< 0.1	7	< 0.1	24	<0.2
Chromium (Cr)	µg/L (ppb)	1	<0.2	1	< 0.9	1	< 0.9	1	< 0.9	1	0.4
Cobalt (Co)	µg/L (ppb)	-	-	1	< 0.1	1	< 0.1	1	0.1	1	0.2
Copper (Cu)	µg/L (ppb)	1	2 ¹	1	2 ¹	1	1.8	7	1	25	3 ¹
Iron (Fe)	µg/L (ppb)	1	55	1	290	1	150	1	200	1	443 ^{1,3,4,5}
Lead (Pb)	µg/L (ppb)	-	-	1	< 0.1	1	< 0.1	1	0.3	1	0.3
Manganese (Mn)	µg/L (ppb)	1	1.7	1	26	1	47	1	14	1	23
Mercury (Hg)	µg/L (ppb)	-	-	1	< 0.1	1	< 0.1	1	< 0.1	-	-

Table A-15 Baseline Water Quality Conditions for Metal Parameters in the Central Mountains Hydrological Zone (cont'd)

Parameter	Units	Skeena River Basin		Nechako River Sub-basin				Skeena River Basin			
		Sutherland River		Stearns Creek		Endako River		Foxy Creek (Downstream)		Foxy Creek (Upstream)	
		Crossing 888		Crossing 6004		Crossing 1001		Crossing 1923		Crossing 1032	
		BC EMS: E268330		AMEC: Water Quality		AMEC: Water Quality		AMEC: Water Quality / BC EMS: 700108		BC EMS: 400763 / 400764	
		13-Sep-07		02-Oct-05		03-Oct-05		1995 / 2005		1995 / 2004	
		n =	Result	n =	Result	n =	Result	n =	Result	n =	Result
Total Metals (cont'd)											
Molybdenum (Mo)	µg/L (ppb)	1	1.6	1	< 0.5	1	< 0.5	1	0.6	1	0.1
Nickel (Ni)	µg/L (ppb)	1	3	1	0.9	1	2	1	2	1	2
Phosphorus (P)	µg/L (ppb)	1	< 100	1	< 50	1	< 50	1	< 50	-	-
Selenium (Se)	µg/L (ppb)	1	<0.2	1	< 0.8	1	< 0.8	1	< 0.8	1	<0.2
Silicon (Si)	µg/L (ppb)	-	-	1	1,780	1	4,190	1	4,150	-	-
Silver (Ag)	µg/L (ppb)	-	-	1	< 0.2	1	< 0.2	1	< 0.2	-	-
Strontium (Sr)	µg/L (ppb)	1	109	-	-	-	-	-	-	1	54
Thallium (Tl)	µg/L (ppb)	-	-	1	< 0.05	1	< 0.05	1	< 0.05	-	-
Uranium (U)	µg/L (ppb)	1	0.1	1	0.2	1	< 0.05	1	0.2	-	-
Vanadium (V)	µg/L (ppb)	1	0.5	1	0.9	1	0.9	1	1	1	2
Zinc (Zn)	µg/L (ppb)	1	<0.1	1	4	1	4	7	<5	25	<5
Dissolved Metals											
Aluminum (Al)	µg/L (ppb)	-	-	1	42	1	< 2	7	38	24	73
Antimony (Sb)	µg/L (ppb)	-	-	1	< 0.1	1	< 0.1	1	0.6	-	-

Table A-15 Baseline Water Quality Conditions for Metal Parameters in the Central Mountains Hydrological Zone (cont'd)

Parameter	Units	Skeena River Basin		Nechako River Sub-basin				Skeena River Basin			
		Sutherland River		Stearns Creek		Endako River		Foxy Creek (Downstream)		Foxy Creek (Upstream)	
		Crossing 888		Crossing 6004		Crossing 1001		Crossing 1923		Crossing 1032	
		BC EMS: E268330		AMEC: Water Quality		AMEC: Water Quality		AMEC: Water Quality / BC EMS: 700108		BC EMS: 400763 / 400764	
		13-Sep-07		02-Oct-05		03-Oct-05		1995 / 2005		1995 / 2004	
		n =	Result	n =	Result	n =	Result	n =	Result	n =	Result
Dissolved Metals (cont'd)											
Arsenic (As)	µg/L (ppb)	-	-	1	< 0.1	1	1	1	0.8	-	-
Barium (Ba)	µg/L (ppb)	-	-	1	16	1	27	1	54	-	-
Beryllium (Be)	µg/L (ppb)	-	-	1	< 0.1	1	< 0.1	1	< 0.1	-	-
Boron (B)	µg/L (ppb)	-	-	1	< 4	1	< 4	1	< 4	-	-
Cadmium (Cd)	µg/L (ppb)	-	-	1	< 0.05	1	< 0.05	7	<0.2	22	<0.2
Chromium (Cr)	µg/L (ppb)	-	-	1	< 0.4	1	< 0.4	1	< 0.4	-	-
Cobalt (Co)	µg/L (ppb)	-	-	1	< 0.05	1	0.07	1	0.1	-	-
Copper (Cu)	µg/L (ppb)	-	-	1	1	1	1.5	7	2	24	3
Iron (Fe)	µg/L (ppb)	-	-	1	130	1	90	1	50	-	-
Lead (Pb)	µg/L (ppb)	-	-	1	< 0.05	1	< 0.05	1	< 0.05	-	-
Manganese (Mn)	µg/L (ppb)	-	-	1	3	1	37	1	11	-	-
Mercury (Hg)	µg/L (ppb)	-	-	1	< 0.1	1	< 0.1	1	< 0.1	-	-
Molybdenum (Mo)	µg/L (ppb)	-	-	1	< 0.3	1	< 0.3	1	0.6	-	-
Nickel (Ni)	µg/L (ppb)	-	-	1	< 0.1	1	1	1	0.6	-	-



Table A-15 Baseline Water Quality Conditions for Metal Parameters in the Central Mountains Hydrological Zone (cont'd)

Parameter	Units	Skeena River Basin		Nechako River Sub-basin				Skeena River Basin			
		Sutherland River		Stearns Creek		Endako River		Foxy Creek (Downstream)		Foxy Creek (Upstream)	
		Crossing 888		Crossing 6004		Crossing 1001		Crossing 1923		Crossing 1032	
		BC EMS: E268330		AMEC: Water Quality		AMEC: Water Quality		AMEC: Water Quality / BC EMS: 700108		BC EMS: 400763 / 400764	
		13-Sep-07		02-Oct-05		03-Oct-05		1995 / 2005		1995 / 2004	
		n =	Result	n =	Result	n =	Result	n =	Result	n =	Result
Dissolved Metals (cont'd)											
Phosphorus (P)	µg/L (ppb)	-	-	1	< 5	1	< 5	1	< 5	-	-
Selenium (Se)	µg/L (ppb)	-	-	1	< 0.4	1	< 0.4	1	< 0.4	-	-
Silicon (Si)	µg/L (ppb)	-	-	1	1,590	1	4,080	1	3,860	-	-
Silver (Ag)	µg/L (ppb)	-	-	1	< 0.05	1	< 0.05	1	< 0.05	-	-
Strontium (Sr)	µg/L (ppb)	-	-	-	-	-	-	-	-	-	-
Thallium (Tl)	µg/L (ppb)	-	-	1	< 0.02	1	< 0.02	1	< 0.02	-	-
Uranium (U)	µg/L (ppb)	-	-	1	0.15	1	< 0.05	1	0.2	-	-

Table A-15 Baseline Water Quality Conditions for Metal Parameters in the Central Mountains Hydrological Zone (cont'd)

Parameter	Units	Skeena River Basin		Nechako River Sub-basin				Skeena River Basin			
		Sutherland River		Stearns Creek		Endako River		Foxy Creek (Downstream)		Foxy Creek (Upstream)	
		Crossing 888		Crossing 6004		Crossing 1001		Crossing 1923		Crossing 1032	
		BC EMS: E268330		AMEC: Water Quality		AMEC: Water Quality		AMEC: Water Quality / BC EMS: 700108		BC EMS: 400763 / 400764	
		13-Sep-07		02-Oct-05		03-Oct-05		1995 / 2005		1995 / 2004	
		n =	Result	n =	Result	n =	Result	n =	Result	n =	Result
Dissolved Metals (cont'd)											
Vanadium (V)	µg/L (ppb)	-	-	1	0.6	1	0.8	1	0.9	-	-
Zinc (Zn)	µg/L (ppb)	-	-	1	< 2	1	4	7	<5	24	<5
<p>NOTES:</p> <p>Bolded numbers indicate either a guideline equivalency or exceedance.</p> <p>1 = Exceedance of the Canadian Environmental Quality Guideline (CEQG) for the Protection of Aquatic Life (CCME 2007). See Table 3 for guideline concentration and explanation.</p> <p>2 = Exceedance of the Alberta Surface Water Quality Guideline (ASWQG) for the Protection of Aquatic Life (AENV 1999). See Table 3 for guideline concentration and explanation.</p> <p>3 = Exceedance of the British Columbia Approved Water Quality Guidelines for the Protection of Aquatic Life (BC MWLAP 2006a). See Table 3 for guideline concentration and explanation.</p> <p>4 = Exceedance of the Health Canada Guideline for Canadian Drinking Water Quality (GCDWQ) (Health Canada 2008). See Table 3 for guideline concentration and explanation.</p> <p>5 = Exceedance of the British Columbia Working Water Quality Guideline (BCWWQG) for Drinking Water (BC MWLAP 2006a). See Table 3 for guideline concentration and explanation.</p>											

Table A-16 Baseline Water Quality Conditions for Physical, Conventional, and Nutrient Parameters in the Coastal Mountains Hydrological Zone

Parameter	Units	Kitimat River Basin											
		Hunter Creek		Chist Creek		Cecil Creek		Trout Creek		Anderson Creek		Moore Creek	
		Crossing 3197		Crossing 1222		Crossing 1223		Crossing 3130		Crossing 1274		Crossing 3141	
		BC EMS: E256659		BC EMS: E256660 / E256662		BC EMS: E239479		BC EMS: E256654		AMEC: Water Quality / BC EMS: E216322		AMEC: Water Quality	
		17-Aug-04		2004 / 2005		01-Nov-99		17-Aug-04		1995 - 2005		03-Oct-05	
		n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result
Field Measured													
pH	pH Units	1	7.4	-	-	-	-	1	7.8	1	7.3	1	7.9
Conductivity	µS/cm	-	-	-	-	1	27	-	-	1	25	1	20
Conductivity, Specific	µS/cm	1	22	-	-	-	-	1	75	3	37	1	30
Dissolved Oxygen (DO)	mg/L (ppm)	-	-	-	-	-	-	-	-	1	12.3	1	11.8
Dissolved Oxygen, saturation	%	-	-	-	-	-	-	-	-	1	103	1	100
Conventional Parameters and Major Ions													
pH	pH Units	-	-	-	-	1	6.4 ^{1,3}	-	-	1	7.0	1	6.8
Conductivity, Specific	µS/cm	-	-	-	-	-	-	-	-	1	37	1	32
Total Dissolved Solids (TDS)	mg/L (ppm)	1	18	4	10	-	-	1	54	1	20	1	12
Alkalinity, Total	mg/L (ppm)	1	9 ³	4	3 ³	-	-	1	36	1	12	1	12
Hardness, Total	mg/L (ppm)	-	16	4	7	1	12	1	35	1	16	1	11
Turbidity	NTU	1	35 ^{3,4,5}	-	30 ^{3,4,5}	-	-	1	1 ^{4,5}	1	< 1	1	1 ^{4,5}
Bicarbonate	mg/L (ppm)	-	-	-	-	-	-	-	-	1	15	1	15
Calcium	mg/L (ppm)	-	-	-	-	-	-	-	-	1	6	1	4 3

Table A-16 Baseline Water Quality Conditions for Physical, Conventional, and Nutrient Parameters in the Coastal Mountains Hydrological Zone (cont'd)

Parameter	Units	Kitimat River Basin											
		Hunter Creek		Chist Creek		Cecil Creek		Trout Creek		Anderson Creek		Moore Creek	
		Crossing 3197		Crossing 1222		Crossing 1223		Crossing 3130		Crossing 1274		Crossing 3141	
		BC EMS: E256659		BC EMS: E256660 / E256662		BC EMS: E239479		BC EMS: E256654		AMEC: Water Quality / BC EMS: E216322		AMEC: Water Quality	
		17-Aug-04		2004 / 2005		01-Nov-99		17-Aug-04		1995 - 2005		03-Oct-05	
		n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result
Conventional Parameters and Major Ions (cont'd)													
Carbonate	mg/L (ppm)	-	-	-	-	-	-	-	-	1	< 1	1	< 1
Chloride	mg/L (ppm)	1	<0.5	4	<0.5	-	-	1	<0.5	3	0.4	1	0.9
Fluoride	mg/L (ppm)	-	-	-	-	-	-	-	-	3	0.1	1	0.1
Magnesium	mg/L (ppm)	-	-	-	-	-	-	-	-	1	< 0.5	1	< 0.5
Potassium	mg/L (ppm)	-	-	-	-	-	-	-	-	3	0.2	1	< 0.5
Sodium	mg/L (ppm)	-	-	-	-	-	-	-	-	3	0.6	1	0.9
Sulphate	mg/L (ppm)	1	1	4	1	1	3	1	2	3	3	1	6
Nutrients													
Chlorophyll a	mg/L (ppm)	-	-	-	-	-	-	-	-	-	-	-	-
Ammonia	mg/L (ppm)	1	0.006	4	0.1	-	-	1	<0.005	3	<0.01	1	< 0.1
Nitrate + Nitrite	mg/L (ppm)	1	0.008	4	0.03	-	-	1	0.04	-	-	-	-
Nitrate	mg/L (ppm)	-	-	2	<0.02	-	-	-	-	3	0.1	1	0.1
Nitrite	mg/L (ppm)	-	-	2	0.04	-	-	-	-	1	< 0.05	1	< 0.05
Nitrogen, Total Kjeldahl (TKN)	mg/L (ppm)	-	-	-	-	-	-	-	-	-	-	-	-

Table A-16 Baseline Water Quality Conditions for Physical, Conventional, and Nutrient Parameters in the Coastal Mountains Hydrological Zone (cont'd)

Parameter	Units	Kitimat River Basin											
		Hunter Creek		Chist Creek		Cecil Creek		Trout Creek		Anderson Creek		Moore Creek	
		Crossing 3197		Crossing 1222		Crossing 1223		Crossing 3130		Crossing 1274		Crossing 3141	
		BC EMS: E256659		BC EMS: E256660 / E256662		BC EMS: E239479		BC EMS: E256654		AMEC: Water Quality / BC EMS: E216322		AMEC: Water Quality	
		17-Aug-04		2004 / 2005		01-Nov-99		17-Aug-04		1995 - 2005		03-Oct-05	
		n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result
Nutrients (cont'd)													
Phosphorus, Dissolved	mg/L (ppm)	-	-	-	-	-	-	-	-	-	-	-	-
Phosphorus, Total	mg/L (ppm)	1	0.2 ^{3,5}	8	0.04 ^{3,5}	1	< 0.1	1	< 0.1	1	< 0.02	1	< 0.02
Organic Carbon, Dissolved (DOC)	mg/L (ppm)	-	-	-	-	-	-	-	-	1	2	1	3
Organic Carbon, Total (TOC)	mg/L (ppm)	1	< 0.5	4	1	-	-	1	3	1	3	1	3
<p>NOTES:</p> <p>Bolded numbers indicate either a guideline equivalency or exceedance.</p> <p>1 = Exceedance of the Canadian Environmental Quality Guideline (CEQG) for the Protection of Aquatic Life (CCME 2007). See Table 2-3 for guideline concentration and explanation.</p> <p>2 = Exceedance of the Alberta Surface Water Quality Guideline (ASWQG) for the Protection of Aquatic Life (AENV 1999). See Table 2-3 for guideline concentration and explanation.</p> <p>3 = Exceedance of the British Columbia Approved Water Quality Guidelines for the Protection of Aquatic Life (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.</p> <p>4 = Exceedance of the Health Canada Guideline for Canadian Drinking Water Quality (GCDWQ) (Health Canada 2008). See Table 2-3 for guideline concentration and explanation.</p> <p>5 = Exceedance of the British Columbia Working Water Quality Guideline (BCWWQG) for Drinking Water (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.</p>													

Table A-17 Baseline Total Suspended Solids Results for the Coastal Mountains Hydrological Zone

Parameter	Units	Skeena River Basin		Kitimat River Basin											
		Gosnell Creek		Hunter Creek		Unnamed Kitimat River Tributary		Chist Creek		Trout Creek		Anderson Creek		Moore Creek	
		Crossing 1111		Crossing 3197		Crossing 1191		Crossing 1222		Crossing 3130		Crossing 1274		Crossing 3141	
		AMEC: Hydrology		BC EMS: E256659		AMEC: Hydrology		BC EMS: E256660 / E256662		BC EMS: E256654		AMEC: Water Quality / BC EMS: E216322		AMEC: Water Quality	
		29-Sep-05		17-Aug-04		29-Sep-05		2004 / 2005		17-Aug-04		1995 - 2005		03-Oct-05	
		n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result
Total Suspended Solids (TSS)	mg/L (ppm)	1	< 2	1	36	1	< 2	4	9	1	< 4	2	< 2	1	< 2

NOTES:

Bolded numbers indicate either a guideline equivalency or exceedance.

- 1 = Exceedance of the Canadian Environmental Quality Guideline (CEQG) for the Protection of Aquatic Life (CCME 2007). See Table 2-3 for guideline concentration and explanation.
- 2 = Exceedance of the Alberta Surface Water Quality Guideline (ASWQG) for the Protection of Aquatic Life (AENV 1999). See Table 2-3 for guideline concentration and explanation.
- 3 = Exceedance of the British Columbia Approved Water Quality Guidelines for the Protection of Aquatic Life (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.
- 4 = Exceedance of the Health Canada Guideline for Canadian Drinking Water Quality (GCDWQ) (Health Canada 2008). See Table 2-3 for guideline concentration and explanation.
- 5 = Exceedance of the British Columbia Working Water Quality Guideline (BCWWQG) for Drinking Water (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.

Table A-18 Baseline Water Quality Conditions for Metal Parameters in the Coastal Mountains Hydrological Zone

Parameter	Units	Kitimat River Basin											
		Hunter Creek		Chist Creek		Cecil Creek		Trout Creek		Anderson Creek		Moore Creek	
		Crossing 3197		Crossing 1222		Crossing 1223		Crossing 3130		Crossing 1274		Crossing 3141	
		BC EMS: E256659		BC EMS: E256660 / E256662		BC EMS: E239479		BC EMS: E256654		AMEC: Water Quality / BC EMS: E216322		AMEC: Water Quality	
		17-Aug-04		2004 / 2005		01-Nov-99		17-Aug-04		1995 - 2005		03-Oct-05	
		n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result
Total Metals													
Aluminum (Al)	µg/L (ppb)	1	394 ^{1,4}	4	609 ^{1,4}	1	310 ^{1,4}	1	59	3	51	1	95
Antimony (Sb)	µg/L (ppb)	-	-	-	-	1	< 60	-	-	3	< 0.1	1	< 0.1
Arsenic (As)	µg/L (ppb)	1	0.1	4	< 0.1	1	< 60	1	0.3	3	< 0.4	1	< 0.4
Barium (Ba)	µg/L (ppb)	1	6	4	34	1	9	1	6	3	9	1	5
Beryllium (Be)	µg/L (ppb)	-	-	-	-	1	< 1	-	-	3	< 0.5	1	< 0.5
Boron (B)	µg/L (ppb)	1	< 8	4	< 8	1	< 10	1	< 8	3	< 10	1	< 10
Cadmium (Cd)	µg/L (ppb)	-	-	-	-	1	< 0.2	-	-	3	< 0.1	1	< 0.1
Chromium (Cr)	µg/L (ppb)	1	0.3	4	0.7	1	10 ^{1,3}	1	< 0.2	3	< 0.9	1	< 0.9
Cobalt (Co)	µg/L (ppb)	1	0.3	2	2	1	7	-	-	3	< 0.1	1	< 0.1
Copper (Cu)	µg/L (ppb)	1	4 ¹	4	1	1	1	1	0.5	3	< 2	1	1.7
Iron (Fe)	µg/L (ppb)	1	2,150 ^{1,3,4,5}	4	2,060 ^{1,3,4,5}	1	271	1	310 ^{1,3,4,5}	3	25	1	< 10
Lead (Pb)	µg/L (ppb)	1	1 ¹	3	0.5	1	< 0.6	1	0.2	3	< 0.1	1	< 0.1

Table A-18 Baseline Water Quality Conditions for Metal Parameters in the Coastal Mountains Hydrological Zone (cont'd)

Parameter	Units	Kitimat River Basin											
		Hunter Creek		Chist Creek		Cecil Creek		Trout Creek		Anderson Creek		Moore Creek	
		Crossing 3197		Crossing 1222		Crossing 1223		Crossing 3130		Crossing 1274		Crossing 3141	
		BC EMS: E256659		BC EMS: E256660 / E256662		BC EMS: E239479		BC EMS: E256654		AMEC: Water Quality / BC EMS: E216322		AMEC: Water Quality	
		17-Aug-04		2004 / 2005		01-Nov-99		17-Aug-04		1995 - 2005		03-Oct-05	
		n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result
Total Metals (cont'd)													
Manganese (Mn)	µg/L (ppb)	1	21	4	20	1	65 ^{4,5}	1	12	3	< 2	1	< 2
Mercury (Hg)	µg/L (ppb)	-	-	-	-	-	-	-	-	1	< 0.1	1	< 0.1
Molybdenum (Mo)	µg/L (ppb)	1	0.3	4	0.1	1	< 10	1	0.4	3	< 0.5	1	< 0.5
Nickel (Ni)	µg/L (ppb)	1	0.4	4	0.5	1	< 20	1	0.1	3	< 10	1	3
Phosphorus (P)	µg/L (ppb)	-	-	-	-	-	-	-	-	1	< 50	1	< 50
Selenium (Se)	µg/L (ppb)	1	< 0.2	4	< 0.2	1	< 60	1	< 0.2	3	< 0.8	1	< 0.8
Silicon (Si)	µg/L (ppb)	-	-	-	-	1	2,010	-	-	3	1410	1	2,670
Silver (Ag)	µg/L (ppb)	-	-	-	-	1	< 10	-	-	3	< 0.2	1	< 0.2
Strontium (Sr)	µg/L (ppb)	1	13	4	17	1	13	1	34	2	20	-	-
Thallium (Tl)	µg/L (ppb)	-	-	1	0.1	-	-	-	-	3	< 0.05	1	< 0.05
Uranium (U)	µg/L (ppb)	1	0.1	4	0.4	-	-	-	-	1	< 0.05	1	< 0.05
Vanadium (V)	µg/L (ppb)	1	1	4	2	1	< 10	1	0.5	3	< 3	1	0.5
Zinc (Zn)	µg/L (ppb)	1	2	4	5	1	7	1	0.5	3	5	1	< 2

Table A-18 Baseline Water Quality Conditions for Metal Parameters in the Coastal Mountains Hydrological Zone (cont'd)

Parameter	Units	Kitimat River Basin											
		Hunter Creek		Chist Creek		Cecil Creek		Trout Creek		Anderson Creek		Moore Creek	
		Crossing 3197		Crossing 1222		Crossing 1223		Crossing 3130		Crossing 1274		Crossing 3141	
		BC EMS: E256659		BC EMS: E256660 / E256662		BC EMS: E239479		BC EMS: E256654		AMEC: Water Quality / BC EMS: E216322		AMEC: Water Quality	
		17-Aug-04		2004 / 2005		01-Nov-99		17-Aug-04		1995 - 2005		03-Oct-05	
		n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result
Dissolved Metals													
Aluminum (Al)	µg/L (ppb)	-	-	-	-	1	240 ^{3,5}	-	-	3	47	1	94
Antimony (Sb)	µg/L (ppb)	-	-	-	-	1	< 50	-	-	3	< 0.1	1	< 0.1
Arsenic (As)	µg/L (ppb)	-	-	-	-	1	< 50	-	-	3	< 0.1	1	< 0.1
Barium (Ba)	µg/L (ppb)	-	-	-	-	1	9	-	-	3	9	1	5
Beryllium (Be)	µg/L (ppb)	-	-	-	-	1	<1	-	-	3	< 0.1	1	< 0.1
Boron (B)	µg/L (ppb)	-	-	-	-	1	< 10	-	-	3	< 4	1	< 4
Cadmium (Cd)	µg/L (ppb)	-	-	-	-	1	< 0.2	-	-	3	< 0.05	1	< 0.05
Chromium (Cr)	µg/L (ppb)	-	-	-	-	1	6	-	-	3	< 0.4	1	< 0.4
Cobalt (Co)	µg/L (ppb)	-	-	-	-	1	< 5	-	-	3	< 0.05	1	0.06
Copper (Cu)	µg/L (ppb)	-	-	-	-	1	< 0.5	-	-	3	< 1	1	1.3
Iron (Fe)	µg/L (ppb)	-	-	-	-	1	236	-	-	3	13	1	< 10
Lead (Pb)	µg/L (ppb)	-	-	-	-	1	< 0.5	-	-	3	< 0.05	1	< 0.05
Manganese (Mn)	µg/L (ppb)	-	-	-	-	1	47	-	-	3	< 1	1	<1

Table A-18 Baseline Water Quality Conditions for Metal Parameters in the Coastal Mountains Hydrological Zone (cont'd)

Parameter	Units	Kitimat River Basin											
		Hunter Creek		Chist Creek		Cecil Creek		Trout Creek		Anderson Creek		Moore Creek	
		Crossing 3197		Crossing 1222		Crossing 1223		Crossing 3130		Crossing 1274		Crossing 3141	
		BC EMS: E256659		BC EMS: E256660 / E256662		BC EMS: E239479		BC EMS: E256654		AMEC: Water Quality / BC EMS: E216322		AMEC: Water Quality	
		17-Aug-04		2004 / 2005		01-Nov-99		17-Aug-04		1995 - 2005		03-Oct-05	
		n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result
Dissolved Metals (cont'd)													
Mercury (Hg)	µg/L (ppb)	-	-	-	-	-	-	-	-	1	< 0.1	1	< 0.1
Molybdenum (Mo)	µg/L (ppb)	-	-	-	-	1	< 10	-	-	3	< 0.3	1	< 0.3
Nickel (Ni)	µg/L (ppb)	-	-	-	-	1	< 20	-	-	3	< 0.1	1	< 0.1
Phosphorus (P)	µg/L (ppb)	-	-	-	-	-	-	-	-	1	< 5	1	< 5
Selenium (Se)	µg/L (ppb)	-	-	-	-	1	< 50	-	-	3	< 0.4	1	< 0.4
Silicon (Si)	µg/L (ppb)	-	-	-	-	1	2,240	-	-	3	1460	1	< 10
Silver (Ag)	µg/L (ppb)	-	-	-	-	1	< 10	-	-	1	< 0.05	1	< 0.05
Strontium (Sr)	µg/L (ppb)	-	-	-	-	1	12	-	-	1	19	-	-
Thallium (Tl)	µg/L (ppb)	-	-	-	-	-	-	-	-	3	< 0.02	1	< 0.02
Uranium (U)	µg/L (ppb)	-	-	-	-	-	-	-	-	1	< 0.05	1	< 0.05

Table A-18 Baseline Water Quality Conditions for Metal Parameters in the Coastal Mountains Hydrological Zone (cont'd)

Parameter	Units	Kitimat River Basin											
		Hunter Creek		Chist Creek		Cecil Creek		Trout Creek		Anderson Creek		Moore Creek	
		Crossing 3197		Crossing 1222		Crossing 1223		Crossing 3130		Crossing 1274		Crossing 3141	
		BC EMS: E256659		BC EMS: E256660 / E256662		BC EMS: E239479		BC EMS: E256654		AMEC: Water Quality / BC EMS: E216322		AMEC: Water Quality	
		17-Aug-04		2004 / 2005		01-Nov-99		17-Aug-04		1995 - 2005		03-Oct-05	
		n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result
Dissolved Metals (cont'd)													
Vanadium (V)	µg/L (ppb)	-	-	-	-	1	< 10	-	-	3	< 0.5	1	< 0.5
Zinc (Zn)	µg/L (ppb)	-	-	-	-	1	4	-	-	3	<2	1	2
NOTES: Bolded numbers indicate either a guideline equivalency or exceedance. 1 = Exceedance of the Canadian Environmental Quality Guideline (CEQG) for the Protection of Aquatic Life (CCME 2007). See Table 2-3 for guideline concentration and explanation. 2 = Exceedance of the Alberta Surface Water Quality Guideline (ASWQG) for the Protection of Aquatic Life (AENV 1999). See Table 2-3 for guideline concentration and explanation. 3 = Exceedance of the British Columbia Approved Water Quality Guidelines for the Protection of Aquatic Life (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation. 4 = Exceedance of the Health Canada Guideline for Canadian Drinking Water Quality (GCDWQ) (Health Canada 2008). See Table 2-3 for guideline concentration and explanation. 5 = Exceedance of the British Columbia Working Water Quality Guideline (BCWWQG) for Drinking Water (BC MWLAP 2006a). See Table 2-3 for guideline concentration and explanation.													

Appendix B Sediment Quality Tables

Table B-1 Baseline Sediment Quality Conditions in the Foothills Hydrological Zone

Parameter	Units	Peace River Basin	
		Smoky River	
		Crossing 3174	
		AMEC: Water Quality	
		30-Sep-05	
		n =	Result
Conventional Parameters			
Texture - Sand	%	1	66
Texture - Silt	%	1	27
Texture - Clay	%	1	7
Total Organic Carbon	%	1	1.4
Total Metals			
Aluminum (Al)	µg/g (ppm)	1	4580
Arsenic (As)	µg/g (ppm)	1	4.9
Barium (Ba)	µg/g (ppm)	1	143
Cadmium (Cd)	µg/g (ppm)	1	0.3
Calcium (Ca)	µg/g (ppm)	1	50400
Chromium (Cr)	µg/g (ppm)	1	7.6
Cobalt (Co)	µg/g (ppm)	1	6
Copper (Cu)	µg/g (ppm)	1	12.7
Iron (Fe)	µg/g (ppm)	1	21500
Lead (Pb)	µg/g (ppm)	1	7
Magnesium (Mg)	µg/g (ppm)	1	9850
Manganese (Mn)	µg/g (ppm)	1	290
Mercury (Hg)	µg/g (ppm)	1	< 0.5
Molybdenum (Mo)	µg/g (ppm)	1	0.8
Nickel (Ni)	µg/g (ppm)	1	16
Phosphorus (P)	µg/g (ppm)	1	779
Potassium (K)	µg/g (ppm)	1	795
Selenium (Se)	µg/g (ppm)	1	< 0.5
Silver (Ag)	µg/g (ppm)	-	-
Sodium (Na)	µg/g (ppm)	1	721
Thallium (Tl)	µg/g (ppm)	1	< 0.5
Vanadium (V)	µg/g (ppm)	1	12
Zinc (Zn)	µg/g (ppm)	1	57



Table B-2 Baseline Sediment Quality Conditions in the Rocky Mountains Hydrological Zone

Parameter	Units	Peace River Basin									
		Unnamed Missinka River Tributary		Unnamed Wichcika Creek Tributary		Unnamed Chuchinka Creek Tributary		Unnamed Chuchinka Creek Tributary		Missinka River	
		Crossing 579		Crossing 592		Crossing 599		Crossing 619		Crossing 480	
		RGS: 93J853113		RGS: 93J851409		RGS: 93J851413		RGS: 93J851414		AMEC: Water Quality	
		17-Sep-85		05-Jul-85		05-Jul-85		05-Jul-85		01-Oct-05	
		n =	Result	n =	Result	n =	Result	n =	Result	n =	Result
Conventional Parameters											
Texture - Sand	%	-	-	-	-	-	-	-	-	1	98
Texture - Silt	%	1	> 67	1	33-67	1	33-67	1	< 33	1	2
Texture - Clay	%									1	< 1
Total Organic Carbon	%	1	0	1	0	1	0	1	0	1	0.7
Total Metals											
Aluminum (Al)	µg/g (ppm)	1	7,000	1	16,200	1	7,000	1	7,900	1	4,450
Arsenic (As)	µg/g (ppm)	1	5	1	2	1	5	1	1	1	6.5¹
Barium (Ba)	µg/g (ppm)	1	47	1	103	1	261	1	167	1	35
Cadmium (Cd)	µg/g (ppm)	1	0.09	1	0.1	1	0.4	1	0.06	1	0.2
Calcium (Ca)	µg/g (ppm)	1	2,800	1	24,700	1	21,200	1	43,200	1	13,400
Chromium (Cr)	µg/g (ppm)	1	12	1	24	1	17	1	19	1	11
Cobalt (Co)	µg/g (ppm)	1	7	1	12	1	8	1	8	1	6.9
Copper (Cu)	µg/g (ppm)	1	11	1	15	1	16	1	13	1	19
Iron (Fe)	µg/g (ppm)	1	18,000	1	29,500²	1	19,200	1	17,100	1	24,800²
Lead (Pb)	µg/g (ppm)	1	9	1	12	1	20	1	6	1	9
Magnesium (Mg)	µg/g (ppm)	1	2,600	1	11,600	1	12,100	1	9,000	1	8,240

Table B-2 Baseline Sediment Quality Conditions in the Rocky Mountains Hydrological Zone (cont'd)

Parameter	Units	Peace River Basin									
		Unnamed Missinka River Tributary		Unnamed Wichcika Creek Tributary		Unnamed Chuchinka Creek Tributary		Unnamed Chuchinka Creek Tributary		Missinka River	
		Crossing 579		Crossing 592		Crossing 599		Crossing 619		Crossing 480	
		RGS: 93J853113		RGS: 93J851409		RGS: 93J851413		RGS: 93J851414		AMEC: Water Quality	
		17-Sep-85		05-Jul-85		05-Jul-85		05-Jul-85		01-Oct-05	
		n =	Result	n =	Result	n =	Result	n =	Result	n =	Result
Total Metals (cont'd)											
Manganese (Mn)	µg/g (ppm)	1	698	1	577	1	632	1	344	1	364
Mercury (Hg)	µg/g (ppm)	1	0.03	1	0.02	1	0.08	1	0.04	1	< 0.5
Molybdenum (Mo)	µg/g (ppm)	1	0.3	1	0.4	1	1.1	1	0.4	1	< 0.5
Nickel (Ni)	µg/g (ppm)	1	15	1	28²	1	21²	1	19²	1	16²
Phosphorus (P)	µg/g (ppm)	1	640	1	790	1	880	1	530	1	868
Potassium (K)	µg/g (ppm)	1	500	1	1,000	1	800	1	400	1	282
Selenium (Se)	µg/g (ppm)	1	0.1	1	0.2	1	0.5	1	0.2	1	< 0.5
Silver (Ag)	µg/g (ppm)	1	0.02	1	0.04	1	0.1	1	0.03	1	-
Sodium (Na)	µg/g (ppm)	1	30	1	80	1	50	1	50	1	213
Thallium (Tl)	µg/g (ppm)	1	0.03	1	0.05	1	0.1	1	0.02	1	< 0.5
Vanadium (V)	µg/g (ppm)	1	10	1	14	1	19	1	12	1	11
Zinc (Zn)	µg/g (ppm)	1	47	1	69	1	71	1	45	1	43
NOTES:											
Bolded numbers indicate either a guideline equivalency or exceedance.											
1 = Exceedance of the CCME Canadian Sediment Quality Guideline (CCME 2002). See Table 2-3 for guideline concentration and explanation.											
2 = Exceedance of the British Columbia Sediment Quality Guideline (BC MWLAP 2006b). See Table 2-3 for guideline concentration and explanation.											

Table B-3 Baseline Sediment Quality Conditions in the Central Interior Hydrological Zone

Parameter	Units	Peace River Basin				Fraser River Basin										Nechako River Sub-basin											
		Unnamed Merton Creek Tributary		Crooked River		Unnamed Slender Lake Tributary		Muskeg River		Unnamed Mossvale Lake Tributary		Unnamed Great Beaver Lake Tributary		Unnamed Great Beaver Lake Tributary		Muskeg River		Unnamed Necoslie River Tributary		Duncan Creek		Sheraton Creek		Tintagel Creek			
		Crossing 700		Crossing 677		Crossing 710		Crossing 720		Crossing 732		Crossing 759		Crossing 765		Crossing 782		Crossing 720		Crossing 826		Crossing 907		Crossing 981		Crossing 6000	
		RGS: 93J851355		AMEC: Water Quality		RGS: 93J851310		RGS: 93J851819		RGS: 93J851492		RGS: 93J853176		RGS: 93J851052		RGS: 93J853182		AMEC: Water Quality		RGS: 93K081434		RGS: 93K071365		RGS: 93K051248		RGS: 93K051249	
		29-Aug-85		01-Oct-05		26-Jul-85		21-Jul-85		20-Jul-85		18-Sep-85		22-Jul-85		18-Sep-85		01-Oct-05		16-Aug-02		11-Aug-02		07-Aug-02		07-Aug-02	
n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result		
Conventional Parameters																											
Texture - Sand	%	1	-	1	97	1	-	1	-	1	-	1	-	1	-	1	-	1	93	1	-	1	-	1	-	1	-
Texture - Silt	%	1	< 33	1	2	1	< 33	1	< 33	1	33-67	1	< 33	1	< 33	1	> 67	1	5	1	33-67	1	33-67	1	< 33	1	< 33
Texture - Clay	%				1														2								
Total Organic Carbon	%	1	0	1	0.2	1	0	1	0	1	< 33	1	> 67	1	> 67	1	< 33	1	0.3	1	0	1	0	1	0	1	0
Total Metals																											
Aluminum (Al)	µg/g (ppm)	1	8,100	1	3,660	1	9,400	1	9,200	1	8,100	1	13,900	1	7,800	1	14,600	1	4,460	1	15,800	1	9,800	1	2,300	1	39,100
Arsenic (As)	µg/g (ppm)	1	4.3	1	2.2	1	4.1	1	3.4	1	3	1	7 ¹	1	1.9	1	6	1	4	1	14 ¹	1	6 ¹	1	7 ¹	1	6 ¹
Barium (Ba)	µg/g (ppm)	1	110	1	42	1	128	1	83	1	133	1	520	1	307	1	357	1	78	1	1500	1	950	1	600	1	740
Cadmium (Cd)	µg/g (ppm)	1	0.30	1	< 0.2	1	0.26	1	0.28	1	0.3	1	0.8 ^{1,2}	1	0.3	1	0.8 ^{1,2}	1	< 0.2	1	0.4	1	0.1	1	0.7 ^{1,2}	1	3 ^{1,2}
Calcium (Ca)	µg/g (ppm)	1	4,200	1	1,820	1	3,300	1	4,100	1	4,400	1	8,000	1	12,500	1	5,800	1	2,780	1	9,000	1	4,700	1	6,200	1	12,200
Chromium (Cr)	µg/g (ppm)	1	65 ¹	1	17	1	69 ¹	1	68 ¹	1	76 ¹	1	69 ¹	1	60 ¹	1	82 ¹	1	28	-	230 ¹	-	100 ¹	-	45 ¹	-	41 ¹
Cobalt (Co)	µg/g (ppm)	1	10	1	5	1	9	1	9	1	11	1	13	1	6	1	10	1	6	1	30	1	14	1	23	1	28
Copper (Cu)	µg/g (ppm)	1	25	1	6	1	17	1	19	1	23	1	29	1	57 ¹	1	30	1	10	1	35	1	14	1	21	1	30
Iron (Fe)	µg/g (ppm)	1	19,500	1	15,300	1	19,900	1	24,000	1	17,600	1	27,700 ²	1	15,100	1	25,200 ²	1	18,700	1	33,500 ²	1	21,100	1	39,600 ²	1	54,600 ²
Lead (Pb)	µg/g (ppm)	1	4	1	2	1	4	1	4	1	5	1	6	1	5	1	5	1	2	1	12	1	7	1	4	1	8
Magnesium (Mg)	µg/g (ppm)	1	6,000	1	3,030	1	5,500	1	5,200	1	8,700	1	6,000	1	7,800	1	6,000	1	4,560	1	9,900	1	4,100	1	4,600	1	5,900
Manganese (Mn)	µg/g (ppm)	1	392	1	262	1	379	1	431	1	443	1	3,015	1	241	1	730	1	522	1	2,833	1	579	1	5,769	1	13,657

Table B-3 Baseline Sediment Quality Conditions in the Central Interior Hydrological Zone (cont'd)

Parameter	Units	Peace River Basin				Fraser River Basin										Nechako River Sub-basin											
		Unnamed Merton Creek Tributary		Crooked River		Unnamed Slender Lake Tributary		Muskeg River		Unnamed Mossvale Lake Tributary		Unnamed Great Beaver Lake Tributary		Unnamed Great Beaver Lake Tributary		Muskeg River		Unnamed Necoslie River Tributary		Duncan Creek		Sheraton Creek		Tintagel Creek			
		Crossing 700		Crossing 677		Crossing 710		Crossing 720		Crossing 732		Crossing 759		Crossing 765		Crossing 782		Crossing 720		Crossing 826		Crossing 907		Crossing 981		Crossing 6000	
		RGS: 93J851355		AMEC: Water Quality		RGS: 93J851310		RGS: 93J851819		RGS: 93J851492		RGS: 93J853176		RGS: 93J851052		RGS: 93J853182		AMEC: Water Quality		RGS: 93K081434		RGS: 93K071365		RGS: 93K051248		RGS: 93K051249	
		29-Aug-85		01-Oct-05		26-Jul-85		21-Jul-85		20-Jul-85		18-Sep-85		22-Jul-85		18-Sep-85		01-Oct-05		16-Aug-02		11-Aug-02		07-Aug-02		07-Aug-02	
n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result		
Total Metals (cont'd)																											
Mercury (Hg)	µg/g (ppm)	1	0.066	1	< 0.5	1	0.077	1	0.2¹	1	0.1	1	0.2¹	1	0.21¹	1	0.06	1	< 0.5	1	0.06	1	0.02	1	0.1	1	0.1
Molybdenum (Mo)	µg/g (ppm)	1	0.63	1	< 0.5	1	0.60	1	0.63	1	0.5	1	1.2	1	1.3	1	0.9	1	< 0.5	1	1.5	1	0.5	1	9	1	17
Nickel (Ni)	µg/g (ppm)	1	58²	1	22²	1	49²	1	44²	1	89²	1	76²	1	61²	1	73²	1	28²	1	74²	1	18²	1	14	1	24²
Phosphorus (P)	µg/g (ppm)	1	690	1	368	1	700	1	640	1	680	1	1,800	1	1,150	1	880	1	561	1	750	1	870	1	1,220	1	1,650
Potassium (K)	µg/g (ppm)	1	400	1	218	1	500	1	400	1	500	1	1,200	1	700	1	900	1	248	1	1,000	1	600	1	600	1	1,000
Selenium (Se)	µg/g (ppm)	1	0.2	1	< 0.5	1	0.1	1	0.2	1	0.1	1	1.1	1	0.6	1	0.4	1	< 0.5	1	0.6	1	0.3	1	0.5	1	0.7
Silver (Ag)	µg/g (ppm)	1	0.048	-	-	1	0.041	1	0.045	1	0.068	1	0.2	1	0.1	1	0.2	-	-	1	0.1	1	0.06	1	0.3	1	0.6²
Sodium (Na)	µg/g (ppm)	1	110	1	25	1	100	1	90	1	120	1	210	1	150	1	100	1	46	1	16,000	1	24,200	1	12,000	1	4,600
Thallium (Tl)	µg/g (ppm)	1	0.08	1	< 0.5	1	0.09	1	0.06	1	0.09	1	0.16	1	0.07	1	0.09	1	< 0.5	1	0.1	1	0.07	1	0.2	1	0.3
Vanadium (V)	µg/g (ppm)	1	53	1	15	1	50	1	72	1	43	1	44	1	27	1	49	1	21	1	63	1	55	1	79	1	89
Zinc (Zn)	µg/g (ppm)	1	50	1	26	1	60	1	52	1	153¹	1	94	1	61	1	111	1	33	1	87	1	54	1	68	1	160¹

NOTES:
Bolded numbers indicate either a guideline equivalency or exceedance.
 1 = Exceedance of the CCME Canadian Sediment Quality Guideline (CCME 2002). See Table 2-3 for guideline concentration and explanation.
 2 = Exceedance of the British Columbia Sediment Quality Guideline (BC MWLAP 2006b). See Table 2-3 for guideline concentration and explanation.

Table B-4 Baseline Sediment Quality Conditions in the Central Mountains Hydrological Zone

Parameter	Units	Nechako River Sub-basin				Skeena River Basin													
		Unnamed Kager Lake Tributary		Endako River		Unnamed Maxan Creek Tributary		Foxy Creek		Klo Creek		24.5 Mile Creek		Unnamed Morice River Tributary		Unnamed Morice River Tributary		Unnamed Gosnell Creek Tributary	
		Crossing 6013		Crossing 1001		Crossing 1017		Crossing 1923		Crossing 3090		Crossing 2046		Crossing 1946		Crossing 1949		Crossing 1095	
		RGS: 93K041102		AMEC: Water Quality		RGS: 93K041053		RGS: 93L861710		RGS: 93L861938		RGS: 93L861939		RGS: 93L861644		RGS: 93L861645		RGS: 93L861540	
		29-Jul-02		03-Oct-05		29-Jul-02		30-Jul-86		02-Aug-86		02-Aug-86		02-Aug-86		02-Aug-86		27-Jul-86	
		n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result
Conventional Parameters																			
Texture - Sand	%	-	-	1	48	-	-	-	-	-	-	-	-	-	-	-	-	-	
Texture - Silt	%	1	> 67	1	42	1	> 67	1	33-67	1	33-67	1	< 33	1	33-67	1	33-67	1	> 67
Texture - Clay	%			1	10														
Total Organic Carbon	%	1	< 33	1	7	1	< 33	1	< 33	1	< 33	1	< 33	1	0	1	0	1	0
Total Metals																			
Aluminum (Al)	µg/g (ppm)	1	15,600	1	2,770	1	16,800	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic (As)	µg/g (ppm)	1	12 ¹	1	2	1	7 ¹	1	3	1	4	1	2	1	2	1	4	1	8 ¹
Barium (Ba)	µg/g (ppm)	1	940	1	64	1	1,100	1	1,343	1	1,210	1	740	1	712	1	666	1	686
Cadmium (Cd)	µg/g (ppm)	1	0.1	1	< 0.2	1	0.2	-	-	-	-	-	-	-	-	-	-	-	-
Calcium (Ca)	µg/g (ppm)	1	8,100	1	2,340	1	7,200	-	-	-	-	-	-	-	-	-	-	-	-
Chromium (Cr)	µg/g (ppm)	1	100 ¹	1	6	1	110 ¹	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt (Co)	µg/g (ppm)	1	19	1	2	1	22	1	15	1	12	1	7	1	7	1	9	1	15
Copper (Cu)	µg/g (ppm)	1	19	1	11	1	20	1	20	1	17	1	15	1	9	1	12	1	35
Iron (Fe)	µg/g (ppm)	1	39,200 ²	1	8,420	1	28,800 ²	1	29,900 ²	1	27,300 ²	1	24,400 ²	1	25,100 ²	1	26,300 ²	1	34,300 ²
Lead (Pb)	µg/g (ppm)	1	7	1	2	1	6	1	8	1	7	1	6	-	-	1	DL ³	1	8
Magnesium (Mg)	µg/g (ppm)	1	7,200	1	1,150	1	5,500	-	-	-	-	-	-	-	-	-	-	-	-
Manganese (Mn)	µg/g (ppm)	1	1,445	1	152	1	1,641	1	1,200	1	680	1	500	1	320	1	360	1	1,500
Mercury (Hg)	µg/g (ppm)	1	0.04	1	< 0.5	1	0.1	1	0.04	1	0.03	1	0.04	1	0.02	1	0.03	1	0.02
Molybdenum (Mo)	µg/g (ppm)	1	0.9	1	< 0.5	1	0.7	1	DL ³	1	DL ³	1	DL ³	1	DL ³	1	DL ³	1	DL ³
Nickel (Ni)	µg/g (ppm)	1	25 ²	1	8	1	28 ²	1	41 ²	1	39 ²	1	18 ²	1	23 ²	1	16 ²	1	19 ²
Phosphorus (P)	µg/g (ppm)	1	1,410	1	234	1	1,100	-	-	-	-	-	-	-	-	-	-	-	-
Potassium (K)	µg/g (ppm)	1	700	1	265	1	1,200	-	-	-	-	-	-	-	-	-	-	-	-
Selenium (Se)	µg/g (ppm)	1	0.2	1	< 0.5	1	0.2	-	-	-	-	-	-	-	-	-	-	-	-
Silver (Ag)	µg/g (ppm)	1	0.1	-	-	1	0.05	-	-	-	-	-	-	-	-	-	-	-	-
Sodium (Na)	µg/g (ppm)	1	19,000	1	63	1	21,900	-	-	-	-	-	-	-	-	-	-	-	-
Thallium (Tl)	µg/g (ppm)	1	0.07	1	< 0.5	1	0.1	-	-	-	-	-	-	-	-	-	-	-	-

Table B-4 Baseline Sediment Quality Conditions in the Central Mountains Hydrological Zone (cont'd)

Parameter	Units	Nechako River Sub-basin				Skeena River Basin													
		Unnamed Kager Lake Tributary		Endako River		Unnamed Maxan Creek Tributary		Foxy Creek		Klo Creek		24.5 Mile Creek		Unnamed Morice River Tributary		Unnamed Morice River Tributary		Unnamed Gosnell Creek Tributary	
		Crossing 6013		Crossing 1001		Crossing 1017		Crossing 1923		Crossing 3090		Crossing 2046		Crossing 1946		Crossing 1949		Crossing 1095	
		RGS: 93K041102		AMEC: Water Quality		RGS: 93K041053		RGS: 93L861710		RGS: 93L861938		RGS: 93L861939		RGS: 93L861644		RGS: 93L861645		RGS: 93L861540	
		29-Jul-02		03-Oct-05		29-Jul-02		30-Jul-86		02-Aug-86		02-Aug-86		02-Aug-86		02-Aug-86		27-Jul-86	
		n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result	n =	Result
Total Metals (cont'd)																			
Vanadium (V)	µg/g (ppm)	1	83	1	10	1	69	1	69	1	47	1	41	1	42	1	44	1	123
Zinc (Zn)	µg/g (ppm)	1	80	1	22	1	63	1	79	1	67	1	72	1	61	1	64	1	86
NOTES:																			
<p>Bolded numbers indicate either a guideline equivalency or exceedance.</p> <p>1 = Exceedance of the CCME Canadian Sediment Quality Guideline (CCME 2002). See Table 2-3 for guideline concentration and explanation.</p> <p>2 = Exceedance of the British Columbia Sediment Quality Guideline (BC MWLAP 2006b). See Table 2-3 for guideline concentration and explanation.</p> <p>3 = The detection limit was not provided in the original data. DL indicated that the concentration was below the detection limit.</p>																			

Table B-5 Baseline Sediment Quality Conditions in the Coastal Mountains Hydrological Zone

Parameter	Units	Skeena River Basin										Kitimat River Basin															
		Unnamed Gosnell Creek Tributary		Unnamed Gosnell Creek Tributary		Unnamed Burnie River Tributary		Unnamed Kitimat River Tributary		Unnamed Kitimat River Tributary		Unnamed Kitimat River Tributary		Unnamed Kitimat River Tributary		Cecil Creek	Unnamed Kitimat River Tributary		Duck Creek	Anderson Creek		Moore Creek					
		Crossing 1110		Crossing 1115		Crossing 1124		Crossing 1181		Crossing 1182		Crossing 1191		Crossing 1195		Crossing 1205	Crossing 1223		Crossing 3136	Crossing 3140		Crossing 1274		Crossing 3141			
		RGS: 93L861806		RGS: 93L861536		RGS: 93L861534		RGS: 103I787714		RGS: 103I787713		RGS: 103I787716		RGS: 103I787720		RGS: 103I787725		RGS: 103I781055	RGS: 103I781014		RGS: 103I781012	RGS: 103I781011		RGS: 103I781010			
		05-Aug-86		27-Jul-86		27-Jul-86		20-Jul-78		20-Jul-78		20-Jul-78		20-Jul-78		21-Jul-78		23-Jun-78		19-Jun-78		19-Jun-78		19-Jun-78			
n=	Result	n=	Result	n=	Result	n=	Result	n=	Result	n=	Result	n=	Result	n=	Result	n=	Result	n=	Result	n=	Result	n=	Result	n=	Result		
Conventional Parameters																											
Texture - Sand	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Texture - Silt	%	1	33-67	1	33-67	1	> 67	1	33-67	1	< 33	1	33-67	1	< 33	1	< 33	1	> 67	1	33-67	1	> 67	1	33-67	1	33-67
Texture - Clay	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Organic Carbon	%	1	< 33	1	< 33	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	33-67	1	0	1	< 33	1	0
Total Metals																											
Aluminum (Al)	µg/g (ppm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic (As)	µg/g (ppm)	1	2	1	5	1	5	1	1	1	1	1	1	1	1	DL ³	1	5	1	1	1	1	1	1	1	1	DL ³
Barium (Ba)	µg/g (ppm)	1	506	1	765	1	741	1	710	1	620	1	690	1	810	1	610	1	760	1	390	1	760	1	640	1	410
Cadmium (Cd)	µg/g (ppm)	-	-	1	0.6 ^{1,2}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calcium (Ca)	µg/g (ppm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium (Cr)	µg/g (ppm)	-	-	-	-	-	-	1	110 ¹	1	130 ¹	1	120 ¹	1	130 ¹	1	60 ¹	1	84 ¹	1	43 ¹	1	69 ¹	1	57 ¹	-	91 ¹
Cobalt (Co)	µg/g (ppm)	1	13	1	10	1	11	1	14	1	12	1	16	1	17	1	14	1	8	1	5	1	8	1	8	1	9
Copper (Cu)	µg/g (ppm)	1	68 ¹	1	33	1	24	1	54 ¹	1	36 ¹	1	68 ¹	1	48 ¹	1	84 ¹	1	18	1	14	1	36 ¹	1	30	1	36 ¹
Iron (Fe)	µg/g (ppm)	1	36,000 ²	1	33,800 ²	1	28,900 ²	1	31,000 ²	1	29,500 ²	1	33,000 ²	1	34,000 ²	1	34,000 ²	1	26,000 ²	1	7,000	1	21,000	1	17,500	1	9,500
Lead (Pb)	µg/g (ppm)	1	8	1	60 ¹	1	8	1	-	-	-	1	11	1	26	1	46 ¹	1	DL ³	1	10	1	DL ³	-	-	-	-
Magnesium (Mg)	µg/g (ppm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese (Mn)	µg/g (ppm)	1	720	1	880	1	980	1	685	1	530	1	840	1	900	1	1,200	1	810	1	305	1	320	1	445	1	195
Mercury (Hg)	µg/g (ppm)	1	0.03	1	0.06	1	0.02	1	DL 3	1	0.03	1	0.04	1	0.04	1	0.09	1	0.03	1	0.1	1	0.02	1	0.06	1	0.04
Molybdenum (Mo)	µg/g (ppm)	1	DL 3	1	DL 3	1	DL 3	1	DL 3	1	DL 3	1	DL 3	1	2	1	4	1	DL 3	1	2	1	DL 3	1	DL 3	1	DL 3
Nickel (Ni)	µg/g (ppm)	1	9	1	10	1	9	1	24 2	1	22 2	1	28 2	1	28 2	1	22 2	1	16 2	1	16 2	1	14	1	6	1	4
Phosphorus (P)	µg/g (ppm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium (K)	µg/g (ppm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium (Se)	µg/g (ppm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table B-5 Baseline Sediment Quality Conditions in the Coastal Mountains Hydrological Zone (cont'd)

Parameter	Units	Skeena River Basin						Kitimat River Basin																			
		Unnamed Gosnell Creek Tributary		Unnamed Gosnell Creek Tributary		Unnamed Burnie River Tributary		Unnamed Kitimat River Tributary		Unnamed Kitimat River Tributary		Unnamed Kitimat River Tributary		Unnamed Kitimat River Tributary		Unnamed Kitimat River Tributary		Cecil Creek	Unnamed Kitimat River Tributary		Duck Creek	Anderson Creek	Moore Creek				
		Crossing 1110		Crossing 1115		Crossing 1124		Crossing 1181		Crossing 1182		Crossing 1191		Crossing 1195		Crossing 1205		Crossing 1223	Crossing 3136		Crossing 3140	Crossing 1274	Crossing 3141				
		RGS: 93L861806		RGS: 93L861536		RGS: 93L861534		RGS: 103I787714		RGS: 103I787713		RGS: 103I787716		RGS: 103I787720		RGS: 103I787725		RGS: 103I781055	RGS: 103I781014		RGS: 103I781012	RGS: 103I781011	RGS: 103I781010				
		05-Aug-86		27-Jul-86		27-Jul-86		20-Jul-78		20-Jul-78		20-Jul-78		20-Jul-78		21-Jul-78		23-Jun-78	19-Jun-78		19-Jun-78	19-Jun-78	19-Jun-78				
		n=	Result	n=	Result	n=	Result	n=	Result	n=	Result	n=	Result	n=	Result	n=	Result	n=	Result	n=	Result	n=	Result	n=	Result	n=	Result
Total Metals (cont'd)																											
Silver (Ag)	µg/g (ppm)	-	-	-	-	1	0.3	-	-	1	DL ³	-	-	-	-	1	0.6²	-	-	-	-	-	-	-	1	DL ³	
Sodium (Na)	µg/g (ppm)	-	-	-	-	-	-	1	31,000	1	25,000	1	23,000	1	20,000	1	15,000	1	25,000	1	12,000	1	26,000	1	29,000	1	16,000
Thallium (Tl)	µg/g (ppm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Vanadium (V)	µg/g (ppm)	1	96	1	76	1	57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Zinc (Zn)	µg/g (ppm)	1	77	1	367¹	1	107	1	72	1	60	1	128¹	1	86	1	225¹	1	64	1	40	1	52	1	36	1	20

NOTES:
Bolded numbers indicate either a guideline equivalency or exceedance.
 1 = Exceedance of the CCME Canadian Sediment Quality Guideline (CCME 2002). See Table 2-3 for guideline concentration and explanation.
 2 = Exceedance of the British Columbia Sediment Quality Guideline (BC MWLAP 2006b). See Table 2-3 for guideline concentration and explanation.
 3 = The detection limit was not provided in the original data. DL indicated that the concentration was below the detection limit.

