Elk Valley Water Quality Plan

Annex L.1

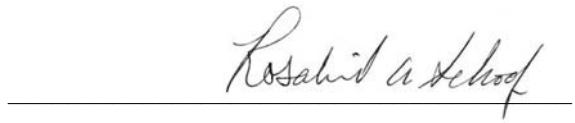
Human Health Evaluation of Current Baseline Conditions

Teck

Elk Valley Water Quality Plan: Human Health Evaluation of Current Baseline Conditions

Prepared for:
Teck Coal Limited
Sparwood, BC

Prepared by:



Rosalind A. Schoof
ENVIRON International Corporation
Seattle, WA

Date:
July 2014

Project Number:
3034724A

ENVIRON

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Executive Summary

In April 2013, the Government of British Columbia used Ministerial Order No. M113 to establish a process to create a plan to address surface water quality concerns associated with mining activity in the Elk Valley watershed. The Elk Valley Water Quality Plan describes environmental management objectives and outcomes for the watershed. This report presents the evaluations related to protection of human health and groundwater within the watershed.

Baseline screening of current conditions identified numerous constituents that did not exceed guideline values in surface water, sediment, fish, and groundwater. Constituents that exceeded guidelines at least once, as well as those with no guideline values, were carried forward to a multi-step effects assessment.

Constituents for which no toxicity reference values were identified were evaluated qualitatively to determine if the absence of a toxicity reference value was a data gap that needed to be filled in order to assess potential health risks. In most cases, constituents without toxicity reference values were judged unlikely to present a potential health risk at the observed concentrations. Many of these constituents were macro- or microminerals not typically included in health-risk assessments. Other constituents could be considered similar in toxicity characteristics to constituents for which toxicity reference values were available and for which guidelines were not exceeded.

Pathway-specific screening against benchmark values was conducted for each exposure medium. Benchmark values were derived for the primary exposure pathways. Based on the outcome of screening for the primary pathways, the need to develop benchmark values for secondary exposure pathways was assessed. Arsenic and nitrate in drinking water exceeded the pathway-specific benchmarks, though the arsenic benchmark was far below natural background concentrations. Other pathways pose risks that are orders of magnitude lower than those for drinking water, so benchmarks for these secondary pathways were not developed. For sediment and groundwater, the primary pathway-specific benchmarks were not exceeded, and thus no benchmarks were derived for secondary pathways. No health risks associated with current water quality conditions in the Elk Valley were identified, when considering current fishing and drinking water restrictions. Thus, no specific actions related to water quality have been identified as required for the protection of human health.

Consideration of future water quality targets includes an evaluation of both long-term and short-term targets protective of human health.

Acronyms and Abbreviations

ABS: dermal absorption fraction

ABS_{GI}: gastrointestinal absorption fraction

ADER: average daily exposure rate

AO: aesthetic objective

ATVs: all-terrain vehicles

AP: average period

BC: British Columbia

BC MoE: BC Ministry of Environment

BW: body weight

CCME: Canadian Council of the Ministers of the Environment

CF: conversion factor

CRL: cancer risk level

CSM: conceptual site model

CSR: contaminated sites regulation

DW: drinking water

dw: dry weight

EA: environmental assessment

ED: exposure duration

EF: exposure frequency

EV: event frequency

EMS: Environmental Monitoring System

ERDZ: Enhanced Resource Development Zone

the Plan: Elk Valley Water Quality Plan

g/day: grams per day

GI: Gastrointestinal

GIS: Geographic Information System

GW: groundwater

HC: Health Canada

HQ: hazard quotient

IR: ingestion rate

IRIS: Integrated Risk Information System

IRMZ: integrated resource management zone

KBLUP: Kootenay/Boundary Land Use Plan

kg: kilogram

K_p: dermal permeability coefficient

KNC: Ktunaxa Nation Council

LADER: lifetime average daily exposure rate

MAC: maximum acceptable concentration

MFLNRO: Ministry of Forest, Lands and Natural Resource Operations

MoSRM: Southern Rocky Mountain Management Plan

mg/kg: milligram per kilogram

mg/L: milligram per liter

MU: management unit

MW: molecular weight

the Order: Ministerial Order No. M113

PAH: polycyclic aromatic hydrocarbon

RDEK: Regional District of East Kootenay

RSL: regional screening level

SSA: skin adherence factor

SF: slope factor

SRMZ: special resource management zone

SW: surface water

Teck: Teck Coal Limited

T_{event}: event duration

TDS: total dissolved solids

TQH: target hazard quotient

TOC: total organic carbon

TOR: terms of reference

TRV: toxicity reference value

UCLM: 95% upper confidence limit of the mean

µg/L: milligram per liter

U.S.: United States of America

USEPA: United States Environmental Protection Agency

WQG: water quality guideline

ww: wet weight

1 Introduction

In April 2013, the Government of British Columbia used Ministerial Order No. M113 (the Order) to establish a process to create the Elk Valley Water Quality Plan (the Plan). The Plan addresses surface water quality concerns associated with mining activity in the Elk Valley. This area is defined in the Order and can be described as including the Fording River drainage area, the Elk River drainage area, and the west shore of Lake Koocanusa from where BC Highway 3 crosses the Kootenay River, and south to the Canada-United States (U.S.) border. The Plan establishes short-, medium- and long-term water quality targets for the Elk Valley.

Teck Coal Limited (Teck) is developing the Plan in cooperation with governments in Canada and the U.S., and with the Ktunaxa Nation Council (KNC). Teck is actively engaging the public throughout the process. The Plan will describe environmental management objectives and outcomes for the Elk Valley, including:

- protection of aquatic ecosystem health
- management of bioaccumulation of selenium, cadmium, nitrate, and sulphate in the receiving environment (including fish tissue)[1]
- protection of human health
- protection of groundwater.

This report presents the evaluations related to protection of human health and groundwater.

1.1 The Order and Terms of Reference

The Order indicates that in consideration of the dependence of the regional economy on mining and related activities, as well as anticipated advances and improvements in water treatment technologies, the Plan is intended to be adaptive and reflect changing technologies. Teck was assigned responsibility for preparing the Plan, and required to submit Terms of Reference (TOR) within 90 days of the Order.

Teck submitted the *Area Management Plan: The Elk Valley Water Quality Plan* TOR on July 15, 2013. Within the TOR, Section 3.0 enumerates issues to be addressed in the EVWQP. Of those issues, this report presents the evaluation related to protection of human health, beginning with evaluating current baseline water quality conditions from the perspective of human health (related to Section 3.4 of the TOR), and then assessing potential human health impacts (Section 3.8 of the TOR).

The TOR envisions water quality targets will be established at seven locations:

- Fording River, downstream of Greenhills Creek (FR4)

[1] Although included in the Order as bioaccumulation concerns, neither sulphate nor nitrate bioaccumulate.

- Fording River, at the mouth (FR5)
- Elk River, downstream of the Greenhills Operation (ER1)
- Elk River, downstream of the Fording River (ER2)
- Elk River, downstream of Michel Creek (ER3)
- Elk River, at Elko Reservoir (ER4)
- Lake Koocanusa, south of the mouth of the Elk River (LK2).

Six management units (MUs) were developed by Teck that can be described by referencing these seven locations: MUs 1 and 2, including portions of the Fording River drainage; MUs 3, 4, and 5, including portions of the Elk River drainage; and MU-6, including portions of Lake Koocanusa below ER4. All MUs together are referred to here as the Designated Area. To be consistent with overall Plan objectives, this human health evaluation was designed to assess potential human health effects within each MU.

The Order specifies assessing impact of the following:

1. Point and non-point sources of waste;
2. Identification of all substances that currently exceed provincial Water Quality Guidelines WQGs) related to the protection of the environment and human health in water, sediment, and biota (e.g. fish tissue);
3. Cumulative point and non-point sources of waste;
4. The potential interactive effects of the mixture of contaminants (selenium, cadmium, nitrate, and sulphate) at the target levels established for the short-, medium-, and long-term;
5. Calcite ($CaCO_3$) formation; and
6. The economic and social costs and benefits of addressing risks to the environment through treatment.

Not all of these potential effects are relevant to the objective of human health protection. Specifically, potential effects related to items 2, 3, and 4 are considered in this document. Evaluation of current baseline water quality conditions addresses item 2. Cumulative effects of point and non-point sources of waste addressed in item 3 are inherently considered by evaluating constituent concentrations in exposure media that integrate input from all sources, including those unrelated to Teck's operations. Additionally, the potential for additive effects due to multiple constituents having common mechanisms of toxicity were considered. The potential for synergistic or antagonistic effects of mixtures of constituents discussed in item 4 is a function of concentration and often of related mechanisms of action. For that reason, consideration of synergistic or antagonistic effects of mixtures was deferred until completion of initial screening steps that focused the effects assessment on those constituents likely to be present at concentrations that could be relevant for interactions.

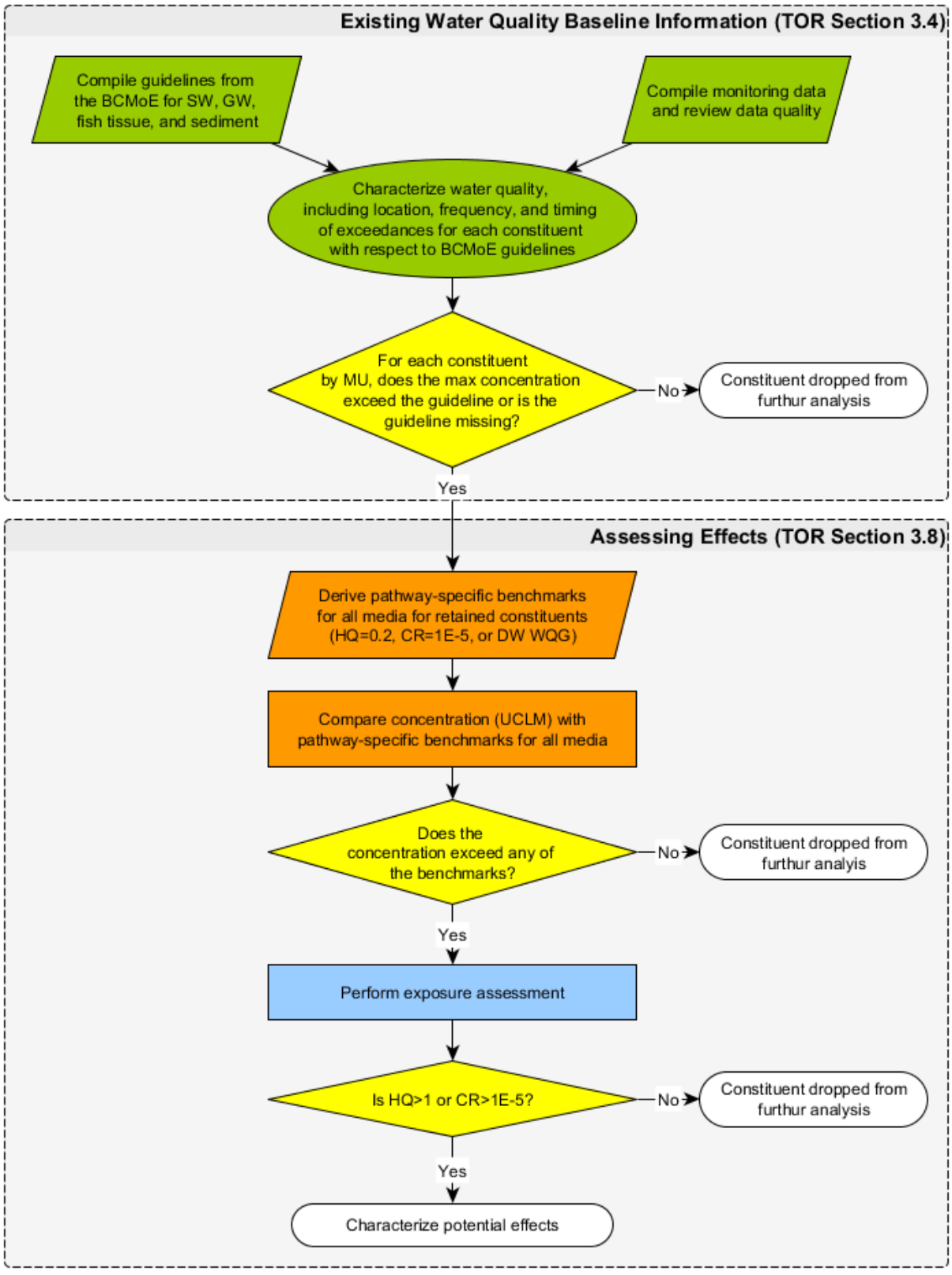
1.2 Human Health Protection Objectives and Evaluation Overview

Per the Technical Advisory Committee recommendation, an influence diagram was created to summarize potential causal relationships between water quality concentrations of the constituents of concern and the values the Plan is seeking to achieve. Key values in the diagram include protection of human health and protection of aquatic ecosystem health. For human health, drinking water and fish consumption (selenium only) are identified as the two receptor pathways of most relevance related to selenium, sulphate, nitrate, and cadmium. The human health evaluation for the Plan considered additional constituents beyond the four specified in the Order, and additional exposure pathways beyond drinking water and fish consumption.

Broader risk assessment has and continues to be addressed as part of Teck's requirements to undertake comprehensive environmental assessments (EAs) required for all major project development applications. Human health risk assessments included as part of the EAs include multimedia assessments for a broad range of constituents of concern, including selenium, cadmium, sulphate, and nitrate. To the extent that approaches and assumptions in the EA risk assessments are applicable, they are considered herein.

As described above, the human health evaluation includes two phases, beginning with evaluation of current baseline water quality conditions from the perspective of human health (related to Section 3.4 of the TOR), followed by an assessment of potential health impacts (Section 3.8 of the TOR). Each phase includes evaluation and decision elements (see Figure 1).

For evaluation of current baseline water quality conditions, existing monitoring data were compiled and reviewed for usability. Concentrations of constituents in surface water, sediment, fish, and groundwater within each MU then were compared to human health protective guidelines based on the pathway with greatest exposure potential for each exposure medium (e.g., drinking water guidelines were applied to surface water and groundwater). Constituents exceeding guidelines were carried through to the second phase for assessment of potential effects. Additional screening occurred at the beginning of the second phase, based on development of pathway-specific benchmarks for multiple exposure pathways for surface water and groundwater. Average constituent concentrations were compared with pathway-specific benchmarks. Consideration of average concentrations, as well as additive exposures and potential for other interactive effects, was used to identify constituents and exposure pathways requiring more detailed assessment of potential adverse health effects.



BC MoE – British Columbia Ministry of the Environment; SW – surface water; GW – groundwater; MU – Management unit; HQ – Hazard Quotient; CR – Cancer Risk; DW – Drinking water; WQG – Water quality guideline; UCLM – 95% upper confidence limit of the mean

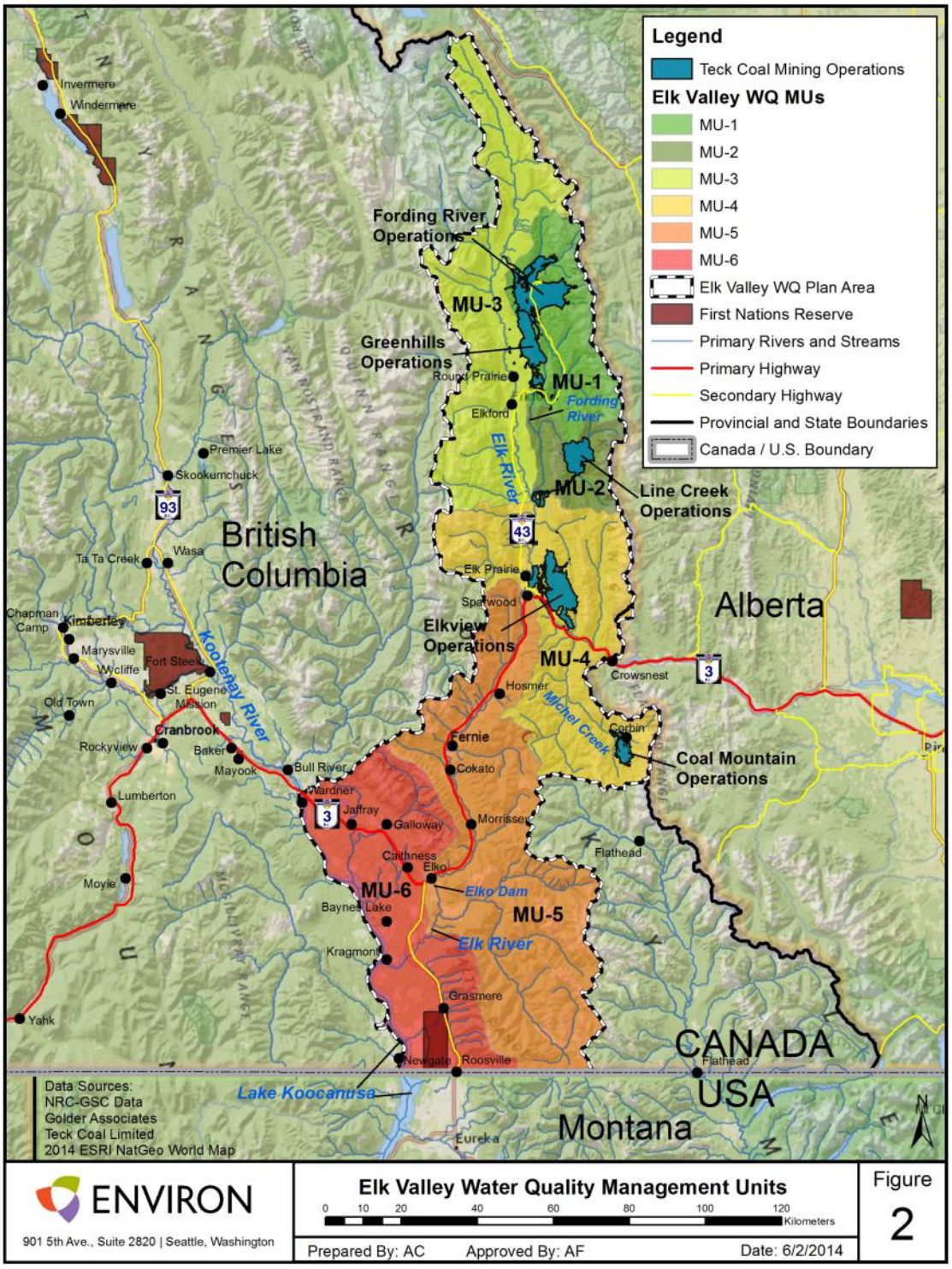
Figure 1: Approach to Addressing Human Health

2 Designated Area Setting

The Elk Valley setting for Teck operations provides the basis for assumptions regarding use of the water bodies identified in the Order, including who relies on the watershed and how the watershed is accessed. A description of the Elk Valley and water use is provided in this section. The location and general vicinity are shown in Figure 2.

There are several residential communities in the Valley, including the District of Elkford, District of Sparwood, and the City of Fernie. The economy that supports these communities depends in part on the area's mining activities, as well as the timber and tourism industries. Teck owns five open-pit bituminous coal mines in the Elk Valley:

- Fording River Operations is the most northern and oldest operation. The Fording River runs through the operation.
- Greenhills Operations is located approximately 8 km northeast of Elkford and is adjacent to the Fording River.
- Line Creek Operations is located approximately 27 km north of Sparwood and is adjacent to Line Creek, a tributary to the Fording River.
- Elkview Operations is located approximately 15 km from Sparwood. Elkview Operations has the potential to affect the Elk River via Michel Creek and its tributaries (e.g., Bodie and Erickson creeks).
- Coal Mountain Operations is the southern-most operation, located approximately 30 km southeast of Sparwood. It is adjacent to Michel Creek, a tributary to the Elk River.


Legend
Teck Coal Mining Operations
Elk Valley WQ MUs
MU-1
MU-2
MU-3
MU-4
MU-5
MU-6
Elk Valley WQ Plan Area
First Nations Reserve
Primary Rivers and Streams
Primary Highway
Secondary Highway
Provincial and State Boundaries
Canada / U.S. Boundary
Fording River Operations
Greenhills Operations
Line Creek Operations
Elkview Operations
Coal Mountain Operations
Elk River
Fording River
Michel Creek
Kootenay River
Elko Dam
Lake Koocanusa
British Columbia
Alberta
CANADA
USA
Montana
Invermere
Windermere
Premier Lake
Skookumchuck
Ta Ta Creek
Wasa
Kimberley
Chapman Camp
Marysville
Fort Steele
Wycliffe
St. Eugene Mission
Old Town
Cranbrook
Rockyview
Baker
Mayook
Bull River
Wardner
Jaffray
Galloway
Lumberton
Moyie
Yahk
Newgate
Roosville
Flathead
Grasmere
Kragmont
Baynes Lake
Cathness
Elko
Morrisey
Cokato
Fernie
Hosmer
Crowsnest
Corbin
Sparwood
Elk Prairie
Elkford
Round Prairie
Data Sources:
NRC-GSC Data
Golder Associates
Teck Coal Limited
2014 ESRI NatGeo World Map
ENVIRON
901 5th Ave., Suite 2820 | Seattle, Washington
Elk Valley Water Quality Management Units
0 10 20 40 60 80 100 120
Kilometers
Prepared By: AC
Approved By: AF
Date: 6/2/2014
Figure
2

2.1 Designated Management Units

To address the requirements of the Order, six MUs designated within the Elk Valley were defined and are depicted in Figure 2. General descriptions of the six MUs are presented below.

Management Unit 1 (MU-1): This MU is bisected by the Fording River upstream of Josephine Falls and represents 9% of the total Elk River watershed. Numerous tributaries including Henretta Creek, Swift Creek, and Porter Creek) drain into the Fording River within this MU. Located just downstream of Greenhills Creek at the southern edge of MU-1 is Order Station FR4 (Environmental Monitoring System [EMS] # 0200378). It provides a synopsis of upstream water quality conditions. Active mines within MU-1 include Fording River Operations and Greenhills Operations. There are no major urban developments or recreational activities within this MU with the exception of the coal mines.

Management Unit 2 (MU-2): The Fording River downstream of Josephine Falls runs along the western limit of MU-2 and represents 4% of the total Elk River watershed. Tributaries that drain into the Fording River within this MU include Gracie Creek and Line Creek. Located downstream of Line Creek and just before the confluence of the Fording and Elk Rivers is Order Station FR5 (EMS# 0200028). With the exception of the Line Creek Operations, there are no major urban developments or recreational activities within this MU.

Management Unit 3 (MU-3): The Elk River runs along the eastern edge of this MU and represents 18% of the total Elk River watershed. Numerous tributaries, including Wolk Creek, Willow South Creek, Cougar Creek, Wolfram Creek, and Thompson Creek, drain into the Elk River within this MU. Located downstream of Thompson Creek and before the District of Elkford is Order Station ER1 (EMS# E206661). Portions of the Greenhills Operations are associated with this MU.

Management Unit 4 (MU-4): This MU represents 20% of the Elk River watershed. The northern portion of MU-4 is bisected by the Elk River, with Michel Creek joining at the southern limits of the MU. Unlike other MUs, MU-4 contains two Order stations to facilitate the monitoring of potential influences and differences between the Fording River and Michel Creek. Situated in the northern half of MU-4 to reflect potential influences from the Fording River, is Order Station ER2 (EMS# 0200027). Order Station ER3 (EMS# 0200393), located at the southern limits of MU-4, is downstream of Michel Creek. Active mines within MU-4 include Elkview Operations and Coal Mountain Operations.

Management Unit 5 (MU-5): MU-5 represents 30% of the Elk River watershed. The Elk River meanders along the valley-bottom of MU-5. Located within Elko Reservoir is Order Station ER4 (EMS# E294312). The highest level of development, notably urbanization, farming, and transportation, is located within MU-5. As illustrated in Figure 2, MU-5 encompasses the City of Fernie, the District of Sparwood, and Elko Dam. Other settlements include Hosmer, Elko, Morrissey, and Cokato. Furthermore, MU-5 supports a wide range of recreation-based activities, such as the Sparwood Fish & Wildlife Association Gun Range, Fernie Rod & Gun Club Range, and Fernie Alpine Resort, as well as wilderness area hiking, camping, biking, snowmobiling, skiing, and water-based recreational activities. No active bituminous coal mines are located within MU-5.

Management Unit 6 (MU-6): This MU represents 19% of the total Elk River watershed and contains the Canadian portion of Lake Koocanusa. This impoundment started to fill in 1972 and reached full pool in June 1974 (Storm et al. 1982). As detailed by HydroQual (1990), the reservoir is long and narrow, and undergoes predictable annual reservoir elevation fluctuations associated with flood control and hydroelectric power considerations. Located within the reservoir is Order Station LK2 (EMS# E294311). The Crowsnest Highway (Highway 3) runs roughly north-south through this MU, continuing south as the Kootenay Highway (Highway 93) through the Canada-U.S. border to Eureka, Montana. Urbanized areas within MU-6 include Grasmere and the Canada-U.S. border crossing town of Roosville. Rural settlements in MU-6, from north to south, include Wardner, Jaffray, Galloway, Caithness, Baynes Lake, and Kragmont. MU-6 supports recreational activities, including activities on Lake Koocanusa as well as in undeveloped public wilderness areas. No mines are located within MU-6.

2.2 Land Use

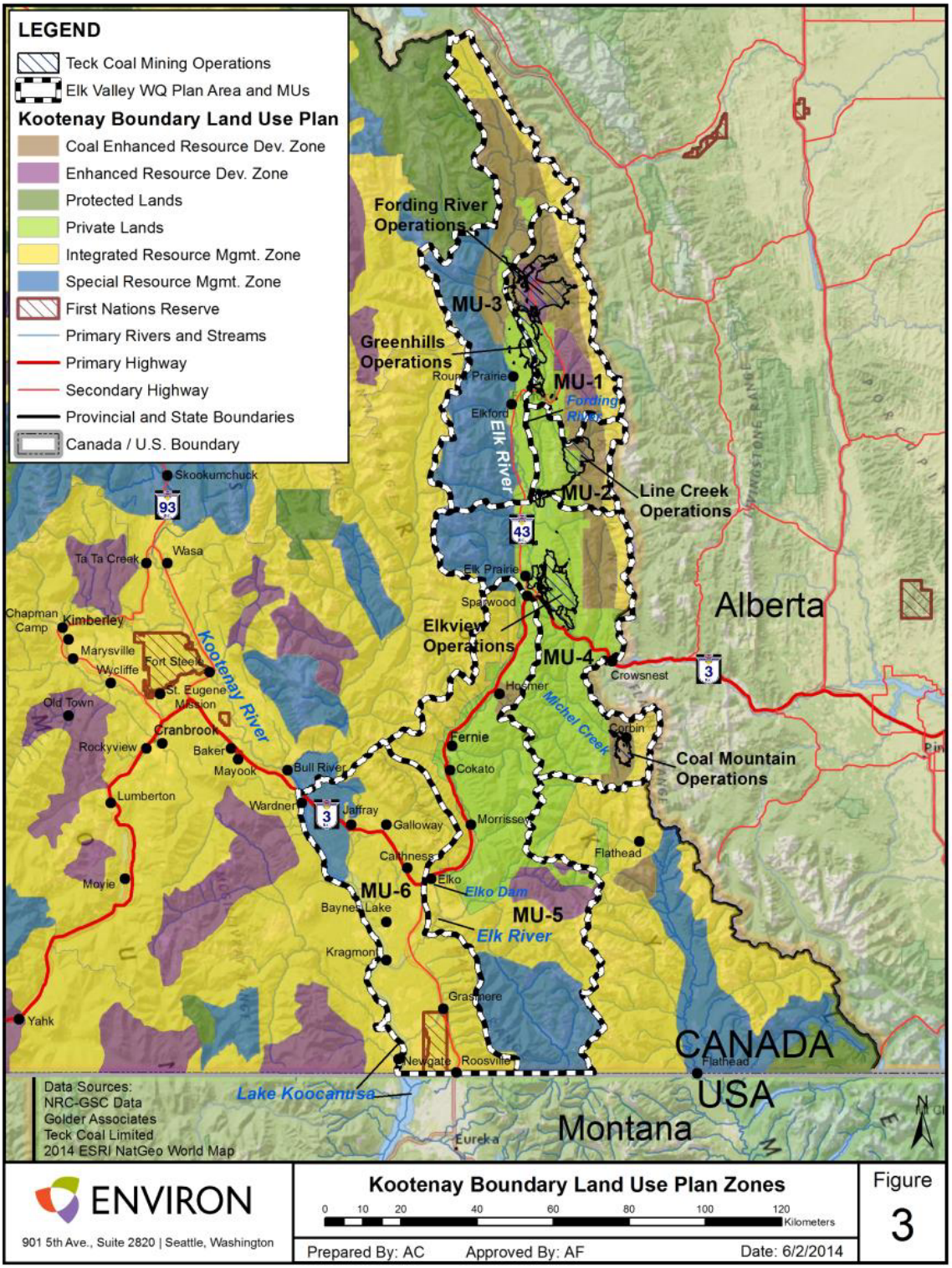
The Designated Area falls within the jurisdictions of two regional land use plans, the East Kootenay Land Use Plan (BC 1995) and the Southern Rocky Mountain Management Plan (MoSRM 2003). Both plans are landscape-level strategic plans for resource management on provincial Crown lands. Zoning information for the Designated Area is under Regional District of East Kootenay (RDEK) Elk Valley Zoning Bylaw No. 829, 1990 (RDEK 2014). Municipal zoning plans provide more specific zoning within incorporated areas of the District of Elkford, City of Fernie, and District of Sparwood.

The Kootenay/Boundary Land Use Plan (KBLUP) Implementation Strategy provides regional land and resource management guidelines and applies to all public lands and waters in the Kootenay/Boundary regional planning area, which corresponds with the Ministry of Forests' Nelson Forest region. The KBLUP provides four main land use designation categories: integrated resource management zone (IRMZ), special resource management zone (SRMZ), enhanced resource development zone (ERDZ), and protected areas (see Figure 3). ERDZ lands are areas suitable for resource development activities and long-term access for coal mining.

RDEK Elk Valley Zoning Bylaw No. 829, 1990, provides the zoning in the Upper and Lower Elk Valley, which covers most of the Designated Area. A significant amount of land in the area is zoned as Rural Residential and, within that, Rural Resource. Large areas are designated as Watershed Protection Zones or as parks and recreation. In addition to recreation on the undeveloped land in the Elk Valley, including hunting, motorized recreation (all-terrain vehicles), camping, horseback riding, hiking, and skiing, Rural Resource areas could potentially provide the public unrestricted access to water for recreation. Teck-owned properties typically require permission for entry, though undeveloped lands may not have access restrictions and the Greenhills property has a pipeline right-of-way used by ATVs. Public access locations for recreation are identified on Figure 4 (MUs 1, 2, and 3) and Figure 5 (MUs 4, 5, and 6).

As shown in Figure 4 (MUs 1, 2, and 3), land use along the upper Elk River is primarily forestlands with some agricultural areas north of Elkford. Downriver from Elkford, land use along the Elk River includes agriculture and rangeland with forestlands. Forestlands, mining, and agriculture land uses are present along the Fording River. In Figure 5 (MUs 4, 5, and 6),

agriculture and forestlands are present further down the Elk River to Sparwood, where a mix of development, recreational, agricultural, and mining land uses are prominent. Forestlands, agriculture, and one protected area are identified along the river between Sparwood and Fernie. Downriver from Fernie to Elko, a protected area and recreation area are identified, with some agriculture among the largely forestlands areas. The area between Elko and Lake Koocanusa is comprised of a mix of forestlands, agriculture, rangeland, a protected area, and populated areas. Land use in the vicinity of Michel Creek is limited to forestlands and mining. As can be seen in Figures 4 and 5, residential areas are concentrated in MU-5, and public recreation areas are focused in MUs 5 and 6.


LEGEND
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Elk Valley WQ Plan Area and MUs
Kootenay Boundary Land Use Plan
Coal Enhanced Resource Dev. Zone
Enhanced Resource Dev. Zone
Protected Lands
Private Lands
Integrated Resource Mgmt. Zone
Special Resource Mgmt. Zone
First Nations Reserve
Primary Rivers and Streams
Primary Highway
Secondary Highway
Provincial and State Boundaries
Canada / U.S. Boundary
Fording River Operations
MU-3
Greenhills Operations
MU-1
Fording River
Elk River
MU-2
Line Creek Operations
Elkview Operations
MU-4
Coal Mountain Operations
Michel Creek
Kootenay River
MU-6
MU-5
Elk River
Elko Dam
Lake Koocanusa
Alberta
CANADA
USA
Montana
Skookumchuck
Ta Ta Creek
Wasa
Chapman Camp
Kimberley
Marysville
Wycliffe
Fort Steele
St. Eugene Mission
Old Town
Cranbrook
Rockyview
Baker
Mayook
Bull River
Lumberton
Wardner
Jaffray
Galloway
Morrissey
Cokato
Fernie
Hosmer
Sparwood
Elk Prairie
Elkford
Round Prairie
Crowsnest
Corbin
Flathead
Cardinesa
Elko
Moyie
Bayne's Lake
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Newgate
Roosville
Eureka
Data Sources:
NRC-GSC Data
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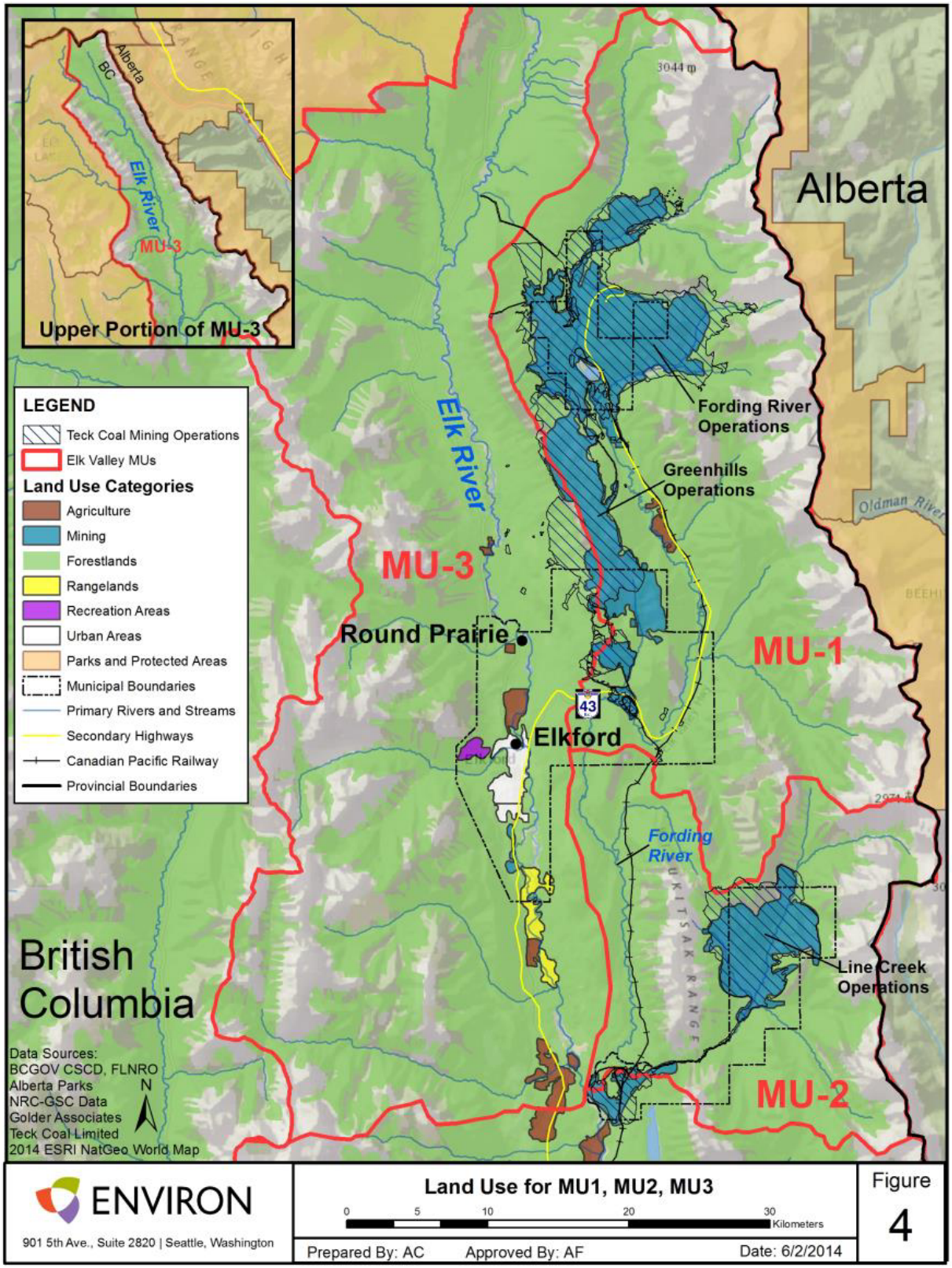
Figure
3


Upper Portion of MU-3
Alberta
BC
Elk River
MU-3
LEGEND
Teck Coal Mining Operations
Elk Valley MUs
Land Use Categories
Agriculture
Mining
Forestlands
Rangelands
Recreation Areas
Urban Areas
Parks and Protected Areas
Municipal Boundaries
Primary Rivers and Streams
Secondary Highways
Canadian Pacific Railway
Provincial Boundaries
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Alberta
Fording River Operations
Greenhills Operations
Elk River
MU-3
Round Prairie
MU-1
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Elkford
Fording River
Line Creek Operations
MU-2
British Columbia
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Alberta Parks
NRC-GSC Data
Golder Associates
Teck Coal Limited
2014 ESRI NatGeo World Map
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ENVIRON
901 5th Ave., Suite 2820 | Seattle, Washington
Land Use for MU1, MU2, MU3
0 5 10 20 30 Kilometers
Prepared By: AC
Approved By: AF
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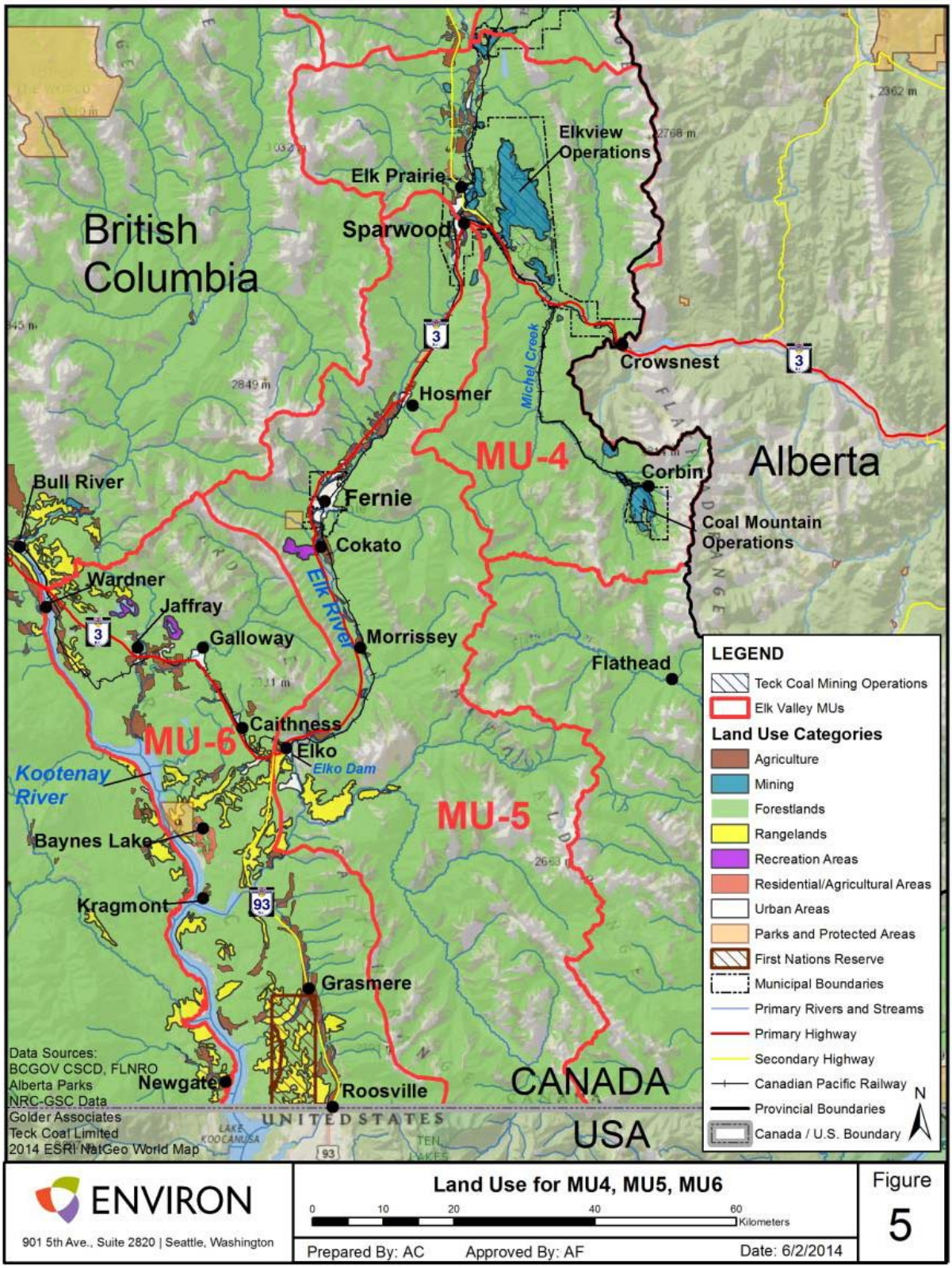
Figure
4


British Columbia
Alberta
Elkview Operations
Elk Prairie
Sparwood
Crowsnest
Hosmer
Michel Creek
MU-4
Corbin
Coal Mountain Operations
Bull River
Fernie
Cokato
Wardner
Jaffray
Galloway
Morrissey
Elk River
Flathead
Caithness
Elko
Elko Dam
MU-6
Kootenay River
MU-5
Baynes Lake
Kragmont
Grasmere
Newgate
Roosville
CANADA
USA
UNITED STATES
LEGEND
Teck Coal Mining Operations
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Land Use Categories
Agriculture
Mining
Forestlands
Rangelands
Recreation Areas
Residential/Agricultural Areas
Urban Areas
Parks and Protected Areas
First Nations Reserve
Municipal Boundaries
Primary Rivers and Streams
Primary Highway
Secondary Highway
Canadian Pacific Railway
Provincial Boundaries
Canada / U.S. Boundary
N
Data Sources:
BCGOV CSCD, FLNRO
Alberta Parks
NRC-GSC Data
Golder Associates
Teck Coal Limited
2014 ESRI NatGeo World Map
ENVIRON
901 5th Ave., Suite 2820 | Seattle, Washington
Land Use for MU4, MU5, MU6
0 10 20 40 60 Kilometers
Prepared By: AC
Approved By: AF
Date: 6/2/2014
Figure 5

2.3 Surface Water Use

Surface water use within the Designated Area is dominated by recreational activities. Permits for surface water diversion have also been granted for the Elk River (14), Fording River (12), Michel Creek (1), and Lake Koocanusa (15) for irrigation and industrial uses, among other uses (BC MoE 2014; Attachment 1). Limited information is available on actual use under existing licences. Permitted uses for domestic, irrigation, and stock-watering are of greatest interest for the evaluation of human health. Of the existing licences, Canadian Forest Products Ltd. (CanFor) holds the only domestic-use licence, drawing from the Elk River. According to the Interior Health Authority (Fleming, pers. comm. 2014), this system is on a "boil water notice" due to lack of water treatment and positive tests for *E. coli* in the raw water. CanFor provides bottled water for staff and visitors and uses the conveyed surface water for sanitation purposes, such as use in washrooms and emergency showers (Fleming, pers. comm. 2014).

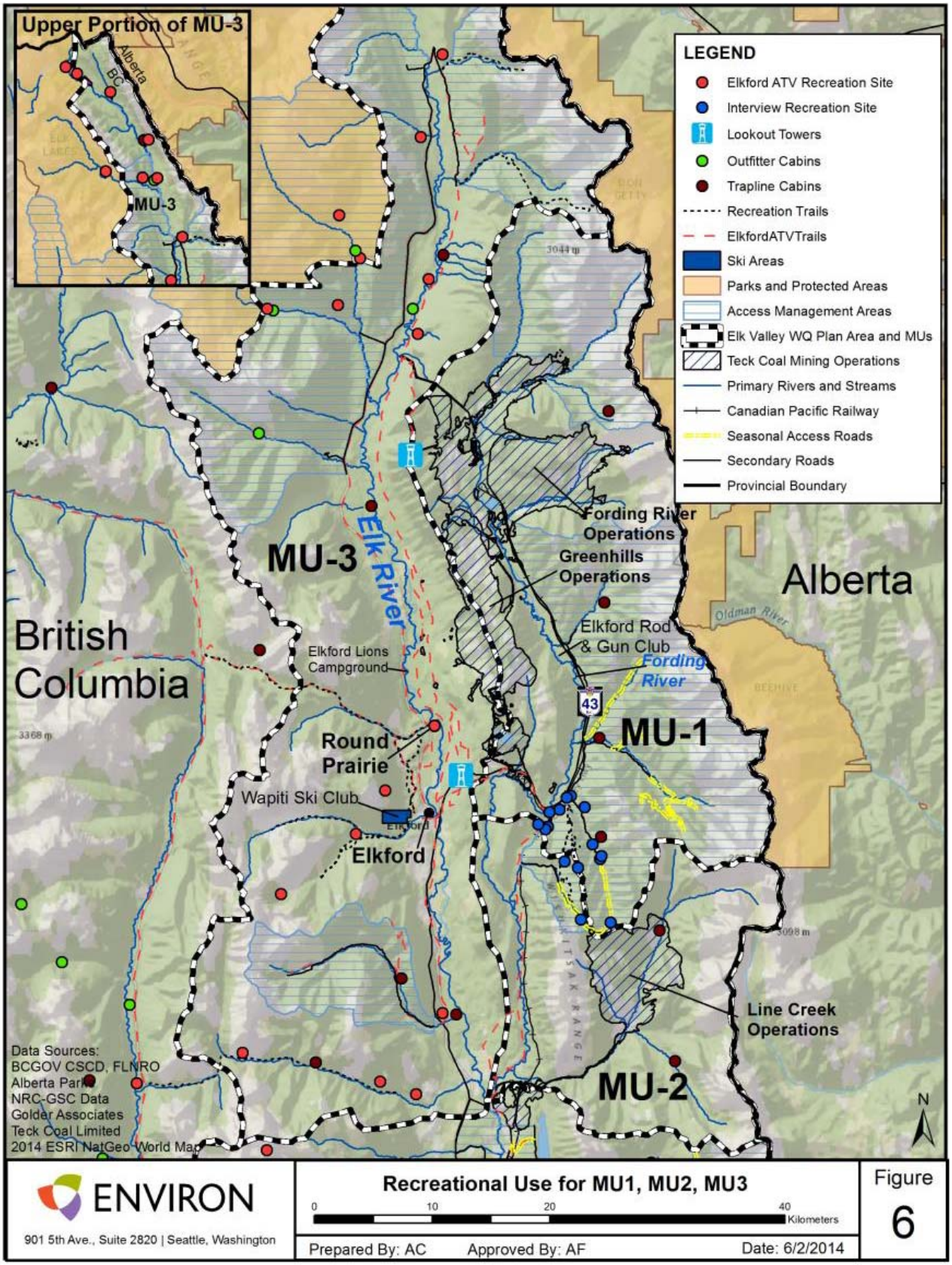
Fourteen licences have been granted for irrigation use: eleven for Lake Koocanusa and three for the Elk River. An additional licence is granted for stock watering from Lake Koocanusa. No additional information is publicly available for these licences other than that provided in Attachment 1.

2.3.1 Surface Water Recreational Access

Waters within the Designated Area are used for fishing, swimming, and non-motorized watercraft such as kayaking, canoeing, and inner-tubing/floating, while Lake Koocanusa is open to motorized boating. All waters within the Designated Area are open to fishing except the segment of Fording River above Josephine Falls and Line Creek and its tributaries. During much of the fishing season, the trout fisheries are catch and release only. All waters within the Designated Area are considered Classified Waters, which are highly productive trout streams in BC. Access may be obtained through both official access points and informal ones, such as through private property and boat-in only access. A number of informal access points on the Elk River between Sparwood, Hosmer, and Fernie, for example, are used by both fishing guides and inner-tubers/floaters.

Official access points are provided by city and provincial parks and are shown in Figure 6 and Figure 7. BC Parks is responsible for the designation, management, and conservation of a system of ecological reserves, provincial parks, and recreation areas throughout the province. Table 1 summarizes access points within the Designated Area. There are four access points along the Elk River managed by BC Parks, two of which (Mount Fernie and Elk Valley provincial parks) provide access for fishing. Morrissey and Elko provincial parks are protected areas. A private access point on the Elk River, the Elkford Lions Municipal Campground, also provides access for fishing.

There are five access points in BC for Lake Koocanusa. All sites provide access for fishing, boating, and swimming. There are no identified official access points along the Fording River. Additional municipal parks are listed in Table 1. Informal access points to the Elk River are found along Highway 3, including entry and exit points for small, non-motorized watercraft.


Upper Portion of MU-3
Alberta
BC
MU-3
LEGEND
Elkford ATV Recreation Site
Interview Recreation Site
Lookout Towers
Outfitter Cabins
Trapline Cabins
Recreation Trails
ElkfordATVTrails
Ski Areas
Parks and Protected Areas
Access Management Areas
Elk Valley WQ Plan Area and MUs
Teck Coal Mining Operations
Primary Rivers and Streams
Canadian Pacific Railway
Seasonal Access Roads
Secondary Roads
Provincial Boundary
Fording River Operations
Greenhills Operations
MU-3
Elk River
British Columbia
Alberta
Oldman River
Elkford Rod & Gun Club
Fording River
Elkford Lions Campground
43
MU-1
Round Prairie
Wapiti Ski Club
Elkford
Line Creek Operations
MU-2
Data Sources:
BCGOV CSCD, FLNRO
Alberta Parks
NRC-GSC Data
Golder Associates
Teck Coal Limited
2014 ESRI NatGeo World Map
N
ENVIRON
901 5th Ave., Suite 2820 | Seattle, Washington
Recreational Use for MU1, MU2, MU3
0 10 20 40 Kilometers
Prepared By: AC
Approved By: AF
Date: 6/2/2014
Figure 6

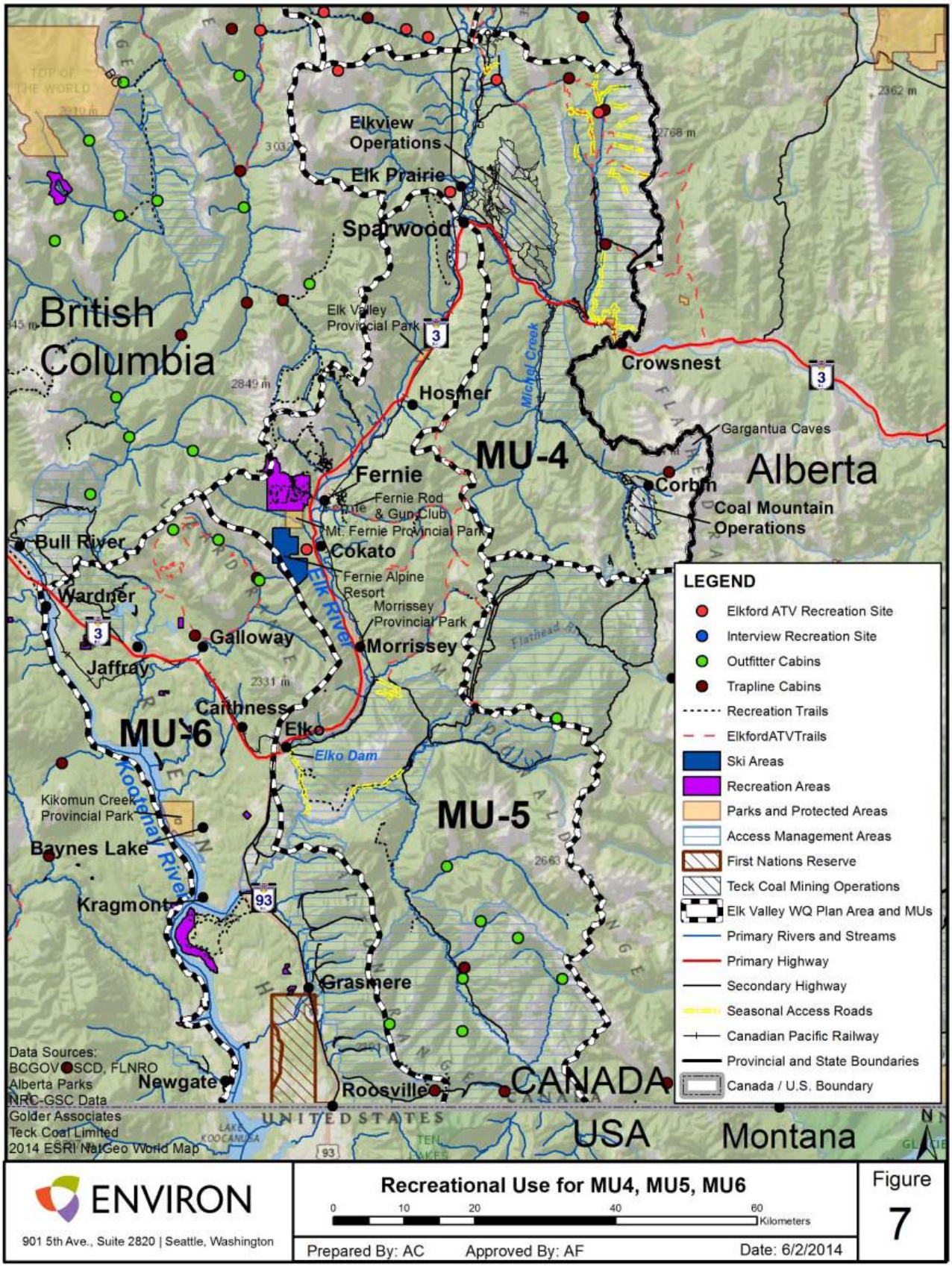

Elkview Operations
Elk Prairie
Sparwood
British Columbia
Elk Valley Provincial Park
Michel Creek
Crowsnest
Hosmer
Gargantua Caves
MU-4
Fernie
Alberta
Corbin
Fernie Rod & Gun Club
Coal Mountain Operations
Mt. Fernie Provincial Park
Bull River
Cokato
Fernie Alpine Resort
Elk River
Wardner
Morrissey Provincial Park
Galloway
Morrissey
Jaffray
Flathead R.
Cranbrook
Elko
Elko Dam
MU-6
MU-5
Kikomun Creek Provincial Park
Baynes Lake
Kootenay River
Kragmont
Grasmere
Roosville
CANADA
UNITED STATES
USA
Montana
Newgate
LEGEND
Elkford ATV Recreation Site
Interview Recreation Site
Outfitter Cabins
Trapline Cabins
Recreation Trails
ElkfordATVTrails
Ski Areas
Recreation Areas
Parks and Protected Areas
Access Management Areas
First Nations Reserve
Teck Coal Mining Operations
Elk Valley WQ Plan Area and MUs
Primary Rivers and Streams
Primary Highway
Secondary Highway
Seasonal Access Roads
Canadian Pacific Railway
Provincial and State Boundaries
Canada / U.S. Boundary
Data Sources:
BCGOV GSCD, FLNRO
Alberta Parks
NRC-GSC Data
Golder Associates
Teck Coal Limited
2014 ESRI NatGeo World Map
ENVIRON
901 5th Ave., Suite 2820 | Seattle, Washington
Recreational Use for MU4, MU5, MU6
0 10 20 40 60 Kilometers
Prepared By: AC
Approved By: AF
Date: 6/2/2014
Figure 7

Table 1: Identified Access Points Within the Study Region

BC Recreational Sites	Water Body	Management Unit	Activities
Elkford Lions Municipal Campground	Elk River	MU-3	Fishing, camping
Riverview Park	Elk River	MU-3	Day use, river access
Peace Park	Elk River	MU-3	Day use, river access
Elk Valley Provincial Park	Elk River	MU-4	Fishing
Mt. Fernie Provincial Park	Elk River	MU-4	Fishing, camping
Morrissey Provincial Park	Elk River	MU-4	River access
Elko Provincial Park	Elk River	MU-5	River access
Sparwood city parks	Elk River	MU-5	Swimming, day use
James White Park	Elk River	MU-5	Swimming, day use
Thompson Park	Elk River	MU-5	Day use
Dogwood Park	Elk River	MU-5	Swimming, day use
Hitching Post	Elk River	MU-5	Day use
Annex Park	Elk River	MU-5	Day use
Kikomun Creek Provincial Park	Lake Koocanusa	MU-6	Fishing, boating, swimming
Dorr Road	Lake Koocanusa	MU-6	Fishing, boating, canoeing, swimming
Englishman Creek	Lake Koocanusa	MU6[1]	Fishing, boat launch, boating, swimming
Gold Creek Bay	Lake Koocanusa	MU6[1]	Fishing, boat launch, boating, swimming
Yaqakxaqlamki (Koocanusa boat launch - public)	Lake Koocanusa	MU-6	Fishing, boat launch

Notes:

[1] This access point is on the west side of Koocanusa, not within the MU-6 boundary; however, it is included as a relevant lake access point.

2.3.2 Recreational Angling and First Nations Fish Harvesting

The BC Ministry of Forest, Lands and Natural Resource Operations (MFLNRO) provides the Freshwater Fishing Regulations Synopsis (Synopsis; MFLNRO 2013), which is updated every two years. The Synopsis provides regional regulations and restrictions on freshwater fishing in BC, as well as water-specific regulations and any exceptions to the regional regulations. Table 2 summarizes the regional access restrictions to freshwater fishing in the Kootenay region (Region 4 of BC). Fishing season in the Kootenay region is from June 15th through March 31st (MFLNRO 2013).

Table 2: Region 4 – Kootenay: General Restrictions
No fishing in any stream in Region 4 from April 1 to June 14.
Trout/char release in streams from Nov. 1 to March 31.
Single barbless hook must be used in all streams of Region 4 all year.

For all game fish, the MFLNRO regulates the daily catch quota and size limits on the fish an angler may keep. Daily catch quotas are the maximum number of fish of a given species, group of species, or size class that an angler may keep in one calendar day. Any fish caught that exceeds the daily catch quota must be returned to the body of water in which it was caught. In addition to catch quotas, the MFLNRO also imposes size limits. Size limits enable fish to spawn at least once before they are harvested, thereby supporting future fishing opportunities.

Table 3 summarizes daily catch quotas and size limits in the Kootenay region. Several sport fish are closed to fishing, except where noted in specific bodies of water in the Kootenay region. These fish include bass, perch, pike, and walleye, which are invasive species that disrupt natural ecosystems and threaten native fish species. To provide a strong disincentive to their illegal introduction, the MFLNRO imposes closures on these species and, in some cases, entire bodies of water where non-native fish species occur (MFLNRO 2013).

Table 3: Regional Daily Catch Quotas, Region 4 – Kootenay	
Fish Species	**Regional Daily Catch Quotas**
Trout/char	5 daily, but not more than 1 rainbow trout or cutthroat trout over 50 centimeters daily; 2 from streams daily; 1 bull trout of any size daily (See water-specific exceptions)
Bass	Closed to fishing
Burbot	2 daily
Crayfish	25 daily
Kokanee	15 daily
Northern pike	Closed to fishing
Walleye	Closed to fishing
Whitefish	15 daily
Yellow perch	Closed to fishing

Water-specific regulations for the Kootenay region are listed in Table 4. The trout quota in the Designated Area Class II Waters is one, compared with the region-specific daily trout catch quota of five. These quotas and limits, combined with catch and release restrictions, result in few opportunities for high levels of fish consumption in many portions of the Designated Area.

Table 4: Water-Specific Regulations

Water-Specific Areas	MU	Notes	Exception to Regional Regulation
Elk River (above Elko Dam)	MUs 1 - 5	Classified Waters	• Bait ban, June 15-Oct 31 • Trout/char release June 15-Oct 31 for specific parts of river • All other parts: trout/char daily quota =1 (none under 30 cm), June 15-Oct 31 • No power boats • Class II water when open, including tributaries
Elk River (below Elko Dam)	MU-6	Classified Waters	• Trout/char daily quota = 1 (no cutthroat under 30 cm, no bull trout under 75 cm) and bait ban, June 15-Oct 31 • No power boats • Class II water when open, including tributaries
Fording River (below Josephine Falls)	MU-1	Classified Waters	• Trout/char release and bait ban, June 15-Oct 31 • Class II water when open, including tributaries
Fording River (above Josephine Falls)	MUs 1 and 2	Classified Waters, Includes tributaries	• Closed all year due to on-going, 5-year Westslope cutthroat trout population assessment / telemetry study
Koocanusa Reservoir	MU-6	--	• Bull trout release Nov 1-Mar 31; no bull trout under 75 cm when open; bait ban Sept 15-June 30 • Fluctuating reservoir levels
Line Creek	MU-2	--	• Closed all year, including tributaries
Michel Creek (above east Hwy 3 bridge)	MU-4	Classified Waters, Includes tributaries	• Trout/char release and bait ban, June 15-Oct 31 • Class II water when open, including tributaries
Michel Creek (below east Hwy 3 bridge)	MU-4	Classified Waters, Includes tributaries	• Trout/char daily quota = 1 (none under 30 cm) and bait ban, June 15-Oct 31 • Class II water when open, including tributaries

The Department of Fisheries and Oceans Canada publishes a survey of recreational fishing in Canada roughly every five years. Reports are available from 1990 through 2010 that contain data on estimated resident active anglers and angling days. An active resident angler is an angler who took a recreational angling trip during the survey year. Specifically for the Kootenay region, data for angling days and number of active anglers is available for 2005 and 2010 (Table 5). In 2005, the estimated number of active anglers was 47,340, of which 30,580 were residents. Total angling days were estimated to exceed 645,000 in 2005, decreasing to roughly 514,000 in 2010. These figures provide context for fishing within the region, though they are not specific to the Elk River or Lake Koocanusa.

Table 5: Estimated Active Anglers and Angling Days, Region 4 – Kootenay

Year	Active Anglers			Angling Days		
	Resident	Non- Resident	Total	Resident	Non-Resident	Total
2005	30,580	16,760	47,340	532,050	113,010	645,060
2010	(1)	(1)	(1)	409,301	105,583	514,884

Source: Freshwater Fisheries Society of BC. http://www.gofishbc.com/home.aspx
Notes:(1) Not available at the time of writing.

Based on a 2013 dietary study of traditional food consumption by residents of the Ktunaxa Traditional Territory, fish species popular with the Ktunaxa Nation include trout (bull, lake, rainbow, and cutthroat), kokanee, and burbot. As noted above, similar fish species are valued for recreational fishers as well.

2.3.3 Fish Consumption Advisories

There are two fish consumption advisories for fish in BC, specific to parasites and mercury. The MFLNRO warns of the risk of infection from parasites in freshwater fish and salmon in BC (MFLNRO 2013). The advisory recommends limiting risk by carefully preparing the fish, but there are no recommended quantities for fish consumption. Mercury levels in fish are not routinely monitored across BC lakes and streams, because the risk of mercury contamination is generally low (MFLNRO 2013). Mercury can accumulate in the muscle of fish, with large predatory species such as lake trout, bass, and walleye tending to accumulate the highest amounts (MFLNRO 2013). Currently, only three areas in BC have consumption advisories due to mercury; none is within or near the Designated Area.

2.4 Groundwater Use

Shallow groundwater is the primary source of drinking water for the communities in the area. For residents in incorporated areas, municipal water systems provide potable groundwater, while residents outside the municipal distribution areas rely on private wells.

Fernie municipal water comes from the Fairy Creek Spring in the Three Sisters watershed, where water is collected from an underground aquifer and then conveyed to a wet well and chlorination facility (Columbia Basin Trust 2010). Consumers in Fernie include approximately 4,200 full-time residents and an additional 2,600 seasonal residents (Operational Services Department 2006).

The District of Sparwood owns three wells, two of which are on the west bank of the Elk River (Franz Environmental Inc. 2013). Wells number 1 and 2, adjacent to the Elk River, are not influenced by surface water under current pumping conditions (SNC-Lavalin 2014a). Well number 3 does appear to be influenced by surface waters from the Elk River, as indicated by increasing selenium concentrations (SNC-Lavalin 2014a; Franz Environmental Inc. 2013). Teck is working with the District of Sparwood to identify a suitable location to install an additional drinking water well that may replace well number 3 in the short term.

The District of Elkford operates four groundwater wells for potable water (District of Elkford 2013). Elkford also operates two wells for non-potable use and irrigation of a golf course and cemetery, and owns a surface water intake on Boivin Creek that has not been in operation since 1980 (District of Elkford 2013).

2.5 Populations of Interest

People in Elk Valley who rely on or enjoy the watershed reside primarily in the population centres mentioned previously: the District of Elkford (population 2,523), the District of Sparwood (population 3,667), the City of Fernie (population 4,448), the East Kootenay Regional District (population 3,645, including district areas outside Elk Valley), and First Nations reserves (population 590) (Statistics Canada 2014). The median age of residents in incorporated areas of Elk Valley ranges from 38 to 40 years, representing a slightly younger population than in unincorporated areas of Elk Valley where the median age reaches 48 years (Statistics Canada 2014).

Residents in the Elk Valley include both full-time permanent residents and seasonal residents who are present primarily during the winter ski and snowmobile season. Residents and non-resident tourists alike depend on surface water (e.g., Elk River, Lake Koocanusa) for recreation, accessing the waterways when the rivers and reservoir are not frozen and snow-covered, which is typically between late June and early September. The primary water-based recreational activities are fishing and the use of non-motorized watercraft, such as rafts, kayaks, and canoes. Valley residents also depend on groundwater for drinking water and outdoor irrigation, as described previously.

2.5.1 Ktunaxa Nation

As of 2011, the Ktunaxa Nation had 1,095 members registered in BC, with approximately half living on the reserve (AANDC 2011). The Ktunaxa Nation has occupied lands adjacent to and including the Kootenay and Columbia Rivers and the Arrow Lakes of BC for more than 10,000 years (KNC 2005). Rivers and streams of the region provide sources of fish and plants, including various trout species. The Ktunaxa Territory is divided into traditional land districts historically associated with key figures in the Ktunaxa creation story and with specific key resources. These traditional land districts are historically associated with particular Ktunaxa individuals or lineages that held authority and responsibility for stewardship of resources in those areas (Robertson 2010). The Designated Area as defined herein falls within two Ktunaxa traditional land districts: Qukin ʔamakʔis (Land of the Raven) and ¢aḿna ʔamakʔis (Land of the Wood Tick). Traditional land districts of the Ktunaxa Territory are illustrated in Figure 8.

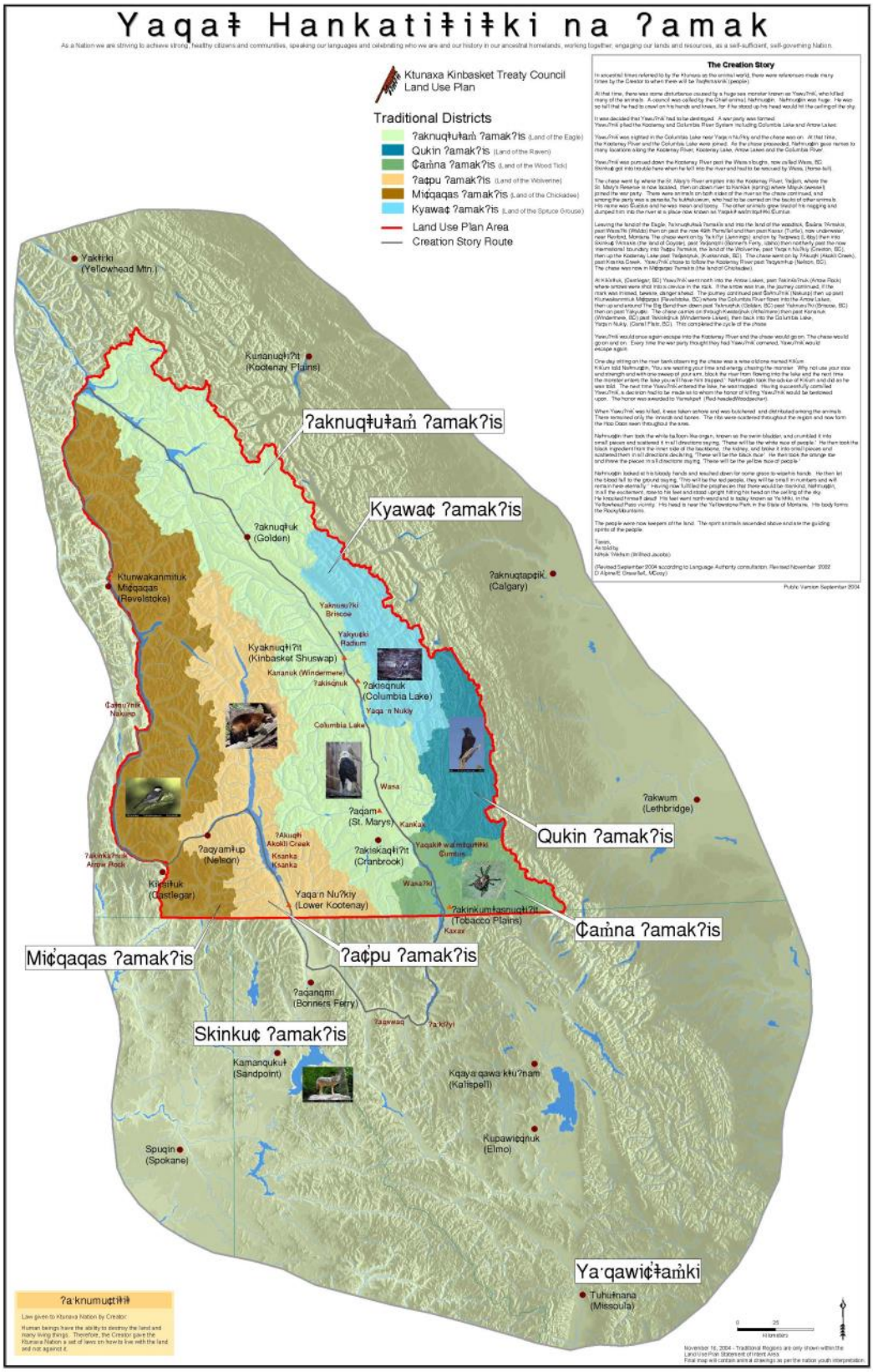


Figure 8: Ktunaxa Traditional Land Districts (from Robertson 2010)

The Firelight Group performed a study of current traditional food use practices of Ktunaxa residents in the Elk Valley (Firelight 2013). Final results were provided in a technical memorandum to the KNC in December 2013. A list of traditional foods was compiled from various sources: previous studies, documented species lists for the Ktunaxa territory, and from personal communication with KNC staff. Traditional foods include fish, game, birds, roots, berries, seeds, nuts, greens, lichen, and tree cambium. After a brief pilot study on eight Ktunaxa community members, households were selected at random from the KNC mailing list and invited to participate in a home interview. A total of 92 households participated for a total of 98 individuals (six households had two participants). Approximately half of the participants lived in the Cranbrook area, with Grasmere, Creston, and Columbia Valley areas also having participants. A majority of participants lived on the reserve (57%). Study questions asked specifically if the interviewees ate traditional foods harvested in the wild. Interviewers also asked questions pertaining to how often and where in the last 10 years the participant had harvested certain traditional foods. For food consumption frequency, participants were asked how often they had eaten particular foods in the past year. For consumers of a particular food, the portion size and season of use was also requested.

2.6 Constituent Influences Within the Designated Area

The Line Creek and Fording River EAs describe constituent emissions and effluents from specific projects and consider releases to a variety of environmental media, such as air, water, soil, and sediment. This evaluation focuses on assessing cumulative impacts of point and nonpoint releases to water. The influence diagram as developed by the Technical Advisory Committee (Figure 9) depicts the constituent sources from Teck's operations to the primary transport medium considered here, which is surface water. Constituents specified in the Order, selenium, cadmium, nitrate, and sulphate, are associated with coal mining operations in the Elk Valley. Sources of these constituents from mining operations are largely associated with waste rock or blasting activities.

Other sources of constituents unrelated to mining operations may include municipal point and nonpoint sources: agriculture, forestry, and associated transportation networks (Urban Systems 2011). Municipal point sources within the Designated Area include effluent discharges from wastewater treatment plants, such as those for the City of Fernie and District of Sparwood, while nonpoint sources include storm water runoff, residential septic fields, and golf courses such as the Sparwood Golf Club, Mountain Meadows Golf Club, and Fernie Golf and Country Club. Additional nonpoint sources include agricultural activities and forestry.

Constituent concentrations in surface water, sediment, fish and groundwater reflect the cumulative impacts of mining operations, other sources and natural background conditions.

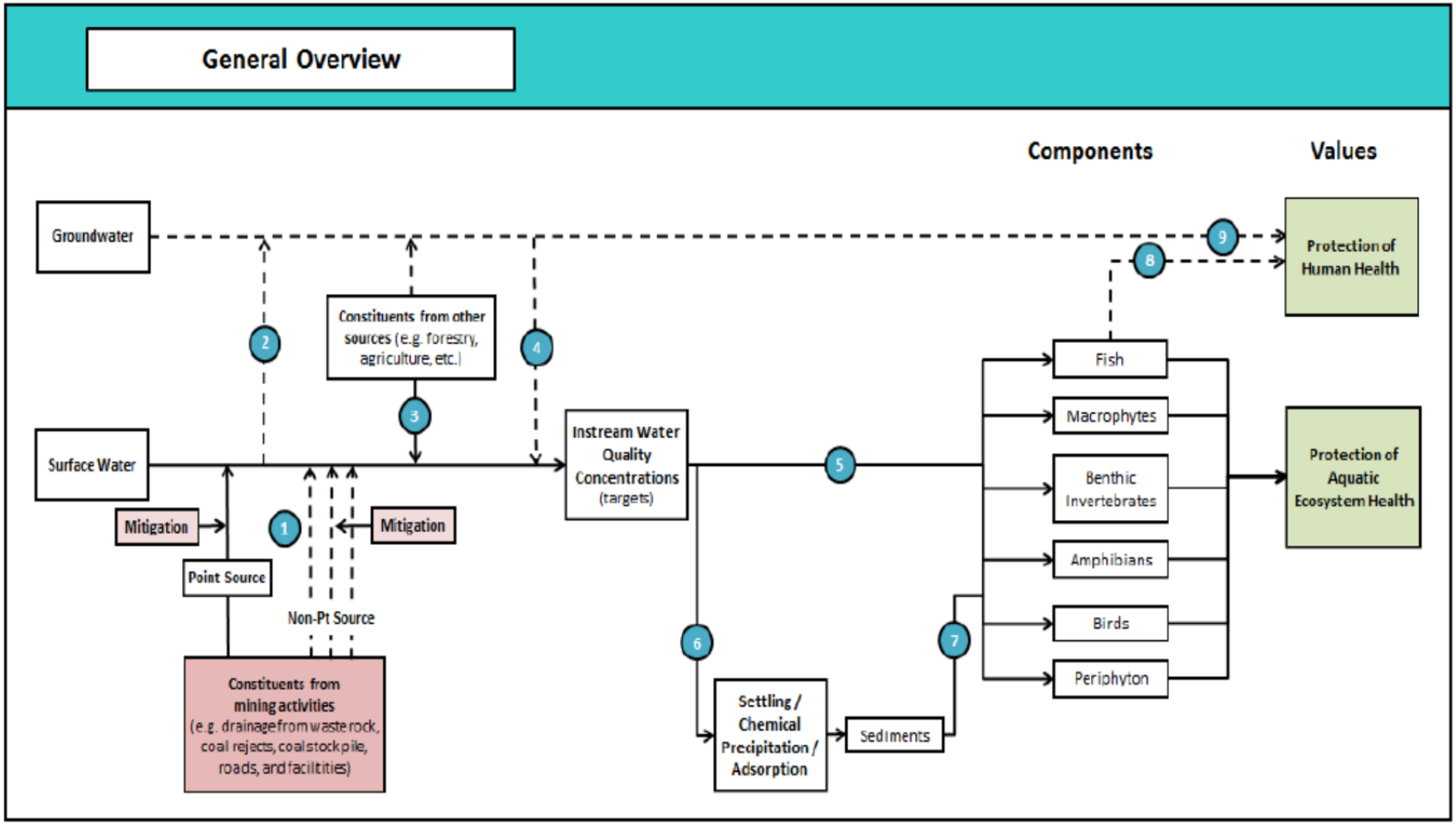


Figure 9: General Overview Influence Diagram as Developed by the Technical Advisory Committee

2.6.1 Constituent Transport

As shown in the influence diagram (Figure 9) and in the schematic conceptual site model (CSM) provided as Figure 10, constituents released to surface water may be dissolved or adsorb to suspended sediment, which may ultimately settle to the river bottom or be transported downstream. When the water levels are low, such as in Lake Koocanusa during drawdown periods, constituents in exposed sediment may be transported via wind erosion. In surface water and sediment, the distribution of constituents between the dissolved and particulate phases is relevant in characterizing exposures to biota, particularly fish and riparian plants consumed by people. Constituent reactions may occur that lead to the formation of a variety of constituent species, particularly for metals and metalloids, which have important implications for assessing the bioavailability of the likes of selenium to fish and assessing its toxicity to people.

Constituents in surface water and sediment may be taken up by fish in Elk Valley waters, as well as by riparian plants and wild animals that graze on riparian plants, consume fish, and drink from the rivers. Transport of constituents also may occur where surface water is conveyed for irrigation or watering livestock[2]. Crops and livestock then may absorb constituents from surface water. Uptake by livestock is expected to be limited as only one surface water licence for stockwater use was identified (see Attachment 1).

Constituents in surface water may be transported to groundwater when recharge of the aquifer by the rivers occurs. This is likely limited to locations where groundwater wells in the floodplain draw sufficient water to create a hydraulic gradient from the Elk River (SNC-Lavalin 2014a). In areas where groundwater may be influenced by surface water, use of groundwater for irrigation (e.g., watering gardens, green spaces) and watering livestock may result in constituent transport. SNC-Lavalin (2014b) confirmed that groundwater in the Elk River floodplain has a high degree of hydraulic connectivity to the Elk River, resulting in a greater potential for shallow groundwater to be influenced by constituents. In particular, shallow groundwater in floodplain areas hydraulically down-gradient of a meander may receive a higher component of surface water recharge.

2.6.2 Potential for Human Contact

Constituents in receiving surface waters, and in groundwater limited to locations influenced by surface water, may be contacted by people through the pathways shown in the schematic CSM (Figure 10) and in the artist's rendering of the CSM provided as Figure 11. The primary exposure media depicted in these figures include surface water, sediment, fish, and groundwater. Exposure media also may include riparian plants and wildlife and irrigated crops and livestock. The completeness of exposure pathways varies depending on people's access to and activities within each MU, which may be affected by factors such as season and water level. Generally, activities are focused within MUs 5 and 6, where population density is greatest and there are more public recreation access points.

[2] Surface water use for irrigation occurs primarily in MU-6 (see Attachment 1, Lake Koocanusa water licences).

Residents in Elk Valley, including members of First Nations, are assumed to participate in a variety of recreational activities within the Designated Area surface waters, including swimming, floating, fishing, and boating. Residents also may hunt and gather riparian plants for consumption. Some residents also consume groundwater that may be seasonally influenced by surface water (see Section 2.6.1). In Figure 10, resident exposures to mine-related constituents are focused on groundwater ingestion in addition to recreation-based exposures. If residents use surface water or groundwater to water gardens, crops, or livestock, there may be potential for some constituents to be taken up into edible tissues of the plants and animals; however, for the constituents of interest, exposure via consumption of these plants and animals is a minor pathway relative to direct consumption of groundwater or surface water. No existing surface water conveyance permits were identified to support use of surface water from the Elk River for human consumption; however, points of diversion do exist for ingestion of water from nearby springs and tributaries west of the Elk River.

Members of First Nations, particularly the Ktunaxa Nation, may contact constituents via the same pathways as other residents, but First Nations often experience a higher frequency of exposure due to greater reliance on natural resources, namely game, fish, and native vegetation. First Nations exposure pathways presented in Figure 10 include all residential and recreational exposure pathways.

Recreational exposure pathways depicted in Figure 10 are focused on direct contact with surface water and sediment, primarily while swimming and floating the rivers, and from consuming fish. While swimming or participating in other water sports, incidental ingestion of surface water and sediment may occur. For hunters, contact with constituents also may occur indirectly through consumption of riparian vegetation and/or terrestrial mammals that reside in or consume surface water within the Designated Area. When seasonal fluctuations in surface water levels result in exposed sediment, primarily in Lake Koocanusa (MU-6), recreational users of the reservoir also may inhale wind-blown sediment particulates. However, inhalation of exposed sediment is a minor pathway compared with direct contact. Similar to exposures to constituents via crops and livestock, consumption of game and riparian vegetation are minor pathways relative to direct contact with surface water and sediment while recreating and eating fish.

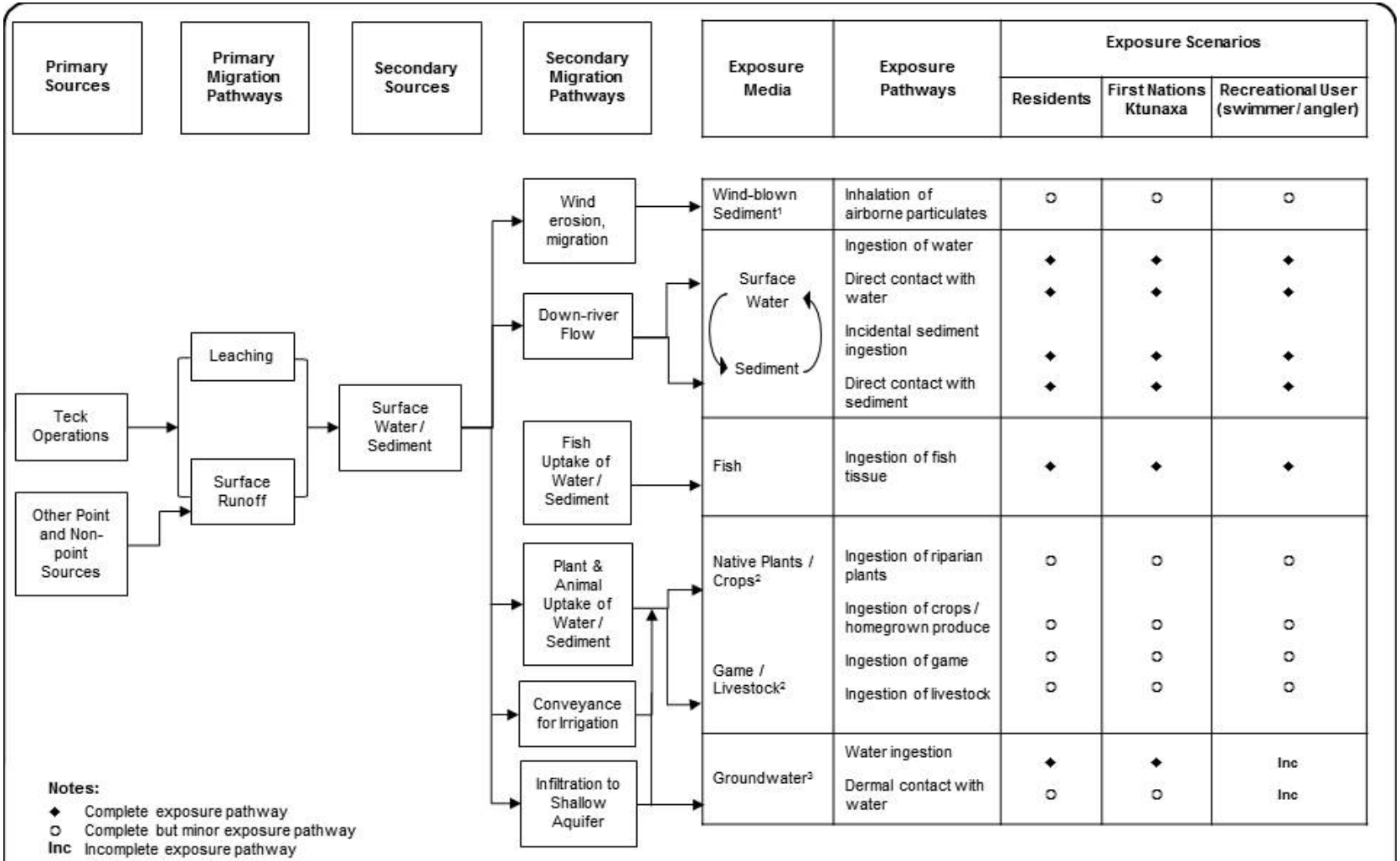


Figure 10: Schematic Conceptual Site Model

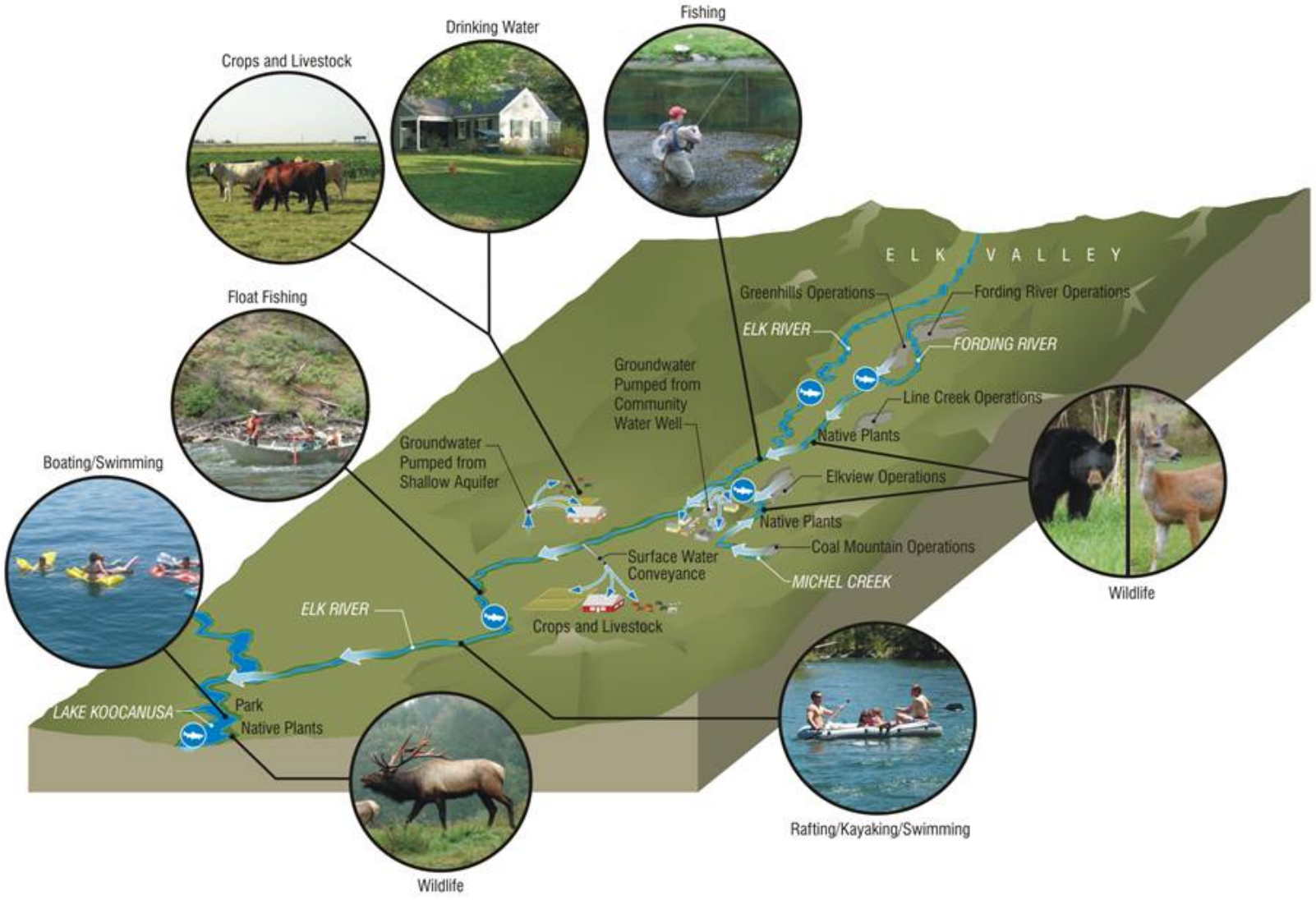


Figure 11: Artist's Rendering Conceptual Site Model

3 Data Quality Evaluation

This section discusses the datasets used in this analysis and the constituents prioritized in the Order, as well as other constituents included in monitoring data collected within the Designated Area. A presentation of summary statistics is included. The data summarized here formed the basis for the current baseline screening.

3.1 Database Development

Surface water, groundwater, fish tissue, and sediment datasets included all relevant data used to perform the Line Creek and Fording River EAs and as collected through the Regional Aquatic Effects Monitoring Program and associated studies. These datasets include sample results for the four constituents identified in the Order, as well as other constituents, all of which were included in this evaluation unless stated otherwise. Each dataset was reviewed for the presence of critical sampling information, such as constituent, concentration units, detection limits, and sampling date. It was also necessary for each sample to be assigned to an MU.

The surface water, fish tissue, and sediment datasets were first limited to samples collected between 2011 and 2013. Data for this timeframe were found to be representative of the Designated Area, as demonstrated by time-series plots for surface water and fish tissue concentrations at each MU.

Surface water data were taken from reference, facility discharge, and receiving environment stations, or from a location with no class identified within the database. Facility discharge locations were removed from the surface water dataset. Reference locations were considered separately during the second phase of the human health evaluation. Mercury and selenium data reported in micrograms per liter (µg/L) were converted to milligrams per liter (mg/L) for consistency. Data for total and dissolved fractions were retained through the analyses, though they were analyzed separately.

Sediment data were categorized as reference, exposed, or mine works locations. Mine works locations were removed from the sediment dataset. Reference locations were considered separately during the second phase of the evaluation. Bulk sediment samples are relevant for assessment of health risk. As a result of including only the bulk fraction, three organic constituents only measured in the fine fraction were excluded from this analysis: aliphatic hydrocarbons, aromatic hydrocarbons, and benzo(b+j+k)fluoranthene.

Fish tissue data included both whole body and muscle tissue samples. MUs 1, 2, and 6 had only muscle tissue data. MUs 3, 4, and 5 had both whole and muscle tissue data, with larger sample sizes for the whole fish data. Due to these differences, both whole body and muscle tissue samples were retained, though analyzed separately. Tissue data were also categorized as being collected from reference, exposed, mine works, or U.S. locations. The reference locations were removed from the current baseline screening, and sample results representing U.S. locations were retained. Given the mobile nature of fish, data from fish captured in mine works locations were also retained in the current baseline screening.

Fish tissue data available from the state of Montana were included with MU-6 samples for the current baseline analyses. Data provided by the Montana Department of Environmental Quality

included only muscle samples analyzed for mercury and selenium. Biopsy samples were removed from the dataset due to quality issues[3]. The biopsy samples were kept frozen for over a year, causing them to become partially or completely desiccated before analysis. Thus the data did not accurately represent wet weight constituent concentrations, and results were judged to be unusable for health risk assessment. The remaining Montana tissue data were analyzed in the current baseline screening.

For the groundwater dataset, a total of 91 locations were sampled in 2014, 79 of which were groundwater wells. For most constituents, data were provided for either total or dissolved concentrations, though for selenium, both total and dissolved concentrations are available. Each well was considered individually in the human health assessment. All samples were included in the assessment after removing duplicates.

3.2 Constituents Under Consideration

For protection of the environment and human health, the Order mandates the identification of all substances, including selenium, cadmium, sulphate, and nitrate, that currently exceed provincial WQGs in water, sediment, or biota. The original surface water dataset contained 50 inorganic constituents, 9 organic constituents, and 11 water quality parameters, such as pH, hardness, etc. The parameters for which drinking water guidelines were available were considered. This analysis did not include some inorganic constituents: ammonia (as N), Kjeldhal nitrogen, ortho-phosphate, selenate, selenite, and zirconium. The above-listed nitrogen and phosphorus compounds were excluded because they are not pertinent to human exposures in the Elk Valley, and other more relevant forms of nitrogen and phosphorus are included in the evaluation (i.e., nitrate, phosphate). The various forms of selenium listed were not included because total selenium, which is more relevant to human health, was available. Additionally, zirconium data were only available from 1998 and 2003 and not from the time period of interest, 2011 to 2013[4]. Ultimately, 44 inorganic constituents were included from the surface water data.

The original sediment dataset contained 33 inorganic constituents, 20 organic constituents, and 14 other physical and water quality parameters, including moisture, pH, and particle size fraction percentages. All inorganic constituents were included in the evaluation. Three organic constituents (aliphatic hydrocarbons, aromatic hydrocarbons, and benzo(b+j+k)fluoranthene) were not included because they were not included in the bulk sediment dataset[5]. Remaining parameters were not considered relevant or necessary for the human health evaluation. Ultimately, 33 inorganic and 17 organic constituents were included from the sediment data.

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[3] Biopsy samples became desiccated following archival in a conventional freezer for time periods ranging from 26 to 514 days after collection. Desiccation of these small-volume samples prevented accurate measurement of tissue moisture content.

[4] The lack of zirconium data is not considered a data gap due to lack of guideline values and a TRV. Although available data were not adequate to support a TRV, toxicity was noted to be low by USEPA (2012).

[5] In the fine fraction, the aliphatic and aromatic hydrocarbon samples were all at or below the detection limit and lacked petroleum hydrocarbon fraction information required for analysis. Benzo(b+j+k)fluoranthene ranged in concentration from 0.023 to 0.706 mg/kg in exposed sampling locations. This constituent is a polycyclic aromatic hydrocarbon (PAH) that lacks human health guidelines in sediment or soil but is similar to other PAHs assessed in the analysis.

Fish tissue data are available for 40 inorganic constituents and one non-chemical parameter: moisture. All 40 inorganic constituents were retained for the analysis. Moisture data were used to convert the fish tissue concentrations from dry weight (dw) to wet weight (ww).

Groundwater data are available for 10 inorganic constituents and two water quality parameters: hardness and alkalinity. All 10 inorganic constituents were included in the evaluation. Hardness was also included for comparison to an aesthetic objective (AO). Neither BC MoE nor Health Canada provide a drinking water guideline for alkalinity.

Availability of data for specific constituents, by matrix, is summarized in Table 6 and Table 7.

Table 6: Inorganic Constituents by Dataset

Inorganic Constituents	Surface Water	Groundwater	Sediment	Fish Tissue
Aluminum	X		X	X
Antimony	X		X	X
Arsenic	X		X	X
Barium	X		X	X
Beryllium	X		X	X
Bismuth	X		X	X
Boron	X		X	X
Bromide	X			
Cadmium	X	X	X	X
Calcium	X	X	X	X
Cesium				X
Chloride	X	X		
Chromium	X		X	X
Cobalt	X		X	X
Copper	X		X	X
Fluoride	X			
Gallium				X
Iron	X		X	X
Lead	X		X	X
Lithium	X		X	X
Magnesium	X	X	X	X
Manganese	X		X	X
Mercury	X		X	X
Molybdenum	X		X	X
Nickel	X		X	X
Nitrate (as N)	X	X		
Nitrite (as N)	X	X		
Phosphate	X			
Phosphorus	X		X	X

Table 6: Inorganic Constituents by Dataset

Inorganic Constituents	Surface Water	Groundwater	Sediment	Fish Tissue
Potassium	X	X	X	X
Rhenium				X
Rubidium				X
Selenium	X	X	X	X
Silica	X			
Silicate, Dissolved	X			
Silicon	X			
Silver	X		X	X
Sodium	X	X	X	X
Strontium	X		X	X
Sulphate (as SO_4)	X	X		
Sulphide	X			
Sulphur	X		X	
Tellurium				X
Thallium	X		X	X
Thorium				X
Tin	X		X	X
Titanium	X		X	X
Uranium	X		X	X
Vanadium	X		X	X
Yttrium				X
Zinc	X		X	X
Zirconium				X

Table 7: Organic Constituents by Dataset		
Organic Constituents	**Surface Water**	**Sediment**
2-Methyl Naphthalene		X
Acenaphthene	X	X
Acenaphthylene		X
Anthracene	X	X
Benzo(a)anthracene	X	X
Benzo(a)pyrene	X	X
Benzo(b)fluoranthene		X
Benzo(g,h,i)perylene		X
Benzo(k)fluoranthene		X
Chrysene		X
Dibenz(a,h)anthracene		X
Fluoranthene	X	X
Fluorene	X	X
Indeno(1,2,3-c,d) Pyrene		X
Naphthalene	X	X
Phenanthrene	X	X
Pyrene	X	X

3.3 Quantitative Data Summaries

Summary statistics were generated for each constituent by MU for each of the four media. Summary statistics include sample size, percent not detected, minimum, mean, and maximum concentration. In calculating the summary statistics, any non-detect samples are reported as equal to the detection limit. Surface water summary statistics are broken out by fraction, total or dissolved, and tissue summary statistics are broken out by whole body and muscle tissue. Summary statistics for Order constituents are provided in Table 8, Table 9, and Table 10 for surface water, sediment, and fish tissue, respectively. Because groundwater wells were considered individually and generally only one sample result is available per well, summary statistics are not provided. Summary statistics for all constituents are provided in Attachment 2, along with the full groundwater data.

Table 8: Summary Statistics for Surface Water Constituents Identified in the Order

MU	Constituent	Sample Size	Percent of Values Not Detected (%)	Minimum Concentration (mg/L)	Mean Concentration (mg/L)	Maximum Concentration (mg/L)
Total Fraction						
MU-1	Cadmium	470	6.2	0.00001	0.0000710	0.00107
MU-2	Cadmium	131	0.76	0.00001	0.000111	0.000519
MU-3	Cadmium	36	64	0.00001	0.0000202	0.000097
MU-4	Cadmium	449	4.7	0.00001	0.0000474	0.000746
MU-5	Cadmium	81	0.0	0.000012	0.0000496	0.000697
MU-6	Cadmium	125	46	0.00001	0.0000224	0.000265
MU-1	Nitrate (as N)	466	0.0	0.278	7.19	27
MU-2	Nitrate (as N)	202	0.0	2.45	7.11	14.7
MU-3	Nitrate (as N)	49	0.0	0.0658	0.189	0.37
MU-4	Nitrate (as N)	449	0.45	0.0064	1.44	4.61
MU-5	Nitrate (as N)	81	0.0	0.416	1.54	2.76
MU-6	Nitrate (as N)	125	0.0	0.0983	0.560	1.67
MU-1	Selenium	550	0.18	0.0005	0.0313	0.105
MU-2	Selenium	131	0.0	0.0122	0.0341	0.0614
MU-3	Selenium	49	0.0	0.00057	0.00129	0.00218
MU-4	Selenium	448	0.0	0.00026	0.00659	0.0214
MU-5	Selenium	81	0.0	0.00248	0.00786	0.0127
MU-6	Selenium	124	0.0	0.00046	0.00299	0.00783
Dissolved Fraction						
MU-1	Cadmium	416	6.5	0.00001	0.0000412	0.000195
MU-2	Cadmium	131	4.6	0.00001	0.0000601	0.000198
MU-3	Cadmium	36	92	0.00001	0.0000106	0.00003
MU-4	Cadmium	422	26	0.00001	0.0000169	0.000156
MU-5	Cadmium	81	8.6	0.00001	0.0000144	0.000031
MU-6	Cadmium	125	55	0.000006	0.0000104	0.000033
MU-1	Selenium	430	0.0	0.00225	0.0329	0.111
MU-2	Selenium	131	0.0	0.0131	0.0365	0.0641
MU-3	Selenium	36	0.0	0.00071	0.00135	0.00218
MU-4	Selenium	421	0.0	0.00027	0.00675	0.0211
MU-5	Selenium	81	0.0	0.00214	0.00801	0.0127
MU-6	Selenium	125	0.0	0.0005	0.00308	0.00859
MU-1	Sulphate (as SO_4)	479	0.0	14.9	157	775
MU-2	Sulphate (as SO_4)	202	0.0	47.1	131	246
MU-3	Sulphate (as SO_4)	51	0.0	12	20.4	27.9
MU-4	Sulphate (as SO_4)	455	0.0	2.34	84.5	385
MU-5	Sulphate (as SO_4)	81	0.0	17.5	60.8	93
MU-6	Sulphate (as SO_4)	125	0.0	13.6	32.0	68

Table 9: Summary Statistics for Sediment Constituents Identified in the Order

MU	Constituent	Sample Size	Percent of Values Not Detected (%)	Minimum Concentration (mg/kg)	Mean Concentration (mg/kg)	Maximum Concentration (mg/kg)
MU-1	Cadmium	46	0.0	0.564	2.27	6.78
MU-2	Cadmium	5	0.0	0.711	1.16	1.53
MU-3	Cadmium	5	0.0	1.01	1.20	1.39
MU-4	Cadmium	24	0.0	0.597	1.36	4.22
MU-5	Cadmium	18	0.0	0.586	0.958	1.57
MU-6	Cadmium	25	0.0	0.099	0.445	1.03
MU-1	Selenium	46	0.0	0.7	10.5	81.6
MU-2	Selenium	5	0.0	0.74	1.12	1.37
MU-3	Selenium	5	0.0	1.22	1.47	1.87
MU-4	Selenium	24	0.0	0.93	2.27	5.3
MU-5	Selenium	18	0.0	0.86	1.50	2.72
MU-6	Selenium	25	16	0.2	0.514	0.91

Table 10: Summary Statistics for Fish Tissue Constituents Identified in the Order

MU	Constituent	Sample Size	Percent of Values Not Detected (%)	Minimum Concentration (mg/kg ww)	Mean Concentration (mg/kg ww)	Maximum Concentration (mg/kg ww)
Muscle						
MU-1	Cadmium	30	3.3	0.000977	0.00912	0.0565
MU-2	Cadmium	15	0.0	0.000817	0.00887	0.0375
MU-3	Cadmium	5	0.0	0.00148	0.0147	0.0502
MU-4	Cadmium	80	21	0.000464	0.0512	0.529
MU-5	Cadmium	33	21	0.000737	0.00671	0.0300
MU-6	Cadmium	11	0.0	0.000288	0.00251	0.0145
MU-1	Selenium	30	0.0	0.854	4.67	15.1
MU-2	Selenium	15	0.0	0.686	2.32	5.75
MU-3	Selenium	5	0.0	0.812	1.71	3.20
MU-4	Selenium	80	0.0	0.200	2.41	13.9
MU-5	Selenium	33	0.0	0.749	1.87	3.12
MU-6	Selenium	287	0.0	0.267	1.11	6.00
Whole Body						
MU-3	Cadmium	10	0.0	0.00797	0.0766	0.421
MU-4	Cadmium	30	0.0	0.0126	0.158	0.702
MU-5	Cadmium	18	0.0	0.00226	0.0663	0.207
MU-3	Selenium	10	0.0	0.828	1.76	2.71
MU-4	Selenium	30	0.0	1.02	4.20	14.9
MU-5	Selenium	18	0.0	0.853	2.25	3.35

4 Current Baseline Assessment

Once the chemistry data were compiled and reviewed for usability, they were summarized and compared to numeric guidelines developed to protect human health, as shown in the first step of Figure 1. This process was consistent with the approach identified in TOR Section 3.4. Results of this process formed the basis for the effects assessment (Section 5), which addresses the requirements described in TOR Section 3.8.

4.1 Guidelines for Baseline Assessment

Current baseline data were organized by MU and exposure medium (e.g., surface water, groundwater, fish tissue, and sediment). Each sampled concentration from data collected within the last three years was compared with the selected numeric human health guideline using a hierarchy recommended by the BC MoE and the Teck consultant team. For the current baseline assessment, human health protective guidelines based on the most intensive possible contact or exposure pathway were used. For example, guidelines for direct consumption of surface water as drinking water are generally lower and more health protective than guidelines based on recreational use. Similarly, guidelines for incidental ingestion of residential soil to screen sediment data are generally more health protective than guidelines based on periodic recreational contact with sediments. The goal in compiling guidelines for the current baseline review was to identify all constituents that might need further assessment.

Constituents exceeding guidelines were identified by MU, and the frequency that guidelines were exceeded was quantified. As depicted in Figure 1, constituents that did not exceed their respective guidelines were not considered further. Constituents that exceeded their respective guidelines, or that lacked guidelines, were further evaluated in the effects assessment.

Guideline values are not readily available for some constituents in some environmental media. In some cases, the absence of guideline values reflects a lack of health risk concern over the entire range of concentrations typically present in the environment. For example, calcium and potassium are seldom included in health risk evaluations. For constituents that lack guidelines, development of guideline values was considered in the pathway screening step.

Water quality and other numeric guidelines were compiled to evaluate constituents analyzed in surface water, groundwater, sediment, and fish tissue. Guidelines were compiled from various provincial and national regulatory agencies (Table 11), with preference given to (in order):

- BC MoE WQGs
- Health Canada
- BC MoE Contaminated Sites Regulation (CSR)
- Canadian Council of the Ministers of the Environment (CCME)
- United States Environmental Protection Agency (USEPA)

Generally, Canadian guidelines were used preferentially; however, USEPA Region 3 fish tissue screening levels were used for the majority of constituents because Canadian fish consumption guidelines are provided only for selenium and mercury. USEPA Regional Screening Levels

(RSLs) were included in the screening for water and soil when Canadian guidelines were unavailable.

Table 11: Sources of Guidelines Related to Human Health

Source	Drinking Water	Fish Consumption	Soil/ Sediment	Recreation
BC MoE. 2006 (updated 2012a). Approved, Working, and Draft Water Quality Guidelines (Criteria Reports).	X	Hg, Se	NA	Few
BC MoE. 2014a. Generic and Matrix Numerical Soil, Sediment, and Water Standards. Contaminated Sites Regulation (CSR).	X	NA	X	NA
CCME. 1999 (Updated 2014). Canadian Environmental Quality Guidelines.	NA	NA	X	NA
Health Canada. 2012a. Guidelines for Canadian Drinking Water Quality and Recreational Water Quality.	X	NA	NA	Microorganisms
Health Canada. 2007. Human Health Risk Assessment of Mercury in Fish and Health Benefits of Fish Consumption.	NA	Hg	NA	NA
USEPA. 2013a. Regional Screening Levels (Formerly PRGs) for Chemical Contaminants. Nov. 2013.	X	NA	X	NA
USEPA. 2013b. Region 3 Fish Tissue Screening Levels. Nov. 2013.	NA	X	NA	NA

Notes:
NA = not available

4.1.1 Guidelines for Surface Water and Groundwater

Guidelines for surface water and groundwater were selected based on the following hierarchy: (1) BC MoE WQGs, (2) HC WQGs, (3) BC MoE CSRs, and (4) USEPA RSLs. BC MoE WQGs are provided for analytes specified in the Order, as well as many additional analytes evaluated. BC MoE (2006 and 2012a) WQGs are generally consistent with those developed by Health Canada (2012a) for drinking water. Health Canada works in partnership with the provinces and territories to develop the Guidelines for Canadian Drinking Water Quality, which include guidelines for microbiological, constituent, and radiological elements for which exposure could lead to adverse health effects in people (Health Canada 2012a; see Table 12).

Table 12: Drinking Water Quality Guidelines Related to Human Health

Constituent [(a)]	Source	Drinking Water Guideline (mg/L)
Inorganic		
Cadmium	Health Canada	0.005
Nitrate (as N)	BC MoE WQG	10
Selenium	BC MoE WQG	0.01
Sulphate (as SO_4)	BC MoE WQG	500
Aluminum	BC MoE WQG	0.2
Antimony	Health Canada	0.006
Arsenic	BC MoE WQG	0.0003
Barium	Health Canada	1
Beryllium	BC MoE WQG	0.004
Boron	BC MoE WQG	5
Bromide	BC MoE WQG	0.05 (mean)
Chloride	BC MoE WQG	250
Chromium, total	BC MoE CSR	0.05
Cobalt	USEPA RSL	0.00094
Copper	BC MoE WQG	0.5
Fluoride	BC MoE WQG	1.5
Iron	Health Canada	0.3
Lead	BC MoE WQG	0.01
Lithium	BC MoE CSR	0.73
Magnesium	BC MoE CSR	100
Manganese	Health Canada	0.05
Mercury	BC MoE WQG	0.001
Molybdenum	BC MoE WQG	0.25
Nickel	USEPA RSL	0.06
Silver	USEPA RSL	0.0142
Sodium	Health Canada	200
Strontium	BC MoE CSR	22
Thallium	BC MoE WQG	0.002
Tin	BC MoE CSR	22
Uranium	Health Canada	0.01
Vanadium	USEPA RSL	0.0126
Zinc	BC MoE WQG	5
Organic		
Acenaphthene	USEPA RSL	0.08
Anthracene	USEPA RSL	0.26
Benzo(a)anthracene	USEPA RSL	0.00029
Benzo(a)pyrene	BC MoE WQG	0.00001
Fluoranthene	USEPA RSL	0.126
Fluorene	USEPA RSL	0.044
Naphthalene	USEPA RSL	0.0014
Pyrene	USEPA RSL	0.0174

Notes:
[a] Constituents specified in the Order are shown in bolded text.
CSR = contaminated sites regulation
RSL = regional screening level
WQG = water quality guideline

These guidelines are used by every jurisdiction in Canada and are the basis for establishing drinking water quality requirements. The *Guidelines for Canadian Drinking Water Quality* typically provide maximum acceptable concentrations (MAC) for protection of human health for most constituents; although the guidelines may also be based on aesthetic and operational considerations (Health Canada 2012a).

BC MoE typically conducts its own review of the available toxicological data for each potential drinking water constituent and may adopt Health Canada guidelines. BC MoE provides approved, working, or draft guidelines that can be used to evaluate safe levels of substances for the protection of a given water use. Working guidelines are used when there are no guidelines approved by the province for a substance of concern. For example, BC MoE working WQGs for bromide, beryllium, and thallium were applied, because there are no currently approved WQGs.

Draft guidelines are guidelines that are currently under review. BC MoE has recently issued new guidelines for selenium (BC MoE 2012a) and sulphate (BC MoE 2013); these guidelines are consistent with those currently recommended by Health Canada. Subsequent to BC MoE issuing the new selenium guideline, Health Canada proposed a draft selenium guideline for public comment that increases the existing guideline from 10 µg/L to 50 µg/L (Health Canada 2013).

Health Canada (2012a) drinking water guidelines were used for constituents when BC MoE guidelines have not yet been proposed or developed. In the absence of other water quality guidelines, BC MoE CSR guidelines were also considered. The BC MoE CSRs provide environmental quality standards for substances in soil, surface water, groundwater, and sediment (BC MoE 2014a). Generic numerical drinking water standards have been designated for various analytes and apply to unfiltered samples obtained at the point of consumption where site-contaminated water is used as a drinking water source (BC MoE 2012b). Since these standards were developed through an independent process, they may not be consistent with other standards. However, they were used in this evaluation for screening purposes if WQGs or Health Canada guidelines were not available.

Last, USEPA (2013a) RSLs were used if no other applicable drinking water screening levels were established for a particular constituent. RSLs were developed using risk assessment guidance from the USEPA Superfund program. They are risk-based concentrations derived from standardized equations combining exposure information assumptions with USEPA toxicity data. Screening levels are considered to be protective of people (including sensitive groups) over a lifetime, but are not always applicable to a particular site. They are used to help identify areas, contaminants, and conditions that require further federal attention at a particular site. Tap water RSLs consider exposure due to water ingestion, as well as dermal and inhalation exposures. These values are provided in terms of a cancer risk of 1 in 1,000,000 and a noncancer hazard quotient (HQ) of 0.1, but they have been modified in the screening table to be consistent with BC MoE and Health Canada risk management levels (i.e., cancer risk=1 in 100,000 and HQ=0.2).

Additional numerical guidelines provided by BC MoE and Health Canada consider specific water and land uses, including recreation, crop irrigation, and livestock watering. Health Canada has developed guidelines for recreational uses of surface water, but they are principally based on

the risk of infection from contact with pathogenic microorganisms, not chemical constituents. BC MoE (2006) developed a limited number of recreation WQGs, but for the constituents analyzed in surface water, none of the recreational guidelines substantially differ from drinking water guidelines. Exposure risk from recreation, crop irrigation, and livestock watering are further discussed in Section 5 for constituents for which an effects evaluation is warranted, based on results from the initial drinking water screening process.

There were 11 inorganic constituents from surface water lacking a guideline: bismuth, calcium, phosphate, phosphorous, potassium, silica, silicate, silicon, sulphide, sulphur, and titanium; there was a single organic constituent lacking a guideline: phenanthrene.

Guidelines were also available for four water quality parameters: pH, total organic carbon (TOC), total dissolved solids (TDS), and hardness (Table 13). The pH guideline is for raw drinking water that requires disinfection. The TOC guideline is for raw drinking water only if it will be disinfected by chlorination, to protect against formation of haloform byproducts. The TDS guideline is an AO based on taste and the excessive scaling that can result from water with more than 500 mg/L TDS. The hardness guideline provides a range that Health Canada considers a balance between corrosion and incrustation in a drinking water supply. All four of these parameters were measured in surface water and hardness was measured in groundwater. Other parameters that were measured in water (alkalinity, dissolved oxygen, turbidity, total suspended solids, conductivity) did not have drinking water guidelines that applied to raw source water in Canada.

Table 13: Drinking Water Quality Guidelines for Conventional Water Quality Parameters

Parameter	Guideline Range	Source
pH	6.5 - 8.5	BC MoE WQG
Total Organic Carbon (mg/L)	4	BC MoE WQG
Total Dissolved Solid (mg/L)	500	Health Canada
Hardness (mg/L)	80 – 100	Health Canada

4.1.2 Guidelines for Sediment

Guidelines for sediment ingestion through recreational contact were selected based on the following hierarchy: (1) BC MoE CSR, (2) CCME guidelines, and (3) USEPA RSLs. The BC MoE CSR (BC MoE 2014a) provides generic and matrix numerical standards that indicate acceptable concentrations of substances in soil and sediments. *Generic numerical standards* are intended to protect human health and the environment for specific types of land uses (e.g., agriculture, urban park, residential, commercial, industrial), whereas the *matrix numerical standards* separate environmental and human health protection components for these sites and provide specific guidelines for the incidental ingestion of soil. Although generic numerical sediment guidelines are provided for some constituents for the protection of aquatic life, they do not include separate values for human health. Thus, the BC MoE CSR matrix and generic numerical standards for residential use soils were first applied for screening sediment data.

Numerical soil standards that have been designated for various constituents evaluated in the plan are provided in Table 14.

CCME soil guidelines and USEPA RSLs were applied if BC MoE CSR values were not available for specific constituents. Since the CCME provides sediment quality guidelines for the protection of aquatic life and not human health, the soil quality guidelines were applied to screen constituents collected in sediment samples. Guidelines pertaining to residential and park land uses were applied. Soil guidelines were considered protective because incidental ingestion of soil in a residential setting is greater than incidental ingestion of sediment during recreational activities. USEPA (2013a) also provides RSLs for soil exposure related to residential land uses. These RSLs consider human exposure due to soil ingestion, as well as dermal and inhalation exposures. These values are based on a cancer risk of 1 in 1,000,000 or an HQ of 0.1, but they have been modified in the screening table to be consistent with BC MoE and Health Canada risk management levels (i.e., cancer risk=1 in 100,000 and HQ=0.2).

Inorganic constituents lacking a sediment guideline were bismuth, calcium, magnesium, phosphorous, potassium, sulphur, and titanium. Acenaphthylene and benzo(g,h,i)perylene were the only organic constituents missing a guideline.

Table 14: Soil and Sediment Guidelines Related to Human Health

Constituent [a]	Source	Sediment Guideline (mg/kg)
Inorganic Constituents		
Cadmium	BC MoE CSR	35
Selenium	BC MoE CSR	3
Aluminum	USEPA RSL	15,400
Antimony	BC MoE CSR	20
Arsenic	BC MoE CSR	100
Barium	BC MoE CSR	6,500
Beryllium	BC MoE CSR	4
Boron	USEPA RSL	3,200
Chromium [b]	USEPA RSL	10,286
Cobalt	BC MoE CSR	50
Copper	BC MoE CSR	15,000
Iron	USEPA RSL	11,000
Lead	BC MoE CSR	400
Lithium	BC MoE CSR	1,600
Manganese	BC MoE CSR	1,800
Mercury	BC MoE CSR	15
Molybdenum	BC MoE CSR	10
Nickel	BC MoE CSR	100
Silver	BC MoE CSR	20
Sodium	BC MoE CSR	1,000,000
Strontium	BC MoE CSR	47,000
Thallium	CCME	1
Tin	BC MoE CSR	50
Uranium	BC MoE CSR	10
Vanadium	BC MoE CSR	200
Zinc	BC MoE CSR	10,000
Organic Constituents		
Anthracene	USEPA RSL	3,400
2-Methyl naphthalene	USEPA RSL	46
Acenaphthene	USEPA RSL	680
Benz(a)anthracene	BC MoE CSR	1
Benzo(a)pyrene	BC MoE CSR	5
Benzo(b)fluoranthene	BC MoE CSR	1
Benzo(k)fluoranthene	BC MoE CSR	1
Chrysene	USEPA RSL	150
Dibenz(a,h)anthracene	BC MoE CSR	1
Fluoranthene	USEPA RSL	460
Fluorene	USEPA RSL	460
Indeno(1,2,3-c,d) pyrene	BC MoE CSR	1
Naphthalene	BC MoE CSR	5
Phenanthrene	BC MoE CSR	5
Pyrene	BC MoE CSR	10

Notes:
[a] Constituents specified in the Order are shown in bolded text.
[b] The chromium guideline is a blended value based on a 1:6 ratio of hexavalent chromium to trivalent chromium values.
CCME = Canadian Council of Ministers of the Environment; CSR = contaminated sites regulation; RSL = regional screening level

4.1.3 Guidelines for Fish Tissue

Environ reviewed Canadian and U.S. fish consumption guidelines for the protection of human health. Guidelines for fish tissue consumption were selected based on the following hierarchy: (1) BC MoE WQGs, (2) HC food standards, and (3) USEPA Region 3 Fish Tissue Screening Levels. BC MoE provides fish tissue guideline values for selenium and mercury (BC MoE 2012a). For selenium, BC MoE uses a matrix of values based on three levels of fish consumption: "high" (220 g/day), "moderate" (110 g/day) and "average" (30 g/day). Guideline values are based on edible tissue, and provided both in terms of wet weight and dry weight, with the conversion based on an estimate of 75% moisture content. These values were derived by using Health Canada's equation for fish ingestion and the dietary tolerable upper intake for selenium. BC MoE provides a "not to exceed" value that is consistent with the Health Canada maximum standard value designated in retail fish (Health Canada 2007, BC MoE 2012a). These values for selenium and mercury have been applied here (Table 15). BC MoE has not developed fish tissue guidelines for constituents other than selenium and mercury.

USEPA (2013a) Region 3 provides the most comprehensive list of constituent screening levels for edible fish tissue[6]. These values include constituent concentrations that could result in a cancer risk of 1 in 1,000,000 and an HQ of 0.1. The assumed fish consumption rate is 54 g/day. For all constituents except selenium and mercury, the USEPA Region 3 screening levels were applied and modified to be consistent with BC MoE and Health Canada risk management levels (i.e., cancer risk=1 in 100,000 and HQ=0.2). This approach is consistent with the EAs under preparation for Teck operations. Modified USEPA Region 3 fish tissue screening levels are provided in Table 15.

In addition, the USEPA Region 3 screening level for arsenic was modified to account for the low proportion of inorganic arsenic to total arsenic in fish tissue. There is strong evidence demonstrating that arsenic in fish is primarily found in organic forms that exhibit low toxicity to people, instead of the more toxic inorganic forms. An adjustment factor of 0.1, or 10 percent, is often applied to total arsenic concentrations in freshwater fish to estimate the fraction of arsenic present as the more toxic inorganic form. The assumption that 10% of total arsenic is inorganic represents an upper-bound estimate of average tissue concentration for a long-time consumer. Schoof and Yager (2007) conducted an extensive literature review and analysis of the fraction of total arsenic that is inorganic in marine/estuarine, anadromous, and freshwater finfish and shellfish. For freshwater finfish, inorganic arsenic averaged 7% of total arsenic. The authors recommended using the 75th percentile (10%) to represent an upper-bound estimate of average exposures for a long-time consumer. More recent studies support the finding that total inorganic arsenic in freshwater fish tissue comprises less than 10% of total arsenic (IDEQ 2008; Rosemond et al. 2008; ODEQ 2011; Exponent and Parametrix 2013).

[6] Environ considered using the BC MoE process for deriving fish tissue guidelines, which is generally consistent with USEPA Region 3 screening level methodology but involves the use of different fish ingestion rates and target risk management levels (Pers. Comm. G. Russo, BC MoE 2014b). Because the USEPA Region 3 values are already calculated and are based on higher fish consumption rates, these values were selected for the current baseline evaluation and adjusted to provide consistency with BC MoE and Health Canada risk management levels.

The 17 constituents in fish tissue lacking a guideline are bismuth, calcium, cesium, gallium, lead, magnesium, phosphorus, potassium, rhenium, rubidium, sodium, tellurium, thallium, thorium, titanium, yttrium, and zirconium.

Table 15: Fish Consumption Guidelines Related to Human Health

Constituent [a]	Source	Tissue Guideline (mg/kg ww)
Cadmium	USEPA RSL	0.28
Selenium	BC MoE WQG	3.6
Aluminum	USEPA RSL	280
Antimony	USEPA RSL	0.11
Arsenic	USEPA RSL	0.021
Barium	USEPA RSL	54
Beryllium	USEPA RSL	0.54
Boron	USEPA RSL	54
Chromium [b]	USEPA RSL	343
Cobalt	USEPA RSL	0.082
Copper	USEPA RSL	10.8
Iron	USEPA RSL	190
Lithium	USEPA RSL	0.54
Manganese	USEPA RSL	38
Mercury	BC MoE WQG, Health Canada	0.5
Molybdenum	USEPA RSL	1.36
Nickel	USEPA RSL	5.4
Silver	USEPA RSL	1.36
Strontium	USEPA RSL	162
Tin	USEPA RSL	162
Uranium	USEPA RSL	0.82
Vanadium	USEPA RSL	1.36
Zinc	USEPA RSL	82

Notes:
[a] Constituents specified in the Order are shown in bolded text.
[b] The chromium guideline is a blended value based on a 1:6 ratio of hexavalent chromium to trivalent chromium values.

4.2 Current Baseline Results

The results of the current baseline assessment are presented in the following sections for surface water (total or dissolved fraction), sediment, fish tissue (whole and muscle tissue), and groundwater (total or dissolved fraction). Constituents exceeding guidelines are summarized by MU for each data type.

4.2.1 Surface Water Results

Surface water screening results are summarized in Table 16. Surface water was tested for 44 inorganic constituents. For the 33 constituents with guideline values, 21 did not exceed the guidelines. Additionally, nine organic constituents were analyzed in surface water, eight of which had guideline values.

The majority of the surface water guidelines are based on the total fraction of the constituent; except for aluminum, which has a guideline based on the dissolved fraction. Nevertheless, the maximum concentration for both the total and dissolved fractions was compared with the guideline values. For bromide and sulphate[7], only dissolved data are available; therefore, the maximum of the dissolved fraction was compared to the guideline.

Table 16: Summary of Surface Water Screening Results

Constituents Carried to Effects Assessment [a]		
	Inorganic	**Organic**
Constituents Exceeding Guideline	Aluminum, Arsenic, Beryllium, Bromide, Cobalt, Iron, Magnesium, Manganese, **Nitrate (as N)**, **Selenium, Sulphate,** Vanadium	None
Constituents Lacking Guideline	Bismuth, Calcium, Phosphate, Phosphorus, Potassium, Silica, Silicate (Dissolved), Silicon, Sulphide, Sulphur, Titanium	Phenanthrene
Constituents Not Carried to Effects Assessment (Screened Out)		
	Inorganic	**Organic**
Constituents Not Exceeding Guidelines	Antimony, Barium, Boron, **Cadmium**, Chloride, Chromium, Copper, Fluoride, Lead, Lithium, Mercury, Molybdenum, Nickel, Nitrite (as N), Silver, Sodium, Strontium, Thallium, Tin, Uranium, Zinc	Acenaphthene, Anthracene, Benzo(a)anthracene, Benzo(a)pyrene, Fluoranthene, Fluorene, Naphthalene, Pyrene

Notes:
[a] Constituents specified in the Order are shown in bolded text.

[7] Sulphate is only measured as dissolved.

Constituents exceeding guidelines for total and dissolved concentrations and carried forward for surface water are summarized in Table 17. Table 18 provides detailed results of the comparison with guidelines organized by MU. The following discussion of surface water screening results focuses on total concentrations for consistency with the basis for guideline values, except as noted above for aluminum, bromide, and sulphate. Comparison of dissolved concentrations to guideline values intended for total concentrations did not result in retaining additional constituents for further analysis.

Of the constituents specified in the Order, selenium, sulphate, and nitrate exceeded the surface water guideline at least once, while cadmium did not exceed the guideline in any of the MUs. Selenium exceeded the guideline in MUs 1, 2, 4, and 5. In MU-2, 100% of samples exceeded the guideline, while in MUs 4 and 5 the percentage exceeding the guideline dropped to 26% and 21%, respectively. Six of 479 sulphate samples in MU-1 exceeded the guideline for the dissolved fraction. Nitrate exceeded the guideline in MUs 1 and 2, with fewer samples exceeding the guideline and a lower maximum concentration in MU-2 than in MU-1.

Constituents not specified in the Order that exceeded a surface water guideline at least once are aluminum, arsenic, beryllium, bromide, cobalt, iron, magnesium, manganese, and vanadium. Multiple samples exceeded guidelines for arsenic[8], bromide, cobalt, iron, magnesium, and manganese, and so these constituents were carried forward in the evaluation. A total of three constituents (aluminum, beryllium, and vanadium) exceeded the guideline only once and also were carried forward. None of the eight organic constituents exceeded guideline values.

In summary, constituents carried forward from the current baseline evaluation for surface water due to the maximum concentration exceeding a drinking water guideline include twelve inorganic constituents: aluminum, arsenic, beryllium, bromide, cobalt, iron, magnesium, manganese, nitrate, selenium, sulphate, and vanadium. Eleven inorganic constituents and one organic constituent without guidelines were also carried forward for further evaluation.

Analysis of the four water quality parameters used to assess general potability (pH, hardness, TDS, and TOC) showed that the surface water samples vary across MUs, with some MUs having parameters that exceeded the guideline values more than others (see Table 19 and additional data provided in Attachment 2). Hardness, pH, and TOC also exceeded guidelines in reference areas.

[8] It should be noted that the arsenic guideline is lower than typical background arsenic concentrations in surface water in BC.

Table 17: Summary of Constituents Exceeding Surface Water Guidelines

MUs	Constituent [a]	Percent Exceeding [b]	Maximum Concentrations [c] (mg/L)	Guideline [d] (mg/L)
Total Concentrations				
MU 1, 2, 3, 4, 5, 6	Aluminum	8-30	0.712-4.03	0.2
MU-1, 2, 3, 4, 5, 6	Arsenic	6-69	0.000640-0.00275	0.0003
MU-1	Beryllium	<1	0.00761	0.004
MU-1, 2, 4, 5, 6	Cobalt	1-13	0.00096-0.00557	0.00094
MU-1, 2, 3, 4, 5, 6	Iron	8-24	1.08-6.37	0.3
MU-1	Magnesium	1	173	100
MU-1, 2, 3, 4, 5, 6	Manganese	3-5	0.0515-0.197	0.05
MU-1, 2	**Nitrate (as N)**	16-27	14.7-27.0	10
MU-1, 2, 4, 5	**Selenium**	21-100	0.0127-0.105	0.010
MU-4, 5	Vanadium	1	0.0156-0.0176	0.0126
Dissolved Concentrations				
MU-4	Aluminum	<1	0.342	0.2
MU-4, 6	Arsenic	9-52	0.00044-0.00047	0.0003
MU-1, 2, 4, 5, 6	Bromide	1-42	0.063-1.60	0.05
MU-4	Cobalt	5	0.00503	0.00094
MU-4	Iron	<1	0.362	0.3
MU-1	Magnesium	2	165	100
MU-1, 2, 4, 5	**Selenium**	21-100	0.0127-0.111	0.010
MU-1	**Sulphate (as SO_4)**	1	775	500

Notes:
[a] Constituents specified in the Order are shown in bolded text.
[b] Range of percent of samples exceeding from MUs in which guideline was exceeded.
[c] Range of maximum concentrations from MUs in which guideline was exceeded.
[d] Aluminum guideline based on dissolved concentration; all other guidelines based on total concentration.

Table 18: Constituents Exceeding Surface Water Guidelines by Management Unit

MU	Constituent [a]	Fraction	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/L)	Mean Concentration (mg/L)	Maximum Concentration (mg/L)	SW Guideline (mg/L)
MU-1	Aluminum [b]	T	473	3.6	38	8.0	0.003	0.0747	1.97	0.2
MU-1	Arsenic	T	473	36	29	6.1	0.0001	0.000163	0.00128	0.0003
MU-1	Beryllium	T	473	99	1	0.21	0.0001	0.000193	0.00761	0.004
MU-1	Bromide	D	474	100	200	42	0.05	0.240	1.5	0.05
MU-1	Cobalt	T	472	45	4	0.85	0.0001	0.000179	0.00206	0.00094
MU-1	Iron	T	471	37	36	7.6	0.03	0.116	3.08	0.3
MU-1	Magnesium	D	416	0.0	7	1.7	7.97	36.7	165	100
MU-1	Magnesium	T	473	0.0	7	1.5	8.24	36.0	173	100
MU-1	Manganese	T	473	0.21	12	2.5	0.000375	0.0129	0.196	0.05
MU-1	**Nitrate (as N)**	T	466	0.0	125	27	0.278	7.19	27	10
MU-1	**Selenium**	D	430	0.0	379	88	0.00225	0.0329	0.111	0.01
MU-1	**Selenium**	T	550	0.18	482	88	0.0005	0.0313	0.105	0.01
MU-1	**Sulphate (as SO_4)**	D	479	0.0	6	1.3	14.9	157	775	500
MU-2	Aluminum [b]	T	131	6.1	12	9.2	0.003	0.0757	0.967	0.2
MU-2	Arsenic	T	131	28	8	6.1	0.0001	0.000162	0.00078	0.0003
MU-2	Bromide	D	202	100	77	38	0.05	0.168	1	0.05
MU-2	Cobalt	T	131	65	1	0.76	0.0001	0.000162	0.00096	0.00094
MU-2	Iron	T	131	58	12	9.2	0.03	0.119	1.8	0.3
MU-2	Manganese	T	131	2.3	6	4.6	0.00001	0.00674	0.114	0.05
MU-2	**Nitrate (as N)**	T	202	0.0	32	16	2.45	7.11	14.7	10
MU-2	**Selenium**	D	131	0.0	131	100	0.0131	0.0365	0.0641	0.01
MU-2	**Selenium**	T	131	0.0	131	100	0.0122	0.0341	0.0614	0.01
MU-3	Aluminum [b]	T	36	17	6	17	0.003	0.0970	0.712	0.2
MU-3	Arsenic	T	36	53	5	14	0.0001	0.000163	0.00064	0.0003
MU-3	Iron	T	36	64	5	14	0.03	0.134	1.08	0.3
MU-3	Manganese	T	36	0.0	1	2.8	0.000421	0.00708	0.0515	0.05
MU-4	Aluminum [b]	D	422	68	1	0.24	0.003	0.00703	0.342	0.2
MU-4	Aluminum [b]	T	449	2.0	128	29	0.003	0.228	3.93	0.2
MU-4	Arsenic	D	422	0.24	38	9.0	0.0001	0.000190	0.00047	0.0003
MU-4	Arsenic	T	449	0.22	135	30	0.0001	0.000310	0.00275	0.0003

Table 18: Constituents Exceeding Surface Water Guidelines by Management Unit

MU	Constituent [a]	Fraction	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/L)	Mean Concentration (mg/L)	Maximum Concentration (mg/L)	SW Guideline (mg/L)
MU-4	Bromide	D	469	100	56	12	0.05	0.103	1.6	0.05
MU-4	Cobalt	D	422	82	19	4.5	0.0001	0.000219	0.00503	0.00094
MU-4	Cobalt	T	449	54	56	12	0.0001	0.000405	0.00577	0.00094
MU-4	Iron	D	422	98	1	0.24	0.03	0.0311	0.362	0.3
MU-4	Iron	T	449	42	94	21	0.03	0.271	6.37	0.3
MU-4	Manganese	T	449	0.22	21	4.7	0.000058	0.0128	0.197	0.05
MU-4	**Selenium**	D	421	0.0	120	29	0.00027	0.00675	0.0211	0.01
MU-4	**Selenium**	T	448	0.0	118	26	0.00026	0.00659	0.0214	0.01
MU-4	Vanadium	T	449	77	1	0.22	0.001	0.00142	0.0156	0.0126
MU-5	Aluminum [b]	T	81	1.2	24	30	0.0047	0.260	4.03	0.2
MU-5	Arsenic	T	81	0.0	22	27	0.00015	0.000323	0.00257	0.0003
MU-5	Bromide	D	81	100	2	2.5	0.05	0.0588	0.41	0.05
MU-5	Cobalt	T	81	67	3	3.7	0.0001	0.000202	0.00259	0.00094
MU-5	Iron	T	81	40	19	23	0.03	0.322	5.75	0.3
MU-5	Manganese	T	81	0.0	4	4.9	0.00159	0.0124	0.179	0.05
MU-5	**Selenium**	D	81	0.0	17	21	0.00214	0.00801	0.0127	0.01
MU-5	**Selenium**	T	81	0.0	17	21	0.00248	0.00786	0.0127	0.01
MU-5	Vanadium	T	81	74	1	1.2	0.001	0.00161	0.0176	0.0126
MU-6	Aluminum [b]	T	125	0.80	29	23	0.0054	0.150	1.57	0.2
MU-6	Arsenic	D	125	0.0	65	52	0.00019	0.000302	0.00044	0.0003
MU-6	Arsenic	T	125	0.0	86	69	0.0002	0.000388	0.00119	0.0003
MU-6	Bromide	D	81	99	1	1.2	0.05	0.0502	0.063	0.05
MU-6	Cobalt	T	125	55	2	1.6	0.000017	0.000139	0.00146	0.00094
MU-6	Iron	T	125	23	21	17	0.0151	0.194	2.55	0.3
MU-6	Manganese	T	125	0.0	5	4.0	0.000205	0.00943	0.151	0.05

Notes:
[a] Constituents specified in the Order are shown in bolded text.
[b] Aluminum guideline based on dissolved concentration; all other guidelines based on total concentration.
SW = surface water; D = dissolved fraction; T= total fraction

Table 19: Surface Water Parameter Data

MU	Parameter	Sample Size	Concentration Range	Guideline	Units	Percent of Samples Out of Guideline Range
MU-1	Hardness	900	114 - 2580	80 - 100	mg/L	100
MU-2	Hardness	202	176 - 512	80 - 100	mg/L	100
MU-3	Hardness	102	144 - 1040	80 - 100	mg/L	100
MU-4	Hardness	1003	95 - 1680	80 - 100	mg/L	99.7
MU-5	Hardness	81	111 - 286	80 - 100	mg/L	100
MU-6	Hardness	125	114 - 269	80 - 100	mg/L	100
Reference	Hardness	563	39.8 - 281	80 - 100	mg/L	93.6
MU-1	pH	1919	2.3 - 10.5	6.5 - 8.5	pH units	6.7
MU-2	pH	392	4.65 - 11.26	6.5 - 8.5	pH units	15.1
MU-3	pH	378	6.77 - 10.8	6.5 - 8.5	pH units	18.0
MU-4	pH	2061	2.45 - 10.3	6.5 - 8.5	pH units	5.5
MU-5	pH	138	2.56 - 8.55	6.5 - 8.5	pH units	13.0
MU-6	pH	126	7.33 - 8.56	6.5 - 8.5	pH units	2.4
Reference	pH	1278	3.69 - 10.46	6.5 - 8.5	pH units	9.3
MU-1	TDS	895	119 - 4490	500	mg/L	61.0
MU-2	TDS	128	204 - 630	500	mg/L	21.9
MU-3	TDS	102	136 - 1440	500	mg/L	30.4
MU-4	TDS	1068	91 - 2320	500	mg/L	43.5
MU-5	TDS	81	137 - 324	500	mg/L	0.0
MU-6	TDS	81	133 - 293	500	mg/L	0.0
Reference	TDS	495	44 - 443	500	mg/l	0.0
MU-1	TOC	862	0.5 - 39.6	4	mg/L	5.6
MU-2	TOC	131	0.5 - 5.34	4	mg/L	2.3
MU-3	TOC	102	0.5 - 16.5	4	mg/L	28.4
MU-4	TOC	964	0.5 - 17.7	4	mg/L	7.5
MU-5	TOC	81	0.5 - 14.3	4	mg/L	2.5
MU-6	TOC	81	0.5 - 4.88	4	mg/L	1.2
Reference	TOC	478	0.5 - 16.3	4	mg/l	10.0

4.2.2 Sediment Results

Sediment screening results are summarized in Table 20. Sediment was tested for 33 inorganic constituents. For the 26 constituents with soil guideline values, 22 did not exceed guideline values. Sediment was also tested for 17 organic constituents. None of the 15 organic constituents with guideline values exceeded those values.

Table 20: Summary of Sediment Screening Results

Constituents Carried to Effects Assessment [a]		
	Inorganic	**Organic**
Constituents Exceeding Guideline	Aluminum, Iron, Nickel, **Selenium**	None
Constituents Lacking Guideline	Bismuth, Calcium, Magnesium, Potassium, Sulphur, Titanium, Phosphorus	Acenaphthylene, Benzo(g,h,i)perylene
Constituents Not Carried to Effects Assessment (Screened Out)		
	Inorganic	**Organic**
Constituents Not Exceeding Guidelines	Antimony, Arsenic, Barium, Beryllium, Boron, **Cadmium**, Chromium, Cobalt, Copper, Lead, Lithium, Manganese, Mercury, Molybdenum, Silver, Sodium, Strontium, Thallium, Tin, Uranium, Vanadium, Zinc	2-Methyl naphthalene, Acenaphthene, Anthracene, Benz(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, Dibenz(a,h)anthracene, Fluoranthene, Fluorene, Indeno(1,2,3-c,d) pyrene, Naphthalene, Phenanthrene, Pyrene

Notes:
[a] Constituents specified in the Order are shown in bolded text.

Constituents exceeding guideline values and carried forward for sediment are summarized in Table 21. Table 22 provides detailed results of the comparison with guidelines organized by MU. All sediment data are reported in mg/kg dw. Of the constituents specified in the Order, only selenium exceeded sediment guidelines (in MUs 1 and 4). In MU-1, 70% of all selenium samples exceeded the guideline. MU-4 had 21% of samples exceeding the guideline. Nitrate and sulphate are not constituents of concern for sediment and so were not analyzed.

Iron exceeded the sediment guideline in every MU. Nickel exceeded the guideline only in MU-1, and aluminum exceeded the guideline only in MU-6. No organic constituents exceeded sediment guidelines. Thus, sediment constituents carried further in the evaluation due to exceeding guidelines included selenium, iron, nickel, and aluminum. Seven inorganic constituents and two organic constituents lacking guideline values were also carried forward.

Table 21: Summary of Constituents Exceeding Sediment Guidelines

MUs	Constituent [a]	Percent Exceeding [b]	Maximum Concentrations [c] (mg/kg dw)	Guideline (mg/kg dw)
MU-6	Aluminum	28	17,400	15,400
MU-1, 2, 3, 4, 5, 6	Iron	54-100	15,500-41,900	11,000
MU-1	Nickel	11	129	100
MU-1, 4	**Selenium**	21-70	5.30-81.6	3

Notes:
[a] Constituents specified in the Order are shown in bolded text.
[b] Range of percent of samples exceeding from MUs in which guideline was exceeded.
[c] Range of maximum concentrations from MUs in which guideline was exceeded.

Table 22: Constituents Exceeding Sediment Guideline by Management Unit

MU	Constituent [a,b]	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/kg)	Mean Concentration (mg/kg)	Maximum Concentration (mg/kg)	Guideline (mg/kg dw)
MU-1	**Selenium**	46	0	32	70	0.700	10.5	81.6	3
MU-1	Nickel	46	0	5	11	14.2	32.9	129	100
MU-1	Iron	46	0	25	54	4750	11600	41900	11000
MU-2	Iron	5	0	3	60	9990	13100	15500	11000
MU-3	Iron	5	0	5	100	12800	15000	17500	11000
MU-4	**Selenium**	24	0	5	21	0.930	2.27	5.30	3
MU-4	Iron	24	0	18	75	9240	13800	26400	11000
MU-5	Iron	18	0	14	78	10300	12400	16900	11000
MU-6	Iron	25	0	25	100	12100	17400	25600	11000
MU-6	Aluminum	25	0	7	28	4570	9880	17400	15400

Notes:
[a] Constituents specified in the Order are shown in bolded text.
[b] Only bulk fraction sediment data included.

4.2.3 Fish Tissue Results

Fish tissue screening results are summarized in Table 23. Fish tissue was tested for 40 inorganic constituents. For the 23 constituents with guideline values, 13 did not exceed guidelines. No organic constituents were analyzed in fish tissue.

Table 23: Summary for Fish Tissue Screening Results

Constituents Carried to Effects Assessment [a]	
Constituents Exceeding Guideline	Aluminum, Antimony, Arsenic, **Cadmium**, Cobalt, Iron, Lithium, **Selenium**, Vanadium, Zinc
Constituents Lacking Guideline	Bismuth, Calcium, Cesium, Gallium, Lead, Magnesium, Phosphorus, Potassium, Rhenium, Rubidium, Sodium, Tellurium, Thallium, Thorium, Titanium, Yttrium, Zirconium
Constituents Not Carried to Effects Assessment (Screened Out)	
Constituents Not Exceeding Guidelines	Barium, Beryllium, Boron, Chromium, Copper, Manganese, Mercury, Molybdenum, Nickel, Silver, Strontium, Tin, Uranium

Notes:
[a] Constituents specified in the Order are shown in bolded text.

Constituents exceeding guidelines for fish are summarized in Table 24. Table 25 provides detailed results of the comparison with guidelines organized by MU. Of the constituents specified in the Order, only selenium and cadmium had samples exceeding the guidelines (nitrate and sulphate are not constituents of concern for fish tissue). In MUs 1, 2, and 6, muscle tissue samples exceeded the selenium guideline, but whole body samples did not. In MU-4, both muscle and whole body fish samples exceeded the guideline. Cadmium had a sample exceeding the guideline in MU-3 in one whole fish sample (out of ten samples), and samples exceeding in MU-4 (in three whole fish samples of 30, and in five muscle samples out of 80).

There were eight other constituents with samples exceeding guidelines. Arsenic had multiple samples exceeding in every MU[9]. Cobalt had multiple samples exceeding in all MUs except MU-6. Iron had one sample exceeding in MU-3 and two samples in MU-4. A total of five constituents (aluminum, antimony, lithium, vanadium and zinc) had only one sample exceeding a fish tissue guideline.

[9] It should be noted that average arsenic concentrations in reference area fish were higher than concentrations in fish from the Designated Area.

Table 24: Summary of Constituents Exceeding Fish Tissue Guidelines

MUs	Constituent [a]	Percent Exceeding [b]	Maximum Concentrations [c] (mg/kg ww)	Guideline (mg/kg ww)
MU-3	Aluminum (Whole)	10	426	280
MU-4	Antimony (Muscle)	1	0.170	0.108
MU-1, 2, 3, 4, 5, 6	Arsenic (muscle)	30-73	0.0600-0.340	0.021
MU-3, 4, 5	Arsenic (whole)	44-90	0.0926-0.159	0.021
MU-4	**Cadmium (muscle)**	6	0.529	0.28
MU-3, 4	**Cadmium (whole)**	10	0.421-0.702	0.28
MU-1, 2, 4, 5	Cobalt (muscle)	6-30	0.114-2.13	0.082
MU-3, 4, 5	Cobalt (whole)	10-28	0.104-0.378	0.082
MU-4	Iron (muscle)	3	361	190
MU-3	Iron (whole)	10	316	190
MU-4	Lithium	1	1.70	0.54
MU-1, 2, 4, 6	**Selenium (muscle)**	6-47	5.75-15.1	3.6
MU-4	**Selenium (whole)**	30	14.9	3.6
MU-3	Vanadium (whole)	10	1.52	1.36
MU-4	Zinc	3	82.1	82

Notes:
[a] Constituents specified in the Order are shown in bolded text.
[b] Range of percent of samples exceeding from MUs in which guideline was exceeded.
[c] Range of maximum concentrations from MUs in which guideline was exceeded.

Table 25: Constituents Exceeding Fish Tissue Guidelines by Management Unit

MU	Constituent [a]	Tissue	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/kg ww)	Mean Concentration (mg/kg ww)	Maximum Concentration (mg/kg ww)	Guideline (mg/kg ww)
MU-1	Arsenic	Muscle	30	0.0	11	36.7	0.00464	0.0221	0.128	0.021
MU-1	Cobalt	Muscle	30	0.0	9	30.0	0.00346	0.0572	0.185	0.082
MU-1	**Selenium**	Muscle	30	0.0	14	46.7	0.854	4.67	15.1	3.6
MU-2	Arsenic	Muscle	15	0.0	5	33.3	0.00600	0.0278	0.193	0.021
MU-2	Cobalt	Muscle	15	0.0	1	6.7	0.00482	0.0358	0.114	0.082
MU-2	**Selenium**	Muscle	15	0.0	2	13.3	0.686	2.32	5.75	3.6
MU-3	Aluminum	Whole	10	0.0	1	10.0	1.21	50.7	426	280
MU-3	Arsenic	Muscle	5	0.0	3	60.0	0.00777	0.0368	0.0823	0.021
MU-3	Arsenic	Whole	10	0.0	9	90.0	0.0149	0.0599	0.159	0.021
MU-3	**Cadmium**	Whole	10	0.0	1	10.0	0.00797	0.0766	0.421	0.28
MU-3	Cobalt	Whole	10	0.0	1	10.0	0.0103	0.0243	0.104	0.082
MU-3	Iron	Whole	10	0.0	1	10.0	10.0	49.2	316	190
MU-3	Vanadium	Whole	10	0.0	1	10.0	0.0134	0.192	1.52	1.36
MU-4	Antimony	Muscle	78	52.6	1	1.3	0.0000404	0.00974	0.170	0.108
MU-4	Arsenic	Whole	30	0.0	27	90.0	0.00643	0.0418	0.0926	0.021
MU-4	Arsenic	Muscle	80	16.3	50	62.5	0.00604	0.0462	0.340	0.021
MU-4	**Cadmium**	Whole	30	0.0	3	10.0	0.0126	0.158	0.702	0.28
MU-4	**Cadmium**	Muscle	80	21.3	5	6.3	0.000464	0.0512	0.529	0.28
MU-4	Cobalt	Whole	30	0.0	7	23.3	0.0150	0.0689	0.378	0.082
MU-4	Cobalt	Muscle	80	8.8	20	25.0	0.00280	0.0753	1.35	0.082
MU-4	Iron	Muscle	80	0.0	2	2.5	2.86	29.0	361	190
MU-4	Lithium	Muscle	80	48.8	1	1.3	0.00290	0.0910	1.70	0.54
MU-4	**Selenium**	Muscle	80	0.0	9	11.3	0.200	2.41	13.9	3.6
MU-4	**Selenium**	Whole	30	0.0	9	30.0	1.02	4.20	14.9	3.6
MU-4	Zinc	Whole	30	0.0	1	3.3	3.40	31.8	82.1	82
MU-5	Arsenic	Whole	18	0.0	8	44.4	0.0122	0.0345	0.110	0.021
MU-5	Arsenic	Muscle	33	12.1	10	30.3	0.00768	0.0195	0.0600	0.021
MU-5	Cobalt	Muscle	33	0.0	2	6.1	0.00190	0.0269	0.213	0.082
MU-5	Cobalt	Whole	18	0.0	5	27.8	0.00867	0.0420	0.128	0.082
MU-6	Arsenic	Muscle	11	0.0	8	72.7	0.0110	0.0413	0.110	0.021
MU-6	**Selenium**	Muscle	287	0.0	16	5.6	0.267	1.11	6.00	3.6

Notes:
[a] Constituents specified in the Order are shown in bolded text.

4.2.4 Groundwater Results

Groundwater screening results are summarized in Table 26. A total of 91 locations were sampled to assess groundwater quality. The majority of the locations sampled (79) were private groundwater wells with additional samples collected from Elkford and Sparwood municipal wells, groundwater supplies with multiple users (e.g., mobile home parks), and surface water points of diversion (springs and creeks). Eight samples were found to exceed or be within 20% of the selenium guideline, and were resampled. One sample exceeded the AO guideline for sulphate; one exceeded the AO guideline for sodium; and one was found to exceed the AO guideline for chloride.

Water samples were tested for 10 inorganic constituents, of which eight had guideline values. Two parameters lacking guidelines values, calcium and potassium, are general water quality parameters not specific to human health.

Table 26: Summary of Groundwater Screening Results

Constituents Carried to Effects Assessment [a]	
Constituents Exceeding Guideline	Chloride, **Selenium**, Sodium, **Sulphate**
Constituents Lacking Guideline	Calcium, Potassium
Constituents Not Carried to Effects Assessment (screened out)	
Constituents Not Exceeding Guidelines	**Cadmium**, Magnesium, **Nitrate (as N)**, Nitrite (as N)

Notes:
[a] Constituents specified in the Order are shown in bolded text.

Constituents exceeding guidelines for groundwater and affected wells are listed in Table 27. As with surface water, guidelines are generally based on total concentrations; however, both total and dissolved concentrations were included in the current baseline evaluation. Of the constituents specified in the Order, five selenium samples and one sulphate sample exceeded the groundwater guideline, and both constituents were carried forward for further evaluation. Sodium and chloride were also carried forward due to samples exceeding guidelines, while calcium and potassium were carried forward due to lack of guideline values. A majority of groundwater samples exceeded the hardness guideline (see Table 28 and data provided in Attachment 2).

Table 27: Wells with Constituents Exceeding Groundwater Guidelines

Well	Sample Date	MU	Constituent [a]	Fraction	Below Detection Limit	Concentration (mg/L)	Guideline (mg/L)
02-17	3/18/2014	MU-4	**Selenium**	D	No	0.0143	0.01
02-17	4/24/2014	MU-4	**Selenium**	D	No	0.0156	0.01
02-17	3/18/2014	MU-4	**Selenium**	T	No	0.0143	0.01
02-17	4/24/2014	MU-4	**Selenium**	T	No	0.0152	0.01
02-18	4/24/2014	MU-4	**Selenium**	D	No	0.0138	0.01
02-18	4/24/2014	MU-4	**Selenium**	T	No	0.0132	0.01
02-20	3/26/2014	MU-4	**Selenium**	D	No	0.0133	0.01
02-20	4/24/2014	MU-4	**Selenium**	D	No	0.0134	0.01
02-20	4/24/2014	MU-4	**Selenium**	T	No	0.013	0.01
02-20	3/26/2014	MU-4	**Selenium**	T	No	0.0133	0.01
07-01	3/28/2014	MU-4	**Selenium**	D	No	0.0102	0.01
02-03	3/4/2014	MU-4	Sodium	T	No	288	200
07-01	3/28/2014	MU-4	**Sulphate**	D	No	550	500
04-22	4/15/2014	MU-5	Chloride	D	No	307	250
03-04	3/11/2014	MU-5	**Selenium**	D	No	0.0119	0.01
03-04	3/11/2014	MU-5	**Selenium**	T	No	0.0111	0.01
04-09	3/17/2014	MU-5	**Selenium**	D	No	0.0113	0.01
04-09	3/17/2014	MU-5	**Selenium**	T	No	0.0108	0.01

Notes:
[a] Constituents specified in the Order are shown in bolded text.

Table 28: Ground Water Hardness Data

MU	Concentration Range (mg/L)	Guideline Range (mg/L)	Percent of Samples Outside of Guideline Range
3	76.3 - 366	80 - 100	100
4	1.29 - 763	80 - 100	100
5	0.51 - 347	80 - 100	98

5 Cumulative Impacts - Effects Assessment

The previous sections of the Chapter outlined on a medium-specific basis the frequency where constituent concentrations have been recorded as exceeding human health guidelines. The following effects assessment, as permitted by the existing data, evaluates potential cumulative impacts from all point and non-point sources, as well as natural background conditions. The effects assessment provides further characterization of constituents that were retained after the current baseline evaluation. The focus of this assessment is identification of potentially complete exposure pathways for environmental media in which constituents exceeded guidelines, followed by further risk-based screening and risk calculations. Such risk-based screening is dependent on the availability of toxicity reference values (TRVs). Some constituents lacking guideline values may not have TRVs, and some constituents may have guideline values that are not health-based. For these constituents, an initial assessment is provided of the general level of toxicity of the constituent, and concentrations are compared with concentrations in reference locations. Based on this analysis, recommendations are made regarding whether further quantitative analysis is needed for these constituents or if data gaps exist that prevent full characterization.

Constituents exceeding guideline values are evaluated in the effects assessment according to the two step approach (refer to Figure 1). Each MU had a unique list of constituents that exceeded guidelines; however, in the interest of a more complete assessment, any constituent that was carried forward was further evaluated in all MUs. For the first step of the effects assessment, an upper-bound estimate of mean concentrations for retained constituents in each MU was compared with pathway-specific benchmarks for primary exposure pathways. The pathway-specific benchmarks were conservatively calculated, assuming that only 20% of the safe dose was allowed for an individual pathway, i.e., if there was only one exposure pathway, an exposure up to five times the benchmark would still be protective. Alternatively, exposures via five pathways at or below the benchmark values would still be safe.

Available data were examined for trends to determine if the mean for samples collected from 2011-2013 would be representative of potential future exposures. The nature of toxicity associated with a constituent was also considered at this stage, to determine if shorter term exposures should be assessed. Among the retained constituents, this issue is relevant only for nitrate. The outcome of this assessment is described in the pathway-specific benchmark surface water section below.

Constituents that did not exceed primary pathway-specific benchmarks were not considered further. Constituents that exceeded a primary pathway-specific benchmark were retained to calculate pathway-specific risks (including secondary pathways) and to consider potential aggregate risks across all pathways. If there was no concern for aggregate risk, the constituent was not considered further. Multiple constituents with a potential for cumulative risks were evaluated further for consideration of physical and chemical factors influencing exposure and toxicity, and for interactive effects. In some cases constituents were also evaluated with respect to reference area concentrations.

5.1 Characterization of Constituents Carried Forward

For a substantial number of constituents in surface water, sediment, fish, and groundwater, no TRVs were readily available to support the pathway-specific screening step. The following sections summarize the constituents for which TRVs were available, and provides qualitative assessment of constituents for which TRVs could not be identified. Data limitations or data gaps are also addressed.

5.1.1 Surface Water

Surface water was tested for both inorganic and organic constituents. The 12 constituents carried forward from the current baseline evaluation for surface water because they exceeded guidelines were aluminum, arsenic, beryllium, bromide, cobalt, iron, magnesium, manganese, nitrate, selenium, sulphate, and vanadium. Three of these constituents (bromide, magnesium, and sulphate) are discussed here qualitatively, but were not included in further screening and risk evaluation for the reasons described below. Similarly, other general water quality parameters used to assess general potability of water supplies (i.e., hardness, pH, TDS and TOC) are not considered in the effects assessment. The remaining nine constituents (aluminum, arsenic, beryllium, cobalt, iron, manganese, nitrate, selenium, and vanadium) were carried forward to the next step of the effects assessment.

Samples appearing to exceed the bromide surface water guideline were not reliable indicators, because the data are all dissolved concentrations, whereas the guideline is based on annual mean total bromide concentration in monthly raw water samples. Most concentrations were undetected; however, the detection limits were all equal to or above the guideline of 0.05 mg/L for total bromide. Consequently, the available data are not adequate to determine if bromide exceeds the guideline. The guideline is intended to determine the needed frequency of bromate monitoring in treated water supplies using ozonation for treatment, so its application in this context is not clear. Nevertheless, this data gap is noted in the conclusions but no further analysis is conducted.

The surface water guideline for magnesium is based on aesthetic factors, including effects on taste and odour. Only seven of 473 magnesium samples exceeded the guideline in MU-1, and the mean concentration was well below the guideline (36 mg/L vs. a guideline of 100 mg/L). As a required nutrient for human health, no TRVs are available for magnesium, and there is no anticipated health risk from reported concentrations. For that reason magnesium was not evaluated further.

The surface water guideline for sulphate is based on aesthetic factors and potential for mild gastrointestinal distress. No TRV is available due to the absence of significant adverse effects at any concentration evaluated. Only six of 479 sulphate samples exceeded the guideline in MU-1, and the mean concentration was well below the guideline (157 mg/L vs. a guideline of 500 mg/L). There is no anticipated health risk from reported concentrations. For that reason sulphate was not evaluated further. Inorganic constituents for which guideline values were not

available are bismuth, calcium, phosphate, phosphorus, potassium, silica, silicate, silicon, sulphide, sulphur, and titanium. Of these constituents listed, calcium, phosphorus (measured in the blood as phosphate ion), potassium, and sulphur are essential macrominerals necessary in our bodies in larger amounts[10]. Phosphorus/phosphate and sulphur/sulphide are present as part of other chemicals and were not evaluated for human health effects as free elements or ions. Bismuth has limited oral bioavailability in people, as evidenced by its use in laxative medicines. Silica/silicate/silicon and titanium are commonly used as whiteners in toothpaste[11]. Due to their low toxicity, these constituents were not evaluated further.

Nine organic constituents were also measured in surface water, eight of which have guideline values. None of these eight constituents exceeded guideline values in the current baseline screening. Phenanthrene is the only organic constituent for which a guideline value was not available. It has a similar toxicity profile to other PAHs for which surface water guidelines values were available. Due to this similarity and the lack of samples exceeding current baseline guidelines among the other PAHs, phenanthrene was not evaluated further.

5.1.2 Sediment

Sediment was tested for both inorganic and organic constituents. Aluminum, iron, nickel, and selenium exceeded guidelines and have TRVs. All four were carried forward to the next step of the effects assessment.

Inorganic constituents for which guideline values were not available include bismuth, calcium, magnesium, phosphorus, potassium, sulphur, and titanium. The absence of guideline values for these constituents in sediment reflects their low toxicity to people, as described in Section 5.1.1. Calcium, magnesium, and potassium are essential macrominerals and generally not considered as human toxicants. Phosphorus and sulphur, also essential macrominerals, were not evaluated for human health effects as free elements. Bismuth has limited oral bioavailability in people as evidenced by its use in laxative medicines and titanium is commonly used as a whitener in consumer products such as toothpaste[12]. Due to their low toxicity, these constituents are not evaluated further in the effects assessment.

Fifteen organic constituents did not exceed sediment guideline values. No guidelines were available for acenaphthylene and benzo(g,h,i)perylene. These constituents have similar toxicity profiles to the organic constituents for which sediment guideline values were available. Additionally, acenaphthylene was below the detection limit in every sample analyzed from the

[10] Magnesium, sodium, and chloride also are necessary macrominerals. Trace minerals needed in smaller amounts include iron, manganese, copper, iodine, zinc, cobalt, fluoride, and selenium.

[11] In contrast to the low oral toxicity of silica and titanium, inhalation of high concentrations of quartz silica or titanium oxide has been classified as carcinogenic to humans for silica (http://www.ccohs.ca/oshanswers/chemicals/chem_profiles/quartz_silica.html) and possibly carcinogenic to humans for titanium (http://www.ccohs.ca/headlines/text186.html).

[12] In contrast to the low oral toxicity of titanium, inhalation of high concentrations of titanium oxide has been classified as possibly carcinogenic to humans, http://www.ccohs.ca/headlines/text186.html.

management areas and from reference data. Benzo(g,h,i)perylene was below the detection limit for MUs 4, 5, and 6 and in the reference data. More than 77% of samples were below the detection limits in MUs 1 and 2 (MU-3 was not sampled). The maximum concentration of benzo(g,h,i)perylene was 0.135 mg/kg dw, which is well below the guideline of 1 mg/kg dw for the similar organic constituents benzo(b)fluoranthene and benzo(k)fluoranthene. Due to this similarity and the lack of samples exceeding guidelines among the other organic constituents, the two organic constituents without sediment guideline values were not evaluated further.

5.1.3 Fish Tissue

Fish tissue was tested for 40 inorganic constituents, of which 22 had guideline values. All ten constituents with samples exceeding guidelines have TRVs and were retained for further evaluation. No organic constituents were analyzed in fish tissue.

Constituents for which no fish tissue guideline is available are bismuth, calcium, cesium, gallium, lead, magnesium, phosphorus, potassium, rhenium, rubidium, sodium, tellurium, thallium, thorium, titanium, yttrium, and zirconium. A lead TRV (SNC-Lavalin 2012) was identified and was used for further assessment of lead in fish tissue.

As described above, bismuth, phosphorus, and titanium are considered to have low toxic potential for people. Calcium, magnesium, phosphorus, potassium, and sodium are also essential macrominerals and are not typically included in health risk assessments. Cesium, gallium, rhenium, rubidium, tellurium, thorium, and yttrium are trace elements that are rarely evaluated in health risk assessments and for which no TRVs have been established. None of these constituents was carried forward in the effects assessment.

There are insufficient data to support derivation of TRVs for thallium and zirconium. Toxicity data for thallium is limited. Animal toxicity studies have reported hair loss (i.e., alopecia), which is generally reversible following cessation of exposure, but similar symptoms have not been reported in humans. USEPA (2009) concluded that weaknesses in the underlying database do not support quantitative toxicity assessment. Zirconium generally exhibits low toxicity and is often used in skin ointments and antiperspirants. USEPA (2012) determined that the available database is inadequate and does not support development of a zirconium TRV. Due to the low toxicity of these constituents and lack of reliable TRVs, thallium and zirconium were not evaluated further.

In summary, constituents carried forward from the current baseline evaluation for fish tissue include the ten constituents that exceeded their respective guidelines: aluminum, arsenic, antimony, cadmium, cobalt, iron, lithium, selenium, vanadium, and zinc, with one additional constituent without a guideline value: lead.

5.1.4 Groundwater

Drinking water wells were tested for the four Order constituents and seven additional inorganic constituents. For most wells, constituent concentrations were represented by one sampling event; in some cases wells were represented by two samples. Maximum concentrations of each constituent for each well were included in this assessment.

Selenium, calcium, potassium, sulphate, chloride, and sodium were retained for further evaluation in the effects assessment. Of 91 locations sampled, selenium slightly exceeded the guideline in five well sources and was carried forward to the next step of the effects assessment. One sulphate sample exceeded the guideline (550 mg/L vs. the guideline of 500 mg/L), which is based on aesthetic factors and potential for mild gastrointestinal distress. No sulphate TRV is available due to the absence of significant adverse effects at any concentration evaluated; consequently, there is no need for further assessment of sulphate. Chloride and sodium exceeded their respective guidelines in one well each. Because these constituents are essential macrominerals and also considered a result of local, non-mine sources, (i.e., water softeners; SNC Lavalin 2014b), they were not evaluated further. Calcium and potassium lack guidelines and TRVs. They are considered essential macrominerals and therefore were not evaluated further.

5.2 Pathway-specific Benchmark Comparison

Pathway-specific benchmark values were developed for constituents requiring additional analysis. Primary exposure pathways are identified in the schematic CSM (Figure 10) and are the basis for the pathway-specific benchmark values calculated in the effects assessment. Secondary exposure pathways shown in the CSM are quantified only if primary pathway-specific benchmarks are exceeded by constituent exposure concentrations. If exposure concentrations do not exceed primary pathway-specific benchmarks, then it is reasonable to assume that exposures via secondary pathways will not result in hazards or risks exceeding management thresholds. For example, if the primary pathway-specific benchmark for direct ingestion of surface water as drinking water is not exceeded by surface water exposure concentrations, then there is no need to evaluate ingestion of livestock or crops that have been irrigated by surface water.

The primary exposure pathways that form the basis for the benchmark calculations are:

- **Ingestion of surface water and groundwater as drinking water:** Although surface water is not typically used for human consumption, this pathway was included to evaluate the most intensive future use and for comparison with secondary exposure pathways, such as eating plants and wildlife that consume surface water.
- **Incidental ingestion of and dermal contact with sediment and surface water while recreating:** A variety of water-based activities are popular in the Elk Valley. Residents who swim, the most contact-intensive activity, were selected as the basis for the pathway-specific benchmark calculation.
- **Fish consumption:** Residents, including First Nations members and visitors, consume locally caught fish. Ktunaxa First Nation consumers were selected as the basis for the pathway-specific benchmark calculation because their ingestion rate is greatest and likely most protective of exposures to other populations.

Exposure concentrations were compared to the pathway-specific benchmarks. Constituents that exceeded the respective pathway-specific benchmarks were retained for further evaluation.

5.2.1 Calculation of Pathway-specific Benchmarks

Pathway-specific benchmarks were calculated for noncancer and cancer endpoints, as appropriate, for all constituents carried forward to the effects assessment. Equations applied in calculation of pathway-specific (e.g., dermal contact with sediment and water, ingestion of sediment and water) benchmarks were derived from Health Canada (2012b) and USEPA (2004) guidance. The general noncancer and cancer benchmark equations are provided below and detailed exposure rate equations are listed in Sections 5.2.1.1 to 5.2.1.4. The general equation for calculating a benchmark based on noncancer health effects associated with ingestion pathways is as follows:

$$\text{Noncancer benchmark (mg/kg or mg/L)} = \frac{TRV_o \times THQ}{ADER_i}$$

Where:

TRV_o = oral toxicity reference value (mg/kg-day; constituent-specific)
THQ = target hazard quotient (unitless; 0.2)
$ADER_i$ = average daily exposure rate for ingestion pathway (L/kg-day, mg/kg-day)

TRVs used in derivation of the pathway-specific benchmarks were obtained primarily from the USEPA Integrated Risk Information System (IRIS) and Health Canada (2010) or other U.S. sources (e.g., PPRTVs, ATSDR13) as recommended in BC MoE risk assessment guidance (2012b). Table 29 lists all TRVs used in benchmark calculations. Swimming might be more appropriately assessed using subchronic or intermediate TRVs, but few were available. For this reason, chronic TRVs were used for all scenarios. The target hazard quotient of 0.2 was selected so that cumulative exposures from multiple pathways and multiple exposure media do not exceed effects thresholds (BC MoE 2012b).

The average daily exposure rate (ADER) factor is a pathway-specific parameter and was calculated as shown in the following sections for each of three age groups: child (5-11 years), teen (12-19 years), and adult (>20 years). The highest value among these groups was applied in the general equation listed above, to derive the pathway-specific benchmark value for each constituent.

[13] PPRTV = Provisional Peer Reviewed Toxicity Values, and ATSDR = Agency for Toxic Substances and Disease Registry.

Table 29: Chronic Toxicity Reference Values Used to Calculate Pathway-specific Benchmarks

Constituent	Chronic Oral TRV (mg/kg-day)	Target Organ/Critical Effect	Source
Aluminum	1	Neurological	PPRTV, 2006
Antimony	0.0004	Blood (survival, blood glucose, cholesterol)	USEPA IRIS, 1991
Arsenic	0.0003	Skin (hyperpigmentation, keratosis)	USEPA IRIS, 1993
Beryllium	0.002	GI tract (small intestinal lesions)	USEPA IRIS, 1998
Cadmium	0.001[a]	Human studies involving chronic exposures (significant proteinuria)	USEPA IRIS, 1994
Cobalt	0.0003	Thyroid	PPRTV, 2008
Iron	0.7	GI tract	PPRTV, 2006
Lead	0.0013	Developmental (decreased IQ)	SNC-Lavalin, 2012
Lithium	0.002	Several organs	PPRTV, 2008
Manganese	0.14	Central nervous system	USEPA IRIS, 1996
Nickel	0.02	Decreased body and organ weight	USEPA IRIS, 1996
Nitrate (as N)	1.6	Circulatory system (methaemoglobinaemia)	USEPA IRIS, 1991
Selenium	0.0057[b]	Skin (clinical selenosis)	Health Canada, 2010
Vanadium	0.005[c]	Skin (decreased hair cysteine, survival, growth)	USEPA IRIS, 1996
Zinc	0.3	Circulatory system (erythrocyte Cu, Zn-superoxide dismutase)	USEPA IRIS, 2005

Notes:
PPRTV = Provisional Peer Reviewed Toxicity Values for Superfund
ATSDR = Agency for Toxic Substances and Disease Registry
IRIS = Integrated Risk Information System
[a] Cadmium TRV is for oral ingestion of food, not water, due to the fact that only cadmium in fish tissue was carried to the effects assessment.
[b] The pathway-specific benchmark for selenium in drinking water is based on the upper tolerable intake level (UL) of 0.4 mg/day set by Health Canada. This UL is also the basis for Health Canada's proposed maximum allowable concentration (MAC) of 50 µg/L. The health-based proposed MAC contrasts with the 1992 guideline currently relied on by BC MoE of 10 µg/L which is based on allowing 10-25% of total selenium intake to be from drinking water.
[c] Derived from reference dose for vanadium pentoxide by factoring out molecular weight of the oxide ion.

The general equation for calculating a benchmark based on noncancer effects associated with both dermal and ingestion pathways is as follows:

$$\text{Noncancer benchmark (mg/kg)} = \left(\frac{TRV_o \times ABS_{GI}}{ADER_d} + \frac{TRV_o}{ADER_i}\right) \times THQ$$

Where:

TRV_o = oral toxicity reference value (mg/kg-day; constituent-specific)
ABS_{GI} = gastrointestinal absorption fraction (unitless; constituent-specific)
THQ = target hazard quotient (unitless; 0.2)
$ADER_i$ = average daily exposure rate for ingestion pathway (L/kg-day, mg/kg-day)
$ADER_d$ = average daily exposure rate for dermal pathway (mg/kg-day)

As seen in the equation above, oral TRVs are modified for the dermal pathway using gastrointestinal absorption fractions (ABS_{GI}) to adjust for differences in absorption efficiency between the oral and dermal exposure routes (USEPA 2004). This adjustment is made when dermal-specific toxicity values are unavailable. Extrapolation of TRVs from oral to dermal exposure routes is performed to account for the fact that most oral TRVs represent the amount of a constituent that is administered. When evaluating exposures via dermal absorption, exposures are expressed as an absorbed dose rather than administered dose. Values used for ABS_{GI} were obtained from USEPA (2013) and are listed in Section 5.2.1.5.

The general equation for calculating a cancer benchmark is as follows:

$$\text{Cancer benchmark (mg/kg or mg/L)} = \frac{CRL}{LADER_i \times SF_o}$$

Where:

CRL = cancer risk level (unitless; 1E-05)
$LADER_i$ = lifetime average daily exposure rate for ingestion pathway (kg/kg-day; pathway-specific)
SF_o = oral cancer slope factor ($(mg/kg\text{-}day)^{-1}$; constituent-specific)

Arsenic was the only carcinogen retained following the current baseline evaluation and evaluated in the effects assessment, and it was assessed for ingestion of fish tissue only. A target cancer risk level of 1 in 100,000 was applied in the benchmark calculation. The slope factor for arsenic is 1.8 (mg/kg-day)-1 Health Canada (2010). The lifetime average daily exposure rate factor (LADER) was calculated for three age groups: child (5-11 years), teen (12-19 years), and adult (>20 years) for each exposure pathway. These three exposure rates were then summed to create a composite exposure rate representative of a lifetime of exposure. The LADER then was applied to the general equation provided above to calculate the pathway-specific benchmark value for arsenic.

Pathway-specific exposure rate factor equations, i.e., ADER or LADER, are provided in the following sections. Exposure parameters used in the equations are provided in Table 30 through Table 33. Generally, exposure parameters were obtained from Health Canada (2012b), Intrinsik (2011), and USEPA (2004) guidance or are based on site-specific information. Exposure parameters common to all equations, body weight, and averaging period are based on default

assumptions provided by Health Canada (2012b). Other parameters are pathway-specific values based on default guidance (Intrinsik 2011, Health Canada 2010 and 2012b, USEPA 2004) for drinking water, incidental water and sediment ingestion rates, skin surface area, sediment to skin adherence values, and dermal absorption values. Site-specific assumptions were developed only for swimming exposure frequency and exposure time, as described below.

5.2.1.1 Ingestion of Drinking Water

Both surface water and groundwater were evaluated as drinking water sources. The equation for estimating the water ingestion exposure rate is as follows:

$$(L)ADER = \frac{IR_w \times EF_b \times EF_c \times ED}{BW \times AP \times CF_a}$$

Where:

(L)ADER = average daily exposure rate (lifetime for carcinogens only) (L/kg-day)
IR_w = surface water or groundwater ingestion rate (L/day)
EF_b = exposure frequency b (weeks/year)
EF_c = exposure frequency c (days/week)
ED = exposure duration (years)
BW = body weight (kilograms)
AP = averaging period for noncarcinogens or carcinogens (years)
CF_a = unit conversion factor (days/year)

Table 30 provides the exposure factors used for calculating the drinking water benchmark. The default drinking water ingestion rate from Health Canada (2012b) was used in the equation above.

Table 30: Exposure Factors for Surface Water and Groundwater Ingestion for Residents

Exposure Factors	Units	Symbol	Infant (0-6 months)	Child (5-11 yrs)	Teen (12-19 yrs)	Adult (>20 years)	Composite (5-80 years)
Receptor-Specific Exposure Factors							
Exposure Frequency b [a]	weeks/year	EF_b	52.0	52	52	52	
Exposure Frequency c [a]	days/week	EF_c	7.0	7	7	7	
Duration of Exposure [a]	years	ED	0.5	7	8	60	
Body Weight [a]	kg_{BW}	BW	8.2	32.9	59.7	70.7	
Averaging Period for Cancer [a]	years	AP_c	80	80	80	80	
Averaging Period for Noncancer [a]	years	AP_{nc}	0.5	7	8	60	
Ingestion of Water							
Drinking Rate [a]	L/day	IR_w	0.3	0.8	1	1.5	
Conversion Factor	days/year	CF_a	365	365	365	365	
Lifetime Average Daily Ingestion of Water Exposure Rates, Cancer	L/kg_{BW}/day	LADER	0.00023	0.0021	0.0017	0.016	0.020
Average Daily Ingestion of Water Exposure Rates, Noncancer	L/kg_{BW}/day	ADER	0.036	0.024	0.017	0.021	0.024

Notes:
BW = body weight
[a] Source: Health Canada. 2012b. Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment, Version 2.0.

5.2.1.2 Incidental Ingestion of and Dermal Contact with Surface Water while Swimming

The swimming exposure pathway includes both incidental ingestion of and dermal contact with surface water (see Table 31). To calculate the pathway-specific benchmark for swimming, separate exposure rates were calculated for ingestion and dermal contact. These exposure rates were then summed to create the swimming-specific benchmarks for surface water. Assumptions regarding swimming frequency are consistent with those applied in the EAs for residential swimmers, which is one hour once per week and every week of the year[14].

The exposure rate for incidental ingestion of surface water while swimming was calculated as shown in Section 5.2.1.1; however, a much smaller estimate of 0.05 L/hour for water intake was assumed. Incidental water ingestion rates were obtained from USEPA (2011) guidance.

The exposure rate for dermal contact with inorganic constituents in surface water while swimming was calculated according to the following equation:

$$(L)ADER = \frac{K_p \times t_{event} \times EV \times EF_b \times EF_c \times ED \times SSA \times CF_b}{BW \times AP \times CF_a}$$

Where:

(L)ADER = average daily exposure rate (lifetime for carcinogens only) (L/kg-day)
K_p = dermal permeability coefficient (cm/hr)
t_{event} = event duration (hr/event)
EV = event frequency (events/day)
EF_b = exposure frequency (days/week)
EF_c = exposure frequency (weeks/year)
ED = exposure duration (years)
SSA = skin surface area (cm^2)
CF_b = unit conversion factor (L/cm^3)
BW = body weight (kg)
AP = averaging period (years)
CF_a = unit conversion factor (days/year)

For dermal contact with surface water, it was assumed that the total skin surface area is exposed to water while swimming.

[14] A recreational swimmer scenario including water contact for 3 hours per week is also evaluated in the EAs, but it was not included here due to the extreme conservatism of assuming that swimming occurs 52 weeks per year when the riverbanks are ice and snow-covered for at least four months of the year and water levels are too high for safe water activities during the spring freshet.

Table 31: Exposure Factors for Incidental Ingestion and Dermal Contact with Surface Water

Exposure Factors	Units	Symbol	Child (5-11 yrs)	Teen (12-19 yrs)	Adult (>20 yrs)	Composite (5-80 yrs)
Event Duration [a]	hours/event	t_{event}	1	1	1	
Event Frequency [a]	events/day	EV	1	1	1	
Exposure Frequency b [b]	weeks/year	EF_c	52	52	52	
Exposure Frequency c [a]	days/week	EF_b	1	1	1	
Duration of Exposure [c]	years	ED	7	8	60	
Body Weight [c]	kg_{BW}	BW	32.9	59.7	70.7	
Averaging Period for Cancer [c]	years	AP_c	80	80	80	
Averaging Period for Noncancer [c]	years	AP	7	8	60	
Incidental Ingestion of Surface Water While Swimming						
Incidental Drinking Rate [d]	L/hour	IR_w	0.05	0.05	0.05	
Conversion Factor	days/year	CF_a	365	365	365	
Lifetime Average Daily Incidental Ingestion Exposure Rates, cancer	$L/kg\text{-}_{BW}/day$	LADER	0.00002	0.00001	0.00008	0.0001
Average Daily Incidental Ingestion Exposure Rates, noncancer	$L/kg\text{-}_{BW}/day$	ADER	0.0002	0.0001	0.0001	0.0002
Surface Water Dermal Contact						
Skin Surface Area [c]	cm^2	SSA	10140	15470	17640	
Conversion Factor	days/year	CF_a	365	365	365	
Lifetime Average Daily Dermal Contact Exposure Rates, cancer	$cm^2\text{-event/kg-}_{BW}/day$	LADER	3.8	3.7	27	34
Average Daily Dermal Contact Exposure Rates, noncancer	$cm^2\text{-event/kg-}_{BW}/day$	ADER	44	37	36	44

Notes:
BW = body weight
[a] Assumed/site-specific
[b] Short duration: Sub-chronic (three months or less per year) exposures should not be amortized beyond days per week; therefore, an exposure term of 52 weeks / 52 weeks is applied.
[c] Source: Health Canada. 2012b. Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment, Version 2.0.
[d] Source: United States Environmental Protection Agency. 2014. Region 4 Human Health Risk Assessment Supplemental Guidance.

5.2.1.3 Incidental Ingestion of and Dermal Contact with Sediment while Swimming

As with water contact, sediment contact while swimming involves both incidental ingestion and direct skin contact exposure pathways (Table 29). Separate exposure rates were calculated for ingestion and dermal contact, and then the rates were added together to create the swimming-specific benchmarks for sediment. Assumptions regarding residential swimmer frequency of exposure are consistent with those applied in the EAs, or, one hour once per week, every week of the year. Incidental ingestion rates for sediment while swimming were obtained from Intrinsik (2011) guidance and were used in the following equation for estimating the exposure rate:

$$(L)ADER = \frac{IR_s \times EF_b \times EF_c \times ED}{BW \times AP \times CF_a \times CF_b}$$

Where:

(L)ADER = average daily exposure rate (lifetime for carcinogens only) ($kg_{sediment}/kg_{BW}$-day)
IR_s = sediment ingestion rate (mg/day)
EF_b = exposure frequency (days/week)
EF_c = exposure frequency (weeks/year)
ED = exposure duration (years)
BW = body weight (kg)
AP = averaging period (years)
CF_a = unit conversion factor (days/year)
CF_b = unit conversion factor (mg/kg)

The exposure rate for dermal contact with inorganic constituents in sediment while swimming was calculated according to the following equation:

$$(L)ADER = \frac{SSA \times AF \times ABS_d \times EV \times EF_b \times EF_c \times ED}{BW \times CF_a \times AP \times CF_b}$$

Where (in addition to the above):

AF = sediment-to-skin adherence factor (kg/cm^2-event)
ABS_d = dermal absorption fraction (unitless)
EV = event frequency (events/day)
SSA = skin surface area (cm^2)

Sediment-to-skin adherence factor and skin surface area assumptions were obtained from Health Canada guidance (Intrinsik 2011). Chemical-specific dermal absorption fractions were obtained from Health Canada (2010) and are listed in Table 34. For skin contact while swimming, it was assumed that the sediment contacts the hands, lower arms, legs, and feet15.

[15] The skin surface area assumption deviates from the assumption applied in the EAs, in which only the hands and feet are assumed to contact sediment while swimming.

Table 32: Exposure Factors for Incidental Ingestion and Dermal Contact with Sediment While Swimming

Exposure Factors	Units	Symbol	Child (5-11 yrs)	Teen (12-19 yrs)	Adult (>20 yrs)	Composite (5-80 yrs)
Event Frequency [a]	events/day	EV	1	1	1	
Exposure Frequency c [b]	weeks/year	EF_c	52	52	52	
Exposure Frequency b [a]	days/week	EF_b	1	1	1	
Duration of Exposure [c]	years	ED	7	8	60	
Body Weight [c]	kg_{BW}	BW	32.9	59.7	70.7	
Averaging Period for Cancer [c]	years	AP_c	80	80	80	
Averaging Period for Noncancer [c]	years	AP	7	8	60	
Incidental Sediment Ingestion						
Ingestion Rate [d,e]	$mg_{Sediment}$/day	IR_s	20	20	20	
Conversion Factor	$mg_{Sediment}/kg_{Sediment}$	CF_b	1,000,000	1,000,000	1,000,000	
Conversion Factor	days/year	CF_a	365	365	365	
Lifetime Average Daily Sediment Ingestion Exposure Rates, Cancer	$kg_{Sediment}/kg_{BW}$/day	LADER	7.58E-09	4.77E-09	3.02E-08	4.3E-08
Average Daily Sediment Ingestion Exposure Rates, Noncancer	$kg_{Sediment}/kg_{BW}$/day	ADER	8.66E-08	4.77E-08	4.03E-08	8.7E-08
Sediment Dermal Contact						
Skin Surface Area [d]	cm^2	SSA	5120	7,965	9,060	
Sediment Adherence Factor [d]	$kg_{Sediment}/cm^2$/event	AF	2.24E-05	2.24E-05	2.24E-05	
Conversion Factor	$mg_{Sediment}/kg_{Sediment}$	CF_b	1,000,000	1,000,000	1,000,000	
Conversion Factor	days/year	CF_a	365	365	365	
Lifetime Average Daily Sediment Dermal Contact Exposure Rates, Cancer	$kg_{Sediment}/kg_{BW}$/day	LADER	4.34E-11	4.25E-11	3.06E-10	3.9E-10
Average Daily Sediment Dermal Contact Exposure Rates, Noncancer	$kg_{Sediment}/kg_{BW}$/day	ADER	4.96E-10	4.25E-10	4.08E-10	5.0E-10

Notes:
BW = body weight
[a] Assumed/site-specific
[b] Short duration: Sub-chronic (three months or less per year) exposures should not be amortized beyond days per week, therefore an exposure term of 52 weeks / 52 weeks is applied.
[c] Source: Health Canada. 2012b. Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment, Version 2.0.
[d] Source: Intrinsik. 2011. Interim Guidance for Evaluating Human Health Risks Associated with Direct Exposure to Contaminated Sediments at Federal Contaminated Sites in Canada. Prepared for Health Canada.
[e] Source: Golder Associates Ltd. 2010. Identification and Evaluation of Protocols for the Derivation of Human Health Sediment Quality Guidelines. Submitted to Health Canada.

5.2.1.4 Fish Ingestion

For ingestion of locally-caught fish, it was assumed that the Ktunaxa First Nation consumer represents the consumer of the largest amount of fish (Table 30). The 95th percentile fish consumption rate for consumers (43 g/day) reported in the Firelight Study (2013) was applied to the pathway-specific exposure rate equations[16]. Because the Firelight Study (2013) examined only rates of ingestion for adults, the adult ingestion rate was adjusted using the relative ingestion rates for different lifestages, following Richardson (1997).

$$(L)ADER = \frac{F_{inorganic} \times IR_f \times EF_b \times EF_c \times ED \times CF_c}{BW \times AP \times CF_a}$$

Where:

(L)ADER	= average daily exposure rate (lifetime for carcinogens only) (kg_{fish}/kg_{BW}-day)
$F_{inorganic}$	= fraction of inorganic vs organic constituent (unitless, for arsenic only)
IR_f	= fish ingestion rate (g/day wet weight)
EF_b	= exposure frequency (days/week)
EF_c	= exposure frequency (weeks/year)
ED	= exposure duration (years)
CF_c	= unit conversion factor (g/kg)
BW	= body weight (kg)
AP	= averaging period (years)
CF_a	= unit conversion factor (days/year)

For arsenic in fish tissue, the exposure rate was adjusted by a factor of 10%. As discussed in Section 4.1.3, an adjustment factor of 0.1 is often applied to total arsenic concentrations in freshwater fish to estimate the fraction of arsenic present as the more toxic inorganic form. The assumption that 10% of total arsenic is inorganic represents an upper-bound estimate of average tissue concentration for a long-term consumer (see discussion in Section 4.1.3).

[16] The fish consumption rate deviates from the assumption applied in the EAs, which relies on the 95th percentile value of 22 g/day for both consumers and nonconsumers. This difference in approach is appropriate given that this assessment focuses on impacts related to only the water bodies within the Designated Area whereas the EAs evaluate selenium intake via multiple media (e.g., air, soil, dust, fish, water). In multi-pathway risk assessment, it would not be appropriate to combine upper range intakes, such as that for consumers only, across multiple media.

Table 33: Exposure Factors from Fish Ingestion for First Nations Residents

Exposure Factors	Units	Symbol	Child (5-11 yrs)	Teen (12-19 yrs)	Adult (>20 yrs)	Composite (5-80 yrs)
Receptor-Specific Exposure Factors						
Exposure Frequency c (Fish) [a]	weeks/year	EF_c	52	52	52	
Exposure Frequency b (Fish) [a]	days/week	EF_b	7	7	7	
Duration of Exposure [a]	years	ED	7	8	60	
Body Weight [a]	kg_{BW}	BW	32.9	59.7	70.7	
Averaging Period for Cancer [a]	years	AP_c	80	80	80	
Averaging Period for Noncancer [a]	years	AP_{nc}	7	8	60	
Fish Ingestion						
Fish Ingestion Rate - ww [b]	g_{fish}/day ww	IR_f	23	31	43	
Conversion Factor 1	g_{fish}/kg_{fish}	CF_c	1000	1000	1000	
Conversion Factor 2	days/year	CF_a	365	365	365	
Lifetime Average Daily Fish Ingestion Exposure Rates, Cancer	kg-fish/kg_{-BW}/day	LADFIR	0.00006	0.00005	0.0005	0.0006
Average Daily Fish Ingestion Exposure Rates, Noncancer	kg-fish/kg_{-BW}/day	ADFIR	0.0007	0.0005	0.0006	0.0007

Notes:
BW = body weight
ww = wet weight
[a] Source: Health Canada. 2012b. Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment, Version 2.0.
[b] Source: Firelight Group. 2013. Final Results of the Ktunaxa Diet Study. Submitted to the Ktunaxa Nation Council.

5.2.1.5 Chemical-specific Factors

Chemical-specific factors used in the dermal exposure pathways are listed in Table 34. Physicochemical properties, such as the molecular weight (MW) and dermal permeability coefficient (Kp), were compiled from the USEPA RSL physicochemical tables (USEPA 2013). Dermal absorption factors (ABS_d) used in adjusting the absorbed dose were obtained from Health Canada guidance (2010). Gastrointestinal absorption factors (ABS_{GI}) used to modify oral toxicity values for use in the dermal exposure pathways were obtained from USEPA (2013).

Table 34: Physical and Chemical Properties of Constituents Carried to Pathway Screening

Constituent	MW (g/mol) [a]	K_p [a]	ABSd [b]	ABS_{GI} [a]
Aluminum	27.0	0.001	0	1
Antimony	122	0.001	0	0.15
Arsenic	74.9	0.001	0.03	1
Beryllium	9.01	0.001	0	0.007
Cadmium	112	0.001	0.01	0.025
Cobalt	58.9	0.0004	0	1
Iron	55.9	0.001	0	1
Lead	207	0.0001	0	1
Lithium	6.94	0.001	0	1
Manganese	54.9	0.001	0	1
Nickel	58.7	0.0002	0.091	0.04
Nitrate (as N)	62.0	0.001	0	1
Selenium	79.0	0.001	0.01	1
Vanadium	50.9	0.001	0	0.026
Zinc	65.4	0.0006	0.1	1

Notes:
[a] Source: USEPA. 2013. Regional Screening Level Tables
[b] Source: Health Canada. 2010. Health Canada Toxicological Reference Values (TRVs) and Chemical-Specific Factors, Version 2.0

5.2.2 Exposure Point Concentrations

Once the noncancer and cancer benchmarks were generated, exposure point concentrations were calculated and compared to the pathway-specific benchmark values. Exposure point concentrations were calculated using USEPA software (ProUCL 2013, version 5.0). To calculate the 95% upper confidence limit of the mean (UCLM) for a constituent, ProUCL requires adequate sample size (>10 samples), distinct observations, and some detected concentrations, i.e., 100% of the samples cannot be below the detection limit. ProUCL was configured to generate all UCLM types (parametric and non-parametric) with 10,000 bootstrap operations. When a high frequency of values below the detect limit prevented estimation of a UCLM, or when variability in the data resulted in a UCLM exceeding the maximum detected concentration, the maximum concentration was selected as the exposure point concentration. Otherwise, the default suggested UCLM was accepted. UCLMs calculated for each constituent, by medium, are provided in Table 35 through Table 39.

5.2.3 Pathway-specific Benchmark Comparison Results

Results of the pathway-specific benchmark screening are presented first for surface water, then for sediment, fish, and groundwater.

5.2.3.1 Surface Water Benchmark Screening Results

Primary complete exposure pathways for surface water include incidental ingestion and dermal contact with water during swimming and other aquatic recreational activities. Surface water use for drinking water was also considered a primary complete exposure pathway even though there is no documented consumption of surface water from the Elk River, Fording River, Michel Creek, or Lake Koocanusa. Secondary pathways include consumption of game or livestock that may have consumed surface water, and consumption of plants that may have grown at the river's edge or were irrigated with river water.

Benchmark screening values were derived only for the two primary pathways: drinking water and swimming. The magnitude of potential exposure from use of surface water as a domestic water supply is far greater than the potential magnitude of exposure from all the other pathways combined. Consequently, if a constituent does not exceed the drinking water benchmark value within an MU, there is no need to characterize risks from swimming or secondary pathways.

The seven constituents evaluated (aluminum, beryllium, cobalt, iron, manganese, selenium, and vanadium) did not exceed screening benchmarks for either drinking water or direct contact with water (incidental ingestion and dermal contact) while swimming (Table 35 and Table 36, respectively). Annual average concentrations of nitrate also did not exceed its benchmark[17], but nitrate was evaluated further using seasonal exposure concentrations. Arsenic exceeded its cancer-based benchmark, as discussed below.

[17] The Health Canada MAC of 10 mg/L was selected for pathway-specific screening because this concentration is specifically protective of infants, the most sensitive population.

Table 35: Noncancer Surface Water Pathway-specific Screening Results – Drinking Water Ingestion

MU	Constituent[a]	Fraction	Maximum Concentration (mg/L)	UCLM (mg/L)	UCLM Type	Ingestion Benchmark (mg/L)	Exceed
MU-1	Aluminum	D	0.0794	0.00476	95% KM (t)	8.2	No
MU-1	Aluminum	T	1.97	0.113	95% KM (Chebyshev)	8.2	No
MU-2	Aluminum	D	0.00410	0.00304	95% KM (t)	8.2	No
MU-2	Aluminum	T	0.967	0.136	95% KM (Chebyshev)	8.2	No
MU-3	Aluminum	D	0.0952	0.00	95% KM (BCA)	8.2	No
MU-3	Aluminum	T	0.712	0.400	99% KM (Chebyshev)	8.2	No
MU-4	Aluminum	D	0.342	0.00853	95% KM (t)	8.2	No
MU-4	Aluminum	T	3.93	0.358	97.5% KM (Chebyshev)	8.2	No
MU-5	Aluminum	D	0.0819	0.0101	95% KM (t)	8.2	No
MU-5	Aluminum	T	4.03	0.644	97.5% KM (Chebyshev)	8.2	No
MU-6	Aluminum	D	0.111	0.0146	95% KM (Chebyshev)	8.2	No
MU-6	Aluminum	T	1.57	0.243	95% KM (Chebyshev)	8.2	No
MU-1	Arsenic	T	0.00128	0.000172	95% KM (BCA)	0.0025	No
MU-2	Arsenic	T	0.000780	0.000178	95% KM (BCA)	0.0025	No
MU-3	Arsenic	T	0.000640	0.000200	95% KM (t)	0.0025	No
MU-4	Arsenic	T	0.00275	0.000329	95% KM (BCA)	0.0025	No
MU-5	Arsenic	T	0.00257	0.000476	95% Chebyshev (Mean, Sd)	0.0025	No
MU-6	Arsenic	T	0.00119	0.000410	95% Student's-t	0.0025	No
MU-1	Beryllium	T	0.00761	0.000191	95% KM (Chebyshev)	2.4	No
MU-2	Beryllium	T	0.000500	0.000111	95% KM (t)	2.4	No
MU-3	Beryllium	T	0.000500	NA	NA	2.4	No
MU-4	Beryllium	D	0.000500	NA	NA	2.4	No
MU-4	Beryllium	T	0.000500	0.000104	95% KM (t)	2.4	No
MU-5	Beryllium	T	0.000500	0.000113	95% KM (t)	2.4	No
MU-6	Beryllium	D	0.000100	0.00000441	95% KM (t)	2.4	No
MU-6	Beryllium	T	0.000206	0.0000242	95% KM (BCA)	2.4	No
MU-1	Cobalt	T	0.00206	0.000193	95% KM (t)	0.0025	No
MU-2	Cobalt	T	0.000960	0.000184	95% KM (t)	0.0025	No
MU-3	Cobalt	T	0.000430	0.000147	95% KM (t)	0.0025	No
MU-4	Cobalt	T	0.00577	0.000457	95% KM (t)	0.0025	No
MU-5	Cobalt	T	0.00259	0.000264	95% KM (t)	0.0025	No
MU-6	Cobalt	T	0.00146	0.000137	95% KM (BCA)	0.0025	No
MU-1	Iron	T	3.08	0.138	95% KM (BCA)	5.8	No
MU-2	Iron	T	1.80	0.160	95% KM (BCA)	5.8	No
MU-3	Iron	T	1.08	0.203	95% KM (t)	5.8	No
MU-4	Iron	T	6.37	0.389	95% KM (Chebyshev)	5.8	No
MU-5	Iron	T	5.75	0.694	95% KM (Chebyshev)	5.8	No
MU-6	Iron	T	2.55	0.341	95% KM (Chebyshev)	5.8	No
MU-1	Manganese	T	0.196	0.0167	95% KM (Chebyshev)	1.2	No
MU-2	Manganese	T	0.114	0.0131	95% KM (Chebyshev)	1.2	No
MU-3	Manganese	T	0.0515	0.0163	95% Chebyshev (Mean, Sd)	1.2	No
MU-4	Manganese	T	0.197	0.0177	95% KM (Chebyshev)	1.2	No
MU-5	Manganese	T	0.179	0.0243	95% Chebyshev (Mean, Sd)	1.2	No
MU-6	Manganese	T	0.151	0.0177	95% Chebyshev (Mean, Sd)	1.2	No
MU-1	**Nitrate**	T	27	8.213	95% Chebyshev (Mean, Sd)	10	No
MU-2	**Nitrate**	T	14.7	7.426	95% Student's-t	10	No
MU-3	**Nitrate**	T	0.37	0.209	95% Student's-t	10	No
MU-4	**Nitrate**	T	4.61	1.672	95% KM (Chebyshev)	10	No
MU-5	**Nitrate**	T	2.76	1.639	95% Student's-t	10	No
MU-6	**Nitrate**	T	1.67	0.715	95% Chebyshev (Mean, Sd)	10	No

Table 35: Noncancer Surface Water Pathway-specific Screening Results – Drinking Water Ingestion

MU	Constituent[a]	Fraction	Maximum Concentration (mg/L)	UCLM (mg/L)	UCLM Type	Ingestion Benchmark (mg/L)	Exceed
MU-1	**Selenium**	T	0.105	0.0326	95% KM (BCA)	0.047	No
MU-2	**Selenium**	T	0.0614	0.0361	95% Student's-t	0.047	No
MU-3	**Selenium**	T	0.00218	0.00138	95% Student's-t	0.047	No
MU-4	**Selenium**	T	0.0214	0.00759	95% Chebyshev (Mean, Sd)	0.047	No
MU-5	**Selenium**	T	0.0127	0.00837	95% Student's-t	0.047	No
MU-6	**Selenium**	T	0.00783	0.00381	95% Chebyshev (Mean, Sd)	0.047	No
MU-1	Vanadium	D	0.00100	NA	NA	1.6	No
MU-1	Vanadium	T	0.00810	0.00117	95% KM (t)	1.6	No
MU-2	Vanadium	T	0.00400	0.00114	95% KM (t)	1.6	No
MU-3	Vanadium	T	0.00310	0.00135	95% KM (t)	1.6	No
MU-4	Vanadium	D	0.00110	NA	NA	1.6	No
MU-4	Vanadium	T	0.0156	0.00153	95% KM (t)	1.6	No
MU-5	Vanadium	T	0.0176	0.00201	95% KM (t)	1.6	No
MU-6	Vanadium	D	0.00100	0.000197	95% KM (t)	1.6	No
MU-6	Vanadium	T	0.00330	0.000541	95% KM (t)	1.6	No

Notes:
[a] Constituents specified in the Order are shown in bolded text.
D = dissolved; T = total; UCLM = 95% upper confidence limit of the mean; NA = Not applicable, a UCLM was not calculated due to dataset with no samples above the detection limit

Table 36: Noncancer Surface Water Pathway-specific Screening Results – Swimming

MU	Constituent [a]	Fraction	Max Concentration (mg/L)	UCLM (mg/L)	UCLM Type	Swimming Benchmark (mg/L) [b]	Exceed
MU-1	Aluminum	D	0.0794	0.00476	95% KM (t)	770	No
MU-1	Aluminum	T	1.97	0.113	95% KM (Chebyshev)	770	No
MU-2	Aluminum	D	0.00410	0.00304	95% KM (t)	770	No
MU-2	Aluminum	T	0.967	0.136	95% KM (Chebyshev)	770	No
MU-3	Aluminum	D	0.0952	0.00	95% KM (BCA)	770	No
MU-3	Aluminum	T	0.712	0.400	99% KM (Chebyshev)	770	No
MU-4	Aluminum	D	0.342	0.00853	95% KM (t)	770	No
MU-4	Aluminum	T	3.93	0.358	97.5% KM (Chebyshev)	770	No
MU-5	Aluminum	D	0.0819	0.0101	95% KM (t)	770	No
MU-5	Aluminum	T	4.03	0.644	97.5% KM (Chebyshev)	770	No
MU-6	Aluminum	D	0.111	0.0146	95% KM (Chebyshev)	770	No
MU-6	Aluminum	T	1.57	0.243	95% KM (Chebyshev)	770	No
MU-1	Arsenic	T	0.00128	0.000172	95% KM (BCA)	0.23	No
MU-2	Arsenic	T	0.000780	0.000178	95% KM (BCA)	0.23	No
MU-3	Arsenic	T	0.000640	0.000200	95% KM (t)	0.23	No
MU-4	Arsenic	T	0.00275	0.000329	95% KM (BCA)	0.23	No
MU-5	Arsenic	T	0.00257	0.000476	95% Chebyshev (Mean, Sd)	0.23	No
MU-6	Arsenic	T	0.00119	0.000410	95% Student's-t	0.23	No
MU-1	Beryllium	T	0.00761	0.000191	95% KM (Chebyshev)	0.062	No
MU-2	Beryllium	T	0.000500	0.000111	95% KM (t)	0.062	No
MU-3	Beryllium	T	0.000500	NA	NA	0.062	No
MU-4	Beryllium	D	0.000500	NA	NA	0.062	No
MU-4	Beryllium	T	0.000500	0.000104	95% KM (t)	0.062	No
MU-5	Beryllium	T	0.000500	0.000113	95% KM (t)	0.062	No
MU-6	Beryllium	D	0.000100	0.00000441	95% KM (t)	0.062	No
MU-6	Beryllium	T	0.000206	0.0000242	95% KM (BCA)	0.062	No
MU-1	Cobalt	T	0.00206	0.000193	95% KM (t)	0.26	No
MU-2	Cobalt	T	0.000960	0.000184	95% KM (t)	0.26	No
MU-3	Cobalt	T	0.000430	0.000147	95% KM (t)	0.26	No
MU-4	Cobalt	T	0.00577	0.000457	95% KM (t)	0.26	No
MU-5	Cobalt	T	0.00259	0.000264	95% KM (t)	0.26	No
MU-6	Cobalt	T	0.00146	0.000137	95% KM (BCA)	0.26	No
MU-1	Iron	T	3.08	0.138	95% KM (BCA)	540	No
MU-2	Iron	T	1.80	0.160	95% KM (BCA)	540	No
MU-3	Iron	T	1.08	0.203	95% KM (t)	540	No
MU-4	Iron	T	6.37	0.389	95% KM (Chebyshev)	540	No
MU-5	Iron	T	5.75	0.694	95% KM (Chebyshev)	540	No
MU-6	Iron	T	2.55	0.341	95% KM (Chebyshev)	540	No
MU-1	Manganese	T	0.196	0.0167	95% KM (Chebyshev)	110	No
MU-2	Manganese	T	0.114	0.0131	95% KM (Chebyshev)	110	No
MU-3	Manganese	T	0.0515	0.0163	95% Chebyshev (Mean, Sd)	110	No
MU-4	Manganese	T	0.197	0.0177	95% KM (Chebyshev)	110	No
MU-5	Manganese	T	0.179	0.0243	95% Chebyshev (Mean, Sd)	110	No
MU-6	Manganese	T	0.151	0.0177	95% Chebyshev (Mean, Sd)	110	No
MU-1	**Nitrate (as N)**	T	27.0	8.21	95% Chebyshev (Mean, Sd)	1200	No
MU-2	**Nitrate (as N)**	T	14.7	7.43	95% Student's-t	1200	No
MU-3	**Nitrate (as N)**	T	0.370	0.209	95% Student's-t	1200	No
MU-4	**Nitrate (as N)**	T	4.61	1.67	95% KM (Chebyshev)	1200	No
MU-5	**Nitrate (as N)**	T	2.76	1.64	95% Student's-t	1200	No
MU-6	**Nitrate (as N)**	T	1.67	0.715	95% Chebyshev (Mean, Sd)	1200	No

Table 36: Noncancer Surface Water Pathway-specific Screening Results – Swimming

MU	Constituent [a]	Fraction	Max Concentration (mg/L)	UCLM (mg/L)	UCLM Type	Swimming Benchmark (mg/L) [b]	Exceed
MU-1	**Selenium**	T	0.105	0.0326	95% KM (BCA)	4.4	No
MU-2	**Selenium**	T	0.0614	0.0361	95% Student's-t	4.4	No
MU-3	**Selenium**	T	0.00218	0.00138	95% Student's-t	4.4	No
MU-4	**Selenium**	T	0.0214	0.00759	95% Chebyshev (Mean, Sd)	4.4	No
MU-5	**Selenium**	T	0.0127	0.00837	95% Student's-t	4.4	No
MU-6	**Selenium**	T	0.00783	0.00381	95% Chebyshev (Mean, Sd)	4.4	No
MU-1	Vanadium	D	0.00100	NA	NA	0.52	No
MU-1	Vanadium	T	0.00810	0.00117	95% KM (t)	0.52	No
MU-2	Vanadium	T	0.00400	0.00114	95% KM (t)	0.52	No
MU-3	Vanadium	T	0.00310	0.00135	95% KM (t)	0.52	No
MU-4	Vanadium	D	0.00110	NA	NA	0.52	No
MU-4	Vanadium	T	0.0156	0.00153	95% KM (t)	0.52	No
MU-5	Vanadium	T	0.0176	0.00201	95% KM (t)	0.52	No
MU-6	Vanadium	D	0.00100	0.000197	95% KM (t)	0.52	No
MU-6	Vanadium	T	0.00330	0.000541	95% KM (t)	0.52	No

Notes:
[a] Constituents specified in the Order are shown in bolded text.
[b] Swimming benchmark is for the combination of incidental ingestion and dermal contact of surface water while swimming.
D = dissolved; T = total; UCLM = 95% upper confidence limit of the mean; NA = Not applicable, a UCLM was not calculated due to dataset with no samples above the detection limit

For surface water, sufficient data were available to assess trends in concentrations over time. Most constituent concentrations did not exhibit marked differences across the three-year period[18]; however, in MU-1, nitrate concentrations were found to be higher in 2013 than in 2011 and 2012. This trend was not observed in MU-2.

Seasonal variation in concentrations may be of concern for infant exposures to nitrate in drinking water. For that reason, surface water nitrate data were also examined over time within each year to assess the timing of concentrations that exceed the guideline. Nitrate, which exceeded the surface water guideline in MUs 1 and 2 only, specifically showed seasonal trends: concentrations increased through the fall and winter and decreased in spring with the occurrence of the freshet (Figure 12). To assess the significance of these trends, UCLMs were calculated on a quarterly basis for 2013 data for MU-1 (due to higher concentrations during 2013) and for 2011-2013 combined for MU-2 (where no differences were noted from year to year). These values were then compared to the benchmark for drinking water.

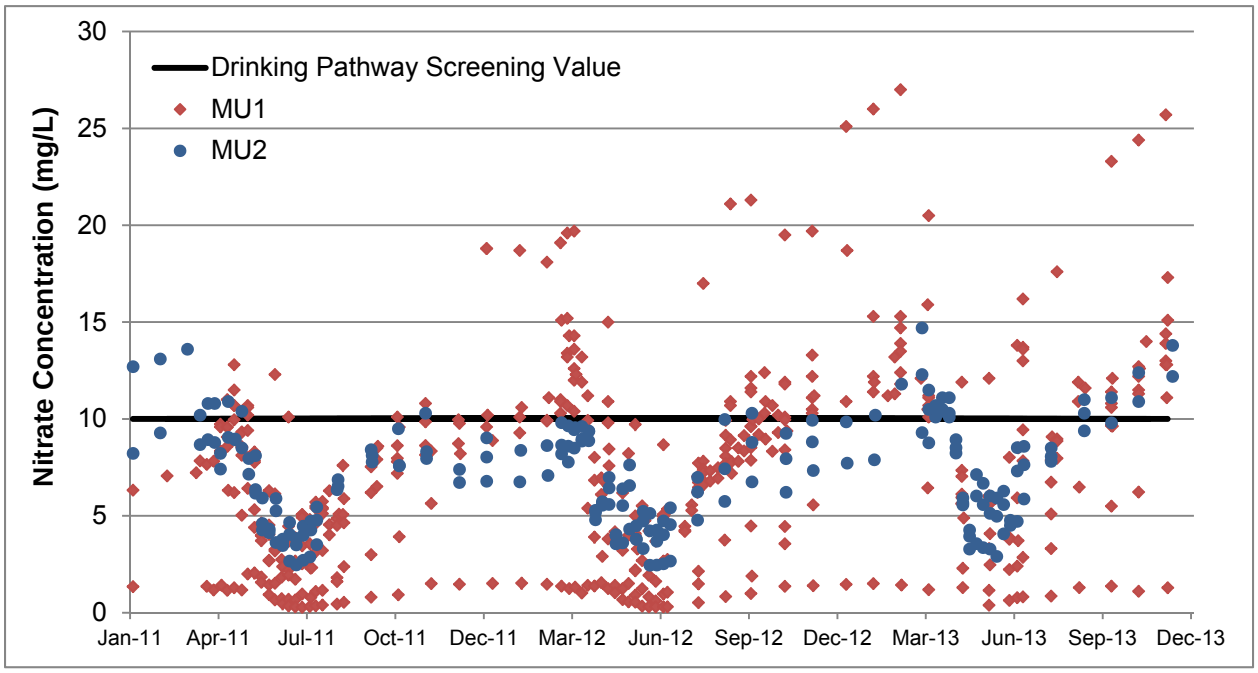

Figure 12: Seasonal Variation in Nitrate Concentrations, MU-1 and MU-2

Nitrate concentrations for 2013 did exceed the drinking water benchmark of 10 mg/L as N for drinking water in MU-1 for the January to March quarter and for the October to December quarter (Table 37). When quarterly MU-1 concentrations were calculated over the three-year period, the nitrate concentration also exceeded the pathway-specific drinking water benchmark during January-March and October-December (data not shown). The swimming pathway

[18]Selenium in certain MUs also appears to be increasing over time; however, that trend is moderate and does not result in the masking of exceeding a benchmark when data from all three years, 2011-2013, are combined to calculate UCLM concentrations.

benchmark was not exceeded in any quarter in either MU. Based on this analysis, it was concluded that nitrate in MU-1 exceeds the surface water noncancer benchmarks for drinking water, and although surface water in MU-1 is not currently used as a drinking water source, nitrate was carried forward to the next step of the effects assessment.

Table 37: Seasonal Variation in Nitrate for MUs 1 and 2

MU Years	Quarter	Sample Size	Maximum (mg/L as N)	Mean (mg/L as N)	UCLM (mg/L as N) [a]
MU-1 2013 only	Jan-Mar	22	27.0	13.3	**20**
	Apr-Jun	34	20.5	6.50	8.3
	Jul-Sep	29	17.6	7.97	9.5
	Oct-Dec	29	25.7	12.0	**17**
MU-2 2011-2013	Jan-Mar	32	14.7	9.57	10
	Apr-Jun	111	11.5	6.19	6.6
	Jul-Sep	36	11.0	6.46	7.1
	Oct-Dec	23	13.8	9.17	10

Notes:
a. Bolded values exceed pathway-specific drinking water benchmark of 10 mg/L as N.

Arsenic exceeded the cancer screening benchmark for drinking water only; however, the cancer screening benchmark is three orders of magnitude lower than the mean arsenic concentration of 0.0002 mg/L for the Elk Valley reference surface water dataset. Arsenic concentrations are below the approved MAC of 0.010 mg/L and above the working MAC of 0.0003 mg/L[19]. Reported natural background arsenic levels throughout BC, ranging from 0.001 to 0.002 mg/L, also exceed the working MAC (BC MoE 2007). The range of mean concentrations for MUs 1 to 6 is 0.00016 to 0.0039 mg/L, which are generally consistent with BC background concentrations. Nevertheless, arsenic was carried forward to the next step of the effects assessment.

5.2.3.2 Sediment Benchmark Screening Results

The primary sediment exposure pathway includes dermal exposure and incidental ingestion of sediment during recreational or harvesting activities. Swimming was selected as the scenario with the most intensive direct contact, and used as the basis for benchmark development. For sediment ingestion and dermal contact while swimming, the frequency of exposure was the same as for the surface water exposure. The exposed skin surface area was assumed to be limited to hands, lower arms, legs, and feet. A secondary sediment exposure pathway could be

[19]The approved MAC (0.010 mg/L) is based on both protection of public health and limitations in water treatment technology. Health Canada and BC MoE also established a working MAC (0.0003 mg/L) for arsenic in drinking water, recommending that arsenic be maintained as close as possible to this level. BC MoE also recommends that site-specific objectives should be developed when natural background arsenic levels exceed the working MAC of 0.0003 mg/L. Source: BC MoE Ambient water quality guidelines of water sources used for drinking water and recreation, Table 1.

uptake into riparian plants that might be harvested and consumed. No benchmark for this pathway was derived, pending assessment of the primary sediment exposure pathway.

Concentrations of aluminum, iron, nickel, and selenium in sediment did not exceed the screening benchmarks for direct contact with sediment in any MU (Table 38). Due to the limited areas of sediment with elevated constituent concentrations compared with background and the lack of constituents exceeding the primary exposure pathway benchmark, the sediment exposure pathways were not examined further.

Table 38: Noncancer Sediment Pathway-specific Screening Results – Swimming

MU	Constituent [a]	Max Concentration (mg/kg)	UCLM (mg/kg)	UCLM Type	Swimming Benchmark [b] (mg/kg)	Exceed
MU-1	Aluminum	12,400	6,150	95% Student's-t	>1,000,000	No
MU-2	Aluminum	9,840	9,990	95% Student's-t	>1,000,000	No
MU-3	Aluminum	9,770	9,650	95% Student's-t	>1,000,000	No
MU-4	Aluminum	15,300	8,800	95% Student's-t	>1,000,000	No
MU-5	Aluminum	8,820	6,890	95% Student's-t	>1,000,000	No
MU-6	Aluminum	17,400	14,290	95% Chebyshev (Mean, Sd)	>1,000,000	No
MU-1	Iron	41,900	12,920	95% Adjusted Gamma	>1,000,000	No
MU-2	Iron	15,500	15,660	95% Student's-t	>1,000,000	No
MU-3	Iron	17,500	16,760	95% Student's-t	>1,000,000	No
MU-4	Iron	26,400	15,150	95% Student's-t	>1,000,000	No
MU-5	Iron	16,900	13,060	95% Student's-t	>1,000,000	No
MU-6	Iron	25,600	19,360	95% Student's-t	>1,000,000	No
MU-1	Nickel	129	52.6	95% Chebyshev (Mean, Sd)	46,000	No
MU-2	Nickel	25.8	25.8	95% Student's-t	46,000	No
MU-3	Nickel	29.9	28.6	95% Student's-t	46,000	No
MU-4	Nickel	54.8	27.3	95% Student's-t	46,000	No
MU-5	Nickel	27.3	19.9	95% Student's-t	46,000	No
MU-6	Nickel	30.5	20.8	95% Student's-t	46,000	No
MU-1	**Selenium**	81.6	15.4	95% H-UCL	13,000	No
MU-2	**Selenium**	1.37	1.40	95% Student's-t	13,000	No
MU-3	**Selenium**	1.87	1.72	95% Student's-t	13,000	No
MU-4	**Selenium**	5.3	2.68	95% Student's-t	13,000	No
MU-5	**Selenium**	2.72	1.70	95% Student's-t	13,000	No
MU-6	**Selenium**	0.91	0.591	95% KM (t)	13,000	No

Notes:
[a] Constituents specified in the Order are shown in bolded text.
[b] Swimming benchmark is for the combination of incidental ingestion of and dermal contact with sediment while swimming.
UCLM = 95% upper confidence limit of the mean

5.2.3.3 Fish Benchmark Screening Results

Benchmark screening was conducted for ten constituents that exceeded guidelines: aluminum, antimony, arsenic, cadmium, cobalt, iron, lithium, selenium, vanadium, and zinc, and for one

additional constituent, lead, without a guideline value for which a TRV was identified (Table 39). Seven of these constituents did not exceed the pathway benchmark: antimony, cadmium, iron, lead, lithium, vanadium, and zinc. UCLM concentrations for aluminum, cobalt, and selenium exceeded the pathway-specific benchmarks for noncancer health endpoints. Aluminum exceeded the benchmark in whole body samples in MU-3. Cobalt exceeded the benchmark in muscle tissue in MUs 1 and 4, and in whole body in MUs 4 and 5. Selenium exceeded for muscle tissue in all MUs except MU-6, and for whole body in MUs 3, 4, and 5. Arsenic exceeded for cancer in MU-3. Potential health risks for the four constituents with pathway-specific benchmarks are examined in Section 5.3.

Table 39: Noncancer Fish Pathway-specific Screening Results

MU	Constituent [a]	Tissue Type	Max Concentration (mg/kg ww)	UCLM (mg/kg ww)	UCLM Type	Ingestion Benchmark (mg/kg ww)	Exceed
MU-1	Aluminum	Muscle	44.9	17.7	95% Adjusted Gamma	290	No
MU-2	Aluminum	Muscle	12.6	9.28	95% Adjusted Gamma	290	No
MU-3	Aluminum	Muscle	2.47	2.08	95% Student's-t	290	No
MU-3	Aluminum	Whole	426	467	99% Chebyshev (Mean, Sd)	290	Yes
MU-4	Aluminum	Muscle	262	47.8	97.5% KM (Chebyshev)	290	No
MU-4	Aluminum	Whole	107	54.0	95% KM (Chebyshev)	290	No
MU-5	Aluminum	Muscle	32.4	6.46	95% Adjusted Gamma	290	No
MU-5	Aluminum	Whole	224	93.2	95% KM (Chebyshev)	290	No
MU-6	Aluminum	Muscle	13.1	4.69	95% Student's-t	290	No
MU-1	Antimony	Muscle	0.0197	0.00598	95% Adjusted Gamma	0.12	No
MU-2	Antimony	Muscle	0.0150	0.00482	95% KM (t)	0.12	No
MU-3	Antimony	Muscle	0.000317	0.000317	95% Student's-t	0.12	No
MU-3	Antimony	Whole	0.00646	0.00412	95% Chebyshev (Mean, Sd)	0.12	No
MU-4	Antimony	Muscle	0.170	0.00494	95% KM (t)	0.12	No
MU-4	Antimony	Whole	0.00550	0.00293	95% KM (t)	0.12	No
MU-5	Antimony	Muscle	0.0300	0.0102	99% KM (Chebyshev)	0.12	No
MU-5	Antimony	Whole	0.00482	0.00223	95% KM (t)	0.12	No
MU-6	Antimony	Muscle	0.00558	0.00212	95% KM (t)	0.12	No
MU-1	Arsenic	Muscle	0.128	0.0284	95% Adjusted Gamma	0.86	No
MU-2	Arsenic	Muscle	0.193	0.0804	95% Chebyshev (Mean, Sd)	0.86	No
MU-3	Arsenic	Muscle	0.0823	0.0650	95% Student's-t	0.86	No
MU-3	Arsenic	Whole	0.159	0.111	95% H-UCL	0.86	No
MU-4	Arsenic	Muscle	0.340	0.0486	95% KM (BCA)	0.86	No
MU-4	Arsenic	Whole	0.0926	0.0477	95% Student's-t	0.86	No
MU-5	Arsenic	Muscle	0.0600	0.0203	95% KM (BCA)	0.86	No
MU-5	Arsenic	Whole	0.110	0.0609	95% Chebyshev (Mean, Sd)	0.86	No
MU-6	Arsenic	Muscle	0.110	0.0584	95% Student's-t	0.86	No
MU-1	**Cadmium**	Muscle	0.0565	0.0190	95% KM (Chebyshev)	0.29	No
MU-2	**Cadmium**	Muscle	0.0375	0.0157	95% Adjusted Gamma	0.29	No
MU-3	**Cadmium**	Muscle	0.0502	0.0341	95% Student's-t	0.29	No
MU-3	**Cadmium**	Whole	0.421	0.247	95% Chebyshev (Mean, Sd)	0.29	No
MU-4	**Cadmium**	Muscle	0.529	0.128	97.5% KM (Chebyshev)	0.29	No
MU-4	**Cadmium**	Whole	0.702	0.222	95% Adjusted Gamma	0.29	No

Table 39: Noncancer Fish Pathway-specific Screening Results

MU	Constituent [a]	Tissue Type	Max Concentration (mg/kg ww)	UCLM (mg/kg ww)	UCLM Type	Ingestion Benchmark (mg/kg ww)	Exceed
MU-5	**Cadmium**	Muscle	0.0300	0.00913	95% KM (Chebyshev)	0.29	No
MU-5	**Cadmium**	Whole	0.207	0.114	95% Adjusted Gamma	0.29	No
MU-6	**Cadmium**	Muscle	0.0145	0.00599	95% Adjusted Gamma	0.29	No
MU-1	Cobalt	Muscle	0.185	0.104	95% Chebyshev (Mean, Sd)	0.086	Yes
MU-2	Cobalt	Muscle	0.114	0.0587	95% Adjusted Gamma	0.086	No
MU-3	Cobalt	Muscle	0.00447	0.00411	95% Student's-t	0.086	No
MU-3	Cobalt	Whole	0.104	0.0639	95% Chebyshev (Mean, Sd)	0.086	No
MU-4	Cobalt	Muscle	1.35	0.153	95% KM (Chebyshev)	0.086	Yes
MU-4	Cobalt	Whole	0.378	0.131	95% Chebyshev (Mean, Sd)	0.086	Yes
MU-5	Cobalt	Muscle	0.213	0.0622	95% Chebyshev (Mean, Sd)	0.086	No
MU-5	Cobalt	Whole	0.128	0.0881	95% Chebyshev (Mean, Sd)	0.086	Yes
MU-6	Cobalt	Muscle	0.0169	0.0110	95% Adjusted Gamma	0.086	No
MU-1	Iron	Muscle	68.5	30.6	95% Adjusted Gamma	200	No
MU-2	Iron	Muscle	27.3	14.0	95% Student's-t	200	No
MU-3	Iron	Muscle	5.80	5.38	95% Student's-t	200	No
MU-3	Iron	Whole	316	179	95% Chebyshev (Mean, Sd)	200	No
MU-4	Iron	Muscle	361	54.4	95% Chebyshev (Mean, Sd)	200	No
MU-4	Iron	Whole	80.0	36.9	95% Adjusted Gamma	200	No
MU-5	Iron	Muscle	113	34.4	95% Chebyshev (Mean, Sd)	200	No
MU-5	Iron	Whole	91.8	35.6	95% Adjusted Gamma	200	No
MU-6	Iron	Muscle	16.9	10.4	95% Adjusted Gamma	200	No
MU-1	Lead	Muscle	1.05	0.263	95% Adjusted Gamma	0.37	No
MU-2	Lead	Muscle	0.310	0.117	95% Adjusted Gamma	0.37	No
MU-3	Lead	Muscle	0.00506	0.00417	95% Student's-t	0.37	No
MU-3	Lead	Whole	0.153	0.0878	95% Chebyshev (Mean, Sd)	0.37	No
MU-4	Lead	Muscle	1.15	0.194	95% KM (Chebyshev)	0.37	No
MU-4	Lead	Whole	0.130	0.0319	95% KM (BCA)	0.37	No
MU-5	Lead	Muscle	0.169	0.0684	95% KM (Chebyshev)	0.37	No
MU-5	Lead	Whole	0.0651	0.0222	95% KM (BCA)	0.37	No
MU-6	Lead	Muscle	0.0883	0.0433	95% Student's-t	0.37	No
MU-1	Lithium	Muscle	0.118	0.0455	95% Student's-t	0.58	No
MU-2	Lithium	Muscle	0.0507	0.0319	95% Student's-t	0.58	No
MU-3	Lithium	Muscle	0.00962	0.00757	95% KM (t)	0.58	No
MU-3	Lithium	Whole	0.388	0.220	95% Chebyshev (Mean, Sd)	0.58	No
MU-4	Lithium	Muscle	1.70	0.0298	95% KM (t)	0.58	No
MU-4	Lithium	Whole	0.142	0.0633	95% KM (t)	0.58	No
MU-5	Lithium	Muscle	0.300	0.0141	95% KM (t)	0.58	No
MU-5	Lithium	Whole	0.120	0.0420	95% KM (BCA)	0.58	No
MU-6	Lithium	Muscle	0.0377	0.0208	95% Student's-t	0.58	No
MU-1	**Selenium**	Muscle	15.1	6.14	95% Adjusted Gamma	1.6	Yes
MU-2	**Selenium**	Muscle	5.75	2.96	95% Student's-t	1.6	Yes
MU-3	**Selenium**	Muscle	3.20	2.58	95% Student's-t	1.6	Yes
MU-3	**Selenium**	Whole	2.71	2.18	95% Student's-t	1.6	Yes

Table 39: Noncancer Fish Pathway-specific Screening Results

MU	Constituent [a]	Tissue Type	Max Concentration (mg/kg ww)	UCLM (mg/kg ww)	UCLM Type	Ingestion Benchmark (mg/kg ww)	Exceed
MU-4	**Selenium**	Muscle	13.9	3.68	95% Chebyshev (Mean, Sd)	1.6	Yes
MU-4	**Selenium**	Whole	14.9	7.68	95% Chebyshev (Mean, Sd)	1.6	Yes
MU-5	**Selenium**	Muscle	3.12	2.05	95% Student's-t	1.6	Yes
MU-5	**Selenium**	Whole	3.35	2.50	95% Student's-t	1.6	Yes
MU-6	**Selenium**	Muscle	6	0.643	95% Student's-t	1.6	No
MU-1	Vanadium	Muscle	0.238	0.0843	95% Adjusted Gamma	1.4	No
MU-2	Vanadium	Muscle	0.0339	0.0218	95% Adjusted Gamma	1.4	No
MU-3	Vanadium	Muscle	0.00441	0.00376	95% Student's-t	1.4	No
MU-3	Vanadium	Whole	1.52	0.839	95% Chebyshev (Mean, Sd)	1.4	No
MU-4	Vanadium	Muscle	1.34	0.211	95% KM (Chebyshev)	1.4	No
MU-4	Vanadium	Whole	0.358	0.190	95% KM (Chebyshev)	1.4	No
MU-5	Vanadium	Muscle	0.0823	0.0292	97.5% KM (Chebyshev)	1.4	No
MU-5	Vanadium	Whole	0.636	0.601	99% KM (Chebyshev)	1.4	No
MU-6	Vanadium	Muscle	0.0302	0.0122	95% Student's-t	1.4	No
MU-1	Zinc	Muscle	30.5	12.1	95% Student's-t	86	No
MU-2	Zinc	Muscle	11.1	5.99	95% Student's-t	86	No
MU-3	Zinc	Muscle	9.70	9.80	95% Student's-t	86	No
MU-3	Zinc	Whole	46.5	35.5	95% Student's-t	86	No
MU-4	Zinc	Muscle	62.0	12.1	95% KM (BCA)	86	No
MU-4	Zinc	Whole	82.1	36.0	95% Student's-t	86	No
MU-5	Zinc	Muscle	15.0	5.40	95% KM (t)	86	No
MU-5	Zinc	Whole	29.7	23.7	95% Student's-t	86	No
MU-6	Zinc	Muscle	17.3	8.23	95% Student's-t	86	No

Notes:
[a] Constituents specified in the Order are shown in bolded text.
UCLM = 95% upper confidence limit of the mean

5.2.3.4 Groundwater Benchmark Screening Results

The primary exposure pathway for groundwater is consumption of drinking water. Secondary exposure pathways may be consumption of plants irrigated with groundwater and consumption of livestock provided groundwater. Initially, benchmark values were derived only for use of groundwater as drinking water. Derivation of other benchmarks was planned only for constituents that exceeded the drinking water benchmark, and then only if the other uses were identified for groundwater in the affected MU.

Selenium was the only constituent retained for pathway-specific evaluation (Table 40). Selenium concentrations did not exceed the pathway-specific (i.e., drinking water) value of 0.047 mg/L[20]; groundwater pathways were not evaluated further.

Table 40: Noncancer Groundwater Pathway-specific Screening Results – Drinking Water

Well	Sample Date	MU	Constituent [a]	Fraction	Concentration (mg/L)	Drinking Water Benchmark (mg/L)	Exceed
02-17	3/18/2014	MU-4	**Selenium**	D	0.0143	0.047	No
02-17	3/18/2014	MU-4	**Selenium**	T	0.0143	0.047	No
02-17	4/24/2014	MU-4	**Selenium**	T	0.0152	0.047	No
02-17	4/24/2014	MU-4	**Selenium**	D	0.0156	0.047	No
02-18	4/24/2014	MU-4	**Selenium**	T	0.0132	0.047	No
02-18	4/24/2014	MU-4	**Selenium**	D	0.0138	0.047	No
02-20	3/26/2014	MU-4	**Selenium**	D	0.0133	0.047	No
02-20	3/26/2014	MU-4	**Selenium**	T	0.0133	0.047	No
02-20	4/24/2014	MU-4	**Selenium**	D	0.0134	0.047	No
02-20	4/24/2014	MU-4	**Selenium**	T	0.013	0.047	No
07-01	3/28/2014	MU-4	**Selenium**	D	0.0102	0.047	No
03-04	3/11/2014	MU-5	**Selenium**	T	0.0111	0.047	No
03-04	3/11/2014	MU-5	**Selenium**	D	0.0119	0.047	No
04-09	3/17/2014	MU-5	**Selenium**	T	0.0108	0.047	No
04-09	3/17/2014	MU-5	**Selenium**	D	0.0113	0.047	No

Notes:
[a] Constituents specified in the Order are shown in bolded text.
D = dissolved; T = total

5.3 Pathway-specific Risk Analysis

Pathway-specific benchmark screening identified one constituent in surface water (nitrate) and four constituents in fish tissue (aluminum, arsenic, cobalt, and selenium) for which more detailed risk analyses were needed. Noncancer hazards are calculated for all of these constituents. One constituent (arsenic) is also carcinogenic when ingested, so for that constituent cancer risks were also calculated.

5.3.1 Noncancer Hazard Estimates

Noncancer health risks are measured by comparing the exposure dose with a TRV, yielding an HQ. HQs are calculated by dividing the expected ADER of a constituent by the TRV, which is the maximum allowable daily concentration. An HQ greater than one indicates that a greater quantity of the constituent is being ingested than is recommended and an increased risk of health effects from exposure to that constituent may occur.

[20] The pathway-specific benchmark for selenium in drinking water is based on the upper tolerable intake level (UL) of 0.4 mg/day set by Health Canada. This UL is also the basis for Health Canada's proposed MAC of 0.050 mg/L. The health-based proposed MAC contrasts with the 1992 guideline currently relied on by BC MoE of 0.010 mg/L which is based on allowing 10-25% of total selenium intake to be from drinking water.

HQs were calculated for nitrate in surface water that might be consumed by infants aged 0 to 6 months who are drinking formula reconstituted from drinking water. Infants are at highest risk to nitrates because their intestinal flora convert nitrate to nitrite, which then binds with haemoglobin to form methaemoglobin (Health Canada 2012c). Methaemoglobinemia, or blue baby syndrome, results in impaired oxygen delivery to tissues, giving the skin a blue color. Seasonal UCLM nitrate concentrations in MU-1 were used to calculate HQs for the infant. HQs for infant ingestion of surface water in MU-1, by quarter, are below one, indicating that adverse effects from ingesting surface water are not expected (Table 41). Currently, surface water in MU-1 is not ingested by infants, children, or adults.

Table 41: Hazard Quotients for Infant, Surface Water Ingestion

2013 (MU-1)	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
Nitrate (as N)	0.4	0.2	0.2	0.4

HQs for the constituents that exceeded the fish pathway benchmarks were calculated using the exposure parameters for the First Nations resident. The ingestion rate is only slightly less for other fish consumers, and risk for other fish consumers are slightly lower than those predicted for First Nations fish consumers (data not shown). Table 42 provides the noncancer HQs for the four constituents that exceeded the pathway benchmark. For aluminum, arsenic, cobalt, and selenium, the HQs are all less than one.

Table 42: Hazard Quotients for First Nations Residents, Fish Ingestion

Constituent [a]	MU-1	MU-2	MU-3	MU-4	MU-5	MU-6
Aluminum, muscle	0.01	0.006	0.001	0.03	0.004	0.003
Aluminum, whole	--	--	0.3	0.04	0.06	--
Arsenic, muscle	0.007	0.02	0.01	0.01	0.005	0.01
Arsenic, whole	--	--	0.03	0.01	0.01	--
Cobalt, muscle	0.2	0.1	0.008	0.3	0.1	0.02
Cobalt, whole	--	--	0.2	0.3	0.2	--
Selenium, muscle	0.8	0.4	0.2	0.4	0.2	0.2
Selenium, whole	--	--	0.3	0.9	0.3	--

Notes:
[a] Constituents specified in the Order are shown in bolded text.
-- No data available for whole fish tissue

The HQ for selenium in MU-1 fish muscle tissue was 0.8 and the HQ in MU-4 for whole fish was 0.9, only slightly less than 1, so an additional assessment was conducted of local fish selenium intake in the context of typical dietary intakes from other sources (Table 43). Average daily selenium intakes for residents of Halifax, Toronto, and Vancouver are provided by Health Canada; no data specific for southeast British Columbia or Alberta are available (Health Canada 2011). Based on Technical Advisory Committee advice that Elk Valley residents' diets reflect an inland diet rather than a coastal diet, the diet composition and selenium intakes of inland city Toronto residents were selected as better representing Designated Area residents compared

with Vancouver or Halifax diets. Combining the Toronto resident selenium intake level (2.2 µg/kg-day) with intake from MU-1 fish muscle tissue using the ADER (4.3 µg/kg-day), results in a total daily selenium intake (6.5 µg/kg-day) above Health Canada's upper limit (UL) intake level (5.7 µg/kg-day). Similar calculations for consumption of fish muscle tissue from MUs 2 to 6 do not cause the UL to be exceeded. The UL also is not exceeded for MU-1 fish when samples collected from a heavily studied settling pond, Clode Pond, are not included in the dataset[21]. MU-1 is currently closed to most fishing[22].

In order to assess if background selenium intakes might be higher among Elk Valley residents, other non-fish sources of dietary selenium intake also were considered, such as consumption of wild game and native vegetation. Table 43 lists average selenium concentrations in foods collected from Toronto, Halifax, and Vancouver (Health Canada 2014). Generally, meats and fish contain higher selenium concentrations relative to vegetation, or fruits and vegetables. The relatively low concentration of selenium in fruits and vegetables results in a negligible contribution to overall dietary selenium intake. A higher contribution to dietary selenium is derived from protein sources, with the highest selenium levels observed in organ meats. Table 43 shows Canadian average concentrations of food categories analogous to traditional foods consumed by Elk Valley residents and First Nations members.

Selenium concentrations have been reported for a limited data set of Elk Valley game. Average selenium concentrations measured in deer, elk, and sheep organ meat (1.3 µg/g wet weight for 17 samples of liver and heart[23]) are greater than concentrations in game muscle tissue (0.51 µg/g wet weight for 33 samples from elk, deer and sheep). Average Elk Valley game organ and muscle tissue selenium concentrations are higher than those reported across three cities surveyed by Health Canada (see Table 43). Selenium concentrations in fish harvested from within the Designated Area also are higher than those reported by Health Canada.

We used a combination of Health Canada dietary intake rates, Health Canada food concentration data, Ktunaxa meat intake rates, and locally harvested game tissue concentrations to estimate the mean dietary selenium intake for Elk Valley residents, apart from the influence of locally-harvested fish. For this estimate, we assumed that a portion of the meat intake consisted of locally harvested game muscle meats (63%, or 66 of 106 g/person-day). The Ktunaxa average game meat intake rate was obtained from the Firelight Study (2014) and the average Canadian total meat intake rate was obtained from Health Canada (2014). Similarly, we assumed that a portion of the total organ meat intake consisted of locally harvested organ meat

[21] Barriers preventing fish migration between Clode Pond, a settling pond, and the Fording River will be installed in the near future. This will result in lower overall fish tissue concentrations for MU-1 as fish reflecting exposures within Clode Pond become inaccessible outside the mine operations fenceline.

[22] Fishing is closed in MU-1 due to an ongoing Westslope cutthroat trout population study in the Upper Fording River (MU-1) and fishing is closed or limited to catch and release for most other waters in MU-1 and MU-2 except by First Nations members.

[23] Selenium concentrations in liver were much higher than heart concentrations.

Table 43: Selenium Concentration in Various Foods Sampled in Toronto, Halifax, and Vancouver

Food Group	Three City Mean Selenium Concentration (µg/g, as prepared)	Elk Valley Mean Selenium Concentration (µg/g, wet weight)	
Fish	0.53 (freshwater & marine, shellfish, canned)	MU-1	4.7
		MU-2	2.3
		MU-3	1.7
		MU-4	2.4
		MU-5	1.9
		MU-6	1.1
Meat	0.28 (beef, pork, lamb, veal)	0.5 (deer, elk, sheep)[a]	
Organ meats	1.14 (kidney, liver)	1.3 (liver, heart)[a]	
Poultry	0.33	Not sampled	
Berries	0.005	Not sampled	
Mushrooms	0.20	Not sampled	
Nuts & seeds	0.29	Not sampled	

[a]Samples of game meat and organs were opportunistically sampled and results provided to us by Teck and Golder.

(65%, or 1.7 of 2.5 g/person-day). The locally harvested game muscle and organ tissue selenium concentrations used to estimate selenium intake from game are listed in Table 43. Selenium concentrations for muscle (0.24 µg/g) and organ (1.4 µg/g) meats for the Toronto population were obtained from Health Canada (2011) and represent the proportion of meats not harvested locally. For Ktunaxa or other Elk Valley residents whose diet includes locally-harvested game as a portion of their total diet, average dietary selenium intake is estimated to be 2.3 µg/kg-day[24] compared with average dietary selenium intake of 2.1 µg/kg-day for "all Canadians" (Health Canada 2011). Taken together, this analysis suggests that selenium intake for Elk Valley resident hunters may be greater than that for other Canadians who do not consume game.

5.3.2 Cancer Risk Estimates

Cancer risks are calculated by multiplying the LADER factor by the TRV. The calculated cancer risk is the incremental probability, or probability in addition to the background risk experienced by all individuals in the course of daily life, that an individual will develop cancer during his or her lifetime due to exposure to a constituent. The risk estimates were compared with the BC MoE default risk management level, which for carcinogens is 1 in 100,000.

[24] The estimates of total dietary selenium intake levels do not include contributions from local freshwater fish because fish intakes are added separately in this analysis. Traditional food intake rates for muscle tissue, organ meat, berries, and mushrooms were obtained from the Firelight Study (2014). Selenium concentrations for game muscle and organ tissue were obtained through opportunistic elk, deer, and sheep sampling within the Designated Area.

Arsenic was the only cancer-causing constituent retained for further evaluation. Cancer risk from drinking surface water based on dissolved arsenic concentrations ranges from 4 in 1,000,000 in MUs 1 and 2 to 1 in 100,000 in MU-6 (Table 44). Cancer risk from drinking surface water based on total arsenic concentrations ranges from 6 in 1,000,000 in MUs 1 and 2, to 2 in 100,000 in MU-5 (Table 42). The risk estimate for MU-5 exceeds the default risk level established by BC MoE only for total concentrations.

Table 44: Cancer Risk for Ingestion of Arsenic in Surface Water

Dissolved Arsenic	**MU-1**	**MU-2**	**MU-3**	**MU-4**	**MU-5**	**MU-6**
Surface Water Samples	416	131	36	422	81	125
Mean as Concentration (mg/L)	0.000118	0.000113	0.000106	0.000190	0.000179	0.000302
UCLM (mg/L)	0.000121	0.000115	0.000112	0.000196	0.000183	0.000313
Lifetime Average Daily Dose from Drinking Water (mg/kg-d)	2.4E-06	2.3E-06	2.2E-06	3.9E-06	3.6E-06	6.2E-06
Cancer Risk	4E-06	4E-06	4E-06	7E-06	6E-06	1E-05
Total Arsenic	**MU-1**	**MU-2**	**MU-3**	**MU-4**	**MU-5**	**MU-6**
Surface Water Samples	473	131	36	449	81	125
Mean as Concentration (mg/L)	0.000163	0.000162	0.000163	0.000310	0.000323	0.000388
UCLM (mg/L)	0.000172	0.000178	0.000200	0.000329	0.000476	0.000410
Lifetime Average Daily Dose from Drinking Water (mg/kg-d)	3.4E-06	3.5E-06	3.9E-06	6.5E-06	9.4E-06	8.1E-06
Cancer Risk	6E-06	6E-06	7E-06	1E-05	2E-05	1E-05

As shown in Table 45, mean concentrations for dissolved surface water arsenic concentrations in MUs 1 to 5 are similar to mean reference surface water concentrations. The mean concentration in MU-6 is higher than the reference area mean.

Table 45: Mean Concentration of Arsenic in Surface Water and Fish Tissue

MU	Sample Size	Mean Concentration	Sample Size	Mean Concentration
Surface Water	**Dissolved (mg/L)**		**Total (mg/L)**	
REFERENCE	521	**0.000176**	547	**0.000239**
MU-1	416	0.000118	473	0.000163
MU-2	131	0.000113	131	0.000162
MU-3	36	0.000106	36	0.000163
MU-4	422	0.000190	449	0.000310
MU-5	81	0.000179	81	0.000323
MU-6	125	0.000302	125	0.000388
Tissue	**Muscle (mg/kg ww)**		**Whole (mg/kg ww)**	
REFERENCE	86	**0.0818**	18	**0.123**
MU-1	30	0.0221	--	--
MU-2	15	0.0278	--	--
MU-3	5	0.0368	10	0.0599
MU-4	80	0.0462	30	0.0418
MU-5	33	0.0195	18	0.0345
MU-6	11	0.0413	--	--

Cancer risk from ingestion of arsenic in fish ranges from 3 in 1,000,000 in MUs 1 and 6, to 1 in 100,000 in MU-3 (Table 46). This range does not exceed the default risk level established by BC MoE. Mean arsenic concentrations in fish tissue for MUs 1 to 6 are lower than mean reference tissue concentrations (Table 45), indicating that ingestion of fish harvested within the Designated Area will not result in higher arsenic intake than ingestion of reference area fish.

Table 46: Cancer Risk from Fish Ingestion – Arsenic

Fish Tissue	MU-1	MU-2	MU-3	MU-4	MU-5	MU-6
Muscle	3E-06	8E-06	5E-06	7E-06	6E-06	3E-06
Whole	--	--	1E-05	5E-06	6E-06	--

Although adding cancer risks for ingestion of surface water (total concentrations only) and fish in MU-5 would slightly exceed the BC MoE risk level, the lack of evidence that surface water is being used as a drinking water source reduces the likelihood that such combined exposures would occur. It is also noteworthy that arsenic concentrations in fish are not higher in MUs that have higher surface water concentrations. Further, the similarity of arsenic concentrations within the Designated Area with those in reference area samples indicates that most arsenic in surface water and fish is likely due to natural sources rather than mine activities.

5.4 Uncertainties and Data Gaps

Data gaps and uncertainties related to analytical detection limits, selection of analytes, availability of game tissue, and dietary selenium intake were identified throughout the analysis are summarized here:

- A data gap was identified for bromide in surface water, where only dissolved concentrations were measured, and the detection limits were equal to or above the guideline value for total bromide. This data gap is not judged to be a high priority from a health risk perspective as there is not currently evidence that bromide is associated with mining activity, and it is not a constituent likely to accumulate in fish.
- For some constituents (bromide, chloride, sulphate), the water quality baseline guidelines are applicable to total constituent concentrations in water while the dataset contained only dissolved concentrations. This data gap is likely insignificant because health risks associated with these constituents are low.
- Over the 2011-2013 time-period, constituents analyzed in surface water were not consistent across all MUs, resulting in slightly varying constituent lists for each MU. For example, sulphur was measured in surface water only in MU-6. The significance of this possible data gap is low, constituents of greatest potential health concern (e.g., nitrate and selenium) were monitored across all MUs.
- Sample size was limited for fish tissue data in the 2011-2013 time period, resulting in lower sample sizes compared to datasets for other environmental media for which samples had been collected throughout the three-year period. Smaller sample sizes typically result in greater variability within datasets, which is reflected in higher estimates of the UCLM. Continued monitoring through the Regional Aquatic Effects Monitoring Program will reduce uncertainty in characterizing fish tissue concentrations for future health assessments.
- Game muscle and organ meats are expected to be harvested locally and could be a factor affecting background selenium intake. Based on the existing data set, there is uncertainty in the estimate of background selenium intake for Elk Valley residents. Lack of selenium concentrations in other traditional foods, such as berries and mushrooms, is not considered an uncertainty because the contribution of these foods to total dietary selenium intake is negligible compared to the selenium contribution from game meats and fish.

5.5 Discussion and Conclusions

Baseline screening of current conditions against guidelines identified numerous constituents that did not exceed guideline values in surface water, sediment, fish, and groundwater. Constituents that exceeded guidelines at least once, as well as those with no guideline values, were carried forward to the multi-step effects assessment (Table 47).

Constituents for which no TRVs were identified were evaluated qualitatively to determine if the absence of a TRV was a data gap that needed to be filled in order to assess potential health risk. In most cases, constituents without TRVs were judged unlikely to present a potential health risk at the observed concentrations. Many of these constituents were macro- or microminerals not typically included in health risk assessments. Other constituents could be considered similar in toxicity characteristics to constituents for which TRVs were available and for which guidelines were not exceeded (e.g., some of the PAHs).

Pathway-specific screening against benchmark values was conducted for each exposure medium. Benchmark values were derived for the primary exposure pathways. Based on the outcome of screening for the primary pathways, the need for development of benchmark values for secondary exposure pathways was assessed. For surface water, arsenic and nitrate in the

drinking water exceeded the pathway-specific benchmarks[25]. Other pathways would pose a risk that is orders of magnitude lower than the drinking water pathway, so benchmarks for the secondary pathways were not developed. For sediment and groundwater, the primary pathway-specific benchmarks were not exceeded, and thus no benchmarks were derived for secondary pathways.

Table 47: Constituents Included in Pathway Screening and Risk Estimates[a]

Exposure Medium	Pathway-specific Benchmark Screening	Risk Estimates	Conclusions
Surface Water	Aluminum, Arsenic, Beryllium, Cobalt, Iron, Manganese, **Selenium,** Vanadium, **Nitrate** (as N)	**Nitrate** (as N)	Nitrate exceeded pathway-specific benchmark, but risk estimates showed no risk of adverse effects. Dissolved arsenic concentrations were similar to those in reference areas and cancer risks did not exceed acceptable levels.
Sediment	Aluminum, Iron, Nickel, **Selenium**	--	No constituents exceeded pathway-specific benchmarks; no risk calculations were necessary.
Fish	Aluminum, Antimony, Arsenic, Cadmium, Cobalt, Iron, Lithium, **Selenium**, Vanadium, Zinc	Aluminum, Arsenic, Cobalt, **Selenium**	Aluminum, arsenic, cobalt and selenium exceeded pathway-specific benchmark, but none were found to pose unacceptable health risks.
Groundwater	**Selenium**	--	No locations had selenium concentrations exceeding pathway-specific benchmark; no risk calculations were necessary.

Notes:
[a] Constituents specified in the Order are shown in bolded text.

Constituents for which risk estimates were calculated included arsenic and nitrate in surface water consumed as drinking water, and aluminum, arsenic, cobalt, and selenium in fish. None were found to pose noncancer risks. However, there is some potential for high fish consumers eating fish exclusively from MU-1 to exceed the UL for selenium when normal dietary intake is also considered. Cancer risks were estimated for arsenic in surface water and fish. The resulting estimates exceeded BC MoE's default threshold risk level of 1 in 100,000 only for total arsenic in surface water in MU-5; dissolved concentrations did not exceed the threshold. Further, the observed arsenic concentrations are more consistent with natural background sources than with mining activities. An additional analysis was conducted for selenium to determine if intakes from fish would still be acceptable when Canadian dietary intakes of selenium were considered. When combining dietary selenium intake levels with selenium intake

[25] Arsenic exceeded a cancer risk benchmark, but the benchmark was far below natural background concentrations.

from local fish, the resulting total intake exceeded the UL for fish from MU-1. This area is not currently open to fishing, but it would not be advisable to consume fish solely from this area should fishing restrictions be removed.

Work conducted to assess protection of human health did not identify health risks associated with current water quality conditions in the Designated Area when considering the current fishing restrictions and no drinking water use in MU-1. Thus, no specific actions related to water quality have been identified that are needed for the protection of human health.

6 Future Conditions

Water quality targets are being established based primarily on protection of aquatic biota. Long-term targets for each of the Order constituents have been proposed for each Order station (Table 48). For the Order constituents, most long term water quality targets to protect aquatic biota are expected to be lower than those needed to protect human health. All selenium long-term targets exceed the current BC MoE health-based water quality guideline; however, the guideline value is not based on adverse health effects, but on a fraction of typical dietary selenium intakes. In the Upper Fording River the selenium target also exceeds the pathway-specific benchmark and the Health Canada MAC, suggesting that although no health risks were identified for current water quality conditions, this stretch of the river should not be used as a drinking water supply.

Table 48: Summary of proposed long-term water quality targets[(a)]

Order Station	Selenium (µg/L) [(b)]	Nitrate (mg/L as N) [(c)]	Sulphate (mg/L) [(d)]	Cadmium (µg/L) [(e)]
Upper Fording River (FR4)	57	11	429	0.39
Lower Fording River (FR5)	40	11	429	0.39
Elk River downstream of Greenhills Operations (ER1)	19	3	429	0.24
Elk River downstream of Fording River (ER2)	19	3	429	0.24
Elk River downstream of Michel Creek and Elk River at Elko Reservoir (ER3, ER4)	19	3	429	0.24
Lake Koocanusa (LK2)	2	3	308	0.19

(a) Hardness dependent targets for nitrate (MU 1 & 2 only), sulphate and cadmium are shown for the following average hardness levels as mg/L as $CaCO_3$: Fording River 360; Elk River 200; and Lake Koocanusa 150

(b) The long-term selenium target for MU 6 is specified in Ministerial Order M113. Targets in MUs 1-5 are site-specific

(c) Nitrate targets in MUs 3-6 are equal to the BC water quality guideline for the protection of aquatic life. Targets in MUs 1-2 are site-specific

(d) Sulphate targets are equal to the BC water quality guideline for the protection of aquatic life. The target for hardness levels greater than 250 mg/L as $CaCO_3$ is equal to the guideline for hardness levels of 180-250 mg/L as $CaCO_3$.

(e) Cadmium targets are equivalent to the Canadian water quality guideline for the protection of aquatic life (CCME 2014), but expressed as a dissolved concentration.

Short-term concentration targets were determined based on technical and economic feasibility, with the goal of stabilizing levels of constituents at locations where concentrations were expected to increase above long-term targets without mitigation (Table 49). Analysis determined that short-term water quality targets were necessary for selenium and nitrate at two Order stations in the Fording River and one in the Elk River downstream of the Fording River. The

short-term targets are above pathway-specific benchmarks for selenium and nitrate, and indicate that surface water in the Upper and Lower Fording River should not be used as a water supply if concentrations are at or above the short term targets.

Table 49: Summary of proposed short-term water quality targets

Order Station	Selenium (µg/L)	Projected target attainment year	Nitrate (mg/L)	Projected target attainment year
Upper Fording River (FR4)	≤ 63	≤ 2019	≤ 14	≤ 2019
Lower Fording River (FR5)	≤ 51	≤ 2019	≤ 13	≤ 2019
Elk River downstream of Fording River (ER2)	≤ 19	≤ 2023	≤ 4	≤ 2019

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Attachment 1

Surface Water Licences

Table A1-1: Surface Water Use Licences for Elk River, Fording River, Michel Creek, and Lake Koocanusa

No	WR Map/Point Code	Stream Name	Purpose	Quantity	Units[1]	Qty Flag[2]	Rediv Flag[3]	Licensee	Water District/ Precinct	License Status	Process Status	Priority Date; Issue Date
4006329	1400 J3 (PD23359)	Lake Koocanusa	Irrigation	9707	MY	T	N	Trottier Kerry F & Donna L	CRN - WARDNER	Active Appl.	Technical Assessment	2013-08-14
C045971	1400 PP (PD23357)	Lake Koocanusa	Irrigation	246696	MY	T	N	Rosen Mountain Ranch Ltd	CRN - WARDNER	Current	N/A	1972-03-23
C046850	1400 RR (PD23358)	Lake Koocanusa	Irrigation	129515.4	MY	T	N	C & C Ranch Ltd	CRN - WARDNER	Current	N/A	1975-04-22
C055481	82.G.014 A (PD23444)	Lake Koocanusa	Irrigation	345374.4	MY	T	N	Marcer Ranching Ltd.	CRN - GOLD CREEK	Pending	Apportionment Pend	1980-06-20
C058846	82.G.014 L (PD23446)	Lake Koocanusa	Irrigation	25903.08	MY	T	N	Merchant Peter Et Al	FER - ROCK CREEK	Current	N/A	1980-04-23
C072685	82.G.004 Q (PD62756)	Lake Koocanusa	Irrigation	34229.07	MY	M	N	Abbey Anthony Lewis	CRN - GOLD CREEK	Current	N/A	1958-06-16
C104868	1400 A4 (PD65924)	Lake Koocanusa	Irrigation	57233.47	MY	T	N	Fox Keith P & Catherine E Po	CRN - WARDNER	Current	N/A	1992-06-04; 1994-07-25
C112495	1400 C4 (PD73305)	Lake Koocanusa	Irrigation	308370	MY	T	N	Byland Floors Ltd	CRN - WARDNER	Current	N/A	1997-07-08; 2002-12-13
C127660	82.G.014 N (PD23447)	Lake Koocanusa	Irrigation	3700	MY	T	N	Todd John	FER - ROCK CREEK	Current	N/A	1984-07-19; 2012-08-29
C127669	PD184766 - 82.G.014	Lake Koocanusa	Irrigation	3700	MY	T	N	Jaskolski Michael Alan & Deborah Ann	FER - ROCK CREEK	Current	N/A	1984-07-19; 2012-08-29
C130819	1400 J3 (PD23359)	Lake Koocanusa	Irrigation	9707	MY	T	N	Pooranalingam Pathmakumar & Priyanthi	CRN - WARDNER	Current	N/A	1981-04-09; 2013-09-24
C120420	82.G.004 (PD78902)	Lake Koocanusa	Enterprise	11.365	MD	T	N	Sunshine Houseboat Vacations Ltd	CRN - GOLD CREEK	Current	N/A	2005-02-10; 2006-02-22

Table A1-1: Surface Water Use Licences for Elk River, Fording River, Michel Creek, and Lake Koocanusa

No	WR Map/Point Code	Stream Name	Purpose	Quantity	Units[1]	Qty Flag[2]	Rediv Flag[3]	Licensee	Water District/ Precinct	License Status	Process Status	Priority Date; Issue Date
C120420	82.G.004 (PD78902)	Lake Koocanusa	Stock-watering	4.546	MD	T	N	Sunshine Houseboat Vacations Ltd	CRN - GOLD CREEK	Current	N/A	2005-02-10; 2006-02-22
C120420	82.G.004 (PD78902)	Lake Koocanusa	Watering	6167.4	MY	T	N	Sunshine Houseboat Vacations Ltd	CRN - GOLD CREEK	Current	N/A	2005-02-10; 2006-02-22
C120760	82.G.005 (PD79231)	Lake Koocanusa	Enterprise	22.73	MD	T	N	567317 Bc Ltd	CRN - GOLD CREEK	Current	N/A	2005-05-18; 2005-09-29
C028321	1835 J3 (PD23625)	Elk River	Irrigation	231277.5	MY	T	N	Bryant Leslie K & Dorothy L	FER - FERNIE	Current	N/A	1963-05-21
C031689	1954A E (PD23794)	Elk River	Domestic	4.546	MD	T	N	Canadian Forest Products Ltd	FER - ROCK CREEK	Current	N/A	1966-08-02
C031689	1954A E (PD23794)	Elk River	Processing	3304.611	MD	T	N	Canadian Forest Products Ltd	FER - ROCK CREEK	Current	N/A	1966-08-02
C035447	82G/NW(10-e) D (PD23667)	Elk River	Processing	818.296	MD	T	N	Garrett Ready Mix Division Of Interoute Con	FER - MICHEL	Current	N/A	1969-06-13
C035691	1929 PP (PD23752)	Elk River	Mining-Washing Coal	.062	MS	T	N	Teck Coal Elkview Operations	FER - MICHEL	Current	N/A	1968-11-01
C035691	1929 PP (PD23752)	Elk River	Work Camps	45.461	MD	T	N	Teck Coal Elkview Operations	FER - MICHEL	Current	N/A	1968-11-01
C049779	1929 PP (PD23752)	Elk River	Mining-Washing Coal	.089	MS	T	N	Teck Coal Elkview Operations	FER - MICHEL	Current	N/A	1977-05-03
C067746	1929 J4 (PD23759)	Elk River	Irrigation	14801.76	MY	T	N	Elkview Coal Corporation	FER - MICHEL	Current	N/A	1986-01-20

Table A1-1: Surface Water Use Licences for Elk River, Fording River, Michel Creek, and Lake Koocanusa

No	WR Map/Point Code	Stream Name	Purpose	Quantity	Units[1]	Qty Flag[2]	Rediv Flag[3]	Licensee	Water District/ Precinct	License Status	Process Status	Priority Date; Issue Date
C109002	1834B T4 (PD23588)	Elk River	Conserv. -Stored Water	7400.88	MY	T	N	City Of Fernie	FER - FERNIE	Current	N/A	1985-04-01; 1995-01-17
C109002	1834B T4 (PD23588)	Elk River	Conserv. -Use Of Water	.028	MS	T	N	City Of Fernie	FER - FERNIE	Current	N/A	1985-04-01; 1995-01-17
C121497	1832 (PD79668)	Elk River	Snow Making	283700.4	MY	T	N	Resorts Of The Canadian Rockies Inc	FER - FERNIE	Current	N/A	2006-01-18; 2006-07-05
C123054	1832 (PD80945)	Elk River	Irrigation	6167.4	MY	T	N	Sliva Susan Carol & Daniel John	FER - FERNIE	Current	N/A	2007-07-17; 2009-04-29
F120603	1954A E (PD23794)	Elk River	Power-General	25.485	MS	T	N	Bc Hydro & Power Authority	FER - ROCK CREEK	Current	N/A	1922-12-16; 2005-04-28
F120604	1954A E (PD23794)	Elk River	Storage-Power	599471.28	MY	T	N	Bc Hydro & Power Authority	FER - ROCK CREEK	Current	N/A	1922-12-16; 2005-04-21
C038211	82J/SW(2-e) LL (PD23423)	Fording River	Enterprise	22.73	MD	M	N	Teck Coal Ltd Fording River Operations	FER - MICHEL	Current	N/A	1970-02-20
C038211	82J/SW(2-e) LL (PD23423)	Fording River	Mining-Washing Coal	.025	MS	M	N	Teck Coal Ltd Fording River Operations	FER - MICHEL	Current	N/A	1970-02-20
C038211	82J/SW(2-e) MM (PD23424)	Fording River	Enterprise	22.73	MD	M	N	Teck Coal Ltd Fording River Operations	FER - MICHEL	Current	N/A	1970-02-20
C038211	82J/SW(2-e) MM (PD23424)	Fording River	Mining-Washing Coal	.025	MS	M	N	Teck Coal Ltd Fording River Operations	FER - MICHEL	Current	N/A	1970-02-20
C038211	82J/SW(2-e) NN (PD23425)	Fording River	Enterprise	22.73	MD	M	N	Teck Coal Ltd Fording River Operations	FER - MICHEL	Current	N/A	1970-02-20

Table A1-1: Surface Water Use Licences for Elk River, Fording River, Michel Creek, and Lake Koocanusa

No	WR Map/Point Code	Stream Name	Purpose	Quantity	Units[1]	Qty Flag[2]	Rediv Flag[3]	Licensee	Water District/ Precinct	License Status	Process Status	Priority Date; Issue Date
C038211	82J/SW(2-e) NN (PD23425)	Fording River	Mining-Washing Coal	.025	MS	M	N	Teck Coal Ltd Fording River Operations	FER - MICHEL	Current	N/A	1970-02-20
C038211	82J/SW(2-e) PP (PD23429)	Fording River	Enterprise	22.73	MD	M	N	Teck Coal Ltd Fording River Operations	FER - MICHEL	Current	N/A	1970-02-20
C038211	82J/SW(2-e) PP (PD23429)	Fording River	Mining-Washing Coal	.025	MS	M	N	Teck Coal Ltd Fording River Operations	FER - MICHEL	Current	N/A	1970-02-20
C047473	82J/SW(2-e) TT (PD23430)	Fording River	Land Improve	0	TF	T	N	Teck Coal Ltd Fording River Operations	FER - MICHEL	Current	N/A	1976-04-02
C049312	82J/SW(2-e) H3 (PD23426)	Fording River	Mining-Hydraulic	.021	MS	T	N	Teck Coal Ltd Fording River Operations	FER - MICHEL	Current	N/A	1976-03-25
C054340	82J/SW(2-e) TT (PD23430)	Fording River	Mining-Washing Coal	.142	MS	T	N	Teck Coal Ltd Fording River Operations	FER - MICHEL	Current	N/A	1979-08-07
C067547	82J/SW(2-c) X (PD23401)	Fording River	Mining-Washing Coal	.057	MS	T	N	Teck Coal Ltd Greenhills Operations	FER - MICHEL	Current	N/A	1980-12-24
C052810	1929 X3 (PD23686)	Michel Creek	Fire Protection	.163	MS	T	N	Teck Coal Elkview Operations	FER - MICHEL	Current	N/A	1979-02-13

Footnote 1:
Unit = The units of measurement for the quantity of water authorized in the license.
MD = cubic meters per day
MS = cubic meters per second
MY = cubic meters per year
TF = total flow; a unit shown against non-consumptive purposes (e.g. land improvement, conservation) for which the total flow of the stream is authorized to pass through the licensed works. No water is diverted from the stream.

Table A1-1: Surface Water Use Licences for Elk River, Fording River, Michel Creek, and Lake Koocanusa

No	WR Map/Point Code	Stream Name	Purpose	Quantity	Units[1]	Qty Flag[2]	Rediv Flag[3]	Licensee	Water District/ Precinct	License Status	Process Status	Priority Date; Issue Date

Footnote 2:
Qty Flag Desc = Description of the code displayed in the Qty Flag column.
T = Total demand for purpose, one Point of Diversion.
M = Maximum licensed demand for purpose; multiple PODs; quantity at each POD unknown (e.g. where an "M" flag is detected, it means that the license authorizes a maximum amount of water that can be obtained from one or more PODs and streams).
D = Multiple PODs for purpose; quantities at each are known; PODs on different sources.
P = Multiple PODs for purpose; quantities at each are known; PODs on same source.
Footnote 3:
Rediversion - Water from one stream is diverted into another stream. The second stream is used as a natural conduit to move the water closer to the place of use. The removal of the water from the second stream is a rediversion of water which originated in the first stream.
Rediversion Flag is displayed as a **Y** or **N** value Where **Y** value is displayed, Purpose, Quantity and Units are blank.

Attachment 2

Summary Statistics for Current Baseline and Reference Data

Table A2-1: Summary Statistics for Surface Water Current Baseline Constituents

MU	Constituent	Fraction	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/L)	Mean Concentration (mg/L)	Maximum Concentration (mg/L)	SW Guideline (mg/L)
MU-1	Acenaphthene	T	5	100	0	0.0	0.00001	0.0000420	0.00005	0.08
MU-1	Aluminum	D	416	77	0	0.0	0.003	0.00424	0.0794	0.2
MU-1	Aluminum	T	473	3.6	38	8.0	0.003	0.0747	1.97	0.2
MU-1	Anthracene	T	5	100	0	0.0	0.00001	0.0000420	0.00005	0.26
MU-1	Antimony	D	416	21	0	0.0	0.0001	0.000205	0.00109	0.006
MU-1	Antimony	T	470	17	0	0.0	0.0001	0.000217	0.00112	0.006
MU-1	Arsenic	D	416	67	0	0.0	0.0001	0.000118	0.00029	0.0003
MU-1	Arsenic	T	473	36	29	6.1	0.0001	0.000163	0.00128	0.0003
MU-1	Barium	D	416	0.0	0	0.0	0.0132	0.0696	0.167	1
MU-1	Barium	T	473	0.0	0	0.0	0.0227	0.0714	0.156	1
MU-1	Benzo(a)anthracene	T	5	100	0	0.0	0.00001	0.0000420	0.00005	0.00029
MU-1	Benzo(a)pyrene	T	5	100	0	0.0	0.00001	0.0000100	0.00001	0.00001
MU-1	Beryllium	D	416	100	0	0.0	0.0001	0.000152	0.0005	0.004
MU-1	Beryllium	T	473	99	1	0.21	0.0001	0.000193	0.00761	0.004
MU-1	Bismuth	D	416	100	NA	0.0	0.0005	0.000500	0.0005	NA
MU-1	Bismuth	T	473	100	NA	0.0	0.0005	0.000500	0.0005	NA
MU-1	Boron	D	416	37	0	0.0	0.01	0.0118	0.042	5
MU-1	Boron	T	473	23	0	0.0	0.01	0.0124	0.037	5
MU-1	Bromide	D	474	100	200	42	0.05	0.240	1.5	0.05
MU-1	Cadmium	D	416	6.5	0	0.0	0.00001	0.0000412	0.000195	0.005
MU-1	Cadmium	T	470	6.2	0	0.0	0.00001	0.0000710	0.00107	0.005
MU-1	Calcium	D	416	0.0	NA	0.0	32.6	85.0	197	NA
MU-1	Calcium	T	473	0.0	NA	0.0	33.3	84.7	202	NA
MU-1	Chloride	D	474	17	0	0.0	0.5	1.93	7.5	250
MU-1	Chromium, total	D	414	28	0	0.0	0.0001	0.000144	0.0005	0.05
MU-1	Chromium, total	T	473	12	0	0.0	0.0001	0.000353	0.00369	0.05
MU-1	Cobalt	D	416	69	0	0.0	0.0001	0.000121	0.00057	0.00094
MU-1	Cobalt	T	472	45	4	0.85	0.0001	0.000179	0.00206	0.00094
MU-1	Copper	D	416	94	0	0.0	0.0005	0.000510	0.00122	0.5
MU-1	Copper	T	473	64	0	0.0	0.0005	0.00166	0.386	0.5
MU-1	Fluoranthene	T	5	100	0	0.0	0.00001	0.0000420	0.00005	0.126
MU-1	Fluorene	T	5	100	0	0.0	0.00001	0.0000420	0.00005	0.044
MU-1	Fluoride	D	472	21	0	0.0	0.083	0.195	0.54	1.5
MU-1	Iron	D	416	99	0	0.0	0.03	0.0309	0.253	0.3
MU-1	Iron	T	471	37	36	7.6	0.03	0.116	3.08	0.3

Table A2-1: Summary Statistics for Surface Water Current Baseline Constituents

MU	Constituent	Fraction	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/L)	Mean Concentration (mg/L)	Maximum Concentration (mg/L)	SW Guideline (mg/L)
MU-1	Lead	D	416	99	0	0.0	0.00005	0.0000518	0.000732	0.01
MU-1	Lead	T	473	67	0	0.0	0.00005	0.000104	0.00234	0.01
MU-1	Lithium	D	416	2.6	0	0.0	0.00162	0.0156	0.0568	0.73
MU-1	Lithium	T	473	3.0	0	0.0	0.00177	0.0153	0.0597	0.73
MU-1	Magnesium	D	416	0.0	7	1.7	7.97	36.7	165	100
MU-1	Magnesium	T	473	0.0	7	1.5	8.24	36.0	173	100
MU-1	Manganese	D	416	0.48	0	0.0	0.00005	0.00651	0.04	0.05
MU-1	Manganese	T	473	0.21	12	2.5	0.000375	0.0129	0.196	0.05
MU-1	Mercury	D	329	100	0	0.0	0.00001	0.0000101	0.00005	0.001
MU-1	Mercury	T	335	100	0	0.0	0.00001	0.0000100	0.000024	0.001
MU-1	Molybdenum	D	412	0.0	0	0.0	0.000434	0.00126	0.00479	0.25
MU-1	Molybdenum	T	473	0.0	0	0.0	0.000458	0.00127	0.00497	0.25
MU-1	Naphthalene	T	5	100	0	0.0	0.00005	0.0000500	0.00005	0.0014
MU-1	Nickel	D	416	7.2	0	0.0	0.0005	0.00240	0.0109	0.06
MU-1	Nickel	T	469	3.6	0	0.0	0.0005	0.00290	0.0128	0.06
MU-1	Nitrate (as N)	T	466	0.0	125	27	0.278	7.19	27	10
MU-1	Nitrite (as N)	T	466	26	0	0.0	0.001	0.00953	0.044	1
MU-1	Phenanthrene	T	5	100	NA	0.0	0.00002	0.0000440	0.00005	NA
MU-1	Phosphate	D	1	100	NA	0.0	0.3	0.300	0.3	NA
MU-1	Phosphate	T	282	18	NA	0.0	0.002	0.0135	0.79	NA
MU-1	Phosphorus	D	469	100	NA	0.0	0.3	0.300	0.3	NA
MU-1	Phosphorus	T	477	77	NA	0.0	0.002	0.217	0.37	NA
MU-1	Potassium	D	416	88	NA	0.0	0.756	2.01	4.1	NA
MU-1	Potassium	T	473	87	NA	0.0	0.789	2.02	4.3	NA
MU-1	Pyrene	T	5	100	0	0.0	0.00001	0.0000420	0.00005	0.0174
MU-1	Selenium	D	430	0.0	379	88	0.00225	0.0329	0.111	0.01
MU-1	Selenium	T	550	0.18	482	88	0.0005	0.0313	0.105	0.01
MU-1	Silica	T	2	0.0	NA	0.0	4.06	4.51	4.96	NA
MU-1	Silicon	D	416	0.0	NA	0.0	0.924	1.83	3.3	NA
MU-1	Silicon	T	473	0.0	NA	0.0	1.05	1.98	6.07	NA
MU-1	Silver	D	416	100	0	0.0	0.00001	0.0000100	0.00001	0.0142
MU-1	Silver	T	473	91	0	0.0	0.00001	0.0000109	0.000066	0.0142
MU-1	Sodium	D	416	71	0	0.0	0.616	2.15	6.2	200
MU-1	Sodium	T	473	72	0	0.0	0.626	2.15	6.5	200
MU-1	Strontium	D	416	0.0	0	0.0	0.027	0.115	0.209	22

Table A2-1: Summary Statistics for Surface Water Current Baseline Constituents

MU	Constituent	Fraction	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/L)	Mean Concentration (mg/L)	Maximum Concentration (mg/L)	SW Guideline (mg/L)
MU-1	Strontium	T	473	0.0	0	0.0	0.027	0.117	0.211	22
MU-1	Sulphate (as SO_4)	D	479	0.0	6	1.3	14.9	157	775	500
MU-1	Thallium	D	416	78	0	0.0	0.00001	0.0000222	0.0001	2
MU-1	Thallium	T	471	70	0	0.0	0.00001	0.0000293	0.0001	2
MU-1	Tin	D	416	100	0	0.0	0.0001	0.000100	0.00012	22
MU-1	Tin	T	473	99	0	0.0	0.0001	0.000102	0.00034	22
MU-1	Titanium	D	416	82	NA	0.0	0.01	0.0106	0.024	NA
MU-1	Titanium	T	473	73	NA	0.0	0.01	0.0114	0.069	NA
MU-1	Uranium	D	416	0.0	0	0.0	0.000369	0.00175	0.00484	0.01
MU-1	Uranium	T	473	0.0	0	0.0	0.000391	0.00173	0.00501	0.01
MU-1	Vanadium	D	416	100	0	0.0	0.001	0.00100	0.001	0.0126
MU-1	Vanadium	T	473	91	0	0.0	0.001	0.00112	0.0081	0.0126
MU-1	Zinc	D	416	93	0	0.0	0.003	0.00306	0.0059	5
MU-1	Zinc	T	473	51	0	0.0	0.003	0.00416	0.0591	5
MU-2	Aluminum	D	131	95	0	0.0	0.003	0.00302	0.0041	0.2
MU-2	Aluminum	T	131	6.1	12	9.2	0.003	0.0757	0.967	0.2
MU-2	Antimony	D	131	15	0	0.0	0.0001	0.000175	0.00035	0.006
MU-2	Antimony	T	131	14	0	0.0	0.0001	0.000196	0.00169	0.006
MU-2	Arsenic	D	131	36	0	0.0	0.0001	0.000113	0.00015	0.0003
MU-2	Arsenic	T	131	28	8	6.1	0.0001	0.000162	0.00078	0.0003
MU-2	Barium	D	131	0.0	0	0.0	0.0325	0.0822	0.131	1
MU-2	Barium	T	131	0.0	0	0.0	0.0345	0.0837	0.127	1
MU-2	Beryllium	D	131	100	0	0.0	0.0001	0.000164	0.0005	0.004
MU-2	Beryllium	T	131	98	0	0.0	0.0001	0.000171	0.0005	0.004
MU-2	Bismuth	D	131	100	NA	0.0	0.0005	0.000500	0.0005	NA
MU-2	Bismuth	T	131	100	NA	0.0	0.0005	0.000500	0.0005	NA
MU-2	Boron	D	131	71	0	0.0	0.01	0.0105	0.016	5
MU-2	Boron	T	131	11	0	0.0	0.01	0.0129	0.019	5
MU-2	Bromide	D	202	100	77	38	0.05	0.168	1	0.05
MU-2	Cadmium	D	131	4.6	0	0.0	0.00001	0.0000601	0.000198	0.005
MU-2	Cadmium	T	131	0.76	0	0.0	0.00001	0.000111	0.000519	0.005
MU-2	Calcium	D	131	0.0	NA	0.0	45.6	83.5	118	NA
MU-2	Calcium	T	202	0.0	NA	0.0	49.1	82.4	123	NA
MU-2	Chloride	D	198	1.5	0	0.0	0.73	2.22	7	250
MU-2	Chromium, total	D	131	24	0	0.0	0.0001	0.000127	0.00026	0.05

Table A2-1: Summary Statistics for Surface Water Current Baseline Constituents

MU	Constituent	Fraction	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/L)	Mean Concentration (mg/L)	Maximum Concentration (mg/L)	SW Guideline (mg/L)
MU-2	Chromium, total	T	131	3.8	0	0.0	0.00012	0.000341	0.0019	0.05
MU-2	Cobalt	D	131	89	0	0.0	0.0001	0.000104	0.00017	0.00094
MU-2	Cobalt	T	131	65	1	0.76	0.0001	0.000162	0.00096	0.00094
MU-2	Copper	D	131	98	0	0.0	0.0005	0.000506	0.00083	0.5
MU-2	Copper	T	131	63	0	0.0	0.0005	0.000964	0.0165	0.5
MU-2	Fluoride	D	202	5.9	0	0.0	0.1	0.216	0.36	1.5
MU-2	Iron	D	131	100	0	0.0	0.03	0.0300	0.03	0.3
MU-2	Iron	T	131	58	12	9.2	0.03	0.119	1.8	0.3
MU-2	Lead	D	131	100	0	0.0	0.00005	0.0000500	0.00005	0.01
MU-2	Lead	T	131	71	0	0.0	0.00005	0.000112	0.00123	0.01
MU-2	Lithium	D	131	0.0	0	0.0	0.00573	0.0177	0.0604	0.73
MU-2	Lithium	T	131	0.0	0	0.0	0.0061	0.0176	0.062	0.73
MU-2	Magnesium	D	131	0.0	0	0.0	15.1	32.4	52.7	100
MU-2	Magnesium	T	202	0.0	0	0.0	16.2	31.7	50.6	100
MU-2	Manganese	D	131	0.0	0	0.0	0.00008	0.000610	0.00372	0.05
MU-2	Manganese	T	131	2.3	6	4.6	0.00001	0.00674	0.114	0.05
MU-2	Mercury	D	103	100	0	0.0	0.00001	0.0000100	0.00001	0.001
MU-2	Mercury	T	102	97	0	0.0	0.00001	0.0000312	0.000861	0.001
MU-2	Molybdenum	D	131	0.0	0	0.0	0.000735	0.00130	0.0028	0.25
MU-2	Molybdenum	T	131	0.0	0	0.0	0.000667	0.00137	0.00275	0.25
MU-2	Nickel	D	131	6.1	0	0.0	0.0005	0.00249	0.00603	0.06
MU-2	Nickel	T	131	2.3	0	0.0	0.0005	0.00287	0.00703	0.06
MU-2	Nitrate (as N)	T	202	0.0	32	16	2.45	7.11	14.7	10
MU-2	Nitrite (as N)	T	202	45	0	0.0	0.001	0.00494	0.05	1
MU-2	Phosphate	T	90	22	NA	0.0	0.002	0.0103	0.104	NA
MU-2	Phosphorus	D	131	100	NA	0.0	0.3	0.300	0.3	NA
MU-2	Phosphorus	T	142	73	NA	0.0	0.002	0.218	0.3	NA
MU-2	Potassium	D	131	95	NA	0.0	0.972	1.96	2	NA
MU-2	Potassium	T	131	95	NA	0.0	1.02	1.96	2	NA
MU-2	Selenium	D	131	0.0	131	100	0.0131	0.0365	0.0641	0.01
MU-2	Selenium	T	131	0.0	131	100	0.0122	0.0341	0.0614	0.01
MU-2	Silica	T	3	0.0	NA	0.0	4.03	4.09	4.14	NA
MU-2	Silicon	D	131	0.0	NA	0.0	1.6	2.07	2.37	NA
MU-2	Silicon	T	131	0.0	NA	0.0	1.64	2.21	3.95	NA
MU-2	Silver	D	131	100	0	0.0	0.00001	0.0000100	0.00001	0.0142

Table A2-1: Summary Statistics for Surface Water Current Baseline Constituents

MU	Constituent	Fraction	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/L)	Mean Concentration (mg/L)	Maximum Concentration (mg/L)	SW Guideline (mg/L)
MU-2	Silver	T	131	92	0	0.0	0.00001	0.0000115	0.000071	0.0142
MU-2	Sodium	D	131	27	0	0.0	1.81	3.71	14.1	200
MU-2	Sodium	T	131	26	0	0.0	1.87	3.76	13.9	200
MU-2	Strontium	D	131	0.0	0	0.0	0.0811	0.165	0.314	22
MU-2	Strontium	T	131	0.0	0	0.0	0.077	0.168	0.311	22
MU-2	Sulphate (as SO_4)	D	202	0.0	0	0.0	47.1	131	246	500
MU-2	Thallium	D	131	100	0	0.0	0.00001	0.0000244	0.0001	2
MU-2	Thallium	T	131	81	0	0.0	0.00001	0.0000265	0.0001	2
MU-2	Tin	D	131	100	0	0.0	0.0001	0.0001000	0.0001	22
MU-2	Tin	T	131	100	0	0.0	0.0001	0.0001000	0.0001	22
MU-2	Titanium	D	131	92	NA	0.0	0.01	0.0102	0.018	NA
MU-2	Titanium	T	131	77	NA	0.0	0.01	0.0106	0.023	NA
MU-2	Uranium	D	131	0.0	0	0.0	0.000889	0.00191	0.00328	0.01
MU-2	Uranium	T	131	0.0	0	0.0	0.000842	0.00196	0.00321	0.01
MU-2	Vanadium	D	131	100	0	0.0	0.001	0.00100	0.001	0.0126
MU-2	Vanadium	T	131	92	0	0.0	0.001	0.00108	0.004	0.0126
MU-2	Zinc	D	131	55	0	0.0	0.003	0.00474	0.0145	5
MU-2	Zinc	T	131	25	0	0.0	0.003	0.00666	0.0299	5
MU-3	Acenaphthene	T	2	100	0	0.0	0.00001	0.0000100	0.00001	0.08
MU-3	Aluminum	D	36	86	0	0.0	0.003	0.00595	0.0952	0.2
MU-3	Aluminum	T	36	17	6	17	0.003	0.0970	0.712	0.2
MU-3	Anthracene	T	2	100	0	0.0	0.00001	0.0000100	0.00001	0.26
MU-3	Antimony	D	36	97	0	0.0	0.0001	0.000102	0.00019	0.006
MU-3	Antimony	T	36	97	0	0.0	0.0001	0.000100	0.00011	0.006
MU-3	Arsenic	D	36	81	0	0.0	0.0001	0.000106	0.00022	0.0003
MU-3	Arsenic	T	36	53	5	14	0.0001	0.000163	0.00064	0.0003
MU-3	Barium	D	36	0.0	0	0.0	0.0369	0.0514	0.0672	1
MU-3	Barium	T	36	0.0	0	0.0	0.0415	0.0536	0.0699	1
MU-3	Benzo(a)anthracene	T	2	100	0	0.0	0.00001	0.0000100	0.00001	0.00029
MU-3	Benzo(a)pyrene	T	2	100	0	0.0	0.00001	0.0000100	0.00001	0.00001
MU-3	Beryllium	D	36	100	0	0.0	0.0001	0.000156	0.0005	0.004
MU-3	Beryllium	T	36	97	0	0.0	0.0001	0.000157	0.0005	0.004
MU-3	Bismuth	D	36	100	NA	0.0	0.0005	0.000500	0.0005	NA
MU-3	Bismuth	T	36	100	NA	0.0	0.0005	0.000500	0.0005	NA
MU-3	Boron	D	36	100	0	0.0	0.01	0.0100	0.01	5

Table A2-1: Summary Statistics for Surface Water Current Baseline Constituents

MU	Constituent	Fraction	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/L)	Mean Concentration (mg/L)	Maximum Concentration (mg/L)	SW Guideline (mg/L)
MU-3	Boron	T	36	86	0	0.0	0.01	0.0101	0.013	5
MU-3	Bromide	D	51	100	0	0.0	0.05	0.0500	0.05	0.05
MU-3	Cadmium	D	36	92	0	0.0	0.00001	0.0000106	0.00003	0.005
MU-3	Cadmium	T	36	64	0	0.0	0.00001	0.0000202	0.000097	0.005
MU-3	Calcium	D	36	0.0	NA	0.0	42.3	50.3	55.2	NA
MU-3	Calcium	T	36	0.0	NA	0.0	45.4	51.6	56	NA
MU-3	Chloride	D	51	18	0	0.0	0.5	1.12	1.9	250
MU-3	Chromium, total	D	36	2.8	0	0.0	0.0002	0.000297	0.0005	0.05
MU-3	Chromium, total	T	36	2.8	0	0.0	0.00014	0.000524	0.00181	0.05
MU-3	Cobalt	D	36	100	0	0.0	0.0001	0.0001000	0.0001	0.00094
MU-3	Cobalt	T	36	83	0	0.0	0.0001	0.000126	0.00043	0.00094
MU-3	Copper	D	36	97	0	0.0	0.0005	0.000501	0.00055	0.5
MU-3	Copper	T	36	78	0	0.0	0.0005	0.000791	0.00675	0.5
MU-3	Fluoranthene	T	2	100	0	0.0	0.00001	0.0000100	0.00001	0.126
MU-3	Fluorene	T	2	100	0	0.0	0.00001	0.0000100	0.00001	0.044
MU-3	Fluoride	D	51	0.0	0	0.0	0.127	0.158	0.179	1.5
MU-3	Iron	D	36	97	0	0.0	0.03	0.0336	0.16	0.3
MU-3	Iron	T	36	64	5	14	0.03	0.134	1.08	0.3
MU-3	Lead	D	36	97	0	0.0	0.00005	0.0000529	0.000155	0.01
MU-3	Lead	T	36	72	0	0.0	0.00005	0.000107	0.000651	0.01
MU-3	Lithium	D	36	17	0	0.0	0.0005	0.00231	0.005	0.73
MU-3	Lithium	T	36	14	0	0.0	0.00155	0.00251	0.005	0.73
MU-3	Magnesium	D	36	0.0	0	0.0	9.44	11.8	13.1	100
MU-3	Magnesium	T	36	0.0	0	0.0	10.1	12.1	13.7	100
MU-3	Manganese	D	36	2.8	0	0.0	0.000128	0.000998	0.0125	0.05
MU-3	Manganese	T	36	0.0	1	2.8	0.000421	0.00708	0.0515	0.05
MU-3	Mercury	D	30	100	0	0.0	0.00001	0.0000100	0.00001	0.001
MU-3	Mercury	T	30	100	0	0.0	0.00001	0.0000100	0.00001	0.001
MU-3	Molybdenum	D	36	0.0	0	0.0	0.000865	0.00102	0.00109	0.25
MU-3	Molybdenum	T	36	0.0	0	0.0	0.000861	0.00105	0.00114	0.25
MU-3	Naphthalene	T	2	100	0	0.0	0.00005	0.0000500	0.00005	0.0014
MU-3	Nickel	D	36	97	0	0.0	0.0005	0.000502	0.00059	0.06
MU-3	Nickel	T	36	81	0	0.0	0.0005	0.000631	0.00204	0.06
MU-3	Nitrate (as N)	T	49	0.0	0	0.0	0.0658	0.189	0.37	10
MU-3	Nitrite (as N)	T	49	98	0	0.0	0.001	0.00100	0.001	1

Table A2-1: Summary Statistics for Surface Water Current Baseline Constituents

MU	Constituent	Fraction	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/L)	Mean Concentration (mg/L)	Maximum Concentration (mg/L)	SW Guideline (mg/L)
MU-3	Phenanthrene	T	2	100	NA	0.0	0.00002	0.0000200	0.00002	NA
MU-3	Phosphate	D	1	100	NA	0.0	0.3	0.300	0.3	NA
MU-3	Phosphate	T	24	62	NA	0.0	0.002	0.00936	0.0652	NA
MU-3	Phosphorus	D	35	100	NA	0.0	0.3	0.300	0.3	NA
MU-3	Phosphorus	T	40	88	NA	0.0	0.002	0.207	0.3	NA
MU-3	Potassium	D	36	89	NA	0.0	0.346	1.82	2	NA
MU-3	Potassium	T	36	89	NA	0.0	0.388	1.82	2	NA
MU-3	Pyrene	T	2	100	0	0.0	0.00001	0.0000100	0.00001	0.0174
MU-3	Selenium	D	36	0.0	0	0.0	0.00071	0.00135	0.00218	0.01
MU-3	Selenium	T	49	0.0	0	0.0	0.00057	0.00129	0.00218	0.01
MU-3	Silicon	D	36	0.0	NA	0.0	1.62	1.86	2.22	NA
MU-3	Silicon	T	36	0.0	NA	0.0	1.8	2.04	2.97	NA
MU-3	Silver	D	36	100	0	0.0	0.00001	0.0000100	0.00001	0.0142
MU-3	Silver	T	36	83	0	0.0	0.00001	0.0000121	0.000054	0.0142
MU-3	Sodium	D	36	89	0	0.0	0.735	1.88	2	200
MU-3	Sodium	T	36	89	0	0.0	0.875	1.89	2	200
MU-3	Strontium	D	36	0.0	0	0.0	0.156	0.186	0.227	22
MU-3	Strontium	T	36	0.0	0	0.0	0.161	0.191	0.217	22
MU-3	Sulphate (as SO_4)	D	51	0.0	0	0.0	12	20.4	27.9	500
MU-3	Thallium	D	36	100	0	0.0	0.00001	0.0000225	0.0001	2
MU-3	Thallium	T	36	83	0	0.0	0.00001	0.0000242	0.0001	2
MU-3	Tin	D	36	100	0	0.0	0.0001	0.0001000	0.0001	22
MU-3	Tin	T	36	97	0	0.0	0.0001	0.000108	0.00039	22
MU-3	Titanium	D	36	94	NA	0.0	0.01	0.0102	0.014	NA
MU-3	Titanium	T	36	92	NA	0.0	0.01	0.0103	0.015	NA
MU-3	Uranium	D	36	0.0	0	0.0	0.000606	0.000751	0.000902	0.01
MU-3	Uranium	T	36	0.0	0	0.0	0.000647	0.000771	0.00093	0.01
MU-3	Vanadium	D	36	100	0	0.0	0.001	0.00100	0.001	0.0126
MU-3	Vanadium	T	36	83	0	0.0	0.001	0.00120	0.0031	0.0126
MU-3	Zinc	D	36	100	0	0.0	0.003	0.00300	0.003	5
MU-3	Zinc	T	36	81	0	0.0	0.003	0.00351	0.0084	5
MU-4	Acenaphthene	T	103	100	0	0.0	0.00001	0.0000403	0.00005	0.08
MU-4	Aluminum	D	422	68	1	0.24	0.003	0.00703	0.342	0.2
MU-4	Aluminum	T	449	2.0	128	29	0.003	0.228	3.93	0.2
MU-4	Anthracene	T	103	100	0	0.0	0.00001	0.0000403	0.00005	0.26

Table A2-1: Summary Statistics for Surface Water Current Baseline Constituents

MU	Constituent	Fraction	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/L)	Mean Concentration (mg/L)	Maximum Concentration (mg/L)	SW Guideline (mg/L)
MU-4	Antimony	D	422	76	0	0.0	0.0001	0.000122	0.0006	0.006
MU-4	Antimony	T	449	57	0	0.0	0.0001	0.000133	0.00062	0.006
MU-4	Arsenic	D	422	0.24	38	9.0	0.0001	0.000190	0.00047	0.0003
MU-4	Arsenic	T	449	0.22	135	30	0.0001	0.000310	0.00275	0.0003
MU-4	Barium	D	422	0.0	0	0.0	0.00884	0.0683	0.139	1
MU-4	Barium	T	449	0.0	0	0.0	0.00973	0.0719	0.204	1
MU-4	Benzo(a)anthracene	T	103	100	0	0.0	0.00001	0.0000403	0.00005	0.00029
MU-4	Benzo(a)pyrene	T	103	100	0	0.0	0.00001	0.0000100	0.00001	0.00001
MU-4	Beryllium	D	422	100	0	0.0	0.0001	0.000199	0.0005	0.004
MU-4	Beryllium	T	449	97	0	0.0	0.0001	0.000194	0.0005	0.004
MU-4	Bismuth	D	422	100	NA	0.0	0.0005	0.000500	0.0005	NA
MU-4	Bismuth	T	449	100	NA	0.0	0.0005	0.000500	0.0005	NA
MU-4	Boron	D	422	43	0	0.0	0.01	0.0132	0.051	5
MU-4	Boron	T	449	26	0	0.0	0.01	0.0146	0.05	5
MU-4	Bromide	D	469	100	56	12	0.05	0.103	1.6	0.05
MU-4	Cadmium	D	422	26	0	0.0	0.00001	0.0000169	0.000156	0.005
MU-4	Cadmium	T	449	4.7	0	0.0	0.00001	0.0000474	0.000746	0.005
MU-4	Calcium	D	422	0.0	NA	0.0	26.5	63.1	138	NA
MU-4	Calcium	T	449	0.0	NA	0.0	28.5	65.3	138	NA
MU-4	Chloride	D	460	3.9	0	0.0	0.94	3.03	21.2	250
MU-4	Chromium, total	D	422	3.8	0	0.0	0.0001	0.000241	0.00108	0.05
MU-4	Chromium, total	T	449	4.0	0	0.0	0.00014	0.000635	0.00636	0.05
MU-4	Cobalt	D	422	82	19	4.5	0.0001	0.000219	0.00503	0.00094
MU-4	Cobalt	T	449	54	56	12	0.0001	0.000405	0.00577	0.00094
MU-4	Copper	D	422	97	0	0.0	0.0005	0.000504	0.0012	0.5
MU-4	Copper	T	449	62	0	0.0	0.0005	0.000893	0.0183	0.5
MU-4	Fluoranthene	T	103	100	0	0.0	0.00001	0.0000403	0.00005	0.126
MU-4	Fluorene	T	103	100	0	0.0	0.00001	0.0000403	0.00005	0.044
MU-4	Fluoride	D	469	5.5	0	0.0	0.063	0.178	0.349	1.5
MU-4	Iron	D	422	98	1	0.24	0.03	0.0311	0.362	0.3
MU-4	Iron	T	449	42	94	21	0.03	0.271	6.37	0.3
MU-4	Lead	D	422	100	0	0.0	0.00005	0.0000505	0.000243	0.01
MU-4	Lead	T	449	52	0	0.0	0.00005	0.000201	0.0049	0.01
MU-4	Lithium	D	422	6.9	0	0.0	0.0005	0.00663	0.029	0.73
MU-4	Lithium	T	449	5.1	0	0.0	0.00069	0.00698	0.0296	0.73

Table A2-1: Summary Statistics for Surface Water Current Baseline Constituents

MU	Constituent	Fraction	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/L)	Mean Concentration (mg/L)	Maximum Concentration (mg/L)	SW Guideline (mg/L)
MU-4	Magnesium	D	422	0.0	0	0.0	4.53	20.0	60	100
MU-4	Magnesium	T	449	0.0	0	0.0	4.7	21.1	60.8	100
MU-4	Manganese	D	422	2.1	0	0.0	0.00005	0.00174	0.0379	0.05
MU-4	Manganese	T	449	0.22	21	4.7	0.000058	0.0128	0.197	0.05
MU-4	Mercury	D	288	100	0	0.0	0.00001	0.0000100	0.00001	0.001
MU-4	Mercury	T	316	100	0	0.0	0.00001	0.0000102	0.00005	0.001
MU-4	Molybdenum	D	422	0.0	0	0.0	0.000231	0.000980	0.00329	0.25
MU-4	Molybdenum	T	449	0.0	0	0.0	0.000249	0.00102	0.00355	0.25
MU-4	Naphthalene	T	103	99	0	0.0	0.00005	0.0000503	0.000077	0.0014
MU-4	Nickel	D	422	42	0	0.0	0.0005	0.00189	0.0287	0.06
MU-4	Nickel	T	449	31	0	0.0	0.0005	0.00298	0.0354	0.06
MU-4	Nitrate (as N)	T	449	0.45	0	0.0	0.0064	1.44	4.61	10
MU-4	Nitrite (as N)	T	450	54	0	0.0	0.001	0.00328	0.064	1
MU-4	Phenanthrene	T	103	100	NA	0.0	0.00002	0.0000427	0.00005	NA
MU-4	Phosphate	D	108	22	NA	0.0	0.001	0.00851	0.128	NA
MU-4	Phosphate	T	186	20	NA	0.0	0.002	0.0225	0.425	NA
MU-4	Phosphorus	D	422	100	NA	0.0	0.3	0.300	0.3	NA
MU-4	Phosphorus	T	522	69	NA	0.0	0.002	0.205	0.71	NA
MU-4	Potassium	D	422	93	NA	0.0	0.219	1.93	2.7	NA
MU-4	Potassium	T	449	93	NA	0.0	0.235	1.94	2.7	NA
MU-4	Pyrene	T	103	100	0	0.0	0.00001	0.0000403	0.00005	0.0174
MU-4	Selenium	D	421	0.0	120	29	0.00027	0.00675	0.0211	0.01
MU-4	Selenium	T	448	0.0	118	26	0.00026	0.00659	0.0214	0.01
MU-4	Silica	T	5	0.0	NA	0.0	3.96	4.05	4.18	NA
MU-4	Silicon	D	422	0.0	NA	0.0	0.924	1.92	3.89	NA
MU-4	Silicon	T	449	0.0	NA	0.0	0.937	2.38	8.28	NA
MU-4	Silver	D	422	99	0	0.0	0.00001	0.0000101	0.00005	0.0142
MU-4	Silver	T	449	85	0	0.0	0.00001	0.0000122	0.000126	0.0142
MU-4	Sodium	D	422	32	0	0.0	0.513	4.20	28.5	200
MU-4	Sodium	T	449	29	0	0.0	0.542	4.47	29.3	200
MU-4	Strontium	D	422	0.0	0	0.0	0.0562	0.182	0.407	22
MU-4	Strontium	T	449	0.0	0	0.0	0.0624	0.189	0.436	22
MU-4	Sulphate (as SO_4)	D	455	0.0	0	0.0	2.34	84.5	385	500
MU-4	Thallium	D	422	79	0	0.0	0.00001	0.0000350	0.0001	2
MU-4	Thallium	T	449	58	0	0.0	0.00001	0.0000388	0.000196	2

Table A2-1: Summary Statistics for Surface Water Current Baseline Constituents

MU	Constituent	Fraction	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/L)	Mean Concentration (mg/L)	Maximum Concentration (mg/L)	SW Guideline (mg/L)
MU-4	Tin	D	422	100	0	0.0	0.0001	0.000100	0.0001	22
MU-4	Tin	T	449	100	0	0.0	0.0001	0.000103	0.0007	22
MU-4	Titanium	D	422	94	NA	0.0	0.01	0.0101	0.03	NA
MU-4	Titanium	T	449	69	NA	0.0	0.01	0.0127	0.058	NA
MU-4	Uranium	D	422	0.0	0	0.0	0.000194	0.00103	0.00356	0.01
MU-4	Uranium	T	449	0.0	0	0.0	0.000216	0.00109	0.00363	0.01
MU-4	Vanadium	D	422	100	0	0.0	0.001	0.00100	0.0011	0.0126
MU-4	Vanadium	T	449	77	1	0.22	0.001	0.00142	0.0156	0.0126
MU-4	Zinc	D	422	94	0	0.0	0.003	0.00314	0.0106	5
MU-4	Zinc	T	449	56	0	0.0	0.003	0.00496	0.0484	5
MU-5	Acenaphthene	T	21	100	0	0.0	0.00001	0.0000405	0.00005	0.08
MU-5	Aluminum	D	81	65	0	0.0	0.003	0.00776	0.0819	0.2
MU-5	Aluminum	T	81	1.2	24	30	0.0047	0.260	4.03	0.2
MU-5	Anthracene	T	21	100	0	0.0	0.00001	0.0000405	0.00005	0.26
MU-5	Antimony	D	81	96	0	0.0	0.0001	0.000100	0.00012	0.006
MU-5	Antimony	T	81	77	0	0.0	0.0001	0.000110	0.00035	0.006
MU-5	Arsenic	D	81	1.2	0	0.0	0.0001	0.000179	0.00023	0.0003
MU-5	Arsenic	T	81	0.0	22	27	0.00015	0.000323	0.00257	0.0003
MU-5	Barium	D	81	0.0	0	0.0	0.0454	0.0785	0.0997	1
MU-5	Barium	T	81	0.0	0	0.0	0.0488	0.0841	0.141	1
MU-5	Benzo(a)anthracene	T	21	100	0	0.0	0.00001	0.0000405	0.00005	0.00029
MU-5	Benzo(a)pyrene	T	21	100	0	0.0	0.00001	0.0000100	0.00001	0.00001
MU-5	Beryllium	D	81	100	0	0.0	0.0001	0.000184	0.0005	0.004
MU-5	Beryllium	T	81	96	0	0.0	0.0001	0.000188	0.0005	0.004
MU-5	Bismuth	D	81	100	NA	0.0	0.0005	0.000500	0.0005	NA
MU-5	Bismuth	T	81	100	NA	0.0	0.0005	0.000500	0.0005	NA
MU-5	Boron	D	81	52	0	0.0	0.01	0.0107	0.014	5
MU-5	Boron	T	81	19	0	0.0	0.01	0.0119	0.021	5
MU-5	Bromide	D	81	100	2	2.5	0.05	0.0588	0.41	0.05
MU-5	Cadmium	D	81	8.6	0	0.0	0.00001	0.0000144	0.000031	0.005
MU-5	Cadmium	T	81	0.0	0	0.0	0.000012	0.0000496	0.000697	0.005
MU-5	Calcium	D	81	0.0	NA	0.0	31	59.7	76.1	NA
MU-5	Calcium	T	81	0.0	NA	0.0	36.8	61.4	79.5	NA
MU-5	Chloride	D	81	0.0	0	0.0	1.2	3.22	6.7	250
MU-5	Chromium, total	D	81	2.5	0	0.0	0.0001	0.000236	0.00053	0.05

Table A2-1: Summary Statistics for Surface Water Current Baseline Constituents

MU	Constituent	Fraction	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/L)	Mean Concentration (mg/L)	Maximum Concentration (mg/L)	SW Guideline (mg/L)
MU-5	Chromium, total	T	81	2.5	0	0.0	0.00023	0.000713	0.00707	0.05
MU-5	Cobalt	D	81	100	0	0.0	0.0001	0.000100	0.0001	0.00094
MU-5	Cobalt	T	81	67	3	3.7	0.0001	0.000202	0.00259	0.00094
MU-5	Copper	D	81	96	0	0.0	0.0005	0.000515	0.00148	0.5
MU-5	Copper	T	81	60	0	0.0	0.0005	0.00102	0.0102	0.5
MU-5	Fluoranthene	T	21	100	0	0.0	0.00001	0.0000405	0.00005	0.126
MU-5	Fluorene	T	21	100	0	0.0	0.00001	0.0000405	0.00005	0.044
MU-5	Fluoride	D	81	0.0	0	0.0	0.1	0.182	0.227	1.5
MU-5	Iron	D	81	98	0	0.0	0.03	0.0302	0.046	0.3
MU-5	Iron	T	81	40	19	23	0.03	0.322	5.75	0.3
MU-5	Lead	D	81	98	0	0.0	0.00005	0.0000508	0.00011	0.01
MU-5	Lead	T	81	48	0	0.0	0.00005	0.000247	0.00454	0.01
MU-5	Lithium	D	81	4.9	0	0.0	0.00166	0.00651	0.0098	0.73
MU-5	Lithium	T	81	4.9	0	0.0	0.00283	0.00679	0.0102	0.73
MU-5	Magnesium	D	81	0.0	0	0.0	8.1	18.1	23.9	100
MU-5	Magnesium	T	81	0.0	0	0.0	10.2	18.7	24.9	100
MU-5	Manganese	D	81	0.0	0	0.0	0.000112	0.00140	0.00821	0.05
MU-5	Manganese	T	81	0.0	4	4.9	0.00159	0.0124	0.179	0.05
MU-5	Mercury	D	60	100	0	0.0	0.00001	0.0000100	0.00001	0.001
MU-5	Mercury	T	60	100	0	0.0	0.00001	0.0000100	0.00001	0.001
MU-5	Molybdenum	D	81	0.0	0	0.0	0.000542	0.00102	0.00131	0.25
MU-5	Molybdenum	T	81	0.0	0	0.0	0.000632	0.00107	0.00164	0.25
MU-5	Naphthalene	T	21	100	0	0.0	0.00005	0.0000500	0.00005	0.0014
MU-5	Nickel	D	81	48	0	0.0	0.0005	0.000610	0.00165	0.06
MU-5	Nickel	T	81	33	0	0.0	0.0005	0.00113	0.0106	0.06
MU-5	Nitrate (as N)	T	81	0.0	0	0.0	0.416	1.54	2.76	10
MU-5	Nitrite (as N)	T	81	46	0	0.0	0.001	0.00160	0.0047	1
MU-5	Phenanthrene	T	21	100	NA	0.0	0.00002	0.0000429	0.00005	NA
MU-5	Phosphate	D	5	40	NA	0.0	0.001	0.00114	0.0014	NA
MU-5	Phosphate	T	44	4.5	NA	0.0	0.002	0.0232	0.217	NA
MU-5	Phosphorus	D	81	100	NA	0.0	0.3	0.300	0.3	NA
MU-5	Phosphorus	T	93	60	NA	0.0	0.0025	0.193	0.396	NA
MU-5	Potassium	D	81	90	NA	0.0	0.619	1.87	2	NA
MU-5	Potassium	T	81	89	NA	0.0	0.65	1.88	2.1	NA
MU-5	Pyrene	T	21	100	0	0.0	0.00001	0.0000405	0.00005	0.0174

Table A2-1: Summary Statistics for Surface Water Current Baseline Constituents

MU	Constituent	Fraction	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/L)	Mean Concentration (mg/L)	Maximum Concentration (mg/L)	SW Guideline (mg/L)
MU-5	Selenium	D	81	0.0	17	21	0.00214	0.00801	0.0127	0.01
MU-5	Selenium	T	81	0.0	17	21	0.00248	0.00786	0.0127	0.01
MU-5	Silica	T	1	0.0	NA	0.0	4.08	4.08	4.08	NA
MU-5	Silicon	D	81	0.0	NA	0.0	1.39	1.99	2.35	NA
MU-5	Silicon	T	81	0.0	NA	0.0	1.66	2.55	11	NA
MU-5	Silver	D	81	100	0	0.0	0.00001	0.0000105	0.00005	0.0142
MU-5	Silver	T	81	80	0	0.0	0.00001	0.0000143	0.000141	0.0142
MU-5	Sodium	D	81	23	0	0.0	2	3.04	4.8	200
MU-5	Sodium	T	81	20	0	0.0	2	3.11	4.9	200
MU-5	Strontium	D	81	0.0	0	0.0	0.0686	0.178	0.257	22
MU-5	Strontium	T	81	0.0	0	0.0	0.0846	0.183	0.264	22
MU-5	Sulphate (as SO_4)	D	81	0.0	0	0.0	17.5	60.8	93	500
MU-5	Thallium	D	81	100	0	0.0	0.00001	0.0000289	0.0001	2
MU-5	Thallium	T	81	74	0	0.0	0.00001	0.0000347	0.000188	2
MU-5	Tin	D	81	94	0	0.0	0.0001	0.000122	0.00144	22
MU-5	Tin	T	81	98	0	0.0	0.0001	0.000100	0.00011	22
MU-5	Titanium	D	81	98	NA	0.0	0.01	0.0100	0.01	NA
MU-5	Titanium	T	81	68	NA	0.0	0.01	0.0131	0.086	NA
MU-5	Uranium	D	81	0.0	0	0.0	0.000376	0.000932	0.00125	0.01
MU-5	Uranium	T	81	0.0	0	0.0	0.000464	0.000970	0.00138	0.01
MU-5	Vanadium	D	81	100	0	0.0	0.001	0.00100	0.001	0.0126
MU-5	Vanadium	T	81	74	1	1.2	0.001	0.00161	0.0176	0.0126
MU-5	Zinc	D	81	96	0	0.0	0.003	0.00309	0.0075	5
MU-5	Zinc	T	81	65	0	0.0	0.003	0.00492	0.0445	5
MU-6	Aluminum	D	125	16	0	0.0	0.0005	0.00905	0.111	0.2
MU-6	Aluminum	T	125	0.80	29	23	0.0054	0.150	1.57	0.2
MU-6	Antimony	D	125	65	0	0.0	0.000053	0.0000870	0.0001	0.006
MU-6	Antimony	T	125	60	0	0.0	0.000053	0.0000936	0.00049	0.006
MU-6	Arsenic	D	125	0.0	65	52	0.00019	0.000302	0.00044	0.0003
MU-6	Arsenic	T	125	0.0	86	69	0.0002	0.000388	0.00119	0.0003
MU-6	Barium	D	125	0.0	0	0.0	0.0342	0.0638	0.106	1
MU-6	Barium	T	125	0.0	0	0.0	0.0343	0.0675	0.132	1
MU-6	Beryllium	D	125	65	0	0.0	0.000001	0.0000660	0.0001	0.004
MU-6	Beryllium	T	125	65	0	0.0	0.000001	0.0000729	0.000206	0.004
MU-6	Bismuth	D	125	94	NA	0.0	0.000001	0.000324	0.0005	NA

Table A2-1: Summary Statistics for Surface Water Current Baseline Constituents

MU	Constituent	Fraction	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/L)	Mean Concentration (mg/L)	Maximum Concentration (mg/L)	SW Guideline (mg/L)
MU-6	Bismuth	T	125	78	NA	0.0	0.000001	0.000325	0.0005	NA
MU-6	Boron	D	125	65	0	0.0	0.0034	0.00886	0.01	5
MU-6	Boron	T	125	54	0	0.0	0.0037	0.00917	0.015	5
MU-6	Bromide	D	81	99	1	1.2	0.05	0.0502	0.063	0.05
MU-6	Cadmium	D	125	55	0	0.0	0.000006	0.0000104	0.000033	0.005
MU-6	Cadmium	T	125	46	0	0.0	0.00001	0.0000224	0.000265	0.005
MU-6	Calcium	D	125	0.0	NA	0.0	32.3	43.3	82.8	NA
MU-6	Calcium	T	81	0.0	NA	0.0	33	41.5	66.2	NA
MU-6	Chloride	D	125	1.6	0	0.0	0.5	2.61	6.3	250
MU-6	Chromium, total	D	125	46	0	0.0	0.0001	0.000144	0.00023	0.05
MU-6	Chromium, total	T	125	0.0	0	0.0	0.00011	0.000388	0.0045	0.05
MU-6	Cobalt	D	125	65	0	0.0	0.000012	0.0000737	0.0001	0.00094
MU-6	Cobalt	T	125	55	2	1.6	0.000017	0.000139	0.00146	0.00094
MU-6	Copper	D	125	62	0	0.0	0.00013	0.000421	0.00094	0.5
MU-6	Copper	T	125	43	0	0.0	0.00008	0.000637	0.0047	0.5
MU-6	Fluoride	D	81	0.0	0	0.0	0.076	0.114	0.193	1.5
MU-6	Iron	D	125	65	0	0.0	0.0006	0.0239	0.0989	0.3
MU-6	Iron	T	125	23	21	17	0.0151	0.194	2.55	0.3
MU-6	Lead	D	125	80	0	0.0	0.000005	0.0000378	0.000095	0.01
MU-6	Lead	T	125	33	0	0.0	0.000005	0.000198	0.0027	0.01
MU-6	Lithium	D	125	0.0	0	0.0	0.00081	0.00340	0.00665	0.73
MU-6	Lithium	T	125	0.0	0	0.0	0.00083	0.00362	0.00699	0.73
MU-6	Magnesium	D	125	0.0	0	0.0	7.8	12.2	18	100
MU-6	Magnesium	T	81	0.0	0	0.0	8.06	11.6	18.3	100
MU-6	Manganese	D	125	1.6	0	0.0	0.00005	0.00109	0.00551	0.05
MU-6	Manganese	T	125	0.0	5	4.0	0.000205	0.00943	0.151	0.05
MU-6	Mercury	D	81	100	0	0.0	0.00001	0.0000100	0.00001	0.001
MU-6	Mercury	T	81	100	0	0.0	0.00001	0.0000100	0.00001	0.001
MU-6	Molybdenum	D	125	0.0	0	0.0	0.000596	0.000826	0.00119	0.25
MU-6	Molybdenum	T	125	0.0	0	0.0	0.000449	0.000858	0.00125	0.25
MU-6	Nickel	D	125	65	0	0.0	0.0002	0.000435	0.0005	0.06
MU-6	Nickel	T	125	53	0	0.0	0.00023	0.000650	0.00512	0.06
MU-6	Nitrate (as N)	T	125	0.0	0	0.0	0.0983	0.560	1.67	10
MU-6	Nitrite (as N)	T	125	15	0	0.0	0.001	0.00296	0.0138	1
MU-6	Phosphate	T	6	0.0	NA	0.0	0.0023	0.00408	0.0075	NA

Table A2-1: Summary Statistics for Surface Water Current Baseline Constituents

MU	Constituent	Fraction	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/L)	Mean Concentration (mg/L)	Maximum Concentration (mg/L)	SW Guideline (mg/L)
MU-6	Phosphorus	D	81	100	NA	0.0	0.3	0.300	0.3	NA
MU-6	Phosphorus	T	123	7.3	NA	0.0	0.0015	0.0374	0.3	NA
MU-6	Potassium	D	125	38	NA	0.0	0.383	1.11	2	NA
MU-6	Potassium	T	81	59	NA	0.0	0.581	1.44	2	NA
MU-6	Selenium	D	125	0.0	0	0.0	0.0005	0.00308	0.00859	0.01
MU-6	Selenium	T	124	0.0	0	0.0	0.00046	0.00299	0.00783	0.01
MU-6	Silicon	D	81	0.0	NA	0.0	1.54	1.95	2.39	NA
MU-6	Silicon	T	81	0.0	NA	0.0	1.64	2.24	3.91	NA
MU-6	Silver	D	125	86	0	0.0	0.000001	0.00000687	0.00001	0.0142
MU-6	Silver	T	125	69	0	0.0	0.000001	0.00000853	0.000041	0.0142
MU-6	Sodium	D	125	4.0	0	0.0	0.943	2.72	4.6	200
MU-6	Sodium	T	81	3.7	0	0.0	2	2.89	4.54	200
MU-6	Strontium	D	125	0.0	0	0.0	0.0872	0.148	0.212	22
MU-6	Strontium	T	125	0.0	0	0.0	0.0976	0.153	0.221	22
MU-6	Sulphate (as SO_4)	D	125	0.0	0	0.0	13.6	32.0	68	500
MU-6	Sulphur	T	44	0.0	NA	0.0	5.32	13.3	19.4	NA
MU-6	Thallium	D	125	60	0	0.0	0.000002	0.00000834	0.000016	2
MU-6	Thallium	T	125	56	0	0.0	0.000002	0.0000108	0.000048	2
MU-6	Tin	D	125	86	0	0.0	0.000005	0.000113	0.00188	22
MU-6	Tin	T	125	97	0	0.0	0.000005	0.0000702	0.00051	22
MU-6	Titanium	D	81	99	NA	0.0	0.01	0.0100	0.011	NA
MU-6	Titanium	T	81	75	NA	0.0	0.01	0.0121	0.03	NA
MU-6	Uranium	D	125	0.0	0	0.0	0.000451	0.000779	0.00109	0.01
MU-6	Uranium	T	125	0.0	0	0.0	0.000513	0.000822	0.00122	0.01
MU-6	Vanadium	D	125	65	0	0.0	0.000114	0.000713	0.001	0.0126
MU-6	Vanadium	T	125	59	0	0.0	0.000116	0.000862	0.0033	0.0126
MU-6	Zinc	D	125	68	0	0.0	0.0002	0.00206	0.0033	5
MU-6	Zinc	T	125	58	0	0.0	0.0002	0.00286	0.0158	5

Notes:
D = dissolved; T = total; SW = surface water; NA = not available
Means are calculated with values below the detection limit set as equal to the detection limit.

Table A2-2: Summary Statistics for Surface Water Conventional Parameters

MU	Parameter	Fraction	Sample Size	Percent Not Detected	Minimum Concentration	Mean Concentration	Maximum Concentration	Units	Guideline Minimum	Guideline Maximum
MU-1	Alkalinity	T	970	0.0	40.2	225	484	mg/l	NA	NA
MU-1	Carbon, dissolved organic	D	890	6.6	0.5	1.34	8.41	mg/l	NA	NA
MU-1	Conductivity	D	135	0.0	56	1300	3652	si	NA	NA
MU-1	Conductivity	D	22	0.0	743	1580	3120	umhos/cm	NA	NA
MU-1	Conductivity	D	1679	0.0	0.693	970	5400	us/cm	NA	NA
MU-1	Dissolved oxygen	D	957	0.0	1.39	13.1	1741	mg/l	NA	NA
MU-1	Hardness	T	900	0.0	114	684	2580	mg/l	80	100
MU-1	pH	D	1919	0.0	2.3	8.21	10.5	pH units	6.5	8.5
MU-1	Total dissolved solids	T	895	0.0	119	925	4490	mg/l	NA	500
MU-1	Total organic carbon	T	862	1.9	0.5	1.89	39.6	mg/l	NA	4
MU-1	Total suspended solids	T	1609	52	0.1	21.1	8080	mg/l	NA	NA
MU-1	Total suspended solids	T	2	0.0	1.4	1.85	2.3	ppm	NA	NA
MU-1	Turbidity	T	1871	0.43	0.02	10.2	790	ntu	NA	NA
MU-2	Alkalinity	T	131	0.0	122	170	207	mg/l	NA	NA
MU-2	Carbon, dissolved organic	D	126	8.7	0.5	1.04	2.74	mg/l	NA	NA
MU-2	Conductivity	D	5	0.0	668	700	758	umhos/cm	NA	NA
MU-2	Conductivity	D	327	0.0	33.54	553	1505	us/cm	NA	NA
MU-2	Dissolved oxygen	D	152	0.0	1.81	12.3	17.63	mg/l	NA	NA
MU-2	Hardness	T	202	0.0	176	335	512	mg/l	80	100
MU-2	pH	D	392	0.0	4.65	8.35	11.26	pH units	6.5	8.5
MU-2	Total dissolved solids	T	128	0.0	204	407	630	mg/l	NA	500
MU-2	Total organic carbon	T	131	4.6	0.5	1.36	5.34	mg/l	NA	4
MU-2	Total suspended solids	T	204	46	1	45.5	2590	mg/l	NA	NA
MU-2	Turbidity	T	265	0.0	0.2	22.1	2518.5	ntu	NA	NA
MU-3	Alkalinity	T	145	0.0	127	185	304	mg/l	NA	NA
MU-3	Carbon, dissolved organic	D	102	17	0.5	2.65	9.6	mg/l	NA	NA
MU-3	Conductivity	D	63	0.0	124	599	1631	si	NA	NA
MU-3	Conductivity	D	6	0.0	315	890	1510	umhos/cm	NA	NA
MU-3	Conductivity	D	264	0.0	7.1	553	1644	us/cm	NA	NA
MU-3	Dissolved oxygen	D	233	0.0	7.7	10.9	15.77	mg/l	NA	NA
MU-3	Hardness	T	102	0.0	144	388	1040	mg/l	80	100
MU-3	pH	D	378	0.0	6.77	8.35	10.8	pH units	6.5	8.5
MU-3	Total dissolved solids	T	102	0.0	136	480	1440	mg/l	NA	500

Table A2-2: Summary Statistics for Surface Water Conventional Parameters

MU	Parameter	Fraction	Sample Size	Percent Not Detected	Minimum Concentration	Mean Concentration	Maximum Concentration	Units	Guideline Minimum	Guideline Maximum
MU-3	Total organic carbon	T	102	4.9	0.5	3.30	16.5	mg/l	NA	4
MU-3	Total suspended solids	T	248	31	0.1	30.1	837	mg/l	NA	NA
MU-3	Turbidity	T	387	0.26	0.01	35.8	5350	ntu	NA	NA
MU-4	Alkalinity	T	1054	0.0	70.5	202	340	mg/l	NA	NA
MU-4	Carbon, dissolved organic	D	989	6.5	0.5	1.36	9.9	mg/l	NA	NA
MU-4	Conductivity	D	125	0.0	191	890	2320	umhos/cm	NA	NA
MU-4	Conductivity	D	1974	0.0	2.4	801	2628	us/cm	NA	NA
MU-4	Dissolved oxygen	D	1031	0.0	4.59	15.7	1736	mg/l	NA	NA
MU-4	Hardness	T	1003	0.0	95	479	1680	mg/l	80	100
MU-4	pH	D	2061	0.0	2.45	8.13	10.3	pH units	6.5	8.5
MU-4	Total dissolved solids	T	1068	0.0	91	610	2320	mg/l	NA	500
MU-4	Total organic carbon	T	964	3.0	0.5	1.84	17.7	mg/l	NA	4
MU-4	Total suspended solids	T	1406	20	0.12	24.8	2850	mg/l	NA	NA
MU-4	Turbidity	T	1628	0.25	0.01	18.7	3910	ntu	NA	NA
MU-5	Alkalinity	T	81	0.0	96	155	186	mg/l	NA	NA
MU-5	Carbon, dissolved organic	D	81	9.9	0.5	1.13	3.15	mg/l	NA	NA
MU-5	Conductivity	D	9	0.0	399	459	502	umhos/cm	NA	NA
MU-5	Conductivity	D	132	0.0	103	398	530	us/cm	NA	NA
MU-5	Dissolved oxygen	D	59	0.0	8.72	33.5	1236	mg/l	NA	NA
MU-5	Hardness	T	81	0.0	111	224	286	mg/l	80	100
MU-5	pH	D	138	0.0	2.56	7.74	8.55	pH units	6.5	8.5
MU-5	Total dissolved solids	T	81	0.0	137	254	324	mg/l	NA	500
MU-5	Total organic carbon	T	81	7.4	0.5	1.50	14.3	mg/l	NA	4
MU-5	Total suspended solids	T	97	14	0.13	24.9	432	mg/l	NA	NA
MU-5	Turbidity	T	116	0.0	0.1	17.3	501	ntu	NA	NA
MU-6	Alkalinity	T	81	0.0	98.2	118	165	mg/l	NA	NA
MU-6	Carbon, dissolved organic	D	125	4.8	0.5	1.19	2.88	mg/L	NA	NA
MU-6	Conductivity	D	3	0.0	368	372	379	umhos/cm	NA	NA
MU-6	Conductivity	D	123	0.0	216	300	415	us/cm	NA	NA
MU-6	Hardness	T	125	0.0	114	158	269	mg/L	80	100
MU-6	pH	D	126	0.0	7.33	8.28	8.56	pH units	6.5	8.5
MU-6	Total dissolved solids	T	81	0.0	133	169	293	mg/l	NA	500
MU-6	Total organic carbon	T	81	1.2	0.5	1.27	4.88	mg/l	NA	4

Table A2-2: Summary Statistics for Surface Water Conventional Parameters

MU	Parameter	Fraction	Sample Size	Percent Not Detected	Minimum Concentration	Mean Concentration	Maximum Concentration	Units	Guideline Minimum	Guideline Maximum
MU-6	Total suspended solids	T	125	34	1	12.4	218	mg/L	NA	NA
MU-6	Turbidity	T	81	0.0	0.56	3.39	21	NTU	NA	NA

Notes:
D = dissolved; T= total; NA = not available
Means are calculated with values below the detection limit set as equal to the detection limit.

Table A2-3: Summary Statistics for Sediment Current Baseline Constituents

MU	Constituent	Sample Size	Percent Not Detected	Percent Exceeding	Minimum Concentration (mg/kg dw)	Mean Concentration (mg/kg dw)	Maximum Concentration (mg/kg dw)	Sediment Guideline (mg/kg dw)
MU-1	2-Methyl Naphthalene	101	0.0	0.0	0.087	1.21	4.7	46
MU-1	Acenaphthene	101	95	0.0	0.05	0.0936	0.3	680
MU-1	Acenaphthylene	101	100	NA	0.05	0.0502	0.07	NA
MU-1	Aluminum	46	0.0	0.0	2500	5750	12400	15400
MU-1	Anthracene	101	98	0.0	0.05	0.0581	0.2	3400
MU-1	Antimony	46	0.0	0.0	0.34	0.735	1.79	20
MU-1	Arsenic	46	0.0	0.0	1.79	4.03	8.35	100
MU-1	Barium	46	0.0	0.0	107	216	355	6500
MU-1	Benz(a)anthracene	101	77	0.0	0.05	0.0668	0.2	1
MU-1	Benzo(a)pyrene	101	97	0.0	0.05	0.0647	0.3	5
MU-1	Benzo(b)fluoranthene	101	25	0.0	0.05	0.0994	0.321	1
MU-1	Benzo(g,h,i)perylene	101	77	NA	0.05	0.0542	0.102	NA
MU-1	Benzo(k)fluoranthene	101	100	0.0	0.05	0.0500	0.05	1
MU-1	Beryllium	46	0.0	0.0	0.26	0.481	0.74	4
MU-1	Bismuth	46	100	NA	0.2	0.200	0.2	NA
MU-1	Boron	11	100	0.0	10	10.0	10	3200
MU-1	Cadmium	46	0.0	0.0	0.564	2.27	6.78	35
MU-1	Calcium	46	0.0	NA	9950	54400	184000	NA
MU-1	Chromium	46	0.0	0.0	5.08	11.7	20.2	20572
MU-1	Chrysene	101	82	0.0	0.05	0.173	0.5	150
MU-1	Cobalt	46	0.0	0.0	1.98	4.41	7.42	50
MU-1	Copper	46	0.0	0.0	7.38	13.8	30.6	15000
MU-1	Dibenz(a,h)anthracene	101	99	0.0	0.05	0.0500	0.051	1
MU-1	Fluoranthene	101	90	0.0	0.05	0.0707	0.63	460
MU-1	Fluorene	101	27	0.0	0.05	0.177	0.745	460
MU-1	Indeno(1,2,3-c,d)pyrene	101	98	0.0	0.05	0.0503	0.07	1
MU-1	Iron	46	0.0	54	4750	11600	41900	11000
MU-1	Lead	46	0.0	0.0	4.22	7.60	10.1	400
MU-1	Lithium	46	0.0	0.0	3.1	7.94	16.6	1600
MU-1	Magnesium	46	0.0	NA	1430	10400	35800	NA
MU-1	Manganese	46	0.0	0.0	17.1	230	1590	1800
MU-1	Mercury	46	0.0	0.0	0.0307	0.0622	0.138	15

Table A2-3: Summary Statistics for Sediment Current Baseline Constituents

MU	Constituent	Sample Size	Percent Not Detected	Percent Exceeding	Minimum Concentration (mg/kg dw)	Mean Concentration (mg/kg dw)	Maximum Concentration (mg/kg dw)	Sediment Guideline (mg/kg dw)
MU-1	Molybdenum	46	0.0	0.0	0.72	1.62	8.04	10
MU-1	Naphthalene	101	0.99	0.0	0.05	0.323	1.17	5
MU-1	Nickel	46	0.0	11	14.2	32.9	129	100
MU-1	Phenanthrene	101	0.0	0.0	0.125	0.863	2.88	5
MU-1	Phosphorus	46	0.0	NA	646	1250	1930	NA
MU-1	Potassium	46	0.0	NA	650	1280	1830	NA
MU-1	Pyrene	101	56	0.0	0.05	0.0825	0.442	10
MU-1	Selenium	46	0.0	70	0.7	10.5	81.6	3
MU-1	Silver	46	0.0	0.0	0.11	0.237	0.71	20
MU-1	Sodium	46	78	0.0	100	104	140	1000000
MU-1	Strontium	46	0.0	0.0	35.1	59.1	88.3	47000
MU-1	Sulphur	35	0.0	NA	900	4190	15200	NA
MU-1	Thallium	46	0.0	0.0	0.141	0.268	0.806	1
MU-1	Tin	46	100	0.0	2	2.00	2	50
MU-1	Titanium	46	0.0	NA	14.3	33.4	96.8	NA
MU-1	Uranium	46	0.0	0.0	0.739	1.29	4.11	10
MU-1	Vanadium	46	0.0	0.0	14.3	31.6	77	200
MU-1	Zinc	46	0.0	0.0	53	133	336	10000
MU-2	2-Methyl Naphthalene	18	0.0	0.0	0.056	0.614	4.29	46
MU-2	Acenaphthene	18	100	0.0	0.05	0.0594	0.18	680
MU-2	Acenaphthylene	18	100	NA	0.05	0.0550	0.14	NA
MU-2	Aluminum	5	0.0	0.0	3560	7040	9840	15400
MU-2	Anthracene	18	100	0.0	0.05	0.0522	0.09	3400
MU-2	Antimony	5	0.0	0.0	0.42	0.752	0.98	20
MU-2	Arsenic	5	0.0	0.0	3.12	5.04	6.38	100
MU-2	Barium	5	0.0	0.0	240	292	337	6500
MU-2	Benz(a)anthracene	18	94	0.0	0.05	0.0569	0.164	1
MU-2	Benzo(a)pyrene	18	100	0.0	0.05	0.0583	0.19	5
MU-2	Benzo(b)fluoranthene	18	61	0.0	0.05	0.0781	0.301	1
MU-2	Benzo(g,h,i)perylene	18	89	NA	0.05	0.0547	0.135	NA
MU-2	Benzo(k)fluoranthene	18	100	0.0	0.05	0.0500	0.05	1
MU-2	Beryllium	5	0.0	0.0	0.32	0.614	0.86	4

Table A2-3: Summary Statistics for Sediment Current Baseline Constituents

MU	Constituent	Sample Size	Percent Not Detected	Percent Exceeding	Minimum Concentration (mg/kg dw)	Mean Concentration (mg/kg dw)	Maximum Concentration (mg/kg dw)	Sediment Guideline (mg/kg dw)
MU-2	Bismuth	5	100	NA	0.2	0.200	0.2	NA
MU-2	Cadmium	5	0.0	0.0	0.711	1.16	1.53	35
MU-2	Calcium	5	0.0	NA	78600	94400	104000	NA
MU-2	Chromium	5	0.0	0.0	7.87	13.6	18.1	20572
MU-2	Chrysene	18	72	0.0	0.05	0.102	0.479	150
MU-2	Cobalt	5	0.0	0.0	3.24	4.94	6.36	50
MU-2	Copper	5	0.0	0.0	9.14	15.7	21.1	15000
MU-2	Dibenz(a,h)anthracene	18	94	0.0	0.05	0.0506	0.06	1
MU-2	Fluoranthene	18	94	0.0	0.05	0.0536	0.1	460
MU-2	Fluorene	18	67	0.0	0.05	0.0987	0.574	460
MU-2	Indeno(1,2,3-c,d)pyrene	18	100	0.0	0.05	0.0500	0.05	1
MU-2	Iron	5	0.0	60	9990	13100	15500	11000
MU-2	Lead	5	0.0	0.0	5.92	8.66	11	400
MU-2	Lithium	5	0.0	0.0	3.5	6.68	9.4	1600
MU-2	Magnesium	5	0.0	NA	8070	10100	10900	NA
MU-2	Manganese	5	0.0	0.0	223	341	418	1800
MU-2	Mercury	5	0.0	0.0	0.044	0.0587	0.0685	15
MU-2	Molybdenum	5	0.0	0.0	1.16	1.68	2.1	10
MU-2	Naphthalene	18	17	0.0	0.05	0.191	1.2	5
MU-2	Nickel	5	0.0	0.0	12.3	20.0	25.8	100
MU-2	Phenanthrene	18	0.0	0.0	0.074	0.417	1.99	5
MU-2	Phosphorus	5	0.0	NA	934	1130	1280	NA
MU-2	Potassium	5	0.0	NA	910	1930	2780	NA
MU-2	Pyrene	18	67	0.0	0.05	0.0635	0.182	10
MU-2	Selenium	5	0.0	0.0	0.74	1.12	1.37	3
MU-2	Silver	5	0.0	0.0	0.14	0.244	0.32	20
MU-2	Sodium	5	60	0.0	100	102	110	1000000
MU-2	Strontium	5	0.0	0.0	87.5	113	126	47000
MU-2	Sulphur	5	0.0	NA	3000	3840	5400	NA
MU-2	Thallium	5	0.0	0.0	0.135	0.241	0.322	1
MU-2	Tin	5	100	0.0	2	2.00	2	50
MU-2	Titanium	5	0.0	NA	13.1	18.3	24.2	NA

Table A2-3: Summary Statistics for Sediment Current Baseline Constituents

MU	Constituent	Sample Size	Percent Not Detected	Percent Exceeding	Minimum Concentration (mg/kg dw)	Mean Concentration (mg/kg dw)	Maximum Concentration (mg/kg dw)	Sediment Guideline (mg/kg dw)
MU-2	Uranium	5	0.0	0.0	1.01	1.19	1.28	10
MU-2	Vanadium	5	0.0	0.0	17.9	33.2	44.5	200
MU-2	Zinc	5	0.0	0.0	56.8	96.7	133	10000
MU-3	Aluminum	5	0.0	0.0	7090	8560	9770	15400
MU-3	Antimony	5	0.0	0.0	0.57	0.670	0.77	20
MU-3	Arsenic	5	0.0	0.0	6.14	6.98	8.04	100
MU-3	Barium	5	0.0	0.0	143	173	216	6500
MU-3	Beryllium	5	0.0	0.0	0.62	0.694	0.78	4
MU-3	Bismuth	5	100	NA	0.2	0.200	0.2	NA
MU-3	Boron	5	20	0.0	10	11.6	14	3200
MU-3	Cadmium	5	0.0	0.0	1.01	1.20	1.39	35
MU-3	Calcium	5	0.0	NA	72200	82000	95100	NA
MU-3	Chromium	5	0.0	0.0	18.4	22.0	24.8	20572
MU-3	Cobalt	5	0.0	0.0	4.74	5.48	6.36	50
MU-3	Copper	5	0.0	0.0	13.2	15.7	18.6	15000
MU-3	Iron	5	0.0	100	12800	15000	17500	11000
MU-3	Lead	5	0.0	0.0	7.4	8.69	9.93	400
MU-3	Lithium	5	0.0	0.0	12.8	15.0	17.6	1600
MU-3	Magnesium	5	0.0	NA	15800	16500	17400	NA
MU-3	Manganese	5	0.0	0.0	579	738	859	1800
MU-3	Mercury	5	0.0	0.0	0.057	0.0698	0.085	15
MU-3	Molybdenum	5	0.0	0.0	1.67	2.01	2.53	10
MU-3	Nickel	5	0.0	0.0	21.7	25.4	29.9	100
MU-3	Phosphorus	5	0.0	NA	1200	1230	1290	NA
MU-3	Potassium	5	0.0	NA	1760	2190	2570	NA
MU-3	Selenium	5	0.0	0.0	1.22	1.47	1.87	3
MU-3	Silver	5	0.0	0.0	0.22	0.274	0.33	20
MU-3	Sodium	5	0.0	0.0	110	120	130	1000000
MU-3	Strontium	5	0.0	0.0	103	112	135	47000
MU-3	Thallium	5	0.0	0.0	0.285	0.338	0.388	1
MU-3	Tin	5	100	0.0	2	2.00	2	50
MU-3	Titanium	5	0.0	NA	25.1	29.5	35.5	NA

Table A2-3: Summary Statistics for Sediment Current Baseline Constituents

MU	Constituent	Sample Size	Percent Not Detected	Percent Exceeding	Minimum Concentration (mg/kg dw)	Mean Concentration (mg/kg dw)	Maximum Concentration (mg/kg dw)	Sediment Guideline (mg/kg dw)
MU-3	Uranium	5	0.0	0.0	1.18	1.33	1.46	10
MU-3	Vanadium	5	0.0	0.0	32.6	38.3	42.8	200
MU-3	Zinc	5	0.0	0.0	89.6	105	126	10000
MU-4	2-Methyl Naphthalene	11	9.1	0.0	0.05	0.116	0.239	46
MU-4	Acenaphthene	11	100	0.0	0.05	0.0500	0.05	680
MU-4	Acenaphthylene	11	100	NA	0.05	0.0500	0.05	NA
MU-4	Aluminum	24	0.0	0.0	4430	7870	15300	15400
MU-4	Anthracene	11	100	0.0	0.05	0.0500	0.05	3400
MU-4	Antimony	24	0.0	0.0	0.33	0.748	1.91	20
MU-4	Arsenic	24	0.0	0.0	3.6	5.89	10.7	100
MU-4	Barium	24	0.0	0.0	104	210	575	6500
MU-4	Benz(a)anthracene	11	100	0.0	0.05	0.0500	0.05	1
MU-4	Benzo(a)pyrene	11	100	0.0	0.05	0.0500	0.05	5
MU-4	Benzo(b)fluoranthene	11	100	0.0	0.05	0.0500	0.05	1
MU-4	Benzo(g,h,i)perylene	11	100	NA	0.05	0.0500	0.05	NA
MU-4	Benzo(k)fluoranthene	11	100	0.0	0.05	0.0500	0.05	1
MU-4	Beryllium	24	0.0	0.0	0.39	0.660	1.45	4
MU-4	Bismuth	24	92	NA	0.2	0.206	0.31	NA
MU-4	Boron	19	42	0.0	10	10.9	15	3200
MU-4	Cadmium	24	0.0	0.0	0.597	1.36	4.22	35
MU-4	Calcium	24	0.0	NA	11600	60200	172000	NA
MU-4	Chromium	24	0.0	0.0	12	16.9	30.5	20572
MU-4	Chrysene	11	100	0.0	0.05	0.0500	0.05	150
MU-4	Cobalt	24	0.0	0.0	3.2	5.69	11.2	50
MU-4	Copper	24	0.0	0.0	7.75	16.7	38.9	15000
MU-4	Dibenz(a,h)anthracene	11	100	0.0	0.05	0.0500	0.05	1
MU-4	Fluoranthene	11	100	0.0	0.05	0.0500	0.05	460
MU-4	Fluorene	11	100	0.0	0.05	0.0500	0.05	460
MU-4	Indeno(1,2,3-c,d)pyrene	11	100	0.0	0.05	0.0500	0.05	1
MU-4	Iron	24	0.0	75	9240	13800	26400	11000
MU-4	Lead	24	0.0	0.0	5.14	9.39	22.1	400
MU-4	Lithium	24	0.0	0.0	6.6	11.7	21	1600

Table A2-3: Summary Statistics for Sediment Current Baseline Constituents

MU	Constituent	Sample Size	Percent Not Detected	Percent Exceeding	Minimum Concentration (mg/kg dw)	Mean Concentration (mg/kg dw)	Maximum Concentration (mg/kg dw)	Sediment Guideline (mg/kg dw)
MU-4	Magnesium	24	0.0	NA	2690	12600	16400	NA
MU-4	Manganese	24	0.0	0.0	103	442	790	1800
MU-4	Mercury	24	4.2	0.0	0.005	0.0574	0.13	15
MU-4	Molybdenum	24	0.0	0.0	0.98	1.60	3	10
MU-4	Naphthalene	11	64	0.0	0.05	0.0552	0.074	5
MU-4	Nickel	24	0.0	0.0	13.5	24.2	54.8	100
MU-4	Phenanthrene	11	9.1	0.0	0.05	0.104	0.176	5
MU-4	Phosphorus	24	0.0	NA	833	1260	2760	NA
MU-4	Potassium	24	0.0	NA	1160	1870	3180	NA
MU-4	Pyrene	11	100	0.0	0.05	0.0500	0.05	10
MU-4	Selenium	24	0.0	21	0.93	2.27	5.3	3
MU-4	Silver	24	0.0	0.0	0.1	0.278	0.78	20
MU-4	Sodium	24	50	0.0	100	107	150	1000000
MU-4	Strontium	24	0.0	0.0	55.2	88.2	200	47000
MU-4	Sulphur	5	0.0	NA	500	580	600	NA
MU-4	Thallium	24	0.0	0.0	0.158	0.310	0.745	1
MU-4	Tin	24	100	0.0	2	2.00	2	50
MU-4	Titanium	24	0.0	NA	17.1	33.2	62.5	NA
MU-4	Uranium	24	0.0	0.0	0.861	1.18	2.39	10
MU-4	Vanadium	24	0.0	0.0	20.8	33.0	65.6	200
MU-4	Zinc	24	0.0	0.0	60.7	103	243	10000
MU-5	2-Methyl Naphthalene	6	0.0	0.0	0.132	0.172	0.205	46
MU-5	Acenaphthene	6	100	0.0	0.05	0.0500	0.05	680
MU-5	Acenaphthylene	6	100	NA	0.05	0.0500	0.05	NA
MU-5	Aluminum	18	0.0	0.0	4280	6380	8820	15400
MU-5	Anthracene	6	100	0.0	0.05	0.0500	0.05	3400
MU-5	Antimony	18	0.0	0.0	0.49	0.576	0.84	20
MU-5	Arsenic	18	0.0	0.0	4.3	5.08	7.35	100
MU-5	Barium	18	0.0	0.0	110	162	217	6500
MU-5	Benz(a)anthracene	6	100	0.0	0.05	0.0500	0.05	1
MU-5	Benzo(a)pyrene	6	100	0.0	0.05	0.0500	0.05	5
MU-5	Benzo(b)fluoranthene	6	17	0.0	0.05	0.0582	0.075	1

Table A2-3: Summary Statistics for Sediment Current Baseline Constituents

MU	Constituent	Sample Size	Percent Not Detected	Percent Exceeding	Minimum Concentration (mg/kg dw)	Mean Concentration (mg/kg dw)	Maximum Concentration (mg/kg dw)	Sediment Guideline (mg/kg dw)
MU-5	Benzo(g,h,i)perylene	6	100	NA	0.05	0.0500	0.05	NA
MU-5	Benzo(k)fluoranthene	6	100	0.0	0.05	0.0500	0.05	1
MU-5	Beryllium	18	0.0	0.0	0.35	0.482	0.7	4
MU-5	Bismuth	18	89	NA	0.2	0.200	0.2	NA
MU-5	Boron	13	85	0.0	10	10.0	10	3200
MU-5	Cadmium	18	0.0	0.0	0.586	0.958	1.57	35
MU-5	Calcium	18	0.0	NA	59000	67600	91800	NA
MU-5	Chromium	18	0.0	0.0	9.87	13.8	20.1	20572
MU-5	Chrysene	6	100	0.0	0.05	0.0517	0.06	150
MU-5	Cobalt	18	0.0	0.0	3.39	4.56	6.62	50
MU-5	Copper	18	0.0	0.0	7.41	12.4	19.6	15000
MU-5	Dibenz(a,h)anthracene	6	100	0.0	0.05	0.0500	0.05	1
MU-5	Fluoranthene	6	83	0.0	0.05	0.0503	0.052	460
MU-5	Fluorene	6	100	0.0	0.05	0.0500	0.05	460
MU-5	Indeno(1,2,3-c,d)pyrene	6	100	0.0	0.05	0.0500	0.05	1
MU-5	Iron	18	0.0	78	10300	12400	16900	11000
MU-5	Lead	18	0.0	0.0	6.21	8.25	12	400
MU-5	Lithium	18	0.0	0.0	7.4	9.88	13.1	1600
MU-5	Magnesium	18	0.0	NA	11400	13500	16400	NA
MU-5	Manganese	18	0.0	0.0	230	360	604	1800
MU-5	Mercury	18	0.0	0.0	0.0207	0.0413	0.0632	15
MU-5	Molybdenum	18	0.0	0.0	0.92	1.27	2.31	10
MU-5	Naphthalene	6	0.0	0.0	0.059	0.0710	0.08	5
MU-5	Nickel	18	0.0	0.0	13.5	18.4	27.3	100
MU-5	Phenanthrene	6	0.0	0.0	0.154	0.184	0.207	5
MU-5	Phosphorus	18	0.0	NA	1080	1190	1390	NA
MU-5	Potassium	18	0.0	NA	810	1380	2130	NA
MU-5	Pyrene	6	100	0.0	0.05	0.0500	0.05	10
MU-5	Selenium	18	0.0	0.0	0.86	1.50	2.72	3
MU-5	Silver	18	0.0	0.0	0.11	0.179	0.31	20
MU-5	Sodium	18	78	0.0	100	105	160	1000000
MU-5	Strontium	18	0.0	0.0	74.9	81.2	91.7	47000

Table A2-3: Summary Statistics for Sediment Current Baseline Constituents

MU	Constituent	Sample Size	Percent Not Detected	Percent Exceeding	Minimum Concentration (mg/kg dw)	Mean Concentration (mg/kg dw)	Maximum Concentration (mg/kg dw)	Sediment Guideline (mg/kg dw)
MU-5	Sulphur	5	0.0	NA	600	780	1000	NA
MU-5	Thallium	18	0.0	0.0	0.131	0.220	0.375	1
MU-5	Tin	18	89	0.0	2	2.00	2	50
MU-5	Titanium	18	0.0	NA	19.4	28.5	52.9	NA
MU-5	Uranium	18	0.0	0.0	0.798	0.953	1.27	10
MU-5	Vanadium	18	0.0	0.0	20.2	26.4	36.2	200
MU-5	Zinc	18	0.0	0.0	62	79.6	114	10000
MU-6	2-Methyl Naphthalene	21	52	0.0	0.05	0.0560	0.079	46
MU-6	Acenaphthene	21	100	0.0	0.05	0.0500	0.05	680
MU-6	Acenaphthylene	21	100	NA	0.05	0.0500	0.05	NA
MU-6	Aluminum	25	0.0	28	4570	9880	17400	15400
MU-6	Anthracene	21	100	0.0	0.05	0.0500	0.05	3400
MU-6	Antimony	25	0.0	0.0	0.33	0.431	0.7	20
MU-6	Arsenic	25	0.0	0.0	3.16	5.73	9.03	100
MU-6	Barium	25	0.0	0.0	34.6	139	220	6500
MU-6	Benz(a)anthracene	21	100	0.0	0.05	0.0500	0.05	1
MU-6	Benzo(a)pyrene	21	100	0.0	0.05	0.0500	0.05	5
MU-6	Benzo(b)fluoranthene	21	90	0.0	0.05	0.0506	0.058	1
MU-6	Benzo(g,h,i)perylene	21	100	NA	0.05	0.0500	0.05	NA
MU-6	Benzo(k)fluoranthene	21	100	0.0	0.05	0.0500	0.05	1
MU-6	Beryllium	25	0.0	0.0	0.22	0.531	0.92	4
MU-6	Bismuth	25	60	NA	0.2	0.231	0.31	NA
MU-6	Boron	10	100	0.0	10	10.0	10	3200
MU-6	Cadmium	25	0.0	0.0	0.099	0.445	1.03	35
MU-6	Calcium	25	0.0	NA	28200	71300	108000	NA
MU-6	Chromium	25	0.0	0.0	6.99	15.2	25.7	20572
MU-6	Chrysene	21	95	0.0	0.05	0.0502	0.055	150
MU-6	Cobalt	25	0.0	0.0	3.89	7.06	11.8	50
MU-6	Copper	25	0.0	0.0	6.35	13.3	22.4	15000
MU-6	Dibenz(a,h)anthracene	21	100	0.0	0.05	0.0500	0.05	1
MU-6	Fluoranthene	21	95	0.0	0.05	0.0514	0.079	460
MU-6	Fluorene	21	100	0.0	0.05	0.0500	0.05	460

Table A2-3: Summary Statistics for Sediment Current Baseline Constituents

MU	Constituent	Sample Size	Percent Not Detected	Percent Exceeding	Minimum Concentration (mg/kg dw)	Mean Concentration (mg/kg dw)	Maximum Concentration (mg/kg dw)	Sediment Guideline (mg/kg dw)
MU-6	Indeno(1,2,3-c,d)pyrene	21	100	0.0	0.05	0.0500	0.05	1
MU-6	Iron	25	0.0	100	12100	17400	25600	11000
MU-6	Lead	25	0.0	0.0	5.99	10.4	17.2	400
MU-6	Lithium	25	0.0	0.0	9.4	19.6	33.3	1600
MU-6	Magnesium	25	0.0	NA	9630	16000	20900	NA
MU-6	Manganese	25	0.0	0.0	141	420	752	1800
MU-6	Mercury	25	0.0	0.0	0.0103	0.0304	0.0602	15
MU-6	Molybdenum	25	20	0.0	0.5	0.956	1.96	10
MU-6	Naphthalene	21	100	0.0	0.05	0.0500	0.05	5
MU-6	Nickel	25	0.0	0.0	8.51	17.9	30.5	100
MU-6	Phenanthrene	21	38	0.0	0.05	0.0617	0.134	5
MU-6	Phosphorus	25	0.0	NA	391	717	977	NA
MU-6	Potassium	25	0.0	NA	490	1510	3230	NA
MU-6	Pyrene	21	95	0.0	0.05	0.0510	0.07	10
MU-6	Selenium	25	16	0.0	0.2	0.514	0.91	3
MU-6	Silver	25	76	0.0	0.1	0.116	0.19	20
MU-6	Sodium	25	60	0.0	100	116	170	1000000
MU-6	Strontium	25	0.0	0.0	29.1	102	208	47000
MU-6	Sulphur	15	47	NA	500	540	700	NA
MU-6	Thallium	25	16	0.0	0.05	0.156	0.318	1
MU-6	Tin	25	100	0.0	2	2.00	2	50
MU-6	Titanium	25	0.0	NA	24.9	61.9	136	NA
MU-6	Uranium	25	0.0	0.0	0.285	0.746	1.11	10
MU-6	Vanadium	25	0.0	0.0	8.27	19.3	36.6	200
MU-6	Zinc	25	0.0	0.0	29	66.5	119	10000

Notes:
NA = not available
Means are calculated with values below the detection limit set as equal to the detection limit.

Table A2-4: Summary Statistics for Fish Tissue Current Baseline Constituents

MU	Constituent	Tissue	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/kg ww)	Mean Concentration (mg/kg ww)	Maximum Concentration (mg/kg ww)	Tissue Guideline (mg/kg ww)
MU-1	Aluminum	Muscle	30	0.0	0	0.0	0.422	11.6	44.9	280
MU-1	Antimony	Muscle	29	0.0	0	0.0	0.00108	0.00466	0.0197	0.108
MU-1	Arsenic	Muscle	30	0.0	11	37	0.00464	0.0221	0.128	0.021
MU-1	Barium	Muscle	30	0.0	0	0.0	0.00980	0.469	2.25	54
MU-1	Beryllium	Muscle	30	33	0	0.0	0.00279	0.00607	0.0163	0.54
MU-1	Bismuth	Muscle	30	17	NA	NA	0.0000782	0.000345	0.00138	NA
MU-1	Boron	Muscle	30	33	0	0.0	0.107	0.244	0.654	54
MU-1	Cadmium	Muscle	30	3.3	0	0.0	0.000977	0.00912	0.0565	0.28
MU-1	Calcium	Muscle	30	0.0	NA	NA	91.4	642	7970	NA
MU-1	Cesium	Muscle	30	0.0	NA	NA	0.00224	0.0104	0.0283	NA
MU-1	Chromium	Muscle	30	0.0	0	0.0	0.0548	0.558	4.20	343
MU-1	Cobalt	Muscle	30	0.0	9	30	0.00346	0.0572	0.185	0.082
MU-1	Copper	Muscle	30	0.0	0	0.0	0.287	0.657	1.82	10.8
MU-1	Gallium	Muscle	30	3.3	NA	NA	0.00145	0.00673	0.0295	NA
MU-1	Iron	Muscle	30	0.0	0	0.0	3.97	23.7	68.5	190
MU-1	Lead	Muscle	30	0.0	NA	NA	0.00231	0.164	1.05	NA
MU-1	Lithium	Muscle	30	0.0	0	0.0	0.00369	0.0361	0.118	0.54
MU-1	Magnesium	Muscle	30	0.0	NA	NA	221	366	838	NA
MU-1	Manganese	Muscle	30	0.0	0	0.0	0.128	0.407	1.91	38
MU-1	Molybdenum	Muscle	30	20	0	0.0	0.00140	0.00675	0.0239	1.36
MU-1	Nickel	Muscle	30	0.0	0	0.0	0.0231	0.162	0.677	5.4
MU-1	Phosphorus	Muscle	30	0.0	NA	NA	1970	3560	9280	NA
MU-1	Potassium	Muscle	30	0.0	NA	NA	2270	5590	14500	NA
MU-1	Rhenium	Muscle	30	10	NA	NA	0.0000333	0.000140	0.000682	NA
MU-1	Rubidium	Muscle	30	0.0	NA	NA	0.779	2.57	5.33	NA
MU-1	Selenium	Muscle	30	0.0	14	47	0.854	4.67	15.1	3.6
MU-1	Silver	Muscle	30	33	0	0.0	0.000522	0.00135	0.00657	1.36
MU-1	Sodium	Muscle	30	0.0	NA	NA	182	500	1830	NA
MU-1	Strontium	Muscle	30	0.0	0	0.0	0.0139	0.294	2.93	162
MU-1	Thallium	Muscle	30	0.0	NA	NA	0.00829	0.0163	0.0494	NA
MU-1	Thorium	Muscle	30	10	NA	NA	0.0000559	0.00321	0.0373	NA

Table A2-4: Summary Statistics for Fish Tissue Current Baseline Constituents

MU	Constituent	Tissue	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/kg ww)	Mean Concentration (mg/kg ww)	Maximum Concentration (mg/kg ww)	Tissue Guideline (mg/kg ww)
MU-1	Tin	Muscle	30	0.0	0	0.0	0.00153	0.00875	0.0363	162
MU-1	Titanium	Muscle	30	0.0	NA	NA	0.0622	0.398	1.67	NA
MU-1	Uranium	Muscle	30	23	0	0.0	0.0000559	0.00168	0.0148	0.82
MU-1	Vanadium	Muscle	30	0.0	0	0.0	0.00171	0.0557	0.238	1.36
MU-1	Yttrium	Muscle	30	0.0	NA	NA	0.000141	0.00666	0.0381	NA
MU-1	Zinc	Muscle	30	0.0	0	0.0	4.88	10.2	30.5	82
MU-1	Zirconium	Muscle	30	0.0	NA	NA	0.00133	0.0301	0.214	NA
MU-2	Aluminum	Muscle	15	0.0	0	0.0	0.0197	3.73	12.6	280
MU-2	Antimony	Muscle	15	27	0	0.0	0.0000262	0.00306	0.0150	0.108
MU-2	Arsenic	Muscle	15	0.0	5	33	0.00600	0.0278	0.193	0.021
MU-2	Barium	Muscle	15	0.0	0	0.0	0.00168	0.103	0.495	54
MU-2	Beryllium	Muscle	15	67	0	0.0	0.000341	0.00233	0.00467	0.54
MU-2	Bismuth	Muscle	15	27	NA	NA	0.0000162	0.000154	0.000482	NA
MU-2	Boron	Muscle	15	33	0	0.0	0.00669	0.123	0.292	54
MU-2	Cadmium	Muscle	15	0.0	0	0.0	0.000817	0.00887	0.0375	0.28
MU-2	Calcium	Muscle	15	0.0	NA	NA	76.0	178	455	NA
MU-2	Cesium	Muscle	15	0.0	NA	NA	0.00388	0.0149	0.0483	NA
MU-2	Chromium	Muscle	15	0.0	0	0.0	0.0113	0.122	0.554	343
MU-2	Cobalt	Muscle	15	0.0	1	6.7	0.00482	0.0358	0.114	0.082
MU-2	Copper	Muscle	15	0.0	0	0.0	0.316	0.469	0.947	10.8
MU-2	Gallium	Muscle	15	0.0	NA	NA	0.000945	0.00339	0.00738	NA
MU-2	Iron	Muscle	15	0.0	0	0.0	3.30	10.9	27.3	190
MU-2	Lead	Muscle	15	0.0	NA	NA	0.000354	0.0455	0.310	NA
MU-2	Lithium	Muscle	15	0.0	0	0.0	0.00699	0.0257	0.0507	0.54
MU-2	Magnesium	Muscle	15	0.0	NA	NA	167	367	793	NA
MU-2	Manganese	Muscle	15	0.0	0	0.0	0.0884	0.241	0.634	38
MU-2	Molybdenum	Muscle	15	0.0	0	0.0	0.000774	0.00608	0.0208	1.36
MU-2	Nickel	Muscle	15	0.0	0	0.0	0.00175	0.0944	0.435	5.4
MU-2	Phosphorus	Muscle	15	0.0	NA	NA	1530	3360	8210	NA
MU-2	Potassium	Muscle	15	0.0	NA	NA	2930	6070	15100	NA
MU-2	Rhenium	Muscle	15	67	NA	NA	0.00000525	0.0000449	0.000133	NA

Table A2-4: Summary Statistics for Fish Tissue Current Baseline Constituents

MU	Constituent	Tissue	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/kg ww)	Mean Concentration (mg/kg ww)	Maximum Concentration (mg/kg ww)	Tissue Guideline (mg/kg ww)
MU-2	Rubidium	Muscle	15	0.0	NA	NA	1.01	2.21	5.33	NA
MU-2	Selenium	Muscle	15	0.0	2	13	0.686	2.32	5.75	3.6
MU-2	Silver	Muscle	15	53	0	0.0	0.0000394	0.000724	0.00334	1.36
MU-2	Sodium	Muscle	15	0.0	NA	NA	166	384	1100	NA
MU-2	Strontium	Muscle	15	0.0	0	0.0	0.0168	0.0962	0.299	162
MU-2	Thallium	Muscle	15	0.0	NA	NA	0.00903	0.0212	0.0465	NA
MU-2	Thorium	Muscle	15	27	NA	NA	0.00000525	0.000696	0.00276	NA
MU-2	Tin	Muscle	15	33	0	0.0	0.0000787	0.0176	0.135	162
MU-2	Titanium	Muscle	15	0.0	NA	NA	0.0103	0.121	0.313	NA
MU-2	Uranium	Muscle	15	6.7	0	0.0	0.0000290	0.000370	0.00103	0.82
MU-2	Vanadium	Muscle	15	0.0	0	0.0	0.00122	0.0119	0.0339	1.36
MU-2	Yttrium	Muscle	15	13	NA	NA	0.0000131	0.00163	0.00692	NA
MU-2	Zinc	Muscle	15	0.0	0	0.0	1.80	4.95	11.1	82
MU-2	Zirconium	Muscle	15	0.0	NA	NA	0.0000905	0.00515	0.0141	NA
MU-3	Aluminum	Muscle	5	0.0	0	0.0	0.182	1.08	2.47	280
MU-3	Aluminum	Whole	10	0.0	1	10	1.21	50.7	426	280
MU-3	Antimony	Muscle	5	0.0	0	0.0	0.000250	0.000291	0.000317	0.108
MU-3	Antimony	Whole	10	0.0	0	0.0	0.000835	0.00173	0.00646	0.108
MU-3	Arsenic	Muscle	5	0.0	3	60	0.00777	0.0368	0.0823	0.021
MU-3	Arsenic	Whole	10	0.0	9	90	0.0149	0.0599	0.159	0.021
MU-3	Barium	Muscle	5	0.0	0	0.0	0.179	0.252	0.342	54
MU-3	Barium	Whole	10	0.0	0	0.0	1.42	3.35	8.37	54
MU-3	Beryllium	Muscle	5	100	0	0.0	0.000545	0.000588	0.000627	0.54
MU-3	Beryllium	Whole	10	0.0	0	0.0	0.00223	0.00279	0.00308	0.54
MU-3	Bismuth	Muscle	5	0.0	NA	NA	0.000182	0.000357	0.000586	NA
MU-3	Bismuth	Whole	10	0.0	NA	NA	0.000240	0.000833	0.00273	NA
MU-3	Boron	Muscle	5	60	0	0.0	0.0112	0.0117	0.0123	54
MU-3	Boron	Whole	10	0.0	0	0.0	0.0186	0.0998	0.694	54
MU-3	Cadmium	Muscle	5	0.0	0	0.0	0.00148	0.0147	0.0502	0.28
MU-3	Cadmium	Whole	10	0.0	1	10	0.00797	0.0766	0.421	0.28
MU-3	Calcium	Muscle	5	0.0	NA	NA	320	405	502	NA

Table A2-4: Summary Statistics for Fish Tissue Current Baseline Constituents

MU	Constituent	Tissue	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/kg ww)	Mean Concentration (mg/kg ww)	Maximum Concentration (mg/kg ww)	Tissue Guideline (mg/kg ww)
MU-3	Calcium	Whole	10	0.0	NA	NA	5460	10000	12200	NA
MU-3	Cesium	Muscle	5	0.0	NA	NA	0.000940	0.00270	0.00797	NA
MU-3	Cesium	Whole	10	0.0	NA	NA	0.000939	0.00793	0.0579	NA
MU-3	Chromium	Muscle	5	0.0	0	0.0	0.0144	0.0195	0.0284	343
MU-3	Chromium	Whole	10	0.0	0	0.0	0.0204	0.112	0.810	343
MU-3	Cobalt	Muscle	5	0.0	0	0.0	0.00213	0.00331	0.00447	0.082
MU-3	Cobalt	Whole	10	0.0	1	10	0.0103	0.0243	0.104	0.082
MU-3	Copper	Muscle	5	0.0	0	0.0	0.278	0.350	0.432	10.8
MU-3	Copper	Whole	10	0.0	0	0.0	0.533	0.907	1.30	10.8
MU-3	Gallium	Muscle	5	0.0	NA	NA	0.00132	0.00174	0.00221	NA
MU-3	Gallium	Whole	10	0.0	NA	NA	0.00445	0.0206	0.143	NA
MU-3	Iron	Muscle	5	0.0	0	0.0	3.12	4.38	5.80	190
MU-3	Iron	Whole	10	0.0	1	10	10.0	49.2	316	190
MU-3	Lead	Muscle	5	0.0	NA	NA	0.00135	0.00282	0.00506	NA
MU-3	Lead	Whole	10	0.0	NA	NA	0.00907	0.0266	0.153	NA
MU-3	Lithium	Muscle	5	20	0	0.0	0.00187	0.00485	0.00962	0.54
MU-3	Lithium	Whole	10	0.0	0	0.0	0.0101	0.0613	0.388	0.54
MU-3	Magnesium	Muscle	5	0.0	NA	NA	257	276	296	NA
MU-3	Magnesium	Whole	10	0.0	NA	NA	332	415	738	NA
MU-3	Manganese	Muscle	5	0.0	0	0.0	0.293	0.483	0.843	38
MU-3	Manganese	Whole	10	0.0	0	0.0	1.84	7.43	16.0	38
MU-3	Molybdenum	Muscle	5	0.0	0	0.0	0.00314	0.00516	0.00778	1.36
MU-3	Molybdenum	Whole	10	0.0	0	0.0	0.0161	0.0266	0.0638	1.36
MU-3	Nickel	Muscle	5	0.0	0	0.0	0.00756	0.00938	0.0112	5.4
MU-3	Nickel	Whole	10	0.0	0	0.0	0.0273	0.0868	0.388	5.4
MU-3	Phosphorus	Muscle	5	0.0	NA	NA	2170	2360	2540	NA
MU-3	Phosphorus	Whole	10	0.0	NA	NA	2940	3260	3420	NA
MU-3	Potassium	Muscle	5	0.0	NA	NA	3800	4270	4720	NA
MU-3	Potassium	Whole	10	0.0	NA	NA	5070	7350	8630	NA
MU-3	Rhenium	Muscle	5	100	NA	NA	0.00000751	0.00000852	0.00000984	NA
MU-3	Rhenium	Whole	10	0.0	NA	NA	0.0000163	0.0000377	0.000117	NA

Table A2-4: Summary Statistics for Fish Tissue Current Baseline Constituents

MU	Constituent	Tissue	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/kg ww)	Mean Concentration (mg/kg ww)	Maximum Concentration (mg/kg ww)	Tissue Guideline (mg/kg ww)
MU-3	Rubidium	Muscle	5	0.0	NA	NA	0.746	0.792	0.838	NA
MU-3	Rubidium	Whole	10	0.0	NA	NA	0.407	0.742	1.63	NA
MU-3	Selenium	Muscle	5	0.0	0	0.0	0.812	1.71	3.20	3.6
MU-3	Selenium	Whole	10	0.0	0	0.0	0.828	1.76	2.71	3.6
MU-3	Silver	Muscle	5	0.0	0	0.0	0.000367	0.00350	0.00573	1.36
MU-3	Silver	Whole	10	0.0	0	0.0	0.00421	0.0224	0.0690	1.36
MU-3	Sodium	Muscle	5	0.0	NA	NA	315	513	636	NA
MU-3	Sodium	Whole	10	0.0	NA	NA	720	914	1120	NA
MU-3	Strontium	Muscle	5	0.0	0	0.0	0.151	0.327	0.462	162
MU-3	Strontium	Whole	10	0.0	0	0.0	6.02	9.99	15.3	162
MU-3	Thallium	Muscle	5	0.0	NA	NA	0.00131	0.00222	0.00291	NA
MU-3	Thallium	Whole	10	0.0	NA	NA	0.000212	0.00955	0.0818	NA
MU-3	Thorium	Muscle	5	0.0	NA	NA	0.0000287	0.000128	0.000488	NA
MU-3	Thorium	Whole	10	0.0	NA	NA	0.000945	0.00425	0.0148	NA
MU-3	Tin	Muscle	5	20	0	0.0	0.000138	0.000442	0.000895	162
MU-3	Tin	Whole	10	0.0	0	0.0	0.000690	0.00354	0.0159	162
MU-3	Titanium	Muscle	5	0.0	NA	NA	0.0310	0.0510	0.0918	NA
MU-3	Titanium	Whole	10	0.0	NA	NA	0.0817	0.597	3.29	NA
MU-3	Uranium	Muscle	5	0.0	0	0.0	0.0000624	0.0000850	0.000107	0.82
MU-3	Uranium	Whole	10	0.0	0	0.0	0.00121	0.00536	0.0328	0.82
MU-3	Vanadium	Muscle	5	0.0	0	0.0	0.00223	0.00294	0.00441	1.36
MU-3	Vanadium	Whole	10	0.0	1	10	0.0134	0.192	1.52	1.36
MU-3	Yttrium	Muscle	5	0.0	NA	NA	0.000108	0.000338	0.000692	NA
MU-3	Yttrium	Whole	10	0.0	NA	NA	0.00138	0.0331	0.281	NA
MU-3	Zinc	Muscle	5	0.0	0	0.0	6.61	8.50	9.70	82
MU-3	Zinc	Whole	10	0.0	0	0.0	22.8	31.6	46.5	82
MU-3	Zirconium	Muscle	5	0.0	NA	NA	0.000718	0.00159	0.00280	NA
MU-3	Zirconium	Whole	10	0.0	NA	NA	0.00525	0.0337	0.238	NA
MU-4	Aluminum	Muscle	80	11	0	0.0	0.101	18.9	262	280
MU-4	Aluminum	Whole	30	3.3	0	0.0	0.536	31.0	107	280
MU-4	Antimony	Whole	30	53	0	0.0	0.000884	0.00313	0.00550	0.108

Table A2-4: Summary Statistics for Fish Tissue Current Baseline Constituents

MU	Constituent	Tissue	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/kg ww)	Mean Concentration (mg/kg ww)	Maximum Concentration (mg/kg ww)	Tissue Guideline (mg/kg ww)
MU-4	Antimony	Muscle	78	53	1	1.3	0.0000404	0.00974	0.170	0.108
MU-4	Arsenic	Muscle	80	16	50	62	0.00604	0.0462	0.340	0.021
MU-4	Arsenic	Whole	30	0.0	27	90	0.00643	0.0418	0.0926	0.021
MU-4	Barium	Muscle	80	1.2	0	0.0	0.00614	0.587	6.90	54
MU-4	Barium	Whole	30	0.0	0	0.0	0.402	2.36	4.59	54
MU-4	Beryllium	Muscle	80	65	0	0.0	0.000505	0.00973	0.170	0.54
MU-4	Beryllium	Whole	30	53	0	0.0	0.00230	0.00294	0.00550	0.54
MU-4	Bismuth	Muscle	80	55	NA	NA	0.0000208	0.00923	0.170	NA
MU-4	Bismuth	Whole	30	67	NA	NA	0.000159	0.00221	0.00550	NA
MU-4	Boron	Muscle	80	60	0	0.0	0.00971	1.14	17.0	54
MU-4	Boron	Whole	30	63	0	0.0	0.0178	0.294	1.96	54
MU-4	Cadmium	Muscle	80	21	5	6.2	0.000464	0.0512	0.529	0.28
MU-4	Cadmium	Whole	30	0.0	3	10	0.0126	0.158	0.702	0.28
MU-4	Calcium	Muscle	52	0.0	NA	NA	65.2	1360	8250	NA
MU-4	Calcium	Whole	30	0.0	NA	NA	793	7780	21300	NA
MU-4	Cesium	Muscle	80	24	NA	NA	0.00256	0.00885	0.0840	NA
MU-4	Cesium	Whole	30	3.3	NA	NA	0.00169	0.00533	0.0146	NA
MU-4	Chromium	Muscle	80	3.8	0	0.0	0.0118	0.335	2.15	343
MU-4	Chromium	Whole	30	17	0	0.0	0.0134	0.0642	0.238	343
MU-4	Cobalt	Whole	30	0.0	7	23	0.0150	0.0689	0.378	0.082
MU-4	Cobalt	Muscle	80	8.8	20	25	0.00280	0.0753	1.35	0.082
MU-4	Copper	Muscle	80	0.0	0	0.0	0.0858	0.590	3.27	10.8
MU-4	Copper	Whole	30	0.0	0	0.0	0.516	0.957	2.09	10.8
MU-4	Gallium	Muscle	80	50	NA	NA	0.00147	0.0194	0.340	NA
MU-4	Gallium	Whole	30	40	NA	NA	0.00499	0.0116	0.0289	NA
MU-4	Iron	Whole	30	0.0	0	0.0	1.26	29.1	80.0	190
MU-4	Iron	Muscle	80	0.0	2	2.5	2.86	29.0	361	190
MU-4	Lead	Muscle	80	6.2	NA	NA	0.00160	0.104	1.15	NA
MU-4	Lead	Whole	30	23	NA	NA	0.00536	0.0231	0.130	NA
MU-4	Lithium	Whole	30	63	0	0.0	0.0261	0.0576	0.142	0.54
MU-4	Lithium	Muscle	80	49	1	1.2	0.00290	0.0910	1.70	0.54

Table A2-4: Summary Statistics for Fish Tissue Current Baseline Constituents

MU	Constituent	Tissue	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/kg ww)	Mean Concentration (mg/kg ww)	Maximum Concentration (mg/kg ww)	Tissue Guideline (mg/kg ww)
MU-4	Magnesium	Muscle	52	0.0	NA	NA	246	362	680	NA
MU-4	Magnesium	Whole	30	0.0	NA	NA	239	356	536	NA
MU-4	Manganese	Muscle	80	8.8	0	0.0	0.0330	0.622	6.20	38
MU-4	Manganese	Whole	30	0.0	0	0.0	0.135	2.73	12.0	38
MU-4	Mercury	Muscle	40	58	0	0.0	0.00523	0.0329	0.331	0.5
MU-4	Mercury	Whole	18	11	0	0.0	0.00675	0.0158	0.0438	0.5
MU-4	Molybdenum	Muscle	80	22	0	0.0	0.000995	0.0252	0.579	1.36
MU-4	Molybdenum	Whole	30	0.0	0	0.0	0.00646	0.0164	0.0351	1.36
MU-4	Nickel	Muscle	80	3.8	0	0.0	0.00267	0.298	3.67	5.4
MU-4	Nickel	Whole	30	6.7	0	0.0	0.0134	0.0910	0.729	5.4
MU-4	Phosphorus	Muscle	52	0.0	NA	NA	2290	3630	6150	NA
MU-4	Phosphorus	Whole	30	0.0	NA	NA	2550	4360	7600	NA
MU-4	Potassium	Muscle	52	0.0	NA	NA	3410	5440	10800	NA
MU-4	Potassium	Whole	30	0.0	NA	NA	3280	5340	13000	NA
MU-4	Rhenium	Muscle	80	69	NA	NA	0.00000761	0.00781	0.170	NA
MU-4	Rhenium	Whole	30	67	NA	NA	0.0000168	0.00207	0.00550	NA
MU-4	Rubidium	Muscle	80	0.0	NA	NA	0.277	2.17	4.24	NA
MU-4	Rubidium	Whole	30	0.0	NA	NA	0.665	1.16	1.85	NA
MU-4	Selenium	Muscle	80	0.0	9	11	0.200	2.41	13.9	3.6
MU-4	Selenium	Whole	30	0.0	9	30	1.02	4.20	14.9	3.6
MU-4	Silver	Muscle	35	11	0	0.0	0.0000606	0.000916	0.00286	1.36
MU-4	Silver	Whole	10	0.0	0	0.0	0.00484	0.0250	0.0404	1.36
MU-4	Sodium	Muscle	52	0.0	NA	NA	189	491	1130	NA
MU-4	Sodium	Whole	30	0.0	NA	NA	712	935	1510	NA
MU-4	Strontium	Muscle	80	5.0	0	0.0	0.0178	0.591	5.11	162
MU-4	Strontium	Whole	30	0.0	0	0.0	0.402	10.7	41.5	162
MU-4	Tellurium	Muscle	45	100	NA	NA	0.00434	0.0276	0.340	NA
MU-4	Tellurium	Whole	12	100	NA	NA	0.00514	0.00571	0.00796	NA
MU-4	Thallium	Muscle	80	2.5	NA	NA	0.00242	0.0224	0.0982	NA
MU-4	Thallium	Whole	30	0.0	NA	NA	0.00547	0.0145	0.111	NA
MU-4	Thorium	Muscle	80	51	NA	NA	0.00000847	0.00953	0.170	NA

Table A2-4: Summary Statistics for Fish Tissue Current Baseline Constituents

MU	Constituent	Tissue	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/kg ww)	Mean Concentration (mg/kg ww)	Maximum Concentration (mg/kg ww)	Tissue Guideline (mg/kg ww)
MU-4	Thorium	Whole	30	40	NA	NA	0.000532	0.00506	0.0159	NA
MU-4	Tin	Muscle	80	26	0	0.0	0.000121	0.0427	0.900	162
MU-4	Tin	Whole	30	3.3	0	0.0	0.000285	0.0215	0.0803	162
MU-4	Titanium	Muscle	80	2.5	NA	NA	0.0173	0.376	4.73	NA
MU-4	Titanium	Whole	30	3.3	NA	NA	0.0134	1.14	7.68	NA
MU-4	Uranium	Muscle	80	38	0	0.0	0.0000826	0.00269	0.0470	0.82
MU-4	Uranium	Whole	30	13	0	0.0	0.000536	0.00336	0.0115	0.82
MU-4	Vanadium	Muscle	80	7.5	0	0.0	0.00144	0.0949	1.34	1.36
MU-4	Vanadium	Whole	30	3.3	0	0.0	0.00536	0.114	0.358	1.36
MU-4	Yttrium	Muscle	80	35	NA	NA	0.0000438	0.0161	0.195	NA
MU-4	Yttrium	Whole	30	10	NA	NA	0.00194	0.0143	0.0435	NA
MU-4	Zinc	Muscle	80	18	0	0.0	1.50	11.2	62.0	82
MU-4	Zinc	Whole	30	0.0	1	3.3	3.40	31.8	82.1	82
MU-4	Zirconium	Muscle	80	51	NA	NA	0.000337	0.221	3.71	NA
MU-4	Zirconium	Whole	30	60	NA	NA	0.00803	0.0518	0.110	NA
MU-5	Aluminum	Muscle	33	0.0	0	0.0	0.0387	3.91	32.4	280
MU-5	Aluminum	Whole	18	11	0	0.0	0.354	31.2	224	280
MU-5	Antimony	Muscle	33	30	0	0.0	0.0000543	0.00478	0.0300	0.108
MU-5	Antimony	Whole	18	17	0	0.0	0.000346	0.00188	0.00482	0.108
MU-5	Arsenic	Muscle	33	12	10	30	0.00768	0.0195	0.0600	0.021
MU-5	Arsenic	Whole	18	0.0	8	44	0.0122	0.0345	0.110	0.021
MU-5	Barium	Muscle	33	0.0	0	0.0	0.00128	0.329	2.97	54
MU-5	Barium	Whole	18	0.0	0	0.0	0.0138	2.30	9.98	54
MU-5	Beryllium	Muscle	33	100	0	0.0	0.000527	0.00396	0.0300	0.54
MU-5	Beryllium	Whole	18	17	0	0.0	0.00176	0.00340	0.0116	0.54
MU-5	Bismuth	Muscle	33	33	NA	NA	0.0000174	0.00356	0.0300	NA
MU-5	Bismuth	Whole	18	44	NA	NA	0.000305	0.00119	0.00314	NA
MU-5	Boron	Muscle	33	67	0	0.0	0.0104	0.374	3.00	54
MU-5	Boron	Whole	18	33	0	0.0	0.0160	0.113	0.314	54
MU-5	Cadmium	Muscle	33	21	0	0.0	0.000737	0.00671	0.0300	0.28
MU-5	Cadmium	Whole	18	0.0	0	0.0	0.00226	0.0663	0.207	0.28

Table A2-4: Summary Statistics for Fish Tissue Current Baseline Constituents

MU	Constituent	Tissue	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/kg ww)	Mean Concentration (mg/kg ww)	Maximum Concentration (mg/kg ww)	Tissue Guideline (mg/kg ww)
MU-5	Calcium	Muscle	25	0.0	NA	NA	56.6	536	2350	NA
MU-5	Calcium	Whole	18	0.0	NA	NA	126	6950	13200	NA
MU-5	Cesium	Muscle	33	21	NA	NA	0.00179	0.00600	0.0213	NA
MU-5	Cesium	Whole	18	0.0	NA	NA	0.000957	0.00449	0.0218	NA
MU-5	Chromium	Muscle	33	0.0	0	0.0	0.0135	0.114	0.704	343
MU-5	Chromium	Whole	18	11	0	0.0	0.00985	0.0613	0.282	343
MU-5	Cobalt	Muscle	33	0.0	2	6.1	0.00190	0.0269	0.213	0.082
MU-5	Cobalt	Whole	18	0.0	5	28	0.00867	0.0420	0.128	0.082
MU-5	Copper	Muscle	33	0.0	0	0.0	0.251	0.481	2.38	10.8
MU-5	Copper	Whole	18	0.0	0	0.0	0.346	0.728	1.05	10.8
MU-5	Gallium	Muscle	33	24	NA	NA	0.00142	0.00844	0.0600	NA
MU-5	Gallium	Whole	18	17	NA	NA	0.00360	0.0114	0.0653	NA
MU-5	Iron	Muscle	33	0.0	0	0.0	2.86	16.6	113	190
MU-5	Iron	Whole	18	0.0	0	0.0	2.89	23.4	91.8	190
MU-5	Lead	Muscle	33	3.0	NA	NA	0.000567	0.0371	0.169	NA
MU-5	Lead	Whole	18	11	NA	NA	0.00350	0.0148	0.0651	NA
MU-5	Lithium	Muscle	33	24	0	0.0	0.00125	0.0407	0.300	0.54
MU-5	Lithium	Whole	18	11	0	0.0	0.00631	0.0305	0.120	0.54
MU-5	Magnesium	Muscle	25	0.0	NA	NA	240	309	440	NA
MU-5	Magnesium	Whole	18	0.0	NA	NA	228	331	415	NA
MU-5	Manganese	Muscle	33	0.0	0	0.0	0.103	0.311	1.15	38
MU-5	Manganese	Whole	18	0.0	0	0.0	0.0605	1.52	6.58	38
MU-5	Mercury	Muscle	8	88	0	0.0	0.0105	0.0382	0.130	0.5
MU-5	Mercury	Whole	8	0.0	0	0.0	0.00535	0.00813	0.0126	0.5
MU-5	Molybdenum	Muscle	33	12	0	0.0	0.000922	0.00878	0.0604	1.36
MU-5	Molybdenum	Whole	18	11	0	0.0	0.00394	0.0154	0.0248	1.36
MU-5	Nickel	Muscle	33	0.0	0	0.0	0.00165	0.214	2.25	5.4
MU-5	Nickel	Whole	18	0.0	0	0.0	0.0118	0.0586	0.154	5.4
MU-5	Phosphorus	Muscle	25	0.0	NA	NA	2240	2920	4360	NA
MU-5	Phosphorus	Whole	18	0.0	NA	NA	2440	3530	4990	NA
MU-5	Potassium	Muscle	25	0.0	NA	NA	4250	5020	7230	NA

Table A2-4: Summary Statistics for Fish Tissue Current Baseline Constituents

MU	Constituent	Tissue	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/kg ww)	Mean Concentration (mg/kg ww)	Maximum Concentration (mg/kg ww)	Tissue Guideline (mg/kg ww)
MU-5	Potassium	Whole	18	0.0	NA	NA	2390	5500	8520	NA
MU-5	Rhenium	Muscle	33	88	NA	NA	0.00000829	0.00323	0.0300	NA
MU-5	Rhenium	Whole	18	44	NA	NA	0.0000169	0.000948	0.00314	NA
MU-5	Rubidium	Muscle	33	0.0	NA	NA	0.685	1.62	4.70	NA
MU-5	Rubidium	Whole	18	0.0	NA	NA	0.551	1.03	1.75	NA
MU-5	Selenium	Muscle	33	0.0	0	0.0	0.749	1.87	3.12	3.6
MU-5	Selenium	Whole	18	0.0	0	0.0	0.853	2.25	3.35	3.6
MU-5	Silver	Muscle	25	52	0	0.0	0.0000622	0.000722	0.00413	1.36
MU-5	Silver	Whole	10	0.0	0	0.0	0.00319	0.00599	0.0159	1.36
MU-5	Sodium	Muscle	25	0.0	NA	NA	158	361	590	NA
MU-5	Sodium	Whole	18	0.0	NA	NA	508	809	1080	NA
MU-5	Strontium	Muscle	33	0.0	0	0.0	0.0142	0.410	1.66	162
MU-5	Strontium	Whole	18	0.0	0	0.0	0.0610	4.67	9.08	162
MU-5	Tellurium	Muscle	8	100	NA	NA	0.00789	0.0265	0.0600	NA
MU-5	Tellurium	Whole	8	100	NA	NA	0.00120	0.00422	0.00628	NA
MU-5	Thallium	Muscle	33	0.0	NA	NA	0.00224	0.0127	0.0395	NA
MU-5	Thallium	Whole	18	0.0	NA	NA	0.00149	0.00795	0.0178	NA
MU-5	Thorium	Muscle	33	39	NA	NA	0.00000869	0.00365	0.0300	NA
MU-5	Thorium	Whole	18	11	NA	NA	0.0000499	0.00669	0.0468	NA
MU-5	Tin	Muscle	33	33	0	0.0	0.000130	0.0192	0.173	162
MU-5	Tin	Whole	18	11	0	0.0	0.000228	0.0123	0.0613	162
MU-5	Titanium	Muscle	33	3.0	NA	NA	0.0196	0.105	0.419	NA
MU-5	Titanium	Whole	16	0.0	NA	NA	0.0362	0.235	0.954	NA
MU-5	Uranium	Muscle	33	30	0	0.0	0.0000286	0.000923	0.00600	0.82
MU-5	Uranium	Whole	18	11	0	0.0	0.000394	0.00275	0.0129	0.82
MU-5	Vanadium	Muscle	33	18	0	0.0	0.000429	0.0145	0.0823	1.36
MU-5	Vanadium	Whole	18	11	0	0.0	0.00468	0.123	0.636	1.36
MU-5	Yttrium	Muscle	33	27	NA	NA	0.0000210	0.00439	0.0300	NA
MU-5	Yttrium	Whole	18	11	NA	NA	0.000268	0.0194	0.113	NA
MU-5	Zinc	Muscle	33	21	0	0.0	2.81	5.69	15.0	82
MU-5	Zinc	Whole	18	0.0	0	0.0	3.73	20.8	29.7	82

Table A2-4: Summary Statistics for Fish Tissue Current Baseline Constituents

MU	Constituent	Tissue	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/kg ww)	Mean Concentration (mg/kg ww)	Maximum Concentration (mg/kg ww)	Tissue Guideline (mg/kg ww)
MU-5	Zirconium	Muscle	33	24	NA	NA	0.000237	0.0692	0.600	NA
MU-5	Zirconium	Whole	18	33	NA	NA	0.00112	0.0233	0.0675	NA
MU-6	Aluminum	Muscle	11	0.0	0	0.0	0.0713	2.62	13.1	280
MU-6	Antimony	Muscle	11	18	0	0.0	0.0000458	0.00118	0.00558	0.108
MU-6	Arsenic	Muscle	11	0.0	8	73	0.0110	0.0413	0.110	0.021
MU-6	Barium	Muscle	11	0.0	0	0.0	0.0158	0.0736	0.209	54
MU-6	Beryllium	Muscle	11	100	0	0.0	0.000524	0.00101	0.00232	0.54
MU-6	Bismuth	Muscle	11	0.0	NA	NA	0.0000378	0.000363	0.00241	NA
MU-6	Boron	Muscle	11	91	0	0.0	0.0104	0.0269	0.0665	54
MU-6	Cadmium	Muscle	11	0.0	0	0.0	0.000288	0.00251	0.0145	0.28
MU-6	Calcium	Muscle	11	0.0	NA	NA	106	255	519	NA
MU-6	Cesium	Muscle	11	0.0	NA	NA	0.00427	0.0122	0.0614	NA
MU-6	Chromium	Muscle	11	0.0	0	0.0	0.0160	0.0916	0.309	343
MU-6	Cobalt	Muscle	11	0.0	0	0.0	0.00345	0.00768	0.0169	0.082
MU-6	Copper	Muscle	11	0.0	0	0.0	0.210	0.296	0.415	10.8
MU-6	Gallium	Muscle	11	0.0	NA	NA	0.00168	0.00248	0.00610	NA
MU-6	Iron	Muscle	11	0.0	0	0.0	2.35	6.59	16.9	190
MU-6	Lead	Muscle	11	0.0	NA	NA	0.00337	0.0273	0.0883	NA
MU-6	Lithium	Muscle	11	0.0	0	0.0	0.00505	0.0152	0.0377	0.54
MU-6	Magnesium	Muscle	11	0.0	NA	NA	290	317	372	NA
MU-6	Manganese	Muscle	11	0.0	0	0.0	0.0878	0.180	0.338	38
MU-6	Mercury	Muscle	221	0.0	0	0.0	0.0164	0.109	0.401	0.5
MU-6	Molybdenum	Muscle	11	0.0	0	0.0	0.000856	0.00179	0.00369	1.36
MU-6	Nickel	Muscle	11	0.0	0	0.0	0.00200	0.0344	0.105	5.4
MU-6	Phosphorus	Muscle	11	0.0	NA	NA	2460	2830	3460	NA
MU-6	Potassium	Muscle	11	0.0	NA	NA	3990	5140	6080	NA
MU-6	Rhenium	Muscle	11	82	NA	NA	0.00000863	0.0000199	0.0000464	NA
MU-6	Rubidium	Muscle	11	0.0	NA	NA	1.20	2.17	3.34	NA
MU-6	Selenium	Muscle	287	0.0	16	5.6	0.267	1.11	6.00	3.6
MU-6	Silver	Muscle	11	100	0	0.0	0.0000648	0.000180	0.000515	1.36
MU-6	Sodium	Muscle	11	0.0	NA	NA	161	317	494	NA

Table A2-4: Summary Statistics for Fish Tissue Current Baseline Constituents

MU	Constituent	Tissue	Sample Size	Percent Not Detected	Samples Exceeding	Percent Exceeding	Minimum Concentration (mg/kg ww)	Mean Concentration (mg/kg ww)	Maximum Concentration (mg/kg ww)	Tissue Guideline (mg/kg ww)
MU-6	Strontium	Muscle	11	0.0	0	0.0	0.0374	0.143	0.286	162
MU-6	Thallium	Muscle	11	0.0	NA	NA	0.00334	0.00528	0.00985	NA
MU-6	Thorium	Muscle	11	9.1	NA	NA	0.00000917	0.000622	0.00349	NA
MU-6	Tin	Muscle	11	45	0	0.0	0.000130	0.00246	0.00928	162
MU-6	Titanium	Muscle	11	0.0	NA	NA	0.0179	0.132	0.489	NA
MU-6	Uranium	Muscle	11	9.1	0	0.0	0.0000285	0.000165	0.000550	0.82
MU-6	Vanadium	Muscle	11	0.0	0	0.0	0.00103	0.00742	0.0302	1.36
MU-6	Yttrium	Muscle	11	0.0	NA	NA	0.0000729	0.00129	0.00748	NA
MU-6	Zinc	Muscle	11	0.0	0	0.0	2.63	5.76	17.3	82
MU-6	Zirconium	Muscle	11	0.0	NA	NA	0.000188	0.00887	0.0464	NA

Notes:
NA = not available;
Means are calculated with values below the detection limit set as equal to the detection limit.

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-3	01-04	2/19/2014	Cadmium	T	0.00005	No	No	0.005
MU-3	01-05	2/19/2014	Cadmium	T	0.00005	No	No	0.005
MU-3	01-02	2/19/2014	Cadmium	T	0.00005	No	No	0.005
MU-3	01-03	2/19/2014	Cadmium	T	0.00005	No	No	0.005
MU-3	01-01	2/20/2014	Cadmium	T	0.00005	No	No	0.005
MU-3	01-06	3/4/2014	Cadmium	T	0.000012	Yes	No	0.005
MU-3	01-07	3/6/2014	Cadmium	T	0.000032	Yes	No	0.005
MU-3	02-05	3/6/2014	Cadmium	T	0.00001	No	No	0.005
MU-3	01-08	3/12/2014	Cadmium	T	0.00001	No	No	0.005
MU-3	02-15	3/18/2014	Cadmium	T	0.000011	Yes	No	0.005
MU-3	01-09	3/31/2014	Cadmium	T	0.00001	No	No	0.005
MU-3	02-24	3/31/2014	Cadmium	T	0.000023	Yes	No	0.005
MU-3	01-10	4/1/2014	Cadmium	T	0.00001	No	No	0.005
MU-3	01-04	2/19/2014	Calcium	T	69.4	Yes	NA	NA
MU-3	01-05	2/19/2014	Calcium	T	56.3	Yes	NA	NA
MU-3	01-02	2/19/2014	Calcium	T	61	Yes	NA	NA
MU-3	01-03	2/19/2014	Calcium	T	56	Yes	NA	NA
MU-3	01-01	2/20/2014	Calcium	T	60.7	Yes	NA	NA
MU-3	01-06	3/4/2014	Calcium	T	59.4	Yes	NA	NA
MU-3	01-07	3/6/2014	Calcium	T	102	Yes	NA	NA
MU-3	02-05	3/6/2014	Calcium	T	52.5	Yes	NA	NA
MU-3	01-08	3/12/2014	Calcium	T	62.8	Yes	NA	NA
MU-3	02-15	3/18/2014	Calcium	T	62.6	Yes	NA	NA
MU-3	01-09	3/31/2014	Calcium	T	56.4	Yes	NA	NA
MU-3	02-24	3/31/2014	Calcium	T	25.9	Yes	NA	NA
MU-3	01-10	4/1/2014	Calcium	T	55.7	Yes	NA	NA
MU-3	01-04	2/19/2014	Chloride	D	2.62	Yes	No	250
MU-3	01-05	2/19/2014	Chloride	D	2.05	Yes	No	250
MU-3	01-02	2/19/2014	Chloride	D	5.27	Yes	No	250
MU-3	01-03	2/19/2014	Chloride	D	0.7	Yes	No	250
MU-3	01-01	2/20/2014	Chloride	D	3.51	Yes	No	250
MU-3	01-06	3/4/2014	Chloride	D	0.67	Yes	No	250
MU-3	01-07	3/6/2014	Chloride	D	0.81	Yes	No	250
MU-3	02-05	3/6/2014	Chloride	D	0.5	No	No	250

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-3	01-08	3/12/2014	Chloride	D	0.5	No	No	250
MU-3	02-15	3/18/2014	Chloride	D	13.1	Yes	No	250
MU-3	01-09	3/31/2014	Chloride	D	0.52	Yes	No	250
MU-3	02-24	3/31/2014	Chloride	D	1.36	Yes	No	250
MU-3	01-10	4/1/2014	Chloride	D	0.5	No	No	250
MU-3	01-04	2/19/2014	Magnesium	T	20.3	Yes	No	100
MU-3	01-05	2/19/2014	Magnesium	T	13.7	Yes	No	100
MU-3	01-02	2/19/2014	Magnesium	T	16.2	Yes	No	100
MU-3	01-03	2/19/2014	Magnesium	T	13.4	Yes	No	100
MU-3	01-01	2/20/2014	Magnesium	T	15.2	Yes	No	100
MU-3	01-06	3/4/2014	Magnesium	T	15	Yes	No	100
MU-3	01-07	3/6/2014	Magnesium	T	36	Yes	No	100
MU-3	02-05	3/6/2014	Magnesium	T	12	Yes	No	100
MU-3	01-08	3/12/2014	Magnesium	T	23.9	Yes	No	100
MU-3	02-15	3/18/2014	Magnesium	T	18.4	Yes	No	100
MU-3	01-09	3/31/2014	Magnesium	T	13.4	Yes	No	100
MU-3	02-24	3/31/2014	Magnesium	T	3.96	Yes	No	100
MU-3	01-10	4/1/2014	Magnesium	T	16.6	Yes	No	100
MU-3	01-04	2/19/2014	Nitrate (as N)	D	0.005	No	No	10
MU-3	01-05	2/19/2014	Nitrate (as N)	D	0.339	Yes	No	10
MU-3	01-02	2/19/2014	Nitrate (as N)	D	0.313	Yes	No	10
MU-3	01-03	2/19/2014	Nitrate (as N)	D	0.427	Yes	No	10
MU-3	01-01	2/20/2014	Nitrate (as N)	D	0.306	Yes	No	10
MU-3	01-06	3/4/2014	Nitrate (as N)	D	0.385	Yes	No	10
MU-3	01-07	3/6/2014	Nitrate (as N)	D	0.358	Yes	No	10
MU-3	02-05	3/6/2014	Nitrate (as N)	D	0.126	Yes	No	10
MU-3	01-08	3/12/2014	Nitrate (as N)	D	0.005	No	No	10
MU-3	02-15	3/18/2014	Nitrate (as N)	D	0.005	No	No	10
MU-3	01-09	3/31/2014	Nitrate (as N)	D	0.498	Yes	No	10
MU-3	02-24	3/31/2014	Nitrate (as N)	D	0.005	No	No	10
MU-3	01-10	4/1/2014	Nitrate (as N)	D	0.215	Yes	No	10
MU-3	01-04	2/19/2014	Nitrite (as N)	D	0.001	No	No	1
MU-3	01-05	2/19/2014	Nitrite (as N)	D	0.001	No	No	1
MU-3	01-02	2/19/2014	Nitrite (as N)	D	0.001	No	No	1

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-3	01-03	2/19/2014	Nitrite (as N)	D	0.001	No	No	1
MU-3	01-01	2/20/2014	Nitrite (as N)	D	0.001	No	No	1
MU-3	01-06	3/4/2014	Nitrite (as N)	D	0.001	No	No	1
MU-3	01-07	3/6/2014	Nitrite (as N)	D	0.001	No	No	1
MU-3	02-05	3/6/2014	Nitrite (as N)	D	0.001	No	No	1
MU-3	01-08	3/12/2014	Nitrite (as N)	D	0.001	No	No	1
MU-3	02-15	3/18/2014	Nitrite (as N)	D	0.001	No	No	1
MU-3	01-09	3/31/2014	Nitrite (as N)	D	0.001	No	No	1
MU-3	02-24	3/31/2014	Nitrite (as N)	D	0.001	No	No	1
MU-3	01-10	4/1/2014	Nitrite (as N)	D	0.001	No	No	1
MU-3	01-04	2/19/2014	Potassium	T	2	No	NA	NA
MU-3	01-05	2/19/2014	Potassium	T	2	No	NA	NA
MU-3	01-02	2/19/2014	Potassium	T	2	No	NA	NA
MU-3	01-03	2/19/2014	Potassium	T	2	No	NA	NA
MU-3	01-01	2/20/2014	Potassium	T	2	No	NA	NA
MU-3	01-06	3/4/2014	Potassium	T	2	No	NA	NA
MU-3	01-07	3/6/2014	Potassium	T	2	No	NA	NA
MU-3	02-05	3/6/2014	Potassium	T	2	No	NA	NA
MU-3	01-08	3/12/2014	Potassium	T	2	No	NA	NA
MU-3	02-15	3/18/2014	Potassium	T	0.636	Yes	NA	NA
MU-3	01-09	3/31/2014	Potassium	T	2	No	NA	NA
MU-3	02-24	3/31/2014	Potassium	T	4.5	Yes	NA	NA
MU-3	01-10	4/1/2014	Potassium	T	2	No	NA	NA
MU-3	01-04	2/19/2014	Selenium	D	0.0001	No	No	0.01
MU-3	01-05	2/19/2014	Selenium	D	0.00179	Yes	No	0.01
MU-3	01-02	2/19/2014	Selenium	D	0.00195	Yes	No	0.01
MU-3	01-03	2/19/2014	Selenium	D	0.00294	Yes	No	0.01
MU-3	01-04	2/19/2014	Selenium	T	0.0001	No	No	0.01
MU-3	01-05	2/19/2014	Selenium	T	0.00168	Yes	No	0.01
MU-3	01-02	2/19/2014	Selenium	T	0.00189	Yes	No	0.01
MU-3	01-03	2/19/2014	Selenium	T	0.00268	Yes	No	0.01
MU-3	01-01	2/20/2014	Selenium	D	0.00192	Yes	No	0.01
MU-3	01-01	2/20/2014	Selenium	T	0.00169	Yes	No	0.01
MU-3	01-06	3/4/2014	Selenium	D	0.00234	Yes	No	0.01

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-3	01-06	3/4/2014	Selenium	T	0.00238	Yes	No	0.01
MU-3	01-07	3/6/2014	Selenium	D	0.00207	Yes	No	0.01
MU-3	02-05	3/6/2014	Selenium	D	0.00099	Yes	No	0.01
MU-3	01-07	3/6/2014	Selenium	T	0.0019	Yes	No	0.01
MU-3	02-05	3/6/2014	Selenium	T	0.001	Yes	No	0.01
MU-3	01-08	3/12/2014	Selenium	D	0.0001	No	No	0.01
MU-3	01-08	3/12/2014	Selenium	T	0.0001	No	No	0.01
MU-3	02-15	3/18/2014	Selenium	D	0.0001	No	No	0.01
MU-3	02-15	3/18/2014	Selenium	T	0.0001	No	No	0.01
MU-3	01-09	3/31/2014	Selenium	D	0.00262	Yes	No	0.01
MU-3	02-24	3/31/2014	Selenium	D	0.0001	No	No	0.01
MU-3	01-09	3/31/2014	Selenium	T	0.00249	Yes	No	0.01
MU-3	02-24	3/31/2014	Selenium	T	0.00011	Yes	No	0.01
MU-3	01-10	4/1/2014	Selenium	D	0.00162	Yes	No	0.01
MU-3	01-10	4/1/2014	Selenium	T	0.0016	Yes	No	0.01
MU-3	01-04	2/19/2014	Sodium	T	3.5	Yes	No	200
MU-3	01-05	2/19/2014	Sodium	T	2	No	No	200
MU-3	01-02	2/19/2014	Sodium	T	5.6	Yes	No	200
MU-3	01-03	2/19/2014	Sodium	T	2	No	No	200
MU-3	01-01	2/20/2014	Sodium	T	3.4	Yes	No	200
MU-3	01-06	3/4/2014	Sodium	T	2	No	No	200
MU-3	01-07	3/6/2014	Sodium	T	4.1	Yes	No	200
MU-3	02-05	3/6/2014	Sodium	T	2	No	No	200
MU-3	01-08	3/12/2014	Sodium	T	6.9	Yes	No	200
MU-3	02-15	3/18/2014	Sodium	T	2.22	Yes	No	200
MU-3	01-09	3/31/2014	Sodium	T	2	No	No	200
MU-3	02-24	3/31/2014	Sodium	T	2	No	No	200
MU-3	01-10	4/1/2014	Sodium	T	2	No	No	200
MU-3	01-04	2/19/2014	Sulphate	D	17.7	Yes	No	500
MU-3	01-05	2/19/2014	Sulphate	D	43	Yes	No	500
MU-3	01-02	2/19/2014	Sulphate	D	57.5	Yes	No	500
MU-3	01-03	2/19/2014	Sulphate	D	28.8	Yes	No	500
MU-3	01-01	2/20/2014	Sulphate	D	49.9	Yes	No	500
MU-3	01-06	3/4/2014	Sulphate	D	26	Yes	No	500

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-3	01-07	3/6/2014	Sulphate	D	69.9	Yes	No	500
MU-3	02-05	3/6/2014	Sulphate	D	15.3	Yes	No	500
MU-3	01-08	3/12/2014	Sulphate	D	29.3	Yes	No	500
MU-3	02-15	3/18/2014	Sulphate	D	9.62	Yes	No	500
MU-3	01-09	3/31/2014	Sulphate	D	31.6	Yes	No	500
MU-3	02-24	3/31/2014	Sulphate	D	0.5	No	No	500
MU-3	01-10	4/1/2014	Sulphate	D	27.2	Yes	No	500
MU-4	02-01	2/17/2014	Cadmium	T	0.00001	No	No	0.005
MU-4	02-02	2/17/2014	Cadmium	T	0.00001	No	No	0.005
MU-4	02-03	3/4/2014	Cadmium	T	0.00001	No	No	0.005
MU-4	02-04	3/4/2014	Cadmium	T	0.00001	No	No	0.005
MU-4	03-01	3/5/2014	Cadmium	T	0.000057	Yes	No	0.005
MU-4	03-02	3/11/2014	Cadmium	T	0.00001	No	No	0.005
MU-4	03-03	3/11/2014	Cadmium	T	0.00001	No	No	0.005
MU-4	02-06	3/12/2014	Cadmium	T	0.000012	Yes	No	0.005
MU-4	02-08	3/12/2014	Cadmium	T	0.000012	Yes	No	0.005
MU-4	02-09	3/13/2014	Cadmium	T	0.000155	Yes	No	0.005
MU-4	02-10	3/13/2014	Cadmium	T	0.000017	Yes	No	0.005
MU-4	02-11	3/13/2014	Cadmium	T	0.00001	No	No	0.005
MU-4	02-12	3/13/2014	Cadmium	T	0.00001	No	No	0.005
MU-4	02-13	3/13/2014	Cadmium	T	0.00001	No	No	0.005
MU-4	02-14	3/13/2014	Cadmium	T	0.000011	Yes	No	0.005
MU-4	02-17	3/18/2014	Cadmium	T	0.000018	Yes	No	0.005
MU-4	02-18	3/18/2014	Cadmium	T	0.000047	Yes	No	0.005
MU-4	02-19	3/18/2014	Cadmium	T	0.000015	Yes	No	0.005
MU-4	02-20	3/26/2014	Cadmium	T	0.000011	Yes	No	0.005
MU-4	02-21	3/26/2014	Cadmium	T	0.00001	No	No	0.005
MU-4	02-22	3/26/2014	Cadmium	T	0.00001	No	No	0.005
MU-4	02-23	3/26/2014	Cadmium	T	0.000024	Yes	No	0.005
MU-4	07-01	3/28/2014	Cadmium	T	0.000031	Yes	No	0.005
MU-4	07-02	3/28/2014	Cadmium	T	0.00001	No	No	0.005
MU-4	02-25	3/31/2014	Cadmium	T	0.00001	No	No	0.005
MU-4	02-26	3/31/2014	Cadmium	T	0.000016	Yes	No	0.005
MU-4	02-27	4/1/2014	Cadmium	T	0.00001	No	No	0.005

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-4	02-28	4/1/2014	Cadmium	T	0.00001	No	No	0.005
MU-4	02-30	4/15/2014	Cadmium	T	0.00001	No	No	0.005
MU-4	02-31	4/15/2014	Cadmium	T	0.000012	Yes	No	0.005
MU-4	02-32	4/15/2014	Cadmium	T	0.00001	No	No	0.005
MU-4	02-10	4/16/2014	Cadmium	T	0.00001	No	No	0.005
MU-4	02-17	4/24/2014	Cadmium	T	0.000108	Yes	No	0.005
MU-4	02-18	4/24/2014	Cadmium	T	0.000015	Yes	No	0.005
MU-4	02-20	4/24/2014	Cadmium	T	0.000014	Yes	No	0.005
MU-4	02-01	2/17/2014	Calcium	T	58.9	Yes	NA	NA
MU-4	02-02	2/17/2014	Calcium	T	58	Yes	NA	NA
MU-4	02-03	3/4/2014	Calcium	T	0.39	Yes	NA	NA
MU-4	02-04	3/4/2014	Calcium	T	73.2	Yes	NA	NA
MU-4	03-01	3/5/2014	Calcium	T	127	Yes	NA	NA
MU-4	03-02	3/11/2014	Calcium	T	60.8	Yes	NA	NA
MU-4	03-03	3/11/2014	Calcium	T	58.1	Yes	NA	NA
MU-4	02-06	3/12/2014	Calcium	T	71.8	Yes	NA	NA
MU-4	02-08	3/12/2014	Calcium	T	66.7	Yes	NA	NA
MU-4	02-09	3/13/2014	Calcium	T	72.8	Yes	NA	NA
MU-4	02-10	3/13/2014	Calcium	T	68.4	Yes	NA	NA
MU-4	02-11	3/13/2014	Calcium	T	71.6	Yes	NA	NA
MU-4	02-12	3/13/2014	Calcium	T	67	Yes	NA	NA
MU-4	02-13	3/13/2014	Calcium	T	63.4	Yes	NA	NA
MU-4	02-14	3/13/2014	Calcium	T	66.2	Yes	NA	NA
MU-4	02-17	3/18/2014	Calcium	T	70.8	Yes	NA	NA
MU-4	02-18	3/18/2014	Calcium	T	86.4	Yes	NA	NA
MU-4	02-19	3/18/2014	Calcium	T	68.5	Yes	NA	NA
MU-4	02-20	3/26/2014	Calcium	T	70.3	Yes	NA	NA
MU-4	02-21	3/26/2014	Calcium	T	62.2	Yes	NA	NA
MU-4	02-22	3/26/2014	Calcium	T	80.3	Yes	NA	NA
MU-4	02-23	3/26/2014	Calcium	T	87.7	Yes	NA	NA
MU-4	07-01	3/28/2014	Calcium	T	196	Yes	NA	NA
MU-4	07-02	3/28/2014	Calcium	T	58.5	Yes	NA	NA
MU-4	02-25	3/31/2014	Calcium	T	67.2	Yes	NA	NA
MU-4	02-26	3/31/2014	Calcium	T	63.1	Yes	NA	NA

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-4	02-27	4/1/2014	Calcium	T	77.3	Yes	NA	NA
MU-4	02-28	4/1/2014	Calcium	T	76.2	Yes	NA	NA
MU-4	02-30	4/15/2014	Calcium	T	70.7	Yes	NA	NA
MU-4	02-31	4/15/2014	Calcium	T	71.4	Yes	NA	NA
MU-4	02-32	4/15/2014	Calcium	T	69.6	Yes	NA	NA
MU-4	02-10	4/16/2014	Calcium	T	69.2	Yes	NA	NA
MU-4	02-17	4/24/2014	Calcium	T	76.5	Yes	NA	NA
MU-4	02-18	4/24/2014	Calcium	T	78.7	Yes	NA	NA
MU-4	02-20	4/24/2014	Calcium	T	73.1	Yes	NA	NA
MU-4	02-01	2/17/2014	Chloride	D	3.21	Yes	No	250
MU-4	02-02	2/17/2014	Chloride	D	2.97	Yes	No	250
MU-4	02-03	3/4/2014	Chloride	D	173	Yes	No	250
MU-4	02-04	3/4/2014	Chloride	D	9.9	Yes	No	250
MU-4	03-01	3/5/2014	Chloride	D	28.3	Yes	No	250
MU-4	03-02	3/11/2014	Chloride	D	4.81	Yes	No	250
MU-4	03-03	3/11/2014	Chloride	D	4.03	Yes	No	250
MU-4	02-06	3/12/2014	Chloride	D	2.57	Yes	No	250
MU-4	02-08	3/12/2014	Chloride	D	3.08	Yes	No	250
MU-4	02-09	3/13/2014	Chloride	D	3.3	Yes	No	250
MU-4	02-10	3/13/2014	Chloride	D	2.54	Yes	No	250
MU-4	02-11	3/13/2014	Chloride	D	10.3	Yes	No	250
MU-4	02-12	3/13/2014	Chloride	D	2.71	Yes	No	250
MU-4	02-13	3/13/2014	Chloride	D	2.04	Yes	No	250
MU-4	02-14	3/13/2014	Chloride	D	4.8	Yes	No	250
MU-4	02-17	3/18/2014	Chloride	D	2.73	Yes	No	250
MU-4	02-18	3/18/2014	Chloride	D	6.6	Yes	No	250
MU-4	02-19	3/18/2014	Chloride	D	3.62	Yes	No	250
MU-4	02-20	3/26/2014	Chloride	D	2.73	Yes	No	250
MU-4	02-21	3/26/2014	Chloride	D	4.02	Yes	No	250
MU-4	02-22	3/26/2014	Chloride	D	24.6	Yes	No	250
MU-4	02-23	3/26/2014	Chloride	D	24.8	Yes	No	250
MU-4	07-01	3/28/2014	Chloride	D	9.5	Yes	No	250
MU-4	07-02	3/28/2014	Chloride	D	13.5	Yes	No	250
MU-4	02-25	3/31/2014	Chloride	D	3.44	Yes	No	250

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-4	02-26	3/31/2014	Chloride	D	3.04	Yes	No	250
MU-4	02-27	4/1/2014	Chloride	D	12.1	Yes	No	250
MU-4	02-28	4/1/2014	Chloride	D	9.91	Yes	No	250
MU-4	02-30	4/15/2014	Chloride	D	6.37	Yes	No	250
MU-4	02-31	4/15/2014	Chloride	D	5.35	Yes	No	250
MU-4	02-32	4/15/2014	Chloride	D	3.67	Yes	No	250
MU-4	02-10	4/16/2014	Chloride	D	2.78	Yes	No	250
MU-4	02-17	4/24/2014	Chloride	D	3.04	Yes	No	250
MU-4	02-18	4/24/2014	Chloride	D	3.3	Yes	No	250
MU-4	02-20	4/24/2014	Chloride	D	3	Yes	No	250
MU-4	02-01	2/17/2014	Magnesium	T	17.6	Yes	No	100
MU-4	02-02	2/17/2014	Magnesium	T	18.6	Yes	No	100
MU-4	02-03	3/4/2014	Magnesium	T	0.1	No	No	100
MU-4	02-04	3/4/2014	Magnesium	T	23.9	Yes	No	100
MU-4	03-01	3/5/2014	Magnesium	T	34.6	Yes	No	100
MU-4	03-02	3/11/2014	Magnesium	T	18.1	Yes	No	100
MU-4	03-03	3/11/2014	Magnesium	T	17.2	Yes	No	100
MU-4	02-06	3/12/2014	Magnesium	T	18.3	Yes	No	100
MU-4	02-08	3/12/2014	Magnesium	T	17.6	Yes	No	100
MU-4	02-09	3/13/2014	Magnesium	T	24.6	Yes	No	100
MU-4	02-10	3/13/2014	Magnesium	T	18.3	Yes	No	100
MU-4	02-11	3/13/2014	Magnesium	T	19.1	Yes	No	100
MU-4	02-12	3/13/2014	Magnesium	T	18.9	Yes	No	100
MU-4	02-13	3/13/2014	Magnesium	T	18.3	Yes	No	100
MU-4	02-14	3/13/2014	Magnesium	T	19.7	Yes	No	100
MU-4	02-17	3/18/2014	Magnesium	T	18.9	Yes	No	100
MU-4	02-18	3/18/2014	Magnesium	T	24	Yes	No	100
MU-4	02-19	3/18/2014	Magnesium	T	19.2	Yes	No	100
MU-4	02-20	3/26/2014	Magnesium	T	20.5	Yes	No	100
MU-4	02-21	3/26/2014	Magnesium	T	19.3	Yes	No	100
MU-4	02-22	3/26/2014	Magnesium	T	21.2	Yes	No	100
MU-4	02-23	3/26/2014	Magnesium	T	20.8	Yes	No	100
MU-4	07-01	3/28/2014	Magnesium	T	77.4	Yes	No	100
MU-4	07-02	3/28/2014	Magnesium	T	16.7	Yes	No	100

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-4	02-25	3/31/2014	Magnesium	T	20.5	Yes	No	100
MU-4	02-26	3/31/2014	Magnesium	T	18.6	Yes	No	100
MU-4	02-27	4/1/2014	Magnesium	T	22.7	Yes	No	100
MU-4	02-28	4/1/2014	Magnesium	T	21.6	Yes	No	100
MU-4	02-30	4/15/2014	Magnesium	T	18.8	Yes	No	100
MU-4	02-31	4/15/2014	Magnesium	T	19.9	Yes	No	100
MU-4	02-32	4/15/2014	Magnesium	T	19.9	Yes	No	100
MU-4	02-10	4/16/2014	Magnesium	T	19	Yes	No	100
MU-4	02-17	4/24/2014	Magnesium	T	21.1	Yes	No	100
MU-4	02-18	4/24/2014	Magnesium	T	21.3	Yes	No	100
MU-4	02-20	4/24/2014	Magnesium	T	20.2	Yes	No	100
MU-4	02-01	2/17/2014	Nitrate (as N)	D	0.528	Yes	No	10
MU-4	02-02	2/17/2014	Nitrate (as N)	D	0.215	Yes	No	10
MU-4	02-03	3/4/2014	Nitrate (as N)	D	1.56	Yes	No	10
MU-4	02-04	3/4/2014	Nitrate (as N)	D	0.57	Yes	No	10
MU-4	03-01	3/5/2014	Nitrate (as N)	D	2.89	Yes	No	10
MU-4	03-02	3/11/2014	Nitrate (as N)	D	0.329	Yes	No	10
MU-4	03-03	3/11/2014	Nitrate (as N)	D	0.289	Yes	No	10
MU-4	02-06	3/12/2014	Nitrate (as N)	D	1.27	Yes	No	10
MU-4	02-08	3/12/2014	Nitrate (as N)	D	1.51	Yes	No	10
MU-4	02-09	3/13/2014	Nitrate (as N)	D	0.0546	Yes	No	10
MU-4	02-10	3/13/2014	Nitrate (as N)	D	2.33	Yes	No	10
MU-4	02-11	3/13/2014	Nitrate (as N)	D	0.274	Yes	No	10
MU-4	02-12	3/13/2014	Nitrate (as N)	D	0.325	Yes	No	10
MU-4	02-13	3/13/2014	Nitrate (as N)	D	0.227	Yes	No	10
MU-4	02-14	3/13/2014	Nitrate (as N)	D	0.348	Yes	No	10
MU-4	02-17	3/18/2014	Nitrate (as N)	D	3.74	Yes	No	10
MU-4	02-18	3/18/2014	Nitrate (as N)	D	2.51	Yes	No	10
MU-4	02-19	3/18/2014	Nitrate (as N)	D	0.162	Yes	No	10
MU-4	02-20	3/26/2014	Nitrate (as N)	D	3.36	Yes	No	10
MU-4	02-21	3/26/2014	Nitrate (as N)	D	0.248	Yes	No	10
MU-4	02-22	3/26/2014	Nitrate (as N)	D	2.79	Yes	No	10
MU-4	02-23	3/26/2014	Nitrate (as N)	D	4.58	Yes	No	10
MU-4	07-01	3/28/2014	Nitrate (as N)	D	3.99	Yes	No	10

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-4	07-02	3/28/2014	Nitrate (as N)	D	0.005	No	No	10
MU-4	02-25	3/31/2014	Nitrate (as N)	D	0.238	Yes	No	10
MU-4	02-26	3/31/2014	Nitrate (as N)	D	0.273	Yes	No	10
MU-4	02-27	4/1/2014	Nitrate (as N)	D	0.005	No	No	10
MU-4	02-28	4/1/2014	Nitrate (as N)	D	0.509	Yes	No	10
MU-4	02-30	4/15/2014	Nitrate (as N)	D	0.633	Yes	No	10
MU-4	02-31	4/15/2014	Nitrate (as N)	D	1.86	Yes	No	10
MU-4	02-32	4/15/2014	Nitrate (as N)	D	0.557	Yes	No	10
MU-4	02-10	4/16/2014	Nitrate (as N)	D	2.39	Yes	No	10
MU-4	02-17	4/24/2014	Nitrate (as N)	D	4.03	Yes	No	10
MU-4	02-18	4/24/2014	Nitrate (as N)	D	3.63	Yes	No	10
MU-4	02-20	4/24/2014	Nitrate (as N)	D	3.36	Yes	No	10
MU-4	02-01	2/17/2014	Nitrite (as N)	D	0.001	No	No	1
MU-4	02-02	2/17/2014	Nitrite (as N)	D	0.001	No	No	1
MU-4	02-03	3/4/2014	Nitrite (as N)	D	0.01	No	No	1
MU-4	02-04	3/4/2014	Nitrite (as N)	D	0.001	No	No	1
MU-4	03-01	3/5/2014	Nitrite (as N)	D	0.01	No	No	1
MU-4	03-02	3/11/2014	Nitrite (as N)	D	0.001	No	No	1
MU-4	03-03	3/11/2014	Nitrite (as N)	D	0.001	No	No	1
MU-4	02-06	3/12/2014	Nitrite (as N)	D	0.001	No	No	1
MU-4	02-08	3/12/2014	Nitrite (as N)	D	0.0032	Yes	No	1
MU-4	02-09	3/13/2014	Nitrite (as N)	D	0.0011	Yes	No	1
MU-4	02-10	3/13/2014	Nitrite (as N)	D	0.001	No	No	1
MU-4	02-11	3/13/2014	Nitrite (as N)	D	0.001	No	No	1
MU-4	02-12	3/13/2014	Nitrite (as N)	D	0.001	No	No	1
MU-4	02-13	3/13/2014	Nitrite (as N)	D	0.001	No	No	1
MU-4	02-14	3/13/2014	Nitrite (as N)	D	0.001	No	No	1
MU-4	02-17	3/18/2014	Nitrite (as N)	D	0.001	No	No	1
MU-4	02-18	3/18/2014	Nitrite (as N)	D	0.0074	Yes	No	1
MU-4	02-19	3/18/2014	Nitrite (as N)	D	0.001	No	No	1
MU-4	02-20	3/26/2014	Nitrite (as N)	D	0.0015	Yes	No	1
MU-4	02-21	3/26/2014	Nitrite (as N)	D	0.0027	Yes	No	1
MU-4	02-22	3/26/2014	Nitrite (as N)	D	0.001	No	No	1
MU-4	02-23	3/26/2014	Nitrite (as N)	D	0.001	No	No	1

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-4	07-01	3/28/2014	Nitrite (as N)	D	0.01	No	No	1
MU-4	07-02	3/28/2014	Nitrite (as N)	D	0.001	No	No	1
MU-4	02-25	3/31/2014	Nitrite (as N)	D	0.001	No	No	1
MU-4	02-26	3/31/2014	Nitrite (as N)	D	0.001	No	No	1
MU-4	02-27	4/1/2014	Nitrite (as N)	D	0.001	No	No	1
MU-4	02-28	4/1/2014	Nitrite (as N)	D	0.001	No	No	1
MU-4	02-30	4/15/2014	Nitrite (as N)	D	0.001	No	No	1
MU-4	02-31	4/15/2014	Nitrite (as N)	D	0.001	No	No	1
MU-4	02-32	4/15/2014	Nitrite (as N)	D	0.001	No	No	1
MU-4	02-10	4/16/2014	Nitrite (as N)	D	0.001	No	No	1
MU-4	02-17	4/24/2014	Nitrite (as N)	D	0.001	No	No	1
MU-4	02-18	4/24/2014	Nitrite (as N)	D	0.001	No	No	1
MU-4	02-20	4/24/2014	Nitrite (as N)	D	0.001	No	No	1
MU-4	02-01	2/17/2014	Potassium	T	0.589	Yes	NA	NA
MU-4	02-02	2/17/2014	Potassium	T	0.618	Yes	NA	NA
MU-4	02-03	3/4/2014	Potassium	T	2	No	NA	NA
MU-4	02-04	3/4/2014	Potassium	T	1.21	Yes	NA	NA
MU-4	03-01	3/5/2014	Potassium	T	3	Yes	NA	NA
MU-4	03-02	3/11/2014	Potassium	T	2	No	NA	NA
MU-4	03-03	3/11/2014	Potassium	T	2	No	NA	NA
MU-4	02-06	3/12/2014	Potassium	T	2	No	NA	NA
MU-4	02-08	3/12/2014	Potassium	T	2	No	NA	NA
MU-4	02-09	3/13/2014	Potassium	T	2	No	NA	NA
MU-4	02-10	3/13/2014	Potassium	T	2	No	NA	NA
MU-4	02-11	3/13/2014	Potassium	T	2	No	NA	NA
MU-4	02-12	3/13/2014	Potassium	T	2	No	NA	NA
MU-4	02-13	3/13/2014	Potassium	T	2	No	NA	NA
MU-4	02-14	3/13/2014	Potassium	T	2	No	NA	NA
MU-4	02-17	3/18/2014	Potassium	T	2	No	NA	NA
MU-4	02-18	3/18/2014	Potassium	T	4.9	Yes	NA	NA
MU-4	02-19	3/18/2014	Potassium	T	2	No	NA	NA
MU-4	02-20	3/26/2014	Potassium	T	2	No	NA	NA
MU-4	02-21	3/26/2014	Potassium	T	2	No	NA	NA
MU-4	02-22	3/26/2014	Potassium	T	2	No	NA	NA

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-4	02-23	3/26/2014	Potassium	T	2	No	NA	NA
MU-4	07-01	3/28/2014	Potassium	T	2	Yes	NA	NA
MU-4	07-02	3/28/2014	Potassium	T	2	No	NA	NA
MU-4	02-25	3/31/2014	Potassium	T	2	No	NA	NA
MU-4	02-26	3/31/2014	Potassium	T	2	No	NA	NA
MU-4	02-27	4/1/2014	Potassium	T	2	No	NA	NA
MU-4	02-28	4/1/2014	Potassium	T	2	No	NA	NA
MU-4	02-30	4/15/2014	Potassium	T	2	No	NA	NA
MU-4	02-31	4/15/2014	Potassium	T	2	No	NA	NA
MU-4	02-32	4/15/2014	Potassium	T	2	No	NA	NA
MU-4	02-10	4/16/2014	Potassium	T	2	No	NA	NA
MU-4	02-17	4/24/2014	Potassium	T	2	No	NA	NA
MU-4	02-18	4/24/2014	Potassium	T	2	No	NA	NA
MU-4	02-20	4/24/2014	Potassium	T	2	No	NA	NA
MU-4	02-01	2/17/2014	Selenium	D	0.00225	Yes	No	0.01
MU-4	02-02	2/17/2014	Selenium	D	0.00183	Yes	No	0.01
MU-4	02-01	2/17/2014	Selenium	T	0.00225	Yes	No	0.01
MU-4	02-02	2/17/2014	Selenium	T	0.00169	Yes	No	0.01
MU-4	02-03	3/4/2014	Selenium	D	0.00064	Yes	No	0.01
MU-4	02-04	3/4/2014	Selenium	D	0.00251	Yes	No	0.01
MU-4	02-03	3/4/2014	Selenium	T	0.00061	Yes	No	0.01
MU-4	02-04	3/4/2014	Selenium	T	0.00236	Yes	No	0.01
MU-4	03-01	3/5/2014	Selenium	D	0.00116	Yes	No	0.01
MU-4	03-01	3/5/2014	Selenium	T	0.00111	Yes	No	0.01
MU-4	03-02	3/11/2014	Selenium	D	0.00115	Yes	No	0.01
MU-4	03-03	3/11/2014	Selenium	D	0.0011	Yes	No	0.01
MU-4	03-02	3/11/2014	Selenium	T	0.00105	Yes	No	0.01
MU-4	03-03	3/11/2014	Selenium	T	0.00103	Yes	No	0.01
MU-4	02-06	3/12/2014	Selenium	D	0.00622	Yes	No	0.01
MU-4	02-08	3/12/2014	Selenium	D	0.00637	Yes	No	0.01
MU-4	02-06	3/12/2014	Selenium	T	0.00574	Yes	No	0.01
MU-4	02-08	3/12/2014	Selenium	T	0.00625	Yes	No	0.01
MU-4	02-09	3/13/2014	Selenium	D	0.00103	Yes	No	0.01
MU-4	02-10	3/13/2014	Selenium	D	0.00983	Yes	No	0.01

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-4	02-11	3/13/2014	Selenium	D	0.00245	Yes	No	0.01
MU-4	02-12	3/13/2014	Selenium	D	0.00217	Yes	No	0.01
MU-4	02-13	3/13/2014	Selenium	D	0.00139	Yes	No	0.01
MU-4	02-14	3/13/2014	Selenium	D	0.00111	Yes	No	0.01
MU-4	02-09	3/13/2014	Selenium	T	0.00121	Yes	No	0.01
MU-4	02-10	3/13/2014	Selenium	T	0.00902	Yes	No	0.01
MU-4	02-11	3/13/2014	Selenium	T	0.00228	Yes	No	0.01
MU-4	02-12	3/13/2014	Selenium	T	0.002	Yes	No	0.01
MU-4	02-13	3/13/2014	Selenium	T	0.00146	Yes	No	0.01
MU-4	02-14	3/13/2014	Selenium	T	0.00106	Yes	No	0.01
MU-4	02-17	3/18/2014	Selenium	D	0.0143	Yes	Yes	0.01
MU-4	02-18	3/18/2014	Selenium	D	0.00961	Yes	No	0.01
MU-4	02-19	3/18/2014	Selenium	D	0.00173	Yes	No	0.01
MU-4	02-17	3/18/2014	Selenium	T	0.0143	Yes	Yes	0.01
MU-4	02-18	3/18/2014	Selenium	T	0.01	Yes	No	0.01
MU-4	02-19	3/18/2014	Selenium	T	0.00169	Yes	No	0.01
MU-4	02-20	3/26/2014	Selenium	D	0.0133	Yes	Yes	0.01
MU-4	02-21	3/26/2014	Selenium	D	0.00177	Yes	No	0.01
MU-4	02-22	3/26/2014	Selenium	D	0.0071	Yes	No	0.01
MU-4	02-23	3/26/2014	Selenium	D	0.00493	Yes	No	0.01
MU-4	02-20	3/26/2014	Selenium	T	0.0133	Yes	Yes	0.01
MU-4	02-21	3/26/2014	Selenium	T	0.00162	Yes	No	0.01
MU-4	02-22	3/26/2014	Selenium	T	0.00691	Yes	No	0.01
MU-4	02-23	3/26/2014	Selenium	T	0.00487	Yes	No	0.01
MU-4	07-01	3/28/2014	Selenium	D	0.0102	Yes	Yes	0.01
MU-4	07-02	3/28/2014	Selenium	D	0.0001	No	No	0.01
MU-4	07-01	3/28/2014	Selenium	T	0.01	Yes	No	0.01
MU-4	07-02	3/28/2014	Selenium	T	0.0001	No	No	0.01
MU-4	02-25	3/31/2014	Selenium	D	0.00187	Yes	No	0.01
MU-4	02-26	3/31/2014	Selenium	D	0.00131	Yes	No	0.01
MU-4	02-25	3/31/2014	Selenium	T	0.00168	Yes	No	0.01
MU-4	02-26	3/31/2014	Selenium	T	0.0013	Yes	No	0.01
MU-4	02-27	4/1/2014	Selenium	D	0.0001	No	No	0.01
MU-4	02-28	4/1/2014	Selenium	D	0.00232	Yes	No	0.01

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-4	02-27	4/1/2014	Selenium	T	0.0001	No	No	0.01
MU-4	02-28	4/1/2014	Selenium	T	0.00218	Yes	No	0.01
MU-4	02-30	4/15/2014	Selenium	D	0.00132	Yes	No	0.01
MU-4	02-31	4/15/2014	Selenium	D	0.00156	Yes	No	0.01
MU-4	02-32	4/15/2014	Selenium	D	0.00207	Yes	No	0.01
MU-4	02-30	4/15/2014	Selenium	T	0.00115	Yes	No	0.01
MU-4	02-31	4/15/2014	Selenium	T	0.00141	Yes	No	0.01
MU-4	02-32	4/15/2014	Selenium	T	0.00197	Yes	No	0.01
MU-4	02-10	4/16/2014	Selenium	D	0.00989	Yes	No	0.01
MU-4	02-10	4/16/2014	Selenium	T	0.00889	Yes	No	0.01
MU-4	02-17	4/24/2014	Selenium	D	0.0156	Yes	Yes	0.01
MU-4	02-18	4/24/2014	Selenium	D	0.0138	Yes	Yes	0.01
MU-4	02-20	4/24/2014	Selenium	D	0.0134	Yes	Yes	0.01
MU-4	02-17	4/24/2014	Selenium	T	0.0152	Yes	Yes	0.01
MU-4	02-18	4/24/2014	Selenium	T	0.0132	Yes	Yes	0.01
MU-4	02-20	4/24/2014	Selenium	T	0.013	Yes	Yes	0.01
MU-4	02-01	2/17/2014	Sodium	T	2.09	Yes	No	200
MU-4	02-02	2/17/2014	Sodium	T	2.48	Yes	No	200
MU-4	02-03	3/4/2014	Sodium	T	288	Yes	Yes	200
MU-4	02-04	3/4/2014	Sodium	T	6.87	Yes	No	200
MU-4	03-01	3/5/2014	Sodium	T	20	Yes	No	200
MU-4	03-02	3/11/2014	Sodium	T	2.6	Yes	No	200
MU-4	03-03	3/11/2014	Sodium	T	2.5	Yes	No	200
MU-4	02-06	3/12/2014	Sodium	T	2.6	Yes	No	200
MU-4	02-08	3/12/2014	Sodium	T	2.8	Yes	No	200
MU-4	02-09	3/13/2014	Sodium	T	3.7	Yes	No	200
MU-4	02-10	3/13/2014	Sodium	T	2.8	Yes	No	200
MU-4	02-11	3/13/2014	Sodium	T	3.7	Yes	No	200
MU-4	02-12	3/13/2014	Sodium	T	2.5	Yes	No	200
MU-4	02-13	3/13/2014	Sodium	T	2	No	No	200
MU-4	02-14	3/13/2014	Sodium	T	2.5	Yes	No	200
MU-4	02-17	3/18/2014	Sodium	T	2.4	Yes	No	200
MU-4	02-18	3/18/2014	Sodium	T	3	Yes	No	200
MU-4	02-19	3/18/2014	Sodium	T	2.8	Yes	No	200

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-4	02-20	3/26/2014	Sodium	T	2.4	Yes	No	200
MU-4	02-21	3/26/2014	Sodium	T	4.2	Yes	No	200
MU-4	02-22	3/26/2014	Sodium	T	9.7	Yes	No	200
MU-4	02-23	3/26/2014	Sodium	T	14.3	Yes	No	200
MU-4	07-01	3/28/2014	Sodium	T	24.3	Yes	No	200
MU-4	07-02	3/28/2014	Sodium	T	25.6	Yes	No	200
MU-4	02-25	3/31/2014	Sodium	T	2.6	Yes	No	200
MU-4	02-26	3/31/2014	Sodium	T	2.5	Yes	No	200
MU-4	02-27	4/1/2014	Sodium	T	4.4	Yes	No	200
MU-4	02-28	4/1/2014	Sodium	T	6.3	Yes	No	200
MU-4	02-30	4/15/2014	Sodium	T	5.1	Yes	No	200
MU-4	02-31	4/15/2014	Sodium	T	3.4	Yes	No	200
MU-4	02-32	4/15/2014	Sodium	T	3	Yes	No	200
MU-4	02-10	4/16/2014	Sodium	T	2.4	Yes	No	200
MU-4	02-17	4/24/2014	Sodium	T	2.6	Yes	No	200
MU-4	02-18	4/24/2014	Sodium	T	2.7	Yes	No	200
MU-4	02-20	4/24/2014	Sodium	T	2.4	Yes	No	200
MU-4	02-01	2/17/2014	Sulphate	D	24.5	Yes	No	500
MU-4	02-02	2/17/2014	Sulphate	D	27.2	Yes	No	500
MU-4	02-03	3/4/2014	Sulphate	D	10.6	Yes	No	500
MU-4	02-04	3/4/2014	Sulphate	D	27.7	Yes	No	500
MU-4	03-01	3/5/2014	Sulphate	D	78	Yes	No	500
MU-4	03-02	3/11/2014	Sulphate	D	26.4	Yes	No	500
MU-4	03-03	3/11/2014	Sulphate	D	26.4	Yes	No	500
MU-4	02-06	3/12/2014	Sulphate	D	42.5	Yes	No	500
MU-4	02-08	3/12/2014	Sulphate	D	41.7	Yes	No	500
MU-4	02-09	3/13/2014	Sulphate	D	16.4	Yes	No	500
MU-4	02-10	3/13/2014	Sulphate	D	52.3	Yes	No	500
MU-4	02-11	3/13/2014	Sulphate	D	23.4	Yes	No	500
MU-4	02-12	3/13/2014	Sulphate	D	27.7	Yes	No	500
MU-4	02-13	3/13/2014	Sulphate	D	21.1	Yes	No	500
MU-4	02-14	3/13/2014	Sulphate	D	18.8	Yes	No	500
MU-4	02-17	3/18/2014	Sulphate	D	74.3	Yes	No	500
MU-4	02-18	3/18/2014	Sulphate	D	61.3	Yes	No	500

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-4	02-19	3/18/2014	Sulphate	D	23.5	Yes	No	500
MU-4	02-20	3/26/2014	Sulphate	D	68.6	Yes	No	500
MU-4	02-21	3/26/2014	Sulphate	D	25.8	Yes	No	500
MU-4	02-22	3/26/2014	Sulphate	D	46.1	Yes	No	500
MU-4	02-23	3/26/2014	Sulphate	D	35.8	Yes	No	500
MU-4	07-01	3/28/2014	Sulphate	D	550	Yes	Yes	500
MU-4	07-02	3/28/2014	Sulphate	D	0.5	No	No	500
MU-4	02-25	3/31/2014	Sulphate	D	26.4	Yes	No	500
MU-4	02-26	3/31/2014	Sulphate	D	18.7	Yes	No	500
MU-4	02-27	4/1/2014	Sulphate	D	18.6	Yes	No	500
MU-4	02-28	4/1/2014	Sulphate	D	30.1	Yes	No	500
MU-4	02-30	4/15/2014	Sulphate	D	18.4	Yes	No	500
MU-4	02-31	4/15/2014	Sulphate	D	22.2	Yes	No	500
MU-4	02-32	4/15/2014	Sulphate	D	23.4	Yes	No	500
MU-4	02-10	4/16/2014	Sulphate	D	53.9	Yes	No	500
MU-4	02-17	4/24/2014	Sulphate	D	81.2	Yes	No	500
MU-4	02-18	4/24/2014	Sulphate	D	74.8	Yes	No	500
MU-4	02-20	4/24/2014	Sulphate	D	71.3	Yes	No	500
MU-5	04-01	2/17/2014	Cadmium	T	0.00001	No	No	0.005
MU-5	04-02	2/17/2014	Cadmium	T	0.00001	No	No	0.005
MU-5	04-03	3/3/2014	Cadmium	T	0.000044	Yes	No	0.005
MU-5	05-01	3/3/2014	Cadmium	T	0.00001	No	No	0.005
MU-5	06-01	3/3/2014	Cadmium	T	0.00001	No	No	0.005
MU-5	06-02	3/3/2014	Cadmium	T	0.000031	Yes	No	0.005
MU-5	04-04	3/5/2014	Cadmium	T	0.000026	Yes	No	0.005
MU-5	04-05	3/5/2014	Cadmium	T	0.000023	Yes	No	0.005
MU-5	04-06	3/5/2014	Cadmium	T	0.000136	Yes	No	0.005
MU-5	05-02	3/7/2014	Cadmium	T	0.00001	No	No	0.005
MU-5	05-03	3/7/2014	Cadmium	T	0.00001	No	No	0.005
MU-5	06-04	3/7/2014	Cadmium	T	0.000017	Yes	No	0.005
MU-5	06-05	3/10/2014	Cadmium	T	0.000018	Yes	No	0.005
MU-5	06-06	3/10/2014	Cadmium	T	0.00003	Yes	No	0.005
MU-5	06-07	3/10/2014	Cadmium	T	0.00001	No	No	0.005
MU-5	03-04	3/11/2014	Cadmium	T	0.000011	Yes	No	0.005

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-5	06-08	3/11/2014	Cadmium	T	0.000011	Yes	No	0.005
MU-5	04-07	3/14/2014	Cadmium	T	0.00001	No	No	0.005
MU-5	04-08	3/14/2014	Cadmium	T	0.000017	Yes	No	0.005
MU-5	04-09	3/17/2014	Cadmium	T	0.00002	Yes	No	0.005
MU-5	05-04	3/17/2014	Cadmium	T	0.000018	Yes	No	0.005
MU-5	05-05	3/17/2014	Cadmium	T	0.00001	No	No	0.005
MU-5	06-09	3/17/2014	Cadmium	T	0.000016	Yes	No	0.005
MU-5	05-06	3/19/2014	Cadmium	T	0.00001	No	No	0.005
MU-5	05-07	3/19/2014	Cadmium	T	0.000042	Yes	No	0.005
MU-5	04-10	3/20/2014	Cadmium	T	0.000019	Yes	No	0.005
MU-5	04-11	3/20/2014	Cadmium	T	0.000037	Yes	No	0.005
MU-5	04-13	3/25/2014	Cadmium	T	0.00001	No	No	0.005
MU-5	04-14	3/25/2014	Cadmium	T	0.000013	Yes	No	0.005
MU-5	05-08	3/25/2014	Cadmium	T	0.000031	Yes	No	0.005
MU-5	05-09	3/25/2014	Cadmium	T	0.00003	Yes	No	0.005
MU-5	04-15	3/26/2014	Cadmium	T	0.000012	Yes	No	0.005
MU-5	04-16	3/27/2014	Cadmium	T	0.000024	Yes	No	0.005
MU-5	04-17	3/27/2014	Cadmium	T	0.000014	Yes	No	0.005
MU-5	04-18	3/27/2014	Cadmium	T	0.000028	Yes	No	0.005
MU-5	04-19	3/27/2014	Cadmium	T	0.000015	Yes	No	0.005
MU-5	04-20	3/27/2014	Cadmium	T	0.000032	Yes	No	0.005
MU-5	05-10	3/27/2014	Cadmium	T	0.000058	Yes	No	0.005
MU-5	05-11	3/27/2014	Cadmium	T	0.00001	No	No	0.005
MU-5	05-12	3/27/2014	Cadmium	T	0.00001	No	No	0.005
MU-5	06-10	4/2/2014	Cadmium	T	0.00002	No	No	0.005
MU-5	06-11	4/14/2014	Cadmium	T	0.000012	Yes	No	0.005
MU-5	06-12	4/14/2014	Cadmium	T	0.000022	Yes	No	0.005
MU-5	04-21	4/15/2014	Cadmium	T	0.000028	Yes	No	0.005
MU-5	04-22	4/15/2014	Cadmium	T	0.000406	Yes	No	0.005
MU-5	04-23	4/15/2014	Cadmium	T	0.00001	No	No	0.005
MU-5	05-14	4/16/2014	Cadmium	T	0.000017	Yes	No	0.005
MU-5	05-02	4/24/2014	Cadmium	T	0.000014	Yes	No	0.005
MU-5	06-05	4/24/2014	Cadmium	T	0.000011	Yes	No	0.005
MU-5	04-01	2/17/2014	Calcium	T	78.3	Yes	NA	NA

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-5	04-02	2/17/2014	Calcium	T	80.4	Yes	NA	NA
MU-5	04-03	3/3/2014	Calcium	T	64.2	Yes	NA	NA
MU-5	05-01	3/3/2014	Calcium	T	45.5	Yes	NA	NA
MU-5	06-01	3/3/2014	Calcium	T	56.4	Yes	NA	NA
MU-5	06-02	3/3/2014	Calcium	T	77.8	Yes	NA	NA
MU-5	04-04	3/5/2014	Calcium	T	85.5	Yes	NA	NA
MU-5	04-05	3/5/2014	Calcium	T	94.4	Yes	NA	NA
MU-5	04-06	3/5/2014	Calcium	T	107	Yes	NA	NA
MU-5	05-02	3/7/2014	Calcium	T	72.2	Yes	NA	NA
MU-5	05-03	3/7/2014	Calcium	T	0.111	Yes	NA	NA
MU-5	06-04	3/7/2014	Calcium	T	93.8	Yes	NA	NA
MU-5	06-05	3/10/2014	Calcium	T	74.1	Yes	NA	NA
MU-5	06-06	3/10/2014	Calcium	T	68.2	Yes	NA	NA
MU-5	06-07	3/10/2014	Calcium	T	72.4	Yes	NA	NA
MU-5	03-04	3/11/2014	Calcium	T	77.2	Yes	NA	NA
MU-5	06-08	3/11/2014	Calcium	T	66.1	Yes	NA	NA
MU-5	04-07	3/14/2014	Calcium	T	58.4	Yes	NA	NA
MU-5	04-08	3/14/2014	Calcium	T	67.8	Yes	NA	NA
MU-5	04-09	3/17/2014	Calcium	T	85.7	Yes	NA	NA
MU-5	05-04	3/17/2014	Calcium	T	76.9	Yes	NA	NA
MU-5	05-05	3/17/2014	Calcium	T	69.3	Yes	NA	NA
MU-5	06-09	3/17/2014	Calcium	T	72.7	Yes	NA	NA
MU-5	05-06	3/19/2014	Calcium	T	66.1	Yes	NA	NA
MU-5	05-07	3/19/2014	Calcium	T	105	Yes	NA	NA
MU-5	04-10	3/20/2014	Calcium	T	51.2	Yes	NA	NA
MU-5	04-11	3/20/2014	Calcium	T	88	Yes	NA	NA
MU-5	04-13	3/25/2014	Calcium	T	91.1	Yes	NA	NA
MU-5	04-14	3/25/2014	Calcium	T	102	Yes	NA	NA
MU-5	05-08	3/25/2014	Calcium	T	66.4	Yes	NA	NA
MU-5	05-09	3/25/2014	Calcium	T	112	Yes	NA	NA
MU-5	04-15	3/26/2014	Calcium	T	59.7	Yes	NA	NA
MU-5	04-16	3/27/2014	Calcium	T	72.7	Yes	NA	NA
MU-5	04-17	3/27/2014	Calcium	T	89.7	Yes	NA	NA
MU-5	04-18	3/27/2014	Calcium	T	70.8	Yes	NA	NA

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-5	04-19	3/27/2014	Calcium	T	74.2	Yes	NA	NA
MU-5	04-20	3/27/2014	Calcium	T	68.9	Yes	NA	NA
MU-5	05-10	3/27/2014	Calcium	T	28.6	Yes	NA	NA
MU-5	05-11	3/27/2014	Calcium	T	66.7	Yes	NA	NA
MU-5	05-12	3/27/2014	Calcium	T	46.1	Yes	NA	NA
MU-5	06-10	4/2/2014	Calcium	T	89.5	Yes	NA	NA
MU-5	06-11	4/14/2014	Calcium	T	70.4	Yes	NA	NA
MU-5	06-12	4/14/2014	Calcium	T	67	Yes	NA	NA
MU-5	04-21	4/15/2014	Calcium	T	81.5	Yes	NA	NA
MU-5	04-22	4/15/2014	Calcium	T	71.8	Yes	NA	NA
MU-5	04-23	4/15/2014	Calcium	T	66.9	Yes	NA	NA
MU-5	05-14	4/16/2014	Calcium	T	74.1	Yes	NA	NA
MU-5	05-02	4/24/2014	Calcium	T	74.1	Yes	NA	NA
MU-5	06-05	4/24/2014	Calcium	T	67.8	Yes	NA	NA
MU-5	04-01	2/17/2014	Chloride	D	21.6	Yes	No	250
MU-5	04-02	2/17/2014	Chloride	D	30.4	Yes	No	250
MU-5	04-03	3/3/2014	Chloride	D	3.23	Yes	No	250
MU-5	05-01	3/3/2014	Chloride	D	1.69	Yes	No	250
MU-5	06-01	3/3/2014	Chloride	D	7.69	Yes	No	250
MU-5	06-02	3/3/2014	Chloride	D	23	Yes	No	250
MU-5	04-04	3/5/2014	Chloride	D	17.2	Yes	No	250
MU-5	04-05	3/5/2014	Chloride	D	11.5	Yes	No	250
MU-5	04-06	3/5/2014	Chloride	D	36.8	Yes	No	250
MU-5	05-02	3/7/2014	Chloride	D	4.21	Yes	No	250
MU-5	05-03	3/7/2014	Chloride	D	2.42	Yes	No	250
MU-5	06-04	3/7/2014	Chloride	D	4.29	Yes	No	250
MU-5	06-05	3/10/2014	Chloride	D	3.67	Yes	No	250
MU-5	06-06	3/10/2014	Chloride	D	10	Yes	No	250
MU-5	06-07	3/10/2014	Chloride	D	5.41	Yes	No	250
MU-5	03-04	3/11/2014	Chloride	D	8.87	Yes	No	250
MU-5	06-08	3/11/2014	Chloride	D	2.61	Yes	No	250
MU-5	04-07	3/14/2014	Chloride	D	10.7	Yes	No	250
MU-5	04-08	3/14/2014	Chloride	D	24.9	Yes	No	250
MU-5	04-09	3/17/2014	Chloride	D	22.2	Yes	No	250

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-5	05-04	3/17/2014	Chloride	D	3.55	Yes	No	250
MU-5	05-05	3/17/2014	Chloride	D	12	Yes	No	250
MU-5	06-09	3/17/2014	Chloride	D	4.39	Yes	No	250
MU-5	05-06	3/19/2014	Chloride	D	2.7	Yes	No	250
MU-5	05-07	3/19/2014	Chloride	D	16.3	Yes	No	250
MU-5	04-10	3/20/2014	Chloride	D	4.65	Yes	No	250
MU-5	04-11	3/20/2014	Chloride	D	16.6	Yes	No	250
MU-5	04-13	3/25/2014	Chloride	D	7.35	Yes	No	250
MU-5	04-14	3/25/2014	Chloride	D	12.3	Yes	No	250
MU-5	05-08	3/25/2014	Chloride	D	24.7	Yes	No	250
MU-5	05-09	3/25/2014	Chloride	D	19.8	Yes	No	250
MU-5	04-15	3/26/2014	Chloride	D	3.6	Yes	No	250
MU-5	04-16	3/27/2014	Chloride	D	2.78	Yes	No	250
MU-5	04-17	3/27/2014	Chloride	D	6.05	Yes	No	250
MU-5	04-18	3/27/2014	Chloride	D	8.84	Yes	No	250
MU-5	04-19	3/27/2014	Chloride	D	12.7	Yes	No	250
MU-5	04-20	3/27/2014	Chloride	D	8.01	Yes	No	250
MU-5	05-10	3/27/2014	Chloride	D	4.87	Yes	No	250
MU-5	05-11	3/27/2014	Chloride	D	16	Yes	No	250
MU-5	05-12	3/27/2014	Chloride	D	30.2	Yes	No	250
MU-5	06-10	4/2/2014	Chloride	D	2.49	Yes	No	250
MU-5	06-11	4/14/2014	Chloride	D	5.22	Yes	No	250
MU-5	06-12	4/14/2014	Chloride	D	4.3	Yes	No	250
MU-5	04-21	4/15/2014	Chloride	D	9.59	Yes	No	250
MU-5	04-22	4/15/2014	Chloride	D	307	Yes	Yes	250
MU-5	04-23	4/15/2014	Chloride	D	5.55	Yes	No	250
MU-5	05-14	4/16/2014	Chloride	D	3.85	Yes	No	250
MU-5	05-02	4/24/2014	Chloride	D	5.28	Yes	No	250
MU-5	06-05	4/24/2014	Chloride	D	1.79	Yes	No	250
MU-5	04-01	2/17/2014	Magnesium	T	19.8	Yes	No	100
MU-5	04-02	2/17/2014	Magnesium	T	20.8	Yes	No	100
MU-5	04-03	3/3/2014	Magnesium	T	13.4	Yes	No	100
MU-5	05-01	3/3/2014	Magnesium	T	21.5	Yes	No	100
MU-5	06-01	3/3/2014	Magnesium	T	18.7	Yes	No	100

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-5	06-02	3/3/2014	Magnesium	T	15.8	Yes	No	100
MU-5	04-04	3/5/2014	Magnesium	T	19.8	Yes	No	100
MU-5	04-05	3/5/2014	Magnesium	T	22.3	Yes	No	100
MU-5	04-06	3/5/2014	Magnesium	T	24.9	Yes	No	100
MU-5	05-02	3/7/2014	Magnesium	T	17.3	Yes	No	100
MU-5	05-03	3/7/2014	Magnesium	T	0.1	No	No	100
MU-5	06-04	3/7/2014	Magnesium	T	16.4	Yes	No	100
MU-5	06-05	3/10/2014	Magnesium	T	18.6	Yes	No	100
MU-5	06-06	3/10/2014	Magnesium	T	16.2	Yes	No	100
MU-5	06-07	3/10/2014	Magnesium	T	16.4	Yes	No	100
MU-5	03-04	3/11/2014	Magnesium	T	22.8	Yes	No	100
MU-5	06-08	3/11/2014	Magnesium	T	15.3	Yes	No	100
MU-5	04-07	3/14/2014	Magnesium	T	20.8	Yes	No	100
MU-5	04-08	3/14/2014	Magnesium	T	32.1	Yes	No	100
MU-5	04-09	3/17/2014	Magnesium	T	21.6	Yes	No	100
MU-5	05-04	3/17/2014	Magnesium	T	15.5	Yes	No	100
MU-5	05-05	3/17/2014	Magnesium	T	20.8	Yes	No	100
MU-5	06-09	3/17/2014	Magnesium	T	15.9	Yes	No	100
MU-5	05-06	3/19/2014	Magnesium	T	20.7	Yes	No	100
MU-5	05-07	3/19/2014	Magnesium	T	18	Yes	No	100
MU-5	04-10	3/20/2014	Magnesium	T	13.9	Yes	No	100
MU-5	04-11	3/20/2014	Magnesium	T	16.8	Yes	No	100
MU-5	04-13	3/25/2014	Magnesium	T	20.3	Yes	No	100
MU-5	04-14	3/25/2014	Magnesium	T	21.4	Yes	No	100
MU-5	05-08	3/25/2014	Magnesium	T	9.86	Yes	No	100
MU-5	05-09	3/25/2014	Magnesium	T	14.4	Yes	No	100
MU-5	04-15	3/26/2014	Magnesium	T	17	Yes	No	100
MU-5	04-16	3/27/2014	Magnesium	T	15.4	Yes	No	100
MU-5	04-17	3/27/2014	Magnesium	T	13.9	Yes	No	100
MU-5	04-18	3/27/2014	Magnesium	T	14.9	Yes	No	100
MU-5	04-19	3/27/2014	Magnesium	T	13.3	Yes	No	100
MU-5	04-20	3/27/2014	Magnesium	T	14.4	Yes	No	100
MU-5	05-10	3/27/2014	Magnesium	T	4.75	Yes	No	100
MU-5	05-11	3/27/2014	Magnesium	T	22.9	Yes	No	100

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-5	05-12	3/27/2014	Magnesium	T	20.6	Yes	No	100
MU-5	06-10	4/2/2014	Magnesium	T	14.8	Yes	No	100
MU-5	06-11	4/14/2014	Magnesium	T	15.5	Yes	No	100
MU-5	06-12	4/14/2014	Magnesium	T	15.2	Yes	No	100
MU-5	04-21	4/15/2014	Magnesium	T	20.2	Yes	No	100
MU-5	04-22	4/15/2014	Magnesium	T	14	Yes	No	100
MU-5	04-23	4/15/2014	Magnesium	T	17.3	Yes	No	100
MU-5	05-14	4/16/2014	Magnesium	T	14.6	Yes	No	100
MU-5	05-02	4/24/2014	Magnesium	T	17.7	Yes	No	100
MU-5	06-05	4/24/2014	Magnesium	T	12.7	Yes	No	100
MU-5	04-01	2/17/2014	Nitrate (as N)	D	0.906	Yes	No	10
MU-5	04-02	2/17/2014	Nitrate (as N)	D	0.449	Yes	No	10
MU-5	04-03	3/3/2014	Nitrate (as N)	D	0.323	Yes	No	10
MU-5	05-01	3/3/2014	Nitrate (as N)	D	0.005	No	No	10
MU-5	06-01	3/3/2014	Nitrate (as N)	D	0.005	No	No	10
MU-5	06-02	3/3/2014	Nitrate (as N)	D	2.07	Yes	No	10
MU-5	04-04	3/5/2014	Nitrate (as N)	D	0.709	Yes	No	10
MU-5	04-05	3/5/2014	Nitrate (as N)	D	0.432	Yes	No	10
MU-5	04-06	3/5/2014	Nitrate (as N)	D	0.05	No	No	10
MU-5	05-02	3/7/2014	Nitrate (as N)	D	1.79	Yes	No	10
MU-5	05-03	3/7/2014	Nitrate (as N)	D	0.005	No	No	10
MU-5	06-04	3/7/2014	Nitrate (as N)	D	1.51	Yes	No	10
MU-5	06-05	3/10/2014	Nitrate (as N)	D	2.01	Yes	No	10
MU-5	06-06	3/10/2014	Nitrate (as N)	D	1.55	Yes	No	10
MU-5	06-07	3/10/2014	Nitrate (as N)	D	1.07	Yes	No	10
MU-5	03-04	3/11/2014	Nitrate (as N)	D	1.44	Yes	No	10
MU-5	06-08	3/11/2014	Nitrate (as N)	D	0.392	Yes	No	10
MU-5	04-07	3/14/2014	Nitrate (as N)	D	0.005	No	No	10
MU-5	04-08	3/14/2014	Nitrate (as N)	D	0.163	Yes	No	10
MU-5	04-09	3/17/2014	Nitrate (as N)	D	1.79	Yes	No	10
MU-5	05-04	3/17/2014	Nitrate (as N)	D	0.0756	Yes	No	10
MU-5	05-05	3/17/2014	Nitrate (as N)	D	0.005	No	No	10
MU-5	06-09	3/17/2014	Nitrate (as N)	D	1.3	Yes	No	10
MU-5	05-06	3/19/2014	Nitrate (as N)	D	0.005	No	No	10

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-5	05-07	3/19/2014	Nitrate (as N)	D	0.506	Yes	No	10
MU-5	04-10	3/20/2014	Nitrate (as N)	D	0.265	Yes	No	10
MU-5	04-11	3/20/2014	Nitrate (as N)	D	0.252	Yes	No	10
MU-5	04-13	3/25/2014	Nitrate (as N)	D	0.0684	Yes	No	10
MU-5	04-14	3/25/2014	Nitrate (as N)	D	0.318	Yes	No	10
MU-5	05-08	3/25/2014	Nitrate (as N)	D	0.947	Yes	No	10
MU-5	05-09	3/25/2014	Nitrate (as N)	D	0.0509	Yes	No	10
MU-5	04-15	3/26/2014	Nitrate (as N)	D	1.66	Yes	No	10
MU-5	04-16	3/27/2014	Nitrate (as N)	D	0.0169	Yes	No	10
MU-5	04-17	3/27/2014	Nitrate (as N)	D	0.43	Yes	No	10
MU-5	04-18	3/27/2014	Nitrate (as N)	D	0.378	Yes	No	10
MU-5	04-19	3/27/2014	Nitrate (as N)	D	0.512	Yes	No	10
MU-5	04-20	3/27/2014	Nitrate (as N)	D	0.301	Yes	No	10
MU-5	05-10	3/27/2014	Nitrate (as N)	D	0.585	Yes	No	10
MU-5	05-11	3/27/2014	Nitrate (as N)	D	0.0504	Yes	No	10
MU-5	05-12	3/27/2014	Nitrate (as N)	D	0.005	No	No	10
MU-5	06-10	4/2/2014	Nitrate (as N)	D	0.27	Yes	No	10
MU-5	06-11	4/14/2014	Nitrate (as N)	D	0.932	Yes	No	10
MU-5	06-12	4/14/2014	Nitrate (as N)	D	1.27	Yes	No	10
MU-5	04-21	4/15/2014	Nitrate (as N)	D	0.005	No	No	10
MU-5	04-22	4/15/2014	Nitrate (as N)	D	0.05	No	No	10
MU-5	04-23	4/15/2014	Nitrate (as N)	D	0.005	No	No	10
MU-5	05-14	4/16/2014	Nitrate (as N)	D	1.36	Yes	No	10
MU-5	05-02	4/24/2014	Nitrate (as N)	D	1.72	Yes	No	10
MU-5	06-05	4/24/2014	Nitrate (as N)	D	0.226	Yes	No	10
MU-5	04-01	2/17/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	04-02	2/17/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	04-03	3/3/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	05-01	3/3/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	06-01	3/3/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	06-02	3/3/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	04-04	3/5/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	04-05	3/5/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	04-06	3/5/2014	Nitrite (as N)	D	0.01	No	No	1

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-5	05-02	3/7/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	05-03	3/7/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	06-04	3/7/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	06-05	3/10/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	06-06	3/10/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	06-07	3/10/2014	Nitrite (as N)	D	0.0021	Yes	No	1
MU-5	03-04	3/11/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	06-08	3/11/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	04-07	3/14/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	04-08	3/14/2014	Nitrite (as N)	D	0.005	No	No	1
MU-5	04-09	3/17/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	05-04	3/17/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	05-05	3/17/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	06-09	3/17/2014	Nitrite (as N)	D	0.0053	Yes	No	1
MU-5	05-06	3/19/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	05-07	3/19/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	04-10	3/20/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	04-11	3/20/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	04-13	3/25/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	04-14	3/25/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	05-08	3/25/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	05-09	3/25/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	04-15	3/26/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	04-16	3/27/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	04-17	3/27/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	04-18	3/27/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	04-19	3/27/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	04-20	3/27/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	05-10	3/27/2014	Nitrite (as N)	D	0.0103	Yes	No	1
MU-5	05-11	3/27/2014	Nitrite (as N)	D	0.0011	Yes	No	1
MU-5	05-12	3/27/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	06-10	4/2/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	06-11	4/14/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	06-12	4/14/2014	Nitrite (as N)	D	0.001	No	No	1

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-5	04-21	4/15/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	04-22	4/15/2014	Nitrite (as N)	D	0.01	No	No	1
MU-5	04-23	4/15/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	05-14	4/16/2014	Nitrite (as N)	D	0.0017	Yes	No	1
MU-5	05-02	4/24/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	06-05	4/24/2014	Nitrite (as N)	D	0.001	No	No	1
MU-5	04-01	2/17/2014	Potassium	T	1.06	Yes	NA	NA
MU-5	04-02	2/17/2014	Potassium	T	1.15	Yes	NA	NA
MU-5	04-03	3/3/2014	Potassium	T	2	No	NA	NA
MU-5	05-01	3/3/2014	Potassium	T	2	No	NA	NA
MU-5	06-01	3/3/2014	Potassium	T	2	No	NA	NA
MU-5	06-02	3/3/2014	Potassium	T	2	No	NA	NA
MU-5	04-04	3/5/2014	Potassium	T	2	No	NA	NA
MU-5	04-05	3/5/2014	Potassium	T	2	No	NA	NA
MU-5	04-06	3/5/2014	Potassium	T	2	No	NA	NA
MU-5	05-02	3/7/2014	Potassium	T	2	No	NA	NA
MU-5	05-03	3/7/2014	Potassium	T	2	No	NA	NA
MU-5	06-04	3/7/2014	Potassium	T	2.8	Yes	NA	NA
MU-5	06-05	3/10/2014	Potassium	T	2	No	NA	NA
MU-5	06-06	3/10/2014	Potassium	T	2	No	NA	NA
MU-5	06-07	3/10/2014	Potassium	T	2	No	NA	NA
MU-5	03-04	3/11/2014	Potassium	T	2	No	NA	NA
MU-5	06-08	3/11/2014	Potassium	T	2	No	NA	NA
MU-5	04-07	3/14/2014	Potassium	T	2	No	NA	NA
MU-5	04-08	3/14/2014	Potassium	T	2	No	NA	NA
MU-5	04-09	3/17/2014	Potassium	T	2	No	NA	NA
MU-5	05-04	3/17/2014	Potassium	T	2	No	NA	NA
MU-5	05-05	3/17/2014	Potassium	T	2	No	NA	NA
MU-5	06-09	3/17/2014	Potassium	T	2	No	NA	NA
MU-5	05-06	3/19/2014	Potassium	T	2	No	NA	NA
MU-5	05-07	3/19/2014	Potassium	T	2	No	NA	NA
MU-5	04-10	3/20/2014	Potassium	T	2	No	NA	NA
MU-5	04-11	3/20/2014	Potassium	T	2.1	Yes	NA	NA
MU-5	04-13	3/25/2014	Potassium	T	2	No	NA	NA

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-5	04-14	3/25/2014	Potassium	T	2	No	NA	NA
MU-5	05-08	3/25/2014	Potassium	T	2	No	NA	NA
MU-5	05-09	3/25/2014	Potassium	T	2	No	NA	NA
MU-5	04-15	3/26/2014	Potassium	T	2	No	NA	NA
MU-5	04-16	3/27/2014	Potassium	T	2	No	NA	NA
MU-5	04-17	3/27/2014	Potassium	T	2	No	NA	NA
MU-5	04-18	3/27/2014	Potassium	T	2	No	NA	NA
MU-5	04-19	3/27/2014	Potassium	T	2	No	NA	NA
MU-5	04-20	3/27/2014	Potassium	T	2	No	NA	NA
MU-5	05-10	3/27/2014	Potassium	T	2	No	NA	NA
MU-5	05-11	3/27/2014	Potassium	T	2	No	NA	NA
MU-5	05-12	3/27/2014	Potassium	T	2	No	NA	NA
MU-5	06-10	4/2/2014	Potassium	T	2	No	NA	NA
MU-5	06-11	4/14/2014	Potassium	T	2	No	NA	NA
MU-5	06-12	4/14/2014	Potassium	T	2	No	NA	NA
MU-5	04-21	4/15/2014	Potassium	T	2	No	NA	NA
MU-5	04-22	4/15/2014	Potassium	T	3.5	Yes	NA	NA
MU-5	04-23	4/15/2014	Potassium	T	2	No	NA	NA
MU-5	05-14	4/16/2014	Potassium	T	2	No	NA	NA
MU-5	05-02	4/24/2014	Potassium	T	2	No	NA	NA
MU-5	06-05	4/24/2014	Potassium	T	2	No	NA	NA
MU-5	04-01	2/17/2014	Selenium	D	0.00463	Yes	No	0.01
MU-5	04-02	2/17/2014	Selenium	D	0.00386	Yes	No	0.01
MU-5	04-01	2/17/2014	Selenium	T	0.00445	Yes	No	0.01
MU-5	04-02	2/17/2014	Selenium	T	0.00393	Yes	No	0.01
MU-5	04-03	3/3/2014	Selenium	D	0.00106	Yes	No	0.01
MU-5	05-01	3/3/2014	Selenium	D	0.0001	No	No	0.01
MU-5	06-01	3/3/2014	Selenium	D	0.0001	No	No	0.01
MU-5	06-02	3/3/2014	Selenium	D	0.00396	Yes	No	0.01
MU-5	04-03	3/3/2014	Selenium	T	0.00103	Yes	No	0.01
MU-5	05-01	3/3/2014	Selenium	T	0.0001	No	No	0.01
MU-5	06-01	3/3/2014	Selenium	T	0.0001	No	No	0.01
MU-5	06-02	3/3/2014	Selenium	T	0.00331	Yes	No	0.01
MU-5	04-04	3/5/2014	Selenium	D	0.00394	Yes	No	0.01

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-5	04-05	3/5/2014	Selenium	D	0.00193	Yes	No	0.01
MU-5	04-06	3/5/2014	Selenium	D	0.0001	No	No	0.01
MU-5	04-04	3/5/2014	Selenium	T	0.00375	Yes	No	0.01
MU-5	04-05	3/5/2014	Selenium	T	0.00176	Yes	No	0.01
MU-5	04-06	3/5/2014	Selenium	T	0.00033	Yes	No	0.01
MU-5	05-02	3/7/2014	Selenium	D	0.00816	Yes	No	0.01
MU-5	05-03	3/7/2014	Selenium	D	0.0001	No	No	0.01
MU-5	06-04	3/7/2014	Selenium	D	0.00611	Yes	No	0.01
MU-5	05-02	3/7/2014	Selenium	T	0.00791	Yes	No	0.01
MU-5	05-03	3/7/2014	Selenium	T	0.0001	No	No	0.01
MU-5	06-04	3/7/2014	Selenium	T	0.00603	Yes	No	0.01
MU-5	06-05	3/10/2014	Selenium	D	0.00987	Yes	No	0.01
MU-5	06-06	3/10/2014	Selenium	D	0.00722	Yes	No	0.01
MU-5	06-07	3/10/2014	Selenium	D	0.00537	Yes	No	0.01
MU-5	06-05	3/10/2014	Selenium	T	0.00948	Yes	No	0.01
MU-5	06-06	3/10/2014	Selenium	T	0.0071	Yes	No	0.01
MU-5	06-07	3/10/2014	Selenium	T	0.00516	Yes	No	0.01
MU-5	03-04	3/11/2014	Selenium	D	0.0119	Yes	Yes	0.01
MU-5	06-08	3/11/2014	Selenium	D	0.00352	Yes	No	0.01
MU-5	03-04	3/11/2014	Selenium	T	0.0111	Yes	Yes	0.01
MU-5	06-08	3/11/2014	Selenium	T	0.00331	Yes	No	0.01
MU-5	04-07	3/14/2014	Selenium	D	0.0001	No	No	0.01
MU-5	04-08	3/14/2014	Selenium	D	0.00044	Yes	No	0.01
MU-5	04-07	3/14/2014	Selenium	T	0.0001	No	No	0.01
MU-5	04-08	3/14/2014	Selenium	T	0.0004	Yes	No	0.01
MU-5	04-09	3/17/2014	Selenium	D	0.0113	Yes	Yes	0.01
MU-5	05-04	3/17/2014	Selenium	D	0.0001	No	No	0.01
MU-5	05-05	3/17/2014	Selenium	D	0.0001	No	No	0.01
MU-5	06-09	3/17/2014	Selenium	D	0.00602	Yes	No	0.01
MU-5	04-09	3/17/2014	Selenium	T	0.0108	Yes	Yes	0.01
MU-5	05-04	3/17/2014	Selenium	T	0.0001	No	No	0.01
MU-5	05-05	3/17/2014	Selenium	T	0.0001	No	No	0.01
MU-5	06-09	3/17/2014	Selenium	T	0.00567	Yes	No	0.01
MU-5	05-06	3/19/2014	Selenium	D	0.0001	No	No	0.01

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-5	05-07	3/19/2014	Selenium	D	0.00093	Yes	No	0.01
MU-5	05-06	3/19/2014	Selenium	T	0.0001	No	No	0.01
MU-5	05-07	3/19/2014	Selenium	T	0.00077	Yes	No	0.01
MU-5	04-10	3/20/2014	Selenium	D	0.00217	Yes	No	0.01
MU-5	04-11	3/20/2014	Selenium	D	0.00096	Yes	No	0.01
MU-5	04-10	3/20/2014	Selenium	T	0.0019	Yes	No	0.01
MU-5	04-11	3/20/2014	Selenium	T	0.00087	Yes	No	0.01
MU-5	04-13	3/25/2014	Selenium	D	0.00053	Yes	No	0.01
MU-5	04-14	3/25/2014	Selenium	D	0.00089	Yes	No	0.01
MU-5	05-08	3/25/2014	Selenium	D	0.0006	Yes	No	0.01
MU-5	05-09	3/25/2014	Selenium	D	0.00041	Yes	No	0.01
MU-5	04-13	3/25/2014	Selenium	T	0.00051	Yes	No	0.01
MU-5	04-14	3/25/2014	Selenium	T	0.00083	Yes	No	0.01
MU-5	05-08	3/25/2014	Selenium	T	0.00057	Yes	No	0.01
MU-5	05-09	3/25/2014	Selenium	T	0.00031	Yes	No	0.01
MU-5	04-15	3/26/2014	Selenium	D	0.00788	Yes	No	0.01
MU-5	04-15	3/26/2014	Selenium	T	0.0077	Yes	No	0.01
MU-5	04-16	3/27/2014	Selenium	D	0.00032	Yes	No	0.01
MU-5	04-17	3/27/2014	Selenium	D	0.00013	Yes	No	0.01
MU-5	04-18	3/27/2014	Selenium	D	0.00249	Yes	No	0.01
MU-5	04-19	3/27/2014	Selenium	D	0.0004	Yes	No	0.01
MU-5	04-20	3/27/2014	Selenium	D	0.00115	Yes	No	0.01
MU-5	05-10	3/27/2014	Selenium	D	0.00114	Yes	No	0.01
MU-5	05-11	3/27/2014	Selenium	D	0.0001	No	No	0.01
MU-5	05-12	3/27/2014	Selenium	D	0.0001	No	No	0.01
MU-5	04-16	3/27/2014	Selenium	T	0.00029	Yes	No	0.01
MU-5	04-17	3/27/2014	Selenium	T	0.00012	Yes	No	0.01
MU-5	04-18	3/27/2014	Selenium	T	0.00249	Yes	No	0.01
MU-5	04-19	3/27/2014	Selenium	T	0.00044	Yes	No	0.01
MU-5	04-20	3/27/2014	Selenium	T	0.00111	Yes	No	0.01
MU-5	05-10	3/27/2014	Selenium	T	0.0011	Yes	No	0.01
MU-5	05-11	3/27/2014	Selenium	T	0.0001	No	No	0.01
MU-5	05-12	3/27/2014	Selenium	T	0.0001	No	No	0.01
MU-5	06-10	4/2/2014	Selenium	D	0.00055	Yes	No	0.01

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-5	06-10	4/2/2014	Selenium	T	0.00053	Yes	No	0.01
MU-5	06-11	4/14/2014	Selenium	D	0.0053	Yes	No	0.01
MU-5	06-12	4/14/2014	Selenium	D	0.00619	Yes	No	0.01
MU-5	06-11	4/14/2014	Selenium	T	0.00469	Yes	No	0.01
MU-5	06-12	4/14/2014	Selenium	T	0.00568	Yes	No	0.01
MU-5	04-21	4/15/2014	Selenium	D	0.0001	No	No	0.01
MU-5	04-22	4/15/2014	Selenium	D	0.00016	Yes	No	0.01
MU-5	04-23	4/15/2014	Selenium	D	0.0001	No	No	0.01
MU-5	04-21	4/15/2014	Selenium	T	0.0001	No	No	0.01
MU-5	04-22	4/15/2014	Selenium	T	0.00018	Yes	No	0.01
MU-5	04-23	4/15/2014	Selenium	T	0.0001	No	No	0.01
MU-5	05-14	4/16/2014	Selenium	D	0.00218	Yes	No	0.01
MU-5	05-14	4/16/2014	Selenium	T	0.0019	Yes	No	0.01
MU-5	05-02	4/24/2014	Selenium	D	0.00788	Yes	No	0.01
MU-5	06-05	4/24/2014	Selenium	D	0.00148	Yes	No	0.01
MU-5	05-02	4/24/2014	Selenium	T	0.00746	Yes	No	0.01
MU-5	06-05	4/24/2014	Selenium	T	0.00142	Yes	No	0.01
MU-5	04-01	2/17/2014	Sodium	T	13.7	Yes	No	200
MU-5	04-02	2/17/2014	Sodium	T	19	Yes	No	200
MU-5	04-03	3/3/2014	Sodium	T	4.7	Yes	No	200
MU-5	05-01	3/3/2014	Sodium	T	21.6	Yes	No	200
MU-5	06-01	3/3/2014	Sodium	T	30	Yes	No	200
MU-5	06-02	3/3/2014	Sodium	T	15.5	Yes	No	200
MU-5	04-04	3/5/2014	Sodium	T	15.1	Yes	No	200
MU-5	04-05	3/5/2014	Sodium	T	22	Yes	No	200
MU-5	04-06	3/5/2014	Sodium	T	28.2	Yes	No	200
MU-5	05-02	3/7/2014	Sodium	T	3.3	Yes	No	200
MU-5	05-03	3/7/2014	Sodium	T	103	Yes	No	200
MU-5	06-04	3/7/2014	Sodium	T	2.9	Yes	No	200
MU-5	06-05	3/10/2014	Sodium	T	3.6	Yes	No	200
MU-5	06-06	3/10/2014	Sodium	T	5.6	Yes	No	200
MU-5	06-07	3/10/2014	Sodium	T	4.8	Yes	No	200
MU-5	03-04	3/11/2014	Sodium	T	6.4	Yes	No	200
MU-5	06-08	3/11/2014	Sodium	T	3.9	Yes	No	200

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-5	04-07	3/14/2014	Sodium	T	22.6	Yes	No	200
MU-5	04-08	3/14/2014	Sodium	T	43.6	Yes	No	200
MU-5	04-09	3/17/2014	Sodium	T	8.2	Yes	No	200
MU-5	05-04	3/17/2014	Sodium	T	3.9	Yes	No	200
MU-5	05-05	3/17/2014	Sodium	T	9.1	Yes	No	200
MU-5	06-09	3/17/2014	Sodium	T	4.5	Yes	No	200
MU-5	05-06	3/19/2014	Sodium	T	8.7	Yes	No	200
MU-5	05-07	3/19/2014	Sodium	T	7.8	Yes	No	200
MU-5	04-10	3/20/2014	Sodium	T	3.7	Yes	No	200
MU-5	04-11	3/20/2014	Sodium	T	6.2	Yes	No	200
MU-5	04-13	3/25/2014	Sodium	T	5.9	Yes	No	200
MU-5	04-14	3/25/2014	Sodium	T	10.6	Yes	No	200
MU-5	05-08	3/25/2014	Sodium	T	9.6	Yes	No	200
MU-5	05-09	3/25/2014	Sodium	T	13.4	Yes	No	200
MU-5	04-15	3/26/2014	Sodium	T	3.3	Yes	No	200
MU-5	04-16	3/27/2014	Sodium	T	4.3	Yes	No	200
MU-5	04-17	3/27/2014	Sodium	T	5.8	Yes	No	200
MU-5	04-18	3/27/2014	Sodium	T	7.1	Yes	No	200
MU-5	04-19	3/27/2014	Sodium	T	9.3	Yes	No	200
MU-5	04-20	3/27/2014	Sodium	T	5	Yes	No	200
MU-5	05-10	3/27/2014	Sodium	T	2.5	Yes	No	200
MU-5	05-11	3/27/2014	Sodium	T	14.7	Yes	No	200
MU-5	05-12	3/27/2014	Sodium	T	37.3	Yes	No	200
MU-5	06-10	4/2/2014	Sodium	T	4.1	Yes	No	200
MU-5	06-11	4/14/2014	Sodium	T	4.7	Yes	No	200
MU-5	06-12	4/14/2014	Sodium	T	4.3	Yes	No	200
MU-5	04-21	4/15/2014	Sodium	T	7.6	Yes	No	200
MU-5	04-22	4/15/2014	Sodium	T	162	Yes	No	200
MU-5	04-23	4/15/2014	Sodium	T	6.8	Yes	No	200
MU-5	05-14	4/16/2014	Sodium	T	2.9	Yes	No	200
MU-5	05-02	4/24/2014	Sodium	T	3.2	Yes	No	200
MU-5	06-05	4/24/2014	Sodium	T	2	No	No	200
MU-5	04-01	2/17/2014	Sulphate	D	52.3	Yes	No	500
MU-5	04-02	2/17/2014	Sulphate	D	45.6	Yes	No	500

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-5	04-03	3/3/2014	Sulphate	D	8.53	Yes	No	500
MU-5	05-01	3/3/2014	Sulphate	D	13.3	Yes	No	500
MU-5	06-01	3/3/2014	Sulphate	D	61.6	Yes	No	500
MU-5	06-02	3/3/2014	Sulphate	D	36.8	Yes	No	500
MU-5	04-04	3/5/2014	Sulphate	D	46.1	Yes	No	500
MU-5	04-05	3/5/2014	Sulphate	D	42.3	Yes	No	500
MU-5	04-06	3/5/2014	Sulphate	D	25.8	Yes	No	500
MU-5	05-02	3/7/2014	Sulphate	D	56.7	Yes	No	500
MU-5	05-03	3/7/2014	Sulphate	D	12.7	Yes	No	500
MU-5	06-04	3/7/2014	Sulphate	D	42.5	Yes	No	500
MU-5	06-05	3/10/2014	Sulphate	D	68.4	Yes	No	500
MU-5	06-06	3/10/2014	Sulphate	D	52.2	Yes	No	500
MU-5	06-07	3/10/2014	Sulphate	D	43	Yes	No	500
MU-5	03-04	3/11/2014	Sulphate	D	88.7	Yes	No	500
MU-5	06-08	3/11/2014	Sulphate	D	45.2	Yes	No	500
MU-5	04-07	3/14/2014	Sulphate	D	51.7	Yes	No	500
MU-5	04-08	3/14/2014	Sulphate	D	114	Yes	No	500
MU-5	04-09	3/17/2014	Sulphate	D	65.5	Yes	No	500
MU-5	05-04	3/17/2014	Sulphate	D	11.4	Yes	No	500
MU-5	05-05	3/17/2014	Sulphate	D	16.1	Yes	No	500
MU-5	06-09	3/17/2014	Sulphate	D	42.5	Yes	No	500
MU-5	05-06	3/19/2014	Sulphate	D	14.7	Yes	No	500
MU-5	05-07	3/19/2014	Sulphate	D	9.43	Yes	No	500
MU-5	04-10	3/20/2014	Sulphate	D	13.9	Yes	No	500
MU-5	04-11	3/20/2014	Sulphate	D	10.4	Yes	No	500
MU-5	04-13	3/25/2014	Sulphate	D	30.1	Yes	No	500
MU-5	04-14	3/25/2014	Sulphate	D	112	Yes	No	500
MU-5	05-08	3/25/2014	Sulphate	D	4.33	Yes	No	500
MU-5	05-09	3/25/2014	Sulphate	D	6.31	Yes	No	500
MU-5	04-15	3/26/2014	Sulphate	D	50.8	Yes	No	500
MU-5	04-16	3/27/2014	Sulphate	D	8.28	Yes	No	500
MU-5	04-17	3/27/2014	Sulphate	D	5.99	Yes	No	500
MU-5	04-18	3/27/2014	Sulphate	D	22.7	Yes	No	500
MU-5	04-19	3/27/2014	Sulphate	D	7.78	Yes	No	500

Table A2-5: Data for Groundwater Current Baseline Constituents

MU	Sample Location	Sample Date	Constituent	Fraction	Concentration (mg/L)	Above Detection Limit	Exceedance	Guideline (mg/L)
MU-5	04-20	3/27/2014	Sulphate	D	9.22	Yes	No	500
MU-5	05-10	3/27/2014	Sulphate	D	8.83	Yes	No	500
MU-5	05-11	3/27/2014	Sulphate	D	17.8	Yes	No	500
MU-5	05-12	3/27/2014	Sulphate	D	15.1	Yes	No	500
MU-5	06-10	4/2/2014	Sulphate	D	4.64	Yes	No	500
MU-5	06-11	4/14/2014	Sulphate	D	41.2	Yes	No	500
MU-5	06-12	4/14/2014	Sulphate	D	41.2	Yes	No	500
MU-5	04-21	4/15/2014	Sulphate	D	11.3	Yes	No	500
MU-5	04-22	4/15/2014	Sulphate	D	5	No	No	500
MU-5	04-23	4/15/2014	Sulphate	D	25.6	Yes	No	500
MU-5	05-14	4/16/2014	Sulphate	D	15	Yes	No	500
MU-5	05-02	4/24/2014	Sulphate	D	54	Yes	No	500
MU-5	06-05	4/24/2014	Sulphate	D	13.1	Yes	No	500

Notes:
NA = not available

Table A2-6: Data for Groundwater Conventional Parameters

MU	Sample Location	Sample Date	Parameter	Concentration (mg/L)	Guideline Minimum (mg/L)	Guideline Maximum (mg/L)
MU-3	01-06	3/4/2014	Alkalinity	180	NA	NA
MU-3	01-02	2/19/2014	Alkalinity	157	NA	NA
MU-3	01-03	2/19/2014	Alkalinity	160	NA	NA
MU-3	01-08	3/12/2014	Alkalinity	220	NA	NA
MU-3	01-07	3/6/2014	Alkalinity	319	NA	NA
MU-3	01-01	2/20/2014	Alkalinity	157	NA	NA
MU-3	01-09	3/31/2014	Alkalinity	159	NA	NA
MU-3	02-05	3/6/2014	Alkalinity	160	NA	NA
MU-3	01-10	4/1/2014	Alkalinity	171	NA	NA
MU-3	01-05	2/19/2014	Alkalinity	155	NA	NA
MU-3	01-04	2/19/2014	Alkalinity	236	NA	NA
MU-3	02-24	3/31/2014	Alkalinity	73.9	NA	NA
MU-3	02-15	3/18/2014	Alkalinity	218	NA	NA
MU-3	01-10	4/1/2014	Hardness	194	80	100
MU-3	02-05	3/6/2014	Hardness	162	80	100
MU-3	01-08	3/12/2014	Hardness	238	80	100
MU-3	02-24	3/31/2014	Hardness	76.3	80	100
MU-3	01-03	2/19/2014	Hardness	195	80	100
MU-3	02-15	3/18/2014	Hardness	232	80	100
MU-3	01-02	2/19/2014	Hardness	193	80	100
MU-3	01-01	2/20/2014	Hardness	214	80	100
MU-3	01-09	3/31/2014	Hardness	182	80	100
MU-3	01-06	3/4/2014	Hardness	195	80	100
MU-3	01-05	2/19/2014	Hardness	179	80	100
MU-3	01-04	2/19/2014	Hardness	236	80	100
MU-3	01-07	3/6/2014	Hardness	366	80	100
MU-4	02-03	3/4/2014	Alkalinity	367	NA	NA
MU-4	02-09	3/13/2014	Alkalinity	260	NA	NA
MU-4	07-01	3/28/2014	Alkalinity	277	NA	NA
MU-4	02-10	3/13/2014	Alkalinity	184	NA	NA
MU-4	02-01	2/17/2014	Alkalinity	203	NA	NA
MU-4	02-25	3/31/2014	Alkalinity	218	NA	NA
MU-4	02-02	2/17/2014	Alkalinity	172	NA	NA
MU-4	02-26	3/31/2014	Alkalinity	211	NA	NA
MU-4	02-22	3/26/2014	Alkalinity	212	NA	NA
MU-4	02-28	4/1/2014	Alkalinity	238	NA	NA
MU-4	02-23	3/26/2014	Alkalinity	252	NA	NA
MU-4	02-04	3/4/2014	Alkalinity	246	NA	NA
MU-4	03-01	3/5/2014	Alkalinity	354	NA	NA
MU-4	03-02	3/11/2014	Alkalinity	186	NA	NA
MU-4	03-03	3/11/2014	Alkalinity	180	NA	NA
MU-4	02-06	3/12/2014	Alkalinity	194	NA	NA
MU-4	02-12	3/13/2014	Alkalinity	213	NA	NA
MU-4	07-02	3/28/2014	Alkalinity	247	NA	NA
MU-4	02-08	3/12/2014	Alkalinity	177	NA	NA
MU-4	02-11	3/13/2014	Alkalinity	210	NA	NA
MU-4	02-31	4/15/2014	Alkalinity	232	NA	NA

Table A2-6: Data for Groundwater Conventional Parameters

MU	Sample Location	Sample Date	Parameter	Concentration (mg/L)	Guideline Minimum (mg/L)	Guideline Maximum (mg/L)
MU-4	02-10	4/16/2014	Alkalinity	191	NA	NA
MU-4	02-27	4/1/2014	Alkalinity	245	NA	NA
MU-4	02-32	4/15/2014	Alkalinity	227	NA	NA
MU-4	02-13	3/13/2014	Alkalinity	194	NA	NA
MU-4	02-21	3/26/2014	Alkalinity	212	NA	NA
MU-4	02-17	3/18/2014	Alkalinity	157	NA	NA
MU-4	02-20	3/26/2014	Alkalinity	172	NA	NA
MU-4	02-20	4/24/2014	Alkalinity	163	NA	NA
MU-4	02-19	3/18/2014	Alkalinity	220	NA	NA
MU-4	02-14	3/13/2014	Alkalinity	216	NA	NA
MU-4	02-18	4/24/2014	Alkalinity	183	NA	NA
MU-4	02-17	4/24/2014	Alkalinity	164	NA	NA
MU-4	02-30	4/15/2014	Alkalinity	243	NA	NA
MU-4	02-18	3/18/2014	Alkalinity	238	NA	NA
MU-4	03-02	3/11/2014	Hardness	209	80	100
MU-4	03-03	3/11/2014	Hardness	205	80	100
MU-4	07-01	3/28/2014	Hardness	763	80	100
MU-4	07-02	3/28/2014	Hardness	202	80	100
MU-4	02-14	3/13/2014	Hardness	236	80	100
MU-4	02-17	4/24/2014	Hardness	278	80	100
MU-4	02-10	3/13/2014	Hardness	246	80	100
MU-4	02-10	4/16/2014	Hardness	238	80	100
MU-4	02-13	3/13/2014	Hardness	229	80	100
MU-4	02-11	3/13/2014	Hardness	258	80	100
MU-4	03-01	3/5/2014	Hardness	433	80	100
MU-4	02-23	3/26/2014	Hardness	305	80	100
MU-4	02-28	4/1/2014	Hardness	260	80	100
MU-4	02-21	3/26/2014	Hardness	235	80	100
MU-4	02-27	4/1/2014	Hardness	260	80	100
MU-4	02-26	3/31/2014	Hardness	234	80	100
MU-4	02-18	4/24/2014	Hardness	284	80	100
MU-4	02-25	3/31/2014	Hardness	252	80	100
MU-4	02-18	3/18/2014	Hardness	314	80	100
MU-4	02-19	3/18/2014	Hardness	250	80	100
MU-4	02-20	3/26/2014	Hardness	260	80	100
MU-4	02-20	4/24/2014	Hardness	265	80	100
MU-4	02-22	3/26/2014	Hardness	288	80	100
MU-4	02-17	3/18/2014	Hardness	242	80	100
MU-4	02-02	2/17/2014	Hardness	222	80	100
MU-4	02-04	3/4/2014	Hardness	281	80	100
MU-4	02-01	2/17/2014	Hardness	220	80	100
MU-4	02-30	4/15/2014	Hardness	244	80	100
MU-4	02-06	3/12/2014	Hardness	236	80	100
MU-4	02-03	3/4/2014	Hardness	1.29	80	100
MU-4	02-12	3/13/2014	Hardness	246	80	100
MU-4	02-08	3/12/2014	Hardness	226	80	100
MU-4	02-32	4/15/2014	Hardness	256	80	100

Table A2-6: Data for Groundwater Conventional Parameters

MU	Sample Location	Sample Date	Parameter	Concentration (mg/L)	Guideline Minimum (mg/L)	Guideline Maximum (mg/L)
MU-4	02-09	3/13/2014	Hardness	283	80	100
MU-4	02-31	4/15/2014	Hardness	260	80	100
MU-5	05-04	3/17/2014	Alkalinity	240	NA	NA
MU-5	05-03	3/7/2014	Alkalinity	212	NA	NA
MU-5	05-07	3/19/2014	Alkalinity	304	NA	NA
MU-5	06-09	3/17/2014	Alkalinity	194	NA	NA
MU-5	06-08	3/11/2014	Alkalinity	174	NA	NA
MU-5	06-07	3/10/2014	Alkalinity	196	NA	NA
MU-5	05-06	3/19/2014	Alkalinity	235	NA	NA
MU-5	06-10	4/2/2014	Alkalinity	276	NA	NA
MU-5	05-05	3/17/2014	Alkalinity	239	NA	NA
MU-5	05-08	3/25/2014	Alkalinity	183	NA	NA
MU-5	06-06	3/10/2014	Alkalinity	176	NA	NA
MU-5	05-02	4/24/2014	Alkalinity	184	NA	NA
MU-5	05-10	3/27/2014	Alkalinity	74.9	NA	NA
MU-5	06-05	4/24/2014	Alkalinity	197	NA	NA
MU-5	05-11	3/27/2014	Alkalinity	253	NA	NA
MU-5	06-05	3/10/2014	Alkalinity	187	NA	NA
MU-5	05-12	3/27/2014	Alkalinity	227	NA	NA
MU-5	05-14	4/16/2014	Alkalinity	215	NA	NA
MU-5	06-01	3/3/2014	Alkalinity	199	NA	NA
MU-5	06-02	3/3/2014	Alkalinity	210	NA	NA
MU-5	06-04	3/7/2014	Alkalinity	241	NA	NA
MU-5	05-09	3/25/2014	Alkalinity	315	NA	NA
MU-5	06-11	4/14/2014	Alkalinity	198	NA	NA
MU-5	04-15	3/26/2014	Alkalinity	157	NA	NA
MU-5	04-07	3/14/2014	Alkalinity	206	NA	NA
MU-5	04-06	3/5/2014	Alkalinity	339	NA	NA
MU-5	04-10	3/20/2014	Alkalinity	173	NA	NA
MU-5	04-05	3/5/2014	Alkalinity	300	NA	NA
MU-5	04-04	3/5/2014	Alkalinity	253	NA	NA
MU-5	04-03	3/3/2014	Alkalinity	206	NA	NA
MU-5	04-11	3/20/2014	Alkalinity	271	NA	NA
MU-5	04-13	3/25/2014	Alkalinity	284	NA	NA
MU-5	06-12	4/14/2014	Alkalinity	191	NA	NA
MU-5	04-01	2/17/2014	Alkalinity	233	NA	NA
MU-5	04-23	4/15/2014	Alkalinity	220	NA	NA
MU-5	03-04	3/11/2014	Alkalinity	188	NA	NA
MU-5	05-02	3/7/2014	Alkalinity	179	NA	NA
MU-5	04-02	2/17/2014	Alkalinity	249	NA	NA
MU-5	04-16	3/27/2014	Alkalinity	233	NA	NA
MU-5	04-17	3/27/2014	Alkalinity	272	NA	NA
MU-5	04-18	3/27/2014	Alkalinity	208	NA	NA
MU-5	04-19	3/27/2014	Alkalinity	227	NA	NA
MU-5	04-20	3/27/2014	Alkalinity	215	NA	NA
MU-5	04-21	4/15/2014	Alkalinity	288	NA	NA
MU-5	04-08	3/14/2014	Alkalinity	232	NA	NA

Table A2-6: Data for Groundwater Conventional Parameters

MU	Sample Location	Sample Date	Parameter	Concentration (mg/L)	Guideline Minimum (mg/L)	Guideline Maximum (mg/L)
MU-5	04-22	4/15/2014	Alkalinity	193	NA	NA
MU-5	04-09	3/17/2014	Alkalinity	205	NA	NA
MU-5	05-01	3/3/2014	Alkalinity	228	NA	NA
MU-5	04-14	3/25/2014	Alkalinity	225	NA	NA
MU-5	06-02	3/3/2014	Hardness	249	80	100
MU-5	05-04	3/17/2014	Hardness	238	80	100
MU-5	05-05	3/17/2014	Hardness	246	80	100
MU-5	05-06	3/19/2014	Hardness	222	80	100
MU-5	05-07	3/19/2014	Hardness	321	80	100
MU-5	05-08	3/25/2014	Hardness	193	80	100
MU-5	05-09	3/25/2014	Hardness	322	80	100
MU-5	05-10	3/27/2014	Hardness	84.6	80	100
MU-5	05-11	3/27/2014	Hardness	243	80	100
MU-5	05-12	3/27/2014	Hardness	178	80	100
MU-5	04-01	2/17/2014	Hardness	277	80	100
MU-5	06-01	3/3/2014	Hardness	208	80	100
MU-5	05-02	3/7/2014	Hardness	230	80	100
MU-5	06-04	3/7/2014	Hardness	279	80	100
MU-5	06-05	4/24/2014	Hardness	222	80	100
MU-5	06-05	3/10/2014	Hardness	262	80	100
MU-5	06-06	3/10/2014	Hardness	237	80	100
MU-5	06-07	3/10/2014	Hardness	248	80	100
MU-5	06-08	3/11/2014	Hardness	205	80	100
MU-5	06-09	3/17/2014	Hardness	236	80	100
MU-5	06-10	4/2/2014	Hardness	284	80	100
MU-5	06-11	4/14/2014	Hardness	229	80	100
MU-5	06-12	4/14/2014	Hardness	221	80	100
MU-5	05-14	4/16/2014	Hardness	226	80	100
MU-5	04-15	3/26/2014	Hardness	219	80	100
MU-5	04-02	2/17/2014	Hardness	286	80	100
MU-5	04-03	3/3/2014	Hardness	201	80	100
MU-5	04-04	3/5/2014	Hardness	257	80	100
MU-5	04-05	3/5/2014	Hardness	316	80	100
MU-5	04-06	3/5/2014	Hardness	347	80	100
MU-5	04-07	3/14/2014	Hardness	226	80	100
MU-5	04-08	3/14/2014	Hardness	289	80	100
MU-5	04-09	3/17/2014	Hardness	267	80	100
MU-5	04-10	3/20/2014	Hardness	182	80	100
MU-5	04-11	3/20/2014	Hardness	279	80	100
MU-5	05-03	3/7/2014	Hardness	0.51	80	100
MU-5	04-14	3/25/2014	Hardness	338	80	100
MU-5	05-02	4/24/2014	Hardness	258	80	100
MU-5	04-16	3/27/2014	Hardness	217	80	100
MU-5	04-17	3/27/2014	Hardness	253	80	100
MU-5	04-18	3/27/2014	Hardness	215	80	100
MU-5	04-19	3/27/2014	Hardness	214	80	100
MU-5	04-20	3/27/2014	Hardness	210	80	100

Table A2-6: Data for Groundwater Conventional Parameters

MU	Sample Location	Sample Date	Parameter	Concentration (mg/L)	Guideline Minimum (mg/L)	Guideline Maximum (mg/L)
MU-5	04-21	4/15/2014	Hardness	282	80	100
MU-5	04-22	4/15/2014	Hardness	228	80	100
MU-5	04-23	4/15/2014	Hardness	238	80	100
MU-5	05-01	3/3/2014	Hardness	193	80	100
MU-5	03-04	3/11/2014	Hardness	268	80	100
MU-5	04-13	3/25/2014	Hardness	298	80	100

Notes:
NA = not available

Table A2-7: Summary Statistics for Surface Water Reference Data

Constituent	Fraction	Percent Not Detected	Minimum Concentration (mg/L)	Mean Concentration (mg/L)	Maximum Concentration (mg/L)
Acenaphthene	T	100	0.00001	0.0000100	0.00001
Aluminum	D	61	0.0027	0.00880	0.276
Aluminum	T	4.8	0.003	0.127	2.58
Anthracene	T	100	0.00001	0.0000100	0.00001
Antimony	D	75	0.000035	0.000108	0.00056
Antimony	T	72	0.000038	0.000112	0.00057
Arsenic	D	36	0.0001	0.000176	0.00056
Arsenic	T	19	0.0001	0.000239	0.00226
Barium	D	0.0	0.00559	0.0718	0.313
Barium	T	0.0	0.007	0.0730	0.307
Benzo(a)anthracene	T	100	0.00001	0.0000100	0.00001
Benzo(a)pyrene	T	100	0.00001	0.0000100	0.00001
Beryllium	D	94	0.000001	0.000142	0.0005
Beryllium	T	92	0.000002	0.000143	0.0005
Bismuth	D	99	0.000001	0.000469	0.0005
Bismuth	T	95	0.000001	0.000471	0.0005
Boron	D	61	0.0009	0.0125	0.048
Boron	T	48	0.0012	0.0133	0.051
Bromide	D	100	0.05	0.0526	1
Cadmium	D	53	0.000002	0.0000163	0.00051
Cadmium	T	28	0.000006	0.0000299	0.000527
Calcium	D	0.0	10.2	43.4	91.2
Calcium	T	0.0	10.3	43.9	78.1
Chloride	D	51	0.5	1.37	10
Chromium, total	D	27	0.00004	0.000176	0.00052
Chromium, total	T	6.4	0.0001	0.000395	0.00336
Cobalt	D	94	0.00002	0.0000963	0.00027
Cobalt	T	79	0.000029	0.000147	0.00352
Copper	D	94	0.00022	0.000524	0.00446
Copper	T	65	0.00019	0.000790	0.0169
Fluoranthene	T	100	0.00001	0.0000100	0.00001
Fluorene	T	100	0.00001	0.0000100	0.00001
Fluoride	D	0.34	0.025	0.161	0.427
Iron	D	90	0.0037	0.0303	0.177
Iron	T	51	0.03	0.161	5.42
Lead	D	93	0.000005	0.0000490	0.000153
Lead	T	64	0.000045	0.000162	0.0101
Lithium	D	13	0.0005	0.00462	0.0231
Lithium	T	12	0.0005	0.00467	0.0209
Magnesium	D	0.0	3.51	12.5	38.1
Magnesium	T	0.0	3.54	12.5	28.5
Manganese	D	13	0.00005	0.000969	0.0166
Manganese	T	5.3	0.00001	0.00642	0.428
Mercury	D	100	0.00001	0.0000101	0.00005
Mercury	T	98	0.00001	0.0000202	0.00211
Molybdenum	D	0.0	0.000236	0.000772	0.00268
Molybdenum	T	0.0	0.000254	0.000796	0.00271

Table A2-7: Summary Statistics for Surface Water Reference Data

Constituent	Fraction	Percent Not Detected	Minimum Concentration (mg/L)	Mean Concentration (mg/L)	Maximum Concentration (mg/L)
Naphthalene	T	100	0.00005	0.0000500	0.00005
Nickel	D	77	0.00009	0.000525	0.0101
Nickel	T	65	0.00014	0.000718	0.0109
Nitrate (as N)	T	14	0.005	0.136	5.34
Nitrite (as N)	T	96	0.001	0.00124	0.05
Phenanthrene	T	100	0.00002	0.0000200	0.00002
Phosphate	D	14	0.001	0.0302	0.3
Phosphate	T	15	0.002	0.0178	0.298
Phosphorus	D	100	0.3	0.300	0.3
Phosphorus	T	63	0.002	0.192	0.54
Potassium	D	90	0.384	1.87	2
Potassium	T	97	0.444	1.96	2.1
Pyrene	T	100	0.00001	0.0000100	0.00001
Selenium	D	0.96	0.00006	0.000965	0.0645
Selenium	T	0.33	0.00004	0.000929	0.0621
Silica	T	0.0	3.48	4.32	5
Silicon	D	0.0	0.775	2.15	4.28
Silicon	T	0.0	0.792	2.38	7.86
Silver	D	97	0.000001	0.00000954	0.00005
Silver	T	85	0.000001	0.0000113	0.000083
Sodium	D	67	0.623	2.95	13.7
Sodium	T	71	0.681	2.66	13.8
Strontium	D	0.0	0.0174	0.116	0.33
Strontium	T	0.0	0.018	0.119	0.338
Sulphate (as SO4)	D	0.0	1.77	22.6	1100
Thallium	D	90	0.000002	0.0000209	0.0001
Thallium	T	78	0.000002	0.0000227	0.000137
Tin	D	96	0.000005	0.0000945	0.00016
Tin	T	95	0.000005	0.0000973	0.0009
Titanium	D	99	0.01	0.0100	0.017
Titanium	T	88	0.01	0.0112	0.069
Uranium	D	0.0	0.000034	0.000547	0.00286
Uranium	T	0.0	0.000046	0.000527	0.00288
Vanadium	D	88	0.000085	0.000965	0.0017
Vanadium	T	76	0.000098	0.00116	0.0076
Zinc	D	89	0.0002	0.00307	0.0561
Zinc	T	67	0.0007	0.00387	0.0663

Notes:
Means are calculated with values below the detection limit set as equal to the detection limit.

Table A2-8: Summary Statistics for Surface Water Conventional Parameter Reference Data

Parameter	Fraction	Sample Size	Percent Not Detected	Minimum Concentration	Mean Concentration	Max Concentration	Units	Guideline Minimum	Guideline Maximum
Alkalinity	T	574	0	38.2	140	282	mg/l	NA	NA
Carbon, dissolved organic	D								