

2020 CLOSED KITWANGA LANDFILL ANNUAL REPORT

June 2021

Prepared for:

British Columbia Ministry of
Environment & Climate Change
Strategy
EnvAuthorizationsReporting@gov.bc.ca

Prepared by:

Regional District of Kitimat-Stikine
Suite 300 - 4545 Lazelle Avenue
Terrace, BC V8G 4E1

Kitwanga Landfill Overview

The Kitwanga Landfill (Landfill) is in the process of closure, with one third currently closed with liner and the remainder to be shaped and closed with clays sourced from the Hazelton Waste Management Facility site over the next 10 years. The Kitwanga Landfill is located approximately 5 km north of the community of Kitwanga. Access is via the Stewart-Cassiar Highway.

The Kitwanga Transfer Station (the transfer station) opened in October of 2017 and is owned and operated by the Regional District of Kitimat-Stikine (Regional District or RDKS). The transfer station is on the site of the closed Landfill.

The transfer station accepts and manages municipal solid waste generated from commercial and residential sources in the Kitwanga area, including the communities of Kitwanga, Cedarvale, Gitanyow, Gitwangak, and Gitsegukla in accordance with the Regional District of Kitimat-Stikine Solid Waste Management Plan (1995). Material is no longer discharged in the Landfill; waste is consolidated and hauled to the Hazelton Waste Management Facility for landfilling.

Landfill operations are regulated by the Ministry of Environment's Operation Certificate MR-5767, most recently amended in November 2012, and conducted in accordance with the Transfer Station Construction and Landfill Closure Design for The Kitwanga Landfill (Sperling Hansen Associates, 2016).

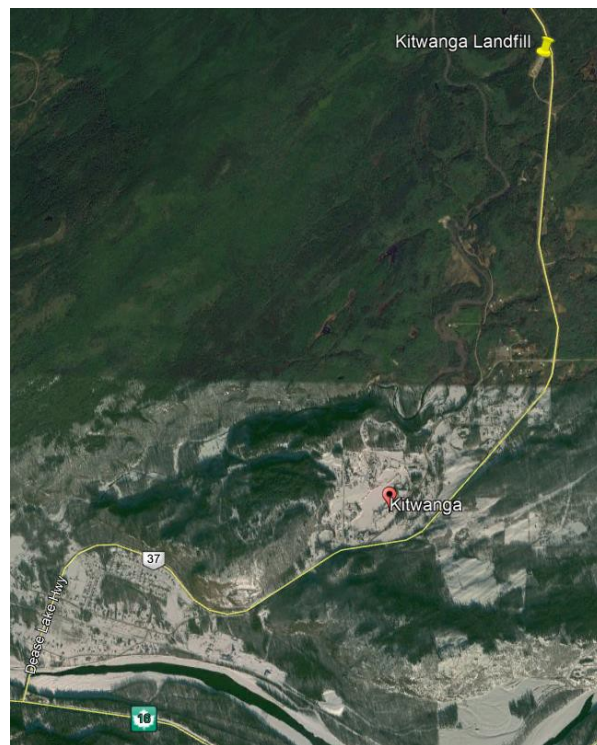


Figure 1 Location of Kitwanga Facility

Environmental monitoring for the Kitwanga Facility was conducted by a Regional District of Kitimat-Stikine Environmental Technician, following the *British Columbia Field Sampling Manual for Continuous Monitoring and the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment, and Biological Samples* (BC MOECCS, 2013). All surface water monitoring results have been analyzed and reviewed by Tattersfield Consulting. The compiled data, interpretation, and recommendations from Tattersfield Consulting can be found in Appendix A.

Table of Contents

Kitwanga Landfill Overview.....	1
1.0 Introduction	4
2.0 Waste Disposal.....	4
3.0 Wildlife Occurrences and Observations.....	6
4.0 Environmental Monitoring Report.....	6
Figure 1 Location of Kitwanga Facility.....	1

1.0 Introduction

This annual report covers the period of January to December 2020. This report has been prepared to fulfill the requirements of the Landfill's Operational Certificate MR-5767.

Issued by the Ministry of Environment (MOE) in November 2012, the Operational Certificate authorizes the discharge of municipal solid and liquid wastes and outlines the criteria for environmental and human protection at the landfill.

As of October 2017, the Kitwanga facility has operated as a transfer station to consolidate waste for landfilling at the Hazelton Waste Management Facility, and as a staging location for diverted materials.

This report meets the requirements in Section (10.5) of the Operational Certificate by providing the following information:

- Total volume or tonnage and type of waste discharged to the landfill during 2020;
- Total volume or tonnage and type of waste recycled and diverted during 2020;
- Occurrences or observations of wildlife attempting to access the facility; and
- The results of all the environmental sampling and monitoring programs undertaken by the Regional District and the evaluation of results by Tattersfield Consulting, as shown in Appendix A.

2.0 Waste Disposal

The Kitwanga Transfer Station serves the Kitwanga area including the communities of: Kitwanga, Gitwangak, Gitanyow, Gitsegukla, and Cedarvale. The Landfill is in the process of closure and no waste was discharged at this location in 2020. Waste consolidated at the transfer station is landfilled at the Hazelton Waste Management Facility.

2.1 Solid Waste Disposal

The total tonnages of materials collected for consolidation and recycling at the Kitwanga Transfer Station from January to December 2020 of are shown in Table 1.

Table 1: Waste Qualities for 2020

Material	2020 Quantity (Tonnes)	
Refuse to Hazelton Waste Management Facility for Landfilling		
Garbage		743.2 ^a
Diverted Wastes		
Metal	96.7	
Tires	1.8	
Printed Paper and Packaging	18.05	
Cardboard	44 ^b	
Household Electronics	5.9	
Small appliances	1.45	
Clean Wood	4 ^c	
Total Diverted	171.9	
Total to Landfill		743.2^a

Note:

Volume data was converted from m³ to tonnes using the U.S. Environmental Protection Agency’s *Volume to Weight Conversion Factors* (2016) value of 175kg/m³ for uncompacted mixed municipal solid waste.

^a This value is based on pre-compaction volume (m³) data collected from January to December 2020.

^b Estimate based on two 6-yard bins filled and emptied weekly.

^c Estimate based on 4 months of volumetric data extrapolated over 12 months and converted to tonnage using EPA volume-to-weight conversion ratios.

2.1.1 Garbage

Garbage is defined as discharged materials, not including hazardous waste, clean wood, metal, printed paper and packaging, cardboard, and electronics and appliances. Clean wood is segregated and not deposited into the landfill.

In 2020, 743.2 tonnes of garbage were consolidated at the Kitwanga Transfer Station for final disposal at the Hazelton Waste Management Facility.

3.0 Diverted Materials

There are designated segregation areas at the Kitwanga facility for: metal materials including large appliances, tires, clean wood, printed paper and packaging, cardboard, household electronics, and small appliances.

3.1.1 Metal

In 2020, a total of 96.7 tonnes of metal, including scrap, propane tanks, and large appliances were collected at the Kitwanga Transfer Station for recycling. All ozone depleting substances were removed from applicable appliances prior to collection by the scrap metal recycler.

3.1.2 Tires

In 2020, a total of 1.8 tonnes of tires were collected at the Kitwanga Transfer Station for recycling through the Tire Stewardship of BC.

3.1.3 Printed Paper and Packing Materials (PPP) and Cardboard

During 2020, 18.05 tonnes of PPP and 44 tonnes of corrugated cardboard was collected at the Kitwanga Transfer Station for recycling.

3.1.4 Electronics

During 2020, 5.9 tonnes of household electronics were collected at the Kitwanga Transfer Station for Stewardship recycling through the Encorp Electronics.

3.1.5 Small appliances

During 2020, 1.45 tonnes of small appliances and power tools were collected at the Kitwanga Transfer Station for Stewardship recycling through Product Care's ElectroRecycle program.

4.0 Wildlife Occurrences and Observations

The Kitwanga Transfer Station/closed landfill is located in a region with bears, wolves, coyotes, several species of birds of prey, and many other species of mammals that may attempt access to the facility. An electric fence surrounds the facility, including the entrance gate, to prevent wildlife access. The fence is kept charged from spring until late fall.

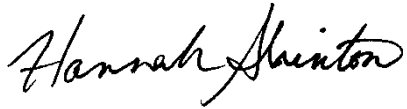
Facility operators are required to conduct fence line inspections at a minimum weekly interval, testing for proper voltage, proper tension on fence stands, overall condition of the fence, and signs of wildlife activity. Inspection results are recorded on the Daily Operation Inspection Form.

There were no wildlife incidents or encounters observed during 2020 at the Kitwanga facility.

5.0 Environmental Monitoring Report

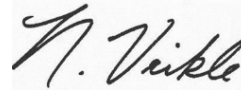
Environmental monitoring for the Kitwanga Landfill was conducted by the Regional District of Kitimat-Stikine Environmental Technician, following the *British Columbia Field Sampling Manual for Continuous Monitoring and the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment, and Biological Samples* (BC MOECCS 2013). All in-situ and laboratory data for groundwater, surface water, and leachate monitoring results has been analyzed and reviewed by Tattersfield Consulting. The compiled data, interpretation, and recommendations can be found in Appendix A.

Document prepared by:



Hannah Shinton, B.Sc.
Environmental Technician
Regional District of Kitimat-Stikine
300 – 4545 Lazelle Avenue
Terrace, BC V8G 4E1
hshinton@rdks.bc.ca

Document reviewed by:



Nicki Veikle
Environmental Coordinator
Regional District of Kitimat-Stikine
300 – 4545 Lazelle Avenue
Terrace, BC V8G 4E1
nveikle@rdks.bc.ca

Appendix A

CLOSED KITWANGA LANDFILL 2020 ENVIRONMENTAL MONITORING REPORT

Prepared for:

Regional District of Kitimat-Stikine
Suite 300 - 4545 Lazelle Avenue
Terrace, BC V8G 4E1

Prepared by:

Tattersfield Consulting
Terrace, BC.

April 2021

Table of Contents

1. Introduction.....	1
1.1. Site Setting.....	1
2. Surface Water Quality Monitoring.....	2
2.1. Protocol.....	3
2.2. Analysis.....	4
2.3. Results.....	4
2.3.1. E278450 Un-named Creek U/S from Kitwanga Landfill.....	4
2.3.2. E278449 Un-named creek D/S from Kitwanga Landfill.....	5
3. Quality Assurance.....	6
4. Trends.....	6
5. Conclusion.....	8
5.1. Recommendations.....	8
Appendix A – 2020 Laboratory Data	
Appendix B – Compiled Data	
Appendix C – Kitwanga Landfill Operational Certificate	

List of Figures

Figure 1. Interim monitoring requirements as shown in the Kitwanga Landfill OC.	1
Figure 2. The Kitwanga Landfill is located ~4.5 km north of Kitwanga to the west of Hwy 37 north.	2
Figure 3. Site plan showing U/S and D/S sampling locations on Unnamed Creek adjacent to the Kitwanga Landfill (adapted from the Kitwanga Landfill OC).	3
Figure 4. Conductivity over time.	6
Figure 5. Total aluminum concentration over time.	7
Figure 6. Total iron concentration over time.	7
Figure 7. Total copper concentrations over time.	8

1. Introduction

The Regional District of Kitimat-Stikine (RDKS) is required to report annually on their environmental monitoring program for the Kitwanga Landfill including an evaluation of surface water samples, identification of any potential impacts on the receiving environment and trend analysis for key parameters.

The on-going Environmental Monitoring program currently reflects interim monitoring requirements outlined in Section 10 – Monitoring Requirements in the Kitwanga Operational Certificate (Figure 1).

Sampling Locations ¹ and EMS ID	Frequency ³	Parameters ³
Unnamed Creek U/S of Kitwanga Landfill E278450	twice annually, in April and September	Field Measurements: pH, dissolved oxygen, specific conductance, temperature <hr/> Lab Analysis: BOD, total nitrogen, phosphorous, ammonia, pH, total and dissolved metals ²
Unnamed Creek D/S of Kitwanga Landfill E278449		
¹ Sampling locations are shown on the site plan ² Lab analysis for dissolved metals shall use a low level scan ³ May be altered in future, depending on results		

Figure 1. Interim monitoring requirements as shown in the Kitwanga Landfill OC.

1.1. Site Setting

The Kitwanga landfill is located approximately 4.5 km north of Kitwanga to the west of Highway 37 north (Figure 2).



Figure 2. The Kitwanga Landfill is located ~4.5 km north of Kitwanga to the west of Hwy 37 north.

2. Surface Water Quality Monitoring

The two monitoring sites are located to the north west of the landfill (Figure 3). Sampling was completed April 29, 2020 and September 16, 2020. Historic sample dates include:

- May 12, 2014
- April 28, 2015
- April 6, 2016
- April 17, 2018
- May 15, 2019
- November 20, 2019

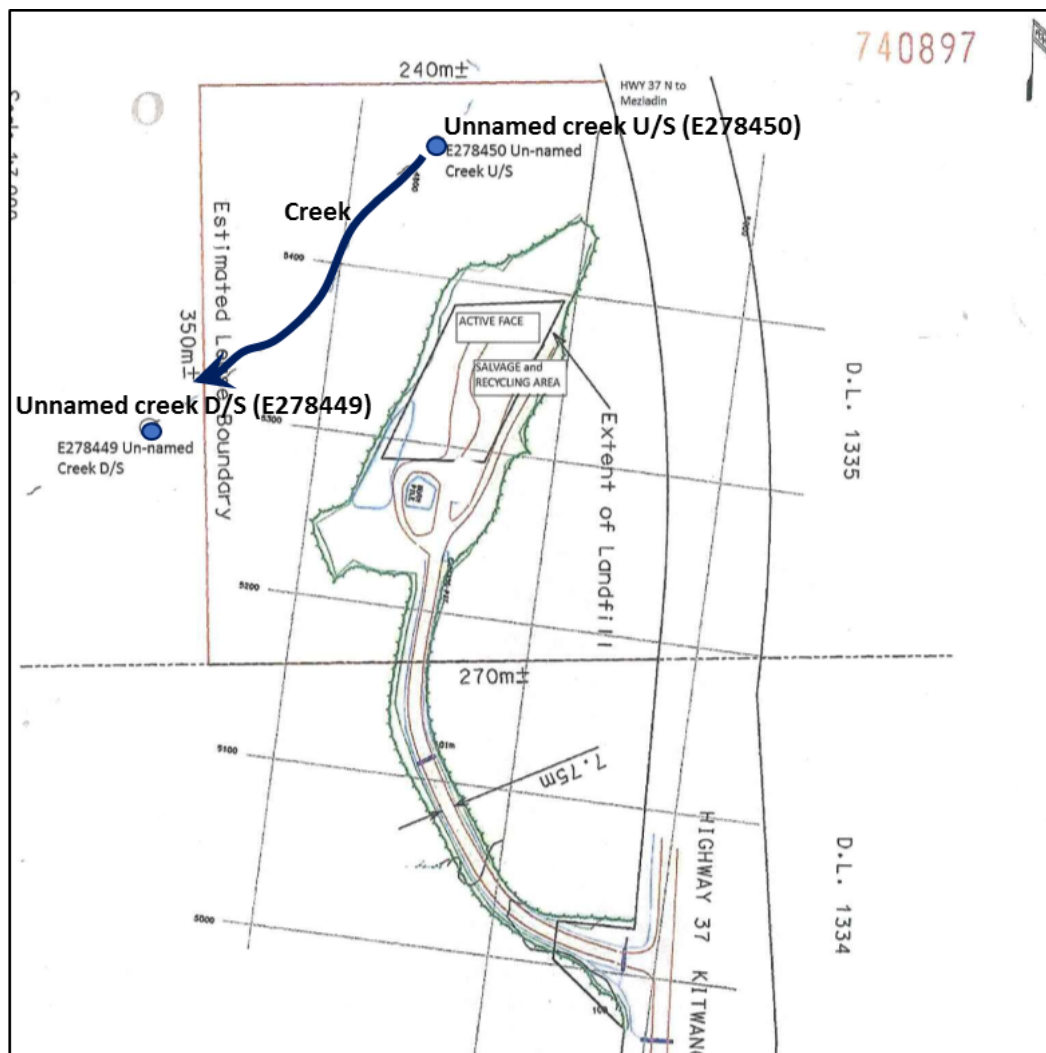


Figure 3. Site plan showing U/S and D/S sampling locations on Unnamed Creek adjacent to the Kitwanga Landfill (adapted from the Kitwanga Landfill OC).

2.1. Protocol

Surface water samples were collected by a Regional District of Kitimat-Stikine Environmental Technician following methods that align with the Ministry of Environment and Climate Change Strategy, 2013 BC Field Sampling Manual and the Guidelines for Environmental Monitoring at Municipal Solid waste Landfills. RDKS' general surface water sampling methods include the following:

- Samples are taken by dipping bottles into streams for those not requiring filtering.
- Syringes with filters are used for dissolved metals and dissolved mercury samples.
- Samples are transported in coolers with ice packs.
- Typically, RDKS obtains:
 - an unfiltered, unpreserved sample for general parameters,
 - an unfiltered sample for nutrients analysis, preserved with sulfuric acid,

- an unfiltered sample for total metals analysis, preserved with nitric acid,
- a filtered sample, for dissolved metals preserved with nitric acid,
- an unfiltered sample for total mercury analysis, preserved with hydrochloric acid, and,
- a filtered sample for dissolved mercury, preserved with hydrochloric acid.
- pH, dissolved oxygen, specific conductance and temperature are recorded in the Field using a YSI meter.

2.2. Analysis

Water samples were sent to ALS Environmental laboratory for analysis. The analytical reports for 2020 are attached in Appendix A. Data was compiled for all sample dates (Appendix B) and reviewed against the following guidelines, which were provided by RDKS:

- BC MoE Water Quality Guidelines for aquatic life (BCWQG -AW)
- BC MoE Contaminated Site Regulation guidelines for drinking water (CSR-DW)

The following required parameters, as specified in the OC, are summarized for each site.

Field:

- pH, dissolved oxygen, specific conductance, temperature

Lab:

- BOD, total nitrogen, phosphorus, ammonia, pH

Trends have been presented for both u/s and d/s locations for conductivity, copper, aluminum and iron as in previous reports.

2.3. Results

2.3.1. E278450 Un-named Creek U/S from Kitwanga Landfill

The E278450 sample site is located U/S from potential leachate effects and establishes background surface water quality. Table 1 summarizes the required parameters. All other results are collated in Appendix B. One exceedance for dissolved iron was noted in the September 16, 2020 sample which was recorded at 0.372 mg/L, above the 0.35mg/L BCWQG-AW guideline. No other exceedances were recorded.

Table 1. Summary of required water quality monitoring results for Un-named creek U/S of Kitwanga Landfill (E278450).

	29-April-2020	16-Sep-2020
Required Field Parameters		
pH	7.23	7.31
Dissolved oxygen (mg/L)	15.2	10

Specific conductance ($\mu\text{S}/\text{cm}$)	40.4	76.4
Temperature ($^{\circ}\text{C}$)	5.4	9.9
Required Lab Parameters		
BOD (mg/L)	<2.0	<2.0
Total Nitrogen (mg/L)	0.351	0.358
Total Phosphorus (mg/L)	<0.050	<0.050
Dissolved Phosphorus (mg/L)	<0.050	<0.050
Ammonia, Total as N (mg/L)	0.0113	-
pH	7.58	7.72

2.3.2. E278449 Un-named creek D/S from Kitwanga Landfill

The E278449 sample site is located D/S from potential leachate effects. Table 2 summarizes the required parameters. All other results are collated in Appendix B. One exceedance for dissolved iron was noted in the September 16, 2020 sample which was recorded at 0.337 mg/L, above the 0.35mg/L BCWQG-AW guideline. No other exceedances were recorded.

Table 2. Summary of required water quality monitoring results for Un-named creek U/S of Kitwanga Landfill (E278449).

	29-April-2020	16-Sep-2020
Required Field Parameters		
pH	7.48	7.32
Dissolved oxygen (mg/L)	7.48	7.32
Specific conductance ($\mu\text{S}/\text{cm}$)	41.70	76.70
Temperature ($^{\circ}\text{C}$)	5.30	9.90
Required Lab Parameters		
BOD (mg/L)	<2.0	<2.0
Total Nitrogen (mg/L)	0.36	0.35
Total Phosphorus (mg/L)	<0.050	<0.050
Dissolved Phosphorus (mg/L)	<0.050	<0.050
Ammonia, Total as N (mg/L)	0.01	0.01
pH	7.56	7.74

3. Quality Assurance

Field duplicate samples were taken at the upstream location in April 2020, and the downstream location in September 2020, for quality assurance purposes. Results are reported as Relative Percent Difference (RPD) between the sample and duplicate sample (Appendix 2).

Relative Percent Difference (RPD) between the sample and field duplicate results >20% can indicate a problem and >50% indicates a definite problem with the sample according to the Ministry of Environment and Climate Change Strategy, 2013 BC Field Sampling Manual.

The following RPD were reported >20%:

- April, 2020 U/S location: total cesium (25.00 RPD); total titanium (38.76 RPD); dissolved titanium (29.89 RPD)
- September 2020 D/S location: total aluminum (27.37 RPD); total cadmium (31.88 RPD); total cesium (27.03 RPD); total chromium (41.10 RPD); total rubidium (26.87 RPD); dissolved chromium (22.22 RPD)

4. Trends

Trends are limited to data from 2014-2018 and 2020. No data were collected in 2019. Figures 4-7 illustrate existing data points for U/S (E274850) and D/S (E278449) for conductivity, total aluminum, total iron and total copper. Blanks in the data table indicate no data available.

Conductivity remains below 106 uS/cm, relatively low range for freshwater streams (Figure 4).

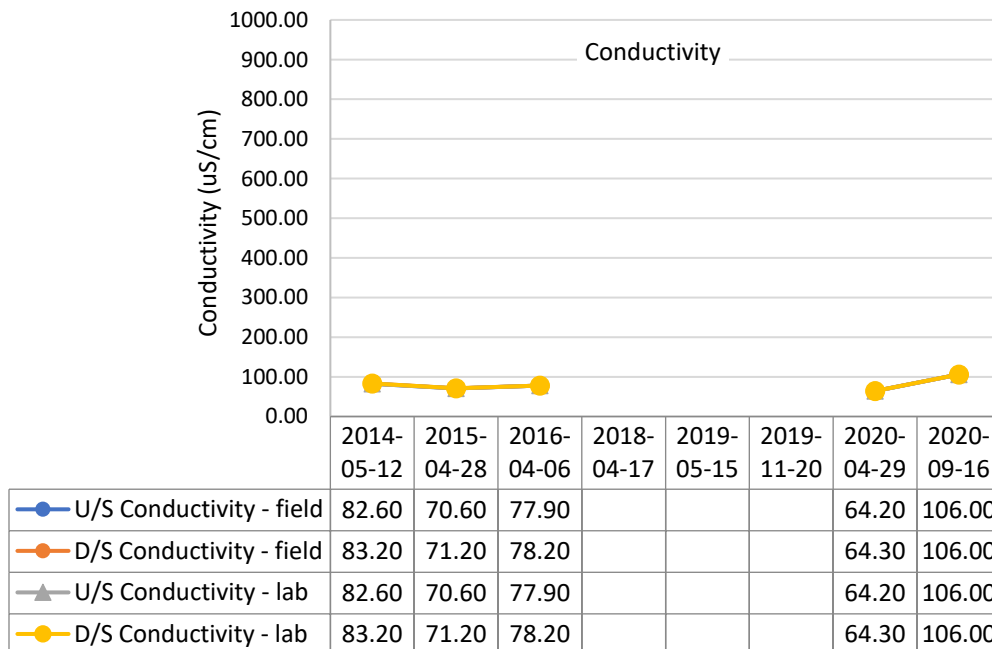


Figure 4. Conductivity over time.

Total Aluminum concentrations in 2020 have decreased since the last recorded sample in 2018. There is no BCWQG-AW guideline noted for total aluminum (Figure 5).

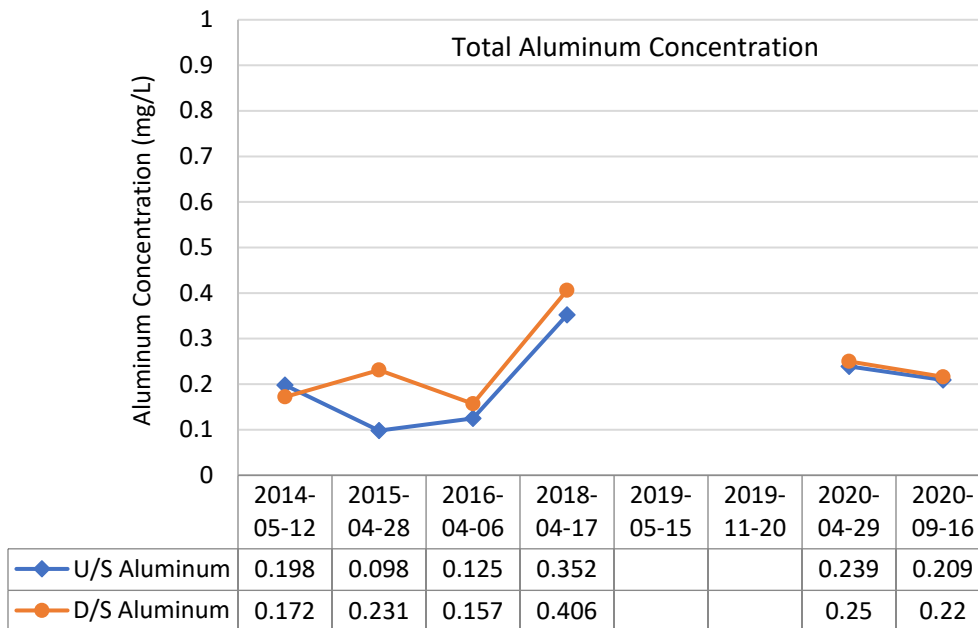


Figure 5. Total aluminum concentration over time.

Total iron concentrations in 2020 increased since the last recorded sample in 2018. Both U/S and D/S results remain below the BCWQG-AW guideline for total iron 1.0 mg/L (Figure 6).

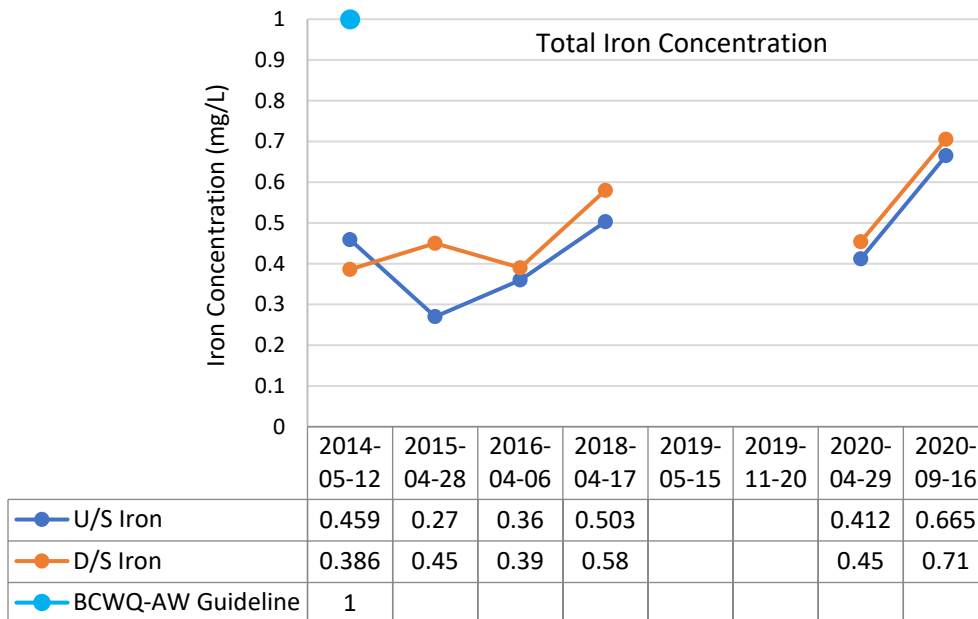


Figure 6. Total iron concentration over time.

Total Copper concentrations have remained below the BCWQG-AW guideline for total copper, 0.0032 mg/L, except in spring 2016 when upstream levels were recorded at 0.0048mg/L. The

2020 values are similar to the last recorded sample, in 2018, and below the BCWQG-AW guideline for total copper 0.0032 mg/L (Figure 7).

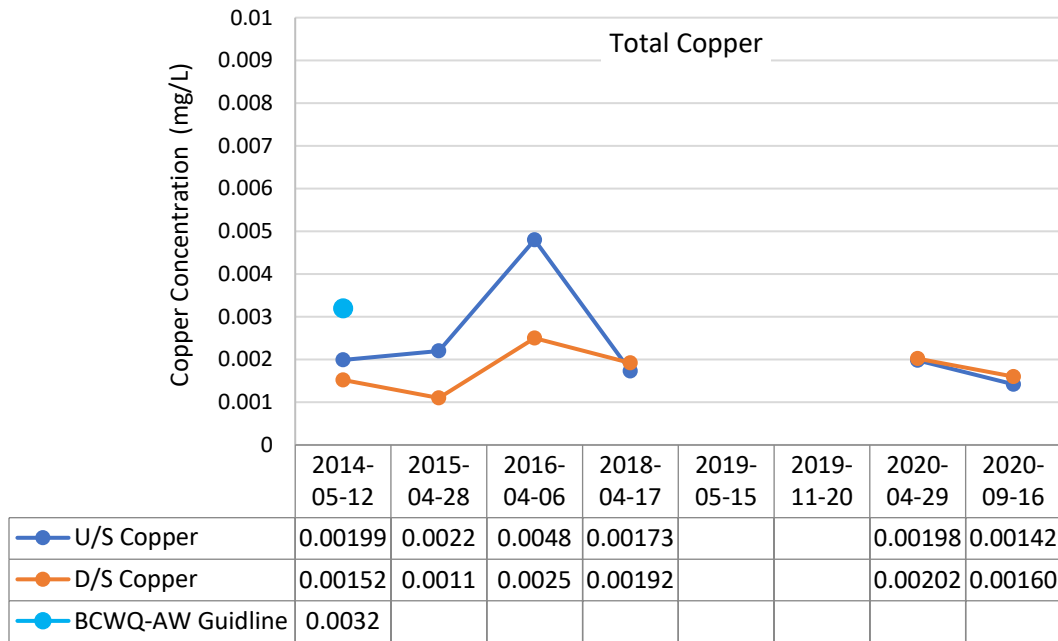


Figure 7. Total copper concentration over time.

5. Conclusion

Based on the data and standards provided by RDKS, and the assumption they accurately reflect the existing water quality conditions at the Kitwanga Landfill and BC water quality standards respectively, the landfill operation was not causing water quality concerns in un-named creek at the time of sampling.

The only exceedance noted in 2020 (total iron) exists both at the upstream and downstream sites, and therefore, is not likely caused by leachate.

Field duplicate samples with RPD >20% did occur and could indicate a possible contaminant in the sample process or lab precision limitations.

5.1. Recommendations

The following recommendations may be taken into consideration for future monitoring efforts:

- Twice annual surface water sampling at the U/S and D/S locations should be continued, as recommended in the OC.
- Sample timing should be reviewed seasonally based on local weather conditions to facilitate successful sampling (i.e., the stream may contain water earlier in the spring; and less likely to be frozen earlier in the fall and/or time sampling during or after a rain event to capture surface water runoff).

- As per Section 9 in the Kitwanga OC, an evaluation could be completed by a qualified professional to determine the need for an on-going environmental monitoring program and the necessity of establishing groundwater monitoring sites.

Report prepared by:



Carmen Tattersfield, MSc., RP.Bio.

Tattersfield Consulting

carmen.tattersfield@gmail.com

Appendix A – 2020 Laboratory Data

CERTIFICATE OF ANALYSIS

Work Order : **VA20A5789**
Client : **Regional District of Kitimat-Stikine**
Contact : **Mary Tress**
Address : **# 300 - 4545 Lazelle Avenue**
 Terrace BC Canada V8G 4E1
Telephone : **----**
Project : **Kitwanga Landfill Surface Water**
PO : **----**
C-O-C number : **----**
Sampler : **Mary Tress**
Site :
Quote number : **Q62338**
No. of samples received : **5**
No. of samples analysed : **5**

Page : 1 of 6
Laboratory : **Vancouver - Environmental**
Account Manager : **Amber Springer**
Address : **8081 Lougheed Highway**
 Burnaby BC Canada V5A 1W9
Telephone : **+1 604 253 4188**
Date Samples Received : **04-May-2020 09:45**
Date Analysis Commenced : **04-May-2020**
Issue Date : **11-May-2020 10:51**

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Laboratory Department</i>
Angela Ren	Team Leader - Metals	Metals, Burnaby, British Columbia
Erick Magalhaes	Laboratory Analyst	Metals, Burnaby, British Columbia
Evan Ben-Oliel	Metal Analyst	Metals, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Inorganics - Water Quality, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia
Shaneel Dayal	Metal Analyst	Metals, Burnaby, British Columbia



General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

<i>Unit</i>	<i>Description</i>
-	No Unit
µS/cm	Microsiemens per centimetre
mg/L	milligrams per litre
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in reports identified as "Preliminary Report" are considered authorized for use.

Workorder Comments

Client requested dissolved metals/mercury on travel blank sample, only one set of bottles were received (without any markings or information)

The bottle received have been assigned to total metals/mercury analysis. As such dissolved metals will not be analysed (as the travel blank sample cannot be subsampled)

Qualifiers

<i>Qualifier</i>	<i>Description</i>
DTMF	Dissolved concentration exceeds total for field-filtered metals sample. Metallic contaminants may have been introduced to dissolved sample during field filtration.
RRV	Reported result verified by repeat analysis.



Analytical Results

Sub-Matrix: Water					Client sample ID				
(Matrix: Water)					Upstream	Downstream	Field Blank	DUP	Travel Blank
Client sampling date / time					29-Apr-2020 10:30	29-Apr-2020 10:00	29-Apr-2020 12:00	29-Apr-2020 12:00	29-Apr-2020
Analyte	CAS Number	Method	LOR	Unit	VA20A5789-001	VA20A5789-002	VA20A5789-003	VA20A5789-004	VA20A5789-005
					Result	Result	Result	Result	Result
Physical Tests									
conductivity	----	E100	2.0	µS/cm	64.2	64.3	<2.0	65.3	<2.0
hardness (as CaCO3), from total Ca/Mg	----	EC100A	0.60	mg/L	31.3	31.4	<0.60	31.2	<0.60
pH	----	E108	0.10	pH units	7.58	7.56	5.50	7.59	5.51
hardness (as CaCO3), dissolved	----	EC100	0.60	mg/L	28.5	28.5	<0.60	27.7	----
Anions and Nutrients									
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	0.0113	0.0109	<0.0050	0.0122	<0.0050
nitrogen, total	7727-37-9	E366	0.030	mg/L	0.351	0.355	<0.030	0.375	<0.030
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0107	0.0124	<0.0020	0.0104	<0.0020
Total Metals									
aluminum, total	7429-90-5	E420	0.0030	mg/L	0.239	0.250	<0.0030	0.222	0.0041 ^{RRV}
antimony, total	7440-36-0	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00034	0.00035	<0.00010	0.00030	<0.00010
barium, total	7440-39-3	E420	0.00010	mg/L	0.0213	0.0213	<0.00010	0.0206	<0.00010
beryllium, total	7440-41-7	E420	0.000100	mg/L	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
boron, total	7440-42-8	E420	0.010	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010
cadmium, total	7440-43-9	E420	0.0000050	mg/L	0.0000059	0.0000063	<0.0000050	0.0000059	<0.0000050
calcium, total	7440-70-2	E420	0.050	mg/L	8.73	8.74	<0.050	8.67	<0.050
cesium, total	7440-46-2	E420	0.000010	mg/L	0.000018	0.000021	<0.000010	0.000014	<0.000010
chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00040	0.00047	<0.00010	0.00034	<0.00010
cobalt, total	7440-48-4	E420	0.00010	mg/L	0.00015	0.00018	<0.00010	0.00016	<0.00010
copper, total	7440-50-8	E420	0.00050	mg/L	0.00198	0.00202	<0.00050	0.00192	<0.00050
iron, total	7439-89-6	E420	0.010	mg/L	0.412	0.454	<0.010	0.368	<0.010
lead, total	7439-92-1	E420	0.000050	mg/L	<0.000050	0.000074	<0.000050	<0.000050	<0.000050
lithium, total	7439-93-2	E420	0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
magnesium, total	7439-95-4	E420	0.0050	mg/L	2.30	2.32	<0.0050	2.31	<0.0050
manganese, total	7439-96-5	E420	0.00010	mg/L	0.0400	0.0394	<0.00010	0.0406	<0.00010
mercury, total	7439-97-6	E508	0.0000050	mg/L	0.0000099	0.0000106	<0.0000050	0.0000108	<0.0000050
molybdenum, total	7439-98-7	E420	0.000050	mg/L	<0.000050	0.000065	<0.000050	<0.000050	<0.000050
nickel, total	7440-02-0	E420	0.00050	mg/L	0.00060	0.00070	<0.00050	0.00059	<0.00050



Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	Upstream	Downstream	Field Blank	DUP	Travel Blank
Client sampling date / time					29-Apr-2020 10:30	29-Apr-2020 10:00	29-Apr-2020 12:00	29-Apr-2020 12:00	29-Apr-2020	
Analyte	CAS Number	Method	LOR	Unit	VA20A5789-001	VA20A5789-002	VA20A5789-003	VA20A5789-004	VA20A5789-005	
					Result	Result	Result	Result	Result	
Total Metals										
phosphorus, total	7723-14-0	E420	0.050	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	
potassium, total	7440-09-7	E420	0.050	mg/L	0.420	0.404	<0.050	0.407	<0.050	
rubidium, total	7440-17-7	E420	0.00020	mg/L	<0.00020	0.00020	<0.00020	<0.00020	<0.00020	
selenium, total	7782-49-2	E420	0.000050	mg/L	0.000057	0.000056	<0.000050	0.000056	<0.000050	
silicon, total	7440-21-3	E420	0.10	mg/L	3.42	3.35	<0.10	3.35	<0.10	
silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	
sodium, total	7440-23-5	E420	0.050	mg/L	3.58	3.51	<0.050	3.56	<0.050	
strontium, total	7440-24-6	E420	0.00020	mg/L	0.0886	0.0882	<0.00020	0.0897	<0.00020	
sulfur, total	7704-34-9	E420	0.50	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50	
tellurium, total	13494-80-9	E420	0.00020	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	
thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	
thorium, total	7440-29-1	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
titanium, total	7440-32-6	E420	0.00030	mg/L	0.00422	0.00354	<0.00030	0.00285	<0.00030	
tungsten, total	7440-33-7	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
uranium, total	7440-61-1	E420	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	
vanadium, total	7440-62-2	E420	0.00050	mg/L	<0.00050	0.00060	<0.00050	<0.00050	<0.00050	
zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	
zirconium, total	7440-67-7	E420	0.00020	mg/L	0.00040	0.00036	<0.00020	0.00034	<0.00020	
Dissolved Metals										
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.126	0.200	<0.0010	0.106	----	
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	----	
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00026	0.00028	<0.00010	0.00026	----	
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0184	0.0203	<0.00010	0.0188	----	
beryllium, dissolved	7440-41-7	E421	0.000100	mg/L	<0.000100	<0.000100	<0.000100	<0.000100	----	
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	----	
boron, dissolved	7440-42-8	E421	0.010	mg/L	<0.010	<0.010	<0.010	<0.010	----	
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	0.0000180 ^{DTMF}	<0.0000050	<0.0000050	<0.0000050	----	
calcium, dissolved	7440-70-2	E421	0.050	mg/L	7.90	7.88	<0.050	7.69	----	
cesium, dissolved	7440-46-2	E421	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	----	
chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	0.00023	0.00033	<0.00010	0.00020	----	



Analytical Results

Sub-Matrix: Water					Client sample ID	Upstream	Downstream	Field Blank	DUP	Travel Blank
(Matrix: Water)										
Client sampling date / time					29-Apr-2020 10:30	29-Apr-2020 10:00	29-Apr-2020 12:00	29-Apr-2020 12:00	29-Apr-2020	
Analyte	CAS Number	Method	LOR	Unit	VA20A5789-001	VA20A5789-002	VA20A5789-003	VA20A5789-004	VA20A5789-005	
					Result	Result	Result	Result	Result	
Dissolved Metals										
cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	----	
copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00181	0.00174	<0.00020	0.00170	----	
iron, dissolved	7439-89-6	E421	0.010	mg/L	0.205	0.286	<0.010	0.195	----	
lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	----	
lithium, dissolved	7439-93-2	E421	0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	----	
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	2.13	2.14	<0.0050	2.07	----	
manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.0128	0.0138	<0.00010	0.0127	----	
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	0.0000102	0.0000094	<0.0000050	0.0000100	----	
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.000061	0.000060	0.000116 ^{DTMF} _{RRV}	0.000071	----	
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00060	0.00068	<0.00050	0.00055	----	
phosphorus, dissolved	7723-14-0	E421	0.050	mg/L	<0.050	<0.050	<0.050	<0.050	----	
potassium, dissolved	7440-09-7	E421	0.050	mg/L	0.363	0.373	<0.050	0.362	----	
rubidium, dissolved	7440-17-7	E421	0.00020	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	----	
selenium, dissolved	7782-49-2	E421	0.000050	mg/L	0.000054	0.000075	<0.000050	<0.000050	----	
silicon, dissolved	7440-21-3	E421	0.050	mg/L	3.07	3.18	<0.050	3.03	----	
silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	----	
sodium, dissolved	7440-23-5	E421	0.050	mg/L	3.26	3.32	<0.050	3.17	----	
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.0846	0.0861	<0.00020	0.0839	----	
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	<0.50	<0.50	<0.50	<0.50	----	
tellurium, dissolved	13494-80-9	E421	0.00020	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	----	
thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	----	
thorium, dissolved	7440-29-1	E421	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	----	
tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	----	
titanium, dissolved	7440-32-6	E421	0.00030	mg/L	0.00273	0.00539 ^{DTMF}	<0.00030	0.00202	----	
tungsten, dissolved	7440-33-7	E421	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	----	
uranium, dissolved	7440-61-1	E421	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	----	
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	----	
zinc, dissolved	7440-66-6	E421	0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	----	
zirconium, dissolved	7440-67-7	E421	0.00020	mg/L	0.00053	0.00062	<0.00020	0.00047	----	
dissolved mercury filtration location	----	EP509	-	-	Field	Field	Field	Field	----	
dissolved metals filtration location	----	EP421	-	-	Field	Field	Field	Field	----	



Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	Upstream	Downstream	Field Blank	DUP	Travel Blank
Client sampling date / time					29-Apr-2020 10:30	29-Apr-2020 10:00	29-Apr-2020 12:00	29-Apr-2020 12:00	29-Apr-2020	
Analyte	CAS Number	Method	LOR	Unit	VA20A5789-001	VA20A5789-002	VA20A5789-003	VA20A5789-004	VA20A5789-005	
Aggregate Organics					Result	Result	Result	Result	Result	
biochemical oxygen demand [BOD]	----	E550	2.0	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	

Please refer to the General Comments section for an explanation of any qualifiers detected.



CERTIFICATE OF ANALYSIS

Work Order : **VA20B5623**
Client : **Regional District of Kitimat-Stikine**
Contact : **Mary Tress**
Address : **# 300 - 4545 Lazelle Avenue**
Terrace BC Canada V8G 4E1
Telephone : **----**
Project : **Kitwanga Landfill Surface Water**
PO : **----**
C-O-C number : **----**
Sampler : **Mary Tress**
Site :
Quote number : **Q62338**
No. of samples received : **5**
No. of samples analysed : **5**

Page : **1 of 6**
Laboratory : **Vancouver - Environmental**
Account Manager : **Amber Springer**
Address : **8081 Lougheed Highway**
Burnaby BC Canada V5A 1W9
Telephone : **+1 604 253 4188**
Date Samples Received : **18-Sep-2020 11:50**
Date Analysis Commenced : **19-Sep-2020**
Issue Date : **25-Sep-2020 16:29**

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Laboratory Department</i>
Angela Ren	Team Leader - Metals	Metals, Burnaby, British Columbia
Angelo Salandanan	Lab Assistant	Metals, Burnaby, British Columbia
Cristina Alexandre	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Dee Lee	Analyst	Metals, Burnaby, British Columbia
Kevin Duarte	Team Leader - Inorganics	Inorganics - Water Quality, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia
Kinny Wu	Lab Analyst	Metals, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics - Water Quality, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia
Shaneel Dayal	Analyst	Metals, Burnaby, British Columbia
Tracy Harley	Supervisor - Water Quality Instrumentation	Inorganics - Water Quality, Burnaby, British Columbia



General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

<i>Unit</i>	<i>Description</i>
-	No Unit
µS/cm	Microsiemens per centimetre
mg/L	milligrams per litre
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in reports identified as "Preliminary Report" are considered authorized for use.

Qualifiers

<i>Qualifier</i>	<i>Description</i>
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
DTMF	Dissolved concentration exceeds total for field-filtered metals sample. Metallic contaminants may have been introduced to dissolved sample during field filtration.



Analytical Results

Sub-Matrix: Water					Client sample ID				
(Matrix: Water)					Upstream	Downstream	Field Blank	DUP	Travel blank
Client sampling date / time					16-Sep-2020 09:45	16-Sep-2020 09:10	16-Sep-2020 10:15	16-Sep-2020 12:00	16-Sep-2020
Analyte	CAS Number	Method	LOR	Unit	VA20B5623-001	VA20B5623-002	VA20B5623-003	VA20B5623-004	VA20B5623-005
					Result	Result	Result	Result	Result
Physical Tests									
conductivity	----	E100	2.0	µS/cm	106	106	<2.0	106	----
hardness (as CaCO3), from total Ca/Mg	----	EC100A	0.60	mg/L	49.5	52.7	<0.60	51.7	<0.60
pH	----	E108	0.10	pH units	7.72	7.74	5.42	7.76	----
hardness (as CaCO3), dissolved	----	EC100	0.60	mg/L	48.8	48.3	<0.60	48.5	----
Anions and Nutrients									
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	0.0073	0.0054	<0.0050	0.0059	<0.0050
nitrogen, total	7727-37-9	E366	0.030	mg/L	0.358	0.353	<0.030	0.362	----
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0157	0.0128	<0.0020	0.0158	----
Total Metals									
aluminum, total	7429-90-5	E420	0.0030	mg/L	0.209	0.216	<0.0030	0.164	<0.0030
antimony, total	7440-36-0	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00068	0.00070	<0.00010	0.00066	<0.00010
barium, total	7440-39-3	E420	0.00010	mg/L	0.0320	0.0329	<0.00010	0.0318	<0.00010
beryllium, total	7440-41-7	E420	0.000100	mg/L	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
boron, total	7440-42-8	E420	0.010	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010
cadmium, total	7440-43-9	E420	0.0000050	mg/L	0.0000080	0.0000080	<0.0000050	0.0000058	<0.0000050
calcium, total	7440-70-2	E420	0.050	mg/L	14.1	14.8	<0.050	14.6	<0.050
cesium, total	7440-46-2	E420	0.000010	mg/L	0.000019	0.000021	<0.000010	0.000016	<0.000010
chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00029	0.00044	<0.00010	0.00029	<0.00010
cobalt, total	7440-48-4	E420	0.00010	mg/L	0.00016	0.00016	<0.00010	0.00015	<0.00010
copper, total	7440-50-8	E420	0.00050	mg/L	0.00142	0.00160	<0.00050	0.00148	<0.00050
iron, total	7439-89-6	E420	0.010	mg/L	0.665	0.705	<0.010	0.629	<0.010
lead, total	7439-92-1	E420	0.000050	mg/L	0.000063	0.000070	<0.000050	0.000066	<0.000050
lithium, total	7439-93-2	E420	0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
magnesium, total	7439-95-4	E420	0.0050	mg/L	3.48	3.83	<0.0050	3.68	<0.0050
manganese, total	7439-96-5	E420	0.00010	mg/L	0.0660	0.0618	<0.00010	0.0599	<0.00010
mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.000157	0.000827	<0.000050	0.000719	<0.000050
nickel, total	7440-02-0	E420	0.00050	mg/L	0.00088	0.00088	<0.00050	0.00096	<0.00050



Analytical Results

Sub-Matrix: Water
 (Matrix: Water)

					Client sample ID	Upstream	Downstream	Field Blank	DUP	Travel blank
					Client sampling date / time	16-Sep-2020 09:45	16-Sep-2020 09:10	16-Sep-2020 10:15	16-Sep-2020 12:00	16-Sep-2020
Analyte	CAS Number	Method	LOR	Unit	VA20B5623-001	VA20B5623-002	VA20B5623-003	VA20B5623-004	VA20B5623-005	
					Result	Result	Result	Result	Result	
Total Metals										
phosphorus, total	7723-14-0	E420	0.050	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	
potassium, total	7440-09-7	E420	0.050	mg/L	0.542	0.593	<0.050	0.576	<0.050	
rubidium, total	7440-17-7	E420	0.00020	mg/L	0.00035	0.00038	<0.00020	0.00029	<0.00020	
selenium, total	7782-49-2	E420	0.000050	mg/L	0.000101	0.000102	<0.000050	0.000110	<0.000050	
silicon, total	7440-21-3	E420	0.10	mg/L	4.41	4.55	<0.10	4.19	<0.10	
silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	
sodium, total	17341-25-2	E420	0.050	mg/L	4.98	5.32	<0.050	5.23	<0.050	
strontium, total	7440-24-6	E420	0.00020	mg/L	0.150	0.150	<0.00020	0.149	<0.00020	
sulfur, total	7704-34-9	E420	0.50	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50	
tellurium, total	13494-80-9	E420	0.00020	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	
thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	
thorium, total	7440-29-1	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
titanium, total	7440-32-6	E420	0.00030	mg/L	0.00393	0.00440	<0.00030	<0.00330 ^{DLM}	<0.00030	
tungsten, total	7440-33-7	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
uranium, total	7440-61-1	E420	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	
vanadium, total	7440-62-2	E420	0.00050	mg/L	0.00061	0.00060	<0.00050	0.00051	<0.00050	
zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	
zirconium, total	7440-67-7	E420	0.00020	mg/L	0.00036	0.00027	<0.00020	0.00031	<0.00020	
Dissolved Metals										
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0510	0.0505	<0.0010	0.0515	----	
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	----	
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00057	0.00051	<0.00010	0.00055	----	
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0276	0.0278	<0.00010	0.0272	----	
beryllium, dissolved	7440-41-7	E421	0.000100	mg/L	<0.000100	<0.000100	<0.000100	<0.000100	----	
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	----	
boron, dissolved	7440-42-8	E421	0.010	mg/L	<0.010	<0.010	<0.010	<0.010	----	
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	<0.0000050	<0.0000050	<0.0000050	<0.0000050	----	
calcium, dissolved	7440-70-2	E421	0.050	mg/L	13.7	13.6	<0.050	13.8	----	
cesium, dissolved	7440-46-2	E421	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	----	
chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	0.00017	0.00016	<0.00010	0.00020	----	



Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	Upstream	Downstream	Field Blank	DUP	Travel blank
Client sampling date / time					16-Sep-2020 09:45	16-Sep-2020 09:10	16-Sep-2020 10:15	16-Sep-2020 12:00	16-Sep-2020	
Analyte	CAS Number	Method	LOR	Unit	VA20B5623-001	VA20B5623-002	VA20B5623-003	VA20B5623-004	VA20B5623-005	
					Result	Result	Result	Result	Result	
Aggregate Organics										
biochemical oxygen demand [BOD]	----	E550	2.0	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	

Please refer to the General Comments section for an explanation of any qualifiers detected.

Appendix B – Compiled Data

Water Quality Results, Un-named Creek U/S of Kitwanga Landfill (E278450)													
		BC MoE Guidelines	BC MoE Guidelines	Upstream Sampling Location									
Field Observations	Units	BCWQG-AW (1)	CSR-DW (2)	2014-05-12	2015-04-28	2016-04-06	2018-04-17	2019-05-15	2019-11-20	2020-04-29	Dup	RPD	2020-09-16
Barometer	mmHg	-						No Sample	No Sample	734.50	-	-	741.40
Conductivity	µs	-								40.40	-	-	76.40
Dissolved Oxygen	%l	-								125.00	-	-	92.00
Dissolved Oxygen	mg/L	-								15.20	-	-	10.00
pH	pH units	6.5-9.0								7.23	-	-	7.31
ORP	mv									361.80	-	-	308.10
Temperature	°C	-								5.40	-	-	9.90
Analyte													
Conductivity	uS/cm	-	-	82.60	70.60	77.90				64.20	65.30	1.70	106.00
Hardness (as CaCO3)	mg/L	-	-	35.40	29.40	35.30	30.50			28.50	27.70	2.85	48.80
pH	pH	6.5-9.0	-	7.40	7.10	7.60	7.59			7.58	7.59	0.13	7.72
Total Suspended Solids	mg/L	25 mg/L (backgr. 25-250 mg/l) (i)	-	-	-	-				-	-		-
Total Dissolved Solids	mg/L	-	-	-	-	-				-	-		-
Acidity	mg/L	-	-	-	-	-				-	-		-
Alkalinity, Total (as CaCO3)	mg/L	-	-	-	-	-				-	-		-
Ammonia, Total (as N)	mg/L	0.681-28.7 (a)	-	<0.03	<0.03	<0.03	0.0093			0.01	0.01	7.66	-
Total Nitrogen	mg/L	-	-				0.325			0.35	0.38	6.61	0.36
Bromide (Br)	mg/L	-	-	-	-	-				-	-		-
Chloride (Cl)	mg/L	600	250 (2)	1.7	1.3	1.6							
Fluoride (F)	mg/L	0.4-1.87 (d)	1.5 (2)	<0.1	<0.10	<0.10				-	-		-
Nitrate (as N)	mg/L	32.8	10 (2)	<0.02	<0.01	<0.01				-	-		-
Nitrite (as N)	mg/L	0.06-0.6 (h)	1 (2)	<0.01	<0.01	<0.01				-	-		-
Sulfate (SO4)	mg/L	128-429 (d)	500 (2)	<0.5	<1.0	<1.0				-	-		-
Total Organic Carbon	mg/L	+/- 20% of background		-	-	-				-	-		-
BOD	mg/L	-	-	<4.0	<4.0	<4.0	3.8			<2.0	<2.0		<2.0
COD	mg/L	-	-	30	34	35				-	-		-

Total Metals													
Aluminum (Al)-Total	mg/L	-	-	0.198	0.098	0.125	0.352			0.24	0.222	7.38	0.21
Antimony (Sb)-Total	mg/L	0.270	-	0.00007	<0.0001	0.0001	<0.00010			<0.00010	<0.00010		<0.00010
Arsenic (As)-Total	mg/L	0.005 (j)	-	0.000513	<0.0005	<0.0005	0.00032			0.00034	0.00030	12.50	0.00068
Barium (Ba)-Total	mg/L	1	-	0.0208	0.024	0.019	0.0205			0.0213	0.0206	3.34	0.0320
Beryllium (Be)-Total	mg/L	0.00013	-	<0.00001	<0.0001	<0.0001	<0.00010			<0.000100	<0.000100		<0.000100
Bismuth		-				<0.0001	<0.000050			<0.000050	<0.000050		<0.000050
Boron (B)-Total	mg/L	1.2 (j)	-	<0.05	0.014	0.007	<0.010			<0.010	<0.010		<0.010
Cadmium (Cd)-Total	mg/L	-	-	0.000008	0.00036	<0.00001	0.0000059			0.0000059	0.00	0.00	0.0000080
Calcium (Ca)-Total	mg/L	<4 sensitive to acid input	-	10.0	8.2	9.8	8.44			8.73	8.67	0.69	14.1
Cesium (Cs)		-					0.000042			0.000018	0.000014	25.00	0.000019
Chromium (Cr)-Total	mg/L	0.001e	-	0.00064	<0.0005	<0.0005	0.00056			0.00040	0.00034	16.22	0.00029
Cobalt (Co)-Total	mg/L	0.11 (j)	-	0.000167	0.00013	0.00011	0.00016			0.00015	0.00016	6.45	0.00016
Copper (Cu)-Total	mg/L	0.0032		0.00199	0.0022	0.0048	0.00173			0.00	0.00192	3.08	0.00
Iron (Fe)-Total	mg/L	1	-	0.459	0.27	0.36	0.503			0.41	0.368	11.28	0.67
Lead (Pb)-Total	mg/L	0.011-0.402 (d,f)	-	0.000093	<0.0001	0.0003	0.000088			<0.000050	<0.000050		0.000063
Lithium (Li)-Total	mg/L	-	-	<0.0005	0.0002	0.0001	<0.0010			<0.0010	<0.0010		<0.0010
Magnesium (Mg)-Total	mg/L	-	-	2.50	2.17	2.63	2.24			2.30	2.31	0.43	3.48
Manganese (Mn)-Total	mg/L	0.8-3.4 (d,f)	-	0.0582	0.0751	0.0538	0.0364			0.0400	0.0406	1.49	0.0660
Mercury (Hg)-Total	mg/L	0.0001 (j)	-	<0.00001	<0.00002	<0.00002	0.0000097			0.0000099	0.0000108	8.70	<0.0000050
Molybdenum (Mo)-Total	mg/L	2 (j)	-	0.00012	0.0001	0.0001	0.000065			<0.000050	<0.000050		0.000157
Nickel (Ni)-Total	mg/L	0.025-0.15 (d,f)	-	0.00096	0.0008	0.0006	0.00097			0.00060	0.00059	1.68	0.00088
Phosphorus - Total	mg/L	0.005-0.015 (lakes only)	-			<0.02	<0.050			<0.050	<0.050		<0.050
Potassium (K)-Total	mg/L	-	-	0.50	0.46	0.43	0.411			0.420	0.407	3.14	0.542
Rubidium (Rd) - Total	mg/L	-	-				0.00029			<0.00020	<0.00020		0.00035
Selenium (Se)-Total		0.002	-				0.000098			0.000057	0.000056	1.77	0.000101
Silicon - Total	mg/L	-	-			3.40	3.41			3.42	3.35	2.07	4.41
Silver (Ag)-Total	mg/L	0.0001-0.003 (d)	-	<0.000005	<0.00005	<0.00005	<0.000010			<0.000010	<0.000010		<0.000010
Sodium (Na)-Total	mg/L	-	-	3.96	4.05	4.32	3.3			3.58	3.56	0.56	4.98
Strontium - Total	mg/L	-	-			0.095	0.0848			0.0886	0.0897	1.23	0.150
Sulfur - Total	mg/L	-	-			<1	<0.50			<0.50	<0.50		<0.50
Tellurium - Total	mg/L	-	-			<0.0002	<0.00020			<0.00020	<0.00020		<0.00020
Thallium (Tl)-Total	mg/L	0.0008	-	<0.000002	<0.00002	<0.00002	<0.000010			<0.000010	<0.000010		<0.000010
Thorium - Total	mg/L	-	-			<0.0001	<0.00010			<0.00010	<0.00010		<0.00010
Tin (Sn)-Total	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.00010			<0.00010	<0.00010		<0.00010
Titanium (Ti)-Total	mg/L	-	-	<0.005	<0.005	<0.005	0.00623			0.00422	0.00285	38.76	0.00393
Tungsten (W) - Total	mg/L	-	-				<0.00010			<0.00010	<0.00010		<0.00010
Uranium (U)-Total	mg/L	0.0085	-	0.000006	<0.00002	<0.00002	<0.000010			<0.000010	<0.000010		<0.000010
Vanadium (V)-Total	mg/L	-	-	0.00058	<0.001	<0.001	0.00078			<0.00050	<0.00050		0.00061
Zinc (Zn)-Total	mg/L	0.033-0.341 (d, f)	-	0.0049	0.006	<0.004	<0.0030			<0.0030	<0.0030		<0.0030
Zirconium - Total	mg/L									0.00	0.00034	16.22	

Dissolved Metals													
Aluminum (Al)-Dissolved	mg/L	0.023-0.1 (b,c)	9.5				0.15			0.126	0.106	17.24	0.0510
Antimony (Sb)-Dissolved	mg/L	-	0.006				<0.00010			<0.00010	<0.00010		<0.00010
Arsenic (As)-Dissolved	mg/L	-	0.01				0.00019			0.00026	0.00026	0.00	0.00057
Barium (Ba)-Dissolved	mg/L	-	1				0.0203			0.0184	0.0188	2.15	0.0276
Beryllium (Be)-Dissolved	mg/L	-	0.008				<0.00010			<0.000100	<0.000100		<0.000100
Bismuth - Dissolved	mg/L	-	-				<0.000050			<0.000050	<0.000050		<0.000050
Boron (B)-Dissolved	mg/L	-	5				<0.010			<0.010	<0.010		<0.010
Cadmium (Cd)-Dissolved	mg/L	0.000027-0.00280 (d,f)	0.005				<0.0000050			0.0000180	<0.0000050		<0.0000050
Calcium (Ca)-Dissolved	mg/L	-	-				8.48			7.90	7.69	2.69	13.7
Cesium (Cs) - Dissolved	mg/L	-	-				<0.000010			<0.000010	<0.000010		<0.000010
Chromium (Cr)-Dissolved	mg/L	-	0.05-6.0				0.00023			0.00023	0.00020	13.95	0.00017
Cobalt (Co)-Dissolved	mg/L	-	0.001				<0.00010			<0.00010	<0.00010		<0.00010
Copper (Cu)-Dissolved	mg/L	-	1.5 (AO)				0.0015			0.00181	0.00170	6.27	0.00118
Iron (Fe)-Dissolved	mg/L	0.35	6.5				0.201			0.205	0.195	5.00	0.372
Lead (Pb)-Dissolved	mg/L	-	0.01				<0.000050			<0.000050	<0.000050		<0.000050
Lithium (Li)-Dissolved	mg/L	-	0.008				<0.0010			<0.0010	<0.0010		<0.0010
Magnesium (Mg)-Dissolved	mg/L	-	-				2.26			2.13	2.07	2.86	3.55
Manganese (Mn)-Dissolved	mg/L	-	1.5				0.0156			0.0128	0.0127	0.78	0.0107
Mercury (Hg)-Dissolved	mg/L	-	0.001				0.0000122			0.0000102	0.0000100	1.98	<0.0000050
Molybdenum (Mo)-Dissolved	mg/L	-	0.25				<0.000050			0.000061	0.000071	15.15	0.000776
Nickel (Ni)-Dissolved	mg/L	-	0.08				<0.00050			0.00060	0.00055	8.70	<0.00050
Phosphorus - Dissolved	mg/L	-	-				<0.050			<0.050	<0.050		<0.050
Potassium (K)-Dissolved	mg/L	-	-				0.391			0.363	0.362	0.28	0.562
Rubidium (Rb) -Dissolved	mg/L	-	-				<0.00020			<0.00020	<0.00020		0.00023
Selenium (Se)-Dissolved	mg/L	-	0.01				0.000053			0.000054	<0.000050		0.000098
Silicon - Dissolved	mg/L	-	-				3.07			3.07	3.03	1.31	3.98
Silver (Ag)-Dissolved	mg/L	-	0.02				<0.000010			<0.000010	<0.000010		<0.000010
Sodium (Na)-Dissolved	mg/L	-	200				3.45			3.26	3.17	2.80	5.09
Strontium - Dissolved	mg/L	-	-				0.0828			0.0846	0.0839	0.83	0.151
Sulfur- Dissolved	mg/L	-	-				<0.50			<0.50	<0.50		<0.50
Tellurium - Dissolved	mg/L	-	-				<0.00020			<0.00020	<0.00020		<0.00020
Thallium (Tl)-Dissolved	mg/L	-	-				<0.000010			<0.000010	<0.000010		<0.000010
Thorium - Dissolved	mg/L	-	-				<0.00010			<0.00010	<0.00010		<0.00010
Tin (Sn)-Dissolved	mg/L	-	2.5				<0.00010			<0.00010	<0.00010		<0.00010
Titanium (Ti)-Dissolved	mg/L	-	-				0.00263			0.00273	0.00202	29.89	0.00121
Tungsten (W) - Dissolved	mg/L	-	0.003				<0.00010			<0.00010	<0.00010		<0.00010
Uranium (U)-Dissolved	mg/L	-	0.02				<0.000010			<0.000010	<0.000010		<0.000010
Vanadium (V)-Dissolved	mg/L	-	0.02				<0.00050			<0.00050	<0.00050		<0.00050
Zinc (Zn)-Dissolved	mg/L	-	3				<0.0010			<0.0010	<0.0010		<0.0010
Zirconium - Dissolved	mg/L	-	-				0.000365	-	-	0.00053	0.00047	12.00	0.00031

NOTES												
<i>(1) BC MoE Approved and Working Water Quality Guidelines, Updated March 2018</i>												
<i>(2) BC Contaminated Sites Regulation (CSR) for protection of aquatic life or drinking water, Schedule 6</i>												
<i>(3) All criteria limits for BCWQG - Drinking Quality Guidelines based on Total Metal Concentration except Aluminum (Dissolved)</i>												
<i>(4) BC MoE Water Quality Guidelines for Protection of Wildlife</i>												
<i>(a) Range based on max pH 8.5 to min pH 6.5 at temperature of 6.0 °C</i>												
<i>(b) at pH less than 6.5, limit is determined by regression equation, else limit is 0.1 mg/L.</i>												
<i>(c) Limit for dissolved metals, not total metals</i>												
<i>(d) Limit dependent upon hardness.</i>												
<i>(e) Limit for chromium(VI) - data reported by lab as total chromium - limit assumes 100% chromium VI in sample</i>												
<i>(f) Where hardness data was unavailable, 50 mg/L was assumed</i>												
<i>(g) Maximum value</i>												
<i>(h) Limit dependent upon chloride concentration</i>												
<i>(i) Change of 25 mg/L from background for a duration of 24 hours during clear flows. Change of 10% of background during turbid flows</i>												
<i>* Criteria exceeds detection limit</i>												
<i>BCWQG-AW BC MoE Quality Guidelines for Protection of Aquatic Life</i>												
<i>CSR-AW/DW BC Contaminated Sites Regulation Water Quality Guidelines for Protection of Aquatic Life</i>												

Water Quality Results, Un-named Creek D/S of Kitwanga Landfill (E278449)													
		BC MoE Guidelines	BC MoE Guidelines	Downstream Sampling Location									
Field Observations	Units	BCWQG-AW (1)	CSR-DW (2)	2014-05-12	2015-04-28	2016-04-06	2018-04-17	2019-05-15	2019-11-20	2020-04-29	2020-09-16	Dup	RPD
Barometer	mmHg	-						No Sample	No Sample	735.70	742.20		
Conductivity	µs	-								41.70	76.70		
Dissolved Oxygen	%l	-								153.00	89.00		
Dissolved Oxygen	mg/L	-								7.48	7.32		
pH	pH units	6.5-9.0								7.48	7.32		
ORP	mv									375.70	312.50		
Temperature	°C	-								5.30	9.90		
Analyte													
Conductivity	uS/cm	-	-	83.20	71.20	78.20				64.30	106.00	106	0.00
Hardness (as CaCO3)	mg/L	-	-	27.00	31.80	35.30	30.90			28.50	48.30	48.5	0.41
pH	pH	6.5-9.0	-	7.40	7.50	7.60	7.41			7.56	7.74	7.76	0.26
Total Suspended Solids	mg/L	25 mg/L (backgr. 25-250 mg/l) (i)	-	-	-	-				-	-	-	
Total Dissolved Solids	mg/L	-	-	-	-	-				-	-	-	
Acidity	mg/L	-	-	-	-	-				-	-	-	
Alkalinity, Total (as CaCO3)	mg/L	-	-	-	-	-				-	-	-	
Ammonia, Total (as N)	mg/L	0.681-28.7 (a)	-	<0.03	<0.03	0.04	0.0084			0.01	0.01	0.0059	8.85
Total Nitrogen	mg/L	-	-				0.355			0.36	0.35	0.362	2.52
Bromide (Br)	mg/L	-	-	-	-	-				-	-	-	
Chloride (Cl)	mg/L	600	250 (2)	1.8	1.7	1.8						-	
Fluoride (F)	mg/L	0.4-1.87 (d)	1.5 (2)	<0.1	<0.10	<0.10						-	
Nitrate (as N)	mg/L	32.8	10 (2)	<0.02	<0.01	0.01				-	-	-	
Nitrite (as N)	mg/L	0.06-0.6 (h)	1 (2)	<0.01	<0.01	<0.01				-	-	-	
Sulfate (SO4)	mg/L	128-429 (d)	500 (2)	<0.5	<1.0	<1.0				-	-	-	
Total Organic Carbon	mg/L	+/- 20% of background		-	-	-				-	-	-	
BOD	mg/L	-	-	<4.0	<4.0	<4.0	6.1			<2.0	<2.0	<2.0	
COD	mg/L	-	-	25	<20	36				-	-		

Total Metals													
Aluminum (Al)-Total	mg/L	-	-	0.172	0.231	0.157	0.406			0.25	0.22	0.164	27.37
Antimony (Sb)-Total	mg/L	0.270	-	0.000065	<0.0001	0.0003	<0.00010			<0.00010	<0.00010	<0.00010	
Arsenic (As)-Total	mg/L	0.005 (j)	-	0.000401	<0.0005	<0.0005	0.00035			0.00035	0.00070	0.00066	5.88
Barium (Ba)-Total	mg/L	1	-	0.0165	0.023	0.019	0.0223			0.0213	0.0329	0.0318	3.40
Beryllium (Be)-Total	mg/L	0.00013	-	<0.00001	<0.0001	<0.0001	<0.00010			<0.000100	<0.000100	<0.000100	
Bismuth		-				<0.0001	<0.000050			<0.000050	<0.000050	<0.000050	
Boron (B)-Total	mg/L	1.2 (j)	-	<0.05	0.012	0.007	<0.010			<0.010	<0.010	<0.010	
Cadmium (Cd)-Total	mg/L	-	-	0.000009	<0.00001	0.00002	0.0000053			0.0000063	0.0000080	0.0000058	31.88
Calcium (Ca)-Total	mg/L	<4 sensitive to acid input	-	7.57	8.9	9.9	8.45			8.74	14.8	14.6	1.36
Cesium (Cs)		-					0.00005			0.000021	0.000021	0.000016	27.03
Chromium (Cr)-Total	mg/L	0.001e	-	0.00058	<0.0005	<0.0005	0.00056			0.00047	0.00044	0.00029	41.10
Cobalt (Co)-Total	mg/L	0.11 (j)	-	0.000142	0.00015	0.00014	0.00019			0.00018	0.00016	0.00015	6.45
Copper (Cu)-Total	mg/L	0.0032	-	0.00152	0.0011	0.0025	0.00192			0.00202	0.00160	0.00148	7.79
Iron (Fe)-Total	mg/L	1	-	0.386	0.45	0.39	0.58			0.45	0.71	0.629	11.39
Lead (Pb)-Total	mg/L	0.011-0.402 (d,f)	-	0.000072	0.0001	0.0001	0.000109			0.000074	0.000070	0.000066	5.88
Lithium (Li)-Total	mg/L	-	-	<0.0005	0.0003	0.0001	<0.0010			<0.0010	<0.0010	<0.0010	
Magnesium (Mg)-Total	mg/L	-	-	1.97	2.31	2.57	2.3			2.32	3.83	3.68	3.99
Manganese (Mn)-Total	mg/L	0.8-3.4 (d,f)	-	0.0466	0.0508	0.0449	0.0437			0.0394	0.0618	0.0599	3.12
Mercury (Hg)-Total	mg/L	0.0001 (j)	-	<0.00001	<0.00002	<0.00002	0.0000118			0.0000106	<0.0000050	<0.0000050	
Molybdenum (Mo)-Total	mg/L	2 (j)	-	0.000091	<0.0001	0.0002	0.000067			0.000065	0.000827	0.000719	13.97
Nickel (Ni)-Total	mg/L	0.025-0.15 (d,f)	-	0.00086	0.0008	0.0007	0.00108			0.00070	0.00088	0.00096	8.70
Phosphorus - Total	mg/L	0.005-0.015 (lakes only)	-			<0.02	<0.050			<0.050	<0.050	<0.050	
Potassium (K)-Total	mg/L	-	-	0.39	0.42	0.43	0.43			0.404	0.593	0.576	2.91
Rubidium (Rd) - Total	mg/L	-	-				0.0003			0.00020	0.00038	0.00029	26.87
Selenium (Se)-Total		0.002	-				0.000055			0.000056	0.000102	0.000110	7.55
Silicon - Total	mg/L	-	-			3.300	3.560			3.35	4.55	4.19	8.24
Silver (Ag)-Total	mg/L	0.0001-0.003 (d)	-	0.000008	<0.00005	<0.00005	<0.000010			<0.000010	<0.000010	<0.000010	
Sodium (Na)-Total	mg/L	-	-	3.03	3.59	4.25	3.49			3.51	5.32	5.23	1.71
Strontium - Total	mg/L	-	-			0.093	0.0844			0.0882	0.150	0.149	0.67
Sulfur - Total	mg/L	-	-			<1	<0.50			<0.50	<0.50	<0.50	
Tellurium - Total	mg/L	-	-			<0.0002	<0.00020			<0.00020	<0.00020	<0.00020	
Thallium (Tl)-Total	mg/L	0.0008	-	0.000002	<0.00002	<0.00002	<0.000010			<0.000010	<0.000010	<0.000010	
Thorium - Total	mg/L	-	-			<0.0001	<0.00010			<0.00010	<0.00010	<0.00010	
Tin (Sn)-Total	mg/L	-	-	<0.0002	<0.0002	<0.0002	<0.00010			<0.00010	<0.00010	<0.00010	
Titanium (Ti)-Total	mg/L	-	-	<0.005	<0.005	<0.005	0.00748			0.00354	0.00440	<0.00330	
Tungsten (W) - Total	mg/L	-	-				<0.00010			<0.00010	<0.00010	<0.00010	
Uranium (U)-Total	mg/L	0.0085	-	0.000006	<0.00002	<0.00002	<0.000010			<0.000010	<0.000010	<0.000010	
Vanadium (V)-Total	mg/L	-	-	0.00057	0.001	<0.001	0.00091			0.00060	0.00060	0.00051	16.22
Zinc (Zn)-Total	mg/L	0.033-0.341 (d, f)	-	0.0037	<0.004	<0.004	<0.0030			<0.0030	<0.0030	<0.0030	
Zirconium - Total	mg/L									-	0.00	0.00031	6.67

Dissolved Metals													
Aluminum (Al)-Dissolved	mg/L	0.023-0.1 (b,c)	9.5				0.15		-	0.200	0.0505	0.0515	1.96
Antimony (Sb)-Dissolved	mg/L	-	0.006				<0.00010		-	<0.00010	<0.00010	<0.00010	
Arsenic (As)-Dissolved	mg/L	-	0.01				0.00021		-	0.00028	0.00051	0.00055	7.55
Barium (Ba)-Dissolved	mg/L	-	1				0.0195		-	0.0203	0.0278	0.0272	2.18
Beryllium (Be)-Dissolved	mg/L	-	0.008				<0.00010		-	<0.000100	<0.000100	<0.000100	
Bismuth - Dissolved	mg/L	-	-				<0.000050		-	<0.000050	<0.000050	<0.000050	
Boron (B)-Dissolved	mg/L	-	5				<0.010		-	<0.010	<0.010	<0.010	
Cadmium (Cd)-Dissolved	mg/L	0.000027-0.00280 (d,f)	0.005				<0.0000050		-	<0.0000050	<0.0000050	<0.0000050	
Calcium (Ca)-Dissolved	mg/L	-	-				8.39		-	7.88	13.6	13.8	1.46
Cesium (Cs) - Dissolved	mg/L	-	-				<0.000010		-	<0.000010	<0.000010	<0.000010	
Chromium (Cr)-Dissolved	mg/L	-	0.05-6.0				0.00014		-	0.00033	0.00016	0.00020	22.22
Cobalt (Co)-Dissolved	mg/L	-	0.001				<0.00010		-	<0.00010	<0.00010	<0.00010	
Copper (Cu)-Dissolved	mg/L	-	1.5 (AO)				0.00151		-	0.00	0.00121	0.00115	5.08
Iron (Fe)-Dissolved	mg/L	0.35	6.5				0.201		-	0.286	0.337	0.353	4.64
Lead (Pb)-Dissolved	mg/L	-	0.01				<0.000050		-	<0.000050	<0.000050	<0.000050	
Lithium (Li)-Dissolved	mg/L	-	0.008				<0.0010		-	<0.0010	<0.0010	<0.0010	
Magnesium (Mg)-Dissolved	mg/L	-	-				2.41		-	2.14	3.45	3.44	0.29
Manganese (Mn)-Dissolved	mg/L	-	1.5				0.0137		-	0.0138	0.00570	0.00586	2.77
Mercury (Hg)-Dissolved	mg/L	-	0.001				0.0000111		-	0.0000094	<0.0000050	<0.0000050	
Molybdenum (Mo)-Dissolved	mg/L	-	0.25				<0.000050		-	0.000060	0.000168	0.000160	4.88
Nickel (Ni)-Dissolved	mg/L	-	0.08				<0.00050		-	0.00068	0.00051	<0.00050	
Phosphorus - Dissolved	mg/L	-	-				<0.050		-	<0.050	<0.050	<0.050	
Potassium (K)-Dissolved	mg/L	-	-				0.41		-	0.373	0.549	0.542	1.28
Rubidium (Rb) -Dissolved	mg/L	-	-				<0.00020		-	<0.00020	0.00022	0.00021	4.65
Selenium (Se)-Dissolved	mg/L	-	0.01				<0.000050		-	0.000075	0.000066	0.000069	4.44
Silicon - Dissolved	mg/L	-	-				3.03		-	3.18	3.92	3.94	0.51
Silver (Ag)-Dissolved	mg/L	-	0.02				<0.000010		-	<0.000010	<0.000010	<0.000010	
Sodium (Na)-Dissolved	mg/L	-	200				3.57		-	3.32	5.17	4.93	4.75
Strontium - Dissolved	mg/L	-	-				0.0825		-	0.0861	0.151	0.143	5.44
Sulfur- Dissolved	mg/L	-	-				<0.50		-	<0.50	<0.50	<0.50	
Tellurium - Dissolved	mg/L	-	-				<0.00020		-	<0.00020	<0.00020	<0.00020	
Thallium (Tl)-Dissolved	mg/L	-	-				<0.000010		-	<0.000010	<0.000010	<0.000010	
Thorium - Dissolved	mg/L	-	-				<0.00010		-	<0.00010	<0.00010	<0.00010	
Tin (Sn)-Dissolved	mg/L	-	2.5				<0.00010		-	<0.00010	<0.00010	<0.00010	
Titanium (Ti)-Dissolved	mg/L	-	-				0.00296		-	0.00539	0.00131	0.00129	1.54
Tungsten (W) - Dissolved	mg/L	-	0.003				<0.00010		-	<0.00010	<0.00010	<0.00010	
Uranium (U)-Dissolved	mg/L	-	0.02				<0.000010		-	<0.000010	<0.000010	<0.000010	
Vanadium (V)-Dissolved	mg/L	-	0.02				<0.00050		-	<0.00050	<0.00050	<0.00050	
Zinc (Zn)-Dissolved	mg/L	-	3				<0.0010		-	<0.0010	<0.0010	<0.0010	
Zirconium - Dissolved	mg/L	-	-				0.000354		-	0.00062	0.00029	0.00035	18.75

Appendix C – Kitwanga Landfill Operational Certificate



File: MR-5767

Date: November 8, 2012

REGISTERED MAIL

Regional District of Kitimat-Stikine
300-4545 Lazelle Avenue
Terrace, BC
V8G 4E1

Dear Operational Certificate Holder:

Enclosed is Operational Certificate MR-5767 issued under the provisions of the *Environmental Management Act*. Your attention is respectfully directed to the terms and conditions outlined in the operational certificate.

This operational certificate does not authorize entry upon, crossing over, or use for any purpose of private or Crown lands or works, unless and except as authorized by the owner of such lands or works. The responsibility for obtaining such authority rests with the operational certificate holder. It is also the responsibility of the operational certificate holder to ensure that all activities conducted under this authorization are carried out with regard to the rights of third parties, and comply with other applicable legislation that may be in force.

This decision may be appealed to the Environmental Appeal Board in accordance with Part 8 of the *Environmental Management Act*. An appeal must be delivered within 30 days from the date that notice of this decision is given. For further information, please contact the Environmental Appeal Board at (250) 387-3464.

Administration of this operational certificate will be carried out by staff from the Skeena Region. Plans, data and reports pertinent to the operational certificate are to be submitted to the Director, Environmental Protection, at Ministry of Environment, Regional Operations, Skeena Region, 3726 Alfred Avenue, Box 5000, Smithers, BC, V0J 2N0.

Yours truly,

Mark Love, P. Ag.
for Director, *Environmental Management Act*
Skeena Region

Enclosure



MINISTRY OF ENVIRONMENT

OPERATIONAL CERTIFICATE
MR-5767

for the

KITWANGA LANDFILL

*Under the Provisions of the Environmental Management Act
and in accordance with the approved
Regional District of Kitimat-Stikine Solid Waste Management Plan, the*

Regional District of Kitimat-Stikine

Suite 300-4545 Lazelle Avenue

Terrace, British Columbia

V8G 4E1

is authorized to store, handle, treat and discharge municipal solid waste from Kitwanga and surrounding area at the Kitwanga landfill, subject to the conditions listed below. Contravention of any of these conditions is a violation of the *Environmental Management Act* and may result in prosecution.

1. LOCATION OF LANDFILL PROPERTY

The location of the property where discharges are authorized to occur is District Lot 1335 Cassiar Land District.

2. AUTHORIZED DISCHARGES

2.1 Discharge of Municipal Solid Waste

This section applies to the discharge of municipal solid waste to ground at the landfill located approximately as shown on the attached site plan. The site reference number for this discharge is E209210. Refer to Section 5 for the operational requirements associated with this discharge.

- 2.1.1 Subject to Sections 4.2, 4.3 and 4.4, the characteristics of the discharge shall be typical of municipal solid waste.
- 2.1.2 The quantity of solid wastes discharged to ground shall not exceed the design capacity of the landfill facility specified as follows: (1) by an engineered final design footprint (see Section 3.3); and (2) by engineered excavation and final grade contours (see Section 3.4).
- 2.1.3 The authorized works are a separate municipal solid waste disposal area and related appurtenances located approximately as shown on the attached site plan.

2.2 Storage and Handling of Wastes for Salvage and Recycling

This section applies to the storage and handling of municipal solid wastes for salvage and recycling. Refer to Section 7 for the operational requirements associated with this discharge.

- 2.2.1 Subject to Section 4.2, the characteristics of the discharge shall be typical of recyclable municipal solid waste.
- 2.2.2 The quantity of recyclable wastes stored or handled is indeterminate.
- 2.2.3 The authorized works are a separate recyclable municipal solid waste storage area and related appurtenances located approximately as shown on the attached site plan.

2.3 Discharge of Air Contaminants from Open Burning

This section applies to the discharge of air contaminants to the atmosphere from the regulated open burning of wood and selected combustibles from a burn pile located approximately as shown on the attached site plan. The site reference number for this discharge is E219223. Refer to Section 8 for the operational requirements associated with this discharge.



Mark Love, P.Ag.

For Director, Environmental Management Act

OPERATIONAL CERTIFICATE: MR-5767

- 2.3.1 The characteristics of the discharge shall be typical of those resulting from the regulated open burning of selected combustibles as per Section 8.3.
- 2.3.2 The maximum authorized rate of discharge is indeterminate.
- 2.3.3 The authorized works are a separate burn area associated with a landfill operation and related appurtenances located approximately as shown on the attached site plan.

3 LANDFILL DESIGN

3.1 Design by Qualified Professional(s)

The landfill and associated works [including but not limited to the size(s) and location(s) of disposal area(s), maximum allowable slopes of disposal area(s), leachate management system, progressive and final closure details, etc.] shall be designed by qualified professionals [such as engineer(s) and/or geoscientist(s)] registered in the Province of British Columbia who have expertise in the field of landfill design. These details shall be incorporated into a "Design, Operations and Closure Plan" (DOCP) and made available to the Director upon request. Where a design feature prepared by a qualified professional is in conflict with any requirement of this operational certificate, it shall be brought to the attention of the Director who shall determine a resolution to the conflict.

3.2 Construction

The landfill and associated works shall be constructed in accordance with the design prepared by qualified professionals, and as documented in the DOCP.

3.3 Engineered Footprint

The landfill design shall include preparation of an engineered final design footprint delineating the maximum extent of solid waste disposal allowable at the facility horizontally (in plan view). The engineered final design footprint shall be clearly shown on a scaled plan of the site and the plan made available in PDF format (see Section 3.6). These details shall be documented in the DOCP.

3.4 Engineered Excavation and Final Grade Contours

The landfill design shall include preparation of engineered excavation grade (if below grade landfilling is to occur) and final grade contours delineating the maximum extent of solid waste disposal allowable at the facility vertically (in cross-sectional view). The engineered excavation and final grade contours shall be clearly shown on scaled drawings (accompanied with typical cross sections to

aid in depicting the landfill profile) and the drawings shall be made available in PDF format (see Section 3.6). These details shall be documented in the DOCP.

3.5 Legal Survey

The landfill property shall be legally surveyed on or before June 30, 2016, or a minimum of 6 months prior to closure, whichever is sooner.

3.6 Scaled Drawings

A scaled site plan accurately showing the legal survey (when completed), the engineered final design footprint, and final design contours, shall be included in the DOCP and made available in PDF format upon request by the Director. Additional scaled drawings showing excavation contours (if relevant) and typical cross sectional views of the site shall also be included in the DOCP.

4. GENERAL REQUIREMENTS

4.1 Site Identification

A sign shall be erected at the main entrance to the landfill which identifies the following: site name, owner, operator, contact phone number and address, hours of operation, tipping fees (if applicable) and prohibition of hazardous wastes. The lettering on the sign shall be such that it is clearly readable by the public upon approach.

4.2 Prohibited Wastes

No wastes as defined by the *Hazardous Waste Regulation* shall be received, stored, treated or disposed of at this site except as authorized by the Director. Lead-acid batteries shall not be landfilled but may be salvaged/recycled provided they are stored, handled and shipped in compliance with the *Hazardous Waste Regulation* and with Section 8 of this operational certificate. Tires equal to or less than 22" in rim size and autohulks shall not be landfilled.

4.3 Waste Asbestos

Notwithstanding Section 4.2 of this operational certificate, the disposal of waste asbestos under Section 2.1 of this operational certificate and in compliance with the requirements of Section 40 of the *Hazardous Waste Regulation* is hereby authorized.

4.4 Contaminated Soil

Soil that contains contaminants in concentrations less than "Hazardous Waste" as defined by the *Hazardous Waste Regulation* may be disposed at the landfill site. Disposal includes monofilling, co-disposal with other wastes, use as a refuse cell berm material and use as a refuse cell cover material. Disposal must occur within a disposal area as authorized by Section 5 of this operational certificate. Disposal does not include use as final cover material.

4.5 Waste Measurement

The quantity of waste material landfilled at the site shall be measured or estimated by means suitable to the Director. The results shall be submitted in accordance with Section 10.5, once per year on or before June 30 for the previous year, expressed in tonnes/yr and/or m³/yr.

4.6 Ozone Depleting Substances

Release of ozone depleting substances from the storage, handling and transport of used refrigerator equipment, freezers, motor vehicle air conditioners and other air conditioning equipment, fire extinguishers and the like is strictly forbidden as per the requirements of the *Ozone Depleting Substances Regulation and Other Halocarbons Regulation*.

4.7 Fire Prevention

The operational certificate holder shall make all reasonable efforts to prevent unauthorized fires from occurring at the landfill site. As a minimum, a fire break clear of all combustible materials at least 15 metres wide shall surround all disposal, treatment and individual storage areas which have received or are receiving combustible materials. Disposal areas that have had 30 cm of compacted mineral soil cell cover or final cover applied are exempt. Water supply and pumping capabilities and/or soil and earth moving equipment shall be maintained at a sufficient level to extinguish fires. In addition, reasonable efforts shall include, but are not necessarily limited to, the preparation of a Fire Prevention and Response Plan.

4.8 Extinguishment of Fires

In the event of an unauthorized fire (including any smouldering fire), the operational certificate holder shall immediately make all reasonable efforts to extinguish the fire. The operational certificate holder shall also immediately notify the Provincial Emergency Program (phone: 1-800-663-3456) and any local fire authority of an unauthorized fire.

4.9 Buffer Zone

No material shall be landfilled within 50 metres of the property boundary.

4.10 Litter Control

The operational certificate holder shall make all reasonable efforts to prevent litter from scattering. Any litter scattered on neighbouring property shall be cleaned up as soon as practicable.

4.11 Water Table Restriction

Wastes shall not be deposited or stored less than 1.2 metres above the highest groundwater level.

4.12 Surface Water Management

The distance between a natural body of surface water and any stored or buried materials shall be a minimum of 25 metres.

4.13 Inert Materials

Specific inert materials may be exempted from the requirements of Section 4.11 by the Director. The permission of the Director must be obtained in writing prior to any disposal or handling of inert materials on an exemption basis.

4.14 Landfill Gas Lower Explosive Limit

The landfill shall be operated such that combustible gas concentrations do not exceed the lower explosive limit in soils at the property boundary or 25% of the lower explosive limit in any on-site or off-site structure or facility, including any services (water, sewer, electrical, etc.).

4.15 Water Quality and Protection

The landfill shall be operated in a manner such that ground or surface water quality does not decrease beyond that specified by the Director, at the landfill property boundary or other specified location.

If exceedences of the specified criteria occur as a result of landfill operations, the Director may require that leachate management control measures or works be undertaken. Terms of reference for any leachate management study and/or design work shall be submitted to the Director for approval prior to conducting the work.

In addition to requirements specified by the director, groundwater must be managed in accordance with the Contaminated Sites Regulation.

4.16 Maintenance of Works and Emergency Procedures

The operational certificate holder shall inspect the operation regularly and maintain it in good working order. The operational certificate holder shall immediately notify the Director of any circumstance which prevents continuing operation in the approved manner or results in non-compliance with the requirements of this operational certificate.

4.17 Electric Fencing

4.17.1 Design, Construction and Maintenance

Wherever required, electric fencing and gate systems at the landfill shall be designed, constructed, and maintained such that bears are prevented from entering into the landfill through any portion of the fence or gates at any time of the day.

4.17.2 Fence Type

Fencing may be either high tensile smooth wire or fence fabric (e.g., mesh-wire, page-wire, chainlink or the like). The configuration of a high tensile smooth wire fence shall consist of a minimum of eight strands, with four energized strands alternating with four grounded strands as follows: the bottom strand shall be a grounded or (-) strand and shall not be more than 10 cm from the ground (soil) at any location; and thence starting from the bottom strand, the other seven strands shall be spaced 15 ± 2 cm, 15 ± 2 cm, 15 ± 2 cm, 20 ± 2 cm, 20 ± 2 cm, 20 ± 2 cm, and 25 ± 2 cm. Additional strands to this minimum configuration may be used.

A fence fabric may be used instead of high tensile smooth wire. The fence fabric shall: be a minimum of 1.22 metre high; be constructed of a minimum wire thickness of 11 gauge, and have a maximum mesh size of 15 cm. The bottom of the fabric shall not be more than 10 cm from the ground (soil) at any location. Any uncharged fence fabric must have a minimum of four strands of charged wires on an outrigger system, spaced as follows: the first strand shall not be higher than 25 cm from the ground; and each of the remaining three strands shall be spaced approximately 25 cm apart from adjacent charged strands.

4.17.3 Wire Tension

For a high tensile smooth wire fence construction, all strands shall be tightened to a minimum of 125 lbs tension at 20°C. The required tension is to



Mark Love, P.Ag.

For Director, Environmental Management Act

OPERATIONAL CERTIFICATE: MR-5767

be corrected for temperature by use of the following formula for 12-½ gauge high tensile steel wire:

$$Tension = 125 - 2.5(Temperature - 20)$$

where: *Tension* is in lbs force

Temperature is in °C

4.17.4 Post Spacing

Fence posts shall be spaced a maximum of 7.5 metres apart.

4.17.5 Grounding System

A grounding system shall be installed consisting of solid grounding rods (i.e., not pipe) with a minimum diameter of 16 mm (5/8 inch) that have a buried length of at least 2 metres. A minimum of three grounding rods (spaced at least 3 metres apart) shall be installed and connected to the energizer. Alternative energizer grounding systems (e.g., grounding plates, or a deep-driven grounding system) may be used provided the grounding is equivalent to or better than three grounding rods. A grounding rod (or equivalent) shall be installed at least once every 450 metres along the fence and connected to the grounded wire strands or uncharged fence fabric. Additional grounding may be required for dry sites or if other conditions affect proper grounding.

4.17.6 Period of Operation

Electric fencing shall be fully operational during the period of April 1 to October 31 inclusive each year and at any other time of year when there is bear activity in the immediate surrounding area. If snow is present during this period, any electrified strands above snow line shall be isolated from the remainder of the system and energized.

4.17.7 Minimum Voltage

Electric fencing shall be operated with a minimum voltage of 6,000 volts.

4.17.8 Gate(s)

Any access through electric fencing for vehicles, equipment and personnel shall consist of an electrified gate system that is closed during non-operating hours. The gate system shall be electrified to a minimum voltage of 6,000 volts at all times except when being opened or closed. Any gate that is open during operating hours shall be periodically checked by the attendant for bear activity during hours of operation. Gaps between the gate and the fence and

ground, and between gate panels (for a double-hung gate), shall not exceed 10 cm.

4.17.9 Fence Inspections

The entire perimeter of the electric fencing shall be inspected at least once every seven days and the voltage of the fencing measured at several points along the fencing and at each gate using a proper electric fence voltmeter matched to the brand of the fence charging unit. The results of voltage testing shall be recorded in a log book. Any results less than the minimum 6,000 volts shall be immediately investigated for the cause of the low voltage (e.g., low battery, litter, vegetation, loose or crossed wires, broken insulators, breaks in the grounding system, etc.). Corrective actions to restore proper voltage shall be immediately undertaken.

Signs of digging or other attempts by bears to penetrate electric fencing shall be recorded in a log book. Any penetrations through electric fencing by bears shall be immediately reported to the Conservation Officer Service at 1-877-952-7277 and to the Director at 250-847-7260.

In cases of low voltage or signs of penetration attempts, inspections shall be increased from once per week to once per day until proper voltage is fully restored and until there are no new signs of penetration attempts, respectively.

4.18 Other Agency Requirements

This operational certificate does not relieve the operational certificate holder from complying with requirements of federal, provincial, regional district or municipal authorities.

5. OPERATIONAL REQUIREMENTS FOR THE DISPOSAL OF SOLID WASTE

5.1 Location

The operational certificate holder shall identify an area for disposal of solid waste (herein referred to as the solid waste disposal area) that is within the authorized municipal solid waste disposal footprint (see Section 2.1.3). Signs which identify the nature of the waste acceptable at the designated solid waste disposal area shall be erected and maintained. The lettering on the sign shall be such that it is clearly readable by the public upon approach.

5.2 Nature of Wastes

Wastes disposed at the active face of the solid waste disposal area may include any municipal solid waste except liquid wastes and hot ashes or as otherwise restricted by Section 4.2.

5.3 Bear-Proofing

The solid waste disposal area shall be maintained inside an electric fence. The electric fence shall comply with all requirements of Section 4.17.

5.4 Waste Compaction

Wastes at the active face of the solid waste disposal area shall be spread in layers of 60 centimetres or less on the active face and then compacted with a minimum of three (3) passes with heavy equipment.

5.5 Maximum Lift Height

The maximum height of any lift of compacted waste in the solid waste disposal area shall be 5 metres.

5.6 Waste Cover

Cover shall be applied to waste in the solid waste disposal area as specified below. The operational certificate holder shall maintain a log book to record all dates of cover application.

5.6.1 Active Face Cover

Except as otherwise stated in Sub-section 5.6.2, the active face of the solid waste disposal area does not normally require cover. Based on information concerning environmental or public health concerns related to exposed waste at the active face, however, the Director may require that the active face be covered completely at a specified frequency with 0.15 m of soil (or functional equivalent) for a specified period.

5.6.2 Cell Cover

A uniform cover of 30 cm compacted soil shall be applied to all sides of the active waste cell in the solid waste disposal area such that no more than 200 m² of waste are exposed at the active face at any time and such that the volume of waste in the cell does not exceed 2000 m³. Once the maximum volume of waste has been reached in a cell, the active face shall be covered with 30 cm of compacted soil and a new waste cell begun.

5.6.3 Final Cover

Completed portions of the solid waste disposal area shall progressively receive final cover during the active life of the landfill (see Section 11.5).

5.7 Dead Animal Disposal

Dead animals and animal parts shall be disposed of in the solid waste disposal area and covered as soon as practicable with a minimum of 60 centimetres of soil and/or waste material such that flies and scavenging animals are prevented from accessing the carrion. Disposal of Specified Risk Material from cattle shall only be done in accordance with Canadian Food Inspection Agency requirements and procedures.

6. OPERATIONAL REQUIREMENTS FOR COMPOSTING

6.1 Composting

Composting operations shall comply with the requirements of the *Organic Matter Recycling Regulation* and any other relevant legislation.

6.2 Bear-Proofing

If the composting operation is to receive any organic wastes that are potential attractants to bears, then composting shall be completely enclosed by an electric fence or contained in a bear-proof structure (building or composting vessel). The electric fence shall comply with all requirements of Section 4.17.

7. OPERATIONAL REQUIREMENTS FOR STORAGE OF SELECTED WASTES FOR SALVAGE AND RECYCLING

7.1 Location

The operational certificate holder may identify an area for the storage of selected wastes for salvage and recycling (herein referred to as the salvage/recycling area). Any salvage/recycling shall be restricted to the designated salvage/recycling area. This area shall be clearly identified at the landfill site. Signs which identify the nature of the materials acceptable at the designated salvage/recycling area shall be erected and maintained. The lettering on the sign shall be such that it is clearly readable by the public upon approach.

7.2 Nature of Wastes

Wastes to be salvaged/recycled may be any items with potential salvage or recycling value such as tires, lead-acid batteries, auto hulks, white goods, furniture, used lumber, used goods and the like, but shall not include any refuse consisting of or containing putrescibles, any liquid wastes, hot ashes or materials otherwise restricted by Section 4.2.



Mark Love, P.Ag.

For Director, Environmental Management Act

7.3 Compliance

Salvage/recycling shall comply with the requirements of the *Storage of Recyclable Material Regulation* and any other relevant legislation and any additional requirements contained in this operational certificate.

7.4 Contamination

Contamination of any of the designated salvage/recycling storage piles with putrescible wastes shall be cleaned up immediately.

8. OPERATIONAL REQUIREMENTS FOR REGULATED OPEN BURNING

8.1 Location

The operational certificate holder may identify an area for the use of open burning to dispose of selected combustibles (herein referred to as the open burning area). Any open burning of selected wastes shall be restricted to the designated open burning area. This area shall be clearly identified at the landfill site. Signs which identify the nature of the waste acceptable at the designated open burning area shall be erected and maintained. The lettering on the sign(s) shall be such that it is clearly readable by the public upon approach.

8.2 Quantity, Timing, and Duration of Discharge

The maximum authorized quantity of wood residue to be open burned during each event is that which has accumulated at the time of burn initiation. The pile(s) shall be constructed so as to ensure a rapid and complete burn. The quantity of air contaminants is indeterminate.

The maximum authorized duration of each burn shall be limited to the period between two hours after sunrise on the day of ignition, and sunset on the following day. Each open burn must be completely extinguished at the end of the authorized burn duration.

Should a condition arise which prevents the burn pile(s) from being burned within this period, the Director must be notified in accordance with Section 8.10 of this authorization.

8.3 Nature of Wastes

No wastes shall be burned which are unacceptable to the Director. Acceptable materials for burning may only include dry, unpainted, untreated demolition, construction and packing-related wood residue, clean stumps and brush, but must exclude nuisance-causing combustibles such as glue-containing wood, painted



and treated wood, sawdust, yard wastes, mulch, wood chips, rubber, plastics, tars, insulation, roofing material, asphalt shingles, etc.

8.4 Favourable Weather for Smoke Dispersion

Open burning shall not proceed unless weather conditions are such that emissions are dispersed away from populated areas.

The operational certificate holder must also obtain a burn registration number from the Ministry of Forests (1-888-797-1717) prior to ignition.

Open burning of wood residue must not be initiated or continued if the local air flow will cause the smoke to negatively impact a nearby population or cause pollution.

No burning shall occur during periods of fire hazard or when burning is prohibited by other agencies.

8.5 Fire Accelerant

A suitable amount of approved fire accelerant such as diesel fuel or commercial fire starter gel or a flame-thrower shall be used to ensure efficient and rapid ignition of the waste material.

8.6 Minimization of Smoke

The burn shall be tended and fed in a manner that ensures minimization of smoke emissions. Measures to minimize smoke shall include, but not necessarily be limited to: stacking of waste in a manner that eliminates dirt; waiting to burn until wastes are reasonably dry after any significant precipitation event; and using adequate equipment and staff.

8.7 Contingency Plan

Prior to burning, a contingency plan must be in place detailing how the open burn will be extinguished in the event of any of the following occurring:

- i) Inadequate smoke dispersion in the surrounding environment;
- ii) wood residue continues to smoulder after the authorized burn period; and,
- iii) the Director requires that the open burn be extinguished for environmental protection reasons.



At a minimum, the plan must detail the actions to be taken to extinguish the open burn should any of the above conditions occur. The plan shall be made available to the Director upon request.

8.8 Extinguishment

All combustion shall be completely extinguished at the end of the authorized period as set out in Section 8.2 "Quantity, Timing and Duration of Discharge."

8.9 Fire Supervision and Suppression

An attendant shall be on-site to supervise the burn. Adequate fire suppression equipment shall be available for the entire duration of the event, and must be capable of extinguishing the fire if necessary. Local fire departments must be notified of the operational certificate holder's intent to burn, prior to ignition.

8.10 Maintenance of Works and Emergency Procedures

The operational certificate holder shall inspect the burn piles regularly and ensure that they are burning well. In the event of an emergency, or condition beyond the control of the operational certificate holder which prevents continuing operation of the approved method of open burning, the operational certificate holder shall notify the Director within two hours. If notification is necessary, it shall be accomplished by contacting the Environmental Protection program at (250) 847 – 7260.

The Director may require additional controls on the burning process and may require that the burn be extinguished at any time based on its impacts on the receiving environment.

8.11 Documentation

Following completion of each burn, notice shall be sent to the Director by fax (250-847-7591) or by e-mail to a Skeena Environmental Protection staff member advising of the following details: time of burn initiation, time of burn cessation, volume of wood residue burned, venting index values obtained for burning, and any extraordinary conditions encountered during the burn

9. MONITORING REQUIREMENTS

The operational certificate holder shall have a qualified professional evaluate whether an environmental effects monitoring program is needed. The assessment and recommended monitoring program, should one be required, shall be submitted for Director's approval on or before June 30, 2013. In addition to surface water sites, the qualified professional should consider the necessity of establishing ground water



Mark Love, P.Ag.

For Director, Environmental Management Act

monitoring locations.

Until June 30, 2013, an interim monitoring program shall be implemented as follows:

Sampling Locations ¹ and EMS ID	Frequency ³	Parameters ³
Unnamed Creek U/S of Kitwanga Landfill E278450	twice annually, in April and September	Field Measurements: pH, dissolved oxygen, specific conductance, temperature
Unnamed Creek D/S of Kitwanga Landfill E278449		Lab Analysis: BOD, total nitrogen, phosphorous, ammonia, pH, total and dissolved metals ²
¹ Sampling locations are shown on the site plan ² Lab analysis for dissolved metals shall use a low level scan ³ May be altered in future, depending on results		

10. REPORTING REQUIREMENTS

10.1 Reporting

All reports, drawings, data, studies and the like shall be submitted in hardcopy and electronic formats unless otherwise specified by the Director.

10.2 Log Book

As required by Sections 4.17.9 and 5.6 the operational certificate holder shall maintain a log book. The log book shall be made available for inspection by Ministry staff upon request.

10.3 Non-compliance Reporting

The operational certificate holder shall immediately notify the Director of any non-compliance with the requirements of this operational certificate and take appropriate remedial action. Written confirmation of all non-compliance events, including available test results, is required by facsimile or email to Environmental Protection staff within 24 hours of the original notification unless otherwise directed by the Director.

10.4 Non-compliance Follow-up

Upon request, the operational certificate holder shall submit to the Director a written report within 30 days of the non-compliance

occurrence. The report shall include, but not necessarily be limited to, the following:

- i) All relevant information and test results related to the non-compliance;
- ii) an explanation of the most probably cause(s) of the non-compliance; and,
- iii) remedial action planned and/or taken to prevent similar non-compliance(s) in the future.

10.5 Annual Report

The operational certificate holder shall submit a basic annual report to the Director on or before June 30 each year for the previous calendar year.

The report shall contain, at a minimum:

- i) The type and tonnage or volume of waste received, recycled, and landfilled for the year;
- ii) occurrences or observations of wildlife attempting to access the facility;
- iii) the results of any monitoring programs undertaken by the operational certificate holder for this site. Trend analysis, as well as an evaluation of any identified impacts of the discharges on the receiving environment in the previous year shall be carried out by a qualified professional, if determined to be necessary by the Director.

11. CLOSURE REQUIREMENTS

11.1 Notification of Closure

The operational certificate holder shall notify the Director in writing of intentions to close the landfill site.

11.2 Closure Plan

A closure plan shall be submitted to the Director no later than 6 months in advance of scheduled closure. The closure plan shall, at a minimum, include the following:

- i) Proposed end-use of the landfill property after closure;



- ii) anticipated total waste volume, tonnage, and life remaining of the landfill;
- iii) a topographic plan showing the final elevation contours of the landfill and surface water diversion and drainage controls;
- iv) design of the final cover suited to the intended end-use of the site, including the thickness and permeability of barrier layers and drainage layers, and information on topsoil, vegetative cover and erosion prevention controls;
- v) procedures for notifying the public about the closure and about alternative waste disposal facilities;
- vi) rodent and nuisance wildlife control procedures;
- vii) a comprehensive monitoring plan, if determined to be necessary by a qualified professional, including groundwater monitoring, surface water monitoring, landfill gas monitoring, leachate monitoring, final cover monitoring, and erosion and settlement monitoring, for a minimum post-closure period of 25 years;
- viii) a plan and accompanying design for the collection, storage and treatment/use of landfill gas for a minimum 25 year post-closure period (if required);
- ix) a plan for operation of any required pollution abatement engineering works such as leachate collection and treatment systems, for a minimum post-closure period of 25 years; and,
- x) an estimated cost, updated annually, to carry out closure and post-closure activities for a minimum period of 25 years.

11.3 Closure Funding

The operational certificate holder shall ensure that sufficient funds will be available to provide for all closure and post-closure requirements as outlined in the closure plan required by Section 11.2, plus a reasonable contingency for any remediation which may be required.

11.4 Final Cover

The final cover system shall be designed by a qualified professional to match the intended end-use of the landfill site and to match the needs of any required environmental management systems (leachate minimization or recirculation, as the case may be, landfill gas collection and treatment, etc.). Generally, the final

cover shall consist of a layer of 1 metre of low permeability ($<1 \times 10^{-5}$ cm/s) compacted soil followed by a layer of topsoil suitable for establishment of vegetation. Higher permeability soil may be used if determined to be acceptable by a qualified professional and specified in the DOCP. The final cover shall be constructed with minimum and maximum slopes as specified by a qualified professional (see Section 3.4) to promote runoff and minimize erosion, with appropriate runoff drainage controls, erosion controls, and gas venting controls. The site shall be seeded with a grass/legume mixture suited to the local climate.

11.5 Progressive Application of Final Cover

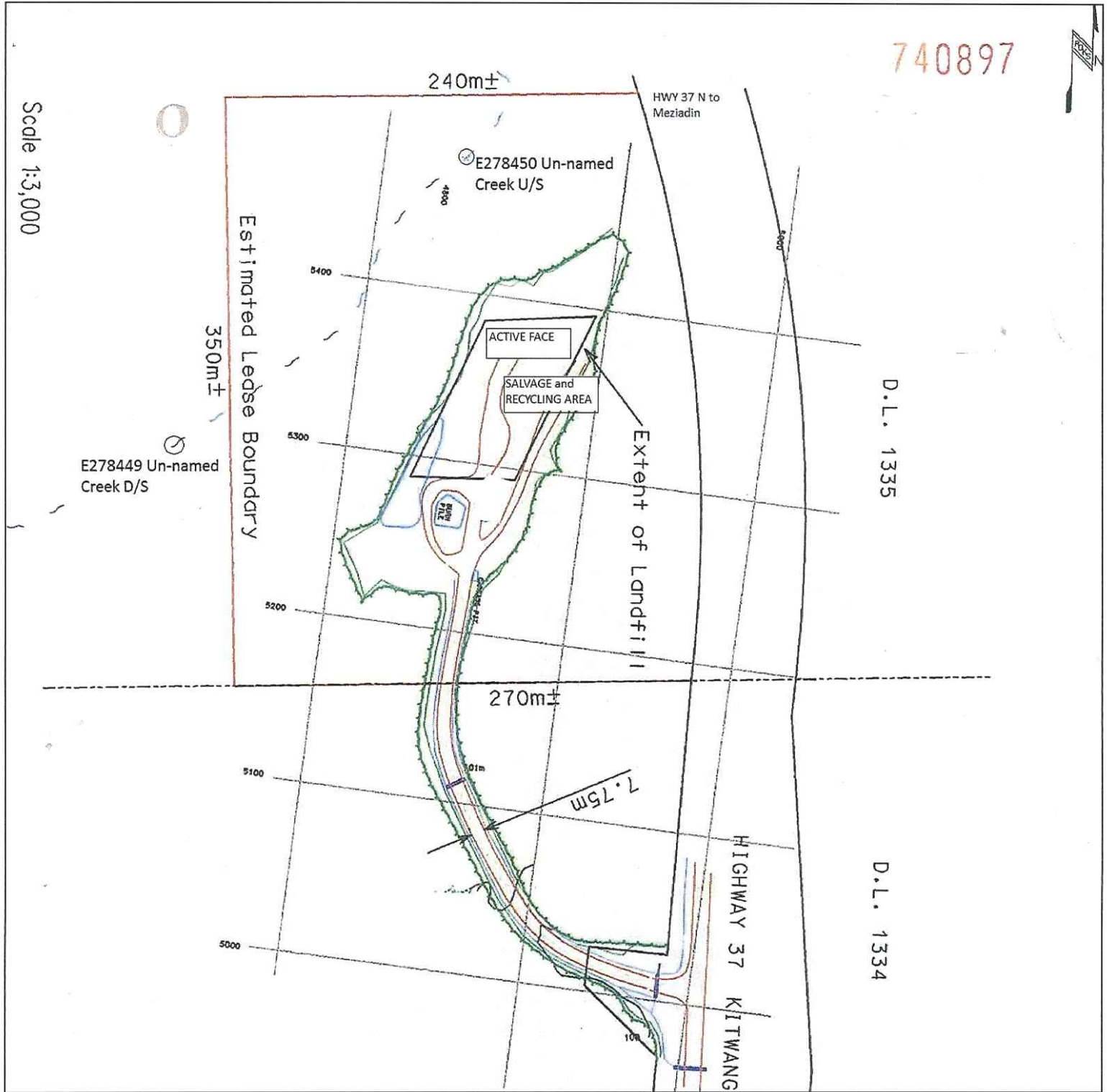
Completed portions of the landfill shall progressively receive final cover during the active life of the landfill. The maximum area of disposed refuse that has not yet received final cover shall not exceed 25% of the total final footprint area. Final cover is to be applied according to the specifications identified in Section 11.4.

12. ENVIRONMENTAL IMPACT

Inspections of the discharge will be carried out by Environmental Protection personnel as a part of the routine operational certificate inspection procedure. Based on these inspections and any other information available to the Director on the effect of the discharge on the receiving environment, the operational certificate holder may be required to undertake additional monitoring, undertake additional studies, install additional pollution control works, or change the method of operation.



SITE PLAN



Date Issued: November 8, 2012

Date Amended:
(most recent)

Page 19 of 19

Mark Love, P.Ag
for Director, *Environmental Management Act*
Skeena Region
Permit Number: MR-5767