Valentine Gold Project: Federal Information Requests

Responses to IR-01 to IR-07 and IR-27 to IR-58

Marathon Gold Corporation
36 Lombard Street, Suite 600
Toronto, ON M5C 2X3

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LIST OF APPENDICES

RESPONSE TO IR-01

ID:	**IR-01**
Expert Department or Group:	Pub-07.05 (Dal)
Guideline Reference:	Section 7.1
EIS Reference:	9.1.3.1 Spatial Boundaries
Context and Rationale:	The EIS Guidelines state that the EIS will present information in sufficient detail to enable the identification of how the project could affect the Valued Components and the analysis of those effects. In the EIS, the spatial boundaries are given as the following: • Project Area + 20 m • Local Assessment Area + 1 km buffer from mine site or 500 m buffer from access road • Regional Assessment Area + 35 km around the Project Area The reasoning behind the spatial boundaries, which become the basis for habitat availability and loss of habitat, is unclear. This information is needed to determine significance of effects on Valued Components.
Information Request:	Provide the ecological rationale for the spatial boundaries of the Project Area, Local Assessment Area and Regional Assessment Area and their applicability to each Valued Component.
Response:	There are several accepted approaches to determining spatial assessment boundaries for a project, including valued component (VC)-centred spatial boundaries, ecosystem-centred spatial boundaries, activity-centred spatial boundaries and administrative, political or other human-made spatial boundaries (Canadian Environmental Assessment Agency 2014). As described in Section 4.2.4.1 of the EIS, spatial boundaries for the Project assessment were largely based on the geographic extent of the measurable potential environmental effects (e.g., the zone of influence [ZOI]) of the Project, but also considered ecological factors (e.g., caribou ranges) as further described below. Boundaries were ultimately selected based on understanding of the extent of Project-related effects, literature review, and professional judgement; this approach to selection of assessment boundaries is consistent with accepted practice and has been used for other federally and provincially approved project-specific assessments. The Project Area is the same spatial boundary for all VCs and is the immediate area in which Project activities and components occur. The

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	Project Area includes the area of direct physical disturbance associated with Project activities. The Local Assessment Area (LAA) is the area in which Project-related environmental effects (either direct or indirect) can be predicted or measured with reasonable accuracy (i.e., the primary ZOI of Project-related effects). The ZOI is informed by the nature of the pathways that may result in a cause-effect relationship between the Project and the VC (Canadian Environmental Assessment Agency 2014). The LAA, which is specific to each VC (as described in the respective VC chapters), encompasses the Project Area and is selected in consideration of the geographic extent of effects on the given VC. For the terrestrial biological VCs, the LAA of a 1 km buffer from mine site and 500 m buffer from access road was selected to reflect the area in which Project effects are most likely to occur for the selected VCs. This includes the direct effects from habitat loss due to site clearing activities and earthworks, as well as indirect sensory disturbances (i.e., noise and light). The Regional Assessment Area (RAA) is the area established for context in the determination of significance of Project-specific effects. The RAA is also used as the basis for capturing more far-reaching effects such as those associated with some accidental events (e.g., downstream effects from a Tailings Management Facility failure or spill of hazardous materials), and to inform the assessment of cumulative effects. The RAA is VC specific (as described in the respective VC chapters) and encompasses both the Project Area and the LAA. For example, the RAA selected for the Caribou VC was based on advice provided from Wildlife Division, which considers the population range for caribou. The biological VCs also refer to the Ecological Land Classification Area (ELCA), which is the area within which detailed habitat data have been collected. The ELCA is used to assess quantitative effects on habitat. In particular, the magnitude of residual effects has been characterized in relationship to the ELCA (i.e., the percentage of the ELCA in which a loss or change will occur). In this context, the ELCA has been used as a surrogate for the RAA, as it is an area sufficiently large to provide regional context and is the area for which comparable ecological land classification data is available. Note that the use of activity-centred assessment boundaries (e.g., boundaries related to the ZOI of Project activities) is often a more conservative approach as compared to ecological-based boundaries. Population ranges for many species considered in the EIS can extend to most of the Island of Newfoundland. Assessing the magnitude of a Project

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	effect (e.g., percentage of habitat loss) in relation to a large geographic area or the broader population (versus the population within a smaller RAA) can cause Project effects to be diluted and underestimated. As well, while the description of existing conditions focusses on the assessment areas, broader regional information has been included where required to understand the life history of a species (e.g., population estimates, wintering habitat for migratory birds). Reference: Canadian Environmental Assessment Agency. 2014. Technical Guidance for Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012. Available at: https://www.canada.ca/en/impact-assessment-agency/services/policy-guidance/technical-guidance-assessing-cumulative-environmental-effects-under-canadian-environmental-assessment-act-2012.html#s1-2
Appendix:	None

RESPONSE TO IR-02

ID:	**IR-02**
Expert Department or Group:	CPAWS-10Pub-07.10 (Dal)
Guideline Reference:	Section 7.2.1
EIS Reference:	EIS Chapter 5 – Atmospheric Environment Section 5.5.3 Atmospheric emissions, noise
Context and Rationale:	The EIS guidelines require information in the EIS on changes to the atmospheric environment including changes in ambient noise levels and any indirect effects to wildlife caused by increased disturbance. Section 5.5.3 of the EIS explains changes in sound quality related to the Project. This section generally refers to sound from construction and indicates that sound emissions will result from blasting during construction. However, appendix 5H lists sound sources and blasting is not included. It is not clear from the EIS whether blasting is included in the acoustic evaluation. This information is needed to determine significance of effects on wildlife (e.g. migratory birds, caribou and species at risk [SAR].
Information Request:	a. Confirm whether blasting was included in the acoustic evaluation or provide a rationale as to why it was not. b. If blasting was not included in the acoustic evaluation, revise the environmental effects assessment on wildlife (e.g., migratory birds, caribou and SAR) to consider the effects of blasting and update the proposed mitigation, follow-up and conclusions as appropriate.
Response:	a. Blasting was included in the acoustic evaluation presented in the EIS (note that Appendix 5H of the EIS lists sound sources associated with equipment only). The potential effects from blasting during Project construction and operation were assessed qualitatively and separately from the steady state activities and traffic noise, as the potential effects from blasting on the acoustic environment are measured differently than those from steady state and traffic-related activity. During Project operation, blasting will alternate pits (Marathon and Leprechaun) such that a blast is expected to occur at a given pit every second day, overall averaging one blast per day for both pits combined or approximately 350 total blasts per year. Blasting during Project construction and operation is impulsive and provides a low frequency air blast and ground vibration. Air blast is low frequency sound generated by energy waves transferred through the air, and is measured in dB. Vibration is energy waves transferred through the ground and measured by particle velocity. The type of geology and the blast configuration greatly influence how the energy of

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	the blast is released into the atmosphere. During a blast, the majority of the energy is consumed in fragmenting the desired portion of rock with the remaining energy released as air blast and ground vibration. Blasting at mines routinely follows best management practices, namely the Blasters Handbook (ISEE 2016) and the Environmental Code of Practice for Metal Mines (ECCC 2009). These guides include recommended threshold values for blasting, and mitigation options to reduce air blast related noise and vibration during blasting events. Relative to blasting for other types of mining (e.g., iron ore), blasting during gold mining requires substantially fewer explosives and is much more localized, thereby resulting in less air blast -related noise and vibration. Therefore, it is expected that noise and vibration emissions from blasting during Project construction and operation will conform to the recommended thresholds outlined in these best-practice guides. b. As noted above, blasting was included in the acoustic evaluation. The assessment of Project effects on wildlife (avifauna, caribou, other wildlife, and species at risk) also considered blasting, as indicated in the Project interactions tables (Table 10.17, Table 11.12, and Table 12.16 of the EIS). Blasting, along with other sources of noise and sensory disturbance, was included and assessed as a Project activity. The assessments largely relied on studies that describe sensory disturbance to wildlife in general, as the specific effects of blasting on wildlife are not well documented in the scientific literature. Noise emissions during blasting will be monitored and reduced by following the best practices from Blaster's Handbook (ISEE 2016) and Environmental Code of Practice for Metal Mines (ECCC 2009). As blasting is expected to be limited to daytime hours (i.e., between 7 am and 7 pm), noise and vibration related effects on nighttime wildlife activities will be avoided. Activities in the Marathon pit area that may result in sensory disturbance to migrating caribou (e.g., blasting, loading, hauling) will be reduced or ceased while caribou are migrating within a set distance from the site (e.g., 10 km north or south) and through the corridor at site. The extent of the activity reduction, and the conditions regarding caribou migration proximity will be determined in consultation with the Newfoundland and Labrador Department of Fisheries, Forestry and Agriculture-Wildlife Division. In addition, to reduce sensory disturbance, a visual survey for caribou will be conducted prior to blasting. If caribou are observed within a 500 m

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	blasting radius buffer activity will be delayed until animals have left the buffer. References: ECCC (Environment and Climate Change Canada). 2009. Environmental Code of Practice for Metal Mines. Available at https://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=CBE3CD59-1&offset=2. ISSE (International Society of Explosives Engineers). 2016. Blaster's Handbook (18th Edition).
Appendix:	None

RESPONSE TO IR-03

ID:	**IR-03**
Expert Department or Group:	-
Guideline Reference:	Section 7.1 and7.1.5
EIS Reference:	Baseline Study Appendix, Attachment 7-D Appendix A Ecological Land Classification – Mineral Claims Block – Page 1 of 8
Context and Rationale:	The EIS Guidelines state that the EIS will present information in sufficient detail to enable the identification of how the project could affect the Valued Components and the analysis of those effects. The EIS Guidelines also require the delineation of drainage basins, at appropriate scales (water bodies and watercourses), including wetlands, boundaries of the watershed and subwatersheds, overlaid by key project components. Mapping provides spatial relationships between ecotypes, infrastructure and habitats. The following requires mapping associated with the description: a. The EIS provided Ecological Land Classification (ELC) maps in the Baseline Study. The scale of the map makes it difficult to decipher the land classifications in the main impacted area. b. The EIS provides a description of the percent of wetland areas affected. A map is important to understand where these habitats are in relation to the surrounding area. This information is needed to determine significance of effects on Valued Components.
Information Request:	Provide mapping for the following: a. Ecological Land Classification (ELC) maps of the Project Area and Local Assessment Area at a scale where ecotypes and habitats can be interpreted. Include all boundaries such as the Project Area and Local Assessment Area boundaries and infrastructure design. b. Wetlands affected directly and indirectly by project activities, wetland types and size, fish habitat, Species at Risk habitat, Caribou habitat, waterfowl habitat/stopover, and breeding bird habitat overlaid with Ecological Land Classification and boundary lines (at a minimum the Project Area and the Local Assessment Area).
Response:	a. An updated Ecological Land Classification (ELC) mapbook (Appendix IR-03.A) is presented at a scale that allows individual ELC units to be interpreted. The Project Area, Local Assessment Area, Project infrastructure as presented in the EIS, and contiguous subwatersheds are overlaid on the ELC units. b. As discussed in Sections 9.5.1.2, 9.5.2.2, and 9.5.3.2 of the EIS, ELC units within the footprint of Project infrastructure or site features are expected to be directly lost or changed, while ELC units within the remainder of the Project Area are assumed to be either directly or

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	indirectly affected by the Project. As discussed in Section 9.5.3.2 of the EIS, wetlands in subwatersheds that are outside of, although contiguous with, the Project Area may experience indirect disturbance. An understanding of the spatial distribution of wildlife habitat can be obtained by viewing this updated ELC mapbook while referencing appropriate habitat value ranking tables within Chapter 10 (Tables 10.5, 10.7, 10.9, 10.11, 10.13), Chapter 11 (Table 11.8), and Chapter 12 (Tables 12.4, 12.7, 12.10, and 12.12). Fish habitat is described within Section 8.2.2.1, and shown on Figures 8-3 to 8-11. For Arctic char, please see the response to IR-29.
Appendix:	Appendix IR-03.A

RESPONSE TO NA

ID:	**NA**
Expert Department or Group:	-
Guideline Reference:	Section 7.1 and 7.2
EIS Reference:	Chapters 6, 8 and 10
Context and Rationale:	The EIS guidelines require baseline information in sufficient detail to enable the identification of how the Project could affect the Valued Components, along with an analysis of those effects/changes according to section 7.2 of the EIS Guidelines. This information is needed to fully evaluate changes in groundwater and their effect on surface water and subsequently fish and fish habitat.
Information Request:	The Agency and NRCan have determined that there are a number of information gaps in the baseline information and deficiencies in the Proponent's analysis related to the following: • Ground water modelling methods and assumptions • Waste rock management plan and mitigations • Baseline sampling and testing distribution related to groundwater and mine waste geochemistry • Groundwater • Surface water interactions • Metal leaching and acid rock drainage occurrence, mitigations, and predictions of effluent quality • Monitoring and follow-up programs. The following IRs 04 to 26 are related to these information gaps. Once these IRs have been addressed, the proponent must incorporate the information provided to update the assessment of effects on fish and fish habitat and migratory birds, waterfowl) where necessary.
Response:	Comment noted. Additional information has been provided in IR-04 to IR-26 to address the items noted.
Appendix:	None

RESPONSE TO IR-04

ID:	**IR-04**
Expert Department or Group:	-
Guideline Reference:	Section 7.1.2
EIS Reference:	Section 9.2.2.7 Soil Quality Baseline Study Appendix 4, Attachment 4-C, Section 4.4.3 (Sediment Quality) Baseline Study Appendix 4, Attachment 4-C, Appendix D.4 (Sediment Data)
Context and Rationale:	The EIS Guidelines require the baseline geochemical concentrations of contaminants of concern in soils and sediment within the local, regional and downstream receiving environments. In the EIS, it states that soils from Test Pits were analyzed; however, the data was not provided in the Baseline Study Appendix 3, Attachment 3-D as referenced in the report. Data is missing for the following: sediments analyzed from any surface water body; and soil and sediment data collected from regional or downstream receiving environments. This information is needed to assess the potential effects on Indigenous health and for follow-up and monitoring programs.
Information Request:	Provide baseline data results for geochemical concentration of contaminants of concern for the soil and sediments from regional or downstream receiving environments, including the test pit and surface water bodies.
Response:	As indicated in the Section 9.2.2.1 of the EIS, the geotechnical test pit (TP) program conducted by GEMTEC Consulting Engineers and Scientists (GEMTEC) (see BSA.3, Attachment 3-D) was one source of data used to help characterize soil and terrain conditions within the Project Area. The test program did not include geochemical sediment and soil data for contaminants of concern but did contain other information that helped establish baseline conditions in the EIS for soils. Since preparation of the EIS, twenty-two surface soil samples were collected throughout the Local Assessment Area (LAA) (Figure IR-04.1). The soil samples (including two duplicates) were submitted for laboratory analysis of metals, including mercury, and results are provided in Appendix IR-04.A. Sediment chemistry of samples from streams, ponds, and lakes is provided in Table IR-04.1. Marathon will undertake baseline sediment environmental effects monitoring (EEM) in 2021 and will continue sediment monitoring in keeping with EEM requirements under the *Metal and Diamond Mining Effluent Regulations* throughout the life of the mine.
Appendix:	Appendix IR-04.A

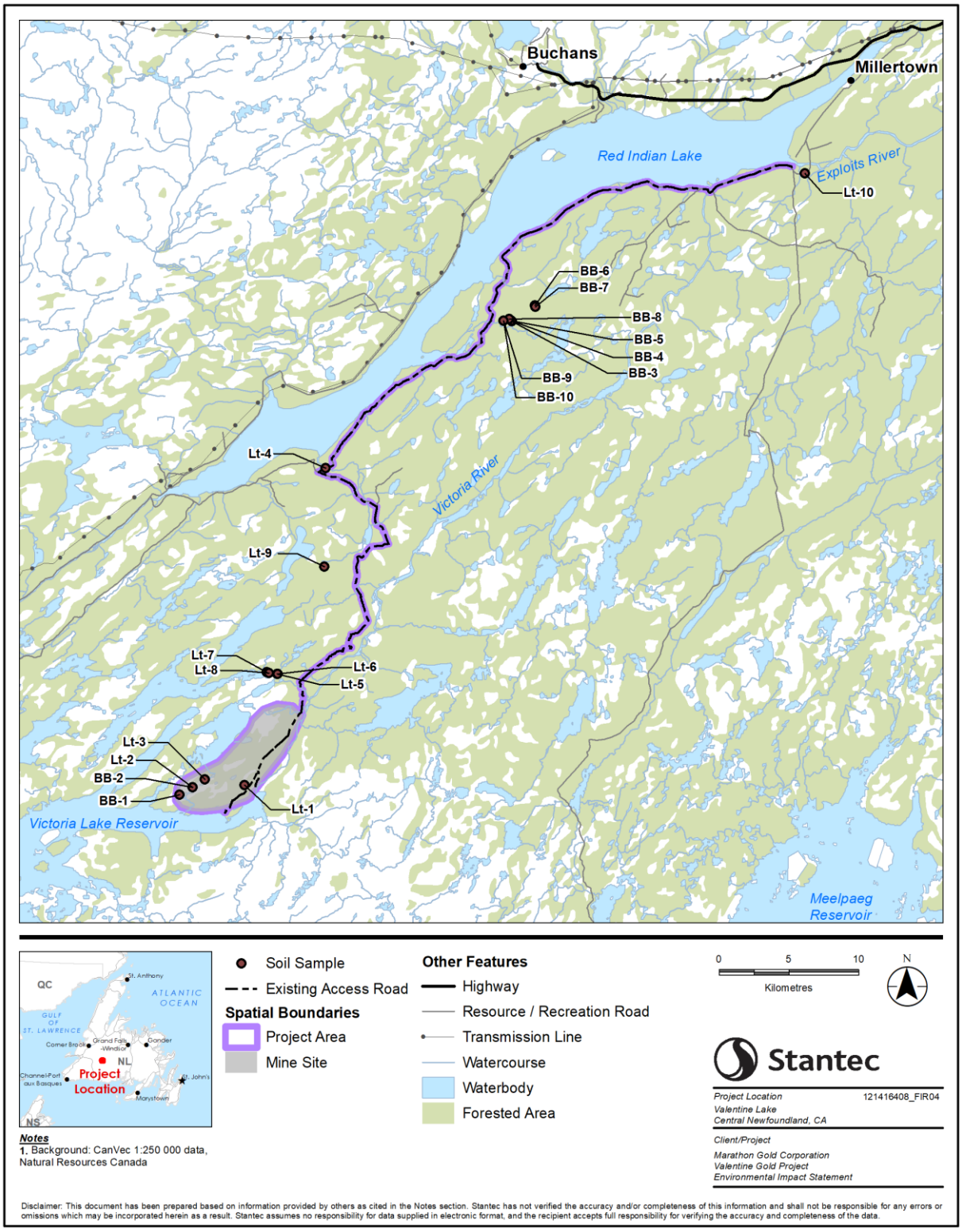

Figure IR-04.1 Soil Sample Locations

Table IR-04.1 Sediment Chemistry Sample Results from Ponds, Lakes and Streams

Sampling Date				9/24/2019 11:01:00 AM	9/27/2019 2:17:00 PM	9/24/2019 12:19:00 PM	9/29/2019 9:28:00 AM	9/23/2019 11:20:00 AM	9/27/2019 1:40:00 PM	9/23/2019 5:13:00 PM	9/24/2019 1:25:00 PM	9/23/2019 2:45:00 PM	9/23/2019 5:10:00 PM	9/27/2019 8:55:00 AM
Habitat				**Streams (Soft Sediment)**					**Ponds**					
Metals	**UNITS**	**CSQG PEL**	**CSQG ISQG**	**C001-02 (14)**	**V1in-02 (22)**	**M1OUT-02 (8)**	**VICP2OUT-02 (16)**	**VALP2OUT-02 (20)**	**V1**	**L1**	**M7**	**VALP2**	**VICP2**	**VALP3**
Acid Extractable Aluminum (Al)	mg/kg			14000	20000	12000	18000	22000	14000	19000	18000	22000	29000	21000
Acid Extractable Antimony (Sb)	mg/kg			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Acid Extractable Arsenic (As)	mg/kg	17	5.9	**240**	**43**	**80**	**110**	**72**	**18**	**290**	**120**	**56**	**86**	**170**
Acid Extractable Barium (Ba)	mg/kg			110	220	63	86	63	91	310	88	48	270	77
Acid Extractable Beryllium (Be)	mg/kg			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Acid Extractable Bismuth (Bi)	mg/kg			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Acid Extractable Boron (B)	mg/kg			<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Acid Extractable Cadmium (Cd)	mg/kg	3.5	0.6	0.33	1.6	0.78	0.75	<0.30	1.6	1.1	1.5	1.1	1.1	0.93
Acid Extractable Chromium (Cr)	mg/kg	90	37.3	24	24	17	21	32	14	17	15	17	17	18
Acid Extractable Cobalt (Co)	mg/kg			30	33	16	18	17	16	43	15	14	16	19
Acid Extractable Copper (Cu)	mg/kg	197	35.7	20	33	31	13	59	28	16	23	19	20	16
Acid Extractable Iron (Fe)	mg/kg			45000	50000	19000	36000	40000	22000	47000	25000	22000	35000	36000
Acid Extractable Lead (Pb)	mg/kg	91.3	35	6.6	9.4	8.2	8.6	8.9	9.3	18	7.1	21	26	5.4
Acid Extractable Lithium (Li)	mg/kg			11	8.1	8.2	12	12	4.4	6.4	7.5	2	4.3	21
Acid Extractable Manganese (Mn)	mg/kg			7400	19000	4600	4400	1500	7100	28000	3700	850	1600	1500
Acid Extractable Mercury (Hg)	mg/kg	0.486	0.17	<0.10	0.14	0.18	0.14	<0.10	0.18	0.2	0.21	0.23	0.17	<0.10
Acid Extractable Molybdenum	mg/kg			<2.0	7.2	5.1	2.9	<2.0	3	5.3	7.2	2.5	5.6	2.8
Acid Extractable Nickel (Ni)	mg/kg			23	24	18	17	24	15	21	19	14	15	22
Acid Extractable Rubidium (Rb)	mg/kg			5.4	3.9	2.3	2.8	8.3	2.5	2.4	2.5	<2.0	2.6	7.9
Acid Extractable Selenium (Se)	mg/kg			<1.0	<1.0	1.8	<1.0	<1.0	1.3	1.3	1.9	1.7	1.5	<1.0
Acid Extractable Silver (Ag)	mg/kg			<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Acid Extractable Strontium (Sr)	mg/kg			15	37	24	21	13	34	37	37	23	200	21
Acid Extractable Thallium (Tl)	mg/kg			<0.10	0.12	0.12	0.1	<0.10	<0.10	0.2	0.13	<0.10	0.17	0.18
Acid Extractable Tin (Sn)	mg/kg			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	<1.0	<1.0
Acid Extractable Uranium (U)	mg/kg			0.95	2.7	7.6	2	0.84	4.3	10	9.5	5.1	6.5	6.2
Acid Extractable Vanadium (V)	mg/kg			54	70	36	56	78	28	41	27	37	48	41
Acid Extractable Zinc (Zn)	mg/kg	315	123	110	170	88	130	76	110	250	170	140	190	200
Grain Size														
Gravel	%			6.2	2.7	<0.10	3.2	<0.10	0.28	0.88	0.19	<0.10	<0.10	2.1
Sand	%			69	67	33	52	0.66	15	50	36	23	32	63
Silt	%			15	26	39	22	79	40	27	24	37	36	21
Clay	%			10	4.2	28	23	21	45	22	41	39	32	14

Note: Bold indicates exceedance of Canadian Sediment Quality Guidelines for the Protection of Aquatic Life Probable Effect Level (CSQG PEL)

Table IR-04.1 Sediment Chemistry Sample Results fro

Sampling Date			9/24/2019 11:22:00 AM	9/24/2019 9:30:00 AM	9/24/2019 1:24:00 PM	9/25/2019 11:30:00 AM	9/25/2019 12:30:00 PM	9/25/2019 1:30:00 PM	
Habitat			**Lakes**						
Metals	**UNITS**	**CSQG PEL**	**VIC02-DP**	**VIC01-MD**	**VIC03-LT**	**VAL01-DP**	**VAL02-MD**	**VAL03-LT**	**Reporting Detection Limit**
Acid Extractable Aluminum (Al)	mg/kg		26000	19000	21000	29000	23000	18000	10
Acid Extractable Antimony (Sb)	mg/kg		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0
Acid Extractable Arsenic (As)	mg/kg	17	**79**	**95**	**95**	**280**	**68**	**71**	2.0
Acid Extractable Barium (Ba)	mg/kg		120	67	58	480	76	120	5.0
Acid Extractable Beryllium (Be)	mg/kg		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0
Acid Extractable Bismuth (Bi)	mg/kg		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0
Acid Extractable Boron (B)	mg/kg		<50	<50	<50	<50	<50	<50	50
Acid Extractable Cadmium (Cd)	mg/kg	3.5	1.1	0.34	0.3	2.9	1.2	1.3	0.30
Acid Extractable Chromium (Cr)	mg/kg	90	34	29	31	33	22	18	2.0
Acid Extractable Cobalt (Co)	mg/kg		31	17	25	50	11	14	1.0
Acid Extractable Copper (Cu)	mg/kg	197	46	39	43	75	32	23	2.0
Acid Extractable Iron (Fe)	mg/kg		47000	44000	45000	57000	27000	21000	50
Acid Extractable Lead (Pb)	mg/kg	91.3	24	8.9	8.8	19	54	37	0.50
Acid Extractable Lithium (Li)	mg/kg		13	11	15	21	6.6	3.8	2.0
Acid Extractable Manganese (Mn)	mg/kg		5100	1100	1600	29000	1800	3600	2.0
Acid Extractable Mercury (Hg)	mg/kg	0.486	0.26	0.12	0.11	<0.10	0.14	<0.10	0.10
Acid Extractable Molybdenum	mg/kg		3.6	2.6	<2.0	11	3.2	2.5	2.0
Acid Extractable Nickel (Ni)	mg/kg		30	24	28	56	17	16	2.0
Acid Extractable Rubidium (Rb)	mg/kg		9.1	5.7	6.7	7.7	4	3.1	2.0
Acid Extractable Selenium (Se)	mg/kg		1.7	<1.0	<1.0	<1.0	1.8	1.3	1.0
Acid Extractable Silver (Ag)	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50
Acid Extractable Strontium (Sr)	mg/kg		16	12	15	20	26	41	5.0
Acid Extractable Thallium (Tl)	mg/kg		0.33	<0.10	<0.10	0.66	0.12	0.18	0.10
Acid Extractable Tin (Sn)	mg/kg		1.3	<1.0	<1.0	<1.0	2	1	1.0
Acid Extractable Uranium (U)	mg/kg		3.6	1.6	1.3	2.5	1.7	1.7	0.10
Acid Extractable Vanadium (V)	mg/kg		90	74	77	76	45	35	2.0
Acid Extractable Zinc (Zn)	mg/kg	315	130	72	71	220	140	160	5.0
Grain Size									
Gravel	%		<0.10	1.4	0.16	22	<0.10	<0.10	0.10
Sand	%		3.9	9.8	17	17	23	39	0.10
Silt	%		65	64	69	39	42	32	0.10
Clay	%		31	25	14	21	35	29	0.10

Note: Bold indicates exceedance of Canadian Sediment C

RESPONSE TO IR-05

ID:	**IR-05**
Expert Department or Group:	-
Guideline Reference:	Section 7.1.2
EIS Reference:	Section 5.3.1.1 of Appendix 7A (Water Quantity and Water Quality Modelling Report: Leprechaun Complex and Processing Plant and TMF Complex). Section 5.3.3.1 of Appendix 7B (Water Quantity and Water Quality Modelling Report: Marathon Complex)
Context and Rationale:	The EIS Guidelines require information on geochemical characterization of leaching potential, including, but not limited to, contaminants of concern from waste rock, pit walls and tailings. Section 5.3.1.1 of Appendix 7A and section 5.3.1.1 of Appendix 7B of the EIS state that leaching rates are obtained from neutral drainage, because none of the geochemical tests have developed acidic leachate. However, some of the groundwater samples (MW2, MW7 in Appendix I of BSA 3-D) have acidic pH. This information is needed to determine significance of effects on fish and fish habitat.
Information Request:	Provide a rationale as to why the geochemical tests using a neutral pH is considered conservative versus using the acidic pH found in some of the groundwater locations.
Response:	The slightly acidic pH values (6.4-6.6) in groundwater samples from well MW-7 are likely associated with naturally occurring fulvic/humic acids leached from soil. This statement is supported by the highest concentration of total organic carbon observed in MW-7 (29-62 mg/L) among all groundwater wells. Sulphate concentration in well MW7 (1-10 mg/L) is also close to average concentrations observed in other wells installed in the overburden (7 mg/L) indicating that sulphide oxidation is not a source of acidity in groundwater. As the chemistry of groundwater samples is not consistent with acid rock drainage / metal leaching from oxidation of sulphide minerals in bedrock, the observed data are not indicative of the potential influence of mine rock leaching on groundwater chemistry. The best evidence of potential mine rock leaching, and influence on receiving water chemistry (surface or groundwater), is from the geochemical testing program conducted on waste rock, pit wall material and tailings.
Appendix:	None

RESPONSE TO IR-06

ID:	**IR-06**
Expert Department or Group:	-
Guideline Reference:	Section 7.1.5
EIS Reference:	Baseline Studies Appendices Attachment 3-D Hydrogeology Baseline Report (2020)(Gemtec),Section 4.1
Context and Rationale:	The EIS Guidelines require the inclusion of all groundwater monitoring wells, including their location, in respect to the Project Area.The EIS states that over 1000 boreholes have been drilled throughout the project site. Each borehole drilled represents a preferential flow path for surface contamination to directly reach groundwater should the holes remain and not be properly decommissioned.
Information Request:	a. Provide a map identifying all boreholes that will be removed with the creation of the open pit and all remaining boreholes in the Project Area. b. Provide an assessment of potential effects from the remaining boreholes that may be vulnerable due to surface infrastructure to providing a direct pathway for surface contaminants to reach groundwater.
Response:	a. Maps identifying the boreholes that will be removed with the creation of the open pit, and the remaining boreholes in the Project Area are provided in Figures IR-06.1 and IR-06.2. Note that all of the boreholes within the open pits will be removed; the boreholes within the footprint of the waste rock pile, overburden stockpile and low-grade ore stockpiles will be decommissioned. b. As shown on Figures 4-2a, b and c of Appendix 6A of the EIS, and on Figures IR-06.1 and IR-06.2, most of the boreholes are located in the area of the open pits and will be partially or completely removed with the development of the open pit. However, there are a few open boreholes located within the footprints of the waste rock piles or tailings management facility. Efforts will be made to locate open exploration boreholes within the footprints of these facilities prior to construction and decommission them to eliminate pathways for contaminants from these features to enter groundwater. The potential vulnerability of the groundwater outside of the waste rock piles or tailings management facility footprints that may result from the remaining boreholes is expected to be minor.
Appendix:	None

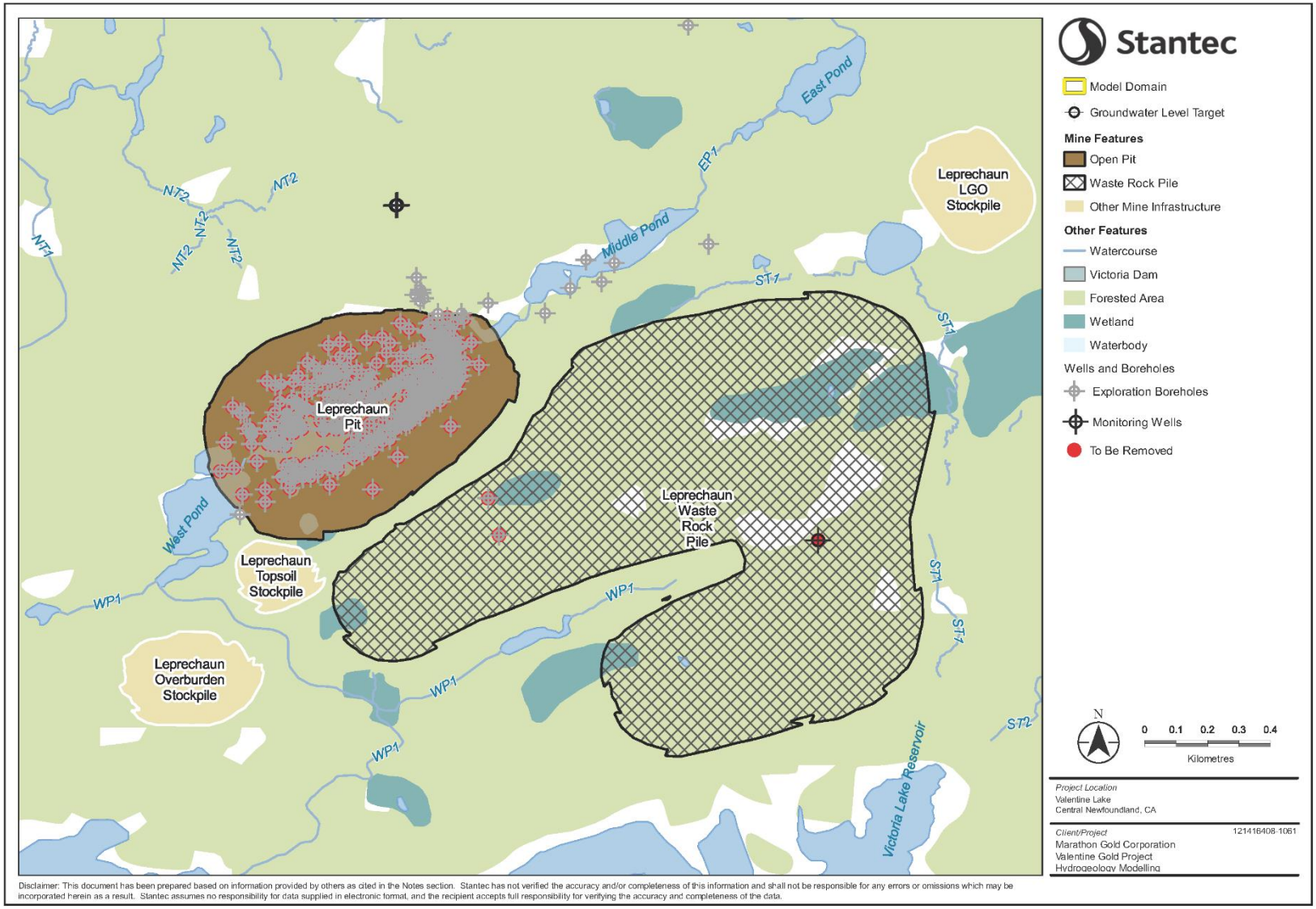

Figure IR-06.1 Boreholes Removed in the Creation of the Leprechaun Open Pit

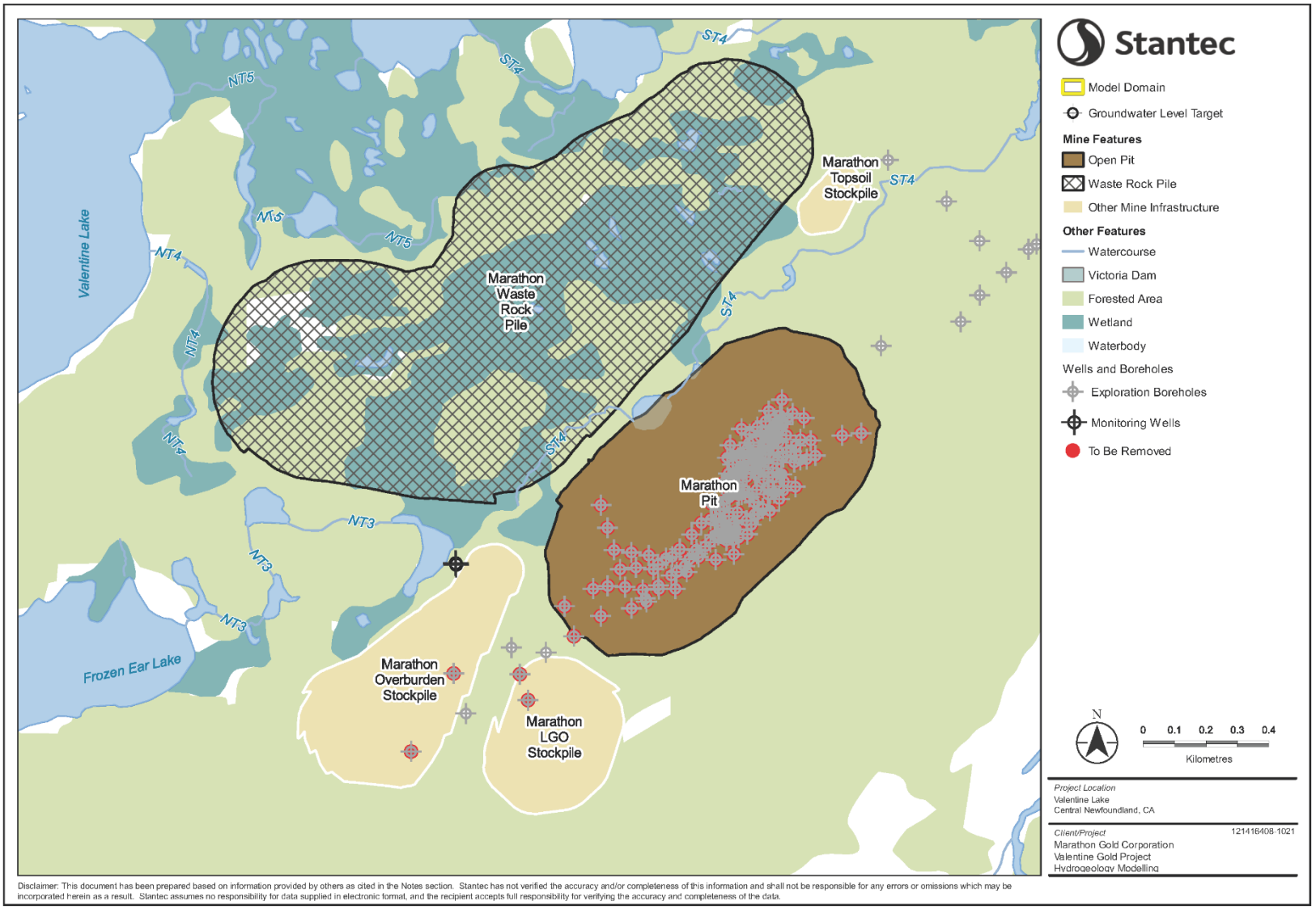

Figure IR-06.2 Boreholes Removed in the Creation of the Marathon Open Pit

RESPONSE TO IR-07

ID:	**IR-07**
Expert Department or Group:	MW-49 Pub-06.02 Pub-07.12 MFN-17
Guideline Reference:	Section 9.2
EIS Reference:	Section 6.4, Table 6.4Section 6.9.2
Context and Rationale:	The EIS guidelines require an outline of monitoring plans that includes the following:- description of the characteristics of the monitoring program where foreseeable (e.g. location of interventions, planned protocols, list of measured parameters, analytical methods employed, schedule, human and financial resources required);- description of the proponent's intervention mechanisms in the event of the observation of non-compliance with the legal and environmental requirements or with the obligations imposed on contractors by the environmental provisions of their contracts;- plans to engage Indigenous groups in monitoring, where appropriate. The EIS states that groundwater monitoring locations will be maintained until the water levels and water quality have stabilized post-closure. However, there is no mention of groundwater quality meeting any provincial or federal regulatory objectives, including the Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life. Section 6.9.2 of the EIS states that a detail groundwater monitoring program will be implemented for main project components to confirm potential changes in groundwater associated with project activities. However, no details are provided. Further, this section also does not indicate if Indigenous groups will be involved in the design or execution of the monitoring plans.
Information Request:	a. Provide an outline of a groundwater monitoring program that will include: a list of parameters to be measured- analytical measures to be employed b. Clarify if Indigenous groups will be engaged, consulted or directly involved in the design and execution of the groundwater monitoring plan
Response:	a. As presented in Section 6.9.2 of the EIS, the type of monitoring equipment, selection of monitoring stations, frequency of sample collection, and duration of the program will be determined based on consultation with the applicable government agencies. In NL, the requirements for groundwater monitoring are defined within the Certificate of Approval (Operations) administered by the Newfoundland and Labrador Department of Environment, Climate Change and Municipalities (NLDECCM) – Pollution Prevention Division. Monitoring well locations are defined in the Certificate of Approval in specific

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	locations down-gradient of key project infrastructure where groundwater quality and quantity effects may be realized. The groundwater monitoring plan will include: • The location of the proposed monitoring wells • Procedures for drilling and constructing the monitoring wells • Chemical and physical parameters to be monitored • Frequency of sampling / monitoring • Methodology for groundwater sampling / monitoring • Reporting requirements It is anticipated that the groundwater monitoring program will include quarterly groundwater sampling of the parameters of primary concern listed in Table IR-07.1. This would include the measurement of in-situ field parameters (dissolved oxygen, pH, conductivity), and submission of water quality samples for laboratory analyses, including but not limited to, general chemistry, trace metals, and cyanide species. As indicated in Section 6.9.2 of the EIS, follow-up monitoring results will be compared with applicable regulatory standards set out in Guidelines for Canadian Drinking Water Quality, Canadian Water Quality Guidelines for Protection of Freshwater Aquatic Life, and Project-specific regulatory approvals. The groundwater monitoring plan will also include specific actions to be implemented should there be exceedances of a designated threshold criteria. b. Marathon has engaged Indigenous groups since 2019 and is continuing to work in a spirit of cooperation with Qalipu Mi'kmaq First Nation (Qalipu) and Miawpukek First Nation (MFN) as the Valentine Gold Project progresses. Marathon continues to meet and engage with both groups with respect to formalizing these relationships in terms of communication, engagement, employment and procurement opportunities, and environmental reporting and monitoring. Marathon has also met with the Mi'kmaq Alsumk Mowimsikik Koqoey Association to specifically discuss this group's potential involvement in environmental monitoring. Marathon is committed to working with Qalipu and MFN to involve these groups in environmental monitoring and to exchange environmental information regarding the Project. In addition to pursuing these objectives, Marathon has joined the Mining Association of Canada (MAC) and intends to develop transparent environmental reporting protocols in accordance with MAC's Towards Sustainable Mining framework (or a similar framework) that will provide detailed reports on all environmental aspects of the Project over the life

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	of mine. These reports will be available for regulators, Indigenous groups, and other stakeholders to review and provide comment on.
Appendix:	None

Table IR-07.1 List of Parameters of Primary Concern

Parameter
Aluminum
Antimony
Arsenic
Barium
Boron
Cadmium
Calcium
Chromium
Copper
Iron
Lead
Magnesium
Manganese
Mercury
Molybdenum
Nickel
Phosphorus
Potassium
Selenium
Silver
Sodium
Thallium
Uranium
Zinc
Chloride
Nitrate + Nitrite
Nitrite
Nitrate
Ammonia
Unionized Ammonia
$Cyanide_{Total}$
$Cyanide_{WAD}$
Sulphate
Fluoride

RESPONSE TO IR-27

ID:	**IR-27**
Expert Department or Group:	-
Guideline Reference:	Section 7.4
EIS Reference:	EIS Section 8.5.1.2 Residual Effects, Page 8.62
Context and Rationale:	The EIS Guidelines require that the EIS includes information on mitigation measures including measures to eliminate, reduce or control the adverse environmental effects of a designated project, as well as restitution for damage to the environment through replacement, restoration, compensation or other means. The EIS states that "The Fish Habitat Offsetting Plan will take into account input from consultation and engagement, and will be developed and implemented in consultation with DFO and in consideration of the "Policy for Applying Measures to Offset Adverse Effects on Fish and Fish Habitat Under the *Fisheries Act*" (DFO 2019)." However, the Fish and Fish Habitat Offsetting plan has not been included in the EIS. This information is needed to assess residual effects after mitigation and the significance of effects on fish and fish habitat.
Information Request:	Provide a conceptual level Fish Habitat Offsetting Plan based on discussions with DFO.
Response:	Marathon is required under the *Fisheries Act* to compensate for habitat alteration, disruption or destruction (HADD) associated with the Project. As part of the *Fisheries Act* Authorization (FAA), an offsetting plan and an irrevocable letter of credit, sufficient to fully cover the cost of implementing the offsetting plan (including development of the project(s) and associated monitoring), are required. The habitat offsetting plan will include a detailed description of the offset project(s), monitoring measures to assess effectiveness, and contingency measures that will be implemented should the offsetting project be determined, through monitoring, to not be meeting the objectives. No works can be initiated that affect fish habitat prior to Fisheries and Oceans Canada (DFO) issuing the *Fisheries Act* authorization, which includes approval of the offsetting plan. Monitoring of the offset project will be completed to verify that the offsetting objectives have been achieved. DFO's *Policy for Applying Measures to Offset Adverse Effects on Fish and Fish Habitat Under the Fisheries Act* (DFO 2019) is guiding the selection of conceptual offsetting projects. The Policy provides the following hierarchy of offsetting measures: habitat restoration and enhancement, habitat creation, chemical or biological manipulations, and complementary measures. In considering habitat restoration and enhancement measures,

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	DFO's preferred approach is for balancing adverse effects through "in-kind" offsetting measures. The "in-kind" approach aims to replace habitat (habitat type per unit area) that is destroyed or altered due to a project with habitat of equivalent or greater quantity and quality. In addition, habitat offsetting measures that are located within the same ecological unit are also preferred options over opportunities in other watersheds. Marathon is currently considering options for potential offsetting projects, including conceptual offsetting opportunities at two locations within the Exploits River Watershed. One location encompasses four areas within North Twin Brook, which were modified to facilitate log driving for historical forestry operations; these consist of rock walls that were used to channelize flow to confine floating logs within the main river channel for transport downstream. In some of the areas, the location of the rock walls and channelization has resulted in areas of the streambed that are dry or have substantially reduced velocities. Unaltered areas within the channelized portion of North Twin Brook have high velocities even when water levels are very low. Modification or removal of the rock walls would restore flow to areas in North Twin Brook that are currently dry or have reduced flow. Most of the substrate within these areas consists of small and large boulders, which do not provide suitable spawning substrate for brook trout and ouananiche (i.e., landlocked salmon). The second conceptual offsetting location is at the outlet of Valentine Lake, which was modified to facilitate log driving for historical forestry operations. Rock walls were constructed in the lower portion of a steady to confine floating logs within the main river channel and divert them away from the steady and river-side channels. Removal or breaching of portions of the rock walls would facilitate increased flow through the downstream and southern portion of the steady and result in a change of substrate from fine to coarser sediments, which are more suitable for all life stages of brook trout and ouananiche. For both conceptual offsetting locations, habitat quantity for brook trout and ouananiche would be increased through the diversion of flow into the areas of the streambed that are currently dry or have reduced water velocity. Habitat quality would also be improved through the addition of smaller coarse substrates (i.e., small and large gravel), which would increase available spawning habitat area for brook trout and ouananiche and provide additional areas for benthic invertebrates (i.e., food). Small and large boulders which make up the rock walls could be used to create boulder clusters within the slower moving areas or within the main channel. This

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	would reduce flows, increase resting places and structure for fish and provide additional areas for food production. Marathon has been consulting with DFO regarding the conceptual offsetting plan. DFO has indicated that habitat restoration or enhancement measures such as the offsetting opportunities proposed by Marathon and as described above are preferred by DFO to increase native fish populations. Both offsetting opportunities are located within the Exploits River Watershed and support fish populations that are ecologically relevant to the Project. Marathon will continue to consult with DFO regarding the selection of an offsetting project and development of the associated plan to counterbalance HADD of fish habitat resulting from the Project. Reference: DFO (Fisheries and Oceans Canada). 2019. Measures to Protect Fish and Fish Habitat. Available online at: https://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures-eng.html
Appendix:	None

RESPONSE TO IR-28

ID:	**IR-28**
Expert Department or Group:	DFO - 01
Guideline Reference:	Section 7.3.1
EIS Reference:	EIS Page 8.22, Section 8.2.2.1, Fish Habitat
Context and Rationale:	The EIS Guidelines require that the EIS describes the effects of changes to the aquatic environment on fish and their habitat. In Table 8.4 under the notes, the EIS states that iron floc is present. As iron floc could have potential impacts to fish and fish habitat, more information is required to help determine this.
Information Request:	Provide additional information on the iron floc including the quantity, source, frequency (ongoing issue or single event) and determine if there is a potential effect on fish and fish habitat.
Response:	Iron floc is a naturally occurring phenomenon which is often associated with groundwater discharge into wetlands, watercourses or waterbodies in mineralized areas. When groundwater with high concentrations of iron comes into contact with oxygen from the atmosphere, iron is oxidized to the ferric state and results in precipitate. Iron floc was frequently noted during baseline assessment in the Project Area and was frequently associated with wetlands or headwater watercourses with groundwater contributions during low flow periods, and likely occurs annually. Fish were confirmed to be present during surveys in streams with naturally occurring iron floc present. Publicly available information presented in the Canada Gazette, Part II, Vol. 143, indicated that tailings deposited into Wabush Lake and Flora Lake for the RioTinto IOC Carol and Cliffs Natural Resources Scully iron ore mines in Labrador respectively, were non-toxic and non-acid generating. Discharged tailings historically result in “red water” in the lakes, however there is no evidence of adverse effects on fish and fish habitat. There are no regulatory requirements related to the colour of effluent discharged to the receiving environment. The main concern with red water is aesthetic. There is the potential for iron hydroxide to precipitate out and form a yellow brown slime on the bottom of sediments, which could inhibit algal growth, result in the mortality of eggs, or plug the gills of benthic invertebrates and fish. Given the predicted concentrations of iron in the receiving environment (Appendix 7C of the EIS), residual effects to fish and fish habitat are not anticipated. Effluent and water quality monitoring, including monitoring for iron, will be conducted as described in Section 7.9.1 of the EIS. Benthic invertebrates and fish will be monitored as part of environmental effects

ID:	**IR-28**
	monitoring required under the *Metal and Diamond Mining Effluent Regulations*.
Appendix:	None

RESPONSE TO IR-29

ID:	**IR-29**
Expert Department or Group:	DFO - 03
Guideline Reference:	Section 7.1.6
EIS Reference:	EIS Page 8.39, Section 8.2.2.4, Fish Community
Context and Rationale:	The EIS guidelines require that the proponent provide a description of habitat and maps, at a suitable scale, indicating the surface area of potential or confirmed fish habitat for spawning, rearing, nursery, feeding, overwintering, migration routes, etc. Arctic Char are known to occur in the Victoria River Watershed and Victoria Lake reservoir. In addition, the EIS states that based on the habitat preferences of Arctic Char in Victoria Lake Reservoir, it is presumed they have the potential to occur in Valentine Lake as well. DFO indicated that there is no habitat information provided on this species. While no char were caught during the baseline surveys, habitat information can be an indicator of the potential for a species to be present in a certain area even if that species has not been identified during fishing surveys. Habitat information will provide an indication of where they may occur and enable a review of potential effects and mitigations. This baseline information is necessary for DFO to accurately assess residual effects after mitigation, and advise on the significance of the effects on fish and fish habitat.
Information Request:	Provide habitat information for Arctic Char within the Local Assessment Area.
Response:	Habitat maps by life stage are provided in Figures IR-29.1 to IR-29.4. The habitat suitability shown in the attached figures are based on the depth preferences of landlocked Arctic char in Bradbury et al. (1999). Sampling conducted previously in Victoria Lake Reservoir in August and September indicated the vertical distribution of Artic char to be between 0 and 30 m (Pippy 1966). References: Bradbury, C., M.M. Roberge, and C.K. Minns. Life History Characteristics of Freshwater Fishes Occurring in Newfoundland and Labrador, with Major Emphasis on Lake Habitat Requirements. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2485. Pippy, J.H.C. 1966. A Biological and Ecological Study of the Salmonidae of Victoria Lake. Environment Canada Fisheries Service. Resource Development Branch, Department of Fisheries of Canada, St. John's, Newfoundland. Progress Report No. 38.
Appendix:	None

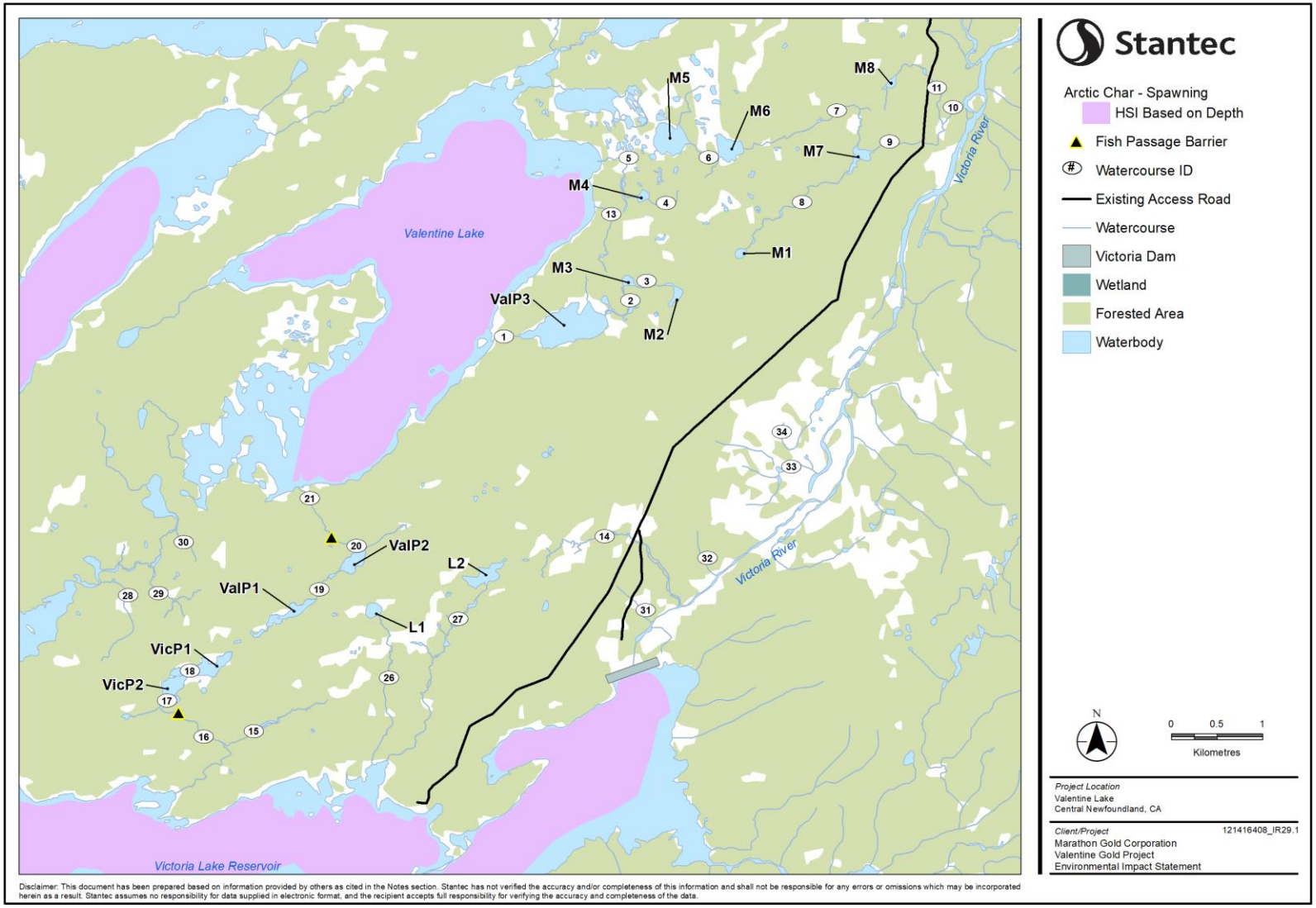

Figure IR-29.1 Arctic Char - Spawning

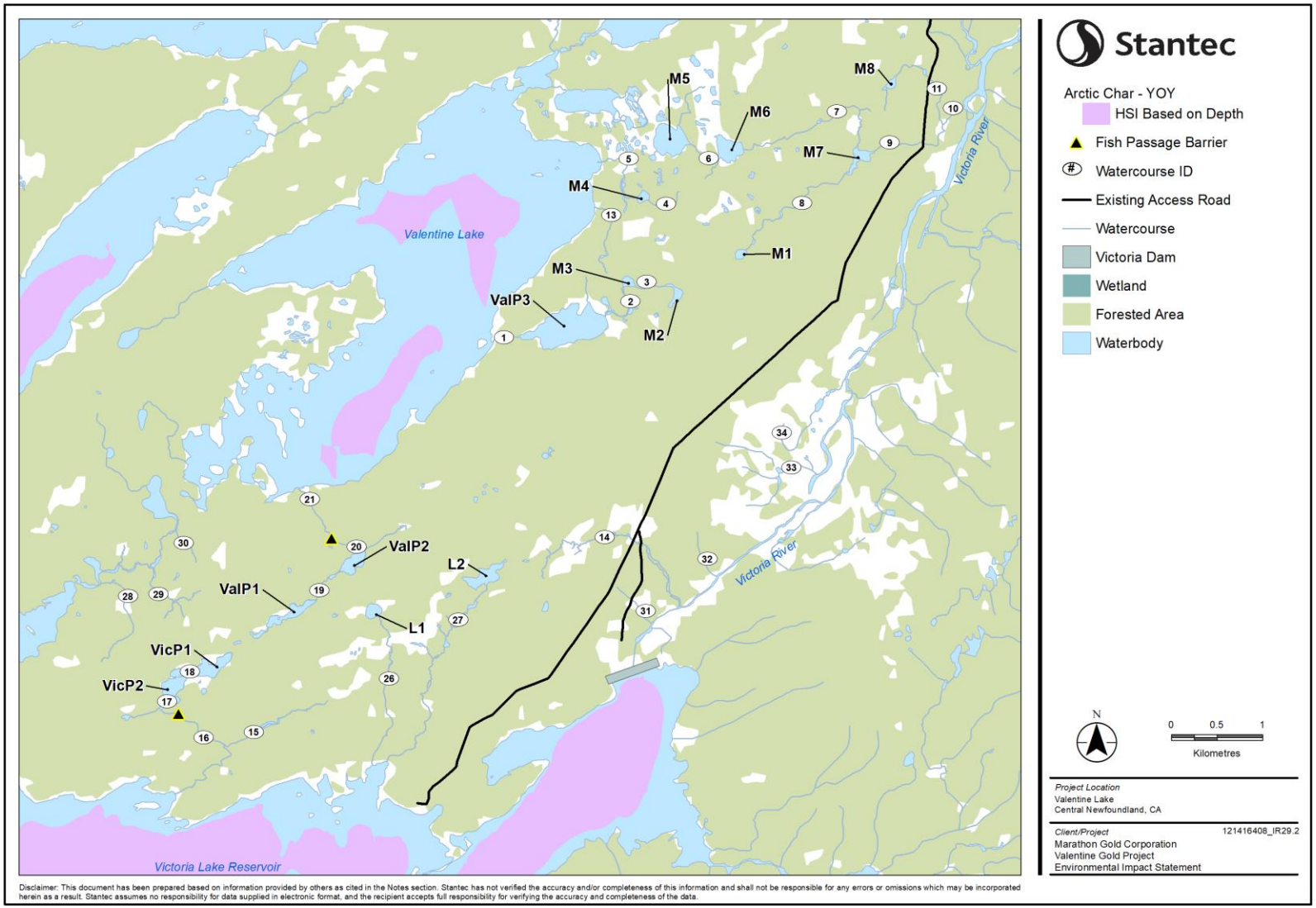

Figure IR-29.2 Arctic Char - YOY

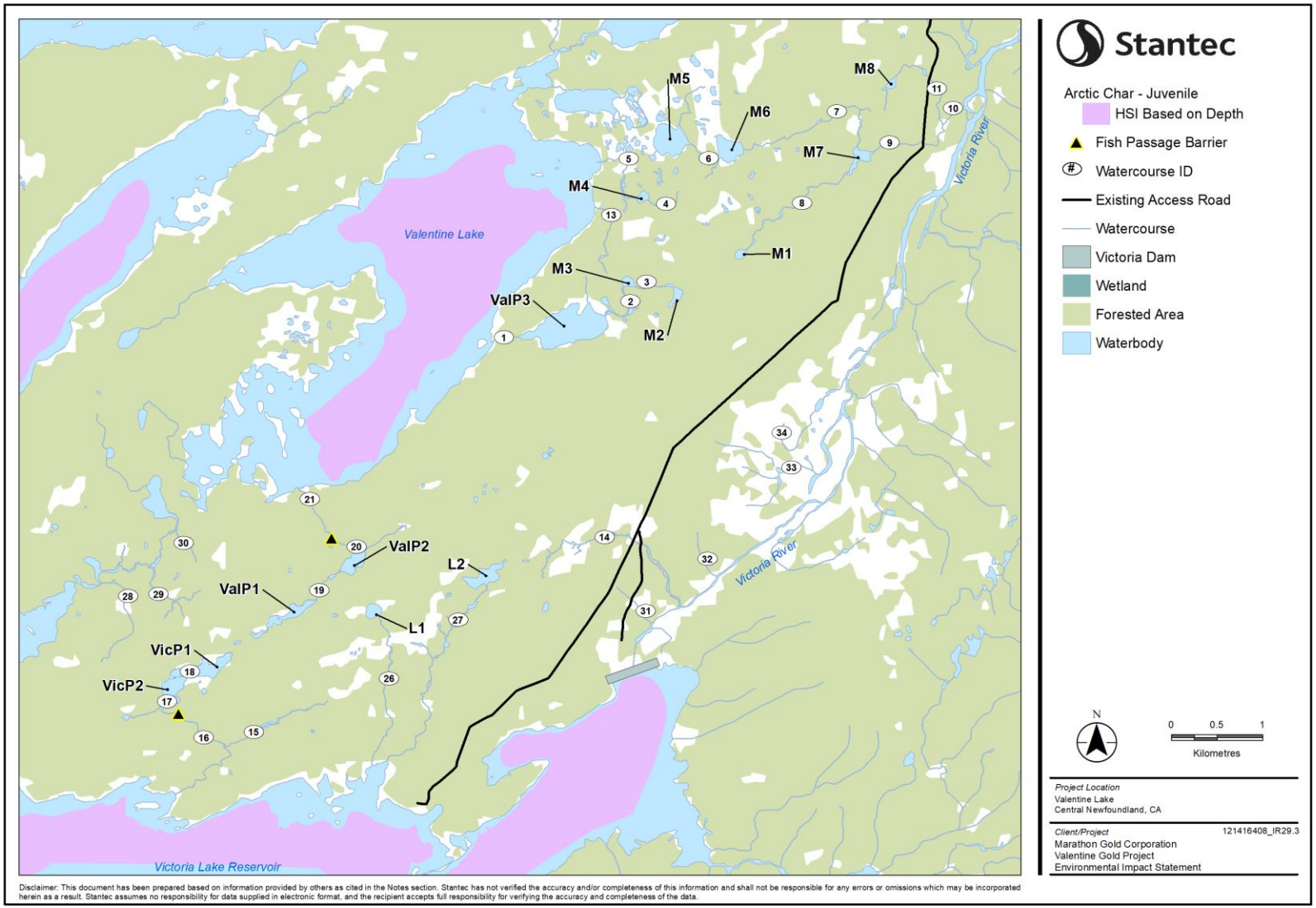

Figure IR-29.3 Arctic Char - Juvenile

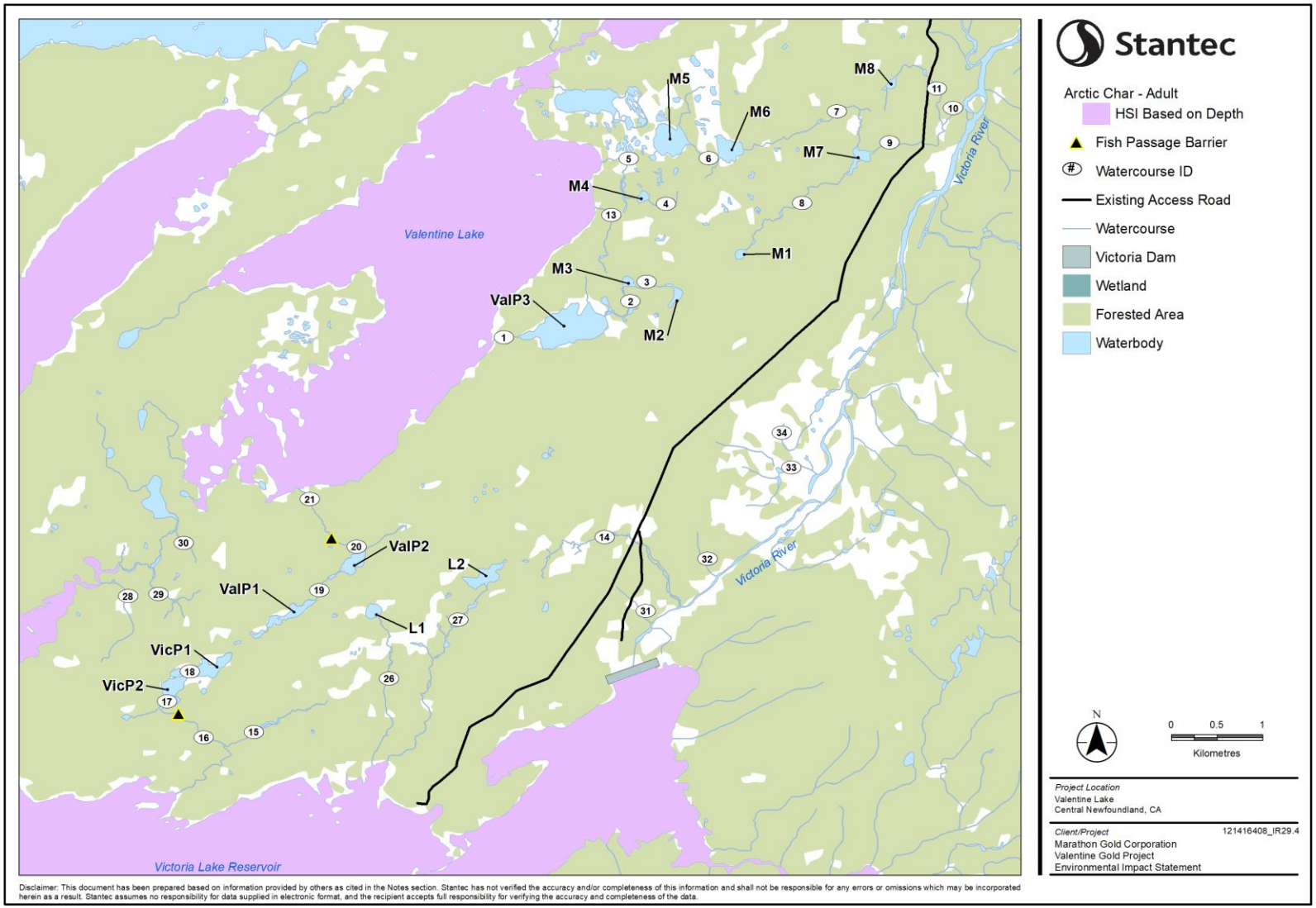

Figure IR-29.4 Arctic Char - Adult

RESPONSE TO IR-30

ID:	**IR-30**
Expert Department or Group:	ECCC-17
Guideline Reference:	Section 7.3.1
EIS Reference:	EIS Chapter 8: Fish and Fish Habitat Page 8.72
Context and Rationale:	The EIS Guidelines require information on the effects of changes to the aquatic environment on fish and their habitat. The EIS states that "Pit lakes are expected to become stratified following closure, and waters in the bottom layers may become anoxic and may contain high concentrations of dissolved trace metals. If the pit lake turns over, the pit lake water that discharges may affect fish health and survival by reducing levels of dissolved oxygen and introducing elevated concentrations of metals (Jennings et al. 2008)." ECCC indicated that it is unclear if the potential risk associated with pit lake turnover on fish and fish habitat has been modelled or otherwise evaluated. This information is needed to determine significance of effects on fish and fish habitat.
Information Request:	Provide information on any modelling or evaluation that has been done on the risk of lake water turnover. If no modelling or evaluation has been completed, provide a rationale for why it has not.
Response:	Pit lake turnover may occur in the upper and oxygenated part of the water column, which is expected to have water quality similar to local lakes; however, destratification (full turnover from top to bottom) of the pit lakes is not expected to occur. As described below, it is anticipated that the pit lake will chemically and thermally stratify, resulting in higher densities in lower layers than overlying layers. This will prevent full turnover. Therefore, it is predicted that pit lake overflow discharge will be oxygenated, similar to baseline water quality conditions and consistent with the predicted effects on fish and fish habitat as presented in the EIS (Chapter 8). During rehabilitation and closure, the Leprechaun and Marathon pit lakes will fill with rainwater, surface water and groundwater, and runoff and seepage from the waste rock piles. Pit lake filling will be accelerated by withdrawing freshwater from Victoria Lake Reservoir and Valentine Lake, resulting in early pit discharge (overflow) water quality similar to existing local baseline water conditions. Over time, water quality in the deeper portions of the pit lake may degrade due to sedimentation, deeper zone anaerobic conditions, and chemostratification of dissolved metals associated with groundwater inflows and leaching from the pit walls. If full turnover of water in a pit lake were to occur (complete destratification), it can mix poor quality water at depth with good quality water at surface,

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	possibly resulting in a release of water that could potentially affect fish and fish habitat. The Leprechaun and Marathon pit lakes were modeled as being fully mixed from top to bottom for a worst-case scenario for trace elements. However, the pit lakes are expected to become permanently stratified when the conditions that cause stratification to occur are stronger than the mixing/turnover forces. In stratified pit lakes, the upper epilimnion can mix with the upper/mid layer hypolimnion, however, a deeper layer, called the monimolimnion, will develop below a permanent chemocline. Castendyk and Webster-Brown (2007) observed that stratified conditions would develop in the Martha Mine open pit lake if groundwater temperatures were ≤ 17ºC and when there was more than one water source to maintain water levels. In the case of the Marathon and Leprechaun pit lakes, groundwater temperatures will be ≤ 17ºC and the pit lakes will receive inputs from rainwater, snowmelt and overland sources. Biogenic (microbially-mediated) stratification may increase the salinity in the monimolimnion. Campbell and Torgensen (1980) document biogenic stratification in iron-rich natural lakes in northern Canada caused by iron reducing bacteria in the monimolimnion, resulting in higher concentrations of total dissolved solids in this deepest water layer. The water quality modeling for the Marathon and Leprechaun pit lakes indicates that runoff from abundant organic bog environments and seepage from waste rock will introduce metals and carbon necessary to develop higher total dissolved solids in the monimolimnion. Therefore, the geochemical model, which assumes full mixing (i.e., no stratification), predicts that some metal concentrations in the pit lake water will be elevated. It is predicted that conditions will be in place for the Marathon and Leprechaun pit lakes to develop permanent stratification based on lower temperature of groundwater, multiple water sources to maintain water depth, and chemical and biogenic conditions. Turnover may occur in the upper and oxygenated part of the water column, which is expected to have water quality similar to local lakes. However, destratification (full turnover from top to bottom) of the pit lakes is not expected to occur given the pit lake is anticipated to chemically and thermally stratify, resulting in higher densities in lower layers than overlying layers. Therefore, it is predicted that pit lake overflow discharge will be oxygenated and similar to baseline water conditions. The above information is consistent with the predicted effects on fish and fish habitat as presented in the EIS (Chapter 8).

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	References: Campbell P. and Torgensen T. 1980. Maintenance of iron meromixis by iron redeposition in a rapidly flushed monimolimnion. Can. J. Fish. Aquat. Sci. 37, 1303-1313. Castendyk D.N. and Webster-Brown J.G. 2007. Sensitivity analyses in pit lake prediction, Martha Mine, New Zealand 1: Relationship between turnover and input water density. Chemical Geology 244 (2007) 42–55. Jennings, S.R., Neuman, D. and Blicker, P. 2008. Acid Mine Drainage and Effects on Fish Health and Ecology: A Review Reclamation Research Group. LLC, Bozeman, Montana.
Appendix:	None

RESPONSE TO IR-31

ID:	**IR-31**
Expert Department or Group:	ECCC-18
Guideline Reference:	Section 7.3.1
EIS Reference:	Appendix 7C – Assimilative Capacity Assessment Report page 6.2
Context and Rationale:	The EIS Guidelines require information on the effects of changes to the aquatic environment on fish and their habitat. During the post-closure period of the decommissioning, rehabilitation and closure phase, some Canadian Water Quality Guidelines - Freshwater Aquatic Life (CWQG-FAL) exceedances are predicted in the Victoria River and Victoria Lake Reservoir for aluminum, copper, zinc, and fluoride associated with the Marathon and Leprechaun waste rock piles. However, the EIS does not evaluate the magnitude and duration of the potential effects on fish and fish habitat resulting from these exceedances. The Assimilative Capacity Assessment Report in Appendix 7C of the EIS states that "Mitigation measures should be considered, such as maintaining perimeter ditching during closure / post-closure to convey seepage to a passive wetland treatment system." The migration measures to explain how these effects will be mitigated are not described in the EIS for the decommissioning, rehabilitation and closure phase of the mine. This information is needed to assess residual effects after mitigation, and the significance of the effects on fish and fish habitat.
Information Request:	a. Assess the magnitude and duration of potential effects on Fish and Fish Habitat resulting from predicted post-closure exceedances of the Canadian Water Quality Guidelines - Freshwater Aquatic Life guidelines from the Marathon and Leprechaun waste rock piles. b. Describe the mitigation measures to explain how these effects will be mitigated.
Response:	a. As indicated in Section 7.5.2 of the EIS, the potential effects of elevated water quality parameters on fish and fish habitat in Victoria River and Victoria Lake Reservoir arising from the Leprechaun and Marathon waste rock piles during the post-closure phase are anticipated to be of moderate magnitude and long-term duration for fish habitat quality and negligible magnitude and long-term duration for fish health and survival. The definitions of magnitude and duration are presented in Section 8.3 of the EIS. It should be noted that the geographic extent of the effects is predicted to be approximately 300 m into Victoria Lake Reservoir and Victoria River, and no water quality effects are predicted beyond the 300 m mixing zone.

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	Since aluminum, copper, zinc, and fluoride are predicted to exceed the Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CWQG-FAL) guidelines in the Victoria River and Victoria Lake Reservoir within the mixing zone, additional mitigation was recommended (see b below). During the closure and post-closure periods, the objectives for water quality are set at CWQG-FAL for long term exposure to be protective of fish and fish habitat, and the mitigation options described below (in part b) will be designed to achieve these objectives. With this mitigation in place, the magnitude of residual effects to fish and fish habitat during closure and post-closure phase are anticipated to be negligible to low and of long-term duration (Section 8.3.1 of the EIS). b. During mine rehabilitation and closure, waste rock piles will be revegetated to reduce infiltration and ultimately seepage. Waste rock pile benches will be graded to promote run-off and remove larger voids within the rock surface before placing the soil layer to support revegetation. Two post-closure water treatment options may be employed to address the predicted post-closure exceedances: (1) conversion of the perimeter conveyance ditches into subsurface flow Permeable Reactive Barrier (PRB) trenches; and/or (2) conversion of the perimeter conveyance ditches into subsurface “French Drains” to convey effluent to an engineered wetland treatment system. Please refer to Figures IR-31.1 and IR-31.2 for an illustration of these two options, which are further discussed below. The seepage from the Tailings Management Facility is expected to require passive treatment for decades and the proposed treatment options can be designed to last for similar periods. Full details will be provided in the Rehabilitation and Closure Plan. The selection of the best option will be based upon the results of a pilot study and further water quality assessment as closure and post closure planning proceeds. To support the design of the PRB and the engineered wetland system, pilot scale treatment studies will be conducted towards the end of mine operation to evaluate the treatment efficiency and to better define the systems’ design parameters. <u>Seepage Treatment Option #1</u> (Figure IR-31.1) The collection ditches will be plugged at intervals to prevent flow down the ditch and converted to sub-surface PRB trenches. In closure, the waste rock piles will be covered with soil and vegetation and therefore shed rain/runoff with non-contact water. However, a portion of precipitation will infiltrate and form seepage. The subsurface PRB will backfill the rock-lined

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	ditches with carbon-rich organic material (e.g., compost) to promote sulfate reducing conditions and subsequent precipitation of metal sulfide solid phases. Groundwater will passively flow through the compost mixture where dissolved metals will be removed via iron sulfide precipitation reactions. Under reducing conditions, sulfate-reducing bacteria convert sulfate to sulfide by catalyzing the oxidation of organic carbon producing hydrogen sulfide. Divalent metals will precipitate in the presence of high concentrations of hydrogen sulfide to form the highly insoluble iron sulfide precipitate. A 30 cm soil cap will be installed over the surface of the PRB trench to prevent oxygen diffusion into and water flow out of the reactive mixture. Rip rap will be installed over the surface surrounding the PRB to prevent scouring and erosion from the conveyance of non-contact runoff from the pile cover to the surrounding undisturbed ground. The subsurface PRB will continue to receive contact seepage, albeit at a reduced seepage rate due to the presence of the soil and vegetation cover. The contact seepage will migrate through the subsurface zone of the trench (smallest proposed ditch class is trapezoidal, 1 m deep, 1 m base width and 2:1 side slopes), through the PRB under anaerobic conditions where metals removal through sulphidic precipitation can occur. Seepage water would then outlet through the opposite side of the trench to the downgradient and outside receiving groundwater environment. Soil for the trench cover and soil plugs that would be placed in the existing ditches to promote transverse seepage migration across the trench will be available as ditch sidecast material proposed in operation as shallow earthen berms. The rate of seepage migration across the sub-surface trench is constrained by the seepage inflow and outflow rates which are based on local soils characteristics, hydraulic conductivity and gradients. The average linear groundwater velocity is estimated between 0.126 m/year to 12.61 m/year. Thus, the seepage residence time through the subsurface trench would range from a few days to weeks, which is sufficient retention time to promote sulfate reducing conditions and the subsequent metal sulfide precipitation reactions. Due to the predictions that seepage quality would not be substantially elevated above CWQG-FAL, the PRB would be sized based on a minimum hydraulic retention time (HRT) of 24 hours. Based on a minimal HRT of 24 hours, the highest CWQG-FAL parameters of potential concern, copper, would be reduced from 48 ug/L to 2 ug/L through treatment in the PRB.

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	Seepage Treatment Option #2 (Figure IR-31.2) For this scenario, the perimeter collection ditches would be converted to subsurface French drains to allow contact seepage from the covered stockpiles to passively intercept seepage and convey seepage downgradient to the sedimentation ponds. The sedimentation ponds would be converted to engineered wetlands or subsurface passive bioreactors, essentially creating treatment with greater capacity and HRT than the PRB. Metals entering the engineered wetlands will be initially removed via sedimentation and filtration processes. Following these physical processes, metals are buried and sequestered in the wetland sediments via adsorption and chemical precipitation reactions. Within the wetland substrates, anaerobic conditions promote the growth of sulfate-reducing bacteria. The substrates are designed to be rich in organic matter and sulfates. Under anaerobic conditions, sulfate-reducing bacteria convert sulfate to sulfide by catalyzing the oxidation of organic carbon producing hydrogen sulfide. Divalent metals (e.g., iron, silver, copper, zinc, cadmium, manganese, and lead) will precipitate in the presence of high concentrations of hydrogen sulfide to form insoluble metal sulfide precipitates. These precipitates will be removed from the water and permanently sequestered within the substrate. The average HRT in the sedimentation ponds is 24 hours based on uncovered stockpile drainage. Accounting for a vegetated soil cover on the piles and assuming that seepage in closure accounts for 1/3 of uncovered runoff and seepage, the HRT could be increased to 3 days or longer with outlet control. Based on a minimal HRT of 3 days, the highest CWQG-FAL parameters of potential concern, copper would be reduced from 48 ug/L to 2 ug/L through treatment in a passive treatment cell retrofitted from the sedimentation pond footprint. Seepage water will be monitored and will not be discharged to the environment until such time that water quality has been shown to consistently meet closure effluent criteria. The engineered wetland would use existing outlet infrastructure to the extent feasible. Once the contact water collection system is retrofitted to an engineered wetland treatment system, monitoring frequencies will be adjusted based on site conditions and performance objectives.
Appendix	None

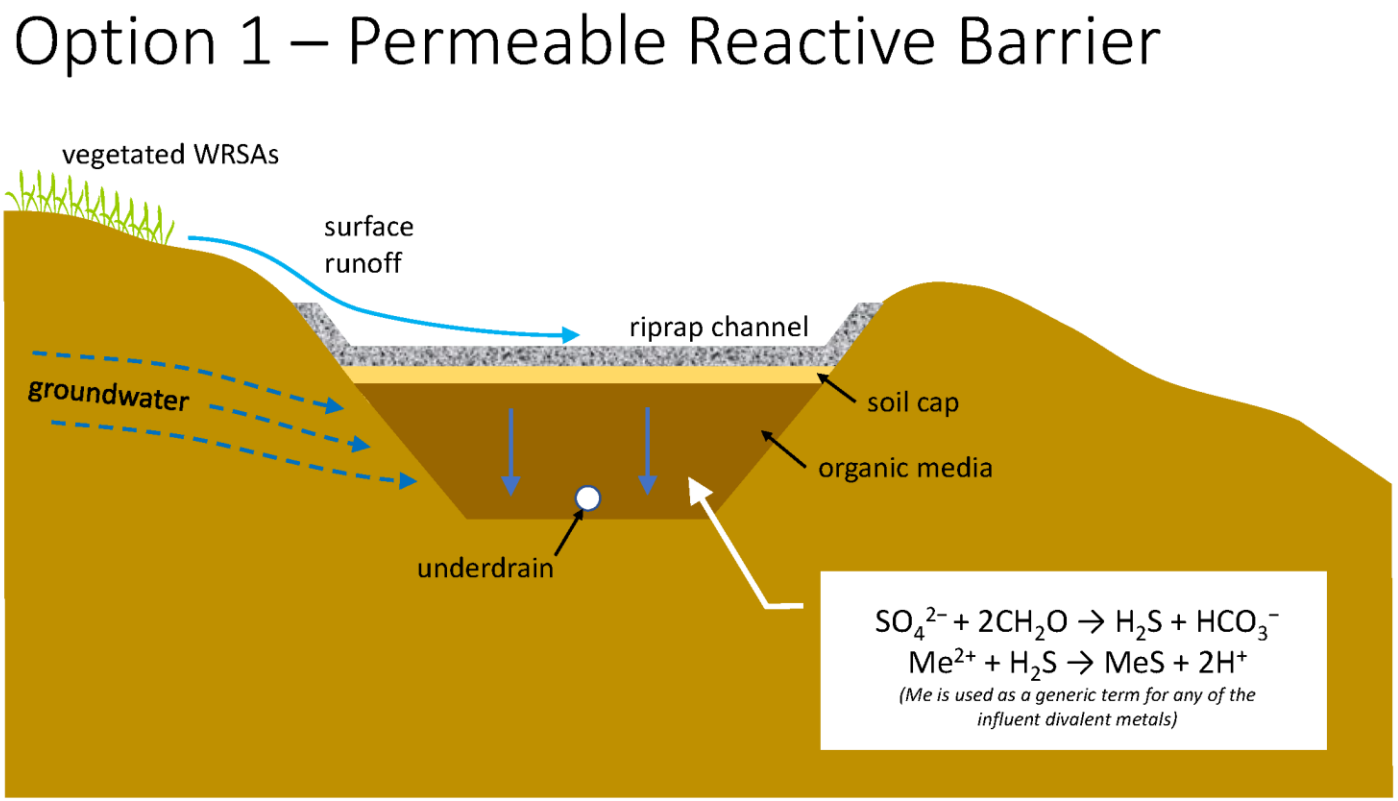

Figure IR-31.1 Option 1 – Permeable Reactive Barrier

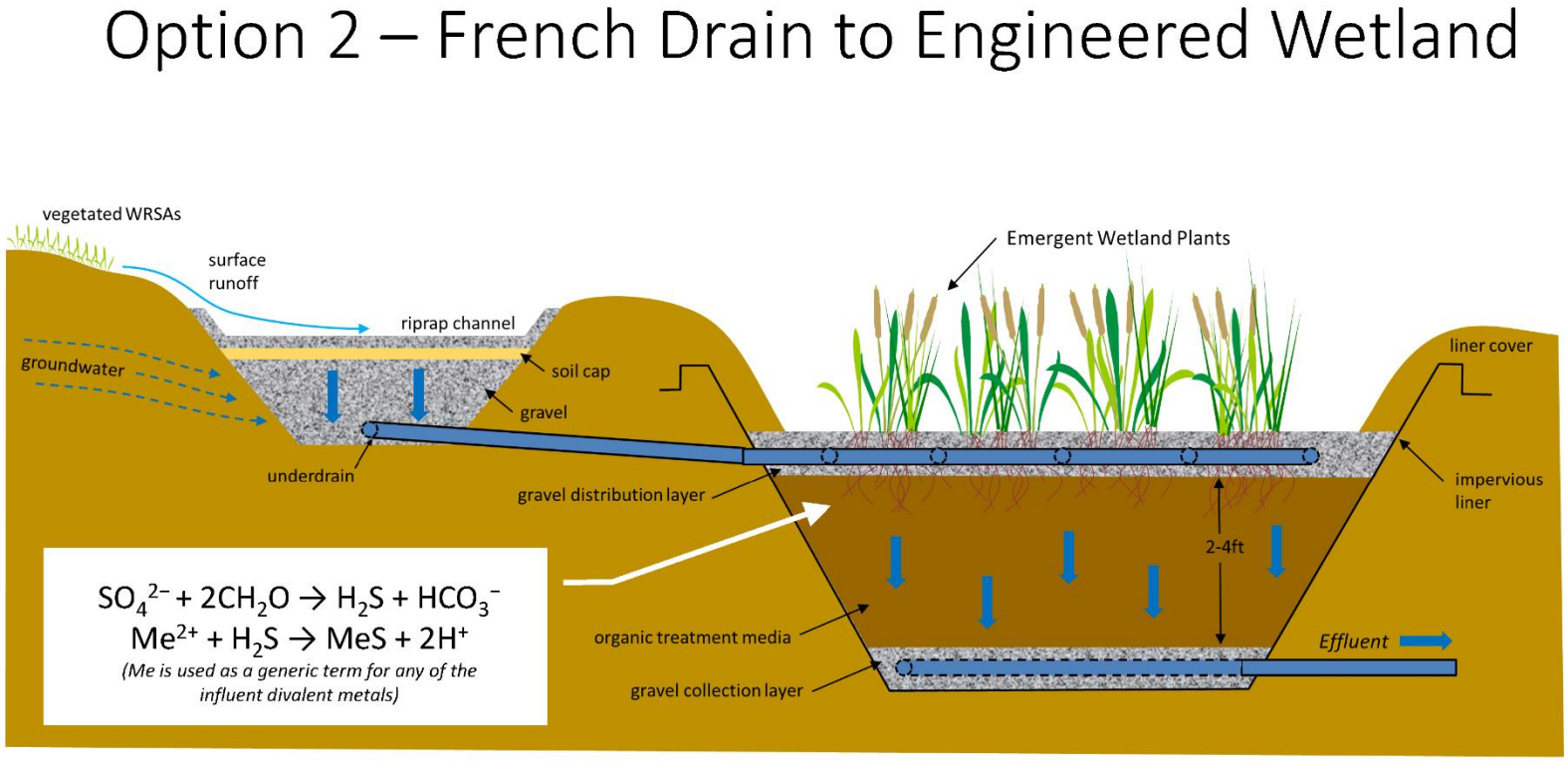

Figure IR-31.2 Option 2 – French Drain to Engineered Wetland

RESPONSE TO IR-32

ID:	**IR-32**
Expert Department or Group:	-
Guideline Reference:	Section 7.3.1
EIS Reference:	Section 7.3.5.2 Analytical Assessment Techniques for Change in Surface Water Quality Sections 5.1.1, 5.1.2,5.3, and 6.0 of BSA 5A (Acid Rock Drainage/Metal Leaching and BSA 3D (Hydrogeology Baseline Report)
Context and Rationale:	The EIS Guidelines require information on the effects of changes to the aquatic environment on fish and their habitat. Section 7.3.5.2 of the EIS refers to the analytical assessment techniques for change in surface water quality. Sections 5.1.1, 5.1.2, 5.3 and 6.0 of Baseline Study Appendix (BSA) 5A (Acid Rock Drainage/Metal Leaching) state that the elevated values of aluminum in the shake flask extraction tests may be due to very-fine- grained/colloidal detrital alumino-silicate mixture rather than being reflective of dissolved aluminum. However, Section 4.3.2.2 of BSA 3C states that aluminum concentrations were found to exceed the Canadian Water Quality Guidelines for Freshwater Aquatic Life (CWQG-FAL) in all surface water quality monitoring stations at least once except for three locations. Table 4.37 in Section 4.3.2.2 of BSA 3C provides a summary of metals analysis at surface water quality monitoring stations. This table indicates that aluminum exceeded the Canadian Water Quality Guidelines for Freshwater Aquatic Life in 221 samples out of a total of 619. In addition, Section 4.7.2 of BSA 3D states that dissolved aluminum exceeded the pH dependent Canadian Water Quality Guidelines for Freshwater Aquatic Life in MW7 in October 2019 and February 2020. This information is needed to determine significance of effects on fish and fish habitat.
Information Request:	Given that the shake flask extraction tests may be reflective of the potential for elevated concentrations of aluminum from mining activities. Revise the effects analysis based on the potential increase in aluminum concentrations. Describe the effect of increasing aluminum concentrations with respect to the CWQG- FAL and fish and fish habitat given the already elevated concentrations of aluminum from existing groundwater and surface water monitoring. Provide information on mitigation to reduce any effects, if applicable.
Response:	The Canadian Water Quality Guideline for the protection of freshwater aquatic life (CWQG-FAL) for aluminum is 5 µg/L if pH < 6.5 and 100 µg/L if pH ≥ 6.5. The summary of metal concentrations at surface water quality monitoring stations presented in Baseline Study Appendix (BSA).3, Attachment 3-C, Table 4.37 demonstrates that 221 of 619 samples exceeded the CWQG-FAL aluminum guideline(s). Overall, baseline

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	monitoring stations had a maximum aluminum concentration of 1,640 ug/L, a mean of 106 ug/L, and a 75th percentile of 106 ug/L. As noted by the reviewer, these samples indicate that baseline aluminum concentrations are elevated in local watercourses and waterbodies. As discussed in BSA.5, Attachment 5-B, the shake flask extraction test results show aluminum concentrations above 100 µg/L in 74% of the Leprechaun deposit tests and in 100% of the Marathon deposit tests. These exceedances are expected to be related to the colloidal form of aluminum within the leachate, as discussed in Section 5.5.2 of BSA.5, Attachment 5-B. As such, it is assumed that total aluminum concentrations are mainly in particulate/colloidal form rather than dissolved form. With respect to water quality predictions for Project discharges, the geochemical model and Assimilative Capacity Assessment are considered conservative as they did not account for reduction of aluminum concentrations in site runoff contact water through natural removal in soils or through sedimentation in the water management ponds. Site runoff contact water will be directed to a series of collection ditches and sedimentation ponds where sediment control is the key function. The sedimentation ponds are designed to remove 80% of incoming suspended solids contained in the contact water through particulate settlement over the residence time within the ponds. These ponds are designed to detain particles down to fine silt sized particles (i.e., 5 µm diameter). The 95th percentile aluminum concentration predicted in discharge from the sedimentation ponds ranges from 280-600 ug/L as summarized in Table 3-2 of the Assimilative Capacity Assessment (Appendix 7C of the EIS). However, and as indicated above, this is a worst-case condition as it does not account for removal of aluminum in site runoff contact water through natural ground contact or sedimentation processes. Aluminum precipitation in naturally acidic environments, such as is found in the Project Area, is influenced by temperature, sulphate and humic substances (Tipping et al. 1988). The landscape within the Project Area is interspersed with wetland environments (i.e., bogs/fens) that contain humic substances and soils. Site runoff contact water will pass through humic material from former bogs/fens containing dissolved organic carbon, and then be collected in ditches. Tipping et al. (1988) indicates that in slightly acidic environments, dissolved organic carbon from humic substances will decrease solubility of aluminum to precipitate as aluminum oxyhydroxides. Tipping et al. (1988) observed aluminum removal ranging from 24-88% in various concentrations of humic substances.

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	Using 24% as the low end of removal of aluminum by humic substances reported in Tipping et al. (1988), aluminum concentrations in site runoff contact water may be reduced by humic acids to a 95th percentile range of 213-456 µg/L. Furthermore, given that aluminum in contact water is expected to be mainly in particulate form, sedimentation ponds are expected to remove an additional 80% of aluminum content, to further reduce aluminum concentration to a 95th percentile range of 43-91 µg/L. Aluminum concentrations in the range of 43-91 µg/L are below the CWQG-FAL threshold of 100 ug/L for pH ≥ 6.5. Therefore, the 95th percentile aluminum concentrations in the effluent from the sedimentation ponds is predicted to be below the pH-adjusted CWQG-FAL threshold prior to discharge. Baseline aluminum conditions are above CWQG-FAL and effluent is predicted to be below CWQG-FAL. Consequently, effluent from sedimentation ponds is not predicted to result in residual effects to fish habitat or in a measurable change in fish heath and survival. As per Schedule 5, Part 1 Section 4(1) of *Metal and Diamond Mining Effluent Regulations* (Effluent Characterization), aluminum will be routinely monitored in mine effluent. References: E. Tipping, C. Woof, P.B. Walters and M. Ohnstad, 1988. Conditions required for the precipitation of aluminum in acidic natural waters. Water Research. Volume 22, Issue 5, Pages 585-592.
Appendix:	None

RESPONSE TO IR-33

ID:	**IR-33**
Expert Department or Group:	-
Guideline Reference:	Section 7.1.5
EIS Reference:	Section 7.2.2.3 of the EIS
Context and Rationale:	The EIS Guidelines require information in the EIS on the delineation of drainage basins, at appropriate scales (water bodies and watercourses), including intermittent streams, flood risk areas and wetlands, boundaries of the watershed and subwatersheds, overlaid by key project components. Table 7.16 in section 7.2.2.3 of the EIS, has elevation at headwaters as a lower value than the elevation at outlet. Normally, it would be expected to be the opposite. Table 7.17 in section 7.2.2.3 of the EIS provides predevelopment watershed areas and does not provide an elevation at headwater or outlet for WS23.Figure 7-11 in Section 7.2.2.3 of the EIS does not illustrate the location of WS23.
Information Request:	a. Confirm the elevation of watersheds at headwaters and outlets and revise if there is an error in Table 7.16. b. Provide an elevation of the headwaters and outlet for WS23 or provide a rationale for why one was not given. c. Provide the location of WS23 on Figure 7-11.
Response:	The delineation of drainage basins was provided on Section 7.2.2 of the EIS. a. The elevation at headwaters was summarized on Table 7.16 in Section 7.2.2.3 of the EIS. The header of the “Elevation at Headwaters (masl)” and the “Elevation at Outlet (masl)” column in Table 7.16 were inadvertently switched and should be transposed. Revised Table 7.16 below presents correct headwater and outlet elevations. The elevations were checked against the available LiDAR derived digital elevation model contours and the elevation at headwaters is higher than the elevation at outlet. b/c. Watershed WS23 is comprised of the Tailings Management Facility and polishing pond infrastructure and drains toward the Victoria River through pre-development watersheds WS12, WS13, and WS14. WS23 will be developed in construction / operation. The reduction of watershed area to the predevelopment WS12, WS12, and WS13 was calculated for construction and operation. This reduction was presented in the EIS, Table 7.36 Summary of Watershed Area, mean annual flow and Environmental Flow Changes through Project Phases. For this reason, presenting WS-23 in the pre-development Table 7.17 Pre-

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	development Watershed Areas or in the Figure 7-17 Pre-development Watershed Areas is not appropriate. Table 7.17 Predevelopment Watershed Areas of Section 7.2.2 of the EIS incorrectly included a row for WS23 and this row has been removed, as shown below in revised Table 7.17. No changes have been made to Figure 7-17 Pre-development Watershed Areas.
Appendix:	None

REVISED Table 7.16 Watershed Area for Hydrometric Stations

Station ID	Watershed Area (km^2)	Elevation at Headwaters (masl)	Elevation at Outlet (masl)
HS1	0.397	421	388
HS2	1.047	437	382
HS3	0.702	429	381
HS4	1.006	429	341
HS5	1.009	413	343
HS6	2.332	429	341
HS7	1.781	437	361
HS8	5.325	402	273
HS9	3.031	435	333
HS10*	3.031	435	333
HS11	1.756	360	258
HS12	1.099	348	260

Note:

* Watershed area for HS10 (Lake monitoring station) was assumed to be the same as HS9 (Lake outlet monitoring station)

Revised Table 7.17 Pre-development Watershed Areas

Watershed (WS) ID	Watershed Area (km^2)	Elevation at Headwaters (masl)	Elevation at Outlet (masl)
WS1	0.387	411	327
WS2	1.292	380	343
WS3	0.361	380	380
WS4	0.553	406	335
WS5	0.113	399	389
WS6	0.980	379	343
WS7	0.319	361	326
WS8	1.389	401	325
WS9	0.588	404	367
WS10	1.938	379	365
WS11	0.307	384	380
WS12	2.246	398	285
WS13	0.653	432	294
WS14	1.467	425	315
WS15	1.411	402	318
WS16	1.146	413	336
WS17	0.617	402	345
WS18	2.140	400	350
WS19	0.271	347	303
WS20	0.708	343	327
WS21	1.813	340	328
WS22	0.813	331	318

RESPONSE TO IR-34

ID:	**IR-34**
Expert Department or Group:	-
Guideline Reference:	Section 7.3.1
EIS Reference:	Section 5.2 of Appendix 7C (Assimilative Capacity Assessment Report) Section 6.0 of Appendix 7CSection 7.5.5.2 of the EIS
Context and Rationale:	The EIS Guidelines require information on the effects of changes to the aquatic environment on fish and their habitat. Tables 5-4, 5-5, 5-6 and 5-7 in section 5.2 of Appendix 7C provide the results of the CORMIX modelling. Based on the tables it is unclear if the CORMIX modelling results are calculated for the distance of the outfall at the Ultimate Receivers (Victoria Lake Reservoir, Victoria River and Valentine Lake) or from the final discharge points. If the results presented are for the ultimate receiver rather than the final discharge points the length of contaminated water is significantly further than the 100 to 200 metres presented in the tables which may have resulted in an underestimation on potential effects on fish and fish habitat. Results for pH have not been provided in the tables and therefore no consideration has been given for metals parameters that have guidelines that are pH dependent as to how far the mixing zone may extend should the pH in the tributary fall. Consideration has not been given to how long it might take for effluent to travel from the final discharge point to the ultimate receiving waters. This information is needed to determine significance of effects on fish and fish habitat.
Information Request:	a. Clarify when and where each parameter will reach a concentration below the Canadian Water Quality Guidelines for Freshwater Aquatic Life for the relevant phases of the Project. b. Assess the effects of pH dependent metal parameters on fish and fish habitat.
Response:	a. A mixing zone assessment was performed for both the immediate mixing zone downstream of the final discharge point (FDPs) and for the mixing zone in the ultimate receivers. The immediate mixing zone results are presented in Tables 4-1, 4-2, 4-3 and 4-4 of the Assimilative Capacity Assessment (Appendix 7C of the EIS). The results for the ultimate receivers (i.e., Victoria Lake Reservoir, Victoria River and Valentine Lake) are presented in Tables 5-4, 5-5, 5-6 and 5-7 of Appendix 7C of the EIS. Travel time in the tributaries, during mean annual flow conditions, varies from 0.7 hours to 2 hours depending on the channel slope and

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	catchment size. Average time for effluent to travel from the final discharge point to the ultimate receiving waters is 1.2 hours. The tributaries have limited assimilative capacity. They also have baseline exceedances of the Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CWQG-FAL) for aluminum, arsenic, phosphorus, iron, and zinc. Based on the results of the Assimilative Capacity Assessment, no *Metal and Diamond Mining Effluent Regulations* (MDMER) exceedances are predicted in the effluent or in the tributaries. However, a number of parameters of potential concern (POPCs) have exceedances of the CWQG FAL in the immediate mixing zone. Two operating scenarios were modelled as part of the Assimilative Capacity Assessment - regulatory operating conditions and normal operating conditions - and the distance required for POPCs to return to either levels below CWQG-FAL or to baseline levels (where baseline already exceeds the CWQG-FAL) were dependent on the scenarios. The regulatory operating conditions are considered worst case and conservative, while normal operating conditions are considered representative of the expected average discharge conditions. Under the normal operating conditions scenario, POPCs either return to baseline or to levels below CWQG-FAL at 100 m into the ultimate receiver. In the regulatory operating condition scenario, the combined effluent from LP-FDP-03 and LP-FDP-05 at the end of the 100 m ultimate receiver mixing zone has potential exceedances for arsenic, copper, lead, zinc and fluoride. Additionally, some exceedances are predicted within 100 m in the combined effluent from MA-FDP-03 and MA-FDP-04 for aluminum, iron, and manganese; these exceedances are due to conservative assumptions of the effluent flow and lower assimilative capacity of the watercourses. These are the only cases of predicted exceedances in the ultimate receivers beyond the 100 m mixing zone. Based on extrapolated dilution ratios for the regulatory scenario, it is expected that all parameters will meet the CWQG-FAL within a 300 m mixing zone. b. pH of the receiver was taken into account in the Assimilative Capacity Assessment (Appendix 7C of the EIS) when reporting the CWQG-FAL for metals that have pH dependent guidelines (i.e., aluminum, cadmium, lead and zinc). As a result, pH dependent metals were considered in the assessment of Project effects on fish and fish habitat (Sections 8.5.2 and 8.5.3 of the EIS), as the assessment was

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	based on the results of the Assimilative Capacity Assessment. Ambient pH in Valentine Lake and Victoria Lake Reservoir governs the pH equilibrium in the mixing zone due to the small amount of effluent and tributary flow in comparison to the volume of the receiver.
Appendix:	None

RESPONSE TO IR-35

ID:	**IR-35**
Expert Department or Group:	-
Guideline Reference:	Section 7.2.2
EIS Reference:	Section 7.5.1.1 of the EIS (Water Quantity and Water Quality Model Results)
Context and Rationale:	The EIS Guidelines require information on changes to hydrological and hydrometric conditions. Table 7.34 and 7.35 in section 7.5.1.1 (Water Quantity and Water Quality Model Results) of the EIS provide the Marathon and Leprechaun forecasted sedimentation pond outflows. The December predicted outflow during closure (year 13 to 17) for MA-SP-05 and LP-SP-05 is an order of magnitude larger (531 compared with 0-59cubic metres per day).
Information Request:	Clarify if there is an error with the value for December predicted outflow during closure or provide an explanation as to why the flows in December are so much higher than other predicted flows during closure.
Response:	Tables 7.34 and 7.35 in Section 7.5.1.1 (Water Quantity and Water Quality Model Results) of the EIS provide the Marathon and Leprechaun forecasted sedimentation pond outflows and reported a higher daily outflow volume for the month of December. The higher daily outflow volume in this month was applied in error due to the incremental volume to fill the pit occurring in the last 20 days of December of closure Year 17. Post-closure, water management pond MA-SP-05 and LP-SP-05 will be removed and an as-close-to natural drainage regime re-established. The monthly average outflow from water management pond MA-SP-05 in Table 7.34 for December for Marathon complex for closure (Year 13 to 17) is revised from 531 m^3/d to 18 m^3/d. The monthly average outflow from water management pond LP-SP-05 in Table 7.35 for December for Leprechaun complex for Closure (Year 13 to 17) is revised from 536 m^3/d in December to 54 m^3/d. This change does not affect the assessment of effects on surface water quantity, quality or fish and fish habitat in Chapters 7 and 8 of the EIS.
Appendix:	None

RESPONSE TO IR-36

ID:	**IR-36**
Expert Department or Group:	MW-30 MFN-10 MFN-11 MFN-12
Guideline Reference:	Section 7.3.1
EIS Reference:	Section 7.5.2.3 of the EIS
Context and Rationale:	The EIS Guidelines require information on the effects of changes to the aquatic environment on fish and their habitat. Section 7.5.2.3 (Change in Surface Water Quality – Residual Effects) of the EIS states that additional water quality treatment will be required for LP-FDP-05 but does not specify what that treatment would be. In addition, this section calculates the dilution for receiving water environments (Victoria Lake Reservoir, Valentine Lake and Victoria River); however, it is unclear if the cumulative effects of multiple discharge points on fish and fish habitat within one receiving water body was considered. MFN has indicated use of much of the LAA and have expressed concerned with the management of mine effluent and water quality in the area. This information is needed to determine significance of effects on fish and fish habitat.
Information Request:	a. Provide information on the water quality treatments that would be implemented for LP-FDP-05 and how long they would be in place (construction, operation, closure). b. Clarify if the cumulative effects of multiple final discharge points discharging into the same receiving water body was considered for fish and fish habitat. If this was not done, assess the cumulative effects on fish and fish habitat from multiple final discharge points discharging into the same receiving water body. c. Indicate whether monitoring and reporting of water quality would take place at each final discharge point or provide a rationale for why it would not take place.
Response:	a. No parameters of potential concern are predicted to exceed the *Metal and Diamond Mining Effluent Regulations* (MDMER) at final discharge points (FDP) including LP-FDP-05. As a result, further water quality treatment is not planned at this FDP. Please refer to the response to IR-34 and part b) below for further discussion of water quality results in relation to the Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CWQG-FAL). As required by MDMER, monitoring will be conducted at each FDP over the life of the Project and monitoring results will be shared with regulators, Indigenous

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	groups and stakeholders. Should exceedances be detected, contingency / mitigation measures will be implemented as follows: • Sampling will be repeated to confirm the exceedance • If confirmed, the cause of the exceedance will be investigated • If the cause was not a short-term or temporal incident that has not already been corrected, further water quality remediation measures (e.g., sedimentation ponds or drainage ditch adaptations, containerized water treatment system) will be developed and implemented in the source zones • Monitoring at the FDP will be continued to confirm the exceedance has been addressed. b. The assimilative capacity assessment is an investigation of the change in water quality in a receiving waterbody due to an effluent discharge. In the case of the Valentine Gold Project, discharge from a FDP or multiple FDPs will travel downstream in its local receiving tributary to the edge of the mixing zone in the ultimate receiving large lake or river (i.e., Victoria Lake Reservoir, Valentine Lake and Victoria River) in less than one day. Therefore, the assimilative capacity model only uses water quality assimilation factors effective under short-term conditions, such as dilution and sedimentation. Chemical, optical, thermal and biological reactions that would further improve receiving water quality over longer time periods or seasonally are not considered. The assimilative capacity assessment (Appendix 7C of the EIS) considered two discharge cases: one a normal or typical case presenting realistic conditions and the second a regulatory case. In the regulatory case, the assimilative capacity model inputs are built to create a worst-case scenario. For instance, very low flow receiving water and poor receiving water quality conditions are assumed, while the effluent being discharged is modeled at its maximum discharge rate and maximum water quality limits. The regulatory case is particularly conservative or over-estimates potential effects in the case of the Project as water discharges from the mine will be reflective of actual climate conditions. When the mine is experiencing dry climate and low runoff and flow conditions (i.e., late summer or mid-winter), discharge from sedimentation ponds will also reduce or cease. When flows moving through the sedimentation ponds reduce, the residence time that flows have in the ponds increases, ultimately increasing sedimentation and improving water quality. For these reasons and those mentioned above regarding how the assimilative capacity model

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	considers water quality improvement factors, the regulatory case is very conservative. The assimilative capacity assessment modeled to the point downstream from the FDPs where receiving water quality will recover to CWQG-FAL or baseline water quality (as several parameters are above CWQG-FAL in receiving waters as a baseline condition). This point downstream is referred to as the edge or boundary of the mixing zone and represents the point at which water quality either cannot improve (i.e., it reaches baseline conditions) or meets regulatory guidelines protective of all freshwater aquatic life (i.e., the CWQG-FAL). For the Project discharges, the edge of the mixing zone under the worst-case regulatory scenario (and considering multiple FDPs discharging into an ultimate receiver) was reached 100 m into the ultimate receiver (i.e., into Victoria Lake Reservoir, Valentine Lake and the Victoria River), except in a couple of cases for some parameters of potential concern where a mixing zone up to 300 m will be required. Taken cumulatively and considering the conservatism inherent in the worst-case regulatory scenario, the extension of the effluent mixing zone 100 to 300 m into the ultimate receivers represents the long-term, cumulative boundary of water quality effects. Considering the worst-case discharge condition, downstream in Red Indian Lake or at the outlet of Victoria Lake Reservoir, the water quality effect would be practically indetectable from baseline conditions. As a result, it is predicted that there will be no adverse, long-term cumulative effects further downstream in Red Indian Lake discharging to the Exploits River or discharging from Victoria Lake Reservoir through the Bay D'Espoir hydroelectric diversion watershed. Therefore, no measurable effects or cumulative effects on downstream fish and fish habitat, including sensitive Atlantic salmon populations in the Exploits River, are anticipated as a result of operational Project discharges. c. As indicated in part a) and as required by MDMER, monitoring will be conducted at each FDP over the life of the Project and monitoring results will be shared with regulators, Indigenous groups and stakeholders. Surface water monitoring locations are described in Table 7.51 of the EIS and shown on Figure 7-45 for the Marathon complex, Figure 7-46 for the Leprechaun complex, and Figure 7-47 for the Process Plant and TMF complex. Table 7.51 of the EIS also indicates the water quality parameters and monitoring frequency anticipated for each monitoring location.

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	As described in Section 7.9.1 of the EIS and pursuant to the MDMER (subsections 5, 14, and 17), monthly acute toxicity and bi-annual sublethal toxicity testing must be completed for effluent from the FDPs to support EEM. Effluent and water quality MDMER monitoring requires routine toxicity testing, EEM, and equipment calibration and testing. A follow-up and monitoring plan, which further refines the proposed surface water monitoring program based on detailed Project design, will be submitted to regulators as part of Project permitting.
Appendix:	None

RESPONSE TO IR-37

ID:	**IR-37**
Expert Department or Group:	-
Guideline Reference:	Section 7.2.2
EIS Reference:	Section 6.2 of Appendix 2A (Water Management Plan)
Context and Rationale:	The EIS Guidelines require information on changes to hydrological and hydrometric conditions. Table 6.2 of Section 6.2 of Appendix 2A (Water Management Plan) provides monthly average flows/outflows to/from sediment ponds for Leprechaun. The annual values for LP-FDP-02 appear disproportionately high. This information is needed to determine significance of effects on fish and fish habitat.
Information Request:	Clarify if the annual values for LP-FDP-02 are accurate and update the effects analysis on fish and fish habitat.
Response:	The higher daily outflow volumes in the months of October, November and December were applied in error. Table 6.2 of Section 6.2 of Appendix 2A (Water Management Plan) is revised to be consistent with Table 7.35 in section 7.5.1.1 (Water Quantity and Water Quality Model Results) of the EIS. This table was not used to determine the significance of effects on fish and fish habitat conducted in Chapter 8. Instead, the assessment referred directly to Table 7.35 in Section 7.5.1.1 (Water Quantity and Water Quality Model Results) of the EIS. Therefore, this change does not affect the assessment of effects on fish and fish habitat in Chapter 8.
Appendix:	None

RESPONSE TO IR-38

ID:	**IR-38**
Expert Department or Group:	ECCC-01 ECCC-02
Guideline Reference:	Section 7.2.2
EIS Reference:	Attachment 3-C of Baseline Study Appendix 3: Water Resources [BSA.3]: Section 3.2.2
Context and Rationale:	The EIS Guidelines require information on changes to hydrological and hydrometric conditions. Section 3.2.2 of BSA 3C provides the estimation of the mean annual flow (MAF) and monthly mean flows (MMF) is critical for water quality and low flow assessments. However, the original (1999) and updated (2014) Regional Flow Frequency Analysis (RFFA) reports note that the edges of the four identified homogeneous regions are approximate. The project is located at the edge of the Northeastern region, within a few kilometres of the Northwestern and Southwestern regions. The Water Survey of Canada (WSC) stations used to develop the Northeastern region equations are further from the project location than the nearest WSC stations in the Northwestern and Southwestern regions. The proponent only presents MAF and MMF estimates using the Northeastern region equations. In addition, continuous level data was collected at the project location for up to 7 years (2012-2019) and transformed to continuous streamflow data via an acceptable rating curve. However, this data does not appear to be used to validate any of the baseline estimates. *approx. 1 year of data at station HS2 is anomalously high (suspected beaver dam). This information is needed to determine predicted effects on changes to surface water and the significance of effects on fish and fish habitat.
Information Request:	a. Provide additional rationale for only using the Northeastern region RFFA. Consider using the streamflow field data to validate this choice. b. Validate the baseline water balance, baseflow index estimates or RRFA using the continuous level data.
Response:	a. Rationale for using the Northeastern region Regional Flow Frequency Analysis (RFFA) includes: • The site is geographically located in the northeast (NE) hydrological region. It is assumed the other gauging stations being referred to are 02YN002- Lloyd's River below King George IV Lake in the southwest (SW) Region (50 km from the site), and 02YN004 Star Brook above Star Lake (30 km from the site). Although both these stations drain to Red Indian Lake and the Exploits River system in the NE hydrological region, they were excluded by AMEC (2014)

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	from inclusion in the NE hydrological region due to statistical dissimilarities with other stations in the region. • A sub-set of Water Survey of Canada stations closer to the site was selected from the NE region to develop regional hydrology regression equations. • The NE region group equations were not used; a regression dataset was developed from a group of stations closer to the site. • Met station /climate data from both the NE and SW regions was used to estimate climate and meteorology. • Of the eight local Project flow gauging stations, three were operated for a longer period extending from 2012 – 2019, with the other five stations set up in either 2018 or 2019. Using the three stations with longer data (HS1, HS2 and HS3), the following is noted: o HS1 has a small watershed area of 0.397 km^2, has a regional equation based mean annual flow (MAF) and unit flow of 0.098 m^3/s and 0.0247 $m^3/s/km^2$. Using the rating curve developed for HS1, the MAF measured for the monitoring period was 0.0127 m^3/s and a unit flow of 0.032 $m^3/s/km^2$. o HS2 is also a small watershed of 1.047 km^2, has a regional equation based MAF and unit flow of 0.0264 m^3/s and 0.0264 $m^3/s/km^2$. Using the rating curve developed for HS1 and adjusting for the anomalously high extended water levels/flow from 2014 as mentioned in the comment, the MAF measured for the monitoring period was 0.021 m^3/s and a unit flow of 0.0201 $m^3/s/km^2$. o HS3 is also a small watershed of 0.702 km^2, has a regional equation based MAF and unit flow of 0.0175 m^3/s and 0.025 $m^3/s/km^2$. Using the rating curve developed for HS1 the MAF measured for the monitoring period was 0.0189 m^3/s and a unit flow of 0.0269 $m^3/s/km^2$. o Notwithstanding the fact that these are very small headwater watersheds, the MAF and unit flows for these three small, field-monitored watersheds are consistent with estimates derived from the selected regional hydrological regression dataset. • The environmental water balance for the Project site estimated climate normal evapotranspiration at 431 mm, which is 35% of climate normal precipitation and is consistent with the Water Resources Atlas of Newfoundland values of 450 – 475 mm/year. The evapotranspiration values estimated in the environmental water balance leave 65% to total streamflow. The selected NE Region gauging station subset yielded an average streamflow of

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	62.5% and shows close agreement with the environmental water balance for the site. • A monthly baseflow index (BFI) was calculated using the Streamflow Analysis and Assessment Software (V4.1) based on 13 years of continuous daily flow data from Water Survey of Canada station 02YO014. Station 02YO014 is a small watershed of just 8.15 km^2 and in that respect very similar to the small watersheds characteristic of the Project site and located approximately 48 km to the NE of the site. Baseflow contributions to total flow at this station for its period of record were found to vary from 23% (April) to 43% (March). The BFI calculated for the entire 13-year period of record was 35%. This BFI is considered applicable to the LAA with some potential variations that may include higher BFI in streams located in perched water tables (i.e., HS1 and HS2 which are located in or near bogs) and potentially lower BFI in streams located in areas of highly permeable bedrock (i.e., HS7 which exhibited very low summer flows). b. As the site is mapped in the NE region, a more locally based NE hydrological region gauging station dataset was used to develop regression relationships. This yielded hydrometric statistics that were validated by local flow gauging results, the environmental water balance and baseflow index estimation methods. Further, as precipitation information from both the NE and SW region was used, the approach taken addresses that the site is located near the boundary of multiple regions. Reference: AMEC. 2014. Regional Flood Frequency Analysis for Newfoundland and Labrador 2014 Update. Prepared for Water Resources Management Division, Department of Environment and Conservation, Government of Newfoundland and Labrador.
Appendix:	None

RESPONSE TO IR-39

ID:	**IR-39**
Expert Department or Group:	ECCC-03
Guideline Reference:	Section 7.2.2
EIS Reference:	Chapter 7 of EIS (Surface Water Resources), section 7.5.1.3 and Table 7.36
Context and Rationale:	The EIS Guidelines require information on changes to hydrological and hydrometric conditions. Table 7.36 and section 7.5.1.3 of the EIS assess the project effects on the watershed flows by comparing to the expected mean annual flow (MAF). The estimates of 50% MAF for the summer environmental flows and 33% MAF for the winter environmental flows, taken from Zadeh (2012), are appropriate estimates for baseline natural conditions. However, these baseline values must be compared to expected low flows in the summer and winter months, respectively, as the expected MAF does not adequately capture the potential for low flows in a non-natural system. It is critical to understand what is happening in the low flows based on seasonal flow and not just annual flow. This information is needed to determine significance of effects on fish and fish habitat.
Information Request:	Provide a comparison of the value of the baseline environmental flows to the expected project flows from the associated months (winter: October to March and summer: April to September) for all watersheds.
Response:	To clarify the assessment method, a 10% change in Mean Annual Flow (MAF) was used as a screening level assessment. Where MAF will be decreased by >10%, the projected MAF was compared to the seasonal environmental flows. MAF and Mean Monthly Flow (MMF) for each baseline watershed is presented in Chapter 7 of the EIS, Table 7.18. Based on the screening assessment, a small number of watersheds are not expected to provide sufficient summer and winter environmental flows during the Project phases, and thus experience localized residual effects. These include WS6, WS12, WS13, and WS14 during operation, WS3, WS6, WS12, WS13, and WS14 during closure, and WS6 post-closure. However, the effect on fish habitat from decreased surface water quantity will be mitigated and compensated for, via the implementation of an offsetting plan, as discussed in the response to IR-27 and in Section 8.9 of the EIS. Section 7.5.1.3 and Table 7.36 of the EIS provide these results for each watershed. Chapter 7 of the EIS (Table 7.36 and Section 7.5.1.3) includes a comparison of the expected MAF for each Project phase to the winter and summer baseline environmental flows. The winter environmental flow was

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	based on 30% of baseline MAF applied to the months of October through March, and the summer environmental flow was based on 50% of baseline MAF applied to the months of April through September. Please refer to Tables IR-39.1 to IR-39.3 for estimates of the MMF for each Project watershed. Table IR-39.1 represents construction and operation. Table IR-39.2 represents closure, although closure is conservatively represented early in the Project phase, as the timing of rehabilitation activities is uncertain and may not be complete until toward the end of the closure period. Therefore, the MMF during closure are similar to the MMF during operation. Table IR-39.3 represents post-closure when all Project rehabilitation activities are assumed to be complete. The values in bold indicate months when the seasonal baseline environmental flow is not maintained. The winter environmental flows are met for all months in all Project phases. As shown in these tables, August is the driest month on record and the MMFs are below the summer baseline environmental flows for all watersheds. However, baseline summer environmental flows are repeatedly not met under pre-development conditions, with the exception of WS5, WS6, WS19, when the monthly flows are slightly above the summer environmental flows. Although during operation some watersheds are predicted to increase from baseline conditions, environmental flows in August are still below baseline environmental flows. Environmental flows return to near baseline conditions during post-closure conditions as natural drainage patterns are returned to pre-development conditions. As shown in Table IR-39.3, the environmental flows in August increase from operation and closure Project phases and approach the summer baseline environmental flow for baseline conditions. Comparison of August MMFs in post-closure with baseline August MMFs demonstrates return to near baseline conditions. Similarly, baseline August MMFs are characteristically lower than summer environmental flows. Thus, in post-closure the local watersheds return to near baseline conditions. While the assessment indicates that environmental flows may not be maintained during August, the assessment of environmental flows in comparison to MMFs in Table 7.18 of Chapter 7 of the EIS indicates that under baseline conditions, watersheds characteristically experience flows at or below environmental flows during August. As shown in Table IR-39.3 during post-closure, while August MMFs in most watersheds increase, the low water condition observed in baseline conditions continues and remains an artifact of existing, natural local conditions.
Appendix:	None

Table IR-39.1 Baseline Environmental Flows Compared to Mean Monthly Flows During Operation and Closure

Pre Development Watersehd ID	Winter Env Flow (L/s) (Oct - Mar)	Mean Monthly Flow for Winter Months (L/s)						Summer Env Flow (L/s) (Apr - Sep)	Mean Monthly Flow for Summer Months (L/s)					
		Oct	Nov	Dec	Jan	Feb	Mar		Apr	May	Jun	Jul	Aug	Sep
WS1	2.9	10.8	10.9	6.9	4.1	4.2	8.1	4.9	29.3	30.7	12.2	5.9	**4.4**	7.3
WS2	14.6	51.8	55.9	38.3	23.9	24.5	42.8	24.4	138.6	130.8	53.1	27.3	**21.2**	34.9
WS3	4.2	15.2	15.6	10.1	6.1	6.2	11.7	6.9	41.2	42.2	16.8	8.2	**6.2**	10.2
WS4	3.8	14.1	14.4	9.3	5.5	5.7	10.7	6.4	38.1	39.2	15.6	7.6	**5.7**	9.4
WS5	0.5	2.0	1.9	1.1	0.6	0.6	1.3	0.8	5.4	6.3	2.5	1.1	**0.8**	1.3
WS6	1.3	4.9	4.9	3.0	1.7	1.8	3.5	2.2	13.5	14.9	5.9	2.7	**2.0**	3.3
WS7	5.6	20.2	21.0	13.8	8.3	8.5	15.8	9.3	54.6	54.9	22.0	10.9	**8.2**	13.6
WS8	9.3	33.3	35.3	23.7	14.6	14.9	26.8	15.5	89.4	86.9	35.0	17.7	**13.6**	22.4
WS9	6.9	24.8	26.0	17.2	10.5	10.7	19.6	11.5	66.9	66.3	26.6	13.3	**10.1**	16.7
WS10	15.7	55.4	60.0	41.2	25.8	26.5	46.0	26.2	148.2	139.2	56.5	29.1	**22.7**	37.3
WS11	4.0	14.7	15.1	9.7	5.8	6.0	11.2	6.7	39.8	40.8	16.3	7.9	**6.0**	9.9
WS12	7.5	26.8	28.2	18.7	11.4	11.7	21.3	12.4	72.3	71.2	28.6	14.3	**11.0**	18.1
WS13	1.7	6.3	6.3	3.9	2.3	2.3	4.6	2.8	17.3	18.7	7.4	3.5	**2.6**	4.3
WS14	4.6	16.7	17.2	11.2	6.7	6.9	12.9	7.6	45.2	46.0	18.4	9.0	**6.8**	11.2
WS15	12.2	43.3	46.3	31.5	19.5	20.0	35.3	20.3	115.9	110.7	44.8	22.8	**17.7**	29.1
WS16	10.2	36.2	38.6	26.0	16.0	16.4	29.3	16.9	97.3	94.0	38.0	19.2	**14.8**	24.4
WS17	2.9	10.6	10.7	6.8	4.0	4.1	8.0	4.8	28.8	30.2	12.0	5.8	**4.3**	7.1
WS18	16.5	58.1	63.0	43.4	27.2	27.9	48.3	27.5	155.3	145.5	59.1	30.5	**23.8**	39.1
WS19	1.6	5.8	5.8	3.6	2.1	2.1	4.2	2.6	15.9	17.4	6.8	3.2	**2.4**	3.9
WS20	4.6	16.7	17.2	11.2	6.7	6.9	12.9	7.6	45.1	45.9	18.3	9.0	**6.8**	11.2
WS21	14.1	50.0	53.9	36.9	23.0	23.6	41.2	23.6	133.9	126.7	51.4	26.3	**20.5**	33.7
WS22	8.8	31.6	33.4	22.3	13.7	14.1	25.3	14.7	84.8	82.7	33.3	16.8	**12.9**	21.2

Note: **Bold** indicates when Enviromental Flows is not met for that month

Table IR-39.2 Baseline Environmental Flows Compared to Mean Monthly Flows During Closure

Pre Development Watersehd ID	Winter Env Flow (L/s) (Oct - Mar)	Mean Monthly Flow for Winter Months (L/s)						Summer Env Flow (L/s) (Apr - Sep)	Mean Monthly Flow for Summer Months (L/s)					
		Oct	Nov	Dec	Jan	Feb	Mar		Apr	May	Jun	Jul	Aug	Sep
WS1	2.9	10.8	10.9	6.9	4.1	4.2	8.1	4.9	29.3	30.7	12.2	5.9	**4.4**	7.3
WS2	8.7	31.2	32.9	22.0	13.5	13.9	25.0	14.5	83.7	81.8	32.9	16.6	**12.7**	21.0
WS3	5.8	20.9	21.7	14.2	8.6	8.8	16.3	9.6	56.3	56.4	22.6	11.2	**8.5**	14.0
WS4	3.8	14.1	14.4	9.3	5.5	5.7	10.7	6.4	38.1	39.2	15.6	7.6	**5.7**	9.4
WS5	0.5	2.0	1.9	1.1	0.6	0.6	1.3	0.8	5.4	6.3	2.5	1.1	**0.8**	1.3
WS6	1.3	4.9	4.9	3.0	1.7	1.8	3.5	2.2	13.5	14.9	5.9	2.7	**2.0**	3.3
WS7	5.6	20.2	21.0	13.8	8.3	8.5	15.8	9.3	54.6	54.9	22.0	10.9	**8.2**	13.6
WS8	9.3	33.3	35.3	23.7	14.6	14.9	26.8	15.5	89.4	86.9	35.0	17.7	**13.6**	22.4
WS9	6.9	24.8	26.0	17.2	10.5	10.7	19.6	11.5	66.9	66.3	26.6	13.3	**10.1**	16.7
WS10	15.7	55.4	60.0	41.2	25.8	26.5	46.0	26.2	148.2	139.2	56.5	29.1	**22.7**	37.3
WS11	4.0	14.7	15.1	9.7	5.8	6.0	11.2	6.7	39.8	40.8	16.3	7.9	**6.0**	9.9
WS12	7.5	26.8	28.2	18.7	11.4	11.7	21.3	12.4	72.3	71.2	28.6	14.3	**11.0**	18.1
WS13	1.7	6.3	6.3	3.9	2.3	2.3	4.6	2.8	17.3	18.7	7.4	3.5	**2.6**	4.3
WS14	4.6	16.7	17.2	11.2	6.7	6.9	12.9	7.6	45.2	46.0	18.4	9.0	**6.8**	11.2
WS15	12.2	43.3	46.3	31.5	19.5	20.0	35.3	20.3	115.9	110.7	44.8	22.8	**17.7**	29.1
WS16	10.2	36.2	38.6	26.0	16.0	16.4	29.3	16.9	97.3	94.0	38.0	19.2	**14.8**	24.4
WS17	2.9	10.6	10.7	6.8	4.0	4.1	8.0	4.8	28.8	30.2	12.0	5.8	**4.3**	7.1
WS18	8.8	31.4	33.2	22.2	13.6	14.0	25.1	14.6	84.4	82.3	33.2	16.7	**12.8**	21.1
WS19	1.6	5.8	5.8	3.6	2.1	2.1	4.2	2.6	15.9	17.4	6.8	3.2	**2.4**	3.9
WS20	4.6	16.7	17.2	11.2	6.7	6.9	12.9	7.6	45.1	45.9	18.3	9.0	**6.8**	11.2
WS21	14.1	50.0	53.9	36.9	23.0	23.6	41.2	23.6	133.9	126.7	51.4	26.3	**20.5**	33.7
WS22	8.8	31.6	33.4	22.3	13.7	14.1	25.3	14.7	84.8	82.7	33.3	16.8	**12.9**	21.2

Note: **Bold** indicates when Enviromental Flows is not met for that month

Table IR-39.3 Baseline Environmental Flows Compared to Mean Monthly Flows During Post-Closure

Pre Development Watersehd ID	Winter Env Flow (L/s) (Oct - Mar)	Mean Monthly Flow for Winter Months (L/s)						Summer Env Flow (L/s) (Apr - Sep)	Mean Monthly Flow for Summer Months (L/s)						Summer Env. Flow (L/s)
		Oct	Nov	Dec	Jan	Feb	Mar		Apr	May	Jun	Jul	Aug	Sep	August
WS1	3.6	13.3	13.6	8.7	5.2	5.3	10.1	6.0	36.1	37.2	14.8	7.2	**5.4**	8.9	**4.3**
WS2	14.6	51.8	55.9	38.3	23.9	24.5	42.8	24.4	138.6	130.8	53.1	27.3	**21.2**	34.9	**14.3**
WS3	5.8	20.9	21.7	14.2	8.6	8.8	16.3	9.6	56.3	56.4	22.6	11.2	**8.5**	14.0	**4.0**
WS4	3.8	14.1	14.4	9.3	5.5	5.7	10.7	6.4	38.1	39.2	15.6	7.6	**5.7**	9.4	**6.1**
WS5	0.5	2.0	1.9	1.1	0.6	0.6	1.3	0.8	5.4	6.3	2.5	1.1	**0.8**	1.3	1.3
WS6	1.3	4.9	4.9	3.0	1.7	1.8	3.5	2.2	13.5	14.9	5.9	2.7	**2.0**	3.3	10.9
WS7	5.6	20.2	21.0	13.8	8.3	8.5	15.8	9.3	54.6	54.9	22.0	10.9	**8.2**	13.6	**3.5**
WS8	8.4	30.0	31.7	21.1	12.9	13.3	24.0	13.9	80.6	78.9	31.8	16.0	**12.2**	20.2	15.4
WS9	5.9	21.5	22.4	14.7	8.9	9.2	16.9	9.9	58.1	58.1	23.3	11.5	**8.8**	14.5	**6.5**
WS10	14.8	52.5	56.7	38.9	24.3	24.9	43.4	24.7	140.4	132.4	53.7	27.6	**21.5**	35.3	**21.5**
WS11	2.3	8.4	8.4	5.3	3.1	3.2	6.2	3.8	22.9	24.4	9.7	4.6	**3.4**	5.7	**3.4**
WS12	17.3	60.8	66.0	45.6	28.6	29.4	50.7	28.8	162.3	151.6	61.6	31.9	**24.9**	40.9	**24.9**
WS13	4.9	17.8	18.4	12.0	7.2	7.4	13.8	8.2	48.1	48.8	19.5	9.6	**7.3**	12.0	**7.3**
WS14	11.2	39.8	42.5	28.8	17.8	18.3	32.4	18.6	106.7	102.5	41.5	21.1	**16.3**	26.8	**16.3**
WS15	12.2	43.4	46.5	31.6	19.6	20.1	35.5	20.4	116.3	111.1	45.0	22.9	**17.8**	29.2	**15.7**
WS16	10.2	36.4	38.7	26.1	16.1	16.5	29.4	17.0	97.6	94.3	38.1	19.3	**14.9**	24.5	**12.7**
WS17	6.5	23.5	24.5	16.2	9.8	10.1	18.5	10.8	63.2	62.9	25.3	12.5	**9.6**	15.8	**6.9**
WS18	16.5	58.1	63.0	43.4	27.2	27.9	48.3	27.5	155.3	145.5	59.1	30.5	**23.8**	39.1	**23.8**
WS19	1.6	5.8	5.8	3.6	2.1	2.1	4.2	2.6	15.9	17.4	6.8	3.2	**2.4**	3.9	3.0
WS20	4.6	16.7	17.2	11.2	6.7	6.9	12.9	7.6	45.1	45.9	18.3	9.0	**6.8**	11.2	7.9
WS21	14.1	50.0	53.9	36.9	23.0	23.6	41.2	23.6	133.9	126.7	51.4	26.3	**20.5**	33.7	**20.1**
WS22	8.8	31.6	33.4	22.3	13.7	14.1	25.3	14.7	84.8	82.7	33.3	16.8	**12.9**	21.2	**9.0**

Note: **Bold** indicates when Enviromental Flows is not met for that month

RESPONSE TO IR-40

ID:	**IR-40**
Expert Department or Group:	ECCC-04 Agency-47 MFN-13, MFN-145(1)(a)(i) Fish and Fish Habitat 5(1)(a)(ii) Aquatic Species
Guideline Reference:	Section 7.2.2
EIS Reference:	Chapter 7 of EIS, section 7.5.1.3 (Residual Effects) and 7.5.1.4 (Summary of Residual Effects on Change in Surface Water Quantity)
Context and Rationale:	The EIS Guidelines require information on changes to hydrological and hydrometric conditions. Water will be pumped from Valentine Lake to help fill Marathon Pit at closure over approx. 8 years. The proponent states that "For Valentine Lake, the proposed pumping rate corresponds to 21% of expected MAF. […] The closure MAF is projected to be 59% and 164% greater than the pre-development summer and winter environmental flows, respectively." Further in the same document, the proponent states that the effects to Valentine Lake at the edge of the Local Assessment Area (LAA) is under 10% (section 7.5.1.4). The proponent assesses the Project effects on the Valentine Lake environmental flows by comparing to the expected mean annual flow (MAF). The expected MAF does not adequately describe the potential for Project effects on low flows (see previous IR, ECCC-MSC-3). Some watercourses have considerable losses in flows, for example WS-6 or VIC-16, which will see a reduction to 65% of the summer environmental flow, calculated as 50% of its MAF and 41% of the winter environmental flow, calculated as 30% of MAF. The EIS does not include mitigation measures for the loss in flow to these waterbodies. This information is needed to determine significance of effects on fish and fish habitat.
Information Request:	a. Provide an explanation for the apparent discrepancy between the expected Mean Annual flow (MAF) for Valentine Lake and the effects to Valentine Lake at the edge of the LAA (Section 7.5.1.4). b. Compare the value of the baseline environmental flows to the expected flows from the associated months (winter: October to March and summer: April to September) for Valentine Lake. c. Assess whether the pumping of Valentine Lake during the closure phase has the potential to affect the lake level, particularly during low water periods. Determine if this would impact the dilution for effluent discharged into Victoria Lake Reservoir and Valentine Lake. d. If the lake level is affected provide an assessment of the potential effects to fish and fish habitat including information on mitigation measures to protect fish and fish habitat for all watercourses that have more than a 10% change in their MAF.

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Response:	a. There is no discrepancy between the assessment of water taking from Valentine Lake itself and the assessment of that same taking further downstream from Valentine Lake at the boundary of the Local Assessment Area (LAA). These assessments are based on different watershed areas. Whereas the water taking is projected to reduce Mean Annual Flow (MAF) by 21% from Valentine Lake, the taking comprises < 10% reduction downstream of Valentine Lake at the LAA boundary. b. A comparison of Mean Monthly Flow (MMF) to baseline environmental flows was completed and summarized in Table IR-40.1 for all Project phases. The comparison was conducted at the outlet of Valentine Lake just upstream of the confluence with Long Lake. The winter environmental flow was based on 30% of baseline MAF applied to the months of October through March and the summer environmental flow was based on 50% of baseline MAF applied to the months of April through September. Item D below considers the effect of pit filling from Valentine Lake. The values in **bold** indicate months when the seasonal baseline environmental flow is not maintained. The winter environmental flows are met for all months in all Project phases. As shown in these tables, July and August are the driest month on record and the MMFs are below the summer baseline environmental flows for each phase. However, baseline summer environmental flows are repeatably not met under baseline conditions and reduced inflows to Valentine Lake during the summer months are primarily an artifact of existing, natural local conditions. The reductions in MMFs between baseline and the Project phases are considered negligible. c. The aquatic assessment estimated water level fluctuation on Valentine Lake is based on visual indicators to be approximately 1 m with relatively deep water along the shoreline. The effect of Marathon pit filling on Valentine Lake is estimated to be up to 0.2 m. Based on the stage, storage area relationships developed for Valentine Lake, a reduction in lake water level of 0.20 m will reduce the lake surface area by < 300 m^2. The area of Valentine Lake is estimated to be 8.23 km^2 and the water surface area reduction is negligible in comparison to the lake's total surface area. As the lake is relatively deep along the shoreline, and the potential reduction in lake water level has minimal effect on the lake surface area, the water taking for pit filling is not expected to affect the assimilative capacity of Valentine Lake nor alter the assimilative capacity assessment completed in the EIS (Appendix

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	7C of the EIS). The mixing zone in Valentine Lake during the water taking would remain consistent with the mixing zone predicted in Valentine Lake in Appendix 7C. Similarly, Victoria Lake Reservoir also has steep shorelines and deep nearshore areas where Project discharges require mixing zones; therefore, no change in Victoria Lake Reservoir mixing zones due to pit filling taking is anticipated. d. A comparison of MMF to baseline environmental flows was completed and summarized in Table IR-40.2 considering the water withdrawal from Valentine Lake to accelerate filling the Marathon pit in Years 10-12 of operation and Years 1 – 5 of closure. The winter environmental flows are met for all Project phases. The MMFs are below the summer environmental flows as it is for baseline conditions. However, in September the summer baseline environmental flows are not met during operation (Years 10-12) and closure as a result of pumping to accelerate Marathon pit filling. The potential Project related effects associated with changes in water quantity with respect to fish habitat are described in Chapter 8, Section 8.5 of the EIS. A water level and flow monitoring program will be implemented specifically to monitor potential effects of the water withdrawal. Flow proportional water withdrawal methods from Valentine Lake could be used to withdraw water in consideration of natural lake water levels, and environmental flows to reduce potential Project related effects. For example, additional water could be pumped from Valentine Lake during the high flow months of March, April and May and reduced (or interrupted) in July, August, and September. Criteria for altering the pumping rate would be developed in consultation with regulators to protect flows and water levels as required and reduce potential effects on fish and fish habitat. Due to the steep nature of Valentine Lake and Victoria Lake Reservoir banks and nearshore zones and the relatively small reduction in shoreline area estimated from proposed water takings, the effects on nearshore fish spawning and rearing habitat are predicted to be negligible. Where residual adverse Project-related effects remain, these will be counterbalanced by offsetting through an authorization pursuant to the *Fisheries Act* as described in Section 8.5.1 of the EIS. As described in the response to IR-27, the Fish Habitat Offsetting Plan is being developed in consultation with Fisheries and Oceans Canada (DFO) and will be submitted to DFO as part of the *Fisheries Act* Authorization process. The approved offsetting plan will be implemented to

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	counterbalance the loss of fish habitat in the LAA (as further described in the response to IR-27); therefore, no significant residual effects to fish habitat are anticipated.
Appendix:	None

Table IR-40.1 Baseline Environmental Flows Compared to Mean Monthly Flows During the Project Phases

Pre Development Watershed ID	Mean Monthly Flow for Winter Months (L/s)						Mean Monthly Flow for Summer Months (L/s)					
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Valentine Lake												
Environmental Flow	209.67						349.45					
Predevelopment (Baseline)	695.0	834.2	648.4	440.7	453.7	673.2	1816.2	1443.8	606.7	**347.1**	**289.8**	834.2
Operation	693.9	832.9	647.3	440.0	453.0	672.1	1813.5	1441.7	605.8	**346.6**	**289.3**	468.5
Closure	693.9	832.9	647.3	440.0	453.0	672.1	1813.5	1441.7	605.8	**346.6**	**289.3**	468.5
Post Closure	693.9	832.9	0.6	440.0	453.0	672.1	1813.5	1441.7	605.8	**346.6**	**289.3**	468.5
Note: **Bold** indicates when Environmental Flow is not met for that month												

Table IR-40.2 Baseline Environmental Flows Compared to Mean Monthly Flows During the Project Phases

Pre Development Watershed ID	Mean Monthly Flow for Winter Months (L/s)						Mean Monthly Flow for Summer Months (L/s)					
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Valentine Lake												
Predevelopment (Baseline)	209.67						349.45					
Baseline	695.0	834.2	648.4	440.7	453.7	673.2	1816.2	1443.8	606.7	**347.1**	**289.8**	834.2
Operation (Years 10-12) – With Pumping	515.9	654.9	469.3	262.0	275.0	494.1	1635.5	1263.7	427.8	**168.6**	**111.3**	**290.5**
Closure – With Pumping	515.9	654.9	469.3	262.0	275.0	494.1	1635.5	1263.7	427.8	**168.6**	**111.3**	**290.5**
Note: **Bold** indicates when Environmental Flow is not met for that month												

RESPONSE TO IR-41

ID:	**IR-41**
Expert Department or Group:	ECCC-12 NRCan-22 Pub-07.11
Guideline Reference:	Section 7.1.5
EIS Reference:	Chapter 4: Assessment of Effects to Surface WaterAppendix 7C – Assimilative Capacity Assessment Report
Context and Rationale:	The EIS guidelines require a sediment quality analysis for key sites likely to receive mine effluents. Sediment quality is an important aspect of a healthy ecosystem especially in supporting fish health in the receiving environment. The proponent has conducted baseline sediment studies but has not modelled or predicted impacts to sediments nor is any monitoring program planned to evaluate sediment quality. While water quality modelling and monitoring programs give good information related to the health of the aquatic environment, continuous loadings of elevated contaminants of potential concern (COPCs) may be deposited to sediments over time which may then act as an ongoing source of contamination in the benthic environment which can affect fish health. COPCs in sediments in streams and rivers can be remobilized over time or during high flow events to create risks to downstream aquatic receptors. Section 4.4.2 of the EIS BSA4-C provides sediment quality for 3 locations in Victoria and Valentine Lakes. However, these locations do not directly correlate to discharge locations.This information is needed to determine significance of effects on fish and fish habitat.
Information Request:	a. Provide time series plots (construction, operation, closure and post-closure) of Al, As, AG, Cd, Cr, Cu, Fe, Mn, Hg, Se, U, Zn, NO2, Cyanide, UN- NH3, SO4, F in sediments of Victoria Lake Reservoir, Valentine Lake and Victoria River. Provide an evaluation of sediment quality and assess the potential environmental effects to fish and fish habitat as a result of any sediment contamination, if applicable. Indicate whether a monitoring program to evaluate changes in sediment quality will be established. b. Provide predicted contaminated sediment conditions for each of the nine Final Discharge Points locations.
Response:	In response to this information request, the following presents further information regarding sediment loading, quality and deposition in effluent receiving environments. A design objective for the water management infrastructure is to keep contact water (any runoff, groundwater or process water that has come into direct contact with mine rock, tailings, or terrain where mine workings and

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	infrastructure occur) and non-contact water separate. Contact water is directed to water management ponds to allow for flow attenuation and water quality treatment prior to discharge to the environment at the final discharge points (FDPs). Non-contact water has been assumed to be represented by baseline water quality. Contact water quality, which includes surface water contacting any mine component, process water, and seepage flow out of stockpiles (ore, overburden and topsoil) and waste rock piles to and from the water management ponds, was modelled using GoldSim. As described in the EIS, the Project has a planned total of 11 FDPs. There are four FDPs at the Marathon Complex that drain to Valentine Lake and the Victoria River either directly or through tributaries. There are five FDPs at the Leprechaun Complex that drain to Victoria Lake Reservoir, either directly to the lake or through tributaries. The Processing Plant and Tailings Management Facility Complex has two FDPs that flow to Victoria Lake Reservoir. Sedimentation ponds provide removal of total suspended solids (TSS); however, sedimentation effects were not incorporated into geochemical or Assimilative Capacity modeling. The following response provides additional information with respect to sediment load and sediment water quality related to contact water. <u>Sediment Load</u> Sedimentation ponds are designed to: • Provide safe and efficient runoff and seepage collection to reduce disruptions to the mine operation during wet weather events/periods • Collect and treat contact water from waste rock piles, stockpiles and open pits • Provide peak flow reduction to mitigate potential flooding issues • Provide sediment removal to meet the *Metal and Diamond Mining Effluent Regulations* (MDMER) effluent TSS concentrations of 15 mg/L The results of sediment load on the ponds are presented in Table IR-41.1. Long term average annual erosion rates from the Project Area were predicted using the Revised Universal Soil Loss Equation for Application in Canada (RUSLEFAC) (Wall et al. 2002). The sedimentation pond design for sediment trapping efficiency was 80%. Particle size distribution was taken into account when deriving the erodibility factor in the Revised Universal Soil Loss Equation (RUSLE). It was assumed that 10% of mobile particles are sand and silt (size < 2 mm). The soil structure was assumed to be medium or coarse granular size with slow to moderate permeability. The ponds were assumed to settle out sediment particle sizes ≥ 0.005 mm.

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	Background TSS water quality concentrations in small tributaries in the Project Area are presented in Table IR-41.2. Table IR-41.3 presents sediment load at the ultimate receivers from the contact and non-contact areas of the mine. The distance from each FDP to the ultimate receiver is different in each case, however, for the purposes of this assessment, a worst-case scenario was assumed in which 100% of the sediment load at the FDP is transported to and settles out in the ultimate receiving water mixing zone. Thus, for MA-FDP-02 discharging to Valentine Lake, it was assumed that 1,253 kg/year will be deposited in the Valentine Lake mixing zone at an approximate material density of 2.0 tonne/m^3, equating to 0.616 m^3 of sediment deposition. Using a mixing zone of 100 m as determined in the Assimilative Capacity Report and calculating 100 m as the radius of a semicircle, the mixing zone area is 1.57 ha and the average sediment deposition depth is < 0.1 mm/year. Alternatively, for LP-FDP-03 (including 03A&B) and LP-FDP-05 with 16,487 kg/year sediment and an ultimate mixing zone of up to 300 m, the sediment deposition in Victoria Lake Reservoir would be approximately 8.2 m^3/year at an annual sediment depth of < 0.1 mm/year. In both cases, and covering the wide range of conservative sediment deposition, the accumulation of sediment in the ultimate receivers is comparable to natural (background) deposition rates. It is therefore not expected to result in adverse effects with respect to redd disturbance, egg smothering, groundwater discharge or sediment-water column oxygen exchange. With respect to the potential for Project discharges to adversely affect sediment chemistry, Table IR-41.4 presents sediment baseline chemistry as well as Canadian Environmental Quality Guidelines (CEQG) for sediment, including the Interim Sediment Quality Guidelines (ISQG) and probable effects levels (PELs). Sediment sampling was conducted in September of 2019 on small creeks and lakes representing catchment areas of the Victoria River, Valentine Lake, and Victoria Lake Reservoir. Baseline sediments exceed the CEQG ISQG for arsenic, cadmium and zinc and the CEQG PEL for arsenic. Table IR-41.5 presents modeling results of sediment chemistry from contact water using the geochemical model. No exceedances of CEQG ISQG and CEQG PEL are predicted for sediment in contact water leaving the sedimentation ponds. Sediment chemistry load predictions for contact areas are presented in Table IR-41.6 and predictions for non-contact areas are shown in Table IR-41.7.

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	Sediment quality for sedimentation pond discharges was estimated based on the proportional distribution of parameters of potential concern observed in geochemical testing and modelling. Table IR-41.8 presents estimates of sediment quality at each FDP based on proportioning sediment load contributions from undisturbed catchment areas at baseline quality and from the sedimentation ponds at the predicted geochemical quality. Based on these predictions of ultimate combined sediment quality, the following observations are made: • Baseline sediment chemistry exceeds CSQG ISQG for arsenic, cadmium and zinc and exceeds CEQG PEL for arsenic • No CEQG ISQG and CEQG PEL exceedances are predicted in sediments from contact areas discharging from Project sedimentation ponds • Average sediment deposition depth in the mixing zone of ultimate receivers for all FDPs is less than 0.1 mm /year which is comparable to natural (background) deposition rates for receivers with similar hydraulics (Chien and Wan 1999) It is anticipated that sediment quality may change due to Project discharges, however, sediment quality in these discharges will not increase above ISQG or PEL and will not diminish baseline sediment quality. Consequently, no adverse effects to fish, fish habitat or benthos are anticipated. The above assessment of sediment deposition and quality is representative of the period in operation when each pond source to each FDP is fully built-out and functional. During construction, approximately half of the proposed sedimentation ponds will be constructed to support construction phase topsoil and overburden stripping and mine facility excavation and dewatering. Except where required early to support construction, sedimentation ponds associated with the waste rock piles are planned for full commissioning in early operations when the Project begins to stockpile waste rock. Therefore, the construction phase sedimentation ponds will primarily be addressing topsoil and overburden sedimentation and dewatering activities at a portion of the site. As a result, the amount of sediment produced during this period will be less, and of better quality than the detailed assessment presented above for the operations phase. Similarly, as per the response to IR-31 and IR-44, the closure concept is to convert the proposed perimeter ditches to passive permeable reactive barriers and, where required, sedimentation ponds to engineered wetland features. The vegetated soil cover proposed for residual mine waste stockpiles will produce non-contact overland runoff which will be routed to

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	natural ground. Only infiltration-based seepage will remain as contact water requiring further treatment in closure. Groundwater is naturally low in "sediment" or particulate form and metals in groundwater are typically considered in the dissolved format, thus not producing significant sediment load. Further, the passive seepage approach uses sulphate reducing bacteria and the carbon-rich material to sequester metals in the subsurface reactive barrier zone thus "discharging" to the receiving groundwater environment treated seepage in dissolved metal format. For these reasons during closure and post-closure, sediment production will be less, and its quality better, than that predicted in the detailed operations phase assessment. Marathon will undertake baseline environmental effects monitoring (EEM) sediment monitoring in 2021 and will continue sediment monitoring in keeping with EEM requirements under MDMER throughout mine life. <u>Summary</u> The above assessment demonstrates that sediment deposition, even when estimated for the worst-case (operation) scenario, would not adversely affect sediment accretion depth in the ultimate receiver mixing zones. No adverse sediment deposition effects are therefore predicted for benthos, fish or fish habitat. Sediment quality will remain the same or potentially improve from baseline conditions for all parameters. The results of this sediment prediction assessment indicate that the Project will not have adverse effects on fish, fish habitat or benthos. References: Ning Chien and Zhaohui Wan (1999) Mechanics of Sediment Transport. ASCE Press. Wall G.J., Coote D.R., Pringle E.A. & Shelton I.J. (2002) RUSLEFAC – Revised Universal Soil Loss Equation for Application in Canada: A Handbook for estimating Soil Loss from Water Erosion in Canada. Research Branch, Agriculture and Agri-Food Canada, Ottawa, ON.
Appendix:	None

Table IR-41.1 Long Term Sediment Load Predictions from Contact Areas

Sedimentation Pond	Facility	Final Discharge Point	Discharge Location	Pond Catchment Area, ha	Long-term Average Soil Loss, kg/yr	Mean Annual Flow at Pond, m^3/day	TSS in Pond, mg/L	TSS at Pond outflow, mg/L
MA-SP-01A/B	Topsoil/Low Grade	MA-FDP-01A/B	Valentine Lake	69.1	8,524	1,492	15.6	3.1
MA-SP-01C	Waste Rock	MA-FDP-01C		18.5	2,978	389	20.9	4.2
MA-SP-02	Waste Rock	MA-FDP-02		55.6	2,931	1,196	6.7	1.3
MA-SP-03	Waste Rock	MA-FDP-03	Victoria River	34.2	2,785	728	10.5	2.1
MA-SP-04	Waste Rock	MA-FDP-04		71.9	7,464	1,556	13.1	2.6
MA-SP-05	Pit			70.4	4,837	1,522	8.7	1.7
LP-SP-01A	Low Grade	LP-FDP-01	Victoria Lake Reservoir	16.0	676	335	5.5	1.1
LP-SP-01B	Topsoil/W Rock			38.8	1,607	828	5.3	1.1
LP-SP-02A	Waste Rock	LP-FDP-02		75.0	9,004	1,623	15.2	3.0
LP-SP-03A	Waste Rock	LP-FDP-03C		52.0	30,464	1,118	74.6	14.9
LP-SP-03C	Overburden/ W Rock			39.1	18,041	836	59.1	11.8
LP-SP-05	Pit	LP-FDP-05		57.8	27,622	1,244	60.8	12.2

Table IR-41.2 Background TSS Concentration from Non-Contact Areas

	Average TSS, mg/L	75th% TSS, mg/L
LP02, LP04 (Tribs to Victoria Lake, LP-FDP-01 to LP-FDP-05)	0.79	1.1
VL01 (Tribs of Valentine Lake, MA-FDP 01, 02)	2.1	2.7
R02 (Tribs to Victoria River, MA-FDP-03,04)	3.6	4.4

Table IR-41.3. Sediment Load at Final Discharge Points (FDPs)

Sedimentation Pond	Final Discharge Point	Discharge Location	Sediment Load from Contact Areas, kg/year	Sediment Load from Non- Contact Areas, kg/year	Total Load at FDP, kg/year
MA-SP-01A/B	MA-FDP-01A/B	Valentine Lake	1,705	5,790	8,090
MA-SP-01C	MA-FDP-01C		596		
MA-SP-02	MA-FDP-02		586	667	1,253
MA-SP-03	MA-FDP-03	Victoria River	557	20,205	23,222
MA-SP-04	MA-FDP-04		1,493		
MA-SP-05			967		
LP-SP-01A	LP-FDP-01	Victoria Lake Reservoir	135	557	1,014
LP-SP-01B			321		
LP-SP-02A	LP-FDP-02		1,801	85	1,885
LP-SP-03A	LP-FDP-03C		6,093	1,261	16,487
LP-SP-03C			3,608		
LP-SP-05	LP-FDP-05		5,524		

Table IR-41.4 Baseline Sediment Chemistry

Parameter	UNITS	CEQG ISQG	CEQG PEL	Valentine Lake Tributaries	Victoria River Tributaries	Victoria Lake Tributaries
Aluminum (Al)	mg/kg	-	-	16,500	18,000	22,000
Arsenic (As)	mg/kg	5.9	17	**125**	**120**	**114**
Cadmium (Cd)	mg/kg	0.6	3.5	**0.86**	**1.50**	**0.73**
Copper (Cu)	mg/kg	35.7	197	23.5	23.0	31.0
Iron (Fe)	mg/kg	-	-	27,500	25,000	36,500
Lead (Pb)	mg/kg	35	91.3	6.8	7.1	15.3
Manganese (Mn)	mg/kg	-	-	3,050	3,700	6,308
Zinc (Zn)	mg/kg	123	315	**144.0**	**170**	**143.8**

Notes:

CEQG - Canadian Environmental Quality Guideline
ISQG - Interim Sediment Quality Guideline
PEL – Probable Effect Level
Bold font denotes concentrations that exceed an applicable guideline (either/or ISQG, PEL)

Table IR-41.5 Sediment Chemistry Predictions for Sedimentation Pond Discharges (mg/kg)

Final Discharge Point	Discharge Location	Al	As	Cd	Cu	Fe	Mn	Pb	Zn
MA-FDP-01	Valentine Lake	6,533	1.10	0.150	26.6	11,976	401	2.6	12.0
MA-FDP-02/03		6,892	0.82	0.024	13.8	17,350	528	1.6	20.2
MA-FDP-04	Victoria River	9,454	1.22	0.045	23.8	19,369	736	2.7	32.2
LP-FDP-01/02	Victoria Lake Reservoir	7,030	2.19	0.046	9.7	4,716	594	11.2	41.8
LP-FDP-03/05		7,559	2.69	0.064	12.2	6,430	651	11.0	49.8

Table IR-41.6 Sediment Chemistry Load Predictions for Contact Areas Discharging from Sedimentation Ponds (kg/year)

Sedimentation Pond	Al	As	Cd	Cu	Fe	Mn	Pb	Zn
MA-SP-01A/B	55.7	0.009	0.0013	0.227	102.1	3.42	0.022	0.102
MA-SP-01C	20.5	0.002	0.0001	0.041	51.7	1.57	0.005	0.060
MA-SP-02	20.2	0.002	0.0001	0.041	50.8	1.55	0.005	0.059
MA-SP-03	19.2	0.002	0.0001	0.038	48.3	1.47	0.004	0.056
MA-SP-04	51.4	0.006	0.0002	0.103	129.5	3.94	0.012	0.150
MA-SP-05	45.7	0.006	0.0002	0.115	93.7	3.56	0.013	0.156
LP-SP-01A	4.8	0.001	0.0000	0.007	3.2	0.40	0.008	0.028
LP-SP-01B	11.3	0.004	0.0001	0.016	7.6	0.96	0.018	0.067
LP-SP-02A	63.3	0.020	0.0004	0.087	42.5	5.35	0.101	0.377
LP-SP-03A	214.2	0.067	0.0014	0.295	143.7	18.11	0.343	1.275
LP-SP-03C	126.8	0.040	0.0008	0.174	85.1	10.73	0.203	0.755
LP-SP-05	208.8	0.074	0.0018	0.338	177.6	17.98	0.304	1.375

Table IR-41.7 Sediment Chemistry Load Predictions for Non-Contact Areas (kg/year)

Final Discharge Point	Discharge Location	Al	As	Cd	Cu	Fe	Mn	Pb	Zn
MA-FDP-01	Valentine Lake	95.5	0.724	0.005	0.136	159.2	17.66	0.039	0.834
MA-FDP-02		11.0	0.083	0.0006	0.016	18.3	2.03	0.005	0.096
MA-FDP-03/04	Victoria River	363.7	2.425	0.0303	0.465	505.1	74.76	0.143	3.435
LP-FDP-01	Victoria Lake Reservoir	12.3	0.064	0.0004	0.017	20.3	3.51	0.009	0.080
LP-FDP-02		1.9	0.010	0.0001	0.003	3.1	0.53	0.001	0.012
LP-FDP-03/05		27.7	0.144	0.0009	0.039	46.0	7.96	0.019	0.181

Table IR-41.8 Sediment Chemistry Load Predictions at FDP (kg/year)

Final Discharge Point	Discharge Location	Al	As	Cd	Cu	Fe	Mn	Pb	Zn
MA-FDP-01	Valentine Lake	171.7	0.736	0.0063	0.404	313.0	22.65	0.066	0.996
MA-FDP-02		31.2	0.086	0.0006	0.056	69.2	3.58	0.009	0.155
MA-FDP-03/04	Victoria River	480.1	2.439	0.0308	0.722	776.6	83.73	0.173	3.797
LP-FDP-01	Victoria Lake Reservoir	28.3	0.069	0.0005	0.039	31.1	4.87	0.034	0.176
LP-FDP-02		65.2	0.029	0.0005	0.090	45.5	5.89	0.103	0.389
LP-FDP-03/05		577.5	0.325	0.0049	0.846	452.4	54.77	0.869	3.587

RESPONSE TO IR-42

ID:	**IR-42**
Expert Department or Group:	ECCC-13
Guideline Reference:	Section 7.3.1
EIS Reference:	Appendix 7C – Assimilative Capacity Assessment Report (page 1.2)
Context and Rationale:	The EIS Guidelines require information on the effects of changes to the aquatic environment on fish and their habitat. The EIS quotes CCME (2003) which defines the mixing zone as, “an area contiguous with a point source (effluent) where the effluent mixes with ambient water and where concentrations of some substances may not comply with water quality guidelines or objectives.” The EIS concludes that in almost all cases where Final Discharge Points (FDPs) are located in small tributaries, the effluent mixing zone extends the length of the tributary and into the ultimate downstream lake / river receivers. The EIS continues to quote CCME (2003) by stating that “Conditions within the mixing zone should not result in bioconcentration of POPC [pollutants of potential concern] to levels that are harmful to organisms, aquatic-dependent wildlife, or human health. Also, accumulation of toxic substances in water or sediment to toxic levels should not occur in the mixing zone” (Canadian Council of Ministers of the Environment (CCME). 2003. Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life: Guidance on the Site-Specific Application of water quality guidelines in Canada: Procedures for deriving numerical water quality objectives. In: Canadian Environmental Quality Guidelines. Winnipeg). The EIS does not provide information on whether the mixing zone could result in conditions with harmful concentrations of POPC that is harmful to fish and fish habitat. This information is needed to determine significance of effects on fish and fish habitat.
Information Request:	Provide supporting data/information that bioconcentration or accumulation of toxic substances that are harmful to fish and fish habitat are not expected to reach toxic or harmful levels in water or sediments within the mixing zones.
Response:	Water quality in the mixing zone was assessed and modelled under conservative assumptions in terms of receiver flow (7Q20 flow), receiver water quality (75th percentile), effluent flow (maximum rates), and effluent water quality (assumed at the Metal and Diamond Mining Effluent Regulations (MDMER) levels) (please refer also to the responses to IR-34). It is expected that during normal operating conditions, these worst-case conditions are unlikely to happen simultaneously.

ID:	IR-42
	As noted, the mixing zone was assessed in the tributaries and within the ultimate receivers (i.e., Victoria River, Victoria Lake Reservoir, and Valentine Lake). These tributaries, due to their small catchment area, have very little assimilative capacity. Moreover, their background concentrations for some parameters (e.g., aluminum, arsenic, manganese, phosphorus and zinc) exceed the Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CWQG-FAL). These parameters are not considered bioaccumulative, with the exception of arsenic which may have the potential to be bioaccumulative (EC 2012). Water quality substantially improves within the mixing zone in the ultimate receiver. Modeling of the most conservative regulatory scenario for the Marathon Complex, Leprechaun Complex, Process Plant and Tailings Management Facility Complex showed that the ultimate mixing zone extends approximately 300 m from the tributary mouth, at which point all parameters meet the CWQG-FAL. Water quality for the regulatory scenario meets the CWQG-FAL within 100 m of the ultimate mixing zone for most parameters of potential concern, except for the combined effluent from LP-FDP-03 and LP-FDP-05, which has potential exceedances for arsenic, copper, lead, zinc and fluoride. Additionally, some exceedances are predicted within 100 m in the combined effluent from MA-FDP-03 and MA-FDP-04 for aluminum, iron, and manganese. Unlike mercury, selenium and cadmium, the parameters that exceed their corresponding CWQG-FAL values are not bioaccumulative (EC 2012). Therefore, they would not be expected to bioconcentrate or bioaccumulate in fish or other aquatic organisms. Bioaccumulative or bioconcentrating parameters, such as cadmium, selenium, and mercury, were not detected in the geochemical testing of the ore samples. The mining processes planned for the Project do not require the use of bioaccumulative or bioconcentrating compounds. In addition, based on the results of the geochemical water quality modelling, the concentrations of these compounds are not expected to exceed CWQG-FAL or MDMER values. Effluent water will meet the MDMER limits for parameters of potential concern and as well for acute toxicity. Marathon will monitor effluent water quality and toxicity as per MDMER requirements. Reference: Environment Canada (EC). 2012. Metal Mining Technical Guidance for Environmental Effects Monitoring. Environment Canada.
Appendix:	None

RESPONSE TO IR-43

ID:	**IR-43**
Expert Department or Group:	ECCC-14
Guideline Reference:	Section 7.1.5
EIS Reference:	Chapter 8, Fish and Fish Habitat, page 8.36
Context and Rationale:	The EIS guidelines require a sediment quality analysis for key sites likely to receive mine effluents. When evaluating sediment quality, Probable Effect Levels (PELs) represents the lower limit of the range of chemical concentrations that is usually or always associated with adverse biological effects and are less conservative than Interim Sediment Quality Guidelines (ISQGs). The EIS compares sediment concentrations to PELs and not ISQGs. This information is needed to determine significance of effects on fish and fish habitat.
Information Request:	Provide the rationale for using PELS, which are considered to be less conservative, to compare sediment and not ISQGs.
Response:	The Interim Sediment Quality Guidelines (ISQG) and Probable Effects Levels (PELs) are both used as screening tools in Canada to predict biological effects in the absence of other information used to evaluate sediment quality. The ISQG and PEL were developed with the intention of being conservative, or protective, in terms of biological effects. Studies used to develop the ISQG and PELs were mainly based on field-collected sediments using measured concentrations of potential contaminants along with other chemicals and associated biological effects. Using the guidelines as predictors, biological effects are rarely expected to occur at concentrations below the ISQG, occasionally between the ISQG and PEL, and more frequently above the PEL. The PEL represents the lower limit of the range of chemical concentrations that are usually or always associated with adverse biological effects. In response to the reviewer's comments, sediment chemistry of samples from streams, ponds, and lakes is provided in Table IR-43.1 and has been updated from Baseline Study Appendix (BSA).4, Attachment 4-C to include the ISQG. Many of the samples had metal levels above the ISQG as a baseline condition. The response to IR-41 presents the results of a sediment quality analysis and the potential for subsequent effects on benthos, fish and fish habitat. The results have been provided in reference to both the ISQGs and PELs.
Appendix:	None

Table IR-43.1 Sediment Chemistry Sample Results from Ponds, Lakes and Streams

Sampling Date				9/24/2019 11:01:00 AM	9/27/2019 2:17:00 PM	9/24/2019 12:19:00 PM	9/29/2019 9:28:00 AM	9/23/2019 11:20:00 AM	9/27/2019 1:40:00 PM	9/23/2019 5:13:00 PM	9/24/2019 1:25:00 PM	9/23/2019 2:45:00 PM	9/23/2019 5:10:00 PM	9/27/2019 8:55:00 AM
Habitat				**Streams (Soft Sediment)**					**Ponds**					
Metals	**UNITS**	**CSQG PEL**	**CSQG ISQG**	**C001-02 (14)**	**V1in-02 (22)**	**M1OUT-02 (8)**	**VICP2OUT-02 (16)**	**VALP2OUT-02 (20)**	**V1**	**L1**	**M7**	**VALP2**	**VICP2**	**VALP3**
Acid Extractable Aluminum (Al)	mg/kg			14000	20000	12000	18000	22000	14000	19000	18000	22000	29000	21000
Acid Extractable Antimony (Sb)	mg/kg			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Acid Extractable Arsenic (As)	mg/kg	17	5.9	**240**	**43**	**80**	**110**	**72**	**18**	**290**	**120**	**56**	**86**	**170**
Acid Extractable Barium (Ba)	mg/kg			110	220	63	86	63	91	310	88	48	270	77
Acid Extractable Beryllium (Be)	mg/kg			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Acid Extractable Bismuth (Bi)	mg/kg			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Acid Extractable Boron (B)	mg/kg			<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Acid Extractable Cadmium (Cd)	mg/kg	3.5	0.6	0.33	1.6	0.78	0.75	<0.30	1.6	1.1	1.5	1.1	1.1	0.93
Acid Extractable Chromium (Cr)	mg/kg	90	37.3	24	24	17	21	32	14	17	15	17	17	18
Acid Extractable Cobalt (Co)	mg/kg			30	33	16	18	17	16	43	15	14	16	19
Acid Extractable Copper (Cu)	mg/kg	197	35.7	20	33	31	13	59	28	16	23	19	20	16
Acid Extractable Iron (Fe)	mg/kg			45000	50000	19000	36000	40000	22000	47000	25000	22000	35000	36000
Acid Extractable Lead (Pb)	mg/kg	91.3	35	6.6	9.4	8.2	8.6	8.9	9.3	18	7.1	21	26	5.4
Acid Extractable Lithium (Li)	mg/kg			11	8.1	8.2	12	12	4.4	6.4	7.5	2	4.3	21
Acid Extractable Manganese (Mn)	mg/kg			7400	19000	4600	4400	1500	7100	28000	3700	850	1600	1500
Acid Extractable Mercury (Hg)	mg/kg	0.486	0.17	<0.10	0.14	0.18	0.14	<0.10	0.18	0.2	0.21	0.23	0.17	<0.10
Acid Extractable Molybdenum	mg/kg			<2.0	7.2	5.1	2.9	<2.0	3	5.3	7.2	2.5	5.6	2.8
Acid Extractable Nickel (Ni)	mg/kg			23	24	18	17	24	15	21	19	14	15	22
Acid Extractable Rubidium (Rb)	mg/kg			5.4	3.9	2.3	2.8	8.3	2.5	2.4	2.5	<2.0	2.6	7.9
Acid Extractable Selenium (Se)	mg/kg			<1.0	<1.0	1.8	<1.0	<1.0	1.3	1.3	1.9	1.7	1.5	<1.0
Acid Extractable Silver (Ag)	mg/kg			<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Acid Extractable Strontium (Sr)	mg/kg			15	37	24	21	13	34	37	37	23	200	21
Acid Extractable Thallium (Tl)	mg/kg			<0.10	0.12	0.12	0.1	<0.10	<0.10	0.2	0.13	<0.10	0.17	0.18
Acid Extractable Tin (Sn)	mg/kg			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	<1.0	<1.0
Acid Extractable Uranium (U)	mg/kg			0.95	2.7	7.6	2	0.84	4.3	10	9.5	5.1	6.5	6.2
Acid Extractable Vanadium (V)	mg/kg			54	70	36	56	78	28	41	27	37	48	41
Acid Extractable Zinc (Zn)	mg/kg	315	123	110	170	88	130	76	110	250	170	140	190	200
Grain Size														
Gravel	%			6.2	2.7	<0.10	3.2	<0.10	0.28	0.88	0.19	<0.10	<0.10	2.1
Sand	%			69	67	33	52	0.66	15	50	36	23	32	63
Silt	%			15	26	39	22	79	40	27	24	37	36	21
Clay	%			10	4.2	28	23	21	45	22	41	39	32	14

Note: Bold indicates exceedance of Canadian Sediment Quality Guidelines for the Protection of Aquatic Life Probable Effect Level (CSQG PEL)

Table IR-43.1 Sediment Chemistry Sample Results fro

Sampling Date			9/24/2019 11:22:00 AM	9/24/2019 9:30:00 AM	9/24/2019 1:24:00 PM	9/25/2019 11:30:00 AM	9/25/2019 12:30:00 PM	9/25/2019 1:30:00 PM	
Habitat			Lakes						
Metals	**UNITS**	**CSQG PEL**	**VIC02-DP**	**VIC01-MD**	**VIC03-LT**	**VAL01-DP**	**VAL02-MD**	**VAL03-LT**	**Reporting Detection Limit**
Acid Extractable Aluminum (Al)	mg/kg		26000	19000	21000	29000	23000	18000	10
Acid Extractable Antimony (Sb)	mg/kg		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0
Acid Extractable Arsenic (As)	mg/kg	17	**79**	**95**	**95**	**280**	**68**	**71**	2.0
Acid Extractable Barium (Ba)	mg/kg		120	67	58	480	76	120	5.0
Acid Extractable Beryllium (Be)	mg/kg		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0
Acid Extractable Bismuth (Bi)	mg/kg		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0
Acid Extractable Boron (B)	mg/kg		<50	<50	<50	<50	<50	<50	50
Acid Extractable Cadmium (Cd)	mg/kg	3.5	1.1	0.34	0.3	2.9	1.2	1.3	0.30
Acid Extractable Chromium (Cr)	mg/kg	90	34	29	31	33	22	18	2.0
Acid Extractable Cobalt (Co)	mg/kg		31	17	25	50	11	14	1.0
Acid Extractable Copper (Cu)	mg/kg	197	46	39	43	75	32	23	2.0
Acid Extractable Iron (Fe)	mg/kg		47000	44000	45000	57000	27000	21000	50
Acid Extractable Lead (Pb)	mg/kg	91.3	24	8.9	8.8	19	54	37	0.50
Acid Extractable Lithium (Li)	mg/kg		13	11	15	21	6.6	3.8	2.0
Acid Extractable Manganese (Mn)	mg/kg		5100	1100	1600	29000	1800	3600	2.0
Acid Extractable Mercury (Hg)	mg/kg	0.486	0.26	0.12	0.11	<0.10	0.14	<0.10	0.10
Acid Extractable Molybdenum	mg/kg		3.6	2.6	<2.0	11	3.2	2.5	2.0
Acid Extractable Nickel (Ni)	mg/kg		30	24	28	56	17	16	2.0
Acid Extractable Rubidium (Rb)	mg/kg		9.1	5.7	6.7	7.7	4	3.1	2.0
Acid Extractable Selenium (Se)	mg/kg		1.7	<1.0	<1.0	<1.0	1.8	1.3	1.0
Acid Extractable Silver (Ag)	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50
Acid Extractable Strontium (Sr)	mg/kg		16	12	15	20	26	41	5.0
Acid Extractable Thallium (Tl)	mg/kg		0.33	<0.10	<0.10	0.66	0.12	0.18	0.10
Acid Extractable Tin (Sn)	mg/kg		1.3	<1.0	<1.0	<1.0	2	1	1.0
Acid Extractable Uranium (U)	mg/kg		3.6	1.6	1.3	2.5	1.7	1.7	0.10
Acid Extractable Vanadium (V)	mg/kg		90	74	77	76	45	35	2.0
Acid Extractable Zinc (Zn)	mg/kg	315	130	72	71	220	140	160	5.0
Grain Size									
Gravel	%		<0.10	1.4	0.16	22	<0.10	<0.10	0.10
Sand	%		3.9	9.8	17	17	23	39	0.10
Silt	%		65	64	69	39	42	32	0.10
Clay	%		31	25	14	21	35	29	0.10

Note: Bold indicates exceedance of Canadian Sediment C

RESPONSE TO IR-44

ID:	**IR-44**
Expert Department or Group:	ECCC-19 Pub—07.11
Guideline Reference:	Section 9
EIS Reference:	Appendix 7A, page iii
Context and Rationale:	The EIS Guidelines require a follow-up program that is designed to verify the accuracy of the effects assessment and to determine the effectiveness of the measures implemented to mitigate the adverse effects of the project. The Water Quantity and Water Quality Report in Appendix 7A of the EIS states that "In post closure, Cu is predicted to exceed the MDMER limit due to an elevated concentration of this metal in TMF toe seepage. Therefore, a mitigation such as passive treatment of seepage should be considered." ECCC indicated that when or if a mine has achieved Recognized Closed Mine (RCM) status under the MDMER, any effluent from the facility will be subject to Section 36(3) of the *Fisheries Act*, which prohibits the deposit of deleterious substances into waters frequented by fish, or to any place, under any conditions, where it may enter water frequented by fish. All reasonable efforts must be made to prevent such a deposit of deleterious substances. It is unclear whether a follow-up program will be carried out to assess the effectiveness of mitigation measures proposed to prevent the deposit of deleterious substances. This information is needed to assess residual effects after mitigation.
Information Request:	Provide information on any proposed follow-up programs to assess the effectiveness of mitigation measures proposed to address the seepage of metals and other contaminants at levels above MDMER from the Tailings Management Facility.
Response:	Refer to response to IR-31 for further discussion regarding passive water treatment during closure/post-closure. Marathon will develop a passive treatment assessment program as part of its Rehabilitation and Closure Plan to the Newfoundland and Labrador Department of Industry, Energy and Technology, noting the final Plan (as finalized towards the end of the mine life) is subject to a provincial Environmental Assessment prior to approval and implementation. It is understood that under Recognized Closed Mine status the water quality threshold for discharge to water frequented by fish is the Canadian Water Quality Guidelines for Protection of Freshwater Aquatic Life (CWQG-FAL). Water quality in Tailings Management Facility (TMF) toe seepage will be monitored through life of mine. A focused passive treatment strategy will be designed and implemented using passive treatment technology capable of

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	remediating the regulatory water quality exceedances. Passive treatments systems to remediate TMF toe seepage water quality during closure and post-closure are described in IR-31. TMF dam toe collection drains may be converted to Permeable Reactive Barriers or French drains routing to engineered wetlands seepage collections ponds/sumps. Marathon will develop a passive treatment testing (pilot) program to be implemented during operation to assess the effectiveness and performance of the proposed passive treatment methods. The passive treatment testing program will be described in the Rehabilitation and Closure Plan submitted to Newfoundland and Labrador Department of Industry, Energy and Technology. The passive systems would be field piloted during operation such that they can be appropriately scaled up in closure. Marathon will consult with regulators and stakeholders regarding the progress and results of passive treatment pilot testing and the application of passive treatment to closure/post-closure phases.
Appendix:	None

RESPONSE TO IR-45

ID:	**IR-45**
Expert Department or Group:	ECCC-20
Guideline Reference:	Section 7.1
EIS Reference:	Baseline Study Appendix 3: Water Resources (BSA.3)
Context and Rationale:	The EIS Guidelines state that the EIS will present information in sufficient detail to enable the identification of how the project could affect the VCs and the analysis of those effects. In addition to the extensive water quality dataset available from other sources, the proponent has added 1 water quality sampling location for each of the 3 ultimate receiving environments; (VICRV – Victoria River, VIC01 – Victoria Lake, VAL01 – Valentine Lake). Data from these 3 locations was available for a 4 month period in 2019 only. Given the importance of these 3 ultimate receiving environments during all phases of the project, Environment and Climate Change Canada is of the view that the data collected at these locations is not adequate to characterize the background water quality conditions (including seasonal variations) in these areas. Additional water quality datasets should be used to characterize the background water quality conditions in these areas. This information is needed to determine significance of effects on fish and fish habitat.
Information Request:	Use other water quality datasets (in addition to those from the 1 water quality sampling location for each of the 3 ultimate receiving environments) to characterize the background water quality conditions (including seasonal variations) in these areas.
Response:	The regional water quality summary provided in Section 7.2.2.4 of the Surface Water Resources valued component in the EIS included a review of other potential water quality data sets within the Regional Assessment Area. Aside from the local water quality sampling conducted by Marathon, no additional current information was available for Valentine Lake, Victoria Lake Reservoir and Victoria River. Three dated reports include water quality information on Victoria Lake (prior to reservoir development) (Pippy 1966), in Victoria River (Porter et al. 1974) and in Red Indian Lake (Porter et al. 1974). However, the number of parameters collected are limited and the data available is not sufficient to adequately characterize the existing conditions or seasonal variations in water quality. Marathon would be pleased to consider additional water quality data available for Victoria Lake Reservoir, Valentine Lake or the Victoria River that government reviewers may be aware of.

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	Water quality sampling will continue to be conducted on Victoria Lake Reservoir, Valentine Lake and Victoria River in the spring, summer and fall of 2021 to continue to document baseline conditions in the ultimate receivers. The results of the additional water quality sampling would be made available to Environment and Climate Change Canada through the environmental effects monitoring program under the *Metal and Diamond Mining Effluent Regulations*. References: Pippy, J.H.C. 1966. A Biological and Ecological Study of the Salmonidae of Victoria Lake. Environment Canada Fisheries Service. Resource Development Branch, Department of Fisheries of Canada, St. John's, Newfoundland. Progress Report No. 38. Porter, T.R., L.G. Riche and G.R. Traverse. 1974. Catalog of Rivers in Insular Newfoundland. Environment Canada Fisheries and Marine Science. Data Record Series Number NEW/D-74-9.
Appendix:	None

RESPONSE TO IR-46

ID:	**IR-46**
Expert Department or Group:	ECCC-21
Guideline Reference:	Section 7.1
EIS Reference:	Baseline Study Appendix 3: Water Resources (BSA.3) Attachment 3C
Context and Rationale:	The EIS Guidelines state that the EIS will present information in sufficient detail to enable the identification of how the project could affect the VCs and the analysis of those effects. The proponent has stated that the Study Area for the 2019 field study includes the watersheds potentially affected by development of the Leprechaun, Sprite, Marathon, and Victory Deposits. The following ponds and streams within the Study Area were sampled as part of the 2019 surveys: -Lakes - Victoria Lake and Valentine Lake-Ponds – VALP2, VICP2, VALP3, L1, M7, M2, V1-Streams – Outlet of VALP2, Outlet of VICP2, Outlet of VALP3, C001, Outlet of M1, Outlet of M2, inlet and outlet of V1The EIS does not include a characterization of sediments in the Victoria River. This information is needed to determine significance of effects on fish and fish habitat.
Information Request:	Provide rationale for why the sediment of the Victoria River, which has been identified as one of the 3 ultimate receiving environments, has not been characterized in the baseline study or provide information on the characterization of the Victoria River. Update the effects assessment of fish and fish habitat as applicable.
Response:	Sediment samples were collected from a number of representative stream locations within the Project Area to establish baseline conditions. As indicated in IR-41, even when estimated for the worst-case (operation) scenario, sediment quality in the ultimate receivers will remain the same or potentially improve from baseline conditions for all parameters. The results of the sediment prediction assessment provided in IR-41 indicate that the Project will not have adverse effects on fish, fish habitat or benthos as a result of changes in sediment quality or quantity. As required under *Metal and Diamond Mining Effluent Regulations* (MDMER), further sediment samples will be collected in depositional sedimentation exposure areas in effluent mixing zones and in reference areas to support environmental effects monitoring (EEM) for benthic invertebrate communities. The Victoria River is not anticipated to be a depositional sedimentation exposure area or reference area used for EEM.
Appendix:	None

RESPONSE TO IR-47

ID:	**IR-47**
Expert Department or Group:	ECCC-22
Guideline Reference:	7.3.1
EIS Reference:	Chapter 7, Surface Water Resources 7.5.2.4 Water Quantity and Water Quality Modelling Reports (7A and 7B)
Context and Rationale:	The EIS Guidelines require information on the effects of changes to the aquatic environment on fish and their habitat. The EIS describes in the following text that water quality is irreversible in some watercourses. The Summary of Residual Effects on Change in Surface Water Quality in Chapter 7 states that "Effects will be continuous and both short term (large storms, one-off events) and long term (seepage from waste rock piles and TMF) in duration. Effects on water quality for most of the watercourses / waterbodies assessed are considered reversible as conditions will return to baseline conditions once Project discharges cease. Irreversible effects may occur as a result of seepage from mine infrastructure (TMF and waste rock piles)". It is for this reason presumably that effects are labelled as both "I/R" (irreversible/reversible) in Table 7.50: Project Residual Effects on Surface Water. In the Water Quantity and Water Quality Modelling Reports (7A and 7B), there are a number of locations where the modelled parameters decline during closure and stabilize in post-closure above CWQG-FAL (presumably irreversible). These are represented graphically in Appendix E. It is unclear which watercourses have reversible/irreversible residual effects. This information is needed to determine significance of effects on fish and fish habitat.
Information Request:	Provide clarification for which watercourses are predicted to have irreversible effects and describe any planned mitigation and monitoring for each.
Response:	Post-closure, water quality exceedances of the Canadian Water Quality Guidelines for Protection of Freshwater Aquatic Life (CWQG-FAL) and baseline conditions were predicted as a result of toe seepage from the tailings management facility, waste rock piles, and Leprechaun pit mine infrastructure. Water quality exceedances were predicted to occur at Stream 1, 2, 3, 6, 7, 8, 9, 10 of the Marathon complex and Stream 16, 16, 17, 26 of the Leprechaun complex (Appendix 7C in the EIS). The assessment of these effects on water quality has been made without mitigation and is therefore considered to be conservative. During rehabilitation and closure, a focused passive treatment strategy will be implemented to remediate toe seepage water quality from the mine site

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	infrastructure and to meet CWQG-FAL in watercourses with water quality exceedances. Watercourses will continue to be monitored post-closure, and it is expected that the passive treatment system will maintain water quality in the listed watercourses within CWQG-FAL guidelines over the long term. Please refer to response to IR-31 for further discussion regarding passive water treatment alternatives during closure/post-closure. A passive treatment assessment program will be developed by Marathon as part of its Rehabilitation and Closure Plan to be submitted to the Newfoundland and Labrador Department of Industry, Energy and Technology.
Appendix:	None

RESPONSE TO IR-48

ID:	**IR-48**
Expert Department or Group:	ECCC-23
Guideline Reference:	7.3.1
EIS Reference:	Appendix 2A, WATER MANAGEMENT PLAN(Stantec)
Context and Rationale:	The EIS Guidelines require information on the effects of changes to the aquatic environment on fish and their habitat.The EIS describes the following seepage scenarios associated with the tailings management facility: seepage through the dam will be low relative to average daily discharge rates at the final discharge points (FDP); some groundwater is predicted to seep from the TMF and travel to the Victoria River and tributaries; and some seepage through and under the dams at the Tailings Management Facility can be anticipated. It is expected that the majority of the seepage from the dams can be collected in ditches and conveyed to small sumps and, if necessary, pumped back into the tailings management facility. The remainder would be lost to the groundwater flow regime.It is unclear if the seepage scenarios described above are accounted for in the water quality model.This information is needed to determine significance of effects on fish and fish habitat.
Information Request:	Provide information on all seepage scenarios that were included in the water quality model or a rationale for excluding some scenarios that have not been included in the model. Update the effects assessment on fish and fish habitat as appropriate.
Response:	Groundwater seepage from the TMF to perimeter ditches was included in the water quality model that was used to predict the water quality at the FDP. The FDP for the TMF discharges to Victoria Lake Reservoir. Groundwater seepage that bypasses the TMF seepage collection ditches discharges to Victoria River and was simulated using the groundwater flow model outside of the water quality model, as it does not relate to an FDP. An assessment of the effects of this seepage on the water quality in Victoria River is included in the Groundwater VC (Section 6.5.2 of the EIS).
Appendix	None

RESPONSE TO IR-49

ID:	**IR-49**
Expert Department or Group:	ECCC-07
Guideline Reference:	Section 2.2.
EIS Reference:	EIS Chapter 2 – Project Description. Section 2.11 - Alternative Means of Carrying out the Project
Context and Rationale:	The EIS Guidelines require that the proponent will identify and consider the environmental effects of alternative means of carrying out the project that are technically and economically feasible. This includes energy sources to power the project site. The EIS does not include alternative lighting design and/or measures, which are a potential mitigation measure to reduce potential impacts of light attraction on migratory birds and species at risk. Alternative lighting designs should be assessed in the Alternative Means of Carrying Out the Project (Section 2.11 in the EIS) as an alternative lighting source. This information is needed to identify the potential environmental effects of the alternative means under consideration for lighting design.
Information Request:	Provide and assessment for alternative lighting design and/or measures in the “Alternative Means of Carrying out the Project” Section 2.11.
Response:	The following information provides an assessment of lighting alternatives. In addition, Chapter 5 of the EIS provides a comprehensive assessment of environmental effects of the Project on the Atmospheric Environment, including lighting. Most of the mine site preparation and construction activities will occur during daytime hours; however, there is potential for such activities to occur during night conditions depending on the construction schedule and the time of year (e.g., during the fall and winter when days are shorter). During this time, it is likely that portable lighting units would be used to meet visibility and worker safety needs. The exact number of mobile lighting units required and their locations are currently unknown, as the development of the Project execution plan is ongoing. However, such equipment could be used throughout the Project Area, surrounding the proposed locations of construction and installation activities. When nighttime construction is necessary and mobile lighting units are required for the activity, it would be minimal and mitigated using directional lighting. The locations, types and number of permanent lighting structures are also currently unknown. Permanent lighting structures will use directed lighting (when and where required), and will likely include a combination of street, flood, and wall pack lighting. These will be installed along key site roads within the Project Area and surrounding vehicle parking lots and site

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	buildings (e.g., accommodations camp, processing facilities, mine services area). The intensity and color of light used, whether lights are shielded or steady burning (versus flashing), and weather conditions (e.g., low cloud ceiling, fog, rain) influence the attractiveness of light for birds. Various lighting design considerations can reduce light effects on avifauna including: • Flashing versus steady-burning lights • Directional lighting (e.g., down lighting and shielded lighting) • Light wavelengths • Light intensity • Motion sensors and programmable lighting Selection of site lighting will occur through detailed Project design. As indicated in Chapter 5, Project lighting plans will be developed using the recommended minimum lighting levels provided by the Illuminating Engineering Society (IES) of North America's IES Lighting Handbook for outdoor worksite lighting, and in consideration of guidelines established by the Commission Internationale de L'Éclairage (CIE). Table IR-49.1 summarizes the alternatives related to Project lighting. All identified lighting options are considered feasible for the Project and will be considered in development of the final Project lighting plan during detailed design. <u>Additional Information:</u> Mitigation specific to reducing Project light emissions is presented in Chapter 5 (Atmospheric Environment) of the EIS and Table 10.18 in Chapter 10 (Avifauna). Generic mitigation measures and best management practices to reduce Project-related effects are provided in Chapter 2, Section 2.11. These are presented below. • The amount of on-site lighting will be reduced such that only the amount of lighting required for safe conduct of construction and operation activities will be installed, and exterior lights will be shielded from above (where the need is identified). • Mobile and permanent lighting will be located such that unavoidable light spill off the working area is not directed toward receptors outside of the Project Area, to the extent practicable. • Lighting will be designed to avoid excessive use of mobile flood lighting units and will be turned off when these are not required. • Full cut-off luminaires will be used wherever practicable to reduce glare, light trespass and sky glow from Project lighting.

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	In addition to those listed in the EIS, the following mitigation measures will be implemented, as required: • To the extent feasible without affecting safe mine operations, exterior lighting will be reduced and/or have limited time of operation during sensitive wildlife periods (e.g., migration). • Permanent lighting at the tailings management facility (TMF) and polishing pond will be minimal, as it is only needed for specific infrastructure (e.g., decant pump, water treatment plant), reducing the attractiveness of these water features to avifauna. With the proposed mitigation and proper light design that incorporates guidance from IES and CIE, the levels of light emissions (light trespass and glare) will be maintained at levels representative of rural areas beyond the Project Area. A Wildlife Response Plan (WRP) will be developed and implemented as part of the Project's Environmental Protection Plan (EPP). The WRP will be developed through liaison with Environment and Climate Change Canada – Canadian Wildlife Service (ECCC-CWS) and in accordance with guidelines for effective wildlife response plans, and will include protocols for scenarios, such as should frequent bird interactions occur at the site or a migratory bird be found stranded at site. The Project will have full-time On-Site Environmental Monitors (OSEMs) who will inspect worksites and activities for conformance with the EPP. The OSEMs will be notified if birds are found injured or dead at the site and will inform regulators (e.g., ECCC-CWS), if applicable.
Appendix:	None

Table IR-49.1 Summary of Project Alternatives Analysis – Project Lighting Considerations

Determining Factors	Options Considered				
	Flashing Lights	Down Lighting / Shielded Lighting	Light Wavelength	Light Intensity	Motion Sensors & Programmable Lighting
Technically Feasible (including regulatory factors)	Yes	Yes	Yes	Yes	Yes
Economically Feasible (including market factors)	Yes	Yes	Yes	Yes	Yes
Environmental Considerations	Flashing lights (e.g., strobe lights, incandescent flashing lights) attract fewer birds compared to steady-burning lights.	Targets light beams to point downward to avoid spill beyond where needed (e.g., full cut-off lights).	White and red-colored lights appear to have higher rates of attraction compared to blue or green (although there is conflicting evidence). Limit shorter wavelength blue-violet light.	Bird attraction is generally correlated with light intensity. Light intensity should be no brighter than necessary.	Can reduce or extinguish non-essential lighting. Ensures lights are available only when needed.
Socio-economic Considerations	-	-	-	-	-
Implications of Failure / Malfunctions of Option	-	-	-	-	-
Options for inclusion in the Project Site Lighting Plan	✓	✓	✓	✓	✓

Table IR-49.1 Summary of Project Alternatives Analysis – Project Lighting Considerations

Determining Factors	Options Considered				
	Flashing Lights	Down Lighting / Shielded Lighting	Light Wavelength	Light Intensity	Motion Sensors & Programmable Lighting

"-" means not applicable.

Sources:

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RESPONSE TO IR-50

ID:	**IR-50**
Expert Department or Group:	ECCC-08-CWS- 02
Guideline Reference:	Section 7.1.7
EIS Reference:	Section 10.2 – Existing Conditions for Avifauna
Context and Rationale:	The EIS Guidelines require information on birds and their habitats that are found or are likely to be found in the study area. This description may be based on existing sources, but supporting evidence is required to demonstrate that the data used are representative of the avifauna and habitats found in the study area. The existing data must be supplemented by surveys designed using Environment and Climate Change Canada guidance. The EIS does not show the distribution of most avifauna field survey locations in relation to current habitats in the project assessment area and proposed project infrastructure, nor are detailed results of bird surveys provided. No bird surveys have been conducted along the access road despite access road upgrades being proposed for the Project. The EIS proposes such surveys as part of the project follow-up program. This information is needed to understand baseline conditions, review the effects analysis and subsequently determine significance of effects on migratory birds.
Information Request:	a. Provide a detailed description of all avifauna surveys (including proposed surveys along the access road) that have been conducted for the Project to date, including maps showing each survey location (e.g. each point count location) in relation to proposed infrastructure and current habitat types. b. Provide tables presenting detailed survey results (i.e., data for each point count survey location for each survey date). Data should include date and time of survey, species, number of individuals, sex and age (adult, juvenile) if known, and breeding evidence (possible, probable or confirmed). Weather conditions (e.g., wind, precipitation) that may have influenced survey results should be identified.
Response:	The results and descriptions of all avifauna surveys conducted to date are included in Baseline Study Appendix 7: Avifauna, Other Wildlife and Their Habitats (BSA 7). Four avifauna field programs were conducted between 2014 and 2019: forest songbird surveys were conducted in 2014 and 2019, and waterfowl surveys were conducted in 2014 and 2017. The objectives, study area, methods and results of these surveys are summarized in Tables IR-50.1 and IR-50.2 (adapted from Table 2.1 in BSA 7) in Appendix IR-50.A. Maps showing the survey locations in relation to Project

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	infrastructure as shown in the EIS are attached in Appendix IR-50.B. Tables IR-50.3 to IR-50.7 (Appendix IR-50.A) indicate where the mapping and detailed survey results are located for each survey. Marathon has consulted with Environment and Climate Change Canada (ECCC)-Canadian Wildlife Services (CWS) and has committed to conducting an environmental effects monitoring (EEM) program for species at risk (SAR). A proposed monitoring plan will be developed and submitted to ECCC-CWS for review and feedback prior to initiation of the program. The objective of the EEM program will be to gain a better understanding of the effects of the Project on avifauna SAR (including olive-sided flycatcher) and their habitat, and identify opportunities to refine mitigation measures as appropriate. Components of the EEM will include the identification of habitat that supports SAR, the identification of SAR through targeted surveys in and around the Project Area, and monitoring of SAR occurrences in relation to Project disturbance. Monitoring for olive-sided flycatchers will focus on the wetland associated with the proposed Marathon waste rock pile, where several olive-sided flycatchers were observed during baseline surveys. Point count surveys will be conducted in suitable wetland habitat at varying distances from Project activities, as well as at a control site, to assess effects of the Project on olive-sided flycatcher. Pre-construction surveys required as part of the proposed EEM program will be conducted in 2021.
Appendix:	Appendix IR-50.A; Appendix IR-50.B

RESPONSE TO IR-51

ID:	**IR-51**
Expert Department or Group:	-
Guideline Reference:	Section 7.1.7
EIS Reference:	Section 10.2.1.1 - Table10.1 – Avifauna Field Surveys Conducted During Baseline Field ProgramsBSA.7, Attachment 7-H Section 3.4
Context and Rationale:	The EIS Guidelines require information on birds and their habitats that are found or are likely to be found in the study area. This description may be based on existing sources, but supporting evidence is required to demonstrate that the data used are representative of the avifauna and habitats found in the study area. The existing data must be supplemented by surveys designed using Environment and Climate Change Canada guidance. Table 10.1 in the EIS and the associated Baseline Study [Appendix 7 Attachment 7- H (Forest Songbird Survey (2019), Section 3.4] indicate that only one crepuscular bird survey was completed on June 28, 2019. The moon illumination for this day was 21.3% and the moonrise was at 2:24am. The optimal time for the survey would be a minimum of 50% illumination and would be after the moon has risen. Given the Common Nighthawk was observed in 2011, a negative observation in 2019 is uncertain given how the surveys were completed. This information is needed for baseline data for the effects analysis on migratory birds and Species at Risk.
Information Request:	a. Provide a rationale for deviating from the standard crepuscular protocol of 2-3 point counts within at least 50% moon illumination and after moonrise. b. Given there was a Common Nighthawk observed incidentally in 2011, provide the rationale for confidence in a negative observation in 2019. Given the uncertainty of presence in the Project Area, provide an assessment of potential effects on Common Nighthawk.
Response:	a. The crepuscular sampling program was developed in consideration of Project logistics (i.e., the Project is located in a remote location, with constraints associated with accessibility and on-site camp accommodations). Although surveys were conducted over a period of two nights, they were conducted at eight different locations within the Local Assessment Area (LAA). At each location, the Environment and Climate Change Canada Canadian Nightjar Survey Protocol (Knight et al. 2019) for data collection were followed. Note that the above Protocol requires surveys to be conducted within one week of a full moon where there is potential for whip-poor-wills or poor-wills in the survey area;

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	otherwise, the survey can be conducted between June 15 and July 15. Newfoundland does not have populations of whip-poor-wills or poor-wills. b. Common nighthawk (*Chordeiles minor*) is considered an uncommon visitor on the Island of Newfoundland (Government of Newfoundland and Labrador 2020). In addition, suitable habitat for common nighthawk is relatively limited within the Project Area. It is possible that common nighthawk may occur in the Project Area (as evidenced by the incidental observation in 2011), but it is expected to be unlikely. The assessment of environmental effects on avifauna, including on the common nighthawk, is discussed in Section 10.5 of the EIS. These effects include habitat loss, sensory disturbance, and increased risk in mortality through project interactions. Since common nighthawk prefers open areas with bare ground for nesting, the Project may increase habitat availability during the breeding season. As discussed in Section 10.5.2.1, the highest risk for mortality occurs during nesting, when clearing activities (vegetation removal) could result in the direct mortality of eggs or flightless young birds. Common nighthawks lay their eggs directly on the ground on dry, bare areas. Preferred nesting habitat includes burns, rock outcrops, clear-cuts, and dry bogs (Committee on the Status of Endangered Wildlife in Canada 2018). Within the LAA, the majority of suitable nesting habitat is anthropogenic (e.g., cleared areas). As discussed in section 10.4, nest searches will be completed prior to any clearing or construction activities during the breeding bird season. Bare areas that could provide habitat for nighthawks will be included in these nest searches. The discovery of nests by staff will be reported to the Marathon environmental manager at site and appropriate action or follow-up will be guided by the Avifauna Management Plan. With the implementation of this mitigation and considering that common nighthawks are not expected to occur in the LAA, the residual effects of the Project on common nighthawk are expected to be low in magnitude, restricted to the LAA, and reversible. Residual effects for common nighthawk are as presented for avifauna in Table 10.20 of the EIS. References: Committee on the Status of Endangered Wildlife in Canada. 2018. COSEWIC assessment and status report on the Common Nighthawk (*Chordeiles minor*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi + 50 pp.

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	Government of Newfoundland and Labrador. 2020. Newfoundland and Labrador Species at Risk Fact Sheets. Available online at: https://www.gov.nl.ca/ffa/wildlife/endangeredspecies/birds/ Knight, E., Hannah, K., Brigham, B., McCracken, J., Falardeau, G., Julien, M.-F., and Guenette, J.-S. 2019. Canadian Nightjar Survey Protocol. Available at: http://wildresearch.ca/wp-content/uploads/2019/05/National-Nightjar-Survey-Protocol-WildResearch-2019.pdf
Appendix:	None

RESPONSE TO IR-52

ID:	IR-52
Expert Department or Group:	-
Guideline Reference:	Section 7.1.7
EIS Reference:	Section 10.2.3.1 Forest Breeding Bird Survey Results: Passerines, Raptors and SAR
Context and Rationale:	The EIS Guidelines require information on birds and their habitats that are found or are likely to be found in the study area. This description may be based on existing sources, but supporting evidence is required to demonstrate that the data used are representative of the avifauna and habitats found in the study area. The existing data must be supplemented by surveys designed using Environment and Climate Change Canada guidance. Forest breeding songbird surveys were conducted in June 2011 (one survey) and June 2019 (one survey) within the Project Area and Local Assessment Area to determine species biodiversity, distribution and relative abundance of avifauna (including Species at Risk). The standard point count methodology of 2-3 point counts 10 days apart in the same location was not used. In the Baseline Study Appendix 7 Attachment 7-H (Forest Songbird Survey (2019)), the 2011 and 2019 point count do not cover the Project Area but focus on the infrastructure area only. This information is needed to provide confidence that the conducted surveys accurately represents baseline conditions. Adequate spatial coverage of bird survey points is needed to determine significance of effects on migratory birds.
Information Request:	a. Provide a rationale for deviating from the standard point count methodology of 2-3 point counts 10 days apart in the same location. The two surveys were completed eight years apart and were not completed at the same location as infrastructure changed between 2011 and 2019. b. Provide rationale for how the method used will provide a full account of the species diversity. Spatially, the surveys were clustered around the proposed infrastructure area and not throughout the Project Area.
Response:	a. The baseline field program for avifauna was developed in consideration of EIS requirements and logistical factors (i.e., the Project is located in a remote location, with limited road access throughout much of the site and limited on-site accommodations). The sample locations were different in 2019 than in 2011 because the locations of proposed Project infrastructure had changed. The 2019 field sampling plan was created by overlaying the current Project footprint with previously

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	surveyed areas to identify spatial gaps in surveyed areas as a focus for the survey. The primary purpose of the breeding bird surveys was to identify species and/or important habitat types that could be directly affected by the Project. For this reason, bird surveys focused on areas where habitat would be cleared for Project infrastructure. Survey locations were clustered within the Project Area due to logistical and access considerations and the limited time window (approximately sun rise to 10 am) in which breeding surveys need to be conducted. b. To provide a full account of species diversity, the locations of survey stations were chosen to be representative of all major habitat types in the area. Ecological Land Classification habitat mapping was used to identify the types of habitat present in the study area and select the survey stations. Survey stations were established 100 m from edges of other habitat types, where possible. The surveys were conducted using methodology presented in Bibby et al. 2000. Although sampling did not occur in all portions of the Project Area, or in the surrounding landscape, it is a standard approach (Bibby et al. 2000) to use the habitat type data to infer which species may occur in similar habitats where surveys did not occur. In addition to the field surveys, existing baseline information was compiled to determine avifaunal species diversity including the Atlantic Canada Conservation Data Centre observation data on species at risk / species of conversation concern in Atlantic Canada, North American Breeding Bird Survey and Christmas Bird Count data. The use of data obtained from field surveys and publicly available information assisted in documenting avifaunal species diversity in the general area. References: Bibby, C.J., N.D. Burgess, D.A. Hill, and S. Mustoe. 2000. Bird Census Techniques, Second Edition. Academic Press.
Appendix:	None

RESPONSE TO IR-53

ID:	**IR-53**
Expert Department or Group:	ECCC-09-CWS- 03MFN-42 Pub-06.04Pub-07.09 (Dal)
Guideline Reference:	Section 7.4 and 9
EIS Reference:	Section 10.2 – Existing Conditions for Avifauna Section 10.3- Assessment Criteria and Methods Section 10.4-Mitigation and Management Measures Section 10.5- Assessment of Environmental Effects on Avifauna
Context and Rationale:	The EIS Guidelines require the EIS to identify and describe mitigation measures to avoid, or lessen potential adverse effects on species and/or critical habitat listed under the *Species at Risk Act*. These measures will be consistent with any applicable recovery strategy and action plans. Olive-sided Flycatchers were observed in the Project Area during 2011 and 2019 breeding bird surveys. In 2019, 6 individuals were associated with the wetland complex in the area of the Northern Waste Rock Pile. The wetlands that cannot be avoided and for those where direct and indirect effects cannot be entirely minimized, conservation allowances for affected wetland habitat for landbird species at risk (SAR) would be an important element to consider to satisfy the requirement to minimize effects to wetland-associated landbird SAR in the Project Area as per S. 79 of the *Species at Risk Act*. Habitat alterations related to mine construction and operation may result in the creation of habitat for migratory bird SAR (for example, Bank Swallows). Landbird SAR may nest in the Project Area, including on project infrastructure. ECCC recommends the implementation of a migratory bird monitoring program throughout the lifespan of the Project to observe migratory bird SAR use of the Project Area. The EIS Guidelines indicate that the goal of a monitoring program is to ensure that proper measures and controls are in place in order to decrease the potential for environmental degradation during all phases of project development. Management practices and mitigation measures to reduce the potential for migratory birds and species at risk to nest in the Project Area have not been proposed in the EIS. Additional information on these mitigation measures, including the process to follow in the event that a migratory bird including a SAR is found to be nesting in the Project Area, is required. This information is needed for a complete assessment of effects on species at risk and determination of significance.
Information Request:	1. a. Clarify why avoidance is not possible in instances where habitat for landbird SAR is encountered.

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	b. Confirm and describe whether and how conservation allowances can be implemented in cases where loss of wetland habitat for land bird SAR is unavoidable. 2. a. Provide information on migratory bird monitoring programs planned for the lifespan of the Project to observe migratory bird SAR use of the Project Area. b. Provide management practices and mitigation measures that will be implemented to reduce the potential for migratory birds including SAR from nesting in areas with ongoing construction activities and project infrastructure (e.g., tailing area, buildings and storage facilities, construction vehicles, equipment, stockpiles, excavations). c. Provide additional information on the measures to be implemented to ensure no significant effects in the event that a migratory bird including SAR is found nesting in modified habitats, active construction area or on project infrastructure.
Response:	1. a. Wetlands were avoided wherever possible, however, given the prevalence of wetlands in this region and engineering constraints, some wetland habitat loss is unavoidable. Olive-sided flycatcher (*Contopus cooperi*), a species at risk (SAR), occurs in forested wetlands, and several individuals were observed in the wetland complex within the proposed footprint of the Marathon waste rock pile (Figure 10-8 of the EIS). Although the wetland habitat within the footprint of the Marathon waste rock pile will be directly lost, similar habitat for olive-sided flycatchers exists within the larger wetland complex located north of the Marathon waste rock pile, most of which will not be directly affected by the Project. Some of the wetland outside of the waste rock pile footprint will be indirectly affected through sensory disturbance or though hydrological changes. However, because bogs typically have low water flow (receiving nearly all their water through precipitation), drawdown effects will be limited in bog portions of the wetland (National Wetlands Working Group 1997). Because of its large size and distance from Project activities, most of this larger wetland complex is not expected to be directly or indirectly affected by the Project. b. The Newfoundland and Labrador Policy for Development in Wetlands (NLDECCM 2001) recognizes the relatively widespread extent of wetlands within the province and focuses on maintaining hydrologic functions and minimizing environmental impacts. Therefore, wetland

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	compensation and conservation allowances are not part of the response to potential wetland impacts in the Province. Wetland habitat suitable for olive-sided flycatchers is abundant throughout the Local Assessment Area and Ecological Land Classification Area. As discussed in Section 10.5.1, only 4.3% of moderate or high-quality habitat for olive-sided flycatchers in the Ecological Land Classification Area is anticipated to be lost. 2. a. An avifauna monitoring program will be implemented and conducted throughout the lifespan of the Project. Monitoring components for the life of mine will be outlined in the Avifauna Management Plan and will be developed through liaison with regulators. These may include breeding bird surveys conducted at varying distances from the mine infrastructure to determine the accuracy of effects predictions on avifauna, follow-up surveys for SAR that were identified in the Project Area, and regular inspection of facilities, infrastructure and equipment to determine if birds are nesting on or near anthropogenic structures. In addition, Marathon has consulted with Environment and Climate Change Canada (ECCC)-Canadian Wildlife Services (CWS) and has committed to conducting an environmental effects monitoring (EEM) program for SAR. A proposed monitoring plan will be developed and submitted to ECCC-CWS for review and feedback prior to initiation of the program. The objective of the EEM program will be to gain a better understanding of the effects of the Project on avifauna SAR (including olive-sided flycatcher) and their habitat, and identify opportunities to refine mitigation measures as appropriate. Components of the EEM will include the identification of habitat that supports SAR, the identification of SAR through targeted surveys in and around the Project Area, and monitoring of SAR occurrences in relation to Project disturbance. Monitoring for olive-sided flycatchers will focus on the wetland associated with the proposed Marathon waste rock pile, where several olive-sided flycatchers were observed during baseline surveys. Point count surveys will be conducted in suitable wetland habitat at varying distances from Project activities, as well as at a control site, to assess the effects of the Project on olive-sided flycatcher. Pre-construction surveys required as part of the proposed EEM program will be conducted in 2021. b. The mitigation measures for avifauna identified in Table 10.18 of the EIS will serve to reduce Project effects on both SAR and non-SAR species. With specific reference to reducing the potential for migratory

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	birds (including SAR) to nest in Project infrastructure or areas with ongoing construction activities, during regular inspection of facilities, infrastructure and equipment, employees and contractors will be instructed to report avifauna use (and in particular, nesting activity) to on-site environmental staff. These inspections will inform the need for, and help support the development of, onsite bird control features to deter nesting on, in or near mine infrastructure. To reduce the likelihood of birds nesting in or on buildings and being adversely affected by mine site activities, design features will be used where practicable to make buildings less attractive or accessible to nesting birds (e.g., minimizing ledges and sheltered areas, avoiding or sealing potential entry points/openings, installing automatic hydraulic door closers). It is also anticipated that most birds will generally avoid active areas during construction and operation, given the noise and activity levels generated by Project activities. Bank swallows are known to construct nesting burrows in soil stockpiles that have steep faces and light soils amenable to burrowing. Soil stockpiles will be constructed and maintained in lifts to achieve flatter slopes and to permit terracing, thereby reducing erosion and maintaining moisture within the topsoil. This structure and composition will make the stockpiles less attractive to these birds. Land clearing during the breeding bird season presents one of the largest threats for birds, as active nests (including eggs or young birds) could be destroyed. To mitigate this risk, clearing and grubbing during the breeding bird season will be avoided to the extent practicable. If avoidance of the breeding bird season is not possible, nest searches will be performed prior to any clearing or construction activities (Section 10.4 of the EIS). If active nests are found, appropriate buffers/setback distances from nests will be established and remain in place until fledging has occurred. Suggested setbacks are as follows: • 30 m for passerine nests • 100 m for waterfowl/waterbird nests • Restricted activities within 200 m of active raptor nests • Restricted clearing within 800 m of active raptor nest If problematic avifauna use of the Tailings Management Facility (TMF) is observed, adaptative management measures will be implemented. These measures may include use of deterrents or exclusionary measures. IR-54 contains a full description of deterrents and mitigation strategies at the TMF. Other mitigation includes maintaining TMF and sedimentation pond embankments free of vegetation, which will limit

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	the attraction of waterfowl and/or wildlife to these ponds for foraging or breeding. c. Employees and contractors will be instructed to report any active nests discovered in the Project Area to on-site environmental staff, and appropriate action or follow-up will adhere to the Avifauna Management Plan. If active nests are found, appropriate buffers/setback distances from nests (please refer to part 2b) will be established and remain in place until fledging has occurred. If a nest is found during soil stockpile development, this area (plus buffer) of the stockpile will be avoided until fledging has occurred; drawing down of soil stockpiles for progressive and ultimate rehabilitation will occur outside of breeding bird season, to the extent practicable. Other relevant mitigation measures are presented in Section 10.4 of the EIS, and adaptive management will be used to guide mitigation measures throughout the lifespan of the Project. References: National Wetland Working Group. 1997. The Canadian Wetland Classification System. Second Edition. Wetlands Research Centre, University of Waterloo. Waterloo, ON. NLDECCM (Newfoundland and Labrador Department of Environment, Climate Change and Municipalities). 2001. Policy for Development in Wetlands. Issued June 2, 1997, re-issued January 17, 2001.
Appendix:	None

RESPONSE TO IR-54

ID:	**IR-54**
Expert Department or Group:	ECCC-10-CWS- 04MFN-41
Guideline Reference:	Section 7.3.2
EIS Reference:	Section 10.4-Avifauna Mitigation and Management Measures Section 10.5-Assessment of Environmental Effects on Avifauna Section 10.9-Follow-up and Monitoring
Context and Rationale:	The EIS Guidelines require information on the deposit of harmful substances in waters that are frequented by migratory birds. In Section 10.5.2.2 of the EIS, the Proponent states that "A change in mortality risk may result from possible ingestion and/or absorption of water in the tailings and/or polishing ponds, with potential exceedances in POPC as outlined under the Metal and Diamond Mining Effluent Regulations, specifically for total cyanide, unionized ammonia (product of cyanide decomposition) and Copper (added as catalysis during cyanide destruction or leached from the ore). Wildlife, including avifauna, have been reported drinking from ponds associated with tailings management facilities (Eisler and Wiemeyer 2004; Donato et al. 2007) and could also be exposed by ingesting aquatic flora and fauna within the TMF." The proponent proposes to monitor avifauna use of these project features and implement adaptive management measures (e.g., deterrents and/or exclusionary measures) as required. Mitigation measures to mitigate the potential risks to migratory birds using the tailings and/or polishing ponds are not clearly outlined in the EIS. This information is needed for a complete assessment of effects on migratory birds including species at risk (SAR).
Information Request:	Provide any plans or mitigation measures to deter migratory birds including SAR from tailings management facilities and settling ponds, including beneficial management practices and/or the development of an avifauna management and follow-up monitoring plan. Provide adaptive management measures in the event that adverse effects to migratory birds are expected.
Response:	In review of the above context and rationale, it appears the focus of this IR is the tailings management facility (TMF) which would include the polishing pond. Water quality within 'settling ponds', which are designed and located across the site to manage and treat contact water (not process water) are expected to contain sediment and minor dissolved metals and other potential constituents like ammonia at very low concentrations. As a result, avifauna or other wildlife that may contact or ingest this water or adjacent vegetation would not be at an increased mortality risk. Information regarding the TMF is provided below.

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	While exposure to the tailings pond could pose a threat to migratory birds, this risk is reduced through the cyanide detoxification process within the mill. Using the sulphur dioxide / air oxidation process will result in the degradation of cyanide and precipitation of metals, prior to tailings being discharged into the TMF. The International Cyanide Code guideline for Weak Acid Dissociable (WAD) cyanide is 50 mg/L for protection of birds and wildlife. WAD cyanide remaining in the tailings following cyanide detoxification (prior to discharge into the TMF) will be below 1 mg/L (destruction target). Any excess water in the tailings pond that is not reclaimed to the process plant will be treated in the water treatment plant and polishing pond prior to being discharged to the environment, with maximum concentrations in compliance with the new authorized limits as per the *Metal and Diamond Mining Effluent Regulations* (MDMER). As the polishing pond receives effluent post-treatment plant, the water within the polishing pond will not pose a threat to migratory birds. Mitigation measures to deter birds from entering the tailings and polishing ponds are included in Section 10.4. Embankments of the TMF and polishing ponds will be maintained free of vegetation. This will limit the attraction of waterfowl and/or wildlife to these ponds for foraging or breeding. Avifauna use of the ponds will be monitored (primarily targeting waterfowl but also other wildlife species). If problematic avifauna use occurs, additional mitigation measures will be implemented and adapted if required. The Avifauna Management Plan to be developed and implemented for this Project will outline the adaptative management strategies to be employed and thresholds for triggering adaptive measures, which may include deterrents and exclusionary measures. Bird deterrents may include visual deterrents such as scarecrows, falcon effigies, kites or eye-safe lasers, and auditory deterrents such as noise cannons, wailers or other noise makers. Since birds become habituated to deterrents (e.g., Andelt et al 1997; Whisson and Takekawa 2000; Ronconi and Cassady St. Clair 2006), these must be regularly relocated and switched out. If bird use of the TMF or polishing ponds continues after the implementation of these deterrent measures, additional mitigation measures may be required. These may include exclusionary measures, which could include the use of bird deterrent floating balls, which cover the water's surface, thus preventing birds from landing and interacting with the effluent. Another option could involve the installation of bird netting over ponds, which also prevents waterfowl from landing on these (Martin and Hager 1990).

ID:	IR-54
	References: Andelt, W.F., T.P. Woolley and S.N. Hopper. 1997. Effectiveness of barriers, pyrotechnics, flashing lights, and Scarey Man for deterring heron predation on fish. Wildlife Society Bulletin, 25, 686–694 Martin, L.R. and Hagar, S. 1990. Bird control on containment pond sites. Proceedings of the Fourteenth Vertebrate Pest Conference. 60. Available online at: https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1059&context=vpc14 Ronconi, R.A. and C. Cassady St. Clair. 2006. Efficacy of a radar-activated on-demand system for deterring waterfowl from oil sands tailings ponds. Journal of Applied Ecology, 43: 111-119. Whisson, D.A. and J.Y. Takekawa. 2000. Testing the effectiveness of an aquatic hazing device on waterbirds in the San Francisco Bay estuary of California. Waterbirds, 23, 56–63.
Appendix:	None

RESPONSE TO IR-55

ID:	**IR-55**
Expert Department or Group:	-
Guideline Reference:	Section 7.1.7
EIS Reference:	Section 10.2.1.2 Avifauna Habitat Assessment
Context and Rationale:	The EIS Guidelines require information on migratory birds and their habitats that are found or are likely to be found in the study area. This description may be based on existing sources, but supporting evidence is required to demonstrate that the data used are representative of the avifauna and habitats found in the study area. Section 10.2.1.2 of the EIS, states the following: Given the number of avifauna species that occur on the Island of Newfoundland, it is not practical to assess habitat use for each in detail. Therefore, representative species from each of the main groups of birds have been selected and considered further with respect to habitat use within the Project Area. In terms of spatial overlap with the Project Area, habitat use by avifauna during breeding is a key focus. Representative species were selected from the following bird groups: passerines, waterfowl (swimming gamebirds, such as duck and goose species), raptors, upland gamebirds and SAR. It is not clear how Lincoln's Sparrow and Yellow-bellied Flycatcher are representative of all passerine habitats. Also, the potentially and known Species at Risk (SAR) described in the EIS are known to have different habitats. Information for each SAR is required. This information is needed for a complete assessment of effects on SAR.
Information Request:	a. Provide a rationale for how the Lincoln's Sparrow and Yellow-bellied Flycatcher encompass a representation of all passerines. b. Provide information on the habitat of each SAR bird. Update the effects assessment and mitigation measures for bird SAR as applicable.
Response:	a. As noted, since it was not feasible to conduct a habitat assessment for every bird species, a subset of representative species was chosen to represent passerines, waterfowl, raptors, upland gamebirds and species at risk (SAR). Species were chosen that were abundant throughout the Local Assessment Area (LAA), yet have specific habitat needs. For passerines, Lincoln's sparrow (*Melospiza lincolnii*) and yellow-bellied flycatcher (*Empidonax flaviventris*) were chosen for assessment because they meet both these selection criteria. In addition, the habitat requirements differ between these two species. Lincoln's sparrow breeds in boggy, willow or sedge and moss dominated habitats, particularly those with a dense shrub cover. It will use black spruce and American larch dominated stands found along the

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	landward margins of bogs and a variety of other riparian type habitats with a dense low shrub cover. Yellow-bellied flycatchers are a characteristic breeding bird of Canadian boreal conifer forests and peatlands, typically nesting in cool, moist conifer or mixed forests, bogs, swamps and muskegs, and other landscapes that are flat or poorly drained (Cornell Lab 2020). Since the habitat needs for Lincoln's sparrow and yellow-bellied flycatcher differ, each species fills in some of the habitat gaps left by the other. It is recognized that these two species do not represent the habitat needs of all passerines. However, eight other bird species (including two SAR passerines) are assessed that each have unique habitat requirements. The strategy behind picking ten species to assess is that most habitat components in the LAA will be represented by at least one of these representative species. As such, all habitat components are included in the overall habitat assessment. b. Information on the habitat of each SAR bird is presented in Section 10.2.3.4 of the EIS. Seven SAR species have the potential to occur in the vicinity of the Project Area: olive-sided flycatcher (*Contopus cooperi*), common nighthawk (*Chordeiles minor*), rusty blackbird (*Euphagus carolinus*), bank swallow (*Riparia riparia*), grey-cheeked thrush (*Catharus minimus minimus*), evening grosbeak (*Coccothraustes vespertinus*), and red crossbill (*Loxia curvirostra*). Of these, detailed habitat assessments were conducted for olive-sided flycatcher and rusty blackbird (Section 10.2.4.5). Habitat needs for the remaining five SAR species are discussed below. Common nighthawks lay their eggs directly on the ground on dry, bare areas. Preferred nesting habitat includes burns, rock outcrops, barrens clear-cuts, and dry bogs (COSEWIC 2018). Within the LAA, the majority of suitable nesting habitat is anthropogenic (e.g., cleared areas). Bank swallows breed colonially, and a wide variety of sites may be used for constructing nest burrows, including natural and artificial sites with vertical banks such as riverbanks, lake and ocean bluffs, aggregate pits, road cuts and soil stockpiles. The preferred substrate for nest burrows appears to be a sand-silt mixture. Burrows are often situated near open terrestrial habitat such as grasslands, meadows, pastures and croplands, which is used for aerial foraging. Large wetlands may be used as communal nocturnal roost sites during the non-breeding periods. In Newfoundland and Labrador, breeding has been reported in low-lying sand pits, sand banks on shorelines, sand-

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	clay banks and sandy dunes, turf atop sea cliffs, and gravel pits (SSAC 2009). Grey-cheeked thrush breeding grounds include dense low coniferous woods, including young regenerating forest, open-canopy old growth forests having a dense understory, and dense, stunted spruce stands (SSAC 2005). Nests are typically built close to or on the ground, often at the bases of willows or alder shrubs. The lower branches of conifers may also be used for nesting (Audubon n.d a.). Evening grosbeak optimal breeding habitat includes open mature mixedwood forests, where fir or white spruce are dominant and spruce budworm is abundant (COSEWIC 2016). Nests are built on the horizontal branches or in forks of trees, typically 6 to 18m above the ground (Audubon n.d. b) Red crossbill preferred habitat includes conifer habitats, with the highest abundance likely occurring in older, mature forests in western Newfoundland (Government of Newfoundland and Labrador 2020). Nests are typically built on the horizontal branches of conifers, with variable nest height. The timing of nesting is irregular, as they often nest when cone crops are abundant (Audubon n.d. c). The assessment of environmental effects on avifauna is discussed in Section 10.5 of the EIS. The effects assessment covers the effects on SAR, and includes habitat loss, sensory disturbance, and increased risk of mortality through Project interactions. The additional information provided above on the habitat for SAR with the potential to occur in the Project Area augments the discussion of existing conditions in Section 10.2 of EIS, however, the assessment of effects on avifauna SAR found in EIS is still considered complete. A summary of the key assessment findings applicable to avifauna SAR, as presented in the EIS (Section 10.5.1.2), is provided below. As discussed in Section 10.5.2.1 of the EIS, the highest risk for mortality occurs during nesting, when construction activities could result in the direct mortality of eggs or young birds prior to fledging. Clearing and grubbing during the breeding bird season will be avoided to the extent practicable. If avoidance of the breeding bird season is not possible, nest searches will be performed prior to any clearing or construction activities (Section 10.4 of the EIS). Bare areas that could provide habitat for common nighthawks will be included in these nest searches. If active nests are found, appropriate buffers/setback

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	distances from nests will be established and remain in place until fledging has occurred. Suggested setbacks are as follows: • 30 m for passerine nests • 100 m for waterfowl/waterbird nests • Restricted activities within 200 m of active raptor nests • Restricted clearing within 800 m of active raptor nest Bank swallows are known to construct nesting burrows in soil stockpiles that have steep faces and light soils that are amenable to burrowing. Soil stockpiles will be constructed and maintained in lifts to achieve flatter slopes and to permit terracing, thereby reducing erosion and maintaining moisture within the topsoil. This structure and composition will make the stockpiles less attractive to these birds. As indicated in Section 10.5.2 of the EIS, although most Project activities with potential to result in change in mortality risk will occur during the construction phase, activities during operation or decommissioning of the Project may also result in increased adverse encounters with avifauna SAR. Collisions with Project vehicles and infrastructure, interactions with the Tailings management facility and sedimentation ponds, and increased access by predators could affect mortality risk. Use of existing roads and adherence to speed limits will help to reduce risk of mortality for avifauna SAR. There is also potential for a change of mortality risk for avifauna species that nest on or in anthropogenic structures, such as bank swallows. As indicated in Section 10.5.2.2 of the EIS, during the closure phase of the Project, removal of structures could result in direct mortality for some avifauna species if the activity is carried out during the nesting period. Prior to demolishing existing building and infrastructure, surveys for breeding birds and for bats will be conducted as per the Avifauna Management Plan. Where practicable, existing buildings and infrastructure will be demolished outside of the migratory breeding bird season. Cessation of Project activities and removal of security during the closure phase could indirectly result in avifauna mortality through increased access for predators and hunters. In addition to the mitigation related to all avifauna included in Section 10.4 of the EIS, an Avifauna Management Plan will be prepared for this Project, and an adaptative management approach will be used. Refer also to the response to IR-53, for further discussion of planned mitigation and monitoring related to avifauna SAR. With the implementation of this mitigation, and as indicated in Table 10.20 of the EIS, residual effects of the Project on a change in habitat and change in

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	mortality risk for avifauna (including avifauna SAR) are expected to be low to moderate in magnitude, restricted to the LAA, and ranging from short to long term. Marathon has consulted with Environment and Climate Change Canada (ECCC)-Canadian Wildlife Services (CWS) and has committed to conducting an environmental effects monitoring (EEM) program for SAR. Further information is provided in IR-50. References: Audubon. n.d. a Guide to North American Birds: Grey-cheeked thrush. Available online at: https://www.audubon.org/field-guide/bird/gray-cheeked-thrush Audubon. n.d. b. Guide to North American Birds: Evening grosbeak. Available online at: https://www.audubon.org/field-guide/bird/evening-grosbeak Audubon. n.d. c. Guide to North American Birds: Red crossbill. Available online at: https://www.audubon.org/field-guide/bird/red-crossbill Cornell Lab. 2020. The Cornell Lab of Ornithology, Birds of North America. Available online at: www.birdsna.org. COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2016. COSEWIC assessment and status report on the Evening Grosbeak *Coccothraustes vespertinus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi + 64 pp. COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2018. COSEWIC assessment and status report on the Common Nighthawk (*Chordeiles minor*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi + 50 pp. Government of Newfoundland and Labrador. 2020. Newfoundland and Labrador Species at Risk Fact Sheets. Available online at: https://www.gov.nl.ca/ffa/wildlife/endangeredspecies/birds/ SSAC (Species Status Advisory Committee). 2005. The Status of Gray-cheeked Thrush (*Catharus minimus*) in Newfoundland and Labrador. Prepared for the Species Status Advisory Committee by Kate Dalley, Kristin Powell and Darroch Whitaker. Biology Department, Acadia University Wolfville, Nova Scotia. March 18, 2005. Available online at: https://www.gov.nl.ca/ffa/files/wildlife-endangeredspecies-ssac-gray-cheeked-thrush-2005-ssac.pdf

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	SSAC (Species Status Advisory Committee). 2009. The Status of Bank Swallow (*Riparia riparia riparia*) in Newfoundland and Labrador. The Species Status Advisory Committee Report No. 23. October 14, 2009. Available online at: https://www.gov.nl.ca/ffa/files/wildlife-endangeredspecies-ssac-bank-swallow-ssac.pdf
Appendix:	None

RESPONSE TO IR-56

ID:	IR-56
Expert Department or Group:	-
Guideline Reference:	Section 7.2.3
EIS Reference:	Section 10.2.4 Avifauna Habitat Assessment Section 9.2.2.1 Vegetation and Wetland Communities
Context and Rationale:	The EIS Guidelines require information on changes to the habitat of migratory and non-migratory birds, including wetlands frequented by birds (types of cover, ecological unit of the area in terms of quality, quantity, diversity, distribution and functions). Section 10.2.4 of the EIS (Avifauna Habitat Assessment), 12 habitat types were identified within the Project Area and Local Assessment Area (LAA) (Table 10.4). Approximately 75% of the Project Area consists of upland, 20% consists of lowland and 4% is open water. Within the LAA, approximately 69% consists of upland, 14% is lowland and 22% is open water. In the EIS, Section 9.2.2.1 (Vegetation and Wetland Communities), it indicates that the percentage of wetland within the Project Area and LAA is likely over 30%, rather than 22.4%, as indicated by the results of the ecological land classification (ELC). The addition comes from the inclusion of alder thickets (6.5% of the Project Area) and Riparian thickets (0.4% of the Project Area) that are likely wetlands, as well as much of the balsam fir forest and the black spruce forest. It is not clear how the proponent determined the potential changes to wetlands habitat for birds, considering the EIS provides contradictory information. This information is needed for a complete assessment of effects on migratory birds and their habitat.
Information Request:	Update the assessment on migratory birds that utilize wetland habitat to take into account the 30% wetland in the LAA or provide a rationale for why the 20% wetland/lowland habitat number was used for evaluating avifauna habitat when the EIS states that wetlands are likely over 30% (as stated in section 9.2.2.1).
Response:	It is acknowledged that Ecological Land Classification (ELC) habitat categories are grouped differently in Chapter 9 versus Chapter 10. Chapter 9 indicates that the majority of both alder thicket and riparian thicket are likely wetlands, and wetlands are present within black spruce forest and likely other forest types, although typically in localized areas that are difficult to differentiate using remote sensing. Therefore, the percentage of wetland within the Project Area and Local Assessment Area is likely over 30%, rather than 22.4%, as indicated by the results of the ELC.

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	The categorization of habitat types as wetland versus upland does not change the avifauna habitat assessment results. For the habitat assessment, a value ranking was given to each of the 12 ELC categories for each focal species (Section 10.2.4 of the EIS). The values given to each habitat type (including riparian thicket, alder thicket, black spruce forest and balsam fir forest) were assigned based on the habitat description, not on whether the habitat was defined as wetland or upland. As such, reclassifying these habitats as wetlands would have no effect on the bird habitat assessment.
Appendix:	None

RESPONSE TO IR-57

ID:	**IR-57**
Expert Department or Group:	MFN-42
Guideline Reference:	Section 7.1.7
EIS Reference:	Section 10.5.1.2 Residual Effects
Context and Rationale:	The EIS Guidelines require information on birds and their habitats that are found or are likely to be found in the study area. This description may be based on existing sources, but supporting evidence is required to demonstrate that the data used are representative of the avifauna and habitats found in the study area. Section 10.5.1.2 of the EIS (Residual Effects) states that, "avifauna species within the Local Assessment Area (LAA) are generally not limited by habitat within their breeding range, that is, habitats are not at maximum capacity and therefore loss of high and moderate value habitat is likely to cause displacement of avifauna using these areas. Additional habitat of varying quality will be made available as a result of Project rehabilitation activities." The EIS also states in relation to species at risk (SAR) that "[a]avifauna potentially displaced by development of the Project are likely to find breeding habitat elsewhere within the LAA or RAA [regional assessment area]." Displaced birds may try to establish in adjacent areas; however, the proponent did not justify their conclusion with evidence from monitoring studies or scientific literature. The adjacent habitats may be at near maximum occupancy of breeding territories and forage capacity and therefore unable to support displaced birds. This information is needed for a complete assessment of effects on migratory birds and their habitat.
Information Request:	Provide a rationale for the assertion that displaced wildlife are likely to find breeding habitat elsewhere. Include, if available, information sources that indicate that the habitats (wetlands and forested) are not at maximum capacity and displacement of avifauna does not disrupt breeding pairs in adjacent areas.
Response:	Marathon acknowledges that carrying capacity likely varies by habitat type and species; unfortunately, there is no specific data available on the carrying capacity for birds on the Island of Newfoundland. The statement that displaced birds are likely to find habitat elsewhere is relevant for rare species and is based on the presumption that, given their status, rare species are not at their carrying capacity in Newfoundland and Labrador. Many migratory bird species are experiencing population declines that are related to a loss of overwintering habitat. Many migratory species that breed in Newfoundland and Labrador overwinter in areas including the

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	southern United States, Mexico, and Central and South America. Some of these overwintering areas are losing forested habitat at high rates due to forest conversion to cropland, grassland or urban environments, which is contributing to the decline of neotropical migrant populations (Robbins et al. 1989; La Sorte et al. 2017). For example, for the olive-sided flycatcher (*Contopus cooperi*), a species at risk known to occur in the Project Area, the loss of wintering habitat is thought to be the greatest cause of population declines (Committee on the Status of Endangered Wildlife in Canada [COSEWIC] 2018). For rusty blackbird (*Euphagus carolinus*), habitat loss is occurring at higher rates in wintering habitat located in the south eastern US than it is in Canadian breeding habitats (COSEWIC 2017). Many other rare (e.g., grey cheeked thrush [*Catharus minimus minimus]*) and common (e.g., swainson's thrush [*Catharus ustulatus*], black-and-white warbler [*Niotilta varia*]) species found in the vicinity of the Project overwinter in Central and/or South America and are also affected by forest loss in that region. As overwintering habitat is often more of a limiting factor than is breeding habitat (COSEWIC 2017, 2018; Cornell University 2017), it is assumed that many migratory birds are not at carrying capacity in their breeding habitats on the Island of Newfoundland. Based on this assumption, migratory birds should be able to move to other available habitats in the breeding area, if habitat is lost in the Project Area. The ecological land classification data indicates that all habitat types that will be lost in the Project Area also occur in the surrounding area (Ecological Land Classification Area [ELCA]). Additionally, for the eight bird species evaluated, no species is assessed to lose more than 8.5% of high and moderate ranked habitat in the ELCA (Section 10.5.1 of the EIS). This indicates that over 90% of suitable habitat remains in the ELCA for all eight focal species. References: Cornell University. 2017, Greatest threat to Eastern forest birds is habitat loss on wintering grounds. ScienceDaily. Science Daily, 24 July 2017. Available online: www.sciencedaily.com/releases/2017/07/170724155603.htm COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2017. Rusty blackbird (*Euphagus carolinus*): COSEWIC assessment and status report 2017. Available online at: https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/cosewic-assessments-status-reports/rusty-blackbird-2017.html#_02_1

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	COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2018. Olive-sided Flycatcher (*Contopus cooperi*): COSEWIC assessment and status report 2018. Available online at: https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/cosewic-assessments-status-reports/olive-sided-flycatcher-2018.html La Sorte, F. A., Fink, D., Blancher, P. J., Rodewald, A. D., Ruiz-Gutierrez, V., Rosenberg, K. V., Hochachka, W. M., Verburg, P. H. and Kelling, S. 2017. Global change and the distributional dynamics of migratory bird populations wintering in Central America. Global Change Biology, 23, 5284– 5296. Robbins, C.S., Sauer, J.R., Greenberg, R.S. and Droege, S. 1989. Population declines in North American birds that migrate to the Neotropics. Proceedings of the National Academy of Sciences, 86(19), 7658-7662.
Appendix:	None

RESPONSE TO IR-58

ID:	**IR-58**
Expert Department or Group:	Pub-07.06 (Dal) QFN MFN-38
Guideline Reference:	Section 7.1.8
EIS Reference:	Section 12.2.2.3
Context and Rationale:	The EIS Guidelines state that the EIS will present information in sufficient detail to enable the identification of how the project could affect the VCs and the analysis of those effects. Specifically, the EIS Guidelines require an assessment of the potential adverse effects of the project on species at risk listed under the Species at Risk Act (SARA) and, where appropriate, its critical habitat; i.e. direct and indirect effects on the survival or recovery of species listed under the SARA, including the American Marten. The American Marten (Newfoundland population; SARA Schedule 1 Threatened) is a species of cultural importance to Indigenous groups. The EIS acknowledges a “moderate adverse impact” to the American Marten due to habitat loss, sensory disturbances and potential increases in mortality events. However, section 12.5.1.3 of the EIS states that this impact is not significant. The EIS also reports that only a small percentage of suitable American Marten habitat in the Regional Assessment Area (RAA) will be lost from proposed project activities. However, the majority of reported known sightings (from within 5 km of the proposed project) occur in a distinct core occupancy area near to the south shore of Red Indian lake. Additional information is needed regarding American Marten occupancy within the rest of the RAA, and justification for the statement that there is ‘ample habitat elsewhere.’ The mitigation measures proposed for the American Marten do not reference specific monitoring or reporting of American Marten observations or road mortality. Also, mitigation does not refer to the proposed critical habitat for American Marten that can be found in the Project Area that the EIS acknowledges could be affected by the Project. This information is needed for baseline data for the effects analysis on American Marten.
Information Request:	a. Provide rationale for the determination of ‘not significant’ for the acknowledged moderate, adverse, mid- to long-term impacts to American Marten. b. Provide additional information on American Marten occupancy and suitable habitat within the RAA. c. Provide information on the mitigation measures for American Marten for critical habitat in the Project Area. Include specific mitigation and monitoring for observations or road mortalities.

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Response:	a. A significant adverse residual effect on marten is defined in Section 12.3.2 of the EIS as one that, "threatens the long-term persistence, viability, or recovery of a wildlife species population in the Regional Assessment Area (RAA), including effects that are contrary or inconsistent with the goals, objectives or activities of the federal recovery strategy for bats (ECCC 2015), provincial recovery plan for marten (the Newfoundland Marten Recovery Team 2010), or other action plans and management plans." Moderate, adverse and medium to long term effects on marten habitat are predicted, however the assessment of these effects does not predict a threat to the long-term persistence, viability, or recovery of marten and are anticipated to be reversible upon decommissioning of the Project. The proposed critical habitat (habitat identified in the provincial recovery plan, although not yet formally protected) for marten covers 1,719.98 km^2 in the RAA, of which only 6.26 km^2 (0.3%) are in the Project Area, including a portion along the existing access road. In terms of mortality risk, adverse residual effects are anticipated to be of low magnitude. b. Marten on the Island of Newfoundland are a genetically and geographically distinct population of the American marten and are restricted to three core areas in Newfoundland: Main River, Terra Nova National Park and west-central Newfoundland (Newfoundland Marten Recovery Team 2010). The west-central Newfoundland population includes three separate core areas: Little Grand Lake / Red Indian Lake, Sandy Lake and Crabbes River. Of these, the Little Grand Lake / Red Indian Lake core area, which includes critical habitat, overlaps the Project Area. The marten population in the Little Grand Lake / Red Indian Lake core area is estimated to be 237 to 481 individuals (Schmelzer 2008 in Nalcor 2012). The discussion of available habitat in the EIS is based on the assumption that marten occupancy on the Island of Newfoundland is below carrying capacity, therefore individuals displaced by the Project should be able to move to other available, suitable habitat. While data is not available on American marten occupancy in the proposed critical habitat, information provided in the Recovery Strategy suggests that forested areas in Newfoundland have the capacity to support more animals (EC 2013). The Recovery Strategy indicates that there is sufficient suitable habitat available to support this species or habitat could be made available through habitat management and sets a population objective of 1000 individuals (EC 2013).

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	The Recovery Strategy indicates that a probability-based marten occupancy model will be created to identify current and potential American marten habitat (EC 2013). Although the study is from 2013, the results of this modelling do not yet appear to be available publicly. When available, these results may provide additional information on occupancy and carrying capacity of American marten in the proposed critical habitat. Trapping and snaring is the historical cause for the population decline of American marten, and this remains a high threat today (EC 2013). That trapping and snaring are limiting American marten populations suggests that the landscape is not at its natural carrying capacity. Furthermore, research has shown that the forested landscape in Newfoundland may be able to support a larger population of marten, however, is limited by incidental mortality caused by trapping and snaring (Hearn 2007). Additional information on marten occupancy is included in the Baseline Report Appendix 7: Avifauna, Other Wildlife and Their Habitats. Marten occupancy is discussed in the following two attachments: Winter Wildlife (Attachment 7-A of the EIS) and Newfoundland Marten (Attachment 7-G of the EIS). Both these studies included hair trap surveys, and the winter wildlife survey also included snow tracking surveys that identified marten. The mapping of the proposed critical habitat (Figure 12-8 of the EIS) is from the provincial recovery plan for marten (The Newfoundland Marten Recovery Team 2010) and is based on occurrence data and habitat quality information. A larger map of the proposed critical habitat (which covers the entirety of the RAA), can be seen in Figure 4 of the Recovery Plan (The Newfoundland Marten Recovery Team 2010). c. Mitigation measures listed in Section 12.4 of the EIS include the implementation of speed limits, and the reporting of wildlife-vehicle collisions and observations of wildlife road mortality (including marten) to the on-site environmental team and the Newfoundland and Labrador Department of Fisheries, Forestry and Agriculture (NLDFFA) - Wildlife Division. Adaptive management measures will be implemented should locations of high frequency wildlife-vehicle interactions be identified The Environmental Protection Plan will include the requirement to report any sightings of marten to the on-site environmental team and the NLDFFA - Wildlife Division. In addition, prior to land clearing activities, sensitive habitat features (including marten dens) will be flagged and evaluated for additional

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	mitigation. Appropriate buffers will be maintained around these features, where feasible (Sections 12.4 and 12.5.1.2 of the EIS). To acquire more information on marten, a monitoring plan will be developed for the Project, as described in Section 12.9 of the EIS. The follow-up program for marten will include conducting hair snag trap surveys. These surveys will be repeated during construction and operation, and again during or after decommissioning, to assess changes in marten presence compared to existing conditions. References: Environment Canada. 2013. Recovery Strategy for the American Marten (*Martes americana atrata*), Newfoundland population, in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. xi pp. + appendix. Gosse, J.W., R. Cox, and S.W. Avery. 2005. Home-range characteristics and habitat use by American martens in Eastern Newfoundland. Journal of Mammalogy 86: 1156-1163. Hearn, B.J. 2007. Factors affecting habitat selection and population characteristics of American marten (*Martes americana atrata*) in Newfoundland. Ph.D. Dissertation, University of Maine, Orono, USA. Hearn, B.J., D.J. Harrison, A.K. Fuller, C.G. Lundrigan, and W.J. Curran. 2010. Paradigm shifts in habitat ecology of threatened Newfoundland martens. Journal of Wildlife Management 74: 719-728. Nalcor Energy. 2012. Labrador-Island Transmission Link Environmental Impact Statement. Vol 2A – Existing Biophysical Environment. Available online at: https://iaac-aeic.gc.ca/050/evaluations/proj/51746 Last accessed on September 20, 2020. Payer, D., and D.J. Harrison. 2003. Influence of forest structure on habitat use by American marten in an industrial forest. Forest Ecology and Management, 179: 145–156. Smith, A.C., and J.A. Schaefer. 2002. Home-range size and habitat selection by American marten (*Martes americana*) in Labrador. Canadian Journal of Zoology 80: 1602-1609.

ID:	**IR-58**
	The Newfoundland Marten Recovery Team. 2010. Recovery plan for the threatened Newfoundland population of American marten (*Martes americana atrata*). Wildlife Division, Department of Environment and Conservation, Government of Newfoundland and Labrador, Corner Brook, Canada. iii + 31 pp. Available online at: https://www.sararegistry.gc.ca/virtual_sara/files/plans/rs_american_marten_newfoundland_population_e_final.pdf.
Appendix:	None

APPENDIX IR-03.A
ELC MAPBOOK

(Submitted as a Separate File)

APPENDIX IR-04.A
SOIL SAMPLE RESULTS

Analytical Results of Acid Extractable Metal Concentrations in Baseline Soils (mg/kg)

Analyte	BB-1	BB-2	BB-3	BB-4	BB-4 Field-Dup (BB-DUP)	BB-5	BB-6	BB-7	BB-8
BV Labs ID	OIR781	OIR782	OIR783	OIR784	OIR791	OIR785	OIR786	OIR787	OIR788
Sampling Date	Nov 7, 2020	Nov 8, 2020	Sep 8, 2020	Sep 8, 2020	Sep 8, 2020	Sep 8, 2020	Sep 8, 2020	Sep 8, 2020	Sep 8, 2020
Aluminum	2200	2900	1100	350	2700	280	570	300	460
Antimony	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Arsenic	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Barium	54	<5.0	120	22	10	30	58	41	35
Beryllium	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Bismuth	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Boron	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium	0.57	0.40	0.58	<0.30	<0.30	0.48	<0.30	<0.30	<0.30
Chromium	<2.0	3.7	<2.0	<2.0	3.3	<2.0	<2.0	<2.0	<2.0
Cobalt	<1.0	2.1	<1.0	<1.0	1.2	<1.0	<1.0	<1.0	<1.0
Copper	7.4	<2.0	4.3	3.5	2.7	3.9	5.2	3.9	4.0
Iron	2600	4100	900	380	4300	320	990	350	540
Lead	53	15	27	9.2	14	17	19	25	27
Lithium	<2.0	2.6	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Manganese	23	47	150	96	44	36	440	240	91
Mercury	0.37	<0.10	0.43	0.31	<0.10	0.32	0.34	0.31	0.46
Molybdenum	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel	2.4	4.0	2.7	<2.0	2.9	2.4	<2.0	2.2	2.1
Rubidium	2.2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Selenium	0.84	<0.50	0.63	<0.50	<0.50	<0.50	<0.50	<0.50	0.67
Silver	<0.50	<0.50	1.3	0.64	<0.50	0.68	<0.50	<0.50	0.56
Strontium	61	<5.0	33	12	8.2	14	11	15	14
Thallium	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Uranium	<0.10	0.11	<0.10	<0.10	0.13	<0.10	<0.10	<0.10	<0.10
Vanadium	4.9	6.8	<2.0	<2.0	6.8	<2.0	2.1	<2.0	2.2
Zinc	30	17	47	55	11	56	65	79	51

Analytical Results of Acid Extractable Metal Concentrations in Baseline Soils (mg/kg)

Analyte	BB-9	BB-10	LT-1	LT-2	LT-3	LT-3 Lab-Dup	LT-4	LT-5	LT-5 Field-Dup (LT-DUP)
BV Labs ID	OIR789	OIR790	OIR770	OIR771	OIR772	OIR772	OIR773	OIR774	OIR780
Sampling Date	Sep 8, 2020	Sep 8, 2020	Sep 5, 2020	Sep 6, 2020	Sep 7, 2020	Sep 7, 2020	Sep 8, 2020	Sep 10, 2020	Sep 10, 2020
Aluminum	890	1000	350	600	12000	13000	3800	1700	2400
Antimony	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Arsenic	<2.0	<2.0	<2.0	<2.0	21	21	<2.0	3.4	2.2
Barium	140	69	16	23	9.3	9.2	59	39	140
Beryllium	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Bismuth	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Boron	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium	0.56	<0.30	0.37	0.37	<0.30	<0.30	0.41	0.40	0.55
Chromium	<2.0	<2.0	<2.0	<2.0	11	12	2.5	<2.0	2.4
Cobalt	<1.0	<1.0	<1.0	<1.0	2.9	3.1	1.3	20	1.5
Copper	4.5	4.9	<2.0	7.7	8.3	8.9	6.3	6.5	5.5
Iron	980	1800	350	580	21000	23000	8000	9900	3900
Lead	31	22	21	12	5.7	5.9	23	11	19
Lithium	<2.0	<2.0	<2.0	<2.0	3.2	3.5	<2.0	<2.0	<2.0
Manganese	290	340	58	320	130	140	280	1500	430
Mercury	0.35	0.33	0.23	0.27	0.11	<0.10	0.20	0.16	0.31
Molybdenum	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel	2.4	2.7	<2.0	<2.0	5.0	5.2	2.8	2.5	3.6
Rubidium	2.4	<2.0	<2.0	2.1	2.6	2.8	<2.0	<2.0	3.3
Selenium	<0.50	<0.50	0.72	<0.50	0.52	0.62	0.55	<0.50	<0.50
Silver	1.2	0.67	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	1.6
Strontium	21	15	16	13	<5.0	<5.0	12	32	31
Thallium	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin	<1.0	<1.0	1.2	1.3	<1.0	<1.0	1.1	1.3	<1.0
Uranium	<0.10	<0.10	<0.10	<0.10	0.23	0.27	0.12	0.11	<0.10
Vanadium	2.0	2.9	<2.0	<2.0	43	45	10	8.8	9.3
Zinc	89	45	16	31	18	19	34	34	190

Analytical Results of Acid Extractable Metal Concentrations in Baseline Soils (mg/kg)

Analyte	LT-6	LT-7	LT-8	LT-9	LT-10
BV Labs ID	OIR775	OIR776	OIR777	OIR778	OIR779
Sampling Date	Sep 10, 2020	Sep 10, 2020	Sep 10, 2020	Sep 10, 2020	Sep 11, 2020
Aluminum	1500	4000	200	2800	6800
Antimony	<2.0	<2.0	<2.0	<2.0	<2.0
Arsenic	<2.0	2.1	<2.0	3.8	6.1
Barium	28	45	17	37	380
Beryllium	<2.0	<2.0	<2.0	<2.0	<2.0
Bismuth	<2.0	<2.0	<2.0	<2.0	<2.0
Boron	<50	<50	<50	<50	<50
Cadmium	<0.30	<0.30	<0.30	<0.30	0.71
Chromium	<2.0	<2.0	<2.0	<2.0	8.5
Cobalt	1.4	1.8	<1.0	4.8	4.1
Copper	3.1	8.0	3.8	4.1	28
Iron	1700	7500	230	15000	12000
Lead	9.4	19	9.0	14	47
Lithium	<2.0	<2.0	<2.0	<2.0	4.5
Manganese	190	130	620	580	440
Mercury	<0.10	0.20	0.19	0.13	0.28
Molybdenum	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel	<2.0	2.3	<2.0	2.2	9.3
Rubidium	<2.0	2.0	<2.0	<2.0	3.2
Selenium	<0.50	0.58	<0.50	<0.50	0.52
Silver	<0.50	<0.50	<0.50	<0.50	1.1
Strontium	28	30	14	20	31
Thallium	<0.10	<0.10	<0.10	<0.10	<0.10
Tin	1.4	1.3	<1.0	<1.0	<1.0
Uranium	<0.10	0.20	<0.10	0.17	0.33
Vanadium	<2.0	5.7	<2.0	10	19
Zinc	21	25	29	18	110

Your Project #: 121416288
Your C.O.C. #: n/a

Attention: Barry Wicks

Stantec Consulting Ltd
141 Kelsey Drive
St. John's, NL
CANADA A1B 0L2

Report Date: 2020/12/10
Report #: R6444235
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C0W4941
Received: 2020/12/01, 09:55

Sample Matrix: Soil
Samples Received: 22

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Metals Solids Acid Extr. ICPMS	22	2020/12/09	2020/12/10	ATL SOP 00058	EPA 6020B R2 m

Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by BV Labs, unless otherwise agreed in writing. BV Labs is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Heather Macumber, Senior Project Manager
Email: Heather.MACUMBER@bvlabs.com
Phone# (902)420-0203 Ext:226

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ELEMENTS BY ATOMIC SPECTROSCOPY (SOIL)

BV Labs ID		OIR770	OIR771		OIR772	OIR772		OIR773		
Sampling Date		2020/09/05	2020/09/06		2020/09/07	2020/09/07		2020/09/08		
COC Number		n/a	n/a		n/a	n/a		n/a		
	UNITS	**LT-1**	**LT-2**	**QC Batch**	**LT-3**	**LT-3 Lab-Dup**	**QC Batch**	**LT-4**	**RDL**	**QC Batch**
Metals										
Acid Extractable Aluminum (Al)	mg/kg	350	600	7099631	12000	13000	7099641	3800	10	7099631
Acid Extractable Antimony (Sb)	mg/kg	<2.0	<2.0	7099631	<2.0	<2.0	7099641	<2.0	2.0	7099631
Acid Extractable Arsenic (As)	mg/kg	<2.0	<2.0	7099631	21	21	7099641	<2.0	2.0	7099631
Acid Extractable Barium (Ba)	mg/kg	16	23	7099631	9.3	9.2	7099641	59	5.0	7099631
Acid Extractable Beryllium (Be)	mg/kg	<2.0	<2.0	7099631	<2.0	<2.0	7099641	<2.0	2.0	7099631
Acid Extractable Bismuth (Bi)	mg/kg	<2.0	<2.0	7099631	<2.0	<2.0	7099641	<2.0	2.0	7099631
Acid Extractable Boron (B)	mg/kg	<50	<50	7099631	<50	<50	7099641	<50	50	7099631
Acid Extractable Cadmium (Cd)	mg/kg	0.37	0.37	7099631	<0.30	<0.30	7099641	0.41	0.30	7099631
Acid Extractable Chromium (Cr)	mg/kg	<2.0	<2.0	7099631	11	12	7099641	2.5	2.0	7099631
Acid Extractable Cobalt (Co)	mg/kg	<1.0	<1.0	7099631	2.9	3.1	7099641	1.3	1.0	7099631
Acid Extractable Copper (Cu)	mg/kg	<2.0	7.7	7099631	8.3	8.9	7099641	6.3	2.0	7099631
Acid Extractable Iron (Fe)	mg/kg	350	580	7099631	21000	23000	7099641	8000	50	7099631
Acid Extractable Lead (Pb)	mg/kg	21	12	7099631	5.7	5.9	7099641	23	0.50	7099631
Acid Extractable Lithium (Li)	mg/kg	<2.0	<2.0	7099631	3.2	3.5	7099641	<2.0	2.0	7099631
Acid Extractable Manganese (Mn)	mg/kg	58	320	7099631	130	140	7099641	280	2.0	7099631
Acid Extractable Mercury (Hg)	mg/kg	0.23	0.27	7099631	0.11	<0.10	7099641	0.20	0.10	7099631
Acid Extractable Molybdenum (Mo)	mg/kg	<2.0	<2.0	7099631	<2.0	<2.0	7099641	<2.0	2.0	7099631
Acid Extractable Nickel (Ni)	mg/kg	<2.0	<2.0	7099631	5.0	5.2	7099641	2.8	2.0	7099631
Acid Extractable Rubidium (Rb)	mg/kg	<2.0	2.1	7099631	2.6	2.8	7099641	<2.0	2.0	7099631
Acid Extractable Selenium (Se)	mg/kg	0.72	<0.50	7099631	0.52	0.62	7099641	0.55	0.50	7099631
Acid Extractable Silver (Ag)	mg/kg	<0.50	<0.50	7099631	<0.50	<0.50	7099641	<0.50	0.50	7099631
Acid Extractable Strontium (Sr)	mg/kg	16	13	7099631	<5.0	<5.0	7099641	12	5.0	7099631
Acid Extractable Thallium (Tl)	mg/kg	<0.10	<0.10	7099631	<0.10	<0.10	7099641	<0.10	0.10	7099631
Acid Extractable Tin (Sn)	mg/kg	1.2	1.3	7099631	<1.0	<1.0	7099641	1.1	1.0	7099631
Acid Extractable Uranium (U)	mg/kg	<0.10	<0.10	7099631	0.23	0.27	7099641	0.12	0.10	7099631
Acid Extractable Vanadium (V)	mg/kg	<2.0	<2.0	7099631	43	45	7099641	10	2.0	7099631
Acid Extractable Zinc (Zn)	mg/kg	16	31	7099631	18	19	7099641	34	5.0	7099631

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

Bureau Veritas Laboratories 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel: 902-420-0203 Toll-free: 800-565-7227 Fax: 902-420-8612 www.bvlabs.com

ELEMENTS BY ATOMIC SPECTROSCOPY (SOIL)

BV Labs ID		OIR774		OIR775	OIR776	OIR777	OIR778	OIR779		
Sampling Date		2020/09/10		2020/09/10	2020/09/10	2020/09/10	2020/09/10	2020/09/11		
COC Number		n/a		n/a	n/a	n/a	n/a	n/a		
	UNITS	**LT-5**	**QC Batch**	**LT-6**	**LT-7**	**LT-8**	**LT-9**	**LT-10**	**RDL**	**QC Batch**
Metals										
Acid Extractable Aluminum (Al)	mg/kg	1700	7099631	1500	4000	200	2800	6800	10	7099641
Acid Extractable Antimony (Sb)	mg/kg	<2.0	7099631	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	7099641
Acid Extractable Arsenic (As)	mg/kg	3.4	7099631	<2.0	2.1	<2.0	3.8	6.1	2.0	7099641
Acid Extractable Barium (Ba)	mg/kg	39	7099631	28	45	17	37	380	5.0	7099641
Acid Extractable Beryllium (Be)	mg/kg	<2.0	7099631	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	7099641
Acid Extractable Bismuth (Bi)	mg/kg	<2.0	7099631	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	7099641
Acid Extractable Boron (B)	mg/kg	<50	7099631	<50	<50	<50	<50	<50	50	7099641
Acid Extractable Cadmium (Cd)	mg/kg	0.40	7099631	<0.30	<0.30	<0.30	<0.30	0.71	0.30	7099641
Acid Extractable Chromium (Cr)	mg/kg	<2.0	7099631	<2.0	<2.0	<2.0	<2.0	8.5	2.0	7099641
Acid Extractable Cobalt (Co)	mg/kg	20	7099631	1.4	1.8	<1.0	4.8	4.1	1.0	7099641
Acid Extractable Copper (Cu)	mg/kg	6.5	7099631	3.1	8.0	3.8	4.1	28	2.0	7099641
Acid Extractable Iron (Fe)	mg/kg	9900	7099631	1700	7500	230	15000	12000	50	7099641
Acid Extractable Lead (Pb)	mg/kg	11	7099631	9.4	19	9.0	14	47	0.50	7099641
Acid Extractable Lithium (Li)	mg/kg	<2.0	7099631	<2.0	<2.0	<2.0	<2.0	4.5	2.0	7099641
Acid Extractable Manganese (Mn)	mg/kg	1500	7099631	190	130	620	580	440	2.0	7099641
Acid Extractable Mercury (Hg)	mg/kg	0.16	7099631	<0.10	0.20	0.19	0.13	0.28	0.10	7099641
Acid Extractable Molybdenum (Mo)	mg/kg	<2.0	7099631	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	7099641
Acid Extractable Nickel (Ni)	mg/kg	2.5	7099631	<2.0	2.3	<2.0	2.2	9.3	2.0	7099641
Acid Extractable Rubidium (Rb)	mg/kg	<2.0	7099631	<2.0	2.0	<2.0	<2.0	3.2	2.0	7099641
Acid Extractable Selenium (Se)	mg/kg	<0.50	7099631	<0.50	0.58	<0.50	<0.50	0.52	0.50	7099641
Acid Extractable Silver (Ag)	mg/kg	<0.50	7099631	<0.50	<0.50	<0.50	<0.50	1.1	0.50	7099641
Acid Extractable Strontium (Sr)	mg/kg	32	7099631	28	30	14	20	31	5.0	7099641
Acid Extractable Thallium (Tl)	mg/kg	<0.10	7099631	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	7099641
Acid Extractable Tin (Sn)	mg/kg	1.3	7099631	1.4	1.3	<1.0	<1.0	<1.0	1.0	7099641
Acid Extractable Uranium (U)	mg/kg	0.11	7099631	<0.10	0.20	<0.10	0.17	0.33	0.10	7099641
Acid Extractable Vanadium (V)	mg/kg	8.8	7099631	<2.0	5.7	<2.0	10	19	2.0	7099641
Acid Extractable Zinc (Zn)	mg/kg	34	7099631	21	25	29	18	110	5.0	7099641

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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ELEMENTS BY ATOMIC SPECTROSCOPY (SOIL)

BV Labs ID		OIR780	OIR781	OIR782	OIR783	OIR784	OIR785		
Sampling Date		2020/09/10	2020/11/07	2020/11/08	2020/09/08	2020/09/08	2020/09/08		
COC Number		n/a	n/a	n/a	n/a	n/a	n/a		
	UNITS	**LT-DUP**	**BB-1**	**BB-2**	**BB-3**	**BB-4**	**BB-5**	**RDL**	**QC Batch**
Metals									
Acid Extractable Aluminum (Al)	mg/kg	2400	2200	2900	1100	350	280	10	7099641
Acid Extractable Antimony (Sb)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	7099641
Acid Extractable Arsenic (As)	mg/kg	2.2	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	7099641
Acid Extractable Barium (Ba)	mg/kg	140	54	<5.0	120	22	30	5.0	7099641
Acid Extractable Beryllium (Be)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	7099641
Acid Extractable Bismuth (Bi)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	7099641
Acid Extractable Boron (B)	mg/kg	<50	<50	<50	<50	<50	<50	50	7099641
Acid Extractable Cadmium (Cd)	mg/kg	0.55	0.57	0.40	0.58	<0.30	0.48	0.30	7099641
Acid Extractable Chromium (Cr)	mg/kg	2.4	<2.0	3.7	<2.0	<2.0	<2.0	2.0	7099641
Acid Extractable Cobalt (Co)	mg/kg	1.5	<1.0	2.1	<1.0	<1.0	<1.0	1.0	7099641
Acid Extractable Copper (Cu)	mg/kg	5.5	7.4	<2.0	4.3	3.5	3.9	2.0	7099641
Acid Extractable Iron (Fe)	mg/kg	3900	2600	4100	900	380	320	50	7099641
Acid Extractable Lead (Pb)	mg/kg	19	53	15	27	9.2	17	0.50	7099641
Acid Extractable Lithium (Li)	mg/kg	<2.0	<2.0	2.6	<2.0	<2.0	<2.0	2.0	7099641
Acid Extractable Manganese (Mn)	mg/kg	430	23	47	150	96	36	2.0	7099641
Acid Extractable Mercury (Hg)	mg/kg	0.31	0.37	<0.10	0.43	0.31	0.32	0.10	7099641
Acid Extractable Molybdenum (Mo)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	7099641
Acid Extractable Nickel (Ni)	mg/kg	3.6	2.4	4.0	2.7	<2.0	2.4	2.0	7099641
Acid Extractable Rubidium (Rb)	mg/kg	3.3	2.2	<2.0	<2.0	<2.0	<2.0	2.0	7099641
Acid Extractable Selenium (Se)	mg/kg	<0.50	0.84	<0.50	0.63	<0.50	<0.50	0.50	7099641
Acid Extractable Silver (Ag)	mg/kg	1.6	<0.50	<0.50	1.3	0.64	0.68	0.50	7099641
Acid Extractable Strontium (Sr)	mg/kg	31	61	<5.0	33	12	14	5.0	7099641
Acid Extractable Thallium (Tl)	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	7099641
Acid Extractable Tin (Sn)	mg/kg	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	1.0	7099641
Acid Extractable Uranium (U)	mg/kg	<0.10	<0.10	0.11	<0.10	<0.10	<0.10	0.10	7099641
Acid Extractable Vanadium (V)	mg/kg	9.3	4.9	6.8	<2.0	<2.0	<2.0	2.0	7099641
Acid Extractable Zinc (Zn)	mg/kg	190	30	17	47	55	56	5.0	7099641

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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ELEMENTS BY ATOMIC SPECTROSCOPY (SOIL)

BV Labs ID		OIR786	OIR787	OIR788	OIR789	OIR790	OIR791		
Sampling Date		2020/09/08	2020/09/08	2020/09/08	2020/09/08	2020/09/08	2020/09/08		
COC Number		n/a	n/a	n/a	n/a	n/a	n/a		
	UNITS	**BB-6**	**BB-7**	**BB-8**	**BB-9**	**BB-10**	**BB-DUP**	**RDL**	**QC Batch**
Metals									
Acid Extractable Aluminum (Al)	mg/kg	570	300	460	890	1000	2700	10	7099641
Acid Extractable Antimony (Sb)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	7099641
Acid Extractable Arsenic (As)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	7099641
Acid Extractable Barium (Ba)	mg/kg	58	41	35	140	69	10	5.0	7099641
Acid Extractable Beryllium (Be)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	7099641
Acid Extractable Bismuth (Bi)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	7099641
Acid Extractable Boron (B)	mg/kg	<50	<50	<50	<50	<50	<50	50	7099641
Acid Extractable Cadmium (Cd)	mg/kg	<0.30	<0.30	<0.30	0.56	<0.30	<0.30	0.30	7099641
Acid Extractable Chromium (Cr)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	3.3	2.0	7099641
Acid Extractable Cobalt (Co)	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	1.2	1.0	7099641
Acid Extractable Copper (Cu)	mg/kg	5.2	3.9	4.0	4.5	4.9	2.7	2.0	7099641
Acid Extractable Iron (Fe)	mg/kg	990	350	540	980	1800	4300	50	7099641
Acid Extractable Lead (Pb)	mg/kg	19	25	27	31	22	14	0.50	7099641
Acid Extractable Lithium (Li)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	7099641
Acid Extractable Manganese (Mn)	mg/kg	440	240	91	290	340	44	2.0	7099641
Acid Extractable Mercury (Hg)	mg/kg	0.34	0.31	0.46	0.35	0.33	<0.10	0.10	7099641
Acid Extractable Molybdenum (Mo)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	7099641
Acid Extractable Nickel (Ni)	mg/kg	<2.0	2.2	2.1	2.4	2.7	2.9	2.0	7099641
Acid Extractable Rubidium (Rb)	mg/kg	<2.0	<2.0	<2.0	2.4	<2.0	<2.0	2.0	7099641
Acid Extractable Selenium (Se)	mg/kg	<0.50	<0.50	0.67	<0.50	<0.50	<0.50	0.50	7099641
Acid Extractable Silver (Ag)	mg/kg	<0.50	<0.50	0.56	1.2	0.67	<0.50	0.50	7099641
Acid Extractable Strontium (Sr)	mg/kg	11	15	14	21	15	8.2	5.0	7099641
Acid Extractable Thallium (Tl)	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	7099641
Acid Extractable Tin (Sn)	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	7099641
Acid Extractable Uranium (U)	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	0.13	0.10	7099641
Acid Extractable Vanadium (V)	mg/kg	2.1	<2.0	2.2	2.0	2.9	6.8	2.0	7099641
Acid Extractable Zinc (Zn)	mg/kg	65	79	51	89	45	11	5.0	7099641

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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TEST SUMMARY

BV Labs ID: OIR770 **Collected:** 2020/09/05
Sample ID: LT-1 **Shipped:**
Matrix: Soil **Received:** 2020/12/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Metals Solids Acid Extr. ICPMS	ICP/MS	7099631	2020/12/09	2020/12/10	Bryon Angevine

BV Labs ID: OIR771 **Collected:** 2020/09/06
Sample ID: LT-2 **Shipped:**
Matrix: Soil **Received:** 2020/12/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Metals Solids Acid Extr. ICPMS	ICP/MS	7099631	2020/12/09	2020/12/10	Bryon Angevine

BV Labs ID: OIR772 **Collected:** 2020/09/07
Sample ID: LT-3 **Shipped:**
Matrix: Soil **Received:** 2020/12/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Metals Solids Acid Extr. ICPMS	ICP/MS	7099641	2020/12/09	2020/12/10	Bryon Angevine

BV Labs ID: OIR772 Dup **Collected:** 2020/09/07
Sample ID: LT-3 **Shipped:**
Matrix: Soil **Received:** 2020/12/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Metals Solids Acid Extr. ICPMS	ICP/MS	7099641	2020/12/09	2020/12/10	Bryon Angevine

BV Labs ID: OIR773 **Collected:** 2020/09/08
Sample ID: LT-4 **Shipped:**
Matrix: Soil **Received:** 2020/12/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Metals Solids Acid Extr. ICPMS	ICP/MS	7099631	2020/12/09	2020/12/10	Bryon Angevine

BV Labs ID: OIR774 **Collected:** 2020/09/10
Sample ID: LT-5 **Shipped:**
Matrix: Soil **Received:** 2020/12/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Metals Solids Acid Extr. ICPMS	ICP/MS	7099631	2020/12/09	2020/12/10	Bryon Angevine

BV Labs ID: OIR775 **Collected:** 2020/09/10
Sample ID: LT-6 **Shipped:**
Matrix: Soil **Received:** 2020/12/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Metals Solids Acid Extr. ICPMS	ICP/MS	7099641	2020/12/09	2020/12/10	Bryon Angevine

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TEST SUMMARY

BV Labs ID: OIR776
Sample ID: LT-7
Matrix: Soil
Collected: 2020/09/10
Shipped:
Received: 2020/12/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Metals Solids Acid Extr. ICPMS	ICP/MS	7099641	2020/12/09	2020/12/10	Bryon Angevine

BV Labs ID: OIR777
Sample ID: LT-8
Matrix: Soil
Collected: 2020/09/10
Shipped:
Received: 2020/12/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Metals Solids Acid Extr. ICPMS	ICP/MS	7099641	2020/12/09	2020/12/10	Bryon Angevine

BV Labs ID: OIR778
Sample ID: LT-9
Matrix: Soil
Collected: 2020/09/10
Shipped:
Received: 2020/12/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Metals Solids Acid Extr. ICPMS	ICP/MS	7099641	2020/12/09	2020/12/10	Bryon Angevine

BV Labs ID: OIR779
Sample ID: LT-10
Matrix: Soil
Collected: 2020/09/11
Shipped:
Received: 2020/12/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Metals Solids Acid Extr. ICPMS	ICP/MS	7099641	2020/12/09	2020/12/10	Bryon Angevine

BV Labs ID: OIR780
Sample ID: LT-DUP
Matrix: Soil
Collected: 2020/09/10
Shipped:
Received: 2020/12/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Metals Solids Acid Extr. ICPMS	ICP/MS	7099641	2020/12/09	2020/12/10	Bryon Angevine

BV Labs ID: OIR781
Sample ID: BB-1
Matrix: Soil
Collected: 2020/11/07
Shipped:
Received: 2020/12/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Metals Solids Acid Extr. ICPMS	ICP/MS	7099641	2020/12/09	2020/12/10	Bryon Angevine

BV Labs ID: OIR782
Sample ID: BB-2
Matrix: Soil
Collected: 2020/11/08
Shipped:
Received: 2020/12/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Metals Solids Acid Extr. ICPMS	ICP/MS	7099641	2020/12/09	2020/12/10	Bryon Angevine

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TEST SUMMARY

BV Labs ID: OIR783 **Collected:** 2020/09/08
Sample ID: BB-3 **Shipped:**
Matrix: Soil **Received:** 2020/12/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Metals Solids Acid Extr. ICPMS	ICP/MS	7099641	2020/12/09	2020/12/10	Bryon Angevine

BV Labs ID: OIR784 **Collected:** 2020/09/08
Sample ID: BB-4 **Shipped:**
Matrix: Soil **Received:** 2020/12/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Metals Solids Acid Extr. ICPMS	ICP/MS	7099641	2020/12/09	2020/12/10	Bryon Angevine

BV Labs ID: OIR785 **Collected:** 2020/09/08
Sample ID: BB-5 **Shipped:**
Matrix: Soil **Received:** 2020/12/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Metals Solids Acid Extr. ICPMS	ICP/MS	7099641	2020/12/09	2020/12/10	Bryon Angevine

BV Labs ID: OIR786 **Collected:** 2020/09/08
Sample ID: BB-6 **Shipped:**
Matrix: Soil **Received:** 2020/12/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Metals Solids Acid Extr. ICPMS	ICP/MS	7099641	2020/12/09	2020/12/10	Bryon Angevine

BV Labs ID: OIR787 **Collected:** 2020/09/08
Sample ID: BB-7 **Shipped:**
Matrix: Soil **Received:** 2020/12/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Metals Solids Acid Extr. ICPMS	ICP/MS	7099641	2020/12/09	2020/12/10	Bryon Angevine

BV Labs ID: OIR788 **Collected:** 2020/09/08
Sample ID: BB-8 **Shipped:**
Matrix: Soil **Received:** 2020/12/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Metals Solids Acid Extr. ICPMS	ICP/MS	7099641	2020/12/09	2020/12/10	Bryon Angevine

BV Labs ID: OIR789 **Collected:** 2020/09/08
Sample ID: BB-9 **Shipped:**
Matrix: Soil **Received:** 2020/12/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Metals Solids Acid Extr. ICPMS	ICP/MS	7099641	2020/12/09	2020/12/10	Bryon Angevine

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TEST SUMMARY

BV Labs ID: OIR790
Sample ID: BB-10
Matrix: Soil

Collected: 2020/09/08
Shipped:
Received: 2020/12/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Metals Solids Acid Extr. ICPMS	ICP/MS	7099641	2020/12/09	2020/12/10	Bryon Angevine

BV Labs ID: OIR791
Sample ID: BB-DUP
Matrix: Soil

Collected: 2020/09/08
Shipped:
Received: 2020/12/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Metals Solids Acid Extr. ICPMS	ICP/MS	7099641	2020/12/09	2020/12/10	Bryon Angevine

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GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	-13.7°C

Mercury analyzed past recommended hold time.

Results relate only to the items tested.

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			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7099631	Acid Extractable Aluminum (Al)	2020/12/10					<10	mg/kg	0.55	35
7099631	Acid Extractable Antimony (Sb)	2020/12/10	90	75 - 125	107	75 - 125	<2.0	mg/kg	NC	35
7099631	Acid Extractable Arsenic (As)	2020/12/10	110	75 - 125	100	75 - 125	<2.0	mg/kg	1.9	35
7099631	Acid Extractable Barium (Ba)	2020/12/10	NC	75 - 125	103	75 - 125	<5.0	mg/kg	5.7	35
7099631	Acid Extractable Beryllium (Be)	2020/12/10	112	75 - 125	103	75 - 125	<2.0	mg/kg	NC	35
7099631	Acid Extractable Bismuth (Bi)	2020/12/10	108	75 - 125	102	75 - 125	<2.0	mg/kg	NC	35
7099631	Acid Extractable Boron (B)	2020/12/10	101	75 - 125	100	75 - 125	<50	mg/kg	NC	35
7099631	Acid Extractable Cadmium (Cd)	2020/12/10	107	75 - 125	99	75 - 125	<0.30	mg/kg	0.64	35
7099631	Acid Extractable Chromium (Cr)	2020/12/10	108	75 - 125	97	75 - 125	<2.0	mg/kg	0.23	35
7099631	Acid Extractable Cobalt (Co)	2020/12/10	107	75 - 125	99	75 - 125	<1.0	mg/kg	0.39	35
7099631	Acid Extractable Copper (Cu)	2020/12/10	NC	75 - 125	96	75 - 125	<2.0	mg/kg	0.19	35
7099631	Acid Extractable Iron (Fe)	2020/12/10					<50	mg/kg	1.3	35
7099631	Acid Extractable Lead (Pb)	2020/12/10	NC	75 - 125	101	75 - 125	<0.50	mg/kg	0.095	35
7099631	Acid Extractable Lithium (Li)	2020/12/10	123	75 - 125	105	75 - 125	<2.0	mg/kg	2.1	35
7099631	Acid Extractable Manganese (Mn)	2020/12/10	NC	75 - 125	99	75 - 125	<2.0	mg/kg	2.3	35
7099631	Acid Extractable Mercury (Hg)	2020/12/10	107	75 - 125	107	75 - 125	<0.10	mg/kg	5.0	35
7099631	Acid Extractable Molybdenum (Mo)	2020/12/10	NC	75 - 125	103	75 - 125	<2.0	mg/kg	1.6	35
7099631	Acid Extractable Nickel (Ni)	2020/12/10	109	75 - 125	100	75 - 125	<2.0	mg/kg	0.46	35
7099631	Acid Extractable Rubidium (Rb)	2020/12/10	104	75 - 125	100	75 - 125	<2.0	mg/kg	0.66	35
7099631	Acid Extractable Selenium (Se)	2020/12/10	106	75 - 125	100	75 - 125	<0.50	mg/kg	7.4	35
7099631	Acid Extractable Silver (Ag)	2020/12/10	NC	75 - 125	101	75 - 125	<0.50	mg/kg	0.17	35
7099631	Acid Extractable Strontium (Sr)	2020/12/10	NC	75 - 125	102	75 - 125	<5.0	mg/kg	1.3	35
7099631	Acid Extractable Thallium (Tl)	2020/12/10	108	75 - 125	101	75 - 125	<0.10	mg/kg	1.8	35
7099631	Acid Extractable Tin (Sn)	2020/12/10	NC	75 - 125	104	75 - 125	<1.0	mg/kg	2.7	35
7099631	Acid Extractable Uranium (U)	2020/12/10	111	75 - 125	102	75 - 125	<0.10	mg/kg	1.9	35
7099631	Acid Extractable Vanadium (V)	2020/12/10	NC	75 - 125	98	75 - 125	<2.0	mg/kg	1.2	35
7099631	Acid Extractable Zinc (Zn)	2020/12/10	NC	75 - 125	102	75 - 125	<5.0	mg/kg	0.69	35
7099641	Acid Extractable Aluminum (Al)	2020/12/10					<10	mg/kg	4.1	35
7099641	Acid Extractable Antimony (Sb)	2020/12/10	111	75 - 125	105	75 - 125	<2.0	mg/kg	NC	35
7099641	Acid Extractable Arsenic (As)	2020/12/10	109	75 - 125	101	75 - 125	<2.0	mg/kg	2.7	35
7099641	Acid Extractable Barium (Ba)	2020/12/10	114	75 - 125	102	75 - 125	<5.0	mg/kg	0.91	35
7099641	Acid Extractable Beryllium (Be)	2020/12/10	113	75 - 125	101	75 - 125	<2.0	mg/kg	NC	35
7099641	Acid Extractable Bismuth (Bi)	2020/12/10	108	75 - 125	101	75 - 125	<2.0	mg/kg	NC	35

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			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7099641	Acid Extractable Boron (B)	2020/12/10	99	75 - 125	103	75 - 125	<50	mg/kg	NC	35
7099641	Acid Extractable Cadmium (Cd)	2020/12/10	106	75 - 125	99	75 - 125	<0.30	mg/kg	NC	35
7099641	Acid Extractable Chromium (Cr)	2020/12/10	110	75 - 125	99	75 - 125	<2.0	mg/kg	4.4	35
7099641	Acid Extractable Cobalt (Co)	2020/12/10	107	75 - 125	101	75 - 125	<1.0	mg/kg	7.6	35
7099641	Acid Extractable Copper (Cu)	2020/12/10	106	75 - 125	97	75 - 125	<2.0	mg/kg	7.3	35
7099641	Acid Extractable Iron (Fe)	2020/12/10					<50	mg/kg	6.7	35
7099641	Acid Extractable Lead (Pb)	2020/12/10	111	75 - 125	102	75 - 125	<0.50	mg/kg	3.5	35
7099641	Acid Extractable Lithium (Li)	2020/12/10	119	75 - 125	104	75 - 125	<2.0	mg/kg	9.9	35
7099641	Acid Extractable Manganese (Mn)	2020/12/10	NC	75 - 125	98	75 - 125	<2.0	mg/kg	5.9	35
7099641	Acid Extractable Mercury (Hg)	2020/12/10	106	75 - 125	107	75 - 125	<0.10	mg/kg	7.0	35
7099641	Acid Extractable Molybdenum (Mo)	2020/12/10	116	75 - 125	105	75 - 125	<2.0	mg/kg	NC	35
7099641	Acid Extractable Nickel (Ni)	2020/12/10	107	75 - 125	100	75 - 125	<2.0	mg/kg	3.9	35
7099641	Acid Extractable Rubidium (Rb)	2020/12/10	106	75 - 125	100	75 - 125	<2.0	mg/kg	4.5	35
7099641	Acid Extractable Selenium (Se)	2020/12/10	104	75 - 125	101	75 - 125	<0.50	mg/kg	17	35
7099641	Acid Extractable Silver (Ag)	2020/12/10	109	75 - 125	99	75 - 125	<0.50	mg/kg	NC	35
7099641	Acid Extractable Strontium (Sr)	2020/12/10	114	75 - 125	104	75 - 125	<5.0	mg/kg	NC	35
7099641	Acid Extractable Thallium (Tl)	2020/12/10	110	75 - 125	99	75 - 125	<0.10	mg/kg	NC	35
7099641	Acid Extractable Tin (Sn)	2020/12/10	106	75 - 125	104	75 - 125	<1.0	mg/kg	NC	35
7099641	Acid Extractable Uranium (U)	2020/12/10	112	75 - 125	102	75 - 125	<0.10	mg/kg	17	35
7099641	Acid Extractable Vanadium (V)	2020/12/10	117	75 - 125	100	75 - 125	<2.0	mg/kg	3.4	35
7099641	Acid Extractable Zinc (Zn)	2020/12/10	108	75 - 125	100	75 - 125	<5.0	mg/kg	6.6	35

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Mike MacGillivray, Scientific Specialist (Inorganics)

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports.
For Service Group specific validation please refer to the Validation Signature Page.

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Company Name: Stantec Consulting	Company Name:	Quotation #:	X Regular TAT (5 business days) Most analyses
Contact Name: Barry Wicks	Contact Name:	Purchase Order#:	PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address: 141 Kelsey Dr	Address:	Project #:	IF RUSH please specify date (Surcharges will be applied)
St. John's NI x PC:	PC:	Site Location:	DATE REQUIRED:
Phone: (709)576-1458	Phone:	Site Province:	
Email: barry.wicks@stantec.com	Email:	Site #:	
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		-13,13,15	

COOLING MEDIA PRESENT Y / N

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS

Analysis Requested

	SAMPLE IDENTIFICATION	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED	FIELD FILTERED &PRESERVED	LAB FILTRATION REQUIRED	RCAP-MS (Total Metals) Well / Surface water	RCAP-MS (Dissolved Metals) Ground waters	Metals (Water): Total Digest (Default Method) for well water & surface water	Metals (Water): Dissolved for ground water	Metals (Water): Mercury (CIRCLE) TOTAL / DISSOLVED	Metals (soil): Metals & Mercury Default Acid Extractable (Available) Digest	Metals (soil): Hot Water Soluble Boron (required for CCME Agricultural/ Landfill)	RBCA Hydrocarbons (BTEX, C6-C32)	CCME Hydrocarbons (CWS-PHC F1/BTEX, F2-F4)	PAHs (Default for water/soil)	PAHs (FWAL /CCME Sediment)	PCBs - Select One: Default or CCME Sediment	VOCs	Total Coliform/E.coli (Presence/Absence)	Total Coliform/E.coli (Count)					HOLD- DO NOT ANALYZE	Regulatory Requirements (Specify) / COMMENTS
1	LT-1	9/5/2020		organic									x														do not pre-weight
2	LT-2	9/6/2020		organic									x														do not pre-weight
3	LT-3	9/7/2020		organic									x														do not pre-weight
4	LT-4	9/8/2020		organic									x														do not pre-weight
5	LT-5	9/10/2020		organic									x														do not pre-weight
6	LT-6	9/10/2020		organic									x														do not pre-weight
7	LT-7	9/10/2020		organic									x														do not pre-weight
8	LT-8	9/10/2020		organic									x														do not pre-weight
9	LT-9	9/10/2020		organic									x														do not pre-weight
10	LT-10	9/11/2020		organic									x														do not pre-weight

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St. John's Nl x PC:	PC:	Site Location:	DATE REQUIRED:
Phone: (709)576-1458	Phone:	Site Province:	
Email: barry.wicks@stantec.com	Email:	Site #:	
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		-13, -13, -15	

COOLING MEDIA PRESENT Y / N

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS

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	SAMPLE IDENTIFICATION	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED	FIELD FILTERED &PRESERVED	LAB FILTRATION REQUIRED	RCAP-MS [Total Metals] Well / Surface water	RCAP-MS [Dissolved Metals] Ground waters	Metals (Water): Total Digest (Default Method) for well water & surface water	Metals (Water): Dissolved for ground water	Metals (Water): Mercury (CIRCLE) TOTAL / DISSOLVED	Metals (soil): Metals & Mercury Default Acid Extractable (Available) Digest	Metals (soil): Hot Water Soluble Boron (required for CCME Agricultural/ Landfill)	RBCA Hydrocarbons (BTEX, C6-C32)	CCME Hydrocarbons (CWS-PHC F1/BTEX, F2-F4)	PAHs (Default for water/soil)	PAHs (FWAL /CCME Sediment)	PCBs - Select One: Default or CCME Sediment	VOCs	Total Coliform/E.coli (Presence/Absence)	Total Coliform/E.coli (Count)				HOLD- DO NOT ANALYZE	Regulatory Requirements (Specify) / COMMENTS
1	Lt_dup			organic									x													do not pre-weight
2	BB-1	11/7/2020		organic									x													do not pre-weight
3	BB-2	11/8/2020		organic									x													do not pre-weight
4	BB-3	9/8/2020		organic									x													do not pre-weight
5	BB-4	9/8/2020		organic									x													do not pre-weight
6	BB-5	9/8/2020		organic									x													do not pre-weight
7	BB-6	9/8/2020		organic									x													do not pre-weight
8	BB-7	9/8/2020		organic									x													do not pre-weight
9	BB-8	9/8/2020		organic									x													do not pre-weight
10	BB-9	9/8/2020											x													do not pre-weight

RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	BV LABS JOB #
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1	BB-10	9/8/2020		organic									x														do not pre-weight
2	BB-dup			organic									x														do not pre-weight
3																											
4																											
5																											
6																											
7																											
8																											
9																											
10																											

RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY:(Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	BV LABS JOB #
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APPENDIX IR-50.A
IR-50 TABLES

Table IR-50.1 Summary of Avifauna Surveys

Rationale / Objectives and Study Area	Methods	Results
Attachment 7-B - 2011 Forest Songbird Surveys (2014)		
Rationale / Objectives The study's main objective was to document breeding songbird species present within the Marathon Mineral Claim Area and provide insight regarding forest songbird populations in the areas surveyed. **Study Area** Transects were selected in areas of current and future exploration within the Marathon Mineral Claim Area (Figure IR50.1): Leprechaun Pond, Valentine Lake East and Frozen Ear Pond.	A series of ten-minute songbird point count surveys were conducted between June 14 and 18, 2011 at locations spaced ~300 m apart. Four transects were completed over five mornings. The ornithologist stood in a fixed location for ten minutes and tallied bird species observed or heard. Surveys commenced at dawn (~0515 h) and no point counts were initiated after 0900 h. Vegetation data was recorded and photographs of habitat were taken at each point count.	Forty-five point counts were conducted. A total of 38 species were identified. The most common species recorded were: white-throated sparrow, ruby-crowned kinglet, Swainson's thrush and yellow-bellied flycatcher. Two federally and provincially listed (threatened) species were detected: olive-sided flycatcher (COSEWIC 2009) and common nighthawk (COSEWIC 2007; SSAC 2007).
Attachment 7-C - 2011 Baseline Waterfowl and Waterfowl Habitat Study (2014)		
Rationale / Objectives The objective was to survey waterfowl use of the Project Area, and identify the types of habitat (i.e., wetlands) within the area of the proposed Project. **Study Area** The study area is within the Marathon Mineral Claim Area (Figure IR50.1). The Victoria Steadies Sensitive Wildlife Area (SWA) overlaps the study area. The study focussed on the Valentine Lake East Site, the Frozen Ear Pond site and the Leprechaun Pond Site, but only the latter location encompassed waterbodies of sufficient size to support waterfowl.	**Waterfowl Breeding Pair Survey**: Aerial helicopter surveys were conducted on May 16, 2011. The flight path was oriented according to the presence of waterbodies. Waterfowl observations were recorded, including social status classification (i.e., lone male, lone female, breeding pair, flocked males and number, flocked females and number, mixed flocks and actual number by sex). Waterfowl were described in terms of 'indicated pairs' (Dzubin 1969) to distinguish individuals that would likely breed in a given area. **Waterfowl Brood Survey:** This survey occurred on July 7, 2011, approximately seven weeks after the breeding pair survey. It focused on locations around Valentine Lake where breeding pairs were observed in May and examined a 50 km stretch of the Victoria River extending northeast and downstream, following similar protocols as for the breeding pair survey. Observations of waterfowl broods were aged following standards outlined in Gollop and Marshall (1954).	**Waterfowl Breeding Pair Survey**: The following species were observed: common loon, Canada goose and five duck species, including ring-necked duck, American black duck, red-breasted merganser, common goldeneye, and common merganser. Waterfowl were only observed at the Leprechaun Pond Site and in the vicinity of the Frozen Ear Pond Site. No sightings occurred at the Valentine Lake East Site. **Waterfowl Brood Survey**: Seventy-six observations of seven waterfowl species (and three unidentified species) occurred, including broods and evidence of adult moulting activity. Most of the observations occurred along Victoria River. Broods were common and the age of young ranged from approximately one to six weeks. The same species of waterfowl observed during the breeding pair surveys were also observed in the July brood survey. Waterfowl were only observed at the Leprechaun Pond Site and in the vicinity of the Frozen Ear Pond Site. No sightings occurred at the Valentine Lake East Site. **Wetlands Characterization**: The majority of the wetland classes encountered were bogs and fens, with shallow water wetlands

Table IR-50.1 Summary of Avifauna Surveys

Rationale / Objectives and Study Area	Methods	Results
	Wetlands Characterization: Wetlands were opportunistically evaluated during waterfowl surveys in May 2011. Wetlands and wetland/waterfowl habitats were classified according to the Canadian Wetland Classification System (Warner and Rubec 1997)**,** identifying three levels of wetland features – class, form, and type.	observed in association with lakes and large rivers in the region. Peatlands were further divided into three bog forms (i.e., domed bog, slope bog and basin bog) and two fen forms (i.e., slope fen and ribbed fen).
Attachment 7-E - Waterfowl (2017)		
Rationale / Objectives The study had two objectives: 1. To describe wetland productivity in terms of waterfowl species richness and species counts in the study area during spring breeding and fall staging, as well as describing the breeding social structure in the spring breeding survey 2. To assess waterfowl use of wetland habitat by calculating the relative abundance of waterfowl using densities and habitat selection during spring breeding and fall staging surveys **Study Area** The waterfowl study area was defined during 2011 baseline surveys and includes the Project footprint, the Sensitive Wildlife Area, and wetland habitats within the Mineral Claim Area (Figure IR50.1).	**Surveys**: Spring breeding surveys occurred on June 6, 2017 and fall staging surveys were completed on September 27, 2017. Transects and protocols were repeated from baseline surveys conducted in 2011. **Productivity:** Guilds of waterfowl (ducks) and waterbirds (geese and shorebirds) that use wetlands were included to assess the productivity of wetlands in the waterfowl study. A guild of raptors was also included due to observations during surveys and known predatory behaviour on waterfowl (Buehler 2000, Smith et al. 2011). **Habitat Use**: The relative abundance of the guilds (described above) was determined based on the density of species in wetland habitats along transects within the waterfowl study area.	**Productivity**: Waterfowl productivity was the highest during the spring breeding survey in 2017 for both species richness and counts. The highest counts were amongst the guilds of geese, dabbling ducks, and diving ducks. No species at risk were observed during surveys. **Habitat Use**: Dabbling ducks, diving ducks, and geese had the highest densities in the waterfowl study. Analyses indicated that waterfowl were selecting preferred wetland habitats rather than being distributed randomly across the landscape. Waterfowl productivity and habitat use indicate that the wetland habitats in the waterfowl study area are used by waterfowl during spring breeding and fall staging.

Table IR-50.1 Summary of Avifauna Surveys

Rationale / Objectives and Study Area	Methods	Results
Attachment 7-H - Forest Songbird Survey (2019)		
Rationale / Objectives Objectives were to: 1. Establish the avifauna diversity and develop a list of bird species for the Mineral Claim Area (Figure IR50.1) 2. Determine whether provincially rare species of birds, as determined by the AC CDC, are present in the Project Area 3. Provide information on the location (spatial distribution), population size, and habitat of rare bird taxa occurring within the Project Area 4. Provide information to Marathon for consideration in Project planning **Study Area** The Study Area is within the Mineral Claim Area (Figure IR50.1). The field sampling plan was created by overlaying the current Project footprint with previously surveyed areas to identify spatial gaps in surveyed areas.	**Songbird surveys:** Surveys were conducted June 26-28, 2019. Songbird survey sites were visited once during the field program, and observers conducted a 10-minute morning point count at each site, following a protocol based on a modified fixed-radius point count sampling procedure (Bibby et al. 2000). Bird species detected during the point count surveys were recorded. Surveys began near dawn and continued until ~10:00 am each survey morning. **Common Night Hawk Survey:** Survey was conducted on June 28, 2019. Eight survey stations were established along roads through the Project Area near areas with potential to provide nesting or foraging habitat. The survey was conducted starting ~60 minutes before sunset and continued until up to two hours after sunset. Survey followed a 6-minute passive point count sampling procedure (Canadian Nightjar Survey Protocol 2018).	**Songbird surveys:** Fifty-two point counts were completed in various habitat types including forested and wetland habitats. Forty-nine species, including two incidental observations of common tern and tree swallow, were identified during the point counts. Excluding incidental observations, the most abundant species observed across the point counts was white-throated sparrow (59 individuals), yellow-bellied flycatcher (52 individuals), and ruby-crowned kinglet (35 individuals). **Common Night Hawk Survey** No common nighthawks were observed or heard during the field surveys. One SAR, olive-sided flycatcher was recorded in the Project Area. A second SAR, rusty blackbird was recorded outside the Project Area but in the LAA. An additional two SOCC, Nashville warbler and bay-breasted warbler, were also encountered in the Project Area.

Table IR-50.2 Location of Detailed Survey Results and Maps

Survey	Detailed Survey Results		Map Location
2011 Forest Songbird Surveys	Table IR50.3	2011 Songbird Survey Results	Figure IR50.2
2011 Baseline Waterfowl and Waterfowl Habitat Survey	Table IR50.4	2011 Spring Breeding Waterfowl Results	Figure IR50.2
	Table IR50.5	2011 Brood Survey Results	Figure IR50.2
2017 Waterfowl Survey	Table IR50.6	2017 Spring Breeding Waterfowl Survey Results	Figure IR50.2
	Table IR50.7	2017 Fall Staging Waterfowl Survey Results	
2019 Avifauna Baseline Survey	EIS Attachment 7-H - Forest Songbird Survey (2019) Appendix B, Table B.4		Figure IR50.2

Table IR-50.3 2011 Songbird Survey Results

Date	Waypoint ID	Start Time	End Time	% Cloud Cover	Temp (°C)	Precipitation	Wind direction	Wind speed (Beaufort scale)	Habitat	Forest Cover	% Cover	Shrub layer	Ground veg	Species	first 5 minutes			second 5 minutes		
															<50m	50-100m	>100m	<50m	50-100m	>100m
14-Jun-11	335	528	538	100	10	lite drizzle; fog	south	0-1	barren hilltop	larch	-	larch, black spruce, rhodora, balsam fir	Cladina lichen, crowberry, rock	Olive-sided Flycatcher						1
14-Jun-11	335	528	538	100	10	lite drizzle; fog	south	0-1	barren hilltop	larch	-	larch, black spruce, rhodora, balsam fir	Cladina lichen, crowberry, rock	Yellow-rumped Warbler	1					
14-Jun-11	335	528	538	100	10	lite drizzle; fog	south	0-1	barren hilltop	larch	-	larch, black spruce, rhodora, balsam fir	Cladina lichen, crowberry, rock	Black-throated Green Warbler					1	
14-Jun-11	335	528	538	100	10	lite drizzle; fog	south	0-1	barren hilltop	larch	-	larch, black spruce, rhodora, balsam fir	Cladina lichen, crowberry, rock	Blackpoll Warbler	1			1		
14-Jun-11	335	528	538	100	10	lite drizzle; fog	south	0-1	barren hilltop	larch	-	larch, black spruce, rhodora, balsam fir	Cladina lichen, crowberry, rock	Lincoln's Sparrow	1	1			1	1
14-Jun-11	335	528	538	100	10	lite drizzle; fog	south	0-1	barren hilltop	larch	-	larch, black spruce, rhodora, balsam fir	Cladina lichen, crowberry, rock	White-throated Sparrow		2			2	
14-Jun-11	335	528	538	100	10	lite drizzle; fog	south	0-1	barren hilltop	larch	-	larch, black spruce, rhodora, balsam fir	Cladina lichen, crowberry, rock	Dark-eyed Junco	1			1	1	
14-Jun-11	335	528	538	100	10	lite drizzle; fog	south	0-1	barren hilltop	larch	-	larch, black spruce, rhodora, balsam fir	Cladina lichen, crowberry, rock	Common Yellowthroat			1			2
14-Jun-11	336	550	600	100	10	0	0	0	Black Spruce scrub	black spruce, white birch	-	black spruce, rhodora	bottle brush,grasses, sedges, sphagnum moss	Yellow-bellied Flycatcher		1			1	
14-Jun-11	336	550	600	100	10	0	0	0	Black Spruce scrub	black spruce, white birch	-	black spruce, rhodora	bottle brush,grasses, sedges, sphagnum moss	Ruby-crowned Kinglet		1		1		1
14-Jun-11	336	550	600	100	10	0	0	0	Black Spruce scrub	black spruce, white birch	-	black spruce, rhodora	bottle brush,grasses, sedges, sphagnum moss	Swainson's Thrush		1			1	
14-Jun-11	336	550	600	100	10	0	0	0	Black Spruce scrub	black spruce, white birch	-	black spruce, rhodora	bottle brush,grasses, sedges, sphagnum moss	White-throated Sparrow		1	1		1	2
14-Jun-11	336	550	600	100	10	0	0	0	Black Spruce scrub	black spruce, white birch	-	black spruce, rhodora	bottle brush,grasses, sedges, sphagnum moss	Dark-eyed Junco						1
14-Jun-11	337	615	625	100	10	0	0	0	fen	larch	-	black spruce, honeysuckle	grasses, sedges	Ruby-crowned Kinglet						1
14-Jun-11	337	615	625	100	10	0	0	0	fen	larch	-	black spruce, honeysuckle	grasses, sedges	Yellow-rumped Warbler					1	
14-Jun-11	337	615	625	100	10	0	0	0	fen	larch	-	black spruce, honeysuckle	grasses, sedges	Blackpoll Warbler		1				
14-Jun-11	337	615	625	100	10	0	0	0	fen	larch	-	black spruce, honeysuckle	grasses, sedges	Lincoln's Sparrow						1
14-Jun-11	337	615	625	100	10	0	0	0	fen	larch	-	black spruce, honeysuckle	grasses, sedges	Swamp Sparrow		1			1	
14-Jun-11	337	615	625	100	10	0	0	0	fen	larch	-	black spruce, honeysuckle	grasses, sedges	White-throated Sparrow	1	2		1		3
14-Jun-11	337	615	625	100	10	0	0	0	fen	larch	-	black spruce, honeysuckle	grasses, sedges	Common Yellowthroat	1			1		
14-Jun-11	338	641	651	100	10	fog	0	0	bog/fen	0	0	larch, black spruce, Betula sp.	grasses, sedges, sphagnum moss, bog rosemary, pale bog laurel	Yellow-bellied Flycatcher		1			1	
14-Jun-11	338	641	651	100	10	fog	0	0	bog/fen	0	0	larch, black spruce, Betula sp.	grasses, sedges, sphagnum moss, bog rosemary, pale bog laurel	Gray Jay				1		
14-Jun-11	338	641	651	100	10	fog	0	0	bog/fen	0	0	larch, black spruce, Betula sp.	grasses, sedges, sphagnum moss, bog rosemary, pale bog laurel	Ruby-crowned Kinglet		1			1	
14-Jun-11	338	641	651	100	10	fog	0	0	bog/fen	0	0	larch, black spruce, Betula sp.	grasses, sedges, sphagnum moss, bog rosemary, pale bog laurel	Blackpoll Warbler		1			1	
14-Jun-11	338	641	651	100	10	fog	0	0	bog/fen	0	0	larch, black spruce, Betula sp.	grasses, sedges, sphagnum moss, bog rosemary, pale bog laurel	Lincoln's Sparrow	1					
14-Jun-11	338	641	651	100	10	fog	0	0	bog/fen	0	0	larch, black spruce, Betula sp.	grasses, sedges, sphagnum moss, bog rosemary, pale bog laurel	White-throated Sparrow		1	1		1	1
14-Jun-11	338	641	651	100	10	fog	0	0	bog/fen	0	0	larch, black spruce, Betula sp.	grasses, sedges, sphagnum moss, bog rosemary, pale bog laurel	Dark-eyed Junco	1			1		
14-Jun-11	338	641	651	100	10	fog	0	0	bog/fen	0	0	larch, black spruce, Betula sp.	grasses, sedges, sphagnum moss, bog rosemary, pale bog laurel	Merlin					1	
14-Jun-11	339	700	710	100	11	0	0	0	bog	larch, black spruce	-	black spruce, sheep laurel	bottlebrush, sphagnum moss, grasses, sedges	Common Loon			1			
14-Jun-11	339	700	710	100	11	0	0	0	bog	larch, black spruce	-	black spruce, sheep laurel	bottlebrush, sphagnum moss, grasses, sedges	Greater Yellowlegs	1					
14-Jun-11	339	700	710	100	11	0	0	0	bog	larch, black spruce	-	black spruce, sheep laurel	bottlebrush, sphagnum moss, grasses, sedges	Yellow-bellied Flycatcher					1	
14-Jun-11	339	700	710	100	11	0	0	0	bog	larch, black spruce	-	black spruce, sheep laurel	bottlebrush, sphagnum moss, grasses, sedges	Ruby-crowned Kinglet		1				1
14-Jun-11	339	700	710	100	11	0	0	0	bog	larch, black spruce	-	black spruce, sheep laurel	bottlebrush, sphagnum moss, grasses, sedges	Swainson's Thrush						1
14-Jun-11	339	700	710	100	11	0	0	0	bog	larch, black spruce	-	black spruce, sheep laurel	bottlebrush, sphagnum moss, grasses, sedges	Hermit Thrush						1
14-Jun-11	339	700	710	100	11	0	0	0	bog	larch, black spruce	-	black spruce, sheep laurel	bottlebrush, sphagnum moss, grasses, sedges	Lincoln's Sparrow					1	
14-Jun-11	339	700	710	100	11	0	0	0	bog	larch, black spruce	-	black spruce, sheep laurel	bottlebrush, sphagnum moss, grasses, sedges	White-throated Sparrow	1	2			2	
14-Jun-11	339	700	710	100	11	0	0	0	bog	larch, black spruce	-	black spruce, sheep laurel	bottlebrush, sphagnum moss, grasses, sedges	Dark-eyed Junco		1			1	
14-Jun-11	339	700	710	100	11	0	0	0	bog	larch, black spruce	-	black spruce, sheep laurel	bottlebrush, sphagnum moss, grasses, sedges	Common Yellowthroat						
14-Jun-11	340	720	730	100	12	0	0	0	mature forest	black spruce, balsam fir, white birch	80	black spruce	NA	Yellow-bellied Flycatcher						
14-Jun-11	340	720	730	100	12	0	0	0	mature forest	black spruce, balsam fir, white birch	80	black spruce	NA	Ruby-crowned Kinglet						
14-Jun-11	340	720	730	100	12	0	0	0	mature forest	black spruce, balsam fir, white birch	80	black spruce	NA	Swainson's Thrush						
14-Jun-11	340	720	730	100	12	0	0	0	mature forest	black spruce, balsam fir, white birch	80	black spruce	NA	Hermit Thrush						
14-Jun-11	340	720	730	100	12	0	0	0	mature forest	black spruce, balsam fir, white birch	80	black spruce	NA	Yellow-rumped Warbler						
14-Jun-11	340	720	730	100	12	0	0	0	mature forest	black spruce, balsam fir, white birch	80	black spruce	NA	Black and white Warbler						
14-Jun-11	340	720	730	100	12	0	0	0	mature forest	black spruce, balsam fir, white birch	80	black spruce	NA	White-throated Sparrow						
14-Jun-11	341	742	752	100	13	0	0	0	black spruce scrub	black spruce, larch	-	rhodora, sheep laurel	Cladina lichen, bunchberry, rock	Hermit Thrush		1			1	
14-Jun-11	341	742	752	100	13	0	0	0	black spruce scrub	black spruce, larch	-	rhodora, sheep laurel	Cladina lichen, bunchberry, rock	Yellow-rumped Warbler	2			1		

Table IR-50.3 2011 Songbird Survey Results

Date	Waypoint ID	Start Time	End Time	% Cloud Cover	Temp (°C)	Precipitation	Wind direction	Wind speed (Beaufort scale)	Habitat	Forest Cover	% Cover	Shrub layer	Ground veg	Species	first 5 minutes			second 5 minutes		
															<50m	50-100m	>100m	<50m	50-100m	>100m
14-Jun-11	341	742	752	100	13	0	0	0	black spruce scrub	black spruce, larch	-	rhodora, sheep laurel	Cladina lichen, bunchberry, rock	Blackpoll Warbler	1			1		
14-Jun-11	341	742	752	100	13	0	0	0	black spruce scrub	black spruce, larch	-	rhodora, sheep laurel	Cladina lichen, bunchberry, rock	Lincoln's Sparrow	1			1		
14-Jun-11	341	742	752	100	13	0	0	0	black spruce scrub	black spruce, larch	-	rhodora, sheep laurel	Cladina lichen, bunchberry, rock	White-throated Sparrow		1	2		1	2
14-Jun-11	341	742	752	100	13	0	0	0	black spruce scrub	black spruce, larch	-	rhodora, sheep laurel	Cladina lichen, bunchberry, rock	Common Yellowthroat	1					
14-Jun-11	341	742	752	100	13	0	0	0	black spruce scrub	black spruce, larch	-	rhodora, sheep laurel	Cladina lichen, bunchberry, rock	Pine Siskin		4				
14-Jun-11	341	742	752	100	13	0	0	0	black spruce scrub	black spruce, larch	-	rhodora, sheep laurel	Cladina lichen, bunchberry, rock	American Goldfinch		4				
14-Jun-11	342	805	815	75	14	0	0	0	bog	0	0	larch, black spruce, labrador tea	grasses, sedges, bottlebrush	Greater Yellowlegs		1				
14-Jun-11	342	805	815	75	14	0	0	0	bog	0	0	larch, black spruce, labrador tea	grasses, sedges, bottlebrush	Hermit Thrush	1					
14-Jun-11	342	805	815	75	14	0	0	0	bog	0	0	larch, black spruce, labrador tea	grasses, sedges, bottlebrush	Yellow-rumped Warbler		1			1	
14-Jun-11	342	805	815	75	14	0	0	0	bog	0	0	larch, black spruce, labrador tea	grasses, sedges, bottlebrush	Black and white Warbler	1					
14-Jun-11	342	805	815	75	14	0	0	0	bog	0	0	larch, black spruce, labrador tea	grasses, sedges, bottlebrush	Lincoln's Sparrow	1			1		
14-Jun-11	342	805	815	75	14	0	0	0	bog	0	0	larch, black spruce, labrador tea	grasses, sedges, bottlebrush	White-throated Sparrow	1			1	2	
14-Jun-11	342	805	815	75	14	0	0	0	bog	0	0	larch, black spruce, labrador tea	grasses, sedges, bottlebrush	Dark-eyed Junco					1	
14-Jun-11	342	805	815	75	14	0	0	0	bog	0	0	larch, black spruce, labrador tea	grasses, sedges, bottlebrush	Wilson's Snipe	1					
14-Jun-11	342	805	815	75	14	0	0	0	bog	0	0	larch, black spruce, labrador tea	grasses, sedges, bottlebrush	Common Yellowthroat	1					
14-Jun-11	343	830	840	70	14	0	0	0	mature forest	balsam fir, black spruce, larch	60	balsam fir, black spruce, larch	bunchberry, crowberry	Magnolia Warbler	1			1		
14-Jun-11	343	830	840	70	14	0	0	0	mature forest	balsam fir, black spruce, larch	60	balsam fir, black spruce, larch	bunchberry, crowberry	Lincoln's Sparrow		1				
14-Jun-11	343	830	840	70	14	0	0	0	mature forest	balsam fir, black spruce, larch	60	balsam fir, black spruce, larch	bunchberry, crowberry	White-throated Sparrow			1		2	2
14-Jun-11	343	830	840	70	14	0	0	0	mature forest	balsam fir, black spruce, larch	60	balsam fir, black spruce, larch	bunchberry, crowberry	Common Yellowthroat		1			1	
14-Jun-11	344	850	900	45	15	0	0	0	forest (not mature)	balsam fir, black spruce	-	balsam fir, black spruce	feather moss, bunchberry	Yellow-bellied Flycatcher	1			1		
14-Jun-11	344	850	900	45	15	0	0	0	forest (not mature)	balsam fir, black spruce	-	balsam fir, black spruce	feather moss, bunchberry	Ruby-crowned Kinglet	1			2		
14-Jun-11	344	850	900	45	15	0	0	0	forest (not mature)	balsam fir, black spruce	-	balsam fir, black spruce	feather moss, bunchberry	Swainson's Thrush		1			1	
14-Jun-11	344	850	900	45	15	0	0	0	forest (not mature)	balsam fir, black spruce	-	balsam fir, black spruce	feather moss, bunchberry	Yellow-rumped Warbler	1			1		
14-Jun-11	344	850	900	45	15	0	0	0	forest (not mature)	balsam fir, black spruce	-	balsam fir, black spruce	feather moss, bunchberry	Northern Waterthrush	2				1	
14-Jun-11	344	850	900	45	15	0	0	0	forest (not mature)	balsam fir, black spruce	-	balsam fir, black spruce	feather moss, bunchberry	Swainson's Thrush					1	
14-Jun-11	344	850	900	45	15	0	0	0	forest (not mature)	balsam fir, black spruce	-	balsam fir, black spruce	feather moss, bunchberry	Wilson's Snipe		1				
15-Jun-11	345	527	537	100	8	0	0	0	riparian	balsam fir	-	sweet gale, leatherleaf	violets, grasses, sedges	Greater Yellowlegs			1			
15-Jun-11	345	527	537	100	8	0	0	0	riparian	balsam fir	-	sweet gale, leatherleaf	violets, grasses, sedges	Yellow-rumped Warbler	2					
15-Jun-11	345	527	537	100	8	0	0	0	riparian	balsam fir	-	sweet gale, leatherleaf	violets, grasses, sedges	White-throated Sparrow		2	1		3	1
15-Jun-11	345	527	537	100	8	0	0	0	riparian	balsam fir	-	sweet gale, leatherleaf	violets, grasses, sedges	Dark-eyed Junco				1		
15-Jun-11	345	527	537	100	8	0	0	0	riparian	balsam fir	-	sweet gale, leatherleaf	violets, grasses, sedges	Common Yellowthroat		1			1	
15-Jun-11	346	545	555	100	8	0	0	0	riparian	black spruce, alder	-	black spruce, alder	violets, bunchberry red raspberry	Greater Yellowlegs		1				
15-Jun-11	346	545	555	100	8	0	0	0	riparian	black spruce, alder	-	black spruce, alder	violets, bunchberry red raspberry	Boreal Chickadee					1	
15-Jun-11	346	545	555	100	8	0	0	0	riparian	black spruce, alder	-	black spruce, alder	violets, bunchberry red raspberry	Swainson's Thrush					1	
15-Jun-11	346	545	555	100	8	0	0	0	riparian	black spruce, alder	-	black spruce, alder	violets, bunchberry red raspberry	Blackpoll Warbler	1			1		
15-Jun-11	346	545	555	100	8	0	0	0	riparian	black spruce, alder	-	black spruce, alder	violets, bunchberry red raspberry	Lincoln's Sparrow		1				
15-Jun-11	346	545	555	100	8	0	0	0	riparian	black spruce, alder	-	black spruce, alder	violets, bunchberry red raspberry	White-throated Sparrow	1	3		1	3	
15-Jun-11	346	545	555	100	8	0	0	0	riparian	black spruce, alder	-	black spruce, alder	violets, bunchberry red raspberry	Common Yellowthroat	1			1		
15-Jun-11	347	609	619	100	8	0	NE	1	barren hill	0	0	balsam fir, black spruce tuckamore (patchy), sheep laurel, leatherleaf	lichen	Greater Yellowlegs						1
15-Jun-11	347	609	619	100	8	0	NE	1	barren hill	0	0	balsam fir, black spruce tuckamore (patchy), sheep laurel, leatherleaf	lichen	Boreal Chickadee				1		
15-Jun-11	347	609	619	100	8	0	NE	1	barren hill	0	0	balsam fir, black spruce tuckamore (patchy), sheep laurel, leatherleaf	lichen	Ruby-crowned Kinglet			1		1	
15-Jun-11	347	609	619	100	8	0	NE	1	barren hill	0	0	balsam fir, black spruce tuckamore (patchy), sheep laurel, leatherleaf	lichen	Swainson's Thrush						1
15-Jun-11	347	609	619	100	8	0	NE	1	barren hill	0	0	balsam fir, black spruce tuckamore (patchy), sheep laurel, leatherleaf	lichen	Northern Waterthrush					1	
15-Jun-11	347	609	619	100	8	0	NE	1	barren hill	0	0	balsam fir, black spruce tuckamore (patchy), sheep laurel, leatherleaf	lichen	Swamp Sparrow			1			
15-Jun-11	347	609	619	100	8	0	NE	1	barren hill	0	0	balsam fir, black spruce tuckamore (patchy), sheep laurel, leatherleaf	lichen	White-throated Sparrow		2			3	
15-Jun-11	347	609	619	100	8	0	NE	1	barren hill	0	0	balsam fir, black spruce tuckamore (patchy), sheep laurel, leatherleaf	lichen	Dark-eyed Junco		1				
15-Jun-11	347	609	619	100	8	0	NE	1	barren hill	0	0	balsam fir, black spruce tuckamore (patchy), sheep laurel, leatherleaf	lichen	Common Yellowthroat		2			2	

Table IR-50.3 2011 Songbird Survey Results

Date	Waypoint ID	Start Time	End Time	% Cloud Cover	Temp (°C)	Precipitation	Wind direction	Wind speed (Beaufort scale)	Habitat	Forest Cover	% Cover	Shrub layer	Ground veg	Species	first 5 minutes			second 5 minutes		
															<50m	50-100m	>100m	<50m	50-100m	>100m
15-Jun-11	348	633	643	100	8	0	NE	1 to 2	barren hill	black spruce	-	larch, black spruce, balsam fir	crowberry, lichen	Greater Yellowlegs						1
15-Jun-11	348	633	643	100	8	0	NE	1 to 2	barren hill	black spruce	-	larch, black spruce, balsam fir	crowberry, lichen	Yellow-bellied Flycatcher					1	
15-Jun-11	348	633	643	100	8	0	NE	1 to 2	barren hill	black spruce	-	larch, black spruce, balsam fir	crowberry, lichen	Ruby-crowned Kinglet		1				
15-Jun-11	348	633	643	100	8	0	NE	1 to 2	barren hill	black spruce	-	larch, black spruce, balsam fir	crowberry, lichen	Hermit Thrush			1			1
15-Jun-11	348	633	643	100	8	0	NE	1 to 2	barren hill	black spruce	-	larch, black spruce, balsam fir	crowberry, lichen	Yellow-rumped Warbler					1	
15-Jun-11	348	633	643	100	8	0	NE	1 to 2	barren hill	black spruce	-	larch, black spruce, balsam fir	crowberry, lichen	Lincoln's Sparrow		1			1	
15-Jun-11	348	633	643	100	8	0	NE	1 to 2	barren hill	black spruce	-	larch, black spruce, balsam fir	crowberry, lichen	White-throated Sparrow		2	2		2	2
15-Jun-11	348	633	643	100	8	0	NE	1 to 2	barren hill	black spruce	-	larch, black spruce, balsam fir	crowberry, lichen	Dark-eyed Junco		1		1		
15-Jun-11	349	655	705	100	9	0	NE	1	barren hill	0	0	rhodora, larch, sheep laurel, black spruce	crowberry, lichen	Common Loon	4					
15-Jun-11	349	655	705	100	9	0	NE	1	barren hill	0	0	rhodora, larch, sheep laurel, black spruce	crowberry, lichen	Boreal Chickadee					1	
15-Jun-11	349	655	705	100	9	0	NE	1	barren hill	0	0	rhodora, larch, sheep laurel, black spruce	crowberry, lichen	Ruby-crowned Kinglet					1	
15-Jun-11	349	655	705	100	9	0	NE	1	barren hill	0	0	rhodora, larch, sheep laurel, black spruce	crowberry, lichen	Hermit Thrush		2			2	
15-Jun-11	349	655	705	100	9	0	NE	1	barren hill	0	0	rhodora, larch, sheep laurel, black spruce	crowberry, lichen	American Robin		1				
15-Jun-11	349	655	705	100	9	0	NE	1	barren hill	0	0	rhodora, larch, sheep laurel, black spruce	crowberry, lichen	Swamp Sparrow		1				
15-Jun-11	349	655	705	100	9	0	NE	1	barren hill	0	0	rhodora, larch, sheep laurel, black spruce	crowberry, lichen	White-throated Sparrow		1	1	1		
15-Jun-11	349	655	705	100	9	0	NE	1	barren hill	0	0	rhodora, larch, sheep laurel, black spruce	crowberry, lichen	Dark-eyed Junco		1			1	
15-Jun-11	349	655	705	100	9	0	NE	1	barren hill	0	0	rhodora, larch, sheep laurel, black spruce	crowberry, lichen	Pine Siskin		1				
15-Jun-11	350	714	724	100	9	0	0	0	mature forest	balsam fir, black spruce white birch	70	balsam fir, black spruce	stairstep moss, bunchberry, wild lily-of-the-valley	Yellow-bellied Flycatcher	1			1		
15-Jun-11	350	714	724	100	9	0	0	0	mature forest	balsam fir, black spruce white birch	70	balsam fir, black spruce	stairstep moss, bunchberry, wild lily-of-the-valley	Olive-sided Flycatcher		1				
15-Jun-11	350	714	724	100	9	0	0	0	mature forest	balsam fir, black spruce white birch	70	balsam fir, black spruce	stairstep moss, bunchberry, wild lily-of-the-valley	Hermit Thrush		1			1	
15-Jun-11	350	714	724	100	9	0	0	0	mature forest	balsam fir, black spruce white birch	70	balsam fir, black spruce	stairstep moss, bunchberry, wild lily-of-the-valley	Yellow-rumped Warbler				1		
15-Jun-11	350	714	724	100	9	0	0	0	mature forest	balsam fir, black spruce white birch	70	balsam fir, black spruce	stairstep moss, bunchberry, wild lily-of-the-valley	White-throated Sparrow		1	1	1	1	
15-Jun-11	350	714	724	100	9	0	0	0	mature forest	balsam fir, black spruce white birch	70	balsam fir, black spruce	stairstep moss, bunchberry, wild lily-of-the-valley	Northern Flicker		1			1	1
15-Jun-11	350	714	724	100	9	0	0	0	mature forest	balsam fir, black spruce white birch	70	balsam fir, black spruce	stairstep moss, bunchberry, wild lily-of-the-valley	unknown woodpecker tapping				1		
15 June 20122	351	734	744	100	8	0	0	0	black spruce scrub	black spruce, larch	-	black spruce, sheep laurel, rhodora, blueberry	NA	Yellow-bellied Flycatcher	2			1		
15 June 20122	351	734	744	100	8	0	0	0	black spruce scrub	black spruce, larch	-	black spruce, sheep laurel, rhodora, blueberry	NA	Olive-sided Flycatcher					1	
15 June 20122	351	734	744	100	8	0	0	0	black spruce scrub	black spruce, larch	-	black spruce, sheep laurel, rhodora, blueberry	NA	Ruby-crowned Kinglet		1			1	
15 June 20122	351	734	744	100	8	0	0	0	black spruce scrub	black spruce, larch	-	black spruce, sheep laurel, rhodora, blueberry	NA	Hermit Thrush		1			1	
15 June 20122	351	734	744	100	8	0	0	0	black spruce scrub	black spruce, larch	-	black spruce, sheep laurel, rhodora, blueberry	NA	Magnolia Warbler		1				
15 June 20122	351	734	744	100	8	0	0	0	black spruce scrub	black spruce, larch	-	black spruce, sheep laurel, rhodora, blueberry	NA	Yellow-rumped Warbler	1			1		
15 June 20122	351	734	744	100	8	0	0	0	black spruce scrub	black spruce, larch	-	black spruce, sheep laurel, rhodora, blueberry	NA	Palm Warbler	1			1		
15 June 20122	351	734	744	100	8	0	0	0	black spruce scrub	black spruce, larch	-	black spruce, sheep laurel, rhodora, blueberry	NA	White-throated Sparrow		2	1		2	1
15 June 20122	352	754	804	100	9	0	0	0	mature forest	black spruce, balsam fir, white birch	-	black spruce, balsam fir	bunchberry, red raspberry, stairstep moss	Yellow-bellied Flycatcher		1			1	
15 June 20122	352	754	804	100	9	0	0	0	mature forest	black spruce, balsam fir, white birch	-	black spruce, balsam fir	bunchberry, red raspberry, stairstep moss	Olive-sided Flycatcher	1			1		
15 June 20122	352	754	804	100	9	0	0	0	mature forest	black spruce, balsam fir, white birch	-	black spruce, balsam fir	bunchberry, red raspberry, stairstep moss	Ruby-crowned Kinglet	1	1		2		
15 June 20122	352	754	804	100	9	0	0	0	mature forest	black spruce, balsam fir, white birch	-	black spruce, balsam fir	bunchberry, red raspberry, stairstep moss	Hermit Thrush			1		1	
15 June 20122	352	754	804	100	9	0	0	0	mature forest	black spruce, balsam fir, white birch	-	black spruce, balsam fir	bunchberry, red raspberry, stairstep moss	Palm Warbler					1	
15 June 20122	352	754	804	100	9	0	0	0	mature forest	black spruce, balsam fir, white birch	-	black spruce, balsam fir	bunchberry, red raspberry, stairstep moss	White-throated Sparrow		1	1		1	1
15-Jun-11	353	814	824	100	9	0	NE	2	bog	0	0	black spruce, larch	sphagnum moss	Yellow-bellied Flycatcher		1			1	
15-Jun-11	353	814	824	100	9	0	NE	2	bog	0	0	black spruce, larch	sphagnum moss	Hermit Thrush			1		1	

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Date	Waypoint ID	Start Time	End Time	% Cloud Cover	Temp (°C)	Precipitation	Wind direction	Wind speed (Beaufort scale)	Habitat	Forest Cover	% Cover	Shrub layer	Ground veg	Species	first 5 minutes			second 5 minutes		
															<50m	50-100m	>100m	<50m	50-100m	>100m
15-Jun-11	353	814	824	100	9	0	NE	2	bog	0	0	black spruce, larch	sphagnum moss	Blackpoll Warbler					1	
15-Jun-11	353	814	824	100	9	0	NE	2	bog	0	0	black spruce, larch	sphagnum moss	Lincoln's Sparrow	1					
15-Jun-11	353	814	824	100	9	0	NE	2	bog	0	0	black spruce, larch	sphagnum moss	White-throated Sparrow		2			1	
15-Jun-11	353	814	824	100	9	0	NE	2	bog	0	0	black spruce, larch	sphagnum moss	Dark-eyed Junco		1			1	
15-Jun-11	353	814	824	100	9	0	NE	2	bog	0	0	black spruce, larch	sphagnum moss	Common Yellowthroat		1			1	
15-Jun-11	354	832	842	100	9	0	NE	1	scrubby forest, wet	black spruce, larch, white birch	20	black spruce, Labrador tea, rhodora, meadow rue	bottlebrush, grasses, sedges, wild lily-of-the-valley	Yellow-bellied Flycatcher		1			1	
15-Jun-11	354	832	842	100	9	0	NE	1	scrubby forest, wet	black spruce, larch, white birch	20	black spruce, Labrador tea, rhodora, meadow rue	bottlebrush, grasses, sedges, wild lily-of-the-valley	Boreal Chickadee	1					
15-Jun-11	354	832	842	100	9	0	NE	1	scrubby forest, wet	black spruce, larch, white birch	20	black spruce, Labrador tea, rhodora, meadow rue	bottlebrush, grasses, sedges, wild lily-of-the-valley	Ruby-crowned Kinglet	1	1			1	1
15-Jun-11	354	832	842	100	9	0	NE	1	scrubby forest, wet	black spruce, larch, white birch	20	black spruce, Labrador tea, rhodora, meadow rue	bottlebrush, grasses, sedges, wild lily-of-the-valley	Swainson's Thrush			1			1
15-Jun-11	354	832	842	100	9	0	NE	1	scrubby forest, wet	black spruce, larch, white birch	20	black spruce, Labrador tea, rhodora, meadow rue	bottlebrush, grasses, sedges, wild lily-of-the-valley	Northern Waterthrush		1				1
15-Jun-11	354	832	842	100	9	0	NE	1	scrubby forest, wet	black spruce, larch, white birch	20	black spruce, Labrador tea, rhodora, meadow rue	bottlebrush, grasses, sedges, wild lily-of-the-valley	White-throated Sparrow		1	1		1	
15-Jun-11	355	855	905	100	10	0	NE	2	scrubby bog	black spruce, balsam fir	-	black spruce	sphagnum moss, bunchberry, yellow bluebead lily, bottlebrush	Yellow-bellied Flycatcher	1					
15-Jun-11	355	855	905	100	10	0	NE	2	scrubby bog	black spruce, balsam fir	-	black spruce	sphagnum moss, bunchberry, yellow bluebead lily, bottlebrush	Ruby-crowned Kinglet		2		1	1	
15-Jun-11	355	855	905	100	10	0	NE	2	scrubby bog	black spruce, balsam fir	-	black spruce	sphagnum moss, bunchberry, yellow bluebead lily, bottlebrush	Swainson's Thrush		1				
15-Jun-11	355	855	905	100	10	0	NE	2	scrubby bog	black spruce, balsam fir	-	black spruce	sphagnum moss, bunchberry, yellow bluebead lily, bottlebrush	Hermit Thrush	1				1	
15-Jun-11	355	855	905	100	10	0	NE	2	scrubby bog	black spruce, balsam fir	-	black spruce	sphagnum moss, bunchberry, yellow bluebead lily, bottlebrush	Blackpoll Warbler				1		
15-Jun-11	355	855	905	100	10	0	NE	2	scrubby bog	black spruce, balsam fir	-	black spruce	sphagnum moss, bunchberry, yellow bluebead lily, bottlebrush	White-throated Sparrow		1			2	1
15-Jun-11	355	855	905	100	10	0	NE	2	scrubby bog	black spruce, balsam fir	-	black spruce	sphagnum moss, bunchberry, yellow bluebead lily, bottlebrush	Common Yellowthroat				1		
16-Jun-11	359	722	732	100	6	lite rain	N	2 to 3	mature forest	black spruce, larch, white birch	65	black spruce, sheep laurel, blueberry	bunchberry	Yellow-bellied Flycatcher		1			1	
16-Jun-11	359	722	732	100	6	lite rain	N	2 to 3	mature forest	black spruce, larch, white birch	65	black spruce, sheep laurel, blueberry	bunchberry	Swainson's Thrush		1			1	
16-Jun-11	359	722	732	100	6	lite rain	N	2 to 3	mature forest	black spruce, larch, white birch	65	black spruce, sheep laurel, blueberry	bunchberry	Yellow-rumped Warbler	1			1		
16-Jun-11	359	722	732	100	6	lite rain	N	2 to 3	mature forest	black spruce, larch, white birch	65	black spruce, sheep laurel, blueberry	bunchberry	Northern Waterthrush		1			1	
16-Jun-11	359	722	732	100	6	lite rain	N	2 to 3	mature forest	black spruce, larch, white birch	65	black spruce, sheep laurel, blueberry	bunchberry	Fox Sparrow		1				
16-Jun-11	359	722	732	100	6	lite rain	N	2 to 3	mature forest	black spruce, larch, white birch	65	black spruce, sheep laurel, blueberry	bunchberry	White-throated Sparrow		1	1			
16-Jun-11	359	722	732	100	6	lite rain	N	2 to 3	mature forest	black spruce, larch, white birch	65	black spruce, sheep laurel, blueberry	bunchberry	Dark-eyed Junco	1			1		
16-Jun-11	361	741	751	100	6	lite mist	N	2 to 3	mature forest	balsam fir, black spruce, white birch	80	black spruce	feather moss, bunchberry, creeping snowberry	Ruby-crowned Kinglet		1			1	
16-Jun-11	361	741	751	100	6	lite mist	N	2 to 3	mature forest	balsam fir, black spruce, white birch	80	black spruce	feather moss, bunchberry, creeping snowberry	Swainson's Thrush			1			
16-Jun-11	361	741	751	100	6	lite mist	N	2 to 3	mature forest	balsam fir, black spruce, white birch	80	black spruce	feather moss, bunchberry, creeping snowberry	Yellow-rumped Warbler	1					
16-Jun-11	361	741	751	100	6	lite mist	N	2 to 3	mature forest	balsam fir, black spruce, white birch	80	black spruce	feather moss, bunchberry, creeping snowberry	Fox Sparrow		1			1	
16-Jun-11	361	741	751	100	6	lite mist	N	2 to 3	mature forest	balsam fir, black spruce, white birch	80	black spruce	feather moss, bunchberry, creeping snowberry	White-throated Sparrow					1	
16-Jun-11	362	802	812	100	6	drizzle to rain	N	1 to 2	mature forest	black spruce, balsam fir, white birch	65	balck spruce, balsam fir	feathermoss	Ruby-crowned Kinglet		1				
16-Jun-11	362	802	812	100	6	drizzle to rain	N	1 to 2	mature forest	black spruce, balsam fir, white birch	65	balck spruce, balsam fir	feathermoss	Fox Sparrow		1				
17-Jun-11	364	535	545	100	7	fog	0	0	mature forest	balsam fir, black spruce, white birch	65	black spruce, balsam fir	feather moss, bunchberry	Yellow-bellied Flycatcher	2			2		
17-Jun-11	364	535	545	100	7	fog	0	0	mature forest	balsam fir, black spruce, white birch	65	black spruce, balsam fir	feather moss, bunchberry	Swainson's Thrush			1			1
17-Jun-11	364	535	545	100	7	fog	0	0	mature forest	balsam fir, black spruce, white birch	65	black spruce, balsam fir	feather moss, bunchberry	Magnolia Warbler	1			1		
17-Jun-11	364	535	545	100	7	fog	0	0	mature forest	balsam fir, black spruce, white birch	65	black spruce, balsam fir	feather moss, bunchberry	Yellow-rumped Warbler				1		
17-Jun-11	364	535	545	100	7	fog	0	0	mature forest	balsam fir, black spruce, white birch	65	black spruce, balsam fir	feather moss, bunchberry	Black-throated Green Warbler	1					
17-Jun-11	364	535	545	100	7	fog	0	0	mature forest	balsam fir, black spruce, white birch	65	black spruce, balsam fir	feather moss, bunchberry	Northern Waterthrush		1				

Table IR-50.3 2011 Songbird Survey Results

Date	Waypoint ID	Start Time	End Time	% Cloud Cover	Temp (°C)	Precipitation	Wind direction	Wind speed (Beaufort scale)	Habitat	Forest Cover	% Cover	Shrub layer	Ground veg	Species	first 5 minutes			second 5 minutes		
															<50m	50-100m	>100m	<50m	50-100m	>100m
17-Jun-11	364	535	545	100	7	fog	0	0	mature forest	balsam fir, black spruce, white birch	65	black spruce, balsam fir	feather moss, bunchberry	Mourning Warbler					1	
17-Jun-11	364	535	545	100	7	fog	0	0	mature forest	balsam fir, black spruce, white birch	65	black spruce, balsam fir	feather moss, bunchberry	Fox Sparrow		2			1	
17-Jun-11	364	535	545	100	7	fog	0	0	mature forest	balsam fir, black spruce, white birch	65	black spruce, balsam fir	feather moss, bunchberry	White-throated Sparrow		2			2	
17-Jun-11	364	535	545	100	7	fog	0	0	mature forest	balsam fir, black spruce, white birch	65	black spruce, balsam fir	feather moss, bunchberry	Brown Creeper	2			1		
17-Jun-11	365	552	602	100	7	fog	N	1	mature forest but scrubby	black spruce, balsam fir, white birch	65	black spruce, sheep laurel	feather moss, creeping snowberry	Yellow-bellied Flycatcher		1			1	
17-Jun-11	365	552	602	100	7	fog	N	1	mature forest but scrubby	black spruce, balsam fir, white birch	65	black spruce, sheep laurel	feather moss, creeping snowberry	Ruby-crowned Kinglet					1	
17-Jun-11	365	552	602	100	7	fog	N	1	mature forest but scrubby	black spruce, balsam fir, white birch	65	black spruce, sheep laurel	feather moss, creeping snowberry	Swainson's Thrush		1	1		1	1
17-Jun-11	365	552	602	100	7	fog	N	1	mature forest but scrubby	black spruce, balsam fir, white birch	65	black spruce, sheep laurel	feather moss, creeping snowberry	Northern Waterthrush		1			1	
17-Jun-11	365	552	602	100	7	fog	N	1	mature forest but scrubby	black spruce, balsam fir, white birch	65	black spruce, sheep laurel	feather moss, creeping snowberry	Mourning Warbler		1			1	
17-Jun-11	365	552	602	100	7	fog	N	1	mature forest but scrubby	black spruce, balsam fir, white birch	65	black spruce, sheep laurel	feather moss, creeping snowberry	Fox Sparrow		2			1	
17-Jun-11	365	552	602	100	7	fog	N	1	mature forest but scrubby	black spruce, balsam fir, white birch	65	black spruce, sheep laurel	feather moss, creeping snowberry	White-throated Sparrow		1	1			
17-Jun-11	365	552	602	100	7	fog	N	1	mature forest but scrubby	black spruce, balsam fir, white birch	65	black spruce, sheep laurel	feather moss, creeping snowberry	White-winged Crossbill					11	
17-Jun-11	366	612	622	100	7	drizzle	0	0	mature forest - a little scrubby because we're on top of hill	black spruce, balsam fir, white birch	65	balsam fir, black spruce	feather moss, creeping snowberry	Olive-sided Flycatcher		1				
17-Jun-11	366	612	622	100	7	drizzle	0	0	mature forest - a little scrubby because we're on top of hill	black spruce, balsam fir, white birch	65	balsam fir, black spruce	feather moss, creeping snowberry	Ruby-crowned Kinglet		1			1	
17-Jun-11	366	612	622	100	7	drizzle	0	0	mature forest - a little scrubby because we're on top of hill	black spruce, balsam fir, white birch	65	balsam fir, black spruce	feather moss, creeping snowberry	Swainson's Thrush			1			
17-Jun-11	366	612	622	100	7	drizzle	0	0	mature forest - a little scrubby because we're on top of hill	black spruce, balsam fir, white birch	65	balsam fir, black spruce	feather moss, creeping snowberry	Magnolia Warbler	1			1		
17-Jun-11	366	612	622	100	7	drizzle	0	0	mature forest - a little scrubby because we're on top of hill	black spruce, balsam fir, white birch	65	balsam fir, black spruce	feather moss, creeping snowberry	Fox Sparrow			1			
17-Jun-11	366	612	622	100	7	drizzle	0	0	mature forest - a little scrubby because we're on top of hill	black spruce, balsam fir, white birch	65	balsam fir, black spruce	feather moss, creeping snowberry	White-throated Sparrow			1			1
17-Jun-11	366	612	622	100	7	drizzle	0	0	mature forest - a little scrubby because we're on top of hill	black spruce, balsam fir, white birch	65	balsam fir, black spruce	feather moss, creeping snowberry	Dark-eyed Junco		1			1	
17-Jun-11	367	635	645	100	7	0	0	0	bog with scrub	black spruce	-	black spruce, alders	sedges, grasses, bottlebrush	Yellow-bellied Flycatcher	1			1		
17-Jun-11	367	635	645	100	7	0	0	0	bog with scrub	black spruce	-	black spruce, alders	sedges, grasses, bottlebrush	Olive-sided Flycatcher	1			2		
17-Jun-11	367	635	645	100	7	0	0	0	bog with scrub	black spruce	-	black spruce, alders	sedges, grasses, bottlebrush	Boreal Chickadee				1		
17-Jun-11	367	635	645	100	7	0	0	0	bog with scrub	black spruce	-	black spruce, alders	sedges, grasses, bottlebrush	Ruby-crowned Kinglet	1			1		
17-Jun-11	367	635	645	100	7	0	0	0	bog with scrub	black spruce	-	black spruce, alders	sedges, grasses, bottlebrush	Hermit Thrush	1			1		
17-Jun-11	367	635	645	100	7	0	0	0	bog with scrub	black spruce	-	black spruce, alders	sedges, grasses, bottlebrush	Fox Sparrow					1	
17-Jun-11	367	635	645	100	7	0	0	0	bog with scrub	black spruce	-	black spruce, alders	sedges, grasses, bottlebrush	White-throated Sparrow				1		
17-Jun-11	367	635	645	100	7	0	0	0	bog with scrub	black spruce	-	black spruce, alders	sedges, grasses, bottlebrush	Pine Grosbeak	1					
17-Jun-11	368	702	712	100	8	0	0	0	mature forest	black spruce, balsam fir	70	balsam fir	feathermoss, bunchberry	Common Loon						1
17-Jun-11	368	702	712	100	8	0	0	0	mature forest	black spruce, balsam fir	70	balsam fir	feathermoss, bunchberry	Swainson's Thrush		1			1	
17-Jun-11	368	702	712	100	8	0	0	0	mature forest	black spruce, balsam fir	70	balsam fir	feathermoss, bunchberry	Yellow-rumped Warbler	1					
17-Jun-11	368	702	712	100	8	0	0	0	mature forest	black spruce, balsam fir	70	balsam fir	feathermoss, bunchberry	White-throated Sparrow		1			1	
17-Jun-11	369	725	735	100	8	0	0	0	scrubby wet area	0	0	black spruce, alder, kalmia angustifolia	feathermoss, bunchberry	Yellow-bellied Flycatcher	1				1	
17-Jun-11	369	725	735	100	8	0	0	0	scrubby wet area	0	0	black spruce, alder, kalmia angustifolia	feathermoss, bunchberry	Ruby-crowned Kinglet					1	

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Date	Waypoint ID	Start Time	End Time	% Cloud Cover	Temp (°C)	Precipitation	Wind direction	Wind speed (Beaufort scale)	Habitat	Forest Cover	% Cover	Shrub layer	Ground veg	Species	first 5 minutes			second 5 minutes		
															<50m	50-100m	>100m	<50m	50-100m	>100m
17-Jun-11	369	725	735	100	8	0	0	0	scrubby wet area	0	0	black spruce, alder, kalmia angustifolia	feathermoss, bunchberry	Hermit Thrush	1				1	
17-Jun-11	369	725	735	100	8	0	0	0	scrubby wet area	0	0	black spruce, alder, kalmia angustifolia	feathermoss, bunchberry	Yellow-rumped Warbler				1		
17-Jun-11	369	725	735	100	8	0	0	0	scrubby wet area	0	0	black spruce, alder, kalmia angustifolia	feathermoss, bunchberry	Black and white Warbler				1		
17-Jun-11	369	725	735	100	8	0	0	0	scrubby wet area	0	0	black spruce, alder, kalmia angustifolia	feathermoss, bunchberry	Fox Sparrow					1	
17-Jun-11	369	725	735	100	8	0	0	0	scrubby wet area	0	0	black spruce, alder, kalmia angustifolia	feathermoss, bunchberry	White-throated Sparrow					1	
17-Jun-11	371	800	810	100	9	0	0	0	mature forest	balsam fir, black spruce	70	balsam fir	feather moss	Ruby-crowned Kinglet					1	
17-Jun-11	371	800	810	100	9	0	0	0	mature forest	balsam fir, black spruce	70	balsam fir	feather moss	Swainson's Thrush					1	
17-Jun-11	371	800	810	100	9	0	0	0	mature forest	balsam fir, black spruce	70	balsam fir	feather moss	Nashville Warbler					1	
17-Jun-11	371	800	810	100	9	0	0	0	mature forest	balsam fir, black spruce	70	balsam fir	feather moss	Magnolia Warbler					1	
17-Jun-11	371	800	810	100	9	0	0	0	mature forest	balsam fir, black spruce	70	balsam fir	feather moss	Yellow-rumped Warbler	1			1		
17-Jun-11	371	800	810	100	9	0	0	0	mature forest	balsam fir, black spruce	70	balsam fir	feather moss	Mourning Warbler				1		
17-Jun-11	371	800	810	100	9	0	0	0	mature forest	balsam fir, black spruce	70	balsam fir	feather moss	White-throated Sparrow		1			1	
17-Jun-11	372	829	839	100	9	0	0	0	mature forest	balsam fir, black spruce, white birch	75	balsam fir, black spruce	feathermoss, bunchberry	Boreal Chickadee	1			1		
17-Jun-11	372	829	839	100	9	0	0	0	mature forest	balsam fir, black spruce, white birch	75	balsam fir, black spruce	feathermoss, bunchberry	Ruby-crowned Kinglet	1			1		
17-Jun-11	372	829	839	100	9	0	0	0	mature forest	balsam fir, black spruce, white birch	75	balsam fir, black spruce	feathermoss, bunchberry	Golden-crowned Kinglet		1				
17-Jun-11	372	829	839	100	9	0	0	0	mature forest	balsam fir, black spruce, white birch	75	balsam fir, black spruce	feathermoss, bunchberry	Black-throated Green Warbler	1			1	1	
17-Jun-11	372	829	839	100	9	0	0	0	mature forest	balsam fir, black spruce, white birch	75	balsam fir, black spruce	feathermoss, bunchberry	Northern Waterthrush	1	1		1	1	
17-Jun-11	372	829	839	100	9	0	0	0	mature forest	balsam fir, black spruce, white birch	75	balsam fir, black spruce	feathermoss, bunchberry	Fox Sparrow		1				1
17-Jun-11	372	829	839	100	9	0	0	0	mature forest	balsam fir, black spruce, white birch	75	balsam fir, black spruce	feathermoss, bunchberry	White-throated Sparrow		2			1	
17-Jun-11	374	845	855	100	9	0	N	1	mature forest	balsam fir, black spruce, white birch	55	white birch, balsam fir, sheep laurel	stairstep moss, feather moss, bunchberry	Greater Yellowlegs						1
17-Jun-11	374	845	855	100	9	0	N	1	mature forest	balsam fir, black spruce, white birch	55	white birch, balsam fir, sheep laurel	stairstep moss, feather moss, bunchberry	Yellow-bellied Flycatcher					1	
17-Jun-11	374	845	855	100	9	0	N	1	mature forest	balsam fir, black spruce, white birch	55	white birch, balsam fir, sheep laurel	stairstep moss, feather moss, bunchberry	Swainson's Thrush		3			3	1
17-Jun-11	374	845	855	100	9	0	N	1	mature forest	balsam fir, black spruce, white birch	55	white birch, balsam fir, sheep laurel	stairstep moss, feather moss, bunchberry	Northern Waterthrush		1			1	1
17-Jun-11	374	845	855	100	9	0	N	1	mature forest	balsam fir, black spruce, white birch	55	white birch, balsam fir, sheep laurel	stairstep moss, feather moss, bunchberry	Fox Sparrow		1			1	
17-Jun-11	374	845	855	100	9	0	N	1	mature forest	balsam fir, black spruce, white birch	55	white birch, balsam fir, sheep laurel	stairstep moss, feather moss, bunchberry	White-throated Sparrow			1			
17-Jun-11	374	845	855	100	9	0	N	1	mature forest	balsam fir, black spruce, white birch	55	white birch, balsam fir, sheep laurel	stairstep moss, feather moss, bunchberry	Northern Goshawk		1			2	
18-Jun-11	375	520	530	100	8	0	0	0	mature forest	white birch, balsam fir, black spruce	85	balsam fir	ferns, red raspberry	Yellow-bellied Flycatcher	1			1		
18-Jun-11	375	520	530	100	8	0	0	0	mature forest	white birch, balsam fir, black spruce	85	balsam fir	ferns, red raspberry	Least Flycatcher	1			1		
18-Jun-11	375	520	530	100	8	0	0	0	mature forest	white birch, balsam fir, black spruce	85	balsam fir	ferns, red raspberry	Swainson's Thrush	1			1		
18-Jun-11	375	520	530	100	8	0	0	0	mature forest	white birch, balsam fir, black spruce	85	balsam fir	ferns, red raspberry	Yellow-rumped Warbler				1		
18-Jun-11	375	520	530	100	8	0	0	0	mature forest	white birch, balsam fir, black spruce	85	balsam fir	ferns, red raspberry	Black-throated Green Warbler	1	1		1	1	
18-Jun-11	375	520	530	100	8	0	0	0	mature forest	white birch, balsam fir, black spruce	85	balsam fir	ferns, red raspberry	Northern Waterthrush			1			
18-Jun-11	375	520	530	100	8	0	0	0	mature forest	white birch, balsam fir, black spruce	85	balsam fir	ferns, red raspberry	Fox Sparrow						1
18-Jun-11	375	520	530	100	8	0	0	0	mature forest	white birch, balsam fir, black spruce	85	balsam fir	ferns, red raspberry	White-throated Sparrow			1		1	
18-Jun-11	376	537	547	100	8	0	0	0	mature forest	balsam fir, white birch, black spruce	85	balsam fir	red raspberry, bunchberry, star flower	Ruby-crowned Kinglet	1				1	
18-Jun-11	376	537	547	100	8	0	0	0	mature forest	balsam fir, white birch, black spruce	85	balsam fir	red raspberry, bunchberry, star flower	Swainson's Thrush		1	1		1	
18-Jun-11	376	537	547	100	8	0	0	0	mature forest	balsam fir, white birch, black spruce	85	balsam fir	red raspberry, bunchberry, star flower	Magnolia Warbler	1					
18-Jun-11	376	537	547	100	8	0	0	0	mature forest	balsam fir, white birch, black spruce	85	balsam fir	red raspberry, bunchberry, star flower	Black-throated Green Warbler	1					

Table IR-50.3 2011 Songbird Survey Results

Date	Waypoint ID	Start Time	End Time	% Cloud Cover	Temp (°C)	Precipitation	Wind direction	Wind speed (Beaufort scale)	Habitat	Forest Cover	% Cover	Shrub layer	Ground veg	Species	first 5 minutes			second 5 minutes		
															<50m	50-100m	>100m	<50m	50-100m	>100m
18-Jun-11	376	537	547	100	8	0	0	0	mature forest	balsam fir, white birch, black spruce	85	balsam fir	red raspberry, bunchberry, star flower	Northern Waterthrush	1		1	1		
18-Jun-11	376	537	547	100	8	0	0	0	mature forest	balsam fir, white birch, black spruce	85	balsam fir	red raspberry, bunchberry, star flower	Fox Sparrow	1					1
18-Jun-11	376	537	547	100	8	0	0	0	mature forest	balsam fir, white birch, black spruce	85	balsam fir	red raspberry, bunchberry, star flower	White-throated Sparrow	1					
18-Jun-11	377	554	604	100	8	0	0	0	mature forest	balsam fir white birch	80	balsam fir	ferns, bunchberry, moss	Yellow-bellied Flycatcher		1			1	
18-Jun-11	377	554	604	100	8	0	0	0	mature forest	balsam fir white birch	80	balsam fir	ferns, bunchberry, moss	Swainson's Thrush			1			1
18-Jun-11	377	554	604	100	8	0	0	0	mature forest	balsam fir white birch	80	balsam fir	ferns, bunchberry, moss	American Robin					1	
18-Jun-11	377	554	604	100	8	0	0	0	mature forest	balsam fir white birch	80	balsam fir	ferns, bunchberry, moss	Yellow-rumped Warbler					1	
18-Jun-11	377	554	604	100	8	0	0	0	mature forest	balsam fir white birch	80	balsam fir	ferns, bunchberry, moss	Northern Waterthrush	1	1	1	1	1	
18-Jun-11	378	613	623	100	8	0	0	0	mature forest	balsam fir, black spruce, white birch	70	balsam fir, black spruce	feather moss, bunchberry, ferns	Golden-crowned Kinglet					1	
18-Jun-11	378	613	623	100	8	0	0	0	mature forest	balsam fir, black spruce, white birch	70	balsam fir, black spruce	feather moss, bunchberry, ferns	American Robin						1
18-Jun-11	378	613	623	100	8	0	0	0	mature forest	balsam fir, black spruce, white birch	70	balsam fir, black spruce	feather moss, bunchberry, ferns	White-throated Sparrow			1			
18-Jun-11	379	635	645	100	8	fog		0	0	regen forest approx 5-6 m tall	50	balsam fir	feather moss, bunchberry	Ruby-crowned Kinglet	1				1	
18-Jun-11	379	635	645	100	8	fog		0	0	regen forest approx 5-6 m tall	50	balsam fir	feather moss, bunchberry	Swamp Sparrow					1	
18-Jun-11	379	635	645	100	8	fog		0	0	regen forest approx 5-6 m tall	50	balsam fir	feather moss, bunchberry	Common Yellowthroat	1			1		
18-Jun-11	380	657	707	100	8	fog	NE	1	barren/bog hilltop	0	0	larch black spruce, leatherleaf, sheep laurel	sphagnum moss	Common Loon						1
18-Jun-11	380	657	707	100	8	fog	NE	1	barren/bog hilltop	0	0	larch black spruce, leatherleaf, sheep laurel	sphagnum moss	Yellow-bellied Flycatcher		1				
18-Jun-11	380	657	707	100	8	fog	NE	1	barren/bog hilltop	0	0	larch black spruce, leatherleaf, sheep laurel	sphagnum moss	Pine Warbler		1			1	
18-Jun-11	380	657	707	100	8	fog	NE	1	barren/bog hilltop	0	0	larch black spruce, leatherleaf, sheep laurel	sphagnum moss	Savannah Sparrow	1			1		
18-Jun-11	380	657	707	100	8	fog	NE	1	barren/bog hilltop	0	0	larch black spruce, leatherleaf, sheep laurel	sphagnum moss	Lincoln's Sparrow	1			1		
18-Jun-11	380	657	707	100	8	fog	NE	1	barren/bog hilltop	0	0	larch black spruce, leatherleaf, sheep laurel	sphagnum moss	White-throated Sparrow		2			2	
18-Jun-11	380	657	707	100	8	fog	NE	1	barren/bog hilltop	0	0	larch black spruce, leatherleaf, sheep laurel	sphagnum moss	Common Yellowthroat	1			1		
18-Jun-11	381	714	724	100	8	fog	NE	1	barren/bog hilltop	0	0	black spruce, balsam fir, larch, sheep laurel, leatherleaf, rhodora, Labrador tea	sphagnum moss, bakeapple	Ruby-crowned Kinglet			1			1
18-Jun-11	381	714	724	100	8	fog	NE	1	barren/bog hilltop	0	0	black spruce, balsam fir, larch, sheep laurel, leatherleaf, rhodora, Labrador tea	sphagnum moss, bakeapple	Hermit Thrush						1
18-Jun-11	381	714	724	100	8	fog	NE	1	barren/bog hilltop	0	0	black spruce, balsam fir, larch, sheep laurel, leatherleaf, rhodora, Labrador tea	sphagnum moss, bakeapple	Pine Warbler	1					
18-Jun-11	381	714	724	100	8	fog	NE	1	barren/bog hilltop	0	0	black spruce, balsam fir, larch, sheep laurel, leatherleaf, rhodora, Labrador tea	sphagnum moss, bakeapple	Lincoln's Sparrow		1				1
18-Jun-11	381	714	724	100	8	fog	NE	1	barren/bog hilltop	0	0	black spruce, balsam fir, larch, sheep laurel, leatherleaf, rhodora, Labrador tea	sphagnum moss, bakeapple	White-throated Sparrow			1		1	
18-Jun-11	381	714	724	100	8	fog	NE	1	barren/bog hilltop	0	0	black spruce, balsam fir, larch, sheep laurel, leatherleaf, rhodora, Labrador tea	sphagnum moss, bakeapple	Common Yellowthroat	1			1		
18-Jun-11	382	731	741	100	8	fog	NE	1	barren/bog hilltop	0	0	larch, black spruce, birch, Labrador tea	grasses, sedges, sphagnum moss	Greater Yellowlegs			1			1
18-Jun-11	382	731	741	100	8	fog	NE	1	barren/bog hilltop	0	0	larch, black spruce, birch, Labrador tea	grasses, sedges, sphagnum moss	Hermit Thrush			2			1
18-Jun-11	382	731	741	100	8	fog	NE	1	barren/bog hilltop	0	0	larch, black spruce, birch, Labrador tea	grasses, sedges, sphagnum moss	Pine Warbler		1			1	
18-Jun-11	382	731	741	100	8	fog	NE	1	barren/bog hilltop	0	0	larch, black spruce, birch, Labrador tea	grasses, sedges, sphagnum moss	Blackpoll Warbler					1	
18-Jun-11	382	731	741	100	8	fog	NE	1	barren/bog hilltop	0	0	larch, black spruce, birch, Labrador tea	grasses, sedges, sphagnum moss	Northern Waterthrush			1			1
18-Jun-11	382	731	741	100	8	fog	NE	1	barren/bog hilltop	0	0	larch, black spruce, birch, Labrador tea	grasses, sedges, sphagnum moss	Fox Sparrow		1			1	
18-Jun-11	382	731	741	100	8	fog	NE	1	barren/bog hilltop	0	0	larch, black spruce, birch, Labrador tea	grasses, sedges, sphagnum moss	White-throated Sparrow			1			2
18-Jun-11	382	731	741	100	8	fog	NE	1	barren/bog hilltop	0	0	larch, black spruce, birch, Labrador tea	grasses, sedges, sphagnum moss	Common Yellowthroat		2			1	
18-Jun-11	383	748	758	100	8	fog	NE	2	barren/bog hilltop	0	0	larch, leatherleaf, sheep laurel	sphagnum moss, lichen, grasses, sedges, bog pools	Greater Yellowlegs	2			2		
18-Jun-11	383	748	758	100	8	fog	NE	2	barren/bog hilltop	0	0	larch, leatherleaf, sheep laurel	sphagnum moss, lichen, grasses, sedges, bog pools	Boreal Chickadee				1		
18-Jun-11	383	748	758	100	8	fog	NE	2	barren/bog hilltop	0	0	larch, leatherleaf, sheep laurel	sphagnum moss, lichen, grasses, sedges, bog pools	Hermit Thrush	1					

Table IR-50.3 2011 Songbird Survey Results

Date	Waypoint ID	Start Time	End Time	% Cloud Cover	Temp (°C)	Precipitation	Wind direction	Wind speed (Beaufort scale)	Habitat	Forest Cover	% Cover	Shrub layer	Ground veg	Species	first 5 minutes			second 5 minutes		
															<50m	50-100m	>100m	<50m	50-100m	>100m
18-Jun-11	383	748	758	100	8	fog	NE	2	barren/bog hilltop	0	0	larch, leatherleaf, sheep laurel	sphagnum moss, lichen, grasses, sedges, bog pools	Pine Warbler	1			1		
18-Jun-11	383	748	758	100	8	fog	NE	2	barren/bog hilltop	0	0	larch, leatherleaf, sheep laurel	sphagnum moss, lichen, grasses, sedges, bog pools	Blackpoll Warbler				1		
18-Jun-11	383	748	758	100	8	fog	NE	2	barren/bog hilltop	0	0	larch, leatherleaf, sheep laurel	sphagnum moss, lichen, grasses, sedges, bog pools	White-throated Sparrow					1	
18-Jun-11	383	748	758	100	8	fog	NE	2	barren/bog hilltop	0	0	larch, leatherleaf, sheep laurel	sphagnum moss, lichen, grasses, sedges, bog pools	Common Yellowthroat		1			2	
18-Jun-11	384	805	815	100	8	fog	NE	2	barren/scrub hilltop	0	0	black spruce, blueberry	sphagnum moss, lichen	Ruby-crowned Kinglet		1				
18-Jun-11	384	805	815	100	8	fog	NE	2	barren/scrub hilltop	0	0	black spruce, blueberry	sphagnum moss, lichen	Hermit Thrush			2		1	
18-Jun-11	384	805	815	100	8	fog	NE	2	barren/scrub hilltop	0	0	black spruce, blueberry	sphagnum moss, lichen	Yellow-rumped Warbler		1			1	
18-Jun-11	384	805	815	100	8	fog	NE	2	barren/scrub hilltop	0	0	black spruce, blueberry	sphagnum moss, lichen	Pine Warbler		1				
18-Jun-11	384	805	815	100	8	fog	NE	2	barren/scrub hilltop	0	0	black spruce, blueberry	sphagnum moss, lichen	Blackpoll Warbler	2				2	
18-Jun-11	384	805	815	100	8	fog	NE	2	barren/scrub hilltop	0	0	black spruce, blueberry	sphagnum moss, lichen	Northern Waterthrush			1			
18-Jun-11	384	805	815	100	8	fog	NE	2	barren/scrub hilltop	0	0	black spruce, blueberry	sphagnum moss, lichen	Fox Sparrow			1			
18-Jun-11	384	805	815	100	8	fog	NE	2	barren/scrub hilltop	0	0	black spruce, blueberry	sphagnum moss, lichen	White-throated Sparrow	2			1	2	
18-Jun-11	384	805	815	100	8	fog	NE	2	barren/scrub hilltop	0	0	black spruce, blueberry	sphagnum moss, lichen	Common Yellowthroat		1			2	
18-Jun-11	385	821	831	100	8	0	0	0	balsam fir regen, wB	balsam fir	65	balsam fir	feather moss, bunchberry, ferns	Yellow-bellied Flycatcher		1				
18-Jun-11	385	821	831	100	8	0	0	0	balsam fir regen, wB	balsam fir	65	balsam fir	feather moss, bunchberry, ferns	Ruby-crowned Kinglet						1
18-Jun-11	385	821	831	100	8	0	0	0	balsam fir regen, wB	balsam fir	65	balsam fir	feather moss, bunchberry, ferns	Swainson's Thrush			1			1
18-Jun-11	385	821	831	100	8	0	0	0	balsam fir regen, wB	balsam fir	65	balsam fir	feather moss, bunchberry, ferns	Dark-eyed Junco					1	
18-Jun-11	386	848	858	100	8	0	0	0	balsam fir regen	balsam fir	65	balsam fir, black spruce	stairstep moss, feather moss	Boreal Chickadee	1			2		
18-Jun-11	386	848	858	100	8	0	0	0	balsam fir regen	balsam fir	65	balsam fir, black spruce	stairstep moss, feather moss	Swainson's Thrush		1			1	
18-Jun-11	386	848	858	100	8	0	0	0	balsam fir regen	balsam fir	65	balsam fir, black spruce	stairstep moss, feather moss	White-throated Sparrow			1			1

Table IR-50.4 2011 Spring Breeding Waterfowl Results
Date: 10-May-11
Weather: 0°C, clear, no precipitation, wind = 10 knots NE
Snow Coverage (% throughout block): 1%
Ice Coverage (% throughout bock): <1%

Waypoint ID	Species	Groupings
2	Ring-necked Duck	Single
7	Canada Goose	Single
10	American Black Duck	Pair
12	American Black Duck	Pair
14	Red-breasted Merganser	Single
15	Common Loon	Single
16	Common Loon	Single
17	Common Loon	Single
18	Common Loon	Pair
19	Canada Geese	Four
20	Common Loon	Pair
22	Common Loon	Single
25	Canada Goose	Pair - on nest
27	Canada Goose	Pair - on nest
30	American Black Duck	Pair
32	Ring-necked Duck	Pair plus 3 males
33	Canada Goose	Pair
34	Common Goldeneye	Single
35	Canada Goose	Single
36	Common Merganser	Male
38	Common Merganser	Male
39	Ring-necked Duck	Pair
40	Canada Goose	Pair
41	Common Loon	Pair
42	Common Merganser	Pair
44	Ring-necked Duck	Two males
47	Common Loon	Three
48	Common Loon	Two
50	Common Merganser	Pair
51	Canada Goose	Pair
52	Common Loon	Single
53	American Black Duck	Single
54	Common Goldeneye	Single
56	American Black Duck	Pair

Table IR-50.5 2011 Brood Survey Results
Date: 7-Jul-11
Survey Time: 3 hours and 10 minutes
Weather: 100% cloud cover, 20°C, SW winds at 30 km/hr

Waypoint ID	Species	Observation
516	American Black Duck	1 Individual
517	American Black Duck	25 Individuals
530	American Black Duck	3 Young + Female
537	American Black Duck	4 Young + Female
543	American Black Duck	3 Young + Female
544	American Black Duck	4 Young + Female
544	American Black Duck	9 Young + Female
545	American Black Duck	2 Young + Female
549	American Black Duck	8 Young + Female
549	American Black Duck	1 Individual
553	American Black Duck	1 Individual
554	American Black Duck	1 duckling
560	American Black Duck	1 Individual
562	American Black Duck	1 Individual
563	American Black Duck	1 Individual
568	American Black Duck	1 Individual
568	American Black Duck	4 Individual
571	American Black Duck	1 Individual
577	American Black Duck	4 Individual
577	American Black Duck	1 Individual
587	American Black Duck	1 Individual
591	American Black Duck	8 Young + Female
605	American Black Duck	1 Individual
611	American Black Duck	5 Young + Female
508	Canada Goose	7 Individuals
546	Canada Goose	3 Individuals
604	Common Goldeneye	1 Individual
615	Common Loon	1 Individual
515	Common Loon	1 Individual
531	Common Loon	1 Indicated Pair
534	Common Loon	1 Individual
567	Common Loon	1 Individual
578	Common Loon	1 Individual
593	Common Loon	1 Individual
595	Common Loon	2 Individuals
596	Common Loon	1 Individual
601	Common Loon	1 Indicated Pair
607	Common Loon	1 Individual
589	Common Merganser	2 Individuals
497	Green-winged Teal	1 Individual
505	gull sp.	2 Individuals

Table IR-50.5 2011 Brood Survey Results
Date: 7-Jul-11
Survey Time: 3 hours and 10 minutes
Weather: 100% cloud cover, 20°C, SW winds at 30 km/hr

Waypoint ID	Species	Observation
617	gull sp.	1 Individual
511	Herring Gull	1 Individual
514	Herring Gull	2 Individuals
606	Herring Gull	1 Individual
503	merganser sp.	1 Individual
504	merganser sp.	10 Young + Female
513	merganser sp.	1 Individual
533	merganser sp.	2 Individuals
513	merganser	5 Young + Female
516	Ring-necked Duck	1 Indicated Pair
517	Ring-necked Duck	8 Young + Female
522	Ring-necked Duck	7 Young + Female
523	Ring-necked Duck	1 Indicated Pair
523	Ring-necked Duck	1 Individual
524	Ring-necked Duck	1 Indicated Pair
526	Ring-necked Duck	1 Indicated Pair
541	Ring-necked Duck	1 Indicated Pair
547	Ring-necked Duck	2 Indicated Pairs
549	Ring-necked Duck	2 Indicated Pairs
556	Ring-necked Duck	1 Indicated Pair
556	Ring-necked Duck	3 Individuals
558	Ring-necked Duck	3 Individuals
559	Ring-necked Duck	2 Indicated Pairs
570	Ring-necked Duck	2 Indicated Pairs
572	Ring-necked Duck	6 Young + Female
573	Ring-necked Duck	6 Individuals
580	Ring-necked Duck	8 Young + Female
581	Ring-necked Duck	13 Individuals
587	Ring-necked Duck	1 Individual
594	Ring-necked Duck	1 Indicated Pair
603	Ring-necked Duck	1 Individual
604	Ring-necked Duck	2 Individuals
605	Ring-necked Duck	1 Indicated Pair
608	Ring-necked Duck	1 Indicated Pair
611	Ring-necked Duck	1 Individual
612	Ring-necked Duck	1 Individual
614	Ring-necked Duck	1 Indicated Pair
614	Ring-necked Duck	1 Individual
614	Ring-necked Duck	8 Young + Female
551	unidentified duckling	1 Individual
555	unidentified ducks in flight	20 Individuals

Table IR-50.5 2011 Brood Survey Results

Date: 7-Jul-11

Survey Time: 3 hours and 10 minutes

Weather: 100% cloud cover, 20°C, SW winds at 30 km/hr

Waypoint ID	Species	Observation
584	unidentified ducks in flight	no data

Table IR-50.6 2017 Spring Breeding Waterfowl Survey Results
Date: 6-Jun-17

Transect	Waypoint ID	Species Name	Number	Temperature (°C)	Wind Speed (km/h)	Wind Direction	Cloud Cover (%)	Snow Cover (%)	Ice Cover (%)
T1	-	-	-	14	10	N	50	0	0
T2	-	-	-	14	10	N	0	0	0
T3	-	-	-	14	10	N	0	0	0
T4	-	-	-	14	10	N	0	0	0
T5	1086	Common loon	1	14	10	N	0	0	0
T6	1090	Unidentified	1	14	10	N	0	0	0
T7	1092	Common Goldeneye	5	14	10	N	0	0	0
T7	1094	Common loon	1	14	10	N	0	0	0
T7	1093	Ring-necked Duck	1	14	10	N	0	0	0
T8	1098	American Black Duck	3	14	10	N	20	0	0
T8	1098	Greater Yellowlegs	2	14	10	N	20	0	0
T8	1098	Ring-necked Duck	2	14	10	N	20	0	0
T8	1097	Unidentified	1	14	10	N	20	0	0
T9	1101	Common Loon	1	14	10	N	0	0	0
T9	1102	Common Loon	2	14	10	N	0	0	0
T9	1103	Ring-necked Duck	2	14	10	N	0	0	0
T9	1102	Spotted Sandpiper	2	14	10	N	0	0	0
T10	1109	American Black Duck	3	14	10	N	0	0	0
T10	1110	Common Goldeneye	1	14	10	N	0	0	0
T10	1106	Green-winged Teal	1	14	10	N	0	0	0
T11	1113	Ring-necked Duck	1	14	10	N	0	0	0
T11	1112	Spotted Sandpiper	1	14	10	N	0	0	0
T12	1115	American Black Duck	1	14	10	N	0	0	0
T12	1115	Common Goldeneye	4	14	10	N	0	0	0
T12	1114	Common Loon	1	14	10	N	0	0	0
T12	1116	Ring-necked Duck	4	14	10	N	0	0	0
T13	1117	Common Loon	1	14	10	N	0	0	0
T14	1119	Common Loon	1	14	10	N	0	0	0
T14	1118	Spotted Sandpiper	2	14	10	N	0	0	0
T15	1123	American Black Duck	1	10	10	NW	50	0	0
T15	1130	American Black Duck	11	10	10	NW	50	0	0
T15	1121	Common Goldeneye	2	10	10	NW	50	0	0
T15	1124	Common Goldeneye	1	10	10	NW	50	0	0
T15	1129	Common Goldeneye	2	10	10	NW	50	0	0
T15	1128	Common Loon	1	10	10	NW	50	0	0
T15	1122	Ring-necked Duck	2	10	10	NW	50	0	0
T15	1126	Ring-necked Duck	2	10	10	NW	50	0	0
T15	1127	Ring-necked Duck	2	10	10	NW	50	0	0
T15	1131	Ring-necked Duck	3	10	10	NW	50	0	0
T15	1120	Spotted Sandpiper	1	10	10	NW	50	0	0
T15	1124	Spotted Sandpiper	2	10	10	NW	50	0	0
T15	1125	Spotted Sandpiper	1	10	10	NW	50	0	0

IR-50.7 2017 Fall Staging Waterfowl Survey Results
Date: 27-Sept-2017

Transect	Waypoint	Species	Number	Comments	Snow Cover (%)	Ice Cover (%)	Visibility	Precipitation	Temperature (ºC)	Wind (Speed km/h and direction)	Cloud Cover (%)	Habitat Description
T7	898	American Black Duck	4		0	0	Excellent	None	4	10 W	95	mixedwood, riparian, bog
T9	899	Ring-necked Duck	1		0	0	Excellent	None	4	10 W	95	mixedwood, riparian, bog
T10	900	Common Loon	1		0	0	Excellent	None	4	10 W	95	lakes, bog, mixedwood, riparian
T10	903	Green-winged Teal	3		0	0	Excellent	None	4	10 W	95	lakes, bog, mixedwood, riparian
T13	905	Common Goldeneye	4		0	0	Excellent	None	4	10 W	95	lakes, mixedwood, bog
T14	906	Common Loon	2	Male and Female	0	0	Excellent	None	4	10 W	95	lakes, bog
T15	884	American Black Duck	1		0	0	Excellent	None	4	10 W	95	riparian
T15	885	American Black Duck	3		0	0	Excellent	None	4	10 W	95	riparian
T15	886	Green-winged Teal	11		0	0	Excellent	None	4	10 W	95	riparian
T15	887	Mallard	2	Male and Female	0	0	Excellent	None	4	10 W	95	riparian
T15	888	Ring-necked Duck	1		0	0	Excellent	None	4	10 W	95	riparian
T15	889	Bald Eagle	1		0	0	Excellent	None	4	10 W	95	riparian
T15	890	Northern Harrier	1		0	0	Excellent	None	4	10 W	95	riparian
-	907	Ring-necked Duck	1		-	-	-	-	-	-	-	-

APPENDIX IR-50.B
IR-50 MAPBOOK

(Submitted as a Separate File)