

REPORT

Government of Northwest Territories
Department of Infrastructure

Hay River Harbour Restoration –
Waste Management Plan
2023-8461



DECEMBER 2023

CONFIDENTIALITY AND © COPYRIGHT FOR THIS REPORT

This document is for the sole use of the addressee and Associated Environmental Consultants Inc. The document contains proprietary and confidential information that shall not be reproduced in any manner or disclosed to or discussed with any other parties without the express written permission of Associated Environmental Consultants Inc. Information in this document is to be considered the intellectual property of Associated Environmental Consultants Inc. in accordance with Canadian copyright law.

This report was prepared by Associated Environmental Consultants Inc. for the account of Government of Northwest Territories Department of Infrastructure. The material in it reflects Associated Environmental Consultants Inc.'s best judgement, in the light of the information available to it, at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Associated Environmental Consultants Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

REVISIONS PAGE

Hay River Harbour Restoration –
Waste Management Plan

Client:	Consultant:
Government of Northwest Territories Department of Infrastructure	Associated Environmental Consultants Inc.

Revision/ Issue	Date	Description	Prepared by/ Reviewed by	Client Review
1	2023-03-31	Submission for MVLWB water licence application	Associated	GNWT-INF
2	2023-06-20	Revised submission for IFT Specifications addendum	Associated	GNWT-INF
3	2023-12-15	Annual review and update for 2024 operations	Associated	GNWT-INF

TABLE OF CONTENTS

SECTION	PAGE NO.
Table of Contents	i
List of Figures	ii
List of Abbreviations	iii
1 Introduction	1
1.1 Corporate Contact Information	1
1.2 Project Description	1
1.3 Regulatory Framework	2
2 Types of Waste	4
3 Methods of Waste Management	4
Closure	
References	
Appendix A – Preliminary Sediment Sampling Results	
Appendix B - 2023 Soil Sampling Results	

LIST OF FIGURES

	PAGE NO.
Figure 1-1 Proposed Dredging Locations	3

LIST OF ABBREVIATIONS

Abbreviation	Definition
CCME	Canadian Council of Ministers of the Environment
FAL	Canadian Sediment Quality Guidelines for the Protection of Freshwater Aquatic Life
GNWT	Government of Northwest Territories
INF	Department of Infrastructure
MTS	Marine Transportation Services
MVLWB	Mackenzie Valley Land and Water Board
SNP	Surveillance Network Program
PEHH	Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health

1 INTRODUCTION

The Government of Northwest Territories (GNWT) – Department of Infrastructure (INF) retained Associated Environmental Consultants Inc. (Associated) to prepare a waste management plan related to dredging works taking place in the Hay River, near its outlet into Great Slave Lake (Dredge Area A), and within the three fingers of the East Channel of the river (Dredge Area B) (Figure 1-1). Dredging was initially proposed to begin on July 16, 2023, and continue until September 14, 2023. In 2023, dredging occurred only in Dredge Area A, from August 11–13, 2023, and September 18–October 7, 2023, due to a major wildfire evacuation in the Town of Hay River and the surrounding community. Dredging for the Dredge Area B and the remainder of Dredge Area A is planned for July 16 to September 14, 2024; however, that window may begin earlier based on discussion ongoing with Fisheries and Oceans Canada (DFO) and stakeholders at the time of this submission. The waste management plan follows the Mackenzie Valley Land and Water Board (MVLWB) Standard Outline for Management Plans (2021), their Guidelines for Developing a Waste Management Plan (2011), and their draft Waste Management Policy (2022).

1.1 Corporate Contact Information

The GNWT-INF is the primary contact for this project and will work closely with GNWT – Marine Transportation Services (MTS).

Applicant's Name:	Mark Cronk		
Position:	Director of Design and Technical Services		
Company Name:	Government of Northwest Territories – Department of Infrastructure		
Mailing Address:	4th floor, Tatsaot'ne Building PO Box 1320 5015 – 49th Street		
Community:	Yellowknife	Telephone:	867-767-9048 ext. 32060
Prov/Terr:	NT	Email:	Mark.Cronk@gov.nt.ca
Postal Code:	X1A 2L9	Other:	

1.2 Project Description

In 2022, the Hay River experienced unusually high water levels, resulting in increased sediment being deposited in the Hay River Harbour and Great Slave Lake at the river outfall. The sediment, which had not been regularly maintained since 1997 had begun to fill the navigation channel. This caused an emergency scenario, since the shallow water in the navigation channel poses a risk to vessels (i.e., MTS barges, Coast Guard, fishing, and recreational vessels) getting stuck in the sediment and not being able to enter or exit the Hay River Harbour. The sediment must be removed so that vessels can travel along the navigation channel. If vessels cannot enter or exit the harbour, the supply for essential goods, including fuel for power and heat could be interrupted for up to 12 communities who rely on the barging system.

The GNWT-INF has proposed dredging the navigation channel to mechanically excavate a channel 30 m wide and 2.4 m deep for emergency use, to be completed by local contractors in coordination with GNWT-MTS. The material dredged from the navigation channel would be loaded onto a barge and allowed to passively dewater; when the barge is at capacity, the dredged material would be offloaded to haul trucks located on shore. The haul trucks would transfer the dredged material to GNWT and Town of Hay River properties on Vale Island. The dredged material would be temporarily stored on Vale Island, contained with 1 m high berms, for ongoing passive dewatering. Once moved from

the barge to land, the sediment¹ (dredged material) will be considered soil (CCME 1999) and may be made available for public use, if appropriate, or would be transferred to a final management area.

This emergency dredging program will include removal and temporary storage of the following estimated volume of sediment:

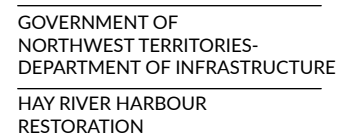
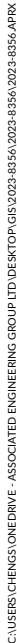
- Dredge Area A: the shipping lanes approaching the outfall to Great Slave Lake to a width of 30 m, dredging 16,000 m³; and
- Dredge Area B: the three fingers in the East Channel, dredging 68,000 m³.

1.3 Regulatory Framework

GNWT-INF is committed to protecting the environment for future generations and will follow the required environmental processes to mitigate the potential environmental impacts from this project. As part of the regulatory process, environmental planning and mitigation will form part of the regulatory applications. Regulatory permits or authorizations, parameters, and regulatory criteria are detailed in the Hay River Harbour Restoration – Monitoring Plan (Associated 2023b). Samples collected during the preliminary assessment and during monitoring efforts will be compared to the following guidelines:

- The results of the water quality samples will be compared to the Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines for the Protection of Aquatic Life.
- The results of the sediment samples taken from the river or barge will be compared to the CCME Canadian Sediment Quality Guidelines for the Protection of Freshwater Aquatic Life (FAL).
- The results of the soil samples taken from the material after it is deposited on land will be compared to the CCME Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health (PEHH) and the soil quality standards in the GNWT Environmental Guideline for Contaminated Site Remediation.

¹ Sediment is unconsolidated material deposited on the bed of a waterbody or in a low spot or depression on land where the water velocity is insufficient to move the material (CCME 1999).



2 TYPES OF WASTE

The two types of waste being considered are 1) waste generated through construction and 2) dredged material from Dredge Areas A and B (Figure 1-1).

As a sediment, the dredged material meets the definition of waste in the draft Waste Management Policy (MVLWB 2022). When the dredged material is removed from the river and is placed on land, it is considered soil². Preliminary in situ sampling and analysis have been completed to determine the presence of potential contaminants of concern relative to applicable CCME FAL for sediment, CCME soil guidelines for parkland/residential and industrial and commercial land uses, and PEHH. The results from the samples collected on January 19, 2023, are shown in Appendix A. These samples were collected from sediment located in Dredge Area A.

A limited Phase I and Phase II Environmental Site Assessment of GNWT-MTS sites was also conducted by others in 2017 (data included in Appendix A). Although the sediment in Dredge Area B had arsenic and cadmium concentrations that exceeded CCME FAL guidelines, the samples met the criteria for CCME soil guidelines for parkland/residential and industrial/commercial land use.

During 2023 operations, a total of 13 dredgeate samples were collected from storage area 1. Samples were taken as composites of five aliquots for each sample location. The analytical results from the 13 samples were compared to the CCME SQG for the Protection of Environmental and Human Health (PEHH) and the GNWT contaminated sites remediation criteria (CCME 2007). All samples were below the CCME SQG and GNWT CSR for parkland/residential land use for all contaminants of concern (Appendix B) (Associated 2023c).

The sediment in Dredge Areas A and B is characterized as fine-grained sand and silt, and sandy loam.

3 METHODS OF WASTE MANAGEMENT

Waste generated by construction will be the responsibility of the contractor who is awarded the dredging project; however, waste will be disposed of appropriately at an approved waste management facility. The contractor will update the waste management plan (after project award) to provide a list of waste types and specific details about the management methods related to the project. Waste management records will be kept by the contractor, including the type of waste, amount and locations of disposal. This information will be summarized in a monthly report for the duration of the project and will be available on request.

The proposed approach to managing the dredged material is to contain the material during dredging and storage, with the objective of reducing the amount of dredged material that enters the water after dredging and setting a minimum distance between the temporary soil storage sites and nearby watercourses (i.e., source reduction). This will be managed through project sequencing and the erosion and sediment control measures outlined in the sediment and erosion control plan (Associated 2023a) and will be monitored as outlined in the monitoring plan (Associated 2023b). The project is expected to be undertaken in the following sequence:

1. The dredged material will be loaded onto a barge and the water runoff will pass through an engineered filter media before re-entering the river.

² The MVLWB (2022) defines waste as "any substance that, if added to water, would degrade or alter or form part of a process of degradation or alteration of the quality of the water to an extent that is determined to its use by people or by any animal, fish, or plant."

2. When the barge is at capacity, the dredged material will be offloaded to trucks on shore and transferred to multiple storage sites on Vale Island to passively dewater further.
3. At the temporary storage sites on Vale Island, the water from the dewatering process will infiltrate onto underlying soil. Excess water from the piles and/or precipitation will be directed to sumps, where the water will infiltrate into the ground. Water quality monitoring at the temporary storage sites will occur as outlined in the Hay River Harbour Restoration – Monitoring Plan (Associated 2023b).
4. Monitoring wells at each temporary stockpile location will be field verified by the contractor, and GPS coordinates provided to GNWT-INF. A surface mound is required around each monitoring well and will consist of compacted clay. The compacted clay will be placed around the casing of the well to move surface water away from it. Concrete Jersey barriers (or approved alternative) will be installed in a triangular shape around each monitoring well to prevent physical damage to the wells. Water (resulting from precipitation and/or dewatering) will not be allowed to accumulate near the monitoring wells and will be actively managed per the Hay River Harbour Restoration – Monitoring Plan (Associated 2023b).

The temporary stockpiles will be managed and demarcated on daily basis according to the monitoring plan (Associated 2023b). Because the material currently meets the PEHH quality guidelines for soil (Appendix A), it is assumed that once dewatered, it will continue to meet guidelines; however, the material will be sampled daily, and if needed, waste management will be adapted as outlined in the monitoring plan (Associated 2023b). If the soil continues to meet guidelines, potential options for reuse include using the soil as fill material to raise land in the local area, as capping material at the solid waste disposal facility, or other purposes to be determined.

If the soil is contaminated at levels greater than regulatory criteria, we will explore remediation and management options including in-situ and ex-situ options.

CLOSURE

This report was prepared for the Government of Northwest Territories – Department of Infrastructure to develop a waste management plan for the emergency works of dredging the Hay River Harbour and manage the dredged material. This report was provided as an annual review and update in winter 2023 to reflect changes in operations, contact information, or other details.

The services provided by Associated Environmental Consultants Inc. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practising under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,

Associated Environmental Consultants Inc.

Prepared by:

Reviewed by:



Melanie Ploresky, P.Ag.
Technical Specialist, Reclamation and
Restoration



Rebekka Lindskoog, R.P.Bio.
Project Manager

REFERENCES

- Associated Environmental Consultants Inc. (Associated). 2023a. Hay River Harbour Restoration – Sediment and Erosion Control Plan.
- Associated Environmental Consultants Inc. (Associated). 2023b. Hay River Harbour Restoration – Monitoring Plan.
- Associated Environmental Consultants Inc. (Associated). 2023c. Hay River Harbour Restoration – 2023 Annual Report.
- Canadian Council of Ministers of the Environment (CCME). 2007. Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health.
- Canadian Council of Ministers of the Environment (CCME). 1999. Canadian Water Quality Guidelines for the Protection of Aquatic Life: Total Particulate Matter and Summary Tables.
- Mackenzie Valley Land and Water Board (MVLWB). 2011. Guidelines for Developing a Waste Management Plan.
- Mackenzie Valley Land and Water Board (MVLWB). 2021. Standard Outline for Management Plans. Available at:
https://mvlwb.com/sites/default/files/2021-06/LWB%20Standard%20Outline%20for%20Management%20Plans%20-%20Approved%20-%20Jun%2010_21_0.pdf
- Mackenzie Valley Land and Water Board (MVLWB). 2022. Waste Management Policy (Draft).

APPENDIX A – PRELIMINARY SEDIMENT SAMPLING RESULTS

Hay River Harbour
Legend for Soil Quality Results

<	Less than reported detection limit
CCME Sediment FAL	CCME. Canadian sediment quality guidelines for the protection of freshwater aquatic life.
CCME SO CL CS	CCME. Canadian Soil Quality Guidelines; and Canada-Wide Standards for Petroleum Hydrocarbons in Soil - for Commercial Land Use and Coarse-grained Soil.
CCME SO CL FS	CCME. Canadian Soil Quality Guidelines; and Canada-Wide Standards for Petroleum Hydrocarbons in Soil - for Commercial Land Use and Fine-grained Soil.
CCME SO IL CS	CCME. Canadian Soil Quality Guidelines; and Canada-Wide Standards for Petroleum Hydrocarbons in Soil - for Industrial Land Use and Coarse-grained Soil.
CCME SO IL FS	CCME. Canadian Soil Quality Guidelines; and Canada-Wide Standards for Petroleum Hydrocarbons in Soil - for Industrial Land Use and Fine-grained Soil.
CCME SO RL/PL CS	CCME. Canadian Soil Quality Guidelines; and Canada-Wide Standards for Petroleum Hydrocarbons in Soil - for Residential/ parkland Land Use and Coarse-grained Soil.
CCME SO RL/PL FS	CCME. Canadian Soil Quality Guidelines; and Canada-Wide Standards for Petroleum Hydrocarbons in Soil - for Residential/ parkland Land Use and Fine-grained Soil.
N	Narrative type of guideline or standard, or Result Note.
NG	No Guideline
CCME Sediment FAL	Highlighted value exceeds CCME Sediment FAL
CCME SO CL CS	Highlighted value exceeds CCME SO CL CS
CCME SO CL FS	Highlighted value exceeds CCME SO CL FS
CCME SO IL CS	Highlighted value exceeds CCME SO IL CS
CCME SO IL FS	Highlighted value exceeds CCME SO IL FS
<u>CCME SO RL/PL CS</u>	Highlighted value exceeds CCME SO RL/PL CS
<u>CCME SO RL/PL FS</u>	Highlighted value exceeds CCME SO RL/PL FS

Hay River Harbour
Soil Quality Results

Sampling Location									Sample 01-A	Sample 01-B	Sample 01-B	Sample 2	Sample 3	SED-019-01	SED-019-02	SED-019-03	SED-019-04	SED-019-05	SED-019-06
Date Sampled									18-Jan-23	18-Jan-23	18-Jan-23	18-Jan-23	18-Jan-23	14-Oct-17	14-Oct-17	14-Oct-17	14-Oct-17	14-Oct-17	14-Oct-17
Lab Sample ID									BKQ530	BKQ531	BKQ532	BKQ533	BKQ534						
Sample Type									Normal	Normal	Duplicate	Normal	Normal						
Analyte	Unit	Guideline																	
		CCME Sediment FAL	CCME SO CL CS	CCME SO CL FS	CCME SO IL CS	CCME SO IL FS	CCME SO RL/PL CS	CCME SO RL/PL FS											
Lab Results																			
General																			
Anion sum	meq/L	NG	NG	NG	NG	NG	NG	NG						14	20	15	10	14	11
Boron (hot water soluble)	mg/kg	NG	NG	NG	NG	NG	NG	NG	0.08	0.065	0.054	0.056	0.1	0.27	0.46	0.45	0.27	0.22	0.5
Boron (in saturated paste)	mg/L	NG	NG	NG	NG	NG	NG	NG	0.22	0.2	0.18	0.17	0.23						
Calcium (in saturated paste)	mg/L	NG	NG	NG	NG	NG	NG	NG						160	220	200	150	200	170
Calcium (in saturated paste) (mass/mass)	mg/kg	NG	NG	NG	NG	NG	NG	NG						56	120	100	59	69	100
Cation sum	meq/L	NG	NG	NG	NG	NG	NG	NG						12	16	15	12	15	13
Cation/EC ratio		NG	NG	NG	NG	NG	NG	NG						12	12	12	12	12	12
Chloride (in saturated paste)	mg/L	NG	NG	NG	NG	NG	NG	NG						110	130	83	56	53	32
Chloride ion	mg/kg	NG	NG	NG	NG	NG	NG	NG						39	69	41	21	19	20
Conductivity (in saturated paste)	µS/cm	NG	4000	4000	4000	4000	2000	2000						1000	1300	1200	970	1200	1100
Grain size		NG	NG	NG	NG	NG	NG	NG	Coarse	Coarse	Coarse	Coarse	Coarse	Coarse	Fine	Fine	Coarse	Coarse	Fine
Ion balance		NG	NG	NG	NG	NG	NG	NG						0.86	0.81	0.96	1.1	1.1	1.2
Magnesium (in saturated paste)	mg/L	NG	NG	NG	NG	NG	NG	NG						31	38	34	28	42	37
Magnesium (in saturated paste) (mass/mass)	mg/kg	NG	NG	NG	NG	NG	NG	NG						11	20	17	11	15	23
Moisture	%	NG	NG	NG	NG	NG	NG	NG	23	19	18	17	22	22	36	31	27	30	45
Percent clay	%	NG	NG	NG	NG	NG	NG	NG	10	6.6	7.2	5.7	14						
Percent sand	%	NG	NG	NG	NG	NG	NG	NG	72	87	89	90	72						
Percent silt	%	NG	NG	NG	NG	NG	NG	NG	18	6.4	4	4.1	14						
pH (in 0.01M CaCl2)		NG	6 - 8	6 - 8	6 - 8	6 - 8	6 - 8	6 - 8						7.24	7.11	7.1	7.15	7.2	7.11
Potassium (in saturated paste)	mg/L	NG	NG	NG	NG	NG	NG	NG						11	16	15	14	11	10
Potassium (in saturated paste) (mass/mass)	mg/kg	NG	NG	NG	NG	NG	NG	NG						4.1	8.5	7.7	5.4	4	6.5
Percent saturation	%	NG	NG	NG	NG	NG	NG	NG	37	33	30	33	46	36	53	50	38	35	62
Sieve - Pan	%	NG	NG	NG	NG	NG	NG	NG	34	15	15	13	26	29	56	58	31	14	68
Sieve analysis - #10 (>2.00mm)	%	NG	NG	NG	NG	NG	NG	NG	<0.20	<0.20	4.8	<0.20	<0.20						
Sieve analysis - #200 (>0.075mm)	%	NG	NG	NG	NG	NG	NG	NG	66	85	85	87	74	72	44	42	69	86	32
Sodium (in saturated paste)	mg/L	NG	NG	NG	NG	NG	NG	NG						34	35	33	27	32	30
Sodium adsorption ratio		NG	12	12	12	12	5	5						0.66	0.57	0.57	0.52	0.54	0.55
Sodium ion	mg/kg	NG	NG	NG	NG	NG	NG	NG						12	18	17	10	11	19
Sulphate (in saturated paste) (mass/mass)	mg/kg	NG	NG	NG	NG	NG	NG	NG						190	400	310	160	210	300
Sulphate (in saturated paste)	mg/L	NG	NG	NG	NG	NG	NG	NG						530	770	620	420	590	480
Texture		NG	NG	NG	NG	NG	NG	NG	Sandy Loam	Loamy Sand	Sand	Sand	Sandy Loam						
Theoretical gypsum requirement	ton US/ha	NG	NG	NG	NG	NG	NG	NG						<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Glycols																			
Diethylene glycol	mg/kg	NG	NG	NG	NG	NG	NG	NG						<10	<10	<10	<10	<10	<10
Ethylene glycol	mg/kg	NG	960	960	960	960	960	960						<10	<10	<10	<10	<10	<10
Propylene glycol	mg/kg	NG	NG	NG	NG	NG	NG	NG						<10	<10	<10	<10	<10	<10
Tetraethylene glycol	mg/kg	NG	NG	NG	NG	NG	NG	NG						<10	<10	<10	<10	<10	<10
Triethylene glycol	mg/kg	NG	NG	NG	NG	NG	NG	NG						<10	<10	<10	<10	<10	<10
Hydrocarbons																			
Benzene	mg/kg	NG	0.030 ^{2.1}	0.0068 ^{3.1}	0.030 ^{4.1}	0.0068 ^{5.1}	0.0095 ^{6.1}	0.0068 ^{7.1}	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Ethylbenzene	mg/kg	NG	0.082 ^{2.2}	0.018 ^{3.2}	0.082 ^{4.2}	0.018 ^{5.2}	0.082 ^{6.2}	0.018 ^{7.2}	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
F1 (C6-C10)	mg/kg	NG	NG	NG	NG	NG	NG	NG	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
F1 (CCME): (C6-C10) (less BTEX)	mg/kg	NG	240 ^{2.3}	170 ^{3.3}	240 ^{4.3}	170 ^{5.3}	30 ^{6.3}	170 ^{7.3}	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
F2 (C10-C16)	mg/kg	NG	260 ^{2.4}	230 ^{3.4}	260 ^{4.4}	230 ^{5.4}	150 ^{6.4}	150 ^{7.4}	<10	<10	<10	<10	<10	<10	10	<10	<10	<10	<10
F3 (C16-C34)	mg/kg	NG	1700 ^{2.5}	2500 ^{3.5}	1700 ^{4.5}	2500 ^{5.5}	300 ^{6.5}	1300 ^{7.5}	<50	<50	<50	<50	52	<50	92	63	<50	<50	120

Hay River Harbour
Soil Quality Results

Sampling Location									Sample 01-A	Sample 01-B	Sample 01-B	Sample 2	Sample 3	SED-019-01	SED-019-02	SED-019-03	SED-019-04	SED-019-05	SED-019-06
Date Sampled									18-Jan-23	18-Jan-23	18-Jan-23	18-Jan-23	18-Jan-23	14-Oct-17	14-Oct-17	14-Oct-17	14-Oct-17	14-Oct-17	14-Oct-17
Lab Sample ID									BKQ530	BKQ531	BKQ532	BKQ533	BKQ534						
Sample Type									Normal	Normal	Duplicate	Normal	Normal						
Analyte	Unit	Guideline																	
		CCME Sediment FAL	CCME SO CL CS	CCME SO CL FS	CCME SO IL CS	CCME SO IL FS	CCME SO RL/PL CS	CCME SO RL/PL FS											
F4 (CCME): (>C34-C50)	mg/kg	NG	3300 ^{2.6}	6600 ^{3.6}	3300 ^{4.6}	6600 ^{5.6}	2800 ^{6.6}	5600 ^{7.6}	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Reached baseline at C50	mg/kg	NG	NG	NG	NG	NG	NG	NG	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Styrene	mg/kg	NG	50	50	50	50	5	5						<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Toluene	mg/kg	NG	0.37 ^{2.7}	0.08 ^{3.7}	0.37 ^{4.7}	0.08 ^{5.7}	0.37 ^{6.7}	0.08 ^{7.7}	<0.050	<0.050	<0.050	<0.050	<0.050	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Xylene	mg/kg	NG	11 ^{2.8}	2.4 ^{3.8}	11 ^{4.8}	2.4 ^{5.8}	11 ^{6.8}	2.4 ^{7.8}	<0.045	<0.045	<0.045	<0.045	<0.045	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
m,p-Xylene	mg/kg	NG	NG	NG	NG	NG	NG	NG	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
o-Xylene	mg/kg	NG	NG	NG	NG	NG	NG	NG	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Miscellaneous Organic Substances																			
Atrazine + desethylatrazine	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080
Bromacil	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.0090	<0.0090	<0.0090	<0.0090	<0.0090	<0.0090
Diuron	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Linuron	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.0070	<0.0070	<0.0070	<0.0070	<0.0070	<0.0070
Simazine	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Tebuthiuron	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Phenolic Substances																			
2-Chlorophenol	mg/kg	NG	5	5	5	5	0.5	0.5						<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
3 + 4-Chlorophenol	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cresol	mg/kg	NG	10	10	10	10	1	1						<0.0071	<0.0071	<0.0071	<0.0071	<0.0071	<0.0071
2,4-Dichlorophenol	mg/kg	NG	5	5	5	5	0.5	0.5						<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
2,6-Dichlorophenol	mg/kg	NG	5	5	5	5	0.5	0.5						<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
2,4-Dimethylphenol	mg/kg	NG	10	10	10	10	1	1						<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
2,4-Dinitrophenol	mg/kg	NG	10	10	10	10	1	1						<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
2-Methyl-4,6-dinitrophenol	mg/kg	NG	10	10	10	10	1	1						<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
4-Chloro-3-methylphenol	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
2-Methylphenol	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
3 + 4-Methylphenol	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
2-Nitrophenol	mg/kg	NG	10	10	10	10	1	1						<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
4-Nitrophenol	mg/kg	NG	10	10	10	10	1	1						<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Pentachlorophenol	mg/kg	NG	7.6	7.6	7.6	7.6	7.6	7.6						<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Phenol	mg/kg	NG	3.8	3.8	3.8	3.8	3.8	3.8						<0.0010	0.0035	0.003	<0.0010	0.0032	0.0081
2,3,4,6-Tetrachlorophenol	mg/kg	NG	5	5	5	5	0.5	0.5						<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
2,3,5,6-Tetrachlorophenol	mg/kg	NG	5	5	5	5	0.5	0.5						<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
2,3,4-Trichlorophenol	mg/kg	NG	5	5	5	5	0.5	0.5						<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
2,3,5-Trichlorophenol	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
2,4,5-Trichlorophenol	mg/kg	NG	5	5	5	5	0.5	0.5						<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
2,4,6-Trichlorophenol	mg/kg	NG	5	5	5	5	0.5	0.5						<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Polycyclic Aromatic Hydrocarbons (PAHs)																			
Acenaphthene	mg/kg	0.00671 ^{1.1}	0.28 ^{2.9}	0.28 ^{3.9}	0.28 ^{4.9}	0.28 ^{5.9}	0.28 ^{6.9}	0.28 ^{7.9}	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Acenaphthylene	mg/kg	0.00587 ^{1.2}	320 ^{2.10}	320 ^{3.10}	320 ^{4.10}	320 ^{5.10}	320 ^{6.10}	320 ^{7.10}	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Acridine	mg/kg	NG	NG	NG	NG	NG	NG	NG	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Anthracene	mg/kg	0.0469 ^{1.3}	32 ^{2.11}	32 ^{3.11}	32 ^{4.11}	32 ^{5.11}	2.5 ^{6.11}	2.5 ^{7.11}	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Benz[a]anthracene	mg/kg	0.0317	10 ^{2.12}	10 ^{3.12}	10 ^{4.12}	10 ^{5.12}	1 ^{6.12}	1 ^{7.12}	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0052	<0.0050	<0.0050	<0.0050	<0.0050
Benzo(c)phenanthrene	mg/kg	NG	NG	NG	NG	NG	NG	NG	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Benzo[a]pyrene	mg/kg	0.0319	72 ^{2.13}	72 ^{3.13}	72 ^{4.13}	72 ^{5.13}	20 ^{6.13}	20 ^{7.13}	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0062	<0.0050	<0.0050	<0.0050	0.0052
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg	NG	NG	NG	NG	NG	NG	NG	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.011	0.017	0.01	0.011	0.0065	0.016
Benzo[e]pyrene	mg/kg	NG	NG	NG	NG	NG	NG	NG	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0077	0.013	0.0086	0.0098	0.0058	0.012

Hay River Harbour
Soil Quality Results

Sampling Location									Sample 01-A	Sample 01-B	Sample 01-B	Sample 2	Sample 3	SED-019-01	SED-019-02	SED-019-03	SED-019-04	SED-019-05	SED-019-06
Date Sampled									18-Jan-23	18-Jan-23	18-Jan-23	18-Jan-23	18-Jan-23	14-Oct-17	14-Oct-17	14-Oct-17	14-Oct-17	14-Oct-17	14-Oct-17
Lab Sample ID									BKQ530	BKQ531	BKQ532	BKQ533	BKQ534						
Sample Type									Normal	Normal	Duplicate	Normal	Normal						
Analyte	Unit	Guideline																	
		CCME Sediment FAL	CCME SO CL CS	CCME SO CL FS	CCME SO IL CS	CCME SO IL FS	CCME SO RL/PL CS	CCME SO RL/PL FS											
Benzo[g,h,i]perylene	mg/kg	NG	N ^{2.14}	N ^{3.14}	N ^{4.14}	N ^{5.14}	N ^{6.14}	N ^{7.14}	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0079	0.013	0.0087	0.0082	0.0061	0.015
Benzo[k]fluoranthene	mg/kg	NG	10 ^{2.15}	10 ^{3.15}	10 ^{4.15}	10 ^{5.15}	1 ^{6.15}	1 ^{7.15}	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Chrysene	mg/kg	0.0571	N ^{2.16}	N ^{3.16}	N ^{4.16}	N ^{5.16}	6.2 ^{6.16}	6.2 ^{7.16}	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0062	0.006	<0.0050	<0.0050	<0.0050	<0.0050
Dibenz[a,h]anthracene	mg/kg	0.00622 ^{1.4}	10 ^{2.17}	10 ^{3.17}	10 ^{4.17}	10 ^{5.17}	1 ^{6.17}	1 ^{7.17}	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Fluoranthene	mg/kg	0.111	180 ^{2.18}	180 ^{3.18}	180 ^{4.18}	180 ^{5.18}	50 ^{6.18}	50 ^{7.18}	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.013	0.017	0.0093	0.0066	<0.0050	0.0081
Fluorene	mg/kg	0.0212 ^{1.5}	0.25 ^{2.19}	0.25 ^{3.19}	0.25 ^{4.19}	0.25 ^{5.19}	0.25 ^{6.19}	0.25 ^{7.19}	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0066	0.0059	<0.0050	<0.0050	0.0063
IACR (CCME)		NG	1.0 ^{2.20}	1.0 ^{3.20}	1.0 ^{4.20}	1.0 ^{5.20}	1.0 ^{6.20}	1.0 ^{7.20}						0.12	0.17	0.11	0.11	<0.10	0.15
Indeno[1,2,3-cd]pyrene	mg/kg	NG	10 ^{2.21}	10 ^{3.21}	10 ^{4.21}	10 ^{5.21}	1 ^{6.21}	1 ^{7.21}	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0058	<0.0050	<0.0050	<0.0050	0.0079
1-Methylnaphthalene	mg/kg	NG	NG	NG	NG	NG	NG	NG	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0052	<0.0050	<0.0050	<0.0050	<0.0050
2-Methylnaphthalene	mg/kg	0.0202 ^{1.6}	NG	NG	NG	NG	NG	NG	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Naphthalene	mg/kg	0.0346 ^{1.7}	0.013 ^{2.22}	0.013 ^{3.22}	0.013 ^{4.22}	0.013 ^{5.22}	0.013 ^{6.22}	0.013 ^{7.22}	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Carcinogenic PAHs (as B(a)P TPE)	mg/kg	NG	0.6 ^{2.23}	0.6 ^{3.23}	0.6 ^{4.23}	0.6 ^{5.23}	0.6 ^{6.23}	0.6 ^{7.23}	<0.0071	<0.0071	<0.0071	<0.0071	<0.0071	<0.0071	0.012	<0.0071	<0.0071	<0.0071	0.011
Carcinogenic PAHs (IACR for coarse soil, AB Tier 1)		NG	NG	NG	NG	NG	NG	NG	<0.10	<0.10	<0.10	<0.10	<0.10						
Carcinogenic PAHs (IACR for fine soil, AB Tier 1)		NG	NG	NG	NG	NG	NG	NG	<0.10	<0.10	<0.10	<0.10	<0.10						
Perylene	mg/kg	NG	NG	NG	NG	NG	NG	NG	0.041	0.031	0.025	0.016	0.05	0.092	0.23	0.17	0.11	0.11	0.25
Phenanthrene	mg/kg	0.0419	0.046 ^{2.24}	0.046 ^{3.24}	0.046 ^{4.24}	0.046 ^{5.24}	0.046 ^{6.24}	0.046 ^{7.24}	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0065	0.013	0.008	<0.0050	<0.0050	0.0088
Pyrene	mg/kg	0.053	100 ^{2.25}	100 ^{3.25}	100 ^{4.25}	100 ^{5.25}	10 ^{6.25}	10 ^{7.25}	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.013	0.018	0.011	0.012	0.0053	0.011
Quinoline	mg/kg	NG	NG	NG	NG	NG	NG	NG	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.019
Volatile Organic Compounds																			
Bromodichloromethane	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Bromoform	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Bromomethane	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Carbon tetrachloride	mg/kg	NG	50	50	50	50	5	5						0.00086	<0.00050	0.0018	0.0019	0.0033	<0.0011
Chlorobenzene	mg/kg	NG	10	10	10	10	1	1						0.003	0.0028	0.0042	0.0049	0.0096	<0.0010
Chloroform	mg/kg	NG	50	50	50	50	5	5						<0.0012	<0.00080	0.0023	0.0025	0.004	<0.00080
Chloromethane	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Dibromochloromethane	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
1,2-Dibromoethane	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.0020	<0.0020	<0.0067	<0.0060	<0.0093	<0.0020
1,2-Dichlorobenzene	mg/kg	NG	10	10	10	10	1	1						<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
1,3-Dichlorobenzene	mg/kg	NG	10	10	10	10	1	1						<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
1,4-Dichlorobenzene	mg/kg	NG	10	10	10	10	1	1						<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
1,1-Dichloroethane	mg/kg	NG	50	50	50	50	5	5						<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
1,2-Dichloroethane	mg/kg	NG	50	50	50	50	5	5						<0.0020	<0.0020	<0.0020	<0.0020	0.0037	<0.0020
1,1-Dichloroethylene	mg/kg	NG	50	50	50	50	5	5						<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
cis-1,2-Dichloroethylene	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
trans-1,2-Dichloroethylene	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Dichloromethane	mg/kg	NG	50	50	50	50	5	5						<0.030	<0.030	<0.030	0.063	0.46	<0.030
1,2-Dichloropropane	mg/kg	NG	50	50	50	50	5	5						<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
cis-1,3-Dichloropropene	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
trans-1,3-Dichloropropene	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
1,3-Dichloropropene (cis + trans) (calculated)	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
Ethyl chloride	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Methyl methacrylate	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Methyl tert-butyl ether	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
1,1,1,2-Tetrachloroethane	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
1,1,1,2,2-Tetrachloroethane	mg/kg	NG	50	50	50	50	5	5						<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Tetrachloroethylene	mg/kg	NG	0.5	0.5	0.6	0.6	0.2	0.2						<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
1,2,3-Trichlorobenzene	mg/kg	NG	10	10	10	10	2	2						<0.040	<0.040	<0.040	<0.040	<0.040	<0.040

Hay River Harbour
Soil Quality Results

Sampling Location									Sample 01-A	Sample 01-B	Sample 01-B	Sample 2	Sample 3	SED-019-01	SED-019-02	SED-019-03	SED-019-04	SED-019-05	SED-019-06
Date Sampled									18-Jan-23	18-Jan-23	18-Jan-23	18-Jan-23	18-Jan-23	14-Oct-17	14-Oct-17	14-Oct-17	14-Oct-17	14-Oct-17	14-Oct-17
Lab Sample ID									BKQ530	BKQ531	BKQ532	BKQ533	BKQ534						
Sample Type									Normal	Normal	Duplicate	Normal	Normal						
Analyte	Unit	Guideline																	
		CCME Sediment FAL	CCME SO CL CS	CCME SO CL FS	CCME SO IL CS	CCME SO IL FS	CCME SO RL/PL CS	CCME SO RL/PL FS											
1,2,4-Trichlorobenzene	mg/kg	NG	10	10	10	10	2	2						<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
1,3,5-Trichlorobenzene	mg/kg	NG	10	10	10	10	2	2						<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
1,1,1-Trichloroethane	mg/kg	NG	50	50	50	50	5	5						<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
1,1,2-Trichloroethane	mg/kg	NG	50	50	50	50	5	5						<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Trichloroethylene	mg/kg	NG	0.01	0.01	0.01	0.01	0.01	0.01						<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Trichlorofluoromethane	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
1,3,5-Trimethylbenzene	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Trimethylbenzene (mixed isomers)	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Vinyl chloride	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.0012	<0.00030	<0.0020	<0.0037	<0.0084	<0.00066
Metals																			
Antimony	mg/kg	NG	40	40	40	40	20	20	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Arsenic	mg/kg	5.900	12	12	12	12	12	12	6.6	6.1	5	5	7	6	8.2	8.6	6.9	6.1	9.6
Barium	mg/kg	NG	2000	2000	2000	2000	500	500	150	130	130	140	160	120	170	140	100	99	160
Beryllium	mg/kg	NG	8	8	8	8	4	4	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.43	<0.40	<0.40	<0.40	<0.40
Cadmium	mg/kg	0.600	22	22	22	22	10	10	0.3	0.21	0.23	0.16	0.3	0.2	0.58	0.59	0.33	0.37	0.84
Chromium	mg/kg	37.300	87	87	87	87	64	64	7.5	5.7	5.5	5.5	8.4	5.8	11	9.1	7.4	6	8.7
Chromium (hexavalent)	mg/kg	NG	1.4	1.4	1.4	1.4	0.4	0.4	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080
Cobalt	mg/kg	NG	300	300	300	300	50	50	5.8	4.8	4	4.1	6.9	4.7	9	8.2	5.9	5.9	9.3
Copper	mg/kg	35.700	91	91	91	91	63	63	8.3	6.4	4.7	5.4	9.1	7.3	17	15	9.9	13	21
Lead	mg/kg	35.000	260	260	600	600	140	140	4.5	3.7	3	3	5.1	4.1	8.3	7	4.8	4.7	7.7
Mercury	mg/kg	0.170	24	24	50	50	6.6	6.6	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.068	0.062	<0.050	0.054	0.054
Molybdenum	mg/kg	NG	40	40	40	40	10	10	0.97	0.83	0.69	0.64	1	0.78	1.4	1.3	0.92	0.93	1.5
Nickel	mg/kg	NG	89	89	89	89	45	45	13	9.7	8.2	8.5	13	11	21	19	13	13	21
Selenium	mg/kg	NG	2.9	2.9	2.9	2.9	1	1	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.66	0.65	<0.50	<0.50	0.88
Silver	mg/kg	NG	40	40	40	40	20	20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Thallium	mg/kg	NG	1	1	1	1	1	1	<0.10	<0.10	<0.10	<0.10	0.1	<0.10	0.17	0.15	<0.10	0.11	0.17
Tin	mg/kg	NG	300	300	300	300	50	50	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Uranium	mg/kg	NG	33	33	300	300	23	23	1.2	0.95	1	0.75	0.96	0.88	1.2	1.3	1.1	1	1.8
Vanadium	mg/kg	NG	130	130	130	130	130	130	14	11	9.4	9.9	15	11	19	16	12	11	17
Zinc	mg/kg	123.000	410 ^{2.26}	410 ^{3.26}	410 ^{4.26}	410 ^{5.26}	250 ^{6.26}	250 ^{7.26}	49	35	40	29	47	43	83	75	50	52	82



Hay River Harbour
Guideline Notes for Soil Quality Results

1. Notes for CCME. Canadian sediment quality guidelines for the protection of freshwater aquatic life. (CCME Sediment FAL)
General Notes:
The CCME sediment quality guidelines for the protection of freshwater aquatic life provide Interim sediment quality guidelines (ISQGs) and probable effect levels (PELs). The Interim sediment quality guidelines have been used in this report.
Note 1.1 for Acenaphthene:
Provisional; adoption of marine ISQG developed using the modified NSTP approach.
Note 1.2 for Acenaphthylene:
Provisional; adoption of marine ISQG developed using the modified NSTP approach.
Note 1.3 for Anthracene:
Provisional; adoption of marine ISQG developed using the modified NSTP approach.
Note 1.4 for Dibenz[a,h]anthracene:
Provisional; adoption of marine ISQG developed using the modified NSTP approach.
Note 1.5 for Fluorene:
Provisional; adoption of marine ISQG developed using the modified NSTP approach.
Note 1.6 for 2-Methylnaphthalene:
Provisional; adoption of marine ISQG developed using the modified NSTP approach.
Note 1.7 for Naphthalene:
Provisional; adoption of marine ISQG developed using the modified NSTP approach.
2. Notes for CCME. Canadian Soil Quality Guidelines; and Canada-Wide Standards for Petroleum Hydrocarbons in Soil - for Commercial Land Use and Coarse-grained Soil. (CCME SO CL CS)
General Notes:
There are different guidelines based on site-specific factors for some analytes. The most stringent guidelines were used.
Note 2.1 for Benzene:
The guideline for benzene is 0.030 mg/kg for the following: <ul style="list-style-type: none"> • Surface soil ($\leq 1.5\text{m}$) with coarse soil texture, and based on a lifetime incremental cancer risk of 1 in 100,000 (10-5). • Subsoil ($> 1.5\text{m}$) with coarse soil texture, and based on a lifetime incremental cancer risk of 1 in 100,000 (10-5). • Surface soil ($\leq 1.5\text{m}$) with coarse soil texture, and based on a lifetime incremental cancer risk of 1 in 1,000,000 (10-6). • Subsoil ($> 1.5\text{m}$) with coarse soil texture, and based on a lifetime incremental cancer risk of 1 in 1,000,000 (10-6).
Note 2.2 for Ethylbenzene:
The guideline for ethylbenzene is 0.082 mg/kg for the following: <ul style="list-style-type: none"> • Surface soil ($\leq 1.5\text{m}$) with coarse soil texture • Subsoil ($> 1.5\text{m}$) with coarse soil texture
Note 2.3 for F1 (CCME): (C6-C10) (less BTEX):
This Tier 1 Level is for coarse, surface soil; and includes protection of potable groundwater. The standard for F1 excludes benzene, toluene, ethylbenzene and xylenes. Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil. / The most stringent guideline was used in this report.
Note 2.4 for F2 (C10-C16):
This Tier 1 Level is for coarse, surface soil. "Coarse" means coarse-textured soil having a median grain size of $> 75\text{ }\mu\text{m}$ as defined by the American Society for Testing and Materials. Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil.
Note 2.5 for F3 (C16-C34):
This Tier 1 Level is for coarse, surface soil. "Coarse" means coarse-textured soil having a median grain size of $> 75\text{ }\mu\text{m}$ as defined by the American Society for Testing and Materials. Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil.
Note 2.6 for F4 (CCME): ($> \text{C34-C50}$):
This Tier 1 Level is for coarse, surface soil. "Coarse" means coarse-textured soil having a median grain size of $> 75\text{ }\mu\text{m}$ as defined by the American Society for Testing and Materials. Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil.
Note 2.7 for Toluene:
The guideline for toluene is 0.37 mg/kg for the following: <ul style="list-style-type: none"> • Surface soil ($\leq 1.5\text{m}$) with coarse soil texture • Subsoil ($> 1.5\text{m}$) with coarse soil texture

Hay River Harbour

Guideline Notes for Soil Quality Results

Note 2.8 for Xylene:
The guideline for xylenes is 11 mg/kg for the following: <ul style="list-style-type: none"> • Surface soil (≤1.5m) with coarse soil texture • Subsoil (>1.5m) with coarse soil texture
Note 2.9 for Acenaphthene:
Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected. Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects. The environmental Soil Quality Guideline for Acenaphthene is 0.28 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).
Note 2.10 for Acenaphthylene:
Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected. Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects. The environmental Soil Quality Guideline for Acenaphthylene is 320 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).
Note 2.11 for Anthracene:
Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected. Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects. The environmental Soil Quality Guideline for Anthracene is 32 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).
Note 2.12 for Benz[a]anthracene:
Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected. Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects. The environmental Soil Quality Guideline for Benz[a]anthracene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).
Note 2.13 for Benzo[a]pyrene:
Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected. Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects. The environmental Soil Quality Guideline for Benzo[a]pyrene is 72 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).
Note 2.14 for Benzo[g,h,i]perylene:
Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected. Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects. An environmental Soil Quality Guideline for Benzo[g,h,i]perylene based on non-carcinogenic effects is not available in Table 1 and 2 of CCME PAHs Factsheet 2010.
Note 2.15 for Benzo[k]fluoranthene:
Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected. Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects. The environmental Soil Quality Guideline for Benzo[k]fluoranthene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

Hay River Harbour

Guideline Notes for Soil Quality Results

Note 2.16 for Chrysene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>An environmental Soil Quality Guideline for Chrysene based on non-carcinogenic effects is not available in Table 1 and 2 of CCME PAHs Factsheet 2010.</p>
Note 2.17 for Dibenz[a,h]anthracene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Dibenz[a,h]anthracene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 2.18 for Fluoranthene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Fluoranthene is 180 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 2.19 for Fluorene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Fluorene is 0.25 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).</p>
Note 2.20 for IACR (CCME):
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p>
Note 2.21 for Indeno[1,2,3-cd]pyrene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Indeno[1,2,3-cd]pyrene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 2.22 for Naphthalene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Naphthalene is 0.013 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>

Hay River Harbour

Guideline Notes for Soil Quality Results

Note 2.23 for Carcinogenic PAHs (as B[a]P TPE):
<p>Guideline for B(A)P Total Potency Equivalent is 0.6 mg/kg based on an incremental lifetime cancer risk (ILCR) of 1 in 1,000,000 (10-6). Guideline for B(A)P Total Potency Equivalent is 5.3 mg/kg based on an incremental lifetime cancer risk (ILCR) of 1 in 100,000 (10-5). Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected. Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>For soil contaminated with coal tar or creosote mixtures, the calculated Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) concentration for soil samples should be multiplied by a safety factor of 3 prior to comparison with the guideline to account for carcinogenic potential of alkylated and other PAHs present for which a Potency Equivalence Factor (PEF) does not currently exist, but which are likely to contribute to mixture carcinogenic potential. / The most stringent guideline was used in this report.</p>
Note 2.24 for Phenanthrene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Phenanthrene is 0.046 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 2.25 for Pyrene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Pyrene is 100 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 2.26 for Zinc:
<p>Reference: Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health; Factsheet for Zinc, 2018.</p> <p>Data are sufficient and adequate to calculate guidelines for human health and environmental health. Therefore, the soil quality guideline is the lower of the two and supersedes the 1999 soil quality guideline and the 1991 interim remediation criteria for soil.</p>
3. Notes for CCME. Canadian Soil Quality Guidelines; and Canada-Wide Standards for Petroleum Hydrocarbons in Soil - for Commercial Land Use and Fine-grained Soil. (CCME SO CL FS)
General Notes:
There are different guidelines based on site-specific factors for some analytes. The most stringent guidelines were used.
Note 3.1 for Benzene:
<p>The guideline for benzene is 0.0068 mg/kg for the following:</p> <ul style="list-style-type: none"> • Surface soil ($\leq 1.5\text{m}$) with fine soil texture, and based on a lifetime incremental cancer risk of 1 in 100,000 (10-5). • Subsoil ($> 1.5\text{m}$) with fine soil texture, and based on a lifetime incremental cancer risk of 1 in 100,000 (10-5). • Surface soil ($\leq 1.5\text{m}$) with fine soil texture, and based on a lifetime incremental cancer risk of 1 in 1,000,000 (10-6). • Subsoil ($> 1.5\text{m}$) with fine soil texture, and based on a lifetime incremental cancer risk of 1 in 1,000,000 (10-6).
Note 3.2 for Ethylbenzene:
<p>The guideline for ethylbenzene is 0.018 mg/kg for the following:</p> <ul style="list-style-type: none"> • Surface soil ($\leq 1.5\text{m}$) with fine soil texture • Subsoil ($> 1.5\text{m}$) with fine soil texture
Note 3.3 for F1 (CCME): (C6-C10) (less BTEX):
<p>This Tier 1 Level is for fine, surface soil and includes protection of potable groundwater. The standard for F1 excludes benzene, toluene, ethylbenzene and xylenes.</p> <p>Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil. / The most stringent guideline was used in this report.</p>
Note 3.4 for F2 (C10-C16):
<p>This Tier 1 Level is for fine, surface soil and includes protection of potable groundwater.</p> <p>"Fine" means fine-textured soil having a median grain size of $< 75\text{ }\mu\text{m}$ as defined by the American Society for Testing and Materials.</p> <p>Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil. / The most stringent standard was used in this report.</p>
Note 3.5 for F3 (C16-C34):
<p>This Tier 1 Level is for fine, surface soil.</p> <p>"Fine" means fine-textured soil having a median grain size of $< 75\text{ }\mu\text{m}$ as defined by the American Society for Testing and Materials.</p> <p>Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil.</p>

Hay River Harbour
Guideline Notes for Soil Quality Results

Note 3.6 for F4 (CCME): (>C34-C50):
<p>This Tier 1 Level is for fine, surface soil.</p> <p>"Fine" means fine-textured soil having a median grain size of <75 µm as defined by the American Society for Testing and Materials.</p> <p>Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008.</p> <p>Table 1 - Summary of Tier 1 Levels for surface soil.</p>
Note 3.7 for Toluene:
<p>The guideline for toluene is 0.08 mg/kg for the following:</p> <ul style="list-style-type: none"> • Surface soil (≤1.5m) with fine soil texture • Subsoil (>1.5m) with fine soil texture
Note 3.8 for Xylene:
<p>The guideline for xylenes is 2.4 mg/kg for the following:</p> <ul style="list-style-type: none"> • Surface soil (≤1.5m) with fine soil texture • Subsoil (>1.5m) with fine soil texture
Note 3.9 for Acenaphthene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Acenaphthene is 0.28 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).</p>
Note 3.10 for Acenaphthylene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Acenaphthylene is 320 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).</p>
Note 3.11 for Anthracene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Anthracene is 32 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 3.12 for Benz[a]anthracene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Benz[a]anthracene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 3.13 for Benzo[a]pyrene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Benzo[a]pyrene is 72 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 3.14 for Benzo[g,h,i]perylene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>An environmental Soil Quality Guideline for Benzo[g,h,i]perylene based on non-carcinogenic effects is not available in Table 1 and 2 of CCME PAHs Factsheet 2010.</p>

Hay River Harbour

Guideline Notes for Soil Quality Results

<p>Note 3.15 for Benzo[k]fluoranthene:</p> <p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Benzo[k]fluoranthene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
<p>Note 3.16 for Chrysene:</p> <p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>An environmental Soil Quality Guideline for Chrysene based on non-carcinogenic effects is not available in Table 1 and 2 of CCME PAHs Factsheet 2010.</p>
<p>Note 3.17 for Dibenz[a,h]anthracene:</p> <p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Dibenz[a,h]anthracene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
<p>Note 3.18 for Fluoranthene:</p> <p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Fluoranthene is 180 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
<p>Note 3.19 for Fluorene:</p> <p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Fluorene is 0.25 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).</p>
<p>Note 3.20 for IACR (CCME):</p> <p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p>
<p>Note 3.21 for Indeno[1,2,3-cd]pyrene:</p> <p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Indeno[1,2,3-cd]pyrene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
<p>Note 3.22 for Naphthalene:</p> <p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Naphthalene is 0.013 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>

Hay River Harbour

Guideline Notes for Soil Quality Results

Note 3.23 for Carcinogenic PAHs (as B[a]P TPE):
<p>Guideline for B(A)P Total Potency Equivalent is 0.6 mg/kg based on an incremental lifetime cancer risk (ILCR) of 1 in 1,000,000 (10-6). Guideline for B(A)P Total Potency Equivalent is 5.3 mg/kg based on an incremental lifetime cancer risk (ILCR) of 1 in 100,000 (10-5). Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected. Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects. For soil contaminated with coal tar or creosote mixtures, the calculated Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) concentration for soil samples should be multiplied by a safety factor of 3 prior to comparison with the guideline to account for carcinogenic potential of alkylated and other PAHs present for which a Potency Equivalence Factor (PEF) does not currently exist, but which are likely to contribute to mixture carcinogenic potential. / The most stringent guideline was used in this report.</p>
Note 3.24 for Phenanthrene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected. Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects. The environmental Soil Quality Guideline for Phenanthrene is 0.046 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 3.25 for Pyrene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected. Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects. The environmental Soil Quality Guideline for Pyrene is 100 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 3.26 for Zinc:
<p>Reference: Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health; Factsheet for Zinc, 2018. Data are sufficient and adequate to calculate guidelines for human health and environmental health. Therefore, the soil quality guideline is the lower of the two and supersedes the 1999 soil quality guideline and the 1991 interim remediation criteria for soil.</p>
4. Notes for CCME. Canadian Soil Quality Guidelines; and Canada-Wide Standards for Petroleum Hydrocarbons in Soil - for Industrial Land Use and Coarse-grained Soil. (CCME SO IL CS)
General Notes:
There are different guidelines based on site-specific factors for some analytes. The most stringent guidelines were used.
Note 4.1 for Benzene:
<p>The guideline for benzene is 0.030 mg/kg for the following:</p> <ul style="list-style-type: none"> • Surface soil with coarse soil texture, and based on a lifetime incremental cancer risk of 1 in 100,000 (10-5). • Subsoil with coarse soil texture, and based on a lifetime incremental cancer risk of 1 in 100,000 (10-5). • Surface soil with coarse soil texture, and based on a lifetime incremental cancer risk of 1 in 1,000,000 (10-6). • Subsoil with coarse soil texture, and based on a lifetime incremental cancer risk of 1 in 1,000,000 (10-6).
Note 4.2 for Ethylbenzene:
<p>The guideline for ethylbenzene is 0.082 mg/kg for the following:</p> <ul style="list-style-type: none"> • Surface soil with coarse soil texture • Subsoil with coarse soil texture
Note 4.3 for F1 (CCME): (C6-C10) (less BTEX):
<p>This Tier 1 Level is for coarse, surface soil and includes protection of potable groundwater. The standard for F1 excludes benzene, toluene, ethylbenzene and xylenes. Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil. / The most stringent guideline was used in this report.</p>
Note 4.4 for F2 (C10-C16):
<p>This Tier 1 Level is for coarse, surface soil. "Coarse" means coarse-textured soil having a median grain size of >75 µm as defined by the American Society for Testing and Materials. Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil.</p>
Note 4.5 for F3 (C16-C34):
<p>This Tier 1 Level is for coarse, surface soil. "Coarse" means coarse-textured soil having a median grain size of >75 µm as defined by the American Society for Testing and Materials. Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil.</p>

Hay River Harbour
Guideline Notes for Soil Quality Results

Note 4.6 for F4 (CCME): (>C34-C50):
<p>This Tier 1 Level is for coarse, surface soil.</p> <p>"Coarse" means coarse-textured soil having a median grain size of >75 µm as defined by the American Society for Testing and Materials.</p> <p>Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008.</p> <p>Table 1 - Summary of Tier 1 Levels for surface soil.</p>
Note 4.7 for Toluene:
<p>The guideline for toluene is 0.37 mg/kg for the following:</p> <ul style="list-style-type: none"> • Surface soil with coarse soil texture • Subsoil with coarse soil texture
Note 4.8 for Xylene:
<p>The guideline for xylenes is 11 mg/kg for the following:</p> <ul style="list-style-type: none"> • Surface soil with coarse soil texture • Subsoil with coarse soil texture
Note 4.9 for Acenaphthene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Acenaphthene is 0.28 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).</p>
Note 4.10 for Acenaphthylene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Acenaphthylene is 320 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).</p>
Note 4.11 for Anthracene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Anthracene is 32 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 4.12 for Benz[a]anthracene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Benzo[a]anthracene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 4.13 for Benzo[a]pyrene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Benzo[a]pyrene is 72 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 4.14 for Benzo[g,h,i]perylene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>An environmental Soil Quality Guideline for Benzo[g,h,i]perylene based on non-carcinogenic effects is not available in Table 1 and 2 of CCME PAHs Factsheet 2010.</p>

Hay River Harbour

Guideline Notes for Soil Quality Results

<p>Note 4.15 for Benzo[k]fluoranthene:</p> <p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Benzo[k]fluoranthene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
<p>Note 4.16 for Chrysene:</p> <p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>An environmental Soil Quality Guideline for Chrysene based on non-carcinogenic effects is not available in Table 1 and 2 of CCME PAHs Factsheet 2010.</p>
<p>Note 4.17 for Dibenz[a,h]anthracene:</p> <p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Dibenz[a,h]anthracene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
<p>Note 4.18 for Fluoranthene:</p> <p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Fluoranthene is 180 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
<p>Note 4.19 for Fluorene:</p> <p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Fluorene is 0.25 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).</p>
<p>Note 4.20 for IACR (CCME):</p> <p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p>
<p>Note 4.21 for Indeno[1,2,3-cd]pyrene:</p> <p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Indeno[1,2,3-cd]pyrene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
<p>Note 4.22 for Naphthalene:</p> <p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Naphthalene is 0.013 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>

Hay River Harbour

Guideline Notes for Soil Quality Results

Note 4.23 for Carcinogenic PAHs (as B[a]P TPE):
<p>Guideline for B(A)P Total Potency Equivalent is 0.6 mg/kg based on an incremental lifetime cancer risk (ILCR) of 1 in 1,000,000 (10-6). Guideline for B(A)P Total Potency Equivalent is 5.3 mg/kg based on an incremental lifetime cancer risk (ILCR) of 1 in 100,000 (10-5). Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected. Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>For soil contaminated with coal tar or creosote mixtures, the calculated Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) concentration for soil samples should be multiplied by a safety factor of 3 prior to comparison with the guideline to account for carcinogenic potential of alkylated and other PAHs present for which a Potency Equivalence Factor (PEF) does not currently exist, but which are likely to contribute to mixture carcinogenic potential. / The most stringent guideline was used in this report.</p>
Note 4.24 for Phenanthrene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Phenanthrene is 0.046 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 4.25 for Pyrene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Pyrene is 100 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 4.26 for Zinc:
<p>Reference: Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health; Factsheet for Zinc, 2018.</p> <p>Data are sufficient and adequate to calculate guidelines for human health and environmental health. Therefore, the soil quality guideline is the lower of the two and supersedes the 1999 soil quality guideline and the 1991 interim remediation criteria for soil.</p>
5. Notes for CCME. Canadian Soil Quality Guidelines; and Canada-Wide Standards for Petroleum Hydrocarbons in Soil - for Industrial Land Use and Fine-grained Soil. (CCME SO IL FS)
General Notes:
There are different guidelines based on site-specific factors for some analytes. The most stringent guidelines were used.
Note 5.1 for Benzene:
<p>The guideline for benzene is 0.0068 mg/kg for the following:</p> <ul style="list-style-type: none"> • Surface soil with fine soil texture, and based on a lifetime incremental cancer risk of 1 in 100,000 (10-5). • Subsoil with fine soil texture, and based on a lifetime incremental cancer risk of 1 in 100,000 (10-5). • Surface soil with fine soil texture, and based on a lifetime incremental cancer risk of 1 in 1,000,000 (10-6). • Subsoil with fine soil texture, and based on a lifetime incremental cancer risk of 1 in 1,000,000 (10-6).
Note 5.2 for Ethylbenzene:
<p>The guideline for ethylbenzene is 0.018 mg/kg for the following:</p> <ul style="list-style-type: none"> • Surface soil with fine soil texture • Subsoil with fine soil texture
Note 5.3 for F1 (CCME): (C6-C10) (less BTEX):
<p>This Tier 1 Level is for fine, surface soil and includes protection of potable groundwater. The standard for F1 excludes benzene, toluene, ethylbenzene and xylenes.</p> <p>Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil. / The most stringent guideline was used in this report.</p>
Note 5.4 for F2 (C10-C16):
<p>This Tier 1 Level is for fine, surface soil and includes protection of potable groundwater.</p> <p>"Fine" means fine-textured soil having a median grain size of <75 µm as defined by the American Society for Testing and Materials.</p> <p>Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil. / The most stringent guideline was used in this report.</p>
Note 5.5 for F3 (C16-C34):
<p>This Tier 1 Level is for fine, surface soil.</p> <p>"Fine" means fine-textured soil having a median grain size of <75 µm as defined by the American Society for Testing and Materials.</p> <p>Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil.</p>

Hay River Harbour
Guideline Notes for Soil Quality Results

Note 5.6 for F4 (CCME): (>C34-C50):
<p>This Tier 1 Level is for fine, surface soil.</p> <p>"Fine" means fine-textured soil having a median grain size of <75 µm as defined by the American Society for Testing and Materials.</p> <p>Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008.</p> <p>Table 1 - Summary of Tier 1 Levels for surface soil.</p>
Note 5.7 for Toluene:
<p>The guideline for toluene is 0.08 mg/kg for the following:</p> <ul style="list-style-type: none"> • Surface soil with fine soil texture • Subsoil with fine soil texture
Note 5.8 for Xylene:
<p>The guideline for xylenes is 2.4 mg/kg for the following:</p> <ul style="list-style-type: none"> • Surface soil with fine soil texture • Subsoil with fine soil texture
Note 5.9 for Acenaphthene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Acenaphthene is 0.28 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).</p>
Note 5.10 for Acenaphthylene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Acenaphthylene is 320 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).</p>
Note 5.11 for Anthracene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Anthracene is 32 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 5.12 for Benz[a]anthracene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Benz[a]anthracene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 5.13 for Benzo[a]pyrene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Benzo[a]pyrene is 72 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 5.14 for Benzo[g,h,i]perylene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>An environmental Soil Quality Guideline for Benzo[g,h,i]perylene based on non-carcinogenic effects is not available in Table 1 and 2 of CCME PAHs Factsheet 2010.</p>

Hay River Harbour

Guideline Notes for Soil Quality Results

<p>Note 5.15 for Benzo[k]fluoranthene:</p> <p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Benzo[k]fluoranthene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
<p>Note 5.16 for Chrysene:</p> <p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>An environmental Soil Quality Guideline for Chrysene based on non-carcinogenic effects is not available in Table 1 and 2 of CCME PAHs Factsheet 2010.</p>
<p>Note 5.17 for Dibenz[a,h]anthracene:</p> <p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Dibenz[a,h]anthracene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
<p>Note 5.18 for Fluoranthene:</p> <p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Fluoranthene is 180 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
<p>Note 5.19 for Fluorene:</p> <p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Fluorene is 0.25 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).</p>
<p>Note 5.20 for IACR (CCME):</p> <p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p>
<p>Note 5.21 for Indeno[1,2,3-cd]pyrene:</p> <p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Indeno[1,2,3-cd]pyrene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
<p>Note 5.22 for Naphthalene:</p> <p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Naphthalene is 0.013 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>

Hay River Harbour

Guideline Notes for Soil Quality Results

Note 5.23 for Carcinogenic PAHs (as B[a]P TPE):
<p>Guideline for B(A)P Total Potency Equivalent is 0.6 mg/kg based on an incremental lifetime cancer risk (ILCR) of 1 in 1,000,000 (10-6). Guideline for B(A)P Total Potency Equivalent is 5.3 mg/kg based on an incremental lifetime cancer risk (ILCR) of 1 in 100,000 (10-5). Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected. Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>For soil contaminated with coal tar or creosote mixtures, the calculated Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) concentration for soil samples should be multiplied by a safety factor of 3 prior to comparison with the guideline to account for carcinogenic potential of alkylated and other PAHs present for which a Potency Equivalence Factor (PEF) does not currently exist, but which are likely to contribute to mixture carcinogenic potential. / The most stringent guideline was used in this report.</p>
Note 5.24 for Phenanthrene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Phenanthrene is 0.046 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 5.25 for Pyrene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Pyrene is 100 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 5.26 for Zinc:
<p>Reference: Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health; Factsheet for Zinc, 2018.</p> <p>Data are sufficient and adequate to calculate guidelines for human health and environmental health. Therefore, the soil quality guideline is the lower of the two and supersedes the 1999 soil quality guideline and the 1991 interim remediation criteria for soil.</p>
6. Notes for CCME. Canadian Soil Quality Guidelines; and Canada-Wide Standards for Petroleum Hydrocarbons in Soil - for Residential/parkland Land Use and Coarse-grained Soil. (CCME SO RL/PL CS)
General Notes:
There are different guidelines based on site-specific factors for some analytes. The most stringent guidelines were used.
Note 6.1 for Benzene:
<p>The guideline for benzene is 0.030 mg/kg for the following:</p> <ul style="list-style-type: none"> • Surface soil (<=1.5 m) with coarse soil texture, and based on a lifetime incremental cancer risk of 1 in 100,000 (10-5). • Subsoil (>1.5 m) with coarse soil texture, and based on a lifetime incremental cancer risk of 1 in 100,000 (10-5). <p>The guideline for benzene is 0.0095 mg/kg for the following:</p> <ul style="list-style-type: none"> • Surface soil (<=1.5 m) with coarse soil texture, and based on a lifetime incremental cancer risk of 1 in 1,000,000 (10-6). <p>The guideline for benzene is 0.011 mg/kg for the following:</p> <ul style="list-style-type: none"> • Subsoil (>1.5 m) with coarse soil texture, and based on a lifetime incremental cancer risk of 1 in 1,000,000 (10-6). / The most stringent guideline was used in this report.
Note 6.2 for Ethylbenzene:
<p>The guideline for ethylbenzene is 0.082 mg/kg for the following:</p> <ul style="list-style-type: none"> • Surface soil with coarse soil texture • Subsoil with coarse soil texture
Note 6.3 for F1 (CCME): (C6-C10) (less BTEX):
<p>Standard assumes contamination near residence, and is for coarse, surface soil. The standard for F1 excludes benzene, toluene, ethylbenzene and xylenes.</p> <p>Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil.</p>
Note 6.4 for F2 (C10-C16):
<p>This Tier 1 Level is for coarse, surface soil.</p> <p>"Coarse" means coarse-textured soil having a median grain size of >75 µm as defined by the American Society for Testing and Materials.</p> <p>Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil.</p>

Hay River Harbour
Guideline Notes for Soil Quality Results

Note 6.5 for F3 (C16-C34):
<p>This Tier 1 Level is for coarse, surface soil.</p> <p>"Coarse" means coarse-textured soil having a median grain size of >75 µm as defined by the American Society for Testing and Materials. Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil.</p>
Note 6.6 for F4 (CCME): (>C34-C50):
<p>This Tier 1 Level is for coarse, surface soil.</p> <p>"Coarse" means coarse-textured soil having a median grain size of >75 µm as defined by the American Society for Testing and Materials. Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil.</p>
Note 6.7 for Toluene:
<p>The guideline for toluene is 0.37 mg/kg for the following:</p> <ul style="list-style-type: none"> • Surface soil with coarse soil texture • Subsoil with coarse soil texture
Note 6.8 for Xylene:
<p>The guideline for xylenes is 11 mg/kg for the following:</p> <ul style="list-style-type: none"> • Surface soil with coarse soil texture • Subsoil with coarse soil texture
Note 6.9 for Acenaphthene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Acenaphthene is 0.28 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).</p>
Note 6.10 for Acenaphthylene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Acenaphthylene is 320 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).</p>
Note 6.11 for Anthracene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Anthracene is 2.5 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 6.12 for Benz[a]anthracene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Benzo[a]anthracene is 1 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 6.13 for Benzo[a]pyrene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Benzo[a]pyrene is 20 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>

Hay River Harbour
Guideline Notes for Soil Quality Results

Note 6.14 for Benzo[g,h,i]perylene:
Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected. Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects. An environmental Soil Quality Guideline for Benzo[g,h,i]perylene based on non-carcinogenic effects is not available in Table 1 and 2 of CCME PAHs Factsheet 2010.
Note 6.15 for Benzo[k]fluoranthene:
Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected. Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects. The environmental Soil Quality Guideline for Benzo[k]fluoranthene is 1 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).
Note 6.16 for Chrysene:
Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected. Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects. An environmental Soil Quality Guideline for Chrysene based on non-carcinogenic effects is 6.2 mg/kg based on Table 2 of CCME PAHs Factsheet 2010.
Note 6.17 for Dibenz[a,h]anthracene:
Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected. Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects. The environmental Soil Quality Guideline for Dibenz[a,h]anthracene is 1 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).
Note 6.18 for Fluoranthene:
Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected. Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects. The environmental Soil Quality Guideline for Fluoranthene is 50 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).
Note 6.19 for Fluorene:
Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected. Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects. The environmental Soil Quality Guideline for Fluorene is 0.25 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).
Note 6.20 for IACR (CCME):
Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected. Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.
Note 6.21 for Indeno[1,2,3-cd]pyrene:
Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected. Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects. The environmental Soil Quality Guideline for Indeno[1,2,3-cd]pyrene is 1 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

Hay River Harbour

Guideline Notes for Soil Quality Results

Note 6.22 for Naphthalene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Naphthalene is 0.013 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 6.23 for Carcinogenic PAHs (as B[a]P TPE):
<p>Guideline for B(A)P Total Potency Equivalent is 0.6 mg/kg based on an incremental lifetime cancer risk (ILCR) of 1 in 1,000,000 (10-6). Guideline for B(A)P Total Potency Equivalent is 5.3 mg/kg based on an incremental lifetime cancer risk (ILCR) of 1 in 100,000 (10-5).</p> <p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected. Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>For soil contaminated with coal tar or creosote mixtures, the calculated Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) concentration for soil samples should be multiplied by a safety factor of 3 prior to comparison with the guideline to account for carcinogenic potential of alkylated and other PAHs present for which a Potency Equivalence Factor (PEF) does not currently exist, but which are likely to contribute to mixture carcinogenic potential. / The most stringent guideline was used in this report.</p>
Note 6.24 for Phenanthrene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Phenanthrene is 0.046 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 6.25 for Pyrene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Pyrene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 6.26 for Zinc:
<p>Reference: Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health; Factsheet for Zinc, 2018.</p> <p>Data are sufficient and adequate to calculate guidelines for human health and environmental health. Therefore, the soil quality guideline is the lower of the two and supersedes the 1999 soil quality guideline and the 1991 interim remediation criteria for soil.</p>
7. Notes for CCME. Canadian Soil Quality Guidelines; and Canada-Wide Standards for Petroleum Hydrocarbons in Soil - for Residential/parkland Land Use and Fine-grained Soil. (CCME SO RL/PL FS)
General Notes:
There are different guidelines based on site-specific factors for some analytes. The most stringent guidelines were used.
Note 7.1 for Benzene:
<p>The guideline for benzene is 0.0068 mg/kg for the following:</p> <ul style="list-style-type: none"> • Surface soil (<=1.5 m) with fine soil texture, and based on a lifetime incremental cancer risk of 1 in 100,000 (10-5). • Subsoil (>1.5 m) with fine soil texture, and based on a lifetime incremental cancer risk of 1 in 100,000 (10-5). • Surface soil (<=1.5 m) with fine soil texture, and based on a lifetime incremental cancer risk of 1 in 1,000,000 (10-6). • Subsoil with (> 1.5 m) fine soil texture, and based on a lifetime incremental cancer risk of 1 in 1,000,000 (10-6).
Note 7.2 for Ethylbenzene:
<p>The guideline for ethylbenzene is 0.018 mg/kg for the following:</p> <ul style="list-style-type: none"> • Surface soil with fine soil texture • Subsoil with fine soil texture
Note 7.3 for F1 (CCME): (C6-C10) (less BTEX):
<p>This Tier 1 Level is for fine, surface soil that includes protection of potable groundwater. The standard for F1 excludes benzene, toluene, ethylbenzene and xylenes.</p> <p>Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil. / The most stringent guideline was used in this report.</p>

Hay River Harbour

Guideline Notes for Soil Quality Results

Note 7.4 for F2 (C10-C16):
<p>This Tier 1 Level is for fine, surface soil.</p> <p>"Fine" means fine-textured soil having a median grain size of <75 µm as defined by the American Society for Testing and Materials.</p> <p>Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008.</p> <p>Table 1 - Summary of Tier 1 Levels for surface soil.</p>
Note 7.5 for F3 (C16-C34):
<p>This Tier 1 Level is for fine, surface soil.</p> <p>"Fine" means fine-textured soil having a median grain size of <75 µm as defined by the American Society for Testing and Materials.</p> <p>Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008.</p> <p>Table 1 - Summary of Tier 1 Levels for surface soil.</p>
Note 7.6 for F4 (CCME): (>C34-C50):
<p>This Tier 1 Level is for fine, surface soil.</p> <p>"Fine" means fine-textured soil having a median grain size of <75 µm as defined by the American Society for Testing and Materials.</p> <p>Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008.</p> <p>Table 1 - Summary of Tier 1 Levels for surface soil.</p>
Note 7.7 for Toluene:
<p>The guideline for toluene is 0.08 mg/kg for the following:</p> <ul style="list-style-type: none"> • Surface soil with fine soil texture • Subsoil with fine soil texture
Note 7.8 for Xylene:
<p>The guideline for xylenes is 2.4 mg/kg for the following:</p> <ul style="list-style-type: none"> • Surface soil with fine soil texture • Subsoil with fine soil texture
Note 7.9 for Acenaphthene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Acenaphthene is 0.28 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).</p>
Note 7.10 for Acenaphthylene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Acenaphthylene is 320 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).</p>
Note 7.11 for Anthracene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Anthracene is 2.5 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 7.12 for Benz[a]anthracene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Benzo[a]anthracene is 1 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>

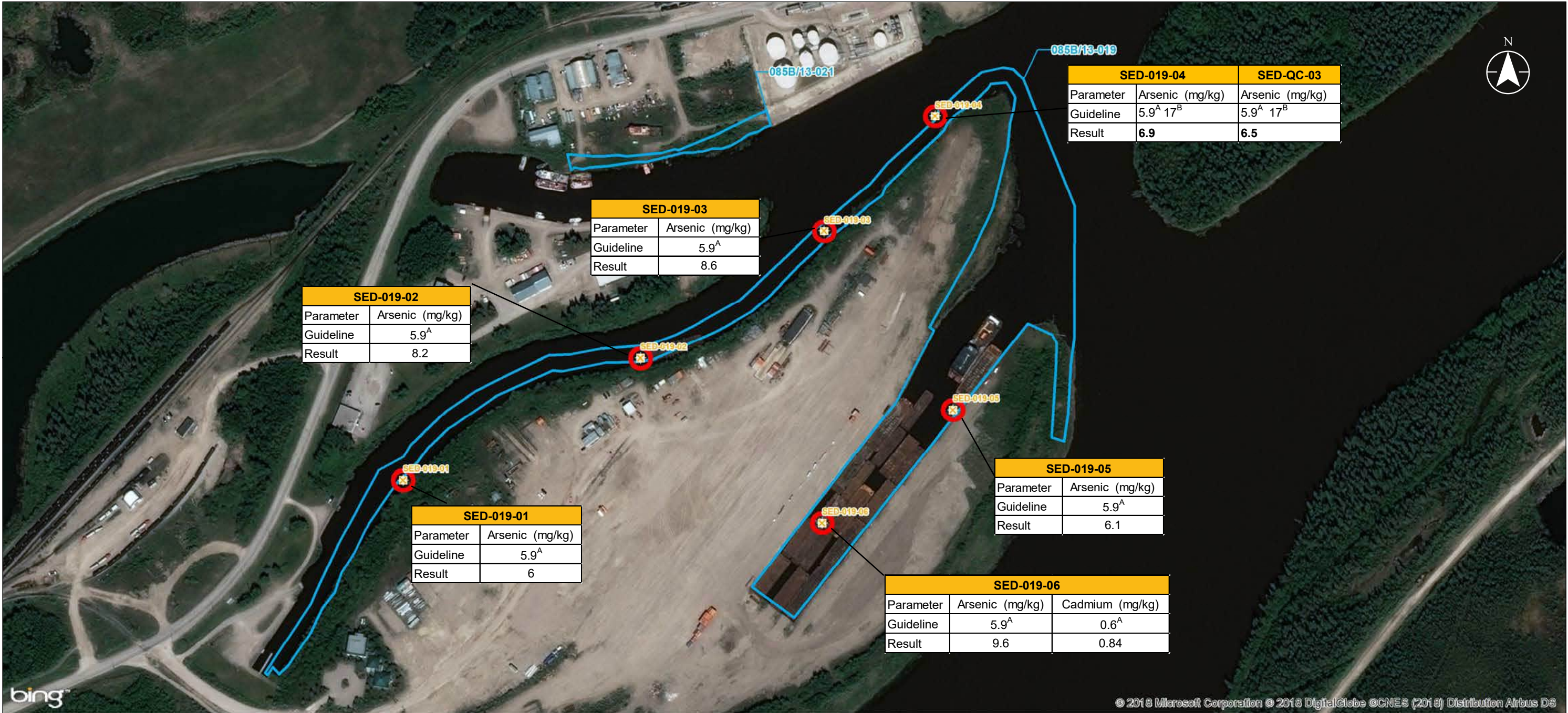
Hay River Harbour

Guideline Notes for Soil Quality Results

Note 7.13 for Benzo[a]pyrene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Benzo[a]pyrene is 20 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 7.14 for Benzo[g,h,i]perylene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>An environmental Soil Quality Guideline for Benzo[g,h,i]perylene based on non-carcinogenic effects is not available in Table 1 and 2 of CCME PAHs Factsheet 2010.</p>
Note 7.15 for Benzo[k]fluoranthene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Benzo[k]fluoranthene is 1 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 7.16 for Chrysene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>An environmental Soil Quality Guideline for Chrysene based on non-carcinogenic effects is 6.2 mg/kg based on Table 2 of CCME PAHs Factsheet 2010.</p>
Note 7.17 for Dibenz[a,h]anthracene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Dibenz[a,h]anthracene is 1 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 7.18 for Fluoranthene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Fluoranthene is 50 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 7.19 for Fluorene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Fluorene is 0.25 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).</p>
Note 7.20 for IACR (CCME):
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p>

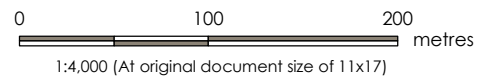
Hay River Harbour
Guideline Notes for Soil Quality Results

Note 7.21 for Indeno[1,2,3-cd]pyrene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Indeno[1,2,3-cd]pyrene is 1 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 7.22 for Naphthalene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Naphthalene is 0.013 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 7.23 for Carcinogenic PAHs (as B[a]P TPE):
<p>Guideline for B(A)P Total Potency Equivalent is 0.6 mg/kg based on an incremental lifetime cancer risk (ILCR) of 1 in 1,000,000 (10⁻⁶).</p> <p>Guideline for B(A)P Total Potency Equivalent is 5.3 mg/kg based on an incremental lifetime cancer risk (ILCR) of 1 in 100,000 (10⁻⁵).</p> <p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected. Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>For soil contaminated with coal tar or creosote mixtures, the calculated Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) concentration for soil samples should be multiplied by a safety factor of 3 prior to comparison with the guideline to account for carcinogenic potential of alkylated and other PAHs present for which a Potency Equivalence Factor (PEF) does not currently exist, but which are likely to contribute to mixture carcinogenic potential. / The most stringent guideline was used in this report.</p>
Note 7.24 for Phenanthrene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Phenanthrene is 0.046 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 7.25 for Pyrene:
<p>Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.</p> <p>Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.</p> <p>The environmental Soil Quality Guideline for Pyrene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).</p>
Note 7.26 for Zinc:
<p>Reference: Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health; Factsheet for Zinc, 2018.</p> <p>Data are sufficient and adequate to calculate guidelines for human health and environmental health. Therefore, the soil quality guideline is the lower of the two and supersedes the 1999 soil quality guideline and the 1991 interim remediation criteria for soil.</p>



- Notes**
- Coordinate System: NAD 1983 UTM Zone 11N
 - Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
 - Water Lot Boundaries depicted on figures are provided by ATLAS. Boundaries are expected to depict the ordinary high water mark during time of establishment of the lease.
 - The base image shows water levels at the time of image capture, which may differ from the water levels during water lot establishment.
 - Surface water and Sediment sample locations depicted on figures represent the shore water interface on the collection date.
 - ^A - Canadian Environmental Quality Guidelines, Sediment Quality Guidelines for the Protection of Aquatic Life, Interim Freshwater Sediment Quality Guideline

- ✕ Approximate Sediment Sample Location
- Laboratory Analytical Results Exceeding Applicable Guidelines
- Water Lease Boundary



Stantec

Northwest Territories

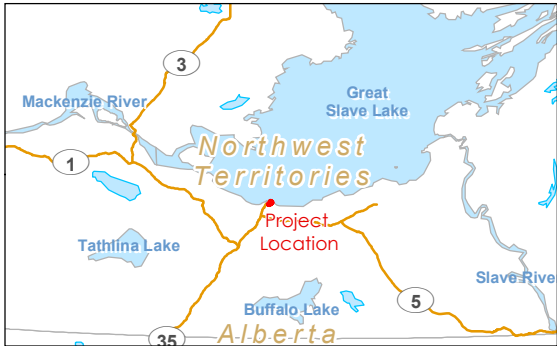
Project Location
Hay River,
Northwest Territories

144930085
Prepared by SB on 2018-01-31
Technical Review by EB on 2018-02-01
Independent Review by DSM on 2018-02-02

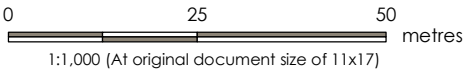
Client/Project
Government of Northwest Territories - CSD
2017 MTS Properties
Limited Phase I/II Environmental Site Assessment

Figure No.
A5-10

Title
**Hay River Water Lease 085B/13-019
Sample Location Plan Showing Sediment
Sample Exceedances**



- Notes**
- Coordinate System: NAD 1983 UTM Zone 11N
 - Base features: Geographics, ©Department of Natural Resources Canada, All rights reserved.
 - Water Lot Boundaries depicted on figures are provided by ATLAS. Boundaries are expected to depict the ordinary high water mark during time of establishment of the lease.
 - The base image shows water levels at the time of image capture, which may differ from the water levels during water lot establishment.
 - Surface water and Sediment sample locations depicted on figures represent the shore water interface on the collection date.
 - ^A - Canadian Environmental Quality Guidelines, Sediment Quality Guidelines for the Protection of Aquatic Life, Interim Freshwater Sediment Quality Guideline



Stantec

Northwest Territories

Project Location
Hay River,
Northwest Territories

Client/Project
Government of Northwest Territories - CSD
2017 MTS Properties
Limited Phase I/II Environmental Site Assessment

Figure No.
A5-11

Title
**Hay River Water Lease 085B/13-021
Sample Location Plan Showing Sediment
Sample Exceedances**

144930085
Prepared by SB on 2018-01-31
Technical Review by EB on 2018-02-01
Independent Review by DSM on 2018-02-02

APPENDIX B - 2023 SOIL SAMPLING RESULTS

Parameters	Sample ID	Sample Results									Guidelines					
		HR23-SP01-001 Depth: 0.15 - 2m	HR23-SP01-001D Depth: 0.15 - 2m	HR23-SP01-002 Depth: 0.15 - 2m	HR23-SP01-002D Depth: 0.15 - 2m	HR23-SP01-003 Depth: 0.15 - 2m	HR23-SP01-003D Depth: 0.15 - 2m	HR23-SP01-004 Depth: 0.15 - 2m	HR23-UN01-001 Depth: 0.15 - 2m	HR23-SP01-005 Depth: 0.15 - 2.5m	CCME SQG PEHH			GNWT CSR		
		Concentration (mg/kg dry weight) Residential/ Parkland	Concentration (mg/kg dry weight) Commercial	Concentration (mg/kg dry weight) Industrial	Coarse - Residential/Park and (mg/kg)	Coarse - Commercial (mg/kg)	Coarse - Industrial (mg/kg)									
Units																
Date		13-Sep-23	13-Sep-23	13-Sep-23	13-Sep-23	13-Sep-23	13-Sep-23	24-Sep-23	24-Sep-23	30-Sep-23						
Type		Dredgate	Dredgate	Dredgate	Dredgate	Dredgate	Dredgate	Dredgate	Berm Material	Dredgate						
Calculated Parameters																
Anion Sum	meq/L	21	30	23	24	18	13	7.9	12	6.6						
Cation Sum	meq/L	25	32	24	26	20	15	9.5	14	8.6						
Cation/EC Ratio	N/A	14	13	12	12	12	12	13	13	11						
Available (KCl) Nitrate (N)	mg/kg	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0						
Calculated Calcium (Ca)	mg/kg	120	190	110	120	110	69	39	68	35						
Calculated Magnesium (Mg)	mg/kg	17	25	15	16	16	10	6.5	11	5.5						
Calculated Sodium (Na)	mg/kg	8.5	15	10	13	12	9.9	4.7	24	7						
Calculated Potassium (K)	mg/kg	5.3	7.5	5.2	5.9	5.2	4.2	2.8	4.2	1.9						
Calculated Chloride (Cl)	mg/kg	<3.1	<3.9	<3.1	4.2	<3.7	<3.3	<2.9	17	<3.0						
Calculated Sulphate (SO4)	mg/kg	310	560	340	360	320	200	110	190	94						
Elements																
Soluble (Hot water) Boron (B)	mg/kg	0.27	0.41	0.32	0.32	0.46	0.65	0.21	0.83	0.13	No data	No data	No data	No data	No data	
Hex. Chromium (Cr 6+)	mg/kg	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	0.4	1.4	1.4	1.4	0.4	
Nutrients																
Available (KCl) Ammonia (N)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	No data	No data	No data	No data	No data	
Available (Mod Kel) Phosphorus (P)	mg/kg	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	No data	No data	No data	No data	No data	
Available (Mod Kel) Potassium (K)	mg/kg	24	88	45	42	32	39	15	62	13						
Available (CaCl2) Sulphur (S)	mg/kg	110	350	150	140	110	68	32	59	41	No data	No data	No data	No data	No data	
Available (KCl) Total Kjeldahl Nitrogen (Calc)	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0						
Available (KCl) Total Nitrogen (N)	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0						
Available (KCl) Nitrite (N)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	No data	No data	No data	No data	No data	
Soluble Parameters																
Soluble Chloride (Cl)	mg/L	<10	<10	<10	13	<10	<10	<10	46	<10	No data	No data	No data	No data	No data	
Soluble Conductivity	dS/m	1.8	2.4	2	2	1.7	1.2	0.75	1.1	0.8						
Soluble (CaCl2) pH	pH	7.43	7.42	7.42	7.41	7.36	7.26	7.22	7.59	7.52	6 to 8	6 to 8	6 to 8	6 to 8	5	
Sodium Adsorption Ratio	N/A	0.35	0.43	0.44	0.53	0.47	0.51	0.34	1.2	0.54	5	12	12	12	5	
Soluble Calcium (Ca)	mg/L	380	490	370	390	300	210	130	180	120	No data	No data	No data	No data	No data	
Soluble Magnesium (Mg)	mg/L	54	65	48	49	44	31	22	28 (1)	18						
Soluble Sodium (Na)	mg/L	27	39	33	42	33	30	16	64	24						
Soluble Potassium (K)	mg/L	17	19	17	18	14	13	9.7	11	6.5						
Saturation %	%	31	39	31	32	36	33	29	38	30						
Soluble Sulphate (SO4)	mg/L	1000	1500	1100	1100	870	600	380	500	320	No data	No data	No data	No data	No data	
Theoretical Gypsum Requirement	tonnes/ha	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20						
Physical Properties																
Grain Size	N/A	COARSE	COARSE	COARSE	COARSE	COARSE	COARSE	COARSE	COARSE	COARSE						
Sieve - #10 (>2.00mm)	%	1	0.77	0.27	0.84	0.73	0.91	0.36	6.5	1.2						
Sieve - #200 (>0.075mm)	%	78	73	74	84	76	72	92	56	83						
Sieve - Pan	%	22	27	26	16	24	28	8.5	44	17						
Ext. Pet. Hydrocarbon																
F1 (C6-C10)	mg/kg	<10	<10	<10	<10	<10	<10	<10	<10	<10	30	320	320	30	310	310
F1 (C6-C10) - BTEX	mg/kg	<10	<10	<10	<10	<10	<10	<10	<10	<10						
F2 (C10-C16 Hydrocarbons)	mg/kg	14	<10	<10	<10	<10	<10	<10	140	23	150	260	260	150	760	760
F3 (C16-C34 Hydrocarbons)	mg/kg	230	81	180	83	140	100	<50	520	120	300	1700	1700	400	1700	1700
F4 (C34-C50 Hydrocarbons)	mg/kg	77	<50	<50	<50	88	53	<50	200	<50	2800	3300	3300	2800	3300	3300
Reached Baseline at C50	mg/kg	Yes	Yes	Yes	Yes	Yes	Yes			Yes						
Surrogate Recovery (%)																
O-TERPHENYL (sur.)	%	100	108	107	102	92	102			116						
Physical Properties																
% sand by hydrometer	%	91	60	84	78	82	83	97	57	94						
% silt by hydrometer	%	4.2	24	9.1	12	11	11	<2.0	24	<2.0						
Clay Content	%	4.7	16	7.1	9.5	7.4	5.5	2.4	18	4.6						
Texture	N/A	SAND	SANDY LOAM	LOAMY SAND	SANDY LOAM	LOAMY SAND	LOAMY SAND	SAND	SANDY LOAM	SAND						
Moisture	%	11	12	14	13	12	14	10	9.4	19						
Elements																
Total Antimony (Sb)	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.59	<0.50	20	40	40	20	40	40
Total Arsenic (As)	mg/kg	5.5	7.2	6.4	6.7	7.1	6.4	3.9	8	4.9	12	12	12	12	12	12
Total Barium (Ba)	mg/kg	130	160	140	150	170	150	85	190	100	500	2000	2000	500	2000	2000
Total Beryllium (Be)	mg/kg	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	4	8	8	4	8	8
Total Cadmium (Cd)	mg/kg	0.19	0.41	0.28	0.31	0.32	0.34	0.11	0.48	0.12	10	22	22	10	22	22
Total Chromium (Cr)	mg/kg	5.3	12	8.3	10	7.1	12	3.7	18	4.1	64	87	87	64	87	87
Total Cobalt (Co)	mg/kg	4.1	6.9	4.9	5.5	5.3	5.3	3.1	7.5	3.3	50	300	300	50	300	300
Total Copper (Cu)	mg/kg	5.1	12	8.6	11	9.6	8.4	7.5	17 (1)	3.4	63	91	91	63	91	91
Total Lead (Pb)	mg/kg	3.5	6.2	4.5	6	6.2	6.9	2.6	14	2.7	140	260	600	140	260	600
Total Mercury (Hg)	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	6.6	24	50	6.6	24	50
Total Molybdenum (Mo)	mg/kg	0.65	1.2	0.82	0.94	0.87	0.99	<0.40	1.8	0.49	10	40	40	10	40	40
Total Nickel (Ni)	mg/kg	8.4	17	11	13	11	13	5.8	22	6.5	45	89	89	50	50	50
Total Selenium (Se)	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	1	2.9	2.9	1	3.9	3.9
Total Silver (Ag)	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	20	40	40	20	40	40
Total Thallium (Tl)	mg/kg	<0.10	0.13	<0.10	<0.10	<0.10	0.1	<0.10	0.14	<0.10	1	1	1	1	1	1
Total Tin (Sn)	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	50	300	300	50	300	300
Total Uranium (U)	mg/kg	0.81	1	0.8	1.1	1.2	0.96	0.69	1	0.69	23	33	300	23		
Total Vanadium (V)	mg/kg	11	19 (1)	13	15	14	14	7.2	20 (2)	8.2	130	130	130	130	130	130
Total Zinc (Zn)	mg/kg	35	71	50	63	60	100	25	76	24	250	410	410	200	360	360
Field Preserved Volatiles																
Benzene	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.011	Table	Table	0.5	5	5
Toluene	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.37	Table	Table	0.8	0.8	0.8

	Sample ID	HR23-SP01-001 Depth: 0.15 - 2m	HR23-SP01-001D Depth: 0.15 - 2m	HR23-SP01-002 Depth: 0.15 - 2m	HR23-SP01-002D Depth: 0.15 - 2m	HR23-SP01-003 Depth: 0.15 - 2m	HR23-SP01-003D Depth: 0.15 - 2m	HR23-SP01-004 Depth: 0.15 - 2m	HR23-UN01-001 Depth: 0.15 - 2m	HR23-SP01-005 Depth: 0.15 - 2.5m	Concentration (mg/kg dry weight) Residential/ Parkland	Concentration (mg/kg dry weight) Commercial	Concentration (mg/kg dry weight) Industrial	Coarse - Residential/Park and (mg/kg)	Coarse - Commercial (mg/kg)	Coarse - Industrial (mg/kg)
Parameters	Units															
Ethylbenzene	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.082	Table	Table	1.2	20	20
m & p-Xylene	mg/kg	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040						
o-Xylene	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.028	<0.020						
Xylenes (Total)	mg/kg	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	2.4	2.4	2.4	1		
Surrogate Recovery (%)																
1,4-Difluorobenzene (sur.)	%	100	102	103	101	102	103	96	97	97						
4-Bromofluorobenzene (sur.)	%	97	97	100	97	98	98	112	111	101						
D10-o-Xylene (sur.)	%	80	85	107	97	95	90	101	104	105						
D4-1,2-Dichloroethane (sur.)	%	94	96	97	96	97	97	90	93	98						
Misc. Inorganics																
Total Organic Carbon (C)	mg/kg	3700	3800	3900	6700	8400	6900	3800	14000	3500						

RDL = Reportable Detection Limit

N/A = Not Applicable

(1) Matrix spike exceeds acceptance limits due to matrix interference.

		Sample Results								Guidelines						
		Sample ID	HR23-SP01-006 Depth: 0.15 - 2.5m	HR23-SP01-007 Depth: 0.15 - 2.5m	HR23-SP01-008 Depth: 0.15 - 2.5m	HR23-SP01-009 Depth: 0.15 - 0.5m	HR23-SP01-010 Depth: 0.15 - 0.5m	HR23-SP01-011 Depth: 0.15 - 0.5m	HR23-SP01-012 Depth: 0.15 - 2.5m	HR23-SP01-013 Depth: 0.15 - 2.5m	CCME SQG PEHH			GNWT CSR		
		Units									Concentration (mg/kg dry weight) Residential/ Parkland	Concentration (mg/kg dry weight) Commercial	Concentration (mg/kg dry weight) Industrial	Coarse - Residential/Park land (mg/kg)	Coarse - Commercial (mg/kg)	Coarse - Industrial (mg/kg)
Parameters		Date	01-Oct-23	02-Oct-23	03-Oct-23	09-Oct-23	09-Oct-23	09-Oct-23	09-Oct-23	09-Oct-23						
		Type	Dredgeate	Dredgeate	Dredgeate	Dredgeate	Dredgeate	Dredgeate	Dredgeate	Dredgeate						
Calculated Parameters																
Anion Sum		meq/L	2.8	11	6	8	2.3	4.6	5.4	3						
Cation Sum		meq/L	4.2	13	8	10	4.3	6.2	7.4	4.9						
Cation/EC Ratio		N/A	11	11	13	13	11	12	12	11						
Available (KCl) Nitrate (N)		mg/kg	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0						
Calculated Calcium (Ca)		mg/kg	17	53	32	39	16	23	29	19						
Calculated Magnesium (Mg)		mg/kg	2.9	8.1	5.8	7.1	2.6	4	5.2	3.3						
Calculated Sodium (Na)		mg/kg	4.1	8.2	7.5	8	4.9	6.2	7.2	4.4						
Calculated Potassium (K)		mg/kg	1.5	2.4	2.1	2.7	1.7	2.2	2.4	1.9						
Calculated Chloride (Cl)		mg/kg	<3.1	4.4	<3.1	5.7	<3.0	4.1	4.2	<3.0						
Calculated Sulphate (SO4)		mg/kg	41	150	88	100	32	58	74	43						
Elements																
Soluble (Hot water) Boron (B)		mg/kg	0.12	0.28	0.15	0.24	0.12	0.14	0.14	0.11	No data	No data	No data	No data		
Hex. Chromium (Cr 6+)		mg/kg	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	0.4	1.4	1.4	0.4		
Nutrients																
Available (KCl) Ammonia (N)		mg/kg	<2.0	2.9	<2.0	<2.0	<2.0	38	<2.0	<2.0	No data	No data	No data			
Available (Mod Kel) Phosphorus (P)		mg/kg	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	No data	No data	No data			
Available (Mod Kel) Potassium (K)		mg/kg	10	19	12	21	11	13	15	11						
Available (CaCl2) Sulphur (S)		mg/kg	24	53	24	36	9.5	16	24	13	No data	No data	No data			
Available (KCl) Total Kjeldahl Nitrogen (Calc)		mg/kg	<5.0	<5.0	<5.0	<10	<10	38	<10	<10						
Available (KCl) Total Nitrogen (N)		mg/kg	<5.0	<5.0	<5.0	<10	<10	38	<10	<10						
Available (KCl) Nitrite (N)		mg/kg	<2.0	2.3	<2.0	<2.8	<2.8	<2.8	<2.8	<2.8	No data	No data	No data			
Soluble Parameters																
Soluble Chloride (Cl)		mg/L	<10	15	<10	20	<10	14	14	<10	No data	No data	No data			
Soluble Conductivity		dS/m	0.4	1.1	0.76	0.81	0.38	0.53	0.6	0.43						
Soluble (CaCl2) pH		pH	7.34	7.49	7.54	7.42	6.37	7.32	7.41	7.42	6 to 8	6 to 8	6 to 8			
Sodium Adsorption Ratio		N/A	0.44	0.51	0.58	0.58	0.54	0.58	0.58	0.44	5	12	12	5		
Soluble Calcium (Ca)		mg/L	55	190	100	140	54	79	96	65	No data	No data	No data			
Soluble Magnesium (Mg)		mg/L	9.6	28	19	25	8.9	14	17	11						
Soluble Sodium (Na)		mg/L	13	28	24	28	16	21	24	15						
Soluble Potassium (K)		mg/L	4.9	8.2	6.9	9.3	5.6	7.7	7.8	6.3						
Saturation %		%	31	29	31	29	30	29	31	30						
Soluble Sulphate (SO4)		mg/L	130	530	290	360	110	200	240	140	No data	No data	No data			
Theoretical Gypsum Requirement		tonnes/ha	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20						
Physical Properties																
Grain Size		N/A	COARSE	COARSE	COARSE	COARSE	COARSE	COARSE	COARSE	COARSE						
Sieve - #10 (>2.00mm)		%	1.1	0.66	1	<0.20	<0.20	<0.20	1.4	0.98						
Sieve - #200 (>0.075mm)		%	83	88	94	88	94	93	93	92						
Sieve - Pan		%	17	12	5.7	12	5.9	7.1	6.8	7.6						
Ext. Pet. Hydrocarbon																
F1 (C6-C10)		mg/kg	<10	<10	<10	<10	<10	<10	<10	<10	30	320	320	30	310	310
F1 (C6-C10) - BTEX		mg/kg	<10	<10	<10	<10	<10	<10	<10	<10						
F2 (C10-C16 Hydrocarbons)		mg/kg	<10	23	<10	47	<10	<10	35	<10	150	260	260	150	760	760
F3 (C16-C34 Hydrocarbons)		mg/kg	58	160	<50	100	<50	<50	63	<50	300	1700	1700	400	1700	1700
F4 (C34-C50 Hydrocarbons)		mg/kg	<50	83	<50	<50	<50	<50	<50	<50	2800	3300	3300	2800	3300	3300
Reached Baseline at C50		mg/kg	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes						
Surrogate Recovery (%)																
O-TERPHENYL (sur.)		%	115	117	111	106	111	105	106	104						
Physical Properties																
% sand by hydrometer		%	96	92	95	90	95	94	93	95						
% silt by hydrometer		%	<2.0	3.3	<2.0	2.2	<2.0	<2.0	<2.0	<2.0						
Clay Content		%	4	4.7	4.9	7.5	4.8	4.9	4.8	4.6						
Texture		N/A	SAND	SAND	SAND	SAND	SAND	SAND	SAND	SAND						
Moisture		%	18	16	9.2	18	18	17	16	13						
Elements																
Total Antimony (Sb)		mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	20	40	40	20	40	40
Total Arsenic (As)		mg/kg	4.3	5.3	4.7	6.7	4.6	4.6	5	4.6	12	12	12	12	12	12
Total Barium (Ba)		mg/kg	96	120	100	150	94	120	110	110	500	2000	2000	500	2000	2000
Total Beryllium (Be)		mg/kg	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	4	8	8	4	8	8
Total Cadmium (Cd)		mg/kg	0.1	0.18	0.15	0.52	0.14	0.12	0.13	0.16	10	22	22	10	22	22
Total Chromium (Cr)		mg/kg	3.6	5.1	3.8	5.5	3.6	3.9	4.3	3.4	64	87	87	64	87	87
Total Cobalt (Co)		mg/kg	2.9	4	3.3	4.6	3.1	3.1	3.5	3.1	50	300	300	50	300	300
Total Copper (Cu)		mg/kg	2.6	4.9	3.7	6.1	2.7	7.3 (1)	3.7	2.7	63	91	91	63	91	91
Total Lead (Pb)		mg/kg	2.3	3.9	2.6	3.6	2.3	2.5	2.8	2.3	140	260	600	140	260	600
Total Mercury (Hg)		mg/kg	<0.050	0.06	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	6.6	24	50	6.6	24	50
Total Molybdenum (Mo)		mg/kg	0.42	0.58	0.42	0.66	<0.40	0.4	0.47	0.43	10	40	40	10	40	40
Total Nickel (Ni)		mg/kg	5.5	8.1	6.3	9.3	5.7	6	6.8	5.7	45	89	89	50	50	50
Total Selenium (Se)		mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	1	2.9	2.9	1	3.9	3.9
Total Silver (Ag)		mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	20	40	40	20	40	40
Total Thallium (Tl)		mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	1	1	1	1	1	1
Total Tin (Sn)		mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	50	300	300	50	300	300
Total Uranium (U)		mg/kg	0.76	0.81	0.57	0.88	0.68	1.3 (1)	0.7	1.3	23	33	300	23		
Total Vanadium (V)		mg/kg	7.9	10	8.1	11	7.2	8.8	8.7	7.4	130	130	130	130	130	130
Total Zinc (Zn)		mg/kg	23	34	24	55	30	24	25	25	250	410	410	200	360	360
Field Preserved Volatiles																

Parameters	Sample ID Units	HR23-SP01-006	HR23-SP01-007	HR23-SP01-008	HR23-SP01-009	HR23-SP01-010	HR23-SP01-011	HR23-SP01-012	HR23-SP01-013	Concentration	Concentration	Concentration	Coarse -	Coarse -	Coarse -
		Depth: 0.15 - 2.5m	Depth: 0.15 - 2.5m	Depth: 0.15 - 2.5m	Depth: 0.15 - 0.5m	Depth: 0.15 - 0.5m	Depth: 0.15 - 0.5m	Depth: 0.15 - 2.5m	Depth: 0.15 - 2.5m	(mg/kg dry weight) Residential/ Parkland	(mg/kg dry weight) Commercial	(mg/kg dry weight) Industrial	Residential/Park land (mg/kg)	Commercial (mg/kg)	Industrial (mg/kg)
Benzene	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.011	Table	Table	0.5	5	5
Toluene	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.37	Table	Table	0.8	0.8	0.8
Ethylbenzene	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.082	Table	Table	1.2	20	20
m & p-Xylene	mg/kg	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040						
o-Xylene	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020						
Xylenes (Total)	mg/kg	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	<0.045	2.4	2.4	2.4	1		
Surrogate Recovery (%)															
1,4-Difluorobenzene (sur.)	%	96	99	97	99	101	99	101	102						
4-Bromofluorobenzene (sur.)	%	98	99	100	94	96	96	97	98						
D10-o-Xylene (sur.)	%	105	101	90	120	119	124	117	120						
D4-1,2-Dichloroethane (sur.)	%	99	98	99	104	104	104	105	103						
Misc. Inorganics															
Total Organic Carbon (C)	mg/kg	3300	4000	2300	4200	1800	1600	2300	1500						

RDL = Reportable Detection Limit

N/A = Not Applicable

(1) Matrix spike exceeds acceptance limits due to matrix interference.



Kathy Racher
Executive Director
Mackenzie Valley Land and Water Board
PO Box 2130
Yellowknife, NT X1A 2P6

Dear Ms. Racher:

Submission of Updated Management Plans for the Hay River Harbour Restoration Type B Water Licence MV2023L8-0005

Despite an unprecedented summer, the Hay River Harbour Restoration project proceeded and was able to successfully dredge a portion of the navigable channel. However, due to the evacuation of Hay River and extremely low water levels, the full scope was not completed, and the project will be carried over to Summer 2024. Therefore, as required by Part B, Condition 9 of the Mackenzie Valley Land and Water Boards (MVLWB) issuance of the Water Licence (WL) and Reasons for Decision for the Hay River Harbour Restoration, the Government of the Northwest Territories Department of Infrastructure (GNWT-INF) is submitting updated management plans to reflect the 2024 open water season, as follows:

- Version 2.0 of the Monitoring Plan
- Version 2.0 of the Sediment and Erosion Control Plan
- Version 2.0 of the Spill Contingency Plan
- Version 2.0 of the Waste Management Plan
- Version 2.0 of the Engagement Plan

The plans were revised based on execution of the summer 2023 program and reflect efficiencies and lessons learned. These efficiencies focus primarily on strengthening dewatering techniques on the barges and in the stockpile sites, strengthening dredgeate management approaches, and increasing adaptability for monitoring and water management. The appended conformance table illustrates the specific updates incorporated into each of the management plans.

Further updates to the program are being pursued for the 2024 dredging season to improve productivity. These are activities that are authorized by other federal bodies and are outside the purview of the Mackenzie Valley Land and Water Board; however, aspects of the activities are captured in the management plans. These authorizations are being pursued in parallel to the WL Management Plan updates and include:

- Extension to the DFO fish timing window
 - The Letter of Advice (LOA) issued by the Department of Fisheries and Oceans (DFO) for the 2023 project year includes an allowable on-water working window of July 16 to September 14, to be protective of fish.
 - GNWT-INF has heard from local knowledge holders, through our recent stakeholder engagement activities, that fish movement in the project area is not a concern once



the ice has melted. It has been suggested by multiple parties that the on-water work should begin earlier in the season.

- Initial dialogue with DFO indicates that an extension to the fish timing window to begin earlier in the season is reasonable.
- GNWT-INF will be submitting a revision of our LOA to DFO seeking an operating window of June 3 to September 14, 2024, which will include continued prioritization of dredging areas. Specifically, on-water work in the Plug will strive to be completed by end of August 2024, while work in the Fingers and inner channel would continue to September 14, 2024.
- The WL's updated management plans reflect this revised fish timing window.
- Off-shore refueling:
 - The project is seeking to incorporate fuel storage and dispensing onboard the spud barges as a measure to eliminate the daily transit of the spud barges to shore for equipment refueling and return to position in the channel. Refueling on the spud barge will reduce the daily transit time to and from the dredging site, reducing vessel traffic in the harbour and increasing project productivity.
 - These fuel-related marine activities are authorized by Transport Canada.
 - Specifically, GNWT-INF is presently seeking authorization from the Marine Transportation Review Board, which will capture both storage and dispensing equipment requirements, in addition to health, safety and environmental protocols.
 - Protocols associated with spills prevention, response and management for the proposed off-shore refueling activities are mirrored in the WL's updated Spill Contingency Plan.

GNWT-INF will be submitting the 2023 annual Water License report, to satisfy requirements outlined in Schedule 2 of MV2023L8-0005, separately from this Updated Management Plan submission.

Should you have any questions or concerns please contact Aileen Stevens, Senior Technical Officer, at (867) 767-9048 ext. 32066 or by email at Aileen_Stevens@gov.nt.ca at your earliest convenience.

Sincerely,

Mark Cronk
Director, Design and Technical Services
Department of Infrastructure



Attached:

- **Conformance table**
- **Version 2.0 of the Hay River Harbour Restoration Monitoring Plan**
- **Version 2.0 of the Sediment and Erosion Control Plan**
- **Version 2.0 of the Spill Contingency Plan**
- **Version 2.0 of the Waste Management Plan**
- **Version 2.0 of the Engagement Plan**

Conformance Table

Plan Title	Revisions
Monitoring Plan Version 2.0	Section 1.0 Introduction - revisions to update the project completion to date, and assumptions (Section 1.4) about the following: - earlier start to DFO window - adaptive management for TSS monitoring and mitigation, and water management at the stockpile properties
	Section 2.3 Historical Water and Sediment Quality - revisions to include 2023 dredgeate sampling results
	Section 3.1.1 Monitoring Locations - revisions to TSS monitoring locations (Dredge Area A) based on 2023 data and observations
	Section 3.1.2 Frequency and Parameters - revisions to the TSS monitoring to require daily reporting from the environmental monitor (instead of weekly) and clarified the reporting requirements
	Section 3.2 Water Quality Monitoring for Dewatering Activities on Vale Island - revisions to include additional guidance on dredgeate saturation management, drainage and grading of the stockpile properties, protection of monitoring wells, and daily monitoring of water accumulation and erosion risk
	Section 3.3 Monitoring for Dewatered Dredged Material - revisions to include additional guidance on the sampling by placement and georeferencing. This applies to Sections 3.3.1 and 3.3.2
	Section 4.1 Water Quality Monitoring in Receiving Waters - revisions to include additional guidance on TSS exceedance reporting and high action level response
	Section 4.2 Water Quality Monitoring for Dewatering Activities on Vale Island - revisions to include requirements for sump monitoring and the Surveillance Network Program, and additional guidance related to accumulated water management
	Section 4.3 Stockpile Monitoring - revisions to include guidance on demarcating stockpiles and sampling frequency
Sediment and Erosion Control Plan Version 2.0	Section 5 Contingencies - revisions to include requirements for additional turbidity monitoring equipment to be onsite in a ready to deploy condition
	Section 1.0 Introduction - revisions to update the project completion to date and updates on the following: - earlier start to DFO window - adaptive management for TSS monitoring and mitigation, and water management at the stockpile properties
	Section 2.0 General Sediment and Erosion Control Measures - revisions to provide additional guidance on construction sequencing and stockpile storage site management, and contractor responsibilities for SEC measures such as drainage preparation, sump installation, silt fence installation, site inspections, protection of monitoring wells and maintenance/replacement of filter media on the barge
	Section 2.5 - Inspections and Monitoring - revisions to include inspections of filter media and reference to SEC installation
	Section 2.7 - Materials - revisions include additions of materials onsite for emergency response and proper storage of materials
	Section 3 Sediment and Erosion Control Measures on Water - revisions to include adaptive management of dredging window and TSS mitigation, monitoring and maintenance of filter media on the barge (new Section 3.1.1 Engineered Filter Media Filtration)
	Section 4 Sediment and Erosion Control Management on Land - revised to include sediment and erosion control plans for each stockpile storage location in the CEMP, and guidance on required regular inspections. In addition: - new Section 4.1.1 Stockpiles - additional guidance on moisture content, dewatering and admixing of dredgeate - revisions to Section 4.1.2 and 4.1.3 about berm construction and inspection, dewatering and sump management, including the Surveillance Network Program sump data submission requirements - revision to 4.3.1 Access Road - addition of adaptive management option (stabilized worksite entrance) - new Section 4.1.5 about Active Management of potential excessive water that may collect in any of the stockpile sites
Spill Contingency Plan Version 2.0	New Section 5 Spring Freshet Management - added this section to provide guidance for additional mitigation measures that may be required at the storage areas for Spring Freshet 2024 and 2025
	Section 1.0 Introduction - revisions to update the project completion to date and updates on the following: - earlier start to DFO window - Section 1.5 Health Safety and Environmental Policy - revisions include additional guidance on spill training, and additional health and safety requirement and notification if floating equipment is located overnight or in the waterway - Sections 1.8 Site Description and 1.9 Type, Amount, and Location of Main Hazardous Materials, and addition of Section 1.9.1 for Fuel and contingencies for refueling activities. Table 1-1 is new that provides details on refueling options. Note that refueling on water will only be allowable contingent on Transport Canada Authorization.
	Section 2.0 Response Organization - revisions to include spill response training and additional guidance on initial spill response responsibility, details on storage of spill response equipment, and listing of additional supplies, and updated contact information
	Section 3.0 Spill Prevention - revisions to include use of a vegetable-based biodegradable hydraulic fluids in the excavator, formal inspections of contractor supplied boats, and storage tanks, requirement for a daily tailgate meeting with the environmental monitor
Waste Management Plan Version 2.0	Section 4.0 - Spill Response Action Plan - revisions to include requirement of a detailed incident response in the contractors CEMP, and details to be included in a spill incident report - new sections on 4.2.1 immediately reportable spills and 4.2.2 minor spills - new section 4.6 Worst Case Scenario to document guidance if there was a large aquatic spill or release into the river or lake
	Section 1.0 Introduction - revisions to update the project completion to date and note potential earlier start to DFO window
Engagement Plan Version 2.0	Section 3.0 Methods of Waste Management - revisions to include required documentation of waste records by the contractor, guidance on the engineered filter media on the barges and protection of monitoring wells
	Revisions to Table 9.2 Engagement Triggers During Construction. Added affected parties to the list of recipients if a spill were to occur.