



# Surveillance Network Program Report Hay River Harbour Remediation Project July 2024

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**Date:** September 9, 2024  
**To:** MVLWB  
**From:** Jamie Young, Outcome Consultants Inc  
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This Surveillance Network Program (SNP) Report for July 2024 is being submitted in accordance with the requirements of the Type B Water Licence MV2023L8-0005 issued to the Government of the Northwest Territories – Department of Infrastructure for the Hay River Harbour Remediation Project.

## Summary of Activities in July 2024

Dredging commenced on June 9, 2024 and continued over the entire month of July. Over that period, sediment was dredged from the area just offshore of the mouth of Hay River (Area A) and from the fingers of Hay River (Area B) and was placed in the Sediment Deposit Areas 1-7. Dredgate from Area A was found predominantly to be coarse-grained sand and was free draining and stackable. Area A dredging was completed on July 2, 2024. The dredgate from Area B and Area C was found to be a mixture of fine and coarse-grained material ranging from sandy loam to loam. Area B dredgate was found to be highly saturated and required containment. Stacking of Area B and Area C dredgate was not possible.

Activities completed in Sediment Deposit Areas were as follows:

Sediment Deposit Area 2 has two monitoring wells which were protected with jersey barriers and berms. Area B dredgate was stockpiled in Sediment Deposit Area 2

Sediment Deposit Area 3 has five monitoring wells. Area A dredgate was placed on the north western side until dredging of Area A was completed on July 2, 2024. Area B dredgate was stored in the eastern side. Soils from Area B and C were stockpiled in the same area on July 3, 2024 due to Area C having the same soil classifications as Area B and relatively small quantity.

Sediment Deposit Area 4 was used to stockpile Area B and Area C dredgate. Soils from Area B and C were stockpiled in the same area on July 4, 2024 due to Area C having the same soil classification and relatively small quantity. Stockpiling started on July 4, 2024 and finished on the July 7, 2024. A silt fence was installed on the July 11, 2024, when potential infiltration through the surrounding berm was noted.

Sediment Deposit Area 5 has one monitoring well in the containment berm. Area B dredgate was stockpiled in Sediment Deposit Area 5. Hauling was complicated in wet conditions as its entrance made haul roads messy and grader and skid steer cleaning was required. Area B dredgate stockpiling in this area stopped on July 23, 2024.

Sediment Deposit Area 6 was used to stockpile Area B Dredgate. Sediment Deposit Area 6 was prepared for dredgate stockpiling with topsoil stripped from July 10 to 12 and berms completed and survey between July 12 and 13, 2024. Stockpiling started on July 14, 2024 and finished on the July 17, 2024.

Sediment Deposit Area 7 was used to stockpile Area B Dredgate. Sediment Deposit Area 7 was prepared for dredgate stockpiling with topsoil stripped between July 4 and 6 and berms completed and surveyed July 7, 2024. Stockpiling started on July 9, 2024 and finished on the July 13, 2024.

While placing material during the month of July, pore water did not drain and accumulate in the defined or attempted sump locations due to the lack of shaping ability of the material. Generally speaking, the pore water from Area A dredgate simply evaporated and Area B dredgate remained saturated. As a result, the sumps in most of the Sediment Deposit Areas accumulated little to no water. Only in Sediment Deposit Areas 3, 5 and 7 was Outcome able to shape sumps to collect water samples for lab analysis. Water samples from dredgate Areas B were collected on July 20, 2024 at Sediment Deposit Area #3. As of the end of July, no water from the dredgate has been discharged or disposed of.

The following information is provided as required in Schedule 1 of the Water Licence.

**A      Tabular Summaries of all data and information generated under the SNP for the month being reported**

The results of water samples from dredgate from Areas A and B have been compared to the CCME Water Quality Guideline Protection Freshwater Aquatic Life (short and long-term exposure criteria), and are attached in Appendix A.

Water samples were collected in the Sediment Deposit Areas on the dates indicated in the table below. If no sample was collected on a given date, there was no water available to sample.

Date	Sediment Deposit Area						
	1	2	3	4	5	6	7
July 2			✓				
July 16		✓	✓	✓	✓		
July 18							✓
July 30			✓		✓		

A summary of the interpretation of water analytical results in Sediment Deposit Area is as follows:

**Sediment Deposit Area 2 had the following exceedances:**

2024/07/16

- Total Iron (concentration 3.2 mg/L compared to 0.3 mg/L for long-term exposure)
- Total Manganese (concentration 0.55 mg/L compared to 0.26 mg/L for short-term exposure)
- Total Selenium (concentration 0.0022 compared to 0.001 for long-term exposure)

**Sediment Deposit Area 3 had the following exceedances:**

2024/07/02

- Total Iron (concentration 3.0 mg/L compared to 0.3 mg/L for long-term exposure)
- Total Lead (concentration 0.046 mg/L compared to 0.004 mg/L for long-term exposure)
- Total Manganese (concentration 0.85 mg/L compared to 0.26 mg/L for short-term exposure)
- Dissolved Manganese (concentration 0.87 mg/L compared to 0.26 for short-term exposure)
- Total Selenium (concentration 0.0013 compared to 0.001 for long-term exposure)

2024/07/16

- Total Iron (concentration 2.2 mg/L compared to 0.3 mg/L for long-term exposure)

**Sediment Deposit Area 4 had the following exceedances:**

2024/07/16

- Total Iron (concentration 0.92 mg/L compared to 0.3 mg/L for long-term exposure)
- Total Manganese (concentration 0.30 mg/L compared to 0.26 mg/L for short-term exposure)

**Sediment Deposit Area 5 had the following exceedances:**

2024/07/16

- Total Iron (concentration 1.6 mg/L compared to 0.3 mg/L for long-term exposure)
- Total Selenium (concentration 0.0026 mg/L compared to 0.0001 mg/L for short-term exposure)

2024/07/30

- Total Arsenic (concentration 0.0056 mg/L compared to 0.005 mg/L for long-term exposure)
- Total Iron (concentration 6.6 mg/L compared to 0.3 mg/L for long-term exposure)
- Total Manganese (concentration 0.28 mg/L compared to 0.26 mg/L for short-term exposure)

**Sediment Deposit Area 7 had the following exceedances:**

2024/07/18

- Total Arsenic (concentration 0.0051 mg/L compared to 0.005 mg/L for long-term exposure)
- Total Iron (concentration 3.2 mg/L compared to 0.3 mg/L for long-term exposure)
- Total Manganese (concentration 0.38 mg/L compared to 0.26 mg/L for Long-term exposure)

**B Information regarding the calibration and status of the meters and device**

The calibration date and information for the field instrument is provided in Appendix B

**C The coordinates of all SNP sites**

Sump location in Sediment Deposit Area 2

- 568780.49m E
- 6747431.30m N

Sump location in Sediment Deposit Area 3

- 568633.987m E
- 6747424.537m N

Sump location in Sediment Deposit Area 4

- 568802.965m E
- 6746846.413m N

Sump location in Sediment Deposit Area 5

- 568810.002m E
- 6747306.394m N

Sump location in Sediment Deposit Area 7

- 568263.20m E
- 6747670.84m N

Water samples from the remaining areas was collected from the point it naturally accumulated due to lack of ability to form sumps.

**D      A tabular summary of cumulative water use**

There was no water used.

**E      Tabular summaries of all data and information generated under the Supplementary Measurement Requirements referred to in Part C**

There were no supplementary measurements referred to in Part C of the Water Licence

## **Appendix A**

### **Interpreted Analytica Data from Sumps**

**Emergency Dredging Project, Hay River, NT**  
Water Quality Monitoring



Bureau Veritas Job Number: C449515  
Report Date: 2024/07/09

OUTCOME CONSULTANTS INC.  
Client Project #: 2024 HREDP

				CCME Water Quality Guideline Protection Freshwater Aquatic Life	
	UNITS	HR24-SP03-(07-02)-SUMP-1		Short-Term Exposure	Long-Term Exposure
Bureau Veritas ID		CQN275			
Sampling Date		2024/07/02 13:38			
COC Number		1/1			
	UNITS	HR24-SP03-(07-02)-SUMP-1			
<b>Ext. Pet. Hydrocarbon</b>					
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10			
F3 (C16-C34 Hydrocarbons)	mg/L	<0.10			
F4 (C34-C50 Hydrocarbons)	mg/L	<0.20			
<b>Volatiles</b>					
Benzene	ug/L	<0.40			370
Toluene	ug/L	<0.40			2
Ethylbenzene	ug/L	<0.40			90
m & p-Xylene	ug/L	<0.80			
o-Xylene	ug/L	<0.40			
Xylenes (Total)	ug/L	<0.89			
F1 (C6-C10) - BTEX	ug/L	<100			
F1 (C6-C10)	ug/L	<100			
<b>Surrogate Recovery (%)</b>					
1,4-Difluorobenzene (sur.)	%	104			
4-Bromofluorobenzene (sur.)	%	99			
D4-1,2-Dichloroethane (sur.)	%	100			
O-TERPHENYL (sur.)	%	104			
Bureau Veritas ID		CQN275			
Sampling Date		2024/07/02 13:38			
COC Number		1/1			
	UNITS	HR24-SP03-(07-02)-SUMP-1			
<b>Calculated Parameters</b>					
Anion Sum	meq/L	11			
Cation Sum	meq/L	10			
Hardness (CaCO3)	mg/L	460			
Ion Balance (% Difference)	%	3.1			
Nitrate (N)	mg/L	0.55		550	13
Nitrate (NO3)	mg/L	2.4			
Nitrite (NO2)	mg/L	0.59			
Calculated Total Dissolved Solids	mg/L				
<b>Elements</b>					

# Emergency Dredging Project, Hay River, NT

## Water Quality Monitoring

	UNITS	HR24-SP03-(07-02)-SUMP-1		Short-Term Exposure	Long-Term Exposure
Dissolved Cadmium (Cd)	ug/L	<0.020			
<b>Misc. Inorganics</b>					
Conductivity	uS/cm	990			
pH	pH	8.06			6.5 to 9.0
<b>Anions</b>					
Alkalinity (PP as CaCO3)	mg/L	<1.0			
Alkalinity (Total as CaCO3)	mg/L	260			
Bicarbonate (HCO3)	mg/L	310			
Carbonate (CO3)	mg/L	<1.0			
Hydroxide (OH)	mg/L	<1.0			
Chloride (Cl)	mg/L	30		640	120
Sulphate (SO4)	mg/L	250			
<b>Nutrients</b>					
Nitrite (N)	mg/L	0.18			
Nitrate plus Nitrite (N)	mg/L	0.73			
<b>Dissolved Metals (Lab Filtered Elements)</b>					
Dissolved Aluminum (Al)	mg/L	0.0091			5
Dissolved Antimony (Sb)	mg/L	0.00076			
Dissolved Arsenic (As)	mg/L	0.0020			5
Dissolved Barium (Ba)	mg/L	0.16			
Dissolved Beryllium (Be)	mg/L	<0.0010			
Dissolved Boron (B)	mg/L	0.15		29	1.5
Dissolved Calcium (Ca)	mg/L	130			
Dissolved Chromium (Cr)	mg/L	<0.0010			
Dissolved Cobalt (Co)	mg/L	0.00092			
Dissolved Copper (Cu)	mg/L	0.0033			2.57
Dissolved Iron (Fe)	mg/L	<0.060			300
Dissolved Lead (Pb)	mg/L	<0.00020			0.004
Dissolved Lithium (Li)	mg/L	0.048			
Dissolved Magnesium (Mg)	mg/L	34			
Dissolved Manganese (Mn)	mg/L	0.054		0.26	
Dissolved Molybdenum (Mo)	mg/L	0.012			73
Dissolved Nickel (Ni)	mg/L	0.0054			0.1
Dissolved Phosphorus (P)	mg/L	<0.10			
Dissolved Potassium (K)	mg/L	9.8			
Dissolved Selenium (Se)	mg/L	0.00093			1
Dissolved Silicon (Si)	mg/L	3.3			
Dissolved Silver (Ag)	mg/L	<0.00010			0.25
Dissolved Sodium (Na)	mg/L	26			
Dissolved Strontium (Sr)	mg/L	0.40			
Dissolved Sulphur (S)	mg/L	77			
Dissolved Thallium (Tl)	mg/L	<0.00020			0.8
Dissolved Tin (Sn)	mg/L	<0.0010			
Dissolved Titanium (Ti)	mg/L	<0.0010			
Dissolved Uranium (U)	mg/L	0.0079		33	15
Dissolved Vanadium (V)	mg/L	<0.0010			
Dissolved Zinc (Zn)	mg/L	<0.0030		equation(1)	equation(1)



**Emergency Dredging Project, Hay River, NT**  
Water Quality Monitoring

	UNITS	HR24-SP03-(07-02)-SUMP-1		Short-Term Exposure	Long-Term Exposure
Bureau Veritas ID		CQN275			
Sampling Date		2024/07/02 13:38			
COC Number		1/1			
	UNITS	HR24-SP03-(07-02)-SUMP-1			
<b>Total Metals</b>					
Total Cadmium (Cd)	ug/L	0.14		7.7	0.37
Total Aluminum (Al)	mg/L	0.86			5
Total Antimony (Sb)	mg/L	0.0010			
Total Arsenic (As)	mg/L	0.0041			0.005
Total Barium (Ba)	mg/L	0.22			
Total Beryllium (Be)	mg/L	<0.0010			
Total Boron (B)	mg/L	0.15		29	1.5
Total Calcium (Ca)	mg/L	140			
Total Chromium (Cr)	mg/L	0.0017			
Total Cobalt (Co)	mg/L	0.0033			
Total Copper (Cu)	mg/L	0.0085			2.57
Total Iron (Fe)	mg/L	3.0			0.3
Total Lead (Pb)	mg/L	0.0046			0.004
Total Lithium (Li)	mg/L	0.021			
Total Magnesium (Mg)	mg/L	38			
Total Manganese (Mn)	mg/L	0.85		0.26	
Total Molybdenum (Mo)	mg/L	0.016			0.073
Total Nickel (Ni)	mg/L	0.010			0.1
Total Phosphorus (P)	mg/L	0.21			
Total Potassium (K)	mg/L	11			
Total Selenium (Se)	mg/L	0.0013			0.001
Total Silicon (Si)	mg/L	4.9			
Total Silver (Ag)	mg/L	0.00011			0.00025
Total Sodium (Na)	mg/L	28			
Total Strontium (Sr)	mg/L	0.49			
Total Sulphur (S)	mg/L	81			
Total Thallium (Tl)	mg/L	<0.00020			0.0008
Total Tin (Sn)	mg/L	0.0028			
Total Titanium (Ti)	mg/L	0.016			
Total Uranium (U)	mg/L	0.010		0.033	0.015
Total Vanadium (V)	mg/L	0.0036			
Total Zinc (Zn)	mg/L	0.044		equation(1)	equation(1)
Bureau Veritas ID		CQN275			
Sampling Date		2024/07/02 13:38			
COC Number		1/1			
	UNITS	HR24-SP03-(07-02)-SUMP-1			
<b>Misc. Inorganics</b>					
Total Dissolved Solids	mg/L	690			
Total Suspended Solids	mg/L	54			

**(1) Exceedance for CCME WQL PAL**

Emergency Dredging Project, Hay River, NT  
Water Quality Monitoring



Bureau Veritas Job Number: C446253  
Report Date: 2024/06/27

OUTCOME CONSULTANTS INC.  
Client Project #: 2024 HREDP

CCME Water Quality Guideline Protection Freshwater Aquatic Life	
Short-Term Exposure	Long-Term Exposure

AT1 BTEX AND F1-F4 IN WATER (WATER)

Bureau Veritas ID		CRK707	CRK708	CRK709	CRK710		
Sampling Date		2024/07/16 12:23	2024/07/16 12:36	2024/07/16 12:41	2024/07/16 12:54		
COC Number		1/1	1/1	1/1	1/1		
	UNITS	HR24-SV02-001	HR24-SV03-001	HR24-SV04-001	HR24-SV05-001		
Ext. Pet. Hydrocarbon							
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10		
F3 (C16-C34 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10		
F4 (C34-C50 Hydrocarbons)	mg/L	<0.20	<0.20	<0.20	<0.20		
Volatiles							
Benzene	ug/L	<0.40	<0.40	<0.40	<0.40		370
Toluene	ug/L	<0.40	<0.40	<0.40	<0.40		2
Ethylbenzene	ug/L	<0.40	<0.40	<0.40	<0.40		90
m & p-Xylene	ug/L	<0.80	<0.80	<0.80	<0.80		
o-Xylene	ug/L	<0.40	<0.40	0.50	<0.40		
Xylenes (Total)	ug/L	<0.89	<0.89	<0.89	<0.89		
F1 (C6-C10) - BTEX	ug/L	<100	<100	<100	<100		
F1 (C6-C10)	ug/L	<100	<100	<100	<100		
Surrogate Recovery (%)							
1,4-Difluorobenzene (sur.)	%	101	102	104	101		
4-Bromofluorobenzene (sur.)	%	98	101	104	103		
D4-1,2-Dichloroethane (sur.)	%	90	96	99	96		
O-TERPHENYL (sur.)	%	108	98	98	97		

ROUTINE + DISS. REG. METALS – LAB FILT (WATER)

Bureau Veritas ID		CRK707	CRK708	CRK709	CRK710		
Sampling Date		2024/07/16 12:23	2024/07/16 12:36	2024/07/16 12:41	2024/07/16 12:54		
COC Number		1/1	1/1	1/1	1/1		
	UNITS	HR24-SV02-001	HR24-SV03-001	HR24-SV04-001	HR24-SV05-001		
Calculated Parameters							
Anion Sum	meq/L	31	4.7	10	32		
Cation Sum	meq/L	31	4.8	11	32		
Hardness (CaCO3)	mg/L	1400	200	470	1500		
Ion Balance (% Difference)	%	0.044	1.1	2.8	1.1		
Nitrate (N)	mg/L	0.79	0.17	1.3	7.5	550	13
Nitrate (NO3)	mg/L	3.5	0.77	5.8	33		
Nitrite (NO2)	mg/L	1.9	0.16	0.62	2.0		
Elements							
Dissolved Cadmium (Cd)	ug/L	0.049	<0.020	<0.020	0.045		
Misc. Inorganics							
Conductivity	uS/cm	2900	430	870	2600		
pH	pH	8.11	8.40	8.44	7.70		6.5 to 9.0
Anions							
Alkalinity (PP as CaCO3)	mg/L	<1.0	3.1	5.2	<1.0		
Alkalinity (Total as CaCO3)	mg/L	130	150	240	69		
Bicarbonate (HCO3)	mg/L	160	170	280	84		
Carbonate (CO3)	mg/L	<1.0	3.7	6.2	<1.0		
Hydroxide (OH)	mg/L	<1.0	<1.0	<1.0	<1.0		
Chloride (Cl)	mg/L	600	19	19	290	640	120
Sulphate (SO4)	mg/L	540	56	220	1100		
Nutrients							
Nitrite (N)	mg/L	0.57	0.049	0.19	0.61		
Nitrate plus Nitrite (N)	mg/L	1.4	0.22	1.5	8.1		
Dissolved Metals (Lab Filtered Elements)							
Dissolved Aluminum (Al)	mg/L	0.0053	0.019	0.014	0.011		5
Dissolved Antimony (Sb)	mg/L	0.00069	<0.00060	<0.00060	<0.00060		
Dissolved Arsenic (As)	mg/L	0.0014	0.0012	0.0020	0.0011		5
Dissolved Barium (Ba)	mg/L	0.21	0.067	0.13	0.074		
Dissolved Beryllium (Be)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010		
Dissolved Boron (B)	mg/L	0.19	0.058	0.087	0.084	29	1.5
Dissolved Calcium (Ca)	mg/L	400	52	120	430		
Dissolved Chromium (Cr)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010		
Dissolved Cobalt (Co)	mg/L	0.0011	0.00050	0.00085	0.00046		
Dissolved Copper (Cu)	mg/L	0.0040	0.0039	0.0041	0.0035		2.57
Dissolved Iron (Fe)	mg/L	<0.060	<0.060	<0.060	<0.060		300
Dissolved Lead (Pb)	mg/L	<0.00020	<0.00020	<0.00020	<0.00020		0.004
Dissolved Lithium (Li)	mg/L	0.036	<0.020	0.021	<0.020		
Dissolved Magnesium (Mg)	mg/L	88	16	43	91		
Dissolved Manganese (Mn)	mg/L	0.13	<0.0040	0.017	0.0045	0.26	
Dissolved Molybdenum (Mo)	mg/L	0.0096	0.0096	0.0095	0.0053		73
Dissolved Nickel (Ni)	mg/L	0.0056	0.0030	0.0057	0.0037		0.1
Dissolved Phosphorus (P)	mg/L	<0.10	<0.10	<0.10	<0.10		
Dissolved Potassium (K)	mg/L	22	4.3	8.0	7.0		
Dissolved Selenium (Se)	mg/L	0.0018	0.00070	0.00066	0.00021		1
Dissolved Silicon (Si)	mg/L	<0.50	1.1	0.67	<0.50		
Dissolved Silver (Ag)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010		0.25
Dissolved Sodium (Na)	mg/L	70	17	23	54		
Dissolved Strontium (Sr)	mg/L	1.7	0.18	0.47	0.87		
Dissolved Sulphur (S)	mg/L	210	19	80	360		
Dissolved Thallium (Tl)	mg/L	<0.00020	<0.00020	<0.00020	<0.00020		0.8
Dissolved Tin (Sn)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010		
Dissolved Titanium (Ti)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010		
Dissolved Uranium (U)	mg/L	0.0078	0.0031	0.0065	0.0051	33	15
Dissolved Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010		
Dissolved Zinc (Zn)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	equation(1)	equation(1)
REGULATED METALS (CCME/AT1) - TOTAL							
Bureau Veritas ID		CRK707	CRK708	CRK709	CRK710		

Emergency Dredging Project, Hay River, NT  
Water Quality Monitoring

AT1 BTEX AND F1-F4 IN WATER (WATER)					Short-Term Exposure	Long-Term Exposure
Sampling Date		2024/07/16 12:23	2024/07/16 12:36	2024/07/16 12:41	2024/07/16 12:54	
COC Number		1/1	1/1	1/1	1/1	
	UNITS	HR24-SV02-001	HR24-SV03-001	HR24-SV04-001	HR24-SV05-001	
Elements						
Total Cadmium (Cd)	ug/L	0.23	0.076	0.068	0.20	7.7 0.37
Total Aluminum (Al)	mg/L	0.77	0.67	0.47	0.76	5
Total Antimony (Sb)	mg/L	0.00067	<0.00060	0.00061	<0.00060	
Total Arsenic (As)	mg/L	0.0036	0.0026	0.0030	0.0027	0.005
Total Barium (Ba)	mg/L	0.24	0.081	0.13	0.089	
Total Beryllium (Be)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	
Total Boron (B)	mg/L	0.17	0.046	0.073	0.068	29 1.5
Total Calcium (Ca)	mg/L	400	50	110	410	
Total Chromium (Cr)	mg/L	0.0019	0.0014	0.0013	0.0017	
Total Cobalt (Co)	mg/L	0.0034	0.0014	0.0020	0.0023	
Total Copper (Cu)	mg/L	0.0091	0.0066	0.0062	0.0073	2.57
Total Iron (Fe)	mg/L	2.2	2.2	0.92	1.6	0.3
Total Lead (Pb)	mg/L	0.0038	0.0017	0.0013	0.0018	0.004
Total Lithium (Li)	mg/L	0.048	<0.020	<0.020	<0.020	
Total Magnesium (Mg)	mg/L	85	15	38	84	
Total Manganese (Mn)	mg/L	0.55	0.064	0.30	0.12	0.26
Total Molybdenum (Mo)	mg/L	0.0083	0.0091	0.012	0.0062	0.073
Total Nickel (Ni)	mg/L	0.011	0.0060	0.0088	0.0075	0.1
Total Phosphorus (P)	mg/L	0.23	0.12	<0.10	0.13	
Total Potassium (K)	mg/L	21	4.2	7.5	6.8	
Total Selenium (Se)	mg/L	0.0022	0.00082	0.00094	0.0026	0.001
Total Silicon (Si)	mg/L	1.6	1.9	0.96	0.70	
Total Silver (Ag)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00025
Total Sodium (Na)	mg/L	66	16	22	52	
Total Strontium (Sr)	mg/L	1.5	0.16	0.41	0.74	
Total Sulphur (S)	mg/L	180	16	65	310	
Total Thallium (Tl)	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	0.0008
Total Tin (Sn)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	
Total Titanium (Ti)	mg/L	0.020	0.012	0.021	0.030	
Total Uranium (U)	mg/L	0.0080	0.0032	0.0076	0.0062	0.033 0.015
Total Vanadium (V)	mg/L	0.0031	0.0028	0.0028	0.0032	
Total Zinc (Zn)	mg/L	0.044	0.036	0.014	0.020	equation(1) equation(1)
RESULTS OF CHEMICAL ANALYSES OF WATER						
Bureau Veritas ID		CRK707	CRK708	CRK709	CRK710	
Sampling Date		2024/07/16 12:23	2024/07/16 12:36	2024/07/16 12:41	2024/07/16 12:54	
COC Number		1/1	1/1	1/1	1/1	
	UNITS	HR24-SV02-001	HR24-SV03-001	HR24-SV04-001	HR24-SV05-001	
Misc. Inorganics						
Total Dissolved Solids	mg/L	2400 (1)	320	630	2200 (1)	
Total Suspended Solids	mg/L	220 (1)	49	41	210	

(1) Exceedance for CCME WQL PA.

**Emergency Dredging Project, Hay River, NT**  
Water Quality Monitoring



Bureau Veritas Job Number: C446253  
Report Date: 2024/06/27

OUTCOME CONSULTANTS INC.  
Client Project #: 2024 HREDP

				CCME Water Quality Guideline Protection Freshwater Aquatic Life	
				Short-Term Exposure	Long-Term Exposure
<b>AT1 BTEX AND F1-F4 IN WATER (WATER)</b>					
<b>ROUTINE + DISS. REG. METALS – LAB FILT (WATER)</b>					
Bureau Veritas ID		CRP963			
Sampling Date		2024/07/18 10:30			
COC Number		1/1			
	UNITS	HR24-SU07-001			
<b>Calculated Parameters</b>					
Anion Sum	meq/L	7.6			
Cation Sum	meq/L	7.8			
Hardness (CaCO <sub>3</sub> )	mg/L	340			
Ion Balance (% Difference)	%	1.6			
Nitrate (N)	mg/L	0.034		550	13
Nitrate (NO <sub>3</sub> )	mg/L	0.15			
Nitrite (NO <sub>2</sub> )	mg/L	0.15			
<b>Elements</b>					
Dissolved Cadmium (Cd)	ug/L	<0.020			
<b>Misc. Inorganics</b>					
Conductivity	uS/cm	660			
pH	pH	8.36			6.5 to 9.0
<b>Anions</b>					
Alkalinity (PP as CaCO <sub>3</sub> )	mg/L	4.0			
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	280			
Bicarbonate (HCO <sub>3</sub> )	mg/L	330			
Carbonate (CO <sub>3</sub> )	mg/L	4.8			
Hydroxide (OH)	mg/L	<1.0			
Chloride (Cl)	mg/L	18		640	120
Sulphate (SO <sub>4</sub> )	mg/L	69			
<b>Nutrients</b>					
Nitrite (N)	mg/L	0.047			
Nitrate plus Nitrite (N)	mg/L	0.080			
<b>Dissolved Metals (Lab Filtered Elements)</b>					
Dissolved Aluminum (Al)	mg/L	0.0072			5
Dissolved Antimony (Sb)	mg/L	<0.00060			
Dissolved Arsenic (As)	mg/L	0.0019			5
Dissolved Barium (Ba)	mg/L	0.14			
Dissolved Beryllium (Be)	mg/L	<0.0010			
Dissolved Boron (B)	mg/L	0.061		29	1.5
Dissolved Calcium (Ca)	mg/L	91			
Dissolved Chromium (Cr)	mg/L	<0.0010			
Dissolved Cobalt (Co)	mg/L	0.00057			
Dissolved Copper (Cu)	mg/L	0.0023			2.57

**Emergency Dredging Project, Hay River, NT**  
Water Quality Monitoring

AT1 BTEX AND F1-F4 IN WATER (WATER)				Short-Term Exposure	Long-Term Exposure
Dissolved Iron (Fe)	mg/L	<0.060			300
Dissolved Lead (Pb)	mg/L	<0.00020			0.004
Dissolved Lithium (Li)	mg/L	<0.020			
Dissolved Magnesium (Mg)	mg/L	27			
Dissolved Manganese (Mn)	mg/L	0.056		0.26	
Dissolved Molybdenum (Mo)	mg/L	0.0097			73
Dissolved Nickel (Ni)	mg/L	0.0036			0.1
Dissolved Phosphorus (P)	mg/L	<0.10			
Dissolved Potassium (K)	mg/L	6.2			
Dissolved Selenium (Se)	mg/L	0.00053			1
Dissolved Silicon (Si)	mg/L	3.0			
Dissolved Silver (Ag)	mg/L	<0.00010			0.25
Dissolved Sodium (Na)	mg/L	20			
Dissolved Strontium (Sr)	mg/L	0.29			
Dissolved Sulphur (S)	mg/L	21			
Dissolved Thallium (Tl)	mg/L	<0.00020			0.8
Dissolved Tin (Sn)	mg/L	<0.0010			
Dissolved Titanium (Ti)	mg/L	<0.0010			
Dissolved Uranium (U)	mg/L	0.0047		33	15
Dissolved Vanadium (V)	mg/L	<0.0010			
Dissolved Zinc (Zn)	mg/L	<0.0030		equation(1)	equation(1)
<b>REGULATED METALS (CCME/AT1) - TOTAL</b>					
Bureau Veritas ID		CRP963			
Sampling Date		2024/07/18 10:30			
COC Number		1/1			
	<b>UNITS</b>	<b>HR24-SU07-001</b>			
<b>Elements</b>					
Total Cadmium (Cd)	ug/L	0.12		7.7	0.37
Total Aluminum (Al)	mg/L	0.79			5
Total Antimony (Sb)	mg/L	<0.00060			
Total Arsenic (As)	mg/L	0.0051			0.005
Total Barium (Ba)	mg/L	0.16			
Total Beryllium (Be)	mg/L	<0.0010			
Total Boron (B)	mg/L	0.065		29	1.5
Total Calcium (Ca)	mg/L	77			
Total Chromium (Cr)	mg/L	0.0018			
Total Cobalt (Co)	mg/L	0.0020			
Total Copper (Cu)	mg/L	0.0058			2.57
Total Iron (Fe)	mg/L	3.2			0.3
Total Lead (Pb)	mg/L	0.0020			0.004
Total Lithium (Li)	mg/L	<0.020			
Total Magnesium (Mg)	mg/L	22			
Total Manganese (Mn)	mg/L	0.38		0.26	
Total Molybdenum (Mo)	mg/L	0.011			0.073
Total Nickel (Ni)	mg/L	0.0073			0.1
Total Phosphorus (P)	mg/L	0.21			
Total Potassium (K)	mg/L	5.4			
Total Selenium (Se)	mg/L	0.00080			0.001

**Emergency Dredging Project, Hay River, NT**  
Water Quality Monitoring

AT1 BTEX AND F1-F4 IN WATER (WATER)				Short-Term Exposure	Long-Term Exposure
Total Silicon (Si)	mg/L	4.0			
Total Silver (Ag)	mg/L	<0.00010			0.00025
Total Sodium (Na)	mg/L	17			
Total Strontium (Sr)	mg/L	0.26			
Total Sulphur (S)	mg/L	19			
Total Thallium (Tl)	mg/L	<0.00020			0.0008
Total Tin (Sn)	mg/L	0.0061			
Total Titanium (Ti)	mg/L	0.015			
Total Uranium (U)	mg/L	0.0055		0.033	0.015
Total Vanadium (V)	mg/L	0.0041			
Total Zinc (Zn)	mg/L	0.053		equation(1)	equation(1)
<b>RESULTS OF CHEMICAL ANALYSES OF WATER</b>					
Bureau Veritas ID		CRP963			
Sampling Date		2024/07/18 10:30			
COC Number		1/1			
	<b>UNITS</b>	<b>HR24-SU07-001</b>			
<b>Misc. Inorganics</b>					
Total Dissolved Solids	mg/L	430			
Total Suspended Solids	mg/L	69			

**(1) Exceedance for CCME WQL PAL**

RDL = Reportable Detection Limit

N/A = Not Applicable

(1) Detection limit raised based on sample volume used for analysis.

**Results relate only to the items tested.**

**Emergency Dredging Project, Hay River, NT**  
Water Quality Monitoring



Bureau Veritas Job Number: C458310  
Report Date: 2024/08/02

OUTCOME CONSULTANTS INC.  
Client Project #: 2024 HREDP

				CCME Water Quality Guideline Protection Freshwater Aquatic Life	
				Short-Term Exposure	Long-Term Exposure
Bureau Veritas ID		CSL884	CSL885		
Sampling Date		2024/07/30 13:30	2024/07/30 13:35		
COC Number		1OF1	1OF1		
	UNITS	HR24-SP02-05-(07-30)-SU01	HR24-SP03-(07-30)-SU02		
<b>Ext. Pet. Hydrocarbon</b>					
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10		
F3 (C16-C34 Hydrocarbons)	mg/L	0.11	<0.10		
F4 (C34-C50 Hydrocarbons)	mg/L	<0.20	<0.20		
<b>Volatiles</b>					
Benzene	ug/L	<0.40	<0.40		370
Toluene	ug/L	<0.40	<0.40		2
Ethylbenzene	ug/L	<0.40	<0.40		90
m & p-Xylene	ug/L	<0.80	<0.80		
o-Xylene	ug/L	<0.40	<0.40		
Xylenes (Total)	ug/L	<0.89	<0.89		
F1 (C6-C10) - BTEX	ug/L	<100	<100		
F1 (C6-C10)	ug/L	<100	<100		
<b>Surrogate Recovery (%)</b>					
1,4-Difluorobenzene (sur.)	%	109	108		
4-Bromofluorobenzene (sur.)	%	86	90		
D4-1,2-Dichloroethane (sur.)	%	98	101		
O-TERPHENYL (sur.)	%	96	91		
Bureau Veritas ID		CSL884	CSL885		
Sampling Date		2024/07/30 13:30	2024/07/30 13:35		
COC Number		1OF1	1OF1		
	UNITS	HR24-SP02-05-(07-30)-SU01	HR24-SP03-(07-30)-SU02		
<b>Calculated Parameters</b>					
Anion Sum	meq/L	8.2	13		
Cation Sum	meq/L	8.5	13		
Hardness (CaCO3)	mg/L	360	590		
Ion Balance (% Difference)	%	1.9	3.1		
Nitrate (N)	mg/L	0.45	0.80	550	13
Nitrate (NO3)	mg/L	2.0	3.5		
Nitrite (NO2)	mg/L	0.79	0.074		
<b>Elements</b>					
Dissolved Cadmium (Cd)	ug/L	<0.020	0.023		
<b>Misc. Inorganics</b>					
Conductivity	uS/cm	770	1100		
pH	pH	8.59	8.40		6.5 to 9.0
<b>Anions</b>					
Alkalinity (PP as CaCO3)	mg/L	6.0	4.0		
Alkalinity (Total as CaCO3)	mg/L	190	220		
Bicarbonate (HCO3)	mg/L	220	260		
Carbonate (CO3)	mg/L	7.3	4.8		
Hydroxide (OH)	mg/L	<1.0	<1.0		
Chloride (Cl)	mg/L	26	32	640	120
Sulphate (SO4)	mg/L	170	340		
<b>Nutrients</b>					
Nitrite (N)	mg/L	0.24	0.023		
Nitrate plus Nitrite (N)	mg/L	0.69	0.82		
<b>Dissolved Metals (Lab Filtered Elements)</b>					
Dissolved Aluminum (Al)	mg/L	0.018	0.0076		5
Dissolved Antimony (Sb)	mg/L	<0.00060	<0.00060		

**Emergency Dredging Project, Hay River, NT**  
Water Quality Monitoring

				Short-Term Exposure	Long-Term Exposure
Dissolved Arsenic (As)	mg/L	0.0014	0.0014		5
Dissolved Barium (Ba)	mg/L	0.11	0.16		
Dissolved Beryllium (Be)	mg/L	<0.0010	<0.0010		
Dissolved Boron (B)	mg/L	0.079	0.15	29	1.5
Dissolved Calcium (Ca)	mg/L	89	150		
Dissolved Chromium (Cr)	mg/L	<0.0010	<0.0010		
Dissolved Cobalt (Co)	mg/L	0.0012	0.00061		
Dissolved Copper (Cu)	mg/L	0.0049	0.0059		2.57
Dissolved Iron (Fe)	mg/L	<0.060	<0.060		300
Dissolved Lead (Pb)	mg/L	<0.00020	<0.00020		0.004
Dissolved Lithium (Li)	mg/L	0.028	0.036		
Dissolved Magnesium (Mg)	mg/L	33	49		
Dissolved Manganese (Mn)	mg/L	0.0068	0.059	0.26	
Dissolved Molybdenum (Mo)	mg/L	0.0099	0.0099		73
Dissolved Nickel (Ni)	mg/L	0.0046	0.0056		0.1
Dissolved Phosphorus (P)	mg/L	<0.10	<0.10		
Dissolved Potassium (K)	mg/L	6.7	10		
Dissolved Selenium (Se)	mg/L	0.00061	0.00049		1
Dissolved Silicon (Si)	mg/L	<0.50	<0.50		
Dissolved Silver (Ag)	mg/L	<0.00010	<0.00010		0.25
Dissolved Sodium (Na)	mg/L	26	32		
Dissolved Strontium (Sr)	mg/L	0.32	0.60		
Dissolved Sulphur (S)	mg/L	59	110		
Dissolved Thallium (Tl)	mg/L	<0.00020	<0.00020		0.8
Dissolved Tin (Sn)	mg/L	<0.0010	<0.0010		
Dissolved Titanium (Ti)	mg/L	<0.0010	<0.0010		
Dissolved Uranium (U)	mg/L	0.0052	0.0075	33	15
Dissolved Vanadium (V)	mg/L	<0.0010	<0.0010		
Dissolved Zinc (Zn)	mg/L	<0.0030	<0.0030	equation(1)	equation(1)
Bureau Veritas ID		CSL884	CSL885		
Sampling Date		2024/07/30 13:30	2024/07/30 13:35		
COC Number		10F1	10F1		
	UNITS	HR24-SP02-05-(07-30)-SU01	HR24-SP03-(07-30)-SU02		
<b>Total Metals</b>					
Total Cadmium (Cd)	ug/L	0.17	0.035	7.7	0.37
Total Aluminum (Al)	mg/L	1.7	0.053		5
Total Antimony (Sb)	mg/L	0.00077	0.00081		
Total Arsenic (As)	mg/L	0.0056	0.0016		0.005
Total Barium (Ba)	mg/L	0.16	0.15		
Total Beryllium (Be)	mg/L	<0.0010	<0.0010		
Total Boron (B)	mg/L	0.077	0.13	29	1.5
Total Calcium (Ca)	mg/L	89	140		
Total Chromium (Cr)	mg/L	0.0032	<0.0010		
Total Cobalt (Co)	mg/L	0.0041	0.00071		
Total Copper (Cu)	mg/L	0.011	0.0067		2.57
Total Iron (Fe)	mg/L	6.6	0.17		0.3
Total Lead (Pb)	mg/L	0.0034	0.00024		0.004
Total Lithium (Li)	mg/L	0.029	0.031		
Total Magnesium (Mg)	mg/L	33	47		
Total Manganese (Mn)	mg/L	0.28	0.063	0.26	
Total Molybdenum (Mo)	mg/L	0.011	0.011		0.073
Total Nickel (Ni)	mg/L	0.012	0.0068		0.1
Total Phosphorus (P)	mg/L	0.34	<0.10		
Total Potassium (K)	mg/L	6.8	9.3		
Total Selenium (Se)	mg/L	0.0010	0.00062		0.001
Total Silicon (Si)	mg/L	3.0	<0.50		
Total Silver (Ag)	mg/L	<0.00010	<0.00010		0.00025
Total Sodium (Na)	mg/L	25	29		
Total Strontium (Sr)	mg/L	0.33	0.57		
Total Sulphur (S)	mg/L	59	110		
Total Thallium (Tl)	mg/L	<0.00020	<0.00020		0.0008
Total Tin (Sn)	mg/L	<0.0010	<0.0010		



Emergency Dredging Project, Hay River, NT  
Water Quality Monitoring

					Short-Term Exposure	Long-Term Exposure
Total Titanium (Ti)	mg/L	0.033	0.0027			
Total Uranium (U)	mg/L	0.0061	0.0086		0.033	0.015
Total Vanadium (V)	mg/L	0.0071	<0.0010			
Total Zinc (Zn)	mg/L	0.045	<0.0030		equation(1)	equation(1)
Bureau Veritas ID		CSL884	CSL885			
Sampling Date		2024/07/30 13:30	2024/07/30 13:35			
COC Number		1OF1	1OF1			
	UNITS	HR24-SP02-05-(07-30)-SU01	HR24-SP03-(07-30)-SU02			
Misc. Inorganics						
Total Dissolved Solids	mg/L	540	820			
Total Suspended Solids	mg/L	330 (1)	5.7			

(1) Exceedance for CCME WQL PAL

## **Appendix B**

### **Calibration Information from Field Multimeter**

24/07/24 17:35:36



34%

View Cal Record

Calibrate Turbidity

Date: [YY/MM/DD] 24/06/01

Time: 10:07:30

Sensor Type: Turbidity

Sensor: 22B101196

Sw Version: 3.0.5

Cal Value: 0.00 FNU

Pre Cal Value: 30.59 FNU

Sensor Value: 0.77 RTU

Temperature: 14.3 Ref °C

Calibrate Status: Calibration  
Aborted!