



Groundwater Monitoring and Surface Water Management Plan v.4

Checkpoint Landfarm and Highway
Maintenance Camp

JUNE | 2024

Summary

This Groundwater Monitoring and Surface Water Management Plan (Plan) is associated with the water licence for the Checkpoint Remediation and Monitoring Project. The Government of the Northwest Territories, Department of Environment and Climate Change and its contractors are to adhere to this management plan when completing groundwater monitoring and surface water management at the Checkpoint Landfarm Facility and former Highway Maintenance Camp.

This version of the Plan has been revised to better reflect the activities that are to occur onsite and includes considerations for the monitoring program occurring at the former Highway Maintenance Camp.

Revision History

Date of Revision	Document Version	Summary of Changes
September 2017	V2.0	
November 2017	V2.1	Updates and references to addition of Groundwater Action Levels
November 2019	V3.0	Addition of HMC post Closure groundwater monitoring
June 2024	V4.0	Revised to better reflect ongoing management of the site.

Table of Contents

1	Introduction and Background	5
1.1	Site Description and Site Locations.....	5
1.2	Responsible Party.....	5
1.3	Plans and Reports.....	6
1.4	Effective Date and Plan Revisions	6
1.5	Objective of the Groundwater and Surface Water Monitoring Plan.....	6
1.6	Site Hydrogeology	7
2	Landfarm Monitoring and Management	8
2.1	Description of the Landfarm Monitoring Program.....	8
2.2	Monitoring and Management of Surface Water.....	9
2.2.1	Surface Water Monitoring Locations	9
2.2.2	Surface Water Monitoring and Discharge Methodology.....	10
2.2.3	Actions to Exceedances of Effluent Criteria in Part F of the Water Licence for Surface Water.....	10
2.3	Landfarm Groundwater Monitoring.....	10
2.3.1	Groundwater Monitoring Locations.....	10
2.3.2	Groundwater Monitoring Methodology.....	11
2.3.3	Actions to Exceedances for Groundwater	11
3	Highway Maintenance Camp Monitoring and Management.....	12
3.1	Description of the HMC Monitoring Program.....	12
3.2	Highway Maintenance Camp Groundwater Monitoring Program	13
3.2.1	Groundwater Monitoring Locations.....	13
3.2.2	Groundwater Monitoring Methodology.....	15
3.2.3	Actions to Exceedances for Groundwater	15
3.3	Highway Maintenance Camp Surface Water Monitoring Program.....	15
3.3.1	Surface Water Monitoring Locations	15
3.3.2	Surface Water Monitoring Methodology	16
3.3.3	Actions to Exceedances in Surface Water	16
4	Sample Management	16
4.1	Quality Assurance/Quality Control Plan for Sample Management.....	16
4.1.1	Groundwater Sample Management.....	16
4.1.2	Surface Water Sample Management	17
5	Reporting.....	17

6	References.....	18
	Appendix A	19

1 Introduction and Background

1.1 Site Description and Site Locations

The Government of the Northwest Territories (GNWT), Department of Environment and Climate Change (ECC) has developed this Groundwater Monitoring and Surface Water Monitoring Plan (Plan) in support of assessment, remediation and monitoring activities at the Checkpoint former Highway Maintenance Camp and the Checkpoint Landfarm Facility.

The Former Highway Maintenance Camp (HMC) was used for various activities between 1970 to 2000. It was first established as a highway maintenance camp by the Government of Canada in the 1970s. It was then transferred to Yukon Construction Co. in the 1980s and remained as a highway maintenance camp until the mid-1990s. The site was then transferred to Mackenzie Wood Projects in 1996 and was used for logging and milling operations. Logging and milling operations ended in 2000 due to the lack of timber supply. Due to the operations at the site, it formerly contained a dump, camp workings, maintenance area, residential areas, sawmill, and various storage areas.

The Landfarm Facility (Landfarm) was developed for remediation of hydrocarbon contaminated soils from the former HMC. All soils placed at the Landfarm are now below guideline criteria and have been approved to be transported back to the HMC to be used as backfill material. Ongoing monitoring is being completed at the site to ensure compliance with the existing water licence. Activities include groundwater and surface water sampling at the Surveillance Network Program (SNP) locations, sampling of the retention pond and overflow cell prior to discharge of water, and discharge from the retention pond and overflow cells into the designated discharge area. It is expected that additional impacted soil will be placed into the Landfarm for remediation when the remediation program at the HMC takes place.

The sites are located approximately 60 kilometers south by Highway 1 from the Village of Fort Simpson, NT. Details on the site location are provided in in Table 1 below.

Table 1. Coordinates for the Checkpoint HMC and Landfarm Sites

Site	Latitude	Longitude
Checkpoint Highway Maintenance Camp	61° 26' 30" N	121° 14' 50" N
Checkpoint Landfarm	61° 27' 59" N	121° 16' 12" W

1.2 Responsible Party

The Checkpoint HMC and Landfarm are under the responsibility of the GNWT, ECC.

1.3 Plans and Reports

The following reporting has been completed by the GNWT for the sites:

- Supplemental Phase III Environmental Site Assessment, BluMetric Environmental Inc. (2017)
- Remedial Action Plan Checkpoint Highway Maintenance Site, BluMetric Environmental Inc., (2017)
- Human Health and Ecological Risk Assessment Checkpoint Highway Maintenance Site, BluMetric Environmental Inc., (2017)
- 2019 & 2020 Remediation Report, Checkpoint Former Highway Maintenance Camp, KBL Environmental, (2020)
- Annual Report, Checkpoint Landfarm, KBL Environmental (2018-2020)
- Final Report: Annual Monitoring Report – Checkpoint Landfarm, Stantec Architecture Ltd. (2021 – ongoing)
- Final Report: Checkpoint Highway Maintenance Camp Monitoring Report, Stantec Architecture Ltd. (2021 – ongoing)

1.4 Effective Date and Plan Revisions

The effective date for this version of the Plan is upon the approval of the plan by the Mackenzie Valley Land and Water Board (MVLWB) and shall be in effect for the duration of activities occurring at the Checkpoint sites. This Plan will be reviewed annually and updated as required.

1.5 Objective of the Groundwater and Surface Water Monitoring Plan

The purpose of this Plan is to outline groundwater monitoring and surface water management methods at the Landfarm and HMC, specifically to maintain compliance with the water licence. The GNWT-ECC and its contractors, will manage operations and comply with applicable licences, permits, territorial and federal laws and regulations related to water management at the sites. Table 2 lists the regulations, guidelines and authorizations that will be applied and referenced during site operations.

Table 2. Regulations, Guidelines and Authorizations Applicable to the Groundwater Monitoring and Surface Water Management Plan

Entity	Regulations, Guidelines and Authorizations
Mackenzie Valley Land and Water Board (MVLWB)	<ul style="list-style-type: none"> • Type A Land Use Permit, 7 June 2017 (Appendix B) – to be updated when new permit issued • Type B Water Licence, 7 June 2017 (Appendix B) – to be updated when new licence issued
Government of the Northwest Territories (GNWT)	<ul style="list-style-type: none"> • <i>NWT Environmental Protection Act</i> (EPA), 1988 • <i>NWT Waters Act</i>, 2016

	<ul style="list-style-type: none"> • Guideline for the General Management of Hazardous Waste in the NWT, 1998 • Environmental Guideline for Contaminated Site Remediation (CSR), 2003 or most recent version
Canadian Council for Ministers of the Environment	<ul style="list-style-type: none"> • Canadian Environmental Quality Guidelines – Water Quality Guidelines for the Protection of Aquatic Life, 2014
Federal Contaminated Sites Action Plan	<ul style="list-style-type: none"> • Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites, 2012

1.6 Site Hydrogeology

The site locations listed in Section 1.1 are approximately 2.5 km apart. The HMC is approximately 12 hectares in size and bound on the northwest by the Liard Highway (Highway 7); while the east side is bound by the Jean Marie River. The landfarm site is comprised of an approximately 1.4 hectare treatment area located within an approximately 9 hectare GNWT Department of Infrastructure gravel quarry on Highway 1, northwest of the Highway 7 junction.

Both the HMC and landfarm are topographically characterized as undulating plains with mixed woods and low lying marsh lands. The HMC is in a cleared area with a less than 1% easterly slope towards the Jean Marie River, where the embankment grades 3 m to 7 m down over 30 m (10% to 20%) to the river level (KBL, 2020a). The site is forested with arcuate scraping and slumping on both sides of the river. Exposed and potential erosional surfaces at the HMC appear on river access pathways. The landfarm is in a cleared area 2.5 km northwest of the HMC and the Jean Marie River. Topography at the landfarm has less than 5 m relief across the 9 hectare GNWT Department of Infrastructure gravel quarry, and surface drainage from the landfarm is to the west.

Both the HMC and landfarm are located in the Great Slave Plain of the Interior Plains physiographic region. The surficial geology of the HMC is comprised of glaciofluvial outwash plains sediment including silt, sand and gravel overlying clay till and the interbedded sandstone and shale bedrock of the Fort Simpson Formation (GSC, 2018). The general stratigraphy at the HMC includes gravelly fill material over a native sandy to silty clay with interbedded organic native material. The landfarm site has more sand locally, as there are vegetated sand dunes north of the landfarm site.

Climate normal data from the Fort Simpson weather station included daily average temperatures ranging from -24.2°C in January to 17.4°C in July. Daily average temperatures are generally above freezing May through September. Monthly average rainfalls between May and October range from 21.0 mm to 61.1 mm. Snow occurs at any time throughout the year with least likelihood between June and August. The water equivalent of the average annual precipitation in this area is 387.6 mm (BluMetric, 2017).

The HMC and landfarm are located in an area of discontinuous permafrost. Frozen ground was not observed in test pits advanced to depths of 4 meters across the HMC (BluMetric, 2017). Permafrost

at the bottom of the active freeze-thaw layer can act as a barrier below the groundwater table, and the movement of groundwater and infiltrating surface water at this site would be expected to follow the local contours of permafrost.

The HMC hydrology is influenced by the natural slope of the ground surface with groundwater elevation contours following topographic contours towards the Jean Marie River (BluMetric, 2017). The groundwater contours indicate flow is east across the HMC with a less than 1% easterly slope towards the Jean Marie River embankment, where the groundwater gradient averages approximately 5%, and varies from 3%, near the P10/11 remedial excavation, to 10%, near monitoring wells MWCP51 and DP-01.

At the HMC, near the P10/11 APEC, the native overburden material is sand, or sand and gravel, with a Clay horizon at approximately 2.0 – 5.0 mbgs with areas of gravel fill material (Columbia Environmental, 2012). The same report contains hydraulic conductivity testing results for MW1 (sand) and CPS-7 (topsoil over gravel) ranging from 10-2 m/s to 10-4 m/s. For an assumed effective porosity of 0.30 to 0.40, and a gradient of 0.01 (inland) to 0.1 (near the riverbank), the reported linear groundwater velocities ranged from 3.3×10^{-5} m/s to 3.3×10^{-3} m/s (approximately 2.88 m/day inland to 288 m/day near the riverbank) (Columbia Environmental, 2012).

The hydraulic conductivities indicate that Constituents of Concern (COCs) will dissipate rapidly after contaminant removal.

2 Landfarm Monitoring and Management

2.1 Description of the Landfarm Monitoring Program

A monitoring program is currently in place at the landfarm to maintain compliance with the existing water licence. The monitoring program at the landfarm includes:

- Groundwater sampling at four existing groundwater sampling locations. Two groundwater sampling events occur twice per year. Once in the spring/summer (May-July) and once in the fall (August-October).
- Surface water sampling and discharge of water from the retention pond and overflow cell. Surface water samples from the retention pond and overflow cell are collected and analyzed prior to discharge of water. Surface water sample results are provided to the regional Water Resource Officer (WRO) for review and approval prior to discharge.
- Discharge of water to a designated area occurs at least once per year during the summer. The frequency of the discharge of water from the retention pond and overflow cell are completed to ensure 1 m of freeboard is available.

The water retention pond dimensions are approximately 30 m by 30 m and the lined overflow cell is approximately 18 m by 30 m. A minimum of 1 m of freeboard will be maintained in the pond. The Operation and Maintenance Plan provides detailed design drawings for the water retention pond and

overflow cell. Additional details on the location, sampling frequency, sampling parameters and rationale for groundwater and surface water sampling is provided in Table 3.

2.2 Monitoring and Management of Surface Water

2.2.1 Surface Water Monitoring Locations

There are four surface water sampling locations in the landfarm. One surface water sample is collected from retention pond (2017-1a) and one from the overflow cell (2017-2a). Results of the analysis of samples collected from the retention pond and overflow cell are provided to the regional WRO for review and approval. Two surface water samples (2017-1b and 2017-2b) are collected during the discharge event to ensure effluent material meets the effluent quality criteria outlined in Part F of the water licence.

Table 3 below summarizes the location, frequency of sampling, parameters to be analyzed and rationale for sampling for each SNP Station.

Table 3. Surface Water SNP Locations

SNP Station #	Location	Sampling Frequency discharge (once/ discharge event)	Sampling Parameters	Rationale
2017-1a	Surface water in the retention pond prior to discharge	Prior to proposed discharge of retention pond and overflow cell. At least once per year.	Please refer to Part F, Item 17 of the Water Licence for a full list of parameters to be analyzed.	Retention Pond – Source
2017-2a	Surface water in the overflow cell prior to discharge			Overflow Cell - Source
2017-1b	Surface water at the point of discharge from the retention pond during discharge event	During discharge of retention pond and overflow cell. At least once per year.		Retention Pond - Discharge
2017-2b	Surface water at the point of discharge from the overflow cell during discharge event			Overflow Pond - Discharge

2.2.2 Surface Water Monitoring and Discharge Methodology

Surface water sampling and discharge methodology will be determined by the contractor hired to complete the monitoring program. The monitoring methodology will be provided to GNWT-ECC for review and approval.

Conditions of the retention pond and the overflow cells will be recorded in the daily field logs during the surface water sampling and discharge events that occur twice a year (spring/summer and fall). If less than 1 m of freeboard is present in the retention pond, water from the retention pond will be pumped into the overflow cell to ensure pond freeboard is maintained.

Drainage patterns from the landfarm are to be assessed to ensure that treated soil runoff water is diverted to the retention pond as per the design. Should it be determined that drainage is not occurring efficiently or that water is ponding in the soil treatment area, equipment will be used to improve drainage away from soil piles.

Surface water sample results from the retention pond and overflow cell will be analyzed by comparing the results with the Effluent Quality Criteria (EQC) specified in the Water Licence and results will be submitted to the Regional Water Resource Officer for review and approval. Notification to the MVLWB will be provided prior to completing discharge onsite. Once approval has been obtained, the surface water will be discharged in the designated discharge area as indicated in Figure 1, Appendix A. The volume of water discharged will not exceed 1000 m³ per day and 3000 m³ per year, unless authorized by an inspector as indicated in Part F, Item 18 of the Water Licence. A record of the total volume of water discharged will be recorded and summarized in the Annual Monitoring Report.

Maps/Diagrams regarding the water retention pond management are included in Appendix A.

2.2.3 Actions to Exceedances of Effluent Criteria in Part F of the Water Licence for Surface Water

Should the effluent exceed the effluent quality criteria specified in Part F of the Water Licence the following actions will be taken:

- If the water exceeds EQC criteria the inspector will be notified immediately; and
- If approval to discharge has not been granted by the inspector, the water will be contained and transported for disposal at an approved receiving facility.

A record of all water removal, treatment, disposal and discharge will be stored electronically and summarized in the Annual Monitoring Report.

2.3 Landfarm Groundwater Monitoring

2.3.1 Groundwater Monitoring Locations

Four monitoring wells were installed at the landfarm. One monitoring well is located upgradient of the landfarm, and three monitoring wells are located downgradient of the landfarm, as shown in

Appendix A. Groundwater and surface water monitoring program will be conducted in accordance with the existing Water Licence (MV2017L8-0004). Table 4 below summarizes the location and rationale for the landfarm monitoring locations, as well as sampling frequency and parameters.

Table 4. Groundwater SNP Locations

SNP Station #	Location	Sampling Frequency	Sampling Parameters	Rationale
2009-1 (MW-1)	N corner of retention pond (61° 28' 02" N and 121° 16' 12" W)	Following spring freshet and before fall freeze-up (total of 2/year)	<ul style="list-style-type: none"> • Total Metals • Field Parameters • Petroleum Hydrocarbons (F1, F2, F3, F4) • Benzene, Toluene, Ethylbenzene, and Xylene (BTEX) • Chemical Oxygen Demand (COD) • Extractable Petroleum Hydrocarbons (TPH) • Total Suspended Solids (TSS) • Oil and Grease • pH 	Downgradient corner of retention pond
2009-2 (MW-2)	NE corner of retention pond (61° 28' 00" N and 121° 16' 10" W)			Downgradient of corner of the overflow pond
2009-3 (MW-3)	W edge of Landfarm (61° 27' 58" N and 121° 16' 17" W)			Downgradient edge of the treatment pad
2009-4 (MW-4)	E corner of Landfarm (61° 27' 59" N and 121° 16' 09" W)			Upgradient background of treatment pad

2.3.2 Groundwater Monitoring Methodology

Groundwater monitoring methodology will be determined by the contractor hired to complete the monitoring program. The groundwater monitoring methodology will be provided to GNWT-ECC for review and approval prior to completing the groundwater monitoring program.

Conditions of the groundwater monitoring wells will be recorded in the daily field logs during the groundwater sampling events that occur twice a year (spring/summer and fall).

2.3.3 Actions to Exceedances for Groundwater

Groundwater sample results are to be compared to the action levels as defined in v.3 of the Groundwater and Leachate Management Plan (KB, 2020a). If samples exceed the action levels outlined, they will be recorded in the Annual Monitoring Report and the monitoring program will continue to monitor the groundwater quality. The groundwater monitoring results will be provided to the regional WRO for information purposes in the Annual Monitoring Report.

3 Highway Maintenance Camp Monitoring and Management

3.1 Description of the HMC Monitoring Program

A monitoring program is currently in place at the HMC to monitor site conditions and to ensure site contamination is not migrating to the nearby Jean Marie River. The monitoring program will continue until further direction can be provided on the next steps for the site. The monitoring program at the HMC includes:

- Groundwater sampling and analysis at 16 existing groundwater monitoring locations. One groundwater sampling event occurs per year in the spring/summer (May-July).
- Surface water sampling and analysis at four locations in the Jean Marie River located adjacent to the site.
- Polyethylene membrane device (PMD) is placed at two surface water sampling locations, one upstream of the HMC and one located downstream of the HMC.

3.2 Highway Maintenance Camp Groundwater Monitoring Program

3.2.1 Groundwater Monitoring Locations

A groundwater monitoring program is in place at the HMC to monitor groundwater conditions at the site. Table 4 below summarizes the location, rationale, parameters to be tested and frequency of the groundwater monitoring events.

Table 4. Groundwater and Surface Water Monitoring Locations at the Highway Maintenance Camp

Well Name	Location	Rationale	Parameters to be Tested	Frequency of Monitoring Events
CPS-1	61° 6'27.0" N, 121° 14' 37.1" W	Downgradient of P8-APEC 3	<ul style="list-style-type: none"> Field Water Quality Parameters (pH, temperature, conductivity) Dissolved Metals Petroleum Hydrocarbons (PHC F1, F2, F3, F4) Benzene, Toluene, Ethylbenzene, and Xylene (BTEX) Polycyclic Aromatic Hydrocarbons (PAH) 	Once per year during the spring/fall (May-July)
CPS-3	Coordinates of well location are not available	upgradient background of APEC 1; cross-gradient for APEC 2		
CPS-6	Coordinates of well location are not available	Source of P10/11		
CPS-7	Coordinates of well location are not available	Source at P10/11		
CPS-8	Coordinates of well location are not available	Downgradient of P10/11		
MW2	Coordinates of well location are not available	Upgradient background and downgradient of P10/11, P6-APEC 1		
MW4	Coordinates of well location are not available	Upgradient background of P9/APEC 1		
MW5	Coordinates of well location are not available	Downgradient of P8-APEC 3		
MWR-C	Coordinates of well location are not available	Downgradient of P10/11		

DP-1	Coordinates of well location are not available	Downgradient of P8-APEC 3		
CP-MW16-1	Coordinates of well location are not available	Downgradient of P9-APEC 1		
CP-MW16-2	Coordinates of well location are not available	Source at P8-APEC 3		
CP-MW16-3	Coordinates of well location are not available	Cross-gradient of P8-APEC 3		
CP-MW16-4	Coordinates of well location are not available	Upgradient background of P7-APEC 2		
CP-MW16-5	Coordinates of well location are not available	Source at P7-APEC 1		
CP-MW16-6	Coordinates of well location are not available	Upgradient background and downgradient of P10/11 and P6- APEC 1		

3.2.2 Groundwater Monitoring Methodology

Groundwater monitoring methodology will be determined by the contractor hired to complete the monitoring program. The groundwater monitoring methodology will be provided to GNWT-ECC for review and approval prior to completing the groundwater monitoring program.

Conditions of the groundwater monitoring wells will be recorded in the daily field logs during the groundwater sampling events that occur once a year (spring/summer).

3.2.3 Actions to Exceedances for Groundwater

Groundwater samples collected at the HMC will be analyzed for parameters listed in Table 4 above. Sample results will be compared to the Site-Specific Closure Levels found in the Closure and Reclamation Plan (KBL, 2020b). If samples exceed the action levels outlined, they will be recorded in the Annual HMC Report, and the monitoring program will continue to monitor the groundwater conditions.

3.3 Highway Maintenance Camp Surface Water Monitoring Program

3.3.1 Surface Water Monitoring Locations

Table 5. Surface Water Monitoring Locations at the Highway Maintenance Camp

Location Name	Location	Rationale	Parameters to be Tested	Frequency
SWUS	East of the south site boundary. Coordinates of sample location are not available.	Upstream background	<ul style="list-style-type: none"> • Routine chemistry parameters • BTEX and PHC F1-F4 • Regulated total metals • PAHs 	Twice per year during the spring/summer and fall
SW01	Adjacent to the site between parcels 8 and 9. Coordinates of sample location are not available.	Source – directly adjacent to the site		
SW02	Adjacent to the site between parcels 7 and 10/11. Coordinates of sample location are not available.	Source – directly adjacent to the site		
SWDS	East of the northern site boundary. Coordinates of sample location are not available.	Downstream background		

3.3.2 Surface Water Monitoring Methodology

Surface water monitoring methodology will be determined by the contractor hired to complete the monitoring program. The surface water monitoring methodology will be provided to GNWT-ECC for review and approval prior to completing the groundwater monitoring program.

3.3.3 Actions to Exceedances in Surface Water

Surface water samples collected at the HMC will be analyzed for parameters listed in Table 5 above. Results of the samples will be compared to the Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines (CWQG) for the Protection of Freshwater Aquatic Life (FAL) (CCME,2014). For parameters without CCME FAL guidelines, sample results will be compared to the Environmental Quality Guidelines (EQG) for Alberta Surface Waters (AEP, 2018). Should the results of the surface water samples exceed the applied guidelines the following actions will be taken:

- If the water exceeds EQC criteria the inspector will be notified immediately, affected parties will be informed; and
- Surface water monitoring program will continue to understand and monitor surface water conditions.

4 Sample Management

4.1 Quality Assurance/Quality Control Plan for Sample Management

4.1.1 Groundwater Sample Management

During each groundwater sampling event, each monitoring well will be assessed to determine its overall state and condition. Any issues will be noted and if necessary, repairs will be completed.

For quality assurance and quality control (QA/QC) the following additional samples will be collected and submitted to the laboratory:

- Collect and submit one blind field duplicate (BFD) sample for approximately 10% of the samples collected at each of the sites, or one per site when less than ten samples are collected.
- Collect and submit one trip blank that has been prepared by the laboratory and transported with the groundwater samples.
- One field blank prepared by field personnel and transported with the groundwater samples. There will be one sample collected per site.

In addition to the above noted field collected QA/QC samples, the laboratory will also complete an internal QA/QC check consisting of Method Blanks, Spiked Blanks and Matrix Spikes to ensure the appropriate QA/QC results are obtained prior to confirming the groundwater sampling programs results.

Results of the biannual Groundwater Monitoring Program will be submitted to the MVLWB as part of the Annual Monitoring Report and HMC Annual Monitoring Report.

4.1.2 Surface Water Sample Management

For QA/QC of surface water samples, the following additional samples will be collected and submitted to the laboratory:

- One trip blank prepared by the laboratory and transported with the surface water samples.
- One field blank prepared by field personnel and transported with surface water samples. One field blank will be collected for each site.
- One blind field duplicate sample will be submitted for analysis at each site.

Surface water samples and blanks will be stored in ice-chilled coolers and to be transported to the laboratory.

Results of the Surface Water Monitoring Program will be submitted to the MVLWB as part of the Annual Monitoring Report and the HMC Annual Monitoring Report.

5 Reporting

Activities and results of the groundwater and surface water monitoring program at the Landfarm will be documented and summarized in the Annual Monitoring Reports. Activities and results of the groundwater and surface water monitoring program at the HMC will be documented and summarized in the HMC Annual Monitoring Report.

6 References

- AEP. (2018). Environmental Quality Guidelines for Alberta Surface Waters, Alberta Environment and Parks.
- BluMetric (2017). Supplemental Phase III Environmental Site Assessment Report at Checkpoint Highway Maintenance Site, Fort Simpson, Northwest Territories.
- CCME (2014). Canadian Environmental Quality Guidelines – Water Quality Guidelines for the Protection of Aquatic Life
- Columbia Environmental, 2012, Supplemental Phase III Environmental Site Assessment Former Checkpoint Highway Camp (SM 049), Junction of Highways 1 And 7, Fort Simpson, Northwest Territories, Project No. 11-0394.
- Dillon Consulting Ltd., 2009, Checkpoint Landfarm Construction- Construction Summary 2009
- EBA Consulting, 2008, Remedial Action Plan (RAP), Former Checkpoint Site, Junction of Highway 1 and 7.
- FCSAP. (2016). Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites.
- Geological Survey of Canada (GSC), 2018, Surficial geology, Fort Simpson, Northwest Territories, NTS 95-H; Canadian Geoscience Map 369 (Surficial Data Model v. 2.3.14 conversion of Map 3-1978), scale 1:125 000. <https://doi.org/10.4095/308384>.
- GNWT (1998). Guideline for the General Management of the Hazardous Waste in the NWT.
- GNWT (1988). *NWT Environmental Protection Act*.
- GNWT (2016) *NWT Waters Act*.
- GNWT (2003). GNWT Environmental Guideline for Contaminated Site Remediation
- GNWT (2017). Guideline for Hazardous Waste Management
- KBL (2017). Operations and Maintenance Plan, Checkpoint Highway Maintenance Camp, Mackenzie Valley Land and Water Board, Class B Licence Application
- KBL (2020a). Groundwater Monitoring and Leachate Management Plan v. 3 Action Levels
- KBL (2020b). Checkpoint Highway Maintenance Camp and Landfarm, Closure and Reclamation Plan.
- MVLWB (2017). Type A Land Use Permit MV2017X0020.
- MVLWB (2017). Type B Water Licence MV2017L8-0004.

Appendix A

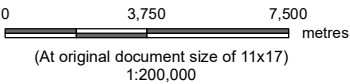
Figures

V:\1130\Activel\miscellaneous\ES_support\114490317\5\2023 Checkpoint Landfarm Monitoring Program\144903175_fig_1_1_HMC_SL.mxd Revised: 2023-07-12 By: calcewen



Legend

● Site Location



Notes
1. Coordinate System: NAD 1983 UTM Zone 10N
2. Background: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



Project Location Near Fort Simpson, Northwest Territories	Prepared by CL on 2023-07-12 TR by LVN on 2023-07-12 IR Review by TS on 2023-07-12
Client/Project Government of the Northwest Territories, Department of Environment and Climate Change 2023 Checkpoint Landfarm Monitoring Program - Draft Sampling Plan	144903401

Figure No.

A-1

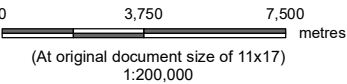
Title

HMC Site Location Plan



Legend

● Site Location



Notes
1. Coordinate System: NAD 1983 UTM Zone 10N
2. Background: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



Project Location
Near Fort Simpson,
Northwest Territories

Prepared by CL on 2023-07-12
TR by LVN on 2023-07-12
IR Review by TS on 2023-07-12

Client/Project
Government of the Northwest Territories,
Department of Environment and Climate Change
2023 Checkpoint Landfarm Monitoring Program -
Draft Sampling Plan

144903401



Figure No.
A-2

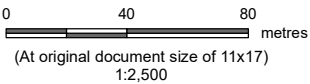
Title
Landfarm Site Location Plan

V:\1130\Activel\miscellaneous\ES_support\114490317\5\2023 Checkpoint Landfarm Monitoring Program\1144903175_fig_3_HMC_GWML.mxd Revised: 2023-07-12 By: calbeewen

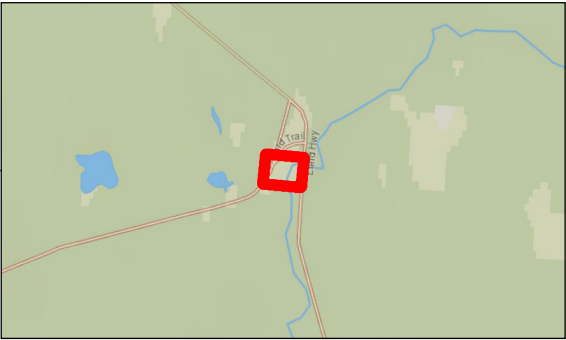


Legend

-  Monitoring Well Location (Destroyed)
-  Monitoring Well Location



- Notes**
1. Coordinate System: NAD 1983 UTM Zone 10N
 2. Background: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.
 3. The analyzed parameters that meet guidelines do not include metals



Project Location Near Fort Simpson, Northwest Territories		Prepared by CL on 2023-07-12 TR by LVN on 2023-07-12 IR Review by TS on 2023-07-12
Client/Project Government of the Northwest Territories, Department of Environment and Climate Change 2023 Checkpoint Landfarm Monitoring Program - Draft Sampling Plan		144903401

Figure No.
A-3

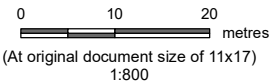
Title
**HMC Groundwater Monitoring and
Sampling Locations**

V:\1130\Active\miscellaneous\ES_support\114490317\5\2023 Checkpoint Landfarm Monitoring Program\144903175_fig_4_Landfarm_GWML.mxd Revised: 2023-07-12 By: calowen



Legend

- Monitoring Well Location



Notes
1. Coordinate System: NAD 1983 UTM Zone 10N
2. Background: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.



Project Location
Near Fort Simpson,
Northwest Territories

Prepared by CL on 2023-07-12
TR by LVN on 2023-07-12
IR Review by TS on 2023-07-12

Client/Project
Government of the Northwest Territories,
Department of Environment and Climate Change
2023 Checkpoint Landfarm Monitoring Program -
Draft Sampling Plan

144903401



Figure No.
A-4

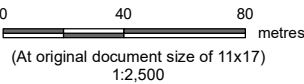
Title
**Landfarm Groundwater Monitoring and
Sampling Locations**

V:\1130\Activel\miscellaneous\ES_support\114490317_5\2023 Checkpoint Landfarm Monitoring Program\1144903175_fig_5_HMC_SWSL.mxd Revised: 2023-07-12 By: calbewen

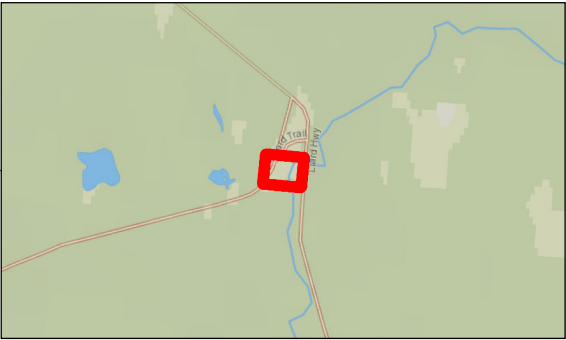


Legend

-  Co Located Surface Water Sampling Location and Polyethylene Membrane Device Sampling Location
-  Surface Water Sampling Location



- Notes**
1. Coordinate System: NAD 1983 UTM Zone 10N
 2. Background: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.



Project Location Near Fort Simpson, Northwest Territories

Prepared by CL on 2023-07-12
TR by LVN on 2023-07-12
IR Review by TS on 2023-07-12

Client/Project Government of the Northwest Territories, Department of Environment and Climate Change
2023 Checkpoint Landfarm Monitoring Program - Draft Sampling Plan

144903401


Figure No. A-5

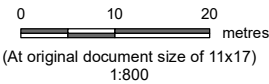
Title HMC Surface Water Sampling Locations

V:\1130\Active\miscellaneous\ES_support\114490317\5\2023 Checkpoint Landfarm Monitoring Program\144903175_fig_6_Landfarm_SWSL.mxd Revised: 2023-07-12 By: caloewen



Legend

-  Surface Water Sampling Location



Notes
1. Coordinate System: NAD 1983 UTM Zone 10N
2. Background: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.



Project Location
Near Fort Simpson,
Northwest Territories

Prepared by CL on 2023-07-12
TR by LVN on 2023-07-12
IR Review by TS on 2023-07-12

Client/Project
Government of the Northwest Territories,
Department of Environment and Climate Change
2023 Checkpoint Landfarm Monitoring Program -
Draft Sampling Plan

144903401

Figure No.
A-6

Title
**Landfarm Surface Water Sampling
Locations**