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May 30, 2022

Gwich'in Land and Water Board  
P.O. Box 2018  
Inuvik, NT X0E 0T0

**Attention: AlecSandra Macdonald, Regulatory Specialist**

Dear Ms. Macdonald:

Please find enclosed an application from KBL Environmental Ltd. (KBL) for G17L1-002 Type B Water Licence Renewal for the Soil Treatment Facility (STF) located in Inuvik, NT pursuant to the *Northwest Territories Water Regulations*.

Please contact Katie Oliver at 780.452.7779 or by email at [koliver@kblenv.com](mailto:koliver@kblenv.com) if you have any questions or comments.

Sincerely,

**KBL Environmental Ltd.**

Katie Oliver  
General Manager, Environmental Consulting





**Mackenzie Valley Land and Water Board**  
**7th Floor - 4910 50th Avenue**  
**P.O. Box 2130**  
**YELLOWKNIFE NT X1A 2P6**  
**Phone (867) 669-0506**  
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**APPLICATION FOR A NEW WATER LICENCE, AMENDMENT OF LICENCE, OR RENEWAL OF LICENCE.**

**Application/License No:**  
 (amendment or renewal only)

<b>1. Name and Mailing Address of Applicant</b> <hr/> KBL Environmental Ltd <hr/> Box 1895, 17 Cameron Road Yellowknife, NT X1A 2P4 <hr/> Telephone: <u>780.452.7779</u> Fax: <u>866.316.7991</u>	<b>2. Address of Head Office in Canada if Incorporate</b> <hr/> Box 1895, 17 Cameron Road Yellowknife, NT X1A 2P4 <hr/> Telephone: <u>780.452.7779</u> Fax: <u>866.316.7991</u>
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**3. Location of Undertaking (describe and attach a map, indicating watercourses and location of any proposed waste deposits).**

Latitude (N) 7582173.14 Longitude (E) 554308.00

**4. Description of Undertaking (describe and attach plans)**

Please see attached application

**5. Type of Undertaking.**

- |                       |                   |                  |                   |
|-----------------------|-------------------|------------------|-------------------|
| 1. Industrial         | <u>X</u>          | 5. Agriculture   | <u>          </u> |
| 2. Mining and Milling | <u>          </u> | 6. Conservation  | <u>          </u> |
| 3. Municipal          | <u>          </u> | 7. Recreation    | <u>          </u> |
| 4. Power              | <u>          </u> | 8. Miscellaneous | <u>          </u> |

**6. Water Use**



To obtain water	_____	Flood control	_____
To cross a watercourse	_____	To divert water	_____
To modify the bed or bank of a watercourse	_____	To alter the flow of, or store water	_____
Other (describe): _____			

Please see attached application

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- 7. Quantity of water involved (litres per second, litres per day or cubic meter per year, including both quantity to be used and quality to be returned to source.**

Please see attached application

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- 8. Waste deposited (quantity, quality, treatment and disposal)**

Please see attached application

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- 9. Other persons or properties affected by this Undertaking (give name, mailing address and location. Attach a list if necessary.**

Please see attached application

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- 10. Predicted environmental impacts of Undertaking and proposed mitigation.**

Please see attached application

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- 11. Contractors and sub-contractors (names, addresses and functions). Attach a list if necessary.**

Please see attached application

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**12. Studies undertaken to date. Attach a list if necessary.**

Please see attached application

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**13. Proposed time schedule.**

Start date: May 15, 2022

Completion date: May 15, 2022

Name (print): Katie Oliver

Signature: 

Title (print): General Manager,  
Environmental Consulting

Date: May 15, 2022

***Please make all cheques payable to "Receiver General of Canada"***

***FOR OFFICE USE ONLY***

Application Fee Amount: \$                     

Receipt No:                     

Water Use Deposit Amount: \$                     

Receipt No:



# **Inuvik Soil Treatment Facility**

Type B Water License Renewal Application  
Gwich'in Land and Water Board  
G17L1-002 Type "B" Licence



**Inuvik Soil Treatment Facility**

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May 30, 2022



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## **APPENDICES**

Appendix A	Facility Map and Drawings
Appendix B	Operation and Maintenance Plan
Appendix C	Waste Management Plan
Appendix D	Closure Reclamation Plan
Appendix E	Environmental Monitoring Plan
Appendix F	Engagement Plan and Engagement Record



## 1.0 NAME AND MAILING ADDRESS OF APPLICANT

<b>Applicants Name</b>	KBL Environmental Ltd.		
<b>Mailing Address</b>	P.O. Box 1895, 17 Cameron Road		
<b>Community</b>	Yellowknife		
<b>Prov/Terr</b>	NT	<b>Postal Code</b>	X1A 2P4
<b>Telephone</b>	780.452.7779	<b>Fax</b>	866.316.7991
<b>Email</b>	<a href="mailto:regulatory@kblenv.com">regulatory@kblenv.com</a>	<b>Other</b>	<a href="mailto:koliver@kblenv.com">koliver@kblenv.com</a>

## 2.0 ADDRESS OF HEAD OFFICE

Please see section 1.0 for the address of the KBL Environmental Ltd. head office.

## 3.0 LOCATION OF EXISTING FACILITY

Town of Inuvik Solid Waste Disposal Facility

Lot 65, Group 1355, CLSR 61339

Inuvik, Northwest Territories

(N) 7582173.14, (E) 554308.00

The soil treatment facility (STF) is located within the existing Town of Inuvik Solid Waste Disposal Facility (SWDF) which is operated under the Gwich'in Land and Water Board (GLWB) licence G17L3-001. The Inuvik SWDF is located on the east side of the Dempster Highway (locally referred to as Airport Road), approximately 180 meters from the nearest surface water body (unnamed lake) and 1.65 km east of the Mackenzie River. The STF is accessed through the SWDF which is gated. A security fence will surround the STF which will act as a secondary access restriction. The Town of Inuvik (the Town) and KBL Environmental Ltd. (KBL) have an agreement to share the main gate access. A map has been attached for your reference in Appendix A – Facility Map and Drawings.

Signage will be located at the Inuvik SWDF that indicates the shared entrance for the facility. The facility is designed with a road which directs traffic flow. A single entrance to the soil treatment pad and a single exit is denoted with entrance/exit signs. The signage at the entrance of the pad specifies that the site is restricted to authorized vehicles due to operating equipment.

## 4.0 DESCRIPTION OF FACILITY

The STF is designed to receive, store, and treat petroleum hydrocarbon contaminated soil, water and snow generated primarily from residential, commercial, and industrial properties where a hydrocarbon release has occurred. During the winter months, contaminated snow is also be received at the facility. The STF includes operation and maintenance of a soil treatment pad and a water retention pond which operates primarily



during the summer months. Following bioremediation, treated soil meeting licence criteria will be transferred for use as daily cover at the Inuvik landfill. Soil determined through laboratory analysis to be unsuitable for re-use will be transported off site to an appropriate facility approved to accept the material for treatment or disposal.

#### **4.1. Waste Acceptance**

No soil is accepted at the facility without all the information necessary to complete a Waste Profile Form, please refer to the Operation and Maintenance Plan found in Appendix B for a copy of the form. The information documented on the form includes the generator source, type of material, and includes confirmation that soil sampling for analysis was completed in a manner to satisfy technical standards. Analytical results (from an accredited laboratory) for petroleum hydrocarbons, metals, and other contaminants of concern must accompany the Waste Profile Form. If it is determined that the required information is incomplete, or the analytical results fail to meet the acceptance criteria, soil will not be accepted and will remain the responsibility of the generator. The acceptance criteria can be found in the Operation and Maintenance Plan located in Appendix B.

The acceptance criteria for the STF was established based on contaminant treatability and applicable regulatory standards. Volatile petroleum hydrocarbon compounds (benzene, toluene, ethylbenzene, and xylene) have no applicable acceptance criteria due to their ease of volatilization. Petroleum hydrocarbon fractions F1-F4 have been assigned acceptance criteria based on the degradability of the hydrocarbons and thus treatability. Metals are not treated in soil at the STF. Please refer to the Operation and Maintenance Plan found in Appendix B for the acceptance criteria for further details on waste acceptance procedures.

#### **4.2. Soil Treatment Pad and Soil Treatment**

The design of the STF consists of a bermed cell that will be constructed above ground and graded to direct precipitation to a water retention pond. The treatment cell is constructed with a berm which is approximately 0.73 m high by 2 m wide and surrounds the cell to divert surface water run-on from entering the cell and act to contain soil within the cell. The cell is approximately 117 m by 47 m with a 2.5% grade towards the southwest so that precipitation is directed to the surface water retention pond located at the west of the site. A 60-mil Linear Low Density Polyethylene (LLDPE) liner was used in the cell. The LLDPE liner was chosen for this project due to the better yield and elongation properties which is most appropriate where differential settlement may be expected. The liner is covered with fill material to protect it from equipment and potential operational impacts. Please refer to Appendix A – Facility Map and Drawings for as-built drawings of the berms, cell, and liner. Liner and berm inspection and maintenance are discussed in the Operation and Maintenance Plan which is in Appendix B.

Incoming soil is segregated and tracked through a unique assigned number. Soil from each project is managed and treated separately. There will be no co-mingling of soil from different projects, nor any dilution of contaminated soils with cleaner soils.

Bioremediation is a method proven to be effective for the treatment of petroleum hydrocarbons in soil. Bioremediation occurs by promoting naturally occurring microbial activity in the soil which accelerates the degradation of the contaminants. To achieve this the process uses one or a combination of the following methods depending on soil volumes and contaminant concentrations:



- Air circulation: soil turning to enable air movement within the soil pile providing oxygen to micro-organisms using an excavator and/or mechanical screens;
- Application of nutrients: addition of fertilizers with nitrogen and phosphorous at calculated dosing ratios based on chemical analysis of soils with application frequency determined by soil and contaminant characteristics;
- Application of bulking agents: for fine grain soils such as clay, small amounts of wood chips or compost can be added to increase porosity increasing air, water and nutrient availability to microbes;
- Application of water from the retention pond or above ground storage tanks to maintain optimum soil moisture content. Moisture will be assessed by reviewing laboratory analytical results. Water application will be aimed at achieving a water filled pore space of between 0.4 to 0.6; and
- Application of chemical oxidants or surfactants. The sourcing and application of any oxidants or bio-surfactants will be reviewed with GNWT-ENR prior application. Amendments selected for use may be stored within appropriate containers at the site.

A sampling protocol has been developed to assess the progress of the bioremediation process and determine whether the soil meets the re-use criteria, requires additional treatment, or must be transported off-site for disposal at a designated facility, please refer to the Operation and Maintenance Plan in Appendix B for the details and criteria. Soil suitable for industrial re-use is determined by analytical results meeting the criteria. Material meeting the re-use criteria is used as daily cover at the Town's landfill. Prior to re-use as daily cover, KBL will provide analytical data to the Town for final approval. ENR is kept informed of any soils that become approved for re-use.

Soils not meeting industrial criteria and is not considered suitable for further treatment will be profiled and transferred for disposal at an approved waste receiving facility. Please refer to the Operation and Maintenance Plan located in Appendix B and the Waste Management Plan located in Appendix C for further details.

Facility documentation, including a copy of this Plan, is maintained on-site. Copies of shipping documents detailing the movement of contaminated soil to the Facility and records of treated soil being removed for daily landfill cover are maintained electronically by KBL. Similar documentation regarding the storage, use, treatment, discharge, and/or disposal of retention pond water is maintained electronically by KBL. All on-site documentation is kept at the SWDF gatehouse; electronic copies of all documentation are maintained on KBL's data management system. All supporting documentation and laboratory certificates of analysis will be included in the STF annual report, or provided when required.

#### **4.3. Surface Water Management**

The water retention pond is designed to collect precipitation runoff from the soil treatment pad. The pond is rectangular with the dimensions of approximately 18 m by 30 m with side slopes of 2.5 horizontal to 1 vertical. The overall pond depth is estimated at 1.9 meters. A minimum of 0.9 meter of freeboard will be maintained at all times in the pond. A 60-mil LLDPE liner lines the pond.

The water retention pond estimated capacity is based on the as-built drawings which are included in



Appendix A. The water retention pond management and maintenance details are discussed in the Operation and Maintenance Plan located in Appendix B.

Two aboveground storage tanks (ASTs) with a capacity of 63,000 liters each are located on-site within the containment of the soil treatment pad. The ASTs are used to store excess water from the water retention pond in the event water levels increase above optimal freeboard. One storage tank will remain empty and dedicated for use as a holding tank if water removal from the pond is required. If it is anticipated that the ASTs are unable to accommodate estimated pond removal volumes, KBL will mobilize vacuum trucks and/or additional ASTs as required.

Retention pond water management may include pumping pond water into ASTs to maintain sufficient freeboard in the pond. Raw water may be used as both soil enhancement and dust suppression within the soil treatment pad, as conditions dictate. The ASTs may also be used to hold pond water until water treatment events; the ASTs may also be used as temporary holding until analytical results determine water quality parameters meet on-site discharge criteria. Additionally, temporary storage of water in the ASTs may be necessary for pond maintenance or inspection. Please refer to the Operation and Maintenance Plan located in Appendix B for further details.

Water held in the retention pond will be analyzed and compared with the environmental quality criteria (EQC) found in Appendix B - Operation and Maintenance Plan. The retention pond water management approach is determined by laboratory analytical results as detailed below:

- If the water is non-hazardous, it may be utilized for application within the soil treatment pad for the provision of moisture to the soil. Moisture is an integral part of promoting microbial activity responsible for the degradation of petroleum hydrocarbons. Water application for bioremediation is permissible provided the water is not hazardous as defined by the *"Guideline for the General Management of Hazardous Waste in the NWT (1998)"*.
- If water meets all EQC parameters, it may be discharged on-site (details are outlined in Appendix B – Operation and Maintenance Plan).
- If water exceeds the EQC criteria but analytical results determine the water to be suitable for treatment using a coagulant or KBL's portable water treatment plant the water will be treated and water quality will be re-analyzed. Details of the portable water treatment plant are found in the Operation and Maintenance Plan in Appendix B.
- If the water exceeds the EQC for contaminants, and is beyond the treatment capacity of KBL's water treatment plant, the water will be transported off-site to an approved facility for treatment or disposal.

A record of all water removal, treatment, disposal or discharge are kept at the facility.

## 5.0 TYPES OF UNDERTAKING

The undertaking would be classified as Industrial.



## 6.0 WATER USE

Not Applicable - there is no water use in conjunction with this application.

## 7.0 QUANTITY OF WATER INVOLVED

(Litres per second, litres per day or cubic meters per year, including both quantity to be used and quality to be returned to source).

Not Applicable – there is no water use in conjunction with the application

## 8.0 WASTE DEPOSITED

The following table identifies the waste streams and disposal that will be required, source of generation, management options, and estimated volume generated.

**Table 8-1: Waste Streams, Source of Generation and Characteristics**

Waste Stream	Source of Generation	Characteristics	Management Options	Volume
Treated Soil	Bioremediation	Bioremediated soil.	Beneficial re-use off-site as fill or daily cover at the Inuvik landfill.	Up to 6000 m <sup>3</sup> /year
Petroleum hydrocarbon contaminated soil	Bioremediation	Soil not successfully bioremediated.	Transported off-site for final disposal at an approved landfill.	Negligible
Water, untreated	Surface Water Retention Pond	Precipitation, water, snow melt and soil treatment pad run-off.	Re-use as soil enhancement and to control dust emissions in the soil treatment pad.	Up to 50 m <sup>3</sup> /day total between June 1 <sup>st</sup> and Sept. 30 <sup>th</sup>
Water, treated	Water Treatment Effluent	Water, snow melt and soil treatment pad effluent that has been treated and meets discharge criteria.	Beneficial reuse as a dust suppressant at the Inuvik landfill or discharge to the environment.	
Water, petroleum hydrocarbon contaminated	Water Treatment Effluent	Water not successfully treated by the water treatment process.	Transported off-site for treatment or disposal at an approved facility.	Negligible
Spent filter media from water treatment	Water Treatment Operation	Spent bag filters, spent granular activated carbon.	Transported off-site for final disposal at an approved landfill.	Negligible
Spill response materials	Spill or accident release from facility or vehicles	Petroleum hydrocarbon contaminated absorbent materials.	Transported off-site for final disposal at an approved landfill.	Unknown
Petroleum hydrocarbon contaminated material	Spill or accident release from facility or vehicles	Petroleum hydrocarbon contaminated soil, water, or snow.	Treatment through on-site soil treatment pad/water treatment process or transported off-site for final disposal at an approved facility.	Unknown



Please refer to Appendix C – Waste Management Plan for specific details surrounding the management of wastes associated with the STF.

## 9.0 OTHER PERSONS OR PROPERTIES AFFECTED BY THIS UNDERTAKING

**Table 9-1: Persons or Properties Affected by Undertaking**

Name	Mailing Address/Location
Town of Inuvik, Senior Administrative Officer	2 Firth Street PO Box 1160 Inuvik, NT X0E 0T0

## 10.0 PREDICTED ENVIRONMENTAL IMPACTS OF UNDERTAKING AND PROPOSED MITIGATION

This section of the application reviews the potential environmental impacts and mitigation measure which KBL will implement to protect environment, health and safety during construction and operation of the Inuvik Soil Treatment Facility (STF) located within the Town of Inuvik's Solid Waste Disposal Facility (SWDF).

### 10.1. Environmental Policy

KBL's commitment to the protection of the environment is demonstrated in how we conduct our day to day business. The highest standards of care are taken by all employees to minimize the environmental impact of all operations. The company management team has the responsibility to take a leadership role and develop policies and procedures that minimize environmental effects. Employees have the responsibility to bring to the attention of their immediate supervisor those procedures and incidents which may impair the environment.

Our policy is to:

- 1) Comply with all applicable government regulations.
- 2) Consider the environmental effects of our operations.
- 3) Provide staff with all the necessary information, training and equipment.
- 4) Develop processes, policies and procedures that minimize the occurrence and consequences of environmental incidents.

Our corporate environmental goal is to minimize the environmental impact of our operations.

### 10.2. Environmental Setting

The STF is situated within an operation solid waste disposal facility that services the Town of Inuvik. The facility first began operating as a landfill in 1976.

Inuvik is situated within the Taiga Plains Ecozone. Inuvik is situated within the Mackenzie Delta Ecoregion.



The ecoregion is marked by very cold winters and cool summers. The mean annual temperature is approximately -9.5°C. The mean summer temperature is 8.5 °C and the mean winter temperature is -26.5°C. Mean annual precipitation ranges from 200 mm to less than 275 mm. The ecoregion is classified as having a high subarctic ecoclimate. The predominant vegetation consists of open, very stunted stands of black spruce and tamarack with secondary quantities of white spruce, and a ground cover of dwarf birch, willow, ericaceous shrubs, cottongrass, lichen, and moss. Poorly drained sites usually support tussocks of sedge, cottongrass, and sphagnum moss. Low shrub tundra, usually dwarf birch and willow is also common. The present delta is remarkable for its multitude of lakes and channels.

Wetlands extend over 50% of the ecoregion, and are characteristically polygonal peat plateau bogs with ribbed fens. Regosolic Static and Gleysolic Static Cryosols with Organic Cryosols developed on level fluvioglacial, organic, and marine deposits are the dominant soils. Extensive discontinuous permafrost with low to medium ice content is prevalent throughout the ecoregion, and is characterized by sparse ice wedges. Characteristic wildlife includes muskrat, beaver, mink, and waterfowl. Land uses are limited to trapping, hunting, recreation, and tourism. Major communities include Aklavik and Inuvik (Ecological Framework of Canada).

Bedrock in the Mackenzie Delta is sedimentary, comprised of Tertiary shale and sandstone. Preglacial, glacial and post glacial deposits overlie the bedrock. Depth to bedrock in the vicinity of Inuvik is approximately 50 meters (EBA 2011).

According to the Town of Inuvik SWDF O&M manual, the majority of the footprint of the SWDF O&M manual, the majority of the footprint of the SWDF is within Inuvik's gravel quarry Lot 65, Group 1355 (CLSR 61339). To the northeast of the site is the steep slopes of Mount Baldy, and to the southwest is Airport Road and its surrounding industrial developments. Immediately to the north is the former Hospital Hill common fill quarry. According to the SWDF O&M manual, geotechnical conditions in the area are mostly gathered from the historical quarrying activity in the Hospital Hill borrow pit. The entire district is underlain by deep permafrost, with occasional large ice lenses.

The SWDF is situated on a low, broad shoulder that extends southwesterly from near the base of Mount Baldy. The Inuvik SWDF is on a low topographic crest which is beneficial for drainage control. The STF will be located near the southwestern limit of Lot 65. As noted by the Town's Director of Public Services, surface water drainage patterns at the SWDF flows primarily towards the east/southeast towards a large pond with lesser surface water flow moving in a west/northwest pattern. The quality of runoff originating from the SWDF is monitored monthly during periods of flow by the Town of Inuvik in accordance with the Town's Water Licence #G17L3-001.

Regionally, groundwater flow is inferred to be westerly towards the Mackenzie River.

#### **10.2.1. Existing Soil Conditions**

The area of the lease contracted to KBL is above an historic landfill cell as reported by the Town's Director of Public Services. KBL commissioned the excavation of three test pits within the boundary of the STF on October 28, 2016. Test pit depth ranged from 1.8 to 2.4 meters below ground surface (mbgs). Permafrost was not encountered in any of the test pits. A brown, organic top layer, pebble and cobble extending to a depth of 0.2 mbgs was encountered in each test pit. Clay with scattered pebbles were encountered to a depth



ranging from 0.2 to 2.4 mbgs. The deepest clay was encountered in the northeast section of the lease area. The clay observed during the test pitting investigation ranged from grey-brown to reddish-brown to dark brown. Garbage was encountered from 1.2 to 1.8 mbgs in the test pit advanced in the southwest section of the lease area. One soil sample was collected from each of the test pits and submitted for laboratory analysis for key soil quality indicator parameters, including petroleum hydrocarbons, metals, and polycyclic aromatic hydrocarbons. KBL utilized the 2003 *Northwest Territories Environmental Guideline for Contaminated Site Remediation* (NWT CSR) for assessment of soil quality. The objective of the NWT CSR is to address potential threats to human health and the environment from contaminated sites. The document provides guidelines for setting soil standards for site remediation and describes the process that is used to manage contaminated or potentially contaminated sites.

The NWT CSR provides criteria for coarse-grained and fine-grained soils in several land use settings. Since the site is situated within a solid waste disposal facility, the industrial land use setting criteria was selected. Consistent with Canada wide standard methods, a conservative approach is used during criteria selection for site assessment and remediation. As the soils encountered on Site were observed to be clay with pebbles and some cobble, the more stringent coarse grained criteria have been applied.

Exceedances were detected in one test pit for lighter fraction petroleum hydrocarbons (F1 and F2); this same sample was also analyzed to have a value just above criteria for naphthalene. Arsenic levels were analyzed to be above criteria in each of the samples collected. Nickel levels were analyzed to exceed criteria in two samples.

**Table 10-1: Soil Analysis Results, Test Pit Samples, October 28, 2016**

Sample ID		INU-100-01	INU-200-01	INU-300-01
Sample Depth (mbgs)		1.1	1.3	0.8
Analytical Parameter	Criteria (mg/kg)			
F1 (C6 – C10)	310	<b>720</b>	<10	17
F2 (>C10 – C16)	760	<b>2900</b>	<10	52
Naphthalene	22	23		
Arsenic	12	<b>46</b>	<b>45</b>	<b>65</b>
Nickel	50	46	<b>54</b>	<b>65</b>

*GNWT Environmental Guideline for Contaminated Site Remediation, 2003, Industrial Land Use; coarse grained*

*mbgs: meters below ground surface*

**BOLD values:** above criteria

<: below detection method

Test pit locations and detailed observations are provided in a Memo by Dillon Consulting Ltd, dated October 28, 2016 attached as Appendix E – Environmental Monitoring Plan and includes the laboratory certificate of analysis.

Garbage was noted at surface in 4 out of 10 field logs from the August 2017 investigation and extended to a maximum depth of 6.1 mbgs.



Baseline soil monitoring was conducted in 2017 and the following exceedances were detected:

Sample ID		BH2-01	BH2-02	BH2-03	BH2-04	BH3-01	BH3-02	BH3-03	BH3-04	BH4-01	BH4-02	BH4-03	BH7-01	BH7-02	BH7-03
Sample Depth (mbgs)		1.1	1.3	0.8											
Analytical Parameter	Criteria (mg/kg)														
Arsenic, total	12	38	26	24	32	39	18	59	36	43	32	18	96	67	31
Copper, total	91									230					
Nickel, total	50	53	51							240	77		51	53	
Zinc, Total										22,000					

\*Government of the Northwest Territories, Environmental Guideline for Contaminated Site Remediation, November 2003, assumes coarse-grain soil

The complete analytical baseline analysis is attached in Attachment D - Environmental Monitoring Plan.

### 10.3. Environmental Effects

#### 10.3.1. Heritage Resources

The facility was constructed in the fall of 2021 and is in an existing industrial area which has operated as a landfill since 1976. The STF lease area is situated in a former landfill cell, as confirmed through the detection of garbage in October 2016 which is indicative that the site is previously disturbed. The Notice of Project, which includes a description of the project was circulated on March 15, 2016 to potentially affected parties identified in consultation with the GLWB. No concerns regarding potential heritage resources were received after the issue of the Notice of Project nor during the community information session held in Inuvik on April 13, 2017. The potential for the location of heritage resources in the project area is considered low; no significant effects to heritage resources are anticipated during project construction, operation of decommissioning.

#### 10.3.2. Terrestrial Environment

The project lease is situated within an operating solid waste disposal facility. Soil analytical results obtained during the 2016 and 2017 test pitting program indicate soil quality in the project area are affected by historical activity. Photographs collected during the test pit program show a previously disturbed area absent of trees, therefore no clearing of land is required for project construction.

As noted, permafrost was not encountered during the 2016 and 2017 test pitting program which ranged in depth from 1.8 to 2.4 mbgs. The soil treatment pad and surface water retention pond are entirely within the boundaries of the existing SWDF and located on an existing landfill cell. Consequently, impacts to the deep permafrost have likely already occurred resulting from operations at the landfill to:

- remove the site vegetation;
- create soil disturbance in the form of excavations below ground level; and
- bacterial generation of metabolic heat from the disposal of organic wastes.



KBL completed a baseline soil sampling program within the footprint of the facility to characterize and delineate any pre-existing impacts resulting from historical SWDF operations. The assessment facilitated being able to differentiate between pre-existing impacts and any potential future impacts created by the operation of the STF, if necessary. Existing contaminants to establish a baseline included: benzene; toluene; ethylbenzene; xylenes (BTEX); volatile organic compounds (VOCs), F1 to F4 hydrocarbon fractions and polycyclic aromatic hydrocarbons (PAHs). Please refer to Appendix E – Environmental Monitoring Plan for more information.

Bear activity in proximity to the SWDF is a potential concern for the safety of facility personnel. The STF will be secured with fencing along the full perimeter of the lease area. Fencing of the STF will also aid in preventing the disposition of unauthorized materials.

Any domestic waste generated by facility personnel will be removed from site daily to minimize the potential to attract wildlife. Details on waste management practices for the STF area located in the facility Waste Management Plan located in Appendix C.

A Spill Contingency Plan has been developed for the facility and can be found in the Operations and Maintenance Plan located in Appendix B..

Waterfowl activity in proximity to the STF water retention pond will be monitored to confirm whether the pond is attracting waterfowl. Should it be determined that the pond is creating an attraction to waterfowl, netting will be installed as a deterrent.

Prior to STF decommissioning, the facility licensee will be required to undertake a comprehensive soil quality assessment program for comparison against pre-construction (baseline) soil conditions. Any requirements for additional monitoring post decommissioning, will be established in consultation with regulatory oversight bodies.

The potential for the facility to impact soil quality, vegetation or terrestrial wildlife in or near the project area is considered low.

### **10.3.3. Aquatic Environment**

KBL completed a drilling program to confirm the depth to permafrost beneath the site. Based on the borehole program completed in the summer of 2017 the measured permafrost depths in the area of the STF varied between 3.5 to 7.1 mbgs, with an apparent active layer (indicated as moist/wet soils) averaging approximately 2 meters above the permafrost layer. After a review of the borehole data, and the determination that both the apparent active layer and permafrost was at an sufficient depth, it was decided that the engineered design of the STF did not require additional mitigation in order to account for the possibility of permafrost impacts. In other words, the permafrost layers were at sufficient depth and the STF design was robust enough, to negate the need for permafrost protection measures.

Regional groundwater flow is inferred to be westerly towards the Mackenzie River. KBL installed a network of groundwater monitoring wells (as indicated on the drawings in Appendix A) to monitor groundwater for potential contaminants of concern during the life of the STF. Regular groundwater



monitoring is completed in accordance with the exiting licence. If groundwater wells are installed, appropriate measures will be undertaken to protect permafrost, as necessary. Please refer to Appendix E – Environmental Monitoring Plan for additional information on the groundwater program.

Water accepted at the STF or generated through surface run-off, leachate or snow melt will be captured in an engineered, LLDPE lined, water retention pond. Drainage patterns from the soil treatment pad will be assessed as part of the regular facility inspections to ensure that the runoff water is diverted to the retention pond as per the design. The water retention pond volume will be monitored regularly during the summer season by a KBL representative. Additionally, more frequent inspections will be completed during significant rainfall events to ensure the retention pond levels maintain within operating requirements. Where pond levels are determined to be approaching operating capacity, pond water will be pumped to above ground storage tanks located on—site.

No water from the retention pond or the above ground storage tanks will be discharged without undergoing laboratory analysis. Should the analytical results fail water discharge criteria, the water will not be discharged until it has undergone treatment with either a coagulant or in the STF portable water treatment plant (WTP) and confirmatory laboratory analysis. The WTP is designed to treat both petroleum hydrocarbons and suspended solids; WTP design information is included in the Waste Management Plan in Appendix C. Effluent quality is confirmed through laboratory analysis to meet the discharge criteria specified in the Operation and Maintenance Plan (Appendix B). Following exhaustion of effluent re-use opportunities (bioremediation enhancement or dust suppression), effluent is batch discharged to the ground surface through a dedicated hose to a constructed discharge channel.

The potential for the facility to impact surface or groundwater quality near the project area is considered low.

#### **10.3.4. Air and Noise**

Operation of the soil treatment pad in a manner that maximizes conditions to promote bacterial degradation involves maintaining a certain degree of soil moisture during the frost-free portion of the year. Maintaining optimal moisture content in the soil also serves to suppress dust and minimize fugitive dust emissions off-site. If wind conditions are such that substantial dust is created during soil handling and treatment, activities will be shut down until conditions stabilize. Accordingly, impacts to terrestrial vegetation adjacent to the site resulting from dust deposition are considered negligible.

The STF is in an existing industrial area. The main activities occurring at the site, bioremediation, are largely passive. Any activities that may generate noise such as tilling soil and managing effluent will be periodic during summer months, of short duration, occur during daytime hours, and are lower in volume and frequency than other activities that concurrently occur in the industrial area. The STF is expected to have negligible impacts on ambient noise levels in the project area.

## **11.0 MONITORING PROGRAM**

The Facility groundwater monitoring program is outlined in Appendix E – Environmental Monitoring Plan.



The facility is designed to direct all surface water runoff into a storm water retention pond. This enables regular sampling and reporting of any water collecting within the pond prior to applicable regulatory guideline comparison to determine pump-off or off-site disposal requirements.

Outside of monitoring the engineered surface water retention pond, it would appear that monitoring the site for surface water runoff down gradient of the facility would be of limited benefit. As reported in Earth Tech (Canada) Inc.'s report "Town of Inuvik, NT – Operation and Maintenance Manual for Solid Waste Disposal Facilities" issued in March 2006, the landfill is situated within a divide between two of Mount Baldy's small watersheds. Northern slopes tend to drain toward Boot Creek, to the west and north and the southern ones drain into a fenland and small ponds to the east and south. Flow from both of these areas is directed around, and not through, the landfill area.

*"As a result, drainage leaving the main part of the landfill is limited to the rain and snow which fall directly on the rather small area of the landfill site itself, plus, possibly, a minor amount of permafrost meltwater from beneath the site. Owing to the very small quantities of water leaving this site, or passing its edges, there is little likelihood that any substantial quantity of contamination would be transported from the site to either of the adjacent watersheds."*

The low risk for off-site migration of contaminants from the SWDF (and therefore the STF) may be reinforced by a statement made in the same report that:

*"the entire district is underlain by deep permafrost, and there are occasional large ice lenses... Inuvik is above the Arctic Circle, and well within the NWT's zone of continuous permafrost. Subsoils below the shallow active layer are frozen to considerable depth. In permafrost terrain, groundwater movement is confined to the seasonally-thawed active layer, and to the seasons of thaw. In the lands immediately surrounding the landfill site, little groundwater movement is expected at all, owing to the shallowness of the active layer (especially where the surface vegetation remains, as in the areas to the south and east) and to the generally low permeability of the area's soils. The compacted roadways running past the west side of the site, into the old Hospital Hill quarry and up to the newer Mt. Baldy one, also act as groundwater barriers. In conclusion, horizontal movement of groundwater out of the Mt. Baldy site is expected to be extremely slow if any at all; and vertical movement is barred by deep permafrost."*

*It has occasionally been asked what effect a landfill has on permafrost, and vice-versa. In a landfill containing completely inert materials, it is likely that the permafrost table will gradually rise into the deposit, further improving encapsulation. A landfill that contains natural organic materials, on the other hand, will support bacteria and generate metabolic heat for a considerable number of years, and may actually drive the permafrost table down, forming a temporary basin in the frozen terrain mass. In a shallow permafrost setting, this would preclude reliance on permafrost as a liner, but in a deep permafrost setting, such as Inuvik's, it is not of practicable significance in terms of groundwater containment."*

With the low likelihood of off-site migration of contaminants from the STF via surface or groundwater, the construction of the soil treatment pad using clean fill will lend itself to periodic monitoring of the soil for



potential contaminants of concern accepted by the STF; specifically, BTEX and F1 to F4 petroleum hydrocarbon fractions. A drilling investigation was completed in 2017 to gather supplemental information on sub-surface soil quality. Regular facility and liner inspections occur during the operation of the STF. At the time of facility decommissioning, soil sampling will be required to examine soil quality beneath the former STF for comparison against pre-construction data. Any requirements for soil remediation activities or long term groundwater monitoring post closure will be specified by the regulatory agencies. Please refer to Appendix E – Environmental Monitoring Plan for a copy of the letter provided by Land Solutions regarding *Environmental Monitoring and Permafrost Considerations at KBL Environmental's Inuvik Soil Treatment Facility (STF)*. Please see Appendix D for a copy of the Closure Reclamation Plan.

As discussed in the previous section, at the time of the geotechnical drilling to confirm the depth to permafrost beneath the proposed site, the type and any active layer considerations will be confirmed. This will assist in exploring the potential for completing a groundwater monitoring program. If a significant active layer is identified above the permafrost table or a groundwater-bearing zone is encountered, KBL will install a network of groundwater monitoring wells (as indicated on the drawings in Appendix A) to monitor groundwater for potential contaminants of concern during the life of the STF. Regular groundwater monitoring will be completed unless conditions indicate that a groundwater gradient and meaningful direction of flow cannot be determined (therefore provides no reliable means of distinguishing impacts from KBL operations from that of the SWDF). If groundwater wells are installed, appropriate measures will be undertaken to protect permafrost, as necessary. Please refer to Appendix E – Environmental Monitoring Plan for a copy of the letter provided by Land Solutions regarding *Environmental Monitoring and Permafrost Considerations at KBL Environmental's Proposed Inuvik Soil Treatment Facility (STF)* for additional information on the groundwater program.

Baseline sampling to assess groundwater conditions were completed in 2018, 2019, 2020, and 2021 prior to construction of the STF. Results will be tabulated and incorporated into the EMP and then submitted to the GLWB for approval. As per the Environmental Management Plan completed by KBL, the contaminants in the material entering the Site are primarily benzene, ethylbenzene, toluene, xylenes (BTEX), heating oil, and gasoline.

Baseline testing was completed in order to establish existing concentration ranges of potential contaminants of concern from the historical landfill operations.

Four monitoring wells were installed at the Site in 2017. One monitoring well was installed upstream of the soil treatment pad, and three were installed downstream (Figure 3). In accordance with Part C of Annex A: Surveillance Network Program (SNP) Annexed to Water License G17L1-002 Part B, Item 2 KBL Environmental the following monitoring is required:

SNP Station #	Description	Sampling Frequency	Parameters per EMP (page 11-13)
0037-4	MW4- northeast and upgradient of the STF	Twice annually (spring and fall)	Metals, PHC F1-F4, BTEX, COD, EPH, TSS, O&G, pH, FP
0037-5	MW1- southeast and downgradient of the STF	Twice annually (spring and fall)	Metals, PHC F1-F4, BTEX, COD, EPH, TSS, O&G, pH, FP



0037-6	MW2- south and downgradient of the STF	Twice annually (spring and fall)	Metals, PHC F1-F4, BTEX, COD, EPH, TSS, O&G, pH, FP
0037-7	MW3- southwest and downgradient of the STF	Twice annually (spring and fall)	Metals, PHC F1-F4, BTEX, COD, EPH, TSS, O&G, pH, FP

Metals- ICP-MS Metal Scan (Total)

Field Parameters (FP)

Petroleum Hydrocarbons (PHC) fractions 1 to 4 (F1-F4)

Benzene, toluene, ethylbenzene, and xylenes (BTEX)

Chemical Oxygen Demand (COD)

Extractable Petroleum Hydrocarbons (EPH)

Total Suspended Solids (TSS)

Oil and Grease (O&G)

However, per the Water License – Current to April 8, 2021 the environmental monitoring program was to include baseline data for: BTEX, volatile organic compounds (VOCs), PHC F1-F4, polycyclic aromatic hydrocarbons (PAHs), and total metals. Due to an oversight, analysis of VOCs and PAHs was missed and will be completed in 2022 and 2021 and the EMP updated upon review of the monitoring results.

The baseline groundwater conditions were evaluated by a third-party hydrogeologist, Beckingham Environmental Ltd and their report is included in the Environmental Monitoring Plan.

Baseline groundwater identified elevated levels over the Federal Interim Groundwater Quality Guidelines of metals (aluminum, arsenic, barium, boron, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, thallium, and zinc).

## 12.0 DOCUMENTATION AND REPORTING

An annual report is submitted to the Gwich'in Land and Water Board in accordance with the terms and conditions of the Water Licence and permit(s) assigned to the STF. A copy of all licences and permits are maintained on site.

## 13.0 ENGAGEMENT PLAN AND ENGAGEMENT RECORD

As per Type B - Water Licence application requirements a copy of the Engagement Plan and Engagement Record are provided in Appendix F for your reference.

## 14.0 REFERENCES

Ecological Framework of Canada, <http://ecozones.ca/english/region/50.html>, accessed March 16, 2017

Environmental Impact Statement for Construction of the Inuvik to Tuktoyaktuk Highway, NWT, EIRB File No. 02/10-05, May 2011, Kiggiak – EBA Consulting Ltd.

Operation and Maintenance Manual for Solid Waste Disposal Facilities, Town of Inuvik, NT, March 2006, Re-issued March 2012, Earth Tech Canada Inc.

Government of Northwest Territories (GNWT). 2003. Environmental Guidelines for Contaminated Site Remediation.



## 15.0 CONTRACTORS AND SUB-CONTRACTORS

The following table listed the KBLs proposed contractors. Should the need arise, KBL may have to substitute additional contractors not identified in this table.

Proposed Contractor	Address	Function
Northwind Industries	P.O. Box 1130, 146 Navy Rd Inuvik, NT X0E 0T0	General Contractor Earthworks
JMS Services	97 Taltheilei Dr, Yellowknife, NT X1A 2P4	Fence Installation

The total number of personnel involved in the operation and the total number of person days required to complete the operation is as follows:

### Routine Operations (per year):

Soil treatment operations 16 weeks per year: 1 person x 16 weeks x 5 days = 80 days per year

Soil receiving/treatment oversight (30 weeks per year): 1 person x 30 weeks x 5 days = 150 days per year

## 16.0 STUDIES UNDERTAKEN TO DATE

No studies have been undertaken to date.

## 17.0 PROPOSED TIME SCHEDULE

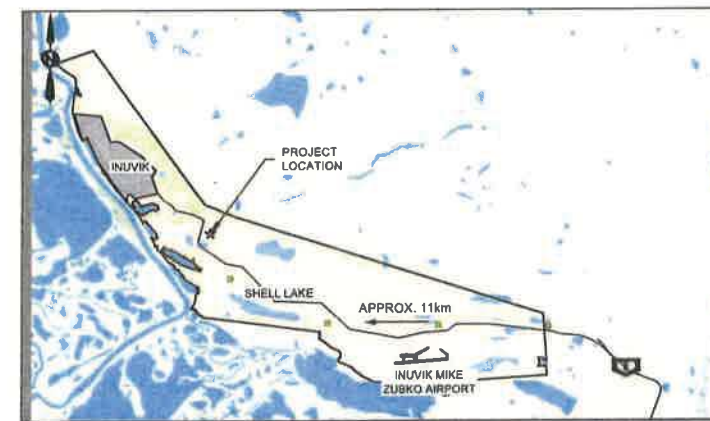
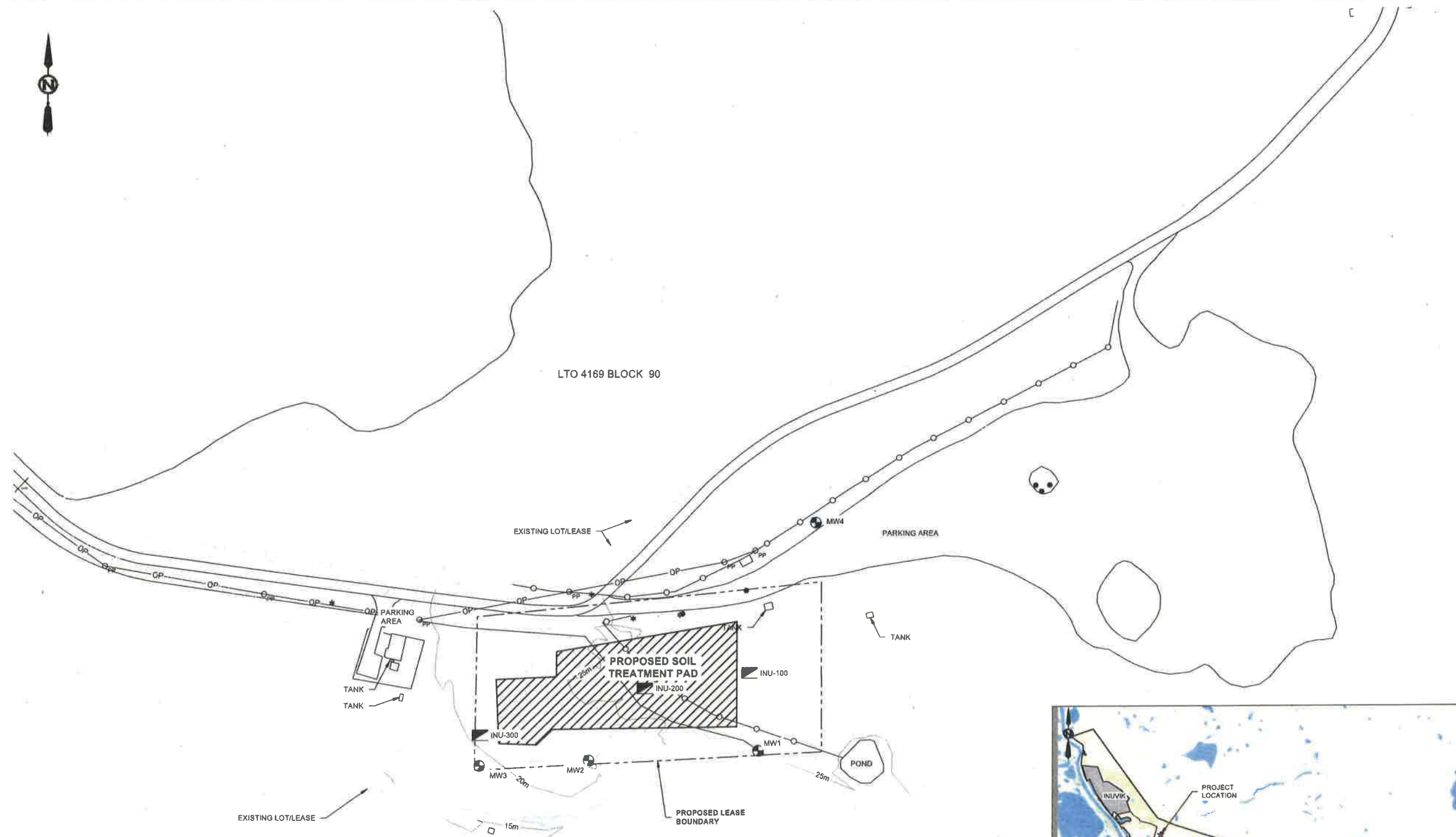
Operations started once construction was completed in the fall of 2022.



# APPENDIX A

## Facility Map and Drawings





PLAN  
KEY



PLAN  
OVERALL SITE

1:2000

#### LEGEND

- 28 m ——— TOPOGRAPHIC MAJOR CONTOUR  
CONTOUR INTERVAL = 5.0m
- TOPOGRAPHIC MINOR CONTOUR
- TREES
- EXISTING FENCE
- OP— EXISTING OVERHEAD POWER LINE
- — — PROPOSED LEASE BOUNDARY
- PP EXISTING POWER POLE
- \* EXISTING LIGHT
- EXISTING TANK
- MW4 EXISTING MONITORING WELL
- INU-100 EXISTING TEST PIT LOCATION
- ▨ PROPOSED WORK AREA

#### NOTES:

1. DATUM: UTM NAD83 ZONE 8.
2. CONTOURS PROVIDED BY KBL.
3. BOLD LINES & TEXT REFERS TO NEW CONSTRUCTION.

No.	DATE	REVISION	BY	APP
0	2017SEP06	ISSUED FOR CONSTRUCTION	NAR	BJ

PROJECT No.	20173924-00	INITIALS
DRAWN BY	J HUBERT	
DESIGNED BY	S BARTSCH / B JARDINE	
SCALE	AS SHOWN	

PERMIT TO PRACTICE  
ASSOCIATED ENGINEERING (B.C.) LTD.  
Signature: *[Signature]*  
Date: 11 Sept 2017  
PERMIT NUMBER: P 554  
The Association of Professional Engineers,  
Geologists and Geophysicists of NWT/NU

**NLR/AE**  
**CONSULTANTS**

**KBL**

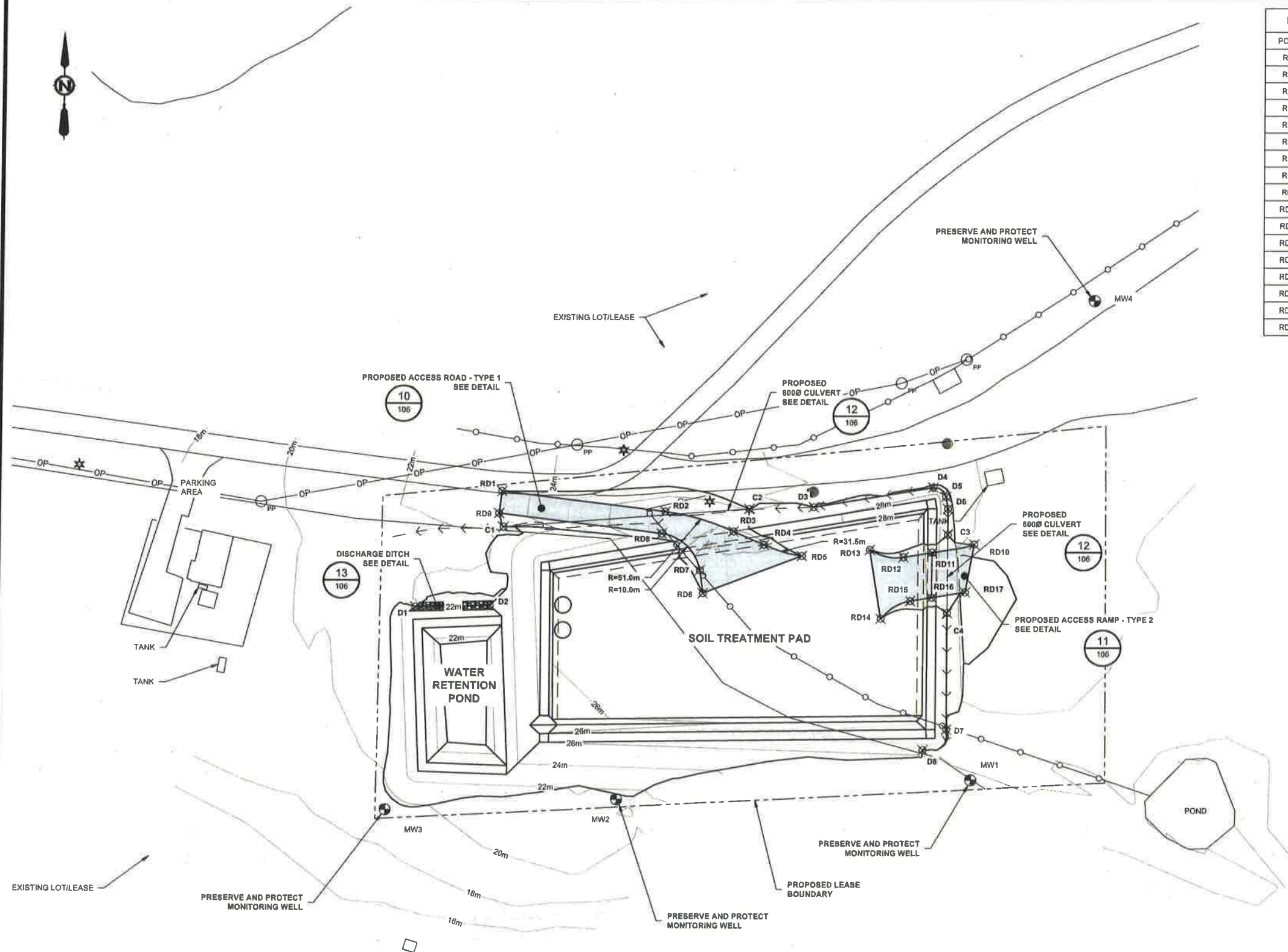
PROJECT  
INUVIK  
SOIL TREATMENT FACILITY

TITLE  
OVERALL SITE PLAN /  
KEY PLAN

DRAWING NUMBER	REV. NO.
3924-00-101	0







ROAD COORDINATE AND ELEVATION TABLE			
POINT	NORTHING	EASTING	ELEVATION
RD1	7582208.33 ±	554255.66 ±	23.31 ±
RD2	7582203.80	554292.17	27.34
RD3	7582198.40	554307.41	24.59
RD4	7582198.43	554314.27	28.23
RD5	7582193.93	554322.88	27.39
RD6	7582185.51	554300.67	26.67
RD7	7582190.88	554299.98	27.65
RD8	7582198.86	554291.36	27.32
RD9	7582203.37 ±	554255.05 ±	23.31 ±
RD10	7582196.59 ±	554361.15 ±	28.09 ±
RD11	7582194.74	554351.73	29.01
RD12	7582193.69	554345.32	28.37
RD13	7582195.33	554337.81	27.88
RD14	7582178.85	554340.30	27.46
RD15	7582183.82	554346.93	28.36
RD16	7582184.80	554351.69	28.84
RD17	7582185.82 ±	554359.16 ±	28.15 ±

DITCH COORDINATE AND ELEVATION TABLE			
POINT	NORTHING	EASTING	ELEVATION
D1	7582182.273	554236.671	21.848
D2	7582182.815	554253.161	22.000
D3	7582204.891	554325.216	26.883
D4	7582209.324	554351.908	27.387
D5	7582207.268	554354.785	27.387
D6	7582204.590	554355.196	27.387
D7	7582154.933	554355.175	26.518
D8	7582150.308	554349.927	26.463

CULVERT COORDINATE AND ELEVATION TABLE			
POINT	NORTHING	EASTING	ELEVATION
C1	7582200.333	554256.037	22.308
C2	7582204.453	554310.905	25.832
C3	7582198.744	554355.193	27.285
C4	7582181.121	554355.186	26.976

**LEGEND**

- 28 m TOPOGRAPHIC MAJOR CONTOUR  
CONTOUR INTERVAL = 2.0 m
- TOPOGRAPHIC MINOR CONTOUR
- TREES
- EXISTING FENCE
- EXISTING OVERHEAD POWER
- EXISTING POWER POLE
- EXISTING LIGHT
- EXISTING TANK
- PROPOSED ROAD AREA
- DRAINAGE DIRECTION
- PROPOSED CULVERT
- PROPOSED LEASE BOUNDARY
- EXISTING MONITORING WELL
- DESIGN COORDINATE POINT
- RIP RAP

- NOTES:**
- DATUM: UTM NAD83 ZONE 8.
  - CONTOURS PROVIDED BY KBL.
  - BOLD LINES & TEXT REFERS TO NEW CONSTRUCTION.
  - MONITORING WELLS EXACT LOCATION TO BE DETERMINED ON SITE.

No.	DATE	REVISION	BY	APP.
0	2017SEP08	ISSUED FOR CONSTRUCTION	NAR	BJ
PROJECT No.		20173924-00	INITIALS	
DRAWN BY		J HUBERT		
DESIGNED BY		S BARTSCH / B JARDINE		
SCALE		1:1000		

PERMIT TO PRACTICE  
ASSOCIATED ENGINEERING (B.C.) LTD.  
Signature: *[Signature]*  
Date: 11 Sept 2017  
PERMIT NUMBER: P 554  
The Association of Professional Engineers,  
Geologists and Geophysicists of NWT/NU

**NLR/AE**  
**CONSULTANTS**

**KBL**

PROJECT:  
INUVIK  
SOIL TREATMENT FACILITY

TITLE	
ROAD LAYOUT PLAN	
DRAWING NUMBER	REV. NO.
3924-00-102	0













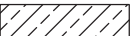







### DESIGN COORDINATE AND ELEVATION TABLE

POINT	NORTHING	EASTING	ELEVATION
B1	7582202.140	554348.601	27.508
B2	7582156.810	554348.544	26.714
B3	7582155.808	554268.400	25.293
B4	7582188.791	554268.400	25.871
T1	7582204.592	554350.696	28.387
T2	7582154.919	554350.675	27.518
T3	7582153.867	554266.484	26.026
T4	7582190.575	554266.484	26.668

### POND COORDINATE AND ELEVATION TABLE

POINT	NORTHING	EASTING	ELEVATION
PD1	7582177.458	554238.258	23.000
PD2	7582178.228	554255.853	23.000
PD3	7582146.599	554257.238	23.000
PD4	7582147.160	554239.584	23.000
PD5	7582173.758	554242.297	21.451
PD6	7582174.704	554252.624	21.648
PD7	7582151.158	554252.624	21.236
PD8	7582151.772	554244.141	21.098

- |   |  |
|---|--|
| <u>LEGEND</u>   |  |
|  28m | TOPOGRAPHIC MAJOR CONTOUR<br>CONTOUR INTERVAL = 2.0m |
|      | TOPOGRAPHIC MINOR CONTOUR                            |
|      | TREES  |
|      | EXISTING FENCE                                       |
|      | EXISTING OVERHEAD POWER                              |
|      | EXISTING POWER POLE                                  |
|      | EXISTING LIGHT                                       |
|      | EXISTING TANK  |
|      | WASTE COVERAGE AREA                                  |
|      | DRAINAGE DIRECTION                                   |
|      | PROPOSED CULVERT                                     |
|      | PROPOSED LEASE BOUNDARY                              |
|      | EXISTING MONITORING WELL                             |
|      | DESIGN COORDINATE POINT                              |

**NOTES:**

1. DATUM: UTM NAD83 ZONE 8.
2. CONTOURS PROVIDED BY KBL.
3. BOLD LINES & TEXT REFERS TO NEW CONSTRUCTION.
4. MONITORING WELLS EXACT LOCATION TO BE DETERMINED ON SITE.
5. PRESERVE AND PROTECT EXISTING MONITORING WELLS.

1. DATUM: UTM NAD83 ZONE 8.
2. CONTOURS PROVIDED BY KBL.
3. BOLD LINES & TEXT REFERS TO NEW CONSTRUCTION.
4. MONITORING WELLS EXACT LOCATION TO BE DETERMINED ON SITE.
5. PRESERVE AND PROTECT EXISTING MONITORING WELLS.

0	2017SEP08	ISSUED FOR CONSTRUCTION	NAR	BJ
No.	DATE	REVISION	BY	APP.

PROJECT No.	20173924-00	INITIALS
DRAWN BY	J HUBERT	
DESIGNED BY	S BARTSCH / B JARDINE	
SCALE	1:1000	

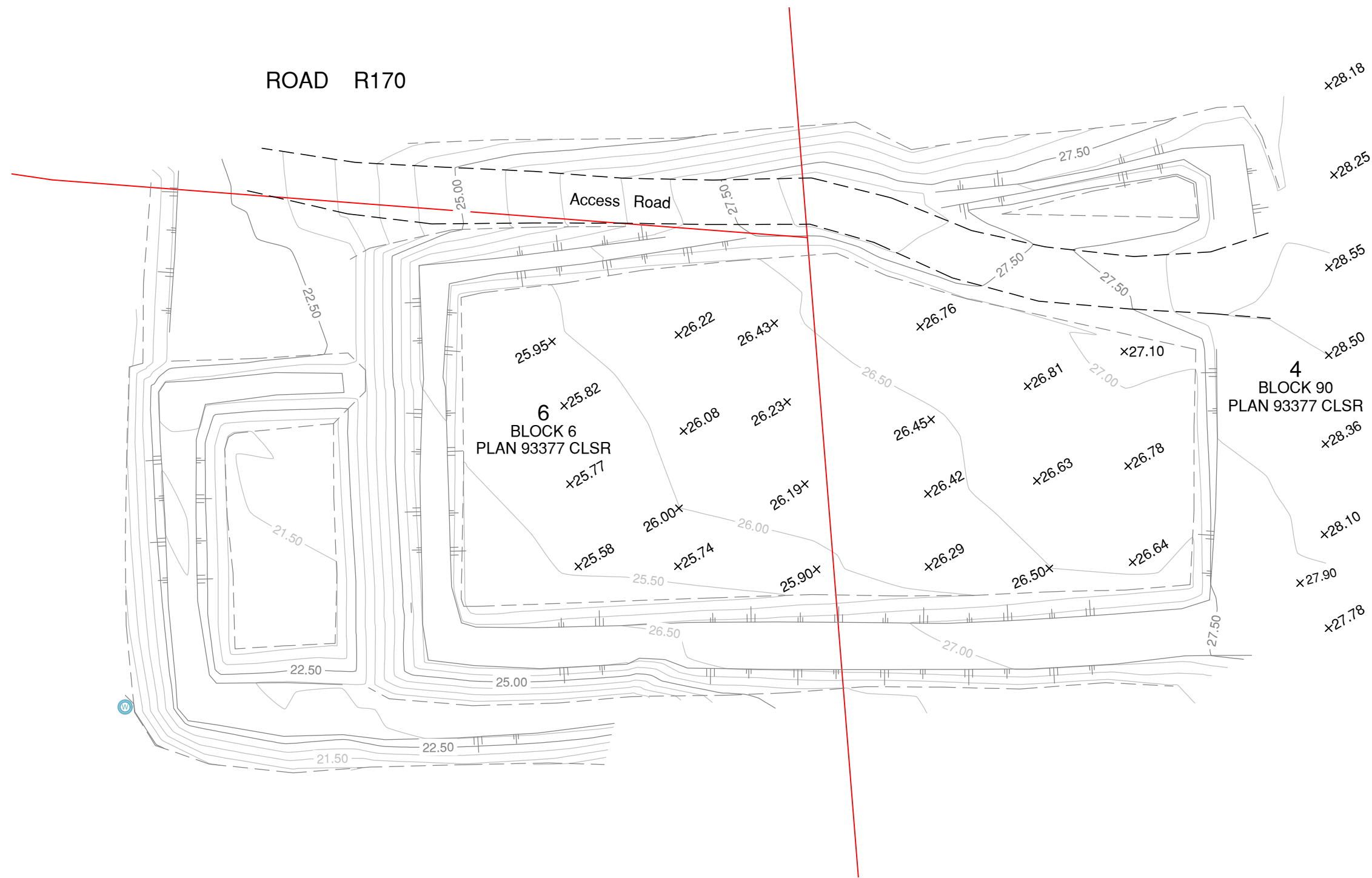
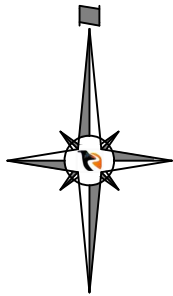

**NLR/AE**  
CONSULTANTS









PROJECT
INUVIK
SOIL TREATMENT FACILITY

TITLE	
DEVELOPMENT PLAN	
DRAWING NUMBER	REV. NO.
3924-00-103	0





#### LEGEND

-  denotes water well
-  denotes top of bank
-  denotes bottom of bank
-  denotes edge of gravel
-  x 5.21 denotes spot elevation
-  denotes property line

Date of Field Survey: October 6, 2021.

Contour interval = 0.50 m.

Elevations shown are ellipsoidal, referenced to the WGS 84 Ellipsoid.

Lot boundaries shown hereon are derived CLSR online mapping and should not be used for detail design.

This plan represents the best information available at the time of survey. GeoVerra Surveys (BC) Limited Partnership and its employees take no responsibility for the location of any underground conduits, pipes, or other facilities whether shown on or omitted from this plan. All underground installations should be located by the respective authorities prior to construction.

#### Revision Table

Title:

INUVIK SOIL TREATMENT FACILITY

Drafted by: MLR

Surveyed by: CW

Checked by: MLE



Mackenzie Delta Geomatics Ltd.  
PO Box 2772  
Inuvik, NT X0E 0T0  
Phone: (867) 678-2980

Project: 21-01912-001

Date: 2021-11-03

Drawing No: TOPO



# APPENDIX B

## Operation and Maintenance Plan



# APPENDIX C

## Waste Management Plan



# APPENDIX D

## Closure Reclamation Plan



# APPENDIX E

## Environmental Monitoring Plan



# APPENDIX F

## Engagement Plan and Engagement Record