

**REMEDIAL ACTION PLAN  
SPEERS LAKE SITES  
NUNAVUT**

Prepared for:



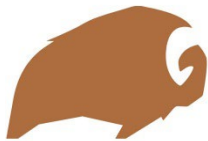
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## EXECUTIVE SUMMARY

**Important:** *This executive summary provides an overview of the main findings of the study to which it pertains. This executive summary does not provide a comprehensive report, and its review should not be considered a substitute for reading the report in its entirety.*

The Joint Venture, BLM-KEL-60 Corporation (JV-60) was retained by Public Services and Procurement Canada (PSPC) Western Region to conduct a Remedial Options Analysis (ROA) and Remedial Action Plan (RAP) for seven sites (the Sites) located in the vicinity of Speers Lake, Nunavut. The seven sites are located in the Kitikmeot district of Nunavut. The included sites and the approximate distance between each Site and Kugluktuk are listed as follows:

- Speers Lake (WK097) – 95 km from Kugluktuk
- Asiak River (WK154) – 40 km from Kugluktuk
- Kendall River (WK165) – 90 km from Kugluktuk
- Tahiapik River (WK170) – 100 km from Kugluktuk
- Impact Lake (WK176) – 90 km from Kugluktuk
- Coppermine Area 199 (WK199) – 50 km from Kugluktuk
- Coppermine Area 210 (WK210) – 75 km from Kugluktuk

The sites are all abandoned former mining exploration sites apart from a former fishing outpost camp at the Kendall River site. The Speers Lake area has been, and continues to be, identified by Inuit as a place of cultural significance and the region is known to have numerous archaeological features which were documented within an Archaeological Investigation of the Sites. The Sites underwent a Phase III Environmental Site Assessment (ESA) and Human Health and Ecological Risk Assessment (HHERA) which did not identify any areas of unacceptable risk associated with soil, water or sediment at the Sites. The areas of environmental concern consisted of hazardous waste located on the Sites.

JV-60 in consultation with Public Services and Procurement Canada (PSPC) and Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC), developed evaluation criteria to meet the remedial objectives that were used to identify the most appropriate remediation or risk management measure for the Sites. The evaluation included assigning numeric scores for effectiveness, ease of implementation, anticipated socio-economic benefit, anticipated cost and anticipated carbon footprint to identify the most appropriate remedial/risk management

approach. The highest scoring option for each of the waste streams became the recommended remediation or risk management option. The remediation or risk management options for the Sites are separated by waste stream type: hazardous waste and non-hazardous waste.

The recommended remediation and risk management options for the two types of waste streams are to remove all hazardous and non-hazardous waste off site and dispose of the waste at off-site facilities. This option scored highest in the Options Evaluation Matrices. This option scored highest in effectiveness, anticipated costs, and anticipated carbon footprint for the hazardous waste stream and highest in effectiveness in the non-hazardous waste stream. Off-site disposal provides the only “walk-away” remedial solution as all environmental impacts and subsequent liabilities are removed from the Sites.

The implementation strategy to remove all hazardous and non-hazardous waste from the Sites will be in accordance with regulations and guidelines of Authorities Having Jurisdiction. The accessibility of the Sites was assessed through the Geotechnical report and rotary aircraft, fixed-wing aircraft, and/or overland CAT Train were identified as viable methods of transportation. A remedial contractor will be responsible for evaluating the site access further through the development of a mobilization and demobilization plan to remove the waste from the Sites as part of the remedial contract deliverables. The hazardous and non-hazardous waste will be appropriately containerized prior to removal from the Sites. All waste removed from the Sites will be disposed of at an appropriate waste facility in the South.

Key experienced JV-60 team members participated in community-level RAP Workout Presentations in the hamlet of Kugluktuk, Nunavut in the Fall of 2024. The recommended options were presented and validated by the participants in the meeting. Following the community consultation, a Class B Cost Estimate will be prepared for the recommended remedial/risk management option for the Sites.

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## 1 INTRODUCTION

The Joint Venture BLM-KEL-60 Corporation (JV-60) was retained by Public Services and Procurement Canada (PSPC) Western Region to conduct a Remedial Options Analysis (ROA) and Remedial Action Plan (RAP) for seven sites located in the vicinity of Speers Lake, Nunavut. The seven sites are located in the Kitikmeot district of Nunavut. The included sites and the approximate distance between each site and Kugluktuk are listed as follows:

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- Coppermine Area 199 (WK199) – 50 km from Kugluktuk
- Coppermine Area 210 (WK210) – 75 km from Kugluktuk

This work was completed in response to the terms of reference (TOR) received on May 15, 2023 (with amendments May 24, 2023, and June 23, 2023): *Terms of Reference (TOR), Consulting Services for Speers Lake Sites, Nunavut*. The work was on behalf of PSPC's client Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC).

The sites are all abandoned former mining exploration sites apart from a former fishing outpost camp at the Kendall River site. They vary in size and complexity, but all included Areas of Environmental Concern (AECs) or Areas of Potential Environmental Concern (APECs) and physical hazards that were explored in a 2023 Phase III Environmental Site Assessment (ESA) field program (BLM-KEL-60 Corporation, 2024b). A human health and ecological risk assessment (HHERA) was also completed for the seven sites (Canada North Environmental Services, 2024), and it concluded that there were no contaminants of concern in any media tested at the sites that would cause unacceptable risk to human health or environmental health. Debris remains at the seven sites, in addition to remaining barrels (empty and full) at some of the sites. A summary of the current site conditions for the seven Sites is provided in Section 4.1.

The Speers Lake area has been, and continues to be, identified by Inuit as a place of cultural significance and the region is known to have numerous archaeological features. A summary of the archaeological investigation conducted for the sites (BLM-KEL-60 Corporation, 2024a) is provided in Section 4.4

Geotechnical evaluations were also conducted at the seven sites. A summary of the geotechnical work including analysis of the borrow and access areas (TREK Geotechnical Inc., 2023) for each Site is provided in Section 4.3

## **2 CLIMATE CHANGE CONSIDERATIONS**

### **2.1 SUMMARY OF FUTURE CLIMATIC CONDITIONS**

The sites are located in Northern Canada and are expected to experience an increased rate of warming associated with Arctic amplification compared to sites located in the southern regions of Canada. The current/historical and long-term climate predictions used in this section come from Chapter 8: Changes in Canada's Regions in a National and Global Context of Canada's Changing Climate Report (CCCR) (Bush & Lemmen, 2019). The current/historical climate predictions are based on 30-year averages, while the long-term climate predictions are based on 24 different models with the median value being chosen as described in the CCCR.

The CCCR describes three different representative concentration pathway (RCP) scenarios, RCP 2.6, RCP 4.5, and RCP 8.5. Each RCP scenario describes a different climate future; RCP 2.6 represents a very stringent pathway where emissions start to decline in 2020 and are reduced to zero by 2100; RCP 4.5 represents an intermediate pathway where emissions peak in 2040 and then decline; and RCP 8.5 represents the worst-case pathway where emissions continue to rise throughout the 21<sup>st</sup> century. For the purpose of this report, the projected values are based on the RCP 8.5 projection representing the high emission scenario. This scenario projects a future where there are few restrictions on emissions and emissions continue to increase rapidly throughout this century and stabilizing by 2250. The RCP 8.5 projection is recommended for use in the Federal Contaminated Sites Action Plan (FCSAP) Decision Making Framework as it aligns with the Precautionary Principle, outlined by the Government of Canada, that site custodian consider the worst-case scenario as a first priority. Table 1 below summarizes relevant climate data for the Speers Lake Site, based on the RCP 8.5 projection (Bush & Lemmen, 2019).

Due to the proximity of the Sites to one another, this climate data is considered accurate for all of the Speers Lake area Sites.

**Table 1: Historical Climate Variables Compared to Projected RCP 8.5 Values**

Climate Scenario	Current/Historical <sup>1</sup>	Projected <sup>1</sup>
Total Precipitation (mm)	177.0	235.5
Number of wet days (>1 mm)	47.0	61.5
Maximum 1-day total precipitation (mm)	12.9	15.9
Mean temperature (°C)	-11.3	-3.4
Maximum mean temperature (°C)	-7.8	-0.2
Minimum mean temperature (°C)	-14.8	-6.4
Number of days with minimum temperature <-25 (°C)	122.6	28.4
Number of Ice days	229.1	189.7

Note:

<sup>1</sup>Data obtained from (Bush & Lemmen, 2019).

In general, the area around Speers Lake is expected to experience an increase in precipitation, increase in wet days, and greater 1-day total precipitation. The climate conditions at the Sites are also expected to experience higher mean temperatures, higher maximum, and minimum mean temperatures as well as a greater number of warmer days and lower number of ice days.

## 2.2 CONCEPTUAL SITE MODEL REVIEW FOR FUTURE CLIMATIC CONDITIONS

It is expected that the future climate of the Speers Lake Sites will continue to have the same exposure pathways associated with the contaminants at the Sites. Due to climate variability, there is potential for either increased or decreased exposure via those pathways for human and ecological receptors due to the warming climate. No new exposure pathways were identified in reviewing the future climate scenario. The presence of current species at risk (SAR) and future SAR exposure pathways may change due to climate impacts to migration and mating zones. This level of analysis is not included in this RAP document. No additional areas of environmental concern have been identified at the Sites when considering the future climatic conditions.

The temperature changes will result in increased water temperatures and soil temperatures and less snow cover on the ground. These warming temperatures may result in enhanced attenuation of the PHC in soils which could lead to decreased concentrations. The decrease in snow cover would result in more days when the surface soils are snow free, indicating a potential for increased exposure to the contamination by human and ecological receptors. The maximum concentrations of contaminants in soil at the Sites exceed applicable guidelines but do not represent unacceptable risks to human or ecological receptors at the Sites. The increase in snow

free days is not expected to result in any risks to vegetation or wildlife populations present at the Sites.

The increased precipitation will result in increased surface erosion, surface run-off and infiltration. All of these processes are likely to result in decreased concentrations of metals and PHCs in the surface soils at the Sites. The increased precipitation and run-off may lead to increased water levels in the waterbodies at the Sites and thus decreases in concentrations of contaminants of concern. Given that the concentrations of contaminants in soil at the Sites are currently not considered to be a risk to human or ecological health, the increased precipitation is not anticipated to result in any additional risks to human or ecological health.

The higher temperatures and greater number of warmer days may have the potential to degrade permafrost. If this occurs the potential for slumping of the soils at some of the Sites as the permafrost melts could lead to the covering of surficial soils and the elimination of some exposure pathways to soil at the Sites.

There is also likely to be increases in grass fires in the region. As there is not a substantial amount of vegetation present, it is unlikely that there will be increased fires at the Sites that would affect the contaminant fate and transport and result in human and ecological risks.

In summary, climate change is not anticipated to result in any additional risk to human health and is unlikely to result in increased risks to ecological receptors at the Speers Lake Sites from exposure to COCs found at the Sites. It is anticipated that contaminant levels will decrease over time as a result of climate change. The HHERA results are considered to address both present and future climate scenarios.

### **2.3 CLIMATE CHANGE IMPACTS ON REMEDIAL AND RISK MANAGEMENT OPTIONS**

Based on a review of future climate predictions for the region, no future risks were identified that would result from climate-driven changes to contaminant distribution, exposure pathways and receptors. The remedial/risk management (R/RM) strategy for the Sites could include infrastructure or administrative controls that may be impacted by increased temperatures or changes to the soil conditions. The R/RM strategies most susceptible to climate change impacts are those that include on-site management and long-term monitoring. In-situ treatment of impacted soils could be impacted by the extended operational season due to increased

temperatures. The construction of storage or landfill facilities would need to consider stability of the soils on which they are constructed which could be impacted by permafrost degradation resulting in slumping and increased potential for erosion. The location of any facilities would need to consider an increase in the high-water mark if the facilities are situated near a river or other large body of water. The main influences on the viability of remedial and risk management options for the Sites are around increased precipitation and higher average temperatures that will result in an increased potential for erosion and slumping due to permafrost thaw. These impacts will be considered for any constructed facilities or administrative controls proposed for the Sites as part of the Remedial Option Evaluation.

### 3 ENVIRONMENTAL CONDITIONS OF THE PROPERTY

Some preliminary studies have been completed for the Sites. A summary of these studies are provided in Table 2 below, a summary of the results from these studies are presented in the Section 4.6 and the Site locations are shown on Figure 1.

**Table 2: Summary of Previous Site Studies**

Previous Study/Assessment	Date
Phase I and Phase II Environmental Site Assessment, Speers Lake, Kitikmeot Region, Nunavut, Golder Associates Ltd.	May 2005
Phase I and Phase II Environmental Site Assessment, Coppermine Area WK210, Kitikmeot Region, Nunavut, Golder Associates Ltd.	May 2005
Phase I and Phase II Environmental Site Assessment, Coppermine Area WK210, Kitikmeot Region, Nunavut, Golder Associates Ltd.	May 2005
Remedial Action Plan, Speers Lake, Nunavut, Golder Associates Ltd.	March 2006
Integrated Phase I and Limited Phase II Environmental Site Assessment, WK154-Asiak River, Kitikmeot Region, Nunavut, WESA.	March 2009
Integrated Phase I and Limited Phase II Environmental Site Assessment, WK165-Kendall River, Kitikmeot Region, Nunavut, WESA.	March 2009
Integrated Phase I and Limited Phase II Environmental Site Assessment, WK170-Tahiapik River, Kitikmeot Region, Nunavut, WESA.	March 2009
Integrated Phase I and Limited Phase II Environmental Site Assessment, WK176-Impact Lake, Kitikmeot Region, Nunavut, WESA.	March 2009

Previous Study/Assessment	Date
Integrated Phase I and Limited Phase II Environmental Site Assessment, WK199-Coppermine Area, Kitikmeot Region, Nunavut, WESA.	March 2009
Speers Lake Site (WK097), Nunavut – Geotechnical Assessment Report – Trek Geotechnical	February 2024
Phase III Environmental Site Assessment, Speers Lake Sites, Kitikmeot Region, Nunavut, BLM-KEL-60	August 2024
Human Health and Ecological Risk Assessment Speers Lake Sites, Nunavut - CanNorth	September 2024

### 3.1 SITE OVERVIEW

#### 3.1.1 Speers Lake WK097

The Speers Lake Site WK097 is a former exploration camp located on the western shore of Speers Lake, approximately 100 kilometres (km) south of Kugluktuk, in the Kitikmeot region of Nunavut at latitude and longitude of 66° 59' 47" N and 115° 15' 08" W. The two main areas of the Site are approximately 550 metres (m) apart and are designated "North Site" and "South Site". The Site location is presented on Figure 2 and Site Plans are presented on Figure 3 (North Area) and Figure 4 (South Area). The Site contains approximately 229 m<sup>3</sup> of debris and untreated/unpainted wood, including 2 wooden structures with metal roof and siding and pink insulation (one collapsed), and various metal and plastic piping. The Site contains 3 lead acid batteries and 347 fuel barrels, 11 of which contain approximately 2,050 L of of an assumed fuel/water mixture.

#### 3.1.2 Asiak River WK154

The Asiak River Site WK154 (the "Site") is located approximately 35 kilometres (km) to the southeast of Kugluktuk, Nunavut, 4 km east of the Asiak River, and 10 km south of the Coronation Gulf, and has coordinates of 67° 37' 02" N, 114° 27' 54" W. The Site location is presented on Figure 5 and a Site Plan is presented on Figure 6. The Site contains approximately 14 m<sup>3</sup> of debris and untreated wood, including an old drill rig, drill rods and wood debris, a kitchen stove and other camp items. The Site contains 9 empty fuel barrels.

### **3.1.3 Kendall River WK165**

The Kendall River site WK165 (the “Site”) is located approximately 90 km southwest of Kugluktuk, Nunavut at latitude and longitude of 67° 07’ 02” N, 116° 07’ 45” W. The Site is located southwest adjacent to the confluence of the Kendall and Coppermine Rivers. The Site location is presented on Figure 7 and a Site Plan is presented on Figure 8. The Site contains approximately 13 m<sup>3</sup> of debris including both painted and unpainted wood, and scrap metal. Half of an empty fuel barrel and 2-20 L empty jerry cans are present at the Site.

### **3.1.4 Tahiapik River WK170**

The Tahiapik River site WK170 (the “Site”) is located approximately 100 km southwest of Kugluktuk, Nunavut, on the southeastern shore of Fran Lake. The Site is located at 67° 16’ 54” N, 116° 55’ 30” W. The Site consists of approximately 29 m<sup>3</sup> of debris and untreated wood, over several debris areas that contain wood, several dilapidated wooden drill core storage racks, and the remains of a floor platform, a burn pit. The Site contains 2 empty fuel barrels, one of which was observed from the air and assumed to be empty based on its orientation and location. Several mining exploration drill holes are also present at the Site. The Site location is presented on Figure 9 and a Site Plan is presented on Figure 10.

### **3.1.5 Impact Lake WK176**

The Impact Lake Site WK176 (the “Site”) is located approximately 90 km west of Kugluktuk, Nunavut, on the south shore of Impact Lake, with coordinates of 67° 34’ 22” N, 117° 04’ 38” W. The Site Location is presented on Figure 11 and a Site Plan is presented on Figure 12. The Site contains approximately 65 m<sup>3</sup> of debris and unpainted wood including 4 – 5 dilapidated wood structures (former tent frames, buildings, and an outhouse), wood debris, and metal debris. Additionally, the Site contains 47 fuel barrels, 14 of which are full or partially full and contain approximately 1,968 L of an assumed fuel/water mixture.

### **3.1.6 Coppermine Area WK199**

The Coppermine Area Site WK199 (the “Site”) is located approximately 45 kilometres (km) south of Kugluktuk, Nunavut, on the north shore of an unnamed lake, approximately 25 km east of the Coppermine River in the Kitikmeot Region. Coordinates for the Site are 67° 24’ 11” N, 115° 09’ 54” W. The Site location is presented on Figure 13 and a Site Plan is presented on Figure 14. The Site contains approximately 11 m<sup>3</sup> of debris including metal debris, plastic tubing, scattered cores, and snowmobile parts. Additionally, the site contains a water tank, two propane tanks (100 lbs in size), and one empty mini fuel barrel.

### **3.1.7 Coppermine Area WK210**

The Coppermine Area Site WK210 (the “Site”) is located on the north shore of the east end of a small unnamed lake in Nunavut approximately 75 kilometres (km) southwest of Kugluktuk at a latitude and longitude of 67° 29’ 08.5” N, 116° 34’ 20” W. The Site location is presented on Figure 15 and a Site Plan is presented on Figure 16. The Site contains approximately 43 m<sup>3</sup> of debris including scrap metal, and scrap untreated wood. Additionally, the Site contains 12 empty fuel barrels, 3 additional barrels of unknown contents, (the barrels were seen from the air), 2 mini fuel barrels, 1 jerry can, 1 compressed gas cylinder, 6 large tanks (4,500 L each) with one containing about 450 L of a fuel/water mixture, 2 empty smaller tanks (2,300L).

## **3.2 ENVIRONMENTAL SITE ASSESSMENTS**

Soil impacts were partially or fully delineated through the Phase III ESA sampling program however delineation of sediment was not completed. As part of the Phase III ESA, a limited hazardous and non-hazardous building material assessment (LHBMA) was also completed. Two building material samples (paint) were collected, one at Asiak River WK154 in AEC 1 on the old drill rig, and one at Kendall River WK165 for red paint located in APEC 3 and APEC 4. Results confirmed that only the paint located at Asiak River WK154 contained leachable lead and was considered hazardous. Liquid samples were collected at Speers Lake WK097, Kendall River WK165, and Coppermine Area WK210 from a barrel, two jerry cans, and a tank. Results indicated that the Barrel Sample located at Speers Lake contained hydrocarbons, the other samples at Kendall River WK165, Coppermine Area WK210 were significantly diluted with water.

During the field program a debris inventory was created for each Site by AEC/APEC. Using this inventory and the topographic drone survey, a volume estimate for on-site debris was created. The estimated total volume of debris on the Sites is approximately 405 m<sup>3</sup>. A 25% void space was applied to the debris piles, where applicable, as the survey does not factor it in, barrels were assumed to be crushed to industry standard volume, while tanks were assumed to be crushed to 10% of their volume. Based on this approach, the estimated total volume of debris (hazardous and non-hazardous with crushed metal) on the Sites is approximately 265 m<sup>3</sup> (excluding lead-based paint from the drill rig at Asiak River). From the survey, the total number of barrels on the Sites is 423, fuel tanks is 8, and propane tanks is 3. The barrel and tank volumes are accounted for in the non-hazardous volumes; however, they would first need to be cleaned. It is assumed that 2 L of sludge would be produced from each barrel and 100 L of sludge from each fuel tank and is accounted for in the hazardous volumes.

Table 3 summarizes the hazardous and non-hazardous debris found on the Sites.

Appendix A provides further details of all debris found on the Sites. Table A1 (Appendix A) summarizes the hazardous debris found on the Sites. Table A2 (Appendix A) summarizes the non-hazardous debris, and the assumed management strategy of non-hazardous debris found on the Sites.

**Table 3: Summary of Hazardous and Non-Hazardous Waste Quantities Grouped by Site**

Site	# Barrels - Empty (assumed sludge volume (L))	# Barrels – With Content (fuel or fuel/water mix, list L present as well)	# Tanks – Empty (with sludge only)	# Tanks –With Content (fuel or fuel/water mix, list L present as well)	Volume (m3) of All Non-Hazardous Debris to be removed from Site (including cleaned barrels and tanks(m <sup>3</sup> ))	Hazardous Materials (m3) (excluding fuel products or sludge)	Volume of all Non-Hazardous Debris to be managed on Site (including burnable Wood and rock core (m <sup>3</sup> ))
Speers Lake – WK097	347 barrels (694 L)	11 barrels 2,050 L	None	None	176.7 m <sup>3</sup>	3 lead batteries	52.5 m <sup>3</sup>
Asiak River – WK 154	9 barrels (18 L)	None	None	None	12.8 m <sup>3</sup>	Lead paint = 2.25 m <sup>3</sup>	1.0 m <sup>3</sup>
Kendall River – WK 165	0.5 barrel 2 jerry cans (20L size)	None	None	None	12.3 m <sup>3</sup>	None <sup>1</sup>	0.75 m <sup>3</sup>
Tahiapik River – WK 170	2 barrels (4 L)	Unknown if 1 barrel contains fuel or fuel/water mix as it was seen from the air.	None	None	5.1 m <sup>3</sup>	None	23.5 m <sup>3</sup>
Impact Lake – WK 170	47 barrels 2 mini barrels (Total 94 L)	14 barrels 1,968 L	None	None	16.8 m <sup>3</sup>	None	47.7 m <sup>3</sup>
Coppermine River – WK199	1 mini barrel (2 L)	None	1 hot water tank 2 propane tanks (100 lbs size)	None	10.0 m <sup>3</sup>	None	1.5 m <sup>3</sup>

Site	# Barrels - Empty (assumed sludge volume (L))	# Barrels – With Content (fuel or fuel/water mix, list L present as well)	# Tanks – Empty (with sludge only)	# Tanks –With Content (fuel or fuel/water mix, list L present as well)	Volume (m3) of All Non-Hazardous Debris to be removed from Site (including cleaned barrels and tanks(m <sup>3</sup> ))	Hazardous Materials (m3) (excluding fuel products or sludge)	Volume of all Non-Hazardous Debris to be managed on Site (including burnable Wood and rock core (m <sup>3</sup> ))
Coppermine River – WK210	15 barrels 2 mini barrels 1 jerry can (20L size) (Total 34 L)	Unknown if 3 barrels contain fuel or fuel water mix as they were seen from the air.	6 large metal tanks (600 L) 2 small metal tanks (200 L) 1 propane tank (100 lbs size)	None	39.9 m <sup>3</sup>	None	3.1 m <sup>3</sup>

Notes:

<sup>1</sup> While paint was found to contain lead, the TCLP results for leachable lead did not exceed applicable hazardous materials guidelines, indicating the paint is non-hazardous (BLM-KEL-60 Corp, 2024b).

### 3.3 GEOTECHNICAL ASSESSMENTS

Geotechnical assessments of the seven Sites were conducted by TREK Geotechnical Inc. (TREK). TREK completed a preliminary terrain assessment for the Speers Lake Site WK097 in March 2022 which included information reviews and aerial photography interpretation to identify potential borrow areas and general terrain features. The intent of the geotechnical field program was to determine the soil types available at each Site for potential remedial activities, visually assess potential staging or facility locations and other pertinent Site features such as drainage, access and permafrost conditions.

Remedial measures are being considered within this report for any remaining environmental contamination, hazardous material, non-hazardous material and debris at the Sites. Remedial measures also considers the removal of materials from Sites for off-site disposal, or containment of the materials (on or off-site), and demolition of existing structures. On-site disposal of Site debris would require the construction of permanent on-site facilities such as landfills, containment cells, or soil covers for re-graded areas. In this regard, the only Site that will be considered for a permanent facility is Speers Lake as it is the Site with the highest quantity of debris. Based on the terrain mapping and test pits completed during the field investigation, four borrow sources have been identified at the Speers Lake Site. Adequate quantities of common fill, riprap, granular fill, and bedding sand are expected to be available across the Site although some may require processing (e.g., screening). Construction of a non-hazardous waste landfill and soil treatment facility (landfarm) can be considered at this Site.

Borrow areas could not be delineated at the remaining six Sites given the limited time on Site to complete a geotechnical assessment. Terrain mapping and site observations suggest that an adequate quantity of backfill material is located at various locations across the Sites. The following Table 4 summarizes the approximate locations of available backfill material at each Site.

**Table 4: Summary of Available Backfill Material Location**

Site	Location of Backfill Material
Asiak River WK154	Adequate quantities of backfill material available across the Site.
Kendall River WK165	Adequate quantities of backfill material is present around TP23-02 or along the Coppermine riverbank with exposed sand material. However, due to potential environmental restrictions and the possibility of reducing riverbank stability, excavation along the riverbank is not recommended.
Tahiapik River WK170	Adequate quantities of backfill material are present around TP23-01 and 02. Borrow areas are approximately 75 metres from the debris site.

Site	Location of Backfill Material
Impact Lake WK176	Adequate quantities of backfill material are present around TP23-01. Borrow areas are approximately 75 metres from the debris site.
Coppermine Area WK199	Adequate quantities of backfill material are present around TP23-03. Borrow areas are approximately 100 metres from the debris site but access to these areas can be difficult due to the presence of rip rap between the Site and borrow areas.
Coppermine Area WK210	Adequate quantities of backfill material available across the Site.

### 3.3.1 Site Access Evaluations

In 2023, all of the Sites were accessed by helicopter. A site access evaluation for the Speers Lake Site was conducted as part of the Phase III ESA activities and was informed by field observations, discussions with local field team members and desktop assessment. Practical access to the Site is by helicopter. Float plane access could be considered on Speers Lake, as there was a barrel cache present along the shore suggesting that Speers Lake was previously used for fixed wing access. Visible vehicle tracks indicate that a cat train route may have been previously used for site development and this historic routing could be considered for equipment mobilization for remedial works.

Site access for the other six Sites is feasible by helicopter. Float plane access was deemed feasible at Impact Lake Site WK176, Coppermine WK199, and Tahiapik River WK170 Sites. It is noted that while float plane access is feasible at the Tahiapik River WK170 Site, there is a 13 m increase in grade from the float plane access point to the Site which may make the use of a float plane to mobilize equipment and demobilize waste from this Site undesirable. Suitable areas for land-based airstrips capable of accommodating fixed wing aircraft were not observed at any of the Sites. Sea lift and overland access using cat trains were not discussed in the site access assessments for the other six Sites.

### 3.4 ARCHAEOLOGICAL ASSESSMENTS

An Archaeological Impact Assessment (AIA) was conducted for the Speers Lake Site by BLM-KEL-60 (BLM-KEL-60 Corporation, 2024a). No prehistoric sites were found there, but 2 contemporary tent rings and a probable cache were documented at APEC 3. It was not possible to determine if these occupation features were from indigenous land use or related to the exploration camp site.

The territorial archaeologist for the Government of Nunavut was consulted and recommended that since the two tent rings and single cache *may* represent evidence of modern indigenous land use, they represent future archaeological sites and indicated that they be avoided, if possible, during remediation activities.

Condensed assessments of archaeological potential were conducted for the six additional Sites. Four Sites were found to hold high archaeological potential, and included Asiak River WK154, Kendall River WK165, Tahiapik River WK170, and Coppermine Area 199 WK199. Coppermine Area 210 WK210 was considered to have moderate archaeological potential, and the Impact Lake WK176 was considered to have low archaeological potential.

The archaeological assessment recommended that an on-ground archaeological assessment be conducted prior to remedial activities taking place, as required by the Government of Nunavut.

### **3.5 HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT**

The Human Health and Ecological Risk Assessment (HHERA) (Canada North Environmental Services, 2024) was carried out using data collected in 2023 as part of the 2023 Phase III ESA completed by BLM-KEL-60 (BLM-KEL-60 Corporation, 2024b). The objective was to evaluate whether contaminants of concern (COCs) at the Sites pose unacceptable risks to human health and/or ecological receptors. The use of this site-specific risk-based approach ensures that appropriate remedial/risk management decisions are made based on the site-specific risks associated with each of the Sites with respect to the evaluation of remedial options.

The Human Health Risk Assessment (HHRA) evaluated the risk to humans who may be present at the Sites, noting that the Sites are difficult to access and are therefore rarely visited by humans. The qualitative analysis of risk to human health at all of the Sites involved a comparison of the maximum measured concentrations in soil to human health guidelines. Results of the qualitative analysis indicated there were no exceedances of the human health guidelines for soil. There were no exceedances of drinking water guidelines at any of the lakes present at the Sites. Therefore, no unacceptable risk to human health was identified at any of the Sites.

The Ecological Risk Assessment (ERA) evaluated the risk to vegetation, soil invertebrates, and wildlife that may forage at the Sites. The qualitative analysis of risk to ecological receptors at all the Sites involved the comparison of the maximum measured concentrations in soil to ecological guidelines. Results of the qualitative analysis indicated that all concentrations were below ecological guidelines. Maximum concentrations in surface water and sediment were deemed not to represent risk to ecological populations and benthic communities were determined not to be at risk. Therefore, no unacceptable risk to ecological health was identified at any of the Sites.

### **3.6 SUMMARY OF AREAS SLATED FOR REMEDIAL ACTION**

Based on the findings of the Phase III ESA and the HHERA, the areas requiring remedial action include hazardous materials and drums/barrels/tanks which have not been cleaned prior to disposal. Cleaned drums, barrels and tanks are considered non-hazardous and are to be disposed of opportunistically along with other non-hazardous debris found at the Sites. A summary of the volumes of waste slated for remedial action are presented in Table 3 above and in Tables A1 and A2 in Appendix A. Waste category and debris quantities were assessed through Site observations and measurements as well as by reviewing Site photographs and aerial imagery (Appendix A). Non-hazardous debris at the Sites includes scattered wood (mostly unpainted), scrap metal and steel fuel barrels (once cleaned). Hazardous materials identified include lead containing paint, batteries, residual fuel, and fuel-impacted water and sludges within the barrels. The following assumptions were used to calculate hazardous material volumes:

- Full barrels were standard size containing 205 litres (L) of liquid.
- Empty barrels contained 2 L of fuel residuals such as sludges.
- Approximately 423 barrels were reported empty but could contain some residual sludge that is impacted by fuel.

The combined volumes of waste by Site are summarized below in Table 5 and were compiled from the waste and debris inventory conducted as part of the Phase III ESA for the Site (BLM-KEL-60 Corp, 2024b).

**Table 5: Summary of On-Site debris on the Speers Lake Sites**

Site	Non-Hazardous Debris* (m <sup>3</sup> )	Hazardous Materials (liquid (L), paint (m <sup>3</sup> ))**	Number of Barrels and Fuel Tanks On-Site
Speers Lake WK097	141.0	2,050 L, 3 lead acid batteries	347 barrels
Asiak River WK154	11.5	2.25 m <sup>3</sup> lead containing paint	9 barrels
Kendall River WK165	12.5	-	-
Tahiapik River WK170	28.0	-	2 barrels
Impact Lake WK176	52.5	1,968 L	47 barrels
Coppermine Area WK199	10.5	-	1 barrel, 2 propane tanks
Coppermine Area WK210	8.0	-	17 barrels, 8 tanks, 1 propane tank
Total	264.0	4018 L, 2.25 m <sup>3</sup> of metal containing lead paint, and 3 lead acid batteries.	423 barrels 8 tanks 3 propane tanks

Notes:

\* includes volume of all non-hazardous debris present at the Site including crushed barrels and tanks, building debris, metal, other miscellaneous debris, and painted wood.

\*\* includes liquid remaining in barrels

Given the proximity of the Sites to one another and the limited quantities of debris (hazardous and non-hazardous) at each Site, the Sites are being evaluated jointly for remediation/risk management. The options evaluation will consider the total amount of debris requiring on-site or off-site disposal and will not evaluate options for each individual Site. The Site with the most debris is Speers Lake, which has been selected as the most probable location for on-site landfilling of debris from not only Speers Lake but from all of the Sites. It is assumed that the recommended option will be applied to all Sites with slight variations in implementation being applied based on site-specific conditions.

#### 4 REMEDIATION GUIDELINES AND CRITERIA

As no soil, water or sediment required remediation, the remedial activities at the Sites focus on managing hazardous and non-hazardous materials that are present on each of the Sites.

The following table summarizes the remedial guidelines that are applicable to the RAP:

**Table 6: Remedial Guidelines Summary**

Material	Technical Guidance	Criteria
Lead Based Paint	Nunavut: Environmental Guideline for Waste Lead and Lead Paint (2014)	Paint with lead concentrations greater than the following: <ul style="list-style-type: none"> <li>• Lead Content 100 mg/kg</li> <li>• Leachable Lead 5.0 mg/L</li> </ul>
Barrel Investigation (Contents)	Indian and Northern Affairs Canada (INAC), Abandoned Military Site Remediation Protocol (AMSRP), INAC, 2009)	Contents can be incinerated on-site or shipped south for disposal depending on the following: <ul style="list-style-type: none"> <li>• Phase (Organic or Aqueous)</li> <li>• % glycols or alcohols (&gt;2% or &lt;2%)</li> <li>• PCB (&gt;2 ppm or &lt;2 ppm)</li> <li>• Chlorine (&gt;1000 ppm or &lt;1000 ppm)</li> <li>• Cadmium (&gt;2 ppm or &lt;2 ppm)</li> <li>• Chromium (&gt;10 ppm or &lt;10 ppm)</li> <li>• Lead (&gt;100 ppm or &lt;100 ppm)</li> </ul>
Burning of unpainted wood	AMSRP guidelines (Indian and Northern Affairs Canada, 2009); Nunavut Department of Environment – Environmental Guidelines for the Burning and Incineration of Solid Waste (Department of Environment, Government of Nunavut, 2012).	Clean and unpainted wood materials

## 5 SITE ACCESS

The Speers Lake Sites include 7 independent locations as described in Section 4.1. The Sites are small in nature and contain similar debris items to each other. The closest community to each Site is Kugluktuk. Table 7 below outlines the access options available to each Site and the distance to Kugluktuk. In general, each Site is accessible overland during the winter season via cat train/skidoo or by helicopter. Four sites are also considered accessible by float plane, and Speers Lake is considered accessible via larger aircraft on skis using an ice runway. Overland travel is largely dependent on local knowledge, permits, and permissions from regulatory bodies thus input from the local communities should be considered to evaluate the viability of this access option.

**Table 7: Access Options Feasibility for Each Site and the Distance to Kugluktuk.**

Site Access	Overland Travel <sup>1</sup>			Air Travel				
	Overland Yes/No	Distance to Kugluktuk (km)	Distance to the Speers Lake (WK097) Site (km)	Helicopter Yes/No	Float Plane (Twin Otter) Yes/No	Ice – Runway (Basler/Electra) Yes/No	Distance to Kugluktuk (km)	Distance to the Speers Lake (WK097) Site (km)
Speers Lake WK097	Yes	130	-	Yes	Yes	Yes	95	-
Asiak River WK154	Yes	60	135	Yes	No	No	40	77
Kendall River WK165	Yes	135	83	Yes	No	No	90	40
Tahiapik WK170	Yes	180	126	Yes	Yes*	No	100	80
Impact Lake WK176	Yes	140	162	Yes	Yes	No	90	102
Coppermine Area WK199	Yes	90	70	Yes	Yes	No	50	45
Coppermine Area WK210	Yes	110	162	Yes	No	No	75	80

Notes:

<sup>1</sup> Overland distance was calculated based on the assumption that the overland route would follow Coppermine River and portage to each location avoiding overland travel as much as possible.

\* There is a 13 m increase in grade from the float plane access point to the Site which may make this option undesirable.

## **6 REMEDIATION STRATEGY**

### **6.1 RAP OBJECTIVES**

This RAP considers the following remedial objectives:

- Make the Sites safe for current and expected land use and with surrounding lands and water bodies
- Minimize long term monitoring/maintenance and management of the Sites
- Effectively reduce federal financial liability associated with remaining debris and barrels using cost effective solutions
- Reduce the environmental liabilities present at the Sites by protecting ecological receptors including aquatic life, terrestrial species and vegetation;
- Maximize local and Inuit benefits and return the Sites to a condition which supports current and future Traditional Land use where possible.
- Minimize environmental impacts during remediation

### **6.2 RAP STRUCTURE**

The remediation or risk management options for the Sites are broken up by waste stream as follows:

- Hazardous waste, and
- Non-hazardous debris.

Each waste stream is evaluated separately. Potential options are presented and described for each group of concerns and are evaluated in a matrix format based on a set of criteria.

### **6.3 REMEDIATION & RISK MANAGEMENT APPROACH**

Common approaches to close or risk manage contaminated Sites according to the FCSAP are categorized as follows:

- Ex Situ Remediation with Off-site Disposal or Treatment – including excavation and off-site disposal of contaminated soils, sediments, or other materials.
- On-site In Situ or Ex Situ Remediation – including remediation of contaminated media in place or in treatment cells located on the Site to reduce/eliminate contamination to meet clean up criteria. This includes land farming, bioremediation, and long-term monitoring.
- Risk Management – uses the results of a risk assessment (HHERA) to determine which contaminants may remain in place and identifies the exposure pathways that need to be limited, or eliminated, for human and ecological receptors. This may include the installation of caps or barriers, as well as long-term monitoring.
- Do nothing - The “do nothing” approach is to leave the Site “as is” with no removals of debris, contaminated soils, or hazardous materials. It does not reduce any potential risk where present.

For the Speers Lake Sites, the applicable approach will be to evaluate off-site disposal, on-site disposal and risk management options, through continuous monitoring

### **6.4 REMEDIAL OPTIONS EVALUATION METHODOLOGY**

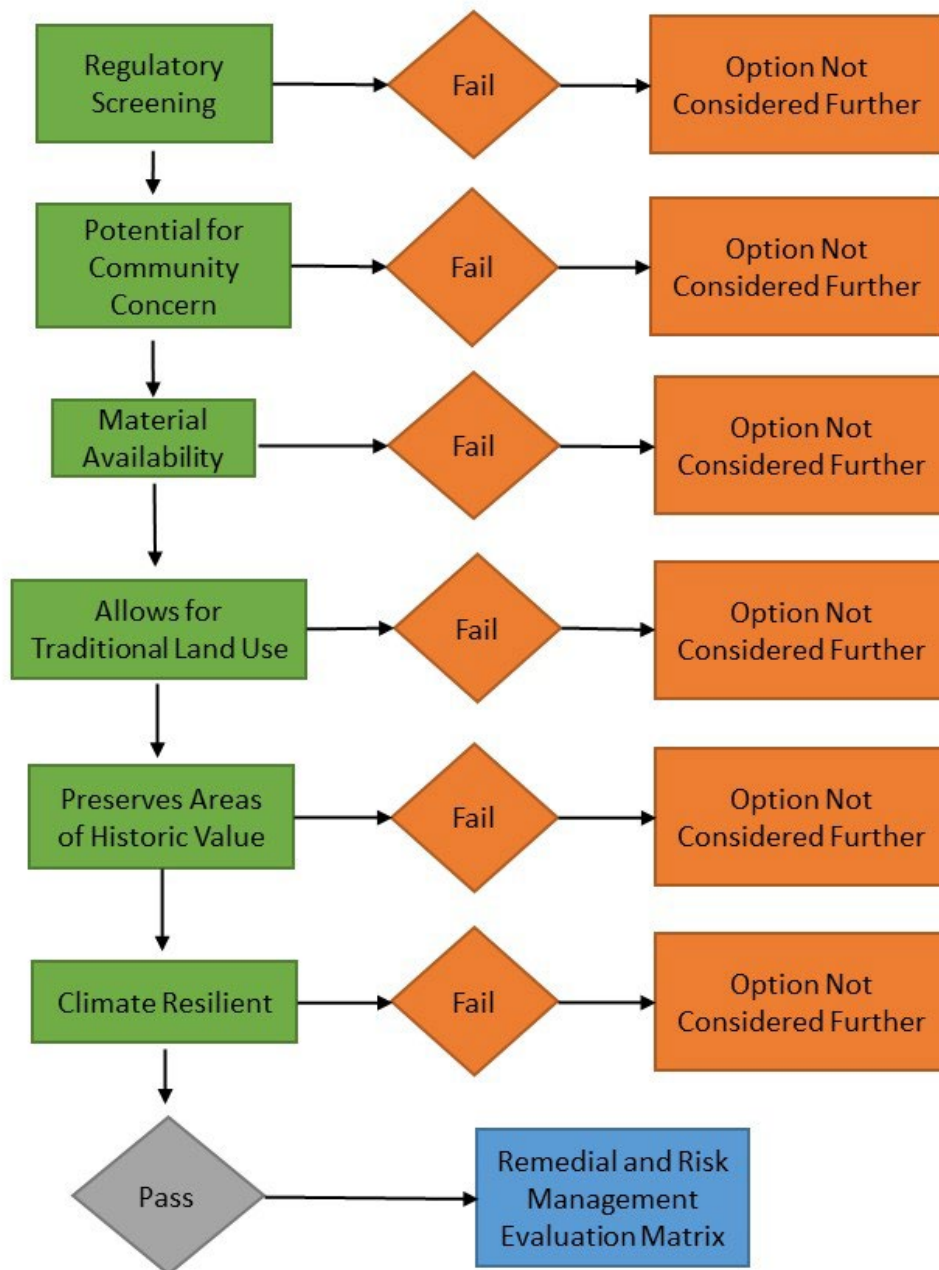
The review of available remediation and risk management options for the Sites were pre-screened and only those passing the pre-screening were subject to the more detailed evaluation using a Remedial and Risk Management evaluation matrix. This allowed the evaluation to focus only on options that met the feasibility requirements specified by the client.

The following sections describe this methodology.

### 6.4.1 Pre-screening

In considering a remediation or risk management option for each waste stream, the following diagram details the pre-screening steps that were followed before an option entered the full evaluation.

**Diagram 1: Remedial Options Pre-screening**



If any remedial option considered fails a step, it is no longer considered in the evaluation process. If the remedial option passes all six steps, it is carried forward as a viable option to be evaluated using the Remedial and Risk Management matrix. Each of the pre-screening steps is described in detail in the following paragraphs.

**Regulatory Screening:** This pre-screening evaluation indicates whether the option would be considered acceptable by applicable regulators/rightsholders (i.e., Nunavut Impact Review Board (NIRB), Nunavut Water Board, CIRNAC Lands Administration, and the Nunavut Planning Commission).

**Potential for Community Concerns:** If the potential for community concern is expected to be minimal or with some challenges, then the option will pass. Options that are expected to face significant challenges will be screened out and no further evaluation will be conducted.

**Material Availability:** Indicates whether the materials are available at the Sites (borrow source, etc.) to use for the option. As summarized in Section 4.3, an evaluation of potential borrow sources that could be used for various remedial approaches such as capping and on-site landfill construction was conducted at the Speers Lake Site which is proposed as the location for any on-site disposal of wastes. Remedial and Risk Management options that require volumes of borrow materials greater than the available volumes assessed as part of the Geotechnical Investigation are eliminated. In cases where it is estimated there would be enough borrow source material for the Remedial or Risk Management option, the option is carried as a viable option to be evaluated in the Risk Management Evaluation Matrix. It should be noted that these assessments of the borrow source availability may need to be carried out for the combined site-wide recommended option if it requires significant borrow materials for implementation.

**Allows for Traditional Land Use:** This pre-screening evaluation indicates whether the option would allow for the continued current and future Traditional Land Use and access to these lands.

**Preserves Areas of Historic Value:** No archaeological sites were found on the Speers Lake WK097 Site; however, two modern contemporary sites and a possible cache were documented. This prescreening option indicates whether the option would preserve areas of historic value that have been identified in the Archaeological Assessment. This pre-screening evaluation indicates if the implementation of this remedial option would prevent the protection of these areas.

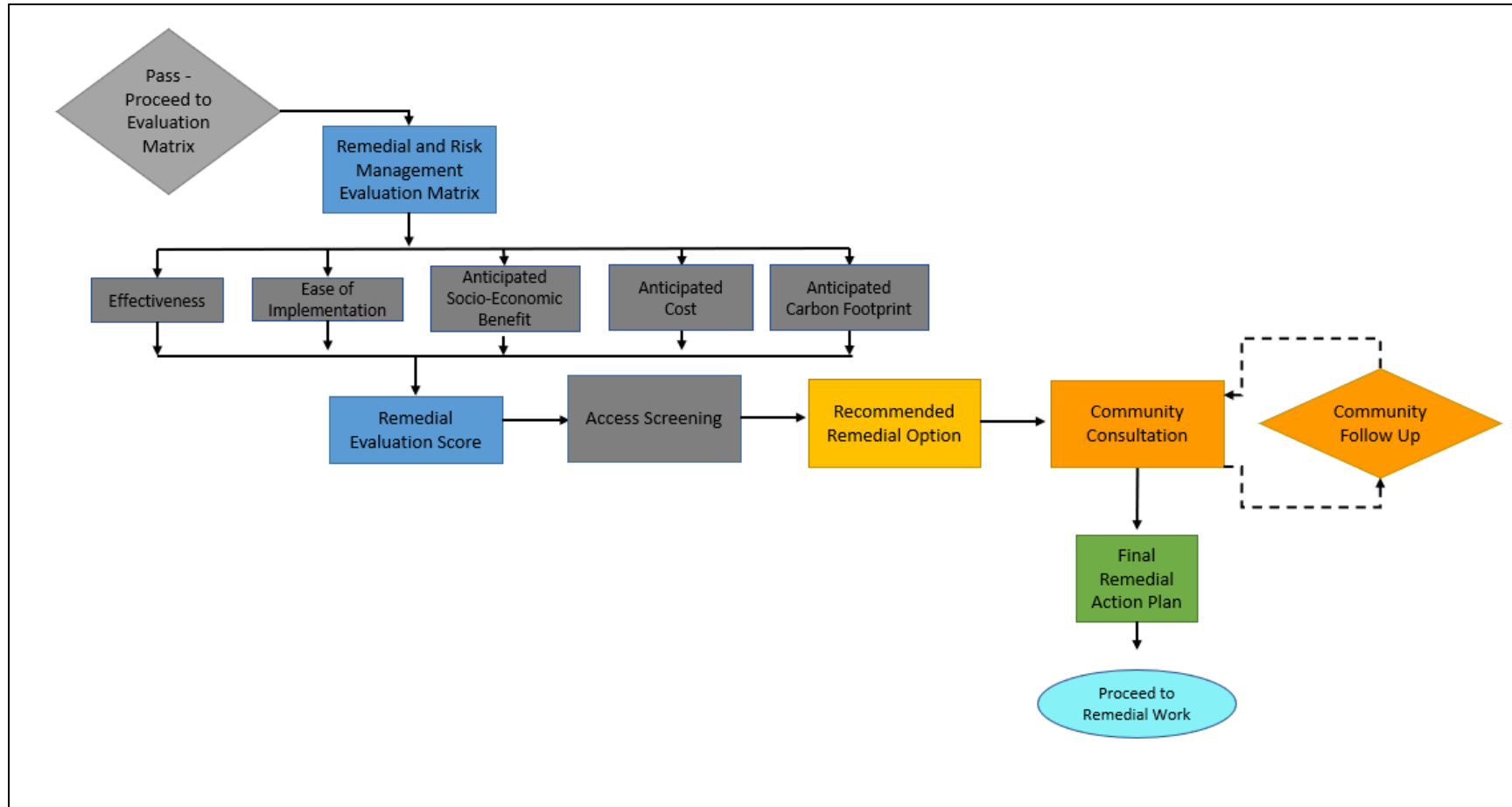
**Resilience to Climate Change:** The pre-screening evaluation examines whether option would continue to be effective under future climate scenarios for the Site. Section 2.3 describes the anticipated climate for the Sites to which the effectiveness of the option should be compared.

#### **6.4.2 Remediation & Risk Management Evaluation Matrix**

Once an option passes the pre-screening, it is evaluated using the Remedial and Risk Management evaluation matrix. The evaluation matrix represents a series of qualitative analyses that evaluates each remedial option against the remedial objectives. A remedial evaluation score is generated from this process to numerically compare each option for a given Site. The process is presented in Diagram 2 below.

The evaluation of each option generates a numerical score that identifies the recommended remedial or risk management option. The recommended option is presented to the client for review and acceptance. The recommended remedial/risk management option will then be presented to the local community and project stakeholders for their feedback. If the option is deemed acceptable, it will move forward as the recommended option at which point it will undergo a more detailed costing exercise.

**Diagram 2: Remedial and Risk Management Evaluation Flow Diagram**



### 6.4.3 Evaluation Criteria and Scoring

The following sections detail the scoring that is used to evaluate each option using the matrix. The purpose of the comparative analysis was to weigh the relative performance of each option against a particular criterion, and to determine which option performs consistently well or consistently better in relation to the criterion of interest. The options were evaluated according to the following criteria:

1. **Effectiveness:** Determine if the option will be effective at protecting human health and ecological receptors at the Sites. Risk management options such as long-term monitoring (LTM) will reduce the overall effectiveness score of the option. Ratings applied:
  - a. Expected to be minimally effective = 1
  - b. Expected to be somewhat effective = 3
  - c. Expected to be moderately effective = 5
  - d. Expected to be fully effective = 7
  
2. **Ease of Implementation:** Assess the level of effort required to implement the option, the availability of needed technologies and services, the level of logistics required, the time that will be required to carry out the option, and the general ability to access each Site (e.g., air, land, and/or water access, altitude, etc.) with the equipment required. Ratings applied:
  - a. Complex: Site Access requires two or more methods of transportation with multiple construction seasons using fixed winged aircraft, rotary aircraft and/or overland hauling by cat train. It also requires the construction of additional infrastructure at the Site such as the construction of an ice airstrip, access roads, and/or float plane docks. Landfills that require long term monitoring are considered complex. Score = 1
  - b. Somewhat Complex: Site Access requires one or two methods of transportation with 1 construction season using fixed wing and/or rotary aircraft to access the Sites. It also requires the construction of additional infrastructure at the Sites such as the construction of an ice airstrip, access roads, and/or float plane docks. Sites that require long term monitoring programs other than landfills are considered somewhat complex. Score = 3

- c. Simple: Site Access requires one method of transportation for one season. It does not require the construction of additional infrastructure at the Sites. Equipment is easily transported by the single method of transportation. Score = 5
  - d. No Access Required: This would apply to the ‘Do Nothing’ option. Score = 7
3. **Anticipated Socio-economic Benefit:** Assess the level of economic and social benefit (i.e. employment during remediation and/or during LTM, capacity building, and training) to the nearest community. Ratings applied:
- a. No socio-economic benefit (Local employment of 0, 0% budget spent locally, no training opportunities) = 1
  - b. Limited socio-economic benefit (Local employment of 1-3, 0-10% budget spent locally, minimal training opportunities) = 3
  - c. Some socio-economic benefit (Local employment of 4-10, 10-20% of budget spent locally, some training opportunities) = 5
  - d. Moderate socio-economic benefit (Local employment of 10 +, >20% of budget spent locally, significant training offered) = 7
4. **Anticipated Cost:** Assess the cost required to implement the option and future monitoring if required. The ratings are based on the cost of each option being within the below ranges described in Table 8 below.

**Table 8: Anticipated Cost Range and Associated Scoring**

Scoring Range	Option Cost Range	Relative Cost	Score
Very High Cost	Greater than \$4M	\$\$\$\$	1
High Cost	\$2M to \$4M	\$\$\$	3
Moderate Cost	\$0.25M to \$2M	\$\$	5
Lowest Cost	Less than \$0.25M	\$	7

5. **Anticipated Carbon Footprint:** Assess the carbon emissions produced by implementing each option and any associated long-term monitoring if required. The CO<sub>2e</sub> is calculated by estimating the fuel consumption of the anticipated transportation and mobilization (e.g., rotary wing, fixed wing, overland) and equipment (e.g., size of equipment, diesel-powered, etc.) and estimating the CO<sub>2e</sub> produced. The ratings are based on the CO<sub>2e</sub> of each option being within the below ranges described in Table 9. Ratings applied:

**Table 9: Anticipated CO<sub>2</sub>e and Associated Scoring**

Scoring Range	Option Cost Range	Score
Very High CO <sub>2</sub> e	Greater than 175 tonnes CO <sub>2</sub> e	1
High CO <sub>2</sub> e	101 – 175 tonnes CO <sub>2</sub> e	3
Moderate CO <sub>2</sub> e	26 – 100 tonnes CO <sub>2</sub> e	5
Lowest CO <sub>2</sub> e	0 – 25 tonnes CO <sub>2</sub> e	7

#### 6.4.4 Weightings of Evaluation Criteria

The weightings proposed for the evaluation criteria reflect the prioritization of key aspects of the project through the evaluation process. These weightings have been selected in conjunction with CIRNAC to represent the project objectives. The highest priority is effectiveness of the proposed option. A summary of the evaluation criteria weightings is summarized in Table 10.

**Table 10: Summary of Weightings for Evaluation Criteria**

Evaluation Criteria	Weightings
1. Effectiveness	4
2. Ease of Implementation	2
3. Anticipated Socio-Economic Benefit	2
4. Anticipated Cost	4
5. Anticipated Carbon Footprint	1
<b>Total Weighting</b>	<b>13</b>

These scores and weightings will be used in the evaluation matrix for each remedial option to determine the best option for each aspect of the Site.

#### 6.4.5 Equipment Access Evaluation

Transporting any heavy equipment required to implement the remedial strategy at the Sites is not being evaluated in detail for costing purposes as estimating these costs has proven difficult based on the lack of similar work having occurred in this region. The remedial options that require heavy equipment (i.e., excavators, loaders, bulldozers, and any other large earth moving equipment) have a larger costing factor built into the mobilization and demobilization costing assumptions. The estimated higher costing factor is based on overland hauling costs from previously remediated CIRNAC sites requiring heavy equipment.

For all options that require heavy equipment, (i.e., excavators, loaders, bulldozers, and any other large earth moving equipment) a cost of \$2,000,000 is being carried forward as a surrogate cost for land transport (i.e. winter cat train) to transport heavy equipment. The cost is estimated based on overland hauling cost from another remote site remediated by CIRNAC.

## **7 REMEDIAL OPTIONS EVALUATION RESULTS**

The potential approaches for the implementation of remedial options are presented for hazardous wastes and non-hazardous debris. The flow chart presented in Diagram 1 was used to screen each option and determine if it would be carried forward to the Option Evaluation Matrix for scoring and costing. The following sections summarize which options passed the screening components (regulatory screening, potential for community concerns, material availability, allows for traditional land use, preserves areas of historic value and is climate resilient) and which options were eliminated from further consideration.

### **7.1 REMEDIATION & RISK MANAGEMENT - HAZARDOUS WASTES**

Hazardous Waste was identified as requiring remediation and/or risk management based on the potential risk it presents. Figures presenting a summary of the debris locations proposed for remediation are found following the text. Hazardous waste is located at Speers Lake WK097, Asiak River WK154, and Impact Lake WK176 and the approximate overall quantities are listed below:

- Liquid – 5,664 L (4018 L of fuel and 1646 L of fuel residues)
- Paint – 2.0 m<sup>2</sup> surface area painted with lead containing paint (leachable)
- Batteries – 3 lead acid batteries

The hazardous liquid waste to be removed from the Sites is assumed to be from several barrels and tanks known to contain PHCs across the Sites. As a detailed inspection of each of the tanks and barrels at the Sites was not feasible during the site assessment, it has been assumed that 100 L of sludge would be produced during the cleaning and processing of tanks and that barrels will contain 2 L of sludge/residues that would require disposal after cleaning and crushing of the barrels. On-site treatment and discharge of water produced during tank and barrel cleaning would need to consider permitting requirements. Off-site disposal of these wastes is another

option that could be considered for the barrel and tank processing residues. Refer to Table 3 in Section 4.2 and Table A1 in Appendix A for a complete summary of the hazardous waste present at each of the Sites.

The following table presents remedial/risk management options for debris located at the Sites.

**Table 11: Summary of Potential Remedial and Risk Management Options for Hazardous Waste Remediation**

Remedial or Risk Management Option	Description
1) Remediation – Dispose of on-site	An on-site hazardous waste landfill would be built at the Speers Lake WK097 Site, and the hazardous waste would be consolidated manually and transported to the on-site hazardous landfill. Excess fuel would be flared or incinerated on-site.
2) Remediation – Dispose of off-site	Hazardous waste would be consolidated, packaged, and shipped off-site to a southern hazardous waste facility for disposal.
3) Risk Management – Consolidation and Long-Term Monitoring	Hazardous waste would be consolidated in a specific location on-site and monitoring of soil quality and the condition of the hazardous waste storage areas will be performed over the long term.
4) “Do Nothing” Approach	Do not proceed with any remedial activities; retain all liabilities associated with the Sites.

Option 1 provides for the potential on-site landfilling however, due to the limited amount of hazardous waste on each Site, this option will involve congregating all hazardous waste on the Speers Lake WK097 Site. Hazardous materials would need to be packaged appropriately for disposal in an on-site hazardous landfill. Heavy equipment would be required for the construction of the hazardous waste landfill which is assumed to be built to specifications outlined in the Abandoned Military Site Remediation Protocol (AMSRP, INAC, 2009). All excess fuel would be incinerated. Long term monitoring would be required following the completion of the on-site landfill.

Option 2 includes the shipment of all hazardous wastes off-site to a licensed disposal facility in the south. Appropriate storage containers are deemed necessary for the liquid organic wastes; currently it is assumed that barrels on-site will be used for primary storage with new secondary containment packaging required for on-site staging and shipping. Hazardous waste packaging and labelling will need to meet all regulatory requirements. Handling hazardous materials including lead painted debris will need to be carried out by trained personnel in accordance with territorial guidelines. Lead painted material must be disposed of at a licensed facility approved to accept this type of waste. These facilities are located in southern Canada. This option would

eliminate all risk on-site and further Site visits would not be required. It is also expected that this option would be able to be completed using hand tools.

Option 3 is the consolidation of hazardous materials on-site with continued long term monitoring. Consolidation of hazardous waste could occur on the Sites where the hazardous wastes currently reside (Impact Lake WK176, Speers Lake WK097, and Asiak River WK154). Consolidation of waste could include the construction of a small compound to store these materials in, away from the elements, with limited access and appropriate signage to identify the hazard to any visitors to the Site. This option will restrict human and large wildlife access to hazardous materials. Long term monitoring inspections and maintenance would be required. This option would eliminate some risk on-site and could be accomplished using hand tools.

Option 4 would not require any additional work, and the Sites would be left as is.

### **7.1.1 Pre-Screening of Options – Hazardous Waste**

Option 1 Remediation – Engineered landfill: This option can be carried out to satisfy Regulatory requirements but would require conformity check by the Nunavut Planning Committee (NPC), screening by the Nunavut Impact Review Board (NIRB), water license by the Nunavut Water Board (NWB), land use permit by CIRNAC and the establishment of a long-term monitoring program for the facility. This option can be carried out in a manner that allows for traditional land use and preserves areas of historical significance. Borrow material is readily available on the Speers Lake Site WK097 to construct the landfill but materials such as the geotextile and specialized installation equipment would need to be mobilized to Site. All hazardous waste would be consolidated from the additional Sites to the Speers Lake WK097 Site. This option is likely to raise concerns within the local community. The nature of the hazardous waste is primarily liquid fuel residues which are not suitable for containment in a hazardous waste landfill and would need to be incinerated. The landfill would be constructed to satisfy expected climate change effects, and long-term monitoring would evaluate any changes to the facility over time. This option has not been carried forward as a viable remedial option for the hazardous waste removal as there is potential for community concern.

Option 2 Remediation - Off-site Disposal: The consolidation and transport of hazardous materials off-site will remove all hazardous materials eliminating the risk that the materials currently pose to human and ecological health. This option is expected to meet the regulatory screening requirements, have no potential for community concerns, allow for traditional land use, and preserves areas of historic value. This option also does not require on-site borrow material, and would be considered climate resilient. This option has been carried forward as a viable remedial option for the hazardous waste removal and has been assessed using the matrix evaluation.

Option 3 Risk Management – Consolidate and Continuous Monitoring: includes consolidating hazardous waste and the implementation of a long term monitoring program of the consolidated storage area and its surroundings. This option is expected to meet regulatory screening as this option would only require screening by NIRB and would not require a water license, and would be climate resilient as any changes to the Sites conditions would be noted during long term monitoring. The Sites would continue to be accessible for traditional land use and would preserve areas of historic value. This option may raise potential concerns from the local community as the hazardous materials would remain on-site however long-term monitoring would occur. This option has been carried forward as a viable remedial option for the hazardous waste disposal at the Sites and has been assessed using the matrix evaluation.

Option 4 is the “do nothing” approach. This option is carried forward to the matrix evaluation as a baseline scenario despite the fact that is unlikely to be accepted by the local community. The purpose of this is to generate a score for evaluation purposes to compare with the other viable options.

Table 12 provides a summary of potential remedial or risk management options for hazardous waste which were carried forward to the Remedial and Risk Management Evaluation Matrix:

**Table 12: Remedial & Risk Management Options Pre-Screening – Hazardous Waste**

Remedial or Risk Management Option	Matrix Pre-Screening						Carried Forward to Evaluation Matrix
	Regulatory Screening	Potential for Community Concern	Material Availability	Allows for Traditional Land Use	Preserves Areas of Historic Value	Climate Resilient	
1. Remediation – Dispose of on-site							No
2. Remediation – Dispose of off-site							Yes
3. Risk Management – Consolidate and Long-Term Monitoring							Yes
4. “Do Nothing” Approach							Yes*
Passes requirement							
Fails requirement							
Carried through for comparison							

Note:

\* Carried through as baseline comparison option.

## 7.1.2 Remediation & Risk Management Options Evaluation Matrices – Hazardous Waste

The following assumptions were made when evaluating the options that passed the pre-screening evaluation; Dispose of Off-site, Consolidate and Long-term Monitoring, and “Do Nothing”.

### Dispose of Off-Site:

- Assumes 100% of hazardous waste requires disposal at a licensed hazardous waste facility in southern Canada.
- Hazardous waste volume is estimated to be 4018 L of fuel, 1646 L of fuel residuals, 3 lead acid batteries and a 2.0 m<sup>2</sup> surface coated with leachable lead paint of unknown thickness.
- The leachable lead paint is located on an old drill rig, this rig is assumed to be removed from the Site as is and the paint will be removed at an appropriate waste facility.
- Contingent upon approval for acceptance of out-of-province waste by the Quebec Ministry of the Environment (assuming barging to Montreal, Quebec) or similar.
- Removal of hazardous materials can be accomplished manually using tools and local labour.
- Local labour will be available in Kugluktuk.
- 5 hours of flight time will be required for each Site visit, except for the Speers Lake Site which will require 10 hours of flight time and a 10 hour round trip for staging the chartered helicopter in Kugluktuk.
- Accommodations assumed to be in Kugluktuk for all out of community labour.
- Includes a 30% cost contingency as there is some uncertainty in the volumes and weights of the hazardous waste and the potential exists for additional wastes to require disposal.

### Consolidate and Long-Term Monitoring:

- Assumes consolidation of hazardous materials can be completed in one day per Site (no camp required as the team will fly back to Kugluktuk daily).
- Assumes each long-term monitoring program can be done in 1 days.

- A small shed and signage will be constructed on-site to store hazardous waste.
- Long term monitoring program is assumed to be 1 day per monitoring year for a total of 7 monitoring visits within the 25-year monitoring period as per the AMSRP (INAC, 2009).
- Access to the Sites by air will continue to be viable.
- Local labour will be available in Kugluktuk
- A total of 22 hours of flight time will be required for the consolidation phase which includes a 4 hour round trip from Kugluktuk to each of the three Sites (12 hours), and a 10 hour round trip for staging the chartered helicopter in Kugluktuk.
- 14 hours of flight time will be required for each LTM event, 4 hour round trip from Kugluktuk to the Sites, and a 10 hour round trip for staging the chartered helicopter in Kugluktuk.

**Do Nothing:**

- Assumes no further work will take place on the Sites

Preliminary costing for each of the proposed remedial / risk management options was completed and each option was given a value based on the costing range described in Section 7.4.3. Carbon footprint evaluations are presented in Appendix B. Table 13 below summarizes key cost items and the anticipated carbon footprint for each option.

**Table 13: Cost and Carbon Footprint Evaluation for Hazardous Waste Remediation Options**

Option	Dispose of Off-Site	Consolidate and Long-term Monitoring	Do Nothing
<b>Total Costs</b>	<b>\$\$</b>	<b>\$\$\$</b>	<b>\$</b>
Anticipated Carbon Footprint	26 t CO <sub>2</sub> e	93 t CO <sub>2</sub> e	-

The potential remedial or risk management options that were carried forward are evaluated and scored in Appendix C and summarized in Table 14.

**Table 14: Summary of Remedial/Risk Management Option Evaluation Matrix – Hazardous Waste Removal**

Risk Management Option	Effectiveness	Ease of Implementation	Anticipated Socio-Economic Benefit	Anticipated Costs	Anticipated Carbon Footprint
Option 2: Remedial - Southern off-site disposal	Fully Effective	Simple	Limited socio-economic benefit	Moderate cost	Moderate CO <sub>2</sub> e
Rating	7	5	3	5	5
Weighting	4	2	2	4	1
Weighted Rating	28	10	6	20	5
<b>Total</b>	<b>69</b>				
Option 3: Risk Management – Consolidate and Continuous Monitoring	Somewhat Effective	Somewhat Complex	Some socio-economic benefit	High cost	Moderate CO <sub>2</sub> e
Rating	3	3	5	3	5
Weighting	4	2	2	4	1
Weighted Rating	12	6	10	12	5
<b>Total</b>	<b>45</b>				
Option 4: Do Nothing	Minimally Effective	No Access Required	Limited socio-economic benefit	Lowest cost	Lowest CO <sub>2</sub> e
Rating	1	7	1	7	7
Weighting	4	2	2	4	1
Weighted Rating	4	14	2	28	7
<b>Total</b>	<b>55</b>				

After evaluation, the options were scored as the following:

- Remediation - Southern Off-site Disposal: **69**
- Risk Management - Consolidate and Long-Term Monitoring: **45**
- Do Nothing: **55**

Following scoring, Southern Off-site Disposal scored the highest and is considered the recommended remedial approach for hazardous waste at the Site.

## 7.2 REMEDIATION & RISK MANAGEMENT – NON-HAZARDOUS WASTES

Non-hazardous debris was identified for remediation and/or risk management based on observations made during the Phase III ESA activities and from the risk that they pose to land users. Non-hazardous waste includes drums/barrels/tanks which are considered hazardous until they have been cleaned according to applicable guidelines. Opportunistic remediation of these items and other non-hazardous wastes like wood, are assumed in this section. The figures following the text present a summary of the debris locations proposed for remediation. Table 15 presents remedial/risk management options for non-hazardous debris located at the Sites. A total of 405 m<sup>3</sup> of non-hazardous debris is estimated for remediation. Refer to Table 3 in Section 4.2 and Table A2 in Appendix A for a complete summary of the non-hazardous waste present at each of the Sites.

Clean, unpainted wood waste is included in the above noted non-hazardous debris volume estimate and includes core box wood waste of approximately 3 m<sup>3</sup> at Speers Lake WK097 and 8 m<sup>3</sup> at Tahiapik River WK170 which is slated to be burned on Site with the ash contained for disposal. A burn permit would be required to approve the burning of the wood waste.

Included in the non-hazardous debris volume estimate, is a total of approximately 12 m<sup>3</sup> of rock core that is to remain at the Sites. The Sites containing rock core are Speers Lake WK097 (3 m<sup>3</sup>), Tahiapik River WK170 (7 m<sup>3</sup>), and Coppermine Area WK199 (1.5 m<sup>3</sup>). The rock core at these Sites will be removed from the core boxes and placed neatly at the Site.

A small concrete pad is also present at the Coppermine Area WK199 Site. The pad will remain on-site as is and is not slated for removal.

**Table 15: Summary of Potential Remedial and Risk Management Options for Non-Hazardous Waste Remediation**

Remedial or Risk Management Option	Description
1) Remediation – Dispose of on-site	An on-site non-hazardous landfill would be built at the Speers Lake WK097 Site, and the non-hazardous debris would be excavated and transported to the on-site landfill for disposal.
2) Remediation – Dispose of off-site	Non-hazardous waste would be consolidated, packaged, and shipped off-site to an off-site landfill for disposal.
3) Risk Management – Consolidate on Site	Non-hazardous waste would be consolidated in specific locations on-site to ensure that physical hazards are minimized.
4) “Do Nothing” Approach	Do not proceed with any remedial activities; retain all liabilities associated with the Sites.

Option 1 above would require heavy equipment to be brought to the Speers Lake Site in order to build an on-site landfill. This option would also require consolidating debris on one Site. Option 3 would ideally use heavy equipment, however it could be accomplished using smaller equipment if required. The heavy equipment may need to be rented/leased for a one year period, depending on barge scheduling for a given year as it could take as little as one year or longer to complete the work. Equipment will then need to be transported to Site. Personnel are expected to be flown in daily from the nearest mainland community via rotary aircraft, along with daily supplies except where on-site work duration extends beyond 14 days.

Option 1 will require the construction of one new non-hazardous landfill (engineered). The landfill would be constructed in close proximity to the large debris piles located at the Speers Lake Site WK097 to minimize the distance that the waste is hauled on the Site. Debris will then be transferred from the other Sites to the Speers Lake Site for disposal. Debris will need to be hand picked from locations where equipment is not available. The non-hazardous waste landfill conceptual design is based on the AMSRP (INAC, 2009) which is considered a best practice document for remote contaminated sites in Canada's Arctic. Option 1 includes constructing a bermed cell with a granular cap. This option would involve new ground disturbances and the transport of borrow material from the fluvial slopes in order to construct the cap on the landfill. This option would require heavy equipment and require long-term monitoring.

Option 2 includes consolidating debris (i.e. cutting tanks, crushing barrels, hand picking smaller debris, etc.) and transferring it to acceptable containers or pallets to be transported off-site. Containers and or pallets must account for the storage of the larger debris such as steel barrels, steel frames, portions of the large tanks and piping. Where possible the materials would be compacted prior to packaging to minimize the volume for shipment. This option could be completed without heavy equipment. No further monitoring would be required.

Option 3 includes consolidating debris (i.e. crushing barrels, hand picking small debris into containers) into central areas for each APEC and installing signage to inform land users of the physical hazard. This option would not require heavy equipment and consolidation would be completed using hand tools, a barrel crusher and all terrain vehicles for transport.

Option 4 would not require any additional work and the Sites would be left as is.

## 7.2.1 Pre-Screening of Options – Non-Hazardous Debris/Waste

Option 1 Remediation - On-site Disposal – Engineered landfill: This option can be carried out to satisfy Regulatory requirements but would require conformity check by the NPC, screening by the NIRB, water license by the NWB, land use permit by CIRNAC, and the establishment of a long-term monitoring program for the facility. This option is expected to raise some community concern, however debris would be consolidated and contained in one area which would reduce physical hazards and improve site cleanliness. Borrow sources are available in sufficient quantities for this option. This option will also allow for traditional land use, as well as preserve areas of historic value. The construction of the non-hazardous waste landfill will be built to specifications outlined in the AMSRP (INAC, 2009). This engineered landfill will also be climate resilient and any degradation of the facility due to the changing climate will be identified through long term monitoring. This option has been carried forward as a viable remedial option for the non-hazardous waste disposal at the Sites and has been assessed using the matrix evaluation.

Option 2 Remediation - Off-site Disposal: This option is expected to pass the regulatory screening as nothing will be constructed or discharged from the Sites and only the burning of clean wood will occur. This option is expected to have little to no potential for concern from the communities in the area as material will be removed from the Sites. No additional borrow material will be needed for this option. Option 2 will also allow for traditional land use, as well as preserve areas of historic value. This option will also be climate resilient as all debris will be removed from the Sites. This option has been carried forward as a viable remedial option for the non-hazardous waste disposal at the Sites and has been assessed using the matrix evaluation.

Option 3 Risk Management – Consolidate: This option includes the consolidation of non-hazardous debris into a single area near a defined APEC (where feasible) and the burning of all unpainted wood waste. This option is expected to pass regulatory screening as debris remaining on-site is non-hazardous and a burn permit will likely be approved. This option may raise some concerns with the communities, however it will minimize the presence of debris on the Sites into key areas and reduce waste through the burning of clean wood. No additional material will be required for the implementation of this option. Traditional land use would be able to continue and areas of historic value would be preserved. This option would be considered climate resilient because only non-hazardous material would be left on Site, piled and packaged to reduce wind blown debris, in an area above high water marks, and away from drainage channels.

This option has been carried forward as a viable remedial option for the non-hazardous waste disposal at the Sites and has been assessed using the matrix evaluation.

Option 4 is the “do nothing” approach. This option is carried forward to the matrix evaluation as a baseline scenario. The purpose of this is to demonstrate the benefits from a base scenario.

Table 16 provides a summary of potential remedial or risk management options for non-hazardous debris which were carried forward to the Remedial and Risk Management Evaluation Matrix:

**Table 16: Remedial & Risk Management Options Pre-Screening – Non-Hazardous Debris/Waste**

Remedial or Risk Management Option	Matrix Pre-Screening						Carried Forward to Evaluation Matrix
	Regulatory Screening	Potential for Community Concerns	Material Availability	Allows for Traditional Land Use	Preserves Areas of Historic Value	Climate Resilient	
1. Remediation – Dispose of on-site							Yes
2. Remediation – Dispose of off-site - Air							Yes
3. Risk Management – Consolidate							Yes
4. “Do Nothing” Approach							Yes*
Passes requirement							
Fails requirement							
Carried through for comparison							

Note:

\* Carried through as baseline comparison option.

## 7.2.2 Remediation & Risk Management Options Evaluation Matrices – Non-Hazardous Debris

The following assumptions were made when evaluating the options that passed the pre-screening evaluation; Dispose of on-site, Dispose of off-site, and Consolidate and continuous monitoring. A summary of site access and feasible transportation options for the Sites is provided in Section 4.3.1

### Dispose of On-Site:

- Assumes a landfill will be constructed at Speers Lake WK097 Site as per the AMSRP typical contaminated soil disposal facility detail (Indian and Northern Affairs Canada, 2009).
- Assumes 274 m<sup>3</sup> of non-hazardous debris and 10% of burnable wood in the form of ash (11.9 m<sup>3</sup>) for a total of 285.9 m<sup>3</sup> will be placed in the landfill.
- Assumes clean, unpainted wood can be burned on-site with an approved burn permit and the ash can be packaged and removed from the Sites and brought to the Speers Lake WK097 Site for disposal.
- Assumes all fuel barrels will require rinsing/cleaning prior to on-site disposal. Rinse water will be collected, packaged and transported off-site.
- Rock cores found on-site will be neatly stacked and left on-site.
- Assumes a granular material cap thickness of 1.0 m, and a granular material berm width of 3.0 m will be placed around the waste material cell to construct the landfill.
- All fill material will be sourced locally.
- Equipment used will be able to access all areas of the Site requiring borrow source extraction and landfill construction.
- Assumes heavy equipment will need to be transported to the Site by overland winter haul.
- Assumes a cat train or equivalent is available to complete this work
- Heavy equipment, materials, camp, and all other equipment and materials required on Site will be transported from Kugluktuk to Speers Lake via cat train during frozen conditions.
- A cat train can traverse overtop water in freezing conditions.

- Additional archaeological permits may be required as the cat train will traverse over land in some areas.
- Heavy equipment would be required for multiple years. Heavy equipment would need to be transported to Kugluktuk by barge the summer before work begins, then overland transit to Site that winter, complete work that summer, overland out that winter and finally, sealift out the following season.
- Assumes all non-hazardous debris will be compiled at Speers Lake Site.
- Assumes any standing structures would be demolished/dismantled before associated debris can be addressed.
- Assumes non-hazardous wastes at additional Sites will be transported via rotary aircraft to the Speers Lake Site
- Assumes 37 days to complete construction of this small landfill and consolidate all non-hazardous debris to the Speers Lake Site.
- Assumes a tent-based camp will be established at Speers Lake during landfill construction.
- A rotary aircraft will be utilized to transport non-hazardous waste to Speers Lake from the other Sites.
- Three flights per day from Speers Lake to each Site via rotary aircraft can be accomplished.
- A 10 hour round trip for staging the chartered helicopter in Kugluktuk.
- Long term monitoring program is assumed to be 1 day per monitoring year for a total of 7 monitoring visits within the 25-year monitoring period as per AMSRP (Indian and Northern Affairs Canada, 2009).
- Includes a 20% contingency that considers waste bulking when waste is placed in the on-site landfill.

#### **Off-site Disposal:**

- Assumes 100% of debris will be disposed of at appropriate waste facilities in the south.
- Debris to be disposed of off-site has an approximate volume of 274 m<sup>3</sup> of non-hazardous debris, and 10% of burnable wood in the form of ash (11.9 m<sup>3</sup>) for a total volume of 285.9 m<sup>3</sup> and weighs approximately 141 tonnes.
- Includes a 30% contingency in waste volume to factor in bulking of waste during containerization and transportation off -site.

- Contingent upon approval for acceptance of out-of-province waste by receiving facility.
- Rock cores found on-site will be neatly stacked and left on-site.
- Assumes clean, unpainted wood can be burned on-site and the ash can be packaged and removed from Site with an approved burn permit.
- Assumes any standing structures would be demolished/dismantled before associated debris can be addressed.
- Local labour will be available in Kugluktuk.
- Assumed that debris can be transported off-site by air.
- Removal of debris can be accomplished manually using hand tools, ATVs, and snowmobiles suitable for transport and local labour.
- Assumes it will take 19 days to complete consolidation at Speers Lake Site. Including breaking down and hauling debris to a staging area.
- Assume it will take 57 trips (22 days) to remove debris using rotary aircraft via sling for all Sites except for Speers Lake where a Basler Fixed wing aircraft can be used during the winter months.
- A 10 hour round trip for staging the chartered rotary aircraft in Kugluktuk.
- A twin otter fixed wing aircraft on floats will be utilized to transport staff to and from Speers Lake during the remediation. A total of 36 hours of flight time will be required for this option, which includes 4 - 4 hour round trips from Kugluktuk to Speers Lake and 2 – 10 hour staging days to prepare.
- Waste from the Speers Lake Site will be staged in the summer for demobilization via a winter trail between the Site and an ice strip located on Speers Lake. Waste will be transported from the Site via larger aircraft utilizing the ice strip for staging in Kugluktuk until the waste can be barged to a licensed waste disposal site.
- Non-hazardous waste will be transported from Speers Lake to Kugluktuk via fixed wing plane on skis or floats.
- Three flights per day from Kugluktuk to Speers Lake via fixed wing plane can be accomplished.
- Float planes were not considered for Impact Lake WK176, Coppermine WK199, and Tahiapik River WK170 Sites as there is a limited quantity of debris to be removed and additional requirements for the building of infrastructure and labour.
- One on-site camp will be constructed for the duration of the construction operations at Speers Lake (19 days). The on-site camp will take 2 days to assemble and disassemble.

- A subsequent summer visit will be required following the winter demobilization to confirm that all debris was removed successfully as part of the final inspection of the Site.

### **Consolidate Non-hazardous Debris:**

- Assumes consolidation of material can be completed in 14 days (no camp required).
- Debris will be piled at each Site and arranged to be resistant to weather events (i.e. large light items would be placed flat on the ground with heavier items on top. Barrels would be stacked horizontally; smaller debris would be consolidated into containers/empty barrels).
- Rock cores found on-site will be neatly stacked and left on-site.
- ATVs will be able to access the Speers Lake Site (slinging by rotary aircraft) and assist in moving debris around.
- Assumes any standing structures would be demolished/dismantled before associated debris can be addressed.
- Debris will not be crushed or compacted.
- Local labour will be available in Kugluktuk.
- Staging will be in Kugluktuk with daily flights to and from Site.
- 56 hours of flight time will be required to complete the consolidation of materials, and a 10 hour round trip for staging the helicopter in Kugluktuk.

### **Do Nothing:**

- Assumes no further work will take place on the Sites

Preliminary costing and anticipated carbon footprint for each of the proposed remedial / risk management options was completed and each option was given a value based on the costing range described in Section 7.4.3 and Appendix B, respectively. Table 17 summarizes key cost items and the anticipated carbon footprint for each option.

**Table 17: Cost and Carbon Footprint Evaluation for Non-Hazardous Waste Remediation Options**

Option	Dispose of On-Site	Dispose of Off-Site	Consolidate Non-Hazardous Debris	Do Nothing
<b>Total Costs</b>	<b>\$\$\$\$</b>	<b>\$\$\$</b>	<b>\$\$</b>	<b>\$</b>
Anticipated Carbon Footprint	171 t CO <sub>2</sub> e	250 t CO <sub>2</sub> e	31 t CO <sub>2</sub> e	0 t CO <sub>2</sub> e

Note:  
 N/a – Not applicable

The potential remedial or risk management options that were carried forward (as identified in Section 8.2.1) are evaluated and scored in Appendix C and summarized in Table 18.

**Table 18: Summary of Remedial/Risk Management Option Evaluation Matrix – Non-Hazardous Debris**

Risk Management Option	Effectiveness	Ease of Implementation	Anticipated Socio-Economic Benefit	Anticipated Relative Costs	Anticipated Carbon Footprint
Option 1: Remedial – On-site landfill	Moderately Effective	Complex Logistics	Moderate socio-economic benefit	Very high cost	High CO <sub>2</sub> e
Rating	5	1	7	1	3
Weighting	4	2	2	4	1
Weighted Rating	20	2	14	4	3
<b>Total</b>	<b>43</b>				
Option 2: Southern Off-site disposal	Fully Effective	Somewhat Complex Logistics	Moderate socio-economic benefit	High cost	Very high CO <sub>2</sub> e
Rating	7	3	7	3	1
Weighting	4	2	2	4	1
Weighted Rating	28	6	14	12	1
<b>Total</b>	<b>61</b>				
Option 3: Risk Management – Consolidate	Somewhat Effective	Simple logistics	Limited socio-economic benefit	Moderate cost	Moderate CO <sub>2</sub> e
Rating	3	5	3	5	5
Weighting	4	2	2	4	1
Weighted Rating	12	10	6	20	5
<b>Total</b>	<b>53</b>				

Risk Management Option	Effectiveness	Ease of Implementation	Anticipated Socio-Economic Benefit	Anticipated Relative Costs	Anticipated Carbon Footprint
Option 4: Do Nothing	Minimally Effective	No Access Required	No socio-economic benefit	Lowest cost	Lowest CO <sub>2</sub> e
Rating	1	7	1	7	7
Weighting	4	2	2	4	1
Weighted Rating	4	14	2	28	7
<b>Total</b>	<b>55</b>				

After evaluation, the options were scored as the following:

- Remediation - On-site Disposal: **43**
- Remediation - Southern Off-site Disposal: **61**
- Risk Management - Consolidate Non-Hazardous Debris: **53**
- Do Nothing - **55**

Following scoring, Southern Off-site Disposal scored the highest and is considered the recommended remedial approach for non-hazardous debris at the Site. It is noted that the Consolidate Non-Hazardous Debris option scored similar as the Do Nothing option which suggests that the consolidation of the waste does not add significant value to the project beyond leaving the waste as it is.

### 7.3 REMEDIAL OPTIONS RECOMMENDATION AND STRATEGY

Remedial options were evaluated for each area of concern and a recommended approach for each has been selected. Access to the Sites was taken into consideration through placeholder costs for mobilizing equipment to and from the Sites via overland hauling where required. The recommended options for each aspect of the Sites are as follows:

- Remediation – Dispose of off-site scored the highest and is considered the recommended remedial approach for hazardous waste at the Sites.
- Remediation – Dispose of off-site scored the highest and is considered the recommended remedial approach for non-hazardous waste at the Sites.

### **7.3.1 Hazardous Waste**

The preferred-hazardous waste remedial option is Remediation – Dispose of Off-site. Appendix A provides further details of all hazardous debris found on the Sites.

#### **7.3.1.1 Hazardous Waste – Removal Off-Site**

Residual fuel as well as waste sludge/residues produced during tank and barrel cleaning are assumed to be collected and disposed of at an approved off-site disposal facility.

The hazardous debris will be collected and placed into suitable containers or barrels and removed from all the Sites. The hazardous waste should be removed from the Sites in accordance with applicable guidelines and regulations of Authorities Having Jurisdiction and industry best practices.

The leachable lead paint found on an old drill rig located at the Asiak River Site WK154 is assumed to be remediated by removing the unit from the Site. Removal of the lead paint (if required by the disposal facility) would be done at an approved waste handling facility off-site.

### **7.3.2 Non-Hazardous Waste**

The preferred non-hazardous waste remedial option is Remediation – Dispose of Off-site. Appendix A provides further details of all hazardous debris found on the Sites.

Unpainted wood debris and old cores will be managed on-site while all other non-hazardous waste will be removed from the Sites.

#### **7.3.2.1 Non-Hazardous Wood Waste**

Clean wood is generally described as any wood material that is unpainted and/or untreated. All clean wood will be burned on-site according to guidelines in the AMSRP (Indian and Northern Affairs Canada, 2009) and the Nunavut Department of Environment – Environmental Guidelines for the Burning and Incineration of Solid Waste (Department of Environment, Government of Nunavut, 2012) which will reduce the 405 m<sup>3</sup> of non-hazardous debris to 286 m<sup>3</sup> including

approximately 12 m<sup>3</sup> of ash . Following incineration, ashes will be collected and shipped off of each Site for appropriate disposal.

### 7.3.2.2 Non-Hazardous Waste – Removal Off-Site

All non-hazardous debris is anticipated to be removed from the Sites to Kugluktuk during the summer season with the exception of the Speers Lake WK097 site where waste would be removed to Kugluktuk in the winter/early spring following waste packaging and staging in the summer season. During the staging period, all debris will be packed in mega bags, barrels, or equivalent approved containers for transportation from the Sites.

### 7.3.2.3 Non-Hazardous Waste – On-Site Management

Old drill core will be left on-site in consolidated areas. Core piles will be left as is where possible but will be managed to ensure they are left in a state that removes any safety hazards that they may pose.

## 8 IMPLEMENTATION STRATEGY

The recommended remedial approach for the hazardous and non-hazardous waste at the Sites discussed in Section 8.3 states that all waste with the exception of the rock core is to be removed from the Sites. Wastes will need to be removed and packaged for transport by the demobilization method selected by the remediation contractor selected for the completion of the work.

It is expected that the removal of hazardous and non-hazardous waste at the Sites will be implemented by a contractor familiar with the conditions and constraints of northern remote site work. The site access plan will need to be developed with suppliers/service providers familiar with accessing remote areas in this region of Nunavut. The implementation strategy of the selected remedial options may be facilitated by following a detail approach based on the Canadian National Master Construction Specification (NMS).

It is noted that the detailed implementation strategy will ultimately be determined by the successful contractor carrying out the work. The following sections outline site specific characteristics that should be considered while implementing the selected remediation options.

## 8.1 GENERAL REQUIREMENTS

The general requirements for the implementation of the recommended option are detailed in Table 19.

**Table 19: Summary of General Requirements Implementation Work Components**

General Requirement Work Component	Description
Testing Laboratory Services	Laboratory testing will be required at the Sites to confirm that each of the Sites has been acceptably remediated. Laboratory testing will also be required at on Site facilities, proposed construction facilities, and temporary controls, as needed.
Project Meetings	Project meetings will be required throughout the project. Project meetings can include but are not limited to community meetings, weekly update meetings, monthly meetings, final inspection on-site meetings, etc.
Construction Progress Schedule	A construction schedule will be prepared using a bar (GANTT) chart outlining the details of the proponents work plan. The schedule will include all work components from project start up to final inspection and will include all project meetings.
Submittal Procedures	A submittal list will be developed. The submittal list will provide a schedule of the required submittals to carry out the work.
Special Project Procedures for Contaminated Sites	<p>Special project procedures for contaminated sites will be required to varying degrees at each of the Sites. The type and extent of the procedures will depend on the quantity of waste present at the given Site. Special procedures will be required for:</p> <ul style="list-style-type: none"> <li>• Barrel and tank sampling and staging areas.</li> <li>• Equipment and personnel decontamination areas.</li> <li>• Equipment and material staging areas.</li> <li>• Debris demolition and stockpile areas.</li> <li>• Wood burning areas.</li> <li>• Wastewater storage tanks/areas.</li> </ul>
Health and Safety Requirements	It is expected that all health and safety, fire safety, and environmental compliance activities will be maintained and completed in accordance with all requirements from Authorities Having Jurisdiction and site-specific constraints. The remote locations of these Sites will be reflected in these plans.
Environmental Procedures	Site controls and procedures will be put in place to facilitate environmental components of the remedial work such as archaeological controls, waste disposal, wildlife protection plan, site maintenance, fuel storage, erosion and sediment control, drainage, work near waterways, dust and particulate control, etc.
Regulatory Requirements	The work will meet or exceed the requirements of the contract documents and the standard codes, referenced documents, regulations, and permits from Authorities Having Jurisdiction.
Quality Control	It is expected that Quality Control inspections will occur as needed on-site.
Temporary Utilities	Temporary utilities will be installed at the Sites as needed to complete the work. Temporary utilities may include water supply, temporary lighting and power, temporary heating and ventilation, and fire protection.

General Requirement Work Component	Description
Construction Facilities	The installation, removal, and use of construction facilities will be required to complete the remedial work. Adequate access at the Sites will be required to use the construction facilities. Construction facilities may include vehicles, equipment, tools, and material storage, sanitary facilities, construction signage, temporary waste storage areas, etc.
Mobilization and Demobilization	A proposed mobilization and demobilization plan will be submitted by the contractor. The mobilization and demobilization plan will detail the approach for the mobilization and demobilization to and from all of the Sites. Mobilization and demobilization strategies may include the use of fixed wing aircraft, rotary aircraft, or overland hauling during the winter. The best approach for access will be determined by the successful contractor.
Camp Facilities	Camp facilities may be required at some Sites to complete the remediation work where off-site accommodations of labour support are not feasible. Camp facilities must be established and operated in accordance with local regulations and Authorities Having Jurisdiction (AHJ).
Common Product Requirements	Equipment and materials proposed for use on-site will require the name and address of manufacturer, trade name, model number, and catalogue number, performance, descriptive test data, manufacturer's installation or application instructions, and evidence of arrangements to procure. All products and equipment will need to be stored adequately at the Sites as needed.
Survey Requirements	Surveying may be required at the Sites to confirm quantities and for general Sites feature layout. A qualified surveyor with surveying experience will be required to carry out any surveying work at the Sites.
Cleaning	The Sites should be maintained in tidy work condition, free from accumulation of waste products and debris. Waste material on-site should be transported to Temporary Waste Storage Areas after they have been processed.
Waste Management and Disposal	Ensure that waste on site is managed and disposed as per the specification for all Sites. Waste manifests and tracking will be required to confirm that wastes have been disposed of at an approved and licensed facility.
Closeout Procedures	It is expected that notification of final completion and a final inspection will be carried out for all work.
Closeout Submittals	It is expected that all closeout submittals required for the project will be provided electronically in a Project Records Document.
Winter Trails and Floating Docks	If winter trails and floating docks are selected as part of the mobilization and demobilization plan, then the locations of the winter trails and floating docks will need to be provided prior to construction. Any winter trails or floating docks will be required to abide by all regulations from Authorities having Jurisdiction.

## 8.2 EXISTING CONDITIONS

The following Table 20 summarizes the guidelines and requirements for the existing conditions of hazardous and non-hazardous debris on the Sites.

**Table 20: Summary of Existing Conditions Implementation Work Components**

Existing Conditions Work Component	Description
Waste Management – Non-hazardous Material	Non-hazardous waste material will require the demolition, burning, collection, sorting, handling, packaging/containerization, transportation, and off-site disposal of all non-hazardous debris at the Sites. It is expected that an inventory of all non-hazardous debris be kept for tracking and submittal purposes.
Hazardous Materials	Some Sites contain fuel tanks/barrels with fuel or fuel water mixture, lead based batteries, and lead based painted materials. It is expected that the hazardous materials will be processed and removed from the Sites. The hazardous material work must be carried out by experienced personnel, familiar with the Site conditions and experienced in handling and packaging these wastes for disposal. The work should be carried in accordance with all applicable guidelines and regulations.
Lead-based Paint Abatement – Minimum Precautions	It is unlikely that lead-based paint will require removal from debris on-site. However, should it be necessary, the work should be carried out in accordance with all applicable guidelines and regulations and should be completed using approved methods.

### 8.3 EARTHWORKS AND WATERWORKS

The following Table 21 outlines the requirements and guidelines required for earthworks and waterworks at the Sites for the recommended approach.

**Table 21: Summary of Earthworks and Waterworks Implementation Work Components**

Earthworks and Waterworks Work Component	Description
Aggregates for Earthworks	It is unlikely that large quantities of aggregates will be required for earthworks at the Sites. For rough grading and Site access improvement purposes, aggregate should be sourced from pre-approved locations at the Sites. All aggregate production and use will be required to abide by a Land Use Permit and all other permitting as required by Authorities Having Jurisdiction. A general overview of the available aggregate material is provided in Section 4.3.
Rough Grading	Rough grading will be required at the Sites for a variety of reasons including but not limited to the following: <ul style="list-style-type: none"> <li>• Development, maintenance, and restoration of Borrow Material source areas.</li> <li>• Grading of depressions created by the removal of debris.</li> <li>• Development, maintenance, removal and/or closure of temporary access trails.</li> <li>• Maintenance, removal and/or closure of temporary waste storage areas (TWSA) and Hazardous Waste Materials Processing Areas.</li> <li>• Maintenance, removal and/or closure of temporary camp area.</li> <li>• General Site areas requiring regrading and reshaping.</li> </ul>

Earthworks and Waterworks Work Component	Description
Preservation of Watercourses and Wetlands	The preservation of watercourses and wetlands is required for work in areas adjacent to and/or within watercourses and wetlands. Procedures will need to be provided to minimize any impacts to these aquatic environments.

Detailed requirements for the implementation of the recommended remedial approach will be provided in detailed design specifications and drawings in support of a future tendering process for the completion of the work.

## 9 ENGAGEMENT

Representatives of CIRNAC, PSPC and JV-60 participated in a community-level RAP Workout Presentations in the hamlet of Kugluktuk, Nunavut on October 22, 2024. Over 70 community members were in attendance along with young adults and children. The meeting included a presentation which provided an overview of the project, work completed to date, the proposed remediation/risk management options and recommended options for each waste stream based on the outcome of the evaluation. A video showing aerial footage of each of the seven sites was also presented. Discussion was encouraged through a question-and-answer period following the presentation. Translation to Inuinnaqtun was provided during the presentation and the question-and-answer period.

The discussion provided local insight pertaining to the proposed remedial approach for the Sites. During the community engagement session, CIRNAC outlined a plan for the removal of all hazardous material and non-hazardous material off-site for disposal excluding the concrete pad at the Coppermine WK199 site and rock cores located at the Speers Lake WK097 site, Coppermine WK199 site, and Tahiapik WK170 site. Community members provided feedback on the Sites including information regarding site history, general feedback regarding the state of the Sites and also ideas for site access to support the remediation including the hiring of local residents to travel over land by snowmobile to remove the waste. Feedback received also emphasized the importance of handling the hazardous materials like fuels, batteries and lead paint appropriately to protect human and ecological health. No opposition to the proposed remedial action plan was indicated by those attending and the general feedback was positive that the Sites will be cleaned up.

Hard copies of the presentation in both English and Inuinnaqtun were provided to the Kugluktuk Angoniatit Association following the meeting. Engagement Meeting Minutes and Attendance sheet is provided in Appendix D

## **10 CLOSING AND LIMITING CONDITIONS STATEMENTS**

The Preliminary Remedial Options Assessment has been conducted using industry-standard best methods and practices. All data incorporated in the risk assessment were collected or assembled by BluMetric Environmental Inc as part of the BLM-KEL-60 Corporation joint venture. The ROA has been prepared following the scope of work developed by Public Services and Procurement Canada (PSPC) on behalf of Indigenous Northern Affairs Canada and information provided by PSPC and Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) regarding Site use and the findings of the Phase III ESA (BLM-KEL-60, 2024b), and HHERA (CanNorth, 2024). The ROA is valid for the intended Site use and practices at the time of writing. The ROA assumptions were based on the findings and conclusions of the Phase III ESA, HHERA and information received from suppliers, service providers and logistical support. This information should be validated accordingly with any intended or actual Site use changes.

The observations and results obtained during the investigation are representative of the conditions encountered at the sampling locations and at the time of the investigation only. No information presented in this report should be interpreted as being indicative of conditions elsewhere on the property. The statements made in this report are based solely on the information obtained to date as part of the above-referenced investigations. BluMetric has used its professional judgment in analyzing this information and formulating its conclusions. No other warranty or representation expressed or implied, as to the accuracy of the information or recommendations is included or intended in this report.

BLM-KEL-60 Corporation makes no warranty as to the accuracy or completeness of the information provided by others, or of conclusions and recommendations predicated on the accuracy of that information.

This report has been prepared for PSPC on behalf of CIRNAC. Any use a third party makes of this report, any reliance on the report, or decisions based upon the report, are the responsibility of those third parties unless authorization is received by BLM-KEL-60 Corporation in writing.

BLM-KEL-60 Corporation accepts no responsibility for any loss or damages suffered by any unauthorized third party as a result of decisions made or actions taken based on this report.

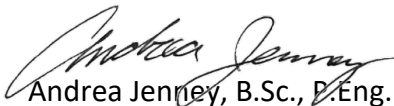
Respectfully submitted,  
**BLM-KEL-60 Corporation**



Stephen Anderson, M.Sc.  
Environmental Scientist



Brett Webster, B.A.Sc.  
Environmental Scientist



Andrea Jenney, B.Sc., P.Eng. (NT/NU)  
Senior Environmental Engineer



## 11 REFERENCES

- BLM-KEL-60 Corp, *Archaeological Impact Assessment (AAI) At Speers Lake (WK097), Land-Use Study and Archaeological Potential Evaluation of Six Additional Sites (WK154, WK165, WK170, WK176, WK199, WK210), Vicinity of Kugluktuk (Kitikmeot Region, Nunavut)*, March 2024a.
- BLM-KEL-60 Corp, *Phase III Environmental Site Assessment, Speers Lake Sites, Kitikmeot Region, Nunavut*, March 2024b.
- Bush, E., & Lemmen, D. S. (2019). *Canada's Changing Climate Report; Government of Canada, Ottawa, ON. 444 p.*
- Canada North Environmental Services. (2024). *Human Health and Ecological Risk Assessment, Speers Lake Sites, Nunavut (4243)*.
- Department of Environment, Government of Nunavut. (2012). *Environmental Guideline for the Burning and Incineration of Solid Waste*.
- Indian and Northern Affairs Canada. (2009). *Abandoned Military Site Remediation Protocol*.
- TREK Geotechnical Inc. (2023). *Speers Lake Sites, NU, Geotechnical Assessment Reports (0154-039-01)*.

## FIGURES



**LEGEND**

★ Site Locations

1				
REV.	DESCRIPTION	YY/MM/DD	BY	CHK

**REFERENCES**  
 PROPRIETARY INFORMATION MAY NOT BE REPRODUCED OR DIVULGED WITHOUT PRIOR WRITTEN CONSENT OF BLUMETRIC ENVIRONMENTAL INC. DO NOT SCALE DRAWING. THIS DRAWING MAY HAVE BEEN REDUCED. ALL SCALE NOTATIONS INDICATED ARE BASED ON 11"x17" FORMAT DRAWINGS.

**CLIENT**  
**Public Services and Procurement Canada**

**PROJECT**  
**Remedial Action Plan Speers Lake Sites  
 Kitikmeot Region, Nunavut**

**TITLE**  
**Site Locations**

**BLM-KEL-60**  
 A Kitikmeot JV Corporation  
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 30b Mitik Street Cambridge Bay, NU X0B 0C0

<b>PROJECT #</b> 230468		<b>DATE</b> November 08, 2024	
<b>DRAWN</b> PB	<b>CHECKED</b> JK	<b>FIG NO.</b> 01	<b>REV</b> 0



**LEGEND**

- North Site Outline
- South Site Outline
- Intermediate Contour (0.5 m)
- Major Contour (1 m)
- Approximate CAT Train Trail
- Site Locations

1				
REV.	DESCRIPTION	YY/MM/DD	BY	CHK

**REFERENCES**  
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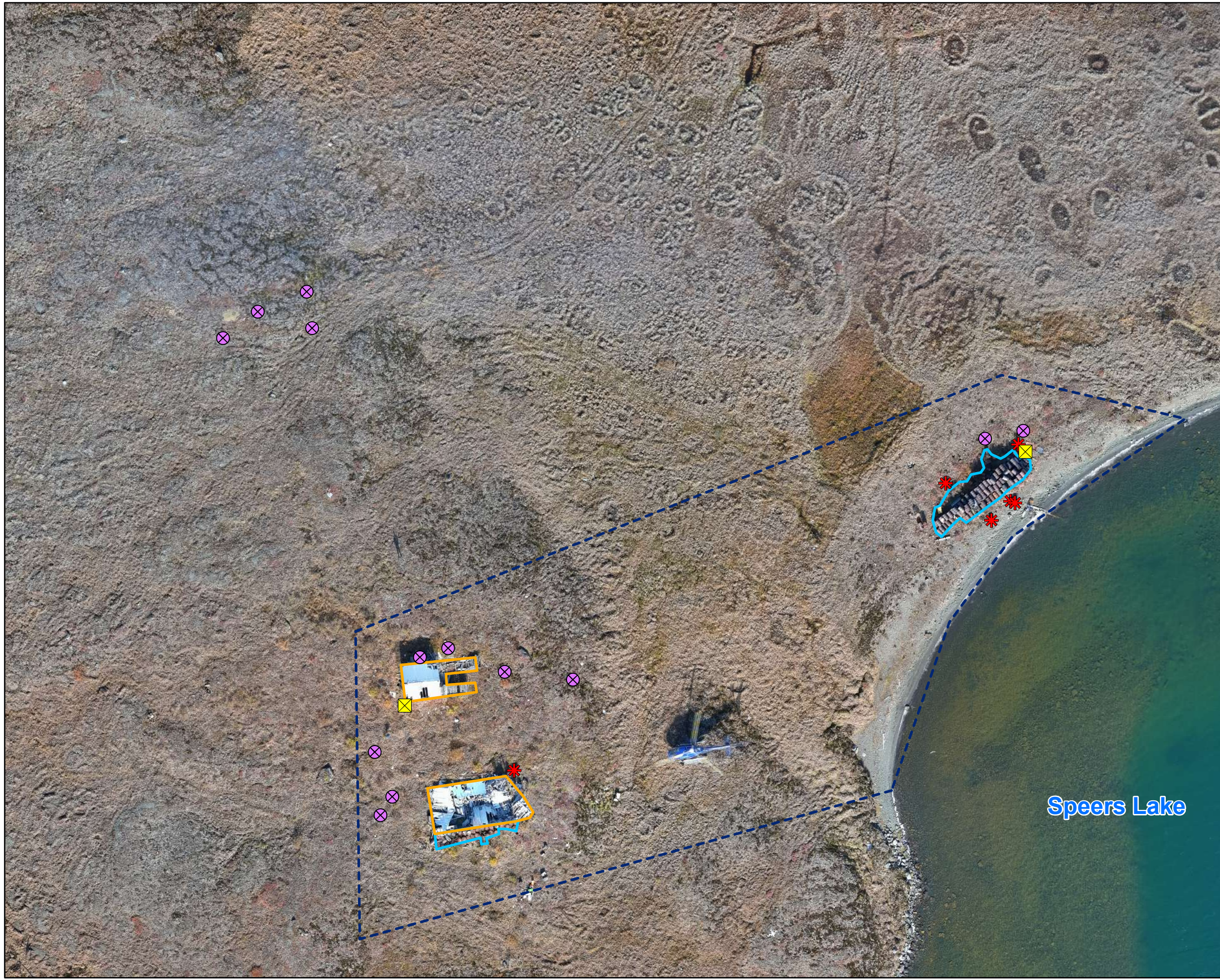
**CLIENT**  
 Public Services and Procurement Canada

**PROJECT**  
 Remedial Action Plan Speers Lake Sites  
 Kitikmeot Region, Nunavut

**TITLE**  
 Speers Lake (WK097)  
 Site Location

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<b>PROJECT #</b> 230468		<b>DATE</b> September 17, 2024	
<b>DRAWN</b> PB	<b>CHECKED</b> SA	<b>FIG NO.</b> 02	<b>REV</b> 0



**LEGEND**

- North Site Outline
- X Debris
- \* Barrel
- Lead Batteries
- Barrel Cache
- Former Structure

1				
REV.	DESCRIPTION	YY/MM/DD	BY	CHK

**REFERENCES**  
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**PROJECT**

**Remedial Action Plan Speers Lake Sites  
Kitikmeot Region, Nunavut**

**TITLE**

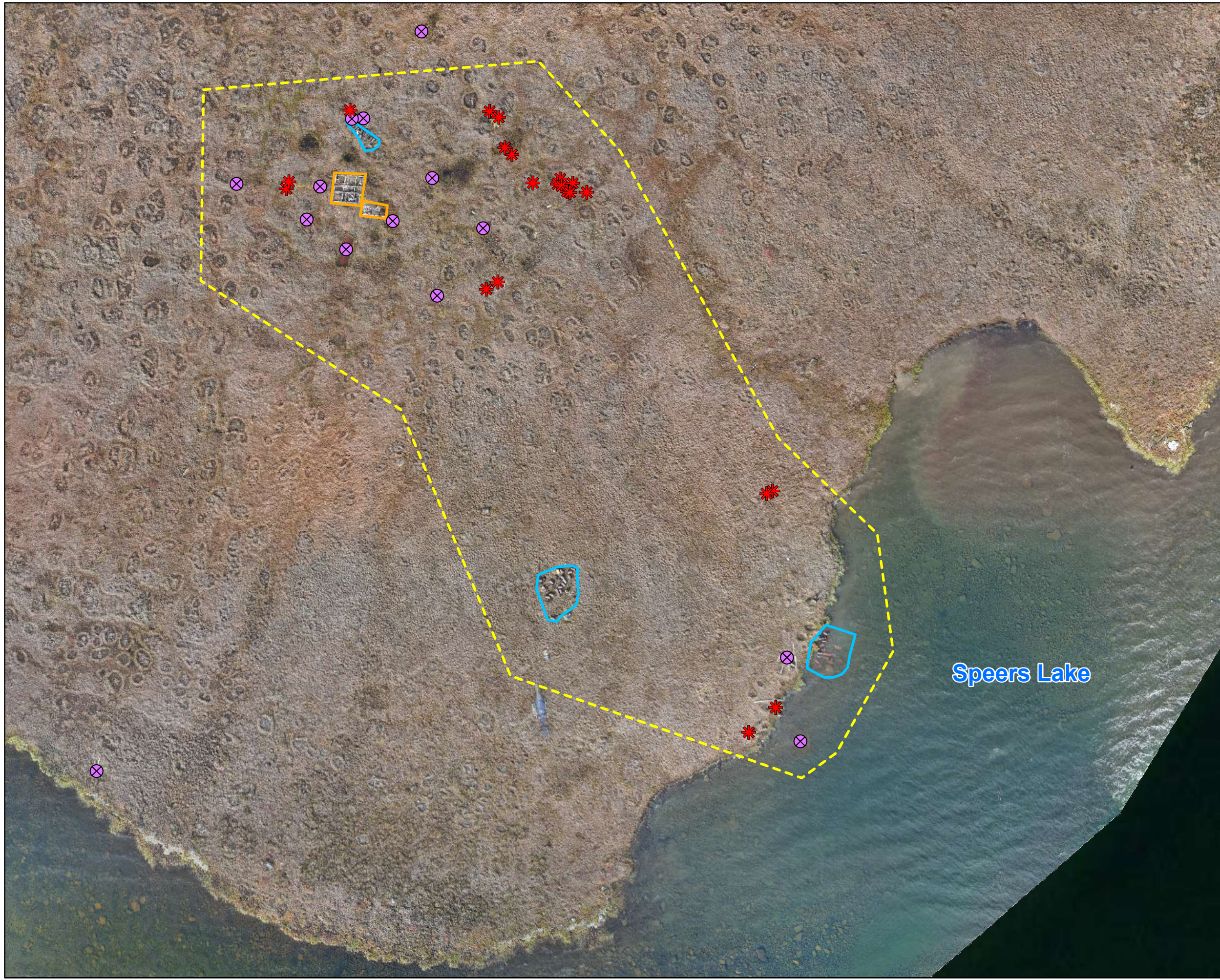
**Speers Lake (WK097)  
North Area Site Features**

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<b>PROJECT #</b> 230468	<b>DATE</b> October 01, 2024
<b>DRAWN</b> PB	<b>CHECKED</b> SA
<b>FIG NO.</b> 03	<b>REV</b> 0



**LEGEND**

- South Site Outline
- X Debris
- \* Barrel
- Barrel Cache
- Former Structure

1				
REV.	DESCRIPTION	YY/MM/DD	BY	CHK

**REFERENCES**  
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0 5 10 15 20 25 Metres

1:750

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**PROJECT**

**Remedial Action Plan Speers Lake Sites  
Kitikmeot Region, Nunavut**

**TITLE**

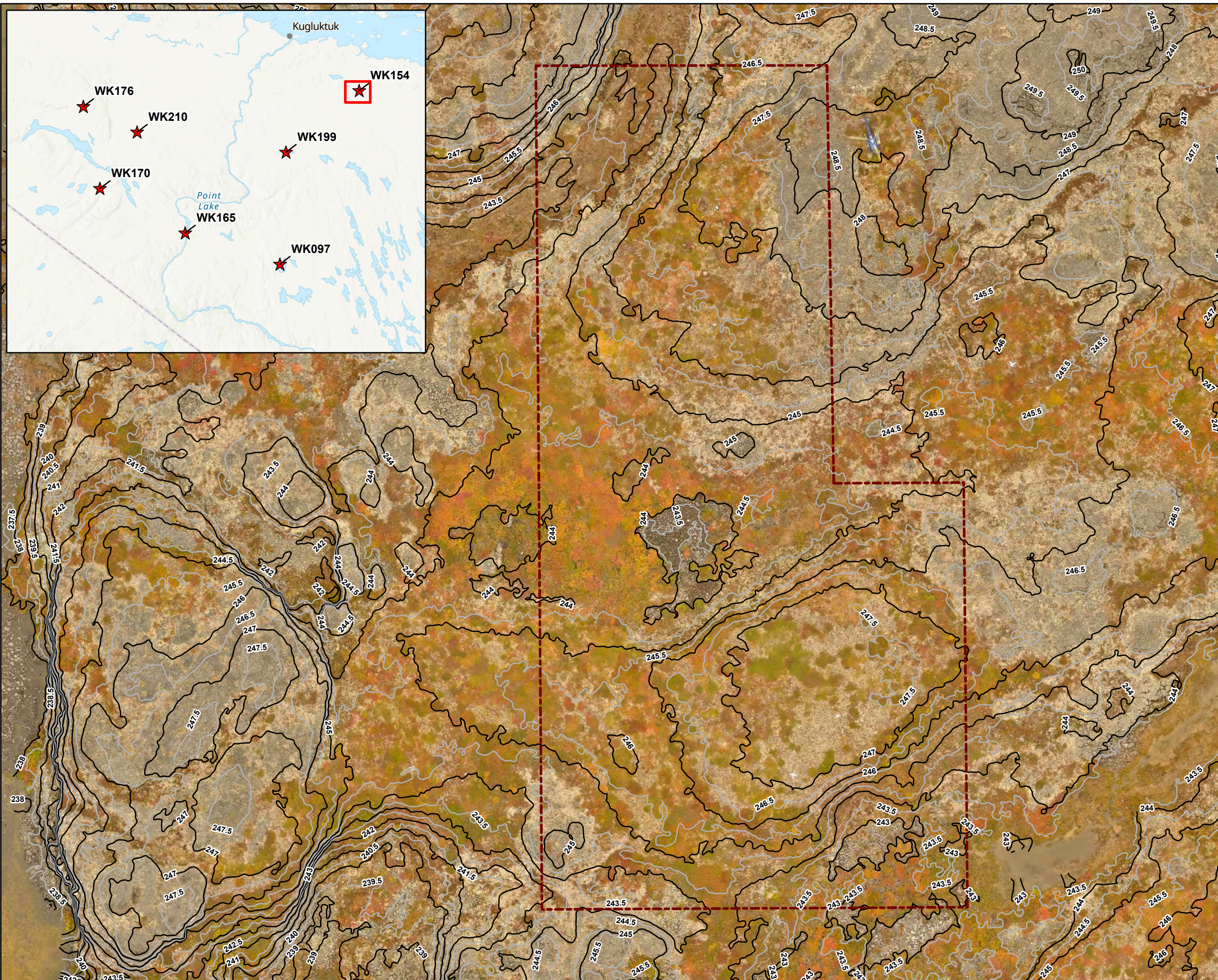
**Speers Lake (WK097)  
South Site Features**

**BLM-KEL-60**

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<b>PROJECT #</b> 230468	<b>DATE</b> October 01, 2024
<b>DRAWN</b> PB	<b>CHECKED</b> SA
<b>FIG NO.</b> 04	<b>REV</b> 0



**LEGEND**

- Site Boundary (approximate)
- Intermediate Contour (0.5 m)
- Major Contour (1 m)
- Site Locations

REV.	DESCRIPTION	YY/MM/DD	BY	CHK
1				

**REFERENCES**  
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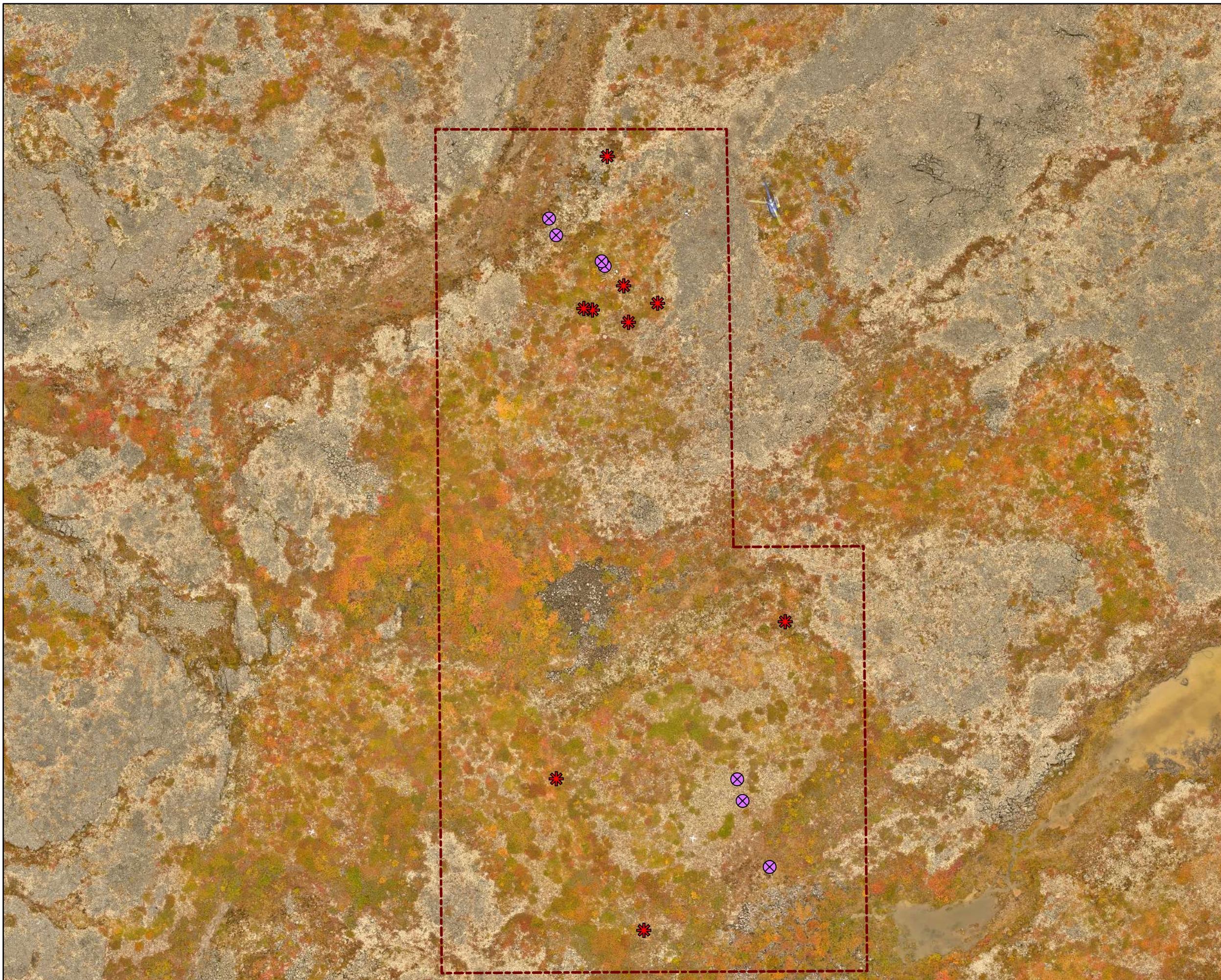
**CLIENT**  
 Public Services and Procurement Canada

**PROJECT**  
 Remedial Action Plan Speers Lake Sites  
 Kitikmeot Region, Nunavut




**TITLE**  
 Asiak River Site (WK154)  
 Site Location

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<b>DRAWN</b> PB	<b>CHECKED</b> SA	<b>FIG NO.</b> 05	<b>REV</b> 0



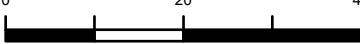
**LEGEND**

-  Site Boundary (approximate)
-  Debris
-  Barrel


1				
REV.	DESCRIPTION	YY/MM/DD	BY	CHK

**REFERENCES**  
PROPRIETARY INFORMATION MAY NOT BE REPRODUCED OR DIVULGED WITHOUT PRIOR WRITTEN CONSENT OF BLUMETRIC ENVIRONMENTAL INC. DO NOT SCALE DRAWING. THIS DRAWING MAY HAVE BEEN REDUCED. ALL SCALE NOTATIONS INDICATED ARE BASED ON 11"x17" FORMAT DRAWINGS.

0      20      40 Metres



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**PROJECT**

**Remedial Action Plan Speers Lake Sites  
Kitikmeot Region, Nunavut**

**TITLE**

**Asiak River Site (WK154)  
Site Features**

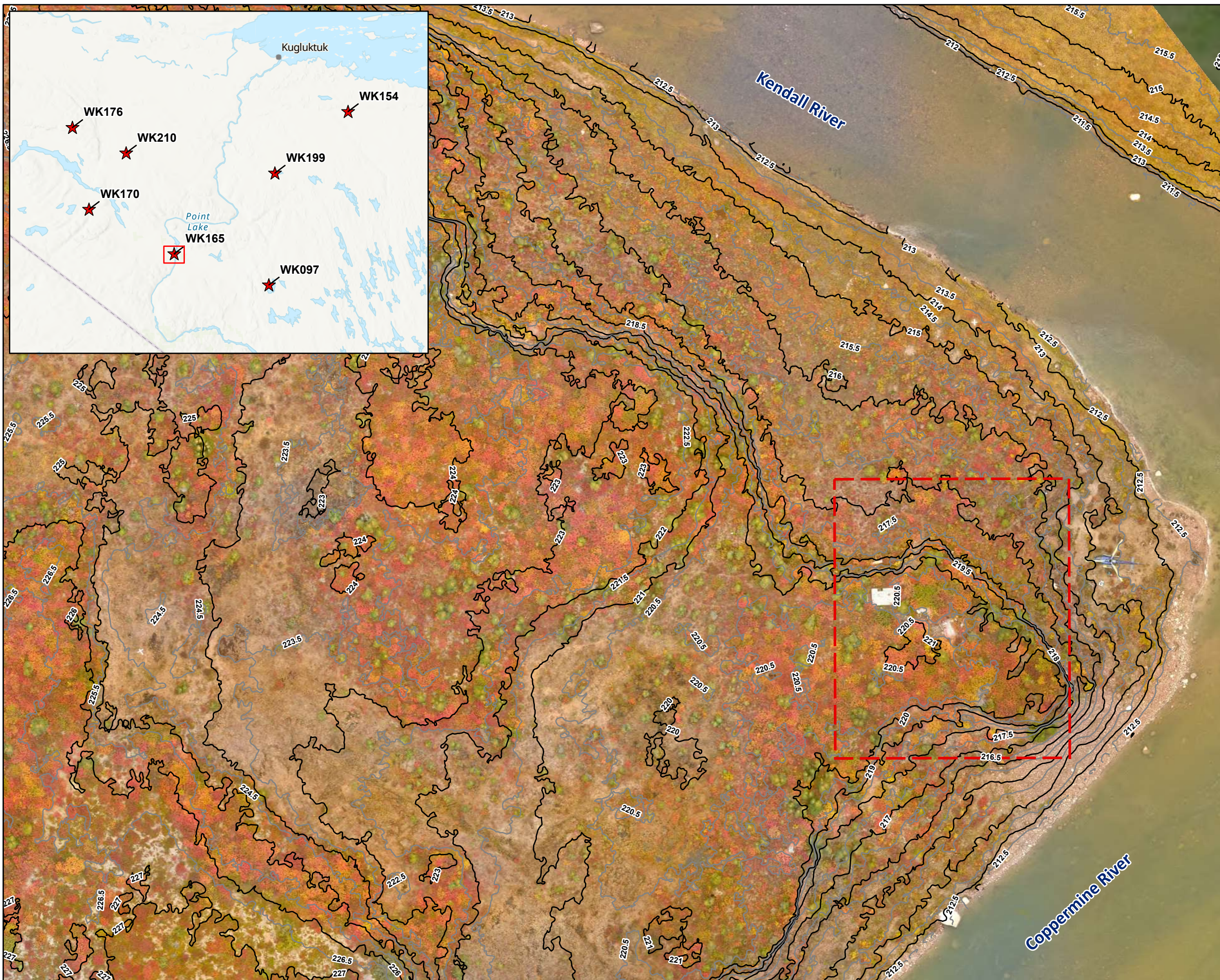


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
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<b>PROJECT #</b> 230468		<b>DATE</b> October 01, 2024	
<b>DRAWN</b> PB	<b>CHECKED</b> SA	<b>FIG NO.</b> 06	<b>REV</b> 0

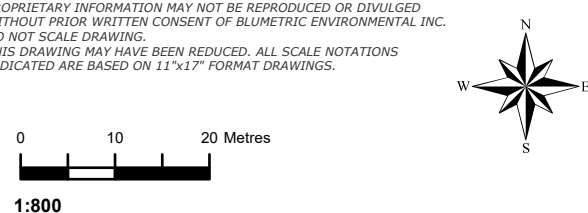


LEGEND

-  Site Area (Approximate)
-  Intermediate Contour (0.5 m)
-  Major Contour (1 m)
-  Site Locations

REV.	DESCRIPTION	YY/MM/DD	BY	CHK
1				

**REFERENCES**  
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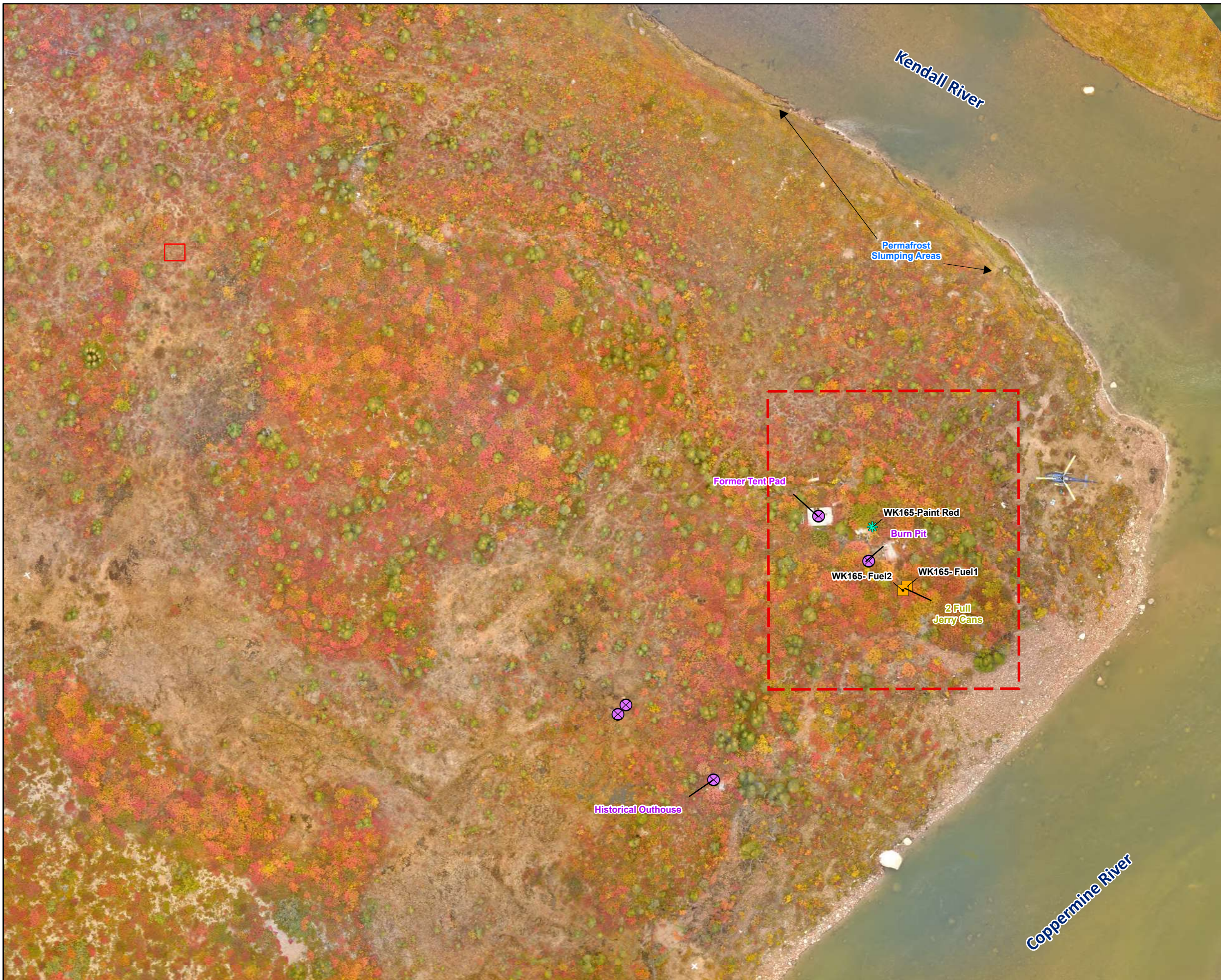
**PROJECT**  
 Remedial Action Plan Speers Lake Sites  
 Kitikmeot Region, Nunavut

**TITLE**  
 Kendall River Site (WK165)  
 Site Location



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<b>DRAWN</b> PB	<b>CHECKED</b> SA	<b>FIG NO.</b> 07	<b>REV</b> 0



LEGEND

- Site Area (Approximate)
- ⊗ Debris
- Fuel Sample Location
- ★ Paint Sample Location

1				
REV.	DESCRIPTION	YY/MM/DD	BY	CHK

**REFERENCES**  
PROPRIETARY INFORMATION MAY NOT BE REPRODUCED OR DIVULGED WITHOUT PRIOR WRITTEN CONSENT OF BLUMETRIC ENVIRONMENTAL INC. DO NOT SCALE DRAWING. THIS DRAWING MAY HAVE BEEN REDUCED. ALL SCALE NOTATIONS INDICATED ARE BASED ON 11"x17" FORMAT DRAWINGS.

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**PROJECT**

**Remedial Action Plan Speers Lake Sites  
Kitikmeot Region, Nunavut**

**TITLE**

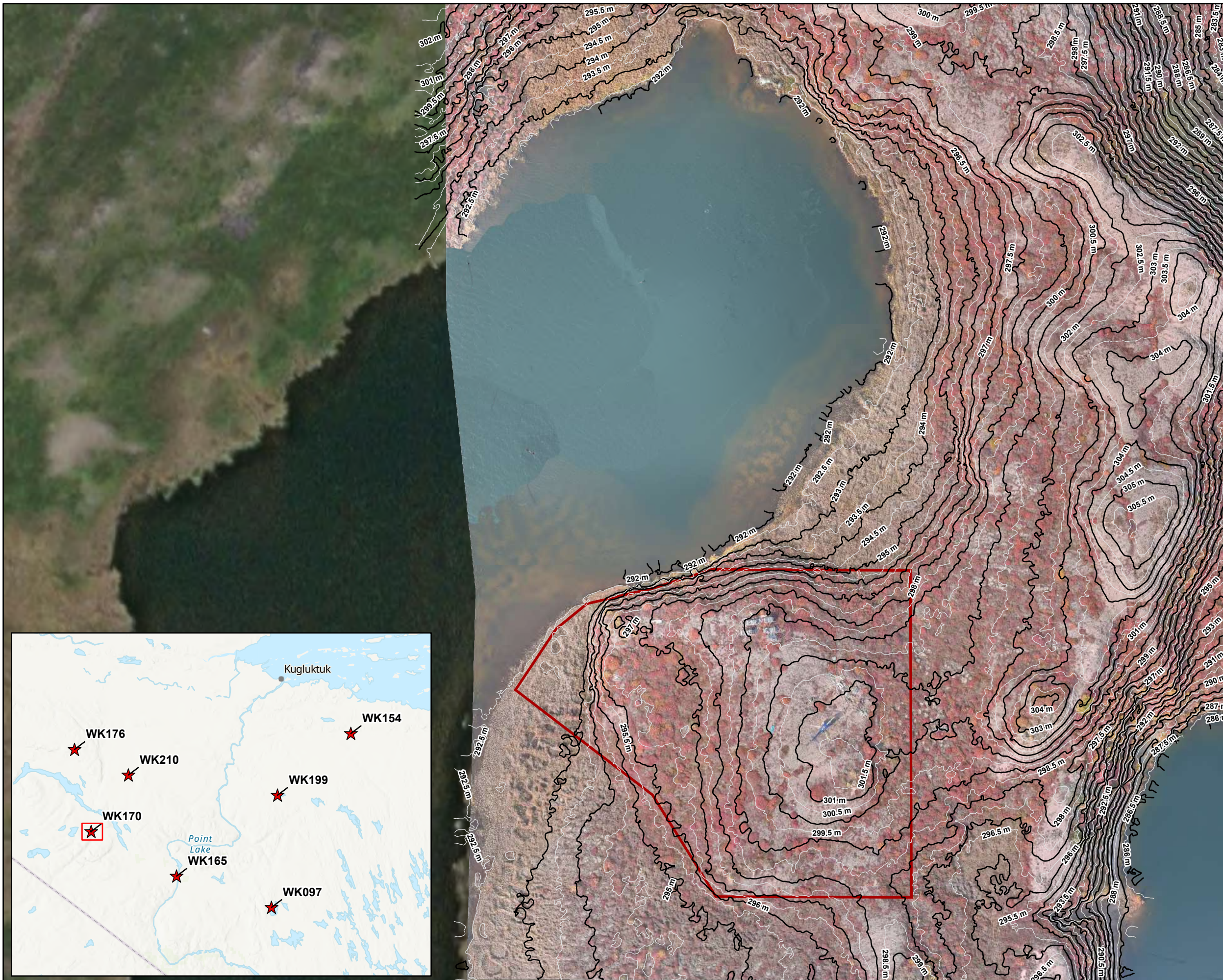
**Kendall River Site (WK165)  
Site Features**

**BLM-KEL-60**

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<b>PROJECT #</b> 230468	<b>DATE</b> September 17, 2024		
<b>DRAWN</b> PB	<b>CHECKED</b> SA	<b>FIG NO.</b> 08	<b>REV</b> 0



**LEGEND**

- Site Area (Approximate)
- Intermediate Contour (0.5 m)
- Major Contour (1 m)
- ★ Site Locations

1				
REV.	DESCRIPTION	YY/MM/DD	BY	CHK

**REFERENCES**

PROPRIETARY INFORMATION MAY NOT BE REPRODUCED OR DIVULGED WITHOUT PRIOR WRITTEN CONSENT OF BLUMETRIC ENVIRONMENTAL INC. DO NOT SCALE DRAWING. THIS DRAWING MAY HAVE BEEN REDUCED. ALL SCALE NOTATIONS INDICATED ARE BASED ON 11"x17" FORMAT DRAWINGS.

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**CLIENT**

**Public Services and Procurement Canada**

**PROJECT**

**Remedial Action Plan Speers Lake Sites  
Kitikmeot Region, Nunavut**

**TITLE**

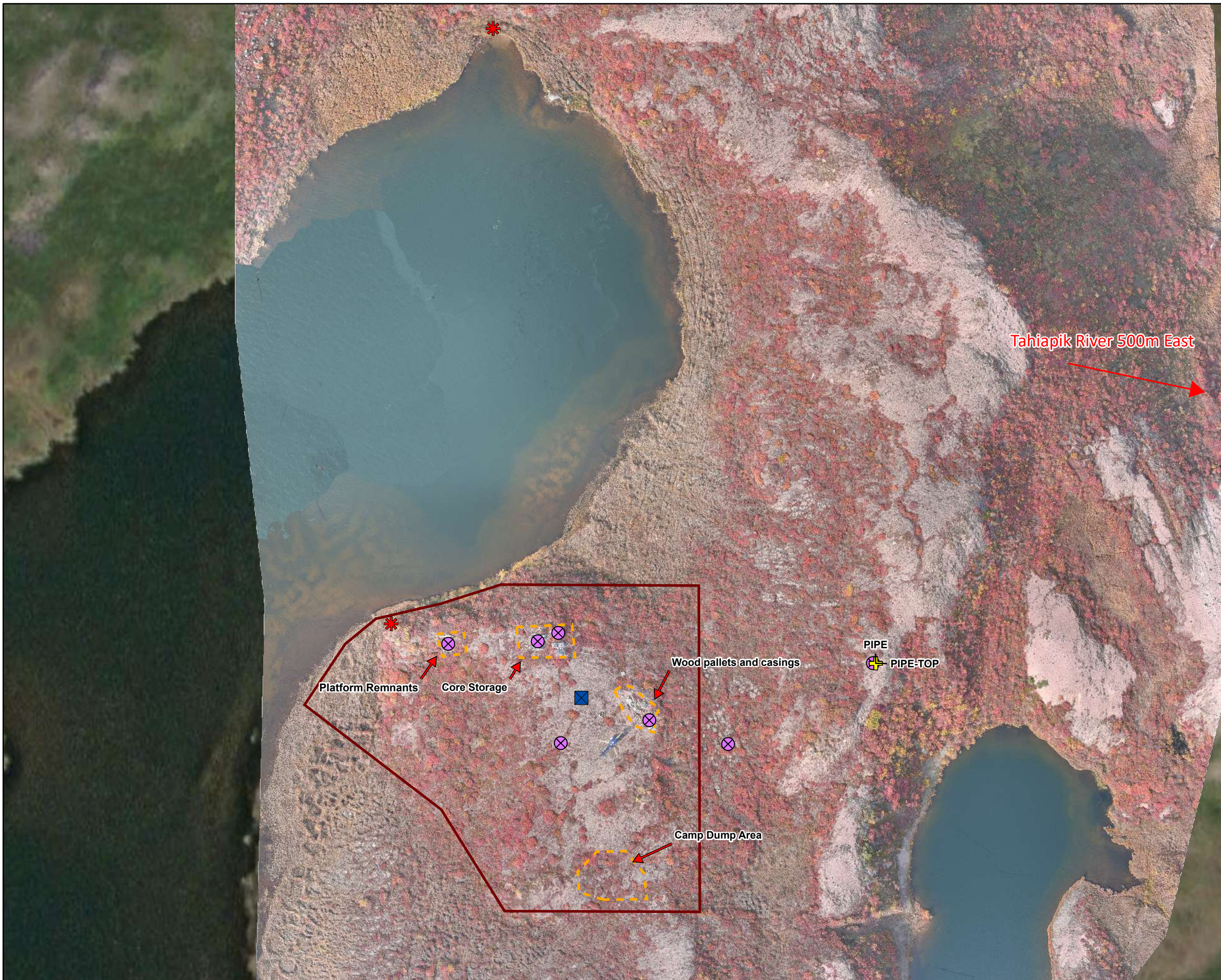
**Tahiapik River (WK170)  
Site Location**

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<b>PROJECT #</b> 230468	<b>DATE</b> September 17, 2024		
<b>DRAWN</b> PB	<b>CHECKED</b> SA	<b>FIG NO.</b> 09	<b>REV</b> 0



**LEGEND**

- Site Area (Approximate)
- Site Feature Areas
- + Site Feature
- Burn Pit
- ⊗ Debris
- ✱ Barrel

1				
REV.	DESCRIPTION	YY/MM/DD	BY	CHK

**REFERENCES**  
PROPRIETARY INFORMATION MAY NOT BE REPRODUCED OR DIVULGED WITHOUT PRIOR WRITTEN CONSENT OF BLUMETRIC ENVIRONMENTAL INC. DO NOT SCALE DRAWING. THIS DRAWING MAY HAVE BEEN REDUCED. ALL SCALE NOTATIONS INDICATED ARE BASED ON 11"x17" FORMAT DRAWINGS.

0      20      40 Metres

1:1,250

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**Public Services and Procurement Canada**

**PROJECT**

**Remedial Action Plan Speers Lake Sites  
Kitikmeot Region, Nunavut**

**TITLE**

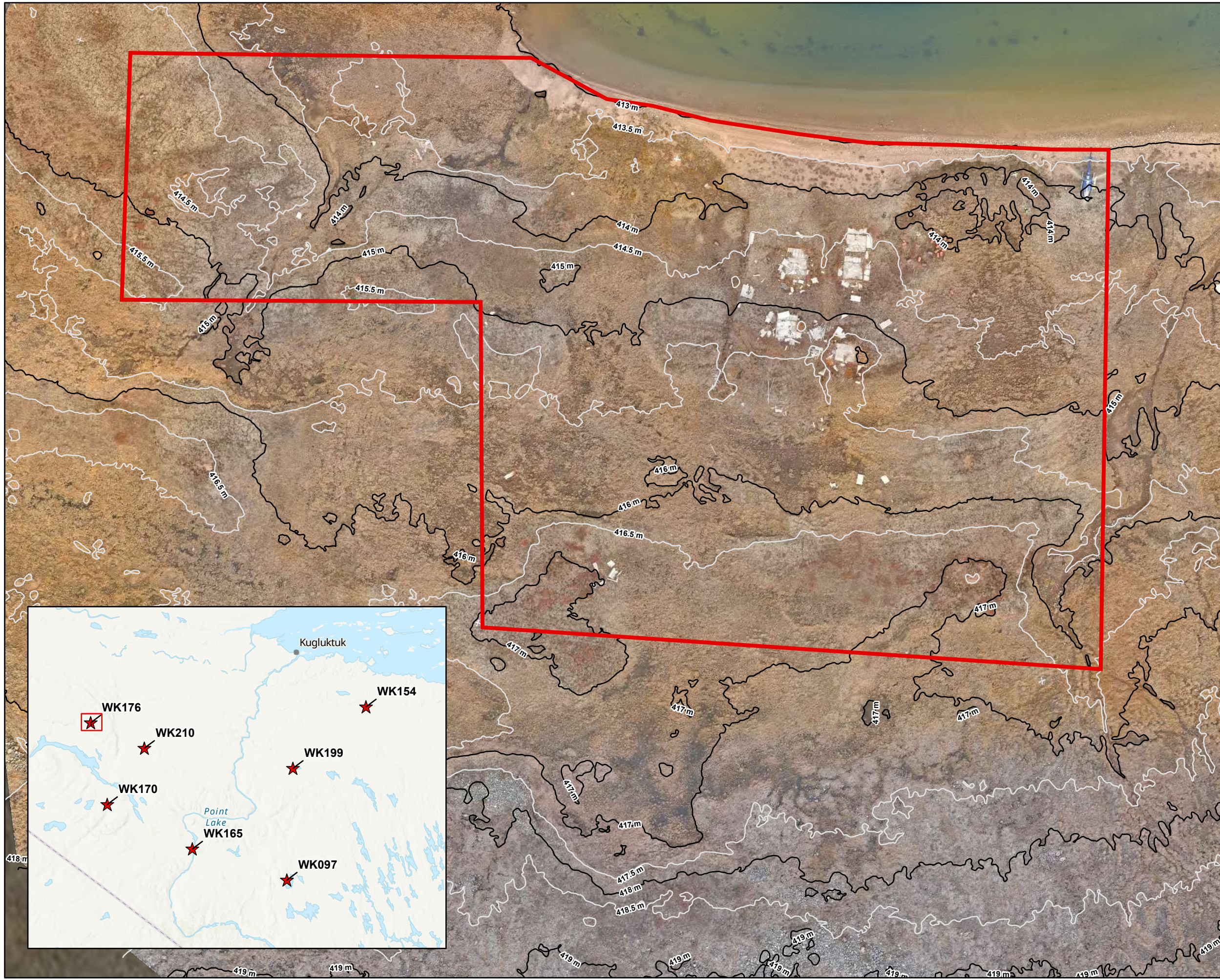
**Tahiapik River Site (WK170)  
Site Features**

**BLM-KEL-60**

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30b Mitik Street Cambridge Bay, NU X0B 0C0

<b>PROJECT #</b> 230468	<b>DATE</b> October 01, 2024		
<b>DRAWN</b> PB	<b>CHECKED</b> SA	<b>FIG NO.</b> 10	<b>REV</b> 0



**LEGEND**

- ★ Site Locations
- Site Area (Approximate)
- Intermediate Contour (0.5 m)
- Major Contour (1 m)

1				
REV.	DESCRIPTION	YY/MM/DD	BY	CHK

**REFERENCES**  
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1:750

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**Remedial Action Plan Speers Lake Sites  
Kitikmeot Region, Nunavut**

**TITLE**

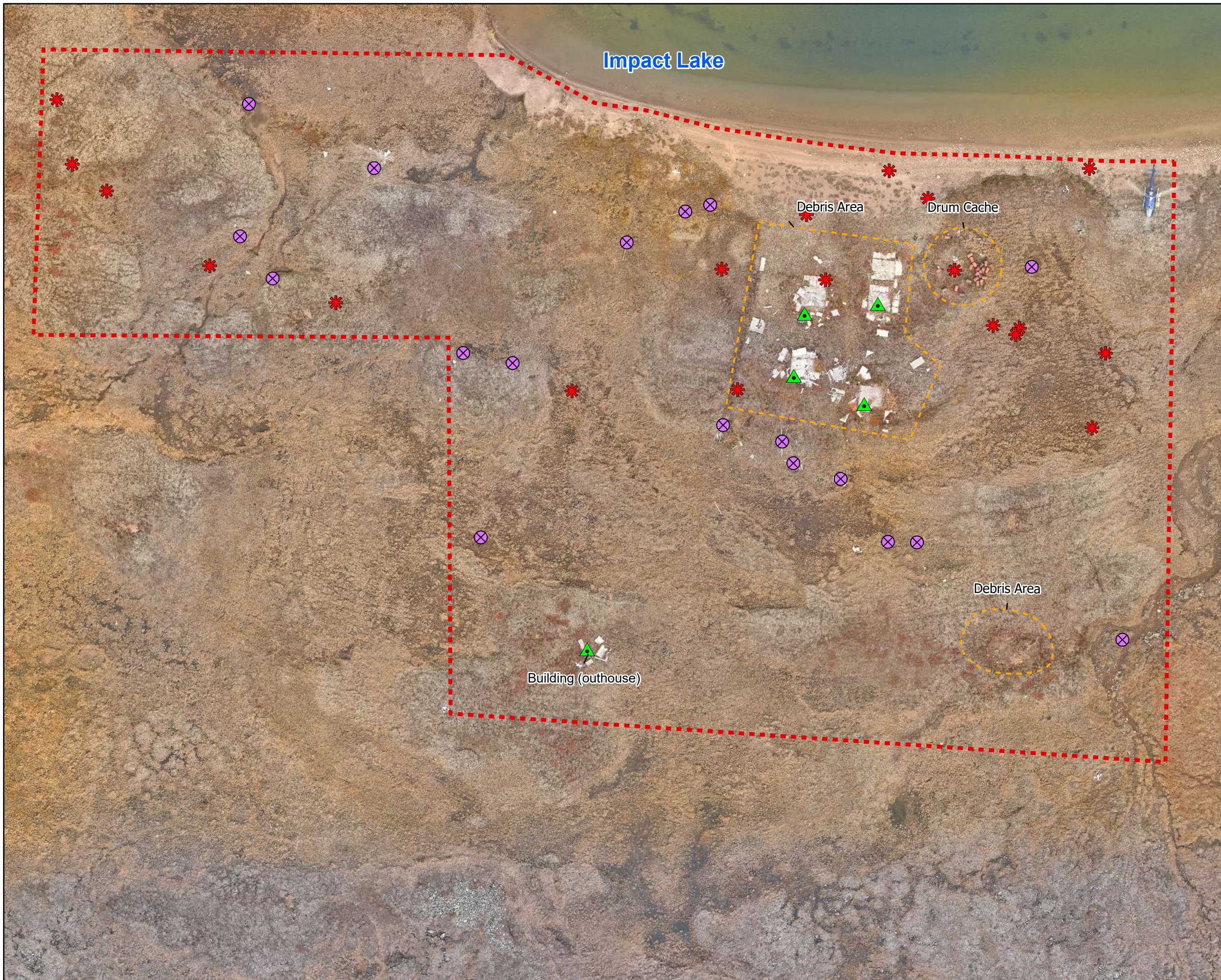
**Impact Lake Site (WK176)  
Site Location**

**BLM-KEL-60**






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BluMetric • KBL • Accutech

30b Mitik Street Cambridge Bay, NU X0B 0C0

PROJECT #	DATE		
<b>230468</b>	<b>September 17, 2024</b>		
DRAWN	CHECKED	FIG NO.	REV
<b>PB</b>	<b>AJ</b>	<b>11</b>	<b>0</b>



**LEGEND**


-  Barrel
-  Former Structure
-  Debris
-  Site Area (Approximate)
-  WK176 Site Feature Areas

1				
REV.	DESCRIPTION	YY/MM/DD	BY	CHK

**REFERENCES**  
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0 10 20 Metres

1:650



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**PROJECT**

**Remedial Action Plan Speers Lake Sites  
Kitikmeot Region, Nunavut**

**TITLE**

**Impact Lake Site (WK176)  
Site Features**



BLM-KEL-60

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<b>PROJECT #</b> 230468		<b>DATE</b> October 01, 2024	
<b>DRAWN</b> PB	<b>CHECKED</b> AJ	<b>FIG NO.</b> 12	<b>REV</b> 0



**LEGEND**

- Site Area (Approximate)
- Intermediate Contour (0.5 m)
- Major Contour (1 m)
- ★ Site Locations

1				
REV.	DESCRIPTION	YY/MM/DD	BY	CHK

**REFERENCES**  
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0 10 20 Metres

1:500

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**PROJECT**

**Remedial Action Plan Speers Lake Sites  
Kitikmeot Region, Nunavut**

**TITLE**

**Coppermine Area Site (WK199)  
Site Location**

**BLM-KEL-60**

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<b>PROJECT #</b> 230468	<b>DATE</b> September 17, 2024		
<b>DRAWN</b> PB	<b>CHECKED</b> SA	<b>FIG NO.</b> 13	<b>REV</b> 0



LEGEND

Site Area (Approximate)

Site Features

- Debris
- Barrel
- Concrete Pad
- Burn Pit
- Machinery
- Drill Core
- Tank

1				
REV.	DESCRIPTION	YY/MM/DD	BY	CHK

**REFERENCES**  
 PROPRIETARY INFORMATION MAY NOT BE REPRODUCED OR DIVULGED WITHOUT PRIOR WRITTEN CONSENT OF BLUMETRIC ENVIRONMENTAL INC. DO NOT SCALE DRAWING. THIS DRAWING MAY HAVE BEEN REDUCED. ALL SCALE NOTATIONS INDICATED ARE BASED ON 11"x17" FORMAT DRAWINGS.

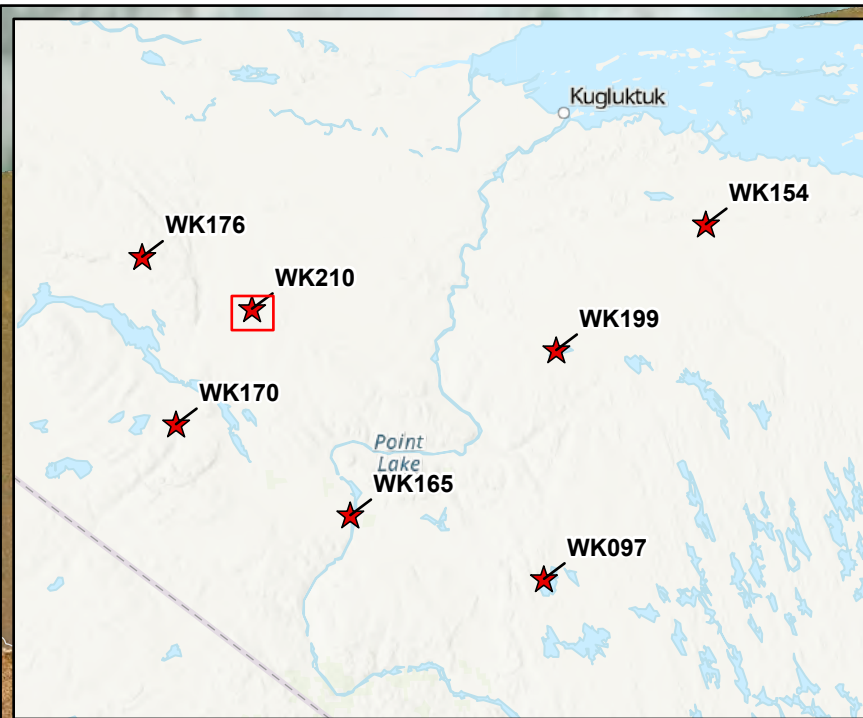
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**Public Services and Procurement Canada**

PROJECT  
**Remedial Action Plan Speers Lake Sites  
 Kitikmeot Region, Nunavut**

TITLE  
**Coppermine Area Site (WK199)  
 Site Features**

**BLM-KEL-60**  
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PROJECT # <b>230468</b>	DATE <b>October 01, 2024</b>
DRAWN <b>PB</b>	CHECKED <b>SA</b>
FIG NO. <b>14</b>	REV <b>0</b>



**LEGEND**

- Site Boundary
- Intermediate Contour (0.5 m)
- Major Contour (1 m)
- ★ Site Locations

1				
REV.	DESCRIPTION	YY/MM/DD	BY	CHK

**REFERENCES**  
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1:750

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**PROJECT**

**Remedial Action Plan Speers Lake Sites  
Kitikmeot Region, Nunavut**

**TITLE**

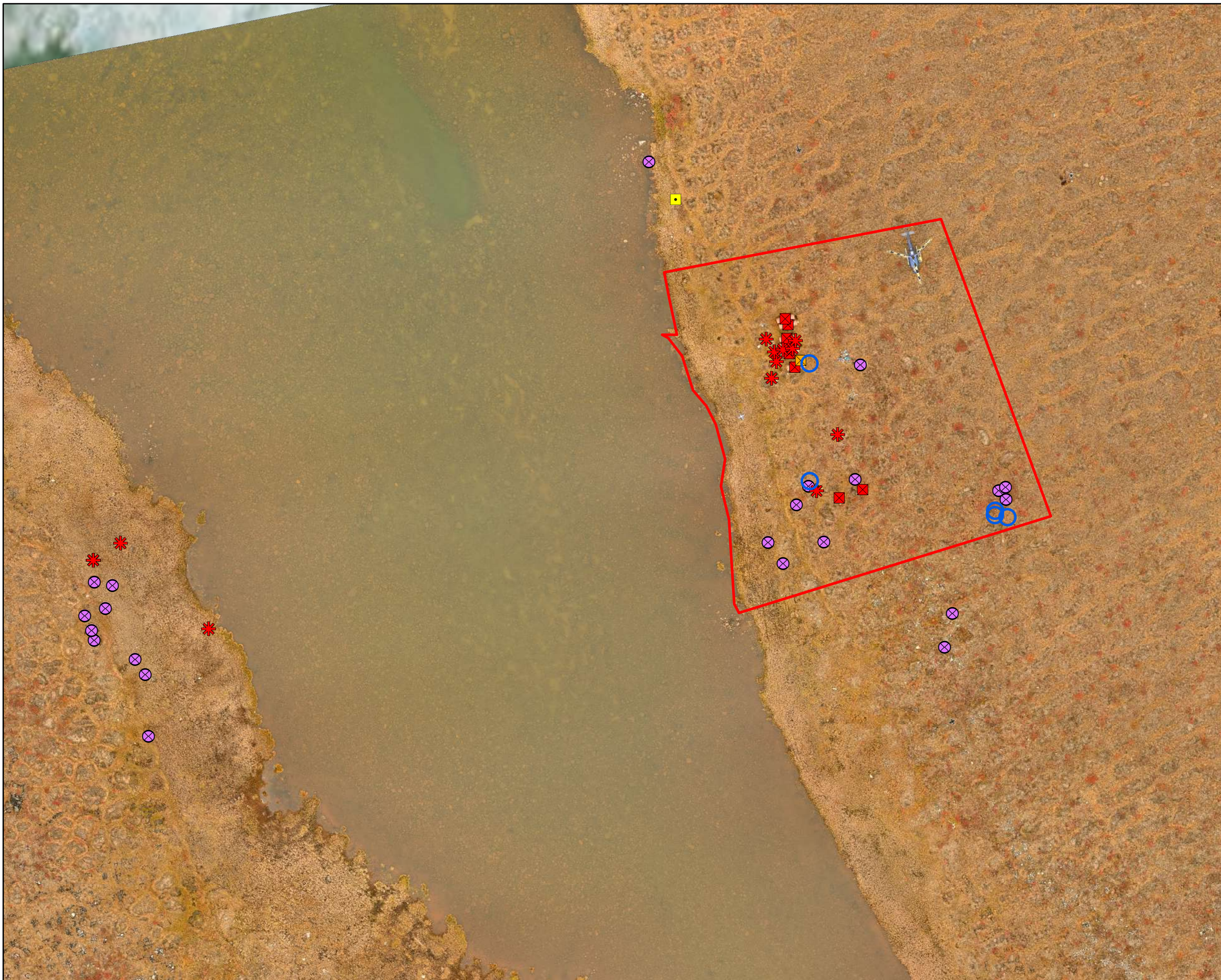
**Coppermine Area Site (WK210)  
Site Location**

**BLM-KEL-60**

A Kitikmeot JV Corporation  
BluMetric • KBL • Accutech

30b Mitik Street Cambridge Bay, NU X0B 0C0

PROJECT #	DATE		
<b>230468</b>	<b>November 08, 2024</b>		
DRAWN	CHECKED	FIG. NO.	REV
<b>PB</b>	<b>SA</b>	<b>15</b>	<b>0</b>



**LEGEND**

- Site Boundary (approximate)
- ⊗ Debris
- ⊠ Tank
- ✱ Barrel
- Gas Cylinder
- Jerry Can
- Mini-Barrel

1				
REV.	DESCRIPTION	YY/MM/DD	BY	CHK

**REFERENCES**  
PROPRIETARY INFORMATION MAY NOT BE REPRODUCED OR DIVULGED WITHOUT PRIOR WRITTEN CONSENT OF BLUMETRIC ENVIRONMENTAL INC. DO NOT SCALE DRAWING. THIS DRAWING MAY HAVE BEEN REDUCED. ALL SCALE NOTATIONS INDICATED ARE BASED ON 11"x17" FORMAT DRAWINGS.

1:750

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**Public Services and Procurement Canada**

**PROJECT**

**Remedial Action Plan Speers Lake Sites  
Kitikmeot Region, Nunavut**

**TITLE**

**Coppermine Area Site (WK210)  
Site Features**

**BLM-KEL-60**

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<b>PROJECT #</b> 230468	<b>DATE</b> November 08, 2024
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<b>DRAWN</b> PB	<b>CHECKED</b> SA	<b>FIG NO.</b> 16	<b>REV</b> 0
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## **APPENDIX A**

### Debris Inventory

**Table A1: Summary of Hazardous Waste Quantities Grouped by Site**

Item #	Site	Area Description	Hazardous Debris					
			Total Debris for Removal					
			Liquids (L)	Paint (m <sup>3</sup> ) <sup>1</sup>	Batteries (count)	Barrels quantity	Barrel Sludge (L)	Tank Sludge (L)
1	Speers Lake WK097	Core Shed	205	-	1	1	2	-
2		Main Collapsed Structure and Metal Debris	1230	-	-	41	82	-
3		Barrel Cache	-	-	2	210	420	-
4		Historical Structure and Debris	-	-	-	39	78	-
5		Metal Barrels and Scattered Debris	410	-	-	26	52	-
6		Scattered Debris in South Beach Area	205	-	-	29	58	-
7		Scattered Metal Debris	-	-	-	-	-	-
8		Scattered Plastic Debris	-	-	-	-	-	-
9		Barrel on the Shoreline	-	-	-	1	2	-
			<b>Sub Total</b>	<b>2050</b>	<b>0</b>	<b>3</b>	<b>347</b>	<b>694</b>
1	Asiak River WK154	Drill Rig	-	2.25	-	-	-	-
2		Misc. Metal, Drill Rods and Wood Debris	-	-	-	-	-	-
3		Metals Barrels	-	-	-	5	10	-
4		Misc. Metal Debris	-	-	-	-	-	-
5		Hydraulic Hose	-	-	-	-	-	-
6		Kitchen Stove and other Misc. Debris	-	-	-	-	-	-
7		Metal Barrel	-	-	-	1	2	-
8		Metal Barrel	-	-	-	1	2	-
9		Metal Barrel	-	-	-	1	2	-
10		Metal Barrel	-	-	-	1	2	-
11		Rubber Hose and Metal Debris	-	-	-	-	-	-

**Table A1: Summary of Hazardous Waste Quantities Grouped by Site**

Item #	Site	Area Description	Hazardous Debris					
			Total Debris for Removal					
			Liquids (L)	Paint (m <sup>3</sup> ) <sup>1</sup>	Batteries (count)	Barrels quantity	Barrel Sludge (L)	Tank Sludge (L)
		<b>Sub Total</b>	<b>0</b>	<b>2.25</b>	<b>0</b>	<b>9</b>	<b>18</b>	<b>0</b>
1	Kendall River WK165	Tent Pads	-	-	-	0.5	-	-
2		Large Tent Pad	-	-	-	-	-	-
3		Metal Jerry Cans	-	-	-	-	-	-
4		Scattered Wood Debris	-	-	-	-	-	-
		<b>Sub Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.5</b>	<b>0</b>	<b>0</b>
1	Tahiapik River WK170	Scattered Drill Core Boxes	-	-	-	-	-	-
2		Scrap Metal Casings and Wood Debris	-	-	-	-	-	-
3		Loose Household Debris	-	-	-	-	-	-
4		Wood Debris Southeast of Metal Casings	-	-	-	-	-	-
5		Barrel Along Lake	-	-	-	1	2	-
6		Camp Pad	-	-	-	-	-	-
7		Camp Dump and Metal Debris	-	-	-	-	-	-
8		Fuel Barrel	-	-	-	1	2	-
	<b>Sub Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>4</b>	<b>0</b>	
1	Impact Lake WK176	Camp Dump	-	-	-	-	-	-
2		Barrel Contents	205	-	-	3	6	-
3		Barrel Cache	1025	-	-	31	62	-
4		Historical Structure and Debris	103	-	-	4	8	-
5		Scattered Debris West of APEC 4	635	-	-	9	18	-
6		Scattered Debris North of APEC 4	-	-	-	-	-	-
	<b>Sub Total</b>	<b>1968</b>	<b>0</b>	<b>0</b>	<b>47</b>	<b>94</b>	<b>0</b>	

**Table A1: Summary of Hazardous Waste Quantities Grouped by Site**

Item #	Site	Area Description	Hazardous Debris					
			Total Debris for Removal					
			Liquids (L)	Paint (m <sup>3</sup> ) <sup>1</sup>	Batteries (count)	Barrels quantity	Barrel Sludge (L)	Tank Sludge (L)
1	Coppermine Area WK199	Scattered Metal Debris	-	-	-	-	-	-
2		Hot Water Tank	-	-	-	-	-	-
3		Propane Tanks	-	-	-	1	2	-
4		Snowmobile Parts	-	-	-	-	-	-
5		Polypropylene Tubing	-	-	-	-	-	-
6		Propane Tank 2	-	-	-	-	-	-
7		Scattered Rock Core	-	-	-	-	-	-
		<b>Sub Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>0</b>
1	Coppermine Area WK210	Large Metal Tanks and Barrels	-	-	-	8	16	600
2		Smaller Metal Tanks and Barrels	-	-	-	2	4	200
3		Metal Barrel	-	-	-	1	2	-
4		Metal Barrels	-	-	-	3	6	-
5		Wooden Signs	-	-	-	-	-	-
6		Propane Tank	-	-	-	-	-	-
7		Collapsed Wooden Dock Structure	-	-	-	-	-	-
8		Camp Dump	-	-	-	-	-	-
9		Additional Debris	-	-	-	3	6	-
		<b>Sub Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>17</b>	<b>34</b>	<b>800</b>
<b>Total Debris by Material</b>			<b>4018</b>	<b>2.25</b>	<b>3</b>	<b>423</b>	<b>846</b>	<b>800</b>

<sup>1</sup>This volume includes the entire drill rig assumed to be removed from Site as is with the paint to be removed at an appropriate waste facility in the south.

**Table A2: Summary of Non-Hazardous Debris Quantities Grouped by Site and Management Strategy**

Item #	Site	Area Description	APEC ID	Non-Hazardous					
				Total Debris for Removal				Total Debris Managed on Site	
				Building Debris (Volume Excluding Clean Wood) <sup>1</sup> (m <sup>3</sup> )	Metal (Crushed volume <sup>5</sup> ) (m <sup>3</sup> )	Other <sup>2</sup> (m <sup>3</sup> )	Painted Wood (m <sup>3</sup> )	Burnable Wood (m <sup>3</sup> )	Rock Core (m <sup>3</sup> )
1	Speers Lake WK097	Core Shed	1	20 (10)	1.3 (1.04)	-	-	13	3 <sup>4</sup>
2		Main Collapsed Structure and Metal Debris	2	45 (22.5)	14 (3.6)	-	-	22.5	-
3		Barrel Cache	3	-	61.9 (9.38)	-	-	2.5	-
4		Historical Structure and Debris	4	15 (7.5)	24.7 (14.56)	1	-	9.5	-
5		Metal Barrels and Scattered Debris	5	-	7.8 (1.04)	-	-	-	-
6		Scattered Debris in South Beach Area	6	-	20.7 (13.16)	-	-	2	-
7		Scattered Metal Debris	-	-	2	-	-	-	-
8		Scattered Plastic Debris	-	-	-	3	-	-	-
9		Barrel on the Shoreline	-	-	0.3 (0.04)	-	-	-	-
			<b>Sub Total</b>		<b>40<sup>1</sup></b>	<b>132.7 (44.82)</b>	<b>4</b>	<b>-</b>	<b>49.5</b>
1	Asiak River WK154	Drill Rig	1	-	2.25	-	-	-	-
2		Misc. Metal, Drill Rods and Wood Debris	1	-	2.25	-	-	0.75	-
3		Metals Barrels	1	-	1.5 (0.2)	-	-	-	-
4		Misc. Metal Debris	-	-	1.13	-	-	-	-
5		Hydraulic Hose	1	-	-	0.2	-	-	-
6		Kitchen Stove and other Misc. Debris	3	-	1.25	-	-	0.25	-
7		Metal Barrel	2	-	0.3 (0.04)	-	-	-	-
8		Metal Barrel	3	-	0.3 (0.04)	-	-	-	-
9		Metal Barrel	3	-	0.3 (0.04)	-	-	-	-

**Table A2: Summary of Non-Hazardous Debris Quantities Grouped by Site and Management Strategy**

Item #	Site	Area Description	APEC ID	Non-Hazardous					
				Total Debris for Removal				Total Debris Managed on Site	
				Building Debris (Volume Excluding Clean Wood) <sup>1</sup> (m <sup>3</sup> )	Metal (Crushed volume <sup>5</sup> ) (m <sup>3</sup> )	Other <sup>2</sup> (m <sup>3</sup> )	Painted Wood (m <sup>3</sup> )	Burnable Wood (m <sup>3</sup> )	Rock Core (m <sup>3</sup> )
10		Metal Barrel	3	-	0.3 (0.04)	-	-	-	-
11		Rubber Hose and Metal Debris	-	-	2	1	-	-	-
		<b>Sub Total</b>		<b>0</b>	<b>11.58 (8.24)</b>	<b>1.2</b>	<b>-</b>	<b>1</b>	<b>0</b>
1	Kendall River WK165	Tent Pads	3	-	0.3 (0.04)	-	6.75	-	-
2		Large Tent Pad	4	-	0.2	-	4.5	-	-
3		Metal Jerry Cans	1	-	0.5 (0.05)	-	-	-	-
4		Scattered Wood Debris	-	-	-	-	-	0.75	-
		<b>Sub Total</b>		<b>0</b>	<b>1.0 (0.29)</b>	<b>0</b>	<b>11.25<sup>3</sup></b>	<b>0.75</b>	<b>0</b>
1	Tahiapik River WK170	Scattered Drill Core Boxes	3	-	-	-	-	8 <sup>4</sup>	7 <sup>4</sup>
2		Scrap Metal Casings and Wood Debris	1	-	3.5	-	-	4	-
3		Loose Household Debris	-	0.2	-	-	-	0.02	-
4		Wood Debris Southeast of Metal Casings	1	-	-	-	-	3	-
5		Barrel Along Lake	5	-	0.3 (0.04)	-	-	-	-
6		Camp Pad	4	-	-	-	-	1.5	-
7		Camp Dump and Metal Debris	-	0.02	0.73	-	-	-	-
8		Fuel Barrel	6	-	0.3 (0.04)	-	-	-	-
	<b>Sub Total</b>		<b>0.22</b>	<b>4.83 (4.31)</b>	<b>0</b>	<b>-</b>	<b>16.52</b>	<b>7</b>	
1	Impact Lake WK176	Camp Dump	1	-	3	-	-	-	-
2		Barrel Contents	2	-	0.9 (0.12)	-	-	-	-

**Table A2: Summary of Non-Hazardous Debris Quantities Grouped by Site and Management Strategy**

Item #	Site	Area Description	APEC ID	Non-Hazardous					
				Total Debris for Removal				Total Debris Managed on Site	
				Building Debris (Volume Excluding Clean Wood) <sup>1</sup> (m <sup>3</sup> )	Metal (Crushed volume <sup>5</sup> ) (m <sup>3</sup> )	Other <sup>2</sup> (m <sup>3</sup> )	Painted Wood (m <sup>3</sup> )	Burnable Wood (m <sup>3</sup> )	Rock Core (m <sup>3</sup> )
3		Barrel Cache	3	-	9.15 (1.22)	-	-	-	-
4		Historical Structure and Debris	4	-	1.05 (0.14)	-	-	40	-
5		Scattered Debris West of APEC 4	5	-	2.7 (0.36)	-	-	4.4	-
6		Scattered Debris North of APEC 4	-	-	-	-	-	3.3	-
		<b>Sub Total</b>		<b>0</b>	<b>16.8 (4.84)</b>	<b>0</b>	<b>-</b>	<b>47.7</b>	<b>0</b>
1	Coppermine Area WK199	Scattered Metal Debris	3	-	5	-	-	-	0.5
2		Hot Water Tank	6	1	1.5	-	-	-	-
3		Propane Tanks	5	-	0.65 (0.52)	-	-	-	-
4		Snowmobile Parts	4	-	-	0.3	-	-	-
5		Polypropylene Piping	-	-	-	1	-	-	-
6		Propane Tank 2	2	-	0.5	-	-	-	-
7		Scattered Rock Core	1	-	-	-	-	-	1
		<b>Sub Total</b>		<b>1</b>	<b>7.65 (7.52)</b>	<b>1.3</b>	<b>-</b>	<b>0</b>	<b>1.5</b>
1	Coppermine Area WK210	Large Metal Tanks and Barrels	1	-	31.61 (3.27)	-	-	-	-
2		Smaller Metal Tanks and Barrels	2	-	5.3 (0.55)	-	-	1	-
3		Metal Barrel	2	-	0.3 (0.04)	-	-	-	-
4		Metal Barrels	-	-	0.9 (0.12)	-	-	-	-
5		Wooden Signs	-	-	-	-	-	0.2	-
6		Propane Tank	-	-	0.5	-	-	-	-

**Table A2: Summary of Non-Hazardous Debris Quantities Grouped by Site and Management Strategy**

Item #	Site	Area Description	APEC ID	Non-Hazardous					
				Total Debris for Removal				Total Debris Managed on Site	
				Building Debris (Volume Excluding Clean Wood) <sup>1</sup> (m <sup>3</sup> )	Metal (Crushed volume <sup>5</sup> ) (m <sup>3</sup> )	Other <sup>2</sup> (m <sup>3</sup> )	Painted Wood (m <sup>3</sup> )	Burnable Wood (m <sup>3</sup> )	Rock Core (m <sup>3</sup> )
7		Collapsed Wooden Dock Structure	-	-	-	-	-	0.75	-
8		Camp Dump	3	-	0.4	-	-	0.1	-
9		Additional Debris	5	-	0.9 (0.12)	-	-	1	-
		<b>Sub Total</b>		<b>0</b>	<b>39.91 (5.00)</b>	<b>0</b>	<b>-</b>	<b>3.05</b>	<b>0</b>
<b>Total Debris by Material (rounded)</b>				<b>41</b>	<b>215 (75)</b>	<b>7</b>	<b>11</b>	<b>119</b>	<b>12</b>
<b>Total Debris for Removal and/or On-Site Management</b>				<b>274 (134)</b>				<b>131</b>	

Notes:

<sup>1</sup> Assumed half of the building debris is clean wood and can be burned on Site (total volumes are split in the table between overall building debris and volume excluding clean burnable wood)





<sup>2</sup> Other column includes plastics, rubbers, and all other types of debris not accounted for in other categories.

<sup>3</sup> Paint at Kendall River is considered a Lead-based paint but is considered non-hazardous.





<sup>4</sup> Core piles assumed to contain 50% clean burnable wood.

<sup>5</sup> Volumes were calculated based on the barrels being crushed to industry standard and tank volumes being reduced to 10%.


**Table A3: Debris Piles Descriptions and Inventory for Speers Lake WK097**

Item	Surface Debris	APEC/AEC	Description	Inventory – Hazardous	Inventory – Non-hazardous
1	<p><b>Core Shed</b></p> 	1	Debris Area 2 consists of the area within AEC 2, located approximately 15 m north of Debris Area 1. This area contains the metal sided and roofed core shed, which was observed to be still standing. Additionally, 3 upright core racks and 3 collapsed core racks, both containing cores were observed. One lead acid battery, collapsed outhouse and associated toilet, 3 metal cots, insulation, plywood, scrap metal and one full metal barrel were also observed in this area.	<p>205 L of liquid in one barrel Lead acid battery</p> <p><b>Total Liquid: 205 L</b> <b>Total Other: 1 battery</b></p>	<p>Misc. building debris: 20 m<sup>3</sup> Metal barrels (crushed): 0.3 m<sup>3</sup> (0.04 m<sup>3</sup>) Misc. metal debris: 1 m<sup>3</sup> Cores and racks: 6 m<sup>3</sup></p> <p><b>Total: 27.3 m<sup>3</sup> (27.04 m<sup>3</sup> crushed)</b></p>
2	<p><b>Main Collapsed Structure and Metal Debris</b></p> 	2	Debris Area 1 consists of the area within APEC 1. This area comprises of the largest partially collapsed structure on the site and contains mixed building material debris in the form of: metal siding, metal roof, dimensional lumber, plywood, pink insulation and wood shelving, mixed metal debris in the form of stove piping, metal bed frames and piping scattered throughout. Additionally, 33 metal barrels (of which 4 were full and 2 half-full) and 2 mini barrels were observed grouped along the exterior southern wall of the structure. 1 additional full barrel was observed on the west side as well as 5 barrels on the east side of the structure. Scrap metal drill casings were observed along the north side of the structure.	<p>5 full and 2 half full barrels</p> <p><b>Total Liquid: 1230 L</b></p>	<p>Misc. building debris: 45 m<sup>3</sup> - includes 22.5 m<sup>3</sup> of wood Misc. metal debris: 2 m<sup>3</sup> Metal barrels (crushed): 12 m<sup>3</sup> (1.6 m<sup>3</sup>)</p> <p><b>Total: 59 m<sup>3</sup> (48.6 m<sup>3</sup> crushed)</b></p>
3	<p><b>Barrel Cache</b></p> 	3	Debris Area 3 consists of the area within AEC 3, and the beach area directly to the east. This area is located approximately 80 m northeast of Debris Area 1. There are 194 barrels, 16 mini barrels and 1 jerry can in this area. The barrels and jerry can were empty. Scattered scrap metal including metal cots and an anchor; wood debris including a collapsed dock; and 2 lead batteries were also observed in this area.	<p>2 lead batteries</p> <p><b>Total Other: 2 batteries</b></p>	<p>Metal barrels (crushed): 60.6 m<sup>3</sup> (8.08 m<sup>3</sup>) Wood debris: 2.5 m<sup>3</sup> Metal debris: 1.3 m<sup>3</sup></p> <p><b>Total: 64.4 m<sup>3</sup> (11.88 m<sup>3</sup> crushed)</b></p>
4	<p><b>Historical Structure and Debris</b></p> 	4	Debris Item 4 consists of the area within APEC 4. The area consists of scrap wood, metal, and barrels. A wooden floor structure is in the middle of the APEC and around this structure 4 metal basins, 2 metal barrels, drill casings that had sunken into the earth, one smaller collapsed wooden structure, a metal lift, plastic tubing, a drill head still in the ground, and scattered scrap metal were observed. Additionally, 37 barrels were observed in the area. The barrels were empty.	<p>None</p>	<p>Structure debris: 15 m<sup>3</sup> - includes 7.5 m<sup>3</sup> of wood Metal barrels (crushed): 11.7 m<sup>3</sup> (1.56 m<sup>3</sup>) Misc. wood debris: 2 m<sup>3</sup> Misc. metal debris: 8 m<sup>3</sup> Metal drill casings: 5 m<sup>3</sup> Plastic tubing: 1 m<sup>3</sup></p> <p><b>Total: 42.7 m<sup>3</sup> (32.56 m<sup>3</sup> crushed)</b></p>

**Table A3: Debris Piles Descriptions and Inventory for Speers Lake WK097**

Item	Surface Debris	APEC/AEC	Description	Inventory – Hazardous	Inventory – Non-hazardous
5	<p><b>Metal Barrels and Scattered Debris</b></p> 	5	Debris Item 5 consists of the area within AEC 5. This debris is largely metal barrels. One group of 26 metal barrels were observed in this area in addition, 2 barrels were full.	<p>410 L in 2 full barrels</p> <p><b>Total Liquid: 410 L</b></p>	<p>Metal barrels (crushed): 7.8 m<sup>3</sup> (1.04 m<sup>3</sup>)</p> <p><b>Total: 7.8 m<sup>3</sup> (1.04 m<sup>3</sup> crushed)</b></p>
6	<p><b>Scattered Debris in South Beach Area</b></p> 	6	Debris Item 6 consists of the area within AEC 6. This debris is made up of 19 metal barrels in a group submerged in the water (some of which have partially disintegrated), and 10 additional barrels along the shoreline, one of which was full. Scattered metal debris including >100 drill casings (most submerged in water) and wood debris is also present throughout the area.	<p>205 L in 1 full metal barrels</p> <p><b>Total Liquid: 205 L</b></p>	<p>Metal debris: 12 m<sup>3</sup> Wood debris: 2 m<sup>3</sup> Metal barrels (crushed): 8.7 m<sup>3</sup> (1.16 m<sup>3</sup>)</p> <p><b>Total: 22.7 m<sup>3</sup> (15.16 m<sup>3</sup> crushed)</b></p>
7	<p><b>Scattered Metal Debris</b></p> 	-	Debris Item 7 consists of scattered miscellaneous metal debris located approximately 170 m northwest of Debris Item 1.	<p>None</p>	<p>Metal debris: 2 m<sup>3</sup></p> <p><b>Total: 2 m<sup>3</sup></b></p>
8	<p><b>Scattered Plastic Debris</b></p> 	-	Debris item 8 consists of scattered plastic pipe located approximately 60 m south west of APEC 1.	<p>-</p>	<p>Plastic Debris: 3 m<sup>3</sup></p> <p><b>Total: 3 m<sup>3</sup></b></p>





**Table A3: Debris Piles Descriptions and Inventory for Speers Lake WK097**

Item	Surface Debris	APEC/AEC	Description	Inventory – Hazardous	Inventory – Non-hazardous
9	<p><b>Barrel on the Shoreline</b></p> 		Debris item 9 consists of a barrel on the shoreline approximately 60 m northeast of AEC 3.	-	Metal barrels (crushed): 0.3 m <sup>3</sup> (0.04 m <sup>3</sup> )  <b>Total: 0.3 m<sup>3</sup> (0.04 m<sup>3</sup> crushed)</b>
<b>Total Volume Estimates</b>				Total Liquid: 2,050 L Total Other: 3 lead acid batteries	<b>Total (debris): 229.2 m<sup>3</sup> (141.32 m<sup>3</sup> crushed)</b>





Notes:

- <sup>1</sup>Analytical results indicate liquid in barrel sample was Fuel
- Barrel volume (205 L) assumed to be 0.3 m<sup>3</sup> whole and 0.04 m<sup>3</sup> crushed (reduced to a 3 inch height),
- Mini barrels are assumed to be 0.15 m<sup>3</sup> whole and 0.02 m<sup>3</sup> crushed (reduced to a 3 inch height)




Table A4: Debris Piles Descriptions and Inventory for Asiak River WK154

ITEM	Surface Debris	AEC/APEC	Description	Inventory – Hazardous	Inventory – Non-hazardous
1	<p><b>Drill Rig</b></p> 	1	Debris Item 1 consists of a disused drill rig. Yellow paint was observed on the drill rig. A sample of this paint was sent for analysis, and it was confirmed to be lead containing.	<p>Lead Paint: 2 m<sup>2</sup> (assumed 2.25 m<sup>3</sup> volume of lead painted metal debris)</p> <p><b>Total: 2 m<sup>2</sup> (2.25 m<sup>3</sup> painted metal debris)</b></p>	<p>Metal debris: 2.25 m<sup>3</sup></p> <p><b>Total: 2.25 m<sup>3</sup></b></p>
2	<p><b>Misc. Metal, Drill Rods and Wood Debris</b></p> 	1	Debris Item 2 consists of approximately 16 to 20 metal drill rod casings, ranging in length from 1.2 to 1.8 metres scattered in the area immediately around and to the south of the drill rig. Other miscellaneous metal and wood debris were observed in this area as well, including an additional smaller sized internal combustion motor.	None	<p>Metal drill rods: 1 m<sup>3</sup></p> <p>Other metal debris: 1.25 m<sup>3</sup></p> <p>Wood debris: 0.75 m<sup>3</sup></p> <p><b>Total: 3.0 m<sup>3</sup></b></p>
3	<p><b>Metal Barrels</b></p> 	1	Debris Item 3 consists of five 205 litre metal barrels scattered in the area to the south of the Debris Item 1 drill rig.	None	<p>Metal barrels (crushed): 1.5 m<sup>3</sup> (0.2 m<sup>3</sup>)</p> <p><b>Total: 1.5 m<sup>3</sup> (0.2 m<sup>3</sup> crushed)</b></p>
4	<p><b>Misc. Metal Debris</b></p> 	-	Debris Item 4 consists of miscellaneous metal debris scattered to the west of Debris Item 1.	None	<p>Metal debris: 1.13 m<sup>3</sup></p> <p><b>Total: 1.13 m<sup>3</sup></b></p>

**Table A4: Debris Piles Descriptions and Inventory for Asiak River WK154**




ITEM	Surface Debris	AEC/APEC	Description	Inventory – Hazardous	Inventory – Non-hazardous
5	<p><b>Hydraulic Hose</b></p> 	1	Debris Item 5 consists of two lengths of hydraulic hose located approximately three to five metres to the west of Debris Item 1.	None	<p>Hydraulic hose: 0.2 m<sup>3</sup></p> <p><b>Total: 0.2 m<sup>3</sup></b></p>
6	<p><b>Kitchen Stove and other Misc. Debris</b></p> 	3	Debris Item 6 consists of a metal kitchen stove and other miscellaneous metal and wooden debris scattered around the area of sample WK154-TP12 approximately 135 m to the south of Debris Item 1.	None	<p>Metal stove: 1 m<sup>3</sup></p> <p>Misc. Metal: 0.25 m<sup>3</sup></p> <p>Misc. Wood: 0.25 m<sup>3</sup></p> <p><b>Total: 1.5 m<sup>3</sup></b></p>
7	<p><b>Metal Barrel</b></p> 	2	Debris Item 7 consists of one metal barrel located approximately 25 metres north of Debris Item 1.	None	<p>Metal barrels (crushed): 0.3 m<sup>3</sup> (0.04 m<sup>3</sup>)</p> <p><b>Total: 0.3 m<sup>3</sup> (0.04 m<sup>3</sup> crushed)</b></p>
8	<p><b>Metal Barrel</b></p> 	3	Debris Item 8 consists of one metal barrel located approximately 40 metres southwest of Debris Item 6.	None	<p>Metal barrels (crushed): 0.3 m<sup>3</sup> (0.04 m<sup>3</sup>)</p> <p><b>Total: 0.3 m<sup>3</sup> (0.04 m<sup>3</sup> crushed)</b></p>

**Table A4: Debris Piles Descriptions and Inventory for Asiak River WK154**


ITEM	Surface Debris	AEC/APEC	Description	Inventory – Hazardous	Inventory – Non-hazardous
9	<p><b>Metal Barrel</b></p> 	3	Debris Item 9 consists of one metal barrel located approximately 40 metres west of Debris Item 6.	None	<p>Metal barrels (crushed): 0.3 m<sup>3</sup> (0.04 m<sup>3</sup>)</p> <p><b>Total: 0.3 m<sup>3</sup> (0.04 m<sup>3</sup> crushed)</b></p>
10	<p><b>Metal Barrel</b></p> 	3	Debris Item 10 consists of one metal barrel located approximately 40 metres north of Debris Item 6.	None	<p>Metal barrels (crushed): 0.3 m<sup>3</sup> (0.04 m<sup>3</sup>)</p> <p><b>Total: 0.3 m<sup>3</sup> (0.04 m<sup>3</sup> crushed)</b></p>
11	<p><b>Rubber Hose and Metal debris</b></p> 	-	Debris Item 11 was seen after review aerial photography of the Site. This area is located approximately 170 m south east of AEC 1. Debris Item 11 consists of some rubber hose, as well as some metal debris which looks to be consistent with the items found in debris item 4.	None	<p>Metal debris: 2 m<sup>3</sup> Rubber hose: 1 m<sup>3</sup></p> <p><b>Total: 3 m<sup>3</sup></b></p>
<b>Total Volume Estimates</b>				<p>Total surface area: 2 m<sup>2</sup> Total estimated volume of lead painted metal debris: 2.25 m<sup>3</sup></p>	<b>Total (debris): 13.78 m<sup>3</sup> (11.44 m<sup>3</sup> crushed)</b>

- Notes: Barrel volume (205 L) assumed to be 0.3 m<sup>3</sup> whole and 0.04 m<sup>3</sup> crushed (reduced to a 3 inch height)

**Table A5: Debris Pile Descriptions and Inventory for Kendall River WK165**




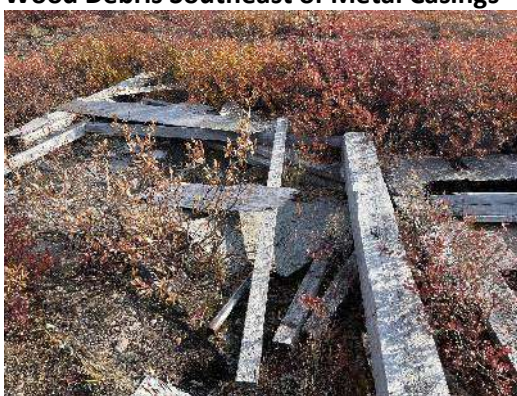
Item	Surface Debris	APEC	Description	Inventory – Hazardous	Inventory – Non-hazardous
1	<p><b>Tent Pads in APEC 3</b></p> 	3	Debris Item 1 consists of the area within APEC 3. All structures in this area have collapsed. Two former tent pads with a 3.7 m by 4.9 m base made of plywood and dimensional lumber were present. Red paint was present on most of the debris in this area. A sample of this paint was obtained and sent for analysis and came back as non-hazardous. Also present is half of a metal barrel (empty).	None	<p>Wood debris: 6.75 m<sup>3</sup>                      Metal barrels (crushed): 0.3 m<sup>3</sup> (0.04 m<sup>3</sup>)</p> <p><b>Total: 7.05 m<sup>3</sup> (6.79 m<sup>3</sup> crushed)</b></p>
2	<p><b>Large Tent Pad in APEC 4</b></p> 	4	Debris Item 2 consists of the area within APEC 4. One tent pad structure had a 3.7 m by 4.9 m base made of plywood and dimensional lumber. No discernable paint or scrap metal was observed in the debris piles. Additional plywood and dimensional lumber was scattered in this area. An old metal 6-foot stepladder was also present.	None	<p>Wood debris: 4.5 m<sup>3</sup>                      Metal debris: 0.2 m<sup>3</sup></p> <p><b>Total: 4.7 m<sup>3</sup></b></p>
3	<p><b>Metal Jerry Can Storage Site</b></p> 	1	Debris Item 3 consists of the area within AEC 1, the area immediately to the southeast of the tent pads of Debris Item 1. There are four metal jerry fuel cans in this area (20L each). Two cans were partially full and two were empty. Results indicate the liquid in the two jerry cans were mostly water (96.9% and 94.8% water).	None	<p>Empty jerry cans (crushed): 0.5m<sup>3</sup> (0.05 m<sup>3</sup>)</p> <p><b>Total: 0.5 m<sup>3</sup> (0.05 m<sup>3</sup> crushed)</b></p>

**Table A5: Debris Pile Descriptions and Inventory for Kendall River WK165**




Item	Surface Debris	APEC	Description	Inventory – Hazardous	Inventory – Non-hazardous
4	<p><b>Various Scattered Wood Debris</b></p> 	Various	<p>Various pieces of wood debris, both plywood and dimensional lumber are scattered across the site. Plywood debris was noted approximately 20 m to the east of the tent pad of Debris Item 1. An old Privy was also noted approximately 30 m to the southwest of the tent pad of Debris Item 2.</p>	None	<p>Wood debris: 0.75 m<sup>3</sup></p> <p><b>Total: 0.75 m<sup>3</sup></b></p>
<b>Total Volume Estimates</b>				<p><b>Total Debris: None</b>  <b>Total Paint: None</b>  <b>Total Liquid: None</b></p>	<p><b>Total (debris): 13 m<sup>3</sup> (12.29 m<sup>3</sup> crushed)</b>  <b>Total (liquid): None</b></p>

Notes: Barrel volume (205 L) assumed to be 0.3 m<sup>3</sup> whole and 0.04 m<sup>3</sup> crushed (reduced to a 3 inch height)



**Table A6: Debris Piles Descriptions and Inventory for Tahiapik WK170**

Item	Surface Debris	APEC	Description	Inventory – Hazardous	Inventory – Non-hazardous
1	<p><b>Scattered Drill Core Boxes</b></p> 	3	Used wooden drill core boxes stacked into piles located East of Fran Lake. Some piles are standing upright while others have begun to lean and collapse. Boxes and support pieces are made of wood with metal nails and fasteners, core samples are arranged throughout.	none	Wood debris and boards 8 m <sup>3</sup> Core samples 7 m <sup>3</sup>  <b>Total: 15 m<sup>3</sup></b>
2	<p><b>Scrap Metal Casings and Wood Debris</b></p> 	1	No structure remains. Located to the Southeast of the drill core boxes, in excess of 50 metal casings and wood debris made up of pallets and other wooden boards/beams are present in this area.	none	Wood debris 4 m <sup>3</sup> Metal debris 3.5 m <sup>3</sup>  <b>Total: 7.5 m<sup>3</sup></b>
3	<p><b>Loose Household Debris</b></p> 	N/a	No structure remains. Wooden debris and household debris (a tarp) are located in this area to the South of the core sample boxes.	none	Wood debris 0.02 m <sup>3</sup> Household debris (tarp) 0.2 m <sup>3</sup>  <b>Total: 0.22 m<sup>3</sup></b>
4	<p><b>Wood Debris Southeast of Metal Casings</b></p> 	1	No structure remains. Wooden plywood, planks and beams are located in this area to the Southeast of Area/Item 2.	none	Wood debris 3m <sup>3</sup>  <b>Total: 3 m<sup>3</sup></b>

**Table A6: Debris Piles Descriptions and Inventory for Tahiapik WK170**

Item	Surface Debris	APEC	Description	Inventory – Hazardous	Inventory – Non-hazardous
5	<p><b>Barrel along the Lake</b></p> 	5	No structure remains. Single empty barrel is present in this area West North West of the drill core boxes.	none	<p>Metal barrels (crushed): 0.3 m<sup>3</sup> (0.04 m<sup>3</sup>)</p> <p><b>Total: 0.3 m3 (0.04 m<sup>3</sup> crushed)</b></p>
6	<p><b>Camp Pad</b></p> 	4	No structure remains. Wooden debris, plywood, beams, and planks are present in this area west of the drill core boxes.	none	<p>Wood debris 1.5 m<sup>3</sup></p> <p><b>Total: 1.5 m<sup>3</sup></b></p>
7	<p><b>Camp Dump and Metal Debris</b></p> 	N/a	No structure remains. Metal debris and household debris (tarp) are present in this area to the South of the drill core boxes.	none	<p>Metal debris 0.73 m<sup>3</sup></p> <p>Household debris (tarp) 0.02 m<sup>3</sup></p> <p><b>Total: 0.75 m<sup>3</sup></b></p>




**Table A6: Debris Piles Descriptions and Inventory for Tahiapik WK170**

Item	Surface Debris	APEC	Description	Inventory – Hazardous	Inventory – Non-hazardous
8	<p><b>Barrel at north end of Fran Lake</b></p> 	6	A single barrel to the north of the main Site area.	unknown	<p>Metal barrels (crushed): 0.3 m<sup>3</sup> (0.04 m<sup>3</sup>)</p> <p><b>Total: 0.3 m<sup>3</sup> (0.04 m<sup>3</sup> crushed)</b></p>
9	<p><b>Historical stick up</b></p> 	-	An old metal stick up from historical drilling activity. It is unknown how deep this drill rod extends.	N/A	<p>Metal debris: &lt;0.1 m<sup>3</sup></p> <p><b>Total: &lt;0.1 m<sup>3</sup></b></p>
<b>Total Volume Estimates</b>				<p><b>Total Debris: None</b>  <b>Total Paint: None</b>  <b>Total Liquid: None</b></p>	<p><b>Total (debris): 28.57m<sup>3</sup> (28.05 m<sup>3</sup> crushed)</b>  <b>Total (liquid): None</b></p>




Notes:

Barrel volume (205 L) assumed to be 0.3 m<sup>3</sup> whole and 0.04 m<sup>3</sup> crushed

**Table A7: Debris Piles Descriptions and Inventory for Impact Lake WK176**

ITEM	Surface Debris	APEC/AEC	Description	Inventory – Hazardous	Inventory – Non-hazardous
1	<p><b>Camp Dump</b></p> 	1	Debris Area 1 consists of the area within APEC 1. This area looks to be the historical camp dump and contains many pieces of stove pipe, old metal food cans, various other pieces of metal, and some glass bottles.	none	Metal debris: 3 m <sup>3</sup> Glass debris: <0.1 m <sup>3</sup>  <b>Total: 3 m<sup>3</sup></b>
2	<p><b>Barrel Contents</b></p> 	2	Debris Area 2 consists of the area within APEC 2 and the area directly north. There are 2 empty barrels and 1 full barrel remaining in this area.	205 L of liquid in one barrel   <b>Total Liquid: 205 L</b>	Metal barrels (crushed): 0.9 m <sup>3</sup> (0.12 m <sup>3</sup> )   <b>Total: 0.9 m<sup>3</sup> (0.12 m<sup>3</sup> crushed)</b>
3	<p><b>Barrel Cache</b></p> 	3	Debris Area 3 consists of the area within AEC 3, the area directly north of AEC 3, and the beach area. There are 30 barrels and 1 mini barrel in this area. Four barrels are full of unknown liquids, and 2 are half full. The remaining barrels (24 full sized and 1 mini barrel) are empty.	1,025 L of liquid in six barrels   <b>Total Liquid: 1,025 L</b>	Metal barrels (crushed): 9.15 m <sup>3</sup> (1.22 m <sup>3</sup> )   <b>Total: 9.15 m<sup>3</sup> (1.22 m<sup>3</sup> crushed)</b>





**Table A7: Debris Piles Descriptions and Inventory for Impact Lake WK176**

ITEM	Surface Debris	APEC/AEC	Description	Inventory – Hazardous	Inventory – Non-hazardous
4	<p><b>Historical Structures and Debris</b></p> 	4	All structures at APEC 4 have collapsed. There are remnants of 5 different structures located in this area. Each structure had a 3.7 m by 4.3 m base and each was built from dimensional lumber and plywood. No paint or scrap metal was observed in the debris piles. Four barrels (3 full sized and 1 mini) are located within or just outside of APEC 4; one barrel is half full and the others are empty.	<p>103 L of liquid in one barrel</p> <p><b>Total Liquid: 103 L</b></p>	<p>Metal barrels (crushed): 1.05 m<sup>3</sup> (0.14 m<sup>3</sup>) Wood debris 40 m<sup>3</sup></p> <p><b>Total: 41.05 m<sup>3</sup> (40.14 m<sup>3</sup> crushed)</b></p>
5	<p><b>Scattered Debris West of APEC 4</b></p> 	5	No structure remains. Wood debris is scattered to the west of APEC 4. This debris is largely dimensional lumber and plywood. There are also 9 barrels scattered throughout the area; 2 are full of liquid, 2 are half full of liquid, and 2 have trace amounts of liquid (approximately 10 L each), the remaining are empty.	<p>635 L of liquid in six barrels</p> <p><b>Total Liquid: 635 L</b></p>	<p>Wooden debris 4.4 m<sup>3</sup> Metal barrels (crushed): 2.7 m<sup>3</sup> (0.36 m<sup>3</sup>)</p> <p><b>Total: 7.1 m<sup>3</sup> (4.76 m<sup>3</sup> crushed)</b></p>
6	<p><b>Scattered Debris North of APEC 4</b></p> 	N/A	No structure remains. Wooden debris is scattered north of APEC 4, including an old outhouse that has since collapsed, several sheets of plywood and mixed dimensional lumber.	<p>none</p>	<p>Wood debris 3.3 m<sup>3</sup></p> <p><b>Total: 3.3 m<sup>3</sup></b></p>
<b>Total Volume Estimates</b>				<b>Total Liquid: 1,968 L</b>	<b>Total (debris): 64.5 m<sup>3</sup> (52.54 m<sup>3</sup> crushed)</b>




Notes: Barrel volume (205 L) assumed to be 0.3 m<sup>3</sup> whole and 0.04 m<sup>3</sup> crushed (reduced to a 3 inch height)

Mini Barrel volume assumed to be 0.15 m<sup>3</sup> whole and 0.02 m<sup>3</sup> crushed (reduced to a 3 inch height)

**Table A8: Debris Piles Descriptions and Inventory for Coppermine Area WK199**

ITEM	Surface Debris	APEC	Description	Inventory – Hazardous	Inventory – Non-hazardous
1	<p><b>Scattered Metal Debris</b></p> 	3	Debris Item 1 consists of a variety of scattered metal debris including long metal pipes/poles, canisters, stove pipes, sheet metal, and tubing. This area also contains some piles of drill cores.	None	Metal debris: 5 m <sup>3</sup> Drill cores: 0.5 m <sup>3</sup>  <b>Total: 5.5 m<sup>3</sup></b>
2	<p><b>Hot Water Tank</b></p> 	6	Debris Item 2 consists of a hot water tank and a concrete pad located southwest of the scattered metal debris of Debris Item 1. No discernable paint was observed on the items.	None	Hot water tank: 1.5 m <sup>3</sup> Concrete pad: 1 m <sup>3</sup>  <b>Total: 2.5 m<sup>3</sup></b>
3	<p><b>Propane Tanks</b></p> 	5	Debris Item 3 consists of one 100-pound propane tank and one mini barrel located south-southeast of the scattered metal debris of Debris Item 1. Both tanks were empty.	None	Empty propane tanks: 0.5 m <sup>3</sup> Metal barrels (crushed): 0.15 m <sup>3</sup> (0.02 m <sup>3</sup> )  <b>Total: 0.65 m<sup>3</sup> (0.52 m<sup>3</sup> crushed)</b>
4	<p><b>Snowmobile Parts</b></p> 	4	Debris Item 4 consists of snowmobile parts, in an area along the shoreline southeast of the metal debris of Debris Item 1. Debris is majority yellow plastic with some pieces semi-submerged in the water.	None	Plastic debris: 0.3 m <sup>3</sup>  <b>Total: 0.3 m<sup>3</sup></b>

**Table A8: Debris Piles Descriptions and Inventory for Coppermine Area WK199**

ITEM	Surface Debris	APEC	Description	Inventory – Hazardous	Inventory – Non-hazardous
5	<p><b>Polypropylene Piping</b></p> 	NA	Debris Item 5 consists of black polypropylene piping, scattered throughout the area. Approximately 50 m of this pipe is located on Site.	None	Plastic debris: 1 m <sup>3</sup>  <b>Total: 1 m<sup>3</sup></b>
6	<p><b>Propane Tank 2</b></p> 	2	Debris Item 6 consists of one 100-pound propane tank located northeast of the scattered metal debris of Debris Item 1. The tank was empty.	None	Empty propane tank: 0.5 m <sup>3</sup>  <b>Total: 0.5 m<sup>3</sup></b>
7	<p><b>Scattered Cores</b></p> 	1	Debris Item 7 consists of several piles of drill cores, scattered throughout the area. No racking system was present in the area.	None	Drill cores: 1 m <sup>3</sup>  <b>Total: 1 m<sup>3</sup></b>
<b>Total Volume Estimates</b>				<b>None</b>	<b>Total (debris): 11.45 m<sup>3</sup> (11.32 m<sup>3</sup>)</b>

Note: Barrel volume (205 L) assumed to be 0.3 m<sup>3</sup> whole and 0.04 m<sup>3</sup> crushed  
 Mini Barrel volume assumed to be 0.15 m<sup>3</sup> whole and 0.02 m<sup>3</sup> crushed

Table A9 - Debris Piles Descriptions and Inventory Coppermine Area (WK210)


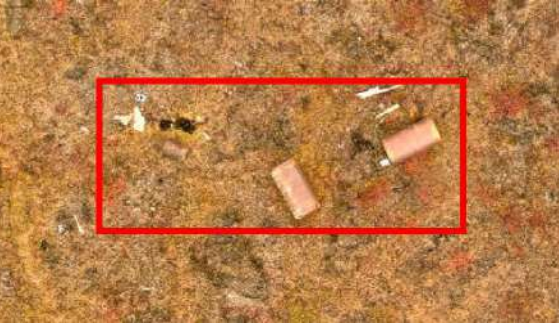







ITEM	Surface Debris	APEC	Description	Inventory – Hazardous	Inventory – Non-hazardous
1	<p><b>Large Metal Tanks and Barrels</b></p> 	1	Debris Item 1 consists of six large metal tanks, seven 205 litre (L) metal barrels, one mini barrel and one 20 L jerry can. One metal tank was observed to be approximately 10% full of an unknown liquid. Analytical results indicated that the liquid was > 90% water.	None <sup>1</sup>	<p>Metal tanks (crushed): 29.16 m<sup>3</sup> (2.92 m<sup>3</sup>)                      Metal barrels (crushed): 2.25 m<sup>3</sup> (0.3 m<sup>3</sup>)                      Other metal debris (crushed): 0.2 m<sup>3</sup> (0.05 m<sup>3</sup>)</p> <p><b>Total: 31.61 m<sup>3</sup> (3.27 m<sup>3</sup> crushed)</b></p>
2	<p><b>Smaller Metal Tanks and Barrels</b></p> 	2	Debris Item 2 consists of two smaller metal tanks, one 205 L metal barrel, one mini barrel, and some wood debris. This area is located approximately 30 metres (m) south-southeast of APEC 1.	None	<p>Tank Volume: 4.85 m<sup>3</sup> (0.49 m<sup>3</sup> crushed)                      Barrel Volume: 0.45 m<sup>3</sup> (0.06 m<sup>3</sup> crushed)                      Wood Debris: 1 m<sup>3</sup></p> <p><b>Total: 6.3 m<sup>3</sup> (1.55 m<sup>3</sup> crushed)</b></p>
3	<p><b>Metal Barrel</b></p> 	2	Debris Item 3 consists of one 205 L metal barrel tank located between Debris Items 1 & 2.	None	<p>Metal barrels (crushed): 0.3 m<sup>3</sup> (0.04 m<sup>3</sup>)</p> <p><b>Total: 0.3 m<sup>3</sup> (0.04 m<sup>3</sup> crushed)</b></p>
4	<p><b>Metal Barrels</b></p> 	-	Debris Item 4 consists of three semi-crushed 205 L metal barrels located approximately 30 m southeast of Debris Item 2.	None	<p>Metal barrels (crushed): 0.9 m<sup>3</sup> (0.12 m<sup>3</sup>)</p> <p><b>Total: 0.9 m<sup>3</sup> (0.12 m<sup>3</sup> crushed)</b></p>

Table A9 - Debris Piles Descriptions and Inventory Coppermine Area (WK210)

ITEM	Surface Debris	APEC	Description	Inventory – Hazardous	Inventory – Non-hazardous
5	<p><b>Wooden Signs</b></p> 	-	Debris Item 5 consists of two wooden signs made of plywood and dimensional lumber located directly south of Debris Item 4.	None	<p>Wooden debris: 0.2 m<sup>3</sup></p> <p><b>Total: 0.2 m<sup>3</sup></b></p>
6	<p><b>Propane Tank</b></p> 	-	Debris Item 6 consists of one 100-pound metal propane tank located approximately 30 m northwest of Debris Item 1.	None	<p>Metal tank: 0.5 m<sup>3</sup></p> <p><b>Total: 0.5 m<sup>3</sup></b></p>
7	<p><b>Collapsed Wooden Dock Structure</b></p> 	-	Debris Item 7 consists of two wooden docks made of plywood and dimensional lumber located directly northwest of Debris Item 6.	None	<p>Wooden debris: 0.75 m<sup>3</sup></p> <p><b>Total: 0.75 m<sup>3</sup></b></p>
8	<p><b>Camp Dump</b></p> 	3	Debris Item 8 consists of the camp dump, which includes various small metal barrels/buckets, various metal debris, and some wood debris.		<p>Metal barrels/buckets: 0.4 m<sup>3</sup></p> <p>Wooden debris: 0.1 m<sup>3</sup></p> <p><b>Total: 0.5 m<sup>3</sup></b></p>

**Table A9 - Debris Piles Descriptions and Inventory Coppermine Area (WK210)**

ITEM	Surface Debris	APEC	Description	Inventory – Hazardous	Inventory – Non-hazardous
9	<p><b>Additional Debris</b></p> 	5	Additional Debris was seen across the Unnamed Lake to the east. This area was only seen from the air. Three additional barrels and some wooden debris was seen scattered in this area.		Metal barrels (crushed): 0.9 m <sup>3</sup> (0.12 m <sup>3</sup> ) Wooden debris: 1 m <sup>3</sup>  <b>Total: 1.9 m<sup>3</sup> (1.12 m<sup>3</sup> crushed)</b>
<b>Total Volume Estimates</b>				<b>Liquid: 0</b>	<b>Total (debris): 42.96 m<sup>3</sup> (8.05 m<sup>3</sup> crushed)</b>

Notes:

- <sup>1</sup>Analytical results indicate liquid in tank sample was significantly diluted with water (95% water) and is not considered to be fuel
- Barrel volume (205 L) assumed to be 0.3 m<sup>3</sup> whole and 0.04 m<sup>3</sup> crushed (reduced to a 3 inch height)
- Mini Barrel volume assumed to be 0.15 m<sup>3</sup> whole and 0.02 m<sup>3</sup> crushed (reduced to a 3 inch height)
- Void space estimated at 90% of volume for metal tanks

## **APPENDIX B**

### Anticipated Carbon Footprint

## Hazardous Waste Option 1: On Site Landfill

Remediation - Prep sites, transport backfill and construct landfill

Table 1 - Sources of Carbon Emissions

Proposed Equipment	Average Fuel Efficiency L/hr <sup>1</sup>	Litres per 100 km (Based off US Department of Energy) <sup>2</sup>	Hours Required (From costing sheet)	Total KM (Table 4)	Total Litres of fuel (L)	Total gallons of fuel (gal)	Total CO <sub>2</sub> e emissions (kg)
AS350B2 Helicopter	180		132	1260	23760	6277	61268
Excavator 326	16.25		96		1560	412	4208
Dozer (D9)	49.75		96		4776	1262	12882
Rock truck (25 tonne)	19.1		96		1834	484	4946
Skid Steer	8.65		96		830	219	2240
Winter CAT Train Haul <sup>3</sup>	69.3		28	280	1940	513	5250
<b>Total</b>							<b>90792</b>

Notes:

<sup>1</sup> Fuel efficiency based on Quote from Kenn Borek Air, Caterpillar Performance Handbook, Version 46, January 2016

<sup>2</sup> Fuel efficiency extracted from U.S.Department of Energy, Alternative Fuels Data Center, January 2020 8

<sup>3</sup> Assumes a D9 dozer or equivalent at a heavy work scenario with an average speed of 10 km/hr, (25 hours on 8

Table 2 - Sources of Carbon Emissions from Travel

Commercial Flights	One way Distance (km)	One way Distance (miles)	Round trip distance (miles)	Total Flights	Total miles	Total CO <sub>2</sub> e emissions (kg)
Ottawa to Yellowknife	3100	1926	3853	10	38525.0	6279
Yellowknife to Kugluktuk	594	369	738	10	7381.9	1203
<b>Total</b>						<b>7482</b>

Table 3 - Total Sources of Carbon Emissions

Total CO <sub>2</sub> e emissions from all sources	98 t CO <sub>2</sub> e
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Table 4 - Reference Material for Table 1

Travel distances	One way Distance (km)
Kugluktuk to Site (overland) <sup>1</sup>	140
Kugluktuk to Site <sup>1</sup>	90
Kugluktuk to Montreal Sealift	6300

Notes:

<sup>1</sup> Distance to Site is to the Speers Lake Site (WK097) due to the majority of the work taking place there

Table 5 - Reference Material for Emission Calculations

Fuel Type	CO <sub>2</sub> Emission Factor (kg CO <sub>2</sub> /unit)	CH <sub>4</sub> Factor (g/mile)	N <sub>2</sub> O Factor (g/mile)	Unit
Diesel <sup>1</sup>	10.21	0.57	0.26	gallon
Jet Fuel <sup>1</sup>	9.75	0	0.3	gallon
Waterborne Craft <sup>2</sup>	0.042	0.0004	0.0027	ton-mile
Commercial Flight - Short Haul (<300 miles) <sup>2</sup>	0.275	0.0091	0.0087	passenger mile
Commercial Flight - Medium Haul (>300 - <2300 miles) <sup>2</sup>	0.162	0.0008	0.0052	passenger mile

Notes:

<sup>1</sup> LNG sourced from: EPA (2008) Climate Leaders Greenhouse Gas Inventory Protocol Core Module Guidance - Direct Emissions

<sup>2</sup> Fuel consumption data and passenger-miles data for rail are from Tables A.14 to A.16 and 9.10 to 9.12 of the Transportation Energy Data Book: Edition 32.

Table 6 - Global Warming Potentials

Green House Gases	CO <sub>2</sub> e
CO <sub>2</sub>	1
CH <sub>4</sub>	25
N <sub>2</sub> O	298

## Hazardous Waste Option 2: Southern Off-Site Disposal

Package materials and staging for off site removal

Table 1 - Sources of Carbon Emissions

Proposed Equipment	Average Fuel Efficiency L/hr <sup>1</sup>	Litres per 100 km (Based off US Department of Energy) <sup>2</sup>	Hours Required (From costing sheet)	Total KM (Table 4)	Total Litres of fuel (L)	Total gallons of fuel (gal)	Total CO <sub>2</sub> e emissions (kg)
AS350B2 Helicopter	180		50	1260	9000	2378	23251
Sealift				6300		0	1173
Transport Truck (Average Class 8) consumption)		39.2		200	78	21	223
<b>Total</b>							<b>24647</b>

Notes:

<sup>1</sup> Fuel efficiency based on Quote from Kenn Borek Air

<sup>2</sup> Fuel efficiency extracted from U.S. Department of Energy, Alternative Fuels Data Center, January 2020

Table 2 - Sources of Carbon Emissions from Travel

Commercial Flights	One way Distance (km)	One way Distance (miles)	Round trip distance (miles)	Total Flights	Total miles	Total CO <sub>2</sub> e emissions (kg)
Ottawa to Yellowknife	3100	1926	3853	2	7705.0	1256
Yellowknife to Kugluktuk	594	369	738	2	1476.4	241
<b>Total</b>						<b>1496</b>

Table 3 - Total Sources of Carbon Emissions

Total CO <sub>2</sub> e emissions from all sources	26 t CO <sub>2</sub> e
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Table 4 - Reference Material for Table 1

Travel distances	One way Distance (km)
Kugluktuk to Site (overland) <sup>1</sup>	140
Kugluktuk to Site <sup>1</sup>	90

Notes:

<sup>1</sup> Distance to Site is to the Speers Lake Site (WK097) due to the majority of the work taking place there

Table 5 - Reference Material for Table 1

Estimated volume of material to be transported off site (m <sup>3</sup> )	Load capacity (assume 10 m <sup>3</sup> /load)	Transport method	Location	Total weight (tons)	Total loads	Total KM
6	6	by Barge	Kugluktuk to Montreal	7	1.0	6300.0
6	6	by Truck	Montreal to Landfill	7	1.0	200.0

Table 6 - Reference Material for Emission Calculations

Fuel Type	CO <sub>2</sub> Emission Factor (kg CO <sub>2</sub> /unit)	CH <sub>4</sub> Factor (g/mile)	N <sub>2</sub> O Factor (g/mile)	Unit
Diesel <sup>1</sup>	10.21	0.57	0.26	gallon
Jet Fuel <sup>1</sup>	9.75	0	0.3	gallon
Waterborne Craft <sup>2</sup>	0.042	0.0004	0.0027	ton-mile
Commercial Flight - Short Haul (<300 miles) <sup>2</sup>	0.275	0.0091	0.0087	passenger mile
Commercial Flight - Medium Haul (>300 - <2300 miles) <sup>2</sup>	0.162	0.0008	0.0052	passenger mile

Notes:

<sup>1</sup> LNG sourced from: EPA (2008) Climate Leaders Greenhouse Gas Inventory Protocol Core Module Guidance - Direct Emissions

<sup>2</sup> Fuel consumption data and passenger-miles data for rail are from Tables A.14 to A.16 and 9.10 to 9.12 of the Transportation Energy Data Book: Edition 32.

Table 7 - Global Warming Potentials

Green House Gases	CO <sub>2</sub> e
CO <sub>2</sub>	1
CH <sub>4</sub>	25
N <sub>2</sub> O	298

## Hazardous Waste Option 3: Risk Management - Consolidate and Continuous Monitoring

Consolidate Hazardous Waste, install signage, set up sampling points.

Table 1 - Sources of Carbon Emissions

Proposed Equipment	Average Fuel Efficiency L/hr <sup>1</sup>	Litres per 100 km (Based off US Department of Energy) <sup>2</sup>	Hours Required (From costing sheet)	Total KM (Table 4)	Total Litres of fuel (L)	Total gallons of fuel (gal)	Total CO <sub>2</sub> e emissions (kg)
AS350B2 Helicopter	180		188	1260	33840	8940	87231
<b>Total</b>							87231

Notes:

<sup>1</sup> Fuel efficiency based on Quote from Kenn Borek Air

<sup>2</sup> Fuel efficiency extracted from U.S.Department of Energy, Alternative Fuels Data Center, January 2020

Table 2 - Sources of Carbon Emissions from Travel

Commercial Flights	One way Distance (km)	One way Distance (miles)	Round trip distance (miles)	Total Flights	Total miles	Total CO <sub>2</sub> e emissions (kg)
Ottawa to Yellowknife	3100	1926	3853	8	30820.0	5023
Yellowknife to Kugluktuk	594	369	738	8	5905.5	962
<b>Total</b>						5985

Table 3 - Total Sources of Carbon Emissions

<b>Total CO<sub>2</sub>e emmissions from all sources</b>	<b>93 t CO<sub>2</sub>e</b>
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Table 4 - Reference Material for Table 1

Travel distances	One way Distance (km)
Kugluktuk to Site (overland) <sup>1</sup>	140
Kugluktuk to Site <sup>1</sup>	90

Notes:

<sup>1</sup> Distance to Site is to the Speers Lake Site (WK097) due to the majority of the work taking place there

Table 5 - Reference Material for Emission Calculations

Fuel Type	CO <sub>2</sub> Emission Factor (kg CO <sub>2</sub> /unit)	CH <sub>4</sub> Factor (g/mile)	N <sub>2</sub> O Factor (g/mile)	Unit
Gasoline <sup>1</sup>	8.78	0.5	0.22	gallon
Diesel <sup>1</sup>	10.21	0.57	0.26	gallon
Jet Fuel <sup>1</sup>	9.75	0	0.3	gallon
Waterborne Craft <sup>2</sup>	0.042	0.0004	0.0027	ton-mile
Commercial Flight - Short Haul (<300 miles) <sup>2</sup>	0.275	0.0091	0.0087	passenger mile
Commercial Flight - Medium Haul (>300 - <2300 miles) <sup>2</sup>	0.162	0.0008	0.0052	passenger mile

Notes:

<sup>1</sup> LNG sourced from: EPA (2008) Climate Leaders Greenhouse Gas Inventory Protocol Core Module Guidance - Direct Emissions

<sup>2</sup> Fuel consumption data and passenger-miles data for rail are from Tables A.14 to A.16 and 9.10 to 9.12 of the Transportation Energy Data Book: Edition 32.

Table 6 - Global Warming Potentials

Green House Gases	CO <sub>2</sub> e
CO <sub>2</sub>	1
CH <sub>4</sub>	25
N <sub>2</sub> O	298

**Non-Hazardous Debris Option 1: On Site Landfill**  
 Remediation - Prep sites, transport backfill and construct landfill

Table 1 - Sources of Carbon Emissions

Proposed Equipment	Average Fuel Efficiency L/hr <sup>1</sup>	Litres per 100 km (Based off US Department of Energy) <sup>2</sup>	Hours Required (From costing sheet)	Total KM (Table 4)	Total Litres of fuel (L)	Total gallons of fuel (gal)	Total CO <sub>2</sub> e emissions (kg)
AS350B2 Helicopter (Crew transport, Slingshot from Sites to Speers Lake)	180		244	6480	43920	11602	113484
Excavator 326	16.25		160		2600	687	7013
Dozer (D9)	49.75		160		7960	2103	21470
Rock truck (25 tonne)	19.1		160		3056	807	8243
Winter CAT Train Haul <sup>3</sup>	69.3		28	280	1940	513	5250
Skid Steer	8.65		160		1384	366	3733
<b>Total</b>						12289	159191

Notes:

<sup>1</sup> Fuel efficiency based on Quote from Kenn Borek Air

<sup>2</sup> Fuel efficiency extracted from U.S.Department of Energy, Alternative Fuels Data Center, January 2020 8

<sup>3</sup> Assumes a D9 dozer or equivalent at a heavy work scenario with an average speed of 8 km/hr, (32 hours one v 8

Table 2 - Sources of Carbon Emissions from Travel

Commercial Flights	One way Distance (km)	One way Distance (miles)	Round trip distance (miles)	Total Flights	Total miles	Total CO <sub>2</sub> e emissions (kg)
Ottawa to Yellowknife	3100	1926	3853	16	61640.0	10046
Yellowknife to Kugluktuk	594	369	738	16	11811.0	1925
<b>Total</b>						11971

Table 3 - Total Sources of Carbon Emissions

<b>Total CO<sub>2</sub>e emissions from all sources</b>	<b>171 t CO<sub>2</sub>e</b>
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Table 4 - Reference Material for Table 1

Travel distances	One way Distance (km)
Kugluktuk to Site (overland) <sup>1</sup>	140
Kugluktuk to Site <sup>1</sup>	90
Kugluktuk to Montreal Sealift	6300

Notes:

<sup>1</sup> Distance to Site is to the Speers Lake Site (WK097) due to the majority of the work taking place there

Table 5 - Reference Material for Table 1

Estimated volume of material to be transported off site (m <sup>3</sup> )	Load capacity (assume 10 m <sup>3</sup> /load)	Transport method	Location	Total weight (tons)	Total loads	Total KM
3.2	3.2	by Barge	Kugluktuk to Montreal	12	1.0	6000.0
3.2	3.2	by Truck	Montreal to Landfill	12	1.0	200.0

Table 6 - Reference Material for Emission Calculations

Fuel Type	CO <sub>2</sub> Emission Factor (kg CO <sub>2</sub> /unit)	CH <sub>4</sub> Factor (g/mile)	N <sub>2</sub> O Factor (g/mile)	Unit
Diesel <sup>1</sup>	10.21	0.57	0.26	gallon
Jet Fuel <sup>1</sup>	9.75	0	0.3	gallon
Waterborne Craft <sup>2</sup>	0.042	0.0004	0.0027	ton-mile
Commercial Flight - Short Haul (<300 miles) <sup>2</sup>	0.275	0.0091	0.0087	passenger mile
Commercial Flight - Medium Haul (>300 - <2300 miles) <sup>2</sup>	0.162	0.0008	0.0052	passenger mile

Notes:

<sup>1</sup> LNG sourced from: EPA (2008) Climate Leaders Greenhouse Gas Inventory Protocol Core Module Guidance - Direct Emissions

<sup>2</sup> Fuel consumption data and passenger-miles data for rail are from Tables A.14 to A.16 and 9.10 to 9.12 of the Transportation Energy Data Book: Edition 32.

Table 7 - Global Warming Potentials

Green House Gases	CO <sub>2</sub> e
CO <sub>2</sub>	1
CH <sub>4</sub>	25
N <sub>2</sub> O	298

## Non-Hazardous Debris Option 2: Southern Off-Site Disposal

Consolidate and remove debris to southern landfill

Table 1 - Sources of Carbon Emissions

Proposed Equipment	Average Fuel Efficiency L/hr <sup>1</sup>	Litres per 100 km (Based off US Department of Energy) <sup>2</sup>	Hours Required (From costing sheet)	Total KM (Table 4)	Total Litres of fuel (L)	Total gallons of fuel (gal)	Total CO <sub>2</sub> e emissions (kg)
Basler DC3T (chartered flight)	600		74	2400	44400	11729	114493
Twin Otter (chartered flight)	400		36	1440	14400	3804	37170
Barge				6300		0	21118
Transport Truck (Average Class 8) consumption)		39.2		2680	1051	278	2987
AS350B2 Helicopter	180		146	4590	26280	6942	67944
<b>Total</b>						<b>15811</b>	<b>243712</b>

Notes:

<sup>1</sup> Fuel efficiency based on Quote from Kenn Borek Air

<sup>2</sup> Fuel efficiency extracted from U.S.Department of Energy, Alternative Fuels Data Center, January 2020

<sup>3</sup> Assumes a D9 dozer or equivalent at a heavy work scenario with an average speed of 8 km/hr, (32 hours one wa 8

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Table 2 - Sources of Carbon Emissions from Travel

Commercial Flights	One way Distance (km)	One way Distance (miles)	Round trip distance (miles)	Total Flights	Total miles	Total CO <sub>2</sub> e emissions (kg)
Ottawa to Yellowknife	3100	1926	3853	8	30820.0	5023
Yellowknife to Kugluktuk	594	369	738	8	5905.5	962
<b>Total</b>						<b>5985</b>

Table 3 - Total Sources of Carbon Emissions

Total CO <sub>2</sub> e emmissions from all sources	250 t CO <sub>2</sub> e
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Table 4 - Reference Material for Table 1

Travel distances	One way Distance (km)
Kugluktuk to Site (overland) <sup>1</sup>	140
Kugluktuk to Site <sup>1</sup>	90
Montreal Port to landfill	100

Notes:

<sup>1</sup> Distance to Site is to the Speers Lake Site (WK097) due to the majority of the work taking place there

Table 5 - Reference Material for Table 1

Estimated volume of material to be transported off site (m <sup>3</sup> )	Load capacity (assume 10 m <sup>3</sup> /load)	Transport method	Location	Total weight (tons)	Total loads	Total KM
134	3.2	by Barge	Kugluktuk to Montreal	126	1.0	6300.0
134	10	by Truck	Montreal to Landfill	126	13.4	2680.0

Table 6 - Reference Material for Emission Calculations

Fuel Type	CO <sub>2</sub> Emission Factor (kg CO <sub>2</sub> /unit)	CH <sub>4</sub> Factor (g/mile)	N <sub>2</sub> O Factor (g/mile)	Unit
Diesel <sup>1</sup>	10.21	0.57	0.26	gallon
Jet Fuel <sup>1</sup>	9.75	0	0.3	gallon
Waterborne Craft <sup>2</sup>	0.042	0.0004	0.0027	ton-mile
Commercial Flight - Short Haul (<300 miles) <sup>2</sup>	0.275	0.0091	0.0087	passenger mile
Commercial Flight - Medium Haul (>300 - <2300 miles) <sup>2</sup>	0.162	0.0008	0.0052	passenger mile

Notes:

<sup>1</sup> LNG sourced from: EPA (2008) Climate Leaders Greenhouse Gas Inventory Protocol Core Module Guidance - Direct Emissions from

<sup>2</sup> Fuel consumption data and passenger-miles data for rail are from Tables A.14 to A.16 and 9.10 to 9.12 of the Transportation Energy Data Book: Edition 32.

Table 7 - Global Warming Potentials

Green House Gases	CO <sub>2</sub> e
CO <sub>2</sub>	1
CH <sub>4</sub>	25
N <sub>2</sub> O	298

## Non-Hazardous Debris Option 3: Consolidate Non Hazardous Debris

Consolidate Materials, Install signage, set up sampling points

Table 1 - Sources of Carbon Emissions

Proposed Equipment	Average Fuel Efficiency L/hr <sup>1</sup>	Litres per 100 km (Based off US Department of Energy) <sup>2</sup>	Hours Required (From costing sheet)	Total KM (Table 4)	Total Litres of fuel (L)	Total gallons of fuel (gal)	Total CO <sub>2</sub> e emissions (kg)
AS350B2 Helicopter	180		66	1260	11880	3138	30669
Total							30669

Notes:

<sup>1</sup> Fuel efficiency based on Quote from Kenn Borek Air

<sup>2</sup> Fuel efficiency extracted from U.S.Department of Energy, Alternative Fuels Data Center, January 2020

<sup>3</sup> Assumes a D9 dozer or equivalent at a heavy work scenario with an average speed of 8 km/hr, (32 hours one way to Site)

Table 2 - Sources of Carbon Emissions from Travel

Commercial Flights	One way Distance (km)	One way Distance (miles)	Round trip distance (miles)	Total Flights	Total miles	Total CO <sub>2</sub> e emissions (kg)
Ottawa to Yellowknife	3100	1926	3853	1	3852.5	628
Yellowknife to Kugluktuk	594	369	738	1	738.2	120
Total						748

Table 3 - Total Sources of Carbon Emissions

Total CO <sub>2</sub> e emissions from all sources	31 t CO <sub>2</sub> e
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Table 4 - Reference Material for Table 1

Travel distances	One way Distance (km)
Kugluktuk to Site (overland) <sup>1</sup>	140
Kugluktuk to Site <sup>1</sup>	90

Notes:

<sup>1</sup> Distance to Site is to the Speers Lake Site (WK097) due to the majority of the work taking place there

Table 5 - Reference Material for Table 1

Estimated volume of material to be transported off site (m <sup>3</sup> )	Load capacity (assume 10 m <sup>3</sup> /load)	Transport method	Location	Total weight (tons)	Total loads	Total KM
3.2	3.2	by Barge	Kugluktuk to Montreal	12	1.0	6000.0
3.2	3.2	by Truck	Montreal to Landfill	12	1.0	200.0

Table 6 - Reference Material for Emission Calculations

Fuel Type	CO <sub>2</sub> Emission Factor (kg CO <sub>2</sub> /unit)	CH <sub>4</sub> Factor (g/mile)	N <sub>2</sub> O Factor (g/mile)	Unit
Diesel <sup>1</sup>	10.21	0.57	0.26	gallon
Jet Fuel <sup>1</sup>	9.75	0	0.3	gallon
Waterborne Craft <sup>2</sup>	0.042	0.0004	0.0027	ton-mile
Commercial Flight - Short Haul (<300 miles) <sup>2</sup>	0.275	0.0091	0.0087	passenger mile
Commercial Flight - Medium Haul (>300 - <2300 miles) <sup>2</sup>	0.162	0.0008	0.0052	passenger mile

Notes:

<sup>1</sup> LNG sourced from: EPA (2008) Climate Leaders Greenhouse Gas Inventory Protocol Core Module Guidance - Direct

<sup>2</sup> Fuel consumption data and passenger-miles data for rail are from Tables A.14 to A.16 and 9.10 to 9.12 of the Transportation Energy Data Book: Edition 32.

Table 7 - Global Warming Potentials

Green House Gases	CO <sub>2</sub> e
CO <sub>2</sub>	1
CH <sub>4</sub>	25
N <sub>2</sub> O	298

## **APPENDIX C**

### Remedial & Risk Management Evaluation

Table C-1: Remedial/Risk Management Option Evaluation Matrix - Hazardous Waste

Risk Management Option	Effectiveness	Ease of Implementation	Anticipated Socio-Economic Benefit	Anticipated Relative Costs	Anticipated Carbon Footprint
Option 2: Remediation - Dispose of Off-Site	Fully Effective	Simple	Limited Socio-economic benefit	Moderate Cost	Moderate CO <sub>2</sub> e
	<p>Hazardous waste placed into appropriate containers and transported to Kugluktuk via air and backhauled on the sealift to a licensed disposal facility in the South</p> <p>All hazardous waste with unacceptable risk in accessible areas will be removed from the sites. Risk substantially reduced by removal of hazardous waste</p> <p>No risks to effectiveness of this option will be posed by climate change.</p> <p>No requirements for long term monitoring or maintenance.</p>	<p>The implementation of this option uses readily available technologies to remove hazardous waste from the site.</p> <p>Hazardous waste can be consolidated and packaged manually, removed from site by air and flown from Site to Kugluktuk in preparation for Sealift to the South for disposal. No major challenges.</p> <p>Skilled labour for this work is available in Kugluktuk and sufficient accommodations are available locally out-of-town labour. Rotary aircraft can be used to move waste.</p> <p>Process of consolidation and off-site disposal would likely require at least 8 working days.</p> <p>No large equipment or additional infrastructure is required at the Sites.</p>	<p>Local employment opportunities would include Wildlife Monitors, Field Assistant and General Labourers for work on-site (1 season)</p> <p>Training opportunities could be provided for field assistants and operators.</p> <p>Accommodations, meals &amp; supplies would be procured locally from Kugluktuk for 1 season.</p> <p>Local contractors have the capacity to bid on all aspects of the project.</p>	<p>Assumes one field season/year to complete work and demob waste</p> <p>No long term monitoring would be required with this option</p> <p>Transportation costs to transport material from site drive the costs for this option.</p>	<p>Assumes transportation by sealift from Kugluktuk to dispose of material in Montreal</p> <p>Assumes a small utility helicopter to transport hazardous material from each Site to Kugluktuk</p> <p>Assumes 50 hours of helicopter time would be required</p>
Rating	7	5	3	5	5
Weighting	4	2	2	4	1
Weighted Rating	28	10	6	20	5
Total Evaluation Score					69

Table C-1: Remedial/Risk Management Option Evaluation Matrix - Hazardous Waste

Risk Management Option	Effectiveness	Ease of Implementation	Anticipated Socio-Economic Benefit	Anticipated Relative Costs	Anticipated Carbon Footprint
Option 3: Risk Management - Consolidate and Continuous Monitoring	Somewhat Effective	Somewhat Complex	Some socio-economic benefit	High Cost	Moderate CO <sub>2</sub> e
	<p>Consolidation reduces risk by placing waste in one area with some containment for any leaks in place. Monitoring will identify any issues occurring with time.</p> <p>Monitoring will allow for communication of risk to local land users on a regular basis.</p> <p>Risk is not reduced significantly therefore considered somewhat effective.</p> <p>Climate change impacts such as severe rainfall events and settling due to permafrost deterioration would not impact the monitoring plan.</p> <p>Long term monitoring is required which requires additional coordination of inspection and sampling activities for the next 25 years.</p>	<p>The implementation of this option is somewhat complex with respect to logistics, as it will require one mode of transportation, and does not require specialized technology. However it does have a LTM component.</p> <p>Labourers are readily available in Kugluktuk.</p> <p>Long term monitoring is straight forward and could be bundled with other sites. Two to three sites could be visited per day and each monitoring event would likely require 3 working days.</p> <p>Process of consolidation would likely require at least 6 working days.</p>	<p>Local employment opportunities would include Wildlife Monitors, Field Assistant for work on-site (1 season)</p> <p>Wildlife Monitor and field assistant required for follow up monitoring visits (Years 1 - 25)</p> <p>Local contractors have the capacity to bid on all components of the project.</p> <p>Accommodations, meals &amp; supplies for initial construction and long term monitoring (25 years) to be provided by local suppliers.</p> <p>Training opportunities could be provided for field assistants during each monitoring year for field assistants completing the inspections.</p>	<p>Assumes one field season or year to complete initial work</p> <p>Assumes observational monitoring events at Years 1, 3, 5, 7, 10, 15 and 25.</p> <p>Each monitoring event would likely require 3 working days.</p>	<p>Consolidating hazardous waste is expected to require up to 34 hours of helicopter use, including 10 hours for positioning to Kugluktuk.</p> <p>Assumes 7 Monitoring events requiring travel using a small utility helicopter to travel to each Site.</p> <p>Assumes 3 days of helicopter use per monitoring event and 10 hours to stage the helicopter in Kugluktuk</p>
Rating	3	3	5	3	5
Weighting	4	2	2	4	1
Weighted Rating	12	6	10	12	5
Total Evaluation Score					45

Table C-1: Remedial/Risk Management Option Evaluation Matrix - Hazardous Waste

Risk Management Option	Effectiveness	Ease of Implementation	Anticipated Socio-Economic Benefit	Anticipated Relative Costs	Anticipated Carbon Footprint
Option 4: Do Nothing	Minimally Effective	No Access Required	Limited socio-economic benefit	Lowest Cost	Lowest CO <sub>2</sub> e
	No further work would be completed, all risks remain.	No further work would be completed, no access to the Sites is required.	No further work would be completed, no socio-economic opportunities.	No further work would be completed, no further costs would occur.	No further work would be completed, no further CO <sub>2</sub> e emissions would occur.
Rating	1	7	1	7	7
Weighting	4	2	2	4	1
Weighted Rating	4	14	2	28	7
Total Evaluation Score					55

Table C-2: Remedial/Risk Management Option Evaluation Matrix - Non-Hazardous Waste

Risk Management Option	Effectiveness	Ease of Implementation	Anticipated Socio-Economic Benefit	Anticipated Relative Costs	Anticipated Carbon Footprint
Option 1: Remediation - Dispose of On-Site	Moderately Effective	Complex	Moderate socio-economic benefit	Very High Cost	High CO <sub>2</sub> e
	<p>Building on-site landfill and placing debris will eliminate any hazards it creates on site. Not as effective as complete removal from Site as degradation of facility may occur.</p> <p>All debris will be placed crushed, flattened or dismantled to minimize volume.</p> <p>Climate change impacts such as severe rainfall events and settling due to permafrost deterioration (where applicable) may deteriorate the landfill. The design should consider this to maintain its integrity for the future.</p> <p>Long term monitoring of the landfill is required which requires additional coordination of inspection and maintenance activities for the next 25 years.</p>	<p>The implementation of this option uses readily available technologies. Due to the remote nature of the site, logistics will be complex as heavy equipment needs to be transported to Site.</p> <p>Equipment required is not available for rental in Kugluktuk. Equipment needs to be flown/cat trained into site and would be rented for an entire year or more. Equipment will then be flown/cat trained back the following year.</p> <p>Mobilizing equipment to site is difficult. Cat train will be used to transport heavy equipment such as a excavator, dozer, rock truck, and skid steers. Equipment size will be limited to payload and volume limits on the aircraft/cat train.</p> <p>Skilled labour for this work is expected to be available in Kugluktuk and sufficient accommodations are available locally for out-of-town labour.</p> <p>Process of building the on-site landfill and hauling material would likely require at least 37 working days.</p> <p>Long term monitoring of the landfill is required which requires additional coordination of inspection and maintenance activities for the next 25 years.</p>	<p>Local employment opportunities would include Wildlife Monitors, Field Assistant, Equipment Operators and General Labourers for work on-site (1 season)</p> <p>Wildlife Monitor and field assistant required for follow up monitoring visits (Years 1 - 25)</p> <p>Local contractors have the capacity to bid on all components of the project.</p> <p>Accommodations, meals &amp; supplies for landfill construction and long term monitoring (25 years) to be provided by local suppliers.</p> <p>Training opportunities could be provided during construction and during each monitoring year for field assistants completing the inspections.</p>	<p>Assumes one year to complete work and demob equipment. Long field program to construct landfill, expensive transport and continued monitoring drives the cost. On site camp for accommodation.</p> <p>Multiple years may be required to transport equipment via seallift.</p> <p>Assumes observational monitoring events at Years 1, 3, 5, 7, 10, 15 and 25.</p> <p>If erosion or washouts occur may need to replace cover materials - representative cost is carried but some uncertainty exists.</p>	<p>Assumes large sized equipment, and their associated fuel consumption rates</p> <p>Assumes a medium work value, Intermittent work loading/pushing low to medium density material. Using 25 - 50% of available horsepower.</p> <p>Assumes a small utility helicopter to transport non-hazardous debris from each Site to the Speers Lake Site for land filling.</p> <p>Assumes a 4 hour usage of a small utility helicopter, plus 10 hours to stage a plane in Kugluktuk for each monitoring event</p> <p>Assumes 7 Monitoring events requiring travel from southern Ontario.</p> <p>Assumes a Cat Train using a high work scenerio. Using 75 - 100% of available horsepower</p>
Rating	5	1	7	1	3
Weighting	4	2	2	4	1
Weighted Rating	20	2	14	4	3
Total Evaluation Score					43

Table C-2: Remedial/Risk Management Option Evaluation Matrix - Non-Hazardous Waste

Risk Management Option	Effectiveness	Ease of Implementation	Anticipated Socio-Economic Benefit	Anticipated Relative Costs	Anticipated Carbon Footprint
Option 2: Remediation - Dispose of Off-Site	Fully Effective	Somewhat Complex	Moderate Socio-economic benefit	High Cost	Very High CO2e
	<p>Debris placed into appropriate containers and transported via aircraft to an appropriate off-site disposal facility</p> <p>All debris will be removed from site. No hazards will remain. Fully effective.</p> <p>No risks to effectiveness of this option will be posed by climate change.</p> <p>No requirements for long term monitoring or maintenance.</p>	<p>The implementation of this option uses readily available technologies to remove debris from the site.</p> <p>Debris can be consolidated manually and equipment can be used to transport heavier materials for packaging. It is assumed that the waste will be transported to Kugluktuk by air followed by sealift to the south to a southern disposal facility.</p> <p>Skilled labour for this work is available in Kugluktuk and sufficient accommodations are available locally for out-of-town labour.</p> <p>Debris would be packaged and flown off-site to the south in 1 spring/summer season for the six smaller Sites.</p> <p>Debris would be packaged in the spring/summer season for the Speers lake Site, and flown off site in the Winter season.</p>	<p>Local employment opportunities would include Wildlife Monitors, Field Assistant, Equipment Operators and General Labourers for work on-site</p> <p>Training opportunities could be provided for field assistants and operators.</p> <p>Accommodations, meals &amp; supplies would be procured locally from Kugluktuk.</p> <p>Local contractors have the capacity to bid on all aspects of the project.</p> <p>Local chartered aircraft would be a large part of the budget increasing local spending past 20%</p>	<p>Assumes one summer field season to complete work and one winter season to demob materials. On site camp for accommodation.</p> <p>No long term monitoring would be required with this option.</p> <p>Transportation costs to the transport material from site to a disposal facility drive the costs for this option.</p>	<p>Assumes transportation to dispose of material in Montreal.</p> <p>Assumes 74 hours of Basler Aircraft time to transport debris from the Speers Lake Site to Kugluktuk, including 10 hours to stage a plane in Kugluktuk.</p> <p>Assumes a twin otter airplane to transport personnel from Kugluktuk to the Speers Site.</p> <p>Assumes a 36 hours of flight time for the Twin Otter, including 10 hours to stage a plane in Kugluktuk.</p> <p>Assumes 146 hours of Helicopter time to transport debris from the six other Sites to Kugluktuk.</p> <p>Assumes a medium work value, Intermittent work loading/pushing low to medium density material. Using 25 - 50% of available horsepower.</p>
Rating	7	3	7	3	1
Weighting	4	2	2	4	1
Weighted Rating	28	6	14	12	1
Total Evaluation Score					61

Table C-2: Remedial/Risk Management Option Evaluation Matrix - Non-Hazardous Waste

Risk Management Option	Effectiveness	Ease of Implementation	Anticipated Socio-Economic Benefit	Anticipated Relative Costs	Anticipated Carbon Footprint
Option 3: Risk Management - Consolidate	Somewhat Effective	Simple	Limited Socio-economic benefit	Moderate Cost	Moderate CO <sub>2</sub> e
	Consolidation will centralize any physical hazards associated with debris  Climate change impacts such as severe rainfall events and settling due to permafrost deterioration could deteriorate the consolidated wastes so somewhat effective	The implementation of this option is simple with respect to logistics and does not require specialized technology. If equipment can be mobilized, consolidation will be more effective.  Labour is readily available in Kugluktuk.  Only one mode of transport is required and only one season of work.	Local employment opportunities would include Wildlife Monitors, Field Assistant for work on-site (1 season)  Local contractors have the capacity to bid on all components of the project.	Assumes one field season or year to complete consolidation work	Consolidating non-hazardous debris is expected to require up to 66 hours of helicopter use, including 10 hours for positioning to Kugluktuk.  Assumes 14 days on site consolidating debris  Daily travel to and from Site is required during consolidation of debris
Rating	3	5	3	5	5
Weighting	4	2	2	4	1
Weighted Rating	12	10	6	20	5
Total Evaluation Score	53				
Option 4: Do Nothing	Minimally Effective	No Access Required	Limited socio-economic benefit	Lowest Cost	Lowest CO <sub>2</sub> e
	No further work would be completed, all risks remain.	No further work would be completed, no access to the Sites is required.	No further work would be completed, no socio-economic opportunities.	No further work would be completed, no further costs would occur.	No further work would be completed, no further CO <sub>2</sub> e emissions would occur.
Rating	1	7	1	7	7
Weighting	4	2	2	4	1
Weighted Rating	4	14	2	28	7
Total Evaluation Score	55				

## **APPENDIX D**

### Engagement Meeting Minutes



<b>Project:</b> 230468 Speers Lake Remediation	<b>Meeting Date:</b> October 22, 2024 6:00pm-8:00pm (Mountain)	<b>List of Attendees:</b>  JV60: Andrea Jenney, Stephen Anderson  PSPC: Marie McGregor  CIRNAC: Rachel Theoret-Gosselin, Cassie Stead
<b>Agenda Item</b>	<b>Notes</b>	
<b>Presentation:</b>	<ul style="list-style-type: none"> <li>• PSPC, CIRNAC and BLM-KEL-60 presented a summary of the Speers Lake Cluster Sites project to the community of Kugluktuk</li> <li>• A meal was provided prior to the start of the meeting with desserts and coffee served at the break</li> <li>• Translation was provided by Mona Tiktalek</li> <li>• Following the presentation a question and answer period was conducted</li> <li>• The attendance sheet (see attached) was filled by participants upon their arrival and 59 names were recorded.</li> <li>• Representatives from the Elder’s Group, the Kugluktuk Angoniatit Association (Hunters and Trappers Organization), and Housing were listed on the attendance sheet.</li> </ul>	
<b>Question and Answer Period</b>	<p>The following is a summary of questions and responses following the presentation:</p> <ul style="list-style-type: none"> <li>• Q: Will the core be removed from the boxes on the Sites?             <ul style="list-style-type: none"> <li>○ Yes, only the core will be left behind</li> </ul> </li> <li>• Q: The posting only noted Speers Lake and did not clearly indicate that the other sites would be presented. Why was that?             <ul style="list-style-type: none"> <li>○ The name used indicates the largest site of the cluster. The sites were bundled for project management purposes.</li> </ul> </li> <li>• Q: Why is transporting the waste to Kugluktuk over the land not being considered? Local residents could collect the waste and transport it back to Kugluktuk over land for shipping out of the community.             <ul style="list-style-type: none"> <li>○ The resident was thanked for this information. This will be considered for the remedial plan.</li> </ul> </li> <li>• Q: Elder Alice provided information. We were taught to not leave anything on the land. Don’t leave your garbage on the land. Don’t leave anything in the lakes to dirty the water or hurt the animals. Please clean any oil that spills. Thank you to the miners.             <ul style="list-style-type: none"> <li>○ Elder thanked for their comment</li> </ul> </li> <li>• Q: The cleanup should have been done by the mining companies. Why aren’t they cleaning them up?             <ul style="list-style-type: none"> <li>○ Many site were abandoned long ago and the companies don’t exist anymore. They are now the responsibility of the Crown.</li> </ul> </li> <li>• Q: How will you transfer the fuels? You could transfer to the new drums or incinerate the fuel.             <ul style="list-style-type: none"> <li>○ This will be left to the contractor. Thank you for the suggestion.</li> </ul> </li> </ul>	



	<ul style="list-style-type: none"><li>• Q: When you are cleaning up the lead paint, if you burn the wood it could be detrimental to human health. How will you deal with the painted materials? The same for the batteries, there are chemicals in them and you can't burn them.<ul style="list-style-type: none"><li>○ The way that the remediation will be implemented will be left to the successful contractor but the recommendation is that lead painted and all hazardous materials will be removed in proper containment.</li></ul></li><li>• Q: How bad are the fish nowadays that they don't taste like they used to. The meat is soft and the colour is different.<ul style="list-style-type: none"><li>○ We can't answer this specifically. The water at the sites was not found to be polluted.</li></ul></li><li>• Q: Elder comment – Nowadays we have mines south of Kugluktuk and these sites are from 60s to the 90s. If they see anything at the Sites during the cleanup – they should tell the community.<ul style="list-style-type: none"><li>○ Elder thanked for their comment</li></ul></li><li>• In individual conversation: A resident described how her father and her father's relative were travelling around the Speers Lake site when they were teenagers and they observed guns and ammunition at the Site. They thought the guns and ammo were from a WWII era.</li></ul>
<b>Closing</b>	Meeting ended at approximately 8pm MST



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## Appendix A Attendance Sheet

## Attendance Sheet - Community Meeting

#	Participant Name	Organization	Contact Info (optional)
1	Clifton Tiktalek	✓	✓
2	Ron (Cailin) Kadlun		
3	James Boff		
4	Rita Muok		
5	Rose Marie Nigivak		
6	Geen Tiktalek		
7	Anissa Ayalgak		
8	Joe Nigivak		
9	Gabriel HIKOMAK	✓	✓
10	Anita Niptanatik		
11	ALICE AYALIK		
12	WALTER AYALIK	✓	
13	ALEN ALGONA		
14	Bobby HIKASITOK	✓	
15	Deirda HAVIOMAK		
16	IDA ASIVIK	✓	982 2893
17	BESSIE KUKILUKAK		982 1324
18	Shelley KUKILUKAK		" 6920
19	Jan HIKOMAK		
20	Nigel Allmuph		
21	Sella Muok	✓	
22	Wyan Algona	✓	
23	Kim Algona	✓	
24	BUTY KADLUN		
25	Jayko Patengayal	Chairman - Elders Group	
26	FANNIE KUKILUKAK		
27	JAPYUCALISAK		
28	BRENDA KOKAK		
29	MILLIE AVAIGAK		
30	Jany Oulak		
31	Georgie Kokak		
32	Teret Algona		
33	Jack Oulak		
34	Kevin OLEAHAK		
35	DAVID KNOGALAK	✓	982 4840
36	Phillip Kalkik		982-5720
37	Ida Ayalik - McWilliam	Keta interested member	
38	Isaiah Keadjuk		982-1da
39	Helen Hala		
40	Agnas Ayalik		
41	Bella Algak		
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43			

## Attendance Sheet - Community Meeting

#	Participant Name	Organization	Contact Info (optional)
1	Wally	✓	✓
2	Packe Norovska	✓	✓
3	Cynthia Hiltchaitok		
4	Anne Ihumatak	✓	✓
5	Colin Kunelek	✓	✓
6	Harry Abjun	HITO	X
7	Daniel Talgatac		
8	Roseanna Haviyaca		X
9	Robert H. H. H.		
10	Amuda Mipukshuk		
11	Luke Mipukshuk		
12	Chris Keaduk		
13	Sylvia Puniak Kilgik.		
14	Gordon Kekak	Housing	X
15	Bruce Hiltchaitok		
16	Lana Hiltchaitok		
17	Reas Kekak		
18	Bernice Kapoluk		
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## Appendix B Meeting Photos



*Photo 1: Community Meeting Attendees – October 22 2024*



*Photo 2: Community Meeting Attendees – October 22 2024*