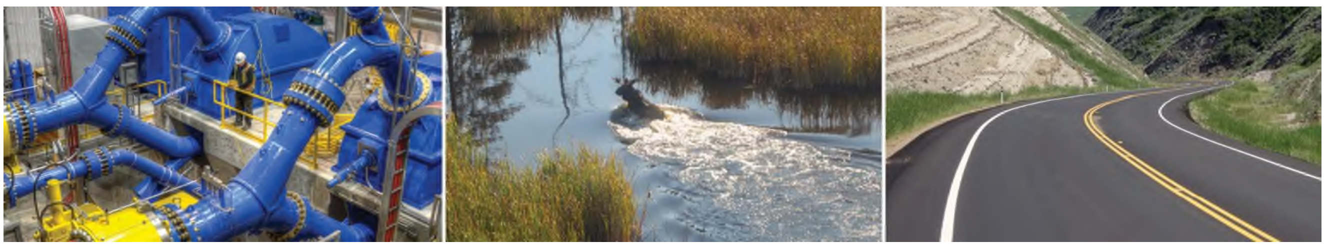
OPTIONS ANALYSIS REV 02
JERICHO DIAMOND MINE, NUNAVUT



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EXECUTIVE SUMMARY

Tetra Tech EBA Inc. (Tetra Tech EBA) was retained by Aboriginal Affairs and Northern Development Canada (AANDC) to carry out an Environmental Site Assessment (ESA), Options Analysis, and Remedial Action Plan for the closure of the Jericho Diamond Mine (Jericho Mine). This document presents the Options Analysis.

Three closure scenarios were considered for the options analysis for the Jericho Mine, as summarized below and in Table 1.

Scenario 1 – Immediate and Full Remediation

This scenario is to decommission and dispose of all site infrastructure as quickly as feasible following the options recommended in this document. The goal is for full remediation to minimize liabilities at the Jericho Mine and to meet or exceed approved remediation plans previously submitted by the mine operators. Estimated costs for this scenario are $21,200,000.

Significant remediation efforts would include filling the open pit, re-aligning the C1 diversion to the pit, covering the PKCA, breaching the West Dam and Divider Dyke A, grading pads and borrow areas, excavating contaminated soil, off-site disposal of hazardous waste, building demolition and landfill of non-hazardous material, and construction of a landfarm for the remediation of hydrocarbon contaminated soils. The estimated contaminated soil volume and resulting landfarm size is relatively large. Further site delineation may lower the expected contaminated soil volume.

Scenario 2 – Limited Remediation.

Scenario 2 is for the remediation of only items presenting an environmental risk while minimizing costs. The Jericho Mine shall be left in a state not requiring annual visits to address environmental issues. Estimated costs for this scenario are $17,100,000.

The Scenario 2 requirement for removal of environmental risks and minimization of annual monitoring costs mean that much of the full remediation plan will still occur. There are few differences between Scenario 1 and Scenario 2. The major buildings such as the process plant and truck shop, and some aesthetic grading are not carried out under Scenario 2; however, many of the major costs such as mobilization and the landfarm construction are required.

Scenario 3 – Preservation of the Site Assets.

The Jericho Mine shall generally be left in its current state, with the intention that it could be reopened, or remediated at a later date while performing ongoing care and maintenance. Estimated costs for this scenario are $3,100,000 over a ten year period. Costs beyond ten years have not been accounted for.

The cost source in this scenario is the annual monitoring and asset preservation costs. This includes geotechnical inspections, water quality monitoring, and care and maintenance. The risk in this scenario is that on-site contamination will spread with time and may result in higher closure costs.

Table 1: Reclamation Scenarios

Component and Action	Scenario 1 Full	Scenario 2 Limited	Scenario 3 Preservation
Open Pit			
Construct Perimeter Berm	Yes	Yes	-
Stabilize Slopes	Yes	-	-
C1 Diversion to the Pit	Yes	-	-
Construct Pit Outflow	Yes	Yes	-
Causeway (Jetty)			
Remove Infrastructure	Yes	-	-
Processed Kimberlite Containment Area			
Cover Cell A	Yes	Yes	-
Breach Divider Dyke A	Yes	Yes	-
Breach West Dam	Yes	Yes	-
Pads			
Grade Stockpile and Coarse PK	Yes	-	-
Roads			
Remove Culverts and Grade	Yes	-	-
Borrow Areas			
Material for Remedial Construction	Yes	-	-
Contaminated Soils			
PHC Soil Excavation and Treatment	Yes	Most	-
Metals and Unknown Soil Disposal	Yes	Yes	-
Non-Hazardous Materials			
Landfill Process Plant and Truck Shop	Yes	-	-
Landfill Remaining Structures	Yes	Yes	-
Landfill Construction and Cover	Yes	Yes	-
Hazardous Materials			
Lead Paint and ASTs	Yes	Yes	-
Organic Liquid Wastes	Yes	Yes	-
Specialist Labour and Analysis	Yes	Yes	-
Other Hazardous Waste	Yes	Yes	-
Landfarm			
Landfarm for PHC Contaminated Soil	Yes	Most	-
Monitoring and Asset Preservation (10 Year Total)			
Water Monitoring	Yes	Yes	Yes
Geotechnical Inspection	Reduced	Yes	Yes
Care and Maintenance	-	Reduced	Yes

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ACRONYMS & ABBREVIATIONS

AANDC	Aboriginal Affairs and Northern Development Canada
AMSL	Above Mean Sea Level
APEC	Area of Potential Environmental Concern
AST	Above-ground Storage Tank
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
CCME	Canadian Council of Ministers of the Environment
ESA	Environmental Site Assessment
FPK	Fine Processed Kimberlite
HDPE	High-Density Polyethylene
HWTA	Hazardous Waste
IOL	Inuit Owned Lands
LBP	Lead-Based Paint
ODS	Ozone Depleting Substances
PAH	Polycyclic Aromatic Hydrocarbon
PCBs	Polychlorinated Biphenyls
PFAL	Protection of Freshwater Aquatic Life
PHC	Petroleum Hydrocarbons
PK	Processed Kimberlite
PKCA	Processed Kimberlite Containment Area
RAP	Remedial Action Plan
RPD	Relative Percent Difference
TDG	Transportation of Dangerous Goods

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Aboriginal Affairs and Northern Development Canada and their agents. Tetra Tech EBA Inc. (Tetra Tech EBA) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Aboriginal Affairs and Northern Development Canada, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in Tetra Tech EBA's Services Agreement. Tetra Tech EBA's General Conditions are provided in Appendix A of this report.

1.0 INTRODUCTION

1.1 General

Tetra Tech EBA Inc. (Tetra Tech EBA) was retained by Aboriginal Affairs and Northern Development Canada (AANDC) to provide consulting services related to closure of the Jericho Diamond Mine (Jericho Mine), Nunavut. This document is an options analysis that summarizes the Jericho Mine remediation alternatives and associated costs. The options analysis will be used in the preparation of the remedial action plan (RAP).

A site investigation was conducted by Tetra Tech EBA from August 19 to September 1, 2014. The goals and findings of the investigation are documented in the gap analysis (Tetra Tech EBA, 2014a) and the Environmental Site Assessment (ESA) (Tetra Tech EBA, 2014b), respectively.

The Jericho Mine is located partially on Crown land and partially on Inuit Owned Lands (IOL). Only the portion on Crown land was investigated and covered in subsequent reporting.

This project has been undertaken under AANDC's Standing Offer number 4600000763.

1.2 Document Scope

The goal of the options analysis is to produce mine closure remediation options to support the RAP. The initial sections of this report provide a background of the Jericho Mine and a summary of the ESA findings. The options section (Section 5.0) goes through the individual mine components and the available remediation options. Sections 6.0 and 7.0 outline infrastructure which will need to be constructed as part of closure work, and Section 8.0 outlines potential borrow sources. Section 9.0 reviews the monitoring and asset preservation activities required for the Jericho Mine over the next ten years.

The overall remediation options for the Jericho Mine are summarized in Section 10.0. In general, three closure scenarios were considered:

- Scenario 1 – Immediate and full remediation. This scenario comprises full remediation of the mine site to reduce environmental and financial liabilities, and to meet or exceed approved remediation plans previously submitted by the mine operators. This option seeks to decommission and dispose of all site infrastructure as quickly as feasible.
- Scenario 2 – Limited remediation. This scenario comprises remediation of only those items presenting an environmental risk. The objective under this scenario is to deal with the significant environmental issues, while minimizing costs. The intent would be to leave the Jericho Mine in a condition not requiring annual visits to address environmental issues.
- Scenario 3 – Preservation of the site assets. Under this scenario the Jericho Mine will generally be left in its current state, with the intention that it could be reopened, or remediated at a later date. Ongoing care and maintenance tasks will be required under this scenario.

1.3 Cost Estimating

Cost estimating has been done by Henry Wong of Haiyin Consulting using the RECLAIM model. The cost estimate references the 2011 Interim Closure and Reclamation Plan (EBA, 2011) and the accompanying cost estimate (Nuna Logistics, 2011), but has been updated based on a review of market costs. Estimating was completed in a manner consistent with classification of an indicative cost estimate as defined by Public Works and Government Services Canada.

2.0 BACKGROUND INFORMATION

The following sections provide an overview of the Jericho Project. Additional information is available in the gap analysis and the ESA (Tetra Tech EBA, 2014a and 2014b).

2.1 Location and Project Details

The Jericho Mine is located approximately 260 km southeast of Kugluktuk, NU and 30 km north of the Lupin Mine in the Contwoyto-Itchen Region. The Jericho Mine is located partially on Crown land and partially on IOL. Figure 1 shows an overview of the site and the division between Crown Land and IOL.

The Jericho Mine was opened in 2006 and operated by Tahera Diamond Corporation (Tahera) until 2008 when Tahera went through bankruptcy proceedings. Shear Diamonds (Nunavut) Corp. (Shear) took over the Jericho Mine in 2010 and operated the mine under care and maintenance until September 2012 at which time Shear suspended operations. No operational activities have occurred since September 2012. AANDC has undertaken basic environmental protection of the Jericho Mine since spring 2013.

The Jericho Mine is accessible by air and the Tibbitt to Contwoyto Winter Road. The winter road was opened to the Jericho Mine during the Tahera operation and construction years. The Jericho Mine has a 1 km long airstrip.

2.2 Regulatory Approvals

The original authorization to operate the Jericho Mine was given in 2004 to Benachee Resources Inc. (a subsidiary of Tahera) by the Nunavut Water Board under licence No. NWB1JER0410. The licence was reassigned to Shear in 2010. The water licence was renewed in 2011 by the Nunavut Water Board under licence No. 2AM-JER119.

Interim reclamation, abandonment, and closure plans were prepared for the Jericho Mine by both Tahera (Tahera 2003, 2007) and Shear (EBA 2011c).

2.3 Regional Geology and Topography

The Jericho Mine is situated within the Canadian Shield. The oldest rocks in the area comprise Archean tonalites or granodiorites that outcrop in the immediate vicinity of the Jericho Mine kimberlite pipe. The region is considered to be very geologically stable and not subject to active tectonic movement. The last tectonic event is believed to have been the emplacement of Proterozoic diabase dykes approximately 1.3 billion years ago. The Jericho Mine kimberlite pipe, on the south shore of Carat Lake, was formed from multiple emplacement events, comprising a precursor dyke and three diatreme intrusive stages (SRK 2003a).

The Jericho Mine was glaciated several times during the Pleistocene era. The last deglaciation was accompanied by deposition of a discontinuous, but locally thick blanket of gravel and silty sand till with many cobbles and boulders. Glaciofluvial and glaciolacustrine deposition was also part of this deglaciation. Glaciofluvial deposits include eskers, outwash deltas, kame deltas, and supra-glacial deltas; these sediments range from clean sand and gravel to very coarse thick boulder and block accumulations. Glaciolacustrine sediments consist mainly of silt and sand. Periglacial processes have caused mechanical breakdown and mass wasting of near-surface rock. Organic soils have developed in some poorly drained areas (SRK 2003a).

Local topographic relief is primarily the result of previous glaciations. The water surface elevation in Carat Lake is approximately 470 m above mean sea level (AMSL), and the topographic highs in the vicinity of the site facilities typically range from approximately 500 m to 550 m AMSL (SRK 2003a). At the central mine area, the topography is relatively flat and gently slopes to the north into Carat Lake. Beyond the Jericho Mine, the topography is characterized as gently rolling to hilly. In particular, south and east of the central mine area includes an elevation gain of approximately 100 m over distances of approximately 500 m (AMEC 2007).

2.4 Regional Climate

Precipitation as rainfall typically occurs between April and November. Snowfall can occur at any time throughout the year, but is not typical in July and August. The mean annual precipitation ranges from 200 mm to 300 mm.

Climate data collection at the Jericho Mine has been discontinuous, with the installation of an automated weather station on the eastern shores of Carat Lake only since the summer of 1995. The available data collected are sufficient to confirm a relatively good correlation with the climate data collected at the Lupin Mine weather station, 30 km south of site. SRK Consulting (SRK) (2003b) provides average climate data which were incorporated into calculations for this report:

- Average Annual Precipitation: 330 mm
- Estimated Runoff in Vicinity of Jericho Kimberlite Pipe: 225 mm
- Estimated Open Water Evaporation: 270 mm

The climate of the region is marked by short, cool summers and cold winters. Air temperatures range from about +20°C during the summer to -30°C in the winter. The mean annual temperature is -11.8°C. Wind direction and speeds are variable, but tend to favour a northeast-southwest orientation.

Wind speed data collected at the Jericho Mine are somewhat consistent with those collected at the Lupin Mine. The Lupin Mine wind data indicates mean monthly wind speeds ranging from 11 km to 20 km per hour in December and October, respectively. Wind directions measured at Carat Lake for 1995 and 1996 were predominantly from the west-southwest, and wind directions collected at the Jericho Mine's airstrip were predominantly north-northwest in both 1997 and 1998. Predominant wind direction in 1999 was due west.

2.5 Permafrost

The Jericho Mine lies in a region of continuous permafrost, with permafrost present everywhere except beneath large lakes, rivers, and some streams that do not freeze to the bottom. Thermistor data extrapolation suggests permafrost depth is approximately 540 m below ground level near the Jericho Mine kimberlite pipe. Temperature profiles show that the zero-annual amplitude depth is approximately 15 m to 18 m below ground level (SRK 2003a).

In surficial soils on site, the active layer typically ranges in thickness from less than 1 m in organic soil to slightly more than 3 m where well drained granular soils are present. Active layer thickness in exposed rock exceeds 3 m. On-site ground penetrating radar and drilling have revealed stratified ground ice in surficial materials, including massive ice deposits at the base of the Carat Lake outwash delta and within the esker complex to the north (SRK 2003a).

2.6 Vegetation and Ecology

The Jericho Mine is located within the Takijuq Lake Upland ecoregion within the southern arctic ecozone. The short growing season and long cold winters restrict plant growth. Despite these difficult growing conditions, shrub tundra communities dominate the area and consist of relatively consistent cover of dwarf birch, willow, Labrador tea, other ericaceous shrubs, and sedge. In particular, drier areas can be dominated by Vaccinium and Dryas species, whereas willow, sphagnum moss, and sedge can dominate the lower areas (ESWG 1996).

2.7 Wildlife

The southern arctic ecozone is described as having low biological productivity due to the short growing season and cold climates. Barren-ground caribou, muskox, grizzly bear, wolverine, Arctic hare, red fox, and grey wolf are common in the area. Birds, such as peregrine falcons, gyrfalcons, waterfowl, shorebirds, and upland nesting birds (e.g., ptarmigan) are present on a seasonal basis, with only the gyrfalcon and common raven possibly over-wintering.

2.8 Human Activities

The land use activities of the area are limited to subsistence fishing, trapping, and hunting (ESWG 1996).

3.0 MINE SITE FEATURES AND CONDITION

Construction and development of the Jericho Mine occurred primarily during Tahera's operation of the mine, prior to 2008. The primary development areas include the airstrip, located on the north portion of the mine site, and the camp and processing area, located in the south. Figure 1 provides an overview of site development and infrastructure. Detailed site drawings of the various areas are shown in Figures 2 through 7.

The following sections provide an overview of the site infrastructure and development at the Jericho Mine. Specific details relating to development are discussed in subsequent sections.

3.1 Site Infrastructure

3.1.1 Buildings

Major site buildings include the truck shop, camp facility and process plant, as shown in Figures 3 and 3.2. Other structures include smaller temporary or portable structures including the airstrip terminal, storage sheds, and shacks. The emulsion plant is the only other permanent building on site; however, it is on IOL.

Truck Shop

The truck shop has a footprint of 872 m^2 with a total shell volume of 10,464 m^3 (Figure 3). It has metal-clad construction and steel structure supports, with a concrete floor slab. It mostly consists of three large bays and one large welding bay, each with a large overhead door. Ancillary rooms include a warehouse, tool crib, and mechanical room. The second floor consists of an electrical and storage room, two offices, a small women's washroom and larger men's washroom, with a lunchroom at the west end. It is connected to the utilidor/corridor of the main camp facility.

Camp Facility

The camp facility is 5,341 m^2 with a total shell volume of 18,694 m^3 (Figures 3 and 3.2). The facility is made up of wood-frame, metal clad trailers constructed by Shanco Camp Services Ltd. It consists of three sleeping quarters' wings on the southwest side of the camp (Halls D, E and F), each containing 33 to 34 rooms. These are connected to recreation facilities, a kitchen and dining area, and an office area located on the camp's northwest side.

A metal clad corridor (utilidor) connects the camp area to the truck shop, process plant and other buildings.

The recreation facilities included a TV and reading room, a phone booth and foosball/pool table room, and an exercise room. The office area is made up of 11 offices, one medical room, one print shop, one miscellaneous safety storage room, one environment laboratory, one mechanical room, one diamond inspection room, one personal protective equipment storage room and one computer server room. Adjacent to the office area was the security area consisting of a security clearance room and an office.

Continuing southeast along the utilidor is a water above-ground storage tank (AST) room with five large water tanks (each 1,800 L), a storage/environmental wing and a parts wing made up of six sea cans. Heading north along the utilidor are contractor offices and gensets made up of four generators in four sea cans with generally vinyl sheet flooring, dropped ceiling tile, and drywall finishes. These areas also included various bathrooms, furnace rooms, utility, and mechanical rooms.

The camp facilities have started to deteriorate and are not currently considered appropriate for housing work crews. Foxes entered the facility in winter 2014 and there was evidence of fox excrement along many of the main hallways and common areas, although it is understood that this was cleaned up subsequent to the August 2014 site visit. There is also water damage in some of the common areas and other rooms of the facility.

Process Plant

The process plant has a footprint of 2,048 m^2 with a shell volume of 47,104 m^3 (Figure 3). It has metal-clad construction and steel structure supports, with a concrete base pad. Prior to entering the process plant, there is an office, lunchroom, locker room, and laboratory area. Most of the plant is an open area filled with diamond processing equipment. The few enclosed areas are a tool crib, mechanicals room, HVAC rooms, a security office, and diamond inspection room. The process plant was designed to process kimberlite ore using conventional diamond processing techniques.

3.1.2 Airstrip

The airstrip was initially constructed in 1997 on an esker north of the exploration camp. It was 1,000 m long by approximately 30 m wide. The strip was extended in 2006 to 1,374 m in length. The strip extension was accomplished by levelling the existing esker surface and adding crushed mine rockfill where required. The airstrip is equipped with runway lights powered by a small generator at the airstrip. Two 62,000 L bermed tanks were located at the south apron for aircraft refueling. Figure 7 shows the airstrip area.

There is a small terminal building beside the airstrip that currently serves as a shelter for workers. Also nearby is a shop, genset, two bermed ASTs, and a small building for outgoing freight. The buildings can be seen in detail in Figure 7.1.

3.1.3 Utilities

The main utility lines include:

- Water intake line from Carat Lake to the main camp area (Figure 3 and Figure 5). This is primarily above ground, except where it enters the main camp facility.
- Pipelines, including the processed kimberlite containment area (PKCA) discharge line, pit dewatering line, water reclamation line, tank farm lines, and pumping lines near the West Dam. All of these are above ground, with the exception of some tank farm lines going from the tank farm to the gensets.
- Buried electrical around the camp area, including some at the airstrip. The precise location of the buried electrical workings is unknown.

3.1.4 Tanks and Bermed Enclosures

The ASTs and bermed enclosures at the Jericho Mine include:

- Tank Farm (ASTs #1-13)
- Genset day tank (AST #18) and berm;
- Airstrip tanks and berm (ASTs #20, 21);
- Truck shop tank and berm (AST #14); and
- Hazardous waste transfer area (HWTA) (ASTs #16, 17, 19, 22, 23).

Tank Farm

The primary tank farm for the Jericho Mine is located at the main camp area, as shown in Figure 3.1. The tank farm is currently divided into two areas: Phase 1 and Phase 2. The Phase 1 area was constructed in winter 2004/2005 and Phase 2 was constructed between May and October 2005. The Phase 1 area contains eight 500,000 L tanks (ASTs #1-8) and a smaller AST (AST #13), and Phase 2 contains four 1,500,000 L tanks (ASTs #9-12).

Both tank farm containment areas are lined with a 60 mil high density polyethylene (HDPE) liner for secondary containment. Tetra Tech EBA understands that the base of the Phase 1 area was constructed of frozen esker fill, while the base of the Phase 2 tank farm was constructed of run-of-mine rockfill.

The Phase 1 pond berms are in reasonable condition; however, there are some low spots which could reduce secondary containment capacity. Hydrocarbons were identified outside the facility which suggest either the liner system is compromised, or spills occurred outside the facility. The tanks are also listing; however, their condition does not appear to have worsened from previous inspections.

The Phase 2 tanks and containment area appear to be functioning adequately.

Hazardous Waste Transfer Area

The HWTA is a HDPE-lined facility used for the temporary storage of hazardous waste prior to disposal or transfer off site. The facility was constructed by Tahera; however, details pertaining to the facility construction are limited. The HWTA is shown in Figure 6.

The facility comprises two cells separated by a centre berm. Site observations indicate the liner system comprises a HDPE liner placed between layers of nonwoven geotextile. The containment berms appear to be constructed of esker and crush material.

Containerized debris is contained in both cells. A significant amount of hydrocarbon impacted soils have also been stored in the northeast corner of the west cell. Tetra Tech EBA understands that this contaminated soil is from former spills occurring around the airstrip.

Previous inspections have noted several issues with liner integrity in both cells. In 2012, Shear began preparations to reline the east cell of the HWTA. All debris, with the exception of several ASTs, were moved to the west cell. The berms on the east cell were raised and coarse processed kimberlite (PK) was placed on the cell floor. The work to reline the cell was not completed prior to Shear's departure from the Jericho Mine.

The HWTA berms are in good condition with no signs of instability; however, the liner system has been compromised in several locations. The perforations appear to be located some distance above the cell floor as ponding water has been observed in both cells.

Generator Tank Containment Area

One 64,000 L fuel tank (AST #18) is located adjacent to the generator area at the plant site, as shown in Figure 3.2. The tank is contained by a lined berm containment area covered with a layer of crushed gravel. The perimeter berms are generally in good condition with no signs of instability or distress. Similarly, the tank appears to be in good condition and functioning adequately.

A low spot in the berm was observed, consistent with previous inspections. The depression in the berm could reduce the secondary containment volume of the berm.

Airstrip Tank Containment Area

Two 64,000 L fuel tanks are located adjacent to the airstrip apron within a lined containment area. The secondary containment liner is covered with a layer of crushed gravel. No signs of berm instability were found though some exposure of the HPDE liner was present during the inspection. It is understood that a fuel spill occurred within the containment area in the winter of 2006/2007. Stained soil is present inside the base of the containment area.

3.1.5 Jetty (Water Intake Causeway)

The jetty was constructed to provide water for the processing plant and as a potable water source for the camp. It was constructed of clean coarse rockfill and extends approximately 90 m into Carat Lake. A vertical steel intake well was installed within the rockfill, the base of which is located in 4.5 m depth of water. This was connected to a horizontal intake section that goes beyond the rockfill and ends with a stainless steel fish screen. Figure 5 shows the jetty location at the top left.

3.1.6 Roads

Several roads have been constructed to facilitate site access, and include haul roads, light vehicle roads, and ramps. The general road network is shown in Figure 1 and summarized in Table 3.1. With the exception of the airport road, all site roads have been constructed with waste rock and capped with surfacing material. The airport road is constructed of esker material, which was sourced from borrow areas near the airstrip. Fill thicknesses vary depending on local topography and grade requirements.

Table 3.1: Roads

Road	Approximate Length (km)	Crossings (Corrugated Steel Pipe Culverts)
Airport Road	3.1	5 – culvert crossings
Carat Lake Road	2.1	1 – 900 mm dia. culvert at C1 Diversion Crossing
PKCA Roads	1.3	None identified
Ring Road	1.4	1 – 406 mm dia. culvert at East Sump

The haul roads and ramps were designed for two-lane, 777 haul truck traffic and are a minimum of 24 m wide. Pit ramps are wider to accommodate crest blast over-break. All other site roads were constructed similarly to the main haul road, but with a running surface width varying from 10 m to 18 m.

Overall, the roads are in fair to good condition. Potholes and rutting are visible in several locations; however, these do not significantly impact the trafficability of the roads. No significant issues with instability or settlement were observed. The culverts along the airstrip road are in good condition and appear to be functioning adequately.

3.1.7 Pads and Laydown Areas

Facilities' pads are composed of either waste rock or esker material of variable thickness to provide a level surface for placement or construction of buildings. Generally, the pads near the airstrip (airstrip apron, reclaimed Carat camp, Carat Lake laydown) have been constructed with either esker material, or directly on the ground surface. Pads near the main camp area have been constructed with waste rock. The pads are in good condition with no problems noted. Pad locations are summarized in Table 3.2.

Table 3.2: Pad Areas

Pad	Reference	Surface Area (m^2)	Material
Main Camp	Figure 3	61,300	Waste rock
Truck Shop	Figure 3	32,100	Waste rock
Low Grade Stockpile Area	Figure 4	99,200	Waste rock
Coarse PK	Figure 3	100,810	Waste rock
Carat Lake Laydown	Figure 6	23,100	Esker
Reclaimed Carat Lake	Figure 6	17,100	Esker
Airstrip Apron	Figure 7	21,600	Esker

3.1.8 Equipment

Table 3.3 lists equipment that Shear considered operational and that is potentially useful for mine closure.

Table 3.3: Potentially Useful On-Site Equipment

Item	Qty.	Location	Comments
Fire Truck	1	Truck Shop	The care and maintenance team reports that both the truck and the integrated water pump are operational.
CAT 950 Loader	1	Main Site Laydown Area	Was in operating condition while on site.
CAT 936E Loader	1	Truck Shop	Appears in reasonable condition, but was not tested.
CAT 980G Loader	1	Truck Shop	Appears in reasonable condition, but was not tested.
CAT D6 Bulldozer	1	Main Site Laydown Area	Significant wear and tear and an older model. It appears to be in very poor condition.
CAT 322C Excavator	1	Main Site Laydown Area	Was in operating condition while on site.
SuperPac Packer	1	Main Site Laydown Area	Flat tires and does not have an enclosed cab. It appears to be in poor condition.
Sterling Dump Truck	1	Process Plant	Attempted to start it, but were unsuccessful.
Komatsu Grader	1	Main Site Laydown Area	Tires are flat and it looks heavily used. It appears to be in poor condition.
Large Godwin Pump	1	Truck Shop	Appears to be in very good condition.

Table 3.3: Potentially Useful On-Site Equipment

Item	Qty.	Location	Comments
Small Godwin Pumps	2	Main Site Laydown Area, Truck Shop Shed	Appears in reasonable condition, but was not tested.
Light Plants	3	Main Site Laydown Area, Truck Shop Shed	Two are uncovered, one is covered. They appear to be in reasonable condition. One was tested and started. The other two were not tested.
Oztek Water Remediation Unit	1	Phase 2 Tank Farm	This is a relatively new unit purchased by Shear and is expected to be in relatively good condition. It is located beside the Temporary Water Treatment in Figure B.1.
Man Lift	2	Process Plant	Scissor-lift and boom lift types. The boom lift was tagged as non-operational. The scissor lift appeared to be in good condition, but was not tested.
Mobile Jaw Crusher	1	Stockpile Area	Appears to be in reasonable condition.
Ford F350 with First Aid Cap and Ford F350 Van	2	Terminal Building	Trucks were in reasonable condition, although operation suffered due to a lack of maintenance. A third truck developed problems while on site and was not longer operational.

3.2 Processed Kimberlite Containment Area

The PKCA is located within the existing Long Lake Basin at the south end of the Jericho Mine (Figure 2). There is central divider dyke (Dyke A) near the center of the PKCA which divides the facility into two cells. Cell A is located on the east side of the dyke and is bounded by the East, Southeast and Saddle Dams. Cell C is located west of Dyke A and is bounded by the West Dam at the downstream end of the cell. A cofferdam was also constructed along the North Dam alignment to protect against seasonal high water levels during operations.

The PKCA facility was designed to allow for staged construction as PK and water elevations rose within the facility. The current status of the dams and dykes is summarized in Table 3.4.

Table 3.4: Summary of Jericho PKCA Structures

Structure	Status	Design Crest Elevation (m)	As-Built Crest Elevation (approx.) (m)	Comments
West Dam	Partially Constructed	528 Crest 524 Core	525 (min.) Crest 520 (min.) Core	
East Dam	Completed	524.5 Crest 523.5 Liner	524.5 Crest 523.5 Liner	A road was constructed on top of the East Dam. The crest of the road is approximately 527 m.
Southeast Dam	Completed	524.5 Crest 523.5 Liner	524.5 Crest 523.5 Liner	
Saddle Dam	Completed	525 Crest 524 Liner	525 Crest 524 Liner	
Divider Dyke A	Partially Constructed	524	Varies – low point 521.5	
North Dam	Not in Place –	528 Crest	Coffer Dam Till 521	Natural Ground of North Dam

Table 3.4: Summary of Jericho PKCA Structures

Structure	Status	Design Crest Elevation (m)	As-Built Crest Elevation (approx.) (m)	Comments
	upstream cofferdam constructed in 2007	524 Core	ROM Crest 522	saddle 518.2 m (approx.)

Tailings placement has been isolated to Cell A, where tailings slurry was spigoted from several discharge points along the east side of the cell. This has created an exposed beach that slopes down from the east side of Cell A to Divider Dyke A. A shallow pond has developed upstream of Divider Dyke A where water pools from the upstream catchment area. Cell C has been retained as a polishing pond.

Tailings strength is expected to be greatest in the upper beach slopes where the material is relatively well drained and coarsest. The upper tailings could readily support foot traffic and AANDC has constructed a road and pad over the upper beach area, suggesting the tailings have some load carrying capacity.

3.2.1 North Cofferdam

The North Cofferdam is an upstream till berm on the north side of Cell C. It was constructed to provide temporary containment in the event of an unexpected water rise. The original plan was to build the North Dam where the North Cofferdam now stands. The North Dam was scheduled to be completed during operations when water levels in the PKCA were expected to rise above the spill point through the North Dam's alignment (approximately 518.2 m). The design was completed by Tetra Tech EBA (EBA 2007) and consists of a frozen core dam with an upstream till berm similar to the West Dam.

The cofferdam crests and sideslopes are in good condition with no signs of distress noted. Overall, the North Cofferdam is in good condition with no significant issues noted.

3.2.2 West Dam

The West Dam is a frozen core dam located at the west end of the PKCA, as shown in Figure 2. The dam core comprises frozen saturated gravel with secondary containment provided by a geosynthetic clay liner. The core material is designed to remain in a frozen condition year round, providing the primary water seepage barrier. The core integrity is maintained naturally; although thermosyphon evaporators were installed in the dam base if additional cooling was required. Rockfill thermal protection above, upstream, and downstream of the core is in place to keep the core frozen. The dam design also includes an upstream till zone placed at lower elevations to reduce convective water movement through the open-graded rockfill.

The dam was designed by Tetra Tech EBA in 2005 (EBA, 2005) and was partially constructed during the winters of 2005/2006 and 2006/2007. At the end of the 2007 season, the core had been constructed to its final elevation at the south abutment; however, the centre portion of the core was only constructed to approximately 520 m instead of its final design elevation of 524 m. The core was subsequently covered with a minimum of approximately 4 m of run-of-mine coarse rockfill for thermal protection.

Overall, the dam is in good condition and no significant issues were noted. The dam is performing within design parameters.

3.2.3 Divider Dyke A

Divider Dyke A splits the PKCA into two areas, as shown in Figure 2. FPK is deposited upstream (east) of Divider Dyke A and the area downstream of the Divider Dyke is used as a polishing pond for the PKCA water.

The dyke consists of a sand and gravel filter zone supported by rockfill superstructure. The filter is protected with a layer of rip-rap on the upstream side. The dyke design is documented in EBA 2005b. The divider dyke has not been fully constructed to its design elevation. The rockfill superstructure crest is at the design elevation of 524 m; however, the filter zone of the dyke has only been brought to an elevation of 521.5 m.

The dyke crests and slopes appear to be in good condition with no signs of distress noted. Overall, the divider dyke is in good condition and no significant issues were noted.

3.2.4 East and Southeast Dams

The East and Southeast dams are impervious geomembrane lined dams at the east end of the PKCA, as shown in Figure 2. The dams are hybrid dams, in which the foundations are keyed into permafrost (rock or till) and the superstructure consists of a conventional lined dam. The liner integrity is protected through the use of a 20 mm minus bedding and cover layer.

Windblown processed kimberlite (PK) was noted on the downstream slopes of both the East and Southeast dams. The PK deposition is limited to the downstream slopes and a width of 5 m to 10 m from the downstream toe. Deposition on the tundra is discontinuous and is typically in the order of 20 mm thick where observed.

Overall, the dams are in good condition and no significant issues were noted.

3.2.5 Saddle Dam

The Saddle Dam is located at the south end of Cell A, as shown in Figure 2. The dam is intended to prevent tailings migration through a low spot in the PKCA topography and was constructed in September 2007. The design consists of a till berm keyed into a till foundation. The berm contains a geosynthetic clay liner to function as a seepage barrier. The design elevation of the liner crest is 524.0 m, with the finished top of the dyke at 525.0 m.

The dam slopes are in good condition with no indication of instability or erosion. There was no water impounded against the structure at the inspection, and it appears as though the dam has never impounded water.

3.3 C1 Diversion

The C1 Diversion diverts natural flow around the open pit, from C1 Lake to Carat Lake (Figure 5). The diversion consists of three reaches, referred to as Reaches A, B, and C. Reach A collects flow from C1 Lake, routing it through a low-lying inlet area and into a rock chasm. The inlet portion of Reach A is lined with a HDPE liner to promote flow into the rock chasm. Reach B is a steep rip-rapped channel intended to transfer flows from Reach A to Reach C. Immediately upstream of Reach B is a 900 mm diameter culvert which passes flow under Carat Lake Road. Reach C is a wide channel flanked by two granular berms with frozen sand and gravel cores to contain high flow events. Low flows meander between the granular berms before reconnecting the natural stream and discharging to Carat Lake.

Overall, the C1 Diversion is performing as intended. A damaged culvert inlet at Carat Lake Road may be restricting flows somewhat, but does not pose an immediate threat to the diversion performance.

Some areas of local instability were observed in each of the reaches. None of these areas pose an immediate threat to the diversion performance and appear to have stabilized over time. Closure design should take into account long-term-performance of the following areas:

- Settlement in Reach A inlet fill pad;

- Sloughing near channel in Reach A inlet; and
- Cracking in north berm (Reach C).

3.4 Waste Rock Piles

The waste rock pile is located east of the pit, as shown in Figure 5. The waste rock pile is located largely on IOL; however, a small portion of the pile falls on AANDC land. The pile is composed primarily of waste rock sourced from pit operations; however, some till was stockpiled in the southern portion of the pile.

The thickness of each dump lift was designed to be approximately 10 m, but the lift thickness was modified in order to develop relatively uniform bench heights. Overall, slopes were designed to be between 2.6:1 to 1.4:1 depending on location and material.

The crest and slopes of the waste rock pile were observed for signs of instability and none were noted. The waste rock pile is in good condition.

3.5 Coarse PK pile

Coarse PK is a waste product generated during ore processing. It comprises gravelly sand and represents approximately 81% of the total PK by mass (EBA, 2006). The coarse PK is stored in a stockpile east of the process plant as shown in Figure 3.

Overall, the coarse PK pile is in good condition. There is no evidence of significant instability, pile settlement, or erosion in most areas. Some sloughing of the slopes was observed at the slope contact with the East Sump. This does not appear to be causing an immediate threat to the overall stability of the coarse PK pile.

3.6 Landfill

Non-hazardous wastes were landfilled by Tahera in the waste rock pile. It is was a combination of a dry waste disposal and burn area. Waste from their incinerator was also disposed of in the area. Solids from the waste water clarifier were apparently placed in a segregated sludge pit located away from the waste cells. The landfill was capped by Shear in 2011 and is no longer in operation.

3.7 Open Pit

The Jericho Mine pit is located south of Carat Lake, as shown in Figure 5. The pit was developed under Tahera ownership and development ceased in 2008. The current pit is approximately 450 m wide and 80 m deep. The pit water is at an elevation of 435.4 m, corresponding to a depth of approximately 25 m.

The pit is largely excavated in bedrock. Exposed surface bedrock is visible along the southern and eastern edges of the pit. Some overburden is present on the west side of the pit; however, the first bench appears to be largely seated in rock.

The pit ramp is in good condition, with minor erosion from surface flow. Some blocky rock structure is observed in the pit walls, and some small rock fall has occurred along the toe of the ramp.

There are localized areas where blocky material has formed a small rubble slope; however, these areas do not appear to be indicative of large scale instability. There is an area of sloughing overburden on the west side of the pit, near the confluence of the Carat Lake and Ring Roads. The bedrock at this location appears to be slightly deeper (in the order of 5 to 6 m) than the rest of the pit and may correspond to the original C1 stream path.

Overburden material at this location has spilled onto the second bench. The area appears consistent with previous inspection records and is not a significant stability concern.

The pit is generally stable in the short term; however, the long-term stability should be evaluated as part of the pit closure design, particularly during pit filling.

4.0 ENVIRONMENTAL CONDITIONS

Tetra Tech EBA prepared an ESA based on the August 19 to September 1, 2014 site investigation (Tetra Tech EBA, 2014b). Relevant environmental findings are discussed in the following sections.

4.1 Contaminated Soil

Fifteen areas of potential environmental concern (APECs) were identified in the ESA. The APEC locations are shown in Figures B.1 and B.2 in Appendix B, and detailed in Figures B.3 through B.14. Tables in Figures B.3 to B.14 show the APEC sampling locations and whether sampling points were above applicable guidelines, below applicable guidelines, or not analyzed.

The main contaminants of concern across the Jericho Mine included petroleum hydrocarbons (PHC) fractions F1 to F4, polycyclic aromatic hydrocarbons (PAHs), benzene, toluene, ethylbenzene, xylene (BTEX), glycols, and metals. Samples were selected based on visual, olfactory, or photo-ionization detector evidence of hydrocarbon impacts observed in the field. Laboratory analysis was compared to the Nunavut Contaminated Sites Regulations for Wildland Use.

Full delineation was not achieved at most of the contaminated soil locations. This was either due to rocky ground preventing vertical delineation, infrastructure blocking horizontal delineation, or lab results identifying contamination extents not predicted in the field. As a result, a conservative approach to estimating volumes was employed. Actual volumes will vary.

Metal impacted material was located at APEC 2, APEC 10, and APEC 13 for an estimated total of 64 m^3, as detailed in Table 4.1. The estimated PHC impacted material observed on site is approximately 7,854 m^3 and is listed in Table 4.2

Table 4.1: Soil Volume Calculations for Metal Contaminated Soils

APEC	Metal Exceedances	Volume (m^3)
2 (Contaminated Soils Storage Area)	Chromium, Nickel, Zinc	2
10 (Truck Shop and Laydown Area)	Chromium, Molybdenum, Nickel	25
13 (Carat Lake Laydown Area)	Zinc	37
	Total	**64 m^3**

Table 4.2: Soil Volume Calculations for PHC Contaminated Soils

APEC	BTEX, PHC Fractions and PAH Exceedances	Area (m^2)	Volume (m^3)
1 (Airstrip)	Benzene, Ethylbenzene, PHC Fractions F2 to F4	415	300
2 (Contaminated Soils Storage Area)	PHC Fractions F2, to F4, Benzo(b+j)fluoranthene, Benzo(k)fluoranthene, Fluorene, Phenanthreene and Pyrene	2,495	3,076
3 (HWTA)	PHC Fractions F2 to F3	550	275
4 (Waste Rock Pile)	PHC Fractions F2 to F3	7	3.5
7 (Phase 2 Tank Farm)	PHC Fractions F2 to F4	3,376	1,688
8 (Phase 1 Tank Farm)	PHC fractions F2 and F3, Acenaphthene, Fluorene ,Phenanthrene and Pyrene,	2,533	1,267
9 (Genset and Fuel Berm)	PHC Fractions F1 to F3	277	388
10 (Truck Shop and Laydown Area)	PHC Fractions F2 to F4	887	546
13 (Carat Lake Laydown Area)	PHC Fractions F2 to F4	192	155
14 (Process Plant)	PHC Fractions F2 to F4	130	130
15 (Reclaimed Carat Camp)	PHC Fractions F1 to F3	10	25
		Total	**7,854 m^3**

4.2 Surface Water Quality

Results from the ESA indicate evidence of the Jericho Mine impacting surface waters as a result of seepage from the waste rock piles, the PKCA and its discharge, inside the pit, and surface runoff and windblown materials from the mine and PKCA. However, water quality results currently meet the Canadian Council of Ministers of the Environment (CCME) Protection of Freshwater Aquatic Life (PFAL), Canadian Drinking Water Quality, and the Water Licence guidelines, with the exception of copper and uranium.

Total copper levels exceeded guideline levels in Key Lake (JER-AEM-23), and uranium levels exceeded guidelines inside the pit (SWQ-02) and East Sump (SWQ-07). Although most water quality parameters meet guideline levels, the trends analysis shows three main parameters: pH, copper, and uranium increased in concentrations across most water monitoring stations since mine start-up; however, the trends are generally stable since the end of mining in 2008. Additional parameters, such as iron, nickel, nitrate, total organic carbon, total suspended solids, and total dissolved solids also increased in concentrations at select water monitoring stations since mine start-up and have stabilized since the end of mining in 2008.

Results of the field surface water quality monitoring program are organized based on the different effects pathways from which the mine has the potential to affect the surrounding surface waters (Figure 8). Water quality samples were collected in August 2014 and compared to historical data using a trend analysis of parameters exceeding applicable guidelines.

4.3 Containment Berm Water Quality

Standing water was observed at the six containment berm locations during the ESA. Samples were analyzed for BTEX, PHC fractions F1 to F2, routine water chemistry, glycol, and/or dissolved and total metals. Water analytical data was compared to CCME PFAL guidelines, control background wells, and the water licence No. 2AM-

JER119. One water sample located in the berm at APEC 2 (Contaminated Soils Storage Area) exceeded CCME PFAL guidelines for anthracene, benz(a)anthracene, benzo(a)pyrene, fluoranthene, fluorene, phenanthrene, and pyrene. The water collected from SW 1-1, SW 3-1, and SW 9-1 were below the CCME PFAL guidelines at the time of sampling. The water located in SW 7-1 and SW 8-1 exceeds the CCME PFAL guidelines, but meets the water licence criteria, except for iron. The exceedances observed for iron are less than the control wells for both total and dissolved metals. Thus, the water in SW7-1 and SW 8-1 does not appear to be impacted.

Table 4.3: Summary of Berm Water Exceedances

Berm Water Locations	Analysis	Exceedance of CCME-FPAL Guidelines	Exceedance of Water License No 2AM-JER1119
SW 1-1 (Airstrip Fuel Storage Berm)	**BTEX, PHC fractions F1 to F2**	Did not exceed guideline	Did not exceed guideline
SW 2-1 (Contaminated Soils Storage Area)	**BTEX, PHC fractions F1 to F2, PAHs, Glycol**	Anthracene, Benz(a)anthracene, Benzo(a)pyrene, Fluoranthene, Fluorene, Phenanthrene, Pyrene	No guidelines for PAHs
SW 3-1 (HWTA)	**BTEX, PHC fractions F1 to F2**	Did not exceed guideline	Did not exceed guideline
SW 7-1 (Phase 2 Tank Farm)	**Routine Water Chemistry, BTEX, PHC fractions F1 to F2, Dissolved and Total Metals**	Copper (total and dissolved), Phosphorus (total and dissolved), Uranium (total and dissolved)	Did not exceed guideline
SW 8-1 (Phase 1 Tank Farm)		Aluminum (total), Copper (total and dissolved), Iron (total and dissolved), Phosphorus (total and dissolved)	No guideline for Iron; Remainder do not exceed guideline
SW 9 -1 (Main Camp Fuel Berm)	**BTEX, PHC fractions F1 to F2**	Did not exceed guideline	Did not exceed guideline

4.4 Seepages and Groundwater Quality

4.4.1 Background Conditions

Background water quality conditions were collected by Tetra Tech EBA in 2014 and SRK in 2003 (2014b Tetra Tech EBA; 2003c SRK). The background conditions are used to establish a baseline for water chemistry in this area, specifically in cases where metals exceed CCME PFAL guidelines. The following metals were greater than the CCME PFAL guidelines in the 2014 sampling period in either the seep samples or groundwater monitoring wells: aluminum, copper, iron, uranium, and zinc. Table 4.4 summarizes the available background water quality information. The sample locations are shown on Figure B.9.

Table 4.4: Background Groundwater and Surface Water Quality Conditions from 2003 and 2014

Parameter	Unit	CCME PFAL	Groundwater Monitoring Well		Surface Water			
			14MWC1	14MWC2	WP1-01	WP1-02	WP2-01	WP2-02
			2014	2014	2003	2003	2003	2003
Total Metals								
Aluminum	mg/L	0.005-0.1	210*	no data†	0.061	0.089	0.030	0.192
Copper	mg/L	0.002-0.004	0.75*	no data†	0.0021	0.0019	0.0017	0.0078
Iron	mg/L	0.3	240*	no data†	0.04	0.26	0.09	0.84
Uranium	mg/L	0.015	0.23*	no data†	0.00029	0.0006	0.00041	0.00279
Zinc	mg/L	0.03	0.75*	no data†	<0.001	0.001	<0.001	0.003
Dissolved Metals								
Aluminum	mg/L	0.005-0.1	0.60	0.22	0.06	0.08	0.03	0.17
Copper	mg/L	0.002-0.004	0.0048	0.0070	0.002	0.001	0.002	0.006
Iron	mg/L	0.3	0.46	1.2	0.003	0.15	0.06	0.46
Uranium	mg/L	0.015	0.00084	0.0053	0.0003	0.0006	0.0004	0.0026
Zinc	mg/L	0.03	0.041	0.0097	<0.005	<0.005	<0.005	<0.005

Note:
*The total metal results for 14MWC1 may not be representative as there was an abundance of sediment in the sample.
†There was insufficient groundwater recovered from 14MWC2 to allow total metals to be analyzed.

A Piper Plot (Figure 4.1) was prepared comparing the water chemistry from the 2014 background monitoring wells (14MWC1, 14MWC2), monitoring wells down-gradient of the waste rock pile (14MW04, 14MW05 and 14MW06), and the waste rock pile seep samples (Seep 1, Seep 2 and Seep 3). Figure A is useful for visually describing differences or similarities in major-ion chemistry in groundwater systems. The clustering of data points on a Piper plot indicates if samples have similar compositions (Freeze et al. 2000). From Figure A it is apparent that the chemical composition of background well 14MWC1 is different than the other wells. There are two other groupings observed in this Piper plot: monitoring well 14MW04, Seep 1, and Seep 3 may have similar water chemistry; and 14MWC2 appears similar to 14MW05, 14MW06, and Seep 2.

From this it appears that the waste rock may be influencing Seep 1, Seep 3, and well 14MW04, whereas Seep 2, well 14MW05, and 14MW06 may not be influenced as much by the waste rock since the chemistry composition is similar to background well 14MWC2. A further discussion on the groundwater and seep water quality is include in the conclusions and recommendation sections.

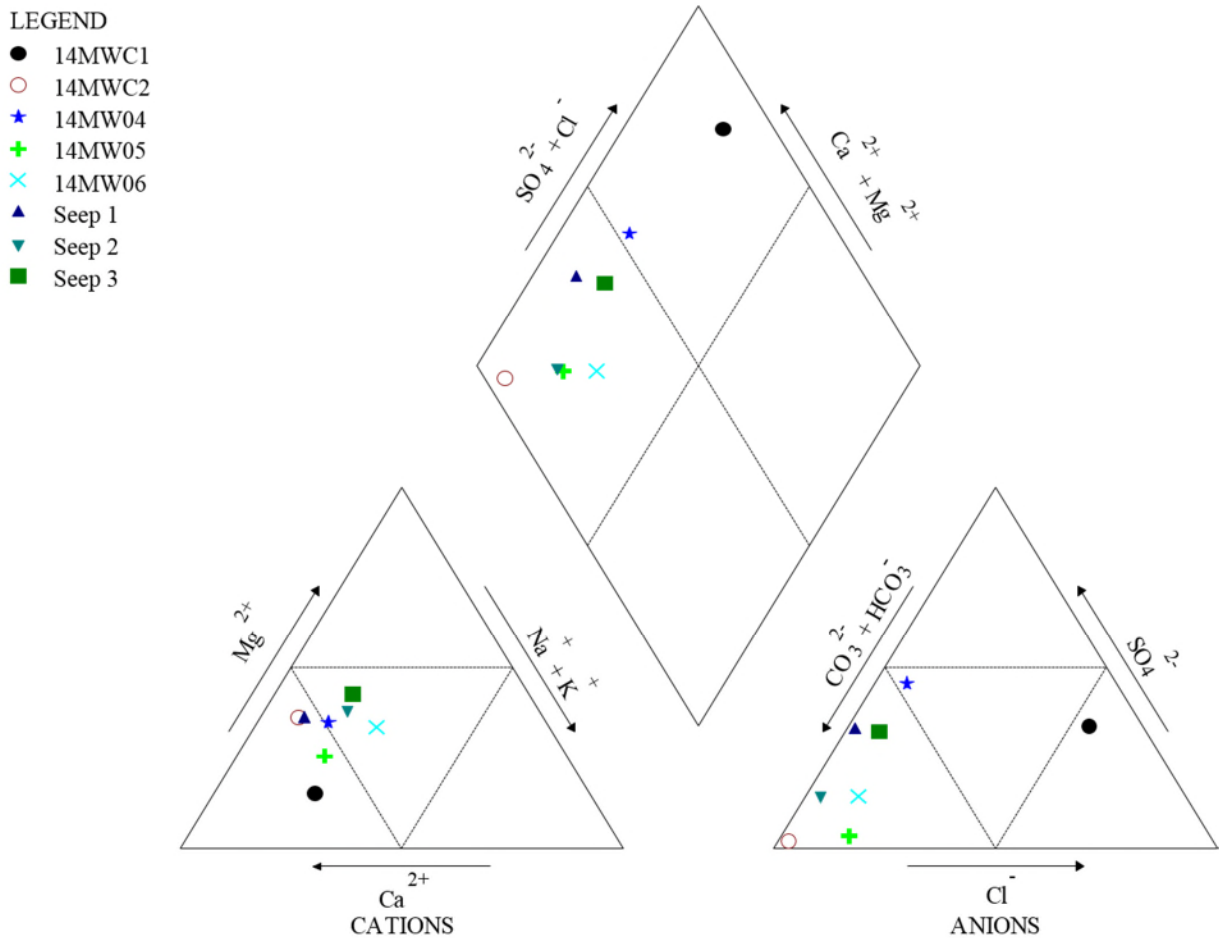

Figure 4.1: Piper plot comparing water chemistry of the background wells, down-gradient wells and seeps from the Waste Rock Pile Area at the Jericho Mine.

4.4.2 Monitoring Wells

Groundwater monitoring was conducted at two locations: APEC 2 (Contaminated Soils Storage Area) (Figure B.5) and APEC 4 (Waste Rock Pile) (Figure B.9). The monitoring wells had levels of total metals and dissolved metals that were greater than CCME PFAL guidelines (Tetra Tech EBA 2014b), although neither may be of concern. The total metal results may be due to the high sediment load, whereas the dissolved metals appear to be in line with the background groundwater monitoring results collected from 14MWC1 and 14MWC2 (Table 4.4), except uranium.

The monitoring wells were installed to depths ranging from 0.67 m below ground surface to 1.0 m below ground surface, within the active layer (<1 m below ground surface). The wells were constructed using 1 inch diameter, screw-jointed Schedule 40 polyvinyl chloride. Each well was constructed using a machine-slotted screen (0.010 inch openings) below an unslotted riser pipe. No sand pack or seal was installed with these wells; therefore, water infiltration from the surface may occur.

Total Metals

Total metal results from the monitoring wells are considered suspect due to sediment within the sample as indicated by the light brown, turbid appearance of the samples when collected. Sediments in the sample can affect the total metals analysis results as the measurement may reflect both structural metals in the sediment as well as not mobile metals in the water. Monitoring wells 14MWC1, 14MW04, 14MW05, and 14MW06 exceeded CCME PFAL guidelines for total aluminum, total arsenic, total cadmium, total copper, total iron, total lead, total nickel, total phosphorus, total selenium, total silver, total thallium, total uranium, and total zinc. The total metals found during the 2014 site investigation may not be considered representative. More representative samples may be acquired by purging and re-sampling the well to clear some near-wellbore sediment load and combine that with low-flow sampling methods. However, the presence of sediment in the samples can likely not be completely prevented given the type of well construction.

Dissolved Metals

Although the samples were filtered with a 0.45 µm filter in the field, there is a possibility that the filters became overloaded with sediment resulting in metal colloids or particles that may have bypassed the filter, which may explain the dissolved metals observed in some of the monitoring wells.

Three monitoring wells (14MW04, 14MW05 and 14MW06) were found to have concentrations of copper, iron or zinc greater than both the CCME PFAL and background water levels (14MWC1 and 14MWC2) (Table 4.5). Aluminum and copper concentrations appear to be in line with background water concentrations. Iron and zinc values are slightly greater than the background water concentrations. Although these values are above the CCME PFAL guidelines, they may not be indicative of impacts on site, as discussed in Sections 4.4.4 and 4.4.5.

Table 4.5: Comparison of Monitoring Wells to Background Controls

Parameter	CCME PFAL (mg/L)	14MW04 (mg/L)	14MW05 (mg/L)	14MW06 (mg/L)	14MWC1 (mg/L)	14MWC2 (mg/L)
Dissolved Metals						
Aluminum	0.005-0.1[1]	**0.17**	**0.61**	**0.34**	**0.60**	**0.22**
Copper	0.002-0.004[1]	**0.0046**	**0.048**	**0.0033**	**0.0048**	**0.0070**
Iron	0.3	0.13	**4.9**	**4.1**	**0.46**	**1.2**
Zinc	0.03	**0.069**	**0.13**	**0.082**	**0.041**	0.0097

Note:
[1] Guideline varies with hardness
BOLD-Exceeds Guideline

4.4.3 Seep Samples

Three seeps down-gradient of the waste rock pile were identified during the site assessment. Samples were collected and analyzed for routine water chemistry and dissolved and total metals (Table 4.6). The seep samples were compared to the CCME PFAL guidelines and the background control monitoring wells. There were exceedances for aluminum (total), copper (total and dissolved), iron (total), and uranium (total and dissolved) when compared to the CCME PFAL guidelines. These exceedances observed in the seeps are below the background control well values, except uranium (dissolved), which was found in the background control wells. Thus, these exceedances may be naturally occurring. The dissolved uranium values were compared to the water licence and found to be less.

Table 4.6: In Situ Water Chemistry: Seepage Testing

Seep Station	pH	EC (µS/cm)	Water Temperature (°C)
Seep 1	9.2	551	4.5
Seep 2	10.4	110	0.7
Seep 3	9.2	214	1.9
Average	9.6	292	2.4
Min.	9.2	110	0.7
Max.	10.4	551	4.5

The Seep 1, Seep 2, and Seep 3 samples exceeded CCME PFAL guidelines for total aluminum, total and dissolved copper, total iron, and total and dissolved uranium. Table 4.7 compares Seep 1, Seep 2, and Seep 3 to the CCME PFAL guidelines, the background groundwater well values, and the 2003 background seep values.

Table 4.7: Comparison of Seep Samples Collected in 2014 to Background Monitoring Wells and Seep Samples Collected in 2003

Parameter	CCME PFAL (mg/L)	Seep 1 (mg/L)	Seep 2 (mg/L)	Seep 3 (mg/L)	Background Well-Range (mg/L)	Background Seep (2003)[1]-Range (mg/L)
Total Metals						
Aluminum (mg/L)	0.005-0.1[2]	1.3	0.19	0.091	210	0.03-0.192
Copper (mg/L)	0.002-0.004[2]	0.012	0.0045	0.0039	0.75	0.0017-0.0078
Iron (mg/L)	0.3	1.9	0.28	0.14	240	0.04-0.84
Uranium (mg/L)	0.015	0.069	0.093	0.034	0.75	0.0006-0.00279
Dissolved Metals						
Aluminum (mg/L)	0.005-0.1[2]	0.0084	0.066	0.059	0.22-0.60	0.03-0.17
Copper (mg/L)	0.002-0.004[2]	0.0073	0.0038	0.0038	0.0048-0.0070	0.001-0.006
Iron (mg/L)	0.3	<0.060	0.13	0.11	0.46-1.2	0.003-0.46
Uranium (mg/L)	0.015	0.063	0.089	0.032	0.00084-0.0053	0.0004-0.0026

Note:
[1]SRK 2003c.
[2]Guideline varies with hardness.

Seep samples from similar sample locations were collected in 2011 and 2012. Table 4.8 compares the values observed in 2011, 2012, and 2014 for aluminum, copper, iron, and uranium to the seep samples collected from the development pile seep survey conducted in 2003 by SRK (SRK 2003c).

Table 4.8: Comparison of Seep Samples Collected in 2003, 2011 to 2014

Parameter	Seep Average Results 2003[4]	Seep 1[1]			Seep 2[2]			Seep 3[3]		
		Sept 2011	May 2012	Aug 2014	Sept 2011	May 2012	Aug 2014	Sept 2011	May 2012	Aug 2014
Total Metals										
Aluminum (mg/L)	0.884	0.0277	0.697	1.3	0.0901	0.189	0.19	0.0743	0.195	0.091
Copper (mg/L)	0.00785	0.00863	0.0113	0.012	0.00456	0.00156	0.0045	0.00486	0.000173	0.0039
Iron (mg/L)	0.6425	0.05	1.13	1.9	0.119	0.175	0.28	0.303	0.193	0.14
Uranium (mg/L)	2.18	0.123	0.0192	0.069	0.0544	0.0107	0.093	0.0437	0.0327	0.034
Dissolved Metals										
Aluminum (mg/L)	0.01	0.00256	0.0383	0.0084	0.0423	0.066	0.066	0.0545	0.0525	0.059
Copper (mg/L)	0.007	0.00821	0.00187	0.0073	0.00417	0.00188	0.0038	0.0044	0.003	0.0038
Iron (mg/L)	<0.03	<0.10	0.038	<0.060	0.064	0.0574	0.13	0.269	0.0497	0.11
Uranium (mg/L)	2.14	0.121	0.0178	0.063	0.0534	0.00852	0.089	0.0436	0.00717	0.032

Note:
[1] In 2011 called JER-SPG-01D; In 2012 called 12SEEP15
[2] In 2011 called JER-SPG-01B; In 2012 called 12SEEP11
[3] In 2011 called JER-SPG-01A; In 2012 called 12SEEP12
[4] SRK 2003c

Total aluminum values from Seep 1 and Seep 2 exceeded CCME PFAL guidelines. Seep 1 has been increasing in aluminum since sampling in 2011, whereas Seep 2 appears to have remained the same. Seep 2 appears to be similar to background conditions sampled in 2003. Seep 1 has elevated total aluminum; however, dissolved aluminum at Seep 1 is within the background controls range. Seep 1 may be within the natural variation for total aluminum on site.

Total and dissolved copper exceeded CCME PFAL guidelines at Seep 1, Seep 2, and Seep 3. Total and dissolved copper from Seep 2 and Seep 3 are within background values. The total and dissolved copper values at Seep 1 are greater than Seep 2 and 3. The dissolved copper value at Seep 1 is within the natural variation observed at background conditions, while total copper is elevated. The total copper at Seep 1 has increased with time, while the dissolved copper has decreased. Total and dissolved copper values observed in this study are similar to background concentrations, except total copper at Seep 1. Figure 4.2 illustrates the trend of Seep 1, Seep 2, and Seep 3 from 2011 to 2014 compared to the average seep value obtained in 2003 from the waste rock pile. Seep 2 and Seep 3 have decreased since 2003, while Seep 1 is slightly greater than the 2003 data in 2011 and 2014. Generally, the concentration of dissolved copper from the waste rock has decreased with time and Seep 2 and Seep 3 are at the average background water quality conditions (average of surface water collected in 2003 and the groundwater wells in 2014).

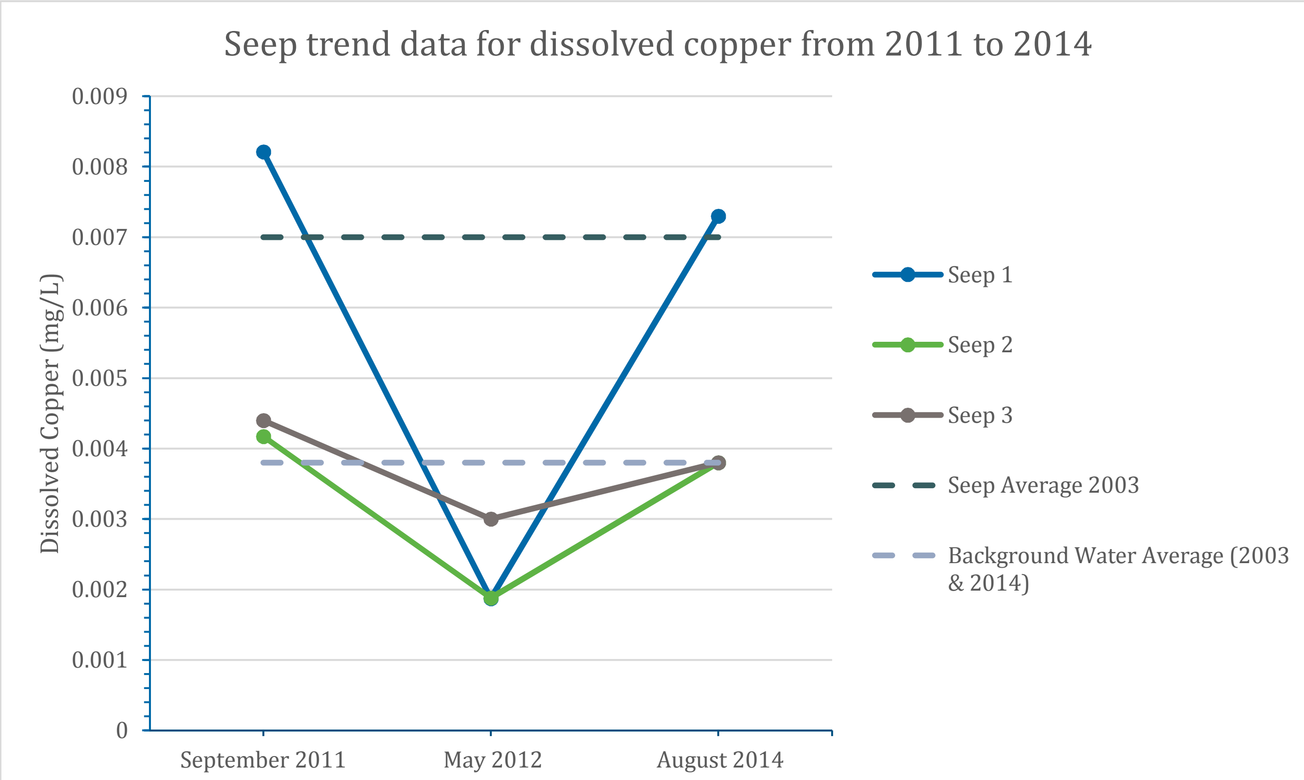

Figure 4.2: Seep trend data for dissolved copper collected from 2011 to 2014, compared to the average seep concentration collected in 2003 from the waste rock pile and the average background dissolved copper concentrations.

Total iron exceeded the CCME PFAL guidelines at Seep 1 (1.9 mg/L), while the dissolved iron was below the CCME PFAL guidelines. The total iron concentrations at Seep 1 may be related to sediment collected in the sample. The background water concentrations from both surface water and groundwater for dissolved iron range from 0.003 mg/L to 1.2 mg/L. The highest concentration of 1.2 mg/L for dissolved iron is similar to the total iron concentration observed at Seep 1. Therefore, iron concentrations appear to be naturally greater than the CCME PFAL guidelines in this area.

Total and dissolved uranium concentrations for Seep 1, Seep 2, and Seep 3 exceeded the CCME PFAL guidelines. Dissolved uranium values are similar to the total uranium values. The average dissolved uranium value from Seep 1 to Seep 3 from 2011 to 2014 is 0.048 mg/L, while the total uranium value is 0.053 mg/L. This suggests that the majority of the uranium measured is in the dissolved form. Total and dissolved uranium values are above the background concentrations as measured by SRK in 2003. The concentration of total and dissolved uranium from Seep 1, Seep 2, and Seep 3 have had little changes since 2011 (Figure 4.3). Uranium concentrations during freshet (May 2012) are below the CCME-PFAL guidelines except Seep 1, which is slightly above. Overall, seep samples from the waste rock have significantly decreased when compared to the seeps sampled down-gradient of the development waste rock pile in 2003. Although the seep samples are below the 2003 concentrations, dissolved uranium values are still greater than the average background concentrations collected from 2003 and 2014 (Figure 4.3). Uranium in the groundwater monitoring wells down-gradient of the waste rock pile are below the CCME-PFAL guidelines, thus uranium may not be impacting the groundwater at the sampled monitoring wells.

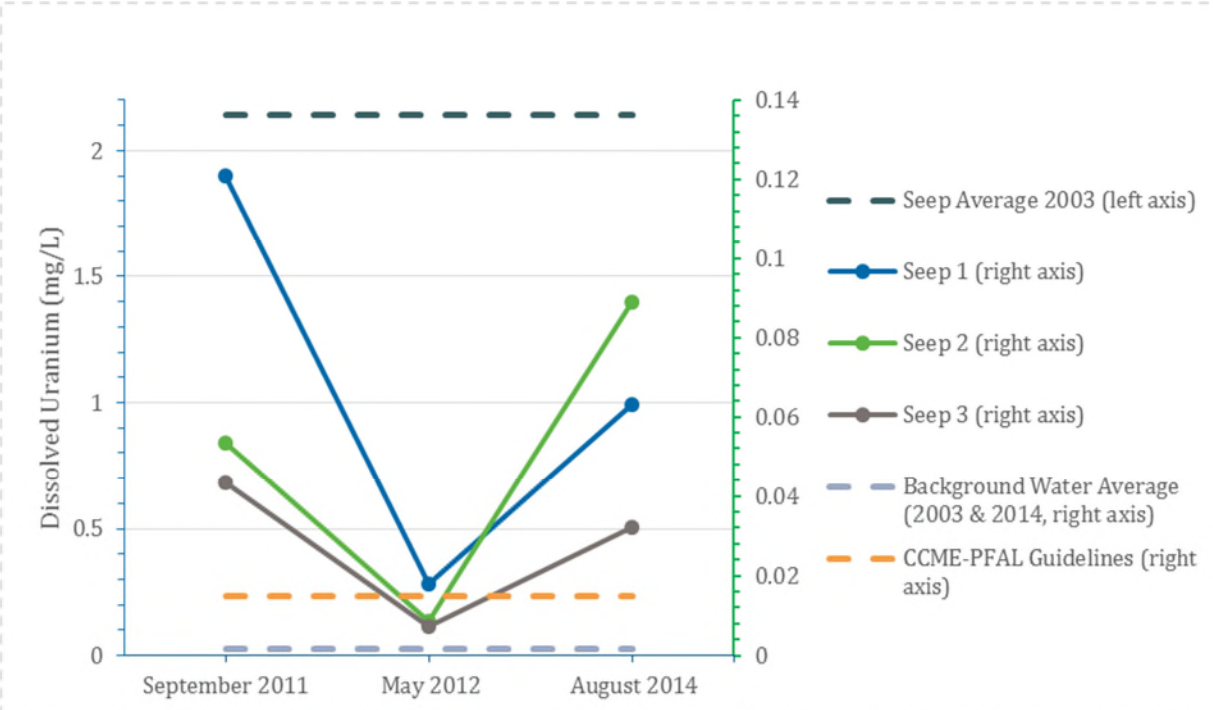

Figure 4.3: Seep trend data for dissolved uranium collected from 2011 to 2014, compared to the average seep concentration collected in 2003 from the waste rock pile, the average background dissolved uranium concentrations and the CCME-PFAL guideline.

A similar trend is apparent from the long-term monitoring (2005 to 2014) of surface water at Carat Lake (JER-AEM-15) where total uranium concentrations increased during mine activities and declined since closure. Total uranium values from JER-AEM-15 were below the CCME-PFAL guidelines in all years sampled.

4.4.4 Synopsis: Groundwater and Seep Water Quality

Monitoring wells 14MW04, 14MW05, and MW06 are located down-gradient of the waste rock piles (Figure B.9). Monitoring wells 14MWC1 and 14MWC1 are considered to represent background groundwater conditions and are located at some distance from the waste rock piles.

All five monitoring wells were completed within the active layer and do not have a sand pack or surface seal. Consequently, the groundwater samples collected in August 2014 were generally turbid. Analytical results for total metals are strongly affected by clay particles suspended in groundwater samples and due to presence of sediment in the samples the analytical results for total metals will not be representative of in situ groundwater conditions.

The overall groundwater quality is characterized by low hardness (calcium and magnesium combined) and a low total dissolved solids concentration. Monitoring well 14MW04 exhibits the highest nitrate concentrations (7.4 mg-N/L) followed by background control sample 14MWC1 (2.1 mg-N/L). The other three groundwater samples have minimal nitrate concentrations. Conversely, the seep samples exhibit notable nitrate concentrations ranging between 2.0 mg-N/L and 11 mg-N/L. Nitrate is a redox sensitive element and the lowest concentrations in the various samples may indicate reducing, partial anoxic groundwater conditions. Suboxic or anoxic shallow groundwater conditions are common when an abundance of organic material is present. Under such conditions, iron is also often in a dissolved state, which coincides with dissolved iron concentrations greater than the CCME PFAL in the samples from 14MW05, 14MW06, 14MWC1, and 14MWC2.

The pH values for the background control groundwater samples range from slightly acidic (pH 5.04 in sample 14MWC1) to near neutral (pH 7.55 in sample 14MWC2). The pH values at the three down-gradient monitoring wells fall within this range.

Dissolved aluminum concentrations are affected by the pH value and possibly also by organic complexing of aluminum due to organic matter (e.g., humic material). The filtered groundwater samples with the lowest pH values also exhibit the highest dissolved aluminum concentrations; however, all aluminum concentrations exceed the referenced CCME PFAL guidelines, including in the two background control samples. It is possible that the amount of sediment in the samples has caused inadequate filtration and contributed to the measured aluminum concentrations; however, as all five groundwater samples, including the background control samples, exceed the CCME PFAL, it is implied that the measured aluminum concentrations in groundwater may be natural and not related to anthropogenic activities in the area. The dissolved aluminum concentrations in the three seep samples did not exceed the CCME PFAL.

Dissolved zinc concentrations exceeded the referenced CCME PFAL guideline in four of the five groundwater samples collected in 2014, including the background control sample 14MWC1. The three seep samples did not have zinc concentrations greater than the CCME PFAL guidelines. There is likely a relationship with the hardness as the highest zinc concentrations occurred in groundwater with a hardness of less than 50 mg/L expressed as $CaCO_3$. Similar to aluminum, the measured zinc concentrations may be natural to the area.

All dissolved copper concentrations measured in the monitoring wells and the seeps exceeded the referenced CCME PFAL guideline in 2013. Copper concentrations measured in 2014 are within the same order of magnitude as the guideline, except at 14MW05. The concentration at 14MW05 is approximately 10 times the concentration measured at the other sample locations and may be anomalous. Because the seep and background control samples have similar copper concentrations, it is not apparent that the waste rock pile is affecting copper concentrations in the area.

Uranium concentrations in all five groundwater samples collected in 2014 are well below the referenced CCME PFAL guideline, while in the seep samples they are up to six times greater. As shown in the uranium graph above, the concentrations in the seep samples are less than in the year 2003 and a seasonality is apparent, with the lowest concentrations in May 2012. There is no obvious difference in uranium concentrations between the five monitoring wells, suggesting that the higher uranium concentration in the seeps is not affecting the water quality at the three down-gradient monitoring wells.

4.4.5 Seepages and Groundwater Conclusions and Recommendations

The review of groundwater quality information from three monitoring wells down-gradient of the waste rock pile and two background control monitoring well locations suggests that exceedances of the CCME PFAL guidelines for the dissolved metals aluminum, copper, iron, and zinc likely represent natural groundwater conditions within the active layer.

Overall, uranium concentrations in seep samples from the waste rock have significantly decreased when compared to the seeps sampled down-gradient of the development waste rock pile in 2003. However, uranium concentrations in the seep samples remain elevated relative to the referenced CCME PFAL guidelines and relative to groundwater samples collected at the five monitoring wells.

There is no evidence to suggest that uranium concentrations in the seeps have affected the groundwater quality in monitoring wells down-gradient of the waste rock pile. The water quality in the surface water in Carat Lake directly below the waste rock pile is below the CCME PFAL guidelines.

Additional sampling is suggested to develop a better understanding of background water conditions in this area. In addition, further monitoring and sampling of seeps and groundwater wells down-gradient of the waste rock pile is suggested to further characterize the water quality and to establish trends. At closure, the seepage from the waste rock may exceed the CCME PFAL guidelines. A site specific water quality criteria may be required for the mine closure taking into account the source water and receiving body.

4.5 Hazardous and Non-Hazardous Materials and Infrastructure

The existing infrastructure is extensive for a remote site. Hazardous materials included a volume of 1,816 m^3 and 2,855 items. Non-hazardous materials included a volume of 225,073 m^3 (uncrushed) and 2,015 items. Hazardous materials were characterized by hazard type and non-hazardous materials were characterized by wood, metal, and other non-hazardous materials.

The truck shop, camp facility, and process plant are the major structures on site. The truck shop and process plant appear to be in good structural condition; however, there is some degradation of the camp facility, largely due to water damage. Also, there is mould observable in all major structures.

There are some equipment and vehicles on site that will be useful for decommissioning. This includes functioning loaders, excavator, pumps, generators, a water remediation unit, and light trucks, as listed earlier in Table 3.3.

Tables 4.9 and 4.10 summarize the hazardous and non-hazardous materials at the site. All volumes are uncrushed. Crushed volumes are discussed further in Sections 5.13 and 5.14.

Table 4.9: Jericho Mine Hazardous Materials Inventory

Material Description	Volume (m^3)	Quantity (units)
Total lead in paint on ASTs	558	-
Fluorescent lights	-	1,674
Fire extinguishers	-	284
Miscellaneous compressed gas cylinders	-	380
Refrigerant items	-	20
Drum items: organic content	-	388
Organic content within four tanks at Phase 2 tank farm 500,000 L tanks (#9-12)	19.5	-
Soil in drums and containers	100	-
Organic content in drums, ASTs, tanks, containers, pails	888	-
Materials in ASTs, tanks, containers, flammable cabinets	270	-
Batteries	-	109
Total	**1,816 m^3**	**2,855 items**

Table 4.10: Jericho Mine Non-Hazardous Materials Inventory

Material Description	Volume (m^3)	Quantity (units)
Wood	980	-
Wood items	-	702
Metal	15,722	-
Metal items	-	204
Sea cans	1,174	-
Miscellaneous inert materials	596	-
Miscellaneous inert materials items	-	494
Cement	154	-
Vehicles / machine items	-	28
Drums: empty	-	587
Large ASTs	124,000	-
Tarp-tented shops	6,186	-
Major structures – Truck Shop	10,464	-
Major structures – Camp Facility	18,694	-
Major structures – Process Plant	47,104	-
Total	**225,073**	**2,015**

5.0 REMEDIATION ACTIVITIES

The following sections detail remediation activities associated with the Jericho Mine's components. Their applicability to the closure scenarios outlined in Section 1.0 are discussed, as is any limitations or risks associated with their implementation or omission.

5.1 Open Pit

Reclamation activities related to the open pit include pit filling, slope stabilization, and channel outflow construction. Each of these activities are discussed in the following sections.

5.1.1 Pit Filling

The open pit will be established as a pit lake at closure. Leaving the pit in an unfilled condition is not considered feasible as there is an average annual net annual precipitation gain at the Jericho Mine and the pit will fill naturally with water on its own. The pit closure strategy for each scenario involves pit filling; the variable is how long it takes.

The nominal closure pit lake water elevation was set at 479 m. This corresponds to the low point around the pit perimeter at the north end, as shown in Figure 9. At this elevation, a portion of the pit wall will be exposed, particularly around the south perimeter of the pit. Pit cross sections showing the design pit lake water elevation are shown in Figures 10 and 11.

The estimated pit volume at elevation 479 m is 4,180,000 m^3, based on a 2008 pit topography completed by Tahera. The present pit water elevation is approximately 435.4 m, corresponding to a water volume of 487,000 m^3.

There are several pit filing options. Each option has implications on pit filling times and water quality (see Section 5.1.2). The options include:

- **Option 1 – Natural Filling**. This option allows the pit to fill naturally using the small catchment area around the pit (Figure 8). Flooding times will be longest with this option as there is negligible groundwater flow and the existing catchment is small.
- **Option 2 – Active Pumping**. The pit could be filled by pumping water via the water intake causeway in Carat Lake to the pit. An estimated 350,000 m^3 of water could be pumped per year, based on allowable withdrawal rates in the current water license. Pumping will require an on-site presence to maintain the equipment. The benefit of pumping water from Carat Lake is that the rate of water input can be controlled; thus, the time required to complete the pit filling and to conduct the associated monitoring tasks can be better planned.
- **Option 3 – C1 Diversion**. The C1 diversion could be routed into the pit. This would provide an estimate average annual pit inflow of 325,000 m^3. It will also remove concerns of the long-term performance of the C1 alignment berm and bring the drainage pathway closer to the original alignment. The proposed breach alignment runs through the Reach A till plug near the original C1 channel flow path, as shown in Figure 9. The breach cross section would be a trapezoidal channel that directs water to the pit. A plug would be required along the existing Reach A alignment to direct water along the new path (Figure 12).
- **Option 4 – Combination**. A combination of active pumping and diverting C1 flows could be used further reduce filling times. This option has an increased capital cost but yields the shortest filling time.

Based on the current site water management infrastructure at Jericho, the catchment areas that can contribute to the pit filling are:

- **Pit Catchment.** Including the open pit area and the south portion of the waste rock pile. Precipitation and runoff in this catchment will naturally flow into the pit. The approximate area of this catchment is 445,500 m^2.
- **C1 Catchment**. Including the Low Grade Ore Stockpile area, plant site area, and coarse PK area. Runoff from this area will flow into Lake C1 and further into Carat Lake through C1 Diversion Channel and Stream C1. The approximate area of this catchment is 1,457,000 m^2.

Both of these catchment areas can be referenced in Figure 8.

Estimated filling times for each option is shown in Table 5.1. Hydrologic inputs for the filling estimates were based on values provided by SRK in *Technical Memorandum C – Supplemental Climate and Hydrology* (SRK 2003b):

- Average Annual Precipitation: 330 mm
- Estimated Runoff in Vicinity of Jericho Kimberlite Pipe: 225 mm
- Estimated Open Water Evaporation: 270 mm

The runoff depth provided in SRK 2003 is based on a runoff coefficient of 0.682. Actual pit water accumulation since 2008 suggests the runoff coefficient may be closer to 0.5; however, there is no site-specific precipitation data to confirm if the water accumulating in the pit was during periods of wet or dry precipitation. In the absence of this data, filling times have been calculated as a range of values.

Table 5.1: Estimated Rates to Fill Current Pit

Filling Option	Filling Options			Estimated Filling Period (years)
	Natural Filling	Redirecting Stream C1 Diversion	Carat Lake Pumping	
	≤ 70,000 m^3/year	241,000 - 328,000 m^3/year	350,000 m^3/year	
1 (Natural)	Yes			44 - 59
2 (Pumping)	Yes		Yes	9
3 (C1 Diversion)	Yes	Yes		9 - 13
4 (Combined)	Yes	Yes	Yes	5 - 6

The preferred filling option is dependent on the closure scenario being considered and the resulting water quality. Extending the filling time gives more time to evaluate the pit water quality (Section 5.1.2), but also results in increased monitoring costs.

Rerouting the C1 Diversion to fill the pit will temporarily suspend concentrated flow downstream of C1 Diversion Reach C. This will not have an impact on Carat Lake, but will impact any fish habitat along the flow path. If this is not acceptable, then the pit may need to be filled by active pumping followed by breaching of the C1 Diversion.

Regardless of the filling option, the pit is expected to need an outflow pathway to Carat Lake that will prevent erosion of the intervening tundra. The proposed outflow location is shown in Figure 9 and conceptual sections shown on Figure 13.

5.1.2 Pit Lake Water Quality

A sample of the existing pit water was taken during the 2014 inspection. Water quality test results met CCME guidelines for the protection of freshwater and aquatic life, with the exception of uranium. Table 5.2 summarizes the historical uranium concentrations measured in the pit water since 2007. The 2014 uranium concentrations has decreased from 2008 measurements, but is still significantly above CCME guidelines.

Table 5.2: Uranium Concentrations in Pit Water (SWQ-02)

CCME PFAL Limit (mg/L)	Total Uranium Concentration (mg/L)				
	27-Jun-07	22-Jul-07	25-Aug-07	9-Oct-08	29-Aug-14
0.015	0.0508	0.0184	0.12	0.234	0.117

Water quality in the pit was estimated for each filling option using historical water data and a simple mixing model. The results are summarized in Table 5.3. From October 2008 to August 2014, the uranium concentration in the pit water dropped by half, however, the overall loading increased by 6.8 kg per year. This loading was applied to the mixing model as a constant annual loading to estimate the pit water quality at closure.

Table 5.3: Predicted Uranium Concentrations in Pit Water

Filling Option	Uranium Concentration (mg/L)	Years from Start of Filling
1 (Natural)	0.083 - 0.108	44 - 59 years
2 (Pumping)	0.027 - 0.028	9 years

Table 5.3: Predicted Uranium Concentrations in Pit Water

Filling Option	Uranium Concentration (mg/L)	Years from Start of Filling
3 (C1 Diversion)	0.028 - 0.033	9 - 13 years
4 (Combination)	0.021 - 0.022	5 - 6 years

The results in Table 5.3 are preliminary and based on linear extrapolation of the loading data, assuming complete mixing on an annual basis. The model predicts that uranium concentrations during natural pit filling are not expected to improve significantly. This is because the catchment area reporting to the pit is relatively small and the existing loading data sourced from the small catchment around the pit. Augmenting natural filling with water from Carat Lake or the C1 Diversion shows a marked improvement in water quality; however, even with the significant dilution from these water bodies, the basic mixing model predicts that uranium will exceed CCME discharge criteria (0.015 mg/l).

The results in Table 5.3 are consistent with water quality predictions made by SRK as part of the Tahera's interim closure and reclamation plan (Tahera 2007). SRK also predicted elevated uranium concentrations at mine closure.

It is recommended that pit lake water quality modelling be undertaken as part of detailed closure design. As a precursor to this, regular water quality testing should be completed on pit water to identify loading trends and pit infill rates.

5.1.3 Open Pit Stabilization

The nominal pit lake water elevation of 479 m will leave a portion of the southern pit high wall exposed. Much of this high wall pit is directly in bedrock, which is of less concern. However, portions of the pit are surrounded by till, which could ravel over the edges, generating water quality and edge stability concerns. The primary areas of exposed till will be on the west side of the pit, as shown in Figure 9. Options to stabilize the exposed pit walls include:

- **Option 1 – Allow to Stabilize Naturally**. This option entails leaving slopes in their current condition. The risk is that the existing till will ravel over the edges, impacting water quality and crest stability. In the short term, this is not expected to be a large concern, particularly if the pit lake is not at discharge elevation.
- **Option 2 – Pull the Till Back**. Under this option, exposed till will be sloped back to provide a stable slope and reduce the risk of till ravelling over the edges. This option would only impact a small portion of the pit since bedrock daylights at most locations around the pit. Approximate areas of till stabilization are shown on Figure 9.
- **Option 3 – Pull the Bedrock Back**. The bedrock can be benched to generate improved littoral zones and fish habitat. However, cutting into the bedrock will come at a significant cost, particularly because none of the mining equipment is currently on site anymore. There is likely no structural or stability requirement to excavate benches based on the visual assessment of the pit; however, mapping of exposed rock faces should be undertaken as part of detailed design.
- **Option 4 – Fill the Pit with Rock Landfill**. The pit can be in-filled with rock material from the surrounding piles. This is an expensive option and is not considered practical.

Stabilizing the till (Option 2) is the preferred option for full closure (Scenario 1). It will reduce the risk of till ravelling over the edges and generating water quality and edge stability concerns. Most of the pit walls are in bedrock, so pulling the till back is not expected to be a significant task. Given that most of the till is near the C1 Diversion, much of the till may already get pulled back if the C1 stream is diverted to the pit. The exposed rock slopes will likely remain stable over the long-term; however, structure mapping should be considered as part of detailed closure design.

The slopes in their present condition are not in distress. They could be left for several years without significant performance concerns. They should be addressed as part of complete remediation, but could be left in their current condition for Scenarios 2 and 3.

A safety berm will need to be constructed around the pit, consistent with previous Interim and Closure Reclamation Plan (ICRP) submissions (EBA 2011). The berm could be constructed with run of mine, or till material. Processed granular fill could be used; however, this is a more expensive construction material and not likely required for this application. In any of the scenarios, it is assumed that a safety berm will be required around the pit edges to prevent land users and potentially wildlife from entering the pit accidentally.

5.2 C1 Diversion

The C1 Diversion currently diverts surface flow from Lake C1 around the pit and into Carat Lake. The C1 Diversion is overall in good condition. There are some localized areas of settlement; however, these appear to have stabilized over recent years and are not expected to impact long-term performance.

The primary issue related to closure of the C1 Diversion is whether to maintain the diversion along its present alignment or to direct flow back into the pit. Each option has implications for long term pit water quality as noted above; however, cost may also be a factor.

- **Option 1 – Maintain Existing Diversion**. The C1 Diversion will be left in its current alignment, although the culvert will be removed as part of the road closure options. Apart from the culvert removal, no remedial action is required to improve long-term performance. Maintaining the diversion along its current alignment will limit the catchment area reporting to the pit lake. This will result in the lake becoming a headwater lake with limited recharge.
- **Option 2 – Divert to the Pit**. The C1 Diversion will be diverted to the pit to reduce filling time and restore the original flow path. As discussed in Section 5.1.1, the C1 Diversion will be breached near the headwaters of Reach A and a plug installed to prevent flow down the alignment. Diverting flows into the pit will re-establish the natural flow path through the area and provide a fresh source of recharge for the pit lake.

Diverting the C1 stream back to the pit is the preferred option for full remediation (Scenario 1) because it restores the natural flow path through the pit area, and provides a consistent source of inflow for the pit lake. It also removes any question about long-term performance of the C1 Diversion and significantly reduces pit filling times (discussed in Section 5.1.1). Figures 9, 12, and 13 show the location of the breaches into the pit, along with profiles and sections.

If the C1 Diversion is routed to the pit as part of pit filling activates, surface flow downstream of Reach C will be eliminated. Flow could be maintained by filling the pit prior to diverting C1 flow. This would require filling the pit naturally or by pumping from Carat Lake.

Routing the C1 Diversion into the pit would not be required for closure Scenarios 2 and 3; however, any decision regarding the C1 Diversion would need to be made based on anticipated pit water quality once the lake reaches discharge elevation.

5.3 Intake Jetty (Water Intake Causeway)

The jetty protrudes into Carat Lake and is predominantly constructed of run of mine. Options to reclaim the jetty include leaving the pad as-is, or lowering it below the water level. Removing material below the water level is expected to require an in-water work authorization and measures such as silt curtains.

- **Option 1 – Remove Infrastructure and Leave Pad**. This option entails removing the pipes and building, but leaving the jetty pad at its current elevation. The intake well pipe would be lowered 0.6 m below the existing jetty level. The intake well will be filled with rock to prevent accidental entry.
- **Option 2 – Remove Pad to Below Lake Level**. The jetty infrastructure can be removed and the pad taken 2 m below Carat Lake's water level. This will remove the visual evidence of the jetty and potentially provide more shallow fish habitat.

For Scenario 1, the preferred option is to remove the infrastructure and leave the pad as-is. There is no geotechnical reason to lower the jetty and it eliminates the need to complete in-water work. For Scenarios 2 and 3, the existing infrastructure could be left in place as it does not pose an immediate environmental risk

5.4 Waste Rock

The waste rock is almost exclusively on IOL, with the exception of an access ramp directly off of the ring road (Figure 5). The waste rock pile appears stable in its present configuration. The ICRP indicates that the waste rock piles will be flattened at closure; however, the existing pile configuration may satisfy long-term stability requirements in its present configuration.

The long-term stability of the pile should be evaluated as part of closure planning; however, there is little value in considering only the portion of the pile on Crown land. Reclamation of the waste pile should consider the pile as a whole and be coordinated with the Kitikmeot Inuit Association.

Recommendations for all scenarios are that no work be undertaken for the portion of the waste rock pile located on Crown land.

The primary waste rock concern is that the piles are designed to drain over Crown land and into Carat Lake. Findings indicate that water quality should be acceptable to leave water draining into Carat Lake, but long-term monitoring will be required. Discussion is included in Section 4.4.4 and 4.4.5.

5.5 Coarse Processed Kimberlite

The coarse PK pile is relatively stable, with the exception of some localized sloughing noted at the contact with the East Sump. The coarse PK pile is expected to be a construction material source for the landfarm (Section 6.0) and cover material in the PKCA (Section 5.6). As a result, the volume may be significantly depleted and slopes altered during reclamation work.

2014 water quality measurements show slightly elevated uranium concentrations in the east sump water. The measured concentration was 0.022 mg/L as opposed to the CCME criteria of 0.015 mg/L. There is not historical water quality measurements for this locations, so concentration trends cannot be established; however, the uranium concentrations are only slightly above CCME guidelines, and the sump area does not discharge directly to receiving environment.

Water quality monitoring should be continued at the east sump post-closure to establish trends; however, Tetra Tech EBA does not anticipate a significant issue with water quality at this location. Similarly water quality monitoring should be continued around the piles. No seeps were found off of the coarse PK pile in August 2014.

There are several closure options for the coarse PK pile. These include:

- **Option 1 – Leave As-is**. The coarse PK pile would be left in its present condition.
- **Option 2 – Regrade Pile**. The coarse PK pile would be generally graded for aesthetics. As part of this work the slope at the contact area with the east sump would be flattened and armoured with riprap. The amount and degree of regrading would depend on the quantity of material used as borrow.
- **Option 3 – Fill East Sump**. Use the coarse PK material as an aggregate source for the landfarm and Cell A and regrade the remainder for aesthetics. This may involve filling in the East Sump.

The preferred closure option for Scenario 1 is to grade the coarse PK pile and armour the sideslopes at their contact with the East Sump (Option 2). There would not be a specific requirement to regrade the pile for Scenarios 1 and 2; however, some regrading would still be required if the coarse PK was used as borrow source for Scenario 2.

There is no requirement to cap the coarse PK pile based on water quality measurements and vegetating the pile is not considered practical, based on experience at other mine sites.

5.6 Processed Kimberlite Containment Area

The long-term closure strategy for the PKCA needs to address two major items:

- Surface water management – how to handle the existing water-impounding structures, which include West Dam, Divider Dyke A, and North Cofferdam.
- Stability – this includes surface stability of exposed PK as well as long-term stability of the water retention structures.

Water quality in the PKCA meets discharge criteria and is not expected to deteriorate in the long-term; therefore, there is no specific requirement to capture and treat contact water as part of reclamation activities.

The existing water structures are in good condition and there are no specific requirements to undertake any remedial work. The East, Southeast and Saddle dams, and North Cofferdam can remain in their current condition without doing any work.

5.6.1 Surface Water Management

One of the primary PKCA issues is managing surface water. Although the catchment area is relatively small (see Figure 8), there is an overall annual net gain of water in the facility. Cell C water level needs to be periodically lowered by the Care and Maintenance team to prevent it from going through the spillway at the North Cofferdam and flowing towards Lake C1.

The two principle options to manage the PKCA surface water include leaving facility in its existing condition and breaching the main water structures. Each of these options are discussed in below.

Option 1 – Leave As-is

The first option would leave the West Dam, North Cofferdam, and Divider Dyke A as-is. This will require that Cell C continue to be pumped on an annual or semi-annual basis to prevent the North Cofferdam from being over topped. Water may also need to be pumped from the pond upstream of Divider Dyke A, depending on the amount of water accumulation on its upstream face. The structures would continue to require geotechnical inspections.

This option is most applicable to Scenario 3. Although the most cost effective, it requires the greatest amount of monitoring and maintenance.

Option 2 – Dam Breach

The second option breaches the West Dam and Divider Dyke A, to allow surface flow out of the facility without the requirement for pumping. Figure 14 depicts the overall breach strategy.

The West Dam would be breached near the original lake elevation of 514.4 m, to direct water along the original flow path. A conceptual breach design is shown in Figure 15. The dam would be breached along the north abutment, exposing the natural contact along the north side of dam alignment, and sloping the remaining dam structure back at a 3H:1V slope. Armouring would be placed along the channel bottom and sideslopes to provide erosion resistance. The estimate excavation volume to breach the West Dam is 26,500 m^3.

To promote flow between Cells A and C, Divider Dyke A would be notched at its north. The proposed notch alignment and cross-section are shown in Figure 16. The design section would have 6H:1V sideslope to discourage snow accumulation and to permit vehicle passage to the West Dam. The channel bottom and sideslopes would be armoured to prevent erosion damage.

Significant PK deposition has occurred in Cell A, to an estimated elevation of 517.5 m immediately upstream of Dyke A. At closure it is desirable to maintain a small pond immediately upstream of the dyke to act as stilling basin and sediment collection pond. A concept elevation of 520 m was set for the upstream pond. The associated sill elevation for Dyke A breach was also set to this elevation.

The accumulation of PK upstream of Dyke A results in a 5 m drop in elevation upstream and downstream of the dyke. To manage flow across the dyke, a control structure is required to transition flows over the large elevation drop. The conceptual control structure comprises a ramped conveyance structure from the Dyke A breach to the Cell C design elevation of 514.4 m. The conceptual control structure discharge is shown in Figure 16.

Option 2 eliminates the requirement to annually pump water out of the PKCA and would be required for Scenario 1 and 2.

If the mine was reopened at a later date, the dam could be restored following breaching; however, significant engineering and construction would be required to restore the structure and verify its integrity. The West Dam is a frozen core dam structure with a saturated core. It is likely that a large portion of the dam surrounding the breach location would need to be excavated until saturated conditions were encountered. The breach would then need to be filled with saturated, granular material, likely in winter conditions to allow the material to freeze back. An investigation of the remaining dam structure would likely be required to verify its condition, particularly if existing GTCs are destroyed as part of the dam breach construction.

Option 3 – North Dam Spillway

Alternatively, the West Dam could be left as-is and the North Cofferdam could be notched to allow flow north. This would direct runoff from the PKCA into the Lake C1 catchment area. Discharge from the PKCA would flow through a marshy area immediately north of the North Dam and there is concern that the flows could cause erosion, high sediment load, and landscape changes as the flow pathway establishes itself in a permafrost-sensitive area. An engineered channel would be likely required to direct overland flow through this area. This would require a site investigation and engineering design. Post-construction monitoring would also be required to verify acceptable performance in the long term.

Directing surface flows through the West Dam alignment (Option 2) is preferred for Scenario 1 and 2, given the environmental risk associated with conveying water through the sensitive area, and the level of engineering required to construct a channel.

5.6.2 Surface Stabilization

Cell A is expected to require surface stabilization for both water and wind erosion. The Cell A tailings surface is exposed and localized erosion channels are evident at spigot locations.

During operations, prevailing winds from the west blew dry tailings over the east and southeast dams, depositing them on the leeward side of the dams and the upstream tundra. Snow fencing, and later truck tires, were placed to function as a wind break and limit wind blow deposition outside the facility. Under AANDC's direction, the tailings surface was watered in 2013 and 2014 prior to freeze up to prevent desiccation of the tailings over winter. A road and pad were constructed on the upper tailings beach area to facilitate this work.

A vegetation cover was considered, but is not considered feasible. A proposed University of Alberta study for the ICRP was not conducted due to the Jericho Mine closure in 2012. Although similar trials at Ekati have met with success, the Jericho Mine is further north and has a slightly different environment and soil conditions If a vegetation cover approach for Jericho Mine was to be seriously considered, it would require a vegetation study taking years and may not be successful. However, there has been almost no natural revegetation of Cell A since operation (six years), which is not an encouraging indicator. In contrast, sections of the Long Lake Containment Facility at Ekati are revegetating in shorter timespans without active planting.

The area of the Cell A is 100,200 m^2. The relatively small area may simplify closure options, as taking a varied or novel approach to covering the cell is not expected to provide significant cost savings.

The tailings surface could be left in its current condition and managed as a maintenance activity (Scenario 3) or capped to reduce erosion (Scenario 1 and 2). The leave as-is and capping options are discussed below.

Option 1 – Leave As-is

Cell A could be left as-is. If left alone, annual watering and freezing will continue to be required to stabilize the surface. This option would be applicable to Scenario 3.

Option 2 – Coarse PK Cover

This option utilizes a coarse PK cover to stabilize the fine PK surface and limit wind-blown tailings. The coarse PK cover could be capped with additional material such as waste rock or till to provide erosion resistance and promote and more varied, natural appearance. A conceptual cover system is shown in Figure 17. The estimate material quantities to construct the PK cover are provided in Section 8, Table 8.1.

The use of coarse PK utilizes material that is readily available and relatively inexpensive to source and place. Variable foundation conditions are expected within Cell A. The upper beach areas should be relatively firm, and readily permit vehicle traffic and material placement. Softer conditions will be encountered towards the settling pond upstream of Dyke A. The use of a geotextile or winter placement may be required to cover wetter ground.

Some grading will likely be required prior to placing coarse PK. Alternatively, additional coarse PK could be placed to fill in depressions in the Cell A surface.

Preferred Option

The coarse PK and till cover is the preferred approach. There is a strong concern that the vegetation cover approach will not work and the relatively small area makes potential savings due to combined or novel approaches relatively minor. A tailings cover will be required for both Scenario 1 and 2.

5.7 Containment Berms

There are several containment berms on site, as noted in Section 3.0. In all cases the berms are physically stable; however, contaminated soil has been identified within most berm perimeters. Closure options for the containment berms include:

- **Option 1 – Removal**. In this option the berms are removed and any contaminated soil disposed of in the appropriate manner. Liner or other synthetic material in the berms can be disposed of in the landfill or hauled off site.
- **Option 2 – Leave in Place**. For this option the berms would be left in their existing configuration. Water accumulating in the bermed enclosure will need to meet discharge criteria prior to being released to the receiving environment.

For Scenario 1 and 2, removal of all containment berms is the preferred option. This option removes and environmental liability and eliminates the requirement to test contact water on a regular basis. Removal of the containment berms is not required for Scenario 3; however, monitor and testing of contact water will be required on at least an annual basis.

5.8 Pads

Pad locations are summarized in Table 5.4. As noted in Section 3.0, the pads near the airstrip (airstrip apron, reclaimed Carat camp, Carat Lake laydown) are generally constructed with either esker material, or directly on the ground surface. Pads near the main camp area have been constructed with waste rock.

All pads are stable and there is no immediate need to reclaim the areas. As part of full remediation (Scenario 1), pad areas should be graded to promote positive drainage and for aesthetics; however there is no requirement to undertake any actions for Scenarios 2 and 3.

The most significant grading will be required on the low grade ore pad. At this location there are several piles of waste kimberlite that have been pushed up. There are no significant stability concerns with these piles, but they should be levelled to improve the overall aesthetics of the site.

5.9 Roads

The existing road network is shown in Figure 1 and summarized in Section 3.0. At closure, the road network should be left in place to facilitate long-term monitoring at the Jericho Mine. Culverts should be removed to prevent blockage and road overtopping. The road surface in the vicinity of the culverts should be graded to allow traffic to pass and water to flow over the road alignment.

Culvert removal should be included as part of full remediation (Scenario 1), but is not required for Scenarios 2 or 3. If the culverts are not removed their conditions should be monitored as part of ongoing site monitoring activities.

The culverts requiring removal are summarized in Table 5.4. There are 5 culverts to be removed along the Airstrip Road, 1 culvert along the Ring Road, and 1 culvert along the C1 Diversion.

Table 5.4: Airport Road Culvert Crossings

Culvert ID	Northing (m)	Easting (m)	Description	Condition
1	7,320,164	478,884	1 – 406 mm dia. CSP culvert	Good condition, no flow obstruction
2	7,320,518	478,925	1 – 305 mm dia. CSP	Slight damage to inlet, outlet submerged
3	7,320,668	478,997	1 – 508 mm dia. CSP	Good condition, no flow obstruction
4	7,321,002	478,938	1 – 406 mm dia. CSP	Slight damage to inlet, does not impact performance
5	7,321,308	478,946	2 – 406 mm dia. CSP, staggered elevations	Lower outlet damaged, flow still passes through
6	7,318,911	477,913	1 – 406 mm dia. CSP culvert	Good condition
7	7,319,781	478,017	1 – 914 mm dia. CSP	Inlet and outlet inverts damaged, no visible piping

Alternatively, the existing road network could be scarified to promote vegetation growth; however, this would impede future inspections and is not preferred.

5.10 Airstrip

The airstrip will be necessary for long-term monitoring at the Jericho Mine. It is recommended that the airstrip be left as-is. This will help facilitate any future development or monitoring in and around the Jericho Mine. In addition, the established northern precedent is to leave airstrips in place.

A small amount of supporting infrastructure, such as the terminal building, should potentially be left intact to support future transport at the airstrip, both for long-term monitoring needs and as an emergency shelter.

5.11 Borrow Sources

The borrow sources are mostly flat, sandy areas with some ridges and depressions left. The existing areas have been depleted and are no longer useful as borrow sources. Closure options for the existing borrow areas include:

- **Option 1 – Leave As-is**. The borrow sources can be left as-is, with no regrading of the material.
- **Option 2 – Regrade the Remaining Material**. The borrow sources can be regraded for aesthetics, which will mean taking down ridges that are over 1 m and filling in small depressions.

Regrading the borrow sources is expected to be a relatively minor task, so regrading is the preferred option for Scenario 1. There is no requirement to regrade the borrow areas for Scenarios 2 or 3.

5.12 Contaminated Soils

The contaminated soils on site are comprised primarily of hydrocarbon impacted soils (PHC Soils). There is an estimated 7,850 m^3 of hydrocarbon impacted soil on site as detailed in Section 4.0. This is largely composed of F2 and F3 fractions; however, there are also some F4 factions present. Comparatively there is relatively small volume of metal and unknown contaminated soils (64 m^3 of soil and 100 m^3 of soil in drums).

This volume is an estimate based on limited knowledge of subsurface conditions and delineation. For the purpose of the option assessment, this volume has been carried forward; however, further sampling and field assessment would provide better confidence around these numbers.

Options to manage the contaminated soils really come down to three options:

- **Option 1 – Leave Contaminated Soils in Place**. This option carries with it the highest degree of risk and liability; however, in some cases where the contaminant source has been removed or the volume is small, leaving the contaminated soil in place could be justified.
- **Option 2 – Excavate Contaminated Soil and Dispose of Off Site**. This option removes the environmental risk; however, the cost of hauling material off site may preclude this being a viable alternative.
- **Option 3 – Excavate Contaminated Soil and On-Site Treatment or Disposal**. Again this option removes the environmental liability, but may be more cost effective than hauling the material off site. Options for on-site disposal include landfarming of hydrocarbon impacted soils or construction of a contaminated soil landfill.

For each scenario the preferred clean up option is APEC specific and risk dependent. Recommended clean up options for each APEC are summarized in Table 5.5.

Table 5.5: Recommended Contaminated Soil Clean Up by Scenario

APEC	Location	Scenario 1	Scenario 2	Scenario 3
1a	Airstrip	-	-	-
1b	Airstrip	Landfarm	Landfarm	-
1c	Airstrip	Off-site Disposal	-	-
1d	Airstrip	Landfarm	-	-
1e	Airstrip	Landfarm	-	-
2	Contaminated Soils Storage	Landfarm / Off-site Disposal	Off-site Disposal / Cover PHC Soil or Landfarm	-
3	HWTA	Landfarm	Landfarm	-
4	Waste Rock Pile	Landfarm	-	-
7	Phase 2 Tank Farm	Landfarm	Landfarm	-
8	Phase 1 Tank Farm	Landfarm	Landfarm	-
9	Gensets	Landfarm	-	-
9	Fuel Berm	Landfarm	Landfarm	-
10	Truck Shop	Landfarm / Off-site Disposal	-	-
13	Carat Lake Laydown	Landfarm	-	-
14	Process Plant	Landfarm	-	-
15	Reclaimed Camp	Landfarm	-	-

For Scenario 2, it has been assumed that all bermed enclosures will be excavated and landfarmed. This is to prevent water accumulation and the need for seasonal pumping.

The integrity of the HWTA is compromised; however, it does provide some degree of containment as evidenced ponding water inside the facility. For scenarios 1 and 2, the existing tanks, drums, and containers should be removed and disposed of appropriately to remove the contaminant source. The large quantity of PHC soil in the west cell of the HWTA should be landfarmed as part of Scenario 1 work; however, it may be covered under Scenario 2 to prevent leaching from the pile. For scenario 3, the water quality in the down-gradient wells should be monitored, and consideration should be given to covering the PHC soil in the west cell. Monitoring well 14MW01 showed trace amounts of hydrocarbons; however, the concentrations are still below guideline criteria and there does not appear to be an immediate environmental risk. The water quality downstream of the HWTA should monitored as part of ongoing care and maintenance and remedial action taken if contaminant migration is observed.

The cases where no action has been recommended generally correspond to lower contaminant volumes or areas where the contaminants appear to be contained. This is not a guarantee that contaminant migration will not occur over time, and monitoring of contaminant levels will be required at locations where no action is taken.

It is expected that the PHC soils can be remediated on site even though they contain a large proportion of heavy end hydrocarbons. However, amendments to the contaminated soil, such as oxidizers, may be required to effectively treat the soil.

Off-site treatment is recommended for all metal impacted soils. The estimated volume of these soils is relatively small and on-site disposal is not considered economical.

5.13 Non-hazardous Materials

Non-hazardous waste includes materials such as wood, metal, ASTs, drums, rubber, concrete, plastic, and other inert items. It also includes major structures such as the truck shop, process plant, and camp facility. The non-hazardous materials have been divided into three waste streams: wood, other non-hazardous waste, and major structures. The total estimated waste volumes are summarized in Table 5.6. Non-hazardous wastes are not considered an environmental concern, but are aesthetic and safety concerns.

Wood Waste

Dilapidated and intact buildings can be a hazard to visitors. The buildings should be demolished or dismantled and the wood separated. Approximately 1,331 m^3 of wood from buildings, items, and debris will need to be disposed of.

Other Waste

Other solid, non-hazardous waste includes metal, metal items, sea cans, miscellaneous inert materials, concrete, machinery, vehicles, empty drums, large ASTs, and tented tarp shops in various locations throughout the site. Some machinery can be put to use, but the majority of the material has little value. The concrete building pads are not included in this volume and are expected to remain in place.

Approximately 20,248 m^3 (crushed volume) of metal, metal items, sea cans, miscellaneous inert materials and items, concrete, machinery, vehicles, empty drums, large ASTs, and tented tarp shops have been identified within buildings and within debris areas. The eight 500,000 L ASTs (#1-8) and four 1,500,000 L ASTs (#9-12) will require drainage of contents and demolition for landfilling.

Major Structures

The major structures on site consist of the truck shop, camp facility, and process plant. The demolished (crushed) volume is estimated to be 39,925 m^3 for the major structures. A lower compaction for the process plant has been assumed due to the large amount of steel in the interior.

Table 5.6: Total Non-Hazardous Materials

Material	Volume (Uncrushed) (m^3)	Quantity (units)	Description	Crushed Volume (% of orig.) (m^3)	Volume (Crushed) (m^3)
Wood	980	-	This includes all wood buildings, not demolished calculations	100%	980
Wood items	-	702	Desks, shelves, beds, tables	50%	351
Metal	15,722	-	This includes trailers and metal buildings, all not demoed calculations, except stockpile shed	75%	11,791
Metal items	-	204	Furnaces, washers/dryers, kitchen sinks, kitchen washer, TV's, electrical equipment, filing cabinets, stove, water tanks, computers, wall heaters	100%	51
Sea cans	1,174	-	Many on site	25%	294
Miscellaneous inert materials	596	-	Canvas, plastic, rubber, empty containers, clean spill pads, tarps, crates, etc.	100%	596
Miscellaneous inert materials items	-	494	Chairs, porcelain sinks, toilets, smoke detectors, etc.	100%	124
Concrete	154	-	Blocks, floors, etc.	100%	154
Vehicles/ machine items	-	28	Trucks, construction equipment, machines.	100%	280
Drums: empty	-	587	Intact drums throughout site	50%	76
Large ASTs	124,000	-	Eight 50,000 L ASTs (#1-8) and four 1,500,000 L ASTs (#9-12)	5%	6,200
Tarp tented shops	6,186	-	Three tented shops on site	10%	619
Major structures - Truck shop	10,464	-	Exterior dimensions of the structure (872 m^2 and 12 m height)	40%	4,186
Major structures - Camp facility	18,694	-	Exterior dimensions of the structure (5,341 m^2 and 3.5 m height)	40%	7,477
Major structures - Process plant	47,104	-	Exterior dimensions of the structure (2,408 m^2 and 23 m height)	60%	28,262
Total	**225,073**	**2,015**	**-**	**-**	**61,505**

5.13.1 Potential Remediation Options

Option 1 – Landfill On Site

A non-hazardous waste landfill could be built. Details of landfill design and use, as well as information on borrow material, is provided in Section 9.0. The steps are as follows:

- Conduct separation of hazardous materials from the non-hazardous waste.
- Demolish the intact buildings.
- Clean drums and tanks and remove residual fluids/fuels from machinery.
- Cut up the tanks; crush the metal debris, drums, and machinery.
- Haul materials to an on-site landfill, compact, and cover

Option 2 – Remove Off Site

The waste would be taken to a staging area and transported to a suitable location for landfilling. This is not considered economical given the volume of material and remote location of the Jericho Mine.

Option 3 – Burning and On-Site Landfill

The unpainted wood will be gathered to a central location, following building demolition and separation. The wood will be burned in a controlled fire at a time of year when the chance for getting out of control will be minimal. To decrease expenses, buildings and wood debris can be burned in place; however, some of the buildings and wood debris may not be in ideal locations. Conceptually, the steps for conducting a controlled burn of the wood at the Jericho Mine are as follows:

- Conduct separation of hazardous materials from the building and debris areas containing wood.
- Demolish the intact wood buildings.
- Conduct separation of other non-hazardous materials that should not be burnt, such as painted wood, metals, fibreglass, etc., from the wood debris.
- Haul wood to designated burn location.
- Conduct controlled burn at appropriate time of year.
- Test ashes for hazardous waste.

Preferred Option

The preferred option for full remediation (Scenario 1) is to landfill the non-hazardous materials on site. Removal off site is not preferred due to high costs, hindered ease of implementation (because of logistical difficulties), and loss of natural capital associated with using fuels during transport. Burning wood is often advantageous on northern sites, however the relatively low wood volume at the Jericho Mine is not expected to make burning cost effective.

The limited remediation scenario (Scenario 2) has assumed the Phase 1 and Phase 2 fuel tanks (ASTs #1 to #12) will be demolished and landfilled. The remaining organic waste in the fuel tanks is to be incinerated as part of

Scenario 2 and this will remove the remaining risk associated with the tanks. Other on-site non-hazardous waste will be left as-is.

5.14 Hazardous Materials

Hazardous materials at the Jericho Mine have been identified due to their toxicity, flammability, corrosivity, or other properties and fall within the definition of hazardous materials under most federal, provincial or territorial legislation under TDG regulations. Table 5.7 is a list of known hazardous materials at the Jericho Mine. The preferred option for hazardous materials in each case applies to both Scenario 1 and 2.

Table 5.7: Total Hazardous Materials

Material	Volume (Uncrushed) (m^3)	Quantity (units)	Description	Crushed Volume (% of orig.) (m^3)	Volume (Crushed) (m^3)
Total lead in paint on ASTs	558	-	Nine 62,000 L ASTs	5%	28
Fluorescent lights	-	1,674	Mostly located in the major structures	50%	2
Fire extinguishers	-	284	Mostly located in the major structures	50%	1
Compressed gas cylinders	-	380	Oxygen, propane, etc.	50%	13
Refrigerant items	-	20	Fridges, freezers, AC units, refrigerant	50%	10
Drum items: organic content (item count is for the container only)	-	388	Gasoline, diesel, Jet A and B, oil, some grease and lubricant	100%	101
Soil in drums and containers	100	-	Unknown contaminants in soil	100%	100
Organic content in drums, ASTs, tanks, containers, pails (fluid volume only)	888	-	Note: Eight 50,000 L tanks (#1-8), volumes unknown, some diesel in the bottom observed and some in pipes	100%	888
Materials in ASTs, tanks, containers, flammable cabinets	270	-	Includes glycol, powder, liquid, solid hazardous chemicals and materials	100%	270
Batteries	-	109	Mostly vehicle lead acid batteries	100%	3
Total	**1,816**	**2,855**			**1,416**

Each of the materials streams listed in Table 5.3 are discussed separately in the following sections.

5.14.1 Total Lead Paint on ASTs

Lead-based paint (LBP) on nine blue ASTs (62,000 L) can be a dermal and respiratory hazard and lead can leach into soil.

There will not be a hazardous landfill built on site, so disposal of the paint (or other hazardous materials) on site is not considered an option. The paint removed from the materials will have to be disposed of as hazardous waste off site following the applicable guideline (GN 2014b). If additional sampling for leachable lead is conducted, and results are below 5 mg/L, then the paint can be disposed of in a non-hazardous landfill out of the territories.

Option 1 – Remove Paint and Landfill On Site

The LBP will be removed from the ASTs, and then the ASTs will be crushed, compacted, and placed in the landfill. The steps are as follows:

- Drain any remaining fuel/fluids from the ASTs (note liquid from cleaning will need to be treated/tested for disposal).
- Collect the ASTs and place the materials in one area.
- Construct an enclosure over and around the materials that will sufficiently collect the paint chips and prevent them from contaminating adjacent areas.
- Remove paint by sandblasting or scrapping and collect the sand/paint for disposal off site in a licensed disposal facility for hazardous waste. Tetra Tech EBA recommends that if LBP waste is to be stored on site awaiting transport, LBP waste should be held in sealed containers to reduce the potential for unauthorized access to the LBP.
- Dismantle, cut apart, crush, and compact materials.
- Sample the surrounding soil to determine that the paint did not contaminate the soil.
- Landfill the substrate and cover. Paint chips are removed off site to a licensed facility.

Option 2 – Cut ASTs and Dispose of Off Site

The LBP will be removed in narrow cut lines from the ASTs and then will be cut, compacted, and hauled off site for disposal. The steps would be similar for Option 1, except that the tanks would be taken off site via the winter road.

Option 3 – Leave Paint On and Dispose of Off Site

Similar to Option 2, but crushing the ASTs would not be an option without removing the LBP. Again, this will be an expensive option.

Preferred Option

The preferred option is to remove the paint in cut lines from the ASTs, cut, and then haul off site for disposal (Option 2). Removing all of the paint on site is expected to be prohibitively expensive due to the size of the tanks and the volume of sand that would be necessary for sandblasting.

The following are potential issues with the partial removal of paint on site and disposing of substrates in an on-site landfill:

- Partial paint removal on site may be difficult to safely implement as sand/water blasting will need to be completed in an enclosed environment following safe work procedures (The Society for Protective Coatings, 2012).

- LBP needs to be handled by personnel with lead abatement training.

5.14.2 Organic Liquid Wastes in Drums, Pipelines, and Tanks

Organic liquid waste includes diesel, gasoline, Jet A, Jet B, heating oil, and other organic wastes within drums. Approximately 888 m^3 of liquid wastes were identified in drums, ASTs, tanks, containers, and pails, but additional volumes could be found during remediation. For example, the eight 50,000 L tanks (ASTs #1-8) in the phase 1 tank farm had observable fluid in the bottom of the tanks, but an exact volume is unknown.

On-site usage of the available organic liquid waste was considered, but liability issues are considered prohibitive.

Option 1 – Incineration On Site

An incinerator designed to meet Nunavut draft air quality guidelines (GN 2012) can be used to dispose of the contents of the drums, pipelines, and tanks. The steps are as follows:

- Sample liquids to ensure incineration criteria are met.
- Empty pipeline and tanks into intact, steel drums.
- Haul drums to incinerator.
- Run drum contents through the incinerator.
- Perform air monitoring during the incineration to ensure compliance with applicable air emission standards.
- Test ash for leachable metals and dispose of accordingly.

Option 2 – Remove Off Site

The drums, pipeline, and tank contents will be properly contained and then transported to another suitable location for landfilling. The steps are as follows:

- Empty pipeline, tanks and drums into appropriate, intact containers for transport.
- Sample for Transportation Dangerous Goods (TDG) and waste disposal.
- Haul to staging area.
- Transport the material off site using the winter road for further shipment to an off-site licensed disposal facility.

Preferred Option

The preferred option is to incinerate as much liquid waste as possible. A limited waste quantity may need to be transported off site if it does not meet incineration guidelines.

The following are potential issues:

- If the existing incinerators on site are not found to be suitable, there may be additional costs to procure and transport a suitable incinerator to site. The equipment is required to meet air pollution controls, specific air emission standards, and be specifically designed to safely incinerate the organic waste, according to the applicable guidelines (GN 2012a).

- Any organic liquid waste that does not meet the incineration guidelines will be shipped off site for disposal at a licensed disposal facility for hazardous waste.

5.14.3 Compressed Gas Cylinders

Approximately 380 cylinders (various sized tanks and helium, nitrogen, propane, acetylene, carbon dioxide, pyrene, and other types of pressurized gas) are known to be present; others may be found during remediation. Approximately 206 of these cylinders appeared to be empty propane cylinders from Borrow Area "A2". No attempt was made to open the cylinders due to safety concerns associated with unknown pressurized gases. The contents are to be considered hazardous until the contents can be safely identified.

Option 1 – Landfill On Site

The cylinder will be depressurized, evacuated, and placed in the landfill. The cylinder will then be covered. The steps are as follows:

- If the content is known, depressurize, evacuate, landfill, and cover.
- If content is not known, or should not be depressurized (e.g., chlorofluorocarbons [CFCs]), a specialist will depressurize, evacuate, and landfill.
- If the content is known and contents cannot be depressurized on site, the cylinder will be placed in an approved container and shipped off site with the content to a licensed landfill.

Option 2 – Remove Off Site

The cylinder will be depressurized as above and then hauled off site for disposal. The steps are as follows:

- If the content is known, depressurize and evacuate. If the content is known, and the shipping company approves the conditions of the cylinder, the cylinder can be shipped with the content.
- If the content is known and contents cannot be depressurized on site, the cylinder will be placed in an approved container and shipped off site with the content.
- If content is not known, a specialist will depressurize and evacuate.
- Haul to staging area.
- In winter, transport the material off site to an off-site licensed disposal facility. The cylinders may or may not be hazardous, depending on if they were depressurized.

Preferred Option

The preferred option is to evacuate the cylinders and landfill on site. Removal off site was not preferred due to the higher cost.

The following are potential issues with landfilling the waste on site:

- Some content is unknown, and some known content in cylinders may not be safely depressurized on site. There will be additional logistical planning associated with transporting the waste off site or evacuating the cylinders in these circumstances following the applicable guidelines (GN 2010b, GN 2011b).

5.14.4 Fire Extinguishers

Fire extinguishers are a hazard due to chemicals within the extinguisher, although this is dependent on type. Approximately 284 fire extinguishers containing ozone depleting substances (ODS), CO_2, and dry chemicals were inventoried throughout the site; others (with content) may be buried under debris. If fire extinguishers are empty, they are not considered hazardous waste and can be landfilled on site.

Option 1 – Landfill On Site

- The content in the fire extinguishers will be evacuated and the canisters placed in the landfill and covered. The content will be disposed of off site at a licensed disposal facility.

Option 2 – Remove Off Site

The fire extinguisher will be hauled off site for disposal. The steps are as follows:

- If the content remaining in the extinguisher contains ODS, then the contents cannot be evacuated.
- If there is content remaining in the extinguisher, and the shipping company approves the conditions of the extinguisher, it can be shipped with the content.
- Haul to staging area.
- Transport the material to an off-site licensed disposal facility.

Preferred Option

The preferred option is to evacuate the fire extinguishers, and landfill them on site. Removal off site is not preferred due to high costs.

Some known content in fire extinguishers may not be safely depressurized on site if it is ODS containing. Therefore, there may be additional logistical planning associated with transporting the waste off site or evacuating the fire extinguishers following the applicable guidelines (GN 2011b).

5.14.5 Other Hazardous Waste

Other hazardous waste at the Jericho Mine includes refrigerant-containing items, fluorescent lights, batteries, glycol, light ballasts, paint, soil in drums, cement, paraffin wax, and various containers of chemicals that have not had a chemical analysis done.

Approximately 270 m^3 of miscellaneous hazardous materials in ASTs, tanks, containers, and flammable cabinets were present on site. There were 20 fridges, freezers, AC units and other items containing refrigerant. There were 1,674 fluorescent lights and 109 batteries. There was also 100 m^3 of soil in drums and containers containing unknown contaminants.

There is only one option for disposal of other solids and liquid hazardous waste: disposal off site in a licenced disposal facility for hazardous waste, according to the applicable guidelines (GN 2010b, GN 2010c, GN 2010d, GN 2011b, GN 2011c, GN 2011d, GN 2011e, GN 2014a).

The hazardous waste will be taken to a staging area and then hauled off site for disposal. The steps are as follows:

- Separate the materials from the buildings and debris areas.
- Haul hazardous materials to staging area.
- Containerize the materials for transport.
- Transport the material to an off-site licensed disposal facility.

5.14.6 Hazardous Materials Summary

A summary of the proposed recommended options is provided in Table 5.8. The recommended option applies to both Scenario 1 and 2.

Table 5.8: Summary of Recommended Remedial Options for Hazardous Waste

Issue	Recommended Option	Description
Total Lead Paint on ASTs	Partially remove paint to enable cut lines, cut, and landfill off-site	Lead painted ASTs will be partially stripped by trained personnel to allow them to be cut apart. The cut ASTs will be taken to a staging area and then shipped off site via the winter road. The paint will be analyzed for leachable lead to determine the appropriate off-site landfill class.
Organic Liquid Wastes in Drums, Pipelines and Tanks	Primarily incinerate and remove the remainder off-site	Organic liquid waste will be mostly incinerated. Waste not meeting the incineration criteria will be shipped off site.
Compressed Gas Cylinders	Evacuate and landfill on site	Depressurize, crush, and landfill on site. Known contents that cannot be safely depressurized will be shipped off site in an approved container, following landfill and shipping company approval.
Fire Extinguishers	Evacuate and landfill on site	Depressurize, crush and landfill on site. Known contents that cannot be safely depressurized will be shipped off site in an approved container, following landfill and shipping company approval.
Other Hazardous Waste	Remove off site	Miscellaneous solid hazardous waste (batteries, mercury vapour in fluorescent lights, paint, refrigerant-containing items, oil absorbent; large amounts of glycol, paraffin wax, bentonite, cement, preservatives, biomedical and pharmaceutical waste, oil/lubricants/fuels, etc.) will be removed off-site to a Class 1 landfill.

6.0 LANDFILL

A landfill will be required for both Scenarios 1 and 2, to accommodate non-hazardous debris generated during cleanup activities. The preferred landfill location was identified in the ESA (Tetra Tech EBA, 2014b) and is shown in Figure 18. The landfill location is situated west of the main camp pad, on largely bedrock controlled terrain.

The generalized cross section consists of a till berm with a 5 m top width for constructability. Preliminary side slopes were set at 2.5H:1V; however, the suitability of the slopes will need to be evaluated as part of detailed design. Erosion protection may be required on the outside face of the landfill berm depending on the till quality and erosion potential.

The natural topography within the landfill footprint slopes down to the north. The landfill is configured to utilize the existing pad as one edge of the landfill, with construct berms constructed on the low side of the landfill to provide containment. Debris will be placed in horizontal lifts from the topographic low (north corner) and progressing up-gradient. Intermediate fill will be used during debris placement to reduce voids in the landfill. The sloped topography within the landfill footprint will allow debris to be placed without construction of an up-gradient berm. Upon completion of demolition the landfill will be capped with an estimated 1.5 m of till / erosion resistant fill.

The estimated compacted debris volumes for Scenario 1 and 2 are 61,500 m^3 and 6,200 m^3, respectively. The landfill configuration shown in Figure 18 corresponds to the Scenario 1 volume. For Scenario 2, a similar approach would be taken; however, the berms would be size accordingly.

Estimated material quantities for the landfill are provided in Section 8.0.

7.0 LANDFARM

A landfarm will be required for bioremediation of the PHCs for Scenarios 1 and 2. No landfarm is required for Scenario 3; however, there is an increased risk of contaminant migration under this scenario and regular site monitoring will be required.

The ESA recommended that the landfarm be constructed on the low grade ore stockpile area as shown in Figure 19. The total estimate of the PHC soil volume is 7,800 m^3. Most of this volume is sourced from the HWTA and Phase 1 and Phase 2 tank farms. Under Scenario 1, all of this material would be excavated and remediated in an on-site landfarm. In Scenario 2, some of the lower risk contaminated areas were not included for remediation. This reduces the PHC soil volume to 6,400 m^3 (or 4,700 m^3 if the stockpiled material in the HWTA is covered).

PHC soils are typically landfarmed in 0.3 m lifts. This corresponds to the required floor areas of 26,000 m^2 and 21,500 m^2 for Scenarios 1 and 2, respectively. The landfarm depicted in Figure 19 has a floor area of approximately 30,000 m^2 and would be suitable for the Scenario 1 soils.

The generalized landfarm design consists of a bermed enclosure graded to direct runoff to a sump area at one corner. The area is lined to prevent contaminant migration and the berms are sized to accommodate runoff from a 1:10 24 hour storm event. The liner system comprises a HDPE liner, sandwiched between layers of nonwoven geotextile for protection. Figure 19 shows a typical detail of the landfarm and its construction. Contaminated soil is spread in a thin layer over the landfill base and tilled to encourage biodegradation of the hydrocarbon impacted soils.

8.0 MATERIAL QUANTITIES

The primary borrow sources for material construction include waste rock, till stockpiled in the waste rock pile, and coarse PK. Where possible, borrow materials will be selected to minimize the processing required (i.e., crushing or screening) to reduce the overall project costs. There is a sufficient waste rock quantity to complete all of the required work. Estimated quantities of the till and PK are 350,000 m^3 and 515,000 m^3, respectively.

Estimated material quantities for the Scenario 1 and Scenario 2 reclamation work are summarized in Tables 8.1 and 8.2.

Table 8.1: Scenario 1 Material Quantities

Component	Excavation (m^3)	Erosion Protection (m^3)	Granular Placement – till (m^3)	Granular Placement – coarse PK (m^3)	Liner System (m^2)
PKCA					
West Dam Breach	26,500	1,000	-	-	-
Dyke A Breach	3,700	300	-	-	-
Dyke A Ramp	-	300	1,000	-	-
Cell A Cover	-	-	30,000	106,000	-
Pit					
C1 Breach	14,000	750	-	-	-
Pit Breach	1,800	250	-	-	-
Landfill					
Berms	-	1,000	26,000	-	-
Cap	-	-	26,500	-	-
Landfarm					
Berms	-	-	10,000	-	-
Base	-	-	-	24,000	30,000
TOTALS	**46,000**	**33,600**	**63,500**	**130,000**	**30,000**

Table 8.2: Scenario 2 Material Quantities

Component	Excavation (m^3)	Erosion Protection (m^3)	Granular Placement – till (m^3)	Granular Placement – coarse PK (m^3)	Liner System (m^2)
PKCA					
West Dam Breach	26,500	1,000	-	-	-
Dyke A Breach	3,700	300	-	-	-
Dyke A Ramp	-	300	1,000	-	-
Cell A Cover	-	-	30,000	106,000	-
Pit					
C1 Breach	-	-	-	-	-
Pit Breach	1,800	250	-	-	-
Landfill					
Berms	-	100	4,000	-	-
Cap	-	-	4,000	-	-
Landfarm					
Berms	-	-	9,000	-	-
Base	-	-	-	20,000	25,000
TOTALS	**32,000**	**31,950**	**18,000**	**126,000**	**25,000**

9.0 MONITORING AND ASSET PRESERVATION

The Jericho Mine will require periodic site visits for geotechnical inspections, water quality monitoring, and care and maintenance. The focus and frequency of these visits will depend on the chosen closure scenario (Section 10.0). This section looks at the monitoring and asset preservation that is expected to be required in the next several years and over the long term.

9.1 Geotechnical Monitoring

Geotechnical monitoring is required for water retaining infrastructure at the Jericho Mine, similar to the inspection completed in the 2014 ESA (Tetra Tech EBA, 2014b). Monitoring can be reduced if infrastructure is removed, although post-reclamation monitoring will still be required to verify the performance of any remedial efforts.

Geotechnical monitoring consists mainly of visual assessments of the Jericho Mine infrastructure. The inspection is to be conducted by a qualified geotechnical engineer and cover the following:

- Visually examine each structure and surrounding area for signs of settlement, seepage, cracking, or any other signs of distress.
- Photograph and record observations made during the inspection. Photographs of the general condition of each structure area should be taken to track year-by-year changes in each structure.
- Ground temperature data should be collected for several structures. This data should be reviewed in conjunction with site observations from each structure to verify performance.

Following the inspection, a report is to be prepared summarizing the assessment and monitoring data.

9.1.1 Reclamation Construction Monitoring

A qualified geotechnical engineer will be present at the mine during construction activities that remove or modify the existing infrastructure. The engineer will be responsible for supervising the earthworks regrading and the collection of associated geotechnical monitoring data.

Reclamation construction monitoring costs have been assumed to be included in the construction estimate and are not separated in Section 10.0.

9.1.2 Post-Reclamation Monitoring

Post-reclamation geotechnical monitoring will be necessary after any construction activities. Short-term post-reclamation monitoring is expected to be required annually for the first two years following reclamation, and then once more after three years. Frequency following that can be determined based on performance. When possible, the inspections should take place during freshet.

9.1.3 Asset-Preservation Monitoring

If Jericho Mine infrastructure is left intact and stability of the existing structures is found to be acceptable, geotechnical inspections can be completed every three years to ensure acceptable performance. When possible, the geotechnical inspections will take place during freshet.

9.2 Water Monitoring

The Jericho Mine will require long-term water quality monitoring including seepage and surface water monitoring. The overall water monitoring plan is assumed to be remain unchanged between closure scenarios because modifying or removing existing infrastructure will not have a significant effect on water quality concerns.

A reduced water monitoring plan, similar to the 2014 Tetra Tech EBA ESA (Tetra Tech EBA 2014b), has been assumed relative to the ICRP (EBA 2011). The Jericho Mine operated for two years out of its expected ten year operational life. As a result, the various mine components are significantly smaller than proposed and the impact to the environment has been likewise reduced.

Seepage Monitoring

Seepage monitoring will include seep sampling where they can be found. This includes the toes of the waste rock pile, the stockpiles, and coarse PK. All incidents of seepage should be documented, including a written description, photographs, as well as UTM coordinates for each source. Field measurements including temperature, pH, dissolved oxygen, and electric conductivity for each sample should be recorded. The seepage water samples will be submitted to a CALA accredited laboratory for the analysis of routine water chemistry, total metal, dissolved metal, and nutrients.

Surface Water Monitoring

Surface water quality should cover the sampling points in Figure 8. The purpose of the surface water monitoring program is to:

- Ensure the runoff water quality meets discharge criteria specified in the water licence, and
- Provide early warning of potential declining water quality due to unexpected causes.

Field measurements including temperature, pH, dissolved oxygen, and electric conductivity for each sample will be recorded. The water samples will be submitted to a CALA accredited laboratory for the analysis of routine water chemistry, total metal, dissolved metal, and nutrients.

9.2.1 Reclamation Construction Monitoring

Regrading associated with reclamation construction may cause geochemistry instability within the rock piles by disturbing the waste rocks. For this reason, the seepage monitoring program should continue annually during any reclamation construction. Sampling should ideally take place in July or August of each year to coincide with maximum seepage concentrations, while avoiding dilution from surface runoff during the freshet period in June.

Surface water quality monitoring should continue on an annual basis during any potential reclamation construction monitoring.

9.2.2 Short-term Monitoring

Monitoring should continue annually in July or August for five years, regardless of scenario. This period of monitoring will establish trends and ideally enable the recommendation of a reduced monitoring frequency over the long term.

9.2.3 Long-term Monitoring

If short-term monitoring results demonstrate no declining water quality results, the monitoring frequency can potentially be reduced to once every three to five years.

9.3 Care and Maintenance

The Jericho Mine will continue to require care and maintenance if the decision is made to preserve the existing site assets. The care and maintenance crew reports that it typically goes on site four times per year, including freshet, mid-summer, late summer, and early fall.

The scope of the care and maintenance crew has included the following to date:

- Berm water management;
- Cell C water management;
- C1 diversion channel management;
- Camp and truck shop maintenance;
- Cell A tailings management;
- Roads and airstrip maintenance; and
- General maintenance of vehicles and equipment.

9.4 Summary of 10-Year Monitoring and Asset Preservation Site Visits

Table 9.1 provides a summary of the monitoring and care and maintenance visits that are projected over the next ten years. For example, there are no care and maintenance visits projected for Scenario 1, assuming remediation starts immediately, but the other two scenarios will require annual care and maintenance for a total of 10 years out of 10.

Table 9.1: 10-Year Monitoring and Asset Preservation Site Visits

Annual Component Required	Scenario 1 Full	Scenario 2 Limited	Scenario 3 Preservation	Projected Annual Cost
Water Monitoring Site Visits	7	7	7	$ 46,774
Geotechnical Inspections	1	3	3	$ 27,548
Care and Maintenance	-	10	10	$ 263,846 (Scenario 1) $177,758 (Scenario 2)

Costs are detailed further in Appendix C.

10.0 OVERALL REMEDIATION SCENARIOS AND COSTS

Three closure scenarios were considered as part of the options assessment for the Jericho Mine. These include:

- **Scenario 1 – Immediate and Full Remediation**, as per the recommended options. This option is to decommission and dispose of all site infrastructure as quickly as feasible. The goal is for full remediation to minimize liabilities at the Jericho Mine and meet or exceed approved remediation plans previously submitted by the mine operators.
- **Scenario 2 – Limited Remediation**. This option is for the remediation of only items presenting an environmental risk while minimizing costs. The Jericho Mine shall be left in a state not requiring annual visits to address environmental issues.
- **Scenario 3 – Preservation of the Site Assets**. The Jericho Mine shall generally be left in its current state, with the intention that it could be reopened, or remediated at a later date while performing ongoing care and maintenance.

Specific reclamation activities associated with each Scenario are summarized in Table 10.1 and discussed in the following subsections. Costs are detailed further in Appendix C.

Monitoring and asset preservation costs have been totalled over a 10 year period. Costs will continue indefinitely, although with a more limited scope as the conditions stabilize.

Table 10.1: Reclamation Scenario Cost

Component	Scenario 1 Full	Scenario 2 Limited	Scenario 3 Preservation
Direct Remediation Costs (Capital Costs)			
Open Pit			
Construct Perimeter Berm	$ 89,000	$ 89,000	$ -
Stabilize Slopes	$ 53,400	$ -	$ -
C1 Diversion to the Pit	$ 340,288	$ -	$ -
Construct Pit Outflow	$ 46,923	$ 46,923	$ -
Causeway (Jetty)			
Remove Infrastructure	$ 2,160	$ -	$ -
Processed Kimberlite Containment Area			
Cover Cell A	$ 2,569,183	$ 2,569,183	$ -
Breach Divider Dyke A	$ 116,592	$ 116,592	$ -
Breach West Dam	$ 635,450	$ 635,450	$ -
Pads			
Grade Stockpile and Coarse PK	$ 121,764	$ -	$ -
Roads			
Remove Culverts and Grade	$ 7,000	$ -	$ -
Borrow Areas			
Material for Remedial Construction	$ 36,000	$ -	$ -
Contaminated Soils			

Table 10.1: Reclamation Scenario Cost

Component	Scenario 1 Full	Scenario 2 Limited	Scenario 3 Preservation
PHC Soil Excavation and Treatment	$ 483,491	$ 399,664	$ -
Metals and Unknown Soil Disposal	$ 205,000	$ 205,000	$ -
Non-Hazardous Materials			
Landfill Process Plant and Truck Shop	$ 1,570,200	$ -	$ -
Landfill Remaining Structures	$ 1,181,472	$ 409,868	$ -
Landfill Construction and Cover	$ 1,238,650	$ 187,665	$ -
Hazardous Materials			
Lead Paint and ASTs	$ 255,732	$ 255,732	$ -
Organic Liquid Wastes	$ 390,225	$ 390,225	$ -
Specialist Labour and Analysis	$ 615,590	$ 615,590	$ -
Other Hazardous Waste	$ 100,000	$ 100,000	$ -
Landfarm			
Landfarm for PHC Contaminated Soil	1,233,700	$ 1,043,550	$ -
SUBTOTAL:	**$ 11,291,819**	**$ 7,064,441**	$ -
Monitoring and Asset Preservation (10 Year Total)			
Water Monitoring	$ 327,418	$ 327,418	$ 327,418
Geotechnical Inspection	$ 27,548	$ 82,644	$ 82,644
Care and Maintenance	$ -	$ 1,777,580	$ 2,638,460
SUBTOTAL:	**$ 354,966**	**$ 2,187,642**	**$ 3,048,522**
Associated Costs			
Mobilization/Demobilization	$ 5,938,894	$ 5,594,310	$ -
Engineering (5% Capital Costs)	$ 564,591	$ 353,222	$ -
Project Management (5% Capital Costs)	$ 564,591	$ 353,222	$ -
HSE, Monitoring, QA/QC (1% Capital Costs)	$ 112,918	$ 70,644	$ -
Bonding and Insurance (1% Capital Costs)	$ 112,918	$ 70,644	$ -
Contingency (20% Capital Costs)	$ 2,258,364	$ 1,412,888	$ -
SUBTOTAL:	**$ 9,552,276**	**$ 7,854,931**	**$ -**
TOTAL:	**$ 21,199,061**	**$ 17,107,014**	**$ 3,048,522**

10.1 Scenario 1: Immediate and Full Remediation

Immediate and full remediation would take the options recommended in Section 5.0. This scenario requires the largest up-front outlay of capital, but removes the need for care and maintenance.

Geotechnical Monitoring

Short-term post-reclamation has been assumed for the first two years. One long-term monitoring evaluation trip has been assumed after five years to check the long-term performance of the structures.

Risk

This scenario reduces the risk of contamination migrating and infrastructure deteriorating to the point that it poses an additional environment concern. However, it also limits or removes the option for future site development

10.2 Scenario 2: Limited Remediation

This option is for the remediation of items presenting an environmental risk while keeping capital costs low. It also keeps much of the mine infrastructure in place for potential future development. Care and maintenance will need to continue.

Geotechnical Monitoring

Geotechnical monitoring has been assumed to be the same as Scenario 3, as the site infrastructure will be largely be in place.

Risk

This scenario attempts to reduce the risk of contamination migrating and creating a larger on-site hazard. It also preserves the Jericho Mine for future development.

10.3 Scenario 3: Preservation of Site Assets

The Jericho Mine shall generally be left in its current state with the intention that it could be reopened or remediated at a later date.

Geotechnical Monitoring

Geotechnical monitoring will need to continue on an annual basis for the first three years, after which it may be possible to reduce the monitoring frequency to once every three years.

Risk

There is a risk that infrastructure could deteriorate and contamination be allowed to migrate, creating a larger and more costly remediation effort. An example is the HWTA, which has a down-gradient, damaged liner.

Scenario 3 largely preserves the Jericho Mine's assets for potential future development.

11.0 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech EBA Inc.

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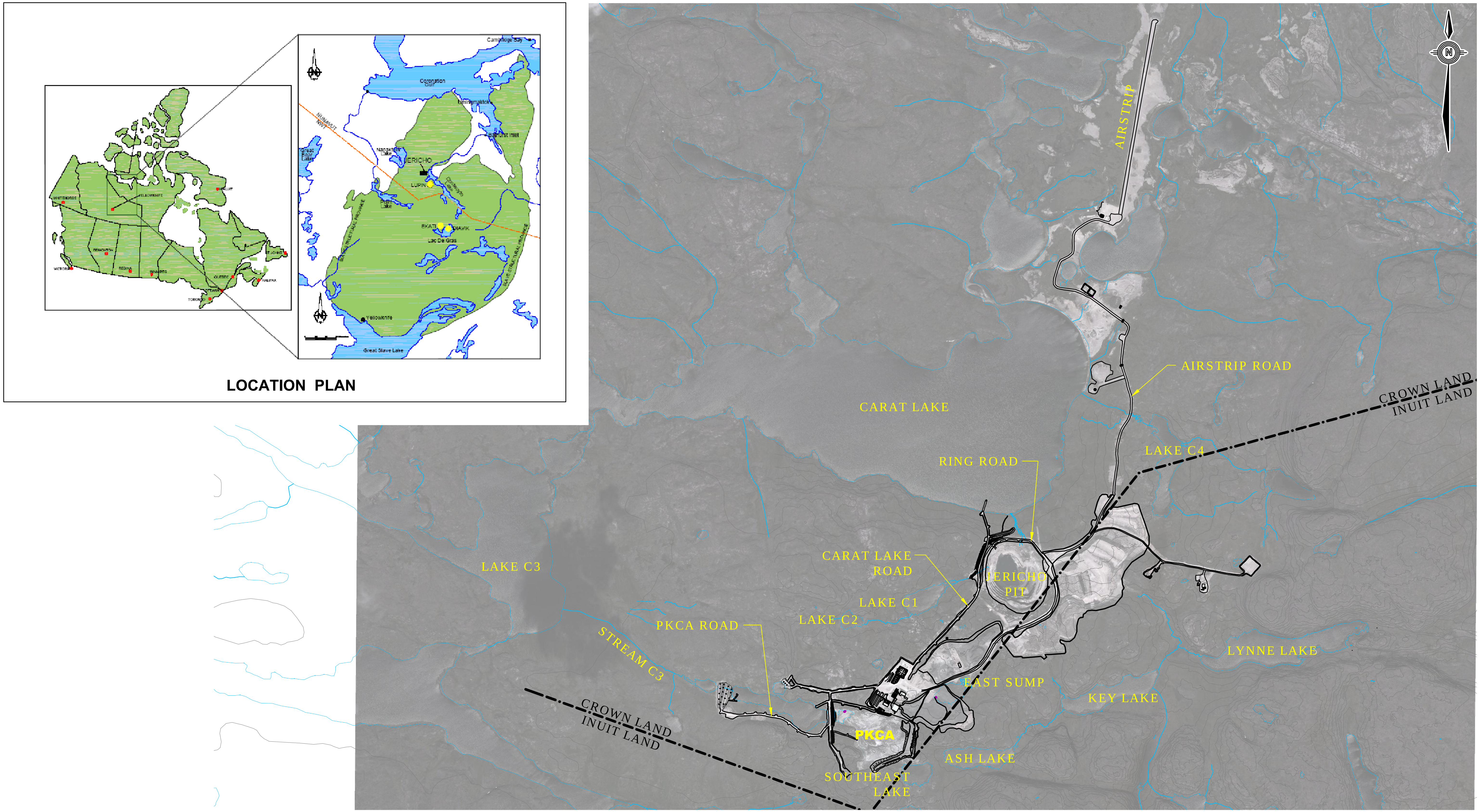
FIGURES



NOTE:
BASE AIRPHOTOS PROVIDED BY OLLERHEAD & ASSOCIATES LTD., AUGUST 2014

0 1,000m
Scale: 1:25,000 @ 11"x17"

STATUS
ISSUED FOR USE

CLIENT
Aboriginal Affairs and Northern Development Canada

TETRA TECH EBA

Closure Assessment
Jericho Diamond Mine, Nunavut

OVERALL SITE PLAN

PROJECT NO.	DWN	CKD	REV	
E14103202	GDK/DBD	WTH	0	**Figure 1**
OFFICE	DATE			
EDM	December 2014			

LEGEND:

- JERICHO SURFACE SAMPLE LOCATION

0 200m

Scale: 1:4,000 @ 11"x17"

NOTE:
BASE AIRPHOTOS PROVIDED BY OLLERHEAD & ASSOCIATES LTD., AUGUST 2014

STATUS
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TETRA TECH EBA

Closure Assessment
Jericho Diamond Mine, Nunavut

PROCESSED KIMBERLITE CONTAINMENT AREA

PROJECT NO.	DWN	CKD	REV
E14103202	GDK/DBD	WTH	0

OFFICE	DATE
EDM	December 2014

Figure 2

Q:\Edmonton\Engineering\E141\Projects\E14103202 - Jericho Reclamation\5.0 Drawings\ESA\2.0 Producton Drawings\Site Plans.dwg [FIGURE 2] December 15, 2014 - 2:58:57 pm (BY: STIRLING, JENNIFER)

LEGEND:

- JERICHO SURFACE SAMPLE LOCATION

0 100m

Scale: 1:2,500 @ 11"x17"

NOTE:
BASE AIRPHOTOS PROVIDED BY OLLERHEAD & ASSOCIATES LTD., AUGUST 2014

STATUS
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TETRA TECH EBA

Closure Assessment
Jericho Diamond Mine, Nunavut

MAIN SITE AND COARSE PK PILE

PROJECT NO.	DWN	CKD	REV
E14103202	GDK/DBD	WTH	0

OFFICE	DATE
EDM	December 2014

Figure 3

Q:\Edmonton\Engineering\E141\Projects\E14103202 - Jericho Reclamation\5.0 Drawings\ESA\2.0 Producton Drawings\Site Plans.dwg [FIGURE 3] December 15, 2014 - 3:00:06 pm (BY: STIRLING, JENNIFER)

NOTE:
BASE AIRPHOTOS PROVIDED BY OLLERHEAD & ASSOCIATES LTD., AUGUST 2014

0 50m
Scale: 1:1,000 @ 11"x17"

STATUS
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TETRA TECH EBA

Closure Assessment
Jericho Diamond Mine, Nunavut

MAIN SITE TANK FARM AND LAYDOWN AREA

PROJECT NO.	DWN	CKD	REV
E14103202	GDK/DBD	WTH	0

OFFICE	DATE
EDM	December 2014

Figure 3.1

Q:\Edmonton\Engineering\E141\Projects\E14103202 - Jericho Reclamation\5.0 Drawings\ESA\2.0 Producton Drawings\Site Plans.dwg [FIGURE 3.1] December 15, 2014 - 3:01:04 pm (BY: STIRLING, JENNIFER)

0 50m

Scale: 1:1,000 @ 11"x17"

NOTE:
BASE AIRPHOTOS PROVIDED BY OLLERHEAD & ASSOCIATES LTD., AUGUST 2014

STATUS
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TETRA TECH EBA

Closure Assessment
Jericho Diamond Mine, Nunavut

MAIN SITE INFRASTRUCTURE

PROJECT NO.	DWN	CKD	REV
E14103202	GDK/DBD	WTH	0
OFFICE	DATE		
EDM	December 2014		

Figure 3.2

Q:\Edmonton\Engineering\E141\Projects\E14103202 - Jericho Reclamation\5.0 Drawings\ESA\2.0 Producton Drawings\Site Plans.dwg [FIGURE 3.2] December 15, 2014 - 3:01:52 pm (BY: STIRLING, JENNIFER)

LEGEND:

- JERICHO SURFACE SAMPLE LOCATION

0 100m

Scale: 1:2,500 @ 11"x17"

NOTE:
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Closure Assessment
Jericho Diamond Mine, Nunavut

LOW GRADE STOCKPILE

PROJECT NO.	DWN	CKD	REV
E14103202	GDK.DBD	WTH	0

OFFICE	DATE
EDM	December 2014

Figure 4

Q:\Edmonton\Engineering\E141\Projects\E14103202 - Jericho Reclamation\5.0 Drawings\ESA\2.0 Production Drawings\Site Plans.dwg [FIGURE 4] December 15, 2014 - 3:03:22 pm (BY: STIRLING, JENNIFER)

LEGEND:

☒ - JERICHO SURFACE SAMPLE LOCATION

0 250m

Scale: 1:5,000 @ 11"x17"

NOTE:
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STATUS
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Closure Assessment
Jericho Diamond Mine, Nunavut

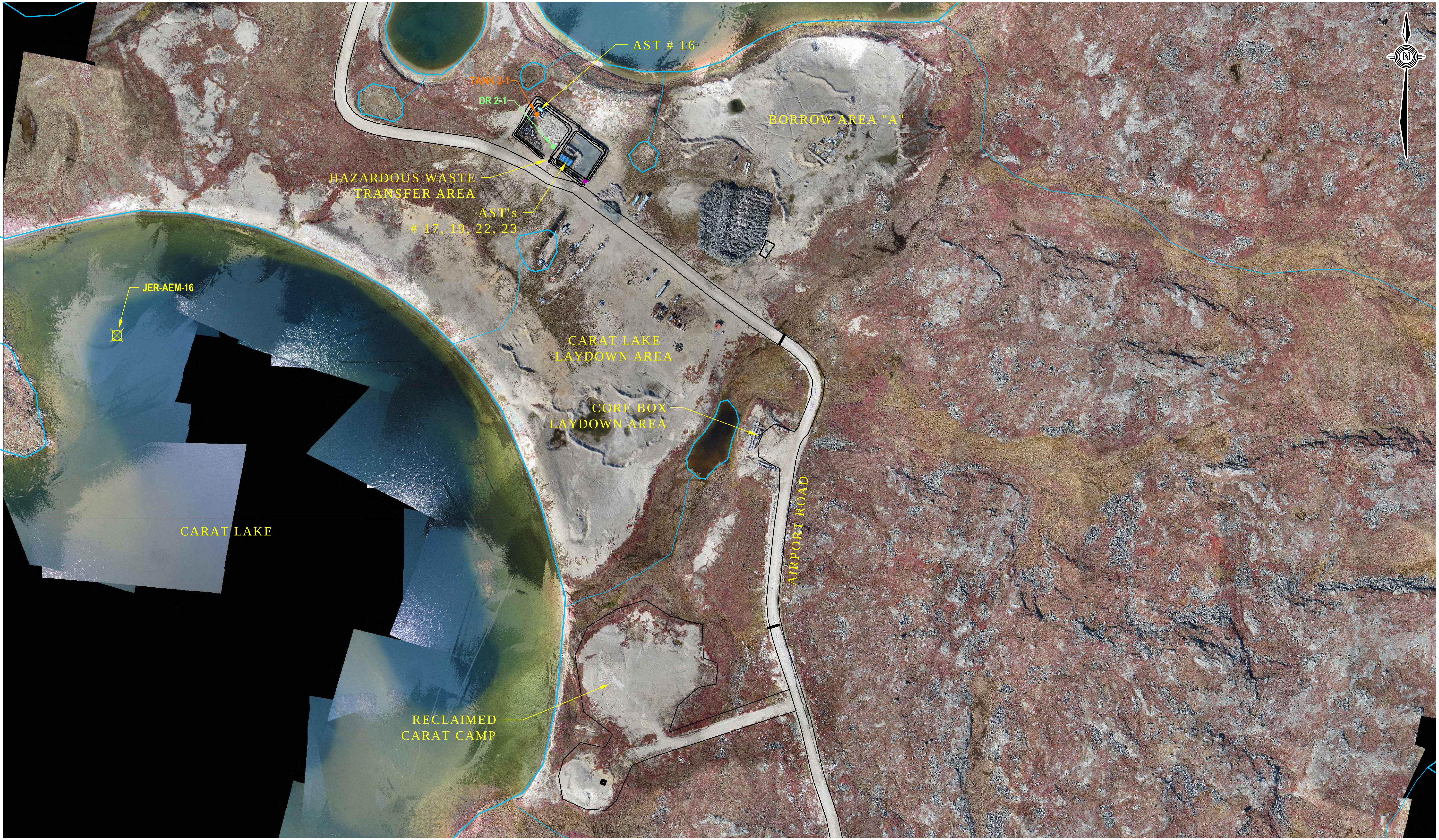
PIT AND WASTE ROCK PILES

PROJECT NO.	DWN	CKD	REV
E14103202	GDK/DBD	WTH	0

OFFICE	DATE
EDM	December 2014

Figure 5

Q:\Edmonton\Engineering\E141\Projects\E14103202 - Jericho Reclamation\5.0 Drawings\ESA\2.0 Production Drawings\Site Plans.dwg [FIGURE 5] December 15, 2014 - 3:04:05 pm (BY: STIRLING, JENNIFER)



LEGEND:

- JERICHO SURFACE SAMPLE LOCATION
- AST CONTENT SAMPLE LOCATION
- DRUM CONTENT SAMPLE LOCATION

0 — 200m

Scale: 1:4,000 @ 11"x17"

NOTE:
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Closure Assessment
Jericho Diamond Mine, Nunavut

CARAT LAKE INFRASTRUCTURE

PROJECT NO.	DWN	CKD	REV
E14103202	GDK/DBD	WTH	0

OFFICE	DATE
EDM	December 2014

Figure 6

Q:\Edmonton\Engineering\E141\Projects\E14103202 - Jericho Reclamation\5.0 Drawings\ESA\2.0 Producton Drawings\Site Plans.dwg [FIGURE 6] December 15, 2014 - 3:04:46 pm (BY: STIRLING, JENNIFER)

NOTE:
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0 250m
Scale: 1:5,000 @ 11"x17"

STATUS
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TETRA TECH EBA

Closure Assessment
Jericho Diamond Mine, Nunavut

AIRSTRIP AREA

PROJECT NO.	DWN	CKD	REV
E14103202	DBD	WTH	0
OFFICE	DATE		
EDM	December, 2014		

Figure 7

LEGEND:

- TOTAL LEAD PAINT SAMPLE

0 50m

Scale: 1:1,000 @ 11"x17"

NOTE:
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STATUS
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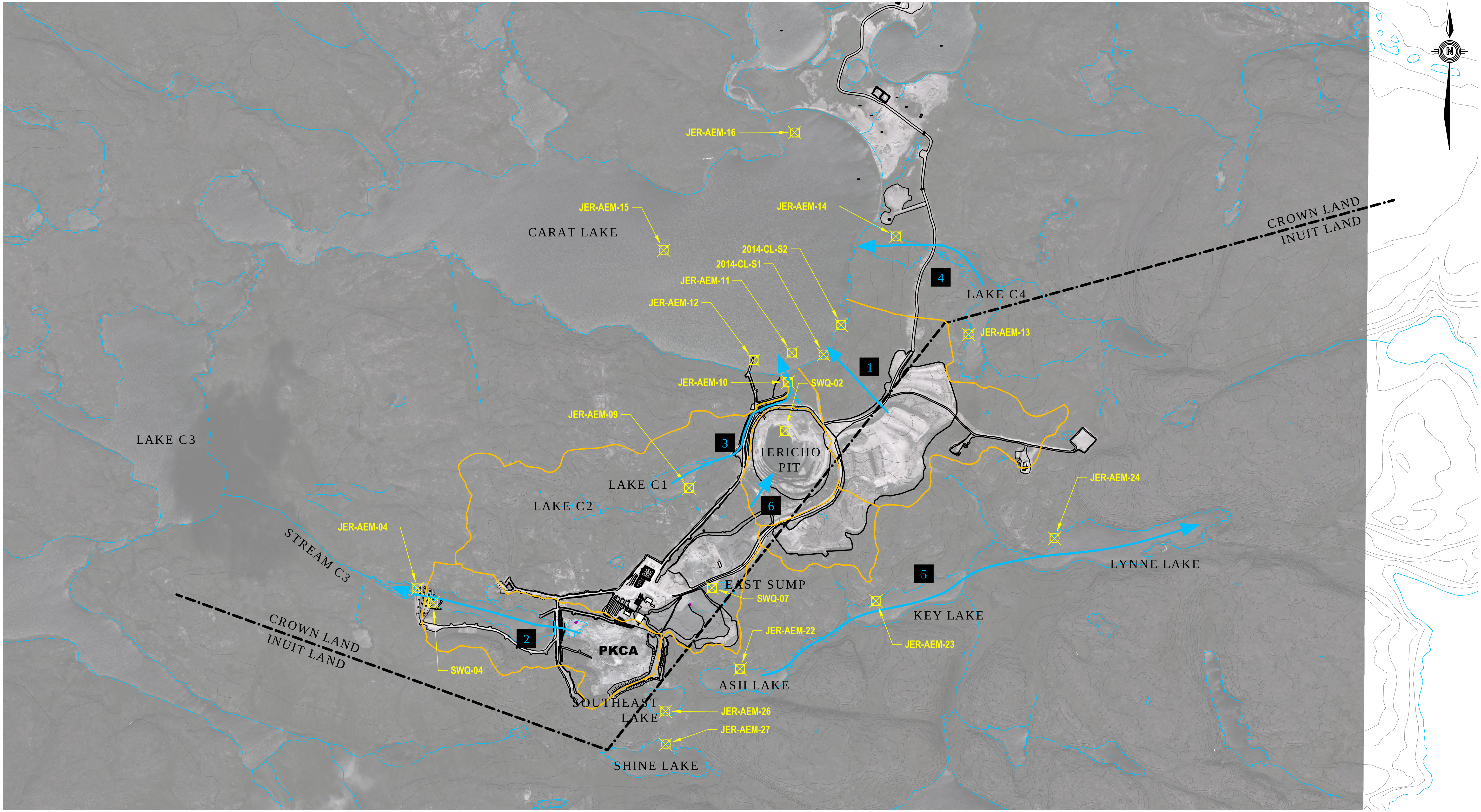
TETRA TECH EBA

Closure Assessment
Jericho Diamond Mine, Nunavut

TERMINAL BUILDING AREA

PROJECT NO.	DWN	CKD	REV
E14103202	GDK/DBD	WTH	0
OFFICE	DATE		
EDM	December 2014		

Figure 7.1



LEGEND:

- JERICHO SURFACE SAMPLE LOCATION
- CATCHMENT AREA

0 1,000m

Scale: 1:20,000 @ 11"x17"

DRAINAGE PATHWAYS:

1. WASTE ROCK SEEPAGE TO CARAT LAKE
2. PKCA DISCHARGE
3. LAKE C1 CATCHMENT
4. LAKE C4 CATCHMENT
5. LYNNE LAKE GROUP
6. PIT CATCHMENT

NOTE:
BASE AIRPHOTOS PROVIDED BY OLLERHEAD & ASSOCIATES LTD., AUGUST 2014

STATUS
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TETRA TECH EBA

Closure Assessment
Jericho Diamond Mine, Nunavut

WATER SAMPLING AND DRAINAGE PATHWAYS

PROJECT NO.	DWN	CKD	REV	
E14103202	GDK/DBD	WTH	0	Figure 8
OFFICE	DATE			
EDM	October 2014			

LEGEND

0 150m

Scale: 1:3,000 @ 11"x17"

NOTES
1. BASE AIRPHOTOS PROVIDED BY OLLERHEAD & ASSOCIATES LTD., AUGUST 2014
2. PIT CONTOURS FROM 2008 TOPOGRAPHIC SURVEY

ISSUED FOR USE

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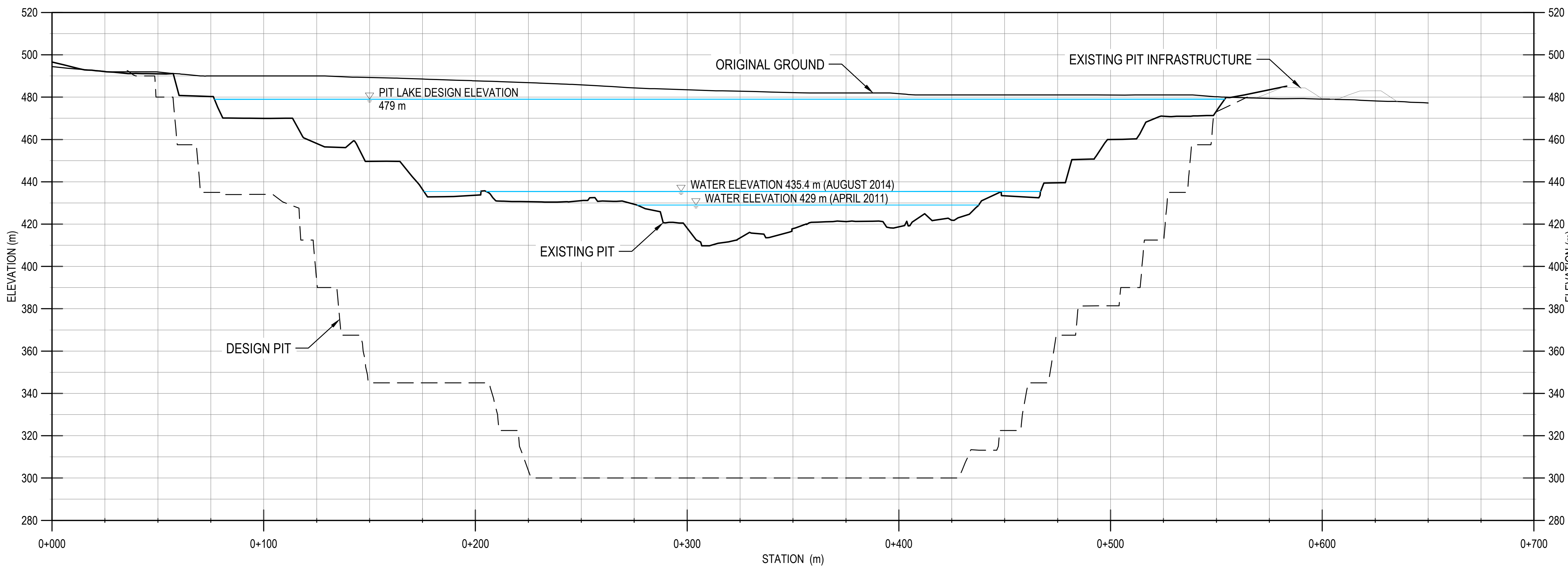
TETRA TECH EBA

Closure Assessment
Jericho Diamond Mine, Nunavut

OPEN PIT CLOSURE OPTIONS

PROJECT NO.	DWN	CKD	REV
E14103202	GDK	WTH	0
OFFICE	DATE		
EDM	November 2014		

Figure 9



SECTION A 9

Q:\Edmonton\Engineering\E141\Projects\E14103202 - Jericho Reclamation\5.0 Drawings\ESA\2.0 Producton Drawings\Options Asessment\OA Figures 9 - 13 pit closure.dwg [FIGURE 10] March 30, 2015 - 12:10:28 pm (BY: STIRLING, JENNIFER)

LEGEND

0 100m

Scale: 1:2,000 @ 11"x17"

NOTES
EXISTING PIT SURVEY FROM 2008 TOPOGRAPHIC SURVEY

ISSUED FOR USE

CLIENT

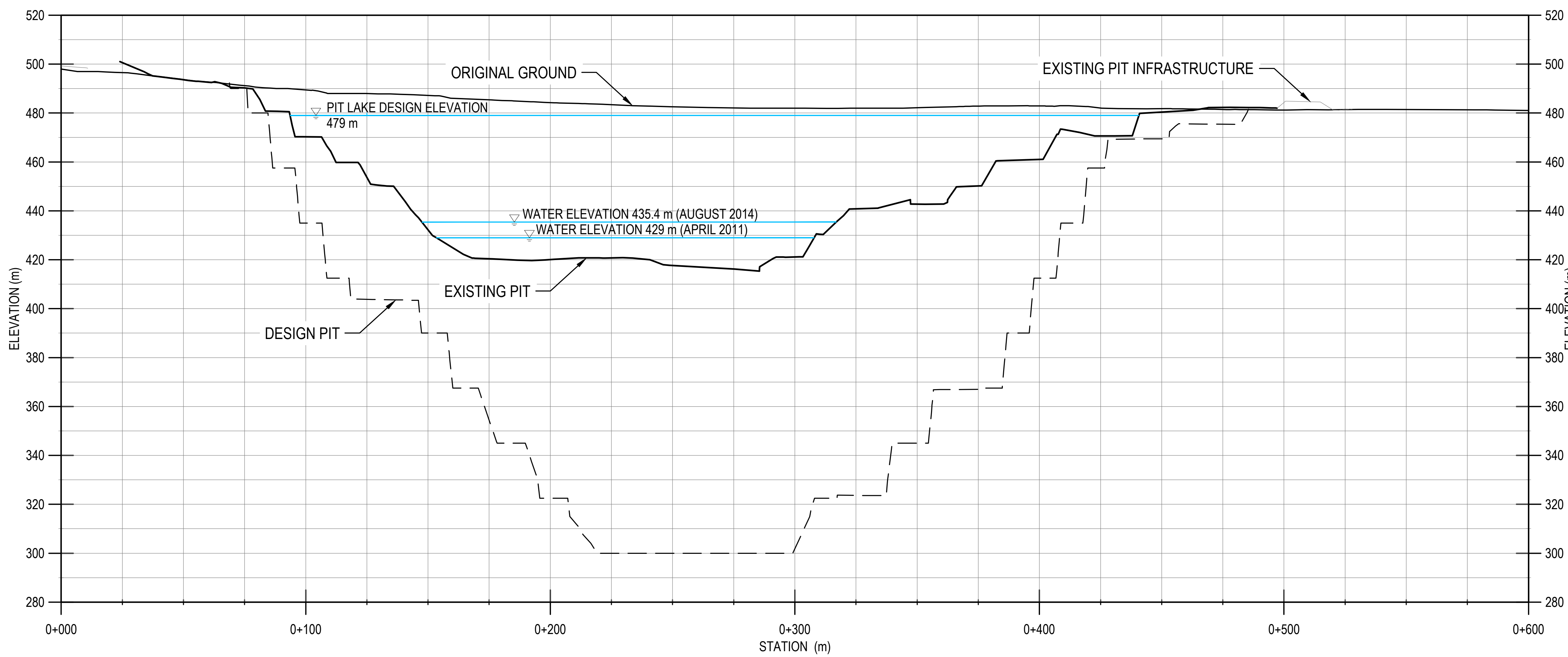
Aboriginal Affairs and Northern Development Canada

TETRA TECH EBA

Closure Assessment
Jericho Diamond Mine, Nunavut

JERICHO PIT SECTION A-A

PROJECT NO.	DWN	CKD	REV	
E14103202	EP	GDK	0	Figure 10
OFFICE	DATE			
EDM	December, 2014			



SECTION B / 9

LEGEND

0 100m

Scale: 1:2,000 @ 11"x17"

NOTES
EXISTING PIT SURVEY FROM 2008 TOPOGRAPHIC SURVEY

ISSUED FOR USE

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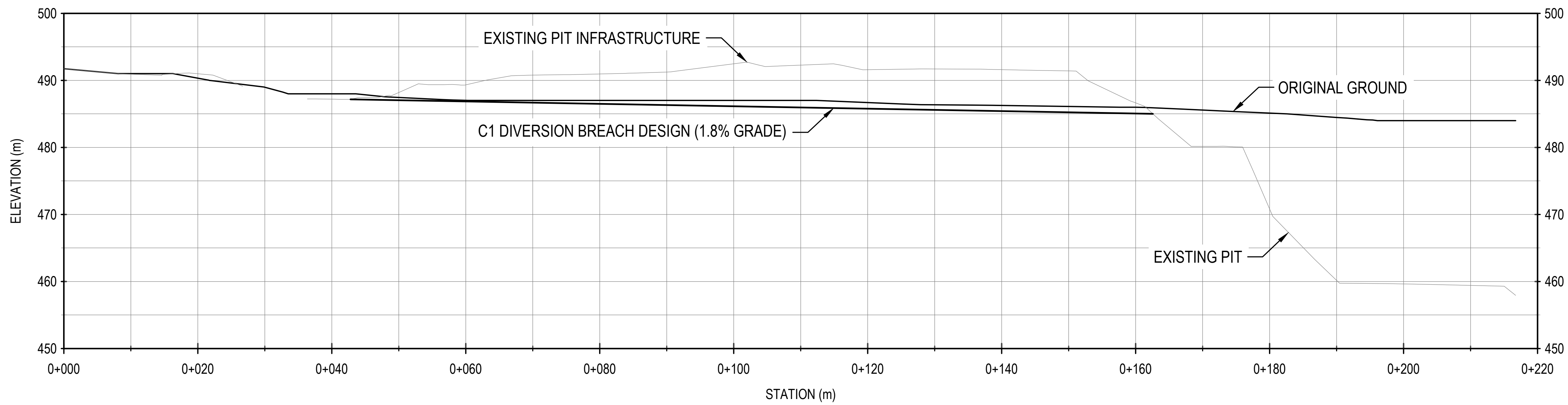
TETRA TECH EBA

Closure Assessment
Jericho Diamond Mine, Nunavut

JERICHO PIT SECTION B-B

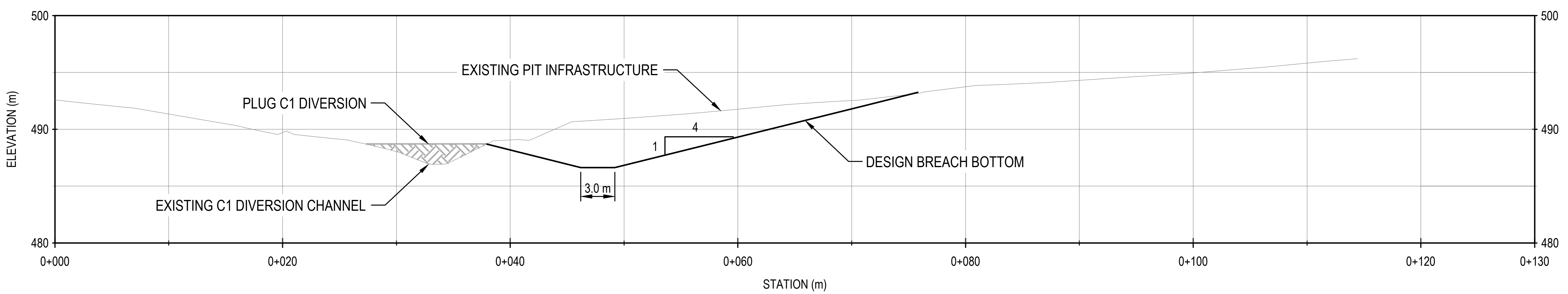
PROJECT NO.	DWN	CKD	REV
E14103202	EP	GDK	0
OFFICE	DATE		
EDM	December, 2014		

Figure 11



SECTION C / 9
C1 DIVERSION BREACH

0 25m
Scale: 1:750 @ 11"x17"



SECTION D / 9
C1 DIVERSION BREACH

0 20m
Scale: 1:400 @ 11"x17"

LEGEND

NOTES
EXISTING PIT SURVEY FROM 2008 TOPOGRAPHIC SURVEY

ISSUED FOR USE

CLIENT
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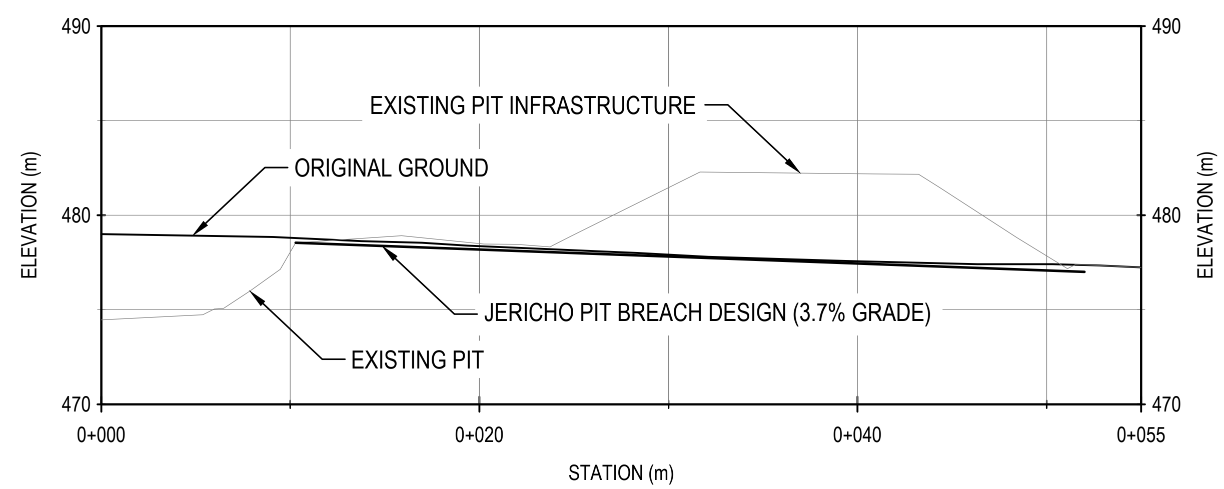
TETRA TECH EBA

Closure Assessment
Jericho Diamond Mine, Nunavut

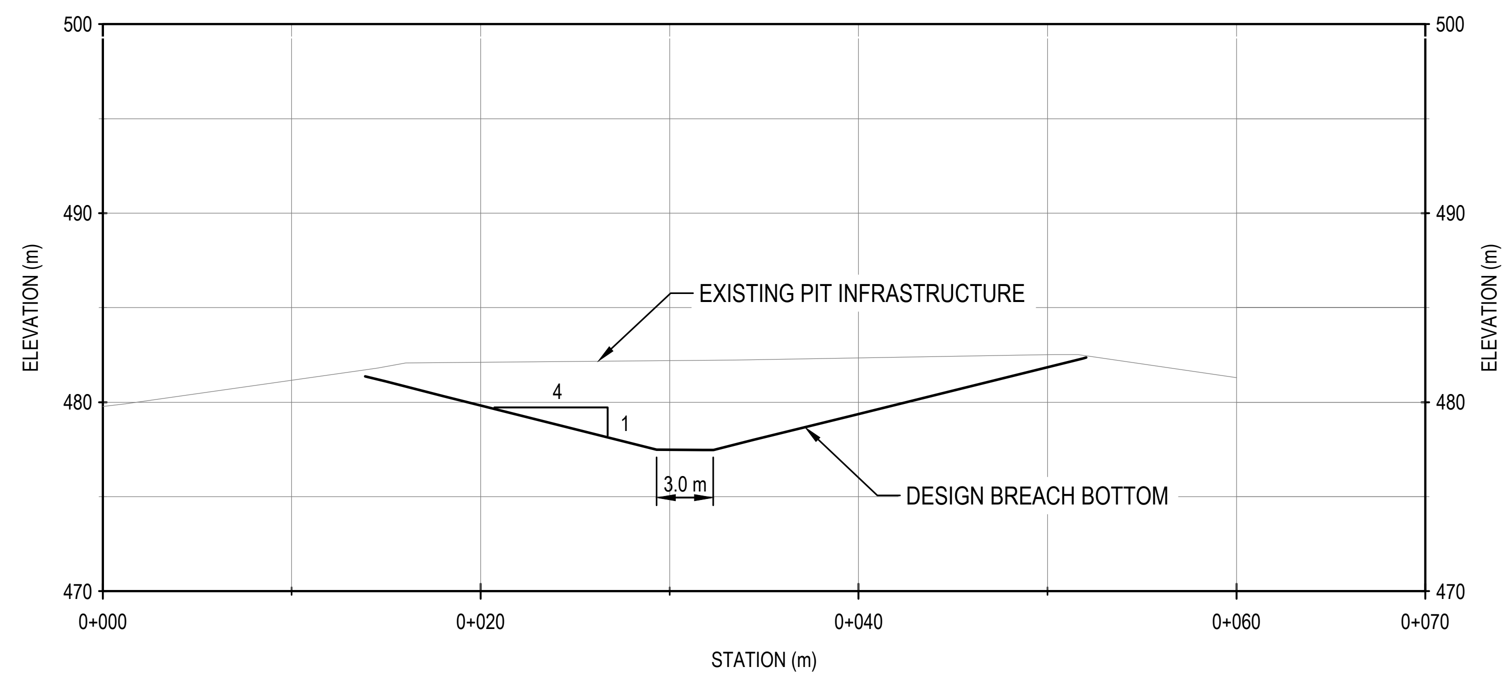
C1 DIVERSION BREACH SECTION AND PROFILE

PROJECT NO.	DWN	CKD	REV
E14103202	EP	GDK	0
OFFICE	DATE		
EDM	December, 2014		

Figure 12



SECTION E
JERICHO PIT BREACH 9



SECTION F
JERICHO PIT BREACH 9

LEGEND

0 20m

Scale: 1:400 @ 11"x17"

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TETRA TECH EBA

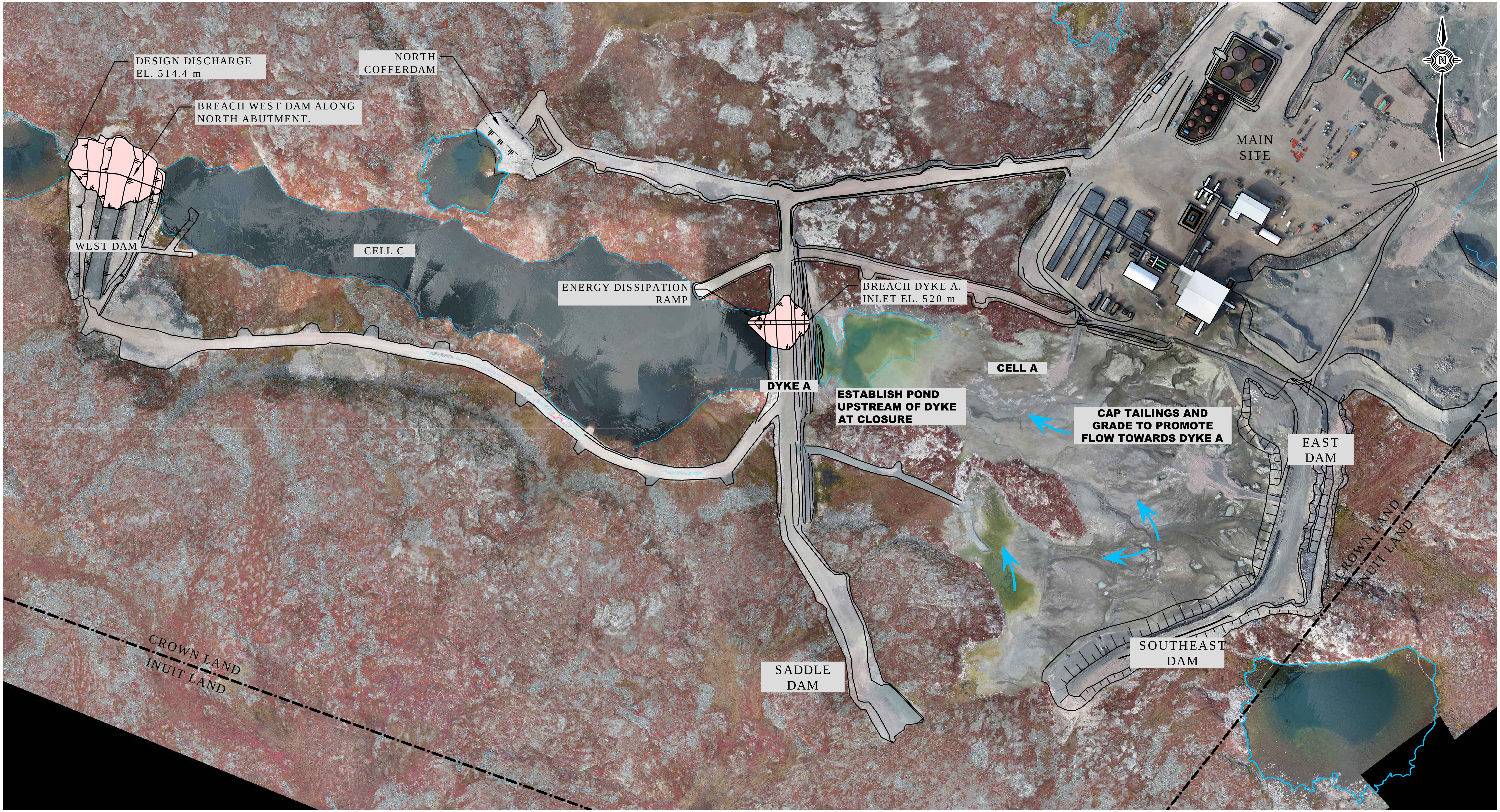
Closure Assessment
Jericho Diamond Mine, Nunavut

JERICHO PIT BREACH
PROFILE AND SECTION

PROJECT NO.	DWN	CKD	REV
E14103202	EP	GDK	0

OFFICE	DATE
EDM	December, 2014

Figure 13



LEGEND

GRADING DIRECTION

0 200m

Scale: 1:4,000 @ 11"x17"

NOTES
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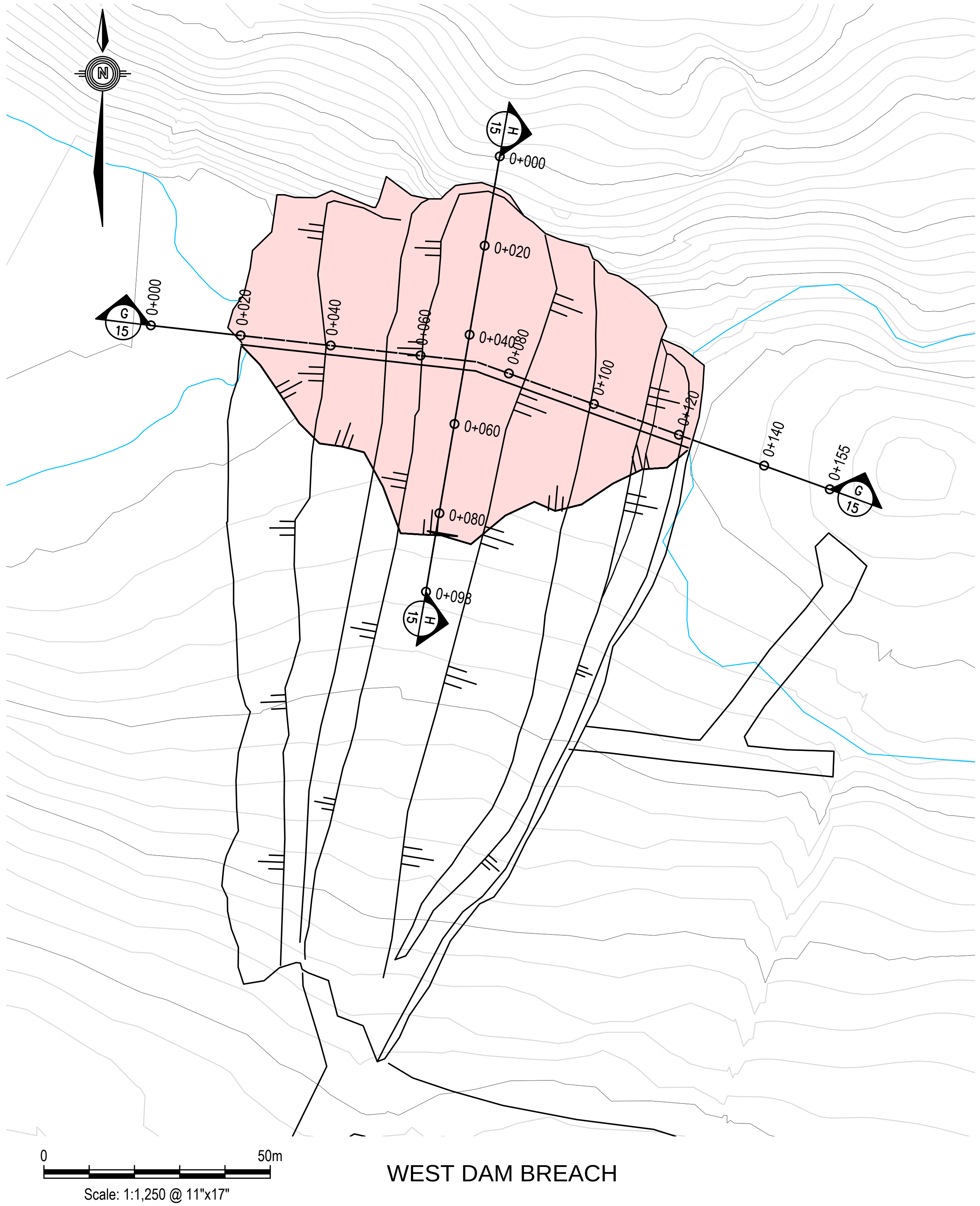
TETRA TECH EBA

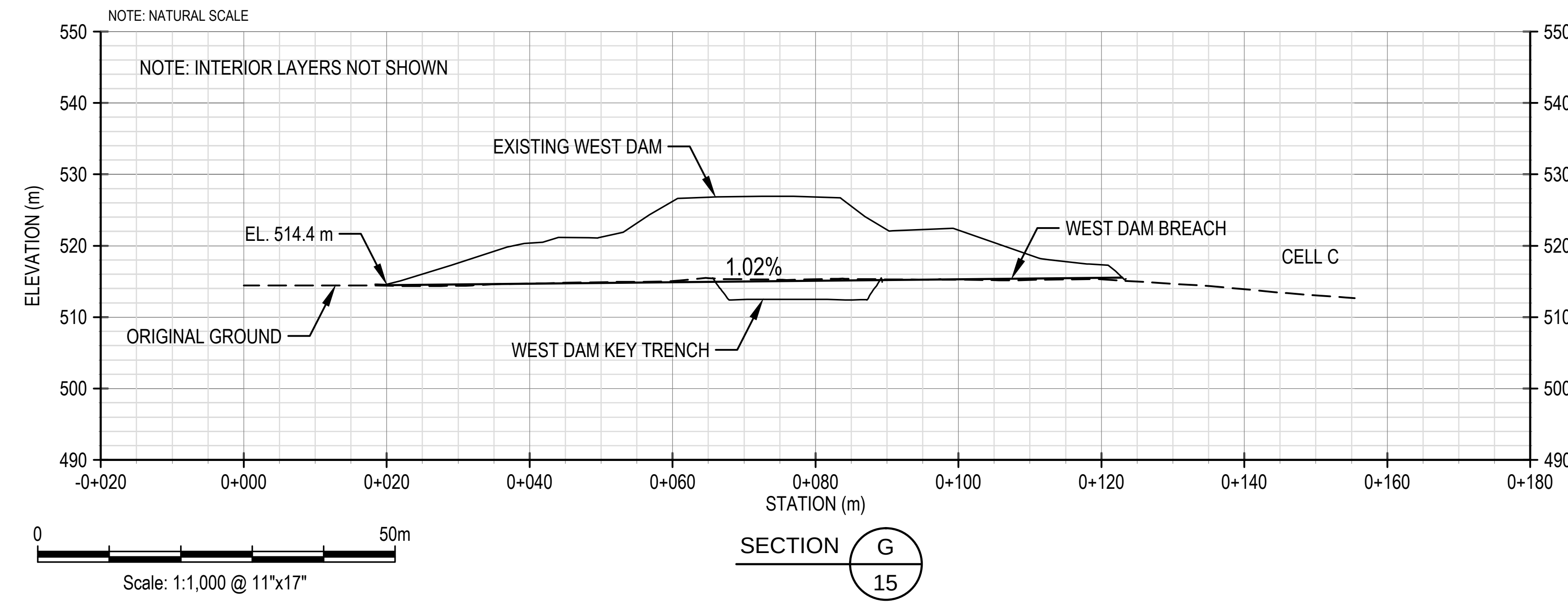
Closure Assessment
Jericho Diamond Mine, Nunavut

PKCA CLOSURE OPTIONS

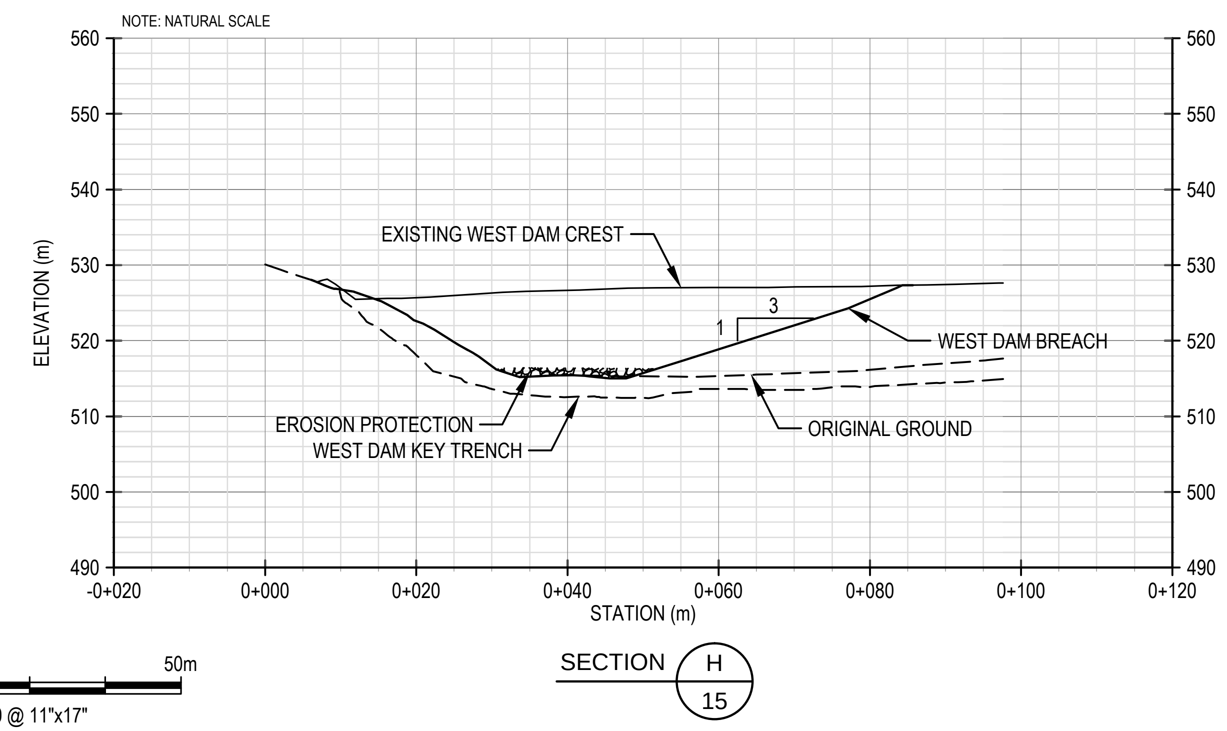
PROJECT NO.	DWN	CKD	REV	
E14103202	GDK/EP	GDK	0	Figure 14
OFFICE	DATE			
EDM	December, 2014			



WEST DAM BREACH



SECTION G / 15



SECTION H / 15

LEGEND

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CLIENT

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TETRA TECH EBA

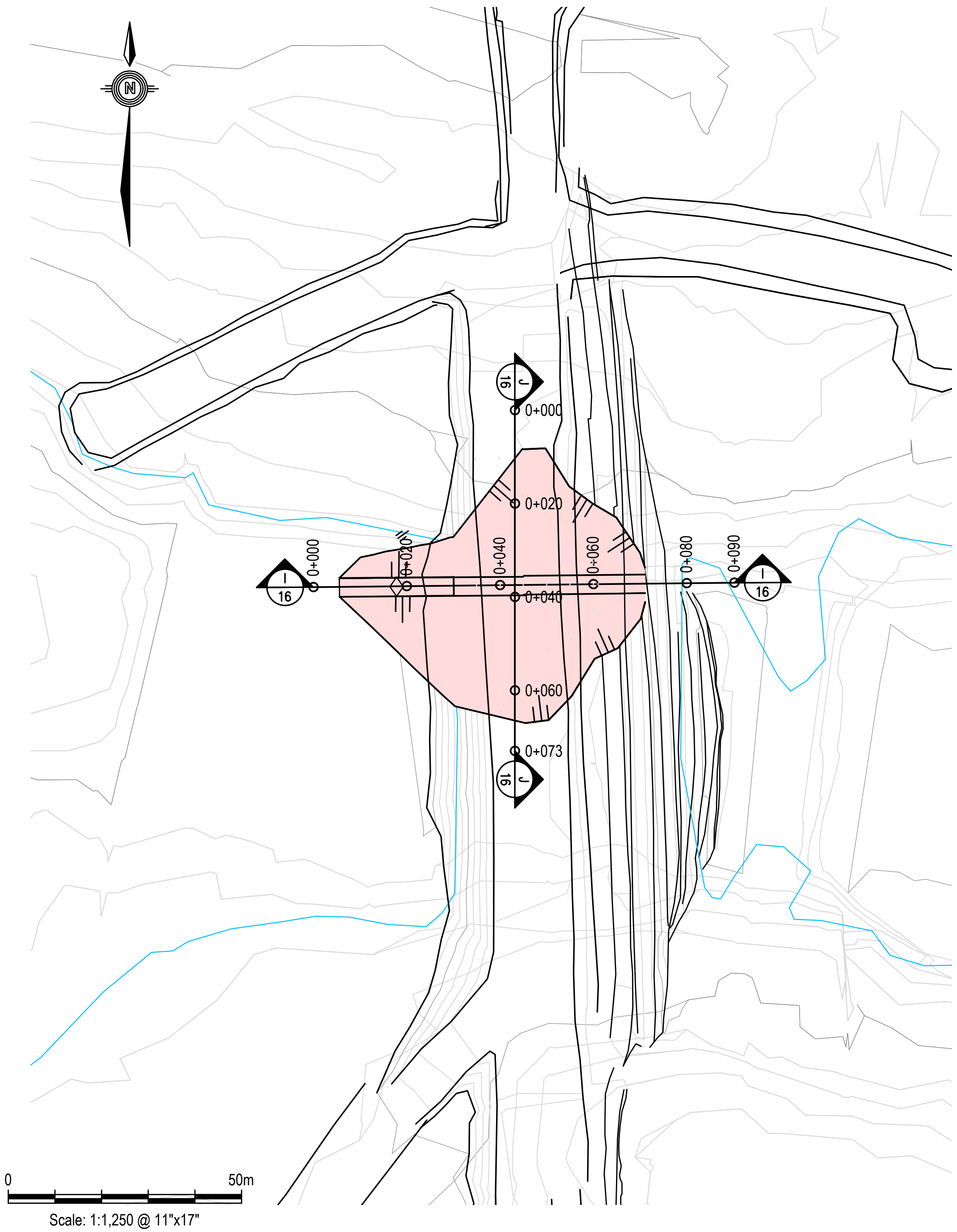
Closure Assessment
Jericho Diamond Mine, Nunavut

WEST DAM BREACH

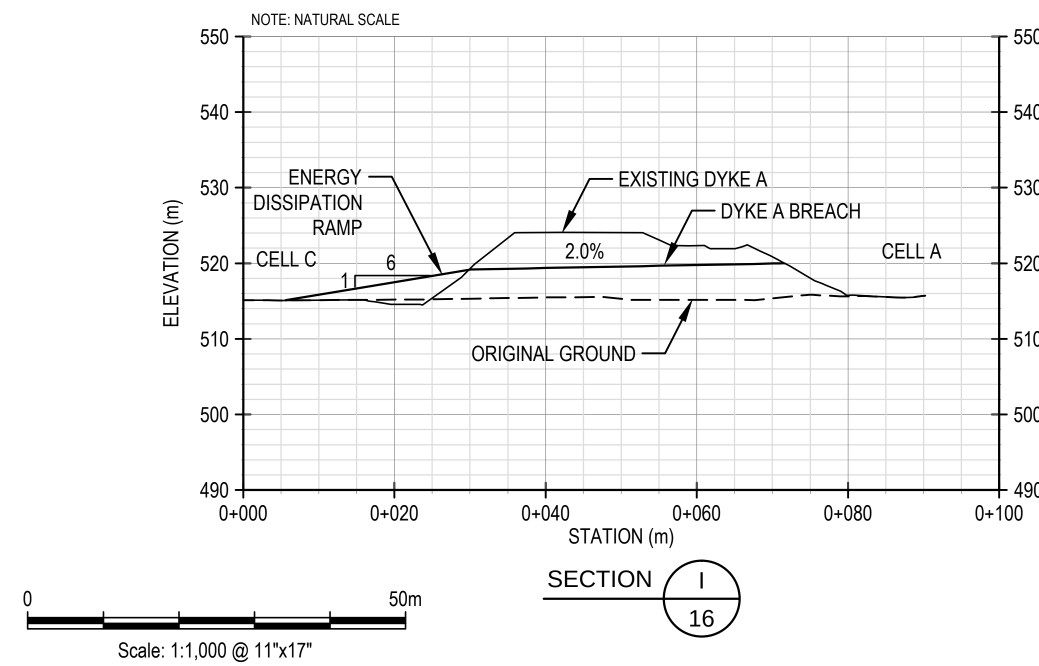
PROJECT NO.	DWN	CKD	REV
E14103202	GDK/EP	GDK	0
OFFICE	DATE		
EDM	December, 2014		

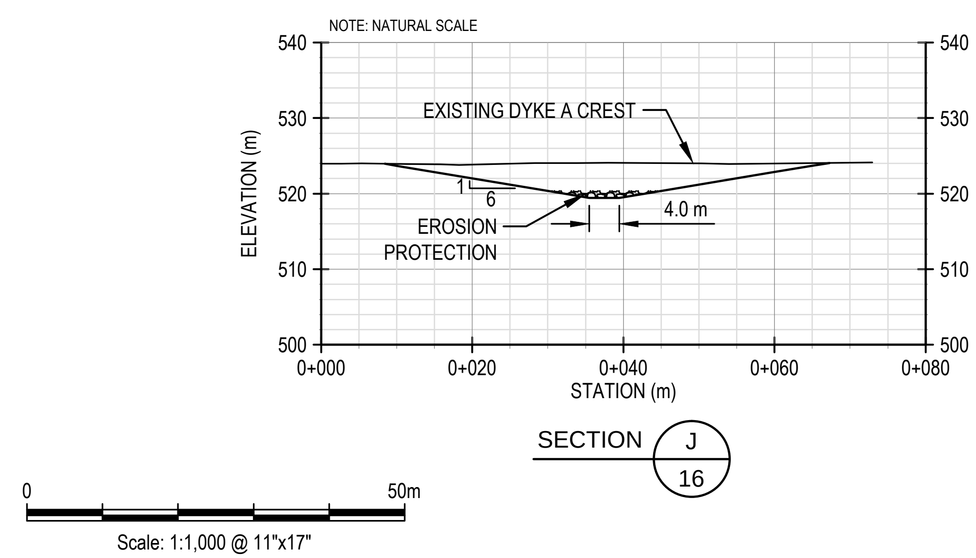
Figure 15

Q:\Edmonton\Engineering\E141\Projects\E14103202 - Jericho Reclamation\5.0 Drawings\ESA\2.0 Producton Drawings\Options Asessment\OA Figures 14 - 17 PKCA.dwg [FIGURE 15] March 30, 2015 - 12:29:29 pm (BY: STIRLING, JENNIFER)



DYKE A BREACH





LEGEND

ISSUED FOR USE

CLIENT

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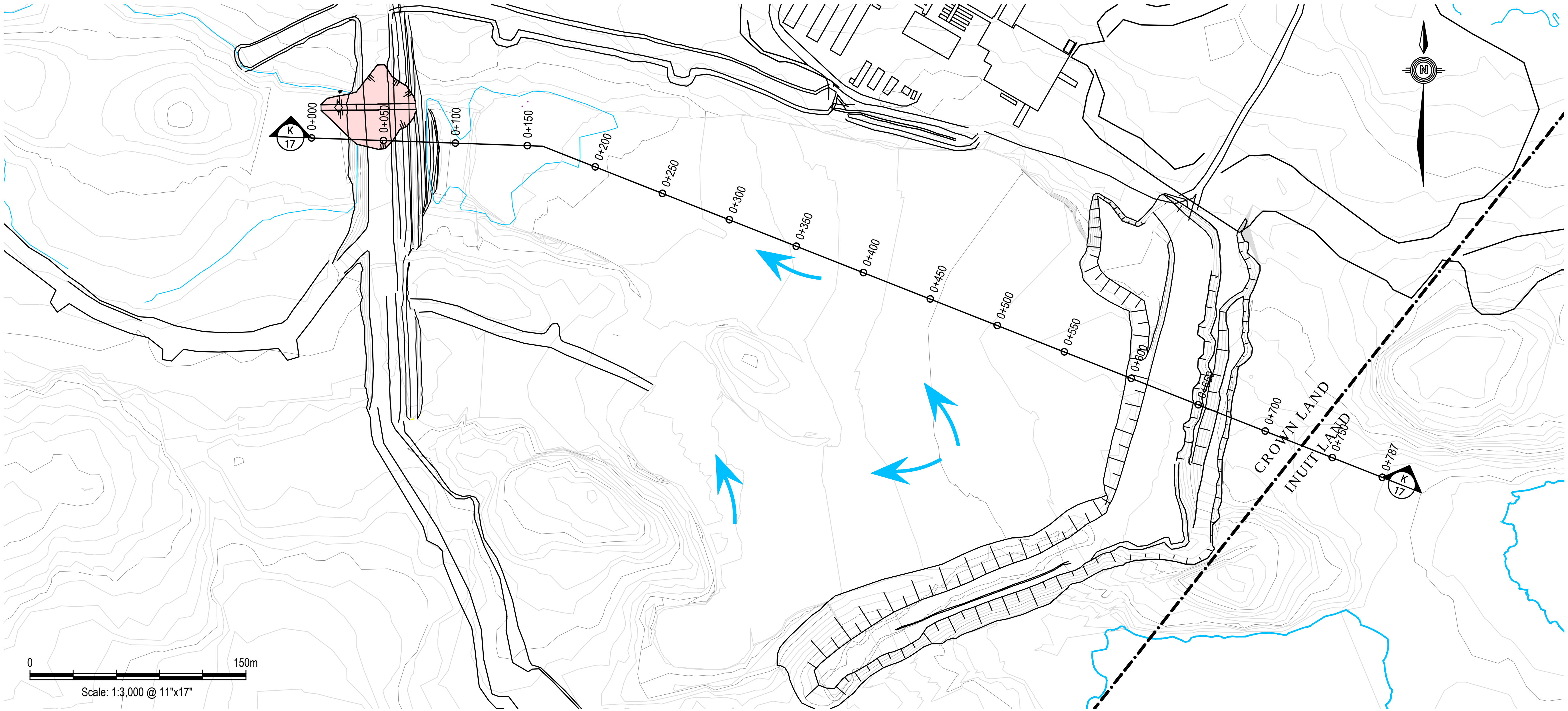
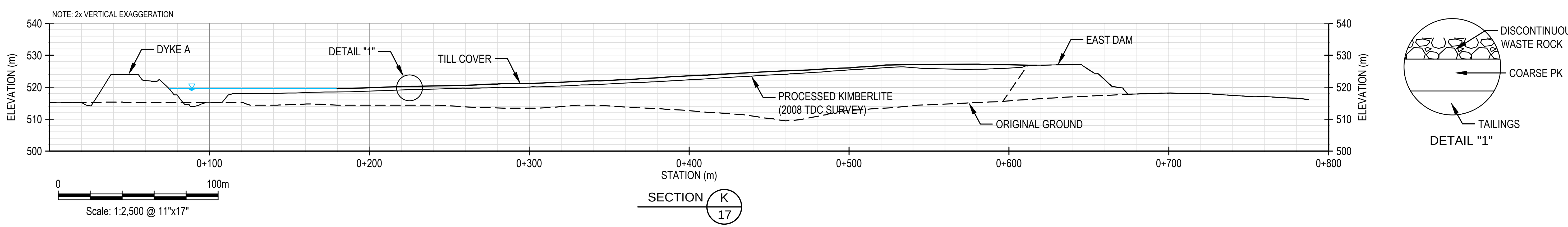
TETRA TECH EBA

Closure Assessment
Jericho Diamond Mine, Nunavut

DYKE A BREACH

PROJECT NO.	DWN	CKD	REV	
E14103202	GDK/EP	GDK	0	Figure 16
OFFICE	DATE			
EDM	December, 2014			





LEGEND

WATER FLOW DIRECTION

ISSUED FOR USE

CLIENT

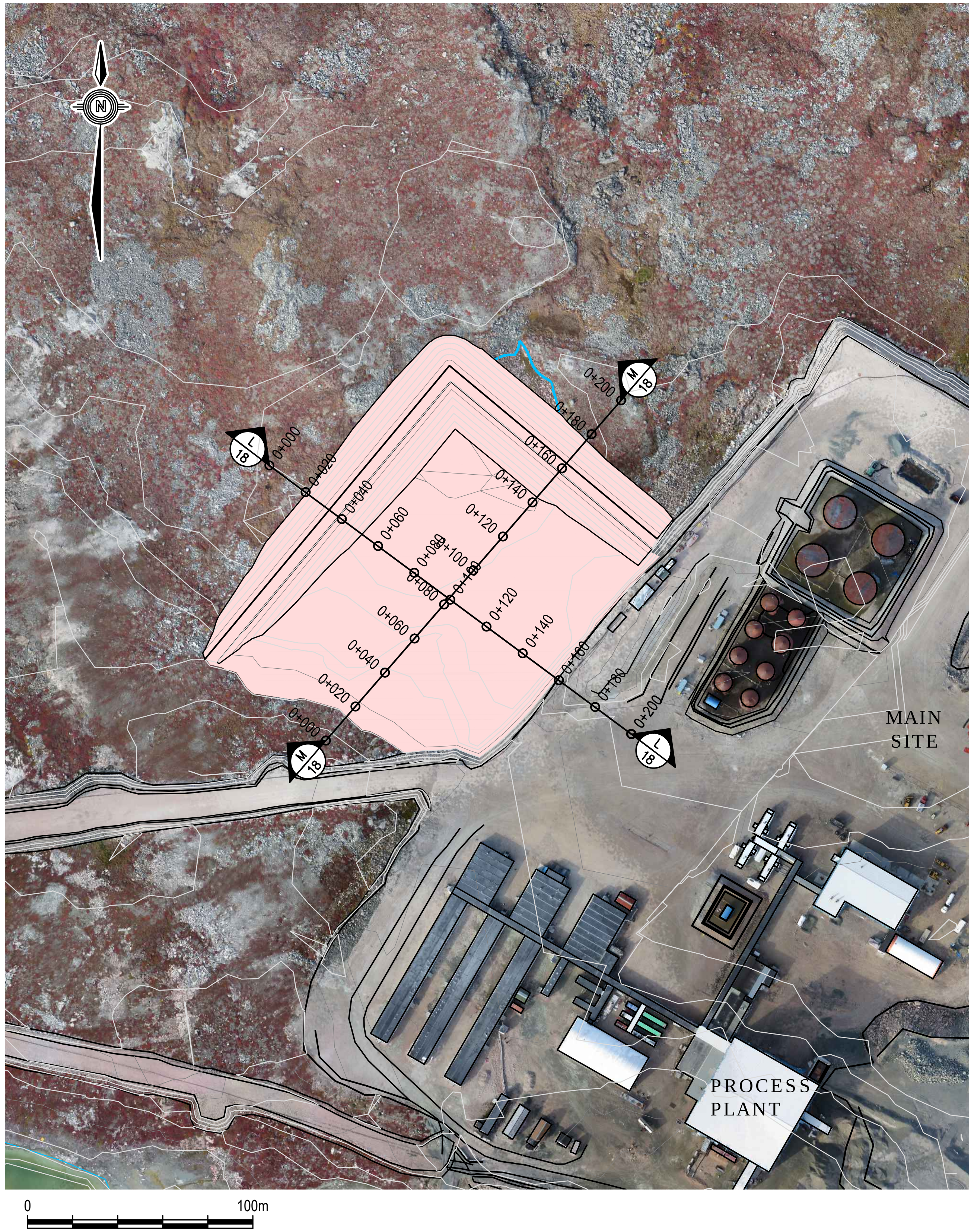
Aboriginal Affairs and Northern Development Canada

TETRA TECH EBA

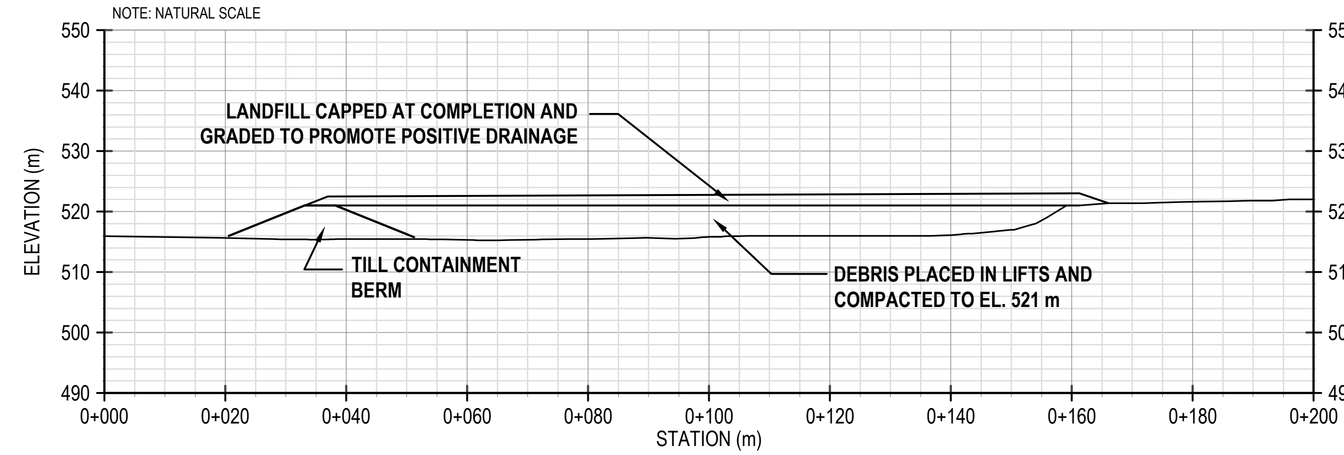
Closure Assessment
Jericho Diamond Mine, Nunavut

PKCA COVER

PROJECT NO.	DWN	CKD	REV	
E14103202	GDK/EP	GDK	0	Figure 17
OFFICE	DATE			
EDM	December, 2014			



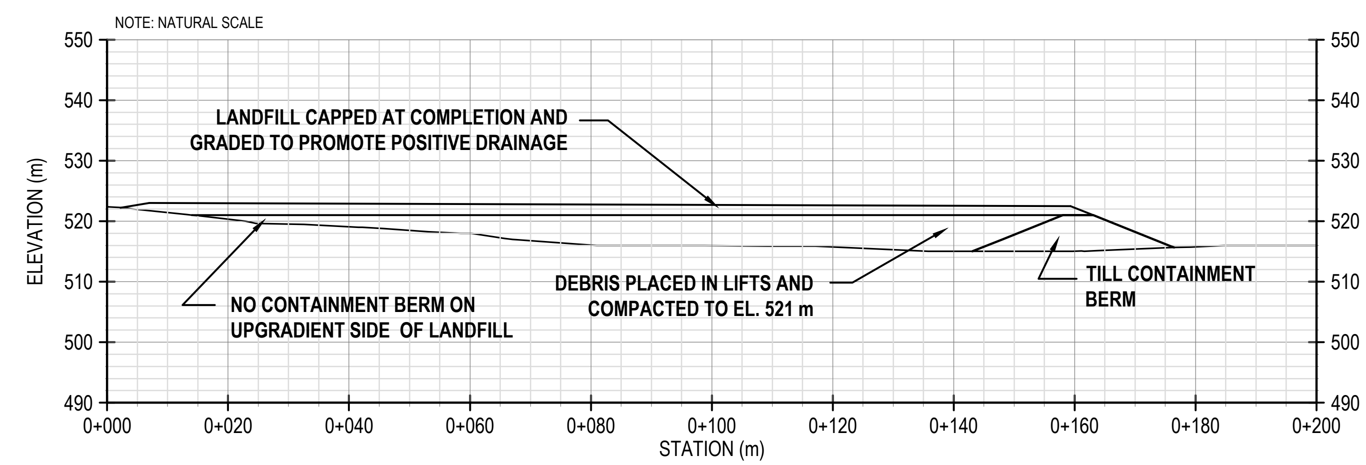
Scale: 1:2,500 @ 11"x17"



SECTION L/18

0 50m

Scale: 1:1,250 @ 11"x17"



SECTION M/18

0 50m

Scale: 1:1,250 @ 11"x17"

LEGEND

NOTES
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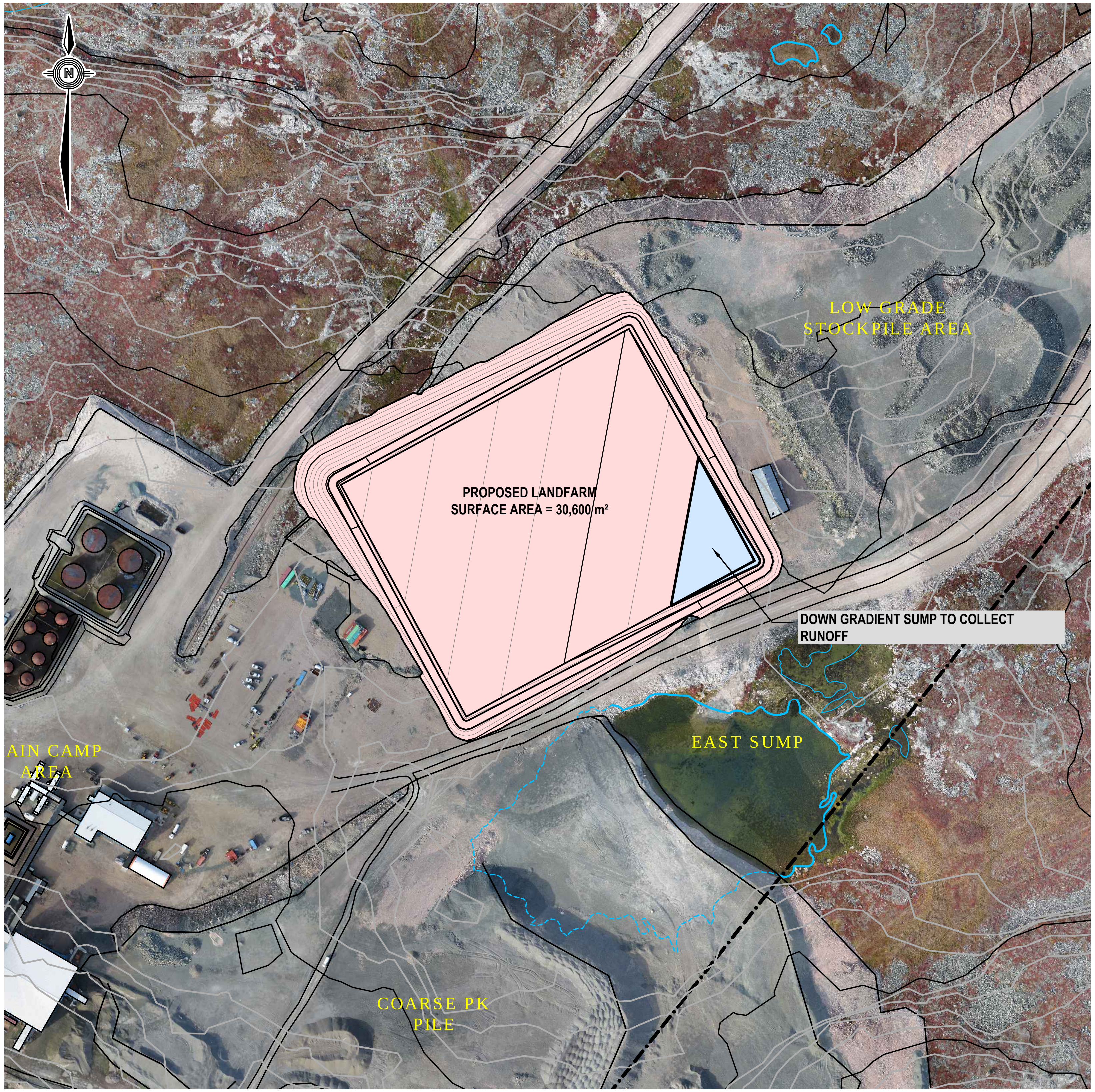
Closure Assessment
Jericho Diamond Mine, Nunavut

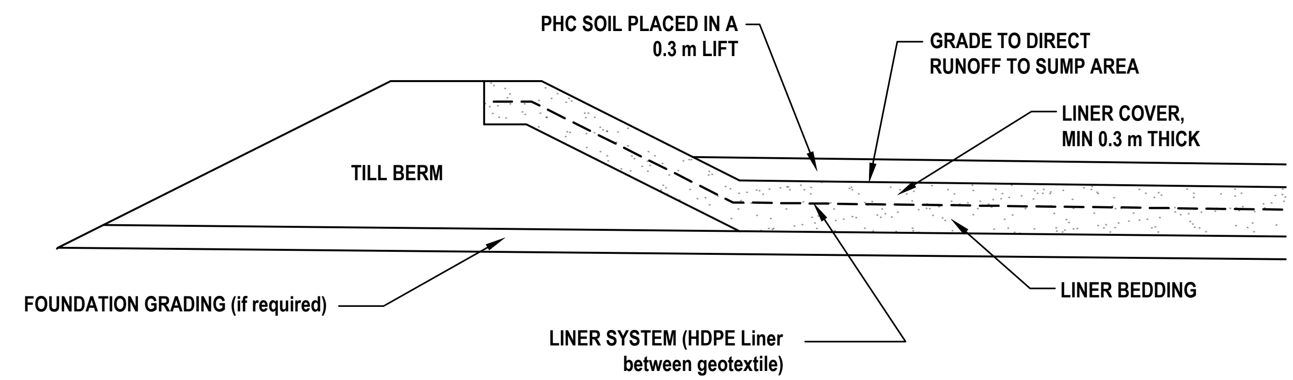
LANDFILL LOCATION AND SECTIONS

PROJECT NO.	DWN	CKD	REV
E14103202	GDK	WTH	0

OFFICE	DATE
EDM	December 2014

Figure 18





LANDFARM - TYPICAL DETAIL

LEGEND:

0 150m

Scale: 1:3,000 @ 11"x17"

NOTE:
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TETRA TECH EBA

Closure Assessment
Jericho Diamond Mine, Nunavut

LANDFARM LOCATION

PROJECT NO.	DWN	CKD	REV
E14103202	GDK/DBD	WTH	0

OFFICE	DATE
EDM	December 2014

Figure 19

Q:\Edmonton\Engineering\E141\Projects\E14103202 - Jericho Reclamation\5.0 Drawings\ESA\2.0 Producton Drawings\Options Asessment\OA Figure 19 landfarm.dwg [FIGURE 19] March 30, 2015 - 1:03:18 pm (BY: STIRLING, JENNIFER)

APPENDIX A
TETRA TECH EBA'S GENERAL CONDITIONS

GENERAL CONDITIONS

GEOTECHNICAL REPORT

This report incorporates and is subject to these "General Conditions".

1.0 USE OF REPORT AND OWNERSHIP

This geotechnical report pertains to a specific site, a specific development and a specific scope of work. It is not applicable to any other sites nor should it be relied upon for types of development other than that to which it refers. Any variation from the site or development would necessitate a supplementary geotechnical assessment.

This report and the recommendations contained in it are intended for the sole use of Tetra Tech EBA's Client. Tetra Tech EBA does not accept any responsibility for the accuracy of any of the data, the analyses or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than Tetra Tech EBA's Client unless otherwise authorized in writing by Tetra Tech EBA. Any unauthorized use of the report is at the sole risk of the user.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of Tetra Tech EBA. Additional copies of the report, if required, may be obtained upon request.

2.0 ALTERNATE REPORT FORMAT

Where Tetra Tech EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed Tetra Tech EBA's instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by Tetra Tech EBA shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of Tetra Tech EBA's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except Tetra Tech EBA. Tetra Tech EBA's instruments of professional service will be used only and exactly as submitted by Tetra Tech EBA.

Electronic files submitted by Tetra Tech EBA have been prepared and submitted using specific software and hardware systems. Tetra Tech EBA makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

3.0 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, Tetra Tech EBA has not been retained to investigate, address or consider and has not investigated, addressed or considered any environmental or regulatory issues associated with development on the subject site.

4.0 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems and methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. Tetra Tech EBA does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

5.0 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

6.0 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historic environment. Tetra Tech EBA does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional investigation and review may be necessary.

7.0 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

8.0 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

9.0 INFLUENCE OF CONSTRUCTION ACTIVITY

There is a direct correlation between construction activity and structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques are known.

10.0 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, as well as the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

11.0 DRAINAGE SYSTEMS

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

12.0 BEARING CAPACITY

Design bearing capacities, loads and allowable stresses quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition assumed. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions assumed in this report in fact exist at the site.

13.0 SAMPLES

Tetra Tech EBA will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

14.0 INFORMATION PROVIDED TO TETRA TECH EBA BY OTHERS

During the performance of the work and the preparation of the report, Tetra Tech EBA may rely on information provided by persons other than the Client. While Tetra Tech EBA endeavours to verify the accuracy of such information when instructed to do so by the Client, Tetra Tech EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.

APPENDIX B
ESA SOILS FIGURES

0 500m

Scale: 1:12,500 @ 11"x17"

NOTE:
BASE AIRPHOTOS PROVIDED BY
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STATUS
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Jericho Diamond Mine, Nunavut

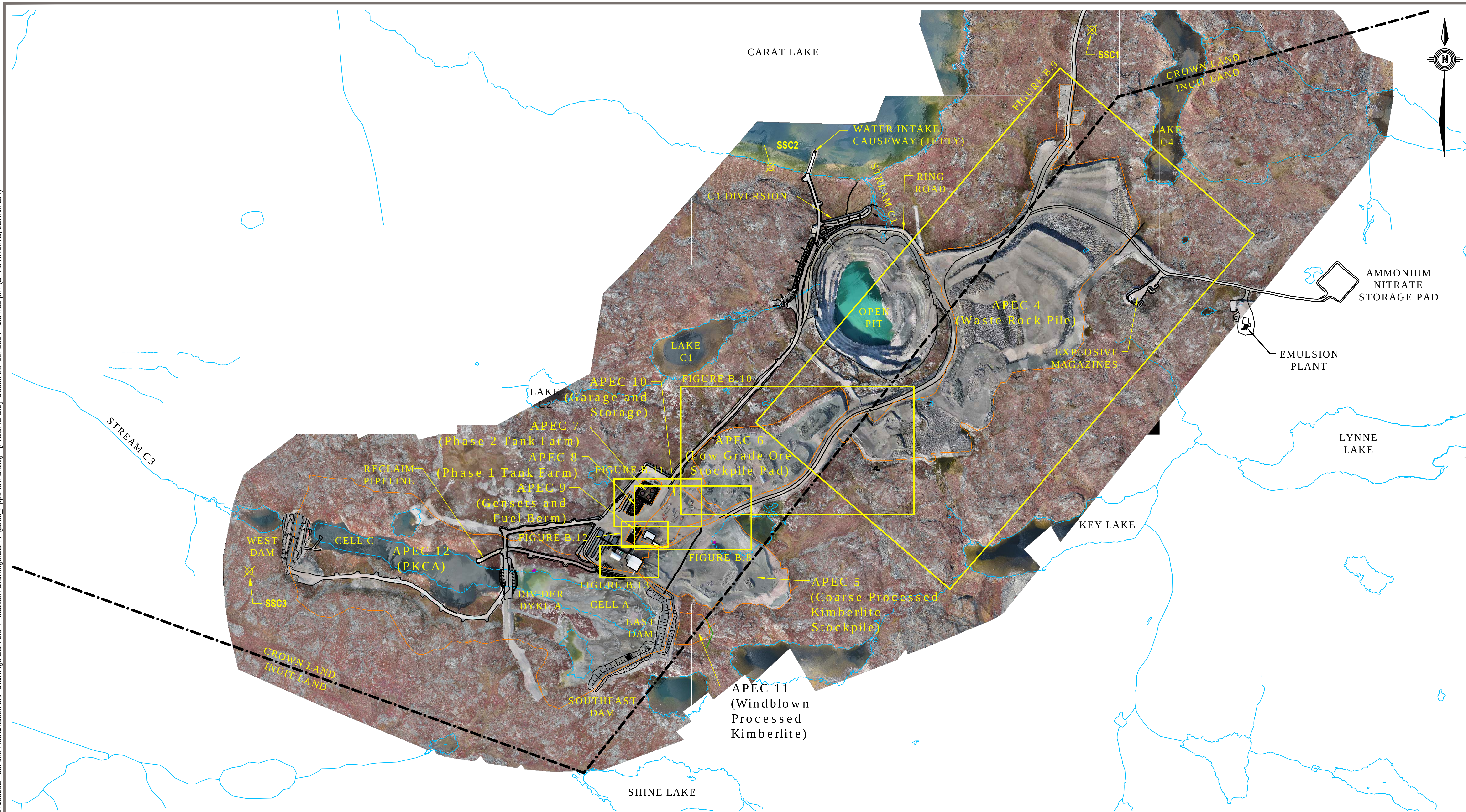
APEC LOCATIONS
PAGE 1 of 2

PROJECT NO.	DWN	CKD	REV
E14103202	GDK/DBD	WTH	0

OFFICE	DATE
EDM	December 2014

Figure B.1

Q:\Edmonton\Engineering\E141\Projects\E14103202 - Jericho Reclamation\5.0 Drawings\ESA\2.0 Producton Drawings\ESA Figures_Appendix B.dwg [FIGURE B.1] December 15, 2014 - 1:34:08 pm (BY: STIRLING, JENNIFER)



Q:\Edmonton\Engineering\E141\Projects\E14103202 - Jericho Reclamation\5.0 Drawings\ESA\2.0 Producton Drawings\ESA Figures_Appendix B.dwg [FIGURE B.2] December 15, 2014 - 1:34:32 pm (BY: STIRLING, JENNIFER)

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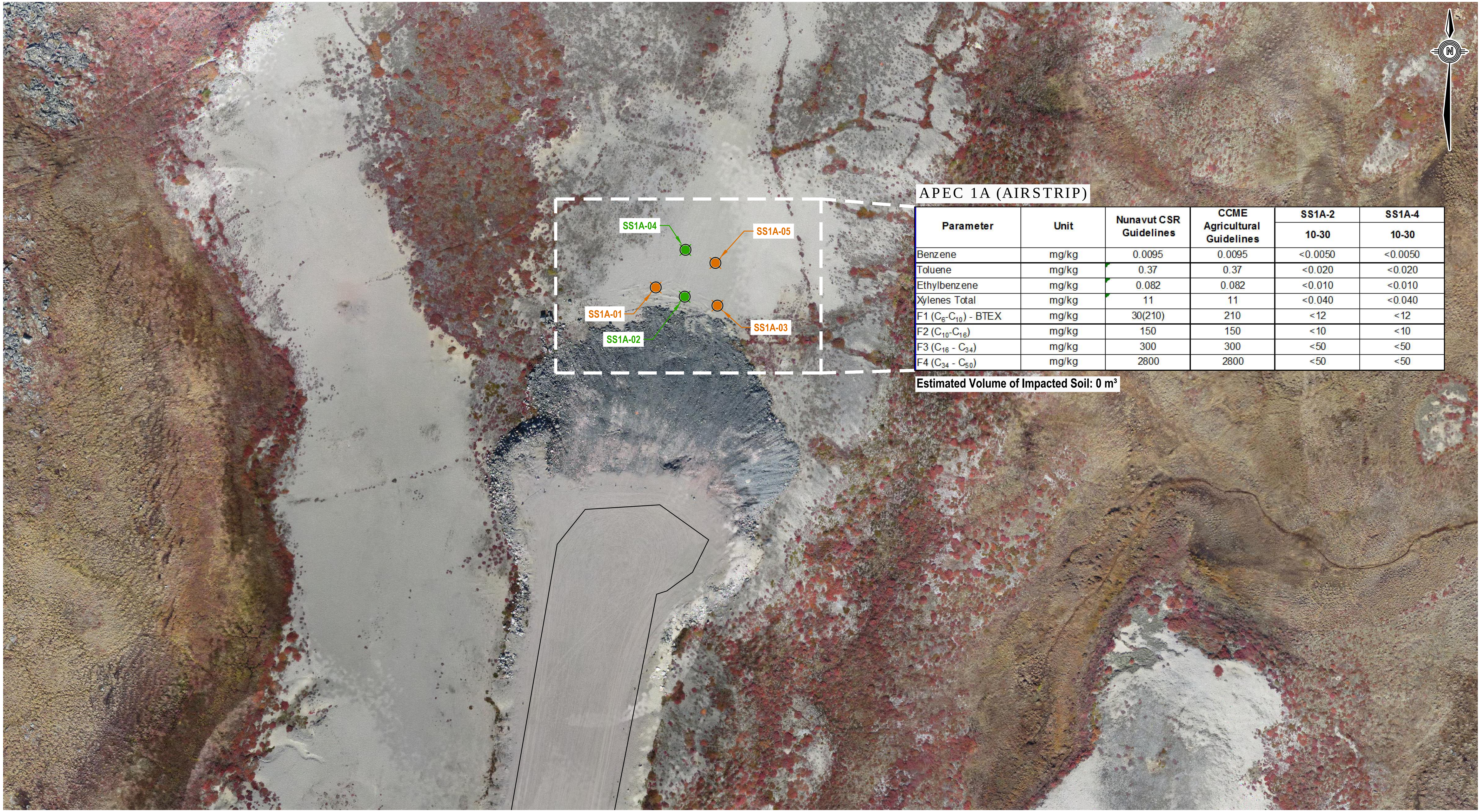
APEC LOCATIONS
PAGE 2 of 2

PROJECT NO.	DWN	CKD	REV
E14103202	GDK/DBD	WTH	0

OFFICE	DATE
EDM	December 2014

Figure B.2



APEC 1A (AIRSTRIP)

Parameter	Unit	Nunavut CSR Guidelines	CCME Agricultural Guidelines	SS1A-2	SS1A-4
				10-30	10-30
Benzene	mg/kg	0.0095	0.0095	<0.0050	<0.0050
Toluene	mg/kg	0.37	0.37	<0.020	<0.020
Ethylbenzene	mg/kg	0.082	0.082	<0.010	<0.010
Xylenes Total	mg/kg	11	11	<0.040	<0.040
F1 (C_6-C_{10}) - BTEX	mg/kg	30(210)	210	<12	<12
F2 (C_{10}-C_{16})	mg/kg	150	150	<10	<10
F3 (C_{16} - C_{34})	mg/kg	300	300	<50	<50
F4 (C_{34} - C_{50})	mg/kg	2800	2800	<50	<50

Estimated Volume of Impacted Soil: 0 m^3

LEGEND:
- SOIL SAMPLE LOCATION
- BELOW APPLICABLE GUIDELINES - SOIL
- NOT ANALYSED

0 — 50m
Scale: 1:1,000 @ 11"x17"

NOTE:
BASE AIRPHOTOS PROVIDED BY OLLERHEAD & ASSOCIATES LTD., AUGUST 2014

STATUS
ISSUED FOR USE

Notes:
NG - No guideline
BOLD - Exceeds CSR Guideline
Shaded - Exceeds CCME Guideline
Italic - Detection limit greater than guideline
N/A - Not applicable
Blank - Not analyzed

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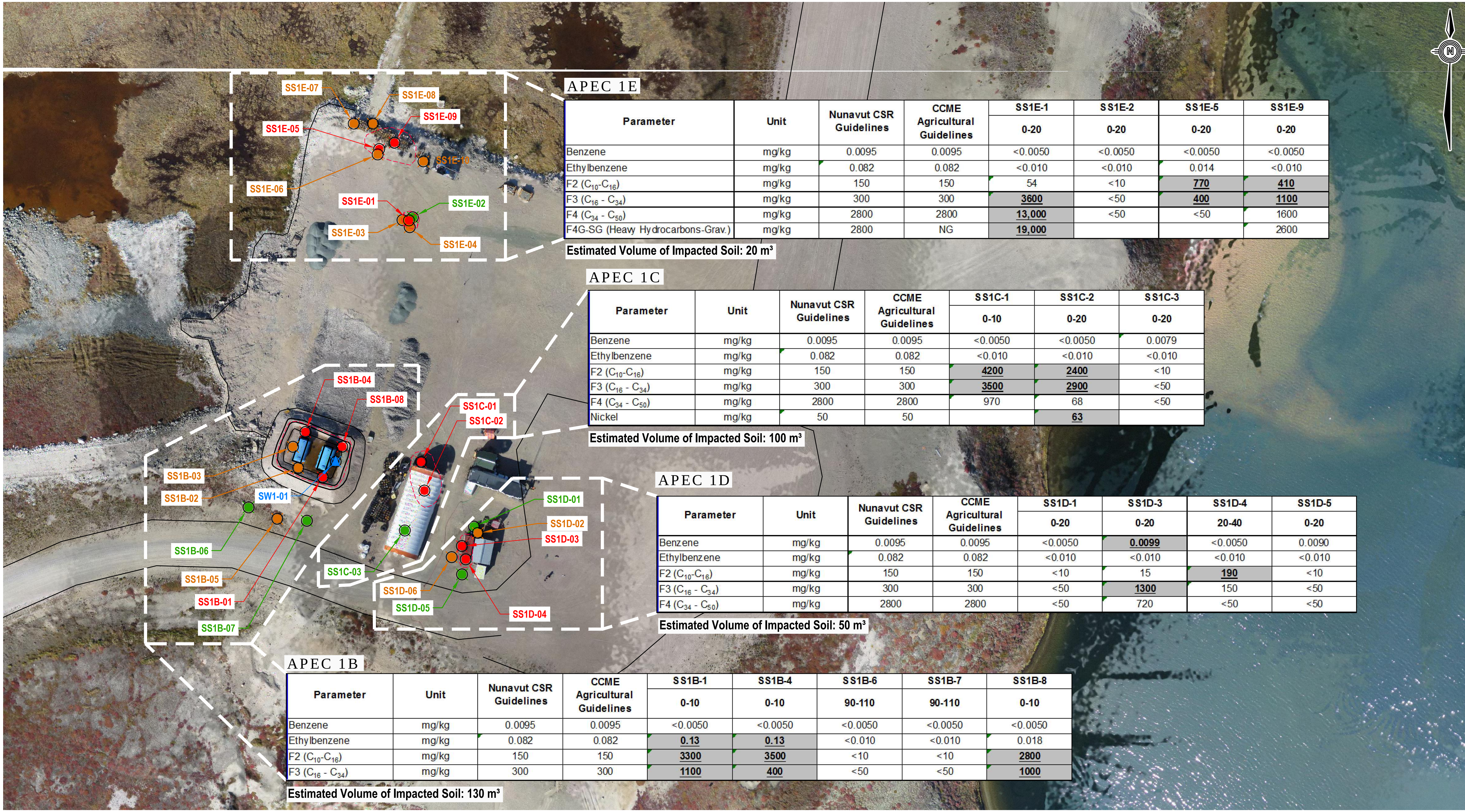
Jericho Diamond Mine, Nunavut

APEC 1 - AIRSTRIP
SOIL SAMPLE LOCATIONS

PROJECT NO.	DWN	CKD	REV
E14103202	GDK/DBD	WTH	0

OFFICE	DATE
EDM	December 2014

Figure B.3



APEC 1E

Parameter	Unit	Nunavut CSR Guidelines	CCME Agricultural Guidelines	SS1E-1	SS1E-2	SS1E-5	SS1E-9
				0-20	0-20	0-20	0-20
Benzene	mg/kg	0.0095	0.0095	<0.0050	<0.0050	<0.0050	<0.0050
Ethylbenzene	mg/kg	0.082	0.082	<0.010	<0.010	0.014	<0.010
F2 (C_{10}-C_{16})	mg/kg	150	150	54	<10	**770**	**410**
F3 (C_{16} - C_{34})	mg/kg	300	300	**3600**	<50	**400**	**1100**
F4 (C_{34} - C_{50})	mg/kg	2800	2800	**13,000**	<50	<50	1600
F4G-SG (Heavy Hydrocarbons-Grav.)	mg/kg	2800	NG	**19,000**			2600

Estimated Volume of Impacted Soil: 20 m³

APEC 1C

Parameter	Unit	Nunavut CSR Guidelines	CCME Agricultural Guidelines	SS1C-1	SS1C-2	SS1C-3
				0-10	0-20	0-20
Benzene	mg/kg	0.0095	0.0095	<0.0050	<0.0050	0.0079
Ethylbenzene	mg/kg	0.082	0.082	<0.010	<0.010	<0.010
F2 (C_{10}-C_{16})	mg/kg	150	150	**4200**	**2400**	<10
F3 (C_{16} - C_{34})	mg/kg	300	300	**3500**	**2900**	<50
F4 (C_{34} - C_{50})	mg/kg	2800	2800	970	68	<50
Nickel	mg/kg	50	50		**63**	

Estimated Volume of Impacted Soil: 100 m³

APEC 1D

Parameter	Unit	Nunavut CSR Guidelines	CCME Agricultural Guidelines	SS1D-1	SS1D-3	SS1D-4	SS1D-5
				0-20	0-20	20-40	0-20
Benzene	mg/kg	0.0095	0.0095	<0.0050	**0.0099**	<0.0050	0.0090
Ethylbenzene	mg/kg	0.082	0.082	<0.010	<0.010	<0.010	<0.010
F2 (C_{10}-C_{16})	mg/kg	150	150	<10	15	**190**	<10
F3 (C_{16} - C_{34})	mg/kg	300	300	<50	**1300**	150	<50
F4 (C_{34} - C_{50})	mg/kg	2800	2800	<50	720	<50	<50

Estimated Volume of Impacted Soil: 50 m³

APEC 1B

Parameter	Unit	Nunavut CSR Guidelines	CCME Agricultural Guidelines	SS1B-1	SS1B-4	SS1B-6	SS1B-7	SS1B-8
				0-10	0-10	90-110	90-110	0-10
Benzene	mg/kg	0.0095	0.0095	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Ethylbenzene	mg/kg	0.082	0.082	**0.13**	**0.13**	<0.010	<0.010	0.018
F2 (C_{10}-C_{16})	mg/kg	150	150	**3300**	**3500**	<10	<10	**2800**
F3 (C_{16} - C_{34})	mg/kg	300	300	**1100**	**400**	<50	<50	**1000**

Estimated Volume of Impacted Soil: 130 m³

LEGEND:
- SOIL SAMPLE LOCATION
- BELOW APPLICABLE GUIDELINES - SOIL
- ABOVE APPLICABLE GUIDELINES - SOIL
- NOT ANALYSED
- APPROXIMATE EXTENT OF IMPACTED SOIL
- BERM WATER SAMPLE LOCATION

0 — 50m
Scale: 1:1,000 @ 11"x17"

NOTE:
BASE AIRPHOTOS PROVIDED BY OLLERHEAD & ASSOCIATES LTD., AUGUST 2014

STATUS
ISSUED FOR USE

Notes:
NG - No guideline
BOLD - Exceeds CSR Guideline
Shaded - Exceeds CCME Guideline
Italic - Detection limit greater than guideline
N/A - Not applicable
Blank - Not analyzed

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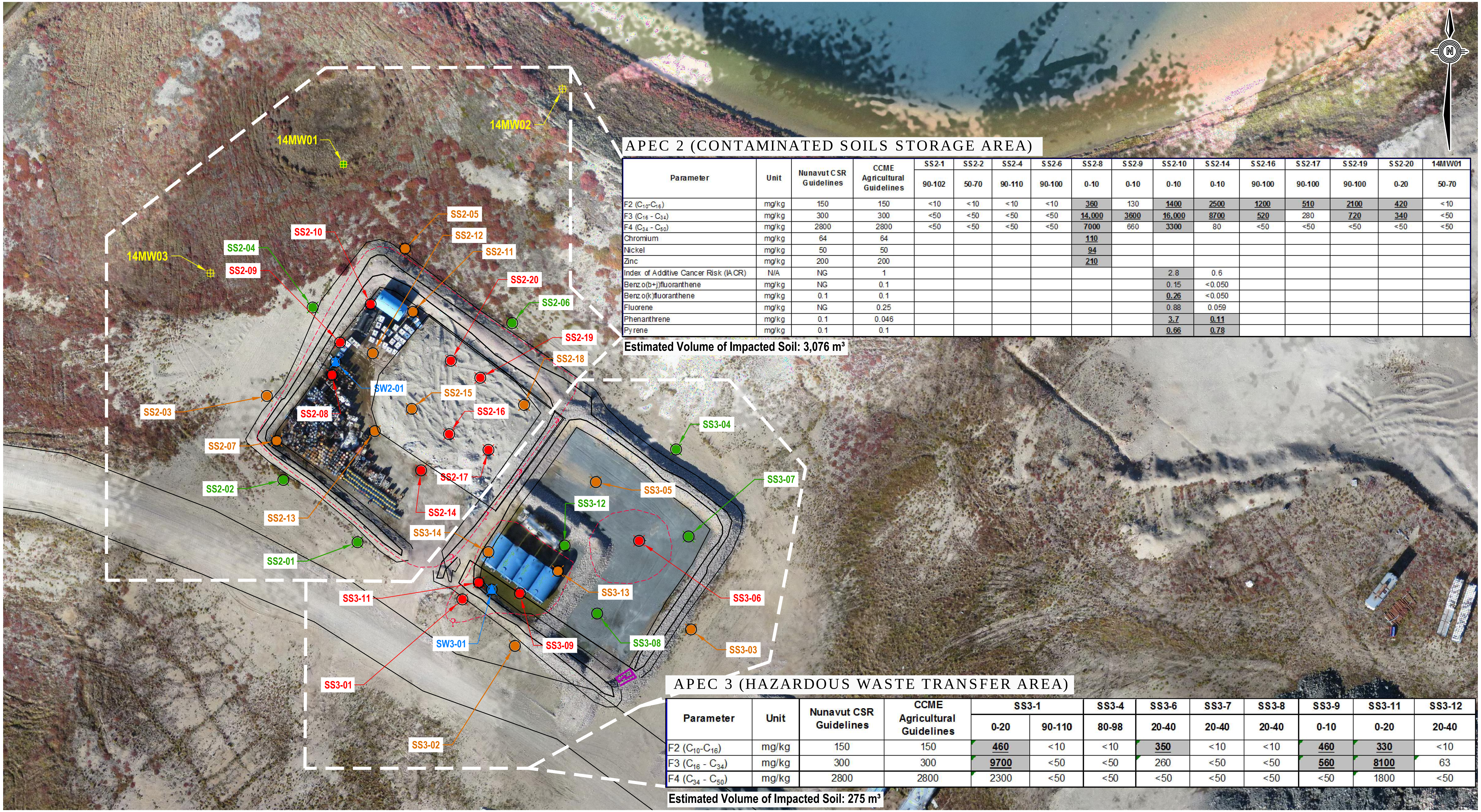
Jericho Diamond Mine, Nunavut

APEC 1 - AIRSTRIP SOIL SAMPLE LOCATIONS

PROJECT NO.	DWN	CKD	REV
E14103202	GDK/DBD	WTH	0

OFFICE	DATE
EDM	December 2014

Figure B.4



APEC 2 (CONTAMINATED SOILS STORAGE AREA)

Parameter	Unit	Nunavut CSR Guidelines	CCME Agricultural Guidelines	SS2-1	SS2-2	SS2-4	SS2-6	SS2-8	SS2-9	SS2-10	SS2-14	SS2-16	SS2-17	SS2-19	SS2-20	14MW01
				90-102	50-70	90-110	90-100	0-10	0-10	0-10	0-10	90-100	90-100	90-100	0-20	50-70
F2 (C_{10}-C_{16})	mg/kg	150	150	<10	<10	<10	<10	**360**	130	**1400**	**2500**	**1200**	**510**	**2100**	**420**	<10
F3 (C_{16} - C_{34})	mg/kg	300	300	<50	<50	<50	<50	**14,000**	**3600**	**16,000**	**8700**	**520**	280	**720**	**340**	<50
F4 (C_{34} - C_{50})	mg/kg	2800	2800	<50	<50	<50	<50	7000	660	3300	80	<50	<50	<50	<50	<50
Chromium	mg/kg	64	64					**110**								
Nickel	mg/kg	50	50					**94**								
Zinc	mg/kg	200	200					**210**								
Index of Additive Cancer Risk (IACR)	N/A	NG	1							2.8	0.6					
Benzo(b+j)fluoranthene	mg/kg	NG	0.1							0.15	<0.050					
Benzo(k)fluoranthene	mg/kg	0.1	0.1							**0.26**	<0.050					
Fluorene	mg/kg	NG	0.25							0.88	0.059					
Phenanthrene	mg/kg	0.1	0.046							**3.7**	**0.11**					
Pyrene	mg/kg	0.1	0.1							**0.66**	**0.78**					

Estimated Volume of Impacted Soil: 3,076 m³

APEC 3 (HAZARDOUS WASTE TRANSFER AREA)

Parameter	Unit	Nunavut CSR Guidelines	CCME Agricultural Guidelines	SS3-1		SS3-4	SS3-6	SS3-7	SS3-8	SS3-9	SS3-11	SS3-12
				0-20	90-110	80-98	20-40	20-40	20-40	0-10	0-20	20-40
F2 (C_{10}-C_{16})	mg/kg	150	150	**460**	<10	<10	**350**	<10	<10	**460**	**330**	<10
F3 (C_{16} - C_{34})	mg/kg	300	300	**9700**	<50	<50	260	<50	<50	**560**	**8100**	63
F4 (C_{34} - C_{50})	mg/kg	2800	2800	2300	<50	<50	<50	<50	<50	<50	1800	<50

Estimated Volume of Impacted Soil: 275 m³

LEGEND:

- SOIL SAMPLE LOCATION
- BELOW APPLICABLE GUIDELINES - SOIL
- ABOVE APPLICABLE GUIDELINES - SOIL
- NOT ANALYSED
- APPROXIMATE EXTENT OF IMPACTED SOIL
- BERM WATER SAMPLE LOCATION
- MONITORING WELL LOCATION
- BELOW APPLICABLE GUIDELINES

0 25m

Scale: 1:750 @ 11"x17"

NOTE:
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STATUS
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Notes:

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N/A - Not applicable
Blank - Not analyzed

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APEC 2 AND 3 - CONTAMINATED SOILS STORAGE AREA AND HAZARDOUS WASTE TRANSFER AREA SOIL SAMPLE LOCATIONS

PROJECT NO.	DWN	CKD	REV
E14103202	GDK/DBD	WTH	0

OFFICE	DATE
EDM	December 2014

Figure B.5

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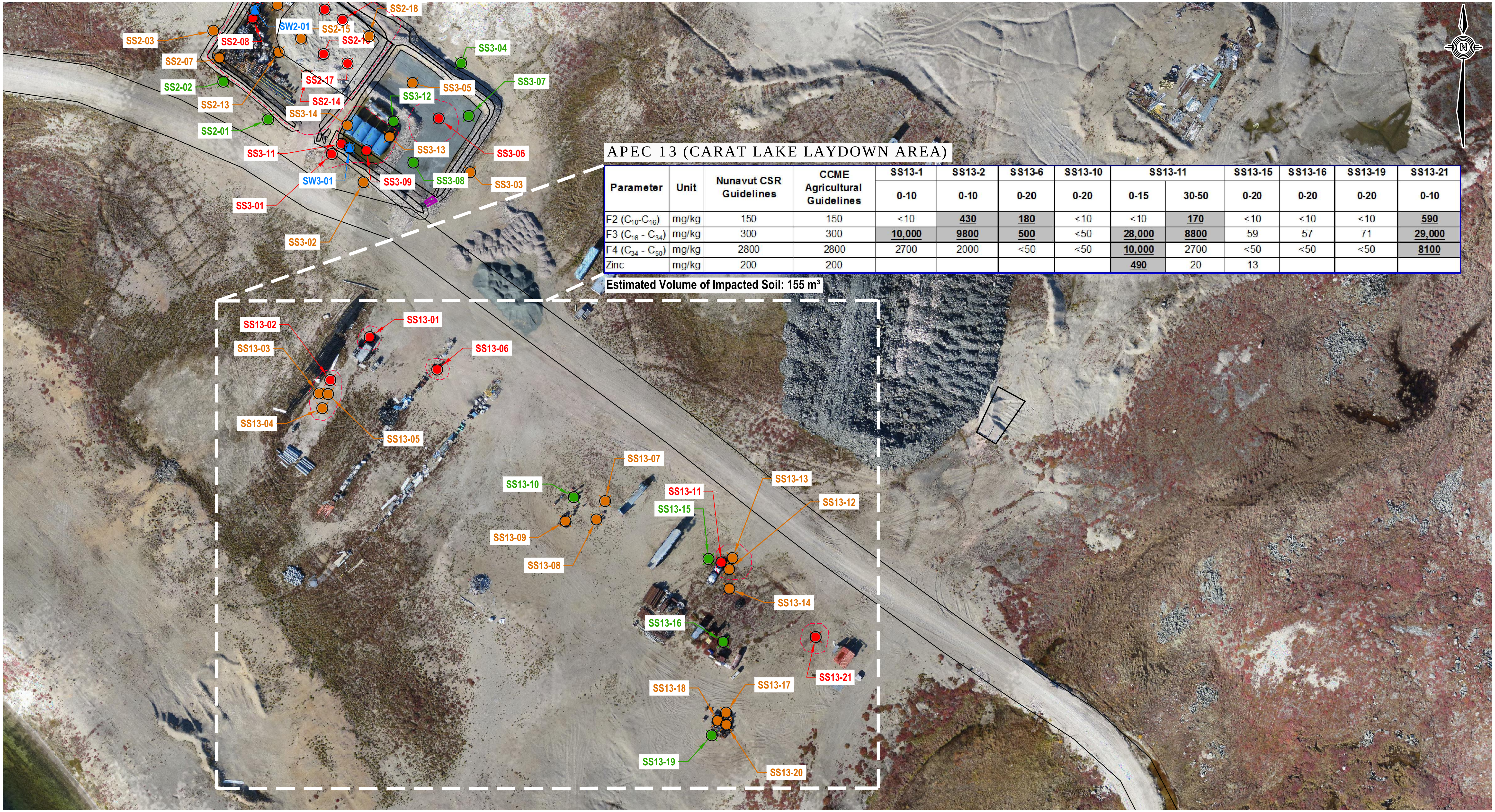

APEC 13 (CARAT LAKE LAYDOWN AREA)

Parameter	Unit	Nunavut CSR Guidelines	CCME Agricultural Guidelines	SS13-1	SS13-2	SS13-6	SS13-10	SS13-11		SS13-15	SS13-16	SS13-19	SS13-21
				0-10	0-10	0-20	0-20	0-15	30-50	0-20	0-20	0-20	0-10
F2 (C_{10}-C_{16})	mg/kg	150	150	<10	**430**	**180**	<10	<10	**170**	<10	<10	<10	**590**
F3 (C_{16} - C_{34})	mg/kg	300	300	**10,000**	**9800**	**500**	<50	**28,000**	**8800**	59	57	71	**29,000**
F4 (C_{34} - C_{50})	mg/kg	2800	2800	2700	2000	<50	<50	**10,000**	2700	<50	<50	<50	**8100**
Zinc	mg/kg	200	200					**490**	20	13			

Estimated Volume of Impacted Soil: 155 m³

LEGEND:
- SOIL SAMPLE LOCATION
- BELOW APPLICABLE GUIDELINES - SOIL
- ABOVE APPLICABLE GUIDELINES - SOIL
- NOT ANALYSED
- APPROXIMATE EXTENT OF IMPACTED SOIL
- BERM WATER SAMPLE LOCATION

NOTE:
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0 50m
Scale: 1:1,250 @ 11"x17"

STATUS
ISSUED FOR USE

Notes:
NG - No guideline
BOLD - Exceeds CSR Guideline
Shaded - Exceeds CCME Guideline
Italic - Detection limit greater than guideline
N/A - Not applicable
Blank - Not analyzed

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APEC 13 - CARAT LAKE LAYDOWN AREA
SOIL SAMPLE LOCATIONS

PROJECT NO.	DWN	CKD	REV
E14103202	GDK/DBD	WTH	0

OFFICE	DATE
EDM	December 2014

Figure B.6

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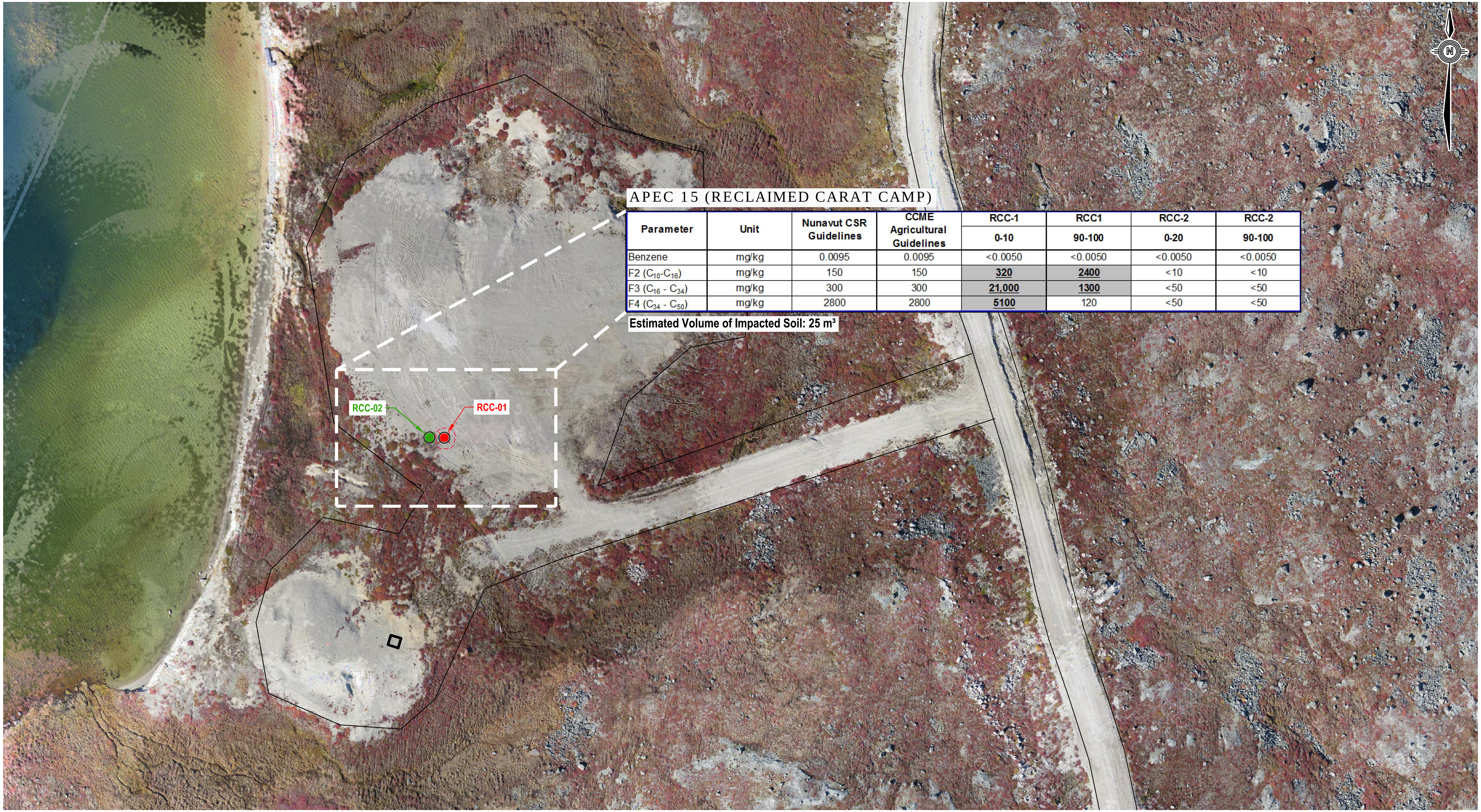

APEC 15 (RECLAIMED CARAT CAMP)

Parameter	Unit	Nunavut CSR Guidelines	CCME Agricultural Guidelines	RCC-1 0-10	RCC1 90-100	RCC-2 0-20	RCC-2 90-100
Benzene	mg/kg	0.0095	0.0095	<0.0050	<0.0050	<0.0050	<0.0050
F2 (C_{10}-C_{16})	mg/kg	150	150	**320**	**2400**	<10	<10
F3 (C_{16} - C_{34})	mg/kg	300	300	**21,000**	**1300**	<50	<50
F4 (C_{34} - C_{50})	mg/kg	2800	2800	**5100**	120	<50	<50

Estimated Volume of Impacted Soil: 25 m^3

LEGEND:

- SOIL SAMPLE LOCATION
- BELOW APPLICABLE GUIDELINES - SOIL
- ABOVE APPLICABLE GUIDELINES - SOIL
- NOT ANALYSED
- APPROXIMATE EXTENT OF IMPACTED SOIL

0 50m

Scale: 1:1,250 @ 11"x17"

NOTE:
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STATUS
ISSUED FOR USE

Notes:
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Shaded - Exceeds CCME Guideline
Italic - Detection limit greater than guideline
N/A - Not applicable
Blank - Not analyzed

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APEC 15 - RECLAIMED CARAT CAMP
SOIL SAMPLE LOCATIONS

PROJECT NO.	DWN	CKD	REV
E14103202	GDK/DBD	WTH	0

OFFICE	DATE
EDM	December 2014

Figure B.7

APEC 10 (TRUCK SHOP AND LAYDOWN AREA)

Parameter	Unit	Nunavut CSR Guidelines	CCME Agricultural Guidelines	SS10-1	SS10-2	SS10-4	SS10-7	SS10-8	SS10-9	SS10-10	SS10-11	SS10-13	SS10-19	SS10-21	SS10-23	SS10-24
				0-20	0-20	0-20	0-20	0-20	0-20	0-20	30-50	0-20	0-20	0-20	0-20	0-20
F2 (C_{10}-C_{16})	mg/kg	150	150	11	<10	**200**	69	75	21	**2500**	<10	<10	**560**	<10	<10	**410**
F3 (C_{16} - C_{34})	mg/kg	300	300	270	91	**680**	**1700**	**16,000**	**730**	**2600**	<50	<50	**14,000**	<50	**1800**	**75,000**
F4 (C_{34} - C_{50})	mg/kg	2800	2800	<50	<50	<50	300	**15,000**	170	<50	<50	<50	1700	<50	100	**29,000**
Chromium	mg/kg	64	64		**69**											
Molybdenum	mg/kg	5 [4]	5		**12**											
Nickel	mg/kg	50	50		**160**										**64**	
Tin	mg/kg	5 [4]	0.1		1.4										1.0	

Estimated Volume of Impacted Soil: 546 m^3

LEGEND:

- SOIL SAMPLE LOCATION
- BELOW APPLICABLE GUIDELINES - SOIL
- ABOVE APPLICABLE GUIDELINES - SOIL
- NOT ANALYSED
- APPROXIMATE EXTENT OF IMPACTED SOIL

0 — 50m

Scale: 1:1,000 @ 11"x17"

NOTE:
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STATUS
ISSUED FOR USE

Notes:

NG - No guideline
BOLD - Exceeds CSR Guideline
Shaded - Exceeds CCME Guideline
Italic - Detection limit greater than guideline
N/A - Not applicable
Blank - Not analyzed

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APEC 10 - TRUCK SHOP AND LAYDOWN AREA SOIL SAMPLE LOCATIONS

PROJECT NO.	DWN	CKD	REV
E14103202	GDK/DBD	WTH	0

OFFICE	DATE
EDM	December 2014

Figure B.8

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APEC 4 (WASTE ROCK PILE)

Parameter	Unit	Nunavut CSR Guidelines	CCME Agricultural Guidelines	SS4-1
				0-20
F2 (C_{10}-C_{16})	mg/kg	150	150	**280**
F3 (C_{16} - C_{34})	mg/kg	300	300	**8300**

Estimated Volume of Impacted Soil: 3.5 m³

LEGEND:

- SOIL SAMPLE LOCATION
- ABOVE APPLICABLE GUIDELINES - SOIL
- APPROXIMATE EXTENT OF IMPACTED SOIL
- SEEP SAMPLE LOCATION
- MONITORING WELL LOCATION

0 — 250m

Scale: 1:5,000 @ 11"x17"

NOTE:
BASE AIRPHOTOS PROVIDED BY OLLERHEAD & ASSOCIATES LTD., AUGUST 2014

STATUS
ISSUED FOR USE

Notes:
NG - No guideline
BOLD - Exceeds CSR Guideline
Shaded - Exceeds CCME Guideline
Italic - Detection limit greater than guideline
N/A - Not applicable
Blank - Not analyzed

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APEC 4 - WASTE ROCK PILE
SOIL SAMPLE LOCATIONS

PROJECT NO.	DWN	CKD	REV
E14103202	GDK	WTH	0

OFFICE	DATE
EDM	December 2014

Figure B.9

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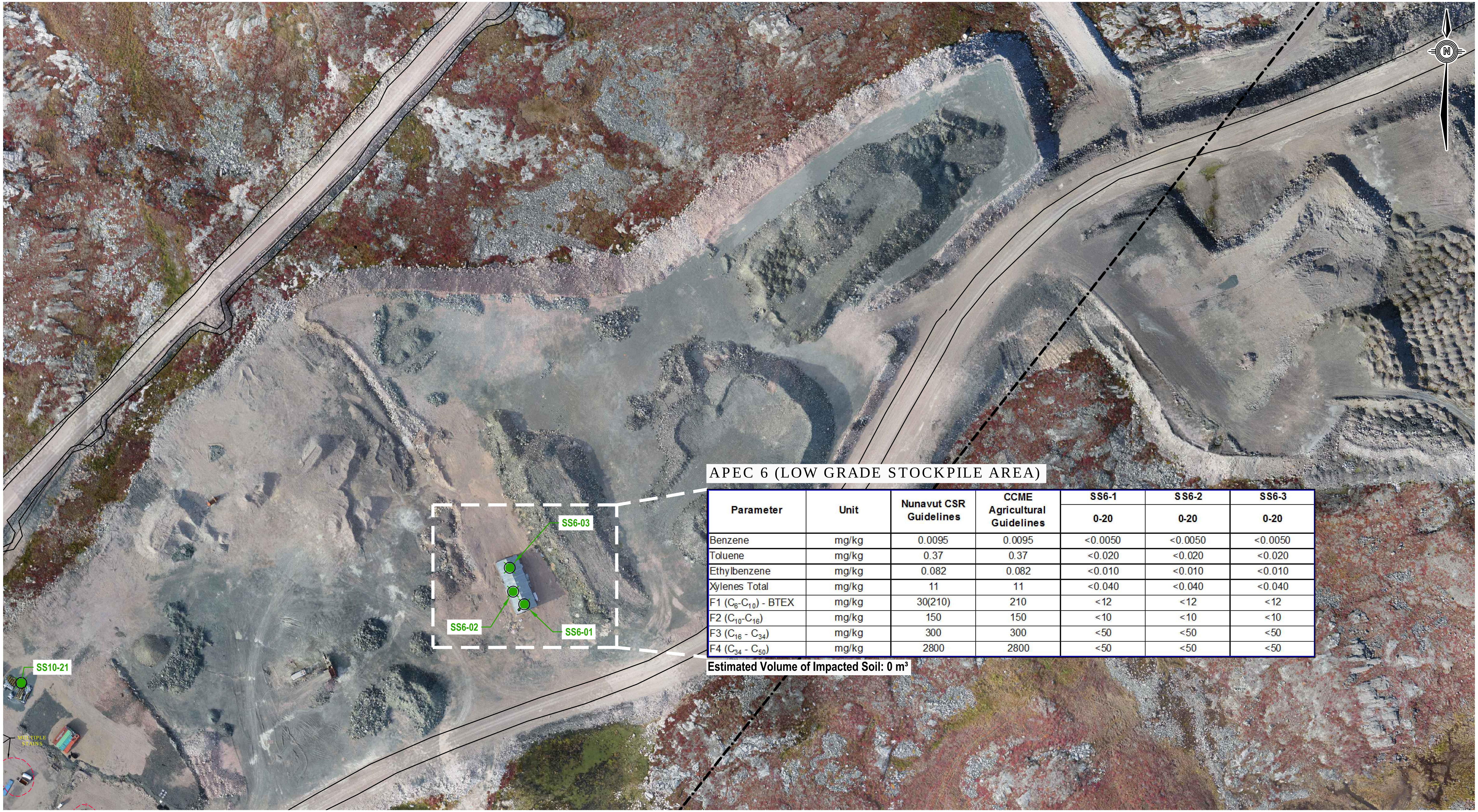

APEC 6 (LOW GRADE STOCKPILE AREA)

Parameter	Unit	Nunavut CSR Guidelines	CCME Agricultural Guidelines	SS6-1	SS6-2	SS6-3
				0-20	0-20	0-20
Benzene	mg/kg	0.0095	0.0095	<0.0050	<0.0050	<0.0050
Toluene	mg/kg	0.37	0.37	<0.020	<0.020	<0.020
Ethylbenzene	mg/kg	0.082	0.082	<0.010	<0.010	<0.010
Xylenes Total	mg/kg	11	11	<0.040	<0.040	<0.040
F1 (C_6-C_{10}) - BTEX	mg/kg	30(210)	210	<12	<12	<12
F2 (C_{10}-C_{16})	mg/kg	150	150	<10	<10	<10
F3 (C_{16} - C_{34})	mg/kg	300	300	<50	<50	<50
F4 (C_{34} - C_{50})	mg/kg	2800	2800	<50	<50	<50

Estimated Volume of Impacted Soil: 0 m³

LEGEND:

- SOIL SAMPLE LOCATION
- BELOW APPLICABLE GUIDELINES - SOIL
- APPROXIMATE EXTENT OF IMPACTED SOIL

0 100m

Scale: 1:2,000 @ 11"x17"

NOTE:
BASE AIRPHOTOS PROVIDED BY OLLERHEAD & ASSOCIATES LTD., AUGUST 2014

STATUS
ISSUED FOR USE

Notes:
NG - No guideline
BOLD - Exceeds CSR Guideline
Shaded - Exceeds CCME Guideline
Italic - Detection limit greater than guideline
N/A - Not applicable
Blank - Not analyzed

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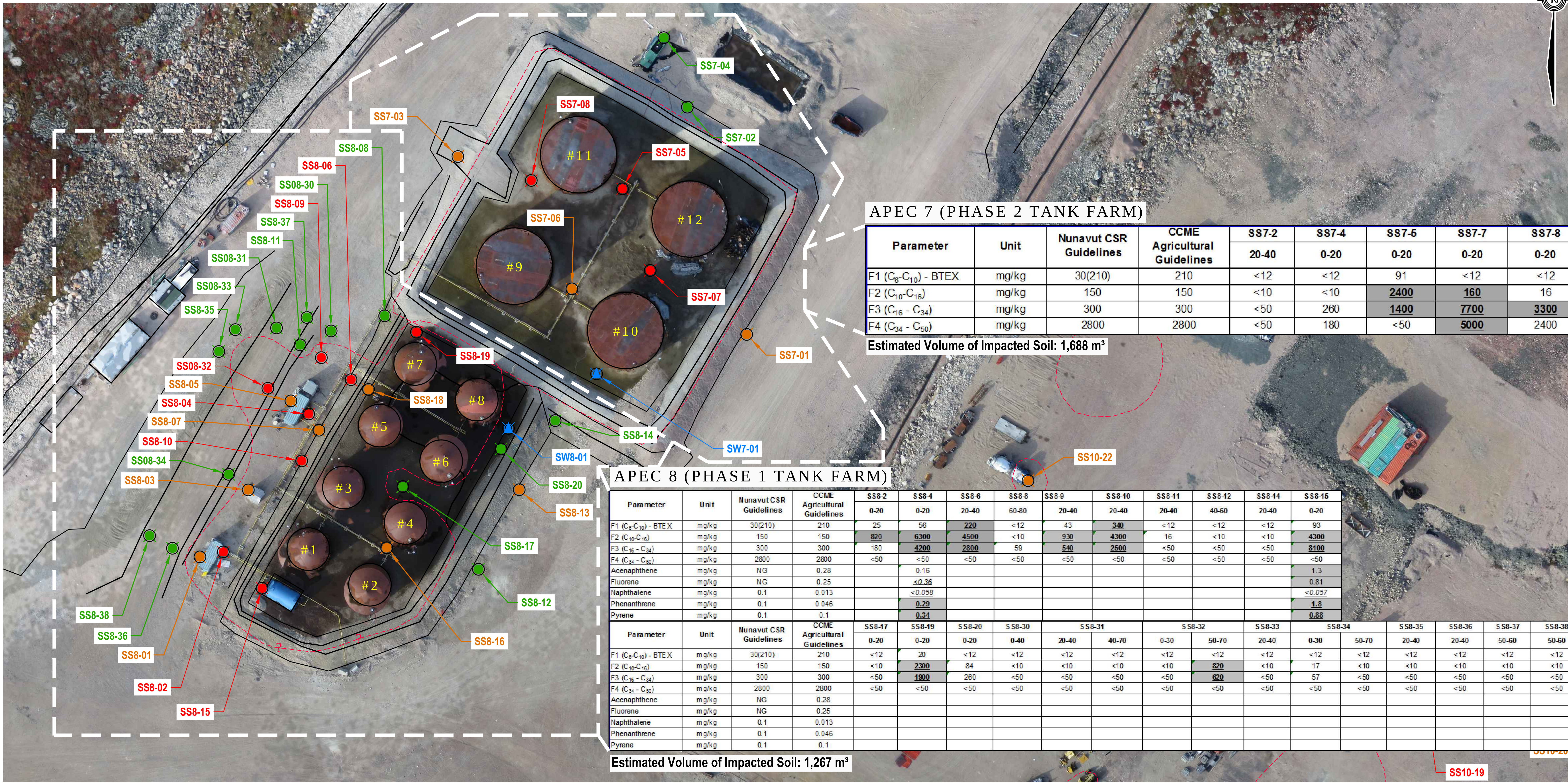
Jericho Diamond Mine, Nunavut

APEC 6 - LOW GRADE STOCKPILE AREA SOIL SAMPLE LOCATIONS

PROJECT NO.	DWN	CKD	REV	
E14103202	GDK/DBD	WTH	0	Figure B.10
OFFICE	DATE			
EDM	December 2014			

Q:\Edmonton\Engineering\E141\Projects\E14103202 - Jericho Reclamation\5.0 Drawings\ESA\2.0 Producton Drawings\ESA Figures_Appendix B.dwg [FIGURE B.10] December 15, 2014 - 1:38:03 pm (BY: STIRLING, JENNIFER)



APEC 7 (PHASE 2 TANK FARM)

Parameter	Unit	Nunavut CSR Guidelines	CCME Agricultural Guidelines	SS7-2	SS7-4	SS7-5	SS7-7	SS7-8
				20-40	0-20	0-20	0-20	0-20
F1 (C_6-C_{10}) - BTEX	mg/kg	30(210)	210	<12	<12	91	<12	<12
F2 (C_{10}-C_{16})	mg/kg	150	150	<10	<10	**2400**	**160**	16
F3 (C_{16} - C_{34})	mg/kg	300	300	<50	260	**1400**	**7700**	**3300**
F4 (C_{34} - C_{50})	mg/kg	2800	2800	<50	180	<50	**5000**	2400

Estimated Volume of Impacted Soil: 1,688 m³

APEC 8 (PHASE 1 TANK FARM)

Parameter	Unit	Nunavut CSR Guidelines	CCME Agricultural Guidelines	SS8-2	SS8-4	SS8-6	SS8-8	SS8-9	SS8-10	SS8-11	SS8-12	SS8-14	SS8-15
				0-20	0-20	20-40	60-80	20-40	20-40	20-40	40-60	20-40	0-20
F1 (C_6-C_{10}) - BTEX	mg/kg	30(210)	210	25	56	**220**	<12	43	**340**	<12	<12	<12	93
F2 (C_{10}-C_{16})	mg/kg	150	150	**820**	**6300**	**4500**	<10	**930**	**4300**	16	<10	<10	**4300**
F3 (C_{16} - C_{34})	mg/kg	300	300	180	**4200**	**2800**	59	**540**	**2500**	<50	<50	<50	**8100**
F4 (C_{34} - C_{50})	mg/kg	2800	2800	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Acenaphthene	mg/kg	NG	0.28		0.16								1.3
Fluorene	mg/kg	NG	0.25		*<0.36*								0.81
Naphthalene	mg/kg	0.1	0.013		*<0.058*								*<0.057*
Phenanthrene	mg/kg	0.1	0.046		**0.29**								**1.8**
Pyrene	mg/kg	0.1	0.1		**0.34**								**0.88**

Parameter	Unit	Nunavut CSR Guidelines	CCME Agricultural Guidelines	SS8-17	SS8-19	SS8-20	SS8-30	SS8-31		SS8-32		SS8-33	SS8-34		SS8-35	SS8-36	SS8-37	SS8-38
				0-20	0-20	0-20	0-40	20-40	40-70	0-30	50-70	20-40	0-30	50-70	20-40	20-40	50-60	50-60
F1 (C_6-C_{10}) - BTEX	mg/kg	30(210)	210	<12	20	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12
F2 (C_{10}-C_{16})	mg/kg	150	150	<10	**2300**	84	<10	<10	<10	<10	**820**	<10	17	<10	<10	<10	<10	<10
F3 (C_{16} - C_{34})	mg/kg	300	300	<50	**1900**	260	<50	<50	<50	<50	**620**	<50	57	<50	<50	<50	<50	<50
F4 (C_{34} - C_{50})	mg/kg	2800	2800	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Acenaphthene	mg/kg	NG	0.28															
Fluorene	mg/kg	NG	0.25															
Naphthalene	mg/kg	0.1	0.013															
Phenanthrene	mg/kg	0.1	0.046															
Pyrene	mg/kg	0.1	0.1															

Estimated Volume of Impacted Soil: 1,267 m³

LEGEND:
- SOIL SAMPLE LOCATION
- BELOW APPLICABLE GUIDELINES - SOIL
- ABOVE APPLICABLE GUIDELINES - SOIL
- NOT ANALYSED
- APPROXIMATE EXTENT OF IMPACTED SOIL
- BERM WATER SAMPLE LOCATION

0 25m

Scale: 1:750 @ 11"x17"

NOTE:
BASE AIRPHOTOS PROVIDED BY OLLERHEAD & ASSOCIATES LTD., AUGUST 2014

STATUS
ISSUED FOR USE

Notes:
NG - No guideline
BOLD - Exceeds CSR Guideline
Shaded - Exceeds CCME Guideline
Italic - Detection limit greater than guideline
N/A - Not applicable
Blank - Not analyzed

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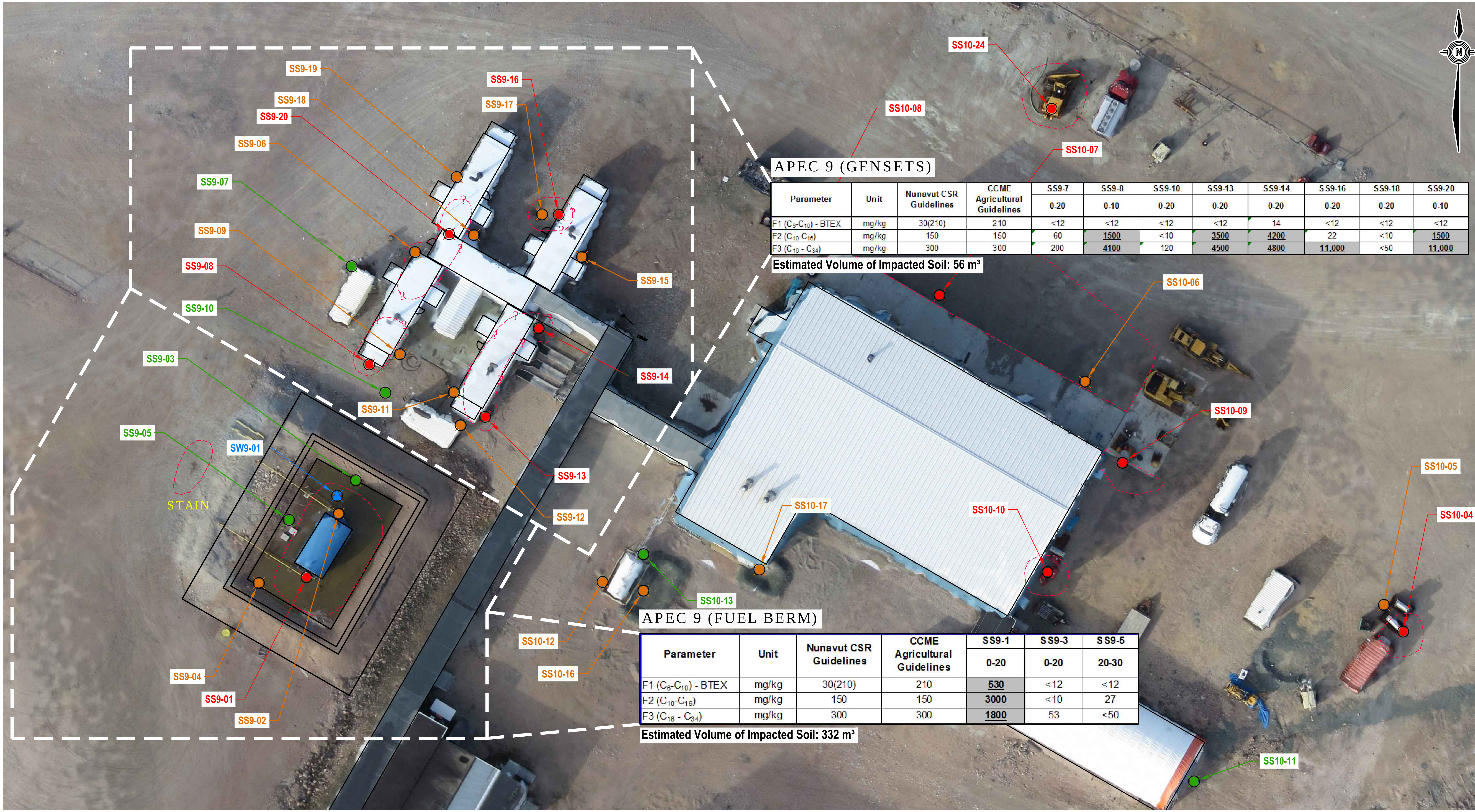
APEC 7 AND APEC 8 - TANK FARM SOIL SAMPLE LOCATIONS

PROJECT NO.	DWN	CKD	REV
E14103202	GDK/DBD	WTH	0
OFFICE	DATE		
EDM	December 2014		

Figure B.11



APEC 9 (GENSETS)

Parameter	Unit	Nunavut CSR Guidelines	CCME Agricultural Guidelines	SS9-7	SS9-8	SS9-10	SS9-13	SS9-14	SS9-16	SS9-18	SS9-20
				0-20	0-10	0-20	0-20	0-20	0-20	0-20	0-10
F1 (C_6-C_{10}) - BTEX	mg/kg	30(210)	210	<12	<12	<12	<12	14	<12	<12	<12
F2 (C_{10}-C_{16})	mg/kg	150	150	60	**1500**	<10	**3500**	**4200**	22	<10	**1500**
F3 (C_{16} - C_{34})	mg/kg	300	300	200	**4100**	120	**4500**	**4800**	**11,000**	<50	**11,000**

Estimated Volume of Impacted Soil: 56 m³

APEC 9 (FUEL BERM)

Parameter	Unit	Nunavut CSR Guidelines	CCME Agricultural Guidelines	SS9-1	SS9-3	SS9-5
				0-20	0-20	20-30
F1 (C_6-C_{10}) - BTEX	mg/kg	30(210)	210	**530**	<12	<12
F2 (C_{10}-C_{16})	mg/kg	150	150	**3000**	<10	27
F3 (C_{16} - C_{34})	mg/kg	300	300	**1800**	53	<50

Estimated Volume of Impacted Soil: 332 m³

LEGEND:
- SOIL SAMPLE LOCATION
- BELOW APPLICABLE GUIDELINES - SOIL
- ABOVE APPLICABLE GUIDELINES - SOIL
- NOT ANALYSED
- APPROXIMATE EXTENT OF IMPACTED SOIL
- BERM WATER SAMPLE LOCATION

0 20m
Scale: 1:400 @ 11"x17"

NOTE:
BASE AIRPHOTOS PROVIDED BY OLLERHEAD & ASSOCIATES LTD., AUGUST 2014

STATUS
ISSUED FOR USE

Notes:
NG - No guideline
BOLD - Exceeds CSR Guideline
Shaded - Exceeds CCME Guideline
Italic - Detection limit greater than guideline
N/A - Not applicable
Blank - Not analyzed

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APEC 9 - GENSETS AND FUEL BERM SOIL SAMPLE LOCATIONS

PROJECT NO.	DWN	CKD	REV
E14103202	GDK/DBD	WTH	0
OFFICE	DATE		
EDM	December 2014		

Figure B.12

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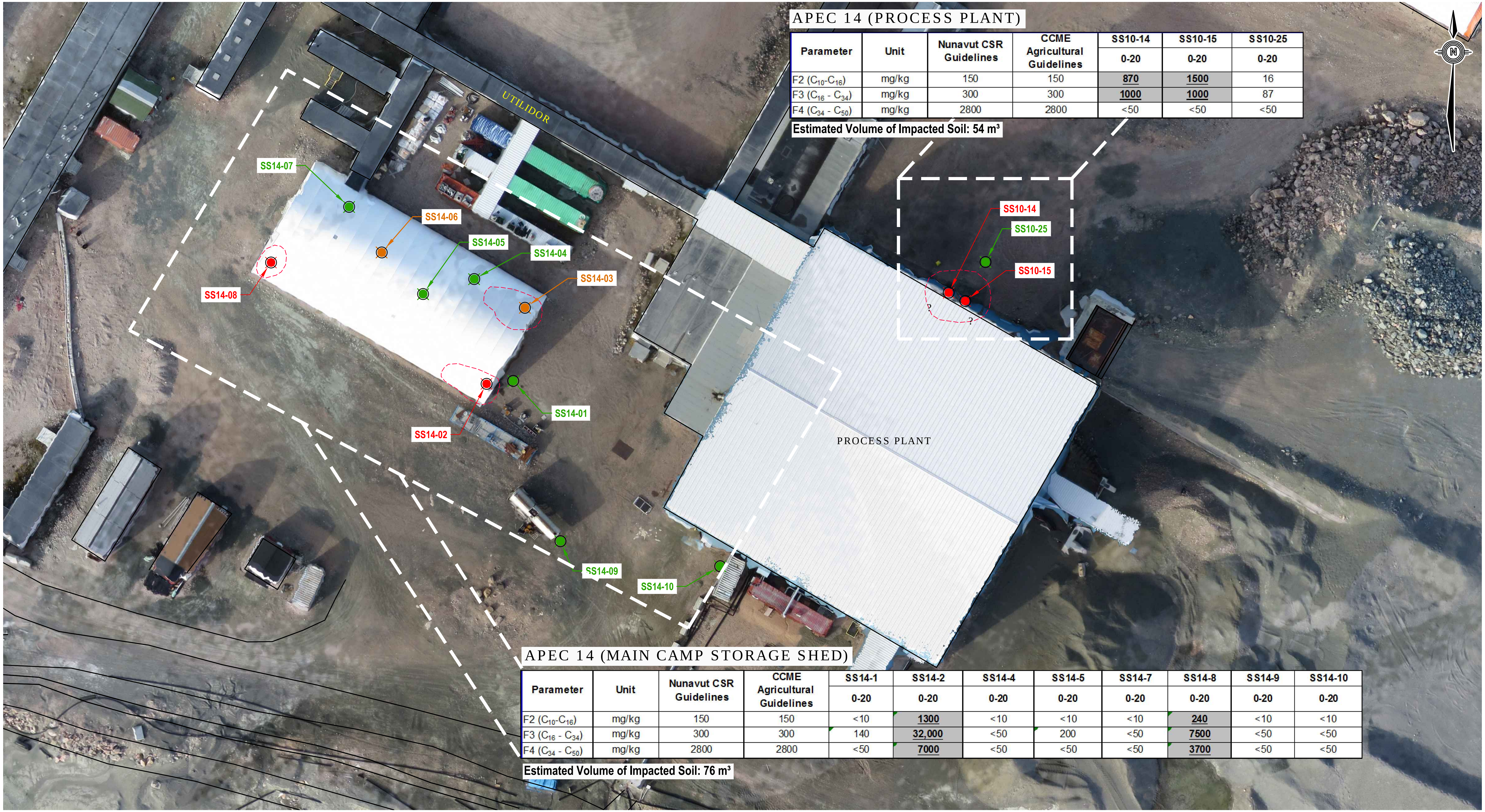

APEC 14 (PROCESS PLANT)

Parameter	Unit	Nunavut CSR Guidelines	CCME Agricultural Guidelines	SS10-14 0-20	SS10-15 0-20	SS10-25 0-20
F2 (C_{10}-C_{16})	mg/kg	150	150	**870**	**1500**	16
F3 (C_{16} - C_{34})	mg/kg	300	300	**1000**	**1000**	87
F4 (C_{34} - C_{50})	mg/kg	2800	2800	<50	<50	<50

Estimated Volume of Impacted Soil: 54 m³

APEC 14 (MAIN CAMP STORAGE SHED)

Parameter	Unit	Nunavut CSR Guidelines	CCME Agricultural Guidelines	SS14-1 0-20	SS14-2 0-20	SS14-4 0-20	SS14-5 0-20	SS14-7 0-20	SS14-8 0-20	SS14-9 0-20	SS14-10 0-20
F2 (C_{10}-C_{16})	mg/kg	150	150	<10	**1300**	<10	<10	<10	**240**	<10	<10
F3 (C_{16} - C_{34})	mg/kg	300	300	140	**32,000**	<50	200	<50	**7500**	<50	<50
F4 (C_{34} - C_{50})	mg/kg	2800	2800	<50	**7000**	<50	<50	<50	**3700**	<50	<50

Estimated Volume of Impacted Soil: 76 m³

LEGEND:
- SOIL SAMPLE LOCATION
- BELOW APPLICABLE GUIDELINES - SOIL
- ABOVE APPLICABLE GUIDELINES - SOIL
- NOT ANALYSED
- APPROXIMATE EXTENT OF IMPACTED SOIL

0 25m
Scale: 1:500 @ 11"x17"

NOTE:
BASE AIRPHOTOS PROVIDED BY OLLERHEAD & ASSOCIATES LTD., AUGUST 2014

STATUS
ISSUED FOR USE

Notes:
NG - No guideline
BOLD - Exceeds CSR Guideline
Shaded - Exceeds CCME Guideline
Italic - Detection limit greater than guideline
N/A - Not applicable
Blank - Not analyzed

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APEC 14 - PROCESS PLANT
SOIL SAMPLE LOCATIONS

PROJECT NO.	DWN	CKD	REV
E14103202	GDK/DBD	WTH	0

OFFICE	DATE
EDM	December 2014

Figure B.13

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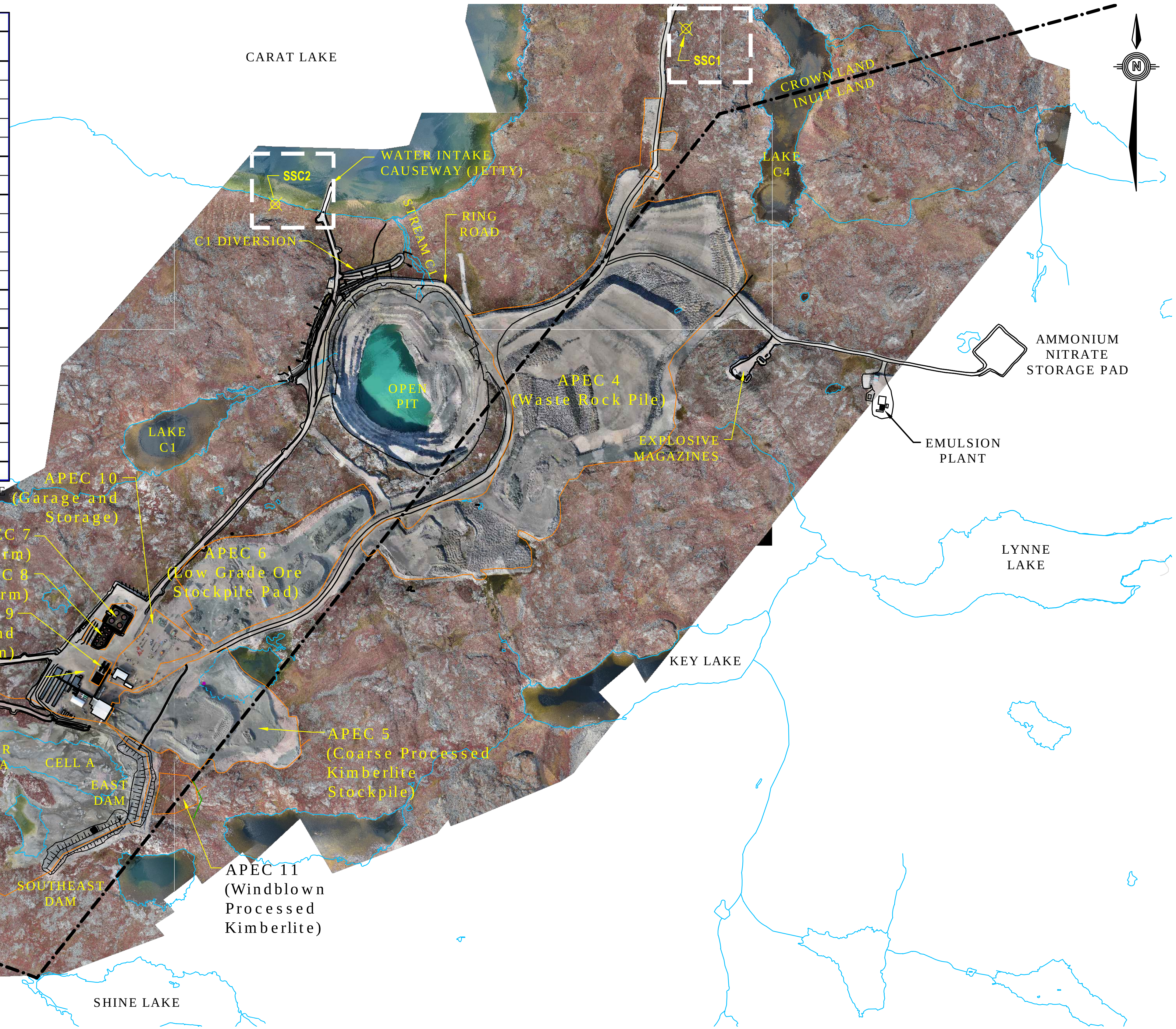
Parameter	Unit	Nunavut CSR Guidelines	CCME Agricultural Guidelines	SSC1	SSC2	SSC3
				20-40	20-30	20-30
Metals						
Antimony	mg/kg	20	20	<1.0	<1.0	<1.0
Arsenic	mg/kg	12	12	2.3	2.1	3.9
Barium	mg/kg	750	750	19	26	21
Beryllium	mg/kg	4	4	<0.40	<0.40	<0.40
Boron	mg/kg	2	2	<0.10	<0.10	<0.10
Cadmium	mg/kg	1.4	1.4	<0.10	<0.10	<0.10
Chromium (hexavalent)	mg/kg	0.4	0.4	<0.15	<0.15	<0.15
Chromium	mg/kg	64	64	18	17	27
Cobalt	mg/kg	40	40	5.0	5.4	4.8
Copper	mg/kg	63	63	18	14	8.7
Lead	mg/kg	70	70	2.3	2.3	2.5
Mercury	mg/kg	6.6	6.6	<0.050	<0.050	<0.050
Molybdenum	mg/kg	5	5	<0.40	<0.40	<0.40
Nickel	mg/kg	50	50	16	15	16
Selenium	mg/kg	1	1	<0.50	<0.50	<0.50
Silver	mg/kg	20	20	<1.0	<1.0	<1.0
Thallium	mg/kg	1	1	<0.30	<0.30	<0.30
Tin	mg/kg	5	0.1	<1.0	<1.0	<1.0
Uranium	mg/kg	23	23	1.2	1.1	<1.0
Vanadium	mg/kg	130	130	30	20	18
Zinc	mg/kg	200	200	18	18	17



LEGEND:

- CONTROL SOIL SAMPLE LOCATION

0 500m

Scale: 1:12,500 @ 11"x17"

NOTE:
BASE AIRPHOTOS PROVIDED BY OLLERHEAD & ASSOCIATES LTD., AUGUST 2014

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CONTROL SOIL SAMPLE LOCATIONS

PROJECT NO.	DWN	CKD	REV
E14103202	GDK/DBD	WTH	0
OFFICE	DATE		
EDM	December 2014		

Figure B.14

APPENDIX C
DETAILED COST SHEETS

Water Monitoring Cost Breakdown

TASK NO.	ITEM / INDIVIDUAL	LEVEL	UNIT	RATE	QUANTITY	TOTAL	SUBTOTAL
1.0	**Project Management and Field Prep**						
	Project Management	Consultant	hr	$ 182.00	16	$ 2,912.00	
	Field Preparation	Consultant	hr	$ 182.00	16	$ 2,912.00	
							$5,824.00
2.0	**Water Monitoring Site Inspection**						
	Mob/Demob - Project Scientist	Consultant	hr	$ 182.00	16	$ 2,912.00	
	Field Work	Consultant	hr	$ 182.00	84	$ 15,288.00	
	Hotels, Subsidence		disb	$ 300.00	1	$ 300.00	
	Commercial Flights		disb	$ 450.00	1	$ 450.00	
	Charter Flight		disb	$ 6,700.00	1	$ 6,700.00	
	Bear Monitor		day	$ 550.00	8	$ 4,400.00	
	Misc Equipment and Supplies		disb	$ 1,000.00	1	$ 1,000.00	
	Water Samples		unit	$ 8,200.00	1	$ 8,200.00	
	Food		day	$ 100.00	7	$ 700.00	
	Freight		disb	$ 1,000.00	1	$ 1,000.00	
							$40,950.00
3.0	**Reporting**						
		Consultant	hr	$ 182.00	70	$ 12,740.00	
		Corporate Consultant	hr	$ 264.00	30	$ 7,920.00	
						TOTAL	**$46,774.00**

Geotechnical Inspection Cost Breakdown

TASK NO.	ITEM / INDIVIDUAL	LEVEL	UNIT	RATE	QUANTITY	TOTAL	SUBTOTAL
1.0	**Project Management and Field Prep**						
	Project Management	Consultant	hr	$ 182.00	16	$ 2,912.00	
	Field Preparation	Consultant	hr	$ 182.00	16	$ 2,912.00	
							$5,824.00
2.0	**Geotechnical Inspection**						
	Mob/Demob - Project Scientist	Consultant	hr	$ 182.00	16	$ 2,912.00	
	Field Work		hr	$ 182.00	36	$ 6,552.00	
	Hotels, Subsidence		disb	$ 300.00	1	$ 300.00	
	Commercial Flights		disb	$ 450.00	1	$ 450.00	
	Charter Flight		disb	$ 6,700.00	1	$ 6,700.00	
	Samples		disb	$ 162.00	5	$ 810.00	
	Bear Monitor		day	$ 550.00	4	$ 2,200.00	
	Misc. equipment and supplies			$ 700.00	1	$ 700.00	
	Food		day	$ 100.00	4	$ 400.00	
	Freight			$ 700.00	1	$ 700.00	
							$21,724.00
3.0	**Reporting**						
		Consultant	hr	$ 182.00	70	$ 12,740.00	
		Corporate Consultant	hr	$ 264.00	30	$ 7,920.00	
						TOTAL	**$27,548.00**

Care and Maintenance: Scenario 1

TASK NO.	ITEM / INDIVIDUAL	LEVEL	UNIT	RATE	QUANTITY	TOTAL	SUBTOTAL
1.0	**Project Management and Field Prep**						
	Project Management	Consultant	hr	$ 182.00	120	$ 21,840.00	
	Field Preparation	Consultant	hr	$ 182.00	120	$ 21,840.00	
							$43,680.00
2.0	**Care and Maintenance Site Inspection**						
	Mob/Demob - Project Scientist	Consultant	hr	$ 182.00	84	$ 15,288.00	
	Mob/Demob - Bear Monitor		day	$ 550.00	7	$ 3,850.00	
	Charter Flight		disb	$ 6,700.00	5	$ 33,500.00	
	Misc Equipment and Supplies		disb	$ 1,000.00	5	$ 5,000.00	
	Food		day	$ 300.00	23	$ 6,900.00	
	Freight		disb	$ 1,000.00	5	$ 5,000.00	
							$69,538.00
3.0	**On-Site Water Management - Tank Farm Berms**						
	Field Work	Consultant	hr	$ 182.00	48	$ 8,736.00	
	Bear Monitor		day	$ 550.00	4	$ 2,200.00	
	Mechanic	Consultant	hr	$ 182.00	48	$ 8,736.00	
	Lab Samples		unit	$ 1,000.00	1	$ 1,000.00	
							$ 20,672.00
4.0	**On-Site Water Management - PKCA**						
	Field Work	Consultant	hr	$ 182.00	36	$ 6,552.00	
	Bear Monitor		day	$ 550.00	3	$ 1,650.00	
	Lab Samples		unit	$ 1,000.00	1	$ 1,000.00	
	Mechanic	Consultant	hr	$ 182.00	36	$ 6,552.00	
							$ 15,754.00
5.0	**On-Site Maintenance - C1 Diversion**						
	Field Work	Consultant	hr	$ 182.00	36	$ 6,552.00	
	Bear Monitor		day	$ 550.00	3	$ 1,650.00	
	Mechanic	Consultant	hr	$ 182.00	36	$ 6,552.00	
							$ 14,754.00
6.0	**On-Site Inspection and Maintenance - Camp and Shop Facilities**						
	Field Work	Consultant	hr	$ 182.00	36	$ 6,552.00	
	Bear Monitor		day	$ 550.00	3	$ 1,650.00	
	Mechanic	Consultant	hr	$ 182.00	36	$ 6,552.00	
							$ 14,754.00
7.0	**On-Site Maintenance - Roads and Airstrip**						
	Field Work	Consultant	hr	$ 182.00	48	$ 8,736.00	
	Bear Monitor		day	$ 550.00	4	$ 2,200.00	
	Mechanic	Consultant	hr	$ 182.00	48	$ 8,736.00	
							$ 19,672.00
8.0	**On-Site Miscellaneous Maintenance**						
	Field Work	Consultant	hr	$ 182.00	48	$ 8,736.00	
	Bear Monitor		day	$ 550.00	3	$ 1,650.00	
	Mechanic	Consultant	hr	$ 182.00	48	$ 8,736.00	
							$ 19,122.00
9.0	**Fuel**						
	Diesel		disb	$ 290.00	60	$ 17,400.00	
	Charter Flights		disb	$ 9,500.00	3	$ 28,500.00	
							$ 45,900.00
						TOTAL	**$263,846.00**

Care and Maintenance: Scenario 2

TASK NO.	ITEM / INDIVIDUAL	LEVEL	UNIT	RATE	QUANTITY	TOTAL	SUBTOTAL
1.0	**Project Management and Field Prep**						
	Project Management	Consultant	hr	$ 182.00	80	$ 14,560.00	
	Field Preparation	Consultant	hr	$ 182.00	80	$ 14,560.00	
							$29,120.00
2.0	**Care and Maintenance Site Inspection**						
	Mob/Demob - Project Scientist	Consultant	hr	$ 182.00	48	$ 8,736.00	
	Mob/Demob - Bear Monitor		day	$ 550.00	4	$ 2,200.00	
	Charter Flight		disb	$ 6,700.00	4	$ 26,800.00	
	Misc Equipment and Supplies		disb	$ 1,000.00	4	$ 4,000.00	
	Food		day	$ 300.00	23	$ 6,900.00	
	Freight		disb	$ 1,000.00	4	$ 4,000.00	
							$52,636.00
3.0	**On-Site Water Management - Tank Farm Berms**						
	Field Work	Consultant	hr	$ 182.00	0	$ -	
	Bear Monitor		day	$ 550.00	0	$ -	
	Mechanic	Consultant	hr	$ 182.00	0	$ -	
	Lab Samples		unit	$ 1,000.00	0	$ -	
							$ -
4.0	**On-Site Water Management - PKCA**						
	Field Work	Consultant	hr	$ 182.00	0	$ -	
	Bear Monitor		day	$ 550.00	0	$ -	
	Lab Samples		unit	$ 1,000.00	0	$ -	
	Mechanic	Consultant	hr	$ 182.00	0	$ -	
							$ -
5.0	**On-Site Maintenance - C1 Diversion**						
	Field Work	Consultant	hr	$ 182.00	36	$ 6,552.00	
	Bear Monitor		day	$ 550.00	3	$ 1,650.00	
	Mechanic	Consultant	hr	$ 182.00	36	$ 6,552.00	
							$ 14,754.00
6.0	**On-Site Inspection and Maintenance - Camp and Shop Facilities**						
	Field Work	Consultant	hr	$ 182.00	36	$ 6,552.00	
	Bear Monitor		day	$ 550.00	3	$ 1,650.00	
	Mechanic	Consultant	hr	$ 182.00	36	$ 6,552.00	
							$ 14,754.00
7.0	**On-Site Maintenance - Roads and Airstrip**						
	Field Work	Consultant	hr	$ 182.00	48	$ 8,736.00	
	Bear Monitor		day	$ 550.00	4	$ 2,200.00	
	Mechanic	Consultant	hr	$ 182.00	48	$ 8,736.00	
							$ 19,672.00
8.0	**On-Site Miscellaneous Maintenance**						
	Field Work	Consultant	hr	$ 182.00	48	$ 8,736.00	
	Bear Monitor		day	$ 550.00	3	$ 1,650.00	
	Mechanic	Consultant	hr	$ 182.00	48	$ 8,736.00	
							$ 19,122.00
9.0	**Fuel**						
	Diesel		disb	$ 290.00	30	$ 8,700.00	
	Charter Flights		disb	$ 9,500.00	2	$ 19,000.00	
							$ 27,700.00
						TOTAL	**$177,758.00**

Open Pit Name: **Open Pit** **Pit # 1**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
PERIMETER BERM									
Fence		m		#N/A	$0.00	$0		$0	$0
Signs		each		#N/A	$0.00	$0		$0	$0
Berm at crest	As per 2011 Estimate	m^3	10000	sb3h	$8.90	$89,000	100%	$89,000	$0
Block roads		m^3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
STABILITY STUDY									
Conduct stability and setback study		allow		#N/A	$0.00	$0		$0	$0
STABILIZE SLOPES									
Off-load crest, soil A	As per 2011 Estimate	m^3	6000	sb3h	$8.90	$53,400	100%	$53,400	$0
Off-load crest, soil B		m^3		#N/A	$0.00	$0		$0	$0
Doze/trim overburden at crest		m^3		#N/A	$0.00	$0		$0	$0
Drill & blast pit crest		m^3		#N/A	$0.00	$0		$0	$0
Buttress slope		m^3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
COVER/CONTOUR SLOPES									
Place fill, soil A		m^3		#N/A	$0.00	$0		$0	$0
Place fill, soil B		m^3		#N/A	$0.00	$0		$0	$0
Rip rap		m^3		#N/A	$0.00	$0		$0	$0
Vegetate slopes		ha		#N/A	$0.00	$0		$0	$0
Vegetate pit floor		ha		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
CONSTRUCT DIVERSION DITCHES									
Excavate C1 Diversion		m^3	14000	SC4h	$23.20	$324,800	100%	$324,800	$0
Armour C1 Diversion	Armour with select waste rock	m^3	750	rr2h	$20.65	$15,488	100%	$15,488	$0
Excavate Outlet		m^3	1800	sc4h	$23.20	$41,760	100%	$41,760	$0
Armour outlet base	Armour with select waste rock	m^3	250	rr2h	$20.65	$5,163	100%	$5,163	$0
CONSTRUCT SPILLWAY									
Excavate channel		m^3		#N/A	$0.00	$0		$0	$0
Concrete		m^3		#N/A	$0.00	$0		$0	$0
Rip rap		m^3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
RECLAIM QUARRIES									
Contour slopes		m^3		#N/A	$0.00	$0		$0	$0
Place overburden		m^3		#N/A	$0.00	$0		$0	$0
Vegetate		m^3		#N/A	$0.00	$0		$0	$0
FLOOD PIT-Capital									
Remove stationary equipment (sump pumps)		each		#N/A	$0.00	$0		$0	$0
Remove dewatering pipeline		m		#N/A	$0.00	$0		$0	$0
Remove power lines		each		#N/A	$0.00	$0		$0	$0
Construct diversion ditches		m^3		#N/A	$0.00	$0		$0	$0
-Ditch, mat'l A		m^3		#N/A	$0.00	$0		$0	$0
-Ditch, mat'l B		m^3		#N/A	$0.00	$0		$0	$0
Construct embankment/dam		m^3		#N/A	$0.00	$0		$0	$0
Supply/install pump station		each		#N/A	$0.00	$0		$0	$0
Supply/install piping system		m		#N/A	$0.00	$0		$0	$0
Remove pump post-closure	As per 2011 Estimate @ $5,000. Allow for increase to 2015 costs ($7,500).	each	1	#N/A	$0.00	$0	100%	$0	$0
Remove pipeline post-closure		m		#N/A	$0.00	$0		$0	$0
FLOOD PIT-Annual Cost									
Operate pumps (power)		m^3		#N/A	$0.00	$0		$0	$0
Maintain pump/pipeline		allow		#N/A	$0.00	$0		$0	$0
Labour: fuel management, commissioning/decom		$/h		#N/A	$0.00	$0		$0	$0
Chemical addition, _____ kg/m3 of water		tonne		#N/A	$0.00	$0		$0	$0
Chemicals, purchase and shipping		tonne		#N/A	$0.00	$0		$0	$0
Passive/biological additives		$/ha		#N/A	$0.00	$0		$0	$0
Passive additives purchase and shipping		tonne		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
					Annual pumping costs	$0			
Number of years of pump flooding		years							
					Total pumping costs	$0		$0	$0
					Total	$529,610		$529,610	$0
					% of Total			100%	0%

Tailings Impoundment Name: **PKCA: Cell A** **Pond # 1**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
CONTROL ACCESS									
Fence		m		#N/A	$0.00	$0		$0	$0
Signs		each		#N/A	$0.00	$0		$0	$0
Berm		m^3		#N/A	$0.00	$0		$0	$0
Block roads		m^3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
STABILIZE EMBANKMENT(S)									
Toe buttress, drainage layer		m^3		#N/A	$0.00	$0		$0	$0
Toe buttress, bulk fill		m^3		#N/A	$0.00	$0		$0	$0
Rip rap		m^3		#N/A	$0.00	$0		$0	$0
Vegetate		ha		#N/A	$0.00	$0		$0	$0
Raise crest		m^3		#N/A	$0.00	$0		$0	$0
Flatten slopes		m^3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
COVER TAILINGS									
Grade/shape tailings surface		m^3		#N/A	$0.00	$0		$0	$0
Liner bedding		m^3		#N/A	$0.00	$0		$0	$0
Subgrade preparation - compact		m^2		#N/A	$0.00	$0		$0	$0
Supply geotextile/geosynthetic		m^2		#N/A	$0.00	$0		$0	$0
Install geotextile/geosynthetic		m^2		#N/A	$0.00	$0		$0	$0
Soil Cover		m^3		#N/A	$0.00	$0		$0	$0
Rock cover	Cap with waste rock (till and coarse PK)	m^3	136,000	SB3s	$18.36	$2,497,183	100%	$2,497,183	$0
Vegetate		m^2		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
BURY PAG ROCK									
Relocate PAG rock		m^3		#N/A	$0.00	$0		$0	$0
Place cover over PAG rock		m^3		#N/A	$0.00	$0		$0	$0
Raise crest of dam		m^3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
STABILIZE DECANT SYSTEM									
Excavate and replace		m^3		#N/A	$0.00	$0		$0	$0
Plug/backfill with concrete or clay		m^3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
REMOVE TAILINGS DISCHARGE									
Cyclones		m^3		#N/A	$0.00	$0		$0	$0
Pipe	As per 2011 Estimate	m	1,000	PLRh	$72.00	$72,000	100%	$72,000	$0
Remove reclaim barge		allow		#N/A	$0.00	$0		$0	$0
CONSTRUCT DIVERSION DITCHES									
Excavate ditches -soil		m^3		#N/A	$0.00	$0		$0	$0
Excavate ditches -rock		m^3		#N/A	$0.00	$0		$0	$0
Rip rap in channel base		m^3		#N/A	$0.00	$0		$0	$0
FLOOD TAILINGS									
Doze tailings to final contour		m^3		#N/A	$0.00	$0		$0	$0
Raise crest of dam		m^3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
UPGRADE SPILLWAY									
Excavate channel, rock		m^3		#N/A	$0.00	$0		$0	$0
Excavate channel, soil		m^3		#N/A	$0.00	$0		$0	$0
Concrete		m^3		#N/A	$0.00	$0		$0	$0
Rip rap		m^3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
CONSTRUCT SEEPAGE COLLECTION POND									
Excavate seepage collection pond		m^3		#N/A	$0.00	$0		$0	$0
Doze & spread excavated material		m^3		#N/A	$0.00	$0		$0	$0
Vegetate spread material		ha		#N/A	$0.00	$0		$0	$0
Bedding layer		m^3		#N/A	$0.00	$0		$0	$0
Supply geomembrane		m^2		#N/A	$0.00	$0		$0	$0
Install geomembrane		m^2		#N/A	$0.00	$0		$0	$0
Erosion protection layer		m^3		#N/A	$0.00	$0		$0	$0
INSTALL GROUNDWATER COLLECTION SYSTEM									
Excavate/install sumps		m^3		#N/A	$0.00	$0		$0	$0
Install pumping wells		m^3		#N/A	$0.00	$0		$0	$0
Install pumps/pipelines/power supply		LS		#N/A	$0.00	$0		$0	$0
SPECIALIZED ITEMS									
Install permanent instrumentation, supply & technican		each		#N/A	$0.00	$0		$0	$0
Install permanent instrumentation, drilling		each		#N/A	$0.00	$0			$0
TREAT SEEPAGE - see "Water Management" and "Water Treatment"									
TREAT SUPERNATANT									
Pump water (to pit, U/G)		m^3		#N/A	$0.00	$0		$0	$0
Equipment maintenance and parts		allow		#N/A	$0.00	$0		$0	$0
Supply reagents		tonne		#N/A	$0.00	$0		$0	$0
				Annual treatment costs		$0			
Number of years of treatment		years							
				Total treatment costs		$0			$0
					Total	$2,569,183		$2,569,183	$0
					% of Total			100%	0%

* for construction of passive treatment system refer to "Water Management"

Rock Pile Name: **Stockpile**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
STABILIZE SLOPES									
Flatten slopes with dozer	Low grade dump (31,365 cu.m), Coarse Rejects (19,370 cu.m) Preferred Alternative: re-grade for aesthetics	m^3	50,735	DRh	$2.40	$121,764	100%	$121,764	$0
Flatten "bubble dump" areas		m^3		#N/A	$0.00	$0		$0	$0
Divert runon, ditch mat'l A		m^3		#N/A	$0.00	$0		$0	$0
Divert runon, ditch mat'l B		m^3		#N/A	$0.00	$0		$0	$0
Toe buttress, drain mat'l		m^3		#N/A	$0.00	$0		$0	$0
Toe buttress, fill mat'l A		m^3		#N/A	$0.00	$0		$0	$0
Toe buttress, fill mat'l B		m^3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
GRADE BORROW AREAS									
Shape and grade borrow areas	Grade borrow area A to promote positive drainage	m^3	15,000	DRh	$2.40	$36,000	100%	$36,000	$0
COVER ROCK PILE									
Subgrade preparation - doze surface		m^3		#N/A	$0.00	$0		$0	$0
Soil cover - excavate,haul,spread&compact	however, not considered as preferred alternative	m^3		#N/A	$0.00	$0		$0	$0
Rock cover - excavate, haul & spread		m^3		#N/A	$0.00	$0		$0	$0
Excavate downslope drainage channel & chute		m^3		#N/A	$0.00	$0		$0	$0
Rip rap drainage channel and chute		m^3		#N/A	$0.00	$0		$0	$0
Vegetate		ha		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
VERY LOW PERMEABILITY COVER (in addition to above)									
Liner subgrade preparation - compact		m^2		#N/A	$0.00	$0		$0	$0
Supply geomembrame		m^2		#N/A	$0.00	$0		$0	$0
Install geomembrane		m^2		#N/A	$0.00	$0		$0	$0
Protective cover - excavate,haul,spread&compact		m^3		#N/A	$0.00	$0		$0	$0
Vegetate		ha		#N/A	$0.00	$0		$0	$0
Install infiltration/seepage instrumentation		allow		#N/A	$0.00	$0		$0	$0
CONSTRUCT DIVERSION DITCHES									
Excavate ditches -soil		m^3		#N/A	$0.00	$0		$0	$0
Excavate ditches -rock		m^3		#N/A	$0.00	$0		$0	$0
Rip rap in channel base		m^3		#N/A	$0.00	$0		$0	$0
CONSTRUCT SEEPAGE COLLECTION POND									
Excavate seepage collection pond		m^3		#N/A	$0.00	$0		$0	$0
Doze & spread excavated material		m^3		#N/A	$0.00	$0		$0	$0
Vegetate spread material		ha		#N/A	$0.00	$0		$0	$0
Bedding layer		m^3		#N/A	$0.00	$0		$0	$0
Supply geomembrane		m^2		#N/A	$0.00	$0		$0	$0
Install geomembrane		m^2		#N/A	$0.00	$0		$0	$0
Erosion protection layer		m^3		#N/A	$0.00	$0		$0	$0
INSTALL GROUNDWATER COLLECTION SYSTEM									
Excavate/install sumps		m^3		#N/A	$0.00	$0		$0	$0
Install pumping wells		m^3		#N/A	$0.00	$0		$0	$0
Install pumps/pipelines/power supply		allow		#N/A	$0.00	$0		$0	$0
RELOCATE DUMPS									
Load, haul, dump or doze		m^3		#N/A	$0.00	$0		$0	$0
Add lime		tonne		#N/A	$0.00	$0		$0	$0
Contour reclaimed area	2011 Estimate to Vegetate Borrow Areas; however, not considered as preferred alternative	ha		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
SPECIALIZED ITEMS									
Install permanent instrumentation		each		#N/A	$0.00	$0		$0	$0
Install permanent instrumentation, drilling		each		#N/A	$0.00	$0		$0	$0
TREAT ROCK PILE SEEPAGE - see "Water Management"									
HEAP LEACH SEEPAGE TREATMENT - Cyanide Detox									
Cyanide destruction water treatment pumping		m^3		#N/A	$0.00	$0		$0	$0
Reagents		tonnes		#N/A	$0.00	$0		$0	$0
Electrician/mechanic to maintain treatment plant		allow		#N/A	$0.00	$0		$0	$0
Equipment maintenance and parts		allow		#N/A	$0.00	$0		$0	$0
			Annual treatment costs			$0			
Number of years of treatment		years							
			Total treatment costs			$0			$0
HEAP LEACH SEEPAGE TREATMENT - ARD/ML**									
Upgrade/modify pumping system - report to WTP		allow		#N/A	$0.00	$0			$0
					Total	$157,764		$157,764	$0
					% of Total			100%	0%

* For construction of passive treatment system refer to "Water Management". ARD/ML seepage treatment becomes post-closure water treatment cost

**Heap leach ARD/ML seepage treatment becomes post-closure water treatment cost

Building / Equip: Scenario 1 **Primary Buildings** **Bldg / Equip #: 1**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
DISPOSE MOBILE EQUIPMENT									
Decontaminate and ship off-site		allow		#N/A	$0.00	$0		$0	$0
Decontaminate and dispose on-site		allow		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
REMOVE BUILDINGS - see note below									
Accommodation Complex	ESA: Camp Facility 5341 sq.m	m^{2}	5,341	BRWI	$27.50	$146,878	100%	$146,878	$0
Process Facilities	ESA: Process Plant 2048 sq.m & 23 m high, AppF showing 6 floors in parts of bldg - therefore footprint x6	m^{3}	12,288	BRS2h	$100.00	$1,228,800	100%	$1,228,800	$0
Offices, Repair, Lab, Warehouse		m^{4}		BRS1h	$65.00	$0	100%	$0	$0
Storage Facilities		m^{5}		#N/A	$0.00	$0		$0	$0
Water and Wastewater Treatment Facilities		m^{6}		#N/A	$0.00	$0		$0	$0
U/G Heating Plant		m^{7}		#N/A	$0.00	$0		$0	$0
Emulsion Plant		m^{8}		#N/A	$0.00	$0		$0	$0
AN Storage Facility		m^{9}		#N/A	$0.00	$0		$0	$0
Warehouse, Shops and Other	ESA: Truck Shop 872 sq.m Revised to AppF dimensions and 1,138 sq.m & 12 m high, AppF showing 3 levels in parts - therefore footprint x3	m^{10}	3,414	BRS2h	$100.00	$341,400	100%	$341,400	$0
Storage Facility at Laydown/Airstrip		m^{11}		#N/A	$0.00	$0		$0	$0
Fuel tanks	ESA: x8- 500,000L tanks	m^{12}	2,815	BRS1l	$45.00	$126,669	100%	$126,669	$0
Fuel Tanks	ESA: x4- 1,500,000L tanks	m^{13}	2,991	BRS1l	$45.00	$134,586	100%	$134,586	$0
Freshwater intake		m^{14}		#N/A	$0.00	$0		$0	$0
Reclaim pumps		m^{15}		#N/A	$0.00	$0		$0	$0
Outfall & Diffuser		m^{16}		#N/A	$0.00	$0		$0	$0
Airstrip lighting, navigation, electrician		m^{17}		#N/A	$0.00	$0		$0	$0
Airstrip lighting, navigation, mechanical		m^{18}		#N/A	$0.00	$0		$0	$0
Break foundation slabs		m^{19}		#N/A	$0.00	$0		$0	$0
Consolidate & dump boneyard debris	ESA: Wood = 980 cu.m + Metals 15,722 cu.m + 124,000 cu.m tanks Total 225,055 cu.m Note: Crushed volumes = 61,440 cu.m	m^{20}	61,440	SB4h	$11.00	$675,840	100%	$675,840	$0
Other	As per 2011 Estimate; Misc. Allowance	m^{21}	1,500	BRS1h	$65.00	$97,500	100%	$97,500	$0
LANDFILL FOR DEMOLITION WASTE									
Erosion Protection		m^{3}	1,000	rr2h	$20.65	$20,650	100%	$20,650	$0
Berms and Base		m^{3}	52,500	SC4h	$23.20	$1,218,000	100%	$1,218,000	$0
Vegetate		ha		#N/A	$0.00	$0		$0	$0
GRADE AND CONTOUR PADS									
Accommodation Complex		ha		#N/A	$0.00	$0		$0	$0
Process Facilities		ha		#N/A	$0.00	$0		$0	$0
Offices, Repair, Lab, Warehouse		ha		#N/A	$0.00	$0		$0	$0
Storage Facilities		ha		#N/A	$0.00	$0		$0	$0
Water and Wastewater Treatment Facilities		ha		#N/A	$0.00	$0		$0	$0
U/G Heating Plant		ha		#N/A	$0.00	$0		$0	$0
Emulsion Plant		ha		#N/A	$0.00	$0		$0	$0
Warehouse, Shops and Other		ha		#N/A	$0.00	$0		$0	$0
Place rock cover	Legacy from 2011 Estimate: No alternative discussed re: Placing soil cover and vegetating	m^{3}		#N/A	$0.00	$0		$0	$0
Vegetate	Legacy from 2011 Estimate: No alternative discussed re: Placing soil cover and vegetating	ha		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
PUNCTURE LINED SUMPS									
Puncture liner and place soil cover		m^{3}		#N/A	$0.00	$0		$0	$0
RECLAIM ROADS									
Remove culverts	ESA: Table 7.4-1	each	7	#N/A	$1,000.00	$7,000	100%	$7,000	$0
Remove bridges		each		#N/A	$0.00	$0		$0	$0
Scarify and install water breaks	No Preferred Alternative to scarify	ha		#N/A	$0.00	$0		$0	$0
Scarify airstrip		ha		#N/A	$0.00	$0		$0	$0
Scarify laydown areas		ha		#N/A	$0.00	$0		$0	$0
Vegetate		ha		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
SPECIALIZED ITEMS									
Dispose of misc. debris and laydown area refuse				#N/A	$0.00	$0		$0	$0
					Total	$3,997,322		$3,997,322	$0
					% of Total			100%	0%

Note: Unit costs are based on 3m high, single storey building. Scale larger building areas accordingly. E.g. 10m high building multiply area by 3.3 (10/3)

Building / Equip: Scenario 2 | **Primary Buildings** | **Bldg / Equip #: 1**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
DISPOSE MOBILE EQUIPMENT									
Decontaminate and ship off-site		allow		#N/A	$0.00	$0		$0	$0
Decontaminate and dispose on-site		allow		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
REMOVE BUILDINGS - see note below									
Accommodation Complex	ESA: Camp Facility 5341 sq.m	m^2	0	BRWh	$41.00	$0	100%	$0	$0
Process Facilities		m^2		#N/A	$0.00	$0	100%	$0	$0
Offices, Repair, Lab, Warehouse	ESA: Process Plant 2048 sq.m, steel	m^2	0	BRS1h	$65.00	$0	100%	$0	$0
Storage Facilities		m^2		#N/A	$0.00	$0		$0	$0
Water and Wastewater Treatment Facilities		m^2		#N/A	$0.00	$0		$0	$0
U/G Heating Plant		m^2		#N/A	$0.00	$0		$0	$0
Emulsion Plant		m^2		#N/A	$0.00	$0		$0	$0
AN Storage Facility		m^2		#N/A	$0.00	$0		$0	$0
Warehouse, Shops and Other	ESA: Truck Shop 872 sq.m, steel, x2 floors	m^2	0	BRS1h	$65.00	$0	100%	$0	$0
Storage Facility at Laydown/Airstrip		m^2		#N/A	$0.00	$0		$0	$0
Fuel tanks	ESA: x8- 500,000L tanks	m^2	2,815	BRS1h	$65.00	$182,966	100%	$182,966	$0
Fuel Tanks	ESA: x4- 1,500,000L tanks	m^2	2,991	BRS1h	$65.00	$194,402	100%	$194,402	$0
Freshwater intake		m^2		#N/A	$0.00	$0		$0	$0
Reclaim pumps		m^2		#N/A	$0.00	$0		$0	$0
Outfall & Diffuser		m^2		#N/A	$0.00	$0		$0	$0
Airstrip lighting, navigation, electrician		mandays		#N/A	$0.00	$0		$0	$0
Airstrip lighting, navigation, mechanical		mandays		#N/A	$0.00	$0		$0	$0
Break foundation slabs		m^2		#N/A	$0.00	$0		$0	$0
Consolidate & dump boneyard debris		m^3	0	SB4h	$11.00	$0	100%	$0	$0
Other	As per 2011 Estimate; Misc. Allowance	m^2	500	BRS1h	$65.00	$32,500	100%	$32,500	$0
LANDFILL FOR DEMOLITION WASTE									
Erosion Protection		m^3	100	rr2h	$20.65	$2,065	100%	$2,065	$0
Berms and Base		m^3	8,000	SC4h	$23.20	$185,600	100%	$185,600	$0
Vegetate		ha		#N/A	$0.00	$0		$0	$0
GRADE AND CONTOUR PADS									
Accommodation Complex		ha		#N/A	$0.00	$0		$0	$0
Process Facilities		ha		#N/A	$0.00	$0		$0	$0
Offices, Repair, Lab, Warehouse		ha		#N/A	$0.00	$0		$0	$0
Storage Facilities		ha		#N/A	$0.00	$0		$0	$0
Water and Wastewater Treatment Facilities		ha		#N/A	$0.00	$0		$0	$0
U/G Heating Plant		ha		#N/A	$0.00	$0		$0	$0
Emulsion Plant		ha		#N/A	$0.00	$0		$0	$0
Warehouse, Shops and Other		ha		#N/A	$0.00	$0		$0	$0
Place rock cover	Legacy from 2011 Estimate: No alternative discussed re: Placing soil cover and vegetating	m^3		#N/A	$0.00	$0		$0	$0
Vegetate	Legacy from 2011 Estimate: No alternative discussed re: Placing soil cover and vegetating	ha		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
PUNCTURE LINED SUMPS									
Puncture liner and place soil cover		m^3		#N/A	$0.00	$0		$0	$0
RECLAIM ROADS									
Remove culverts	ESA: Table 7.4-1	each	7	#N/A	$1,000.00	$7,000	100%	$7,000	$0
Remove bridges		each		#N/A	$0.00	$0		$0	$0
Scarify and install water breaks	No Preferred Alternative to scarify	ha		#N/A	$0.00	$0		$0	$0
Scarify airstrip		ha		#N/A	$0.00	$0		$0	$0
Scarify laydown areas		ha		#N/A	$0.00	$0		$0	$0
Vegetate		ha		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
SPECIALIZED ITEMS									
Dispose of misc. debris and laydown area refuse				#N/A	$0.00	$0		$0	$0
					Total	$604,533		$604,533	$0
					% of Total			100%	0%

Note: Unit costs are based on 3m high, single storey building. Scale larger building areas accordingly. E.g. 10m high building multiply area by 3.3 (10/3)

Chemicals/Soil Area Name: Scenario 1 Clean Up

Note: The procedures, equipment and packaging for clean up and removal of chemicals or contaminated soils are highly dependent on the nature of the chemicals and their existing state of containment. Government guidelines should be consulted on an individual chemical basis. Any estimate made here should be considered very rough unless specific evaluations have been conducted.

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
HAZARDOUS MATERIALS AUDIT									
Hazardous materials audit		mandays		#N/A	$0.00	$0		$0	$0
BUILDING DECONTAMINATION & CONSOLIDATION OF HAZARDOUS MATERIALS									
Environmental technician/coordinator	Assume x2 Consultants for 1 season = 3 months: +Building Demolition; +Soil Remediation; and +Barrel Characterization	manhours	2,208	ENVCOh	$130.00	$287,040	100%	$287,040	$0
Decontaminate: oil, fuel		manhours		#N/A	$0.00	$0		$0	$0
Decontaminate maintenance shop		manhours		#N/A	$0.00	$0		$0	$0
Decontaminate power plant		manhours		#N/A	$0.00	$0		$0	$0
Decontaminate bulk fuel storage		manhours		#N/A	$0.00	$0		$0	$0
Decontaminate ANFO plant		manhours		#N/A	$0.00	$0		$0	$0
Decontaminate offices/warehouse/accom	Allow x6 labours for 1 season = 3 months: for all building decontamination + hazmat consolidation	manhours	6,624	Lab-sh	$49.60	$328,550	100%	$328,550	$0
Removal of asbestos siding on buildings	ESA: no asbestos	m^2		#N/A	$0.00	$0		$0	$0
Removal of friable asbestos on equipment	ESA: no asbestos	m^2		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
HAZARDOUS MATERIALS REMOVAL									
Waste oils		litre		#N/A	$0.00	$0		$0	$0
Waste fuel	ESA: 907.5 cu.m liquid	litre	907,500	Orl	$0.43	$390,225	100%	$390,225	$0
Waste batteries		kg		#N/A	$0.00	$0		$0	$0
Assay & environmental lab reagents		kg		#N/A	$0.00	$0		$0	$0
Machine shop paints, solvents etc		litre		#N/A	$0.00	$0		$0	$0
Glycol		litre		#N/A	$0.00	$0		$0	$0
Process reagents		kg		#N/A	$0.00	$0		$0	$0
Nuclear sources		allow		#N/A	$0.00	$0		$0	$0
Other hazardous materials		allow		#N/A	$0.00	$0		$0	$0
HAZARDOUS MATERIALS									
Transportation to disposal facility	ESA: 1,816 cu.m of hazardous material of which 907.5 cu.m liquid (assume incinerate on-site despite flashpoint) and 558 cu.m lead-in paint as a volume of whole AST - using AST transport weight of 126.6 tonnes	kmtonnes	164,580	HHW	$0.40	$65,832	100%	$65,832	$0
Disposal fees	ESA: 558 cu.m AST = 126.6 tonnes of steel	kg	126,600	HHW	$1.50	$189,900	100%	$189,900	$0
Other	Allowance for other Hazardous Materials @ transport and disposal (Various Miscellaneous materials)	each	1	HHW	$100,000.00	$100,000	100%	$100,000	$0
CONTAMINATED SOILS									
Contam. soil investigation - Phase 1		each		#N/A	$0.00	$0		$0	$0
Contam. soil investigation - Phase 2		each		#N/A	$0.00	$0		$0	$0
CONTAMINATED SOIL REMOVAL AND GRADING									
Excavate and transport to onsite facility	7,804 cu.m of PHC impacted soil	m^3	7,804	SC2h	$11.75	$91,697	100%	$91,697	$0
Grade excavations	Contour excavations and backfill as required	m^3	5,436	sb2l	$4.60	$25,006	100%	$25,006	$0
Manage hydrocarbon remediation at facility	Preferred Alternative: Treat on-site	m^3	7,804	CSRI	$47.00	$366,788	100%	$366,788	$0
Reagents/stabilizing agent		m^2		#N/A	$0.00	$0		$0	$0
Excavate and transport to offsite facility	ESA: 64 cu.m of metal impacted soil	m^3	164	HHW	$1,250.00	$205,000	100%	$205,000	$0
Contour decontaminated area		m^3		#N/A	$0.00	$0		$0	$0
CONTAMINATED SOIL VERY LOW PERMEABILITY COVER									
Supply and install geomembrane, HDPE, ES3, GCL	Preferred Alternative: Landfarm 30,000 sq.m for liner - supply and install unit cost	m^2	30,000	GSHDPEI	$7.95	$238,500	100%	$238,500	$0
Supply and install geotextile	Two layers (sandwich HDPE)	m^2	60,000	gstl	$3.44	$206,400	100%	$206,400	$0
Upper and lower bedding layers	Preferred Alternative: Landfarm 35,000 cu.m for coarse PK for bed and berms	m^3	34,000	SC4h	$23.20	$788,800	100%	$788,800	$0
Install geomembrane, HDPE, ES3, GCL		m^2		#N/A	$0.00	$0		$0	$0
Erosion protection layer		m^3		#N/A	$0.00	$0		$0	$0
Vegetate		m^2		#N/A	$0.00	$0		$0	$0
Install infiltration/seepage instrumentation		allow		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
OTHER									
				#N/A	$0.00	$0		$0	$0
					Total	$3,283,738		$3,283,738	$0
					% of Total			100%	0%

Chemicals/Soil Area Name: Scenario 2 Clean Up

Note: The procedures, equipment and packaging for clean up and removal of chemicals or contaminated soils are highly dependent on the nature of the chemicals and their existing state of containment. Government guidelines should be consulted on an individual chemical basis. Any estimate made here should be considered very rough unless specific evaluations have been conducted.

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
HAZARDOUS MATERIALS AUDIT									
Hazardous materials audit		mandays		#N/A	$0.00	$0		$0	$0
BUILDING DECONTAMINATION & CONSOLIDATION OF HAZARDOUS MATERIALS									
Environmental technician/coordinator	Assume x2 Consultants for 1 season = 3 months: +Building Demolition; +Soil Remediation; and +Barrel Characterization	manhours	2,208	ENVCOh	$130.00	$287,040	100%	$287,040	$0
Decontaminate: oil, fuel		manhours		#N/A	$0.00	$0		$0	$0
Decontaminate maintenance shop		manhours		#N/A	$0.00	$0		$0	$0
Decontaminate power plant		manhours		#N/A	$0.00	$0		$0	$0
Decontaminate bulk fuel storage		manhours		#N/A	$0.00	$0		$0	$0
Decontaminate ANFO plant		manhours		#N/A	$0.00	$0		$0	$0
Decontaminate offices/warehouse/accom	Allow x6 labours for 1 season = 3 months: for all building decontamination + hazmat consolidation	manhours	6,624	Lab-sh	$49.60	$328,550	100%	$328,550	$0
Removal of asbestos siding on buildings	ESA: no asbestos	m^2		#N/A	$0.00	$0		$0	$0
Removal of friable asbestos on equipment	ESA: no asbestos	m^2		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
HAZARDOUS MATERIALS REMOVAL									
Waste oils		litre		#N/A	$0.00	$0		$0	$0
Waste fuel	ESA: 907.5 cu.m liquid	litre	907,500	Orl	$0.43	$390,225	100%	$390,225	$0
Waste batteries		kg		#N/A	$0.00	$0		$0	$0
Assay & environmental lab reagents		kg		#N/A	$0.00	$0		$0	$0
Machine shop paints, solvents etc		litre		#N/A	$0.00	$0		$0	$0
Glycol		litre		#N/A	$0.00	$0		$0	$0
Process reagents		kg		#N/A	$0.00	$0		$0	$0
Nuclear sources		allow		#N/A	$0.00	$0		$0	$0
Other hazardous materials		allow		#N/A	$0.00	$0		$0	$0
HAZARDOUS MATERIALS									
Transportation to disposal facility	ESA: 1,816 cu.m of hazardous material of which 907.5 cu.m liquid (assume incinerate on-site despite flashpoint) and 558 cu.m lead-in paint as a volume of whole AST - using AST transport weight of 126.6 tonnes	kmtonnes	164,580	HHW	$0.40	$65,832	100%	$65,832	$0
Disposal fees	ESA: 558 cu.m AST = 126.6 tonnes of	kg	126,600	HHW	$1.50	$189,900	100%	$189,900	$0
Other	Allowance for other Hazardous Materials @ transport and disposal (Various Miscellaneous materials)	each	1	HHW	$100,000.00	$100,000	100%	$100,000	$0
CONTAMINATED SOILS									
Contam. soil investigation - Phase 1		each		#N/A	$0.00	$0		$0	$0
Contam. soil investigation - Phase 2		each		#N/A	$0.00	$0		$0	$0
CONTAMINATED SOIL REMOVAL AND GRADING									
Excavate and transport to onsite facility	7,804 cu.m of PHC impacted soil	m^3	6,436	SC2h	$11.75	$75,623	100%	$75,623	$0
Grade excavations	Contour excavations and backfill as	m^3	4,685	sb2l	$4.60	$21,549	100%	$21,549	$0
Manage hydrocarbon remediation at facility	Preferred Alternative: Treat on-site	m^3	6,436	CSRI	$47.00	$302,492	100%	$302,492	$0
Reagents/stabilizing agent		m^2		#N/A	$0.00	$0		$0	$0
Excavate and transport to offsite facility	ESA: 64 cu.m of metal impacted soil	m^3	164	HHW	$1,250.00	$205,000	100%	$205,000	$0
Contour decontaminated area		m^3		#N/A	$0.00	$0		$0	$0
CONTAMINATED SOIL VERY LOW PERMEABILITY COVER									
Supply and install geomembrame, HDPE, E	Preferred Alternative: Landfarm 25,000 sq.m for liner - supply and install unit cost	m^2	25,000	GSHDPEI	$7.95	$198,750	100%	$198,750	$0
Supply and install geotextile		m^2	50,000	gstl	$3.44	$172,000	100%	$172,000	$0
Upper and lower bedding layers	Preferred Alternative: Landfarm 29,000 cu.m for coarse PK for bed and berms	m^3	29,000	SC4h	$23.20	$672,800	100%	$672,800	$0
Install geomembrane, HDPE, ES3, GCL		m2		#N/A	$0.00	$0		$0	$0
Erosion protection layer		m^3		#N/A	$0.00	$0		$0	$0
Vegetate		m^2		#N/A	$0.00	$0		$0	$0
Install infiltration/seepage instrumentation		allow		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
OTHER									
				#N/A	$0.00	$0		$0	$0
					Total	$3,009,761		$3,009,761	$0
					% of Total			100%	0%

Capital Expenditures and Short Term Water Treatment Identified in 'Instructions' worksheet

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
DYKE A BREACH AND RAMP						
Remove fill	Dyke A Breach	m^3	3,700	SC4h	$23.20	$85,840
Granular Placement - Till	Dyke A Ramp	m^3	1,000	sb3s	$18.36	$18,362
Place erosion protection	Erosion protection on ramp and breach	m^3	600	rr2h	$20.65	$12,390
STABILIZE SEDIMENT PONDS/WATER MANAGEMENT PONDS						
Place soil cover		m^3		#N/A	$0.00	$0
Doze & spread excavated material		m^3		#N/A	$0.00	$0
Vegetate spread material		ha		#N/A	$0.00	$0
Rip-rap in channel base		each		#N/A	$0.00	$0
WEST DAM BREACH						
Breach West Dam	Preferred Alternative: Notch West Dam - remove 26,500 cu.ı	m^3	26,500	SC4h	$23.20	$614,800
Place erosion protection	load/haul/place select rock	m^3	1,000	rr2h	$20.65	$20,650
Stabilize side slopes		m^3		#N/A	$0.00	$0
Rip-rap in channel base		m^3		#N/A	$0.00	$0
BREACH DITCHES						
Excavate breaches		m^3		#N/A	$0.00	$0
Backfill/recontour		m^3		#N/A	$0.00	$0
Install flow dissipation		m^3		#N/A	$0.00	$0
Vegetate remainder of ditch		m^2		#N/A	$0.00	$0
DECOMISSION FRESH WATER SUPPLY						
Breach embankment		m		#N/A	$0.00	$0
Remove pump		LS		#N/A	$0.00	$0
Remove pipeline	ESA: 90m into Carat Lake	m	90	PSRh	$24.00	$2,160
WATER CONTROL IN RECLAMATION QUARRY						
Install pumping system		LS		#N/A	$0.00	$0
Remove pumping system		LS		#N/A	$0.00	$0
REMOVE PIPELINES						
Remove pipes		m		#N/A	$0.00	$0
Concrete plug deep pipes		m^3		#N/A	$0.00	$0
Other				#N/A	$0.00	$0
GROUNDWATER COLLECTION SYSTEM						
Excavate/install sumps		m^3		#N/A	$0.00	$0
Install pumping wells		m^3		#N/A	$0.00	$0
Install pumps/pipelines/power supply		LS		#N/A	$0.00	$0
CONSTRUCT CONTAMINATED WATER STORAGE POND						
Excavate pond		m^3		#N/A	$0.00	$0
Doze & spread excavated material		m^3		#N/A	$0.00	$0
Vegetate spread material		ha		#N/A	$0.00	$0
Bedding layer		m^3		#N/A	$0.00	$0
Supply geomembrane		m^2		#N/A	$0.00	$0
Install geomembrane		m^2		#N/A	$0.00	$0
Erosion protection layer		m^3		#N/A	$0.00	$0
CONSTRUCT PASSIVE TREATMENT SYSTEM (e.g. Constructed Wetland)						
Construct access roads		km		#N/A	$0.00	$0
Install HDPE piping system from collection pond		m		#N/A	$0.00	$0
Inter-cell flow structures		allow		#N/A	$0.00	$0
Install liners		m^2		#N/A	$0.00	$0
Install growth media		m^3		#N/A	$0.00	$0
Wetland vegetation		ha		#N/A	$0.00	$0
CONSTRUCT WATER TREATMENT PLANT						
Build treatment plant		LS		#N/A	$0.00	$0
Build sludge containment facility		LS		#N/A	$0.00	$0
					Total	$754,202

For cost of long-term/post-closure water treatment see "WATER TREATMENT" Worksheet"

Mobilization/Demobilization: Scenario 1

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
MOBILIZE HEAVY EQUIPMENT	600 km Yellowknife to Jericho		203400			
Excavators	3 x 30 tonnes (demo, earthworks,	kmtonnes	54000	MHERI	$ 3.40	$183,600
Dump trucks	5 x 25 tonnes	kmtonnes	75000	MHERI	$ 3.40	$255,000
Dozers	5 + 12 tonnes	kmtonnes	10200	MHERI	$ 3.40	$34,680
Demolition shears	1 x 5 tonnes	kmtonnes	3000	MHERI	$ 3.40	$10,200
Crane	1 x 30 tonne	kmtonnes	18000	MHERI	$ 3.40	$61,200
Loader	20 + 30 tonne	kmtonnes	30000	MHERI	$ 3.40	$102,000
Compactor	1 x 12 tonne	each	7200	MHERI	$ 3.40	$24,480
Light duty vehicles	5 trucks	each	6000	MHERI	$ 3.40	$20,400
MOBILIZE MISC. EQUIPMENT						
Pump shipping		each		#N/A	$ -	$0
Pipe shipping		m		#N/A	$ -	$0
Minor tools and equipment	x2 shipping containers of tools and equipment @ 30 tonnes	kmtonnes	36000	MHERI	$ 3.40	$122,400
Truck tires		allow		#N/A	$ -	$0
Other				#N/A	$ -	$0
MOBILIZE CAMP						
Reclamation activities	Refurbish camp	allow	1	MCRI	$ 50,000.00	$50,000
Long term reclamation activities (e.g. pump flooding)		allow		#N/A	$ -	$0
MOBILIZE WORKERS						
Reclamation activities - transport	x3 years (30 Workers x3 flights mob + 1 flight/ 2 week rotating shift change (4 flights/ season))	each	21	MWh	$ 9,100.00	$191,100
Reclamation activities - travel time	x3 years (30 Workers @ 1-day mob (10hrs) + x4 12 person cross-shifts)	manhours	2340	lab-sh	$ 49.60	$116,064
Long term reclamation activities (e.g. pump flooding) - transport		each		#N/A	$ -	$0
Long term reclamation activities (e.g. pump flooding) - travel time		each		#N/A	$ -	$0
Monitoring Airfare		each		#N/A	$ -	$0
WORKER ACCOMODATIONS						
Reclamation activities	Assume 30 workers @ x3 - 3 month seasons	mandays	8208	ACCMI	$ 100.00	$820,800
Long term reclamation activities (e.g. pump flooding)		manmonths		#N/A	$ -	$0
MOBILIZE FUEL						
Fuel freight - reclamation activities	Calculated from Resource Schedule Cost + Delivery	litre	600,000	FCDh+ FCMh	$ 1.81	$1,086,000
Fuel freight - long term reclamation activities		litre		#N/A	$ -	$0
Fuel freight accommodations		litre		#N/A	$ -	$0
WINTER ROAD (mobilization and demobilization)						
Construction and operation	Diavik to Jericho = 200 km	km	200	WRCI	$ 2,000.00	$400,000
Construction and operation	Diavik to Jericho = 200 km	km	200	WRCI	$ 2,000.00	$400,000
Limited winter use		km		#N/A	$ -	$0
Winter road tariff		km		#N/A	$ -	$0
DEMOBILIZE HEAVY EQUIPMENT	600 km Jericho to Yellowknife					
Excavators	3 x 30 tonnes (demo, earthworks,	kmtonnes	54000	MHERI	$ 3.40	$183,600
Dump trucks	5 x 25 tonnes	kmtonnes	75000	MHERI	$ 3.40	$255,000
Dozers	5 + 12 tonnes	kmtonnes	10200	MHERI	$ 3.40	$34,680
Demolition shears	1 x 5 tonnes	kmtonnes	3000	MHERI	$ 3.40	$10,200
Crane	1 x 30 tonne	kmtonnes	18000	MHERI	$ 3.40	$61,200
Loader	20 + 30 tonne	kmtonnes	30000	MHERI	$ 3.40	$102,000
Compactor	1 x 12 tonne	each	7200	MHERI	$ 3.40	$24,480
Light duty vehicles	5 trucks	km	6000	MHERI	$ 3.40	$20,400
Other	126.6 tonnes of Steel w/ lead-in-paint coat + 140.8 tonnes of metals impacted soil	0	365550	MHERI	$ 3.40	$1,242,870
DEMOBILIZE CAMP						
		allow		#N/A	$ -	$0
DEMOBILIZE WORKERS						
crew travel time	x3 years (30 Workers @ 1-day demob	manhours	900	lab-sh	$ 49.60	$44,640
crew transportation	x3 years (30 Workers x3 flights demob on Twin Otter)	each	9	MWh	$ 9,100.00	$81,900
					Total	**$5,938,894**

Mobilization/Demobilization: Scenario 2

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code		Unit Cost	Cost
MOBILIZE HEAVY EQUIPMENT	600 km Yellowknife		203400				
Excavators	3 x 30 tonnes (demo,	kmtonnes	54000	MHERl	$	3.40	$183,600
Dump trucks	5 x 25 tonnes	kmtonnes	75000	MHERl	$	3.40	$255,000
Dozers	5 + 12 tonnes	kmtonnes	10200	MHERl	$	3.40	$34,680
Demolition shears	1 x 5 tonnes	kmtonnes	3000	MHERl	$	3.40	$10,200
Crane	1 x 30 tonne	kmtonnes	18000	MHERl	$	3.40	$61,200
Loader	20 + 30 tonne	kmtonnes	30000	MHERl	$	3.40	$102,000
Compactor	1 x 12 tonne	each	7200	MHERl	$	3.40	$24,480
Light duty vehicles	5 trucks	each	6000	MHERl	$	3.40	$20,400
MOBILIZE MISC. EQUIPMENT							
Pump shipping		each		#N/A	$	-	$0
Pipe shipping		m		#N/A	$	-	$0
Minor tools and equipment	x2 shipping containers of tools and equipment @ 30 tonnes	kmtonnes	36000	MHERl	$	3.40	$122,400
Truck tires		allow		#N/A	$	-	$0
Other				#N/A	$	-	$0
MOBILIZE CAMP							
Reclamation activities	Refurbish camp	allow	1	MCRl	$	50,000.00	$50,000
Long term reclamation activities (e.g. pump flooding)		allow		#N/A	$	-	$0
MOBILIZE WORKERS							
Reclamation activities - transport	x3 years (30 Workers x3 flights mob + 1 flight/ 2 week rotating shift change (4 flights/ season))	each	21	MWh	$	9,100.00	$191,100
Reclamation activities - travel time	x3 years (30 Workers @ 1-day mob (10hrs) + x4 12 person cross-shifts)	manhours	1950	lab-sh	$	49.60	$96,720
Long term reclamation activities (e.g. pump flooding) - transport		each		#N/A	$	-	$0
Long term reclamation activities (e.g. pump flooding) - travel time		each		#N/A	$	-	$0
Monitoring Airfare		each		#N/A	$	-	$0
WORKER ACCOMODATIONS							
Reclamation activities	Assume 30 workers @ x3 - 3 month seasons	mandays	6840	ACCMl	$	100.00	$684,000
Long term reclamation activities (e.g. pump flooding)		manmonths		#N/A	$	-	$0
MOBILIZE FUEL							
Fuel freight - reclamation activities	Calculated from Resource Schedule Cost + Delivery	litre	500,000	FCDh+ FCMh	$	1.81	$905,000
Fuel freight - long term reclamation activities		litre		#N/A	$	-	$0
Fuel freight accommodations		litre		#N/A	$	-	$0
WINTER ROAD							
Construction and operation	Diavik to Jericho = 200 km	km	200	WRCl	$	2,000.00	$400,000
Construction and operation	Diavik to Jericho = 200 km	km	200	WRCl	$	2,000.00	$400,000
Limited winter use		km		#N/A	$	-	$0
Winter road tariff		km		#N/A	$	-	$0
DEMOBILIZE HEAVY EQUIPMENT	600 km Jericho to						
Excavators	3 x 30 tonnes (demo,	kmtonnes	54000	MHERl	$	3.40	$183,600
Dump trucks	5 x 25 tonnes	kmtonnes	75000	MHERl	$	3.40	$255,000
Dozers	5 + 12 tonnes	kmtonnes	10200	MHERl	$	3.40	$34,680
Demolition shears	1 x 5 tonnes	kmtonnes	3000	MHERl	$	3.40	$10,200
Crane	1 x 30 tonne	kmtonnes	18000	MHERl	$	3.40	$61,200
Loader	20 + 30 tonne	kmtonnes	30000	MHERl	$	3.40	$102,000
Compactor	1 x 12 tonne	each	7200	MHERl	$	3.40	$24,480
Light duty vehicles	5 trucks	km	6000	MHERl	$	3.40	$20,400
Other	126.6 tonnes of Steel w/ lead-in-paint coat + 140.8 tonnes of metals impacted soil	0	365550	MHERl	$	3.40	$1,242,870
DEMOBILIZE CAMP							
		allow		#N/A	$	-	$0
DEMOBILIZE WORKERS							
crew travel time	x3 years (30 Workers	manhours	750	lab-sh	$	49.60	$37,200
crew transportation	x3 years (30 Workers x3 flights demob on Twin Otter)	each	9	MWh	$	9,100.00	$81,900
						Total	**$5,594,310**

Filter by unit

Unit Cost Table (for refining unit costs see "Estimator" worksheet)

ITEM	Detail	COST CODE	UNITS	LOW $	HIGH $	SPECIFIED $	COMMENTS
ACCOMODATION							
		ACCM	manday	100.00	175.00		
BUILDINGS - DECONTAMINATE							
	Asbestos	BDA	m^2	25.60	51.20		Low: removal of asbestos siding & flooring; High: removal of insulated pipes, friable asbestos
BUILDINGS - REMOVE							Unit costs are based on 3m high, single storey building. Scale areas accordingly.
	Wood	BRW	m^2	27.50	41.00		
	Concrete	BRC	m^2	40.00	65.00	6.00	Specified: puncture concrete foundation slabs
	Steel - teardown	BRS1	m^2	45.00	65.00		
	Steel - for salvage	BRS2	m^2	67.00	100.00		
CONCRETE WORK							
	Small pour	CSF	m^3	426.50	639.75		Low: YK; High=1.5xLow
	Large pour	CLF	m^3	353.50	530.25	2,130.00	Specified: concrete crown pillar
CONTAMINATED SOILS							
	ESA Phase 1	CS1	each	7500.00			Low: small, "clean" site
	ESA Phase 1	CS2	each	50000.00			Low: small, "clean" site
	Remediate on site	CSR	m^3	47.00	146.00	90.00	mid range value - may be closer to reality, particularly if there's lots of heavy end
DOZING							
	doze rock piles	DR	m^3	1.05	2.40		Low cost: doze crest off dump
	doze overburden/soil piles	DS	m^3	0.95	3.80		High cost: push up to 300 m
EXCAVATE ROCK; LOW SPECS AND QA/QC							
	drill/blast/load/short haul	RB1	m^3	11.40	17.05		Low: quarry operations for bulk fill
	drill/blast/load/long haul	RB2	m^3	12.05	17.80		
	RB1 + spread and compact	RB3	m^3	12.05	17.80		
	RB2 + spread and compact	RB4	m^3	12.50	30.75		
	Specified activity	RBS	m^3				
EXCAVATE ROCK; HIGH SPECS AND QA/Q							(e.g. ditch/spillway excavation)
	drill/blast/load/short haul	RC1	m^3	12.05	17.80		Low: foundation excavation;High:spillway excavation
	drill/blast/load/long haul	RC2	m^3	12.70	18.40		
	RC1 + spread and compact	RC3	m^3	12.70	18.40		e.g., cover construction
	RC2 + spread and compact	RC4	m^3	13.50	19.20		e.g., cover construction
	Specified activity	RCS	m^3			175.00	Specified-drift excavation
EXCAVATE RIP-RAP							
	drill/blast/load/short haul/place	RR1	m^3	13.50	17.75		High: quarry & place rip rap in channel
	drill/blast/load/long haul/place	RR2	m^3	14.20	20.65		
	source is waste dump/short haul	RR3	m^3	7.00			cost includes sorting
	source is waste dump/long haul	RR4	m^3	7.60			
	Specified activity	RRS	m^3				
EXCAVATE SOIL; LOW SPECS AND QA/QC							
	clear & grub	SBC	m^2	3.40	5.00		
	excavate/load/short haul	SB1	m^3	4.30	5.90		
	excavate/load/long haul	SB2	m^3	4.60	7.30		
	SB1 + spread and compact	SB3	m^3	5.10	8.90	18.36	Low: non-engineered; High: engineered; Specified calculated from Estimator
	SB2 + spread and compact	SB4	m^3	5.50	11.00		Low: non-engineered; High: engineered
	Specified activity	SBS	m^3	3.20	6.30		Low: rehandle waste rock dump by dozing; High:rehandle waste rock by hauling
	Tailings	SBT	m^3	1.35	3.70	15.50	High: contour surface - wet or frozen; Specified: haul/place wet infill
EXCAVATE SOIL; HIGH SPECS AND QA/QC							
	excavate/load/short haul	SC1	m^3	6.80	9.30		
	excavate/load/long haul	SC2	m^3	7.10	11.75		
	SC1 + spread and compact	SC3	m^3	8.90	14.20		Low: non-engineered; High: engineered
	SC2 + spread and compact	SC4	m^3	9.30	23.20		Low: non-engineered; High: engineered (e.g. complex covers, low volume dam construction)
	Specified activity	SCS	m^3			18.80	Backfill adit with waste rock
FENCE							
		FNC	m	13.55	203.00		
FUEL AND ELECTRICITY							
	Fuel cost - gas	FCG	litre	1.05	1.40		
	Fuel cost - diesel	FCD	litre	0.99	1.39		
	Fuel mobilization	FCM	litre	0.22	0.42		High: winter road usage
	Electricity	FCE	kW-h	0.17	0.19	0.49	Low and High: Yellowknife; Specified: diesel generator
GEO-SYNTHETICS							
	geotextile	GST	m^2	3.44			Supply and install
	geogrid	GSG	m^2	5.75			
	liner, HDPE	GSHDPE	m^2	7.95			Supply and install; large quantity
	liner, ES3	GSES3	m^2	20.20			FOB Yellowknife
	geosynthetic installation	GSI	m^2	3.16	14.00		Low: geotextile; High:ES3 or HDPE
	bentonite soil amendment	GSBA	tonne	308.30	348.50		FOB Edmonton, add shipping & mixing
Grouting (/m^3 of rock grouted)							
		grout	m^3	236.55	286.75		High: cement, FOB Yellowknife
LABOUR & EQUIPMENT RATES							
	Site manager	sman	$/hr	125.00	152.00		
	Supervisor	super	$/hr	52.00	91.84		
	Registered engineer	eng	$/hr	95.00	220.00		
	Environmental coordinator	envco	$/hr	74.16	130.00		
	Environmental technologist	envtech	$/hr	36.00			
	Electrician	elec	$/hr	74.00	95.00		
	Journeyman - various	journey	$/hr	44.00	71.79		
	Labour - skilled	lab-s	$/hr	41.00	49.60		
	Labour - unskilled	lab-us	$/hr	31.00	43.98		
	Equipment operator	oper	$/hr	41.00	65.00		
	Heavy duty mechanic	mech	$/hr	49.00	72.85		
	Water treatment plant operator	oper-wt	$/hr	41.00	59.86		
	Security / first aid	safety	$/hr	36.00	66.97		
	Administrative staff	admin	$/hr	38.00	57.89		
	Equipment rates include operator and fuel						
	Loader - 4 cu.yd (3.06m3)	load-s	$/hr	175.00			
	Loader - 7 cu.yd (5.35m3)	load-l	$/hr	315.00			2011 Estimate w/ Cat 980 Loaders
	Excavator - 26.76-30.84 tonnes	exc-s	$/hr	190.00			
	Excavator - 68.95+tonnes	exc-l	$/hr	420.00			2011 Estimate w/ Cat 345 Ultra High Demo Excavator
	Grader	grad	$/hr	190.00			
	Dump truck off hwy 30-50 tonnes	truck-s	$/hr	225.00			2011 Estimate w/ Cat 730 Trucks
	Dump truck off hwy 55-75 tonnes	truck-l	$/hr	300.00			2011 Estimate w/ Cat 740 Trucks
	dozer, small	dozers	$/hr	205.00	260.00		2011 Estimate w/ Cat D8 Dozer
	dozer, large	dozerl	$/hr	490.00	565.00		2011 Estimate w/ Cat D10 Dozer
	smooth drum compactor	comp	$/hr	155.00			
	scooptram, 6 yd3 bucket	scoop	$/hr	170.00			
	flat bed truck with hiab	hiab	$/hr	155.00			
	fuel truck	ftruck	$/hr	150.00			
	water truck	wtruck	$/hr	58.00	150.00		
MOBILIZE HEAVY EQUIPMENT							
	Road access	MHER	kmtonne	3.40	10.25		
	Air access	MHEA	kmtonne	12.00			cargo rate>500lb
MOBILIZE CAMP							
	Road access	MCR	each	50000.00			refurbish existing camp
MOBILIZE WORKERS							
	flight	MW	each	4500.00	9100.00		Low: e.g. 8 passenger; High: Dash 7
OIL REMOVAL							
	oil removal	OR	litre	0.43	1.20		Low: waste oil heater; High: ship offsite
PCB Removal							

Filter by unit

Unit Cost Table (for refining unit costs see "Estimator" worksheet)

Remove from site	PCBR	litre	40.20	46.90		Low: shipping, handling & disposal from Yellowknife
PIPES, SMALL (<6in dia.)						
remove/dispose on site	PSR	m	1.00	24.00		Low: remove/dispose on site; High: remove/re-use
supply	PSS	m	6.10	11.10		Low: supply; High: supply and ship
install	PSI	m	25.00			
PIPES, LARGE (>6in dia.)						
remove/dispose on site	PLR	m	22.00	72.00		Low: remove/dispose on site; High: remove/re-use
supply	PLS	m	129.00	143.00		Low: supply; High: supply and ship
install	PLI	m	50.00			
POWER LINES						
remove/dispose on site	POWR	m	25.50			
PROCESS CHEMICALS						
Remove from site	PCR	kg	0.45	2.50		Low: shipping, handling & disposal from Yellowknife
PUMPS						
Pump capital cost	PC	each	195000.00			
Pump shipping	PS	each	2500.00			
Pump operating cost	POC	m^3	0.12			pump operating costs should be calculated based on pump capacity, fuel costs, etc.
Pump maintenance	PM	allow	25000.00			
PUMP SAND BACKFILL						
	PBF	m^3	85.00	300.00		
SCARIFY - ROAD/MINE SITE						
	SCFY	ha	4300	6030	2150	
SHAFT, RAISE & PORTAL CLOSURES						
Shaft & Raises	SR	m^2	645.00	2132.00		Low: pre-cast concrete slabs, little site prep. Area=shaft+>1m all around
Portals	POR	m^3	18.80	250.00	1200.00	Low: unit cost code SCS;High:excavate & backfill collapsed portal; Spec: installed pressure plug
SITE INSPECTION REPORT						
	RPT	each	10000.00	20000.00		
SPILLWAY - CLEAR						
	SW	each	3000.00	7000.00		
SURVEY/INSTRUMENTATION						
	SI	each	1800.00	3600.00		2 person crew
TREATMENT PLANT - CONSTRUCT						
Small (< 1000 m^3/d)	TPS	lump sum	9000000	15000000		
Large (> 1000 m^3/d)	TPL	lump sum	15000000	46000000		
Constructed Wetland	CWTS	ha	200000	300000		
TREATMENT PLANT - OPERATE						
	TPO	m^3	0.35	2.00		
TREATMENT CHEMICALS						
ferric sulphate	ferric	kg	1.19			
ferrous sulphate	ferrous	kg	1.32			
lime	lime	kg	0.56			
hydrogen peroxide, 35%	hperox	kg	1.50			
Sodium Metabisulfate	Nametab	kg	1.18			
Caustic soda, 50%	caustic	kg	0.74			
Sulfuric acid, 93%	sulfuric	kg	0.31			
flocculant	flocc	kg	6.00			
copper sulphate	copper	kg				
shipping	shipping	kg	0.20			
VEGETATION						
Hydroseed, Flat	VHF	ha	4000.00			
Hydroseed, Sloped	VHS	ha	4500.00			
Veg. blanket/erosion mat	VB	ha	13000.00			
Tree planting	VT	ha	2600.00	6000.00		
Wetland species	VW	ha			47.72	Specified= /m3, Wetland Growth Media Substrate mixed and installed (sand, biochar and fertilizer, woodchips)
WATER SAMPLING/ANALYSIS/REPORTING						
	WS	each	7000.00	10000.00		
WINTER ROAD						
Construction	WRC	km	2000.00	11500.00		2014-Dec Contractor price at $1700/ km
Usage	WRU	kmtonne	0.29			

Unit Cost Estimator

1 Equipment Productivity Figures and Graphs have been reproduced from Caterpillar Performance Handbook - Edition 42

EXCAVATION

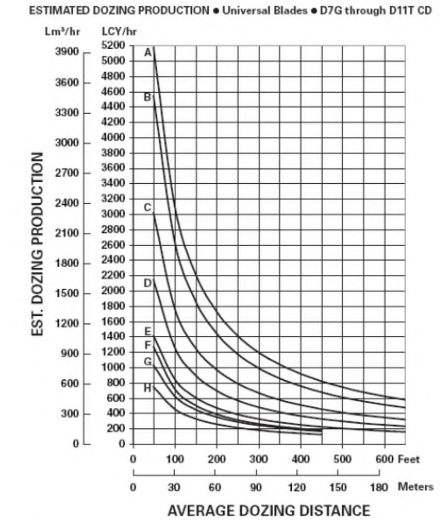
Productivity			
	Machine Cat 336EL	7.26	tonnes
bucket capacity	General Duty Capacity	3.3	m^3
fill factor		75%	%
cycle time	as per RECLAIM	45	seconds
operator skill		75%	%
machine availability	or Job efficiency	83%	%
altitude adjustment		100%	%
Hourly productivity		123.26	m^3/hr
Operating Costs			
- Contractor			
Contractor hourly rate	AHRCA 2013	$230.00	$/hr
Excavation cost - contractor rate		1.87	$/$m^3$
- Owner			
ownership, daily			$/day
maintenance			$/hr
fuel			$/hr
consumables (cutters, tires)			$/hr
operator			$/hr
Owner hourly rate		$0.00	$/hr
Excavation cost - owner rate		$0.00	$/$m^3$
Excavation cost - select contractor or owner rate (D22 or D31)			$/$m^3$

HAUL AND DUMPING

Productivity			
	Machine Cat 730		
truck capacity	Heaped Capacity	17.5	m^3
fill factor		80%	%
load time	Calculated from Excavator	6.8	min.
haul distance		1.5	km
average velocity	based on tricky terrain	15.0	km/hr
haul time + return time		12.0	min.
wait time		0.5	min.
dump time		1.0	min.
cycle time		20.3	min.
machine availability	Already allowed for Excavator availability	100%	%
altitude adjustment		100%	%
		20.3	ve. min/cycle
Hourly productivity		41.4	m^3/hr
Operating Costs			
- Contractor			
Contractor hourly rate	AHRCA 2013	$214.00	$/hr
Haul and Dump - contractor rate		5.17	$/$m^3$
- Owner			
ownership, daily			$/day
maintenance			$/hr
fuel			$/hr
consumables (cutters, tires)			$/hr
operator			$/hr
Owner hourly rate		$0.00	$/hr
Haul/Dumping Cost - owner rate		$0.00	$/$m^3$
Haul/Dumping Cost - select contractor or owner rate (I22 or I31			$/$m^3$

SPREADING/DOZING

Productivity			
	Machine Cat D8		
Estimate production using example curves providec	150m	600	m^3/hr
equivalent from other supplier			
Correction factors (see table provided)			
operator skill		0.75	
material type, see table		0.80	
slot dozing		1.00	
side by side dozing		1.00	
visibility		1.00	
job efficiency		0.83	
altitude adjustment		1.00	
slope adjustment		1.00	
Hourly productivity		298.8	m^3/hr
Operating Costs			
- Contractor			
Hourly rate - contractor supplied	AHRCA 2013	$293.00	$/hr
Dozing - contractor rate		0.98	$/$m^3$
- Owner			
ownership, daily			$/day
maintenance			$/hr
fuel			$/hr
consumables (cutters, tires)			$/hr
operator			$/hr
Owner hourly rate		$0.00	
Spreading/Dozing Cost - owner rate		$0.00	$/hr
Spreading/Dozing Cost - select contractor or owner rate (N22 or N31)			$/$m^3$



KEY
A – D11T CD
B – D11T
C – D10T
D – D9T
E – D8T
F – D7E
G – D7R Series 2
H – D7G

NOTE: This chart is based on numerous field studies made under varying job conditions. Refer to correction factors following these charts.

Activity Unit cost w/ Excavator, 3x Trucks and D8	18.36	$/$m^3$
Activity Unit cost w/ 329 Excavator, 2x Trucks and D8	14.81	$/$m^3$

Excavator

	CAT 329EL	CAT 336EL	CAT 349 E
general duty - heaped bucket capacity, m^3	2.4	3.3	3.08
	Typical Cycle Times (seconds)		
easy digging, shallow digging, small swing angle	13	14	14
med. to hard digging, rocky soil, swing angle to 90 deg.	18	20	20
tough digging, sandstone, caliche, at max. machine depth, swing angle > 120 deg.	24	26	27

Material	Fill Factor (% of heaped bucket capacity
Moist loam or sandy clay	100 - 110
sand and gravel (not till)	95 - 110
hard tough clay	80 - 90
rock - well blasted	60 - 75
rock - poorly blasted	40 -60

Note: Estimated Bucket Payload = (Heaped Bucket Capacity) x (Bucket Fill Factor)

Operator Skill	poor	average	good
Correction factor	0.6	0.75	1

Machine availability	poor	average	good
Correction factor	0.9	0.95	1

Job Efficiency Estimator	Work Time/ Hour		Efficiency
	60	Min	100
	55		91
	50		83
	45		75
	40		67

Trucking

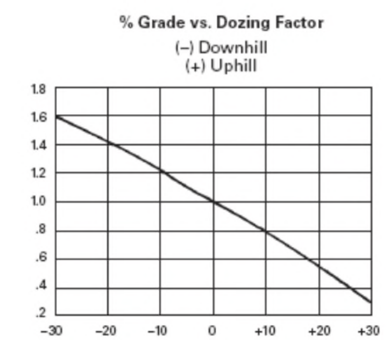
	CAT 730G	CAT 770G	CAT 777G
Truck capacity - heaped, m3	17.5	25.1	42

Dozing

JOB CONDITION CORRECTION FACTORS

	TRACK-TYPE TRACTOR
OPERATOR –	
Excellent	1.00
Average	0.75
Poor	0.60
MATERIAL –	
Loose stockpile	1.20
Hard to cut; frozen –	
with tilt cylinder	0.80
without tilt cylinder	0.70
Hard to drift; "dead" (dry, non-cohesive material) or very sticky material	0.80
Rock, ripped or blasted	0.60-0.80
SLOT DOZING	1.20
SIDE BY SIDE DOZING	1.15-1.25
VISIBILITY –	
Dust, rain, snow, fog or darkness	0.80
JOB EFFICIENCY –	
50 min/hr	0.83
40 min/hr	0.67
BULLDOZER*	
Adjust based on SAE capacity relative to the base blade used in the Estimated Dozing Production graphs.	
GRADES – See following graph.	

*NOTE: Angling blades and cushion blades are not considered production dozing tools. Depending on job conditions, the A-blade and C-blade will average 50-75% of straight blade production.



Note: HHW Entries

Estimate from Monthly Rental perspective

	monthly rate		year
CAT 336	$	13,000.00	$ 156,000.00
30 ton rock truck	$	10,250.00	$ 123,000.00
d8	$	12,000.00	$ 144,000.00

280,972 cu.m @ 7.2 months = 3 years

1 CAT 336
3 30 ton rock truck — based on truck production to support excavation production
1 d8

3 years — x2+, 3-month seasons

Total rental Costs	$	2,007,000.00	
heavy equipment operator cost for 5 workers @ $65/hr (12 hrs per day) for 228 hours	$	889,200.00	not including rotations
unit cost for earthworks	$	10.31 /cu.m	not including foreman and superintendent costs
Total Fleet	$	4,113,000.00	