APPENDIX 1:

EMAIL CONFIRMING NUNAVUT PLANNING COMMISSION DETERMINATION

Michael Westlake - RE: LUP Conformity Review

From: Brian Aglukark <aglukark@nunavut.ca>
To: Michael Westlake <Michael.Westlake@aadnc-aandc.gc.ca>
Date: 8/28/2015 10:37 AM
Subject: RE: LUP Conformity Review
CC: Jonathan Savoy <jsavoy@nunavut.ca>, Peter Scholz <pscholz@nunavut.ca>

Good morning Michael,

Apologies to the delay in responding to you.

You are correct, based on the location of the activities in FOX-D (Kivitoo, Nunavut) you are proposing, it is located outside the boundaries of an approved land use plan therefore no requirement a conformity determination review with an approved plan.

But, NuPPAA regulations require all proposed projects including amendments to existing authorized projects and new project proposals located inside the designated area [Nunavut Settlement Area] be submitted to the NPC for review. Michael, those projects that are located outside the boundaries of an approved plan are now required to be reviewed by the NPC to determine whether a NIRB screening is required. Your project as described below will require a NPC review if it is not an extension to an existing authorized project.

For the NPC to complete its review, please fill-out an application online through our website at www.nunavut.ca. You must also include completed application forms associated with other permits, authorizations from other agencies.

Do not hesitate to contact Peter Scholz at pscholz@nunavut.ca or Jonathan Savoy at jsavoy@nunavut.ca .

Mutna,

Brian Aglukark

From: Michael Westlake [mailto:Michael.Westlake@aadnc-aandc.gc.ca]
Sent: August-28-15 8:38 AM
To: Brian Aglukark <aglukark@nunavut.ca>
Subject: Re: LUP Conformity Review

Good morning Brian,

I hope your summer has gone well. I'm just following up on an email that I sent you a while back (located below). We are getting ready to submit our licences and approvals shortly and were hoping to have a response from you in this regard so that we could include it in the application package.

Thanking you in advance,

Michael

>>> Michael Westlake 7/30/2015 3:10 PM >>>

Good afternoon Brian,

I'm pulling together permitting/licensing for the remediation of contaminants of FOX-D (Kivitoo, Nunavut), which was an Intermediate Distant Early Warning (DEW) Line Site constructed in 1957 and operated until October 1963. The site is located on the Davis Straight, 50km to the west of the nearest community Qikiqtarjuaq, at approximately 67° 57' 01" N latitude and 64° 55’ 04” W longitude.

I'm of the understanding that this area is in the South Baffin planning area and due to the fact that it does not have a finalized Land Use Plan, it's not subject to a conformity review. For our Water Licence Application I require written confirmation of this, and would appreciate if you would be able to provide it for me. If I'm not correct in my assumption I would be happy to submit NPC Conformity Review documentation for the project.

Thanking you in advance,

Michael

Michael Westlake
Contaminated Sites | Sites Contaminés
Northern Affairs | Affaires du Nord
Aboriginal Affairs and Northern Development Canada (AANDC) | Affaires Autochtones et Développement du Nord Canada (AADNC
Tel: (819) 994-6773
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michael.westlake@aadnc-aandc.gc.ca

APPENDIX 2:

NUNAVUT IMPACT REVIEW BOARD (NIRB) PART 1 FORM (ENGLISH, INUKTITUT)

ᐃᓕᖅᑐᓕᕐᓂᖅ PART 1-Γ
ᑐᓴᖅᑐᑎᒃᓴᓕᕆᔨᓕᓪᓚᓂ ᐱᓕᕆᐊᓗᐅᔪᐊᓕᓚᓄᓕᓂ ᑐᓴᓱᓴᐅᔪᓂ ᐱᔪᐅᔪᓕᔪᓂ

ᑐᓴᕈᓐᓇᕆᓴᓂ ᐱᔪᐅᔪᓐᓇᖅᑐᑦ ᐱᔭᕇᒋᓪᓂ ᓄᓇᕗᑦ ᐊᖏᕐᑎᓕᕆᓂ ᕿᑎᒪᔨᖏᓐᓄᑐᒃ ᑕᐃᓗᑎᓂ ᐅᕐᖏᓇ ᖃᕈᓂᐅᔪᒃᑯᑦ http://ftp.nirb.ca/ ᐅᖏᓪᓗᓂᑭᖅ ᐊᖏᐅᑎᑕᑎᓂ ᓄᓇᕗᑦ ᐊᖏᕐᑎᓕᕆᓂ ᕿᑎᒪᔨᖏᓐᓂᒃ ᐊᓯᓚᐊᕐᓇᓂᑦ, ᐱᓕᕆᐊᖅᓯᒪᔪᓄᑐᒃ ᖃᑎᖃᓕᖏᓕᖏᓂ, ᐊᒻᒪᓗ ᐱᓕᕆᐊᖅᓴᐅᑦ ᑐᓴᐅᑭ ᖃᑎᖃᑦᓴᐅᖅᑎᓂᖃᖅᓯᒪᔪᓂ ᑕᐃᓗᑎᓂ ᓄᓇᕗᑦ ᐊᖏᕐᑎᓕᕆᓂ ᕿᑎᒪᔨᖏᓐᓂᒃ ᖃᕈᓂᐅᔪᒃᑯᑦ ᓴᖃᐅᒪᔪᓂ ᐅᕐᖏᓂ http://ftp.nirb.ca/.

ᐅᓴᔨᖃᑎᒌᓂᔪᐊᖃᖅᓯᒪᔪᓕᐊᓪᓚᓂ
ᕿᑐᐅᓴᒪᓂᐊᖅᑎᓂ ᑐᓴᓱᓴᐅᑎᑎᓂ ᐱᓕᓐᓂᓪᓚᐊᐅᓴᓪᓕᖅᓯᒪᓂᖏᓐᓂᒃᑕᒪᓕᑕ ᐅᑯᑎᔭᓇ ᐊᐅᑎᓂᕿᑐᑎᒪᓂᖅᓯᒪᔪᓂ ᐃᓕᓐᓂᒃᑐᓕᕆᓂ sections 1 - 9 ᐱᓴᓵᖅᑕᐅᖅᑎᓇᐊᖅᓯᒪᔪᓂ ᐊᒻᒪᓗ ᐃᓄᖅᑎᑐᓂ (ᐃᓄᐃᓐᓇᖅᑐᓂ ᖃᑎᑎᒋᐅᓚᐸᑕ).

ᐃᓕᓐᓄ 1: ᑐᓴᖅᑐᑎᓂ ᑐᓴᓱᓴᖅ

1. ᐱᓕᕆᐊᖅᓴᐅᑦ ᑕᐃᔨᓂᓄᑦ FOX-D (Kivitoo, Nunavut) Site Remediation Project

2. ᑐᓴᔪᖅᑎᑦ ᐊᑎᓄᑦ ᐊᒻᒪᓗ ᑐᖁᑕᒋᑦ:

	ᐅᖃᓕᓂᐅᔪᓂ:	
Aboriginal Affairs and Northern Development Canada (AANDC)	ᓯᑲᐊᖅᑯᑦ:	
	ᖃᓄᕈᐅᓴᖅᑯᑦ	

3. ᖃᓄᐅᔨᕕᖃᐅᔨᕕᖅᑲᓂᕐᓂᖅᓯᒪᔪᓄᑦ ᓯᓚᑦᓂᐅᔨᓗᓂ ᐊᑎᓄᑦ ᑐᖁᑎᓄᖓᓗᓗ:

	ᐅᖃᓕᓂᐅᔪᓂ:	(819) 934-1188
Mark Yetman	ᓯᑲᐊᖅᑯᑦ:	819-934-9229
Senior Project Advisor, AANDC	ᖃᓄᕈᐅᓴᖅᑯᑦ	Mark.yetman@aandc.gc.ca

ᐃᓕᓐᓄ 2: ᑲᔪᓯᖅᑲᐃᔨᓂᓕ ᑲᔪᓯᖅᑲᖅᑕᐅᔨᓴᓕᖅᑐᓂᓕ

1. ᑕᒪᖅᑕᑦ ᓇᓗᓇᐃᖅᑕᐅᓇᓚᓗᓂᓕ ᑲᔪᓯᑎᑦᓯᔨᓂᓕ ᐊᐅᑐᐊᓂᓕᕆᓚᐅᖅᓯᒪᔪᓂᒃ ᐱᓕᕆᐊᖅᓴᐅᔪᓐᓇᖅᑐᒃ ᑐᓴᔪᖅᑎᑦ:

X	ᐊᐃᕕᐅᑐᖅᓯᒪᔪᓂ ᐃᓄᐃᓐᓇᓂ ᑐᑐᔨᓴᖅᑎᑎᑦ (RIA)		ᑲᓇᑕᒥ ᖃᐅᔨᒪᔪᑎᑕᐅᓂᐊᖅᑐᓄᓇᓂ ᐊᐅᓂᖅᑕᐃᓚᓕᒪᔨᓂ (CLS)
X	ᓄᓇᕗᑦ ᐃᒪᓕᓚᔨᓂ ᑲᑎᒪᔨᖏᓐᓂ (NWB)		ᑲᓇᑕᒥ ᐊᖏᕐᑎᓕᕆᔨᖅᑐᓂ (EC)
X	ᓄᓇᕗᑦ ᐸᖃᐃᔨᓂ ᑲᑎᒪᔨᖏᓐᓂ (NPC)		ᓄᓇᕗᒥ ᓴᖏᒪᑦᑯᑦ (GN)
x	ᐃᓄᓕᓚᔨᑐᖅᑯᑦ (AANDC)		ᑲᓇᑕᒥ ᐅᓇᑕᖅᑐᔨᓕᓚᔨᖅᑐᓂ (DND)
	ᐃᖅᑲᓇᓕᓚᔨᖅᑯᑦ ᐊᒻᒪᓗ ᐃᒪᖏᐅᑕᓕᓚᔨᖅᑯᑦ (DFO)		ᕼᐊᒻᒪᒪᓕᖅᑯᑦ
	ᓄᓇᓕᖓ ᓴᖏᒪᓕᓚᔨᖅᑯᑦ ᐱᔨᑦᓯᖅᑎᑦᓯᓕᐊ (CG&S)		ᑲᓇᑕᒥ ᒥᖅᓴᐃᓯᖅᓂᐊᓕᓚᔨᖅᑯᑦ (PC)
	ᓄᓇᕗᒥ ᖃᐅᔨᓴᖅᑐᑎᓕᓚᔨᖅᑯᑦ (NRI)		ᑲᓇᑕᒥ ᓂᕆᐊᑎᓕᓚᔨᑦ(CWS)
	ᐃᓕᖅᑯᓕᓚᔨᖅᑯᑦ ᐱᖅᑯᓕᓚᔨᖅᑯᓕᓐᓂᒃ ᓴᖏᒪᑦᑯᓂᓕ (C&H)		ᐊᓯᖅᑎᑦ (ᓇᓗᓇᐃᖅᓯᒪᔪᓂ ᑭᑲᑯᓴᒪᓐᓇᑐᑦ):

2. ᑎᑎᕐᓗᒋᑦ ᐊᑐᑎᓪᓗᑦ ᐱᓕᕆᓂᐅᑎᑦ, ᓕᐃᓴᑦ, ᐊᓯᖏᑦᓴᖅᓂᒃ ᐊᑐᑕᐅᓕᕆᓂᖅᓯᒪᓕᒃᑲᓂᑦ ᑐᓴᕐᑐᑎᑎᔪᓂ ᐱᓕᕆᐊᓚᐅᕐᓕᓕᓂᑦ, ᐃᓱᓕᔪᓐᓇᖅᑐᓕᒃ ᐅᕙᓪᓗᒥ:

none

3. ᐊᖏᔪᑦ ᑎᑎᕐᓗᒋᑦ ᐱᓕᕆᓂᐅᑎᑕᑭᑎᑕᐅᑎᓚᐊᕐᑲᖅᑕᑎᑦ, ᓕᐃᓴᖏᑦᑕᑭᑎᑎᑕᐅᑎᓚᐊᕐᑲᖅᑕᑎᑦᓯᒪ, ᐅᕝᕙᓘᓐᓃᑦ ᐊᓯᖏᑦᓴᖅᓂᒃ ᐊᑐᑕᐅᓕᕆᓂᖅᓯᒪᓕᒃᑲᓂᑦ ᐱᓕᕆᐊᓚᐅᕐᓕᓕᓂᑦ ᐱᔨᑎᖅᑲᖅᑕᑦ ᐱᓕᕆᐊᓚᐅᕐᓕᓕᒫᑦ ᑐᓴᕐᑐᑎᒃᓯᒪᓂ ᐱᓕᕆᐊᓚᐅᕐᓕᓕᒫᑦ:

- Nunavut Water Board “General Water Licence Application” (appendix 2)
- QIKIQTANI INUIT ASSOCIATION – Access to Inuit Owned Land Permit (appendix 9)
- Aboriginal Affairs and northern Development Canada Land Use Permit (appendix 10)
-Nunavut Planning Commission Land-Use Conformity (Appendix 1)

3. 4. ᐅᓇ ᐱᓕᕆᐊᓚᐊᓕᓴᐃᑦ ᐅᕝᕙᓘᓐᓃᑦ ᓇᐅᒃᑯᑐᐃᓇᓐᓂᖅᓯᒪᓕᒃᑲᓂᑦ ᐱᓕᕆᐊᓚᐊᓕᓴᖏᓐᓂᑦ ᐃᓗᐊᓂᑐᑦ ᕿᑎᕐᕕᐅᓕᕆᓂᕐᒥᓕᒃᑯᑦ ᐅᕝᕙᓘᓐᓃᑦ ᖃᐅᐅᔾᔨᑕᐅᓕᕆᒃᑐᓂᕐᑕᐅᓕᕆᓂᖅᓯᒪᓂᑦ ᓄᓇᕗᒻᒥ ᐊᖏᑎᓕᕆᓂᕐᒧᑦ ᑲᑎᒪᔨᓄᑦ ?

□ ᐃ X ᐊᑦᑐ

ᐃᓚᒃᑯᑦ, ᑎᑎᕋᒃ ᐱᓕᕆᐊᓚᐅᕐᓕᓕᒫᑦ ᑕᐃᔨᓯᕐᓂᖅᑐ ᐊᓖᑕᐅ NIRB-ᒥᑦ ᑎᑎᖃᕐᒥᑎᖏᑦᑕᒧᑦ ᓇᓴᐅᑎᖅᑐ

P.O. Box 1360 Cambridge Bay, NU, X0B 0C0 • PHONE: 867-983-4600 • TOLL FREE: 1-866-233-3033 • FAX: 867-983-2574

ᐃᓕᖅ 3: ᐱᓕᕆᔨᒃᑯᐊᓕᕐᓂᑦ ᑐᓴᕐᕿᑦ ᖃᓄᐃᓕᒋᐊᓂᖅ ᑭᓂᖅᖃᖅ

1. **1.** ᓇᓗᓇᐃᖏᓗᒍ ᑐᓴᕐᖃᑐᑎᖅᑯᓄᑦ ᐱᓕᕆᐊᒃᓴᑭᔨᓚᕐᖅ (ᐃᒪᐃᕐᑐᒥᔪ ᓴᓂᕎᒍᑦ ᑎᑎᕐᓗᑭᑦ ᐊᑐᕐᓂᖃᖅᑐᓗᒻᒥᓪ) (1,2): (ᑕᑯᑭᕐᓗᒍ ᐊᑕᔪᖅ A ᐱᓕᕆᐊᒃᓴᑭᑦ ᖃᓄᐃᓕᒋᔪᑦ ᑐᑭᓯᑐᖃᖅᑕᑭᓴᒪᓂᖅᑎᑦ)

1	ᓴᓪ ᖃᓄᐃᓕᑐᑐᐃᓇᖃᑦ ᐊᕐᕌᑎᒃᓴᓕᓂᐅᕐᓂᖅ ᐅᓴᕋᖃᓴᓂᐅᕐᓂᖅ	☐	**9**	ᐃᓂᑐᖃᖏᓐᓂᖅ ᐊᖃᑭᖃᓴᐃᓂᖅ/ ᓄᓇᒥᖅ ᐊᔪᖃᑭᓴᐃᓂᖅ	X
2	ᐅᑭᐅᖃᑦ ᐊᑐᕆᐊᒃᖃᖅ /ᐅᓴᕋᓐᓂᖅ ᖃᖅᐅᓴᒪᒃᖃᓂᖅ	☐	**10**	ᐅᖃᓴᕐᔪᐊᖃᓴᓂᐅᕐᓂᖅ ᓄᓇᒦᑕᑐᑐᖃᖅᓂᓗ ᒪᓴᓕᖃᓴᓂᐅᕐᓂᖅ	☐
3	ᓴᙵᕋᕐᒪᖃᓴᓂᐅᕐᓂᖅ (ᓄᓇᐅᔪ ᖃᐅᖏᓂᖅ ᑎᓐᒥᔪᖅᑎᑦ)	☐	**11**	ᑕᕆᐅᑐᐃᓐᓇᕐᒥ ᐱᓕᕆᐊᕆᓴᐅᔪᑦ	☐
4	ᓯᕗᓪᒧᑎᐊᖅᑲᓂᖅᓴᓕᔪᑦ ᓴᙵᕋᕐᒪᖃᓴᓂᐅᕐᓂᕐᒧᑦ ᓄᓇᐅᔪ ᐃᑭᐊᓐᓂᓕᑐᓂᖅ ᖃᖅᐅᓴᒪᓂᖅ	☐	**12**	ᖃᖅᐅᓴᒪᓂᖅ/ᐅᑭᐅᖃᖅᑕᖅᑑᔪ ᖃᖅᐅᓴᒪᓂᐅᔪᑦ ᐊᒪᕐᒌᓐᓇ ᖃᖅᐅᓴᒪᓂᕿᑕᐅᓂᓐᓇ*	☐
5	ᐅᓴᕋᓴᐅᓕᓕᐅᕐᓂᖅ/ᐅᓴᕋᖃᑕᒪᐅᔪᓂᖅ ᐊᒥᓴᓂᖅ ᖃᖅᐅᓴᒪᓂᖅ	☐	**13**	ᐊᓐᓇᓴᐊᒪᓂᕐᒧᑦ ᐱᓕᕆᐊᕆᓴᖅᒪᓕᑦ *	☐
6	ᐃᑎᖅᒪᐃᑦ/ᑐᐊᔪᖅᑕᐃᓕᓪᓗ	☐	**14**	ᔪᓕᕋᖅᑐᓕᕆᓂᕐᒧᐊᓕᓐᓄᓕᔪᑦ *	☐
7	ᑕᕆᐅᒥ ᒪᓇᓴᐅᓴᒪᔪᑦ (ᐅᒥᐊᕐᑯᐃᐊᖅ, ᒪᑉᓕᓪᓗᐊᖅᑕᐃᑕᓕᔪᑦ, ᐃᖅᒪᕐᒪᖅ)	☐	**15**	ᐊᓴᓐᓄ [(2)]:	☐
8	ᖃᓄᐃᑎᒥ ᐃᑎᓂᖅᓄᖅᑎᑎᕐᒪᓇᐊᖏᓐᓂᓂᖅ ᐃᓗᓕᓕᓐᓂᓂᖅ ᖃᖅᐅᓴᒪᓂᖅ ᐅᓴᕋᑕᓕᓪᓕ ᖃᖅᐅᓴᒪᓗᑎᑯᓴᑦ ᐅᖅᑐᕋᐅᑎᑯᓴᑦ	☐			☐

ᖃᖅᐅᓴᒪᓴᐅᒪᓇᐊᖅᑕᖅᑐᖅ:

1. ᖃᓄᐃᓕᑐᑐᐃᓐᓇᐃᓕᑦ ᐱᓕᕆᐊᒃᓴᑭᔨᓕᓂᓐᓇᐃᓐᓇᓕᑦ, ᑭᓴᐊᓂ (*)-ᒥᖅ ᓴᓂᕎᒍᑦ ᑎᑎᖅᓴᒪᓕᔪᑦ, ᐱᓕᕆᐊᖅᑕᒪᓕᔪᖅ ᖃᐃᑦᓴᓚᐊᖅᑯᓂᐊᖅᒥᓕᔪᖅᑕᐅᖅ **ᐃᓕᓐᓄ 2-ᒥᑦᑐᒥᖅᑕᐅᖅ ᐱᓕᕆᐊᕆᔨᒪᓕᕆᑕᖅᑐᓐᓄᓕᑦ ᑐᓴᓴᖅᐅᑎᖅᓴᖅᑲᓐᓂᖅᓴᓂᖅ Project Specific Information Requirement (PSIR) ᑕᑕᑎᖅᓴᒪᓐᓂᖅ**. Ċᓐᓇ NIRB-ᑯᓐᓄᑦ ᑐᓴᕐᖃᑐᑎᐅᓂᖅᓄᑦ ᐱᓴᓰᖅᓴᒪᔪᖅᑎᑐᑦ ᐃᓴᒪᓕᖅᓴᐅᔪᓐᓇᐃᓐᓇᓐᓂᕐᒪᑐᑦ Ċᓐᓇ ᐃᓕᓐᓄ 2 PSIR ᑕᑕᑎᖅᑕᐅᓴᒪᓴᓰᖅᑐᑐᐊᖅᑦ.
2. ᖃᐅᔨᒪᓴᐅᑦᓴᐊᓕᐊᑎᖅᖃᖅᑐᖅ ᐱᓴᓰᖅᑕᐅᔪᓐᓇᑯᓐᓂᒍ NIRB-ᑯᓐᓄᑦ ᐱᓕᕆᐊᕆᓴᐅᕙᑦᓕᓕᐊᓂᕆᓴᕆᐊᑎᖅᑕᖅᑐᒪ,tĊᑯᑯᐊ NIRB-ᑯᑦ ᖃᖅᐊᒍᐃᓐᓇᓕᓴᐊᖅ ᑐᓴᒪᓴᐅᑎᑎᖅᑯᓂᐅᖅᑐᓂᓂᖅ ᑐᓴᓴᑎᖅᑭᓐᓇᓕᒪᔪᐊᖏᓐᓂᖅ ᐱᓕᕆᐊᕆᓴᐅᕙᑦᓕᓕᐊᓂᖅᒪᓂᖅ.
3. “ᐊᓴᖏᑦ” ᓂᑭᐊᖅᑕᐅᒍᓂ, ᖃᐅᔨᓴᒥᐊᓐᓇᒪᓂᐊᕆᑎᖅᖃᖅᑕᒥᑦ NIRB-ᑯᑦ ᖃᓄᐅᖅ ᐱᓕᕆᐊᕆᓴᐅᕆᐊᕆᑎᖅᖃᓕᖏᓐᓄᑦ ᐃᓕᓐᓄ 2 PSIR ᑕᑕᑎᖅᑕᐅᓴᒪᓂᐊᕆᑎᖅᑎᓂᐊᕐᓂᖅ.

2. ᐱᓕᕆᐊᑲᓴᓂᓕ 3, 4 ᐅᕐᓂᒍᓐᓂᓕ 5 ᖃᑦᓯᓂᑐᓂᑐᓂᓕ ᓂᕈᐊᖅᑕᐅᓐᓂᕈᑎᑦ, ᖃᓄᐃᔨᑐᓪᓗᒥᒃ ᐅᔾᖃᖅᑕᕈᒪᔭᕆᐊᒃᓴᓕ ᑎᑎᕋᖅᓯᒍ. ᑎᑎᕋᐅᓯᕆᐊᕐᓴᖅᓯᒍ.

	ᓴᓇᕋᔨᖅᓴᐃᑦ (ᓱᖅᓴ zinc, ᑲᐳᖅ copper, ᔪᓕ gold, ᓯᐅᑦᔪᖅ silver,ᐊᓯᖏᑦᓯᓗ)_____
	ᑕᐃᒪᓐ
	ᔨᕋᐃᓂᐊᒪ
	ᐊᓯᖏᑦ: _____

3a. ᐱᓕᕆᐊᑲᓴᐅᔪᓂ 12, 13 ᐅᕐᓂᒍᓐᓂᑦ 14 ᖃᑦᓯᓂ ᓂᕈᐊᖅᑕᐅᓐᓂᕈᑎᑦ, ᐊᑎᕋᐊᖏᓐᓂᒋᑦᓂᖅ ᐱᔨᓴᕐᓗᖓ ᐊᐱᖅᑯᑕᐅᓯᒪᔨᓕᓗ ᑭᐅᓗᑎᑦ ᐊᑕᓂᒋᑦ.

ᐃᖏᕐᕋᔨᑕᐅᓂᐊᖅᑐᓂᖅ (ᑦ)	ᖃᑎᖅᑦ	ᖃᓄᖅ ᐊᑐᖅᑕᐅᓂᐊᖅᓯᒪᓂᖅ	ᖃᓄᐅᑎᒃ
ᐅᑲᑐᑎᑎᓗᒍ: ᖃᑦᓯᒍᓕᑦ	*1*	*ᐱᓕᕆᐊᓇᖏᐊᔪᓂᑦ (ᔨᓂᑦ) ᐊᐅᔾᖅᑐᑕᐅᖃᑎᒌᕐᓂᑐᓂᓗᓂ*	*6 -ᓂᑦ ᐅᑦᓗᓂᑦ*

3b. ᐅᖃᐅᓯᕆᓚᑎᑦ ᑐᓕᑦᑕᕐᖃᖅᑳᑦ, ᐅᓯᐊᑦᑯᑯᑕᖃᖅᑳᑦ, ᒥᑕᕐᖃᖅᑳᑦ, ᐅᕐᓂᒍᓐᓂᑦ ᑐᑦᓯᔾᔨᑐᖃᖅᑳᑦ ᐱᓕᕆᐊᓇᔪᒪᔭᓂᑦ. ᐱᔨᑎᖃᖅᑐᑐᓂᑦ. **ᖃᐅᐅᔪᒪᔭᐅᓇᐊᖃᖅᑐᑐᖅ**: ᓚᒋᑦ ᐊᖃᑭᑦᓯᕆᐊᑕᐅᔭᕆᐊᐊᒋᑦ ᐃᓕᓴᐃ 2-ᑯᖅᑐᑦ ᑕᑕᑎᕐᖃᖅᑐᑐᐃᓐᓇᐊᓇᕆᐊᖃᖅᓯᒪᓂᓂᖅ.

There is an existing airstrip on site. Small maintenance related measures might have to be done to the surface of the airstrip to make it functional for operations. There is also an existing barge landing area which will be used for remediation of the site, and transfer of materials via sealift to the south for disposal at appropriate licenced facilities.

3c. ᑐᐱᕐᕕᒃᖃᖅᑲᐃᓐᓇᓚᐊᖃᖅᑎᕐᓂᑐᓂᖅ, ᖃᓄᐃᑕᑐᓂᐊᕐᓂᓕᒫᓂᖅ ᐅᕐᖃᐅᓯᐅᑦᓯᐊᓚᐊᓕᒋᑦ ᖃᓄᐃᑕᑐᓂᓗᓗ ᐊᐅᓪᓚᑦᓂᑦ ᐃᓕᓴᐃᑦᓂᐊᕐᓂᖅᑕᕐᓂᓂ ᐅᕐᖃᐅᓯᕆᐊᓕᒫᑦᑐᓂᑦᑕᐅᖅ ᑕᐃᒪᐃᓐᓂᐊᕐᓂᑐᓂᑐᓂᓕᒫᓂ.

A small temporary camp will be established on site.

4. ᖁᓇᔨᑦ

ᖃᑦᓯᐅᐅᓪᑦ ᖁᓇᖃᑕᐅᔭᑦ = (A)	30	ᖃᓄᐃᑎᒥᒪᓚᓇᒃ ᖁᓇᓂᐊᖃᖅᑦᑦ = (B)	180	ᖃᓄᐃᑎᐅᓂᐊᕐᓂᓐᓚᑦᑦ (A) x (B) = 5400	ᑲᑎᒪᔨᑦᑦ

5. ᖃᓄᖓᐅᑎᒪᔨᓗᒍ

ᖃᓄᖓᒪᓕᕆᓇᒃ ᖁᓇᓂᐊᖃᖅᑦᑦ	July 2016	ᒥᑦ	September 2020 ᔪᑦ
ᖃᓄᐃᑎᒥᑎᒋᔭᐅᓂᐊᕐᓂᖅᑕᐅᓂᖓᓄᓇᓕᒫᓂᖓ:	July 2016	ᒥᑦ	September 2020 ᔪᑦ

6a. ᐊᐃᖅᑐᖅᓯᒪᐅᕐᓂᖏᑦ (ᑎᑎᕐᓗᓂᑦ ᑕᒪᐃᑦ ᐊᑐᕐᓂᖅᓂᐊᖅᑐᑦ):

	ᖃᐅᔨᖅᑕᕆᔨᑦ ᐅᐊᖏᓐᓄᓂᑐ		ᑭᓐᓇᒥᐅᓂ		ᖃᐅᔨᖅᑕᕆᔨᑦ		ᓄᓇᕗᕐᖓᐅᓪᓚᑦ ᑭᒡᓕᓂᖅᑐᑐᕆᔨᓯᒪᓂᐊᓂ: _____
X	ᖃᐅᔨᖅᑕᕆᔨᑦ ᓂᒋᐊᓂ		ᒥᖏᐃᐃᖅᓯᖏᓐᓄᒥ				

6b. ᐅᖅᑲᐅᓯᕐᓂᐊᖅᑐᓕᒍ ᓄᓇᕗᑦ ᓇᓕᐊᖏᓂ ᐊᖏᖅᑐᖅᓯᒪᐅᕐᓂᖏᓐᓄᓐᓂᖏᓂᐊᕐᓇᖏᓐᓂᖏᓂᒃ ᑐᑭᓯᖅᑐᑎᑎᒍᑦ ᐱᓕᕐᓇᕐᓇᓚᐃᓐᑦ, ᓇᓕᐊᖏᓂᒃᓗ ᓄᓇᒋᐅᔨᔪᒥᑦ ᖃᑲᓂᐊᓐᓂᖅᓱᖏᓪᓕ ᓄᓇᒥ ᓴᓗᒥᓯᑲᖏᐅᔨᒥᑦᓴᕐᓇᖏᓐᓄᒃᓗ.

The site is located 50 km to the west of the nearest community, Qikiqtarjuaq, Nunavut, at approximately 67° 57' 01" N latitude and 64° 55’ 04” W longitude. After military operations at the site ceased, the site became part of the Auyittuk National Park. FOX-D was within Auyuittuq National Park under the management of Parks Canada until 1992, when custody of the site was transferred to AANDC (formerly Indian and Northern Affairs Canada (INAC)).

6c. ᑎᑎᕋᐅᓯᕐᓂᓕᒍ ᐱᓕᕐᓇᐊᕐᓴᐃᒋᓚᕆᔭᐃᑦ ᐃᓂᖏᓐ ᐱᓕᕐᓇᐊᕐᓴᐃᐅᓕᐅᖅᑲᓯᒪᓚᐊᖏᓐᓂᖏᓪᓗ ᑐᑭᓯᖅᑐᑎᑎᒍᑦ /ᑐᐱᔨᔭᐃᓂᖅᑕᕆᔨᐅᕐᓇᖏᓐᓂᖏᓂᒃᓗ ᐅᖅᑲᐅᓯᕐᓂᔪᖅ.

Please see attached Archaeological Site Assessment for FOX-D which can be found in appendix 6.

7. ᓄᓇᐅᒧᑦ ᐱᓵᔪᑎᖅᑲᖅᑐᖅ (ᑕᒪᐃᑦ ᐊᑐᕐᓂᖅᓂᐊᖅᑐᑦ ᑎᑎᕐᓗᓂᑦ):

X	ᑲᓇᑕᐅᑉᐸ ᒪᓕᒪᓐᓕᑕ ᓄᓇᕗᑎᓐᓄᒃ		ᑲᒥᓯᓇᐅᑉᐸ ᓄᓇᕗᑎᓐᓄᒃ		ᕿᐊᒪᓚᐅᑉᐸ ᓄᓇᕗᑎᓐᓄᒃ
X	ᐃᓄᐃᑦ ᓇᖏᒥᓂᔪᓐᓇᖅᓂᒃ ᓄᓇᐅᑉᐸ ᖁᑲᓐᓂᕐᑐᑦ		ᐃᓄᐃᑦ ᓇᖏᒥᓂᔪᓐᓇᖅᓂᒃ ᓄᓇᐅᑉᐸ ᐃᑭᐊᓐᓂᕐᑐᑦ		

8a. ᓄᓇᖕᒪᐊᖅᑎᒍᑦ ᓯᵇᑯᑦᓯᓚᓪᓚᐊᖏᓐᓂᖅᓱᒪᓐᓇᑲᓐ:

Min ᐊᖏᓗᑦ (degree/minute)	67°55'41.33"N	Min ᓴᓂᓗᑦ (degree/minute)	64°51'1.34"W
Max ᐊᖏᓗᑦ (degree/minute)	67°57’42.31”N	Max ᓴᓂᓗᑦ (degree/minute)	64°57'58.30"W

ᓄᓇᖕᒥᐊᒥ ᐅᒥᖕᒪᓐ ᐃᓕᓴᕐᓂᑦᑐᑦ: 026P15

(ᐱᓕᕆᐊᓂᐊᖅᑕᕐᓴᑦ ᓄᓇᖓᐊᑦ ᐃᓕᖅᓱᐅᑎᓂᐊᖅᐸᑎᑦ (1:50,000 ᐊᑐᐃᓐᓇᐅᔨᖅᑕᕆᔨᓂᕐᓂ, 1:250, 000 ᐃᓕᖅᓱᐅᑎᑦᓯᕆᒋᐊᓪᓚᑦ) ᑲᓇᑕᐅᑦ ᓄᓇᒋᐅᑕᓕᕆᓚᐅᖅᓯᓂᐅᓂ ᐊᑐᐃᓐᓇᐅᔨᖅᑕᕆᔨᖅᑐᖅ)

8b. ᑐᓴᕐᔅᑐᑎᑎᒍᑦ ᐱᓕᕆᐊᕆᔭᒪᓕᐃᑦ ᐃᓗᓗᑐᖅᑎᓂᐊᕐᓂᓗᓐᓂᑦ ᑐᐱᖅᑕᕆᐅᖅᑎᓂᐊᕐᓂᓗᓐᓂᑦ, ᓱᑯᓴᐊᓐᓂᑕᓕᕆᓂᐊᖅᓯᓂᐅᓂᖅ ᓄᓇᖓᐊᖅᑐᑎᓂᓴᓂᐊᖅᑎᒍᑦ ᐊᑐᐃᓐᓇᐅᑎᓂᓴᓂᐊᖅᑐᖅ>ᑎᑦ

Min ᐊᖓᒍᑦ (degree/minute)	67°56'3.42"N	Min Long (degree/minute)	64°53'24.56"W
Max ᐊᖓᒍᑦ (degree/minute)	67°56'3.42"N	Max Long (degree/minute)	64°53'24.56"W

ᖃᓄᐃᓕᓐᓂᑦ ᐊᐅᓚᑦᑐᑦᑕᐅᖅ :
ᓄᓇᖓᔪᒥ ᑲᒥᖓᒍ
ᓇᓴᐅᑎᖃᖅᑐᒥᑦᑐᑦ:

026P15

(ᐱᓕᕆᐊᓂᐊᖅᑕᕆᔨᓂᕐᓂ ᓄᓇᖓᐊᑦ ᐃᓕᖅᓱᐅᑎᓂᐊᖅᐸᑎᑦ (1:50,000 ᐊᑐᐃᓐᓇᐅᔨᖅᑕᕆᔨᓂᕐᓂ, 1:250, 000 ᐃᓕᖅᓱᐅᑎᓂᓴᓂᐊᖅᑐᖅ) ᑲᓇᑕᐅᑦ ᓄᓇᒋᐅᑕᓕᕆᓚᐅᖅᓯᓂᐅᓂ ᐊᑐᐃᓐᓇᐅᔨᖅᑕᕆᔨᖅᑐᖅ)

ᖃᐅᔨᓴᓕᖅᐅᓂᐊᖅᑯᖅ ᓱᓕᑦᓱᓂᓴᒃᑎᒋᐊᖅᑎᓂᓕᐅᖅᓱᓂᖅ ᐱᓕᕆᐊᕆᓚᖅᐅᔪᓕᔪᓂᑦ ᑐᓴᒪᔭᓕᐅᑎᒪᔭᖅᑲᓇᓕᓂᖅ ᑐᐱᖅᑕᑐᓕᐊᖅᑎᓂᓕᐅᖅᓱᓂᖅ ᐱᓕᕆᐊᕆᔪᓕᓴᓂᓕᒃᑕᖅᑐᒪᔭᖅᑲᓇᓕᓂᖅ ᑐᓴᒪᔭᓕᐅᑎᒪᔭᖅᑲᓇᓕᓂᖅᓱᓂᖅ ᑐᐱᖅᑕᑐᓕᐊᖅᑎᓂᓴᓂᐊᖅᑐᖅ (PSIR). ᖃᓄᑕᐅᔪᖅᑎᒍᑦ ᓄᓇᖓᐊᓕᓕᐅᓂᓂᓐᓄᑐᐃᓐᓇᓕᕆᐊᖃᖅᑐᖅ (GIS).

ᐃᓕᖓ 4: ᑐᓴᕐᔅᑐᑎᑎᒋᔭᑦ ᐱᓕᕆᐊᕆᔪᓕᔪᓕᔪᒍᑦ ᖃᓄᐃᓕᑐᑐᓂᐊᕐᓂᖓᓐᓄᑦ ᐅᖃᐅᔨᐅᓂᖓ

ᐃᓕᖅᓱᐅᑎᓗᒍ ᑐᓴᕐᔅᑐᑎᑎᒋᔭᑦ ᐱᓕᕆᐊᕆᔪᓕᔪᓕᔪᒍᑦ ᖃᓄᐃᓕᑐᑐᓂᐊᕐᓂᖓᓐᓄᑦ ᐅᖃᐅᔨᕆᔪᑎᑦ, ᒡᒃᔾᐊ ᑎᑎᕋᖅᑕᑎᑦ 500-ᓂᒃ ᐅᖃᐅᔨᓱᑎᑦ ᑎᑎᕋᖅᑎᓕᐊᕋᖅᑐᑦ ᖃᖓᓐᓂᐅᑎᔨᔪᓕᐊᕋᖅᖰᑎᑦᑐᑦ, ᖃᖅᑎᓗᓀᑐᑦᓗᓐᓂᑦ ᐃᓄᒃᑎᑦᓗᓐᓂᑦ (+ᐃᓄᐃᓐᓇᓴᖅᑎᑦᓗᓐᓂᑦ, ᖁᑎᕆᐅᓐᓂᓐᓂᐊᕐᓂᓂᐅᓂ). ᐱᓕᕆᐊᕆᔪᓕᔪᓕᔪᓐᓂᑦ ᐅᖃᐅᔨᐅᓂᖓᓐᓄ ᐅᑯᓂᖓᓐᓄ ᐃᓗᑕᖃᖅᑎᓕᐊᕋᖅᑐᖅ:

- ᐱᓕᕆᐊᑲᓴᓕᑦ ᐱᓕᕆᐊᕆᔪᓕᔪᓕᐊᕋᖅᑐᑦ, ᐱᑕᖃᖅᑎᕆᖃᓂᖓᓐᓂᑕ ᐊᓪᓚᑕ ᖃᓄᖅᑎᑎᑕ ᐱᓕᕆᐊᕆᔪᓕᔪᓕᐊᕆᓚᖓᓂᐅᓂᖅ;
- ᐊᐅᑦᑕᖃᖅᑕᐅᑎᐅᓂᐊᕋᖅᑐᑦ ᐊᐳᓪᓚᑦᑕᑕᐅᓂᐊᕋᖅᑐᑦ;
- ᓱᓇᐃᓐᓇᓚᐅᑦ ᓇᑦᐸᖅᑎᖃᖅᑕᐅᓂᐊᕋᖅᑐᑦ (ᓇᐸᑯᓘᓂᐊᕋᖅᑐᑦ/ ᐊᑐᖃᖅᑕᕆᐅᐃᓇᓂᐊᕋᖅᑐᑦᓗᓐᓂᑦ);
- ᐊᓱᖓᓐᓂᑦ ᐊᑐᖃᖅᑕᕆᐅᓐᓄᑦᓇᖅᑐᑦ; ᐊᓪᓚᑕ
- ᓱᕐᓂᓴᓘᑯᑦ ᓴᓇᔨᕆᐅᔨᓂᐊᕋᖅᑐᑦ, ᓴᓇᔨᕆᓂᐊᕆᓱᑎᕆᔨᓇᓕᑦᑕ ᓱᓇᑦ ᐊᑐᖃᖅᑕᕆᐅᐊᕆᓚᖓᓂᐅᓂᖅ ᐱᓕᕆᐊᕆᖏᐃᔨᐅᓂᐊᕋᖅᑐᒥ ᐊᓪᓚᑕ ᖃᓄᐱᑎᓂᕆᐅᓂᐊᕆᓱᑎᕆᔨᓂᕐᑕ ᐊᑐᖃᖅᑕᕆᐅᓂᐊᕆᓚᖓᓂᑕ.

ᖃᓄᐃᓕᑐᑐᓂᓕᕆᓚᐅᖅᑐᖅᑐᖅ: ᐱᓕᕆᐊᕆᔪᓕᐅᓂᐊᕐᓴᓂᕐ NIRB Part 2 PSIR-ᒧᑦ ᑕᑕᑎᔭᑕᑎᖃᖅᑎᓂᕆᐅᓂᐊᕋᖅᑐᖅᑎᑎᒃ ᐃᓕᖓ 8-ᑭᑕᖅᑐ ᑭᓱᐊᓂ ᑕᑕᑎᖃᖅᑕᐅᔪᓕᐊᕋᖅᑐᖅᑐᖅ ᑕᒪᓐᓇᑕᐊᐊᖏᓚᑐᓂ, ᐊᓱᖓᑦᓂᓕ ᐃᓕᖓ 5-ᒥᒃ ᐱᑎᐊᖏᐅᑐᒍ ᑕᑕᑎᖃᖅᑕᐅᔪᓕᐊᕋᖅᑐᖅᑐᖅ.

ᐃᓕᖓ 5: ᐊᑐᖃᖅᑕᐅᔨᖅᑎᑦ ᐊᑐᖃᖅᑕᐅᓂᐊᕆᓚᖓᓂᑦ

1. ᐱᕆᔨᑎᑦ ᐊᑐᖃᖅᑕᐅᓂᐊᕋᖅᑐᑦ ᑎᑎᕋᖅᓗᑦ (ᐃᓕᖅᓱᐅᑎᓗᑦ ᐃᔨᑕᑭᑎᑦ, ᐅᖃᓱᖅᑐᐃᐃᑎᑦ, ᑎᓪᓕᓱᑦ, ᓄᓇᖅᔨᔭᑦ, ᐊᓱᑭᓗᐅᖅᓯᓂᓗ.):

ᖃᓄᐃᓐᓇᖅ ᐱᕆᔨ ᐅᓇᓱᐅᑎᓚᓗ	ᐊᖓᑕᓚᓗ – ᑕᑭᓚᓗ >ᖅᑐᓂ	ᓱᓇᒧᑦ

2a. ᐅᖅᓯᒪᓕᐅᑦ ᐊᑦᑕᓇᖅᑐᖅᑎᑦᓗ ᐊᑐᖅᑕᐅᓂᐅᕆᔨᑦ ᐅᖅᑲᐅᓯᕐᓯᐊᓚᐊᓪᓕᑦ:

ᐅᖅᓯᒪᓕᑦ	ᐅᖅᓯᖅᑲᐅᑎᑦ ᐊᑐᖅᑕᐅᓂᐊᖅᑐᑦ ᐃᓚᖅᖅᑎᑎᓂᖏᓪᓕᑦᓗ ᖅᑦᑕᐅᕐᓴᐃᑦ	ᐅᖅᓯᒪᓕᐃᑦ ᐊᑐᖅᑕᐅᓂᐊᖅᑐᑦ ᑲᑎᑦᓗᑎᑦ (ᓄᑕᐃᑦ ᐊᑐᖏᓗᑎᑦ)	ᖃᓄᖅ ᑐᖅᑯᖅᑕᐅᓯᒪᓂᐅᕆᔨᕐᑦ
ᐅᖅᓯᓴᐊᐊᖅ			
ᒪᕆᓀᖅ			
ᑎᖏᒥᔨᖅᓯᐅᑎᑦ			
ᐳᑦᑕᓀᑦ			
ᐊᓯᖏᑎᑦ			
ᐊᑦᑕᐃᖅᑐᖅᑕᓀᑦ ᐃᓕᐅᖅᓯᖅᓯᒪᔨᑦᓗ		ᑲᑎᑦᓗᑎᑦ ᐊᑦᑕᐃᖅᑐᖅᑕᓀᑦ ᐃᓕᐅᖅᓯᖅᓯᒪᔨᑦᓗ (ᓄᑕᐃᑦ ᐊᑐᖏᓗᑎᑦ)	

2b. ძᕆᔨᖅᑕᕆᖅᕐᓂᐊᓵᖅᑎᑦᓗᒍ ᖃᓄᖅ ᐸᖏᐅᑎᖅᕐᓂᐊᓪᓚᕆᕆᓚ ძᕆᔨᖅᑕᕆᖅᕐᓂᖅᐸᑦ ᐅᖅᑲᐅᓪᓚᓯᐊᐅᖅ .

3a. ᖃᓄᐅᑎᑭ ᐃᒪᖏᑲ ᐊᑐᖅᑕᑦᕐᓂᐊᕐᓯᑎᖅᓴᓗᖅᐱᑦ

ᐅᑦᓗ ᑕᒪᖅ ᐱᖅᓯᓯᐊᖅᑎᕐᓗᒍ (m³)	ᓯᓇᒧᑦ ᖃᓄᖅᑐᑦ ᐃᒥᖅᑕᕆᖅᑕᑦᕐᓂᐊᓪᓚᕆᕆᓚ	ᓇᑭᑦ ᐃᒥᖅᑕᕆᖅᑕᑦᕐᓂᐊᓪᓚᕆᕆᓚ

3b. ᐃᒥᖅᑕᕆᖅᑕᑦᕐᓂᐊᕐᓂᕐᒧᑦ ᓄᓇᕗᒥ ᐃᒪᓕᓪᓂᕐᒧᑦ ᑲᑎᒪᔨᓂᖅ ᓕᐃᓴᖅᑕᕐᓯᐊᖅᐱᑦ ?

☐ ᐃ ☐ ᐊᖏᑐ

ᐃ-ᖃᐅᓂᕈᓂ, ᖃᓄᐃᑕᑐᖅᑯᑦ ᓕᐃᓴᖅᓯᑎᒍᑦ ?

☐ Class A ᐃᒥᖅᑕᕐᓂᕐᒧᑦ ᓕᐃᓴᖅᓴ

☐ Class B ᐃᒥᖅᑕᕐᓂᕐᒧᑦ ᓕᐃᓴᖅᓴ

ᐃᓕᖅ 6: ᐊᒃᑕᑯᑦ ᐃᑎᐅᖃᖅᑕᐅᓂᐊᖅᓂᖅᐳᓄᑦ ᓴᓗᓚᖅᓴᐃᓂᖅᓗᓪᓗᑦ

1. ᑎᑎᕕᖅᓗᑎᑦ ᐊᒃᑕᖅᑕᐅᓵᒃᓴᑦ ᑐᒃᓯᖅᑐᑎᒃᑯᑦ ᐱᓕᕆᐊᓚᐅᓂᐅᔪᓚᑦ ᓴᖅᑭᐊᑎᑕᐅᓂᐊᕐᓯᑎᐅᔪᑦ :

ᐊᒃᑕᑯᖅ	ᓴᖅᑭᐊᓂᐊᕐᓯᑎᓴᐅᔪᑦ	ᖃᓄᖅ ᐃᑎᐅᖃᖅᑕᐅᓂᐊᖅᑕᑦ	ᓴᓗᓚᖅᓴᐃᑕᐅᒃᖃᓐᓂᐊᖅᑐᑦ
ᖃᐅᖅᑕᑦ (ᐃᓄᖓᓕᒫᖅᑐᑦ)			
ᐅᐊᓴᑎᑲᓚᖅᓯᑦ			
ᐃᑯᐊᓕᑕᐅᔪᓐᓇᖅᑐᑦ			
ᐃᑯᐊᓕᑕᐅᔪᓐᓇᖏᑦᑐᑦ			
ᓄᓇᒥᑦᑐᑦ (ᓄᓇ, ᐊᑐᖅᑕᐅᔪᓐᓇᕐᓂᐊᖏᑦᑐᑦ, ᓯᖃᓕᖅᑐᖅᑕᐅᓯᒪᓂᑯᐃᐸᑦ)			
ᐊᑦᑕᓇᖅᑐᖅᑕᓪᓕᖅ			
ᐊᓯᖏᑦ:			

2. ᐅᖃᐅᓯᕆᓕᑐᒍ ᖃᓄᖅ ᐊᒃᑕᑯᑦ ᐃᑎᐅᖃᖅᑕᐅᖃᖅᑕᑦᓂᐊᕆᐊᖏᑦᓄᓪᓕᑦ.

ᐃᓕᖅ 7: ᓄᓇᓕᒋᑲᐅᔪᑦ ᐃᓕᐅᑎᑕᐅᓂᐊᕐᓯᑎᓴᐅᔪᑦ & ᐊᐃᕐᑐᖅᓯᒪᐅᖃᖅᑐᒧᓪᓗ ᐃᑲᔪᑕᐅᓂᐊᖅᑐᑦ

1. ᑎᑎᕕᖅᓗᑎᑦ ᓄᓇᓕᒋᑲᐅᔫ ᑭᓚᖅᑐᐃᐃᓪᑦ ᖃᐅᐅᓴᖃᖅᑎᑕᐅᔪᐃᐊᖅᑕᑦ ᐊᓘᒪᓗ ᑲᑎᒪᔨᔪᑎᐃᓴᖅᑕᕐᖃᖅᓯᓂᓗ ᐊᑐᐃᓴᓇᐅᑎᓪᓗᑎᑦ:

ᓄᓇᓕᒋᑲᖅ	ᐊᑎᖏᓚ	ᑲᑐᔾᔨᖃᑎᒋᑦ	ᐅᓪᓗᖓ ᖃᐅᐅᓴᖃᖅᑕᐅᓂᐊᖅᓚ

ᐃᓕᖅᑲᓇ: ᑭᓯᑐᐃᓐᓇᕐᒧᑦ ᐊᐱᖅᑯᑎᑦ

1. ᖃᐅᔨᓪᓚᕆᔨᓂᖅ ᐃᓕᓴᓂᑕᖃᖅᖢᓗᓂᓴᓂᖅ ᐊᐅᑐᐃᓂᐊᖅᐲᑦ ?

☐ ᐃ ☒ ᐊᑦᑕ

ᐃᓕᖅᑕ 9: ᐊᑎᓕᐅᑭᓯᑦ

ᑐᐅᓴᖅᑎᑦ ᐊᑎᓕᐅᕐᓗᒍ ᐅᓪᓗᖅᓗᓐ ᑎᑎᕐᓗᒍ :

Project Manager

2015-09-21

ᐊᑎᓕᐅᑭᓯᑦ ᑭᓯᓕᒫᕆᐅᓂᖓ ᐅᓪᓗᒥ

ᐊᑕᓪᓚᖅ A
ᐱᓕᕆᐊᓱᐅᓂᐊᖅᑐᑦᓂᓄᑦ ᑐᑭᖏᑦ

ᐊᑐᕆᐊᒃᓴᓕᐅᕐᒪᓂᖅ: ᑐᓴᖅᑎᑎᕆᔨᑦ ᐱᓕᕆᐊᓱᐅᕐᓚᕐᖅ ᓄᓇᕆᔨᓗᓄᑦ ᐊᑐᕆᐊᖅᑕᕐᕆᐅᓇᖅᑑᓪᓗᒍ ᓄᓇ ᓯᓂᓪᓗᐊᖅᑕᐅᑦᑕᐃᓕᓕᒐᓂᓪᓚᑦ.

ᓯᕗᓪᒫᑎᐊᖅᑕᐅᓯᒪᓚᖅ ᓴᐃᕐᓴᒃᓴᖅᓯᐅᕐᒪᓂᖅ: ᑐᓴᖅᑎᑎᕆᔨᑦ ᐱᓕᕆᐊᓱᐅᕐᓚᕐᖅ ᐅᓪᓗᐃᖅᑕᐅᕐᓇᓯᐊᖅᑐᓗᒃ ᐊᐅᓂᖅᓚᑦ, ᐱᐅᓂᖅᓚᑦ, ᖃᐅᓄᐃᑎᑎᓂᖅᓚᓪ ᓴᐃᕐᓴᒃᓴᖅᑕᕐᕆᖃᖅᑎᑦ ᐊᓘᓚᓪ ᑭᓇᐅᔪᓕᐅᕐᑕᕐᕆᐅᓇᖅᑐᓂᖅᓯᖅᑕᖅᓯᐅᕐᒪᓂᖅᓚᓪ ᐅᔪᖅᓯᓯᐃᓕᓕᐅᖅᑕᕐᕆᐅᓇᖅᑐᓂᖅᓯᖅᑕᖅᓯᐅᕐᒪᓂᖅᓚᓪ ᓴᐃᕐᓴᒃᓴᖅᑕᕐᕆᖃᖅᑎᑦ.

ᖃᐅᓄᐃᑎᑎᐃᓇᓇᕐᒥᓂ ᓯᓚᖅᓂ ᐊᖏᓂᖅᓯᐅᕐᓚᕐᖅ: ᑐᓴᖅᑎᑎᕆᔨᑦ ᐱᓕᕆᐊᓱᐅᕐᓚᕐᖅ ᐊᖏᖅᑐᒍᓐᓇᖅ ᐊᑐᕆᐊᖅᑕᕐᕆᐅᓇᖅᑐᓂᖅᓯᖅᑕᖅᓯᐅᕐᒪᓂᖅᓚᓪ ᐊᖏᖅᑐᒍᓐ

ᓄᓇᒥ ᑕᓪᓕᒥᔨᖅᓂ ᓄᓇᖅᐱᐊᓕᓕᒫᓂᖅ: ᑐᓴᕐᕆᑎᑦᓴᓕᕆᓂᖅ ᐱᓕᕆᐊᓪᓚᐅᓕᓴᖅ ᖃᐅᖅᑎᕐᖅᖅᑐᒧᑦ ᑕᓕᑐᐅᖅᑕᕐᕕᑐᓂᓗ ᖃᐅᓄᑎᒥ ᓄᓇᓕᒃ ᐃᓕᐊᑐᐃᓐᓇᖅᓂ ᓕᕆᕐᖃᑦ ᖃᐅᔨᖅᑐᑐᒧᑦ ᐃᓐᓇᑐᒧᑦ ᐱᓕᕆᓂᖅ ᐃᓕᓴᕐᕕᒃᓴᓪᓚᐅᖅᑕᕐᓂᖅ ᖃᐅᔨᓴᓕᒪᑦ ᖃᐅᔨᓴᖅᑕᕐᕕᓂᑎᒃ ᓴᖅᑭᖓᓕᕆᓂᒃ ᐃᖅᑕᕐᕕᒃᓴᓪᓚᐅᖅᑕᕐᕕᓂᖅ ᑎᑎᕋᐅᓂᒃ ᐱᓕᕆᓂᖅ ᖃᐅᔨᓴᖅᑕᕐᕕᓂᑎᒃ ᓄᓇᓕᒃ ᖃᐅᔨᓴᖅᑕᕐᕕᓂᑎᒃ ᐱᓕᕆᓂᖅ

PART 1 FORM
PROJECT PROPOSAL INFORMATION REQUIREMENTS

To access NIRB documents, project screenings, and project reviews please visit the Nunavut Impact Review Board's ftp site http://ftp.nirb.ca/. The NIRB's website (www.nirb.ca) is currently under construction. Please contact info@nirb.ca should you have any questions or require further information.

IMPORTANT!
Please be advised that your application will not be processed until the Sections 1 - 9 are completed in their entirety, in both English and Inuktitut (+ Inuinnaqtun, if in the Kitikmeot).

SECTION 1: APPLICANT INFORMATION

1. Project Name

FOX-D (Kivitoo, Nunavut) Site Remediation Project

2. Applicant's full name and mailing address:

	Phone:	
Aboriginal Affairs and Northern Development Canada (AANDC)	Fax:	
	Email:	

3. Primary contact's full name and mailing address:

	Phone:	(819) 934-1188
Mark Yetman	Fax:	819-934-9229
Senior Project Advisor, AANDC	Email:	Mark.yetman@aandc.gc.ca

SECTION 2: AUTHORIZATION NEEDED

1. Indicate <u>all</u> authorizations associated with the project proposal:

X	Regional Inuit Association (RIA)		Canadian Launch Safety (CLS)
X	Nunavut Water Board (NWB)		Canadian Wildlife Service (CWS)
X	Nunavut Planning Commission (NPC)		Department of National Defense (DND)
	Government of Nunavut (GN)		Environment Canada (EC)
	Community Government & Services (CG&S)		Fisheries and Oceans Canada (DFO)
	Culture and Heritage (CH)		Parks Canada (PC)
	Nunavut Research Institute (NRI)		Hamlet
X	Aboriginal Affairs and Northern Development Canada (AANDC)		Other (please specify):

2. List the <u>active</u> permits, licenses, or other authorizations related to the project proposal, and their expiry date(s):

None

3. **List the pending* permits, licenses, or other authorizations related to the project proposal:**

- Nunavut Water Board "General Water Licence Application" (appendix 2)
- QIKIQTANI INUIT ASSOCIATION – Access to Inuit Owned Land Permit (appendix 9)
- Aboriginal Affairs and northern Development Canada Land Use Permit (appendix 10)
-Nunavut Planning Commission Land-Use Conformity (Appendix 1)

*Please provide a copy of all applications to the NIRB.

4. **Has this project or any components of this project been previously screened or reviewed by NIRB?**

☐ **YES** x **NO**

If YES, indicate the previous project name and NIRB File No.

SECTION 3: PROJECT PROPOSAL DESCRIPTION

1. **Indicate the type of project proposal (check all that apply)[1,2]: (See Appendix A for Project Type Definitions)**

1	All-Weather Road/Access Trail	☐	**9**	Site Cleanup/Remediation	X
2	Winter Road/ Winter Trail	☐	**10**	Oil and Natural Gas Exploration/Activities	☐
3	Mineral Exploration	☐	**11**	Marine Based Activities	☐
4	Advanced Mineral Exploration	☐	**12**	Scientific/International Polar Year Research*	☐
5	Mine Development /Bulk Sampling	☐	**13**	Harvesting Activities*	☐
6	Pits and quarries	☐	**14**	Tourism Activities*	☐
7	Offshore Infrastructure (port, break water, dock)	☐	**15**	Other[2]:	☐
8	Seismic Survey	☐			☐

Please note:

1. All project types listed above, except those marked with an asterisk (*), will also require the Proponent to submit a **Part 2 Project Specific Information Requirement (PSIR) Form**. The NIRB application process will not be considered complete without the Part 2 PSIR Form.
2. Please be advised that in order to complete the NIRB process, the NIRB may request additional information at any time during the process.
3. If "Other" is selected, contact NIRB for direction on whether a Part 2 PSIR Form is required.

2. If Project Type 3, 4 or 5 was selected in previous question, please indicate the mineral of interest that is being extracted. Include a brief description.

- [ ] Base Metals (zinc, copper, gold, silver, etc)_____
- [ ] Diamonds
- [ ] Uranium
- [ ] Other: _____

3a. If Project Type 12, 13 or 14 was selected above, complete the table and questions below.

Transportation Type	Quantity	Proposed Use	Length of Use

3b. Describe any docks, piers, air strips or related structures that are to be used in conjunction with the proposed project activities. **Please note**: *the building of new structures may require a Part 2 Form.*

There is an existing airstrip on site. Small maintenance related measures might have to be done to the surface of the airstrip to make it functional for operations. There is also an existing barge landing area which will be used for remediation of the site, and transfer of materials via sealift to the south for disposal at appropriate licenced facilities.

3c. If a temporary camp site is to be established, describe the proposed structures in detail and indicate the type and source of power for the camp site if applicable.

A small temporary camp will be established on site.

4. Personnel

Total No. of personnel on site = (A) 30

Total No. of days on-site = (B) 180

Total No. of Person days (A) × (B) = 5400

5. Timing

Period of operation: from **July 2016** to **September 2020**

Proposed term of authorization: from **July 2016** to **September 2020**

6a. Region (check all that apply):

- [ ] North Baffin
- [x] South Baffin
- [ ] Kivalliq
- [ ] National Park
- [ ] Kitikmeot
- [ ] Transboundary: _____

6b. Describe the location of the proposed project activities in a regional context, noting the proximity to the nearest communities and any protected areas.

The site is located 50 km to the west of the nearest community, Qikiqtarjuaq, Nunavut, at approximately 67° 57' 01" N latitude and 64° 55' 04" W longitude. After military operations at the site ceased, the site

became part of the Auyittuk National Park. FOX-D was within Auyuittuq National Park under the management of Parks Canada until 1992, when custody of the site was transferred to AANDC (formerly Indian and Northern Affairs Canada (INAC)).

6c. Discuss the history of the site if it has been used for any project activities in the past.

FOX-D (Kivitoo) was an Intermediate Distant Early Warning (DEW) Line Site constructed in 1957 and operated until October 1963. (Further details are provided in section 4 of this application.)

6d. Indicate if there are any known archaeological/palaeontological historical sites in the area.
Please see attached Archaeological Site Assessment for Fox-D which can be found in appendix 6.

7. Land Status (check all that applies):

X	Crown		Commissioners'		Municipal
X	Inuit Owned Surface Lands		Inuit Owned Sub-Surface Lands		

8a. Co-ordinates:

Min Lat (degree/minute)	67°55'41.33"N	Min Long (degree/minute)	64°51'1.34"W
Max Lat (degree/minute)	67°57'42.31"N	Max Long (degree/minute)	64°57'58.30"W

NTS Map Sheet No: 026P15
(Please ensure that maps of the project are attached (1:50,000 **if available**, 1:250, 000 **Mandatory**) available from Natural Resources Canada)

8b. If the project proposal includes a **camp**, please provide the coordinates of the camp location

Min Lat (degree/minute)	67°56'3.42"N	Min Long (degree/minute)	64°53'24.56"W
Max Lat (degree/minute)	67°56'3.42"N	Max Long (degree/minute)	64°53'24.56"W

If different from above for the camp:
NTS Map Sheet No: 026P15
Please ensure that maps of the project are attached (1:50,000 **if available**, 1:250, 000 **Mandatory**) available from Natural Resources Canada

Please note that additional location information may be required in a subsequent Project Specific Information Requirement (PSIR) submission. This may take the form of a digital Geographic Information Systems (GIS) file.

SECTION 4: NON-TECHNICAL PROJECT PROPOSAL DESCRIPTION

Please include a non-technical description of the project proposal, no more than 500 words, in English and Inuktitut (+Inuinnaqtun, if in the Kitikmeot). The project description should outline the following:

- The project activities, their necessity and duration;
- Method of transportation;

- Any structures that will be erected (permanent/ temporary);
- Alternatives considered; and
- Long-term developments, the projected outcome of the development for the area and its timeline.

IMPORTANT: IF THE PROPOSED ACTIVITIES REQUIRE SUBMISSION OF A NIRB PART 2 PSIR FORM, PLEASE COMPLETE SECTION 8 ONLY, OTHERWISE CONTINUE ON WITH SECTION 5.

PLEASE SEE APPENDIX 3 FOR THE EXECUTIVE SUMMARY.

SECTION 5: MATERIAL USE

1. List equipment to be used (including drills, pumps, aircraft, vehicles, etc.):

Equipment type and number	Size – dimensions	Proposed use

2a. Detail fuel and hazardous material use:

Fuel	Number of Containers and Capacity of Containers	Total Amount of Fuel (in Litres)	Proposed Storage Methods
Diesel			
Gasoline			
Aviation fuel			
Propane			
Other			
Hazardous Materials and Chemicals		**Total Amount of Hazardous Materials and Chemicals (in Litres)**	

2b. Describe the proposed Spill Prevention Plan.

3a. Detail the anticipated daily water consumption rates

Daily amount (m^3)	Proposed water retrieval methods	Proposed water retrieval location

3b. Have you applied for a water License* with the Nunavut Water Board?

X **YES** ☐ **NO**

If yes, what class of licence?

☐ **Class A Water Licence** X **Class B Water Licence**

*Please provide a copy of the application or licence to the NIRB.

SECTION 6: WASTE DISPOSAL AND TREATMENT METHODS

1. List the types of waste associated with the proposed project activities:

Type of waste	Projected amount generated	Method of Disposal	Additional treatment procedures
Sewage (human waste)			
Greywater			
Combustible wastes			
Non-Combustible wastes			
Overburden (organic soil, waste material, tailings)			
Hazardous waste			
Other:			

2. Describe the proposed Waste Management Plan.

SECTION 7: COMMUNITY INVOLVEMENT & REGIONAL BENEFITS

1. List the community representatives that have been contacted and provide the minutes of the meetings if available:

Community	Name	Organization	Date Contacted

SECTION 8: GENERAL QUESTIONS

1. Will you be disturbing any known archaeological sites?

☐ **YES** X **NO**

SECTION 9: APPLICANT SIGNATURE

Please sign and date your application:

Signature	Title	Date
[signature]	Project Manager	2015-09-21

APPENDIX A
Project Type Definitions

Access Trail: A project proposal with the objective of providing vehicular access to an area of interest involving minimal alteration to the terrain.

Advanced Exploration: A project proposal with the objective of identifying size, grade, and physical characteristics of a mineral occurrence and to assess the economic and technical feasibility of developing the mineral deposit into a producing mine

All-Weather Road: A project proposal with the objective of road construction for use in all seasons.

Bulk Sampling: A project proposal with the objective of extracting of large samples of mineralized material involving hundreds to thousands of tonnes. Samples are selected as representative of the potential mineral deposit being sampled. May involve crushing/milling (on small-scale)

Harvesting activities: A project proposal with the objective of harvesting animals, marine mammals and/or fish from their natural habitats by means of hunting or trapping for traditional and commercial use.

Marine Based Activities: Any activity occurring in the marine environment, such as vessel use associated with land-based activities or disposal at sea.

*Please note that normal community re-supply or individual ship movements not associated with land-based project proposals shall not be screened by NIRB (Section 12.12.2 of NLCA).

Mine Development: A project proposal with the objective of extracting broken rock with mineralization of sufficient grade and tonnage to sustain commercial mining operations (ore). Mining a body of ore can be achieved by either open pit and/or underground development. Mine development may involve milling. Milling involves treatment of the extracted ore through a combination of mechanical and chemical processes to selectively recover the valuable mineral.

Mineral Exploration: A project proposal with the objective of exploring an area to find geological anomalies. It involves site reconnaissance (ground and/or air) to locate broad and fiscal mineral deposits.

Offshore Infrastructure: A project proposal with the objective of building off loading facilities constructed off the shoreline and connected to the mainland of the marine or freshwater environment. Examples include a jetty, dock, or port facility.

Oil and Gas Exploration/Activities: A project proposal that includes 1) exploration, such as seismic or geological mapping, 2) drilling of oil and gas wells, 3) construction and operation of a pipeline, a gas processing plant or any oil and gas facility within Nunavut.

Pits and Quarries: A project proposal with the objective of pitting, which involves the extraction of granular material (i.e. sands and gravels) and quarrying, which involves the removal of consolidated rock (i.e. bedrock, frozen soil).

Scientific Research: A project proposal with the objective of implementing a series of site activities comprised of observation of phenomena, measurement and collection of data necessary for scientific investigation in designated areas within a limited time period.

Seismic Survey: A project proposal with the objective of conducting a survey to map the depths and contours of rock strata by timing the reflections of sound waves released from the surface. Survey site locations may be offshore (not within 12 nautical miles of any coast), near shore, and extended onshore.

Site Cleanups: A project proposal with the objective of site cleanups (includes DEW line site cleanups), which focuses on the remediation of chemically contaminated soils, stabilization of landfills and dumps, demolition/disposal of infrastructure and debris and monitoring after cleanup is completed.

Tourism Activity: A project proposal with the objective of conducting travel predominantly for recreational, sport or leisure purposes within a designated area and limited time period.

Winter Road: A project proposal with the objective of building a road for winter use by leveling and compacting surface snow and ice. Winter road is removed at end of season.

Winter Trail: A project proposal with the objective of building a trail for winter use by a single pass of a tracked vehicle using a blade, if necessary.

APPENDIX 3:

NUNAVUT IMPACT REVIEW BOARD (NIRB)
PART 2 FORM

SCREENING PART 2 FORM
PROJECT SPECIFIC INFORMATION REQUIREMENTS (PSIR)

1. SUBMISSIONS

The Proponent must submit all information pertaining to the Project as a whole. The information requirements below are designed for the purpose of environmental assessment and are not limited to the scope of a single permit or license application.

IMPORTANT: Please be advised of the following:

1. NIRB does not accept references to an ftp or web sites as a submission.

2. The Proponent must provide NIRB with 1 (one) electronic copy and 1 (one) hardcopy of the required information in English.

3. All maps should be shapefiles, be legible, and should include grids, be of appropriate scale, indicate the scale, include latitude and longitude references, NTS Maps numbers, title, legend and a north arrow. To the extent possible, avoid hand-drawn demarcations and faxed maps; and,

4. Please complete all required information in each section below. If the required information is not applicable to the project proposal, please indicate this in the response with "n/a". If the request has been provided in a different section or report, please note the section or report where the response can be found.

2. GENERAL PROJECT INFORMATION REQUIREMENTS

Project Coordinates and Maps

1. The preferred method for submitting project coordinates information is through the use of a Geographic Information System (GIS) compatible digital file. Although an ESRI ArcView 3.x shape file (in decimal degrees) is the preferred interchange format, the NIRB has the capacity to receive over 100 GIS and CAD related formats, including MapInfo and AutoCAD, provided proper format and projection metadata is also submitted. The NIRB requires coordinates for the project proposal which reflect the entire project area as defined by:

   - Area/sites of investigation;
   - Boundaries of the foreseen land use permit/right-of-way area(s) to be applied for;
   - Location of any proposed infrastructure or activity(s); and,

- Boundaries of the mineral claim block(s) where proposed activities will be undertaken.

FOX-D (Kivitoo) was an Intermediate Distant Early Warning (DEW) Line Site constructed in 1957 and operated until October 1963. The site is located on the Davis Strait. The site is located 50 km to the west of the nearest community, Qikiqtarjuaq, Nunavut. The site is accessible by fixed wing aircraft, helicopter, and sealift. The proposed site activities will take place within the boundaries detailed below:

NW: Latitude: (67°57'42.31"N) Longitude: 64°55'13.18"W)
NE: Latitude: (67°56'25.39"N) Longitude: (64°51'1.34"W)
SE: Latitude: (67°55'41.33"N) Longitude: (64°51'44.69"W)
SW: Latitude: (67°55'45.36"N) Longitude: (64°57'58.30"W)

Additional Site Maps and Drawings as well as further details on site activities are available in the Remedial Action Plan (RAP) which can be found in Appendix 4.

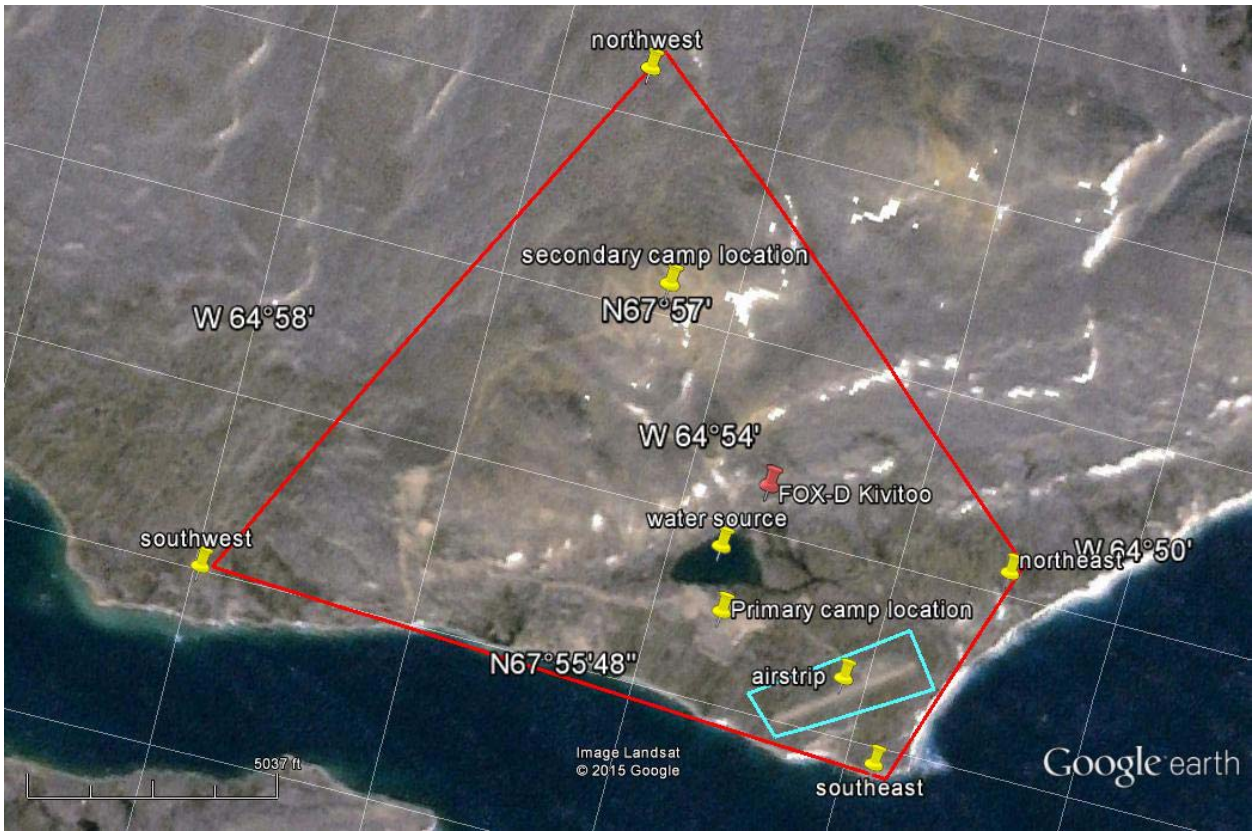
2. Map of the project site within a regional context indicating the distance to the closest communities.

The site is located on the Davis Strait. The site is located 50 km to the west of the nearest community, Qikiqtarjuaq, Nunavut.

3. Map of any camp site including locations of camp facilities.

Primary Camp:
Latitude: (67°56'3.42"N) Longitude: (64°53'24.56"W)

Secondary Camp :
Latitude: (67°57'2.23"N) Longitude: (64°54'35.47"W)



4. Map of the project site indicating existing and/or proposed infrastructure, proximity to water bodies and proximity to wildlife and wildlife habitat.

Please consult maps that are located in the back section of the Remedial Action Plan which can be found in appendix 4.

Project General Information

5. Discuss the need and purpose of the proposed project.

The purpose of the project is to eliminate/reduce the hazards (human health and environmental) associated with the former Intermediate Distant Early Warning (DEW) Line site. The hazards at the site include PCBs, heavy metals, asbestos, petroleum hydrocarbons, and physical hazards associated with the site infrastructure and debris.

6. Discuss alternatives to the project and alternative methods of carrying out the project, including the no-go alternative. Provide justification for the chosen option(s).

Alternative methods for carrying out the project are discussed in the Remedial Action Plan (Appendix ___). The Remedial Action Plan also provides justification for the methods chosen based on eliminating/reducing the hazard and the associated costs.

7. Provide a schedule for all project activities.

Construction
Proposed Start Date: ___July/2016__ (month/year) Proposed Completion Date: _____September/2016___ (month/year)

Operation
Proposed Start Date: ____July/2017__ (month/year) Proposed Completion Date: _October/2018_____ (month/year)

Closure
Proposed Start Date: _____June/2019 (month/year) Proposed Completion Date: _____August/2019_____ (month/year)

Post - Closure
Proposed Start Date: ___September/2019 Proposed Completion Date: __March/2020__

A detailed project schedule is included in appendix 7.

8. List the acts, regulations and guidelines that apply to project activities.

- Canada Labour Code (R.S. 1985, c.L.-2)
- Canada Occupational Health and Safety Regulations (SOR/86-304)
- Environmental Protection Act (Nunavut) (R.S.N.W.T. 1988, c.E-7)
- Transportation of Dangerous Goods Act (S.C. 1992, c. 34) a 1999, c. 31
- Nunavut Land Claim Agreement (Agreement Between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in Right of Canada, 1993)
- Spill Contingency Planning and Reporting Regulations (N.W.T. Reg. 068-93)
- Migratory Birds Convention Act (1994, c. 22)
- National Fire Code of Canada (1995) a. 2002
- Ozone Depleting Substances Regulations (SOR/99-7)
- Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health (CCME, 1999)
- Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME, 1999)
- CCME - Canadian Sediment Quality Guidelines for the Protection of Aquatic Life (2002).
- Canadian Environmental Protection Act (1999, c. 33)
- Controlled Products Regulations (SOR/88-66) a.SOR/2001-254
- Transportation of Dangerous Goods Regulations (SOR/2001-286) a. SOR/2003-400
- Intra-provincial Movement of Hazardous Waste Regulations (SOR/2002-301)
- Nunavut Waters and Surface Rights Tribunal Act (2002, c. 10)
- Nunavut Environmental Guideline for Waste Asbestos (GN, 2002)
- Contaminated Sites Management Policy (INAC, 2002)
- Northern Affairs Contaminated Sites Management Policy (INAC, 2002)
- A Federal Approach to Contaminated Sites (CSMWG, 2002)
- Used Oil and Waste Fuel Management Regulations (N.W.T. Reg. 064-2003)
- INAC NCSP Project Level Risk Management Guidance Document (AANDC, 2008);
- Contaminated Sites Cost Estimating Guide (AANDC, 2012)
- Treasury Board Policy on Management of Real Property (TB, 2006)
- Risk Management Tool & Reporting Tool User Guide (INAC, 2007)
- Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil (CCME, 2008)
- Environment, Health & Safety Management System Manual (AANDC, 2012)
- Environment, Health & Safety Standard Operating Procedures Manual (INAC, 2008)
- Environment, Health & Safety Control Framework, Northern Contaminated Sites Program (INAC, 2008)
- Environment, Health & Safety Audit Program Guide (INAC, 2008)
- Construction Project Safety Management Guide, 5th Edition (PWGSC, 2008)

- Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations (SOR/2008-197)
- PCB Regulations (SOR/2008-273)
- Abandoned Military Site Remediation Protocol (INAC, 2009)

9. List the approvals, permits and licenses required to conduct the project.

The approvals, permits and licenses required include:

- Water Licence (appendix 2)
- Crown Land Use Permit (appendix 10)
- Inuit Owned Land Access Permit (appendix 9)

DFO Operational Statement (OS) Conformity

10. Indicate whether any of the following Department of Fisheries and Oceans (DFO) Operational Statement (OS) activities apply to the project proposal:
    - Bridge Maintenance
      N/A
    - Clear Span Bridge
      N/A
    - Culvert Maintenance
      Yes
    - Ice Bridge
      N/A
    - Routine Maintenance Dredging
      N/A
    - Installation of Moorings
      N/A

11. If any of the DFO's OS apply to the project proposal, does the Proponent agree to meet the conditions and incorporate the measures to protect fish and fish habitat as outlined in the applicable OS? If yes, provide a signed statement of confirmation.

    Aboriginal and Northern Development Canada agrees to meet the conditions and incorporate the measures to protect fish and fish habitat as outlined in the applicable Operational Statements.

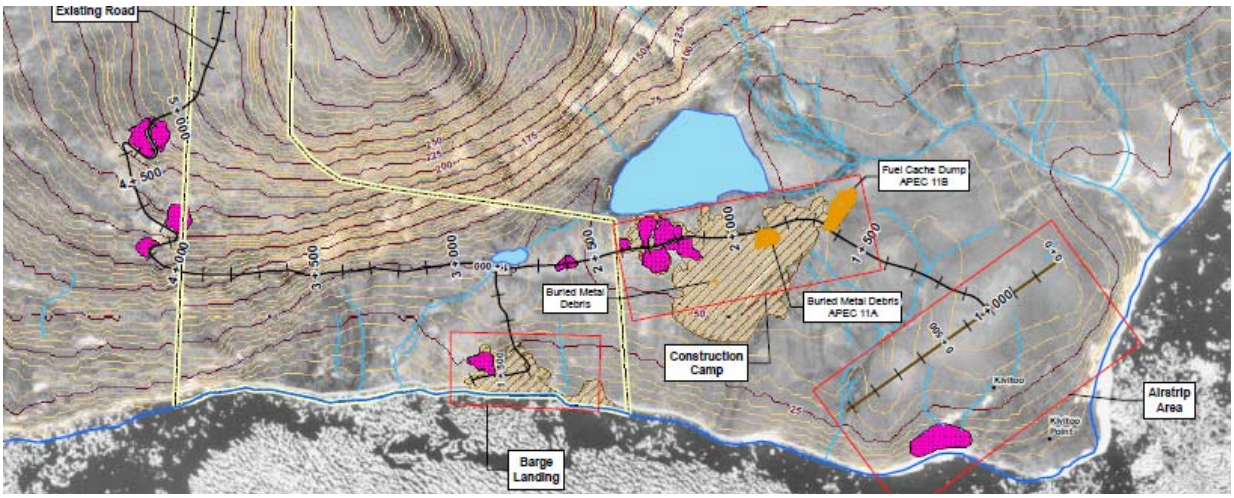
Mark Yetman
Senior Project Officer – Contaminated Sites Program

Date 2015-09-21

Transportation

12. Describe how the project site will be accessed and how supplies will be brought to site. Provide a map showing access route(s).

Equipment and materials will be mobilized to the site via sealift/barge. The sealift/barge will land at the beach area titled “Barge Landing” in the diagram below. Perishables and other material will be brought to the site on charter aircraft.



13. If a previous airstrip is being used, provide a description of the type of airstrip (ice-strip/all-weather), including its location. Describe dust management procedures (if applicable) and provide a map showing location of airstrip.

An abandoned airstrip exists at the site. This airstrip will be used throughout the remediation activities. Minor repairs to the airstrip will be completed on an as-needed basis. A map showing the location of the airstrip can be seen in the question above. Further maps can be found in the Remedial Action Plan which can be found in appendix 4.

14. If an airstrip is being constructed, provide the following information:
    a. Discuss design considerations for permafrost
       N/A
    b. Discuss construction techniques
       N/A
    c. Describe the construction materials, type and sources, and the acid rock drainage (ARD) and metal leaching (ML) characteristics (if rock material is required for airstrip bed).
       N/A
    d. Describe dust management procedures.
       N/A
    e. Provide a map showing location of proposed airstrip.
       N/A

15. Describe expected flight altitudes, frequency of flights and anticipated flight routes.

Flights will fly at a minimum altitude of 1,100 metres and maintain a minimum horizontal distance of 1,500 metres from concentrations of birds. Flights to and from the site will occur one to two times per week.

Camp Site

16. Describe all existing and proposed camp structures and infrastructure

All existing structures will be demolished as part of the remedial activities. Details of the existing infrastructure can be found in the Remedial Action Plan which is found in Appendix 4.

Proposed infrastructure (to support remedial activities) includes:

- Temporary camp (including a sewage lagoon and incinerator for waste treatment and disposal)
- Temporary garage

17. Describe the type of camp:
    a. Mobile
    - Yes, camp will consist of mobile camp units transported to site

    b. Temporary
    - Yes, camp facility will be removed upon project completion

    c. Seasonal
    - Yes, camp will operate seasonally between July and September
    d. Permanent
    -No, the camp will be removed upon remediation of the site

    e. Other
    -N/A

18. Describe the maximum number of personnel expected on site, including the timing for those personnel involved with the project.

The maximum number of personnel expected to be on site is 30. Site activities will take place from July to September each year. The number of Personnel on site will be lower at the beginning and end of each season as the camp is set-up/decommissioned/winterized.

Equipment

19. Provide a list of equipment required for the project and discuss the uses for the equipment.

    The equipment required to complete the remediation project includes:

- Excavator(s) to remove impacted soils for treatment and for use in trail and/or road improvements;
- Front end loader(s) to consolidate materials and for road improvements;
- Haul truck(s) to move materials to staging and treatment areas;
- Crusher(s) to develop on-site aggregate material;
- Waste incinerator(s) (both for the camp waste and for incineration of certain materials currently located on-site);
- Dozer (s) to be used for landfill construction and road improvements;
- Water truck to haul water to camp if required or for dust suppression;
- Waste compactor;
- Drum crusher;
- All-terrain vehicle (s) with trailers;
- Packer to ensure compaction is appropriate with the natural terrain;
- Generators (for remedial equipment); and,
- Other miscellaneous equipment determined by contractor.

20. If possible, provide digital photos of equipment.
    N/A

Water

21. Describe the location of water source(s), the water intake methods, and all methods employed to prevent fish entrapment. Provide a map showing the water intake locations.

Water will be sourced from the Freshwater Lake located centrally on the site (GPS Coordinates 67°56'15.96"N, 64°53'33.44"W). Water will be pumped from the lake into a tank on either a truck or trailer. It will then be transported to the camp and pumped into the camp tank. The water intake hose will be covered with a screen to ensure that no fish become trapped. The exact location of this has yet to be determined. Figures are provided in the Remedial Action Plan located in Appendix 4.

22. Describe the estimated rate of water consumption (m^3/day).

Total: 4.7_ m^3/day

115 Litres/day/person x 30 people (max) = 3,450 Litres/day
1,250 Litres/day for miscellaneous activities (ex. washing equipment and drums)

23. Describe how waste water will be managed. If relevant, provide detail regarding location of sumps, including capacity of sumps and monitoring.

We anticipate that both black and grey water will be directed into a sewage lagoon system. This system will consist of two independently operated temporary lagoons. Each lagoon will have an individual capacity for 45 days of wastewater storage or one half of the duration of the construction season, whichever is more. Maximum fluid depth will not exceed one metre. The location of the lagoons will be a minimum of 100 metres from the construction camp or other temporary facilities and drainage paths, and downwind of the construction camp (based on the prevailing wind direction). Discharge criteria will be as follows:

- Biological Oxygen Demand (BOD) – 80 mg/kg
- Total Suspended Solids (TSS) – 100mg/kg
- Fecal Coliforms – 1 x 104 CFU/100 mL
- pH – 6.0 to 9.0
- Oil and Grease – no visible sheen

24. If applicable, discuss how surface water and underground water will be managed and monitored.

N/A

Waste Water (Grey water, Sewage, Other)

25. Describe the quantities, treatment, storage, transportation, and disposal methods for the following (where relevant):
    - Sewage

30 litres/day x 30 people (max) = 900 litres/day

The sewage will be directed into a sewage lagoon system (as described in #23 above).

- Camp grey water

80 litres/day x 30 people (max) = 2,400 litres/day

The camp grey water will be directed into a sewage lagoon system (as described in #23 above).

- Combustible solid waste

Combustible solid waste generated from camp operations will be incinerated in an on site incinerator.

- Non-combustible solid waste, including bulky items/scrap metal

- 14,834 m3 excavated, sorted and separated into different waste types where it is safe and practical to do so, and disposed off-site in an appropriate licensed facility.
- Buried debris that is inaccessible for excavation in Class C dumps (APECs 9 and 10) should be buried and re-stabilized in-situ. Rocks and concrete foundations from APECs 1-4 to be used as rip-rap and fill in void space at APEC 9. Area will be covered with rip rap and erosion resistant material for stability.

For further details please consult the Remedial Action Plan that is attached in Appendix 4.

- Hazardous waste or oil

All hazardous wastes and oil will be packaged as per Transportation of Dangerous Goods (TDG) requirements and shipped south to a facility licenced to dispose of the hazardous materials. Amounts of each Hazardous waste can be found in the Remedial Action Plan in Appendix 4.

- Contaminated soils/snow

Contaminated soils will be handled as described in the Remedial Action Plan (Appendix 4). To summarize:

Type of Waste	Composition	Quantity Generated	Treatment Method	Disposal Method
Contaminated soil- metals, PCB	Soil lightly contaminated with metals and PCB	Total = 194 m^3 PCB= 1 m^3 Metal= 193 m^3	Excavated, containerized, labelled in accordance with the Transportation of Dangerous Goods Act	Disposal at a southern licensed disposal facility
Contaminated Soil- PHC	Soils lightly contaminated with PHC	PHC= 3,205 m^3	Screen PHC Type A soils and treat in on-site constructed biological and/or aeration treatment unit (3,005 m3).	Excavate PHC Type B soils (200 m3) and place into containers, and ship off-site to a licensed disposal facility.

- Empty barrels/ fuel drums

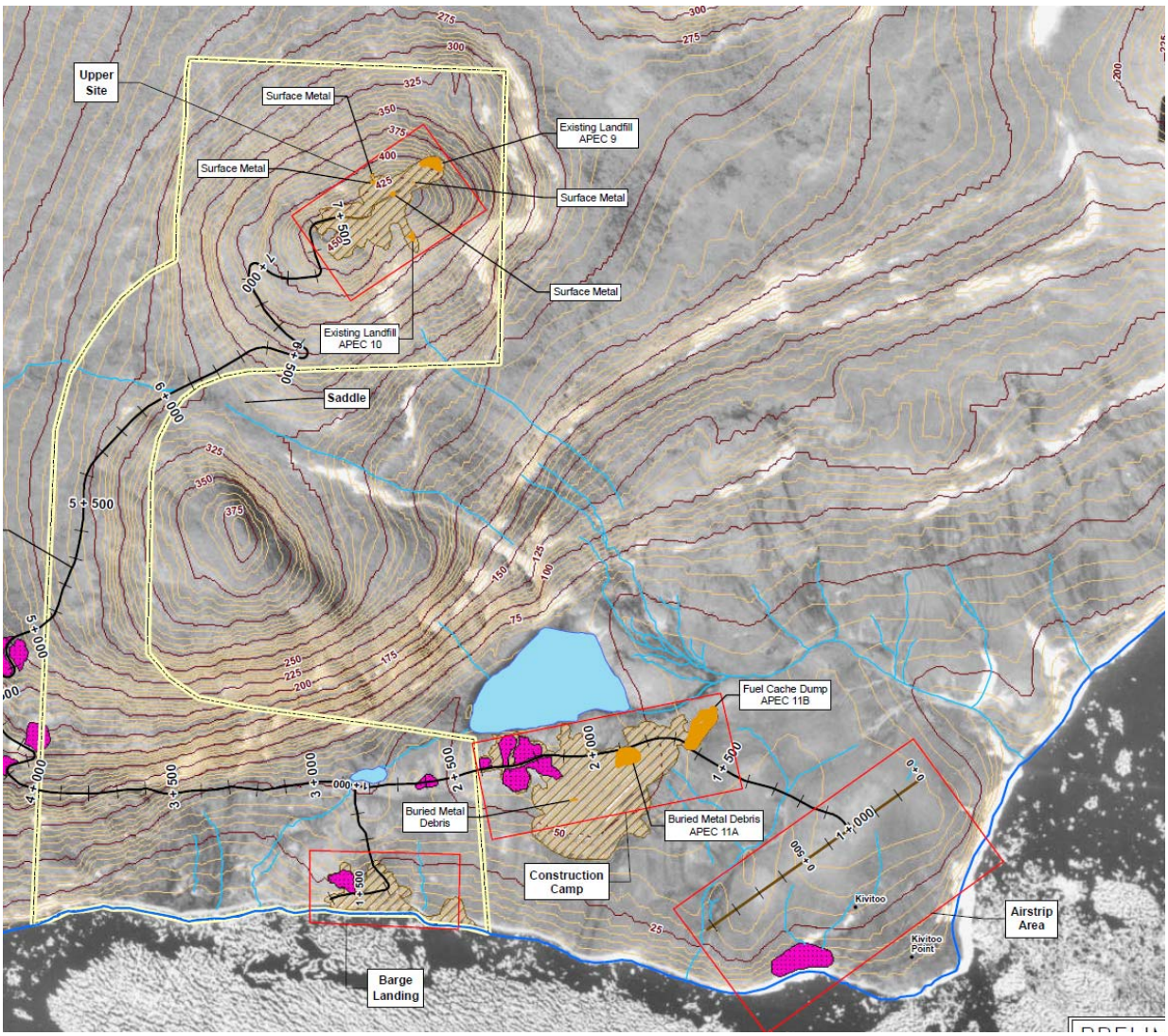
- Empty barrels/fuel drums will be handled as per the Barrel Protocol described in the Abandoned Military Site Remediation Protocol (INAC 2009) which can be found in appendix D of the Remedial Action Plan (Appendix 4).
- Barrels will be inspected, sampled, tested, have any contents removed and treated, cleaned, crushed, packaged, and then be transported south to a licenced disposal location.
- Additional barrels resulting from remedial activities will be handled in the same manner.

- Any other waste produced

None identified at this time.

26. If the project proposal includes a landfill or landfarm, indicate the locations on a map, provide the conceptual design parameters, and discuss waste management and contact-water management procedures.

This project will only use existing landfills that are on site and will not construct any new ones. Buried debris that is inaccessible for excavation in Class C dumps (APECs 9 and 10) will be buried and re-stabilized in-situ. Rocks and concrete foundations from APECs 1-4 to be used as rip-rap and fill in void space at APEC 9. Area will be covered with rip rap and erosion resistant material for stability. All buried and partially buried debris that are accessible will excavated, sorted and separated into different waste types where it is safe and practical to do so, and disposed off-site in an appropriate licensed facility.



Fuel

27. Describe the types of fuel, quantities (number of containers, type of containers and capacity of containers), method of storage and containment. Indicate the location on a map where fuel is to be stored, and method of transportation of fuel to project site.

Fuel	Number of Containers and Capacity of Containers	Total Amount of Fuel (in Litres)	Proposed Storage Methods
Diesel	approximately 220 barrels	45,100 L	On pallets, 4 drums each, strapped
Gasoline	Approximately 25 barrels	5125 L	On pallets, 4 drums each, strapped
Aviation fuel	Approximately 25 barrels	5125 L	On pallets, 4 drums each, strapped
Propane	approximately 8 containers	960kg	Cylinders will be transported/stored in a cage where they are strapped to prevent movement.

Please note: These fuel numbers may change slightly once a contractor is hired.

The fuel will be stored near the camp but at least 100 metres from the camp facilities.

28. Describe any secondary containment measures to be employed, including the type of material or system used. If no secondary containment is to be employed, please provide justification.

All fuel drums will be stored together. The storage area will be inspected daily. Drums that are in use will be stored in insta-berms (or similar) to contain any spills. Spill kits and empty drums or tanks will be kept in near the storage area so that any spills can be contained and cleaned up.

29. Describe the method of fuel transfer and the method of refuelling.

An electric pump will be used to transfer fuel from the drums into the equipment or tank. All fuel transfers will be supervised and spill kits will be readily available to address any spills.

30. Describe spill control measures in place.

All fuel transfers will be supervised and spill kits will be readily available to address any spills. The exact location and contents of the spill kits will be determined once a contractor is hired.

Please refer to Environment Canada's fuel storage tank system regulations (*Storage Tank System for Petroleum and Allied Petroleum Products*) website at http://www.ec.gc.ca/st-rs/ for details on fuel storage requirements.

Chemicals and Hazardous Materials*

**included but not limited to oils, greases, drill mud, antifreeze, calcium or sodium chloride salt, lead acid batteries and cleaners*

31. Describe the types, quantities (number of containers, the type of container and capacity of containers), method of storage and containment. Indicate the location on a map where material is to be stored, and method of transportation of materials to project site.

A small amount of oil and grease will be brought to site to complete the maintenance requirements for the equipment on site. These will be transported as per the requirements of the Transportation of Dangerous Goods (TDG) Act & Regulations. The oil and grease will be stored in the fuel storage area until used. Used oil and grease will be collected and shipped off site for disposal at a licenced disposal facility. The exact quantities of these will be determined once a contractor is hired.

32. Describe any secondary containment measures to be employed, including the type of material or system used.

The secondary containment that will be employed are insta-berms (or similar) for the products that are in use.

33. Describe the method of chemical transfer.

N/A

34. Describe spill control measures in place.

Spill kits will be readily available on all equipment and in areas that the oil and grease are being used. The exact location and contents of the spill kits will be determined once a contractor is hired.

Workforce and Human Resources/Socio-Economic Impacts

35. Discuss opportunities for training and employment of local Inuit beneficiaries.

The contract for remedial activities will contain an Aboriginal Opportunities Considerations (AOC) clause that requires the contractor to maintain a target level of Inuit employment on the project (and applies a penalty if the contractor fails to meet the target level). On past similar projects the Inuit employment level in the AOC has been in the range of 60-70%. The AOC also sets a target level of Inuit subcontracting. Past similar projects have had minimum Inuit subcontracting levels of 60-80%.

The contract will also contain a training fund that will allow the contractor access to up to 2% of the contract value, to a maximum of $200,000, to provide training programs to local Inuit beneficiaries.

36. Discuss workforce mobilization and schedule, including the duration of work and rotation length, and the transportation of workers to site.

The workforce will be mobilized to site from Qikiqtarjuaq via charter aircraft. Work will take place during July to September/October in every year of the project. The exact schedule will depend on the contractor hired and the sealift/barge schedules. Workers will work on a rotational schedule to be determined by the contractor.

37. Discuss, where relevant, any specific hiring policies for Inuit beneficiaries.

N/A

Public Involvement/ Traditional Knowledge

38. Indicate which communities, groups, or organizations would be affected by this project proposal.

This project is closest to Qikiqtarjuaq. Residents of Qikiqtarjuaq will be positively affected by this project and the employment/training opportunities it provides. The project will also remove hazardous materials from the environment; this will benefit human and environmental health in the area.

39. Describe any consultation with interested Parties which has occurred regarding the development of the project proposal.

A community consultation was scheduled for January 28, 2014, but was postponed and rescheduled to January 29, 2014 due to weather. The event was advertised locally over the radio and by posters. Presentation handouts were printed in English and Inuktitut. Information on AANDC's contaminated sites program were made available in English, French and Inuktitut. All information was presented on a table near the entrance. A sign-in sheet was also provided. The consultation was attended by 58 individuals from the community of Qikiqtarjuaq. A presentation was given outlining:

- AANDC's contaminated sites program;
- The bidding and tender process;
- The applicable guidelines and site criteria relevant to the FOX-D site;
- Environmental concerns at FOX-D;
- Archaeological areas of interest near the site; and,
- The proposed remedial action plan and the project timeline.

40. Provide a summary of public involvement measures, a summary of concerns expressed, and strategies employed to address any concerns.

See answer to question 39. No concerns were raised in this consultation.

41. Describe how traditional knowledge was obtained, and how it has been integrated into the project.

At the present time traditional knowledge has not been directly integrated into the project, however, community elders from Qikiqtarjuaq did attend the community consultation.

42. Discuss future consultation plans.

Additional community meetings will be held in Qikiqtarjuaq. The first will be in June/July 2016 to tell people about the plan for this summer and potential employment/training and sub-contracting opportunities. There will also be a meeting held prior to the 2017 and 2018 works (May/June) and one at the conclusion of the work in either late 2019 or early 2020. The purpose of the final meeting will be to let the community know the results of the work.

3. PROJECT SPECIFIC INFORMATION

The following table identifies the project types identified in Section 3 of the NIRB, Part 1 Form. Please complete all relevant sections.

It is the proponent's responsibility to review all sections in addition to the required sections to ensure a complete application form.

Table 1: Project Type and Information Required

Project Type	Type of Project Proposal	Information Request
1	All-Weather Road/Access Trail	Section A-1 and Section A-2
2	Winter Road/Winter Trail	Section A-1 and Section A-3
3	Mineral Exploration	Section B-1 through Section B-4
4	Advanced Mineral Exploration	Section B-1 through Section B-8
5	Mine Development/Bulk Sampling	Section B-1 through Section B-12
6	Pits and Quarries	Section C
7	Offshore Infrastructure(port, break water, dock)	Section D
8	Seismic Survey	Section E
9	Site Cleanup/Remediation	Section F
10	Oil and Natural Gas Exploration/Activities	Section B-3 and Section G
11	Marine Based Activities	Section H
12	Municipal and Industrial Development	Section I

SECTION A: Roads/Trails

A-1. Project Information

1. Describe any field investigations and the results of field investigations used in selecting the proposed route (e.g. geotechnical, snow pack)
2. Provide a conceptual plan of the road, including example road cross-sections and water crossings.
3. Discuss the type and volume of traffic using the road/trail (i.e. type of vehicles and cargo and number of trips annually).
4. Discuss public access to the road.
5. Describe maintenance procedures.
6. Describe whether any portion of the road will be located outside of the Nunavut Settlement Area and whether any other regulatory requirements must be met (e.g. CEAA).

A-2. All-Weather Road/Access Trail

7. Discuss road design considerations for permafrost.
8. Describe the construction materials (type and sources for materials), and the acid rock drainage (ARD) and metal leaching characteristics of the construction materials.
9. Discuss construction techniques, including timing for construction activities.
10. Indicate on a map the locations of designated refuelling areas, water crossings, culverts, and quarries/borrow sources.
11. Identify the proposed traffic speed and measures employed to ensure public safety.
12. Describe dust management procedures.

A-3. Winter Road/Trail

13. Describe the surface preparation, including the use of snow berms or compaction, and any flooding. If flooding is to be used, provide the location of the water source on a map.
14. Describe the operating time period.
15. Identify the proposed traffic speed and measures employed to ensure public safety.
16. Discuss whether the selected route traverses any fish-bearing water bodies.

SECTION B: Mineral Exploration /Advanced Exploration /Development

B-1. Project Information

1. Describe the type of mineral resource under exploration.

B-2. Exploration Activity

2. Indicate the type of exploration activity:
   - Bulk Sampling (underground or other)
   - Stripping (mining shallow bedded mineral deposits in which the overlying material is stripped off, the mineral removed and the overburden replaced)
   - Trenching
   - Pitting
   - Delineation drilling
   - Preliminary Delineation drilling
   - Exploration drilling
   - Geophysical work (indicate ground and/or air)
   - Other
3. Describe the exploration activities associated with this project:
   - Satellite remote sensing
   - Aircraft remote sensing
   - Soil sampling
   - Sediment sampling
   - On land drilling (indicate drill type)
   - On ice drilling (indicate drill type)
   - Water based drilling (indicate drill type)
   - Overburden removal
   - Explosives transportation and storage
   - Work within navigable waters
   - On site sample processing
   - Off site sample processing
   - Waste rock storage
   - Ore storage
   - Tailings disposal
   - Portal and underground ramp construction
   - Landfilling
   - Landfarming
   - Other

B-3. Geosciences

4. Indicate the geophysical operation type:
    a. Seismic (please complete Section E)
    b. Magnetic
    c. Gravimetric
    d. Electromagnetic
    e. Other (specify)
5. Indicate the geological operation type:
    a. Geological Mapping
    b. Aerial Photography
    c. Geotechnical Survey
    d. Ground Penetrating Survey
    e. Other (specify)
6. Indicate on a map the boundary subject to air and/or ground geophysical work.
7. Provide flight altitudes and locations where flight altitudes will be below 610m.

B-4. Drilling

8. Provide the number of drill holes and depths (provide estimates and maximums where possible).
9. Discuss any drill additives to be used.
10. Describe method for dealing with drill cuttings.
11. Describe method for dealing with drill water.
12. Describe how drill equipment will be mobilized.
13. Describe how drill holes will be abandoned.
14. If project proposal involves uranium exploration drilling, discuss the potential for radiation exposure and radiation protection measures. Please refer to the *Canadian Guidelines for Naturally Occurring Radioactive Materials* for more information.

B-5. Stripping/ Trenching/ Pit Excavation

15. Discuss methods employed. (i.e. mechanical, manual, hydraulic, blasting, other)

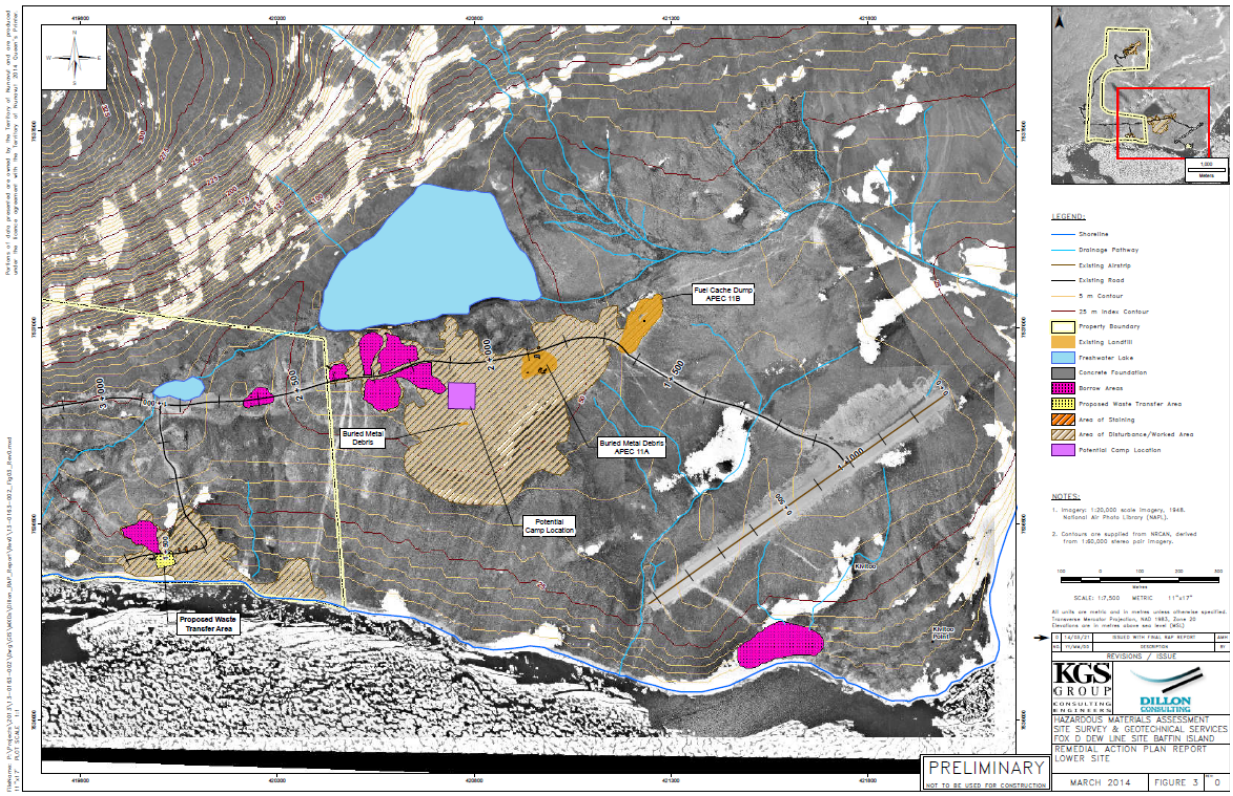
Mechanical, excavations will be completed with an excavator.

16. Describe expected dimensions of excavation(s) including depth(s).

Borrow Source	Location	Estimated Volume of Material (m^3)	Description
B1	(2+600) main road	9,000	Cleaner gravel, (less boulders/cobbles)
B2	(500) Barge road	3,000	Cleaner gravel, (less boulders/cobbles)
B3	(4+125) main road	3,200	Clean ggravel, higher amount boulders/cobbles
B4	(4+250) main road	10,000	Generally cleaner sands and gravel (some boulders/cobbles)
B5	(4+800) main road	17,000	Mixed sand, gravel and cobbles.

The sand and gravel borrow sources are estimated to contain 48,000 m3. As per the Environmental site Assessment (appendix 5), this amount is adequate for the remedial activities associated with this project.

17. Indicate the locations on a map.



18. Discuss the expected volume material to be removed.

Less than 48,000m3

19. Discuss methods used to determine acid rock drainage (ARD) and metal leaching potential and results.

If the borrow material is suspected of having acid rock drainage and metal leaching potential then it will be sampled. This is unlikely as the material used will be from the surface/near surface and no blasting will occur.

SECTION C: Pits and Quarries

1. Describe all activities included in this project.
   - Pitting

     None

   - Quarrying

See section B-5 Above

- Overburden removal

  None

- Road use and/or construction (please complete Section A)

  See section A above

- Explosives transportation and storage

  None

- Work within navigable waters

  None

- Blasting

  None

- Stockpiling

  None

- Crushing

  None

- Washing

  None

- Other

  None

2. Describe any field investigations and the results of field investigations used in determining new extraction sites.

   Environmental Site Assessment (appendix 5)
   Remedial Action Plan (appendix 4)

3. Identify any carving stone deposits.

None identified

4. Provide a conceptual design including footprint.

Please see diagrams in Remedial Action Plan in Appendix 4.

5. Describe the type and volume of material to be extracted.

See section B-5 above

6. Describe the depth of overburden.

None

7. Describe any existing and potential for thermokarst development and any thermokarst prevention measures.

None

8. Describe any existing or potential for flooding and any flood control measures.

None

9. Describe any existing or potential for erosion and any erosion control measures.

Borrow areas will be re-graded and sloped to prevent erosion

10. Describe any existing or potential for sedimentation and any sedimentation control measures.

None, but if any, then silt fences will be installed as required.

11. Describe any existing or potential for slumping and any slump control measures.

None

12. Describe the moisture content of the ground.

Well drained

13. Describe any evidence of ice lenses.

None

14. If blasting, describe methods employed.

Not applicable

15. Describe the explosive type(s), hazard class, volumes, uses, location of storage (show on map), and method of storage.

Not applicable

16. Discuss methods used to determine acid rock drainage (ARD) and metal leaching (ML) potential and results.

If the borrow material is suspected of having acid rock drainage and metal leaching potential then it will be sampled. This is unlikely as the material used will be from the surface/near surface and no blasting will occur.

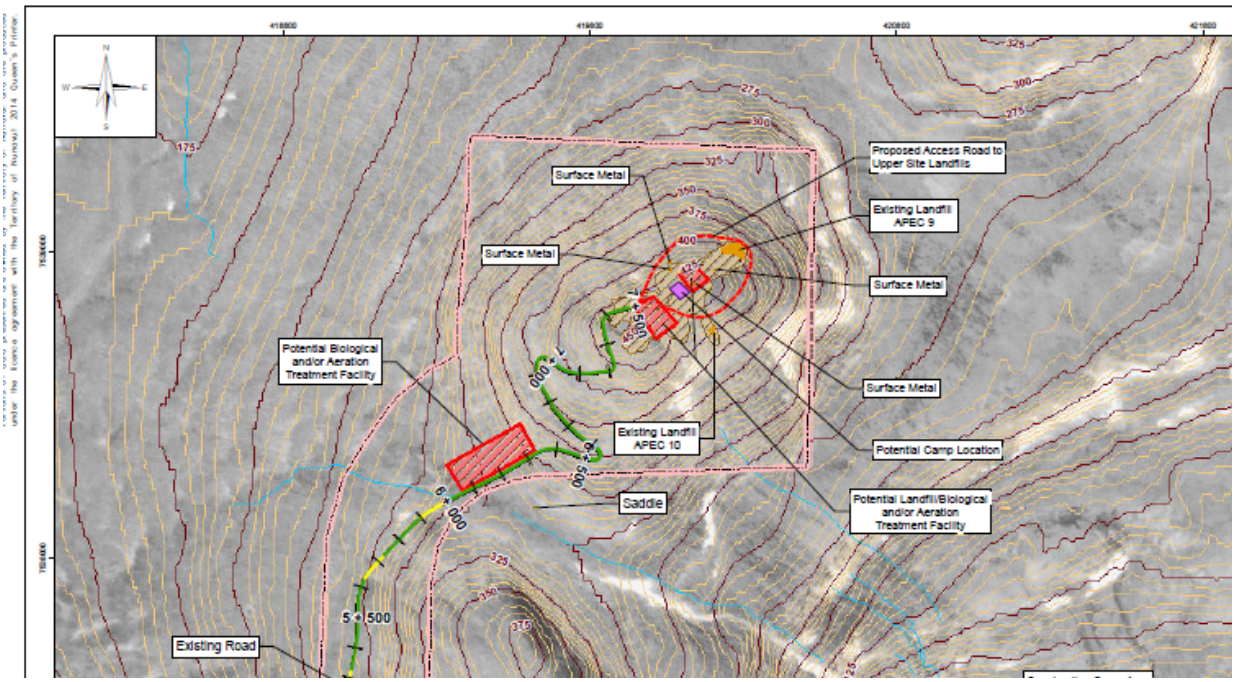
17. Discuss safety measures for the workforce and the public.

A Site Specific Health and Safety Plan (SSHSP) will be developed and implemented for the project. Public access is prohibited.

SECTION D: Site Cleanup/Remediation

1. Describe the location, content, and condition of any existing landfills and dumps (indicate locations on a map).

   There are two existing Class C landfills which can be seen in the diagram below, labelled as APEC 9 and 10. Field investigations conducted by Dillon Consulting in 2013 observed minimal, isolated PCB impacts in the dump area. However, the health and safety risks associated with access and de-stabilizing the northeast slope dump (APEC 9) by de



2. Identify salvageable equipment, infrastructure and/or supplies.

   None

3. Provide a list of all contaminants to be cleaned up, anticipated volumes and a map delineating contaminated areas. This includes buildings, equipment, scrap metal and debris, and barrels as well as soil, water (surface and groundwater) and sediment.

Type of Waste	Composition	Quantity Generated	Treatment Method	Disposal Method

Hazardous materials	Asbestos containing titles, insulation, etc., and lead-acid batteries	Total =1.54 m^3 Asbestos= 1.32 m^3 Lead acid= 0,22m^3	Double-bagged in Yellow bags, placed in a barge container to be shipped south for proper disposal.	Disposal at a southern licensed disposal facility
PCB/Lead Amended Paint Products	PCB/Lead Amended Paint Products	0.031 m^3	Dismantle contaminated paint items and ship off-site to an appropriate disposal facility.	Dismantle contaminated paint items and ship off-site to an appropriate disposal facility.
Contaminated soil- metals, PCB	Soil lightly contaminated with metals and PCB	Total = 194 m^3 PCB= 1 m^3 Metal= 193 m^3	Excavated, containerized, labelled in accordance with the Transportation of Dangerous Goods Act	Disposal at a southern licensed disposal facility
Contaminated Soil- PHC	Soils lightly contaminated with PHC	PHC= 3,205 m^3	Screen PHC Type A soils and treat in on-site constructed biological and/or aeration treatment unit (3,005 m3).	Excavate PHC Type B soils (200 m3) and place into containers, and ship off-site to a licensed disposal facility.
Non-hazardous	heavy equipment, barrels, scrap metal, scrap wood, concrete, electrical equipment and plumbing parts	14,834 m^3	Treatment off-site	14,834 m3 excavated, sorted and separated into different waste types where it is safe and practical to do so, and disposed off-site in an appropriate licensed facility.
Non-hazardous	Debris in existing class C dumps	6,645 m^3	Buried debris that is inaccessible	Buried debris that is inaccessible

			for excavation in Class C dumps (APECs 9 and 10) should be buried and re-stabilized in-situ. Rocks and concrete foundations from APECs 1-4 to be used as rip-rap and fill in void space at APEC 9. Area will be covered with rip rap and erosion resistant material for stability.	for excavation in Class C dumps (APECs 9 and 10) should be buried and re-stabilized in-situ. Rocks and concrete foundations from APECs 1-4 to be used as rip-rap and fill in void space at APEC 9. Area will be covered with rip rap and erosion resistant material for stability.
Water in barrels	Analysis of collected water in the abandoned barrels indicates that the dissolved metals meet DLCU barrel protocol.		Disposal on ground is permitted once water has been polished with an absorbent materials, additional sampling of more barrels during remediation program is required.	Disposal on ground is permitted once water has been polished with an absorbent materials, additional sampling of more barrels during remediation program is required.

Maps delineating the contaminated areas can be found in the Remedial Action Plan (RAP) (Appendix 4)

4. Describe the degree of pollution/contamination, and list the contaminants and toxicity.

The degree of contamination is low to moderate.

5. Describe technologies used for clean-up and/or disposal of contaminated materials. Include a list of all the physical, chemical and biological cleanup/ remediation methods, operational procedures, and the dosage/frequency of reagents and bacterial medium.

Only proven methods/technologies will be used. See the Remedial Action Plan (Appendix 4) for the clean-up plans.

6. Identify and describe all materials to be disposed of off site, including the proposed off site facilities, method of transport and containment measures.

See chart in question 3 above for list of materials that are being disposed of off-site. A sea lift barge will be used to ship these materials South. The exact disposal location has yet to be determined but will be once a contract is in place.

7. Discuss the viability of landfarming, given site specific climate and geographic conditions.

Landfarming has proven to be a viable option for the treatment of hydrocarbons (F1-F3) on other Distant Early Warning (DEW) Line sites. This technique is most effective on lighter end hydrocarbons and typically requires a couple of seasons to reduce contaminant levels to below criteria. Building the landfarm and starting treatment on the hydrocarbon contaminated soil will be the first priority for the contractor on this project. Completing this task first will allow for the maximum about of treatment time.

8. Describe the explosive types, hazard classes, volumes, uses, location of storage (indicate on a map), and method of storage (if applicable).

   none

9. If blasting, describe the methods employed.

Not applicable

10. Describe all methods of erosion control, dust suppression, and contouring and re-vegetation of lands.

None required

11. Describe **all** activities included in this project.
    - Excavation (please complete Section B-5)
      See section B-5
    - Road use and/or construction (please complete Section A)
      See section A
    - Airstrip use and/or construction
      See Part 2 – Transportation Questions 12-15.
    - Camp use and/or construction
      See Part 2 – Camp Site Transportation Questions 16-18.
    - Stockpiling of contaminated material
      Contaminated materials will be consolidated and packaged for transportation. They will be stored at a staging area until they are loaded onto the barge/sealift for removal from site. Confirmatory samples will be taken from the staging area once the materials are removed to confirm that the area is not contaminated.

- Pit and/or quarry (please complete Section C)

  Please see section C

- Work within navigable waters (please complete Section H)

  Not applicable

- Barrel crushing

  See Part 2 – Waste Water Questions 25. Empty barrels will be handled as pre the Barrel Protocol described in the Abandoned Military Site Remediation Protocol (INAC 2009).

- Building Demolition

All existing structures will be demolished as part of the remedial activities. See Remedial action Plan for additional details.

- Other

None

4. DESCRIPTION OF THE EXISTING ENVIRONMENT

Describe the existing environment, including physical, biological and socioeconomic aspects. Where appropriate, identify local study areas (LSA) and regional study areas (RSA).

Please note that the detail provided in the description of the existing environment should be appropriate for the type of project proposal and its scope.

The following is intended as a guide only.

Physical Environment

Please note that a description of the physical environment is intended to cover all components of a project, including roads/trails, marine routes, etc. that are in existence at present time.

A description of the physical environment can be found in the Fox-D Final Environmental Impact Assessment which is located in appendix 5.

- Proximity to protected areas, including:
  i. designated environmental areas, including parks;
  ii. heritage sites;
  iii. sensitive areas, including all sensitive marine habitat areas;
  iv. recreational areas;

v. sport and commercial fishing areas;
vi. breeding, spawning and nursery areas;
vii. known migration routes of terrestrial and marine species;
viii. marine resources;
ix. areas of natural beauty, cultural or historical history;
x. protected wildlife areas; and
xi. other protected areas.

- Eskers and other unique landscapes (e.g. sand hills, marshes, wetlands, floodplains).
- Evidence of ground, slope or rock instability, seismicity.
- Evidence of thermokarsts.
- Evidence of ice lenses.
- Surface and bedrock geology.
- Topography.
- Permafrost (e.g. stability, depth, thickness, continuity, taliks).
- Sediment and soil quality.
- Hydrology/ limnology (e.g. watershed boundaries, lakes, streams, sediment geochemistry, surface water flow, groundwater flow, flood zones).
- Tidal processes and bathymetry in the project area (if applicable).
- Water quality and quantity.
- Air quality.
- Climate conditions and predicted future climate trends.
- Noise levels.
- Other physical Valued Ecosystem Components (VEC) as determined through community consultation and/or literature review.

Biological Environment

- Vegetation (terrestrial as well as freshwater and marine where applicable).
- Wildlife, including habitat and migration patterns.
- Birds, including habitat and migration patterns.
- Species of concern as identified by federal or territorial agencies, including any wildlife species listed under the *Species at Risk Act (SARA)*, its critical habitat or the residences of individuals of the species.
- Aquatic (freshwater and marine) species, including habitat and migration/spawning patterns.
- Other biological Valued Ecosystem Components (VEC) as determined through community consultation and/or literature review.

Socioeconomic Environment

- Proximity to communities.
- Archaeological and culturally significant sites (e.g. pingos, soap stone quarries) in the project (Local Study Area) and adjacent area (Regional Study Area).
- Palaeontological component of surface and bedrock geology.
- Land and resource use in the area, including subsistence harvesting, tourism, trapping and guiding operations.
- Local and regional traffic patterns.
- Human Health, broadly defined as a complete state of wellbeing (including physical, social, psychological, and spiritual aspects).
- Other Valued Socioeconomic Components (VSEC) as determined through community consultation and/or literature review.

5. IDENTIFICATION OF IMPACTS AND PROPOSED MITIGATION MEASURES

An identification of impacts and proposed mitigation measures can be found in the Fox-D Final Environmental Impact Assessment which is located in appendix 5.

1. Please complete the attached Table 1 – Identification of Environmental Impacts, taking into consideration the components/activities and project phase(s) identified in Section 4 of this document. Identify impacts in Table 1 as either positive (P), negative and mitigable (M), negative and non- mitigable (N), or unknown (U).

Please see Table 1

2. Discuss the impacts identified in the above table.

Please see Fox-D Final Environmental Impact Assessment which is located in appendix 5.

3. Discuss potential socioeconomic impacts, including human health.

Please see Fox-D Final Environmental Impact Assessment which is located in appendix 5.

4. Discuss potential for transboundary effects related to the project.

None

5. Identify any potentially adverse effects of the project proposal on species listed under the *Species at Risk Act (SARA)* and their critical habitats or residences, what measures will be taken to avoid or lessen those effects and how the effects will be monitored.

Please see Fox-D Final Environmental Impact Assessment which is located in appendix 5.

6. Discuss proposed measures to mitigate all identified negative impacts.

Please see Fox-D Final Environmental Impact Assessment which is located in appendix 5.

6. CUMULATIVE EFFECTS

Cumulative impacts for this project are discussed in the Fox-D Final Environmental Impact Assessment which is located in appendix 5.

A cumulative impact (or effect) can be defined as the impact on the environment that results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions. Cumulative impacts can also result from individually minor but collectively significant actions taking place over a period of time.

Discuss how the effects of this project interact with the effects of relevant past, present and reasonably foreseeable projects in a regional context.

7. SUPPORTING DOCUMENTS

Where relevant, provide the following supporting documents:

- Abandonment and Decommissioning Plan

Please see Remedial Action Plan in appendix 4.

- Existing site photos with descriptions

Please see the Fox-D Final Environmental Impact Assessment which is located in appendix 5.

- Emergency Response Plan

Not available, will be completed prior to mobilizing to site.

- Comprehensive Spill Prevention/Plan (must consider hazardous waste and fuel handling, storage, disposal, spill prevention measures, staff training and emergency contacts)

Not available, will be completed prior to mobilizing to site.

- Waste Management Plan/Program

Not available, will be completed prior to mobilizing to site.

- Monitoring and Management Plans (e.g. water quality, air pollution, noise control and wildlife protection etc.)

Not available, will be completed prior to mobilizing to site.

- If project activities are located within Caribou Protection Areas or Schedule 1 Species at Risk known locations, please provide a Wildlife Mitigation and Monitoring Plan

Not Applicable

In addition, for Project Type 9 (Site Cleanup/Remediation), please provide the following additional supporting documents:

- Remediation Plan including cleanup criteria and how the criteria were derived.

Please see attached Remedial Action Plan found in appendix 4.

- Human Health Risk Assessment of the contaminants at the site.

Not available

TABLE 1 - IDENTIFICATION OF ENVIRONMENTAL IMPACTS

		ENVIRONMENTAL COMPONENTS	PHYSICAL	designated environmental areas (ie. Parks, Wildlife Protected areas)	ground stability	permafrost	hydrology/ limnology	water quality	climate conditions	eskers and other unique or fragile landscapes	surface and bedrock geology	sediment and soil quality	tidal processes and bathymetry	air quality	noise levels	other VEC:	other VEC:	other VEC:	BIOLOGICAL	vegetation	wildlife, including habitat and migration patterns	birds, including habitat and migration patterns	aquatic species, incl. habitat and migration/spawning	wildlife protected areas	other VEC:	other VEC:	other VEC:	SOCIO-ECONOMIC	archaeological and cultural historic sites	employment	community wellness	community infrastructure	human health	other VSEC
PROJECT ACTIVITIES																																	
CONSTRUCTION	Site grading & borrow development				M			M						M							M	M	M										
	Dump closure							M				M											P										
	Site re-grading				P																												
	Facility demolition																				M	M											
OPERATION	Hydrocarbon contaminated soil removal & landfarming												N																			P	
	Vehicle etc emissions												M																				
	Contaminated soil removal				M			P				P									P	P	P/M									P	
	Transportation of hazardous goods							M				M																					
	Camp operation				M			M				M																					
	General activities															M	P				M	M								P			M

DECOMMISSIONING																																	

Note: Please indicate in the matrix cell whether the interaction causes an impact and whether the impact is

P = Positive
N = Negative and non-mitigatable
M = Negative and mitigatable
U = Unknown

If no impact is expected please leave the cell blank

APPENDIX 4:

EXECUTIVE SUMMARY (ENGLISH, INUKTITUT)

EXECUTIVE SUMMARY

1. PROJECT BACKGROUND & LOCATION

Aboriginal Affairs and Northern Development Canada (AANDC) has applied for, and secured, funds under the Federal Contaminated Sites Action Plan (FCSAP) for the investigation and remediation of FOX-D (Kivitoo, Nunavut) which was an Intermediate Distant Early Warning (DEW) Line Site constructed in 1957 and operated until October 1963. The site is located on the Davis Strait 50 km to the west of the nearest community, Qikiqtarjuaq, Nunavut, at approximately 67° 57' 01" N latitude and 64° 55' 04" W longitude. The site is accessible by fixed wing aircraft, helicopter, and sealift. Site maps and drawings are included in the Remedial Action Plan which can be found in appendix 4 . The contaminants identified at the site include debris, PCBs, heavy metals, asbestos and hydrocarbons.

After military operations at the site ceased, the site became part of the Auyittuk National Park. FOX-D was within Auyuittuq National Park under the management of Parks Canada until 1992, when custody of the site was transferred to AANDC. Parks Canada managed a partial cleanup of the site between 1973 and 1983. The site is composed of two areas: the Upper Site and Lower Site. All structures at the site were removed to their foundations, with the exception of two vertical fuel storage tanks and a smaller transfer tank left in place at the upper site.

The Upper Site is located at 450 m above sea level and consisted of a continuous wave tower, a main building train, a warehouse, a garage, two 75,000 litre petroleum, oil, lubricant (POL) tanks, and a small building that may have been an Inuit house. Shortly before the site closed in 1963, a fire completely destroyed the main building train, charred remains are still present at the site. To the northeast of these remains, two imprints of what were believed to be temporary accommodations are visible.

The Lower Site is located on a coastal plain to the south of the upper site. It originally consisted of two POL tanks, a beach landing area, drum storage and an airstrip. A freshwater lake, borrow source areas and a construction camp area were also present at the lower site. Currently, the foundation of the two POL tanks, the remnants of the airstrip, and one small shed are all that remain. The Upper Site to the Lower Site is connected by a 4 km access road.

2. PROJECT ACTIVITIES & SCHEDULE

The site investigation and characterization phases for this project were completed in the summer of 2014. A Remedial Action Plan (RAP) for the proposed activities was prepared and is included in appendix 4. Project work is scheduled to start in the summer 2016 with the mobilization of equipment to the site via sealift/barge. Once the equipment is on-site we anticipate working at the site for about a month or two before the camp is shut-down and winterized. In the summer of 2017 and possibly 2018 if need

be, project work will resume for another 2-3 months. Upon completion all the equipment will be removed from the site via sealift/barge. Throughout the construction activities personnel will be mobilized to and from site via fixed wing aircraft and/or helicopter using the on-site airstrip.

The RAP was developed using the INAC *Abandoned Military Sites Remediation Protocol (2009).* This document identifies how INAC will handle most aspects of the site clean up. Site remediation activities at FOX-D will include:

- establish a temporary camp to support site operations.
- PCB and metal contaminated soil will be excavated and disposed of at an off-site licensed disposal facility.
- hydrocarbon contaminated soil will be treated using biological and/or aeration methods on-site combined with off-site disposal at an approved disposal facility.
- existing site infrastructure will be demolished and demolition wastes will be sorted into hazardous and non-hazardous materials and disposed of properly.
- non-hazardous waste materials excluding materials to remain in APECs 9 and 10) will be collected, consolidated and packaged for off-site disposal. APECs 9 and 10 will be regraded and remain in place.
- hazardous materials will be containerized and labelled in accordance with the Transportation of Dangerous Goods Act and disposed of off-site.
-
- lead and PCB amended paint materials that are tested to be hazardous, will be dismantled and disposed off-site.
- materials in existing class C landfills will be remediated as described in the RAP.
- roads and airstrips will be reconstructed and repaired as necessary
- several borrow sources will be developed and the material will be used to assist in the remediation work.
- a Waste Handling Facility (WHF) will be required at the FOX-D site to temporarily store and sort various waste items.

ᐊᐅᓪᓗᐊᕐᓂᐊᖅᑐᖅ ᓇᐃᔭᖅᑕᐅᓯᒪᔪᓂ ᐅᓂᒃᑲᓪᓚᐊᖅ

1. PROJECT BACKGROUND & LOCATION ᐱᓕᕆᐊᒃᓴ

ᓄᓇᕗᑦᑲᖅᑐᑎᓴᒃᑯᑦ ᐅᑭᐅᖅᑕᖅᑐᒥ ᐱᔪᓐᓕᐊᔨᓕᕆᓴᐅᓂᖅᓯᓐᓂ ᑲᓇᑕᒥ (ᓄᓇᕗᑦᑲᖅᑐᑎᓴᒃᑯᑦ) ᐅᒃᑐᓕᐅᕐᓗᒃ ᐱᔪᓐᓇᖅᓯᓕᐅᖅᓯᕗᑎᓐᓄ ᑭᓇᐅᔾᔨᒃᓴᓂᒃ ᐊᑐᑕᒃᓴᓂᒃ ᑐᖏᓐᓴᔪᓂᒃ ᑲᑎᑦᑲᖅᑐᑐᖅᑐᑐᒃᑯᓂᒃ ᓄᓇᓂᒃ ᖃᓄᐃᓕᓕᐅᕈᑎᖃᖅᓂᕐᒧᑦ <ᕐᓇᐅᑎᓄᑦ, (ᓇᐃᔭᖅᑕᐅᓯᒪᔪᓂᑐᑎᒃ ᑎᑎᖃᖅᑎᓕ FCSAP–ᓂ) ᖃᐅᔨᓴᖅᑕᐅᔪᓐᓇᖅᓂᖏᓐᓄᓂ ᐊᒻᒪᓗ ᓴᓗᒪᖅᓴᖅᑕᐅᓂᖏᓐᓄᓂ ᓇᔪᖅᑕᐅᕐᓚᐅᕐᖅᓯᒪᔪᕈᒃ FOX–D–Γ ᑭᐃᑐᖅᑎ, ᓄᓇᕗᑦ, ᑕᐃᔨᓯᒪᓂ ᐊᑯᓂᐅᖏᓪᓕᐊᔪᓐᓇᖅᑐᒃ ᐅᖏᓪᓗᓯᓗᒃ ᐊᑭᖏᖅᑎᓂᒃ ᓇᐅᑦᑎᖅᑐᐃᓐᓇᕐᓚᐅᕐᖅᑐᒃ ᐅᖏᓪᓗᓯᑲᓇᐃᓐᓇᖅᑐᒃ ᓴᓂᒍᑎᐊᖅᑎᑕᐅᓚᐅᖅᑐᒃ ᓴᓇᔨᐅᓚᐅᖅᓯᒪᔪᓂᒃ 1957-ᖏᑎᑦᓗᒍ, ᐊᐅᓚᐅᕐᓚᐅᖅᑐᒃᑯᓂᒃ ᑎᑎᖅᑕᒥ ᑕᐃᔨᓯᒪᓂ ᓇᐅᑦᑎᖅᑐᒥ ᐊᑐᖅᑐᖅᑕᐅᓯᒪᔪᓂᒃ ᐊᑭᑖᑦᑕᐅᓯᒪᔪᓂᒃ ᓴᓇᔨᓯᒪᔪᓂᒃ ᓴᓂᒍᑎᐊᖅᑎᑕᐅᓚᐅᖅᑐᒃ 67° 57' 01" N latitude ᑐᑭᓯᑦ ᐅᐊᖏᓇᖅᑐᓯᐊᓂ ᐊᒻᒪᓗ ᐊᒻᒪᓗ 64° 55’ 04” W longitude ᓴᓂᓯᑦ ᐱᖏᖏᓇᖅᑐᓯᐊᓂᑦ. ᑕᐅᕐᖅᓇ ᓄᓇᖏ ᑎᑭᑕᐅᔾᔨᓇᖅᑐᖅ ᖃᖏᑦᑕᓯᒃᑯᑦ, ᖃᑯᓕᒍᓕᑯᑦ ᐊᒻᒪᓗ ᐅᒥᐊᖅᐊᖅᑯᑦ. ᓄᓇᖓᐊᓕᐊᑦ ᓇᓂᖏᑐᓂᒃ ᐊᒻᒪᓗ ᑎᑎᕋᐅᓴᖅᑕᐅᓯᒪᔪᓂ ᐃᓕᑎᓴᐅᔾᔨᓂ ᓴᓇᔨᓯᒪᓕᐅᖅᓯᒪᔪᓂᒃ ᖃᖏᑦᑕᓯᒃᑲᓇᐃᓐᓇᖅᑐᒃ ᐊᑎᓕᐅᖅᑐᒃ ᑎᑎᕋᐅᓴᐃᓂᒃ ᐃᓕᑎᓴᐅᔾᔨᓂ ᑕᐅᕐᖅᓇ ᓄᓇᓕᒃ ᐃᓕᓴᕐᕕᒃ 4-Γ. ᑕᐃᒃᑯᐊ ᓯᑭᖅᑐᓕᑦ ᐃᓕᑕᕆᔨᐅᓯᒪᔪᓂ ᑕᐅᕐᖅᓇ ᐃᓕᓴᖅᑎᑐᓂ ᐊᑦᑕᑯᓕᖅᑐᓂᒃ, ᓄᖓᔪᐊᔅᑐᓕᖅᓂᒃ ᐱᓯᐲᓂᒃ, ᐅᓴᐃᓚᐃᔅᑐᓂᒃ ᓴᓄᕀᓄᐃᓂᕐᒪᓂᒃ, ᐅᑕᐅᖅᑕᐃᓕᓕᐅᕈᑎᒃᑯᑦ ᐃᓕᓴᕐᕕᒃ ᐊᖏᗺᐃᑦᑐᒃ ᐊᒻᒪᓗ ᐅᖅᓯᐊᓗᐃᔅᑐᓄᓇᓕᖅᑐᒃ.

ᑭᖓᓂᐊᔪᑦ ᐅᓇᑕᖅᑐᒃᓴᐃᑦ ᐊᐅᓪᓚᕆᑎᖅᑕᑭᓐᓂᖅᑎᒃ ᑕᐅᕐᓂ ᓄᓇᒥ, ᓄᓇᖓ ᐃᓕᓴᐅᓕᓚᐅᖅᑐᖅ ᐊᐅᔾᔨᐃᑦᑐᑦ ᑲᓇᑕᒥᐅᑕᓚᒧᓄᑦ ᒥᖓᐃᖅᓯᕐᓴᖓᓗᓄᑦ. ᑕᐃᒃᑯᐊ ᓄᓇᐃᑦ FOX–D–Γ ᑭᐃᑐᖅᒥ ᐃᓗᐊᓂᓚᐅᕐᓴᒥᑕ ᐊᐅᔾᔨᐃᑦᑐᑦ ᑲᓇᑕᒥᐅᑕᓚᒧᓗᑦ ᒥᖓᐃᖅᓯᕐᓴᖓᓗᓂ, ᐊᐅᓚᐅᕐᓚᐅᖅᑐᖅᑕᐅᓂ ᒥᖓᐃᖅᓯᕐᓴᖓᓗᓂᓪᓗᑯᓂᒃ ᑲᓇᑕᒥᐅᑕᓚᒧᓗᑦ ᒥᖓᐃᖅᓯᕐᓴᖓᓗᓂ, ᐊᐅᓚᐅᕐᓚᐅᖅᑐᖅᑕᐅᓂ ᒥᖓᐃᖅᓯᕐᓴᖓᓗᓂᓪᓗᑯᓂᒃ ᓄᓇᓂᒃ ᑲᓇᑕᒥ ᑎᑭᑦ 1992-ᒧᑦ, ᓄᑕᐅᓚᐅᖅᑐᖅᑕᐅᓚᐅᖅᑐᖅᑕᐅᓂᖅᓯᓐᓂ ᓄᓇᖓᐊᓕᐊᑦ. ᒥᖓᐃᖅᓯᕐᓴᖓᓗᓂᓪᓗᑯᓂᒃ ᓄᓇᓂᒃ ᑲᓇᑕᒥ ᐊᐅᓚᕆᓚᐅᖅᓯᒪᔪᓂᒃ ᐃᓕᓴᐅᓂᖏᓐᓄᓂ ᓄᓇᓂᒃ ᐊᑯᓂᐅᖏᓪᓕᐊᔪᓐᓇᖅᑐᒃ ᐊᑯᓂᐅᖏᓪᓗᓯᓗᒃ ᐊᑎᖅᑎᐃᓐᓇ 1973 ᐊᒻᒪᓗ 1983-Γ. ᓄᓇᖓᓂ ᑕᐅᕐᖅᑐᒥ ᐃᓕᓴᖅᑎᖅᓴᖅ ᒪᖅᑭᖓᓂ: ᖃᓄᐃᖓᓂᖅᓴᐅᓂᖏᑦᑐᑐᒃ ᐊᒻᒪᓗ ᐊᑎᐃᖓᓂᖅᓴᐅᓂᖏᑦᑐᑐᒃ ᓄᓇᓖᑦ. ᑕᒪᖅᑎᒃ ᐱᖃᓄᐃᖅᑲᓇᑦ ᓇᓗᓇᐃᖅᑐᓂ, ᐱᓕᐅᖏᓐᓄᑦᑐᑎᒃ ᒪᖅᑭᖓᓂᒃ ᐊᑎᖅᑎᐃᓐᓇ ᑕᐅᕐᓂᒥ ᐊᓱᖅᑕᐅᓚᐅᖅᑐᑦ ᑐᖏᓐᓄᓂᒃ, ᐱᓕᐅᖏᓐᓄᑦᑐᑎᒃ ᒪᖅᑭᖓᓂᒃ ᐊᑎᖅᑎᐃᓐᓇ ᓇᓗᓇᐃᖅᑐᓂ ᐅᑭᐅᖅᑕᖅᑐᒃᑯᓂᒃ ᐅᓂᒃᑲᓪᓚᐊᖅᑐᖅᑕᐅᓂ, ᐱᖓᓱᐊᕆᔨᒃᑯᑦ ᐊᑎᖅᑎᐃᓐᓇ ᑎᑎᕋᐅᓴᖅᑕᐅᓯᒪᔪᓂᒃ ᐊᑐᖅᑐ

ᓄᓇᕗᑎᓂᒃ ᐱᓇᓱᒃᖃᕗᑎᒃ, ᒪᕐᕉᓂᓪᓗ ᖃᐅᔨᑕᕆᓚᓂᓂ 75,000-ᓂᒃ ᓂᒋᓚᓂᓂᒃ ᐅᖃᕗᐊᓗᖃᕐᓂᖅᑕᒃ, ᐅᖃᕗᖅᑐᑭᑎᓂᒃ, ᐊᒻᒪᓗ ᑭᓂᑎᑭᖏᓐᓂᓂᒃ ᐅᖃᕗᐊᓗᖃᒃᐅᑎᐊᓗᐃᑦ, ᐊᒻᒪᓗ ᒥᑭᔪᖅ ᐃᒃᓗᕐᓂᒋᖅ ᐃᓄᓐᓄᑦ ᐃᓄᐃᓕᓴᕐᓂᖅᑐᑦ. ᒪᑐᓂᐊᓕᕆᖃᑎᒌᓗᐊ ᑕᒪᓐᓇ 1963-ᖓᑎᓕᓗᐊ, ᐃᑯᐊᓕᒃᑐᑐᖃᑕᐅᖃᕗᕐᓂᒪᖓᑕ ᑕᒪᐃᓐᓇᒥᑎᒋᓂᖅ ᐱᑕᖃᓕᕆᓂᖅ ᐊᑐᖃᕗᑦᑕᐅᓂᖃᖅᖢᖓᓂᕗᖅᑐᑦ ᑲᑎᒪᔨᓂᖅ ᐱᖁᑎᓕᕆᔨᒃᑐᑦ ᐃᓕᓴᕐᓂᖅᑐᑦ, ᐊᒥᐊᑯᑯᓂᖃᖅᖢᖓᓂᑦ ᓯᓚ ᑕᐅᖓᓂ ᐃᑯᐊᓕᒃᑐᓗᐊᓂᖅᑐᑦ ᑕᐅᖓᓂ. ᐅᐊᖓᑕᒪᓐᓇᖅᑐᒥᓂᖅ ᐱᖁᑎᓕᕆᓂᖅ ᐱᓕᕆᔨᒃᑐᑦ ᑕᐅᖓᓂ ᐊᒻᒪᓗ ᓯᓚᑦᑐᓂᖅᑐᑦ ᐃᓕᓴᕐᓂᖅᑐᑦ ᑕᐅᖓᓂ. ᐅᐊᖓᓇᖅᓯᒪᓕᒃ ᐅᓇᖅᓯᒪᓕᒃ ᐃᓄᐃᑦᑕᐅᓂᖃᖅᖢᖓᓂᑦ ᐊᒻᒪᓗ ᑲᑎᒪᔨᓂᖅᑐᑦ ᐱᖁᑎᓕᕆᓂᖅ ᐃᓄᐃᑦᑕᐅᓂᖃᖅᖢᖓᓂᑦ ᐊᒻᒪᓗ ᑲᑎᒪᔨᓂᖅᑐᑦ

ᑕᐃᒃᑯᐊ ᓴᓗᒪᓂᕐᓴᐃᓂᕐᔪᑦ ᖃᓄᓇᑕᐅᑎᒃᓴᓄᑦ <ᕐᓇᐅᑦᑐᑦ ᓴᓇᔅᐅᓪᓚᑦᑐᕐᑕᖃᑦᑕᓂᕐᓂᓗᑎᒃ ᐃᓄᓕᓴᐃᔨᑐᖃᑦᑐᑦ ᑎᑎᖃᕐᑐᓂᖅᓯᒪᔪᑦ ᑕᐃᔨᐅᔪᑦ ᑭᒪᒃᑕᐅᔭᑐᓄᖅᓯᒪᔪᑦ *ᑭᒪᒃᑕᐅᔭᑐᐃᓇᖅᓯᒪᔪᑦ ᐅᓇᑕᓂᖅᓴᒃᓴᓄᑦ ᐃᓂᓕᓴᓂᓇᖅᑐᓂᒃᓴᓄᑦ ᓴᓇᓴᒃᓴᖅᑕᐅᓂᖅᓯᒪᔪᑦ ᐊᖏᑎᑦᑎᓂ (2009).*

Ċᒃᑯᐊ ᑎᑎᖃᐃᑦ ᓇᓗᓇᐃᔨᐃᓕᓴᐅᑦ ᖃᓄᓇᖅ ᓄᓇᖃᖅᑲᖅᑐᑕᓚᒃᑯᑦ ᐊᐅᑕᕐᑎᓂᐊᕐᓕᖅᑲᑎᑦ ᑕᒪᐃᓐᓂᒃᑲᓂᕐᔪᐊᖅ ᓄᓇᖓᓐᓂᒃ ᓴᓗᒪᓂᕐᓴᐃᓂᕐᒥᒃ. ᓄᓇᒥᒃ ᓴᓗᒪᓂᖅᑕᐅᓂᖓᓂᑦ ᑕᐅᙵᓂ FOX-D–ᑭᐃᑐᓂᒥ ᐃᑕᖃᖅᓂᓂᐊᖅᑐᑦ ᒪᑯᓂᖅ:

- ᓴᓇᔨᐅᓯᒪᓂᖅ ᑕᖅᒪᓂᕐᕕᓴᔨᐅᙵᓂᐊᖅᑐᓂᒃ ᐃᑲᔪᖅᑎᒃᓴᓄᑦ ᓄᓇᒥ ᐊᐅᑕᑕᐅᓂᐊᖅᑐᓂᒃ.
- ᓄᖓᔪᐃᑦᑐᕐᖓᓂᒃ ᐱᓯᐲᓕᕐᖓᓂᒃ ᐊᓪᒪᓗ ᓴᐃᐃᓂᖅᓄᑦ ᓯᑭᖅᑎᖅᑕᐅᓯᒪᔪᑦ ᓄᓇᐃᑦ ᐃᔪᐃᑦ ᖃᓄᖅᑕᐅᓂᐊᖅᑐᑦ >ᐊ3ᓚᒃᖅᑕᐅᓗᑎᒃ ᐊᑲᖅᑕᐅᓗᑎᒃ ᐊᓪᒪᓗ ᐊᐅᑦᓭᖅᑎᑕᐅᓗᑎᒃ ᐊᓯᐊᓄᑦ ᓄᓇᒧᑦ ᓭᐃᔭᓯᓴᖅᑐᓄᑦ ᐊᑦᓯᐃᓴᖅᑦᓯᐊᖅᑐᓄᑦ ᑕᒪᒃᑯᓂᖓᓐᓂ.
- ᐅᖅᓯᐊᓗᐃᓐᓇᐃᓕᓂᐅᑕᖅᑐᑦ ᓄᓇᐃᑦ ᐃᔪᐃᑦ ᓴᓗᒪᓂᖅᓴᖅᑕᐅᓂᐊᖅᑐᑦ ᐊᑐᔪᑎᒃ ᖃᐅᔨᖓᑕᓂᖓᓂᒃ ᐊᓪᒪᓗ/ᐅᕐᓚᓗᓐᓂᑦ ᑎᓂᒋᑲᖃᐃᐅᔭᓐᓇᖅᑐᓂᒃ ᓴᓇᔨᐅᐊᖅᑕᐅᓗᑎᒃ ᓴᓗᒪᓂᖅᓴᖅᑕᐅᓂᖓᓐᓂᓄᑦ ᐊᓪᒪᓗ ᐊᓯᐊᓂᑐᓄᑦ ᐊᐅᑕᖅᑕᐅᓗᑎᒃ ᐊᖓᔪᖅᑐᕐᓗᒋᑦᓯᐊᖅᑐᓂᒃ ᐊᑦᓯᐃᓴᖅᑦᓯᐊᖅᑐᓂᒃ.
- ᐃᓐᓇᐅᔨᖅ ᓄᓇᒋᑦᑐᓂᒃ ᐱᖁᔨᒪᓂᐊᓕᐅᓄᑦ ᓯᕆᑎᖅᑕᐅᓂᐊᖅᑐᑦ ᐊᐅᑕᖅᑕᐅᓗᑎᒃᓗ ᐊᓚᖅᑐᖅᓯᒪᔨᓂᒃ ᐅᓗᓕᐊᓇᖅᑐᖅᑐᖅᑐᓂᒃ ᐊᓪᒪᓗ ᐅᓗᓕᐊᓇᖅᑐᖅᓯᒪᓕᒡᓗ ᐊᐅᑕᖅᑕᐅᓗᑎᒃ ᐊᐅᓪᓛᖅᑐᖅᑐᓂᒃ ᐊᓯᐊᓄᑦ ᐊᐅᑦᓭᖅᑎᑕᐅᓗᖏᒡᓗ ᐊᐅᓯᐊᓕᓐᓄᑦ. ᑕᐃᒃᑯᐊ ᐃᓕᓴᐅᔪᓂᖅᓴᖅᑕᐅᓂᐊᖅᑐᑦ ᐊᐅᑕᖅᑕᐅᓗᑎᒃ ᐊᓪᒪᓗ ᐊᐅᑦᓭᖅᑎᑕᐅᓗᑎᒃ ᐊᓯᐊᓄᑦ ᓄᓇᒧᑦ ᓄᓇᖓᓐᓂ

- ᐊᖏᑕᐅᖏᓂᖅ ᐊᐅᓪᓗᐊᓕᐅᖅᓯᒪᓂᖅᑐᑦ (WHF–ᒥᖅ ᓇᓗᓇᐃᖅᑯᑕᓚᒥᖅ) ᐱᑕᖅᑏᐊᖅᖃᓂᐊᖏᑦ ᑕᐅᖅᓄᓂ FOX-D–ᒥ ᑭᐃᔨᖅᒥ, ᑐᖅᑯᖅᓯᓯᒪᖅᐃᐅᖅᑲᐃᓐᓇᖅᓂᐊᖅᑐᒥ ᐊᒻᒪᓗ ᐊᐃᔪᑐᐃᐃᐅᓂᐊᖅᑐᒥ ᐊᔪᕐᑎᑦᑎᑐᑎᓂᖅᓯᒪᓂᖅ ᐊᖏᑕᑯᖁᓂᖅ.

APPENDIX 5:

REMEDIAL ACTION PLAN

Remedial Action Plan for FOX-D (Kivitoo, NU)

Final Report

March 2014

Remedial Action Plan for FOX-D (Kivitoo, NU)

Project No. 13-7942-3000

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Submitted by

Dillon Consulting Limited

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(In reply, please refer to)
Our File: 13-7942

March 31, 2014

Northern Contaminated Sites
Public Works and Government Services Canada
Suite 420, Greenstone Building, 5101 – 50th Avenue
Yellowknife, Northwest Territories X1A 3Z4

Attention: Ms. Janice Lee
Project Manager

RE: Remedial Action Plan for FOX-D (Kivitoo, Nunavut)

Dear: Ms. Lee

Please find enclosed one (1) digital copy of the above mentioned report.

This report contains the recommended remediation methods for the various environmental issues identified at the site and also provides information regarding remedial design, implementation and anticipated remedial costs.

If you have any questions or comments, please feel free to contact Douglas Bell, M.Sc., P.Geo., or Indra Kalinovich, Ph.D., C.Chem. E.I.T., at 204-453-2301.

Yours truly,

DILLON CONSULTING LIMITED

Doug Bell, M.Sc., P.Geo
Partner

IKK/knh

Attached:

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EXECUTIVE SUMMARY

Public Works and Government Services Canada (PWGSC) retained Dillon Consulting Limited (Dillon) to complete a Remedial Action Plan (RAP) for the former military base FOX-D, located at 67°57'58"N and 64°54'28"W near the former whaling station and Inuit spring/summer camp at Kivitoo, Nunavut. Dillon, along with KGS Group (KGS) have prepared this report which identifies remediation options, critiques potential remediation methods, and provides recommendations for site restoration, as well as a preliminary cost estimate to undertake the remedial work.

This RAP for the former FOX-D Intermediate DEW Line Site was designed in accordance with the INAC AMRSP (March 2009). This Protocol is designed to address legal requirements, health, and safety issues, Aboriginal and Northern Development Canada (AANDC)'s Contaminated Sites Management Policy requirements and standard environmental issues. The Protocol identifies financially prudent methodologies that address all the requirements listed above, while maintaining a cost-effective remediation project.

The table below provides a summary of the environmental issues identified at FOX-D and the proposed remedial action plan for each:

Environmental Concern	Site Assessment Findings	Recommendation Remediation Method
Metals Contaminated Soils	193 $m^3$of soils with concentrations of Cu, Cd, and Zn, which exceed the DCC Tier II criteria were identified on-site. This volume includes material that is co-contaminated with PAHs and PHCs.	Excavate, containerize, and label soils that exceed DCC Tier II criteria and dispose off-site at an appropriately licensed facility.
Petroleum Hydrocarbon Contaminated Soils	Approximately 3,205 m^3 of hydrocarbon contaminated soil in exceedance of the INAC Abandoned Military Site Remediation Protocol for PHC Soils.	Screen PHC Type A soils and treat in on-site constructed biological and/or aeration treatment unit (3,005 m^3). Excavate PHC Type B soils (200 m^3) and place into containers, and ship off-site to a licensed disposal facility.
Non-Hazardous Materials	Approximately 14,834 m^3 of non-hazardous debris consisting of heavy equipment, barrels, scrap metal, scrap wood, concrete, electrical equipment and plumbing parts to be handled and shipped off-site.	All buried and partially buried debris in Class B dumps (APEC 11) should be excavated, sorted and separated into different waste types where it is safe and practical to do so, and disposed off-site in an appropriate licensed facility. Buried debris that is inaccessible for excavation in Class C dumps (APECs 9 and 10) should be buried and re-stabilized in-situ. Rocks and concrete foundations from APECs 1-4 to be used as rip-rap and fill in void space at APEC 9. Area will be covered with rip rap and erosion resistant material for stability.

Environmental Concern	Site Assessment Findings	Recommendation Remediation Method
		All other debris is to be consolidated, packaged and shipped off-site to an appropriate licenced disposal facility.
Water in Barrels	Analysis of collected water in the abandoned barrels indicates that the dissolved metals meet DLCU barrel protocol.	Disposal on ground is permitted once water has been polished with an absorbent materials, additional sampling of more barrels during remediation program is required.
PCB/Lead Amended Paint Products	Approximately 0.031 m^3 of PCB/lead amended paint materials were discovered on-site (not including metal)	Dismantle contaminated paint items and ship off-site to an appropriate disposal facility.
Hazardous Materials	Approximately 1.82 $m^3$of hazardous materials were identified at the site. These materials consisted of lead acid batteries (0.22 m^3) and asbestos containing materials (1.32 m^3).	All hazardous materials (such as batteries) will be containerized and labeled and shipped to be disposed at a licensed facility.
Structures	Upper Site POL Tanks (2) Upper Site Transfer Tank (1) Concrete Foundations	All non-hazardous materials and debris from Upper Site structures buildings shall be demolished to their foundations and removed off-site for disposal at an appropriate licensed facility.

Successful implementation of the recommended remedial actions will require logistical coordination of various on-site elements; these are summarized below with additional details provided in the body of the report:

- ***Site access*** - there is currently an airstrip at the Site, and numerous locations suitable for helicopter and/or fixed wing aircraft landing. Mob/demob is possible by sealift or barge, although it is anticipated that mob/demob will take place via sealift, with support and re-supply service provided by helicopter and/or charter plane.
- ***Facilitation and operation of an on-site camp*** - a camp will be required during the remedial activities. Although the hamlet of Qikiqtarjuaq is nearby, the ability to house and efficiently mobilize workers to the Site is not deemed to be feasible. The camp must be large enough to support approximately 20 site workers and approximately three to five camp staff.
- ***Infrastructure/Roads*** - due to lack of upkeep and erosion, some portions of the existing roads to be utilized during remedial activities will require repair and upgrading. The main road to be utilized on-site will be the road leading from the airstrip to the main station area. There are sections of the road requiring extensive rebuilding, regrading, and significant drainage control. This level of repair and rebuilding constitutes approximately 375 m (5%) of the total road length. The remainder of the road will require some patching and topping up of existing road topping (medium grading) and/or localized grading (light grading).
- ***Borrow Source Development*** - required borrow material can be drawn preferentially from the main station area gravel. The sand and gravel borrow sources are estimated to contain approximately 68,000 m^3. It is anticipated that this amount is adequate for the remedial activities.

Once the borrow source requirements for the FOX-D remediation have been satisfied all borrow sources will be re-contoured to restore natural drainage and to match surrounding topography and minimize changes to the existing permafrost regime.

- ***Potential Biological and/or Aeration Treatment CellConstruction*** **-** the potential treatment cell location (saddle at Upper Site) was selected based on the required treatment cell size, distance to material to be treated and distance to borrow sources. The treatment cell shall be constructed in a controlled manner with minimal lifts to control compaction and settlement. Surface water run-on and run-off will be controlled through proper grading to positively shed water and to prevent ponding and seepage into the treatment cell. Consideration to the treatment cell cap angles must be designed as to not to encourage erosion of the impacted soil surface.
- ***Waste handling facility Construction*** - a Waste Handling Facility (WHF) will be required at the FOX-D site to receive and sort various waste items. The fluids handling area within the WHF shall be lined with an engineered synthetic liner to prevent the migration of contaminants resulting from any accidental spills. The fluids handling area is to be bermed and the engineered liner should have some fill cover to protect the liner integrity. The WHF area shall be located west of the barge landing area.

Assuming the project is tendered in the winter of 2014, the anticipated project duration will be from 2014 – 2017, including mobilization and demobilization via sealift and barge.

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1 INTRODUCTION

1.1 Site Description

FOX-D was constructed as an Intermediate Distant Early Warning (DEW) Line Site in 1957 and operated until October 1963. The Site is located on the Davis Strait at 67°57'58"N and 64°54'28"W, on the northeast side of the Cumberland Peninsula and the northeast coast of Baffin Island (**Figure 1**).

The Site can be separated into four distinct areas connected along a gravel road:

- An Upper Site on the crest of a hill 447 metres above sea level (masl) north of Beach Site;
- A Lower Site between the beach and the airstrip (the latter two described below);
- A Beach Site at the mouth of Kivitoo Harbour; and,
- An airstrip approximately 2 km east of the beach.

Shortly before the site closed in 1963, a fire completely destroyed the main building train. A clean-up of physical debris was sponsored by Parks Canada (now Heritage Canada) in the mid-1970s, due to Kivitoo's proximity to Auyuittaq National Park. The fate of debris removed during the Parks Canada clean-up is unclear. Much of the debris can be found in what is now known as the construction camp, on the Lower Site. There are persistent word-of-mouth accounts that ocean disposal methods were practiced.

The Site is located near Kivitoo, a former Inuit spring/summer camp region and whaling station, which was abandoned when the settlement was moved to nearby Qikiqtarjuaq in the 1950s. A graveyard associated with the prior settlement is present on-site. Most of the previously inhabited Site areas are within the current Crown parcel of land (**Figure 1**).

Two abandoned airstrips have been reported to be in the area. However, only the Upper and Lower Sites as described above lie within the Crown parcel of land. One of these airstrips is visible from the main summit, looking north east. Reportedly, the airstrip was abandoned due to soil strength issues associated with the marine sediments (Pers. Communication, 2013).

The Upper Site consists of the following identified areas:

- Transfer Tank;
- POL Tanks;
- Antenna;
- Burnt Building Remains;
- Warehouse Foundation;
- Two Distinct Soil Stains (identified as Stain #1 and Stain #2 by Franz Environmental Inc., 2011);
- Former Garage;
- Burnt Debris; and,
- Dump Site.

The Lower Site is located on a coast plain to the south of the Upper Site. It once consisted of two POL tanks, a beach landing area, drum storage, and an airstrip. The foundation of the two POL tanks, remnants of the airstrip and one small shed are all that remain. Within the area lie a freshwater lake, borrow source areas and a former construction camp area. The Lower Site is connected to the Upper Site by a 5 km access road.

The majority of the original facilities at FOX-D have been demolished and partially buried. The transfer tank, two Upper Site POL tanks, concrete foundations, airstrip, and shed are the only remaining structures on-site.

Potential borrow source areas are located approximately 900 m northwest of the airstrip and contain various potential borrow sources. Debris in this area was limited to caches of empty barrels. **Figures 2-3** provide detailed site drawing of FOX-D, including the location of all sub sites listed above.

1.2 Background

Data from previous assessments conducted by Environmental Services Group (ESG, Royal Military College) and others from 1994-2013 indicate that hydrocarbon, polychlorinated biphenyl (PCBs) and metals contamination exists on the former DEW Line site and may require remediation under Territorial and/or Federal Acts and Regulations. In 2013, Dillon Consulting Limited (Dillon) scored the site as 87.9 under the National Classification System for Contaminated Sites (NCSCS), making the Site a Class "1" site – High Priority Action.

Environmental Site Investigations were first initiated on the site by Environmental Services Group (ESG) in 1994, and subsequently in 1995 and 2010.

As part of a larger investigation into environmental conditions at former military stations in Canada's North, an environmental study was performed at the FOX-D, (Kivitoo, Nunavut) site in August 1994 by ESG at Royal Roads Military College in Victoria, BC. A total of 70 soil samples and 36 plant samples were collected for evaluation of contaminants, potential migration pathways, and potential impacts on the terrestrial food chain. The Site was divided into six areas (three Upper Site, three Lower Site) based on historical site use and drainage patterns. Soils were sampled and analysed for PCBs, metals, pesticides, polyaromatic hydrocarbons (PAHs), and acid base neutral (ABN) extractable analysis. Plant samples were analysed for PCBs and metals.

Four marine areas in the Baffin Region were also surveyed during August – September 1994 to evaluate the extent and effect of historic ocean disposal practices. Kivitoo was chosen to represent a smaller, DEW Line Site that was abandoned in the early 1960s. Side-scan sonar was used to determine objects on the seabed floor. Scuba divers and remote operated vehicles equipped with cameras identified and documented the sea floor condition. Sediment and biological samples were analysed to evaluate the presence and associated impacts with chemical contamination. Eleven marine sediment samples were analysed for inorganic elements and PCBs. Nine of the samples were analysed for chlorinated pesticides, and two were analyzed for PAHs. There was no evidence for local inputs of inorganic elements, PAHs or chlorinated pesticides. No objects of human origin were found near Kivitoo. The fjord depths and large survey area prohibited ease of investigation required outside the survey area.

In August and September of 2009, ESG performed a background geochemical assessment and limited contaminated soil sampling program on behalf of Indian and Northern Affairs Canada (INAC, now Aboriginal Affairs and Northern Development Canada (AANDC)). The goal of the background geochemical assessment was to establish the natural levels of inorganic contaminants in the surrounding environment.

In July 2011, Franz Environmental Inc. (Franz) was retained by AANDC to conduct a visual inspection and a sampling program at FOX-D. A total of 12 test pits were advanced by Franz, and 11 soil samples were collected. Evidence of buried drums or olfactory evidence of Petroleum Hydrocarbons (PHC) on the Lower Site was not observed. Localized staining was observed around the Lower Site. In 2011, Franz scored the site as 72.6 under the National Classification System for Contaminated Sites (NCSCS), making the Site a Class "1" site – High Priority Action.

A Phase III Environmental Site Assessment (ESA) was conducted by Dillon in 2013, which provided the necessary information to complete this Remedial Action Plan (RAP).

This RAP was prepared to provide a conceptual remediation design and preliminary specifications for clean-up of the FOX-D site.

2 OBJECTIVES

The main purpose of this RAP was to identify remediation options, critique potential remediation methods, and provide recommendations for site restoration. Based on assessment activities completed by Dillon and KGS Group in August 2013, a comprehensive site remediation work plan was developed. Remediation options were developed for each waste stream identified at the site, and were critically evaluated to discuss potential risks, advantages, and disadvantages of each remediation option. Based on a number of factors, outlined below, recommendations were made for the preferred remediation approach. Community meetings with Public Works and Government Services Canada (PWGSC) and AANDC will be conducted to incorporate community contribution in selecting the remedial option for each waste stream.

This RAP was designed to meet the following clean-up objectives in accordance with the AANDC Abandoned Military Site Remediation Protocol (AMSRP):

1. Restore the site to an environmentally safe condition;
2. Prevent the migration of contaminants into the Arctic ecosystem;
3. Remove physical hazards for the protection of human health and safety; and,
4. Implement a cost-effective remediation solution.

The end product will be a cost effective RAP for FOX-D, complete with a cost estimate to undertake remedial work (to be attached as a separate document).

3 BIOPHYSICAL ENVIRONMENT

3.1 Physiographic Description

The FOX-D site is located just north of the Pangnirtung Upland ecoregion which rises rapidly from sea level and consists of a belt of deeply dissected, crystalline Archean aged rocks. Its general aspect is one of a broad, gently warped, old erosion surface etched by erosion along joint systems, and zones of weakness. Long arms of the sea penetrate the ecoregion as glacier-filled sounds or fjords. Bare bedrock is common, and Static Cryosols with some Turbic and some Organic Cryosols, developed on discontinuous morainal, organic, and marine deposits, are the dominant soils in the ecoregion (Smith et al. 1998). Permafrost and/or bedrock were estimated to be at a depth of 1.4 to 1.5 m. The FOX-D site is located in the zone of continuous permafrost, which is defined as those areas where 90% to 100% of the soil and rock remain at a temperature continuously below 0^{o}C for a period of at least two years. Overburden material at the site consists of till and granular deposits that are typically free from ground ice.

3.2 Climate

The FOX-D site is located in the Northern Arctic Ecozone region of Canada. Canadian Climate Normals Data from 1971 to 2000 for the Iqaluit weather station (Environment Canada, 2013) showed that the annual daily mean temperature is -9.8°C with daily mean temperatures ranging from -26.6°C (January) to 7.7°C (July). The daily maximum temperatures range from -22.5°C (January) to 11.6°C (July), and daily minimum temperatures range from -32.2°C (February) to 3.7°C (July). The extreme temperature range is from -45.6°C (February) to 25.8°C (July). In general, precipitation falls primarily as snow during the winter months, with the greatest snowfalls occurring in October, November, and April. Rainfall dominates during the summer season, with overall levels of precipitation peaking in July and August. Annually, the average precipitation level is about 412 mm.

3.3 Flora and Fauna

Vegetation in the Pangnirtung Upland ecoregion is characterized by a nearly continuous cover of dwarf tundra vegetation, consisting of dwarf birch, willow, northern Labrador tea, Dryas spp., and Vaccinium spp. tall dwarf birch, willow, and alder occur on warm sites; wet areas are dominated by willow and sedge.

Fauna in the area includes arctic hare, arctic char, arctic lemming, polar bears, various species of birds, and geese. Marine species include walrus, ring seal, narwhal, walrus, and bowhead whale.

4 AANDC SITE REMEDIATION PROTOCOL

4.1 General

Numerous factors can impact the suitability of site remediation plans and should be considered when evaluating a site-specific remediation plan. For this reason, Indian and Northern Affairs Canada (INAC, now AANDC) created the AMSRP (2005, 2009) to provide a consistent approach for designing RAPs for abandoned military sites. This protocol was designed to address all legal requirements, health and safety issues, Territorial and Federal requirements, and standard environmental issues. The protocol identifies financially prudent methodologies that address all of the requirements listed above, while maintaining a cost-effective remediation project. This RAP for the former FOX-D Intermediate DEW Line Site was designed in accordance to the INAC Protocol.

The following sections provide an outline of typical environmental issues and their remedial action procedures addressed by the Protocol. These technical aspects are described in greater detail in the INAC AMSRP (**Appendix B**). The following considerations should be considered in the development and implementation of the RAP for the FOX-D site:

- Respect all historical agreements and obligations in a fair and reasonable manner;
- Ensure consistency with Federal and Territorial regulations and guidelines for the management of contaminated sites;
- Apply the Canadian Council of Ministers of the Environment (CCME) environmental protection and management approaches (CCME 2007, 2008);
- Apply simple, practical remedial solutions wherever possible, with flexibility as necessary to adjust to site-specific conditions when they are identified;
- Establish cost-effective solutions through the use of best practices to ensure appropriate levels of environmental protection for all sites;
- Recognize the concerns of global warming in an Arctic setting; and,
- Ensure the long-term effectiveness of the environmental remedial measures.

The applicable AMSRP, Federal, and/or Territorial guidelines were reviewed and are summarized below:

Table 4-1: Summary of Applicable Remedial Guidelines

Guideline Author	Title	Description	Year
INAC	Abandoned Military Site Remediation Protocol	Barrel content guideline	2009
Government of Nunavut	Environmental Guideline for Waste Lead and Waste Paint	Lead paint waste guideline	2011
Government of Nunavut	Environmental Guideline for Waste Paint	Waste paint guideline	2010
Government of Nunavut	Environmental Guideline for Mercury-Containing Products and Waste Mercury	Mercury disposal guideline	2010
Government of Nunavut	Environmental Guideline for the General Management of Hazardous Waste	Reference and waste guidelines	2010
Government of Nunavut	Environmental Guideline for the Burning and Incineration of Solid Waste	Guidelines for incineration considerations	2012
Government of Nunavut	Environmental Guideline for Waste Asbestos	Guideline required for handling and abatement	2011
Government of Nunavut	Environmental Guideline for Waste Batteries	Guideline and disposal options	2011
Government of Nunavut	Environmental Guideline for Waste Solvent	Waste solvent disposal options	2011
Canadian Council of Ministers of the Environment	Environmental Quality Guidelines	Soil and water quality guidelines for metals, hydrocarbons, and inorganics.	2008
Canadian Environmental Protection Act	PCB Regulations	Waste remediation and landfill guideline	2011
Environment Canada	Industrial Treated Wood Users Guidance Document	Management of treated wood	2004

4.2 Landfills

4.2.1 Landfill Closure

Landfills on AANDC abandoned military sites are classified as Class A, Class B, or Class C. A Class A landfill is a landfill located in an unstable, high erosion location and requires relocation. If, during the relocation process, hazardous materials are noted, the hazardous materials are segregated for off-site disposal. A Class B landfill is a landfill situated in a suitable, stable location but has contaminated leachate release. The leachate from these landfills must be contained within an engineered containment system. Otherwise, the landfill must be relocated to an engineered landfill or waste removed for off-site disposal. A Class C landfill is suited in a stable and suitable location, with no release of contaminated leachate. These landfills can be left in place. Additional granular material can be placed to prevent erosion and promote proper drainage if required.

4.2.2 Landfill Development

Landfill design at abandoned military sites must consider waste types to be retained within the landfill, proximity to drainage courses and distance to borrow sources required for landfill construction. Non-hazardous and/or non-regulated contaminated soils are to be stored in newly constructed, on-site landfills. All hazardous waste is to be disposed of off-site.

4.3 Physical Debris

Debris across the site must be collected and segregated into hazardous and non-hazardous waste streams. Non-hazardous material shall be crushed, shredded, and/or incinerated prior to off-site disposal to reduce volumes. Hazardous materials shall be disposed of off-site in accordance with applicable guidelines and regulations.

4.4 Soils

Soil conditions at FOX-D were assessed using the INAC AMSRP as the governing criteria. Heavy metals, PHC, which includes F1-F4 fraction hydrocarbons and BTEX parameters, and PCB concentrations in soils were compared to the DEW Line Clean-Up (DLCU) Criteria, which was developed for the Department of National Defence.

The AMSRP incorporates the CCME guidelines as appropriate, with the consideration of previously conducted quantitative risk assessments within the guidance documents. There are four exposure pathways and they include:

- Human and ecological contact;
- Soil and food ingestion;
- Ground/surface water; and,
- Indoor vapour intrusion.

All pathways are deemed applicable to the Site, as there is the potential for new shacks or cabins to be built at the Site in the future. As part of the data interpretation, the most stringent criteria among the four exposure pathways are used.

Soil depth and soil type are important factors affecting the availability and transport of contaminants. The AMSRP provides specific guidelines for contaminants based upon their depth below ground surface. All soil samples were collected within 0.6 metres below ground surface (mbgs) which represented refusal, or maximum encountered depth, during the Phase III ESA field program.

For Type B hydrocarbons (which are defined as the sum of PHC F1, F2, and F3, as stated in the AMSRP), soils below 0.5 mbgs are considered sub-surface and will have a higher guideline threshold applied. Special consideration for the proximity to water bodies is included in the AMSRP.

The remedial requirements for hydrocarbons are shown below:

Table 4-2: AMSRP Guidelines for Petroleum Hydrocarbons in Soil

Depth below Ground Surface (mbgs)	Hydrocarbon Type	Within 30 m to Water (Yes/No)	Criteria[1] (mg/kg)
< 0.5	B	NO	2,500[1]
> 0.5	B	NO	5,000[1]
Any depth	B	YES	330[1]
Any depth	PHC Fraction F2	NO	11,000
Any depth	PHC Fraction F3	NO	20,000
Any depth	A (F3 + F4)	NO	20,000

[1] AMSRP Guidelines, AMSRP Tier 1/2: Abandoned Military Site Remediation Criteria (INAC, 2009)

For Type A contaminated soil, the sum of F3 and F4 must be greater than 70% of the total PHC concentration, and the F2 concentration must be less than the F4 concentration.

Contaminated soils identified will be categorized as:

- Regulated;
- Hazardous, or,
- Contaminated, but not hazardous.

Soils that are identified as being regulated will be remediated and/or disposed of following applicable regulations. Hazardous soils will be disposed of off-site. Contaminated but not hazardous soils must be remediated to meet DCC DLCU Criteria. Soils classified as contaminated, but not hazardous, are to be remediated based on one of three primary contaminated soil types:

1. Metal contaminated soils must be disposed off-site or encapsulated on-site;
2. Remediation options for hydrocarbon contaminated soil include remediated in-situ, ex-situ, or off-site; capped in place; natural attenuation; or chemical amendment; and,
3. PCB contaminated soil must be either disposed off-site or encapsulated on-site.

In cases where co-contamination of soils is present, the most conservative remedial option that addresses both contaminants must be applied.

4.5 Water

Surface water with heavy metal contamination (in exceedance of the CCME Freshwater Aquatic Life Criteria) was observed in one location at FOX-D; however, it should be noted that the concentrations are diluted relatively quickly and all elevated levels were observed in seasonal drainage water, only. The areas where exceedances were noted are a significant distance away from any possible fish habitats and drainage direction is away from the nearest known fish habitat. It should be noted that the volumes of surface water where the exceedances were noted are minimal. It is not anticipated that contamination noted on-site is adversely affecting water sources downgradient and off-site. It is expected that removal of the source contamination (buried barrels) would address the problem and therefore no remedial options for contaminated water are discussed in this RAP.

The Freshwater Lake, located near the Construction Camp, was assumed to be used as a potable water source for hunters and trappers in the area. Further surface water assessment and monitoring should be conducted; this is further discussed in Section 7.8. In the event that surface water bodies show water impacts related to site activities, remedial activities should be conducted to applicable CCME *Canadian Water Quality Guidelines for the Protection of Freshwater/Marine Aquatic Life* (PFAL) (CCME 2007) and/or the *Canadian Drinking Water Guidelines* (DW), (Health Canada 2012). With the absence of federal guidelines for PHC fractions F1 and F2 in water, the *Alberta Tier 1 Guidelines* (AENV 2010) should be used. In the event of a discrepancy between the PFAL and DW guidelines, the most stringent guideline value should be applied for remedial activities.

The majority of the water guidelines are obtained from the summary table of the CCME PFAL (CCME 2007); however, various inorganic compounds are pH, temperature or water hardness dependent. These compounds include aluminum, ammonia, cadmium, copper, lead, and nickel.

Based on the equations provided in the summary table, specific guideline values were calculated using the average laboratory pH and hardness.

4.6 Hazardous Materials

In general, all hazardous materials will be shipped off-site to a licensed hazardous waste disposal facility. Petroleum products (free of chlorine, PCBs, heavy metals, etc.), are to be incinerated. Heavier petroleum products are to be mixed and burned on-site, or shipped off -site.

PCB paint and PCB painted components regulated under the CEPA (>50 ppm) are to be disposed of off-site at an appropriate facility. Lead-based paint (leachable lead >5 mg/L) considered to be hazardous will be collected and transported off-site, whereas painted components not considered hazardous may be disposed of in on-site landfills.

4.7 Barrels

Barrels located at the site will be addressed in accordance with the DLCU Barrel Protocol (**Appendix C**). In general, empty barrels will be crushed and disposed in on-site landfills. The contents of filled barrels will be inspected and tested, and either incinerated on-site or shipped off-site for disposal.

The now empty barrels will be rinsed, crushed and disposed in on site landfills. Buried barrels will be addressed by geophysical testing. If the buried barrels are empty, the area will be stabilized by compaction and covered in place. If fluids are noted in the barrels, the barrels will be excavated and the contents will be inspected and tested. Depending on the results, the contents will either be incinerated on site or shipped off-site for disposal. Barrel contents were collected by Dillon from several barrels on-site and submitted for laboratory analysis (Dillon, 2013). Results indicated that neither glycol nor non-aqueous phase liquids were observed in the barrels, and dissolved metals concentrations were below the DLCU Barrel Protocol. Consequently, specific barrels were identified to be within the allowable range for disposal to ground following polishing with absorbent material.

4.8 Buildings and Infrastructure

All existing buildings and infrastructure shall be demolished to their foundations. All hazardous material is to be removed prior to or during demolition activities. All removed hazardous material is to be disposed of in accordance with protocol outlined in Section 5.4. Under special circumstances, some buildings may be left place once clear ownership of the building has been determined.

4.9 Borrow Sources

Borrow sources for granular material will be required for the construction of new landfills and for general site grading purposes. Existing borrow sources located on AANDC's property, including abandoned gravel pads and road infrastructure, will be fully exhausted prior to exploiting new sources. Upon completing remedial activities, all borrow areas will be re-contoured to restore natural drainage and to match surrounding topography.

4.10 Site Grading

Disturbed areas on the site will be graded and shaped to blend in with the natural contours and to eliminate potential hazards for wildlife and humans accessing the site in the future. The disturbed areas include contaminated soils excavations, existing and new landfills, debris areas, disturbed areas resulting from demolition activities; borrow areas, and any areas disturbed as a result of remediation activities.

4.11 Contractor Support Activities

For the completion of remedial activities, a camp will be established on-site and will be situated in a previously disturbed location to minimize the extent of new disturbances. Waste generated by the camp will be incinerated and disposed of off-site. Sewage will be treated using an appropriately sized treatment system, and effluent quality will adhere to applicable licenses. Potable water located on site will be tested and used in accordance with the applicable water license.

Contingencies for water supply will include filters, and a supply of bottled water. Fuel required to operate the camp and to complete remedial activities will be stored on-site in accordance with applicable legislation and licenses.

5 COMMUNITY CONSULTATION

A draft copy of the RAP was distributed by AANDC to the community of Qikiqtarjuaq for their review and comment. In addition, a community consultation open to the public, hosted by AANDC, was held in January 2014. Minutes from the community consultation are located in Appendix D.

6 EVALUATION OF REMEDIAL OPTIONS

6.1 Cleanup Objectives

The following remedial objectives are based on guidance provided from Northern Contaminated Sites, PWGSC and the INAC AMSRP, March 2009.

- Restore the site to an environmentally safe condition;
- Prevent the migration of contaminants into the Arctic ecosystem;
- Remove physical hazards for the protection of human health and safety; and,
- Implement a cost effective remediation solution.

6.2 Remedial Options Analysis

Evaluation of the various remedial options was done using a systematic process that identifies parameters in which to rank the options, and the relative importance of those parameters. A decision-making matrix based on the Kepner-Tregoe process was used. For each remedial option identified, the following weighted attributes are considered important for determining which option may be the most preferred.

Cost - This will include all costs including initial costs of implementing the option and any long-term costs such as monitoring. This attribute is weighted the highest at 25%.

Effectiveness in Meeting Remedial Goals - This attribute includes an evaluation on whether the option will meet a regulatory target, such as a guideline criteria or site-specific risk-based criteria. Where criteria or site-specific criteria are not met an evaluation is made on whether the exposure pathway can be effectively managed or a receptor can be prevented from being impacted by the contaminant or hazard. This attribute has been weighted moderately at 15%.

Ease of Implementation - This includes how easily an option can be implemented, with proven solutions and the solutions that can be done easy on remote sites ranking higher than solutions that are problematic, less proven or are more complex. This attribute has been weighted moderately at 15%.

Regulatory Acceptance - Is the likelihood that an option could be readily accepted by the various regulators including Environment Canada and Territorial regulators. This attribute has been weighted relatively moderately at 15%.

Community Acceptance - This is how likely stakeholders from the community and First Nations nearby Hope Lake, Willow Creek, and Husky Creek will accept the remedial option. This attribute is weighted relatively moderate at 15%.

Loss of Natural Capital - Natural capital can be defined as the value that natural ecosystems contribute in terms of ecosystem goods (i.e., fish, wildlife, trees) or services (water catchment, erosion control, carbon cycling). The loss of the natural ecosystem through disturbance does have an impact to natural capital. The higher ranking corresponds to a lesser chance that there will be a loss of natural capitol. This attribute has been weighted lower at 10%.

Timeframe for Remediation - Is the length of time that an option will take to remediate to applicable criteria. Options involving risk management will rank lower typically due to the timeframe required (i.e. natural attenuation). This attribute has been weighted at 5%.

6.3 Site Issues

The following sections present a summary of the contaminant and waste disposal issues, as well as the potential remedial methods, for site issues identified from past site assessments. In the cases where more than one remedial method is identified, the options will be evaluated based on the remedial objectives and a recommendation for the favourable remedial method will be provided. Specific issues that need to be addressed at the FOX-D site include:

- Disposal of contaminated soils (PHC, metals, PCBs);
- Treatment/disposal of impacted soils (PHCs, and PAHs);
- Collection and disposal of hazardous materials (asbestos containing materials, batteries);
- Collection and disposal of lead and PCB amended paint;
- Proper disposal for the buried and partially buried debris located in two locations at the Upper Site, and in two locations at the Lower Site;
- POL tanks and transfer tank on the Upper Site; and,
- Collection and disposal of non-hazardous surface debris piles and dumps (located at Upper Site, Construction Camp, Airstrip Fuel Cache Dump, barrels, electrical cabinet, airstrip, borrow areas and scattered in other areas of the site).

6.4 Contaminated Soils

A summary of the contaminated soils and the preferred remedial options are presented in **Table 6-1.**

In accordance with the INAC AMSRP, March 2009, the following remedial options are presented for consideration. FOX-D is an abandoned and remote site; therefore the remedial plan must be designed accordingly. Solutions that achieve remedial objectives and minimize site remediation costs will be deemed favourable.

Despite the fact that in-situ technologies reduce contaminant exposure to humans and the environment, in-situ remediation technologies were not researched in detail. In-situ remedial technologies are care and maintenance intensive and have not generally proven to be pragmatic technologies for remote, northern site remediation. For this reason in situ technologies were not explored in great detail.

Table 6-1: Summary of Impacted Soils at FOX-D

Location	Exceedance of Applicable Guidelines	Within 30 m of a Water Body	DCC I (m^3)	DCC II (m^3)	Volume of PHC Impacted Soil (m^3)	Comments
APEC 1 – POL Tanks	PHC Type B	No	-	-	200	On-Site Biological Treatment and/or Aeration
APEC 3- Burnt Building Remains	PHCs/metals	No	-	190	50	Exceeds DCC Level II Criteria. Remove for off-site Disposal in an appropriately licensed facility.
APEC 5 – Stain #1	PHC Type B	No	-	-	80	On-Site Biological Treatment and/or Aeration
APEC 6 – Former Garage	PHC Type B	No	-	-	50	On-Site Biological Treatment and/or Aeration
APEC 7 – Stain #2	PHC Type B	No	-	-	230	On-Site Biological Treatment and/or Aeration
APEC 8 – Burnt Debris	PHCs/metals	No	-	3	-	Exceeds DCC Level II Criteria. Impacted area is co-contaminated. Remove for off-site disposal in an appropriately licensed facility.
APEC 9 – Northeast Slope Dump	PCBs, PHCs	No	-	< 1	615	Isolated hot spots of PCBs – remove for off-site Disposal in an appropriately licensed facility; On-Site Biological Treatment and/or Aeration
APEC 11A – Construction Camp	PHC Type B	No	-	-	1,140	On-Site Biological Treatment and/or Aeration
APEC 11B – Airstrip Fuel Cache Dump	PHC Type B	No	-	-	220	On-Site Biological Treatment and/or Aeration
APEC 12 – Landing Area	PHC Type A/B	Yes	-	-	620	On-Site Biological Treatment and/or Aeration

6.4.1 PCB Contaminated Soils

6.4.1.1 Contaminant Issue

The approximate 1 m^3 of PCB contaminated soil that exists on-site is located at the northeastern slope dumps site, as shown on **Figure 12** of **Appendix A**. The soil exceeds the INAC AMSRP (Greater than DCC Tier II) for PCBs. There are no DCC Tier I exceedances for PCBs in soil.

6.4.1.2 Recommended Remedial Method

Due to the limited quantities delineated, the soil shall be excavated, containerized, labelled in accordance with the Transportation of Dangerous Goods Act and shipped off-site to a disposal facility that is licensed to accept metal contaminated soils co-contaminated with PCBs. These soils should be addressed as per the Tier II soils identified in **Section 6.4.2** below.

6.4.2 Metal Contaminated Soils

6.4.2.1 Contaminant Issue

The 193 m^3 of metal contaminated soil that exists on site is located at the two burned debris areas: APECs 3 and 8, as shown on **Figures 6** and **11**, respectively, of **Appendix A**. The soil exceeds the INAC AMSRP (Greater than DCC Tier II). The soil exceeds the site-specific criteria as outlined by ESG in 2011. The soils are classified as exceeding Tier II.

6.4.2.2 Recommended Remedial Method

Due to the small amounts of metal contaminated soils on-site and the large operational and maintenance costs of metal contaminated soil remedial technologies as well as the high costs to construct and maintain a landfill, on-site remediation or disposal of the soils on-site was not explored. All metal contaminated soils that exceed the DCC Level II criteria (193 m^3) be excavated, containerized, labelled in accordance with the Transportation of Dangerous Goods Act and shipped off-site to a disposal facility that is licensed to accept metals contaminated soils.

6.4.3 Hydrocarbon Contaminated Soils

6.4.3.1 Contaminant Issue

The Phase III site investigation identified approximately 3,205 $m^3$of PHC contaminated soils that exceed the INAC AMSRP. This includes an estimate of 1,225 m^3 of PHC contaminated soil at the Upper Site, and 1,980 m^3 of PHC contaminated soils at the Lower Site. Assumed depths of impacts to 0.5 m were used for estimates, shown in **Table 6-2**. These values will be incorporated into estimated soil volumes that are likely to increase as a result of bulking during excavation (25% contingency). The estimates take into account both screening and bulking, which are likely to off-set each other. The hydrocarbon contaminated soils are located at the following areas (as shown on **Figures 4-16**):

- APEC 1 (POL Tank);
- APEC 3 (Burnt Building Remains);

- APEC 5 (Stain #1);
- APEC 6 (Former Garage);
- APEC 7 (Stain #2);
- APEC 9 (Northeast Slope Dump);
- APEC 11 (Construction Camp and Airstrip Fuel Cache Dump); and,
- APEC 12 (Landing Area).

Hydrocarbon fractions in the contaminated soils at the POL tank are mostly F2's and F3's, typical of weathered arctic diesel fuel contamination. The heavier end hydrocarbons are associated with waste oils and contamination remaining from the burning of oils and heavier fuels.

Table 6-2: PHC Impacted Soil Volume Estimates

Area	Estimated Volume of PHC-impacts exceeding (AMSRP SQG) m^3	Estimated Volume of PHC-impacts exceeding Type A AMSRP SQG m^3	Estimated Volume of PHC-impacts exceeding Type B AMSRP SQG m^3	Dominant Hydrocarbon Type
APEC 1B	200	200	-	B
APEC 3	50	-	50	A
APEC 5	80	-	80	A
APEC 6	50	-	70	A
APEC 7	230	-	230	A
APEC 9	615	100	615	A
APEC 11	1,240	320	1,360	A/B
APEC 12	620	260	575	A
TOTAL	**3,205**	**880**	**2,960**	

6.4.3.2 Remedial Options

Option #1: Excavation and Off-Site Disposal

The first potential remedial option for the hydrocarbon soils at FOX-D is to excavate all PHC contaminated soils ship them south to a facility licensed to accept hydrocarbon contaminated soils. The steps are as follows:

- Excavate PHC impacted soils from specified areas and package for transport according to TC TDG regulations. The excavation work would be completed during the summer;
- Haul impacted materials to staging area;
- PHC impacted soil would be loaded onto a barge/sealift and moved off site to Churchill, Manitoba, or Valleyfield, Quebec. The PHC impacted soil would then be transported to a licensed disposal facility with appropriate waste manifests and landfill approvals; and,
- Backfilling of excavations, then re-contouring and re-vegetation would be completed as required in areas of excavation, once backfilling is complete. It is then recommended to conduct a geotechnical evaluation to confirm soil compaction/settlement has occurred sufficiently at the Site.

This remedial option requires several barges and/or ships to mobilize and land various remedial equipment and supplies to the Site, so that the remedial work can be completed. Heavy equipment would be required to move PHC impacted soils from the site.

Since the contamination will be completely removed from the Site, it meets all of the remedial objectives; however, the major disadvantage of this method is the cost for shipping the material off-site.

This option is favourable because it removes the material from the site, thus prohibiting future site visits for biological and/or aeration treatment or monitoring purposes. It is anticipated that the cost of removing the material via barge is more cost effective than building, operating and monitoring a biological and/or aeration treatment cell or landfill. This remedial option would meet all clean-up objectives.

Option #2: On-Site biological and/or aeration treatment(Type B Hydrocarbon exceedances) Off-Site Disposal (Type A exceedances)

Option 2 for handling the petroleum contaminated soils is the use of a land farm for Type B exceedances with removal and off-site disposal of Type A exceedances (which are recalcitrant to biological and/or aeration treatment activities in the Canadian North). The off-site landfill disposal option is described above in Option #1. Biological and/or aeration treatments are a remediation technique used to reduce the hydrocarbon levels in soil via volatilization, biodegradation and photo degradation. The hydrocarbon soils are spread out on a self-contained, lined treatment cell Chemical amendments (fertilizer) and water may be added to the soil to promote biodegradation of the hydrocarbons. The soil is scarified or "turned" using heavy equipment to break up the soil, add oxygen and promote volatilization. Microbes in the soil (bacteria and fungi) breakdown the hydrocarbon chains converting them into biomass.

On-site borrow sources may be used for the construction of the Biological/Aeration Treatment Unit. In order to carry out this remedial process, a Biological/Aeration treatment unit footprint area of approximately 6,410 m^2 would be required for the Site (at a lift thickness of 0.3 m). A suitable location with this area was identified as the saddle location along the road connecting the Upper Site and the Lower Site.

In a northern climate, a minimum of two to five years is required for remediation depending on temperatures, moisture, soil contaminants, and fertilizer application/soil turning. More rapid attenuation has been observed in using an Allu bucket technique at other DEW Line locations. Biological and/or aeration treatment requires a work crew to visit the FOX-D site to scarify the contaminated soil, add the chemical fertilizer, and monitor the soil contamination levels. Once the soil has been remediated below the applicable criteria, the biological/aeration cell may be decommissioned in place and contoured into natural topography. Biological/aeration treatment processes will be carried out while the site is in operation. It is anticipated that concentrations in soil may be reduced to values below the applicable AMSRP criteria in this timeframe.

The general steps for on-site treatment are as follows:

- Perform bench scale testing to optimize the treatment process prior to treatment cell construction and mobilization of equipment to Site;

- Grading and construction of a biological and/or aeration treatment cell with an impermeable liner and perimeter berms. Seepage collection points or groundwater monitoring wells should be included to ensure the integrity of the impermeable liner. Some leachate is anticipated based upon the Phase III ESA findings for F2 and F3 PHCs. The design requires a sump and leachate collection within the design;
- Excavation and hauling of PHC impacted soils to the treatment cell site;
- Treatment and tillage of PHC impacted soils. Demarcation of the impermeable liner is needed to ensure that it is not damaged during treatment. Treatment including nutrients and aeration should be considered to meet the remedial targets;
- Collection and submission of soil analytical samples from the treatment cell to quantify the level of contamination, nutrient and microbial levels, and determine need for additional treatment; and,
- Once the soils are successfully remediated, clean soils will be backfilled into original locations or used as fill for areas across the site. Reclamation activities may include grading to promote natural drainage of water, seeding, and if required, fertilization. The artificial liner will be removed and disposed off-site prior to site closure activities.

An advantage of biological and/or aeration treatment is that the contamination is eventually eliminated. This eliminates the need for long-term inspections and monitoring, and removes any long-term liability of the site. Notable disadvantages include the time and effort required for the construction of the treatment cell and the remediation process, as well as monitoring the activity and ensuring the material is remediated to the applicable criteria.

Biological and/or aeration treatment of the PHC contaminated soils would meet the INAC Clean-up Objectives one, two and three.

Option #3: Landfill On-Site

A secure landfill was evaluated as a third option. A landfill can be constructed at the FOX-D site using the available borrow sources. A landfill containing contaminated soils shall have an engineered clay or synthetic liner to ensure the contaminants within the soil are not allowed to become mobile. Proper design of the landfill will ensure that permafrost is developed within the landfill to further decrease the mobility potential of the contaminants.

Advantages of the landfill are that the remedial work can be completed in one season. Disadvantages for this option are similar to the capping option (described below). The main disadvantages of landfilling the contaminated soils are that the contamination will remain on-site. This requires long term inspections and monitoring of the landfill at significant extra capital and labour costs to ensure the contamination remains contained within the landfill.

The landfill option meets INAC Clean-up Objectives one, two, and three; however, long term monitoring and inspections of the landfill are required as the contamination will remain on-site. Consequently, the cost for building and monitoring a landfill is likely off-set by the cost to excavate the material and dispose of it off-site. Due to the lack of suitable space for landfilling soils on-site, this will not be pursued further as a viable remedial option.

Option #4: Engineered Cap in Place

Option 4 for dealing with the hydrocarbon contamination at the FOX-D site is to grade and cover the contaminated areas with an engineered cap. The cap would consist of a 1.0 m thick layer of compacted engineered fill, graded to promote drainage.

A cap would reduce the amount of rain and surface water coming into contact with the contamination and prevent further dispersion of the hydrocarbon contamination. The cap would eliminate the possibility of humans and/or fauna from coming into contact with the contamination. This remedial option has a relatively low cost and a minimal level of effort. The capping of the hydrocarbon contaminated soils could easily take place during other site remedial activities.

In addition to the engineered cap a chemical amendment can be added to the contaminated soil. The chemical amendment (fertilizers, nutrients, nitrogen etc.) promote biodegradation of the hydrocarbons by providing the necessary chemicals and nutrients required by the microbes for the degradation to occur.

The hydrocarbon impacted soils are excavated and the chemical amendment would be mixed into the soils and the soils would be replaced and capped as noted above. The additional costs for the chemical amendment include the costs for the excavation of the impacted areas; the addition of the amendment, the amendment itself and the cost to replace and compact the soils after the amendment is added. The availability of suitable borrow materials required for an engineered cap may impact cost and/or feasibility.

Disadvantages associated with this remedial option are that it would require further monitoring events to ensure the capping system remains in good condition (no erosion, frost heaving) and that the hydrocarbons do not become mobile. The capping would greatly reduce the natural occurring bioremediation of the soils by limiting the amount of oxygen reaching the contaminated soil. Less oxygen reduces the rate of aerobic degradation of the hydrocarbons. There would be little to no control over the bioremediation process and on-going monitoring of the contaminated area would be required. As the impacts are not being attenuated and remain on-site, long-term monitoring may be required.

Option #5: In Situ Soil Vapour Extraction

Vapour extraction is a remedial method used to remediate hydrocarbon contaminated soils. Air is pushed or drawn through the contaminated soils and the lighter end hydrocarbons volatilize into the air. The air is then released into the atmosphere or run through carbon filters to remove the hydrocarbons. Contamination favouring this option is light end hydrocarbons (F1 Fractions). Heavier fractions of hydrocarbons are less likely to volatilize and require different remediation methods. The soils must be porous, freely allowing the air to move through the soil and volatilize the hydrocarbons. Poorly graded dry sands and gravels are ideal for vapour extraction. Saturated well graded soils are not favourable for Soil Vapour Extraction.

Vapour Extraction systems rely on powered blowers and require frequent adjustments and maintenance during the extraction process. FOX-D is a remote, unmanned site, rendering this remedial measure to be costly. The types of hydrocarbon contamination at FOX-D are not compatible with vapour extraction remediation methods. The contamination at the FOX-D site comprises the larger fractions of hydrocarbons (F2, F3 and F4 at some locations). Vapour extraction will not be explored further as a remedial option.

Option #6: Biopile

A biopile is a remediation technology used to remediate hydrocarbon contaminated soils. The PHC contaminated soils are collected into piles and wrapped in synthetic liners to promote anaerobic degradation of the hydrocarbons and retain heat to promote the bioactivity. Temperatures measured within an active biopile are often much higher than ambient temperatures.

Biopiling has had limited success as an effective remediation technique at remote and unmanned northern sites due to low ambient temperatures and the care and maintenance involved with operating the biopile system. Biopiles will not be explored further as a remedial option.

6.4.3.3 Remedial Options Analysis

Cost of Remediation

Each remedial option has been ranked as following:

***Lowest Cost*:** Option 4, In-situ engineered cap, is anticipated to be the most cost effective option.

***Middle Cost*:** The costs for remedial Option 2 (biological and/or aeration treatment with some off-site disposal) are greater than for Option 4 due to cost for borrow material as well as design and the construction of the treatment cell and off-site disposal.

Highest Cost: Off-Site Disposal to an approved Facility (Option 1) is estimated to have the greatest cost.

Effectiveness in Meeting Remedial Goals

Each remedial option has been ranked as following:

Most Effective: Excavate the impacted soil and remove it off-site for disposal in an approved off-site licensed disposal facility. This option results in the complete removal of the source and its associated environmental liabilities.

***Middle*:** Single stage biological and/or aeration treatment is considered to be the next most effective option as PHCs will biodegrade and be chemically broken down over time within a reduced timeframe. All biological and/or treatment options will achieve the remedial targets required for the Site.

Least Effective: In-situ engineered capping is considered to be the least effective as the source will remain on-site and minimal degradation will occur.

Timeframe for Remediation

Each remedial option has been ranked as following:

Shortest Timeframe: Excavate the impacted soil and remove off site for disposal is considered the most time effective, as it is anticipated that this option will require one to two years to complete including off-site transport via barge/ship.

Middle: In-situ engineered capping is anticipated to be completed within one to two years.

Longest Timeframe: Biological and/or aeration treatment is anticipated to take two years until remedial works are completed that meet applicable remedial targets.

Ease of Implementation

Easiest to Implement: Covering impacted soils in situ using developed aggregated on-site is anticipated to have the greatest ease of implementation.

Middle: Biological and/or aeration treatment using onsite developed aggregate is anticipated to have more complexity than option #4, due to the design and construction of a suitable treatment facility.

Hardest to Implement: Off-site removal to an approved off-site facility is anticipated to have some difficulty due to the logistical challenges of transporting a large volume of impacted soil from Davis Strait by barge, and to transport the impacted soil to an approved off-site facility.

Regulatory Acceptance

Each remedial option has been ranked as following:

Greatest Regulatory Acceptance: Excavate the impacted soil and remove off site for disposal is considered to have greatest regulatory acceptance due to removing fully removing site impacts in a short timeframe from the Site.

Middle: Biological and/or aeration treatment (Option 2) using on-site developed aggregate is anticipated to have regulatory support as native bedrock will be used ensure no invasive species are introduced from off-site aggregate.

Lowest Regulatory Acceptance: Engineered Cap, Leave In-Situ is expected to have the lowest level of regulatory support as remediation efforts are non-destructive and will require further visitation at the Site.

Community Acceptance

Biological and/or aeration treatment was presented as the selected remedial option at the Community Consultation. No objections were raised.

Preferred Remedial Option:

The options are evaluated below:

Table 6-3: Hydrocarbon Remedial Options Analysis

Option/Attribute	Attribute Weighting	Excavate, Off-Site Disposal	Biological and/or Aeration Treatment On-Site	Engineered Cap, Leave In-Situ
Cost	25%	1	2	3
Effectiveness in Meeting Remedial Goals	15%	3	2	1
Ease of Implementation	15%	2	1	3
Regulatory Acceptance	15%	3	2	1
Anticipated Community Acceptance	*15%*	2.5	2.5	1
No Loss of Natural Capitol	10%	1	3	2
Timeframe for Remediation	5%	3	1	2
Total Score		16	14	13
Weighted Score		1.8	1.8	1.5
Number of High Scores		3	1	2
Ranking		1	3	2

Based upon the remedial option assessment, biological and/or aeration treatment on-site combined with off-site disposal at an approved disposal facility is the preferred remedial option. This option will address all remedial objectives in a more cost-effective approach than shipping all PHC-impacted soils off-site.

The following are potential issues with disposing of the PHCs at an approved off-site facility:

Special approval from AANDC and PWGSC, after further community discussion, should be considered regrading backfilling excavations; this may further reduce the need for aggregate and reduce the overall cost for this remedial option.

- All excavations should be sloped to the natural terrain to ensure safety if this alternate option is adopted;
- All of the PHC impacted soil should be acceptable for disposal in a licensed disposal facility subject to landfill characterization. Waste manifests, and off-site landfill approval is required before removing the PHC impacted soil from the property, as per the Government of Nunavut waste transfer guidelines defined in the Contaminated Site Remediation Guidelines (Government of Nunavut, 2009);
- Proper containment for sea transport is needed;
- Impacted soil should be handled properly, following Government of Nunavut and other Federal guidelines (regardless of remedial option); and,
- There will be additional logistical planning associated with transporting the required material (i.e. geosynthetic liner) to Site. The equipment requirements will likely remain similar to construction equipment required for other tasks associated with Site clean-up.

6.5 Site Materials

6.5.1 Non-Hazardous Materials

Approximately 21,827 m^3 of non-hazardous materials are estimated to be deposited at the FOX-D Intermediate DEW Line site. This volume estimate includes an estimate for 6,645 m^3 of buried, half-buried debris and scattered debris in Class C dumps, and 800 m^3 of debris that will be generated when the remaining structures and foundations buildings are demolished. Once all the structures have been demolished to their foundations, the demolished material can be collected and transported off-site. The total non-hazardous materials to be moved off-site is approximately 6,040 m^3, with a potential additional 8,793 m^3 from APEC 11A (Landfill, unknown waste). The following table presents a summary of the non-hazardous locations of the non-hazardous materials.

Table 6-4: Summary of Non-Hazardous Materials

Location	Volume (m^3)	Comments
Upper and Lower Sites	1.50	76 steel drums were observed scattered throughout the upper and lower sites. Does not include suspected buried or partially buried drums.
APEC 1A - Transfer Tank APEC 1B - POL Tanks	17.3	Tanks include the POL tanks at the upper site and the transfer tank at the upper site.
APEC 1B - POL Tanks APEC 3 - Burnt Building Remains APEC 12 - Landing Area	0.2	Pipes/drains include the valve at the former POL tanks at the Lower site and the underground pipes at the burnt remains and the POL tanks area at the upper site.
APEC 2 - Antenna	1.8	Radio Antenna
APEC 9A - Dump Site	1.75	Includes the metal cabinets within the dump site and the metal cabinets located 20 - 25 m northeast of the dump site.
APEC 6 - Former Garage (Upper Site)	256.2	Staining observed on the concrete foundation.
APEC 4 - Warehouse Foundation (Upper Site)	215.4	Concrete Foundation
APEC 1B - POL Tanks (Upper Site)	32.5	POL Tank Foundation (2 foundations)
APEC 2 - Antenna (Upper Site)	100	Concrete Anchors (3 anchors)
APEC 11A - Construction Camp (Lower Site)	43.9	Concrete Foundation at Construction Camp
APEC 12 - Barge Landing (Lower Site)	32.5	Former POL Tank Foundation (2 foundations)
APEC 12 - Barge Landing (Lower Site)	1.7	Thrust Blocks (3 blocks)
APEC 12 - Barge Landing (Lower Site)	1.8	Valve Thrust Blocks (2 blocks)
APEC 9 - Dump Site (Upper Site)	6,095	Exposed and partially buried metal waste, drums, metal cabinets, PCB transformer and asbestos observed within the dump site.
APEC 10 - Dump Site (Upper Site)	550.7	Landfill area not identified in previous reports. Exposed and partially buried metal waste and drums observed within the dump site.
APEC 11A - Construction Camp Landfill (Lower Site)	4,885	Landfill area not identified in previous reports. Exposed and partially buried metal waste and drums observed in landfill.
APEC 11A - Construction Camp Landfill (Lower Site)	8,793	Landfill area not identified in previous reports.
APEC 11A - Construction Camp (Lower Site)	577.9	Surface staining.
APEC 11B - Construction Camp (Lower Site)	219	Partially buried drums visible.
TOTAL ESTIMATED VOLUME OF NON-HAZARDOUS DEBRIS		**21,827m^3**

The total estimated volume of on-site non-hazardous debris is 21,827 m^3, taking into account the volume of crushed barrels. Based on the soil sample results and inspections of the buried debris, the buried debris areas on the Upper Site are classified as Class C landfills in accordance with the INAC AMSRP, March 2009. Non-hazardous waste remaining behind in Class Dumps is estimated to be 6,645 m^3, with a total estimated volume of 14,834 m^3 non-hazardous waste to be handled.

Remedial options for the buried debris include the following: Firstly, the buried or partially buried debris areas can be crushed and stabilized/capped in place. The second option involves unearthing the debris, followed by assessing and sorting the debris, and disposing of the debris according to the remedial option selected.

The 2013 Phase III ESA included the collection and analysis of concrete samples collected from three areas of the site. As reported, the analysis indicated PCBs concentrations less than 50 ppm in all the samples.

All buildings/infrastructure shall be demolished to their foundations in accordance with the INAC AMSRP, March 2005/2009. All barrels shall be addressed using the Department of National Defence (DND) DLCU Barrel Protocol (**Appendix C)**.

A detailed summary of the non-hazardous materials located at the FOX-D site is provided in **Appendix E**. Remedial options for non-hazardous materials are described below, and options for hazardous materials are discussed in **Section 6.5.2**.

6.5.1.1 Remedial Options

Option #1: Buried in Place

Once all the structures have been demolished to their foundations, the site materials can be buried in place. The debris would be flattened and covered with compacted engineered fill or placed in a nearby excavation or low spot in the surrounding terrain and then covered with compacted fill. The cover of compacted fill must be engineered to promote positive drainage and the cap must be graded to match surrounding terrain. Advantage of this method is that it is less expensive as the contractor does not have to remove, transport and place material in a landfill some distance away. The disadvantages of this method is that the material is not placed in a secure engineered landfill and that a large contractor effort would be required to move fill to cover the debris piles that are scattered around the site. In the event that additional debris is discovered on site, the debris shall be addressed using the INAC AMSRP, March 2009. In the event that the materials are buried on-site, future monitoring would be required.

Option #2: Consolidate Wastes and Place in On Site Non-hazardous Waste Landfill

Once all the structures have been demolished to their foundations, the demolished materials as well as the non-hazardous materials from the surface debris piles that are scattered around the site, as well as from the buried debris area would be transported to an engineered, on-site landfill. This option is more cost intensive, but it gathers all the site material into one secure area reducing future monitoring inspection efforts.

Placing the non- hazardous demolition waste in an on-site engineered landfill is in accordance with the INAC AMSRP, March 2009.

The largest volume of non-hazardous materials that a new, on-site, engineered landfill is estimated to accommodate is 12,000 m^3, assuming 1 m of excavation (to bedrock) and 2 m of above grade material, with a footprint of 50 x 70 m. The estimated volume of debris at the upper site is 800 m^3 (not including debris located at APEC 9 (northeastern dump site). The total estimated volume of on-site non-hazardous debris to be handled is 14,834 m^3. The amount of debris is greater than what an on-site engineered landfill can accommodate. Regardless, some debris materials will need to be removed off-site for disposal.

Option #3: Off-site Disposal

Once all the structures have been demolished to their foundations, the demolished material can be collected and transported off-site (approximately 14,834 m^3). As FOX-D has sea access, materials would be hauled down to the Lower Site barge landing area (APEC 12) for barge pick up and disposal at another location. Due to the large costs associated with hauling demolition material and barging, off-site disposal is often deemed to be a lesser cost-effective remedial option.

6.5.1.2 Remedial Options Analysis

Cost of Remediation

Each remedial option has been ranked as following:

***Lowest Cost*:** Option 1, In-situ engineered cap, is anticipated to be the most cost effective option.

***Middle Cost*:** Off-Site Disposal to an approved Facility (Option 3) is estimated to have the next lowest cost.

Highest Cost: The most costly remedial option is landfilling (Option 2). Regardless, some non-hazardous material will need to be shipped off-site. The costs for this remedial option are very high due to cost for borrow material as well as design and the construction of the landfill.

Effectiveness in Meeting Remedial Goals

Each remedial option has been ranked as following:

Most Effective: Debris removal from the site for disposal in an approved off-site licensed disposal facility. This option results in the complete removal of the source and its associated environmental liabilities. No further site monitoring required.

***Middle*:** Landfilling is anticipated to be less effective than full removal, and more effective than in-situ burial. Material will be contained on-site in a controlled, engineered facility.

Least Effective: In-situ engineered capping is considered to be the least effective as all materials will remain on-site.

Timeframe for Remediation

Each remedial option has been ranked as following:

Shortest Timeframe: Debris burial is anticipated to have the shortest timeframe and may take two to three years.

Middle: Debris removal for off-site disposal is anticipated to take longer than capping, as material will need to be crushed and packaged for transport.

Longest Timeframe: Landfill construction is anticipated to take the longest, as both a landfill facility will need to be constructed and extraneous debris materials will need to be crushed and packaged for transport.

Ease of Implementation

Easiest to Implement: Covering impacted soils in situ using developed aggregated on-site is anticipated to have the greatest ease of implementation.

Middle: Off-site removal to an approved off-site facility is anticipated to have some difficulty due to the logistical challenges of transporting a large volume of impacted soil from Davis Strait by barge, and to transport the impacted soil to an approved off-site facility.

Hardest to Implement: Landfill construction, combined with off-site removal to an approved off-site facility is anticipated to have the greatest difficulty due to the logistical challenges as mentioned above, as well as the construction of an engineered landfill on-site at a remote, northern location.

Regulatory Acceptance

Each remedial option has been ranked as following:

Greatest Regulatory Acceptance: Debris removal for off-site disposal is considered to have greatest regulatory acceptance due to fully removing site impacts in a short timeframe from the Site.

Middle: Landfilling is anticipated to have regulatory support, as both debris removal for off-site disposal and landfilling non-hazardous debris in an engineered landfill is acceptable under the Remediation Protocol (INAC, 2009).

Lowest Regulatory Acceptance: Engineered Cap, Leave In-Situ is expected to have the lowest level of regulatory support as remediation efforts are non-destructive and will require further visitation at the Site.

Community Acceptance

Off-site disposal was presented as the selected remedial option at the Community Consultation. No objections were raised.

Preferred Remedial Option:
The options are evaluated below:

Table 6-5: Non-Hazardous Materials Remedial Options Analysis

Option/Attribute	Attribute Weighting	Off-Site Disposal	Landfill On-Site	Engineered Cap, Leave In-Situ
Cost	25%	1	2	3
Effectiveness in Meeting Remedial Goals	15%	3	2	1
Ease of Implementation	15%	2	1	3
Regulatory Acceptance	15%	3	2	1
Anticipated Community Acceptance	*15%*	*3*	*2*	*1*
No Loss of Natural Capitol	10%	3	2	3
Timeframe for Remediation	5%	3	2	1
Total Score		18	9.5	14.5
Weighted Score		2.4	1.9	2.0
Number of High Scores		5	0	3
Ranking		1	3	2

6.5.1.3 Recommendation

It is recommended that non-hazardous waste materials (14,834 m^3, excluding materials to remain in APECs 9 and 10) to be collected, consolidated and packaged for off-site disposal. APECs 9 and 10 will be regraded and remain in place.

Remedial options for APEC 9 are assessed separately and discussed in **Section 6.5.3**.

6.5.2 Hazardous Materials

Hazardous materials are known to be present at the FOX-D Site based on assessment work completed in 2013. A detailed inventory of hazardous waste is provided in **Appendix E**. All hazardous materials (with the exception of Asbestos Containing Materials) will be containerized and labelled in accordance with the Transportation of Dangerous Goods Act in Accordance with the INAC Abandoned Military Sites Remediation protocol and disposed of off-site.

Approximately 0.031 m^3 of PCB/Lead painted materials and 1.54 m^3 of hazardous materials (asbestos materials and lead-acid batteries) were identified during the 2013 environmental site assessment. Lead impacts associated with paint samples from APEC 2 (Antenna) were deemed to be non-hazardous; however, PCBs measured in paint samples from APEC 2 were above the Federal Health Canada guideline (2.0 µg/g), but below the CCME waste management criteria (<50 mg/kg).

A detailed description of the painted materials that are considered hazardous/ non-hazardous is provided in **Appendix E**. The presented volumes of hazardous materials, includes potential materials that may have been deposited in the northeast slope dump, based on previous assessments (1994) and field observations.

6.5.2.1 Collected Water

Disposal on Ground

The investigation work completed by Dillon and KGS Group in 2013 confirmed that the dissolved metal concentrations in the water that has collected in the barrels meets DLCU barrel protocol and is suitable for ground disposal following polishing with adsorbent material.

6.5.2.2 Asbestos

Asbestos is an inhalation hazard and is more of a safety hazard than a hazardous waste, but due to special handling, precautions and disposal, it is similar in nature to hazardous waste and needs to be dealt with adequately. Approximately 1.3 m^3 of asbestos will need to be removed and appropriately disposed of, according to the applicable guideline (Government of Nunavut, 2011).

Asbestos Containing Materials (ACM) at the FOX-D site is limited to the main station area. Asbestos is located throughout the remaining structures and within the buried debris piles. Asbestos Containing Materials (ACM) includes floor tiles, pipe insulation, fire door insulation, transit board, and vermiculite insulation. All asbestos is to be properly abated, in accordance with applicable Federal and Territorial Asbestos regulations, prior to any demolition activities.

Option #1: Asbestos Abatement, Place in On-Site Landfill

All asbestos is to be abated in accordance with applicable Federal and Territorial Asbestos regulations and guidelines. All ACM debris shall be abated and placed in a sealed, airtight container, clearly labelled "ASBESTOS". The material will be double-bagged or containerized in a sound, sealable and not-damaged or leaking container, in accordance with the applicable guideline. The asbestos is then placed in the engineered landfill constructed on-site. The location of the asbestos material located within the landfill should be noted for future reference. This method is in accordance with the INAC AMSRP.

Option #2: Asbestos Abatement, Remove Off-Site

The asbestos would be hauled to a staging area, and then hauled by barge or ship to another suitable location for landfilling. The steps are as follows:

- Conduct removal of asbestos materials. Asbestos should be handled and removed by trained personnel and double-bagged or containerized in a sound, sealable, undamaged and/or non-leaking container, in accordance with the applicable guideline;
- Haul to staging area; and,
- Load and haul for further shipment to a licensed disposal landfill for this type of hazardous waste.

The options are evaluated below:

Table 6-6: Asbestos Remedial Options Analysis

Option/Attribute	Attribute Weighting	Excavate, Off-Site Disposal	Landfill On-Site
Cost	25%	1	2
Effectiveness in Meeting Remedial Goals	15%	2	1
Ease of Implementation	15%	2	1
Regulatory Acceptance	15%	2	1
Anticipated Community Acceptance	*15%*	*2*	*1*
No Loss of Natural Capitol	10%	2	1
Timeframe for Remediation	5%	2	1
Total Score		13	6
Weighted Score		2	1
Number of High Scores		6	1
Ranking		1	2

The highest ranked and preferred option meets the INAC Abandoned Military Site Clean-up Protocol Clean-up Objectives one, two, and three. It is recommended that the asbestos-containing materials be containerized and disposed off-site. There will be additional logistical planning associated with transporting the asbestos waste off-site and determining landfill acceptance of the asbestos waste at a licensed disposal facility.

6.5.2.3 PCB & Lead Contaminated Paint

Landfill On-Site

Paint abatement consists of physically removing the PCB and/or lead contaminated paint from the substrate. This is accomplished by physical scrapping, chemical stripping, sand blasting and various other abrasive physical removal techniques. As the paint being removed contains lead and or PCBs, abatement methods must be conducted in a manner that protects the worker and the environment from PCB and lead contamination. Abatement methods generating dust must be conducted in a sealed, negative pressure environment with the area exhaust filtered with a certified High Efficiency Particulate Air (HEPA) Filter. Misted water is used to control the paint dust, requiring the waste water to be filtered to remove the contaminated paint or collected and treated as hazardous waste. These required mitigation measures increase costs dramatically.

The lead paint would be removed from the POL tanks; they would be then be dismantled and placed in the landfill. The steps are as follows:

- Clean the inside of the tanks and drain any remaining fuel/fluids from the excavator (note liquid from cleaning would need to be treated/tested for disposal);
- Construct an enclosure over and around the tanks and excavator 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;

- Dismantle and cut apart;
- Sample the surrounding soil to determine that the paint did not contaminate the soil; and,
- Landfill and cover.

Paint Removal, Off-site Disposal

This option would meet the INAC clean-up objectives for restoring the site to an environmentally safe condition and preventing the migration of the contaminants as all of the PCB containing paint would be removed from site. The abatement process as described above is involved and costly. The abatement costs combined with the disposal costs make this option less cost effective.

Leave Paint, Off-site Disposal

As an alternative to paint abatement, building materials painted with contaminated paint can be dismantled and disposed of as hazardous materials, bypassing the requirement for the paint to be abated. The transport and disposal costs are higher due to the fact that the painted building materials are disposed of along with the paint; however, these additional costs are smaller than the additional costs of paint abatement. As there is minimal scrapping and abrasion during the dismantling activities, negative air enclosures and filtration systems are not required. Dismantled material volumes can be minimized by cutting and compacting.

Table 6-7: Summary of Remedial Options for PCB & Lead Contaminated Paint

Option/Attribute	Attribute Weighting	Leave Paint, Off-Site Disposal	Remove Paint, Off-Site Disposal	Remove Paint, Landfill On-Site
Cost	25%	3	2	1
Effectiveness in Meeting Remedial Goals	15%	1.5	1.5	3
Ease of Implementation	15%	2	1	3
Regulatory Acceptance	15%	3	2	1
Anticipated Community Acceptance	*15%*	*3*	*2*	*1*
No Loss of Natural Capitol	10%	3	2	1
Timeframe for Remediation	5%	3	2	1
Total Score		18.5	12.5	11
Weighted Score		2.6	1.8	1.6
Number of High Scores		5	0	2
Ranking		1	2	3

The highest ranked and preferred option meets the INAC Abandoned Military Site Clean-up Protocol Clean-up Objectives one, two, and three.

It is recommended that the lead and PCB amended paint materials that are tested to be hazardous, be dismantled and disposed off-site.

This remedial method is in accordance with the INAC AMSRP, March 2009. Care is to be taken during the dismantling to prevent dust and paint chips from being released into the environment and to protect the workers that are conducting the dismantling from PCB and lead contamination. All dismantled PCB and/or lead contaminated paint material shall be packaged, transported and disposed of in accordance with the current regulations governing the handling and disposal of hazardous materials.

6.5.3 Buried Debris in Existing Class C Landfills

Ordinarily, due to the high potential that hazardous building materials have been deposited in the buried debris areas, and that these materials may contain products with PCB levels greater than 50 ppm (regulated by CEPA), it would be recommended that the buried waste sites be unearthed, sorted, and disposed of accordingly. Field investigations conducted in 2013 (Dillon, 2013) observed minimal, isolated PCB impacts in the dump areas. However, the health and safety risks associated with access and de-stabilizing the northeast slope dump (APEC 9) by debris removal may outweigh the environmental hazards posed by burying and stabilizing the debris in-situ. Steep slopes govern the area and limits access. There are health and safety concerns associated with de-stabilizing the northeast slope by debris removal.

Two options are available for the material located at APECs 9 and 10 and are discussed below.

6.5.3.1 Remedial Options

Option #1: Re-stabilize and Bury In-Situ

Remedial Option 1 would involve re-stabilizing non-hazardous materials in the Northeastern slope dump and eliminating void space to the fullest extent possible. An access road, starting from the POL Tank Area and extending along the north side of the slope will need to be constructed, to allow heavy equipment access to the area. Un-buried debris will be removed for off-site disposal. The material will be stabilized, covered with borrow material and re-graded to protect the area from erosion and cover degradation.

Under this remedial option, it is recommended that non-hazardous debris at the Upper Site (such as concrete foundation fragments and paint-splattered rocks) be used to fill void space in the dump site and brace the material from erosion down-slope. Both concrete and the rocks are non-hazardous, but are heavy materials and will increase shipping and disposal costs for off-site disposal.

Soil impacts associated with this area were observed to be non-migratory. Stabilization and covering of this material would effectively cut off all potential ecological, environmental and human health risks.

On-going monitoring of the site would not be required under the AMSRP (INAC, 2009), as the area will remain a Class C landfill. Based on results from the Phase III Environmental Site Assessment and field observations in 2013 (Dillon-KGS Group, 2013), there is no evidence for contaminant migration from the dump.

Option #2: Excavate all Materials for Off-Site Disposal

Under Option 2, all materials in APECs 9 and 10 would be removed, packaged for off-site disposal. Provided the unknowns associated with the buried materials, the amount of visible void space and topography, the length of time for Option 2 will extend the remediation program by an estimated three years. A secondary access road may need to be constructed on the southern side of the summit. The removal of materials from APEC 9 will need to proceed slowly, with great care taken to maintaining slope stability.

6.5.3.2 Remedial Options Analysis

Additional costs associated with Option 2 include the addition of heavy materials for disposal and additional time during the remediation phase. Option 2 would allow for a complete, walk-away site approach and fulfill all remedial objectives.

Table 6-8: Class C Dump Remedial Options Analysis

Option/Attribute	Attribute Weighting	Excavate, Off-Site Disposal	Leave In-Situ
Cost	25%	1	2
Effectiveness in Meeting Remedial Goals	15%	2	1
Ease of Implementation	15%	1	2
Regulatory Acceptance	15%	2	1
Anticipated Community Acceptance	*15%*	*2*	*1*
No Loss of Natural Capitol	10%	1	2
Timeframe for Remediation	5%	1	2
Total Score		10	11
Weighted Score		1.5	1.5
Number of High Scores		3	4
Ranking		2	1

Based upon the remedial option assessment, in-situ burial is the preferred remedial option. Off-site disposal is more effective removing all impacted soils from the Site, however, due to the longer timeframe is significantly more expensive than stabilizing and burial.

6.5.3.3 Recommendations

It is recommended that the northeastern dump slope be stabilized and covered with granular material. It is recommended that the remedial/excavation work in the buried debris areas be completed following a specific work procedure and on-site workers will need to wear the appropriate level of PPE and be properly trained. During the sorting operation, specific items that should be removed from the non-hazardous debris include asbestos containing material tiles and insulation. Stabilization, compaction and erosion protection were presented as the recommended remedial options for the Upper Site Dumps (APECs 9 and 10).

6.5.4 Physical Hazards

Physical Hazards are considered to be man-made structures; openings and other features that could constitute a risk to humans. All areas with half-buried debris pose physical hazards to humans. A specific safety plan will have to be completed for removal of debris that is located on steep slopes and for sorting of material in the debris areas. This will include, but not be limited to type and placement of equipment and proper safety gear for people working in these areas.

6.6 Recommended Remediation Options

Table 6-9: Summary of Recommended Remediation Methods

Environmental Concern	Site Assessment Findings	Recommendation Remediation Method
Metals Contaminated Soils	193 $m^3$of soils with concentrations of Cu, Cd, and Zn, which exceed the DCC Tier II criteria were identified on-site. This volume includes material that is co-contaminated with PAHs and PHCs.	Excavate, containerize, and label soils that exceed DCC Tier II criteria and dispose off-site at an appropriately licensed facility.
Petroleum Hydrocarbon Contaminated Soils	Approximately 3,205 m^3 of hydrocarbon contaminated soil in exceedance of the INAC Abandoned Military Site Remediation Protocol for PHC Soils.	Screen PHC Type A soils and treat in on-site constructed biological and/or aeration treatment unit (3,005 m^3). Excavate PHC Type B soils (200 m^3) and place into containers, and ship off-site to a licensed disposal facility.
Non-Hazardous Materials	Approximately 14,834 m^3 of non-hazardous debris consisting of heavy equipment, barrels, scrap metal, scrap wood, concrete, electrical equipment and plumbing parts to be handled and shipped off-site.	All buried and partially buried debris in Class B dumps (APEC 11) should be excavated, sorted and separated into different waste types where it is safe and practical to do so, and disposed off-site in an appropriate licensed facility. Buried debris that is inaccessible for excavation in Class C dumps (APECs 9 and 10) should be buried and re-stabilized in-situ. Rocks and concrete foundations from APECs 1-4 to be used as rip-rap and fill in void space at APEC 9. Area will be covered with rip rap and erosion resistant material for stability. All other debris is to be consolidated, packaged and shipped off-site to an appropriate licenced disposal facility.
Water in Barrels	Analysis of collected water in the abandoned barrels indicates that the dissolved metals meet DLCU barrel protocol.	Disposal on ground is permitted once water has been polished with an absorbent materials, additional sampling of more barrels during remediation program is required.
PCB/Lead Amended Paint Products	Approximately 0.031 m^3 of PCB/lead amended paint materials were discovered on site (not including metal)	Dismantle contaminated paint items and ship off-site to an appropriate disposal facility.
Hazardous Materials	Approximately 1.82 $m^3$of hazardous materials were identified at the site. These materials consisted of lead acid batteries (0.22 m^3) and asbestos containing materials (1.32 m^3).	All hazardous materials (such as batteries) will be containerized and labeled and shipped to be disposed at a licensed facility.
Structures	Upper Site POL Tanks (2) Upper Site Transfer Tank (1) Concrete Foundations	All non-hazardous materials and debris from Upper Site structures buildings shall be demolished to their foundations and removed off-site for disposal at an appropriate licensed facility.

7 REMEDIAL DESIGN AND IMPLEMENTATION

7.1 Remedial Objectives

The remedial design for the FOX-D Intermediate DEW Line site has been developed in accordance with the Indian Affairs and Northern Development, AMSRP, March 2009. The following section outlines the general design and implementation of the preliminary draft FOX-D RAP.

Remedial Design and Implementation Objectives:

1. Ensure safety of workers on-site;
2. Prevent further contamination at the FOX-D DEW Line site;
3. Minimize impact to environment, fauna, flora; and,
4. Achieve remedial objectives.

The contractor shall have a site specific, Health and Safety Plan in place and understood by all involved workers prior to work starting on the site. Contractor shall have a spill contingency plan in place to deal with any unforeseen and accidental releases of contaminants.

7.2 Remediation Logistics

There is currently an airstrip at the Site and numerous locations suitable for helicopter and/or fixed wing aircraft landing. Mob/demob is possible by sealift or barge, although it is anticipated that mob/demob will take place via sealift, with support and re-supply service provided by helicopter and/or charter plane.

7.3 Camp

A camp will be required during the remedial activities. Although the hamlet of Qikiqtarjuaq is nearby, the ability to house and efficiently mobilize workers to the Site is not deemed to be feasible. The camp must be large enough to support approximately 20 site workers and approximately three to five camp staff. The camp shall include a potable water source, sewage collection, and treatment in accordance with all applicable guidelines and regulations, bear safety measures, emergency rations and an emergency rescue contingency plan.

Two areas were identified as potential locations for construction and workers camps (**Figure G-1**). The camp will need to house workers and will need to meet the specifications laid out by PWGSC and Workers Safety and Compensation Committee. Facilities that will be required include the following:

- Sleeping quarters;
- Office (contains communications area);
- Kitchen and dining area;
- Bathroom and showers;
- Laundry facilities;

- First aid facilities (may depend on the number of workers);
- Sewage lagoon or water treatment system;
- Incinerator;
- Mechanics and equipment area that would have a petroleum and lube containment area, tanks and drums;
- Water supply and pumps;
- Diesel powered generator and back-up; and,
- Emergency shelter.

A water sample was collected by Dillon from the freshwater lake (**Figures 1** and **3**) and submitted for routine potable and total metals analysis (Dillon, 2013). Results for major ion and total metals in the water sample were found to be below the CCME Guidelines for Canadian Drinking Water Quality. It should be noted; however, that additional testing would be required on an on-going basis for potable use during remediation.

7.4 Anticipated Contracting Equipment

Anticipated equipment needs for this project are:

- Excavator(s) to remove impacted soils for treatment and for use in trail and/or road improvements;
- Front end loader(s) to consolidate materials and for road improvements;
- Haul truck(s) to move materials to staging and treatment areas;
- Crusher(s) to develop on-site aggregate material;
- Waste incinerator(s) (both for the camp waste and for incineration of certain materials currently located on-site);
- Dozer (s) to be used for landfill construction and road improvements;
- Water truck to haul water to camp if required or for dust suppression;
- Waste compactor;
- Drum crusher;
- All-terrain vehicle (s) with trailers;
- Packer to ensure compaction is appropriate with the natural terrain;
- Generators (for remedial equipment); and,
- Other miscellaneous equipment determined by contractor.

7.5 Infrastructure/Roads

7.5.1 Airstrip

A more detailed discussion on the Airstrip condition is presented in the Phase III ESA. If contractors are preparing to use the airstrip at FOX-D, it is recommended that the contractor evaluate the runway condition prior to use. The contractor shall utilize the airstrip at its own risk. The airstrip must be continually evaluated by the operational pilots and staff at the FOX-D site. If and when excessive erosion and/or rutting are noted, the airstrip shall be repaired immediately as required and to the satisfaction of the operational pilots. Further assessments and the use of a Boeing Penetrometer shall be employed before larger aircraft are taken under consideration for landing on the airstrip at FOX-D.

Dillon-KGS recommend that no aircraft larger than the DHC-8 Twin Otter with tundra tires land at the airstrip at FOX-D. Other permissible choices of similar weighted aircraft include DHC-6 Twin Otter Series 300, Beech King Air 100, 200 Series, and Beech King Air 300, 300C 350, 350C all equipped with larger tires suitable for gravel runway landings.

7.5.2 Existing Roads

Due to lack of upkeep and erosion, some portions of the existing roads to be utilized during remedial activities will require repair and upgrading. The main road to be utilized on site will be the road leading from the airstrip to the main station area. Areas requiring rebuilding, regrading and significant drainage control are shown on **Figure 16** as "heavy regrading". This level of repair and rebuilding constitutes approximately 375 m (5%) of the total road length. The remainder of the road will require some patching and topping up of existing road topping (medium grading) and/or localized grading (light grading). This work can be completed using existing fill from the main station area and borrow material from the borrow source areas shown on **Figures 2** and **19**. Suitable borrow materials are generally poorly graded sands and gravels with fine contents ranging from 2% to 32%.

7.6 Borrow Source Development

Borrow sources shall be developed in accordance with the Indian and Northern Affairs Canada AMSRP. Required borrow material shall be drawn preferentially from the main station area gravel. Borrow source requirements required beyond those available amounts shall be taken from the borrow source areas as shown on **Figure 19**.

Once the borrow source requirements for the FOX-D remediation have been satisfied all borrow sources will be re-contoured to restore natural drainage and to match surrounding topography and minimize changes to the existing permafrost regime.

The sand and gravel borrow sources are estimated to contain approximately 68,000 m^3. It is anticipated that this amount is adequate for the remedial activities.

7.7 Potential Biological and/or Aeration Treatment Cell Construction

The potential biological and/or aeration treatment cell location was selected based on the required treatment cell size, distance to material to be landfilled and distance to borrow sources. The treatment cell location (shown on **Figure 18**) at the saddle requires the least amount of transportation for the majority of the soil and it is situated in an area where the probability of erosion and infiltration are minimized, has a southern exposure, and is contained within AANDC's property boundary.

The treatment cell shall be constructed in a controlled manner with minimal lifts to control compaction and settlement. Surface water run-on and run-off will be controlled through proper grading to positively shed water and to prevent ponding and seepage into the treatment unit. Consideration to the treatment cell cap angles must be designed as to not to encourage erosion of the capping material. The treatment and surrounding berm areas will be lined with a geomembrane liner to prevent the migration of nutrients and PHC-impacted surface waters.

7.8 Waste Handling Facility Construction

A Waste Handling Facility (WHF) will be required at the FOX-D site to receive and sort various waste items. The fluids handling area within the WHF shall be lined with an engineered clay/synthetic liner to prevent the migration of contaminants resulting from any accidental spills. The fluids handling area is to be bermed and the engineered liner should have some fill cover to protect the liner integrity. The waste handling facility shall have applicable safety items and PPE which include but are not limited to: extinguisher, first aid kit, eye wash station, emergency spill kit etc. Materials to be received and sorted at the WHF include but are not limited to:

- Barrels (Barrel Protocol);
  - Empty;
  - Unknown fluids;
  - POLs;
  - Cleaning, rinsate, crushing;
- Batteries;
- Compressed Gas Cylinders;
- Items painted with PCB and Lead Paint; and,
- Soils for off-site removal.

The WHF area shall be located west of the barge landing area as shown on **Figure 18**. The WHF will be surrounded by temporary road to provide access to vehicles and equipment required in the delivery sorting and transport of the site waste. Upon decommissioning of the WHF the area beneath the facility shall be sampled for confirmatory purposes.

7.9 Schedule

Assuming the project is tendered in the winter 2014, the following is a proposed schedule for the remediation of this site:

- Community meetings (Winter 2014);
- Permitting (Winter 2014 or Spring 2015);
- Bidders site meeting (Summer 2014);
- Contract tender (Summer 2014);
- Contract award (Fall 2014);
- Mobilization (Summer 2015);
- Year 1 Remedial Activities (Summer 2016);
- Year 2 Remedial Activities (Summer 2017);
- Demobilization (Summer 2017); and,
- Sea-lift Demobilization of Equipment (Summer/Fall 2017).

8 PROJECT AND LONG-TERM MONITORING

The purpose of project and long term monitoring is to confirm compliance of the remedial activities with the specified clean-up objectives and clean-up criteria. During the remedial program, quantities of all site materials should be estimated, tracked and measured. Contaminated areas that have been excavated shall be confirmed clean by field screening methods and then samples shall be taken for laboratory confirmation.

8.1 Verification and Monitoring During Remediation Activities

Verification and monitoring of construction works, environmental clean-up, verification of quantities, and quality of work will need to be carried out during the remediation works of this project (INAC 2009). Skill sets needed include residential engineering experience, hazardous materials testing and abatement, environmental health and safety monitoring, soil sampling, and geotechnical and materials testing. The following work tasks will need to be performed:

Disposal of Non-Hazardous Waste

- Ensuring removal of all hazardous materials prior to removal or demolition of buildings;
- Removal of all non-wood materials identified as non-hazardous from buildings and verification of hauling to the staging area;
- Verification of clean-up of all debris areas and hauling to the on-site staging area;
- Verification of building demolition, wood collection from buildings/debris areas and removal to burn area. Supervision and air monitoring, followed by sampling and testing of ashes, if necessary; and,
- Photo documentation and surveying of above activities where applicable.

Hazardous Materials Testing and Abatement

- Supervision and air monitoring of asbestos abatement and verification of contractor activities against applicable regulations for such work;
- Testing of liquid in drums, ASTs and equipment for TDG and disposal options as required;
- Supervision and verification of depressurization and evacuation of cylinders and fire extinguishers;
- Testing of solid suspected hazardous materials to determine appropriate disposition;
- Verification of appropriate storage of hazardous waste in staging area until shipment; and,
- Verification of shipments including waste manifests and quantities of materials off-site.

Remediation of Impacted Soil Areas

- Soil confirmatory sampling beneath and adjacent to PHC, metal, and Co-contaminated impacted soil areas to ensure complete removal of on-site sources;
- Baseline soil sampling to be completed prior to construction of temporary storage area, camp workers area, sewage lagoon, incinerator areas, fuel and lube oil storage facilities, camp area, and mechanics area;
- Verification of waste manifests for impacted soil that it transported off-site to an off-site landfill disposal facility;
- Photo documentation and surveying of all soil remediation areas, including pre-construction, and post construction/site closure activities;
- Verification of quantities taken from borrow area; and,
- Compaction monitoring following completion of remedial activities at the Site.

8.2 Post Remediation Long-term Monitoring

Long Term Monitoring will be evaluated with the Remedial Activities at FOX-D are completed.

9 LIMITATIONS

This report was prepared exclusively for the purposes, project and site location(s) outlined in the report. The report is based on information provided to, or obtained by Dillon as indicated in the report, and applies solely to site conditions existing at the time of the site investigation(s). Dillon's report represents a reasonable review of available information within an agreed work scope, schedule and budget. It is therefore possible that currently unrecognized contamination or potentially hazardous materials may exist at the site(s), and that the levels of contamination or hazardous materials may vary across the site(s). Further review and updating of the report may be required as local and site conditions, and the regulatory and planning frameworks, change over time.

This report was prepared by Dillon for the sole benefit of our Client (Public Works and Government Services Canada). The material in the report reflects Dillon's judgment in light of the information available to Dillon at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Dillon accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Respectfully Submitted:

DILLON CONSULTING LIMITED

REGISTERED PROFESSIONAL GEOLOGIST
Mar 31/14
D.D. BELL
LICENSEE
NWT/NU

Indra Kalinovich, PhD, C.Chem, E.I.T.

Doug Bell, MSc, P.Geo

IKK/knh

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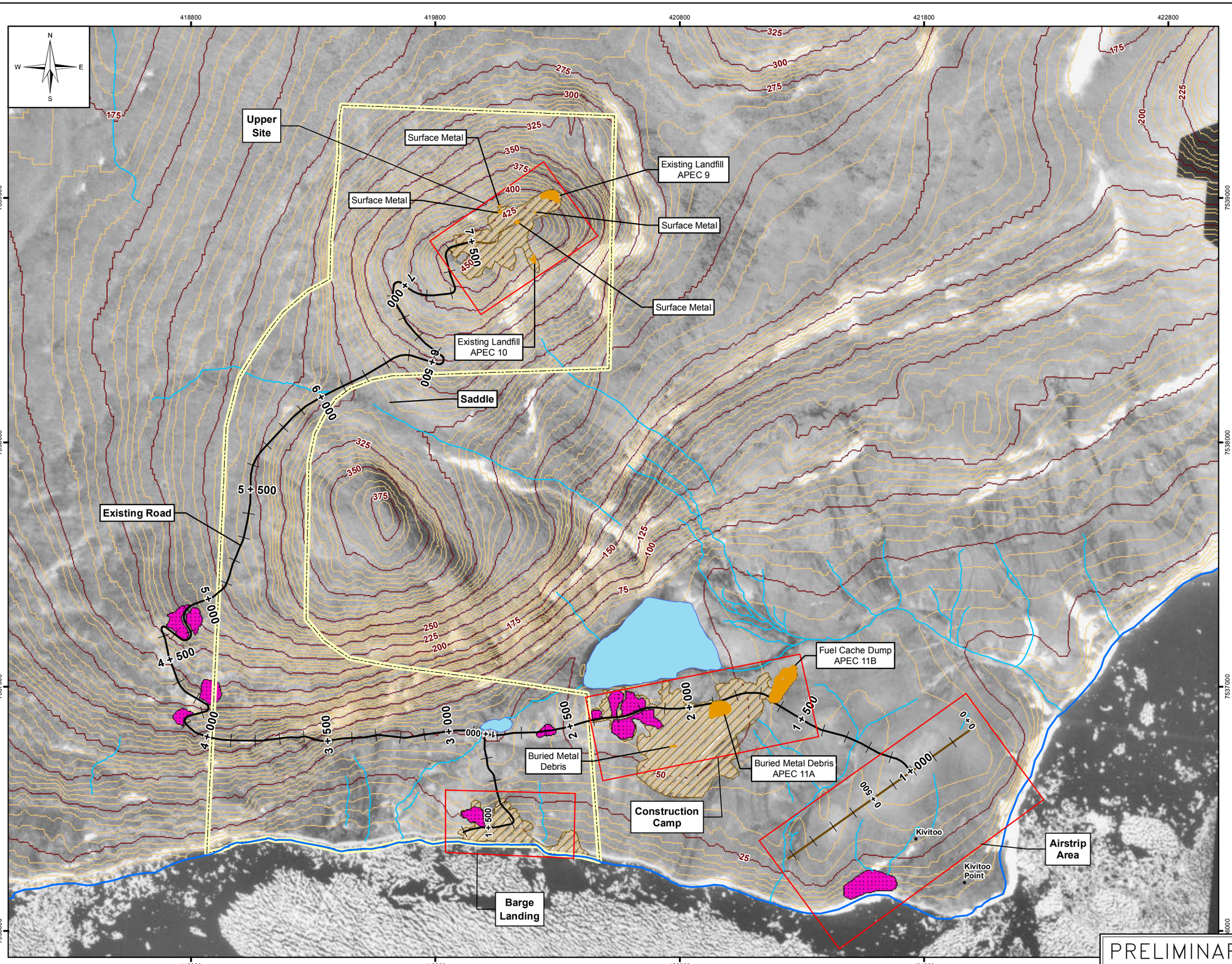
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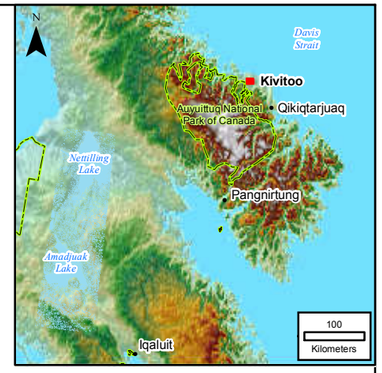
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APPENDIX A

FIGURES

Portions of data presented are owned by the Territory of Nunavut and are produced under the licence agreement with the Territory of Nunavut 2014 Queen's Printer.





LEGEND:

- Drainage Pathway
- Shoreline
- 5 m Contour
- 25 m Index Contour
- Existing Road
- Airstrip
- Property Boundary
- Existing Landfills
- Freshwater Lake
- Borrow Areas
- Area of Disturbance/Worked Area

NOTES:

1. Imagery: 1:20,000 scale imagery, 1948. National Air Photo Library (NAPL).
2. Contours are supplied from NRCAN, derived from 1:60,000 stereo pair imagery.

200 0 200 400 600
Metres

SCALE: 1:15,000 METRIC 11"x17"

All units are metric and in metres unless otherwise specified.
Transverse Mercator Projection, NAD 1983, Zone 20
Elevations are in metres above sea level (MSL)

NO.	YY/MM/DD	DESCRIPTION	BY
0	14/03/21	ISSUED WITH FINAL RAP REPORT	AMH

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SITE SURVEY & GEOTECHNICAL SERVICES
FOX D DEW LINE SITE BAFFIN ISLAND

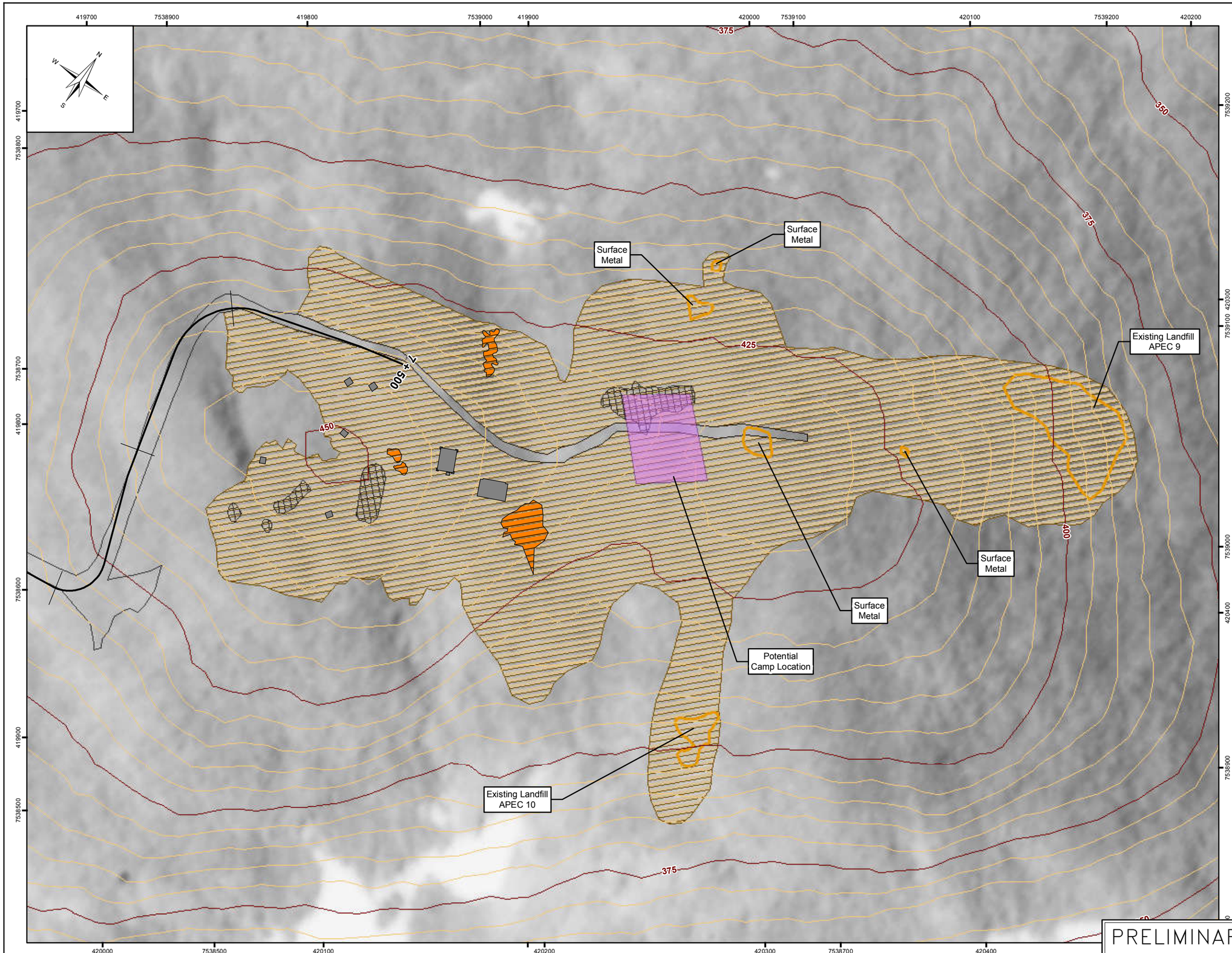
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SITE PLAN

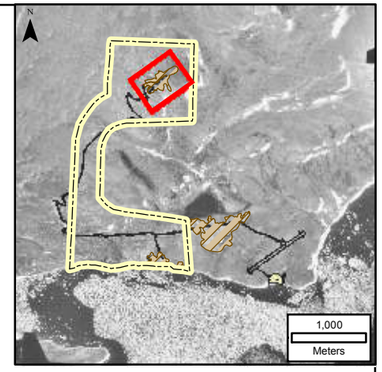
PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

MARCH 2014 | FIGURE 1 | REV: 0

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11"x17" PLOT SCALE 1:1

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LEGEND:

- Existing Road
- 5 m Contour
- 25 m Index Contour
- Existing Landfills
- Concrete Foundation
- Area of Staining
- Road/Airstrip
- Debris
- Area of Disturbance/Worked Area
- Potential Camp Location

NOTES:

1. Imagery: 1:20,000 scale imagery, 1948. National Air Photo Library (NAPL).
2. Contours are supplied from NRCAN, derived from 1:60,000 stereo pair imagery.

20 0 20 40 60 80
Metres

SCALE: 1:2,000 METRIC 11"x17"

All units are metric and in metres unless otherwise specified.
Transverse Mercator Projection, NAD 1983, Zone 20
Elevations are in metres above sea level (MSL)

NO.	YY/MM/DD	DESCRIPTION	BY
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DILLON CONSULTING

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SITE SURVEY & GEOTECHNICAL SERVICES
FOX D DEW LINE SITE BAFFIN ISLAND

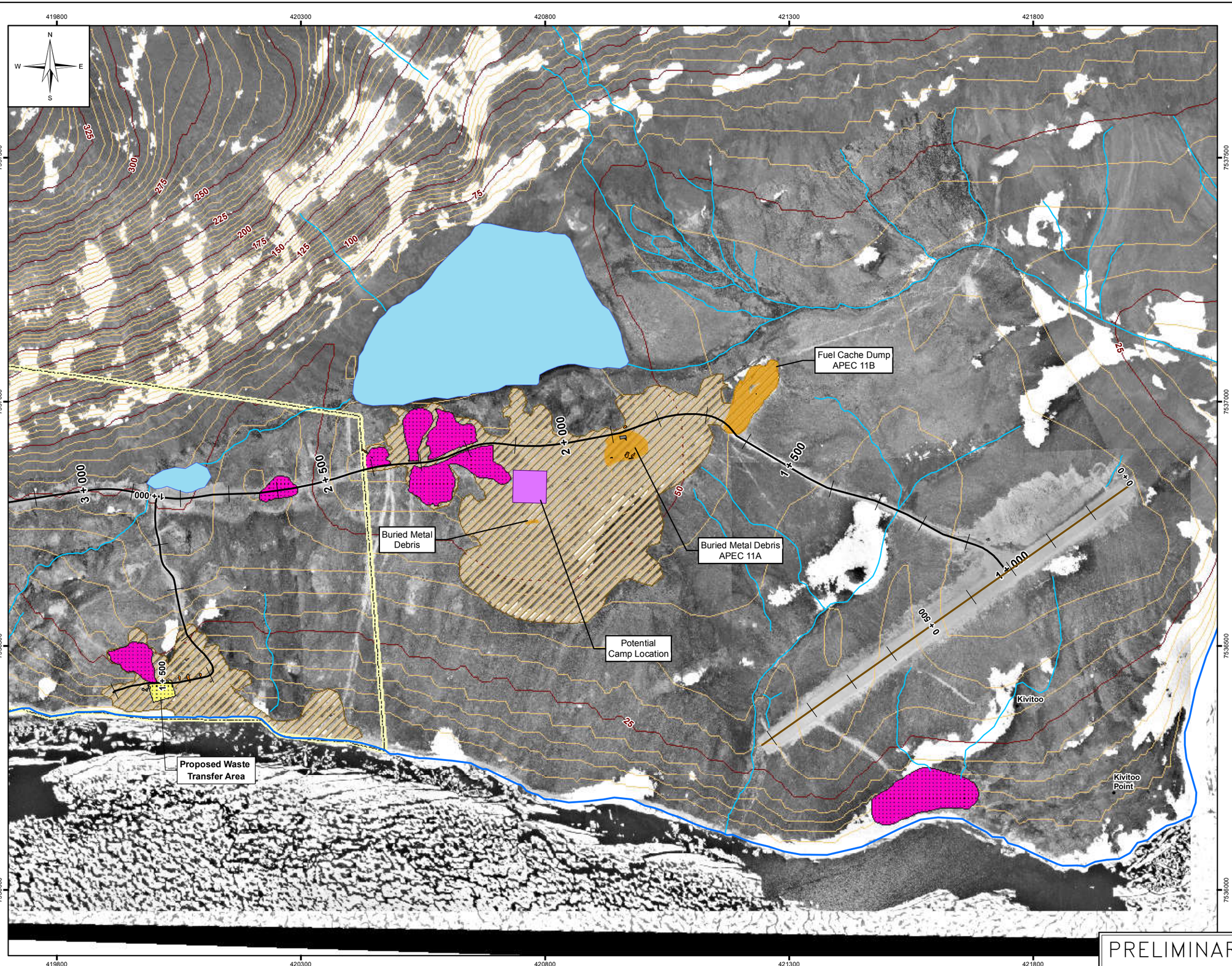
REMEDIAL ACTION PLAN REPORT
UPPER SITE

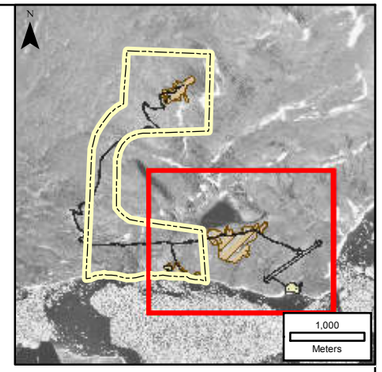
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NOT TO BE USED FOR CONSTRUCTION

MARCH 2014 | FIGURE 2 | REV: 0

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11"x17" PLOT SCALE 1:1

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LEGEND:

- Shoreline
- Drainage Pathway
- Existing Airstrip
- Existing Road
- 5 m Contour
- 25 m Index Contour
- Property Boundary
- Existing Landfill
- Freshwater Lake
- Concrete Foundation
- Borrow Areas
- Proposed Waste Transfer Area
- Area of Staining
- Area of Disturbance/Worked Area
- Potential Camp Location

NOTES:

1. Imagery: 1:20,000 scale imagery, 1948. National Air Photo Library (NAPL).
2. Contours are supplied from NRCAN, derived from 1:60,000 stereo pair imagery.

100 0 100 200 300
Metres

SCALE: 1:7,500 METRIC 11"x17"

All units are metric and in metres unless otherwise specified.
Transverse Mercator Projection, NAD 1983, Zone 20
Elevations are in metres above sea level (MSL)

NO.	YY/MM/DD	DESCRIPTION	BY
0	14/03/21	ISSUED WITH FINAL RAP REPORT	AMH

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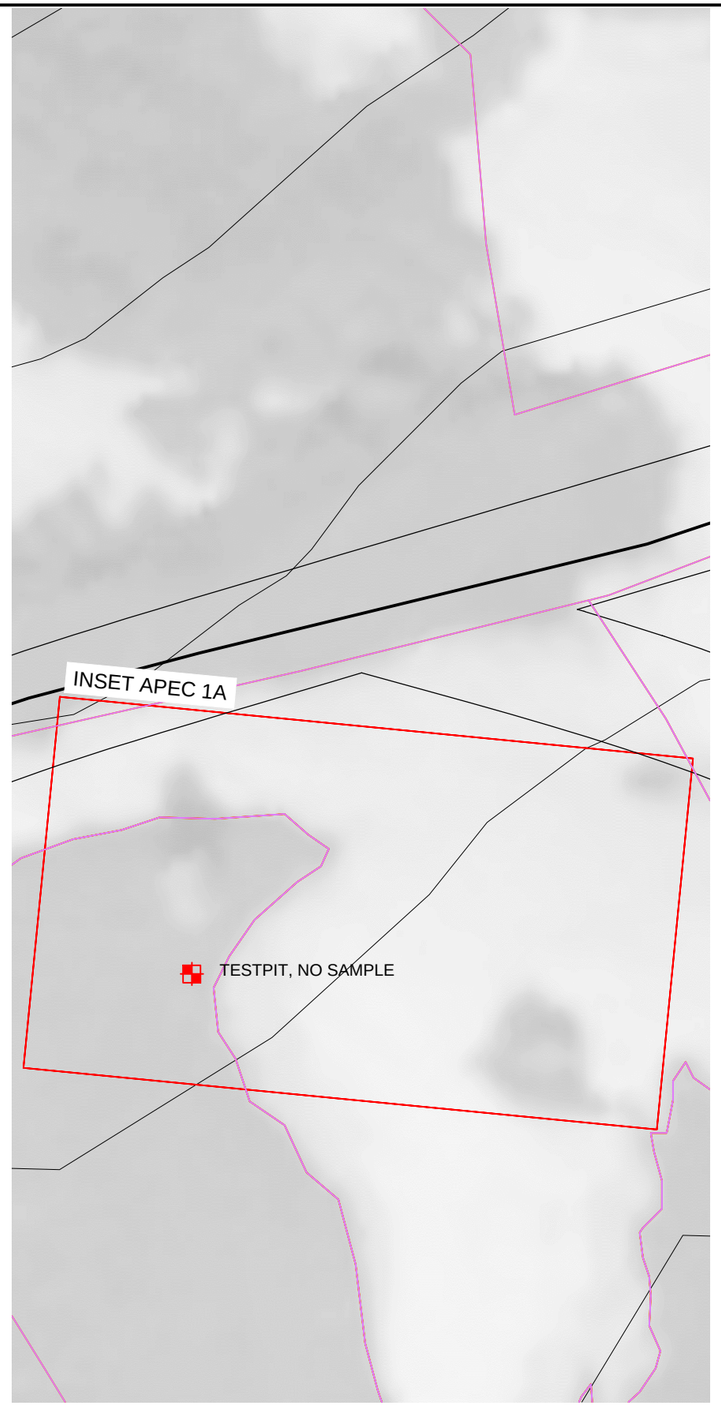
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FOX D DEW LINE SITE BAFFIN ISLAND

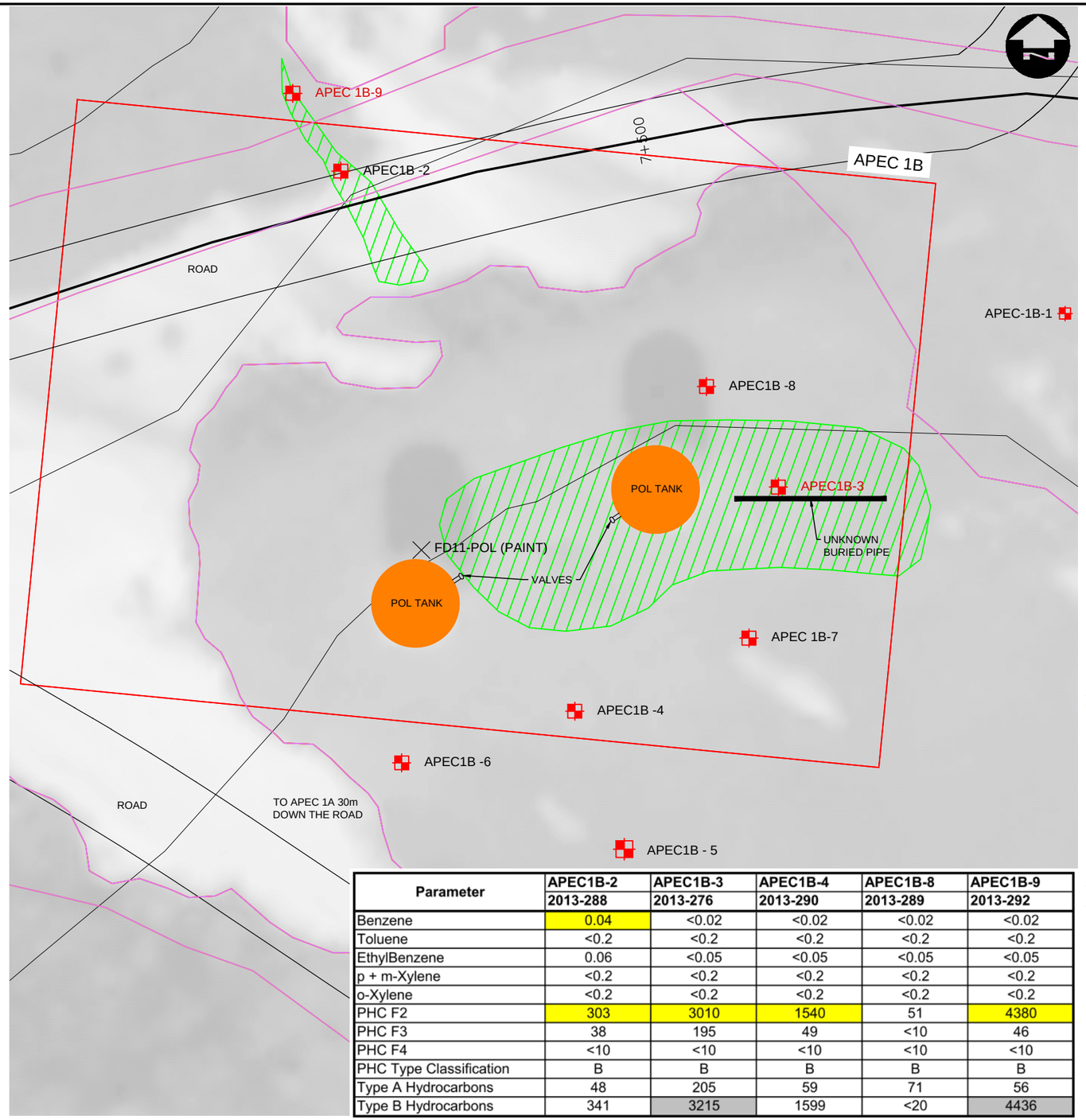
REMEDIAL ACTION PLAN REPORT
LOWER SITE

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

MARCH 2014 | FIGURE 3 | REV: 0

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11"x17" PLOT SCALE 1:1





LEGEND

- Testpit Location
- Water Sample
- Exceeds AMSRP Criteria Type A Hydrocarbons
- Exceeds AMSRP Criteria Type B Hydrocarbons
- Staining
- Debris
- APEC
- Concrete
- Crown Land
- Water
- Road
- Drainage Pathways
- Airstrip
- Geophysical Survey Area
- Disturbed Limits
- EM 31 survey Area

Parameter		AMSRP Clean-up Criteria Type B	AMSRP Clean-up Criteria Type A	CSW for PHC in Soil
PHC (ppm)	PHC F1	---	---	210
	PHC F2	---	---	150
	PHC F3	---	---	300
	PHC F4	---	---	2800
	PHC Type	---	---	---
	PHC Concentration	2500[a]	20000[b]	---

20= Denotes exceedances for AMSRP Clean-up Criteria
20= Denotes exceedances for Federal Guidelines
20= Denotes exceedances for Federal and AMSRP Criteria

a = AMSRP Clean-up Criteria, Protection of Terrestial Wildlife, Type B Hydrocarbon (sum of F1 + F3 + F4), 0 - 0.5 metres below ground surface

b = AMSRP Clean-up Criteria, Protection of Human Health, Type A Hydrocarbon (sum of F3 + F4 >70% of the total PHC concentration (F1 to F4) and (F2<F4)

Parameter	AMSRP Clean-up Criteria[1] Tier I	AMSRP Clean-up Criteria[1] Tier II	ESG Recommended Remediation Criteria (2010)	Federal CCME[2] Residential/ Parkland
Polychlorinated Biphenyls (ppm)				
Copper	---	100	109	63
Zinc	---	500	Same as AMSRP	200
Total PCB	1.0	5.0	---	1.3

20= Denotes exceedances for DCC DEW Line Clean-up Criteria
20= Denotes exceedances for CCME 2007 Residential/Parland Guidelines
20= Denotes exceedances of Site Specific criteria
20= Denotes exceedances for Federal and AMSRP Criteria
--- No Criteria

1 = Indian and Northern Affairs Canada, Abandoned Military Site Remediation Protocol, Table 4.1, DCC DEW Line Criteria for soil, March 2009.
2 = Canadian Council of Ministers of the Environment, Canada Soil Quality Guidelines, Summary Tables (Update 7.0), Sept 2007, Residential/Parland, Coarse Grained Soils.

Parameter	APEC1B-2 2013-288	APEC1B-3 2013-276	APEC1B-4 2013-290	APEC1B-8 2013-289	APEC1B-9 2013-292
Benzene	0.04	<0.02	<0.02	<0.02	<0.02
Toluene	<0.2	<0.2	<0.2	<0.2	<0.2
EthylBenzene	0.06	<0.05	<0.05	<0.05	<0.05
p + m-Xylene	<0.2	<0.2	<0.2	<0.2	<0.2
o-Xylene	<0.2	<0.2	<0.2	<0.2	<0.2
PHC F2	303	3010	1540	51	4380
PHC F3	38	195	49	<10	46
PHC F4	<10	<10	<10	<10	<10
PHC Type Classification	B	B	B	B	B
Type A Hydrocarbons	48	205	59	71	56
Type B Hydrocarbons	341	3215	1599	<20	4436

NOTES:
1. Imagery: 1:20,000 Scale Imagery, 1948. National Air Photo Library (NAPL).
2. Contours are supplies from NRCAN, derived from 1:60,000 stereo pair imagery.
3. Survey Completed by KGS Group, August 2013

FINAL

Metres
HORIZONTAL SCALE: 1:250 11" X 17"

0 5 10 15 20 25

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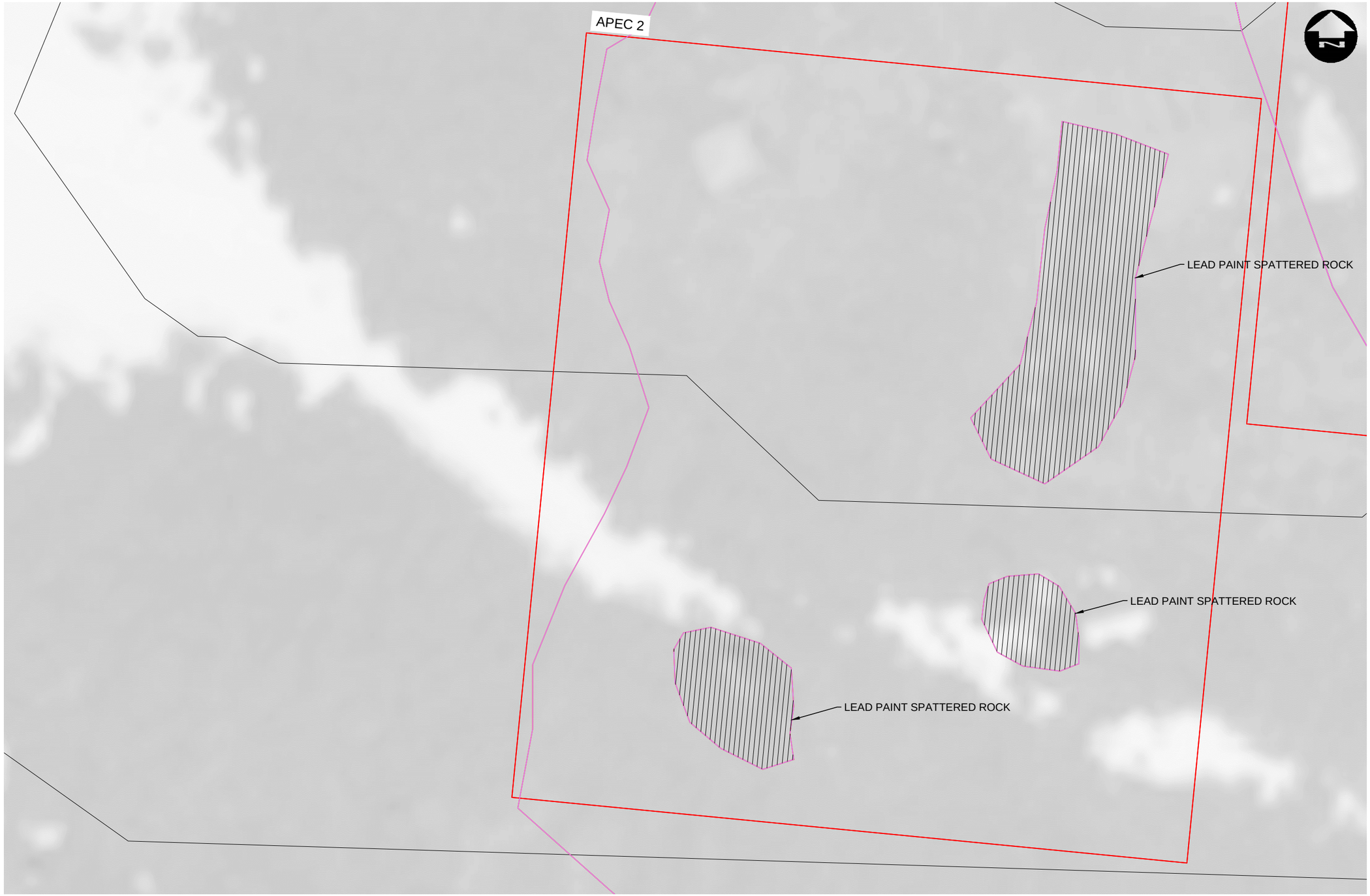
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REMEDIAL ACTION PLAN,
FOX-D

MARCH 2014 | FIGURE 4 | REV. 0

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LEGEND

- Testpit Location
- Water Sample
- Exceeds AMSRP Criteria Type A Hydrocarbons
- Exceeds AMSRP Criteria Type B Hydrocarbons
- Staining
- Debris
- APEC
- Concrete
- Crown Land
- Water
- Road
- Drainage Pathways
- Airstrip
- Geophysical Survey Area
- Disturbed Limits
- EM 31 survey Area

Parameter		AMSRP Clean-up Criteria Type B	AMSRP Clean-up Criteria Type A	CSW for PHC in Soil
PHC (ppm)	PHC F1	---	---	210
	PHC F2	---	---	150
	PHC F3	---	---	300
	PHC F4	---	---	2800
	PHC Type	---	---	---
	PHC Concentration	2500 [a]	20000 [b]	---

20= Denotes exceedances for AMSRP Clean-up Criteria
20= Denotes exceedances for Federal Guidelines
20= Denotes exceedances for Federal and AMSRP Criteria

a = AMSRP Clean-up Criteria, Protection of Terrestial Wildlife, Type B Hydrocarbon (sum of F1 + F3 + F4), 0 - 0.5 metres below ground surface

b = AMSRP Clean-up Criteria, Protection of Human Health, Type A Hydrocarbon (sum of F3 + F4 >70% of the total PHC concentration (F1 to F4) and (F2<F4)

Parameter	AMSRP Clean-up Criteria[1] Tier I	AMSRP Clean-up Criteria[1] Tier II	ESG Recommended Remediation Criteria (2010)	Federal CCME[2] Residential/ Parkland
Polychlorinated Biphenyls (ppm)				
Copper	---	100	109	63
Zinc	---	500	Same as AMSRP	200
Total PCB	1.0	5.0	---	1.3

20= Denotes exceedances for DCC DEW Line Clean-up Criteria
20= Denotes exceedances for CCME 2007 Residential/Parland Guidelines
20= Denotes exceedances of Site Specific criteria
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FOX-D

APEC 2 - ANTENNA

MARCH 2014 | FIGURE 5 | REV: 0

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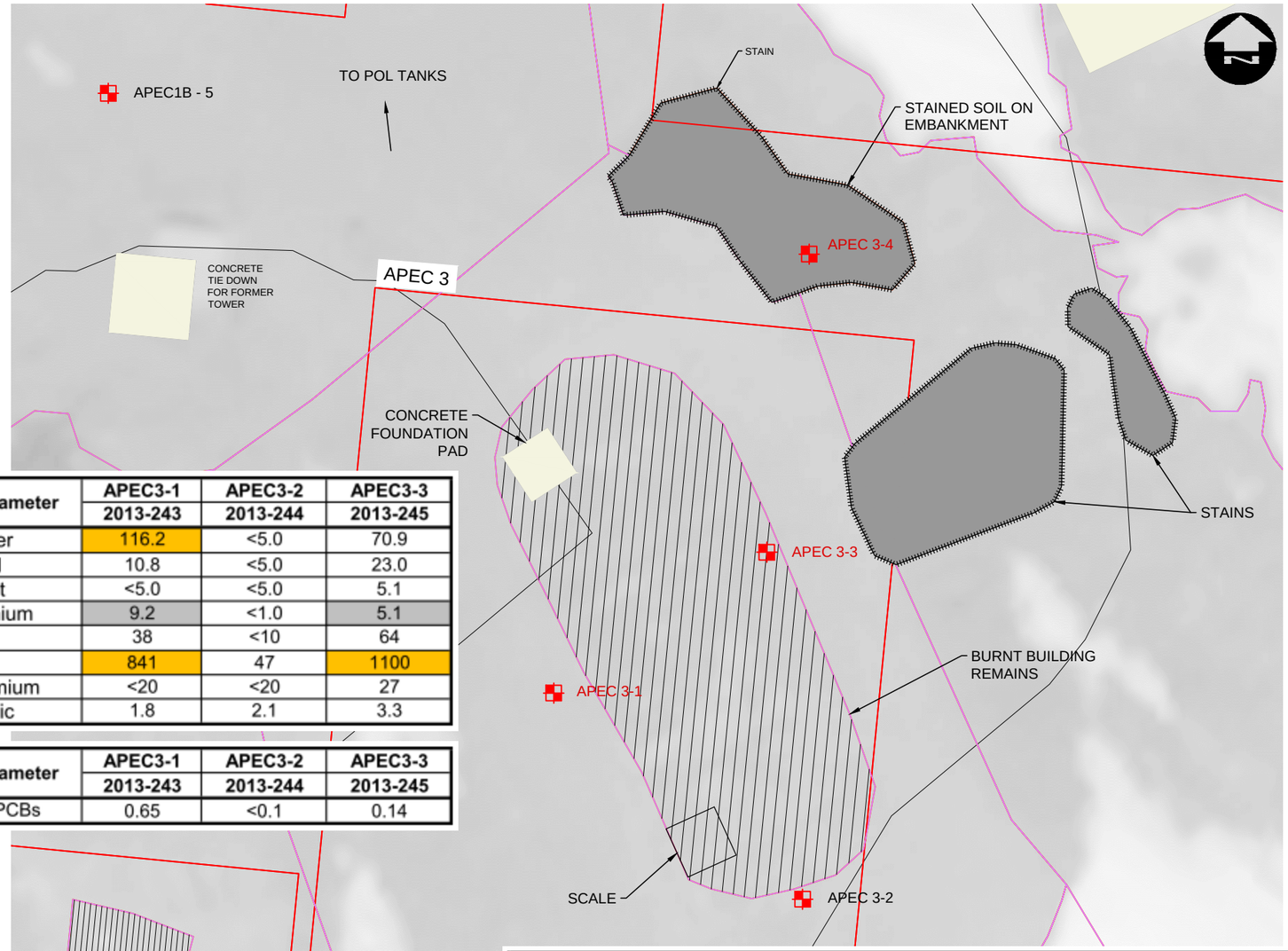
Metres

HORIZONTAL SCALE: 1:250 11" X 17"

0 5 10 15 20 25

NOTES:
1. Imagery: 1:20,000 Scale Imagery, 1948. National Air Photo Library (NAPL).
2. Contours are supplies from NRCAN, derived from 1:60,000 stereo pair imagery.
3. Survey Completed by KGS Group, August 2013

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Parameter	APEC3-1	APEC3-2	APEC3-3
	2013-243	2013-244	2013-245
Copper	116.2	<5.0	70.9
Nickel	10.8	<5.0	23.0
Cobalt	<5.0	<5.0	5.1
Cadmium	9.2	<1.0	5.1
Lead	38	<10	64
Zinc	841	47	1100
Chromium	<20	<20	27
Arsenic	1.8	2.1	3.3

Parameter	APEC3-1	APEC3-2	APEC3-3
	2013-243	2013-244	2013-245
Total PCBs	0.65	<0.1	0.14

Parameter	APEC3-1	APEC3-2	APEC3-2	APEC3-3	APEC3-3D	APEC3-4
	2013-321	2013-280	2013-281	2013-279	2013-322	2013-328
Benzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Toluene	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EthylBenzene	<0.05	0.10	<0.05	0.09	<0.05	<0.05
p + m-Xylene	<0.2	<0.2	<0.2	0.06	<0.2	<0.2
o-Xylene	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
PHC F2	<10	<10	262	<10	<10	851
PHC F3	<10	<10	248	<10	<10	14600
PHC F4	<10	<10	<10	<10	<10	3620
PHC TYPE	N/A	N/A	B	N/A	N/A	A
Type A Hydrocarbons	<20	<20	258	<20	<20	18220
Type B Hydrocarbons	<30	<30	520	<30	<30	15461

FINAL

Metres

HORIZONTAL SCALE: 1:300 11" X 17"

0 6 12 18 24 30

NOTES:
1. Imagery: 1:20,000 Scale Imagery, 1948. National Air Photo Library (NAPL).
2. Contours are supplies from NRCAN, derived from 1:60,000 stereo pair imagery.
3. Survey Completed by KGS Group, August 2013

LEGEND

- Testpit Location
- Water Sample
- Exceeds AMSRP Criteria Type A Hydrocarbons
- Exceeds AMSRP Criteria Type B Hydrocarbons
- Staining
- Debris
- APEC
- Concrete
- Crown Land
- Water
- Road
- Drainage Pathways
- Airstrip
- Geophysical Survey Area
- Disturbed Limits
- EM 31 survey Area

	Parameter	AMSRP Clean-up Criteria Type B	AMSRP Clean-up Criteria Type A	CSW for PHC in Soil
PHC (ppm)	PHC F1	---	---	210
	PHC F2	---	---	150
	PHC F3	---	---	300
	PHC F4	---	---	2800
	PHC Type	---	---	---
	PHC Concentration	2500[b]	20000[b]	---

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20= Denotes exceedances for Federal Guidelines
20= Denotes exceedances for Federal and AMSRP Criteria

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Parameter	AMSRP Clean-up Criteria[1] Tier I	AMSRP Clean-up Criteria[1] Tier II	ESG Recommended Remediation Criteria (2010)	Federal CCME[2] Residential/ Parkland
Polychlorinated Biphenyls (ppm)				
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Zinc	---	500	Same as AMSRP	200
Total PCB	1.0	5.0	---	1.3

20= Denotes exceedances for DCC DEW Line Clean-up Criteria
20= Denotes exceedances for CCME 2007 Residential/Parland Guidelines
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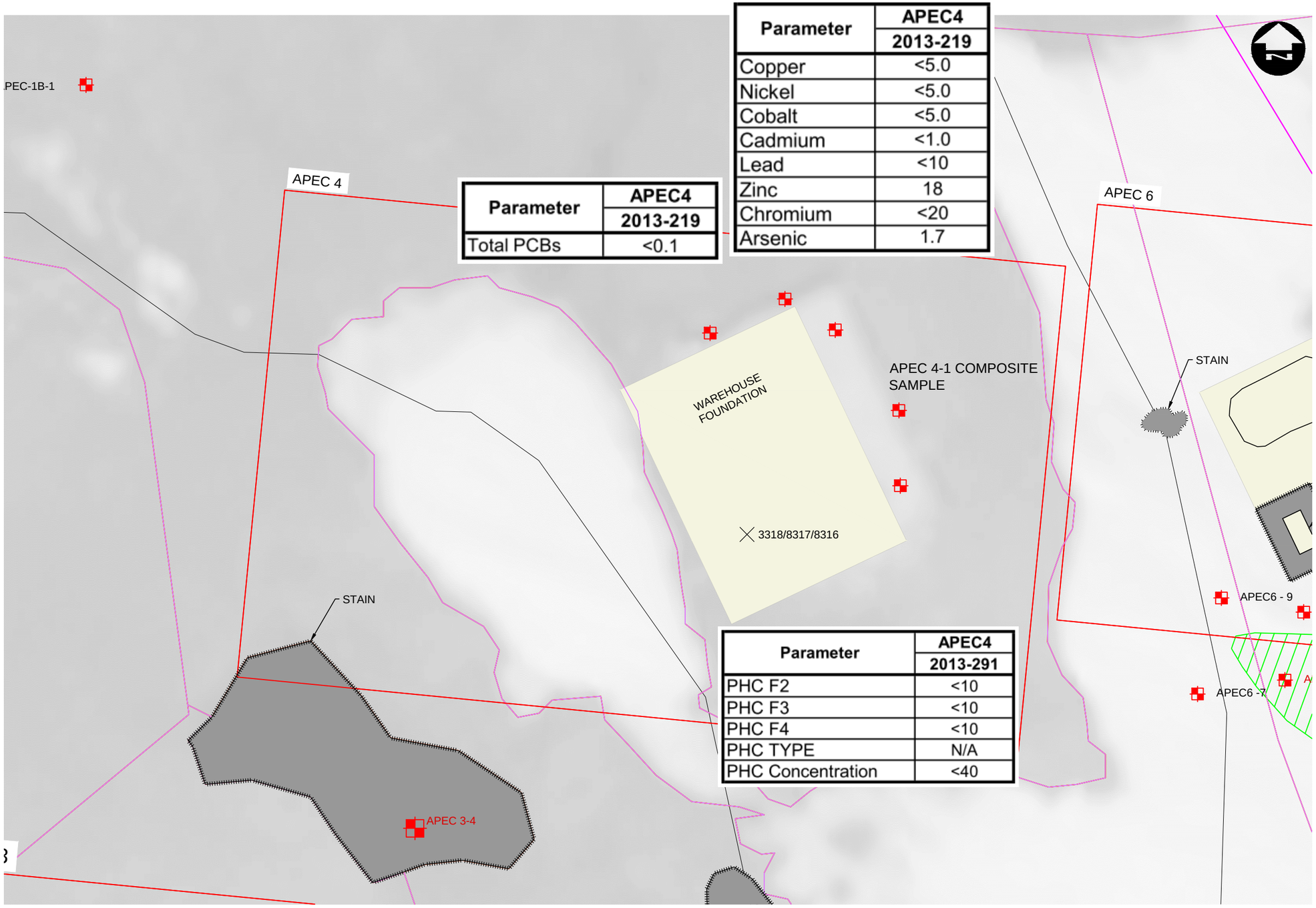
DILLON CONSULTING

REMEDIAL ACTION PLAN, FOX-D

APEC 3 - BURNT BUILDING REMAINS

MARCH 2014 | FIGURE 6 | REV. 0

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Parameter	APEC4 2013-219
Total PCBs	<0.1

Parameter	APEC4 2013-219
Copper	<5.0
Nickel	<5.0
Cobalt	<5.0
Cadmium	<1.0
Lead	<10
Zinc	18
Chromium	<20
Arsenic	1.7

Parameter	APEC4 2013-291
PHC F2	<10
PHC F3	<10
PHC F4	<10
PHC TYPE	N/A
PHC Concentration	<40

LEGEND

- Testpit Location
- Water Sample
- Exceeds AMSRP Criteria Type A Hydrocarbons
- Exceeds AMSRP Criteria Type B Hydrocarbons
- Staining
- Debris
- APEC
- Concrete
- Crown Land
- Water
- Road
- Drainage Pathways
- Airstrip
- Geophysical Survey Area
- Disturbed Limits
- EM 31 survey Area

	Parameter	AMSRP Clean-up Criteria Type B	AMSRP Clean-up Criteria Type A	CSW for PHC in Soil
PHC (ppm)	PHC F1	---	---	210
	PHC F2	---	---	150
	PHC F3	---	---	300
	PHC F4	---	---	2800
	PHC Type	---	---	---
	PHC Concentration	2500[a]	20000[b]	---

20= Denotes exceedances for AMSRP Clean-up Criteria
20= Denotes exceedances for Federal Guidelines
20= Denotes exceedances for Federal and AMSRP Criteria

a = AMSRP Clean-up Criteria, Protection of Terrestial Wildlife, Type B Hydrocarbon (sum of F1 + F3 + F4), 0 - 0.5 metres below ground surface

b = AMSRP Clean-up Criteria, Protection of Human Health, Type A Hydrocarbon (sum of F3 + F4 >70% of the total PHC concentration (F1 to F4) and (F2<F4)

Parameter	AMSRP Clean-up Criteria[1] Tier I	AMSRP Clean-up Criteria[1] Tier II	ESG Recommended Remediation Criteria (2010)	Federal CCME[2] Residential/ Parkland
Polychlorinated Biphenyls (ppm)				
Copper	---	100	109	63
Zinc	---	500	Same as AMSRP	200
Total PCB	1.0	5.0	---	1.3

20= Denotes exceedances for DCC DEW Line Clean-up Criteria
20= Denotes exceedances for CCME 2007 Residential/Parland Guidelines
20= Denotes exceedances of Site Specific criteria
20= Denotes exceedances for Federal and AMSRP Criteria
--- No Criteria

1 = Indian and Northern Affairs Canada, Abandoned Military Site Remediation Protocol, Table 4.1, DCC DEW Line Criteria for soil, March 2009.
2 = Canadian Council of Ministers of the Environment, Canada Soil Quality Guidelines, Summary Tables (Update 7.0), Sept 2007, Residential/Parland, Coarse Grained Soils.

NO.	YY/MM/DD	DESCRIPTION	BY
0	14/03/27	Completed Final	P.M.W.

REVISIONS / ISSUE

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REMEDIAL ACTION PLAN,
FOX-D

APEC 4 - WAREHOUSE FOUNDATION

MARCH 2014 | FIGURE 7 | REV. 0

FINAL

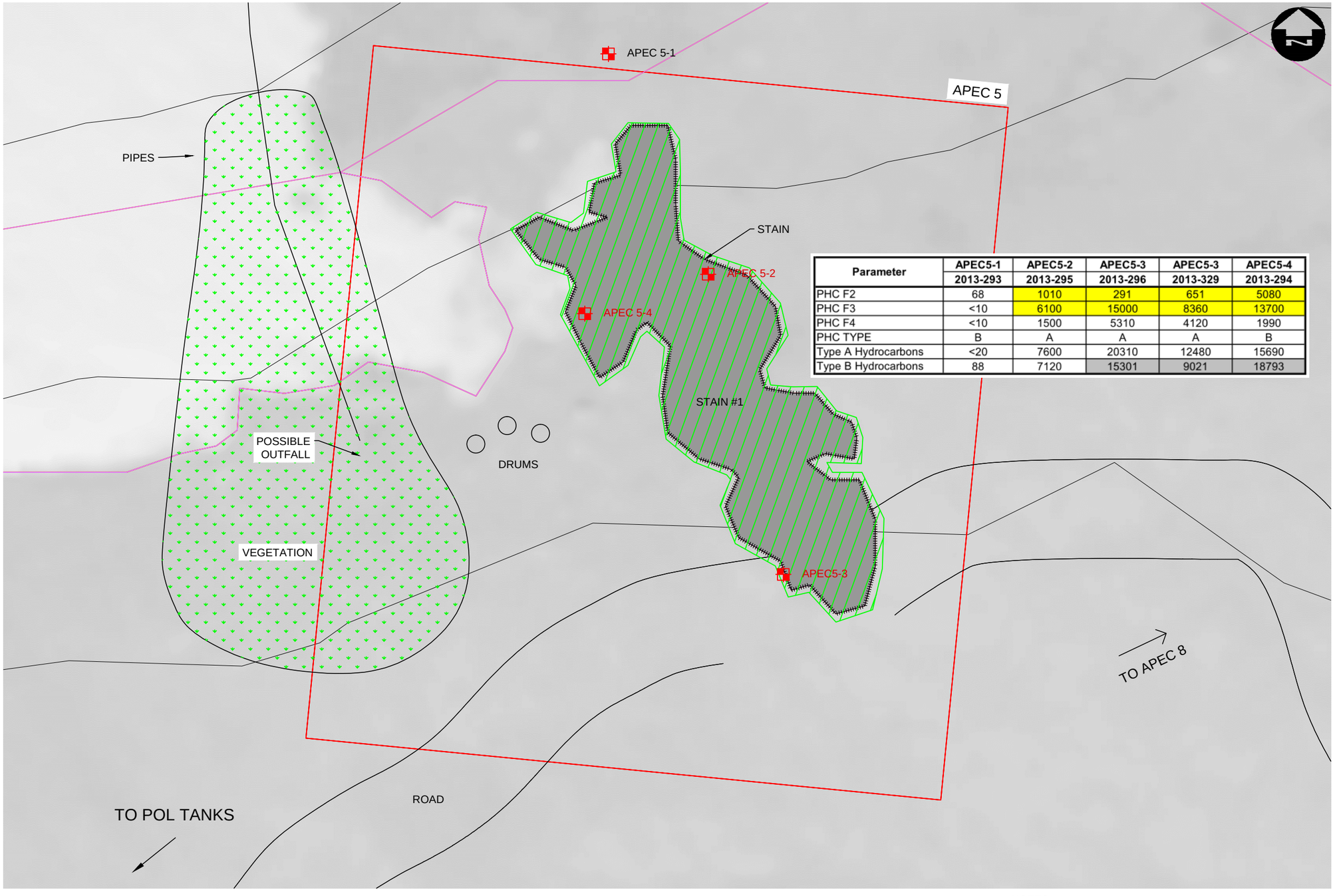
Metres

HORIZONTAL SCALE: 1:200 11" X 17"

0 4 8 12 16 20

NOTES:
1. Imagery: 1:20,000 Scale Imagery, 1948. National Air Photo Library (NAPL).
2. Contours are supplies from NRCAN, derived from 1:60,000 stereo pair imagery.
3. Survey Completed by KGS Group, August 2013

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Parameter	APEC5-1 2013-293	APEC5-2 2013-295	APEC5-3 2013-296	APEC5-3 2013-329	APEC5-4 2013-294
PHC F2	68	1010	291	651	5080
PHC F3	<10	6100	15000	8360	13700
PHC F4	<10	1500	5310	4120	1990
PHC TYPE	B	A	A	A	B
Type A Hydrocarbons	<20	7600	20310	12480	15690
Type B Hydrocarbons	88	7120	15301	9021	18793

LEGEND

- Testpit Location
- Water Sample
- Exceeds AMSRP Criteria Type A Hydrocarbons
- Exceeds AMSRP Criteria Type B Hydrocarbons
- Staining
- Debris
- APEC
- Concrete
- Crown Land
- Water
- Road
- Drainage Pathways
- Airstrip
- Geophysical Survey Area
- Disturbed Limits
- EM 31 survey Area

	Parameter	AMSRP Clean-up Criteria Type B	AMSRP Clean-up Criteria Type A	CSW for PHC in Soil
PHC (ppm)	PHC F1	---	---	210
	PHC F2	---	---	150
	PHC F3	---	---	300
	PHC F4	---	---	2800
	PHC Type	---	---	---
	PHC Concentration	2500[a]	20000[b]	---

20= Denotes exceedances for AMSRP Clean-up Criteria
20= Denotes exceedances for Federal Guidelines
20= Denotes exceedances for Federal and AMSRP Criteria

a = AMSRP Clean-up Criteria, Protection of Terrestial Wildlife, Type B Hydrocarbon (sum of F1 + F3 + F4), 0 - 0.5 metres below ground surface

b = AMSRP Clean-up Criteria, Protection of Human Health, Type A Hydrocarbon (sum of F3 + F4 >70% of the total PHC concentration (F1 to F4) and (F2<F4)

Parameter	AMSRP Clean-up Criteria[1] Tier I	AMSRP Clean-up Criteria[1] Tier II	ESG Recommended Remediation Criteria (2010)	Federal CCME[2] Residential/ Parkland
Polychlorinated Biphenenyls (ppm)				
Copper	---	100	109	63
Zinc	---	500	Same as AMSRP	200
Total PCB	1.0	5.0	---	1.3

20= Denotes exceedances for DCC DEW Line Clean-up Criteria
20= Denotes exceedances for CCME 2007 Residential/Parland Guidelines
20= Denotes exceedances of Site Specific criteria
20= Denotes exceedances for Federal and AMSRP Criteria
--- No Criteria

1 = Indian and Northern Affairs Canada, Abandoned Military Site Remediation Protocol, Table 4.1, DCC DEW Line Criteria for soil, March 2009.

2 = Canadian Council of Ministers of the Environment, Canada Soil Quality Guidelines, Summary Tables (Update 7.0), Sept 2007, Residential/Parland, Coarse Grained Soils.

NO	YY/MM/DD	DESCRIPTION	BY
0	14/03/27	Completed Final	P.M.W.

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REMEDIAL ACTION PLAN,
FOX-D

APEC 5 - STAIN #1

MARCH 2014 | FIGURE 8 | REV. 0

FINAL

Metres

HORIZONTAL SCALE: 1:200 11" X 17"

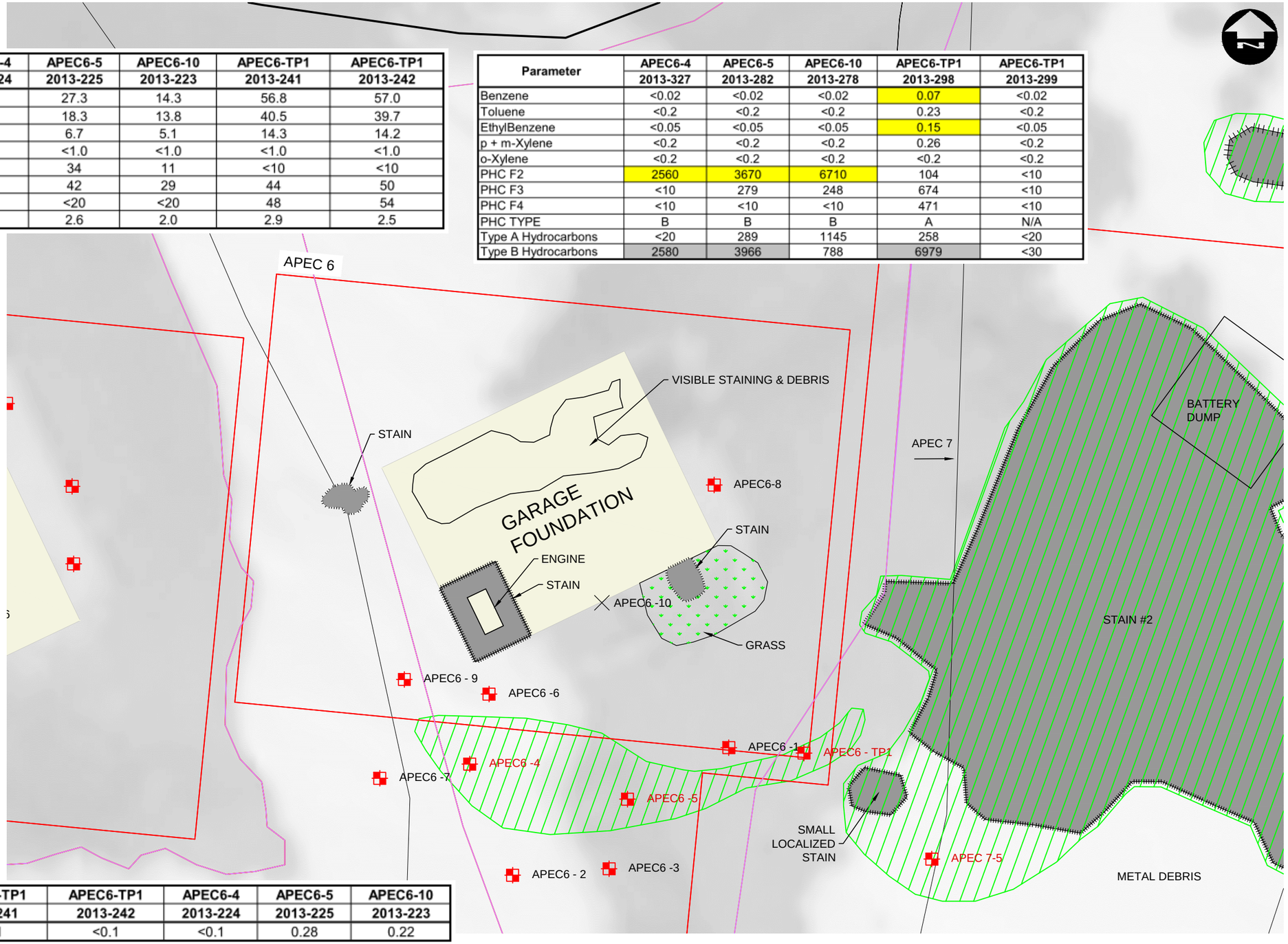
0 4 8 12 16 20

NOTES:
1. Imagery: 1:20,000 Scale Imagery, 1948. National Air Photo Library (NAPL).
2. Contours are supplies from NRCAN, derived from 1:60,000 stereo pair imagery.
3. Survey Completed by KGS Group, August 2013

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Parameter	APEC6-4 2013-224	APEC6-5 2013-225	APEC6-10 2013-223	APEC6-TP1 2013-241	APEC6-TP1 2013-242
Copper	5.7	27.3	14.3	56.8	57.0
Nickel	<5.0	18.3	13.8	40.5	39.7
Cobalt	<5.0	6.7	5.1	14.3	14.2
Cadmium	<1.0	<1.0	<1.0	<1.0	<1.0
Lead	<10	34	11	<10	<10
Zinc	19	42	29	44	50
Chromium	<20	<20	<20	48	54
Arsenic	1.8	2.6	2.0	2.9	2.5

Parameter	APEC6-4 2013-327	APEC6-5 2013-282	APEC6-10 2013-278	APEC6-TP1 2013-298	APEC6-TP1 2013-299
Benzene	<0.02	<0.02	<0.02	0.07	<0.02
Toluene	<0.2	<0.2	<0.2	0.23	<0.2
EthylBenzene	<0.05	<0.05	<0.05	0.15	<0.05
p + m-Xylene	<0.2	<0.2	<0.2	0.26	<0.2
o-Xylene	<0.2	<0.2	<0.2	<0.2	<0.2
PHC F2	2560	3670	6710	104	<10
PHC F3	<10	279	248	674	<10
PHC F4	<10	<10	<10	471	<10
PHC TYPE	B	B	B	A	N/A
Type A Hydrocarbons	<20	289	1145	258	<20
Type B Hydrocarbons	2580	3966	788	6979	<30



Parameter	APEC6-TP1 2013-241	APEC6-TP1 2013-242	APEC6-4 2013-224	APEC6-5 2013-225	APEC6-10 2013-223
Total PCBs	<0.1	<0.1	<0.1	0.28	0.22

LEGEND

- Testpit Location
- Water Sample
- Exceeds AMSRP Criteria Type A Hydrocarbons
- Exceeds AMSRP Criteria Type B Hydrocarbons
- Staining
- Debris
- APEC
- Concrete
- Crown Land
- Water
- Road
- Drainage Pathways
- Airstrip
- Geophysical Survey Area
- Disturbed Limits
- EM 31 survey Area

Parameter		AMSRP Clean-up Criteria Type B	AMSRP Clean-up Criteria Type A	CSW for PHC in Soil
PHC (ppm)	PHC F1	---	---	210
	PHC F2	---	---	150
	PHC F3	---	---	300
	PHC F4	---	---	2800
	PHC Type	---	---	---
	PHC Concentration	2500[a]	20000[b]	---

20= Denotes exceedances for AMSRP Clean-up Criteria
20= Denotes exceedances for Federal Guidelines
20= Denotes exceedances for Federal and AMSRP Criteria

a = AMSRP Clean-up Criteria, Protection of Terrestial Wildlife, Type B Hydrocarbon (sum of F1 + F3 + F4), 0 - 0.5 metres below ground surface

b = AMSRP Clean-up Criteria, Protection of Human Health, Type A Hydrocarbon (sum of F3 + F4 >70% of the total PHC concentration (F1 to F4) and (F2<F4)

Parameter	AMSRP Clean-up Criteria[1] Tier I	AMSRP Clean-up Criteria[1] Tier II	ESG Recommended Remediation Criteria (2010)	Federal CCME[2] Residential/ Parkland
Polychlorinated Biphenenyls (ppm)				
Copper	---	100	109	63
Zinc	---	500	Same as AMSRP	200
Total PCB	1.0	5.0	---	1.3

20= Denotes exceedances for DCC DEW Line Clean-up Criteria
20= Denotes exceedances for CCME 2007 Residential/Parland Guidelines
20= Denotes exceedances of Site Specific criteria
20= Denotes exceedances for Federal and AMSRP Criteria
--- No Criteria

1 = Indian and Northern Affairs Canada, Abandoned Military Site Remediation Protocol, Table 4.1, DCC DEW Line Criteria for soil, March 2009.
2 = Canadian Council of Ministers of the Environment, Canada Soil Quality Guidelines, Summary Tables (Update 7.0), Sept 2007, Residential/Parland, Coarse Grained Soils.

NO	YY/MM/DD	DESCRIPTION	BY
0	14/03/27	Completed Final	P.M.W.

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REMEDIAL ACTION PLAN,
FOX-D

APEC 6 - FORMER GARAGE

MARCH 2014 | FIGURE 9 | REV. 0

FINAL

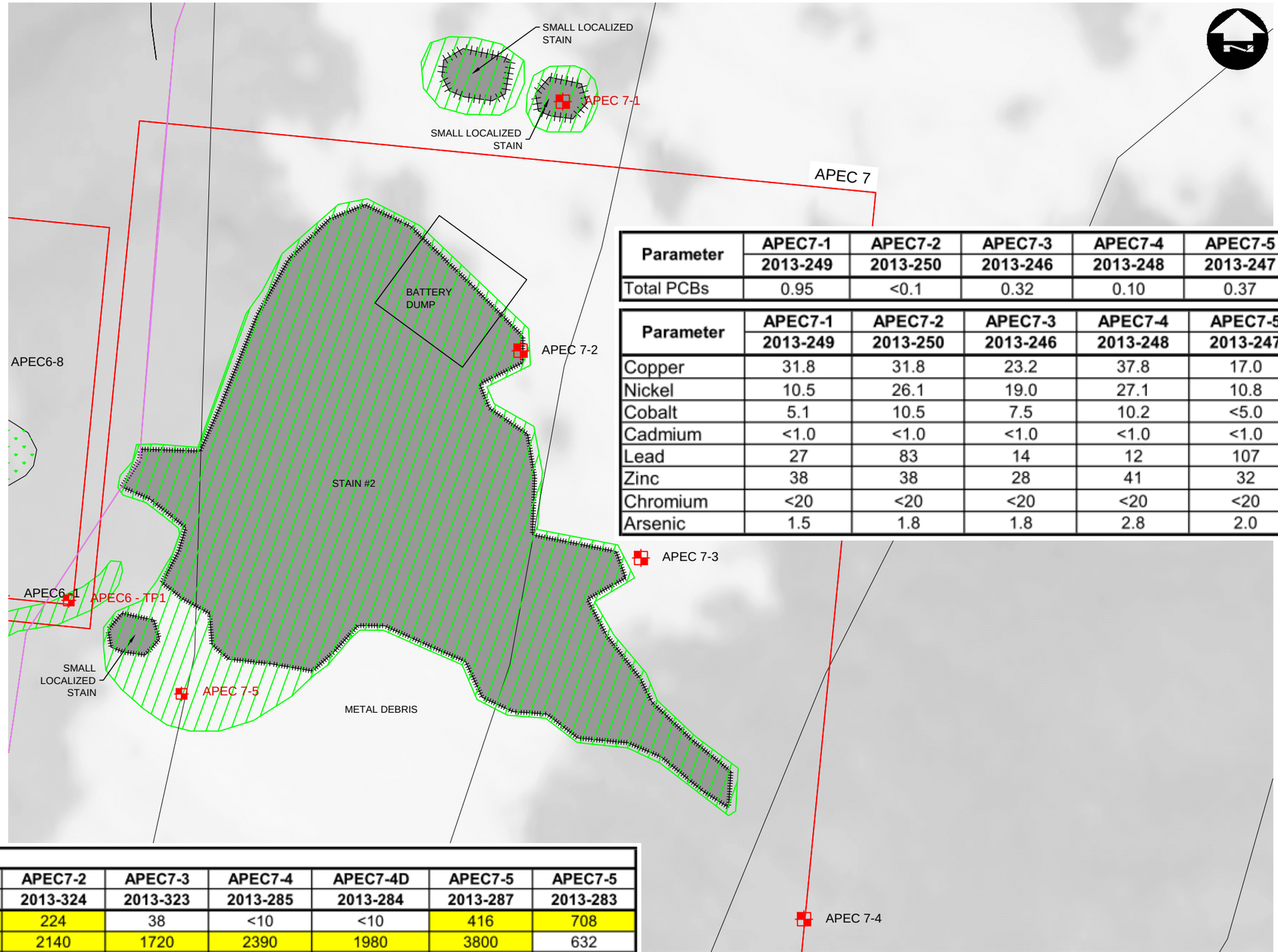
Metres

HORIZONTAL SCALE: 1:200 11" X 17"

0 4 8 12 16 20

NOTES:
1. Imagery: 1:20,000 Scale Imagery, 1948. National Air Photo Library (NAPL).
2. Contours are supplies from NRCAN, derived from 1:60,000 stereo pair imagery.
3. Survey Completed by KGS Group, August 2013

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Parameter	APEC7-1	APEC7-2	APEC7-3	APEC7-4	APEC7-5
	2013-249	2013-250	2013-246	2013-248	2013-247
Total PCBs	0.95	<0.1	0.32	0.10	0.37

Parameter	APEC7-1	APEC7-2	APEC7-3	APEC7-4	APEC7-5
	2013-249	2013-250	2013-246	2013-248	2013-247
Copper	31.8	31.8	23.2	37.8	17.0
Nickel	10.5	26.1	19.0	27.1	10.8
Cobalt	5.1	10.5	7.5	10.2	<5.0
Cadmium	<1.0	<1.0	<1.0	<1.0	<1.0
Lead	27	83	14	12	107
Zinc	38	38	28	41	32
Chromium	<20	<20	<20	<20	<20
Arsenic	1.5	1.8	1.8	2.8	2.0

Parameter	APEC7-1	APEC7-2	APEC7-3	APEC7-4	APEC7-4D	APEC7-5	APEC7-5
	2013-286	2013-324	2013-323	2013-285	2013-284	2013-287	2013-283
PHC F2	836	224	38	<10	<10	416	708
PHC F3	7200	2140	1720	2390	1980	3800	632
PHC F4	1440	116	<10	887	680	1530	<10
PHC TYPE	A	B	B	A	A	A	B
Type A Hydrocarbons	8640	2256	1730	3277	2660	5330	642
Type B Hydrocarbons	8046	2374	1768	2410	2000	4226	1350

FINAL

Metres

HORIZONTAL SCALE: 1:250 11" X 17"

0 5 10 15 20 25

NOTES:
1. Imagery: 1:20,000 Scale Imagery, 1948. National Air Photo Library (NAPL).
2. Contours are supplies from NRCAN, derived from 1:60,000 stereo pair imagery.
3. Survey Completed by KGS Group, August 2013

LEGEND

- Testpit Location
- Water Sample
- Exceeds AMSRP Criteria Type A Hydrocarbons
- Exceeds AMSRP Criteria Type B Hydrocarbons
- Staining
- Debris
- APEC
- Concrete
- Crown Land
- Water
- Road
- Drainage Pathways
- Airstrip
- Geophysical Survey Area
- Disturbed Limits
- EM 31 survey Area

	Parameter	AMSRP Clean-up Criteria Type B	AMSRP Clean-up Criteria Type A	CSW for PHC in Soil
PHC (ppm)	PHC F1	---	---	210
	PHC F2	---	---	150
	PHC F3	---	---	300
	PHC F4	---	---	2800
	PHC Type	---	---	---
	PHC Concentration	2500[a]	20000[b]	---

20= Denotes exceedances for AMSRP Clean-up Criteria
20= Denotes exceedances for Federal Guidelines
20= Denotes exceedances for Federal and AMSRP Criteria

a = AMSRP Clean-up Criteria, Protection of Terrestial Wildlife, Type B Hydrocarbon (sum of F1 + F3 + F4), 0 - 0.5 metres below ground surface

b = AMSRP Clean-up Criteria, Protection of Human Health, Type A Hydrocarbon (sum of F3 + F4 >70% of the total PHC concentration (F1 to F4) and (F2<F4)

Parameter	AMSRP Clean-up Criteria[1] Tier I	AMSRP Clean-up Criteria[1] Tier II	ESG Recommended Remediation Criteria (2010)	Federal CCME[2] Residential/ Parkland
Polychlorinated Bipherenyls (ppm)				
Copper	---	100	109	63
Zinc	---	500	Same as AMSRP	200
Total PCB	1.0	5.0	---	1.3

20= Denotes exceedances for DCC DEW Line Clean-up Criteria
20= Denotes exceedances for CCME 2007 Residential/Parland Guidelines
20= Denotes exceedances of Site Specific criteria
20= Denotes exceedances for Federal and AMSRP Criteria
--- No Criteria

1 = Indian and Northern Affairs Canada, Abandoned Military Site Remediation Protocol, Table 4.1, DCC DEW Line Criteria for soil, March 2009.
2 = Canadian Council of Ministers of the Environment, Canada Soil Quality Guidelines, Summary Tables (Update 7.0), Sept 2007, Residential/Parland, Coarse Grained Soils.

NO	YY/MM/DD	DESCRIPTION	BY
0	14/03/27	Completed Final	P.M.W.

REVISIONS / ISSUE

KGS GROUP CONSULTING ENGINEERS

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REMEDIAL ACTION PLAN,
FOX-D

APEC 7 - STAIN #2

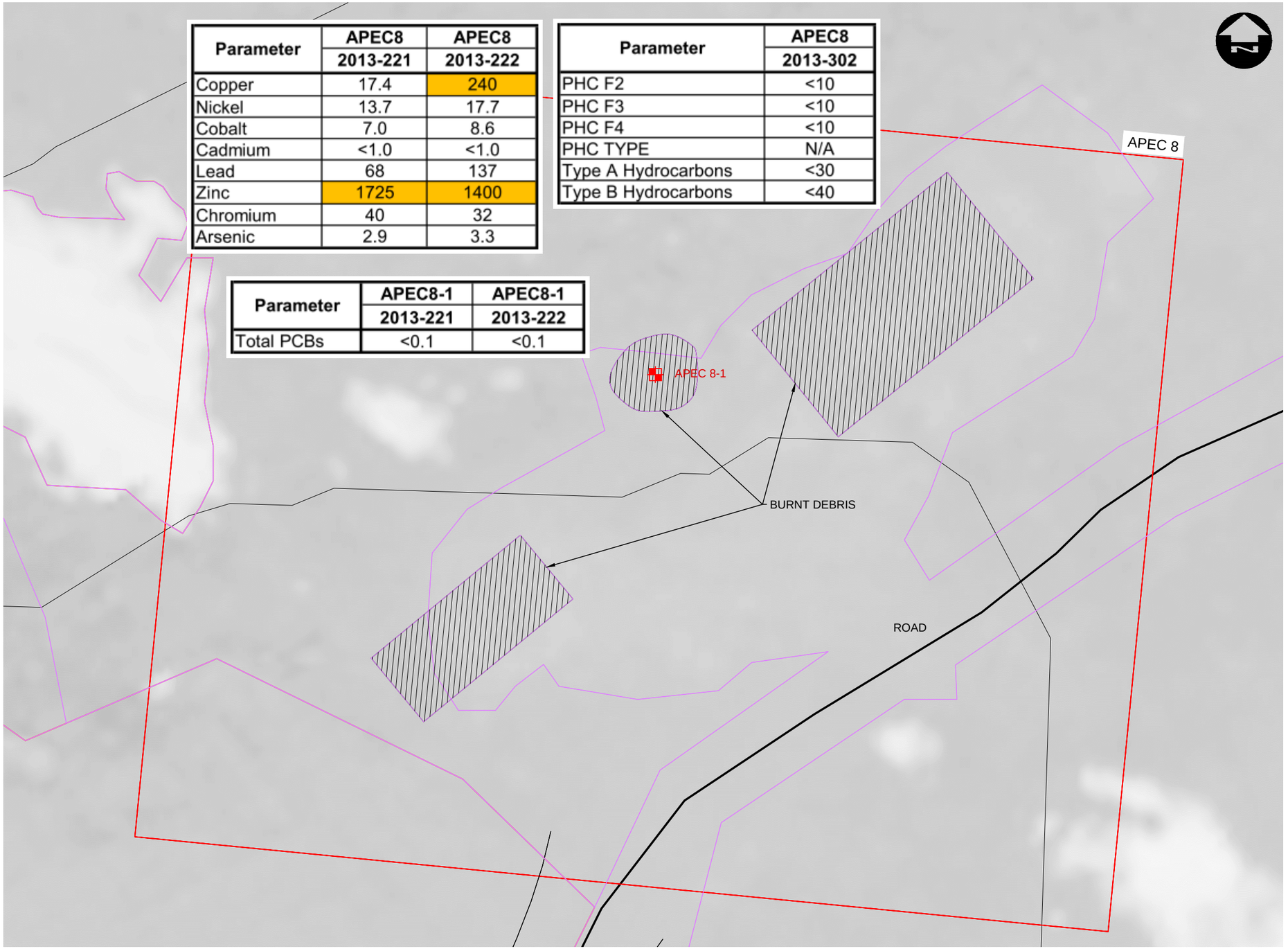
MARCH 2014 | FIGURE 10 | REV. 0

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Parameter	APEC8 2013-221	APEC8 2013-222
Copper	17.4	240
Nickel	13.7	17.7
Cobalt	7.0	8.6
Cadmium	<1.0	<1.0
Lead	68	137
Zinc	1725	1400
Chromium	40	32
Arsenic	2.9	3.3

Parameter	APEC8 2013-302
PHC F2	<10
PHC F3	<10
PHC F4	<10
PHC TYPE	N/A
Type A Hydrocarbons	<30
Type B Hydrocarbons	<40

Parameter	APEC8-1 2013-221	APEC8-1 2013-222
Total PCBs	<0.1	<0.1



LEGEND

- Testpit Location
- Water Sample
- Exceeds AMSRP Criteria Type A Hydrocarbons
- Exceeds AMSRP Criteria Type B Hydrocarbons
- Staining
- Debris
- APEC
- Concrete
- Crown Land
- Water
- Road
- Drainage Pathways
- Airstrip
- Geophysical Survey Area
- Disturbed Limits
- EM 31 survey Area

	Parameter	AMSRP Clean-up Criteria Type B	AMSRP Clean-up Criteria Type A	CSW for PHC in Soil
PHC (ppm)	PHC F1	---	---	210
	PHC F2	---	---	150
	PHC F3	---	---	300
	PHC F4	---	---	2800
	PHC Type	---	---	---
	PHC Concentration	2500[a]	20000[b]	---

20= Denotes exceedances for AMSRP Clean-up Criteria
20= Denotes exceedances for Federal Guidelines
20= Denotes exceedances for Federal and AMSRP Criteria

a = AMSRP Clean-up Criteria, Protection of Terrestial Wildlife, Type B Hydrocarbon (sum of F1 + F3 + F4), 0 - 0.5 metres below ground surface

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Parameter	AMSRP Clean-up Criteria[1] Tier I	AMSRP Clean-up Criteria[1] Tier II	ESG Recommended Remediation Criteria (2010)	Federal CCME[2] Residential/ Parkland
Polychlorinated Biphenenyls (ppm)				
Copper	---	100	109	63
Zinc	---	500	Same as AMSRP	200
Total PCB	1.0	5.0	---	1.3

20= Denotes exceedances for DCC DEW Line Clean-up Criteria
20= Denotes exceedances for CCME 2007 Residential/Parland Guidelines
20= Denotes exceedances of Site Specific criteria
20= Denotes exceedances for Federal and AMSRP Criteria
--- No Criteria

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NO.	YYMMDD	DESCRIPTION	BY
0	14/03/27	Completed Final	P.M.W.

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REMEDIAL ACTION PLAN,
FOX-D

APEC 8 - BURNT DEBRIS

MARCH 2014 | FIGURE 11 | REV. 0

FINAL

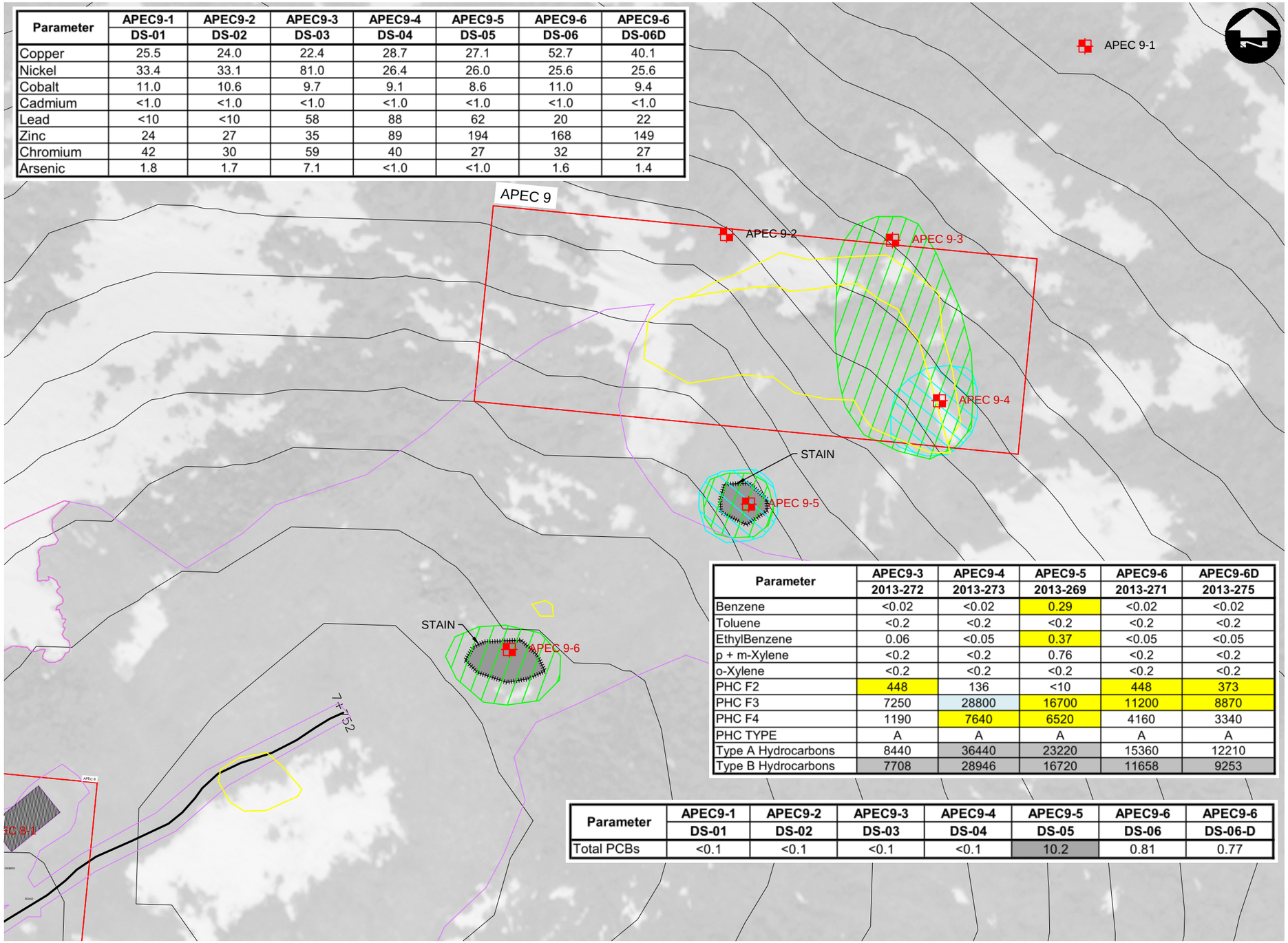
Metres
HORIZONTAL SCALE: 1:250 11" X 17"

0 5 10 15 20 25

NOTES:
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3. Survey Completed by KGS Group, August 2013

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Parameter	APEC9-1 DS-01	APEC9-2 DS-02	APEC9-3 DS-03	APEC9-4 DS-04	APEC9-5 DS-05	APEC9-6 DS-06	APEC9-6 DS-06D
Copper	25.5	24.0	22.4	28.7	27.1	52.7	40.1
Nickel	33.4	33.1	81.0	26.4	26.0	25.6	25.6
Cobalt	11.0	10.6	9.7	9.1	8.6	11.0	9.4
Cadmium	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Lead	<10	<10	58	88	62	20	22
Zinc	24	27	35	89	194	168	149
Chromium	42	30	59	40	27	32	27
Arsenic	1.8	1.7	7.1	<1.0	<1.0	1.6	1.4



Parameter	APEC9-3 2013-272	APEC9-4 2013-273	APEC9-5 2013-269	APEC9-6 2013-271	APEC9-6D 2013-275
Benzene	<0.02	<0.02	0.29	<0.02	<0.02
Toluene	<0.2	<0.2	<0.2	<0.2	<0.2
EthylBenzene	0.06	<0.05	0.37	<0.05	<0.05
p + m-Xylene	<0.2	<0.2	0.76	<0.2	<0.2
o-Xylene	<0.2	<0.2	<0.2	<0.2	<0.2
PHC F2	448	136	<10	448	373
PHC F3	7250	28800	16700	11200	8870
PHC F4	1190	7640	6520	4160	3340
PHC TYPE	A	A	A	A	A
Type A Hydrocarbons	8440	36440	23220	15360	12210
Type B Hydrocarbons	7708	28946	16720	11658	9253

Parameter	APEC9-1 DS-01	APEC9-2 DS-02	APEC9-3 DS-03	APEC9-4 DS-04	APEC9-5 DS-05	APEC9-6 DS-06	APEC9-6 DS-06-D
Total PCBs	<0.1	<0.1	<0.1	<0.1	10.2	0.81	0.77

LEGEND

- Testpit Location
- Water Sample
- Exceeds AMSRP Criteria Type A Hydrocarbons
- Exceeds AMSRP Criteria Type B Hydrocarbons
- Staining
- Debris
- APEC
- Concrete
- Crown Land
- Water
- Road
- Drainage Pathways
- Airstrip
- Geophysical Survey Area
- Disturbed Limits
- EM 31 survey Area

	Parameter	AMSRP Clean-up Criteria Type B	AMSRP Clean-up Criteria Type A	CSW for PHC in Soil
PHC (ppm)	PHC F1	---	---	210
	PHC F2	---	---	150
	PHC F3	---	---	300
	PHC F4	---	---	2800
	PHC Type	---	---	---
	PHC Concentration	2500[b]	20000[b]	---

20= Denotes exceedances for AMSRP Clean-up Criteria
20= Denotes exceedances for Federal Guidelines
20= Denotes exceedances for Federal and AMSRP Criteria

a = AMSRP Clean-up Criteria, Protection of Terrestial Wildlife, Type B Hydrocarbon (sum of F1 + F3 + F4), 0 - 0.5 metres below ground surface

b = AMSRP Clean-up Criteria, Protection of Human Health, Type A Hydrocarbon (sum of F3 + F4 >70% of the total PHC concentration (F1 to F4) and (F2<F4)

Parameter	AMSRP Clean-up Criteria[1] Tier I	AMSRP Clean-up Criteria[1] Tier II	ESG Recommended Remediation Criteria (2010)	Federal CCME[2] Residential/ Parkland
Polychlorinated Biphenenyls (ppm)				
Copper	---	100	109	63
Zinc	---	500	Same as AMSRP	200
Total PCB	1.0	5.0	---	1.3

20= Denotes exceedances for DCC DEW Line Clean-up Criteria
20= Denotes exceedances for CCME 2007 Residential/Parland Guidelines
20= Denotes exceedances of Site Specific criteria
20= Denotes exceedances for Federal and AMSRP Criteria
--- No Criteria

1 = Indian and Northern Affairs Canada, Abandoned Military Site Remediation Protocol, Table 4.1, DCC DEW Line Criteria for soil, March 2009.
2 = Canadian Council of Ministers of the Environment, Canada Soil Quality Guidelines, Summary Tables (Update 7.0), Sept 2007, Residential/Parland, Coarse Grained Soils.

NO.	YY/MM/DD	DESCRIPTION	BY
0	14/03/27	Completed Final	P.M.W.

REVISIONS / ISSUE

FINAL

Metres

HORIZONTAL SCALE: 1:1000 11" X 17"

0 20 40 60 80 100

NOTES:
1. Imagery: 1:20,000 Scale Imagery, 1948. National Air Photo Library (NAPL).
2. Contours are supplies from NRCAN, derived from 1:60,000 stereo pair imagery.
3. Survey Completed by KGS Group, August 2013

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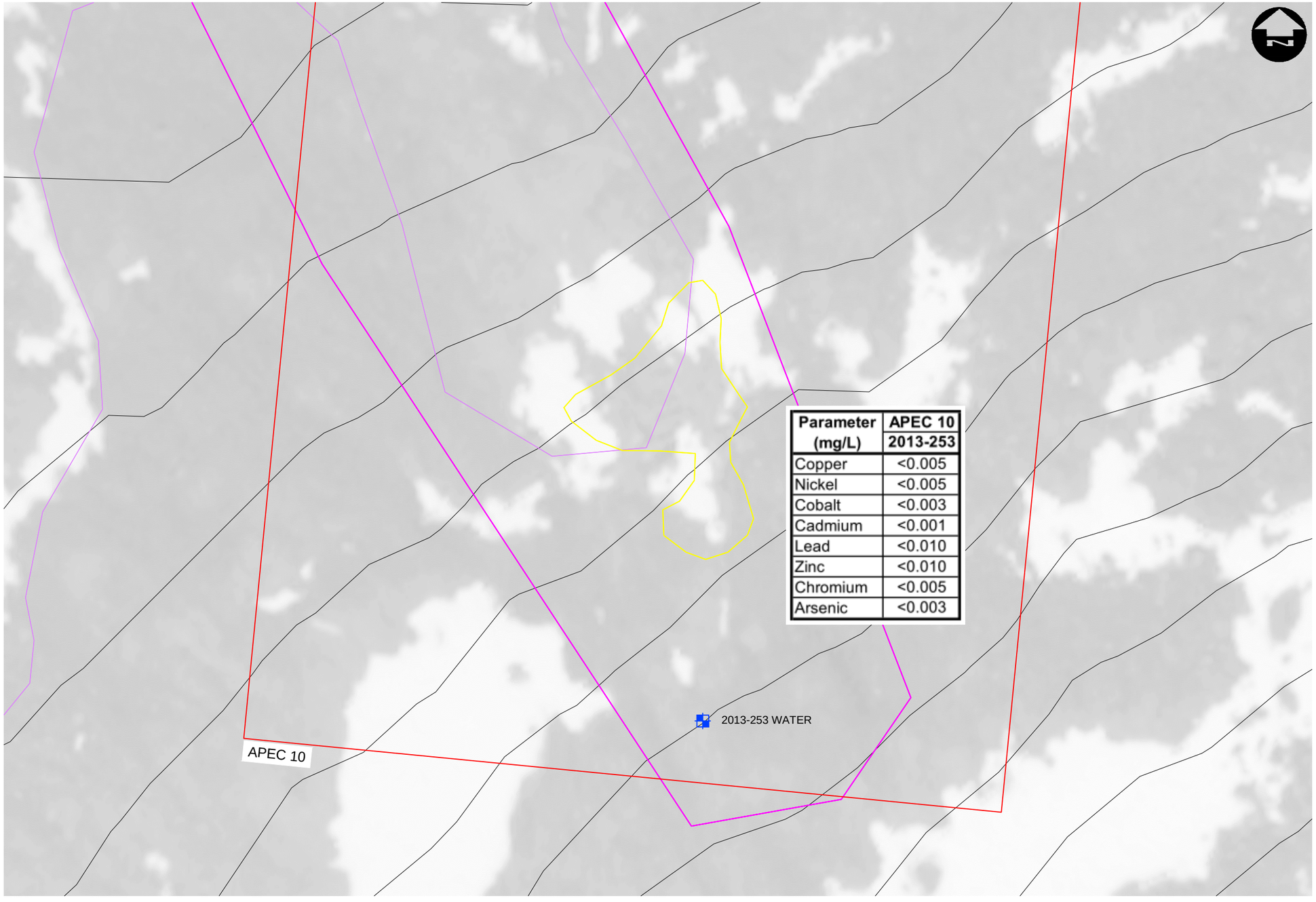
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REMEDIAL ACTION PLAN,
FOX-D

APEC 9 - NORTHERN SLOPE DUMP SITE

MARCH 2014 | FIGURE 12 | REV 0

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Parameter (mg/L)	APEC 10 2013-253
Copper	<0.005
Nickel	<0.005
Cobalt	<0.003
Cadmium	<0.001
Lead	<0.010
Zinc	<0.010
Chromium	<0.005
Arsenic	<0.003

LEGEND

- Testpit Location
- Water Sample
- Exceeds AMSRP Criteria Type A Hydrocarbons
- Exceeds AMSRP Criteria Type B Hydrocarbons
- Staining
- Debris
- APEC
- Concrete
- Crown Land
- Water
- Road
- Drainage Pathways
- Airstrip
- Geophysical Survey Area
- Disturbed Limits
- EM 31 survey Area

	Parameter	AMSRP Clean-up Criteria Type B	AMSRP Clean-up Criteria Type A	CSW for PHC in Soil
PHC (ppm)	PHC F1	---	---	210
	PHC F2	---	---	150
	PHC F3	---	---	300
	PHC F4	---	---	2800
	PHC Type	---	---	---
	PHC Concentration	2500[a]	20000[b]	---

20= Denotes exceedances for AMSRP Clean-up Criteria
20= Denotes exceedances for Federal Guidelines
20= Denotes exceedances for Federal and AMSRP Criteria

a = AMSRP Clean-up Criteria, Protection of Terrestial Wildlife, Type B Hydrocarbon (sum of F1 + F3 + F4), 0 - 0.5 metres below ground surface

b = AMSRP Clean-up Criteria, Protection of Human Health, Type A Hydrocarbon (sum of F3 + F4 >70% of the total PHC concentration (F1 to F4) and (F2<F4)

Parameter	AMSRP Clean-up Criteria[1] Tier I	AMSRP Clean-up Criteria[1] Tier II	ESG Recommended Remediation Criteria (2010)	Federal CCME[2] Residential/ Parkland
Polychlorinated Biphenenyls (ppm)				
Copper	---	100	109	63
Zinc	---	500	Same as AMSRP	200
Total PCB	1.0	5.0	---	1.3

20= Denotes exceedances for DCC DEW Line Clean-up Criteria
20= Denotes exceedances for CCME 2007 Residential/Parland Guidelines
20= Denotes exceedances of Site Specific criteria
20= Denotes exceedances for Federal and AMSRP Criteria
--- No Criteria

1 = Indian and Northern Affairs Canada, Abandoned Military Site Remediation Protocol, Table 4.1, DCC DEW Line Criteria for soil, March 2009.
2 = Canadian Council of Ministers of the Environment, Canada Soil Quality Guidelines, Summary Tables (Update 7.0), Sept 2007, Residential/Parland, Coarse Grained Soils.

NO.	YY/MM/DD	DESCRIPTION	BY
0	14/03/27	Completed Final	P.M.W.

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REMEDIAL ACTION PLAN,
FOX-D

APEC 10 - SOUTHERN SLOPE DUMP SITE

MARCH 2014 | FIGURE 13 | REV. 0

FINAL

Metres

HORIZONTAL SCALE: 1:500 11" X 17"

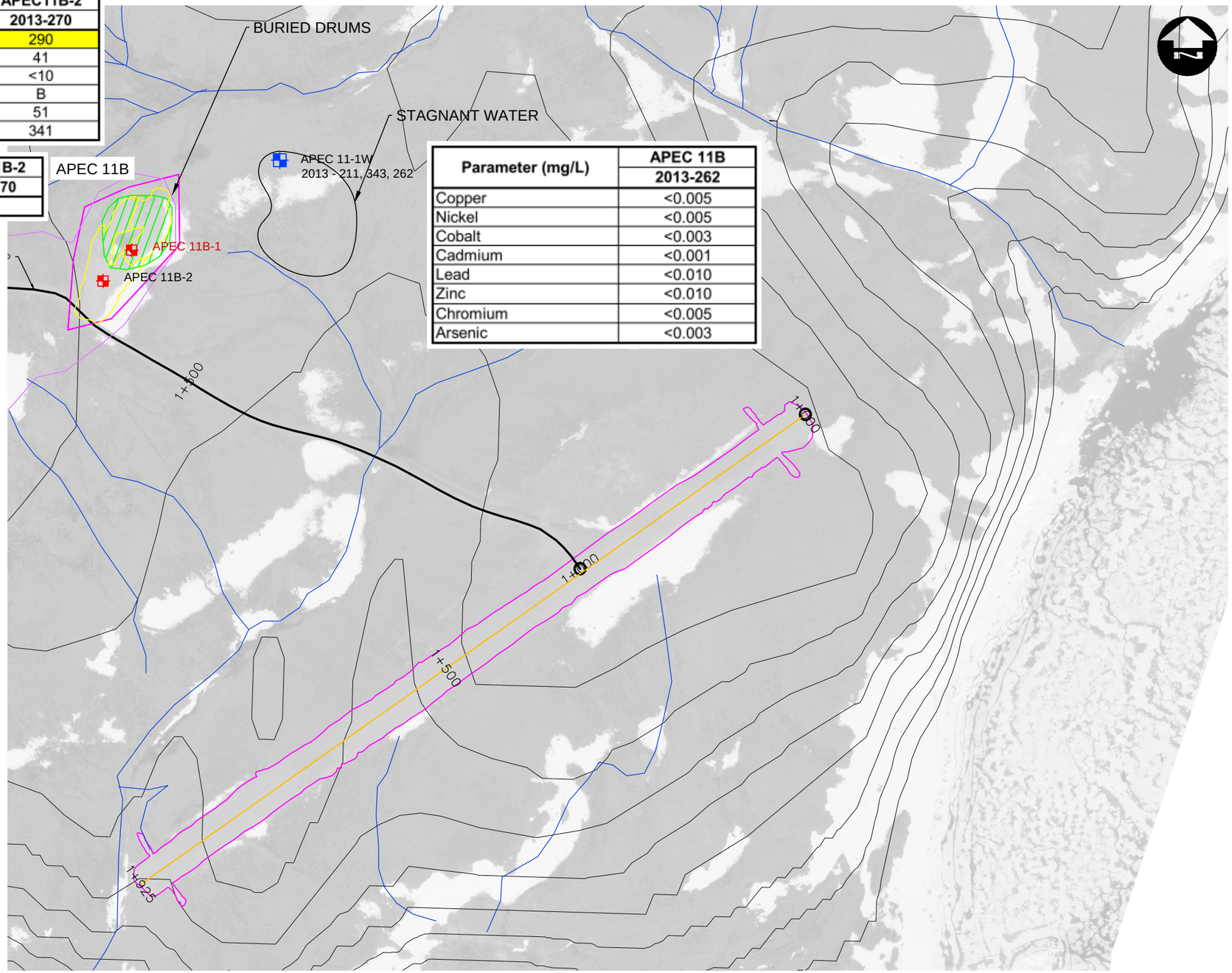
0 100 200 300 400 500

NOTES:
1. Imagery: 1:20,000 Scale Imagery, 1948. National Air Photo Library (NAPL).
2. Contours are supplies from NRCAN, derived from 1:60,000 stereo pair imagery.
3. Survey Completed by KGS Group, August 2013

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Parameter	APEC11B-1	APEC11B-2
	2013-317	2013-270
PHC F2	<10	290
PHC F3	11800	41
PHC F4	<10	<10
PHC TYPE	A	B
Type A Hydrocarbons	11810	51
Type B Hydrocarbons	11820	341

Parameter	APEC 11B-1	APEC11B-2
	FC-1	2013-270
Total PCBs	<0.1	<0.1



Parameter (mg/L)	APEC 11B
	2013-262
Copper	<0.005
Nickel	<0.005
Cobalt	<0.003
Cadmium	<0.001
Lead	<0.010
Zinc	<0.010
Chromium	<0.005
Arsenic	<0.003

LEGEND

- Testpit Location
- Water Sample
- Exceeds AMSRP Criteria Type A Hydrocarbons
- Exceeds AMSRP Criteria Type B Hydrocarbons
- Staining
- Debris
- APEC
- Concrete
- Crown Land
- Water
- Road
- Drainage Pathways
- Airstrip
- Geophysical Survey Area
- Disturbed Limits
- EM 31 survey Area

Parameter		AMSRP Clean-up Criteria Type B	AMSRP Clean-up Criteria Type A	CSW for PHC in Soil
PHC (ppm)	PHC F1	---	---	210
	PHC F2	---	---	150
	PHC F3	---	---	300
	PHC F4	---	---	2800
	PHC Type	---	---	---
	PHC Concentration	2500[a]	20000[b]	---

20= Denotes exceedances for AMSRP Clean-up Criteria
20= Denotes exceedances for Federal Guidelines
20= Denotes exceedances for Federal and AMSRP Criteria

a = AMSRP Clean-up Criteria, Protection of Terrestial Wildlife, Type B Hydrocarbon (sum of F1 + F3 + F4), 0 - 0.5 metres below ground surface

b = AMSRP Clean-up Criteria, Protection of Human Health, Type A Hydrocarbon (sum of F3 + F4 >70% of the total PHC concentration (F1 to F4) and (F2<F4)

Parameter	AMSRP Clean-up Criteria[1] Tier I	AMSRP Clean-up Criteria[1] Tier II	ESG Recommended Remediation Criteria (2010)	Federal CCME[2] Residential/ Parkland
Polychlorinated Biphenyls (ppm)				
Copper	---	100	109	63
Zinc	---	500	Same as AMSRP	200
Total PCB	1.0	5.0	---	1.3

20= Denotes exceedances for DCC DEW Line Clean-up Criteria
20= Denotes exceedances for CCME 2007 Residential/Parland Guidelines
20= Denotes exceedances of Site Specific criteria
20= Denotes exceedances for Federal and AMSRP Criteria
--- No Criteria

1 = Indian and Northern Affairs Canada, Abandoned Military Site Remediation Protocol, Table 4.1, DCC DEW Line Criteria for soil, March 2009.
2 = Canadian Council of Ministers of the Environment, Canada Soil Quality Guidelines, Summary Tables (Update 7.0), Sept 2007, Residential/Parland, Coarse Grained Soils.

NO.	YY/MM/DD	DESCRIPTION	BY
0	14/03/27	Completed Final	P.M.W.

REVISIONS / ISSUE

FINAL

Metres
HORIZONTAL SCALE: 1:5000 11" X 17"

0 100 200 300 400 500

NOTES:
1. Imagery: 1:20,000 Scale Imagery, 1948. National Air Photo Library (NAPL).
2. Contours are supplies from NRCAN, derived from 1:60,000 stereo pair imagery.
3. Survey Completed by KGS Group, August 2013

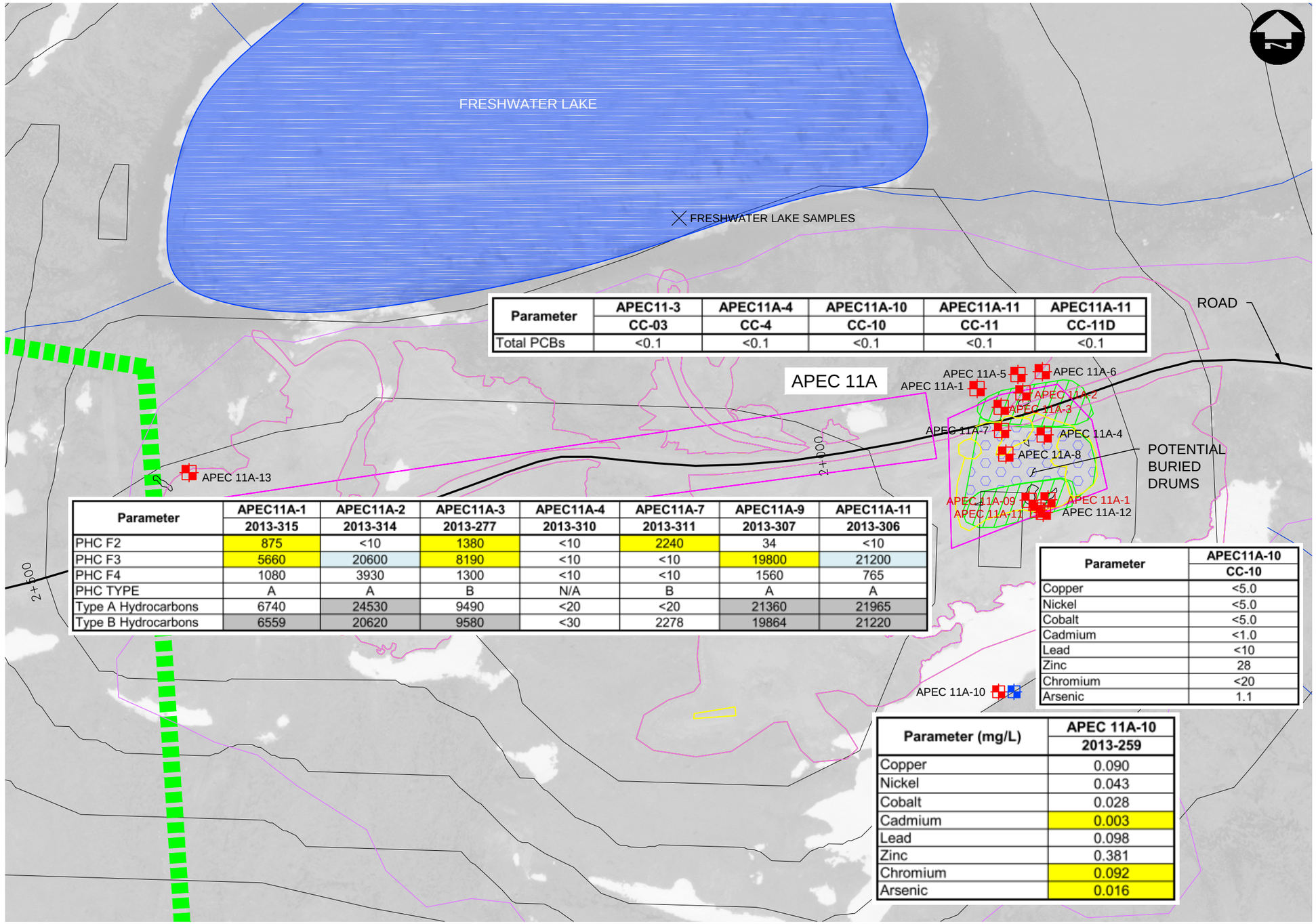
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DILLON CONSULTING

REMEDIAL ACTION PLAN,
FOX-D

APEC 11B - FUEL CACHE DUMP

MARCH 2014 | FIGURE 14 | REV. 0

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Parameter	APEC11-3	APEC11A-4	APEC11A-10	APEC11A-11	APEC11A-11
	CC-03	CC-4	CC-10	CC-11	CC-11D
Total PCBs	<0.1	<0.1	<0.1	<0.1	<0.1

Parameter	APEC11A-1	APEC11A-2	APEC11A-3	APEC11A-4	APEC11A-7	APEC11A-9	APEC11A-11
	2013-315	2013-314	2013-277	2013-310	2013-311	2013-307	2013-306
PHC F2	875	<10	1380	<10	2240	34	<10
PHC F3	5660	20600	8190	<10	<10	19800	21200
PHC F4	1080	3930	1300	<10	<10	1560	765
PHC TYPE	A	A	B	N/A	B	A	A
Type A Hydrocarbons	6740	24530	9490	<20	<20	21360	21965
Type B Hydrocarbons	6559	20620	9580	<30	2278	19864	21220

Parameter	APEC11A-10
	CC-10
Copper	<5.0
Nickel	<5.0
Cobalt	<5.0
Cadmium	<1.0
Lead	<10
Zinc	28
Chromium	<20
Arsenic	1.1

Parameter (mg/L)	APEC 11A-10
	2013-259
Copper	0.090
Nickel	0.043
Cobalt	0.028
Cadmium	0.003
Lead	0.098
Zinc	0.381
Chromium	0.092
Arsenic	0.016

FINAL

Metres

HORIZONTAL SCALE: 1:2500 11" X 17"

0 50 100 150 200 250

NOTES:
1. Imagery: 1:20,000 Scale Imagery, 1948. National Air Photo Library (NAPL).
2. Contours are supplies from NRCAN, derived from 1:60,000 stereo pair imagery.
3. Survey Completed by KGS Group, August 2013

LEGEND

- Testpit Location
- Water Sample
- Exceeds AMSRP Criteria Type A Hydrocarbons
- Exceeds AMSRP Criteria Type B Hydrocarbons
- Staining
- Debris
- APEC
- Concrete
- Crown Land
- Water
- Road
- Drainage Pathways
- Airstrip
- Geophysical Survey Area
- Disturbed Limits
- EM 31 survey Area

	Parameter	AMSRP Clean-up Criteria Type B	AMSRP Clean-up Criteria Type A	CSW for PHC in Soil
PHC (ppm)	PHC F1	---	---	210
	PHC F2	---	---	150
	PHC F3	---	---	300
	PHC F4	---	---	2800
	PHC Type	---	---	---
	PHC Concentration	2500[a]	20000[b]	---

20= Denotes exceedances for AMSRP Clean-up Criteria
20= Denotes exceedances for Federal Guidelines
20= Denotes exceedances for Federal and AMSRP Criteria

a = AMSRP Clean-up Criteria, Protection of Terrestial Wildlife, Type B Hydrocarbon (sum of F1 + F3 + F4), 0 - 0.5 metres below ground surface

b = AMSRP Clean-up Criteria, Protection of Human Health, Type A Hydrocarbon (sum of F3 + F4 >70% of the total PHC concentration (F1 to F4) and (F2<F4)

Parameter	AMSRP Clean-up Criteria[1] Tier I	AMSRP Clean-up Criteria[1] Tier II	ESG Recommended Remediation Criteria (2010)	Federal CCME[2] Residential/ Parkland
Polychlorinated Biphenyls (ppm)				
Copper	---	100	109	63
Zinc	---	500	Same as AMSRP	200
Total PCB	1.0	5.0	---	1.3

20= Denotes exceedances for DCC DEW Line Clean-up Criteria
20= Denotes exceedances for CCME 2007 Residential/Parland Guidelines
20= Denotes exceedances of Site Specific criteria
20= Denotes exceedances for Federal and AMSRP Criteria
--- No Criteria

1 = Indian and Northern Affairs Canada, Abandoned Military Site Remediation Protocol, Table 4.1, DCC DEW Line Criteria for soil, March 2009.
2 = Canadian Council of Ministers of the Environment, Canada Soil Quality Guidelines, Summary Tables (Update 7.0), Sept 2007, Residential/Parland, Coarse Grained Soils.

NO	YY/MM/DD	DESCRIPTION	BY
0	14/03/27	Completed Final	P.M.W.

REVISIONS / ISSUE

KGS GROUP CONSULTING ENGINEERS

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REMEDIAL ACTION PLAN, FOX-D

APEC 11A - CONSTRUCTION CAMP

MARCH 2014 | FIGURE 15 | REV. 0

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Parameter	APEC12-4 2013-308	APEC12-4 2013-309	APEC12-5 2013-320	APEC12-5D 2013-319	APEC12-6 2013-318	APEC12-7 2013-274	APEC12-8 2013-313	APEC12-9 2013-312	APEC12-10 2013-326
PHC F2	1330	<10	<10	<10	<10	<10	<10	<10	<10
PHC F3	72	<10	17000	12600	19900	9560	2610	<10	<10
PHC F4	<10	<10	2120	2150	10500	9020	2280	<10	<10
PHC TYPE	B	N/A	A	A	A	A	A	N/A	N/A
Type A Hydrocarbons	82	<20	19120	14750	30400	18580	4890	<20	<20
Type B Hydrocarbons	1416	<30	17020	12620	19920	9580	2630	<30	<30

Parameter (mg/L)	APEC 12 2013-342	APEC 12 2013-344	APEC 12 2013-345
F1 (C6-C10 Hydrocarbons)	-	<0.1	-
F2 (C10-C16 Hydrocarbons)	-	<0.1	-
F3 (C16-C34 Hydrocarbons)	-	<0.5	-
F4 (C34-C50 Hydrocarbons)	-	<0.5	-
Fuel Oil	<1.0	-	<1.0
Lubricating Oil and Grease	<1.0	-	<1.0

ROAD
CULVERT
STAIN
APEC 12-8
APEC 12-5
APEC 12-6
STAIN
DRAINAGE PATHWAY
APEC 12-9
DISTURBED LIMITS
POL TANK
CULVERT
1+500
DRAINAGE PATHWAY
APEC 12-7
2013- 215 WATER
APEC 12-2
APEC 12-1
1+604
2013- 344 WATER
APEC 12-10
APEC 12-4
APEC 12-3
SHORELINE
DAVIS STRAIT

FINAL

Metres
HORIZONTAL SCALE: 1:1000 11" X 17"

0 20 40 60 80 100

NOTES:
1. Imagery: 1:20,000 Scale Imagery, 1948. National Air Photo Library (NAPL).
2. Contours are supplies from NRCAN, derived from 1:60,000 stereo pair imagery.
3. Survey Completed by KGS Group, August 2013

LEGEND

- Testpit Location
- Water Sample
- Exceeds AMSRP Criteria Type A Hydrocarbons
- Exceeds AMSRP Criteria Type B Hydrocarbons
- Staining
- Debris
- APEC
- Concrete
- Crown Land
- Water
- Road
- Drainage Pathways
- Airstrip
- Geophysical Survey Area
- Disturbed Limits
- EM 31 survey Area

Parameter		AMSRP Clean-up Criteria Type B	AMSRP Clean-up Criteria Type A	CSW for PHC in Soil
PHC (ppm)	PHC F1	---	---	210
	PHC F2	---	---	150
	PHC F3	---	---	300
	PHC F4	---	---	2800
	PHC Type	---	---	---
	PHC Concentration	2500[a]	20000[b]	---

20= Denotes exceedances for AMSRP Clean-up Criteria
20= Denotes exceedances for Federal Guidelines
20= Denotes exceedances for Federal and AMSRP Criteria

a = AMSRP Clean-up Criteria, Protection of Terrestial Wildlife, Type B Hydrocarbon (sum of F1 + F3 + F4), 0 - 0.5 metres below ground surface

b = AMSRP Clean-up Criteria, Protection of Human Health, Type A Hydrocarbon (sum of F3 + F4 >70% of the total PHC concentration (F1 to F4) and (F2<F4)

Parameter	AMSRP Clean-up Criteria[1] Tier I	AMSRP Clean-up Criteria[1] Tier II	ESG Recommended Remediation Criteria (2010)	Federal CCME[2] Residential/ Parkland
Polychlorinated Biphenyls (ppm)				
Copper	---	100	109	63
Zinc	---	500	Same as AMSRP	200
Total PCB	1.0	5.0	---	1.3

20= Denotes exceedances for DCC DEW Line Clean-up Criteria
20= Denotes exceedances for CCME 2007 Residential/Parland Guidelines
20= Denotes exceedances of Site Specific criteria
20= Denotes exceedances for Federal and AMSRP Criteria
--- No Criteria

1 = Indian and Northern Affairs Canada, Abandoned Military Site Remediation Protocol, Table 4.1, DCC DEW Line Criteria for soil, March 2009.
2 = Canadian Council of Ministers of the Environment, Canada Soil Quality Guidelines, Summary Tables (Update 7.0), Sept 2007, Residential/Parland, Coarse Grained Soils.

NO	YY/MM/DD	DESCRIPTION	BY
0	14/03/27	Completed Final	P.M.W.

REVISIONS / ISSUE

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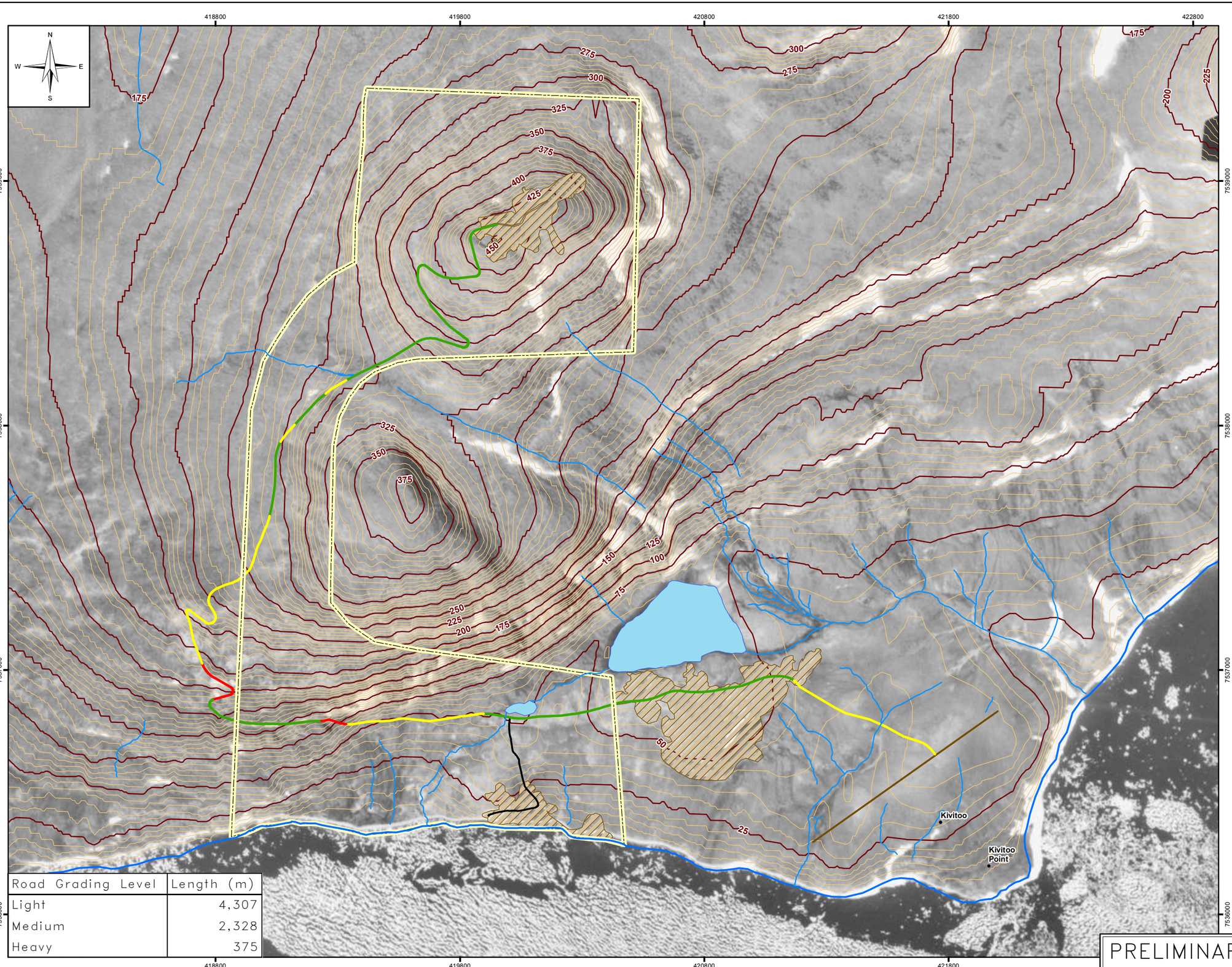
REMEDIAL ACTION PLAN,
FOX-D

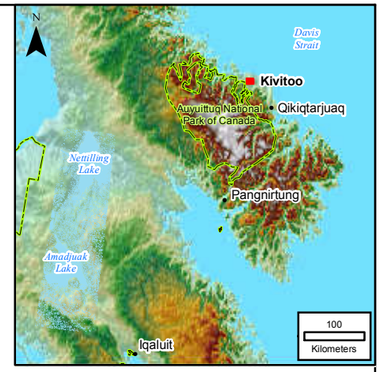
APEC 12 - BEACH POL AND LANDING AREA

MARCH 2014 | FIGURE 16 | REV. 0

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LEGEND:

- Drainage Pathway
- Shoreline
- 5 m Contour
- 25 m Index Contour
- Existing Road
- Airstrip
- Light Grading
- Medium Grading
- Heavy Grading
- Property Boundary
- Lake
- Area of Disturbance/Worked Area

Road Grading Level	Length (m)
Light	4,307
Medium	2,328
Heavy	375

NOTES:

1. Imagery: 1:20,000 scale imagery, 1948. National Air Photo Library (NAPL).
2. Contours are supplied from NRCAN, derived from 1:60,000 stereo pair imagery.

200 0 200 400 600
Metres

SCALE: 1:15,000 METRIC 11"x17"

All units are metric and in metres unless otherwise specified.
Transverse Mercator Projection, NAD 1983, Zone 20
Elevations are in metres above sea level (MSL)

NO.	YY/MM/DD	DESCRIPTION	BY
0	14/03/21	ISSUED WITH FINAL RAP REPORT	AMH

REVISIONS / ISSUE

KGS GROUP CONSULTING ENGINEERS

DILLON CONSULTING

HAZARDOUS MATERIALS ASSESSMENT
SITE SURVEY & GEOTECHNICAL SERVICES
FOX D DEW LINE SITE BAFFIN ISLAND

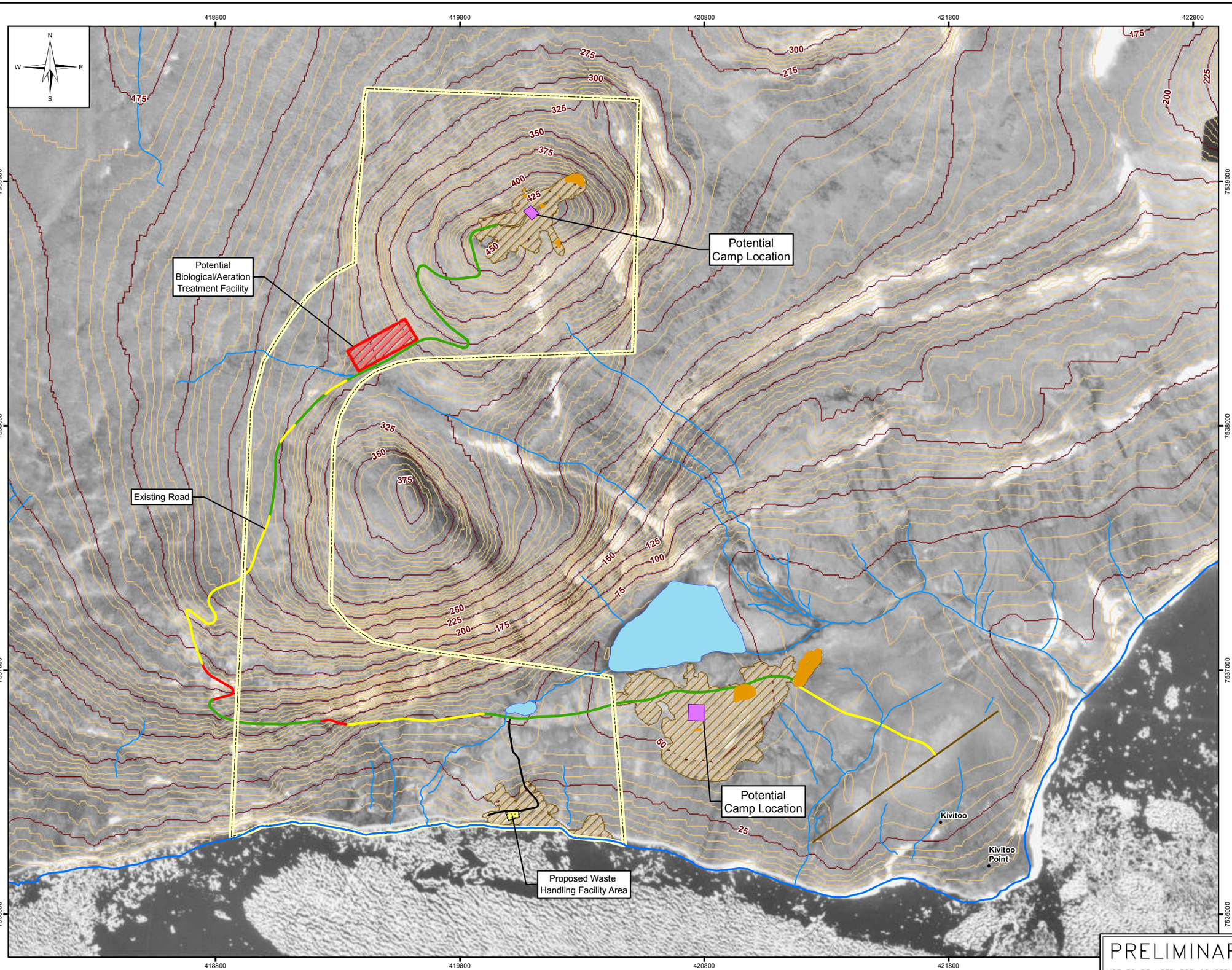
REMEDIAL ACTION PLAN REPORT
AREA ROAD UPGRADES

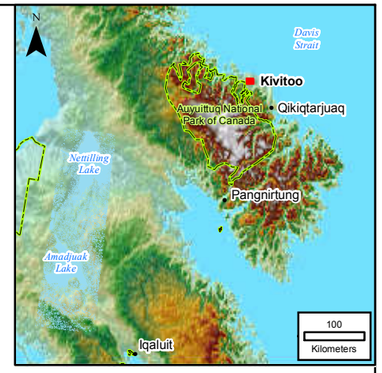
PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

MARCH 2014 | FIGURE 17 | REV: 0

FileName: P:\Projects\2013\13-0163-002\Dwg\GIS\MXDs\Dillon_RAP_Report\Rev0\13-0163-002_Fig17_Rev0.mxd
11"x17" PLOT SCALE 1:1

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LEGEND:

- Drainage Pathway
- Shoreline
- 5 m Contour
- 25 m Index Contour
- Existing Road
- Airstrip
- Light Grading
- Medium Grading
- Heavy Grading
- Property Boundary
- Existing Landfill
- Lake
- Area of Disturbance/Worked Area
- Proposed Waste Transfer Area
- Potential Biological/Aeration Facility
- Potential Camp Location

NOTES:

1. Imagery: 1:20,000 scale imagery, 1948. National Air Photo Library (NAPL).
2. Contours are supplied from NRCAN, derived from 1:60,000 stereo pair imagery.

200 0 200 400 600
Metres

SCALE: 1:15,000 METRIC 11"x17"

All units are metric and in metres unless otherwise specified.
Transverse Mercator Projection, NAD 1983, Zone 20
Elevations are in metres above sea level (MSL)

NO.	YY/MM/DD	DESCRIPTION	BY
0	14/03/21	ISSUED WITH FINAL RAP REPORT	AMH

REVISIONS / ISSUE

KGS GROUP CONSULTING ENGINEERS

DILLON CONSULTING

HAZARDOUS MATERIALS ASSESSMENT SITE SURVEY & GEOTECHNICAL SERVICES FOX D DEW LINE SITE BAFFIN ISLAND

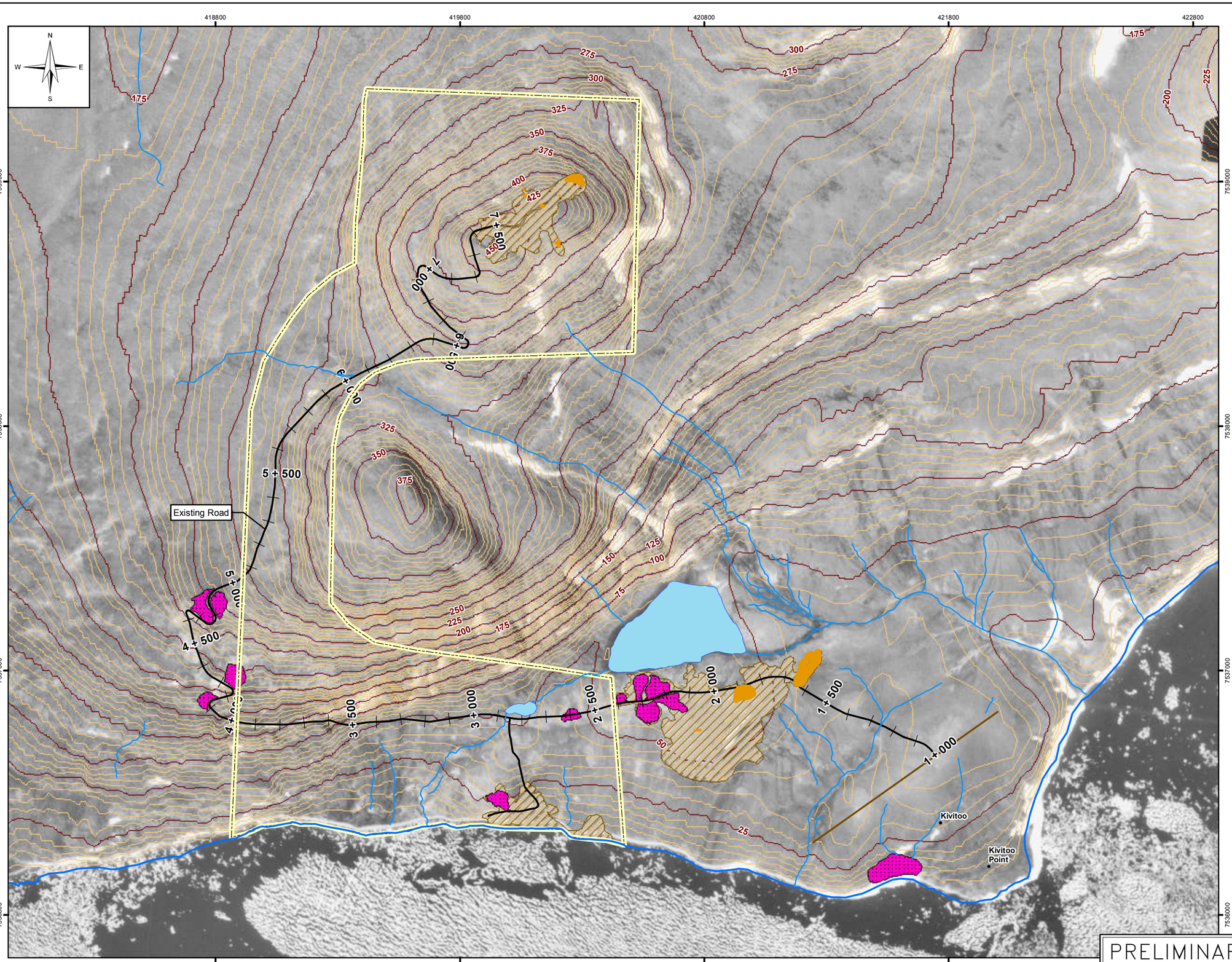
REMEDIAL ACTION PLAN REPORT PROPOSED WORKS

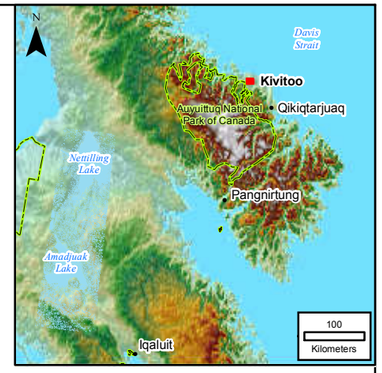
PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

MARCH 2014 | FIGURE 18 | REV: 0

FileName: P:\Projects\2013\13-0163-002\Dwg\GIS\MXDs\Dillon_RAP_Report\Rev0\13-0163-002_Fig18_Rev0.mxd
11"x17" PLOT SCALE 1:1

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LEGEND:

- Drainage Pathway
- Shoreline
- 5 m Contour
- 25 m Index Contour
- Existing Road
- Airstrip
- Property Boundary
- Existing Landfill
- Freshwater Lake
- Borrow Areas
- Area of Disturbance/Worked Area

NOTES:

1. Imagery: 1:20,000 scale imagery, 1948. National Air Photo Library (NAPL).
2. Contours are supplied from NRCAN, derived from 1:60,000 stereo pair imagery.

200 0 200 400 600
Metres

SCALE: 1:15,000 METRIC 11"x17"

All units are metric and in metres unless otherwise specified.
Transverse Mercator Projection, NAD 1983, Zone 20
Elevations are in metres above sea level (MSL)

NO.	YY/MM/DD	DESCRIPTION	BY
0	14/03/21	ISSUED WITH FINAL RAP REPORT	AMH

REVISIONS / ISSUE

KGS GROUP CONSULTING ENGINEERS

DILLON CONSULTING

HAZARDOUS MATERIALS ASSESSMENT
SITE SURVEY & GEOTECHNICAL SERVICES
FOX D DEW LINE SITE BAFFIN ISLAND

REMEDIAL ACTION PLAN REPORT
BORROW SOURCES

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

MARCH 2014 | FIGURE 19 | REV: 0

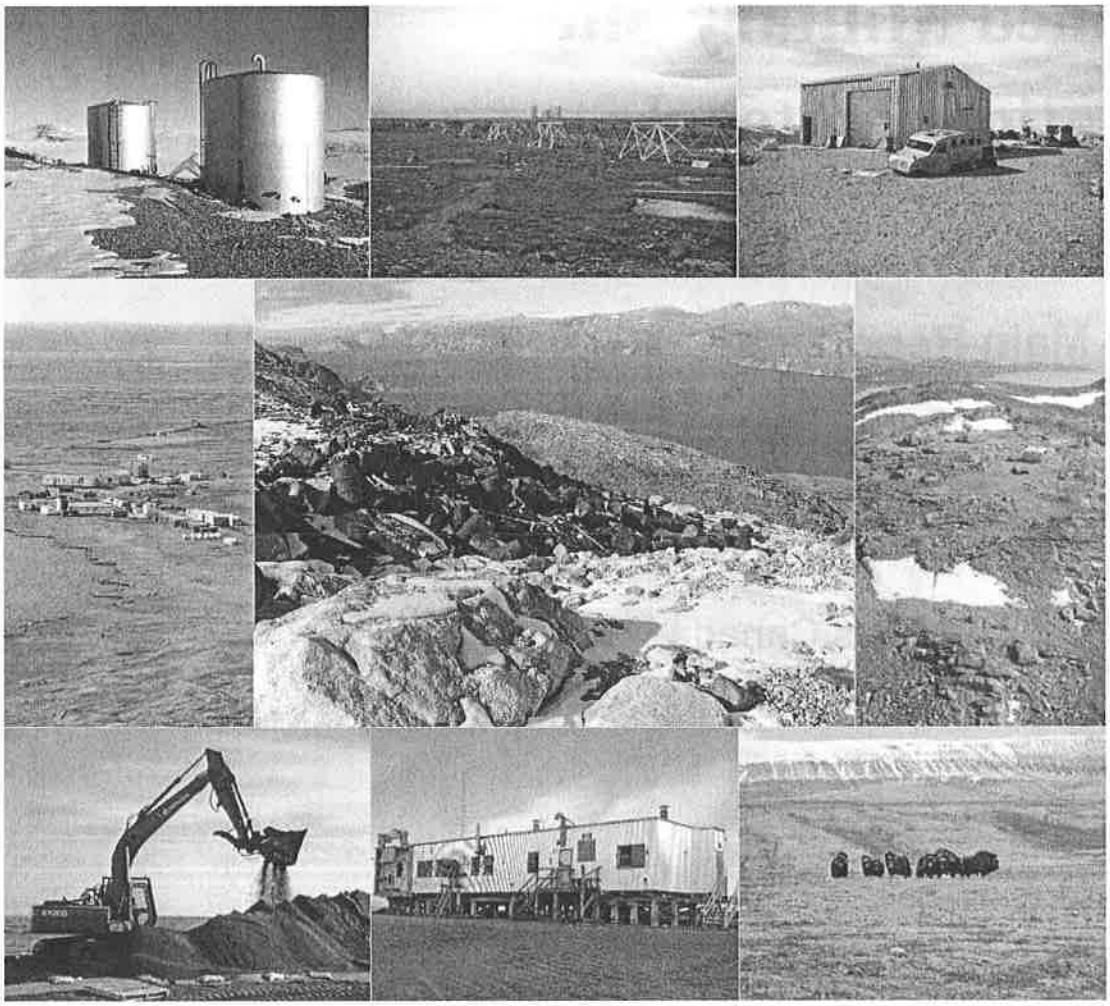
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APPENDIX B

AANDC ABANDONED MILITARY SITE REMEDIATION PROTOCOL

Affaires indiennes et du Nord Canada | Indian and Northern Affairs Canada

Abandoned Military Site Remediation Protocol



Volume I – Main Report

Indian and Northern Affairs Canada
Northern Affairs Organization
Contaminated Sites Program

Final
March 2009

Indian and Northern Affairs Canada
Affaires indiennes et du Nord Canada

Abandoned Military Site Remediation Protocol

Volume I – Main Report

March 2009

Indian and Northern Affairs Canada

ACKNOWLEDGMENTS

This Protocol is an update on the previous Indian and Northern Affairs Canada (INAC) Abandoned Military Site Remediation Protocol, which was produced in 2005. Considerable intellectual effort has gone into the revisions and updates contained in this new Protocol and INAC wishes to recognize and thank the organizations involved in its development.

This document, which is comprised of Volume I (Main Report) and Volume II (Supporting Technical Documentation) is a product of the collaborative efforts by the following organizations:

- Environmental Sciences Group, Royal Military College of Canada
- Golder Associates Ltd.
- EBA Engineering Consultants Ltd.
- UMA Engineering Ltd. (now AECOM)
- Qikiqtaaluk Environmental Inc.
- Jacques Whitford Ltd.
- Dept. of Geological Sciences and Geological Engineering, Queen's University

INAC also wishes to recognize and thank the members of the Technical Advisory Working Group who provided invaluable input to development of this Protocol.

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1 INTRODUCTION

In the 1950s, at the height of the Cold War, a number of facilities were constructed in the Canadian Arctic to provide surveillance of northern approaches to the continent. The largest installation was the Distant Early Warning (DEW) Line, a series of radar stations spanning the northern coastline from Alaska to Greenland. In total, 63 stations were constructed, 42 of which were located in Canada. In 1963, due to advances in technology, installations at 21 of the sites were considered redundant and these sites were abandoned. All buildings, vehicles, Petroleum Oil Lubricant (POL) storage tanks and miscellaneous debris were left in place. Administration of these sites was transferred to Indian and Northern Affairs Canada (INAC) (Fletcher 1989; INAC 2002). Other abandoned military sites include those associated with the Pole Vault line in the eastern Arctic. Locations of INAC military sites in the Canadian Arctic are indicated on Figure 1. The remainder of the installations on the DEW Line continued to operate until the early 1990s, at which point most of them were converted to the North Warning System (NWS). Decommissioning and cleanup of these 21 sites, excluding facilities that are required for the operation of the NWS, is the responsibility of the Department of National Defence (DND).

Several environmental issues were at these abandoned military sites based on previous preliminary and detailed assessments at the INAC and DND sites (ESG 1991, 1993). These issues include physical hazards related to unconsolidated debris and aged structures, and environmental impacts associated with soil contamination. In 1996, DND initiated remediation of the DEW Line sites under its jurisdiction and cleanup of these sites is on going. The cleanup follows the conditions of the DEW Line Cleanup Protocol (ESG, 1993 and ESG/UMA, 1995) and the co-operation agreements between DND and Nunavut Tunngavik Inc. (NTI) (DGE 1998) and DND and the Inuvialuit Regional Corporation (IRC) (DGE 1996).

INAC has completed the remediation of a number of sites across the Canadian Arctic namely Iqaluit Upper Base, Resolution Island (BAF-5), Horton River (BAR-E), Sarcpa Lake (CAM-F), and Pearce Point (PIN-A). The approach adopted for remediation of these sites has generally been consistent with the methodology applied at the DND DEW sites (PWGSC 2001 to 2003). Due to the commitment of the Federal Government to future funding of contaminated site clean up, INAC recognizes the need for a consistent protocol for abandoned military site cleanup (INAC 2002).

A number of factors must be considered when determining the most suitable approach to site remediation for remote sites in the Arctic environment. The Abandoned Military Site Remediation Protocol (AMSRP) is based on an approach that addresses legal requirements, INAC's Contaminated Sites Policy (including risk management requirements), and standard environmental management practices (INAC 2002).

This Protocol also takes into consideration financially prudent methodologies that address environmental issues while striking a balance with remedial cost. An over-arching principle has been to balance the environmental benefits of remediation activities with potential negative physical impacts to the Arctic environment.

The primary objectives of this document are to provide sufficient background information to understand the environmental issues present at these sites, and to describe the guiding principles for their assessment and remediation. AMSRP, Volume 2 (INAC 2009) provides additional supporting technical information.

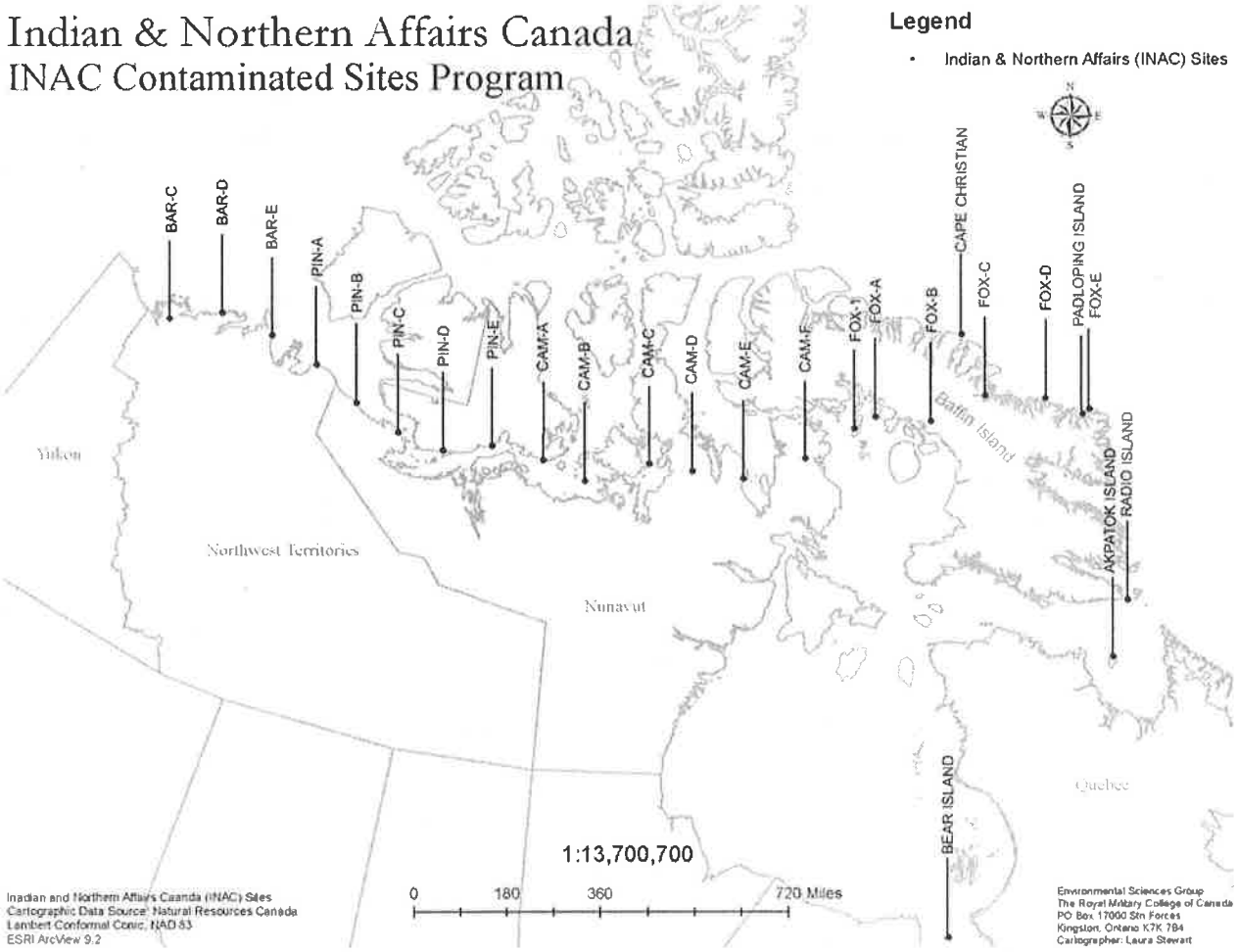


Figure 1 Location of INAC Military Sites

1.1 Scope of Document

This document is structured in a manner generally consistent with the steps outlined in the Federal Contaminated Sites Action Plan (CSM 2000) as shown in Figure 2. As previously indicated, issues of environmental concern have been identified at the INAC DEW Lines (Step 1). Extensive historical data (Steps 2 and 3) from initial environmental assessments, as well as detailed information collected through assessment of DEW sites under the jurisdiction of DND, has been used to develop the requirements for the detailed assessment of the INAC sites (Step 5), as described in Section 4. Guidelines for development of a remediation strategy (Step 7) are provided in Section 5. Implementation related issues, such as confirmatory sampling, waste manifesting, construction quality assurance/quality control measures (Step 9) are described in Section 6. Post-implementation monitoring requirements are described in Section 7 (Step 10).

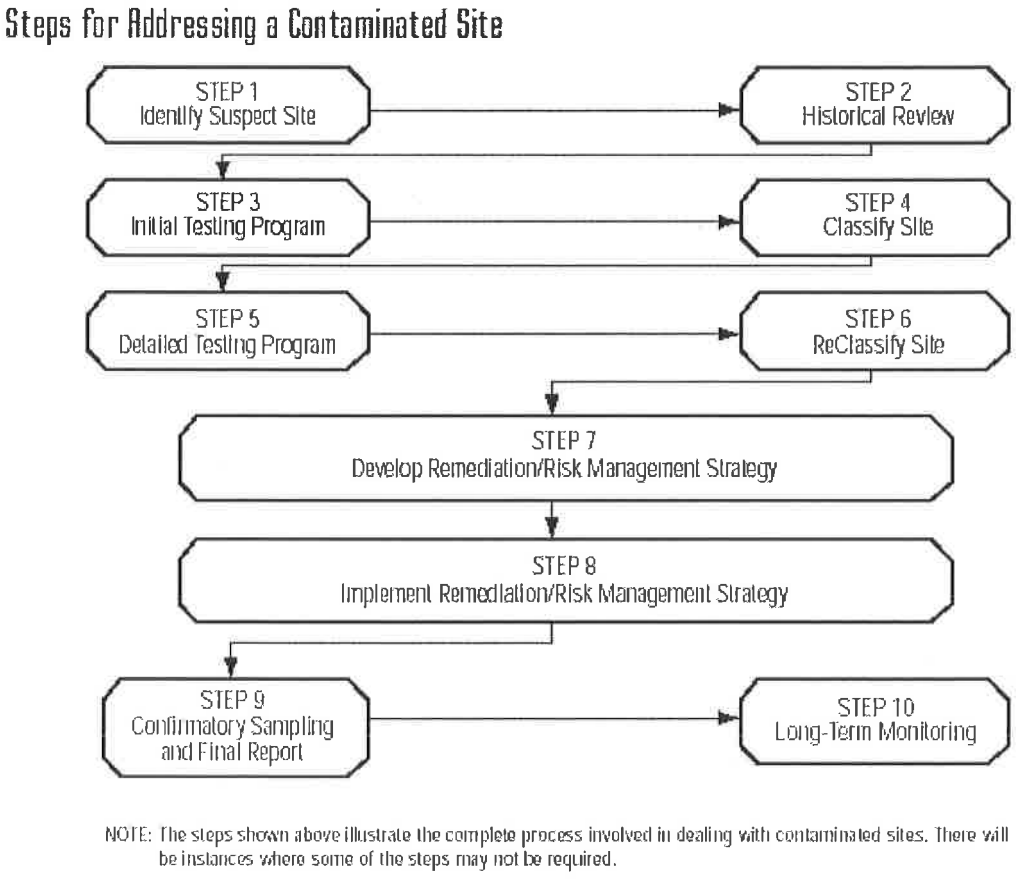


Figure 2 Steps for Addressing a Contaminated Site

2 BACKGROUND

2.1 CCME Environmental Quality Guidelines

Where remediation of federal real property is carried out, departments and agencies are to set remediation objectives in accordance with the most applicable of the three methods developed by the Canadian Council of Ministers of the Environment (CCME) (CCME 1997):

CCME Tier 1: Follow CCME Environmental Quality Guidelines (CCME 1997, 1999), as amended from time to time, and, where applicable, the *Canada-wide Standard for Petroleum Hydrocarbons in Soil* (CCME 2008), as amended from time to time. To the extent that guidelines do not exist for a particular type of contamination, or are technically or economically inappropriate for a particular situation, departments and agencies may follow equivalent guidelines or standards (e.g. provincial);

CCME Tier 2: Follow modified CCME Environmental Quality Guidelines where site conditions, land use, receptors, or exposure pathways differ only slightly from the protocols used in the development of the guidelines; and

CCME Tier 3: Develop site-specific remediation objectives based on a site-specific risk assessment, as outlined by the CCME, or equivalent, where site conditions are unique or particularly sensitive.

Although the CCME Environmental Quality Guidelines are broad in application and address a wide variety of land uses and potential contaminants from diverse sources, they do not specifically address the environmental conditions representative of the Arctic, as discussed in AMSRP Volume 2 (INAC 2009).

2.2 Department of National Defence (DND) DEW Line Cleanup (DLCU) Protocol

The initial environmental assessment of DEW Line sites under the jurisdiction of DND was one of the first major contaminant investigations in the Arctic related to point source contaminants. Following these assessments in the early 1990s, DND developed a remedial protocol in consultation with other government agencies and stakeholders (ESG 1991, 1993), and referred to it as the DEW Line Cleanup (DLCU) Protocol. This Protocol was developed at a time when no remediation standards and criteria specific to the Canadian Arctic existed. The remedial criteria were developed using a contaminant source and pathway targeted approach, consistent with CCME's Tier 3 method. A broad suite of chemicals was investigated and contaminants of concern at DEW Line sites were identified as those contaminants that were consistently elevated relative to the site background levels and the available Canadian federal or provincial guidelines (CCME 1991). The rationale for selection of contaminants of concern is provided in AMSRP Volume 2 (INAC 2009). Engineering input with respect to remediation strategies was used to refine the cleanup protocol (ESG/UMA 1995) prior to its implementation at the first DND sites in 1996.

Cleanup of Arctic sites presents a number of unique challenges, including but not limited to:

- Remote site location, with access limited to sea-lift and small aircraft during the summer months, and over-land during winter;
- Short construction season, typically from July to September, which may limit the technical feasibility of remedial options;
- Lack of centralized waste disposal facilities;
- High costs associated with mobilization of equipment and personnel to the sites, both during the site assessment and remedial phases; and
- Sensitivity of the Arctic ecosystem to changes in physical habitat.

Experience gained since 1996 at the DND sites has been reviewed annually to evaluate lessons learned and to incorporate new information and methodologies as they become available. The DLCU protocol therefore is the culmination of scientific and engineering expertise that has been applied across the Arctic at the DND sites.

Although there are many similarities between INAC and DND DEW sites, the INAC sites were in operation for a significantly shorter period of time, and environmental issues tend to differ in scale. In addition, there may have been other land use subsequent to the DEW Line activities. INAC sites and the associated known land uses are summarized in Table 2.1

Table 2.1 Summary of INAC Military Sites and Historic Land Use

Site Designation/Name	Location	Other Historic Land Use/ or Issues
BAR-C Tununuk Camp	NWT	Imperial Oil as Lessee
BAR-D, Atkinson Point	NWT	Canadian Marine Drilling (CANMAR) Canadian Reindeer Ltd. (note: cleanup on-going)
BAR-E Horton River	NWT	SRR, (note: cleanup completed, monitoring on-going)
PIN-A Pearce Point	NWT	Biological Research Station (note: cleanup completed, monitoring ongoing)
PIN-B Clifton Point	Nunavut/Kitikmeot	
PIN-C Bernard Harbour	Nunavut/Kitikmeot	
PIN-D Ross Point	Nunavut/Kitikmeot	
PIN-E Cape Peel	Nunavut/Kitikmeot	
CAM-A Sturt Point	Nunavut/Kitikmeot	
CAM-B Hat Island	Nunavut/Kitikmeot	Short Range Radar (SRR) as part of North Warning System
CAM-C Matheson Point	Nunavut/Kitikmeot	
CAM-D Simpson Lake	Nunavut/Kitikmeot	SRR (module train dismantled and buried on site)
CAM-E Keith Bay	Nunavut/Qikiqtaaluk	Module train gone/some evidence of burning
CAM-F Sarcpa Lake	Nunavut/ Qikiqtaaluk	Research Station (note: cleanup completed, monitoring ongoing)
FOX-1 Rowley Island	Nunavut/Qikiqtaaluk	SRR (large burn area, module train gone)
FOX-A Bray Island	Nunavut/Qikiqtaaluk	SRR (module train gone)
FOX-B Nudluardjuk Lake	Nunavut/Qikiqtaaluk	SRR (module train gone)
FOX-C Ekalugad Fiord	Nunavut/Qikiqtaaluk	
FOX-D Kivitoo	Nunavut/Qikiqtaaluk	Fire destroyed main building train in 1963
FOX-E Durban Island	Nunavut/Qikiqtaaluk	Partially burned building

Site Designation/Name	Location	Other Historic Land Use/ or Issues
Cape Christian	Nunavut/Qikiqtaaluk	LORAN Site
Padloping Island	Nunavut/Qikiqtaaluk	Navigational aid and weather station
Radio Island	Nunavut/Qikiqtaaluk	Navigational aid and weather station (note: cleanup completed, no monitoring required)
Bear Island	Nunavut/Qikiqtaaluk	Mid-Canada site
BAF-5 Resolution Island	Nunavut/Qikiqtaaluk	Pole-Vault site (note: cleanup completed, monitoring ongoing)
Iqaluit, Upper Base	Nunavut/Qikiqtaaluk	Pole-Vault site (note: cleanup completed, monitoring ongoing)

Cleanup objectives were set for the INAC sites, and the INAC AMSRP was developed as outlined in the following sections.

3 CLEANUP OBJECTIVES

Cleanup objectives, which are consistent with the Federal Contaminated Sites Management Working Group (CSMWG) objective to "integrate sustainable development and pollution prevention principles while meeting environmental regulations and protecting public health" (CSM 2000, TB 1998, 2000, 2002), are as follows:

- To restore sites to meet the environmental objectives established for northern sites;
- To prevent migration of contaminants into the Arctic ecosystem;
- To remove physical hazards for the protection of human health and safety; and
- To implement a cost effective remediation solution.

These objectives are consistent with those applied in the remediation of DEW Line sites under the jurisdiction of DND (DGE 1996, 1998). The following considerations need to be taken into account when developing and implementing a Remedial Action Plan (RAP) for INAC sites:

- Respect all historical agreements and obligations in a fair and reasonable manner;
- Ensure consistency with federal guidelines for management of contaminated sites;
- Apply the Canadian Council of Ministers of the Environment (CCME) environmental protection and management approaches (CCME 1996, 1997, 1999, 2001, 2008) as applicable;
- Apply simple, practical remedial solutions wherever possible, with flexibility as necessary to adjust to site-specific conditions when they are identified;
- Establish cost effective solutions through use of best practices to ensure appropriate levels of environmental protection for all sites;
- Recognize the concerns of climate change in an Arctic setting; and
- Ensure long-term effectiveness of the environmental remedial measures.

It is Canadian government policy that all federal departments and agencies ensure sound environmental stewardship with respect to property in their care by avoiding contamination and managing contaminated sites in a consistent and systematic manner that recognizes the principle of risk management and results in the best value for the Canadian taxpayer (TB 1998, 2000, 2002). The following section identifies the primary factors that have been considered in developing a remediation approach.

3.1 Biophysical Environment

The INAC abandoned military sites are located across the Arctic in the Southern Arctic Ecozone in the western Arctic, in the Northern Arctic Ecozone in the central and eastern Arctic, and the Arctic Cordillera along the east coast of Baffin Island. The majority of the sites are located along the coastline. (Agriculture and Agri-Food Canada, 1996).

Mean annual temperatures are in the range of -11^{0}C in the western Arctic and tend to be colder in the central and eastern Arctic. Accordingly, all sites are located within the zone of continuous permafrost. Much of the Arctic region is classified as polar desert as annual precipitation, predominantly as snow, is generally within the range of 100 to 300 mm. One exception is the eastern coastline of Baffin Island near Cumberland Peninsula, where precipitation can be in the order of 400 to 600 mm annually.

As indicated, the Arctic ecosystem is characterized by extreme environmental conditions, including cold temperatures, large seasonal fluctuations in incoming solar radiation, extensive snow and ice cover, and short growing seasons. These conditions affect the productivity, species diversity, wildlife behaviour (e.g., migration), and food chain characteristics of Arctic ecozones. For example, productivity in terrestrial, freshwater, and marine environments is reduced due to limited nutrient availability, low light, low temperatures, ice cover, and short growing seasons. Compared to most other ecosystems, the Arctic is characterized by relatively low reproduction, organisms that are slower to reach sexual maturity and are generally longer lived, lower species diversity, and distinctive sub-ice biological communities. Relatively short food chains, which are characteristically known for their dominance of marine mammals and birds, are associated with simple predator-prey relationships (e.g. phytoplankton-zooplankton-fish-seal-polar bear or phytoplankton-zooplankton-whale). The combination of all these physical factors affect the sparse distribution and number of Arctic biological communities and makes them very sensitive to physical disturbances such as habitat destruction (AMAP 1998, CACAR 2003).

The assessment and remedial protocols developed are cognizant of striking a balance between the physical disturbances of existing impacted areas versus the physical disturbances of developing new areas required to support remediation activities.

4 ASSESSMENT PROTOCOL

The elements of the assessment protocol have been developed through the review of previous work at related sites (eg. PWGSC 2001a-c, 2002a-f, IEG 2001, EWG 1998, 1999, UMA 1994) and take into consideration information of particular relevance to the unique character of the INAC sites. Typical environmental issues at abandoned military sites include:

- Contaminated soils;
- Existing solid waste disposal areas;
- Debris on surface and in waters near the sites;
- Debris associated with the demolition of structures/facilities; and
- Hazardous waste.

The objective of the environmental assessment of these sites is to collect sufficient information to allow development of a Remedial Action Plan (RAP).

Issues related to implementation, including but not limited to: environmental screening, permitting, and construction, also require information to be collected at the assessment stage. These information requirements can include:

- Geotechnical site information relating to potential development areas for landfills and/or hydrocarbon contaminated soil treatment area, and available borrow sources;
- Site access, such as condition of roadways, the airstrip, barge landing areas, requirements for winter roads or CAT train routes;
- Potable water supply and seasonal fluctuations of potable water supply;
- Siting of camp facilities and temporary storage areas;
- Natural Environment Assessment;
- Traditional Knowledge Surveys/Assessment; and
- Archaeological Assessment.

This section of the protocol provides guidance related to conducting an environmental site assessment that meets the requirements of the INAC cleanup objectives.

4.1 Background Geo-Chemical Assessment

Application of remedial criteria must take into account background concentrations of inorganic elements, as naturally elevated concentrations of a select number of inorganic elements may impact assessment and subsequent remedial activities. High natural variability in concentrations of inorganic elements on a local scale has been observed at several DND DEW Line sites (PIN-1, DYE-M, FOX-2, FOX-3). Based on a desk-top study of the geochemistry and surficial and bedrock geology, a detailed investigation of background concentrations is required in conjunction with the environmental site assessment of the following sites:

- Ross Point (PIN-D)
- Nadluarjuk Lake (FOX-B),
- Kivitoo (FOX-D),
- Durban Island (FOX-E) and
- Padloping Island.

A statistically valid approach must be used to design a sampling program for the collection of representative samples from background areas. Guidance for the background geochemistry investigation is provided in AMSRP Volume 2 (INAC 2009).

4.2 Contaminated Soils

4.2.1 Inorganic Elements and PCBs – DCC Criteria

The contaminants of concern for INAC abandoned military sites, where historic land use is limited to former DEW Line operations, is based on a detailed review of data collected to date from DND and INAC site assessment and delineation programs. The DEW Line Cleanup (DLCU) Protocol, which includes criteria for a specific, limited set of contaminants, is considered appropriate for INAC sites. Supporting documentation for selection of these criteria is provided in AMSRP Volume 2 (INAC 2009).

This provides a consistent approach across all sites, and is generally considered protective of the Arctic ecosystem as described in AMSRP Volume 2 (INAC 2009). Table 4.1 identifies the parameters and criteria.

Table 4.1 DEW Line Cleanup Criteria (DCC) for Soil[a]

Parameter in Soil	CRITERIA[b] mg/kg	
Inorganic Elements	*DCC Tier I [c]*	*DCC Tier II[d]*
Arsenic (As)		30
Cadmium		5.0
Chromium		250
Cobalt		50
Copper		100
Lead	200	500
Mercury		2.0
Nickel		100
Zinc		500
Polychlorinated biphenyls		
PCBs	*1.0*	*5.0*

a. These criteria were adopted specifically for the cleanup of Arctic DEW Line Sites from the 1991 versions of the Quebec Soil Contamination Indicators and the Canadian Council of Ministers of the Environment Interim Canadian Environmental Criteria for Contaminated Sites. They were validated by an assessment of the soil concentration at which the substance was taken up by vascular plants and thereby constituted an input to the Arctic ecosystem.

b. Soil criteria are given in parts per million, ppm.

c. Soils containing lead and/or PCBs at concentrations in excess of DCC Tier I, but less than DCC Tier II, may be landfilled in a Non-Hazardous Waste Landfill,

d. Soils containing one or more substrates in excess of DCC Tier II are to be treated/disposed of in a manner that precludes contact with the Arctic ecosystem.

A review of data collected on INAC sites with land use other than DEW Line activities indicated that the likelihood of other parameters occurring systematically at concentrations exceeding applicable criteria in the absence of other contaminants of concern is low (AMSRP Volume 2 (INAC 2009)).

Based on historic patterns of waste disposal and contamination observed at other abandoned military sites, soils contaminated in excess of the DCC criteria are typically found in the following locations:

- In the vicinity of buildings;
- Former sewage discharge areas;
- Former open storage areas;
- Where surface debris is present;
- Solid waste disposal areas; and
- Petroleum, Oil, Lubricant (POL) bulk storage areas and along fuel lines and transfer locations.

Delineation of the lateral extent and depth of contamination is required to determine quantities of sufficient accuracy to develop a RAP and the subsequent Contractual Drawings and Specifications. A detailed sampling plan shall be developed for each potential area of concern identified as part of historic review, and shall include the following information:

- Description of the objective for each potential area of concern;
- Sampling locations;
- Sampling methodology;
- Proposed number of samples and media;
- Parameters for analyses; and
- Analytical requirements and Quality Assurance/Quality Control measures.

Delineation shall be achieved by sampling in a grid pattern over the affected area. The estimated size of the area determines the grid spacing: the larger the estimated area, the larger the grid spacing. Test pits shall be excavated to determine the depth of contamination. Test pits shall also be excavated outside the area of surface contamination to evaluate whether sub-surface migration of contaminants has occurred. Greater sample density may be warranted based on site specific conditions, particularly in areas where soils contaminated with PCB concentrations in excess of 50 ppm are suspected; such as near buildings where electrical transformers were housed, vehicle maintenance structures, and near exit doors of facilities. It is recommended that a reasonable degree of over-sampling and an iterative approach to analyses be employed to provide greater confidence that closure is achieved during the assessment phase, recognizing that the cost of analyses is only a fraction of disposal costs.

Additional samples shall be collected and analysed to determine transport and disposal requirements should off-site disposal of contaminated soils be required.

4.2.2 Hydrocarbon Contaminated Soils

Where free product is encountered, the free phase liquid will be addressed prior to the application of a qualitative risk assessment method for establishing remediation requirements.

A review of the assumptions used for the derivation of the CCME CWS for Petroleum Hydrocarbons (PHC) as well as the need to minimize physical disturbance suggests that direct application of criteria for the protection of all receptors may not be appropriate at the INAC sites AMSRP Volume 2 (INAC 2009). A revised set of criteria are provided in Table 4.2. These criteria incorporate the CWS PHC as appropriate, as well as previous quantitative risk assessment results. Two classes of hydrocarbons were identified, Type A – non-mobile, and Type B – mobile. Type A refers to heavy end products, such as lubricating oils, and are easily differentiated by dark staining. Relative to the CWS PHC, Type A consists of the sum of F3 and F4 constituents. Type B includes lighter end or more volatile hydrocarbon products such as MoGas, jet fuel and diesel, and is approximately equal to the sum of the F1 through F3 fractions. When all four fractions are present, the dominant hydrocarbon type is defined by the percentage of the sum of F3 and F4, relative to the sum of F1 to F4 (total TPH). For Type A contaminated soil, the sum of F3 plus F4 must be greater than 70% of the total TPH concentration **and** the F2 concentration must be less than the F4 concentration.

Table 4.2 Remedial Objectives – Hydrocarbon Contaminated Soil – INAC Abandoned Military Sites

Exposure Pathway	F1	F2	F3	F4	Type B Hydrocarbon Contamination	Type A Hydrocarbon Concentration
Protection of Freshwater Aquatic Life[(a)]	1290[(a)]	330[(a)]	NA	NA	330[(a)]	NA
Direct Soil Eco-Contact	Not utilized – See AMSRP Volume 2 (INAC 2009)					
Protection of Terrestrial Wildlife					2500[(b)]	
Human Health		11000	20000			20,000
Management Limit					5000[(c)]	

Notes:

(a) Within 30 m of a water body

(b) For surface soils to 0.5 metres depth.

(c) Below 0.5 m depth, a value of 5000 mg/kg may be applied based on professional judgement.

Based on historic patterns of contamination observed at other abandoned military sites, soils contaminated with hydrocarbons are typically found in the following locations:

- In the vicinity of buildings near fuel distribution lines, fuel dispensing tanks;
- Former open storage areas and/or debris areas where barrels may be present;
- Petroleum, Oil, Lubricant (POL) bulk storage areas; and
- Solid waste disposal areas.

Delineation of the lateral extent and depth of contamination is required to determine quantities of sufficient accuracy to develop a RAP and the subsequent Contractual Drawings and Specifications. A detailed sampling plan shall be developed for each potential area of concern identified as part of historic review, and must include the following information:

- Description of the objective for each potential area of concern;
- Sampling locations;
- Proposed sampling methods for shallow and depth samples, where the depth sampling should achieve a depth consistent with the estimated active layer thickness;
- Proposed number of samples and media;
- Parameters for analyses in accordance with Table 4.2;
- Sampling methodology, analytical requirements, Quality Assurance/Quality Control measures.

At minimum, the information requirements as outlined in Table 4.2 shall be incorporated into the Sampling Plan.

Table 4.3 Hydrocarbon Contaminated Soil Information Requirements

Item	Comments
Hydrocarbon Contaminated Soils – Stained Soils (F3/F4 fraction) – Type A	
Areal Extent -Visible surface staining	Topographic survey and location/coordinates of stained areas and sample locations Provide sketches with measurements
Topography	Examine for evidence of erosion (drainage channels)
Soil Description	Include description of grain size distribution, well graded or poorly graded. Fine grained, coarse grained, maximum particle size
Sampling	Collect soil samples for analyses of F1 to F4 fractions to characterize contamination, analyses for presence of co-contaminants such as PCBs.
Confirm Depth of Staining	Testpit to extent of stain, collect soil sample for PHC analyses at 0.5 m depth.
In areas of multiple staining	Identify and survey extent of stains Collect individual samples from most visibly stained areas to represent "worst" case. Focus on stained areas larger than 4 m^2
Evidence of residual or free product	
Hydrocarbon Contaminated Soils – Near Fuel Storage, Distribution or Dispensing Areas (F1-F3 fraction) Type B	
Within 30 m of water body supporting aquatic life	
Describe surrounding environment	Consulting locals and elders who use the area may prove to be useful.
Sampling – Hydrocarbons	Delineate **laterally and at depth** to 330 mg/kg as per on-site analytical capabilities Collect sufficient samples for laboratory analyses of hydrocarbon fractions to confirm correlation with on-site analytical results. Over-sampling (within reason) and iterative analyses may be required where there is poor correlation with test-kits (organic materials)
Sample groundwater in testpit excavation in source zone.	Collect groundwater samples and analyze for dissolved hydrocarbons (F1, F2) and wastewater discharge criteria (Section 6). Measure water levels, and presence of free product, if applicable

Item	Comments
Greater than 30 m distant of water body supporting aquatic life	
Sampling – Hydrocarbons	Delineate **laterally and at depth** to 2500 mg/kg as per on-site analytical capabilities. Collect sufficient samples for laboratory analyses of hydrocarbon fractions to confirm correlation with on-site analytical results For the purposes of comparison, use the summation of F1 to F3 concentrations.
Collect soil samples for grain size distribution	Representative samples should be taken of soils within and downgradient of the source zone for determination of grain size distribution, and water content.
All Hydrocarbon Contaminated Soil Areas	
Topography	Survey sample locations and topography of source zone and surrounding area. Include min. 25 m buffer zone around contaminated areas. Document seepage zones (toe of embankments), if applicable. Evidence of erosion
Evidence of impacted vegetation	Note presence and extent of vegetation; identify areas of stressed vegetation if applicable.
Wildlife	Note presence or evidence of wildlife (nests, burrows, etc.) within impacted and surrounding area. Review in context with overall Natural Environment Survey (Section 4.9)

Additional representative samples shall be collected and analysed to assist in the determination of treatment requirements. Samples should be collected from areas representing the largest contributions to the PHC contaminated soil volumes (such as bulk fuel storage areas). These analyses include, but are not limited to:

- Water content
- Total Available Nutrients; Total Organic Carbon
- Treatability tests to assess bioremediation potential (bacterial counts, hydrocarbon degraders).

4.3 Solid Waste Disposal Areas

Solid Waste Disposal Areas (WDA) on INAC abandoned military sites are generally smaller in extent than those located on DND DEW Line sites, and may be more appropriately referred to as buried debris areas or dump sites. As part of the historic review, areas of ground disturbance/landfill activity will be identified for further investigation. A detailed investigation/sampling plan shall be developed for each area, and must include the following information:

- Description of the objective for each potential area of concern
- Methodology for determining extent of buried debris using non-intrusive geophysical surveys, such as Electro-Magnetic Surveys (EM) or Ground Penetrating Radar (GPR), and associated ground-truthing. The consultant is to indicate the type of geophysical survey to be used based on anticipated ground conditions. In general, a grid-survey pattern shall be used that provides adequate coverage of the area. Identification of areas of surface debris within the geophysical survey area is required to allow correlation with geophysical survey results. All geophysical surveys must be referenced to a UTM coordinate system.
- Identification of sampling locations both up- and down-gradient of the landfill, debris area or dump site.
- Proposed sampling methods for shallow and depth samples, where depth sampling should achieve a depth consistent with the estimated active layer thickness.
- Proposed number of samples and media.
- Parameters for analyses.
- Sampling methodology, analytical requirements, and Quality Assurance/Quality Control measures.

In addition, general site information shall be collected as outlined in Section 4.9 and 4.10, as well as specific information for each WDA as described below to support the evaluation of the potential environmental risk associated with the WDA (Annex A).

Physical Characteristics:

Areal Extent of WDA Extent

Depth of Buried Debris, as applicable

Contaminant Characterization (concentrations/extent)

Volume and extent of exposed debris, where exposed debris is defined as surface and/or partially buried debris within 0.5 meters of the surface.

Pathway/Transport Mechanisms

Surface expressions of contaminated soil and/or leachate.

Grades/Topography

Surface cover materials type and depth

Evidence of erosion

Precipitation

Distance to downgradient perennial surface water bodies

Receptor Characteristics

Distance to freshwater/marine habitat and habitat usage.

Terrestrial Habitat

Traditional Land Use

Minor modifications to the evaluation matrix prepared by the DND/NTI Environmental Working Group (EWG 1998) will be used for the assessment of potential environmental risk (Annex A). These modifications included:

- Addressing remedial requirements for dump sites and debris areas (generally smaller in size than landfills)
- Modifying contaminant characterization to include leachate migration and the presence of contaminants as one category.
- Including consideration of snow pack as well as annual precipitation.

Additional detail regarding the evaluation of WDAs is provided in Annex A.

4.4 Surface Debris

Surface debris is present on many of the sites, and may consist of a variety of waste materials including:

- Scrap metal and wood wastes (painted/unpainted);
- Barrels, potentially containing product; and
- Asbestos, batteries, and electrical equipment.

All areas of debris shall be inventoried to the extent possible to provide volume estimates and characterization of waste materials. Site debris shall be classified as inert, non-hazardous wastes or hazardous wastes in accordance with the following Acts and Regulations.

- Federal Transportation of Dangerous Goods Act and Regulations
- The Canadian Environmental Protection Act
- The Nunavut or Northwest Territories Environmental Protection Act

The number of barrels containing product shall be inventoried where it is safe to do so. However, it is impractical to sample and analyse contents of all barrels on site during the assessment phase. To provide information required for the Remedial Action Plan, a statistically relevant number of barrels shall be sampled and analysed. The actual number of barrels sampled will depend on the total number of barrels at the site, and should be determined using professional judgement. Samples will be analysed for parameters in accordance with the barrel protocol, and as summarized below:

Organic Phase: Total Chlorine, PCBs, Cadmium, Chromium, Lead

Aqueous Phase: % Alcohols and Glycols, Total Chlorine, Cadmium, Chromium, Lead

If the aqueous phase is less than 2% alcohols or glycols, water shall be analysed in accordance with waste water discharge criteria. Annex B provides further information on the Barrel Protocol.

4.5 Submerged Debris

Debris may be present in the near shore marine environment and/or lakes that are present on the site. Observations of debris in water shall be recorded to the extent possible and supplemented with local and anecdotal knowledge. Previous studies have confirmed that such debris is primarily a risk to navigation in shallow waters (AMSRP Volume 2 (INAC 2009)).

4.6 Buildings/Structure Inventory

Existing buildings and infrastructure at a site will be demolished down to their foundations as part of the cleanup. To assist in the development of the RAP, an inventory of building contents, foundation construction materials and details, and building/structure construction materials and dimensions are required. Building contents, where present, shall be inventoried and classified as non-hazardous or hazardous wastes. Hazardous building materials may include, but not be limited to: PCB and lead-amended paint, asbestos containing materials (ACMs), fluorescent lights, and mercury containing switches.

Painted building materials shall be tested for total lead and PCBs, and leachable lead and PCBs in order to determine disposal requirements. The thickness and density of the paint and substrate material shall be recorded as it may be required to calculate total PCB concentrations. Samples of concrete, excluding paint, shall be collected and analysed for PCBs. The locations and number of samples are to be determined in the field. Samples should be collected from both stained and non-stained areas on concrete on surface and at depth. Over-sampling and iterative analyses is recommended. As part of the assessment, a detailed waste inventory shall be prepared that includes: dimensions, building materials, foundation materials (concrete slab, timber piles, timber crib), estimated volume and mass of wastes, and the basis of any assumptions used in the estimate. Painted materials must be specifically identified and the extent of paint coverage and adherence quantified.

4.7 Geotechnical Requirements

4.7.1 Potential Development Areas

New engineered landfills and hydrocarbon treatment areas may be required during cleanup. Potential locations shall be identified and surveyed during the site assessment phase. Guidelines for the siting of potential development areas include:

- Avoidance of permafrost sensitive areas, vegetated areas and archaeological features.
- Avoidance of contaminated areas.
- Maintain a distance of 300 m or more from downgradient permanent water features.
- Locate at elevations greater than 2 metres above sea level or storm surge level
- Ground surface topography with grades of 6% or less.
- Proximity to borrow sources, waste materials.

The INAC sites are all located within the zone of continuous permafrost. The sensitivity of permafrost to climate warming consists of two components, the thermal response to warming and the impact of thaw (physical response) (Smith, Burgess, 2004) as cited in AMSRP Volume 2 (INAC 2009). The physical response of the terrain to permafrost degradation is mainly dependent on the ice content of the frozen material (Dyke et al., 1997). Warming of ice-rich perennially frozen ground would eventually lead to its thawing and the resultant thaw settlement, slope instability, thaw slumping, thermokarst, and other permafrost degradation-related processes. Excess ground ice can be identified by landforms at surface, such as patterned ground. An evaluation of the potential for impacts due to climate change is provided in AMSRP Volume 2 (INAC 2009).

Potential development areas shall be surveyed to provide detailed topographic information to allow generation of ground contours. A buffer zone of a minimum of 50 m should be surveyed around all proposed development areas. In previously disturbed areas, soil sampling and analyses shall be carried out to confirm or disprove the presence of any historic contamination using a targeted approach. Additional sampling should be carried out over a grid with spacing of approximately 50 m x 50 m.

4.7.2 Borrow Sources

During cleanup, borrow material is required for construction of new landfills, development of treatment areas, backfilling of contaminated soil excavation, closure of existing landfills, general regrading and for road construction/maintenance.

Available existing sources of borrow material should be exhausted before exploiting new areas. Areas of excess ground ice or of biophysical significance (denning/nesting areas) are to be avoided. Use of abandoned gravel pads and road infrastructure as granular source material is preferable, wherever possible. Existing gravel pads shall be screened for the presence of contaminants during the assessment phase.

Borrow sources shall be identified and characterized and estimated quantities developed. Test-pits shall be excavated to confirm subsurface stratigraphy, seepage, depth to permafrost table or bedrock, and ground ice conditions. Select soil samples shall be retained for geotechnical laboratory testing to assist in the development of Specifications. Testing shall include, but not be limited to: water content, grain size distribution, and moisture density relationships. At sites where background inorganic element concentrations are elevated, additional samples shall be collected for geo-chemical characterization of the borrow material.

4.7.3 Site Access

Access to the sites is typically by barge/ship and aircraft and on site by existing access roads. A limited number of sites are land-locked. Use of the airstrip is essential to mobilize materials and equipment required for site activities. An inspection and sampling of the airstrip fill materials shall be completed during the assessment phase to determine the load capacity to support a variety of aircraft. Drainage and erosion features shall be documented in order to assess the useable length, and/or upgrading requirements.

Investigation of potential CAT Train and/or other equipment mobilization options shall be investigated for the mobilization of heavy equipment. Construction records for Short Range Radar (SRR) sites located in the vicinity may be available as reference. Suitability of the beach for barge landing/sea lift access shall also be assessed. Local knowledge and Traditional Knowledge (TK) may prove useful in evaluating potential CAT train routes as well as suitable barge landing sites.

Helicopter landing pads, associated with Short Range Radar sites, are within the DND reserve. Only a non-intrusive visual inspection should be carried out to document the physical status of these areas.

4.7.4 Siting of Camp Facilities and Temporary Storage areas.

Laydown areas are required for temporary camp structures, equipment and storage during the cleanup. Potential locations shall be identified during the site assessment phase. Where possible, these will be located in previously disturbed areas such as borrow or storage areas, to minimize any new disturbances.

4.8 Potable Water Supply

A suitable drinking water supply shall be identified during the site assessment phase. A qualitative assessment of the flow rates (as applicable) shall be made at the time of the site assessment, as flow will vary throughout the season, with higher flows typically in spring run-off. Identifying the high water mark, and estimating depth of the stream/lake, as applicable, will aid in this evaluation. The Contractor will be advised that water withdrawal rates may not exceed 10% of the flow volume or 10% of the water volume in a lake, and to modify consumption as appropriate. Water samples shall be collected and analysed for criteria in accordance with the latest edition of the CCME Guidelines for Drinking Water Quality.

4.9 Natural Environment Assessment

A thorough assessment of the natural environment of the site and surrounding area shall be conducted as part of the detailed environmental site assessment. This assessment shall be carried out mainly by a biologist with input from a local community representative, where appropriate. This study shall consist of describing the regional and local setting, local ecosystems, species assemblage as well as potential impacts to vegetation and wildlife from cleanup activities and proposed mitigation measures. Additional information requirements are outlined in the following subsections.

4.9.1 Regional and Local Setting

The report should address the following information requirements.

- Location (site coordinates, main natural and man-made features present);
- Ecosetting (ecozones and ecoregions);
- Climate (mean temperature and precipitation data);
- Vegetation;
- Landforms and soils (main land features, soil types, general topography); and
- Human usage and disturbance (TK input will be valuable to assess human usage of the area).

4.9.2 Local Ecosystems

This subsection should describe 1) the various inland ecosystems; 2) the ecosystems present in the former operational areas (*i.e.,* disturbed areas and areas with infrastructure); as well as, if applicable, 3) the shore/coastline ecosystem; and the 4) open ocean ecosystem.

Each identified ecosystem should be described in terms of the various terrestrial and freshwater habitats, the vegetation and wildlife species present in those habitats, as well as past and current impacts and disturbances to habitats. Local and traditional knowledge from people who use these areas for hunting and fishing may provide useful information on plant and wildlife species present as well as ecosystem health.

4.9.3 Species Assemblage

This subsection should describe the various species at risk (*i.e.,* extirpated, endangered, threatened, or special concern) according to the Species at Risk Act (SARA) that occur in the general vicinity of the site, as well as any migratory species that known to breed or nest in the area (Migratory Birds Convention Act).

All species (*i.e.,* birds, mammals, fish, and plants) observed or known to use the site and surrounding areas should be documented. Observations should be described in terms of numbers and behaviour during sighting (*e.g.,* migrating, nesting/breeding, feeding, etc.). Species not observed on site but known to use the area may be documented by consulting local community representatives as well as various studies and reports.

4.9.4 Impacts and Mitigation

Potential impacts to vegetation and wildlife from site investigation and remediation activities should be clearly identified. Proposed constraints and other recommendations should also be presented as part of the Natural Environment Assessment, in order to incorporate these requirements into the Environmental Protection Plan.

4.10 Traditional Knowledge Surveys/Assessment

Traditional Knowledge (TK) forms an integral part of the development of the RAP. Incorporating TK during the assessment phase can provide guidance on targeting specific areas of concern to local residents. Qualitative knowledge provided by local residents can be used to complement and enhance the largely quantitative information provided by the physical studies completed.

TK can be efficiently obtained through a local community representative (*i.e.,* local TK consultant) who can liaise between the Consultant and various TK holders in the community. The local TK consultant may either be an Elder or someone else who knows the site well (*e.g.,* hunter, ranger). The ideal local TK consultant possesses some TK, but more importantly knows who to consult in the community to obtain relevant site information and TK.

4.10.1 Typical TK and Local Knowledge

TK may be grouped into four main categories:

1. Historical and Archaeological Features
2. Wildlife Use
3. Land Use
4. Site Specific Information

Historical and archaeological features provide information on traditional land use of the area. These features, often hidden from the untrained eye, will be identified by local TK holders as to their use and relative age, and can complement the work of the archaeological assessment.

Wildlife use of the land in and around the site includes migration routes, mating and calving grounds, as well as summer and winter-feeding areas of large land mammals. Nesting, moulting, and summer feeding grounds of migratory birds such as geese and ducks, as well as migration routes and feeding areas of sea mammals must also be identified.

Land use relates to traditional usage of the land and sea for hunting, fishing, camping, and harvesting products on land (*e.g.,* berries, eggs, medicine, tea, drinking water), and harvesting of sea products (*e.g.,* clams, kelp).

Site-specific information about the military site while it was under construction or in operation, including events (spills, accidents), waste management practices (storage, dumping), as well as natural occurrences, should also be documented.

4.11 Archaeological Assessment

The overall purpose of the archaeological assessment is to obtain the necessary archaeological regulatory approval at the assessment stage as required to implement the remediation program. The scope of the archaeological assessment shall include:

- Preparation and submission of permit applications to the Department of Culture, Language, Elders and Youth (Nunavut) or the Prince of Wales Northern Heritage Centre (NWT).
- Completion of an Overview for each site, which would include file searches to determine the number, nature and terrain associations of previously recorded sites.
- Completion of a field inventory and assessment of each site;
- Completion of a heritage features or structures evaluation for consideration of heritage value;
- Provision of a heritage resource impact assessment for each site
- Implementation of more detailed investigations at key sites and appropriate mitigation at significant sites affected by proposed projects (if required); and
- Preparation of a final permit report for each site and, if required, provides a summary of these results suitable for inclusion in a screening document.

Areas of high and moderate archaeological potential for containing cultural material will require detailed examination during the assessment phase, to ensure the protection and if required, development of mitigation measures to be implemented prior to or during cleanup.

5 REMEDIATION PROTOCOL

The elements of the remediation protocol have been developed through the review of previous work at related sites by DND and INAC, and take into consideration information of particular relevance to the unique character of the INAC sites.

The primary components of cleanup on the INAC abandoned military sites include:

- Treatment/Disposal of Contaminated Soil
- Disposal of Debris/Demolition Waste
- Closure of Existing Solid Waste Disposal Areas
- Construction of New Landfills
- Development of Borrow Sources and Site Grading Activities

The goals of a RAP are to provide the foundation for development of a cleanup design that will reduce the environmental liabilities present at the site, maximize benefits to local communities and provide good value to the Crown. More specifically, the RAP is to identify and evaluate options applicable to the treatment and/or disposal of waste materials present at a site. These waste materials typically include:

- Soil contaminated with inorganic elements, PCBs and/or petroleum hydrocarbons;
- Non-hazardous and hazardous wastes associated with building/facility demolition;
- Visible/accessible debris including barrel contents; and
- Buried debris/landfills as identified by geophysical surveys

The estimated volume of waste materials in each stream shall be determined and options evaluated on the basis of effectiveness to reduce and/or mitigate environmental risks in the short and long term, long term liability or residual risks, relative costs, monitoring costs and community acceptance. The costs associated with implementing remedial solutions include, but are not limited to: resources, such as materials, equipment, and personnel, and site logistics. Mobilization and site access constitute a significant cost for remote site cleanups, and can have significant impact on selection of the preferred remedial option. The evaluations shall be summarized and preferred remedial options identified for each waste stream. Options shall be integrated to finalize the recommended approach for site remediation.

During remediation planning public community consultations are conducted in surrounding communities to obtain feedback on the draft RAP.

5.1 Contaminated Soils

Contaminated soils are considered in three primary categories: soils that are regulated; soils classified as hazardous; and, soils classified as contaminated but not hazardous waste. Contaminated soils that are regulated shall be remediated and/or disposed of in compliance with the applicable regulations. Hazardous contaminated soils are defined as those that exceed criteria as provided in the Transportation of Dangerous Goods Act and Regulations. Contaminated soils that are not regulated or hazardous shall be excavated to the depth and extent to meet the DCC (see section 4.2.1) or PHC remedial targets (Section 4.2.2).

Three primary contaminated soil types have been identified; inorganic element contaminated soil, PCB contaminated soil and hydrocarbon contaminated soil. Where multiple contaminants are present in the soils, the most conservative remedial option that addresses all contaminant types shall be applied. A summary of remedial options for contaminated soils is presented in Table 5.1.

Table 5.1 Summary of Remedial Options – Contaminated Soil

Contaminated Soil	Remedial Options
DCC Tier I	▪ Excavate and place in an on-site engineered landfill or ▪ Cap in place under 0.3 m of clean fill if in a stable location
DCC Tier II	• Excavate and dispose of in an on-site Tier II facility or • Containerize for off-site disposal[1]
Inorganic Elements Leaching	• Transport in accordance with the TDGA for disposal at an off-site facility
PCB Contaminated Soil in excess of CEPA	• Store in accordance with PCB Regulations pending a decision regarding disposal
Type A TPH (Non-Mobile Hydrocarbon Contaminated Soil)	• Excavate and place in an on-site engineered landfill or • Scarify surficial stains that meet PHC criteria.
DCC Tier I -Type A TPH	• Excavate and place in an on-site engineered landfill or • Cap in place under 0.3 m of clean fill if in a stable location
DCC Tier II -Type A TPH	• Excavate and place in an on-site Tier II disposal facility or • Containerize for off-site disposal[1]
Type B TPH (Mobile Hydrocarbon Contaminated Soil)	• *In-situ* or *ex-situ* treatment to reduce environmental risk to meet guidelines
DCC Tier I -Type B TPH	• Ex-situ treatment to meet guidelines and place in an on-site engineered landfill or cap under 0.3 m of clean fill in a stable location after treatment. • Small areas of contamination may be excavated and disposed of in a Tier II disposal facility
DCC Tier II -Type B TPH	• Excavate and place in an on-site Tier II Facility or • Containerize for off-site disposal[1]
Hazardous Soil	• Dispose in compliance with applicable regulations

[1] Decision of whether to dispose of on or off-site is based on cost –benefit analyses (see Section 5.4.2).

5.2 Debris – Site Debris and Demolition Wastes

Site debris shall be collected and segregated into hazardous and non-hazardous waste streams for disposal:

Non hazardous waste: The volume of the non-hazardous materials shall be minimized through crushing, shredding, or incineration, prior to placement in an on-site engineered landfill. If there is no existing landfill on-site, and no suitable location for a new engineered landfill, non-hazardous materials shall be disposed of off-site; and

Hazardous waste: These materials shall be disposed of off-site, in accordance with the current regulations governing the handling and disposal of hazardous materials.

Hazardous materials referred to in this section are defined as any materials, which are, designated "hazardous" or "dangerous goods" under Territorial or Federal legislation. Generally, all hazardous materials identified at the site shall be collected and transported off site, in accordance with the Transportation of Dangerous Goods Act (TC 2002), to a licensed hazardous waste disposal facility.

Hazardous materials that are typical of abandoned military sites and require special consideration include the following:

PCB Contaminated Concrete: Concrete (excluding paint) with PCB concentrations in excess of 50 ppm is regulated under the CEPA, and shall be collected and transported off-site, in accordance with the Transportation of Dangerous Goods Act and CEPA to a licensed hazardous waste disposal facility.

PCB Paint on Building Components: PCB paint and PCB painted components that are regulated under the CEPA, shall be collected and transported off site, in accordance with the Transportation of Dangerous Goods Act and CEPA, to a licensed hazardous waste disposal facility. The thickness and density of the paint and substrate material shall be recorded as it may be required to calculate total PCB concentrations. Loose paint materials/paint chips are regulated under CEPA when PCB concentrations in the paint are greater than 50 ppm.

Lead-Based Paint on Building Components: Lead-based painted components that are classified as hazardous material shall be collected and transported off site, in accordance with the Transportation of Dangerous Goods Act to a licensed hazardous waste disposal facility. Painted components that exceed the relevant federal or Territorial criteria but are not considered hazardous shall be collected and disposed in an on-site engineered landfill. Lead-based painted materials are considered hazardous when the lead leachate concentrations from a test of the component (paint and substrate) exceed 5 mg/L or the concentration as provided in the latest schedule of the TDGA. Additional discussion related to the classification of painted material is provided in AMSRP Volume 2, (INAC 2009).

There are also a few exceptions, which are described below:

Asbestos: Asbestos waste shall be collected, double bagged and disposed of in an on-site engineered landfill, in accordance with the appropriate legislation. Where no on-site facility is available, asbestos waste shall be shipped off-site for disposal. Where asbestos materials are painted, disposal requirements are based on paint analyses.

Petroleum Products: Petroleum products, such as gasoline or diesel, which do not contain other hazardous products (chlorine, PCB, metals, etc.) will be incinerated on-site under appropriate emissions controls. Heavier petroleum products such as lubricating oil will be disposed of off-site or mixed with lighter petroleum products and incinerated on-site under appropriate emissions controls in accordance with the Barrel Protocol provided in Annex B.

Compressed Gas Cylinders: Compressed gas cylinders with known contents shall be vented. Once empty, the metal cylinder shall be disposed on-site in an engineered landfill. Where no on-site facility is available, compressed gas cylinders shall be shipped off-site for disposal.

Creosote Treated Timbers: Timbers shall be wrapped in polyethylene sheets and disposed on-site in an engineered landfill. Where no on-site facility is available, creosote treated timbers shall be shipped off-site for disposal.

5.2.1 Submerged Debris

Submerged debris shall be removed from the near-shore environment to a depth of 2 metres or 30 metres off-shore, whichever is encountered first. Work in marine and freshwater environments shall be in accordance with all stipulations as provided by the Department of Fisheries and Oceans. Debris, once removed, shall be classified as hazardous or non-hazardous and disposed of as indicated in the previous sub-section.

5.2.2 Barrels

Barrels shall be handled according to the Barrel Protocol (Annex B) and as outlined below:

Empty Barrels: Empty barrels shall be crushed and disposed in an on-site engineered landfill;

Filled or Partially Filled Barrels: Barrel contents shall be inspected and tested if necessary and disposed of appropriately (off-site or incinerated). The empty barrel shall be rinsed, crushed and disposed on-site in an engineered landfill. The spent rinse liquid shall be tested and disposed of appropriately. Absorbent materials used as part of this process shall be incinerated if incineration criteria are met, or disposed of as hazardous material, as required; and

Buried Empty Barrels: Areas containing buried empty barrels will be inspected to determine if any of the barrels contain material and characterized through a geophysical survey. If the barrels are found to be empty, the area will be stabilized through compaction to crush any corroded barrels, if the area is deemed suitable from a geotechnical perspective. A cover of borrow material shall be placed over the area and compacted.

The criteria used to determine the acceptability of product for on-site incineration are summarized in Table 5.2 as follows:

Table 5.2 Barrel Protocol Criteria and Disposal Summary

Phase	% Alcohol or Glycols	PCBs	Chlorine ppm	Cadmium ppm	Chromium ppm	Lead ppm	Disposal
Organic		<2	<1000	<2	<10	<100	On-Site Incineration
Organic		>2	>1000	>2	>10	>100	Ship South
Aqueous	>2		>1000	>2	>10	>100	Ship South
Aqueous	>2		<1000	<2	<10	<100	On-Site Incineration
Aqueous	<2						Discard in accordance with wastewater discharge criteria

Wastewater generated during barrel cleaning shall be treated to meet discharge criteria in accordance with permits and licences issued for cleanup activities.

5.2.3 Buildings and Infrastructure

Existing buildings and infrastructure shall be demolished to concrete foundations. Above-grade timber foundations shall be removed. Where concrete foundations are above grade, the area will be re-graded with the placement of additional granular fill to match surrounding topography. Exposed timber piles shall be removed to a minimum of 0.3 m below ground surface. All hazardous materials shall be segregated prior to or during demolition. Non-hazardous demolition materials and asbestos shall be collected and disposed in an on-site engineered landfill. If there is no existing landfill on site and no suitable location for a new engineered landfill, the non-hazardous materials shall be disposed of off-site. Hazardous demolition materials shall be disposed off-site.

PCB amended painted material shall be containerized in accordance with the Transportation of Dangerous Goods Act, and transported off-site to a licensed treatment disposal facility.

Only in exceptional circumstances will existing buildings remain intact on site following the remediation program. These structures may remain as emergency shelters only once clear transfer of ownership has been established.

5.3 Solid Waste Disposal Area (WDA) Closure

The following section applies to landfills, dumps and debris areas, collectively referred to as WDA.Using the WDA evaluation matrix (Annex A), WDA can be classified into one of three broad categories. Actions associated with each category of WDA have been identified. Where a WDA exists on INAC abandoned military sites, the condition of the WDA shall be evaluated to determine the most appropriate action;

Class A: If the WDA is located in an unstable, high erosion location, it shall be relocated to a properly engineered landfill. A WDA located at an elevation of less than two metres above mean sea level will be removed. During the relocation process, any identified hazardous materials shall be segregated for off-site disposal.

Class B: If the WDA is located in a suitable, stable location, but there is evidence of contaminant migration, potential remedial solutions include excavation or provision of a suitably engineered containment system. Permafrost containment shall be designed in accordance with the geothermal requirements outlined in Section 5.4.2. The remedial solution selected shall be based on a cost-benefit analyses that includes consideration of construction costs and long-term monitoring costs.

Class C: If the WDA is located in a suitable, stable location, with no evidence of contaminant migration, it may be left in place. If required, additional granular fill shall be placed to ensure erosion protection and proper drainage. Consideration must be given to surrounding topography (to blend into existing terrain) and long term monitoring costs.

Additional information related to landfill design and closure is provided in AMSRP Volume 2, (INAC 2009).

5.4 Landfill Development

New engineered landfills may be required for the disposal of non-regulated contaminated soils and non-hazardous debris collected or generated during cleanup. Two classes of landfills are provided:

- Non-Hazardous Waste (NHW) Landfill
- Tier II Contaminated Soil Landfill

5.4.1 Non-Hazardous Waste Landfill

A NHW Landfill is a new landfill constructed for the disposal of non-hazardous debris and building demolition waste. Tier I contaminated soils and Type A PHC soil may also be disposed of in these landfills. Landfills constructed to date at DND DEW sites are predominately above ground facilities. These landfills do not rely on permafrost for containment nor do they include a geosynthetic liner.

The general design parameters include a perimeter berm and landfill cover constructed of a well graded sand and gravel. Clay is generally not available at the abandoned military sites. The sand and gravel should have a minimum of 8% fines (<0.08 mm) and be compacted to a minimum of 95% maximum dry density (ASTM D698). The landfill should have a maximum debris thickness of 3 m and minimum cover thickness of 1.0 m.

To reduce settlement and ground subsidence, debris should be placed in maximum 0.5 m thick lifts with granular fill placed over each lift of debris to fill the voids (intermediate fill). Intermediate fill should be a minimum of 0.15 m thick and worked into the underlying debris. The final landfill surface must be graded such that water ponding does not occur. Ponding and infiltration could increase the seasonal thaw depth or contribute to leachate generation. The landfill surface must not be so steep that it promotes erosion of the cover materials, which could expose debris.

Fill material for the landfill cap should be a well-graded material that is relatively erosion resistant and will have moderate water infiltration. Alternative designs or surface treatments, such as imported coarser gravels and cobbles, vegetation covers at sites where it is possible to vegetate the sites, roller compacted concrete or other synthetic surfaces, are required if erosion resistant materials are not present on site.

Final landfill design parameters including granular fill specifications, side slopes, cover thickness, and maximum height of landfill are dependent on site specific ground conditions and borrow availability. Designs must be reviewed by a geotechnical engineer with permafrost experience.

5.4.2 Tier II Contaminated Soil Landfill

The decision as to whether to construct a Tier II Contaminated Soil Landfill on site is based on a number of factors, including but not limited to those summarized in Table 5.3. These criteria were based on generic designs and relative cost estimates and may not accurately reflect site-specific conditions. These are provided as a guideline only.

Table 5.3 Decision Criteria Tier II Contaminated Soil Landfill

Is the site landlocked?	For landlocked sites, off-site transport costs increase significantly. Consideration should be given to on-site disposal facility.
Is landfill excavation required.	Landfill excavations pose contracting risks due to unknown quantities of waste material. To mitigate risks, an on-site Tier II disposal facility should be considered.
Are known contaminated soil volumes less than 300 to 500 m^3.	If yes, evaluate contingency factors and potential over-runs. If significant risk of quantity overrun is present, construct landfill on-site. If volume of contaminated soil estimated to be below these values, ship off-site for disposal.
Are known volumes of contaminated soil between 500 and 1000 m^3	Evaluate site specific conditions, and develop preliminary design and cost estimate for an on-site disposal facility using site specific information. Confirm availability and quality of borrow material.
Are known volumes of contaminated soil greater than 1000 m^3.	If yes, confirm availability and quality of granular borrow. If granular borrow sufficient, develop preliminary design and cost estimate for an on-site disposal facility, using site specific conditions. Re-evaluate on-site disposal costs versus off-site disposal and confirm cost-benefit.

The Tier II Contaminated Soil Landfill design is based on the containment of contaminated soil in a landfill provided with a geo-synthetic liner and a granular fill cover of sufficient thickness to maintain the contaminated soil in a frozen condition. The required fill thickness is a function of the climatic conditions selected as the design criteria.

Geothermal analyses are required to substantiate the use of permafrost as a means of containment for the landfills. Analyses are carried out to predict the short-term and long-term ground temperatures for the Tier II Contaminated Soil Landfill to determine:

- Length of time for landfill freezeback;
- Short-term and long-term thermal regime in the landfill; and
- Depth of annual thaw (active layer) in the cover material.

Geothermal analyses should be carried out for the landfills using two-dimensional finite element computer models. The models simulate transient, two-dimensional heat conduction with a change of phase for a variety of boundary conditions. Heat exchange at the ground surface should be modeled with an energy balance equation that considers air temperatures, wind velocity, snow depth, and solar radiation. The models should include the temperature phase change relationships for saline soils, such that freezing depression and unfrozen water content variations can be explicitly modeled.

Soil thermal properties required to carry out geothermal analyses include: porewater composition, latent heat, specific heat (frozen and unfrozen), and thermal conductivity (frozen and unfrozen). These properties are determined indirectly from well-established correlations with soil index properties, moisture content, grain size distribution, bulk density, salinity, etc. (Farouki, 1986; Johnston, 1981). Soil index properties are based on information collected during the site investigations.

Climatic data required for the thermal model include monthly mean air temperature, wind speed, solar radiation, and snow cover. The thermal analysis should be calibrated to measured temperatures and/or observed active layers thicknesses. The landfill designs include analyses for mean temperature conditions, warm conditions and long-term climate change. Statistical analyses are carried out to determine mean monthly temperatures representative of a 1 in 100 warm year. The freezing index and thawing index for each year are calculated from the recorded air temperature data. The index for each year is ranked in ascending order and plotted. A "best-fit" line is drawn through the set of points to estimate the 1 in 100 warm year index. Mean monthly air temperatures are increased by the ratio of the 1 in 100 warm year freezing or thawing index to the mean year freezing or thawing index to estimate the mean monthly temperatures of a 1 in 100 warm year. The influence of climate change should be evaluated by similar methods presented in ACIA (2005). This includes the average estimated seasonal temperature changes by various Global Circulation Models (GCMs).

Given the uncertainties in climate change and the cost of returning to a site at a future date, it is recommended that the Soil Disposal Facility be designed for 100 years of long-term climate warming (average of four GCMs) as a minimum. With this design condition, the active layer could penetrate the contaminated soil if a warm year occurred. Containment during this condition would be provided by the thick soil cover and the geomembrane liner. Additional factors of safety can also be applied to account for uncertainties in the geothermal model, soil input parameters, and climate input parameters, or the facilities can be designed for climate change plus one 1 in 100 warm year.

5.5 Borrow Source Development

Granular borrow material will be required for the development of new landfills and general site grading purposes.

5.5.1 Site Grading

Grading operations generally consist of the shaping and regrading of disturbed areas to blend in with the natural contours, in accordance with all applicable licenses. Disturbed areas may include:

- contaminated soil excavation areas,
- existing and new landfill areas,
- debris areas,
- areas disturbed during demolition activities,
- granular borrow areas, and
- any area disturbed during establishment and operation of the camp, equipment storage and maintenance activities.

5.6 Contractor Support Activities

For implementation of remedial activities, a Contractor will establish a camp and storage areas on-site, where required. Where possible, these will be located in previously disturbed areas such as borrow or storage areas, to minimize any new disturbances in accordance with all applicable licenses.

Domestic refuse generated by the camp shall be incinerated and disposed of on-site in an engineered landfill. Sewage shall be handled by an appropriately sized sewage treatment system, in accordance with applicable legislation and all applicable licenses.

Wastewater generated by the Contractor, shall be treated to meet discharge criteria as stipulated in permits and licenses issued for the project.

Potable water supplies at the site will be tested and used, only if they meet the Canadian Drinking Water Quality Standards (CCME 2002) or the latest edition thereof, in accordance with all applicable licenses.

Fuel required for the operation of the camp will be stored on-site in accordance with applicable legislation and licenses.

All hazardous materials shall be segregated prior to or during demolition. Non-hazardous demolition materials and asbestos shall be collected and disposed in an on-site engineered landfill. Hazardous demolition materials shall be disposed off-site.

Only in exceptional circumstances shall existing buildings remain intact on site following the remediation program. These structures may remain as emergency shelters once clear transfer of ownership has been established.

6 CONSTRUCTION RELATED IMPLEMENTATION REQUIREMENTS

Consistent with Step 9 of the Federal Contaminated Sites Action Plan, confirmation that the objectives of the RAP have been met is required. Based on the issues typically associated with the remediation of INAC sites, confirmatory testing encompasses a wider range of activities. These include, but are not necessarily limited to:

- Confirmatory testing of contaminated soils;
- Quality Assurance testing of earthworks associated with the remediation and construction of landfills;
- Testing as required for waste manifesting to allow for shipment and disposal of materials off-site; and
- Testing as required to meet the requirements of Land Use Permits, and/or other Licences/Permits issued for the cleanup program.

The requirements and/or guidelines for these testing programs are outlined in the following sub-sections.

6.1 Confirmatory Testing Contaminated Soils

Following excavation of contaminated material confirmatory samples shall be collected and analyzed to ensure that cleanup objectives have been met. Sampling will be conducted by a third party qualified to carry out such work. A detailed sampling plan shall be developed for each area of concern identified for excavation in the RAP, and must include the following information:

- Description of the objective for each potential area of concern
- Sampling locations
- Sampling methodology
- Proposed number of samples and media
- Parameters for analyses
- Analytical requirements, and Quality Assurance/Quality Control measures.

6.1.1 Tier I contaminated soils

Tier I criteria were developed to address aerial transport of contaminants; excavation and backfilling precludes this pathway. If, during the site assessment, sufficient evidence has been collected to demonstrate that soils at depths of greater than 0.3 m below surface do not exceed Tier II levels for inorganic elements or PCBs, confirmatory sampling will not be required.

6.1.2 Tier II contaminated soils

Confirmatory sampling shall be carried out using a systematic grid sampling design following the DND DLCU Confirmatory Sampling Protocol as summarized in Table 6.1. This design provides a practical and simple method for designating sample locations and ensures uniform coverage of a site. Discrete samples should be collected at every point on the grid. For small areas, all samples shall be analyzed, whereas for larger areas only a fraction of the interior grid samples shall be analyzed. When choosing sample locations for analysis, consideration shall be given to areas of previously high concentrations. No single sample result or the mean of a duplicate/replicate sample shall exceed the cleanup objectives. In cases where field analytical methodology is used, 10-20% of the samples analyzed in the field should also be analyzed in the laboratory for quality control purposes.

Table 6.1 Confirmatory Testing Grid Sizes

Size of area	Grid size	# Perimeter samples analyzed	# Interior grid samples analyzed
<100 m^2	3x3 m	all	all
>100 m^2, <2500 m^2	6x6 m	50%	40%
>2500 m^2	12x12 m	50%	40%

6.1.3 Hazardous Soils

Confirmatory sampling following excavation of soils considered hazardous according to CEPA (PCBs >50 ppm) or the TDGA may require a more closely spaced grid than outlined in Table 6.1 to minimize the overall volume of materials requiring off-site disposal.

6.1.4 Type B TPH (Fractions F1 to F3)

Confirmatory sampling following excavation of petroleum hydrocarbon impacted soils within 30 m of a water body supporting aquatic life will follow the confirmatory sampling protocol outlined in section 6.1.2. The remedial solution for petroleum hydrocarbon impacted soils further removed from surface water bodies involves excavation of source areas. In cases where field analytical methodology is used, 10-20% of the samples analyzed in the field should also be analyzed in the laboratory for quality control purposes. For comparison purposes, total petroleum hydrocarbons (TPH) data obtained by hexane extraction can be compared to data generated using the CCME analytical procedure for PHC in soils by summing fractions F1 to F3. The presence of residual petroleum hydrocarbon contamination is expected following excavation to design limits as outlined in the RAP. Representative samples from the base of the excavation will be collected and analyzed for record keeping purposes using the CCME analytical procedure for PHC in soils.

6.1.5 Ex-situ Confirmatory Sampling

Soils excavated from landfills and dumps will be classified ex-situ. Excavated soils will be placed in windrows or stockpiles with a maximum stockpile size of 20 m^3 (B.C. Environment, 1995). Debris is separated from the soil and sorted as potentially hazardous and non-hazardous under the supervision of the Hazardous Materials Specialist. Stained soil and soil associated with potentially contaminated debris such as battery waste or barrels must be stockpiled separately from other soil to prevent dilution and facilitate disposal.

As part of the sampling protocol, two types of soil samples shall be collected from stockpiles: discrete and composite. Sample locations are selected at various surface and depth locations in each stockpile to obtain samples that are representative of the entire pile. Five discrete samples are collected and analyzed for the first 20 stockpiles and every 20^{th} stockpile thereafter. Composite samples shall be collected and analyzed at all stockpiles. Composite samples consist of approximately equal volumes of soil collected from five discrete sample locations.

The standard deviation for each stockpile shall be calculated based on discrete sample results. These standard deviations are then used to calculate the average standard error for all stockpiles (Equation 1). Twice the average standard error is added to the analytical result for the composite sample to provide a 95% upper confidence limit (Equation 2).

$$SE_{avg} = \frac{\sum_{1}^{m}\left(\frac{SD}{\sqrt{n}}\right)}{m} \qquad \textbf{(Equation 1)}$$

$$UCL = [Composite_x] + 2(SE_{avg}) \qquad \textbf{(Equation 2)}$$

n = number of sample values,

SE_{avg} = average standard error,

SD = standard deviation of the sample values,

m = number of stockpiles,

UCL = upper confidence limit and

x = the stockpile number.

Classification of stockpiles for disposal is based on a comparison of the 95% upper confidence limit values and the relevant clean up objectives. The first 20 stockpiles shall be analyzed for the eight inorganic elements for which the DCC criteria are applicable and PCBs. Selection of samples for analysis for petroleum hydrocarbon will be based on visual and/or olfactory evidence. This process shall be repeated for every 20th stockpile thereafter. All the remaining stockpiles will be tested for copper, lead and zinc and any other analyte that exceeded the DCC criterion previously until it is no longer present (Table 6.2). Field analysis can provide adequate detection limits for statistical classification of certain contaminants (PCBs and PHC), while others (inorganic elements) must be analyzed in CAEAL accredited laboratories for more precise results.

Table 6.2 Analytical Requirements for Stockpile Sampling

Stockpile No.	Samples Collected	Analytical Suite	Samples for Analyses
1 through 20	5 discrete 1 composite	PCBs, Cu, Ni, Co, Cd, Pb, Zn, Cr, As PHC and Hg where evident	All discrete and all composite samples are analyzed for first 20 stockpiles
Every 20th thereafter	5 discrete 1 composite	PCBs, Cu, Ni, Co, Cd, Pb, Zn, Cr, As PHC and Hg where evident	All discrete and all composite samples are analyzed
Remaining stockpiles	1 composite	PCBs, Cu, Pb, Zn PHC, Hg and other inorganic elements where evident	Every composite sample is analysed.

Once the excavation is complete, the base of the landfill excavation must be sampled in accordance with confirmatory sampling protocol for Tier II soils.

6.1.6 Confirmatory Sampling of Material Processing Areas

Residual contamination may be present at barrel processing areas, hazardous materials processing areas, and stockpile lay down areas after clean up activities are complete. Once an area is no longer in use, a detailed inspection for evidence of staining and other indicators of contamination such as visible debris or paint flakes shall be carried out. Samples must be collected in these areas in a grid pattern based on the size of the area (see Table 6.1). In cases where field analytical methodology is used, 10-20% of the samples analyzed in the field should also be analyzed in the laboratory for quality control purposes.

6.2 Quality Assurance Testing of Earthworks

At most sites, earthworks will be carried out as part of the construction of new landfills, remediation of existing landfills, and/or development of hydrocarbon contaminated soil treatment areas. Contract Specifications developed for the project will identify specific requirements for fill gradation and compaction standards. As part of the testing to be carried out during cleanup, quality assurance (QA) testing is required to confirm that the earthworks are in conformance with the Specifications. The number and type of testing will be dependent on the volume of fill to be placed and the number of different material types employed in the cleanup. A QA program shall be developed in conjunction with the design engineer to determine the optimal number of tests required.

6.3 Testing Related to Permits/Regulatory Requirements

The Owner representative and the Contractor will be required to carry out testing to confirm that the requirements of the Land Use Permits and Water Licenses issued for the project are met.

This testing typically includes:

- Effluent testing for waste water generated from camp operations.
- Testing to confirm potability of drinking water supplies
- Testing of waste water generated from cleanup operations.

7 POST-CONSTRUCTION MONITORING

7.1 Introduction

A post-construction landfill monitoring program was developed by DND in conjunction with the Inuvialuit in the Western Arctic and the Inuit in Nunavut for landfills remediated and/or constructed during the cleanup of DEW Line sites. DND initiated cleanup of their DEW Line sites in 1996 and have collected a significant volume of landfill monitoring data since that time. Indian and Northern Affairs Canada, INAC, have initiated cleanup of abandoned military sites under their jurisdiction, and will implement a site monitoring program following remedial construction activities.

This section describes the recommended monitoring plan. It has been based on the DND landfill monitoring program and on landfill monitoring data collected at DND and INAC DEW Line sites to date. Additional monitoring requirements related to the natural environment and traditional knowledge have been added to the program.

A detailed description of the post-construction monitoring program is provided in AMSRP Volume 2 (INAC 2009).

7.2 Monitoring Program

The recommended monitoring program for abandoned military sites consists of:

- Baseline Geo-chemical Monitoring.
- Natural Environment Monitoring.
- Landfill Monitoring.

These are briefly described in the following subsections.

7.2.1 Baseline Geo-Chemical Monitoring

Geochemical Characterization of Soil Conditions

In all proposed development areas, and existing landfill areas (with the exception of existing landfills to be excavated), it is recommended that geochemical characterization of soil conditions be carried out during the assessment or remediation phase. For proposed development areas, sampling should be carried out on a grid spacing of approximately 50 m by 50 m. For existing landfills, testpits should be excavated at a minimum spacing of 50 m of landfill perimeter with a minimum of five testpits per area. Soil stratigraphy is to be logged in accordance with the Unified Soil Classification System, and evidence of

seepage and or soil staining recorded. Soil samples should be collected at surface and at 50 cm intervals to the maximum depth of the active layer, and analysed for the following parameters:

- PCBs (polychlorinated biphenyls);
- Hydrocarbon Fractions, F1, F2, F3 and F4; and
- Inorganic elements: arsenic, cadmium, chromium, cobalt, copper, lead, nickel, and zinc.

These data supplement information collected during the assessment phase of a site.

Geochemical Characterization of Groundwater Quality

In proposed landfill development areas or at landfills requiring leachate containment, it is recommended that a detailed characterization of groundwater quality be carried out. A minimum of three wells per area is recommended; however, this may be increased if the size of the landfill warrants increased coverage. The locations of monitoring wells should be selected based on the potential for groundwater (based on the testpit program for soil characterization), and to be representative of both up and downgradient areas. The depth of the monitoring well will be based on anticipated maximum depth of thaw. The monitoring wells should be located no further than 10 m beyond the final construction perimeter as defined by the design.

For baseline water quality, water samples should be collected at minimum monthly for one full season to allow assessment of changes in water quality as the active layer deepens. The wells for baseline sampling are typically installed in the final construction season. This minimizes the potential for damage during construction.

Recommended analytical requirements are outlined below:

- Petroleum Hydrocarbon Fractions, F1 and F2
- Total and dissolved metals.
- Major ions, hardness, total dissolved solids, total suspended solids.
- pH and conductivity.

Given the low solubility of PCBs, analyses of PCBs may be limited to once over the season, near the time of maximum thaw.

For each monitoring event, water level, pH, conductivity, and turbidity should be measured.

If significant variability is observed in groundwater monitoring data, a second season of baseline monitoring should be carried out following remedial activities.

Typically, only dissolved metals are measured in groundwater monitoring programs; however, previous concerns existed with respect to transport of contaminants with colloidal material. The requirement for total metal analyses should be reviewed at the completion of baseline monitoring, and eliminated if concentrations can be correlated with Total Suspended Solids (TSS) concentrations.

7.2.2 Natural Environment Monitoring

A natural environment assessment (NEA) conducted during the ESA phase of site remediation will serve as a reference for post-construction site monitoring. Local and traditional knowledge will be obtained from a local community representative familiar with the site (ideally the same person who assisted with the NEA). Natural environment data will be collected during the site visit as well as during community meetings with people who use or visit the site/area frequently (*i.e.,* year-round). The purpose of collecting this new data is not to find correlations with landfill monitoring data but rather to provide anecdotal data related to the presence of wildlife and changes over time.

Site specific data to be collected during the site visit should try to include as many of the following items:

- Wildlife sightings (species, number, gender, juveniles)
- Other evidence of recent presence of wildlife (droppings, tracks, feathers/fur, carcass remains, etc.)
- Wildlife activity (summering/nesting/denning, migratory/passing through)
- Qualitative assessment of relative numbers versus previous years (more, same, less)
- Revegetation of disturbed areas versus previous years (more, same, less)

Regional information to be collected during visits to the area throughout the year should include as many of the following items as possible:

- Use by people for traditional activities
- Season(s)
- Activities (hunting, fishing, trapping, camping, other harvesting)
- Relative frequency versus previous years (more, same, less)
- Wildlife species present (sightings or evidence)
- Wildlife presence versus previous years (more, same, less)
- Health of wildlife observed or harvested (good, average, poor)

- Relative health of wildlife versus previous years (better, same, worse)

7.2.3 Landfill Monitoring

In general, there are four types of landfills that require monitoring:

- New landfills for non-hazardous materials and Tier I soil;
- Landfills to be closed by the addition of granular fill and regraded;
- Landfills to be closed with leachate containment; and
- Tier II soil disposal facilities.

Based on site conditions at INAC's abandoned military sites, it is considered unlikely that leachate containment would be considered; however, it is included for consistency with previous monitoring plans at military sites. A summary of requirements is provided in Table 7.1.

Table 7.1 Summary of Landfill Monitoring Requirements

	Monitoring Requirements				
Landfill Type	**Baseline Monitoring** S- Soil GW - groundwater	**Visual Inspection**	**Soil Sampling**	**GW Sampling**	**Thermal Monitoring**
New Non-Hazardous Waste (NHW) Landfill (LF)	S, GW	✓	as required[a]	✓	
Regraded LF (low potential risk)	S	✓	as required[a]		
Leachate Contained LF (moderate potential risk)	S, GW	✓	as required[a]	✓	✓
New Tier II Soil Facility	S, GW	✓	as required[a]	✓	✓

[a] Refer to Section 7.3.4 for details.

Baseline monitoring requirements were described in Section 7.2.1. The details of the other four landfill monitoring elements are described in the following subsections.

7.3 Specific Monitoring Requirements

7.3.1 Visual Inspection

The physical integrity of the landfill should be inspected and reported using photographs (from the air, when possible, as well as ground level) and hand drawn sketches. Documented observations should at minimum include the items identified in Table 7.2. It is recommended that Table 7.2 be adapted for use as a field checklist to facilitate this data collection.

Table 7.2 Visual Inspection Requirements - Landfills

Item	Presence/ Absence	Extent	Description Photographic Reference
Settlement Erosion Frost Action Animal Burrows Vegetation Staining Vegetation Stress Seepage Points Exposed Debris Condition of Monitoring Instruments Other features of note	Yes or No	Provide dimensions, as applicable of: Length Width Depth	Features of note, photographic reference with scale, view point and direction

7.3.2 Groundwater Sampling

Results of analyses of groundwater samples from landfills should be compared to the baseline and background samples as this is indicative of changing environmental conditions at the site. In general, a

minimum of three to four groundwater monitoring wells will be associated with Non-Hazardous Waste Landfills, Tier II landfills and Existing Landfills – Leachate Containment.

Consistent with the baseline analyses, groundwater samples should be tested for:

- Petroleum Hydrocarbon Fractions, F1 and F2
- Total and dissolved metals.
- Major ions, hardness, total dissolved solids, total suspended solids.
- pH and conductivity.
- PCBs

For each monitoring event, water level, pH, conductivity, and turbidity should be measured in-situ. The evaluation of whether both total and dissolved metals are required will be evaluated after baseline monitoring.

Given the low solubility of PCBs in water, analyses of PCBs may be discontinued if not detected in the first five years of monitoring.

7.3.3 Thermal Monitoring

One component of the leachate containment system incorporates aggradation of the permafrost through the landfill contents such that the active layer does not penetrate the waste materials. Geothermal analyses were carried out to predict the length of time for freezeback of the landfill; long-term and short-term thermal regime in the ground; and the depth of the active layer in the cover material. The analyses have shown that it takes several years for the landfill temperatures to equilibrate and stabilize.

A thermal monitoring system provides measurement of sub-surface ground temperatures, which allows comparison to and verification of the predicted ground temperatures. The thermal monitoring system consists of installation of thermistor strings, with "thermistor beads" at select intervals to provide ground temperature profiles at various locations within the landfill. The thermistor strings are attached to automated data-loggers which allow for remote data collection. In general, a minimum of three thermistors is placed; this is evaluated on a landfill-specific basis. Thermistor installation follows standard engineering practice.

7.3.4 Soil Sampling

As previously indicated, soil sampling and analyses provide limited information with respect to the performance of a landfill. Soil sampling will be limited to locations where seepage or staining has been identified as part of the visual inspection. Analytical requirements include:

- Petroleum Hydrocarbon Fractions, F1 to F4
- Arsenic, Cadmium, Cobalt, Copper, Chromium, Lead, Nickel, and Zinc
- PCBs
- Soil samples should be collected over the interval of 0 to 0.15 m, and 0.35 to 0.50 m depth.

7.4 Monitoring Frequency

Conceptually, three phases have been identified for landfill monitoring as described in the following sub-sections. Natural environment monitoring may be conducted according to the same schedule.

Phase I: Monitoring of conditions to confirm that thermal equilibrium and physical stability criterion are achieved.

During Phase I, monitoring would take place in years 1, 3, 5. The five-year term was selected on the basis that ground-temperature thermal regimes at these specific landfills would require three to five years to reach equilibrium.

Visual and thermal monitoring should be carried out on Tier II soil facilities and leachate contained landfills.

Visual inspections of the constructed and remediated landfills would also be carried out. It is anticipated that, if there is settlement or erosion within the initial years following remediation, it is likely attributable to construction quality. Changes after the first three years are more likely attributable to changes in the site conditions (i.e. warmer temperatures, changes in surface water drainage patterns).

It is recommended that groundwater monitoring take place in Years 3 and 5. The timing of the groundwater sampling event should consider the variability of water quality measured during the baseline monitoring.

An evaluation of the Phase I data would be carried out at the end of five years to confirm that thermal equilibrium has been achieved, and that no stability issues had been identified. The Phase I monitoring program may be extended, if required.

Phase II: Verification of equilibrium conditions established during Phase I.

At the completion of Phase I monitoring and review of the results, the Phase II monitoring frequency may be modified or downgraded. If no significant issues are identified for landfills of low potential environmental risk (as defined by the landfill evaluation matrix), monitoring may be discontinued at the conclusion of Phase I. If additional monitoring is warranted based on the thermal, groundwater or physical inspection, it is recommended that the monitoring frequency in Phase II be carried out according to the following schedule: Year 7, Year 10, Year 15, and Year 25. Year 25 would mark the end of Phase II monitoring.

Physical inspections of all landfills would be carried out at each monitoring event. The requirement for continued thermal monitoring would be based on Phase I results, or if significant climate changes had been recorded in the region.

Groundwater monitoring would be carried out at each monitoring event. The optimal time period for sampling would be based on the results obtained during baseline and Phase I monitoring.

Phase III: Monitoring for long term issues such as liner integrity, permafrost stability, and significant storm events.

At the end of Phase II, 25 years after implementation of the remedial actions for a given landfill, a re-evaluation of the monitoring program should be carried out prior to initiating Phase III. It is difficult to predict beyond 25 years how world events and improvements in technology may impact monitoring requirements.

7.5 Interpreting Monitoring Results

Landfill monitoring results (thermal, chemical and visual) have to be interpreted in concert with one another as described in AMSRP Volume 2 (INAC 2009).

7.6 Reporting Format

To provide a basis for comparison between monitoring events, it is recommended that a consistent format be used in reporting.

An outline is provided as follows:

1 Introduction. The introduction should provide an outline of the work elements, the timing of and weather conditions during field work, and describe the scope of the document.

For each individual landfill, the following information is to be provided.

2a. Landfill Summary: For each landfill, a summary should be prepared that describes the monitoring carried out, any notable groundwater analytical results, and any associated staining, seepage, exposed

debris, and/or evidence of vandalism. In addition, visual inspection issues identified as significant or unacceptable should be identified. The overall performance rating of the landfill should be provided.

2b. Completed Visual Inspection Report.

2c. A preliminary stability assessment, as described in Section 4.

2d. Annotated drawings on a tabloid paper, indicating all visual inspection features.

2e. Completed thermistor inspection reports, where appropriate.

2f. Photographic records.

2g. Thermal monitoring data, where appropriate.

2h Groundwater analytical data.

2i. Monitoring well sampling logs.

In Annexes to the report, the following information is to be provided.

- Formal laboratory results.
- QA/QC evaluation of the analytical results.
- Handwritten field notes.

Example field note templates are provided in AMSRP Volume 2 (INAC 2009).

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Annex A – Dump site, landfill and debris area (waste disposal area – WDA) evaluation

SUMMARY

In 1997, the DEW Line Cleanup Environmental Working Group (EWG), comprised of members representing Nunavut Tungaavik Inc. (NTI) and the Department of National Defence (DND) / Defence Construction Canada (DCC), was formed to address environmental issues associated with the DEW Line sites under the jurisdiction of DND. One of their tasks was the development of a matrix to assess potential environmental risk associated with existing landfills at the DEW Line sites. The evaluation matrix considered three primary categories, contaminant source, exposure pathways and potential receptors. In the development of the matrix, landfills typical of the DND DEW Line sites were considered. The DND DEW Line sites were in operation for nearly 40 years, and landfill activity was generally extensive.

By comparison, most INAC Abandoned Military Sites were generally only operational for a much shorter period of time, approximately five to six years. Accordingly, waste disposal practices were different. At many sites, waste materials were not consolidated in a single area, and dump sites and/or isolated areas of partially buried debris are common. These areas are collectively referred to as Waste Disposal Areas (WDA).

This current document presents an Evaluation Matrix for WDAs that considers conditions more specific to INAC Abandoned Military sites.

1 INTRODUCTION

To address the varied nature of landfills at abandoned military sites, a consistent method for the assessment of their potential risk to the arctic environment, in the form of a risk evaluation matrix, was developed by the DND/NTI EWG in 1997 (EWG 1998). Since that time, the matrix has been utilized to develop recommendations for landfill remediation at DND DEW Line sites. This document provides a modified evaluation matrix to address the dump sites, landfills and buried debris areas more typical of the abandoned military sites under the jurisdiction of INAC. As a whole, these are referred to as Waste Disposal Areas (WDAs).

The DND/NTI evaluation matrix was based on the CCME National Classification System for Contaminated Sites, and adapted to address the particular concerns of the Arctic environment. This revised version also references the Federal Contaminated Site Action Plan (FCSAP) Contaminated Site Classification Guidance Document. The matrix is divided into three categories of equal weight: contaminated source, pathways, and receptors. The interaction of these three elements results in environmental risk. Each category is assigned 50 points, which are distributed among several factors. Each of these factors has been made as specific as possible in order to reduce the subjectivity of the matrix to a minimum. In addition, each of the three main categories is assigned a highly subjective "special considerations" factor according to the method described in the CCME Classification System. As it is unlikely that any classification system could address all possible factors, a special considerations factor allows the user to increase or decrease the score "to emphasize important concerns about a site and should be used as an exception rather than as a rule" (CCME 1992, p.6-7).

The intended purpose of the matrix is to evaluate the potential environmental risk posed by WDAs in their current condition.

Two conservative assumptions are made during the evaluation of all WDAs

- The contents of WDAs are generally unknown and all potential contaminants may be present.
- If contaminants come into contact with receptors, they could have adverse effects on the receptors.

2 MATRIX FACTORS

2.1 Contaminant Source – Category A

Four factors were considered under Contaminant Source to describe specific disposal areas as follows:

A.1 Areal extent of waste disposal.

A.2 Estimated depth of buried debris

A.3 Contaminant Characteristics – combined presence of leachate and surface contaminated soil.

A.4 Presence of Surface Debris

Contaminant characteristics were assigned the greatest weighting in this category as it is a strong indicator of potential environmental risk associated with the WDAs. The volume of a WDA is considered to be related to its potential to be contaminated – the greater the volume, the greater the risk that contaminants are present. The volume of the waste disposal area is divided into two parameters, area and depth. The area is relatively easy to measure; the estimated depth of the buried waste is given less weight in the matrix as it is difficult to measure using non-intrusive techniques.

A.1 Areal Extent of Waste Disposal

The larger the area impacted by waste disposal, the greater the potential for contaminants to be present exists. The areal extent of dump sites can be easily surveyed based on the presence of surface wastes. Landfill or buried debris areas are based on the results of geotechnical/geophysical site surveys and visual observations. A value of 10 000 m^2 is used as the basis for comparison. All WDAs greater than 10 000 m^2 are awarded the maximum points for this category. Scoring for all other WDAs is prorated relative to 10 000 m^2. WDAs less than 1000 m^2 are referred to as debris areas.

Scores are provided for all WDAs following the detailed field investigations that are carried out prior to cleanup/construction. The objectives of these investigations are to delineate the extent of known contamination, and confirm existing site and WDA conditions.

A.2 Estimated Depth

The depth of landfills and debris areas can be estimated by visual inspection of surrounding topographic features. The average depth of the active layer is used as a qualifier for the description of landfill depth, as this is generally the maximum depth of investigation. The depth of the active layer may range from one to two meters at these sites, depending on material type; therefore an average depth of 1.5 meters was used in the rating. Landfills and buried debris with estimated depths of greater than 1.5 meters were scored higher than those with estimated depths of less than 1.5 meters. For the majority sites, it is anticipated that the depth of buried waste is 1.5 metres or less. Exceptions to this may include dumping within ravine areas or other natural depressions. A minimum score of 2 is allotted to all WDAs in the absence of specific data.

A.3 Contaminant Characteristics

Contamination associated with WDAs may be elevated with respect to background concentrations, but less than applicable criteria. In this case, elevated concentrations may be indicative of chronic low levels of contaminants leaching from the WDA, as a result of infiltration and percolation of surface water, or flow of active layer groundwater through areas of buried debris. In some cases, contamination on the surface may exceed applicable criteria as a result of direct spills or leaking containers.

With consideration of the FSCAP Hazard Ranking of contaminants and the DCC Criteria, all contaminants included in the DCC are considered high concern, with the exception of Petroleum Hydrocarbon Fractions F3 and F4. The F3 and F4 fractions are considered essentially insoluble and are therefore immobile. In the scoring of this category, four categories are provided:

- Concentrations not elevated with respect to background; however, the potential for contamination is considered possible.
- Concentrations elevated with respect to background; but less than DCC criteria. Elevated with respect to background refers to a concentration in excess of the three times the mean background concentration. With respect to organic contaminants, such as hydrocarbons and PCBs, the method detection limit is assumed to represent background concentrations.
- Concentrations in excess of DCC Tier I guidelines.
- Concentrations in excess of DCC Tier II guidelines.

A.4 Presence of surface debris

At some WDAs, in particular dump sites, surface debris is very extensive, while at others there is almost no debris. Scoring needs to be quantitative; therefore the percentage of the surface area of the landfill that is covered with debris is used as the basis for scoring. A WDA that has surface debris covering more than 50% of its surface receives a full score. Debris areas, and dump sites as implied by the designation, generally receive full score for this category.

2.2 Pathways – Category B

The primary transport mechanisms for contaminants at these sites are considered to be:

B.1 Aerial transport of fine particles; and

B.2 Dissolved phase and/or colloidal transport in water, both as surface water run-off or subsurface water flow.

B.1 Aerial Transport of Contaminants

All contaminants can be transported as particles. Windblown debris is not considered in this category, as debris pickup is inherent in any cleanup. Surface contamination or surface expressions of leachate impacted soils imply the potential for aerial transport. This factor is given a low weight because the quantity of contaminated soil on the surface is generally low relative to the quantity of contaminated soil at the site as a whole. In addition, it is anticipated that relative to the effect of water movement, aerial transport contributes less to the transport of contaminants away from a landfill.

B.2 Water Movement

Dissolved phase and/or colloidal transport in water includes movement of surface water and subsurface water within the active layer. "Groundwater" is not addressed as an issue separate from surface water, as the movement of water within the active layer is generally subject to the same driving forces or gradients as surface water. The intent of this sub-category is to examine factors that affect migration away from the WDA – slope, runoff, extent and type of cover on below grade disposal areas, annual precipitation and distance to surface water. Among these factors, topography, runoff potential and proximity to surface water are given the greatest weight.

B.2.1 Topography

The degree of the slope on which the WDA is located is one of the major factors contributing to transport of contaminants. Scoring is carried out on a progressive scale. In cases where there are different slopes in the area, a weighted average is used.

B.2.2 Cover Material – Depth

The extent to which contaminants are available for transport is also dependent on the depth and type of cover material, where present. The potential for leachate generation and correspondingly, leachate migration, is related to infiltration of water. Cover over the WDA helps mitigate infiltration of water into the landfill contents. As the thickness of the cover increases, the likelihood that potential contaminants will be released decreases. If the active layer is contained in the cover material above the debris, then the potential for surface water infiltration into the WDA is small; this circumstance is assigned the lowest score.

B.2.3 Cover Material – Type

The erosion potential of a WDA is partly based on the type of cover material. Erosion can eventually lead to the exposure of the waste. Some cover materials are more susceptible to erosion than others; well graded gravels are the least susceptible, and silty materials are the most susceptible. In cases where there is no cover, this factor is assigned the highest score. Where the cover materials consist of a combination of soil types, the scoring should reflect the more conservative or higher score.

B.2.4 Surface Water/Run-Off Potential

This factor aims to describe the destructive potential of water action on the WDA, which could take the form of waves; streams, rivers or lakes; or seasonal drainage. Where there is significant seasonal drainage, the run-off potential is high. "Significant seasonal drainage" is defined as run-off that has the potential to transport large quantities and concentrations of contaminants to surface water courses over a short period of time (CCME 1992, p.23). Significant seasonal drainage also includes consideration of major snow drifting in the area.

B.2.5 Precipitation

The amount of precipitation received, either as rain or snow fall, affects the amount of surface water infiltration or run-off, and potentially erosion. The majority of the abandoned military sites receive less than 500 mm of precipitation annually, with the exception of sites on the lower east coast of Baffin Island. Typically, the amount of precipitation at any site is relatively low. Any given rainfall event is unlikely to generate major run-off; however, spring thaw and corresponding run-off may be significant at some sites. Detailed precipitation data is not available for the INAC sites; therefore data was interpolated from the Hydrological Atlas of Canada Maps [accessed on line: http://atlas.nrcan.gc.ca/site/english/maps/archives/5thedition] as summarized below for various areas. For sites not listed below, the aforementioned maps should be consulted.

Sites	Annual Precipitation (mm)	Annual Snowfall (cm)	Average Maximum Snow Pack depth (cm)
Clifton Point	100-200	100	30
Bernard Harbour east to Matheson Point	100-200	80	30
Simpson Lake to Sarcpa Lake	150-200	100	50
Bray Island, Rowley Island	150-200	100	60
Nadlaurdjuk Lake	200-300	100	60
Ekalugad Fiord	200-300	200	70
Kivitoo	350	240	100
Durban Island	+400	240	100

As spring run-off likely represents the maximum precipitation event, scoring is provided relative to the maximum snow pack depth, with a score of 4 allotted to snow pack depth of 100 cm. If site specific factors, such as drifting in the WDA are present, the score may be increased to 5, the maximum allotted to this category.

B.2.6 Distance to Down-gradient Perennial Surface Water/Seasonal Drainage Channel

The distance to surface water will affect the probability of contaminants reaching the watercourse. This factor can include streams, seasonal or perennial, running directly through the WDA, or streams and lakes downgradient from the WDA, but it is intended to exclude small ponds with no outflow. On very steep slopes, this distance should consider the horizontal distance to the water body rather than the elevation difference. The impact of drainage with respect to contaminant exposure is not considered in this category (it is considered under Receptors); this factor determines whether there is a drainage pathway away from the WDA.

2.3 Receptors – Category C

This section addresses the potential for impact on receptors, specifically, aquatic and terrestrial habitats, as well as human exposure. Impact on humans is the primary consideration; however, it should be recognized that impact on humans is implicit in the scoring of factors addressing ecosystem impact. The scoring within each category is to be based on recorded data, as well as local knowledge of the land use in the area, and therefore requires local input.

C.1 Potential Impact on Receiving Freshwater/Marine Habitat

Selection of the water body in this category is based on potential effects on the receiving habitat. Consideration must be given to the regional drainage patterns. For example, where the drainage from a WDA is overland (i.e. there is no direct connection between the WDA and the downgradient water body), water bodies beyond two kilometers should not be used in the evaluation. This is based on the premise that natural attenuation of any potential contamination will occur with overland flow. Where a direct connection between a WDA and a downgradient water body exists, via a stream or interconnected ponds, the two-kilometre limit should not be used.

C.1.1 Proximity to Receiving Freshwater/Marine Habitat

"Receiving habitat" is considered to be a significant body of water near the limit of the WDA where contaminants are likely to have an impact. The water body may support freshwater or marine life and/or may be used by avifauna and/or terrestrial mammals as a water source. It is not necessarily the seasonal drainage course or perennial water body closest to the limit of the WDA toe. The objective is to select a habitat that supports receptors rather than identify the closest body of water. It is assumed that only habitat downgradient from the WDA is to be considered (given that aerial transport of contaminants to habitat upgradient from the WDA will be addressed by the remediation of contaminated soil).

C.1.2 Estimated Habitat Usage – Freshwater/Marine

The score within this category is based on the frequency of usage within the selected receiving environment and considers the level of biodiversity and the occurrence of calving/spawning grounds. Freshwater and/or marine wildlife are potentially more at risk compared with terrestrial wildlife or avifauna, the latter of which are exposed through water ingestion. Thus, when terrestrial wildlife or avifauna are the primary receptor, the score for this factor should fall into the moderate or low category based on the potential frequency of usage. Otherwise, when the selected water body sustains freshwater and/or marine wildlife, the level of biodiversity should be used to evaluate the score. It should be noted that the most conservative approach - in the selection of the receiving water body - must be used when scores from section C.1.1 and C.1.2 are combined. Finally, "biologically sensitive" areas such as bird sanctuaries and/or endangered, threatened or vulnerable populations should be considered as "special considerations".

C.2 Potential Impact on Receiving Terrestrial Habitat

C.2.1 Extent of Vegetation

The extent of vegetation considers the area within 300 metres downgradient of the WDA. Within this distance, vegetation is expected to be most susceptible to uptake of contaminants if they are leaching from the WDA. However, topography and the potential for run-off must be considered and a greater or lesser distance could be considered.

C.2.2 Estimated Habitat Usage – Terrestrial/Avifauna

The same criteria as for usage of aquatic habitat are to be applied.

C.3 Potential Human Exposure Through Land Use

C.3.1 Presence/Occupation

This factor addresses strictly dermal exposure and inhalation; consumption of food and water from the area are dealt with in subsequent factors. The risk of dermal exposure or inhalation is much lower when soil is frozen; therefore winter occupation of the site is assigned a low risk. "Summer" in this factor is intended to include the spring, summer and fall periods when the ground surface is not frozen. Within this factor, the scoring takes into account the likelihood and the duration of contact. Using this method, proximity to a community is considered (high likelihood of contact), although proximity to a community does not necessarily trigger a high score if visits are infrequent (low duration of contact).

The likelihood of contact considers proximity to community or to a camp, as well as proximity to "travel routes". The duration of contact considers full time residences (i.e. permanent community for high, summer camp for moderate, winter camp or travel routes as low). Scores may be interpolated between the allocated points, according to Table 1 below. Unmanned Short Range Radar (SRR) sites, part of the North Warning System, are co-located at some of the former abandoned military sites, and periodic maintenance of these facilities is carried out. As a

conservative approach, it may be considered that maintenance workers may have a low likelihood of contact and low duration of contact.

Table 1: Scoring Guide for Section C.3.1

	High Likelihood of Contact	Moderate Likelihood of Contact	Low Likelihood of Contact
High Duration of Contact	8	6	4
Moderate Duration of Contact	6	4	2
Low Duration of Contact	4	2	1

Different areas on a site may need to be considered individually.

C.3.2 Proximity to Drinking Water Source

Regardless of whether the source is seasonal or perennial, an established community or a summer camp water source located downgradient of the WDA is to be considered in this factor.

C.3.3 Food Consumption

This factor is divided into two sub-sections, and the score is the sum of the score for each of the two sub-sections.

Sedentary organisms are more susceptible to local inputs as their exposure is greater if they are downgradient from the WDA. These organisms can include bottom-dwellers such as sculpins, mussels, sea urchins etc., as well as terrestrial vegetation, which can be used for medicinal purposes. This kind of contamination "is quite localized when considered on a broad regional scale" (DIAND 1997, pg. 5).

Migratory marine animals may have body burdens of contaminants; these are not directly attributable to local contaminant sources, as the vast majority of organochlorines, for instance, arrive in the Arctic via long range transport. Caribou living in the general area of DEW sites do not have elevated levels of contaminants, as they feed over a very wide area. The Canadian Arctic Contaminant Assessment Report (DIAND, 1997) describes these results in more detail.

It is recognized, however, that sources such as abandoned military sites do contribute contaminants to the Arctic ecosystem. For the purpose of scoring the matrix, therefore, a high consumption of animals from the area surrounding the site has the potential to pose a higher risk than a low consumption, although in general the risk remains low.

2.4 Special Considerations

As indicated in the introduction to the matrix, each of the three main categories includes a "*special considerations*" factor. The proposed value of the special considerations factor is a maximum of ten percent of the overall score for each category. It is intended that no circumstance will allow a user to assign a special considerations score that will cause the score for that category to exceed the maximum allotted. To avoid undue bias, it is also suggested that the user should complete the entire evaluation form and score a site before addressing special considerations in the total score.

The Environmental Working Group (EWG) based their landfill risk evaluation matrix on the CCME model which defines three categories: contaminant source, pathways and receptors. Within those three categories, the EWG tried to address all of the possible factors contributing to risk. Recognizing that even a thorough matrix could never address all possible risk factors, special considerations were included to address specific risk factors that are not general to all of the abandoned military sites.

As noted in the CCME document, the special considerations factor is not intended to be applied on a regular basis, as it addresses very site-specific risk factors. In fact, if the special consideration factor was being consistently applied in the scoring of a WDA, it would indicate that the matrix itself was incomplete. Special considerations should be site-specific characteristics that can be documented.

Three examples of how special considerations could be applied are provided to clarify the use of such a classification:

Example 1. Wildlife on site

It may be that "special considerations" points would be assigned to the Receptors category when endangered, threatened and/or vulnerable species (COSEWIC, 1997) are known to visit the WDA.

Example 2. Proximity to a community

In the WDA risk evaluation matrix, human exposure to a WDA is measured in the following way: people can spend time at the WDA (potential dermal exposure), they can drink water from an area near the WDA (potential ingestion), they could live very close to the WDA (potential exposure through aerial transport) or they could eat animals that feed near the WDA (potential ingestion). These considerations form section C.3 of the risk evaluation matrix. If a WDA is located near a community, there is a greater likelihood that people will spend time at the site than there is for areas far from a community. It is not necessarily the case, however, that WDAs near communities receive frequent visits; therefore, instead of creating a special section addressing proximity to a community, the risk of human exposure (see Table 1-1) is more accurately evaluated by measuring time spent at a WDA. In these cases, however, "special considerations" points may be added to the receptors category to address a community's specific concerns, such as the physical hazards associated with an exposed dump site.

2.5 Traditional Knowledge

The matrix for the evaluation of potential environmental risk was developed recognizing that local input would be relied upon in the scoring of WDAs. Additional guidance on the collection of Traditional Knowledge is provided in Section 4.10 of the protocol.

3 INTERPRETATION OF SCORES

The score obtained through the application of the matrix is intended to represent the potential environmental risk posed by a given WDA in its current state. The objective of remediation is to mitigate the risk associated with a WDA by preventing the migration of contaminants that may be present in the landfill, and by removing physical hazards.

During the development of the matrix by the EWG, WDAs at four different sites were evaluated by environmental scientists and engineers to assess the applicability of the matrix and to determine cut-off values between categories. WDA scoring 105 points or more is classified as potentially high risk (Class A) and require excavation. The high score accorded to these WDAs is generally a result of the ecological sensitivity of the area and the geometry and surrounding topography of the landfill, which precludes the development of a cost-effective and long-term design solution such as pathway intervention and/or stabilization of the landfill. WDAs with a score of 100-104 points must be considered on a case by case basis – some may require complete excavation while others may be considered Class B landfills. WDAs that score less than 105 require excavation/removal if one or more of the following conditions are met:

- The WDA is located at an elevation of less than 2 m higher than an ocean.
- The WDA consists of unconsolidated wastes at surface. Debris should be removed, classified, and sorted, and non-hazardous contents placed in an engineered landfill.
- WDA, with areal extent of less than 1000 m^2 and scoring a total of 89 points or more are classified as potentially high risk and require excavation to the full extent/depth of the debris. In addition, if these WDAs score greater than 23 points in the contaminant source category, complete excavation of the area is recommended.

A WDA with a score in the range 75 to 99 points is classified as moderate potential environmental risk (Class B). An engineered leachate containment system will be provided for these WDAs to mitigate against potential environmental risks. In specific cases where an engineered leachate containment system cannot be constructed, an evaluation of excavation will be carried out with the objective of determining whether complete excavation or partial excavation with a leachate containment system is required.

For WDAs of less than 1000 m^2, it is considered unlikely that leachate containment will be cost-effective when compared to excavation and removal of debris. Consideration must therefore be given to the level of contamination present. If contaminants are present in excess of criteria, it is recommended that the debris area be excavated to its full extent. If contamination does not exceed criteria, debris should be cut-off and removed within the upper 0.5 metres of the ground surface. The area should then be regraded to match surrounding topography.

A WDA with a score of 75 or less is classified as low potential environmental risk (Class C). In general, the remediation approach for these areas includes placement of an engineered cover, following collection, sorting, and appropriate disposal of debris from the surface, and excavation and disposal of any surface contaminated soils from the area. Some of the factors to be considered in the design of the cover include: thickness and type of the existing cover materials; slopes on the landfill; surrounding topography and available granular fill. The cover is designed to promote surface water run-off (i.e. no areas of standing water), prevent erosion, and mitigate against settlement. Where required, the slope of the WDA may be modified and/or geotextiles may be incorporated into the granular cover to provide a long-term solution. Generally, the final thickness of cover material is approximately 0.75 metres, and may be greater, dependent on site specific conditions. The granular cover material is to be placed in layers and compacted before the placement of the next layer of granular fill, until the design thickness is reached.

Overall, it is to be stressed that the matrix is to be used in the assessment of potential environmental risks associated with a specific WDA. It is not intended to be used as the sole criterion in determining the remediation solution for a WDA. The results of the matrix, both total score and the score from each major category, are to be considered in conjunction with the engineering evaluation of site conditions, to determine appropriate design solutions. Review of the individual category scores relative to the total score will highlight particular areas of concern that are to be addressed during the design process.

The potential impacts of climate change are also to be considered in evaluating remedial solutions.

It should be emphasized that the total score has an error associated with it of approximately 5 points; there is inevitable subjectivity in the scoring process and scores that fall near decision points should be considered on a case by case basis.

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ATTACHMENT 1

WASTE DISPOSAL AREA

EVALUATION MATRIX

	ENVIRONMENTAL RISK EVALUATION MATRIX WASTE DISPOSAL AREAS - ABANDONED MILITARY SITES	Maximum Score
A. A.1	CONTAMINANT SOURCE AREAL EXTENT OF WASTE DISPOSAL AREA	
	>10,000 m2	10
	For areas less than 10,000 = Area of Waste Disposal Area X 10 / 10 000	2-9
	Minimum Score	1
A.2	ESTIMATED DEPTH OF BURIED WASTES	
	greater than 1.5 m	5
	less than 1.5 m	2-4
A.3	CONTAMINANT CHARACTERIZATION	
	Concentrations in excess of DCC Tier II Criteria	25
	Concentrations in excess of DCC Tier I Criteria	20
	Concentrations elevated relative to background	10
	Potential Contamination	5
A.5	PRESENCE OF SURFACE DEBRIS	
	>50% of surface area	10
	<50% of surface area, pro-rated	1-9
	No debris observed	0
	SPECIAL CONSIDERATIONS	+/- 5
	TOTAL SCORE - CONTAMINANT SOURCE	

	ENVIRONMENTAL RISK EVALUATION MATRIX WASTE DISPOSAL AREAS - ABANDONED MILITARY SITES	Maximum Score
B.	**PATHWAY/TRANSPORT MECHANISMS**	
B.1	**AERIAL TRANSPORT OF CONTAMINANTS**	
	All Waste Disposal Areas Scored as 2, if surface sol contamination (A.4) or leachate (A.3) has been identified.	
B.2	**WATER MOVEMENT**	
B.2.1	**TOPOGRAPHY**	
	Steeply Slope (>40 % Grade)	12
	Sloping (10% to 40% Grade)	4-11
	Subdued to 10% Slope	2-3
	Flat (< 3%)	1
B.2.2	**COVER MATERIALS –DEPTH**	
	No to little existing cover	4
	Greater than 50% exposed/surface debris	3
	Occasional exposed/surface debris	2
	Existing cover, minimal debris,	1
	Cover thickness > average active layer thickness	0
B.2.3	**COVER MATERIAL – TYPE**	
	No cover	5
	Silty/Sandy Material	4
	Sandy/Gravel Material	3
	Gravel Material	1-2

B.	**PATHWAY/TRANSPORT MECHANISMS continued**	
B.2.4	**SURFACE WATER/RUN-OFF POTENTIAL**	
	Very High - evidence of erosion, continuing run-off, or wave action	12
	High - evidence of erosion, seasonal, widespread, storm waves	10
	Moderate - % area affected by erosion	3-9
	Low - no evidence of erosion, slight slopes	1-2
B.2.5	**PRECIPITATION**	
	> 100 cm snow pack	4
	< 100 cm snowpack (pro-rated)	1-4
	Snow Drifting	1
B.2.6	**DISTANCE TO DOWNGRADIENT PERENNIAL SURFACE WATER/SEASONAL DRAINAGE CHANNEL**	
	0 to 100 m	10
	100 to 300 m	7-9
	300 to 1 km	2-6
	greater than 1 km	1
	SPECIAL CONSIDERATIONS	+/- 5
	TOTAL SCORE – PATHWAYS	

	ENVIRONMENTAL RISK EVALUATION MATRIX WASTE DISPOSAL AREAS - ABANDONED MILITARY SITES	Maximum Score
C.	**RECEPTORS**	
C.1	**POTENTIAL IMPACT ON RECEIVING FRESHWATER/MARINE HABITAT**	
C.1.1	**PROXIMITY TO RECEIVING FRESHWATER/MARINE HABITAT**	
	0 to 100 m	6
	100 to 300 m	4-5
	300 to 1 km	2-3
	greater than 1 km	1
C.1.2	**ESTIMATED HABITAT USAGE - FRESHWATER/MARINE**	
	High; High Biodiversity/ High Occurrence/Calving or Spawning Area	5-6
	Moderate: Moderate Biodiversity, Migratory	3-4
	Low: Low biodiversity; rare sightings	1-2
C.2	**POTENTIAL IMPACT ON RECEIVING TERRESTRIAL HABITAT**	
C.2.1	**Extent of Vegetation**	
	Extensive vegetation growth, (80 to 100 % ground cover)	6
	Moderate vegetation growth (40 to 80% ground cover)	4-5
	Low vegetation growth (20 to 40% ground cover)	2-3
	Sparse vegetation (<20% ground cover)	1
C.2.2	**ESTIMATED HABITAT USAGE - TERRESTRIAL/AVIFAUNA**	
	High; High Biodiversity/ High Occurrence/Calving, Denning or Nesting Area	5-6
	Moderate: Moderate Biodiversity, Migratory	3-4
	Low: Low biodiversity; rare sightings	1-2

C.	RECEPTORS continued.	
C.3	POTENTIAL HUMAN EXPOSURE THROUGH LAND USE	
C.3.1	**Presence/Occupation**	
	Duration of Contact /Likelihood of Contact	7-8
	see chart and provide rationale for scoring	4-6
		1-3
C.3.2	**Proximity to Drinking Water Source**	
	0 to 100 m	8
	100 to 300 m	5-7
	300 to 1 km	2-4
	greater than 1 km	1
C.3.3	**Food Consumption**	
	High quantity of sedentary organisms - marine & plant life	8
	Moderate quantity of sedentary organisms - marine & plant life	6
	Low quantity of sedentary organisms - marine & plant life	4
	No consumption	0
	High quantity of migratory organisms	2
	Moderate quantity of migratory organisms	1
	Low quantity of migratory organisms	0.5
	No consumption	0
	SPECIAL CONSIDERATIONS *TOTAL SCORE – RECEPTORS*	+/-5
	TOTAL SCORE	

Annex B – Barrel Protocol

1 INTRODUCTION

In order to determine the correct disposal method for barrels and their contents, the contents must first be identified. All barrel contents should be sampled and analyzed according to DND DEW Line Cleanup standard procedures, as described in this section.

Analytical data obtained for the samples collected from barrels located at the site should be compared to the criteria included in Table 1, below. Barrel contents are identified as organic or aqueous and the concentrations of glycols, alcohols, PCBs, chlorine, cadmium, chromium and lead are determined. The flash point of organic waste and aqueous waste (> 2% glycols/alcohols) must also be determined. Uncontaminated aqueous phases can be disposed of on the land according to the discharge criteria; uncontaminated organic phases can be incinerated; contaminated aqueous material should be scrubbed free of organic material; and contaminated organic material should be disposed of as hazardous material.

During the delineation phase of the site investigation, an inventory of the number and locations of barrels at the site is to be compiled. This inventory should include buried or partially buried barrels that will be taken out of the landfills during excavation. Where significant numbers of barrels are present on a site, and if safe to do so, representative samples shall be collected to provide a preliminary indication of whether on-site incineration is a viable alternative. Otherwise, barrels are only sampled during the cleanup phase and as such, the handling, transportation and opening of barrels is the responsibility of the site Contractor.

Other waste fuels and oils are also sampled according to this protocol. These may come from a variety of sources including, but not necessarily limited to, old generators, fuel tanks and pipelines, and transformers.

2 INSPECTION

All barrels are to be inspected to address the following items which shall be recorded and used as a guide prior to opening barrels.

- Symbols, words, or other marks on the barrel that identify its contents, and/or that its contents are hazardous: e.g. radioactive, explosive, corrosive, toxic, flammable.
- Symbols, words, or other marks on the barrel that indicate that it contains discarded laboratory chemicals, reagents, or other potentially dangerous materials in small-volume containers.
- Signs of deterioration or damage such as corrosion, rust, or leaks at seams, rims, and V grooves, or signs that the barrel is under pressure such as bulging and swelling.
- Spillage or discoloration on the top and sides of the barrel.

3 SAMPLING

Barrels shall not be transported until it has been determined that they are not under pressure, do not leak, and are sufficiently sound for transport.

Barrels to be sampled should be set in an upright position, provided that this does not cause them to leak and that it is physically possible.

Barrels should only be opened according to accepted procedures and under qualified supervision, preferably using remotely operated, non-sparking equipment.

Once open, barrels will be sampled by personnel wearing proper personal protective equipment as described below. Samples of the contents of all barrels shall be extracted using a drum thief and placed into a pre-labelled glass vial. The number and type of liquid phases, and their respective thickness, and the size of each barrel are to be recorded.

In instances where there are a large number of barrels with obviously similar contents, these can be grouped together and 30 to 40% of the barrels in the group sampled. Barrels containing less than 50 mm of liquid may be combined with compatible material prior to sampling; samples inferred to contain only water on a visual examination shall be tested prior to this consolidation. Barrel contents, which consist of black oil, shall not be consolidated.

All barrels shall be clearly numbered using spray paint or other suitable paint marker. The number on this label should be the only sample coding provided to the laboratory.

The barrel locations and barrel sample descriptions should be recorded.

Samples should be kept at ambient temperatures and shipped by guaranteed freight to laboratories where they should be kept cold pending analysis.

4 TESTING

Liquid samples shall be inspected and classified as either containing water or organic materials. Samples thought to contain water shall be analyzed to confirm that they are indeed water, and contain less than 2% glycols or alcohols.

The contents of barrels containing organic materials, including aqueous samples which contain more than 2% glycols or alcohols, shall be tested for flash point, PCBs, total chlorine, cadmium, chromium and lead following the targeted barrel testing approach presented in Figure 1. Analyses will be conducted on a rush basis where indicated. In addition, major organic components should be identified e.g. fuel oil, lubricating oil.

If on site incineration of waste is not planned, waste samples need only be tested for flash point, PCB, and pH (at regular turnaround time) in order to classify the waste for transport and disposal options.

Contents of barrels which contain two or more phases shall have all phases analyzed; the organic phases as described above and the aqueous phase to ascertain whether it contains less than 2% organic substances. In addition, the aqueous phase shall be tested for any components found in the organic phases above the criteria provided in the protocol.

5 DISPOSAL OF BARREL CONTENTS

Barrels containing only rust and sediment shall be treated as empty barrels.

Barrel contents comprising water only (less than 2% glycols or alcohols) shall be transferred to an open vessel such as a utility tub or half-barrel and any organic material removed by agitation with a pillow or segment of oil absorbent material. The water shall be tested prior to discharge in accordance with wastewater discharge criteria. Where water meets criteria, it may be discharged to the ground a minimum of 30 meters distance from natural drainage courses. Used oil absorbent material shall be treated as described in the following subsection.

Barrel contents which are composed of water with glycols and/or alcohols or organic phases, and which contain less than 2 ppm PCBs, 1000 ppm chlorine, 2 ppm cadmium, 10 ppm chromium, 100 ppm lead, and that have a flash point between 25°C and 225°C, may be disposed of by incineration. Alternatively these contents may be disposed of off-site at a licensed disposal facility. The solid residual material resulting from incineration shall be subjected to a leachate extraction test. Material found to not be leachable shall be disposed of as DCC Tier II contaminated soil. Leachable material shall be treated as hazardous waste and disposed of off-site at a licensed disposal facility.

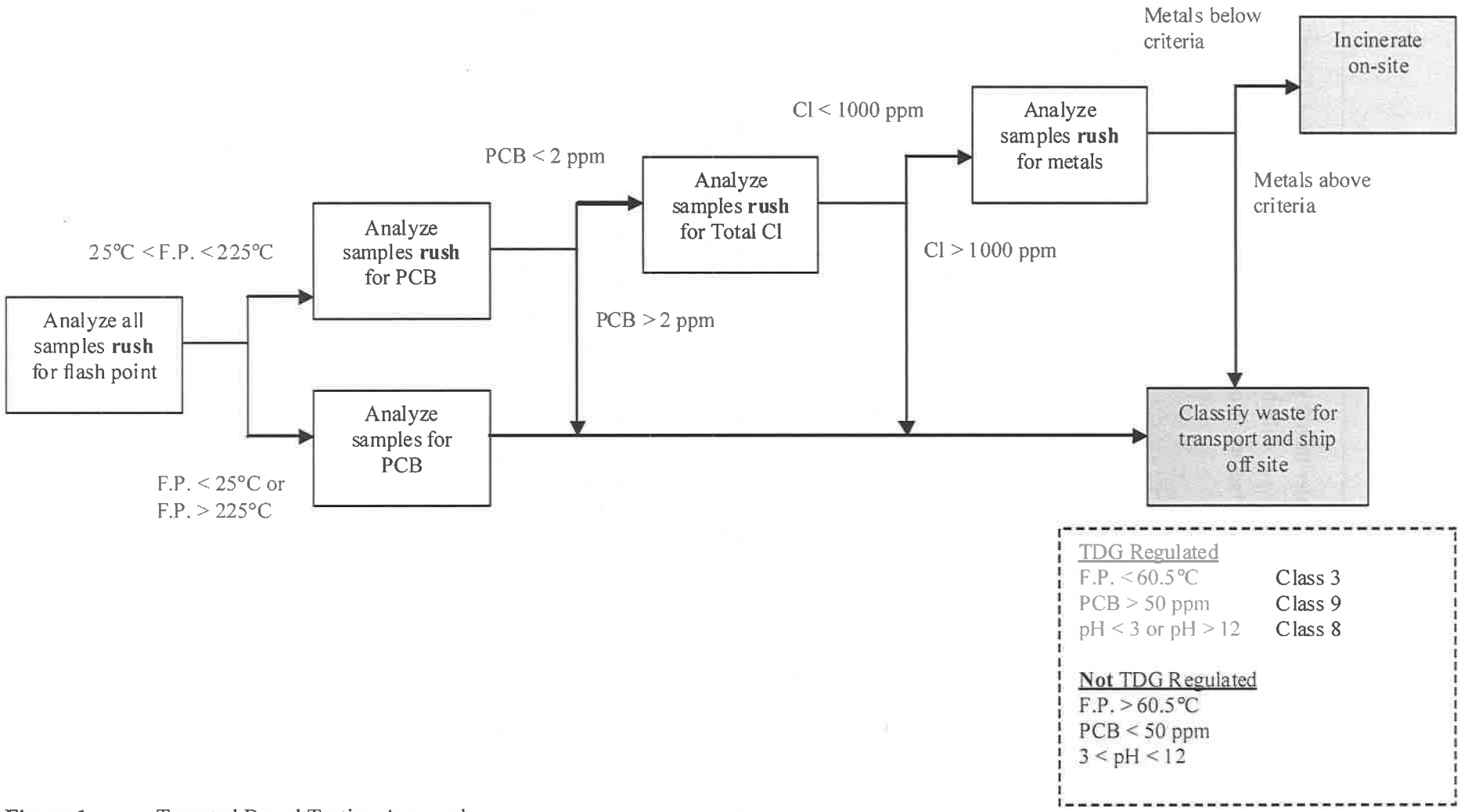


Figure 1 Targeted Barrel Testing Approach

Barrel contents, which contain greater than 2 ppm PCBs, 1000 ppm chlorine, 2 ppm cadmium, 10 ppm chromium or 100 ppm lead, or that have a flash point below 25°C or greater than 225°C shall be disposed of off-site at a licensed disposal facility. Contents may be combined with compatible materials for shipping purposes.

Used oil absorbent material should be treated as hazardous waste and disposed of off-site at a licensed disposal facility. If it is shown to be uncontaminated with PCBs (< 2 ppm), chlorine (< 1000 ppm), cadmium (< 2 ppm), chromium (< 10 ppm) and lead (< 100 ppm), it may be incinerated on-site.

6 DISPOSAL OF BARRELS

Empty barrels may be crushed or shredded and landfilled on-site as non-hazardous waste after they have been cleaned in an appropriate manner. The barrels shall be crushed in such a manner so as to reduce their volume by a minimum of 75%. Shredded barrels may be disposed of off-site as recycled metals.

7 PERSONNEL PROTECTIVE EQUIPMENT

Safety equipment required includes a respirator with organic vapour cartridges, safety glasses, a hard hat, rubber safety boots, double gloves (chemically resistant on the outside, and latex or vinyl on the inside) and disposable Syranex-coated coveralls.

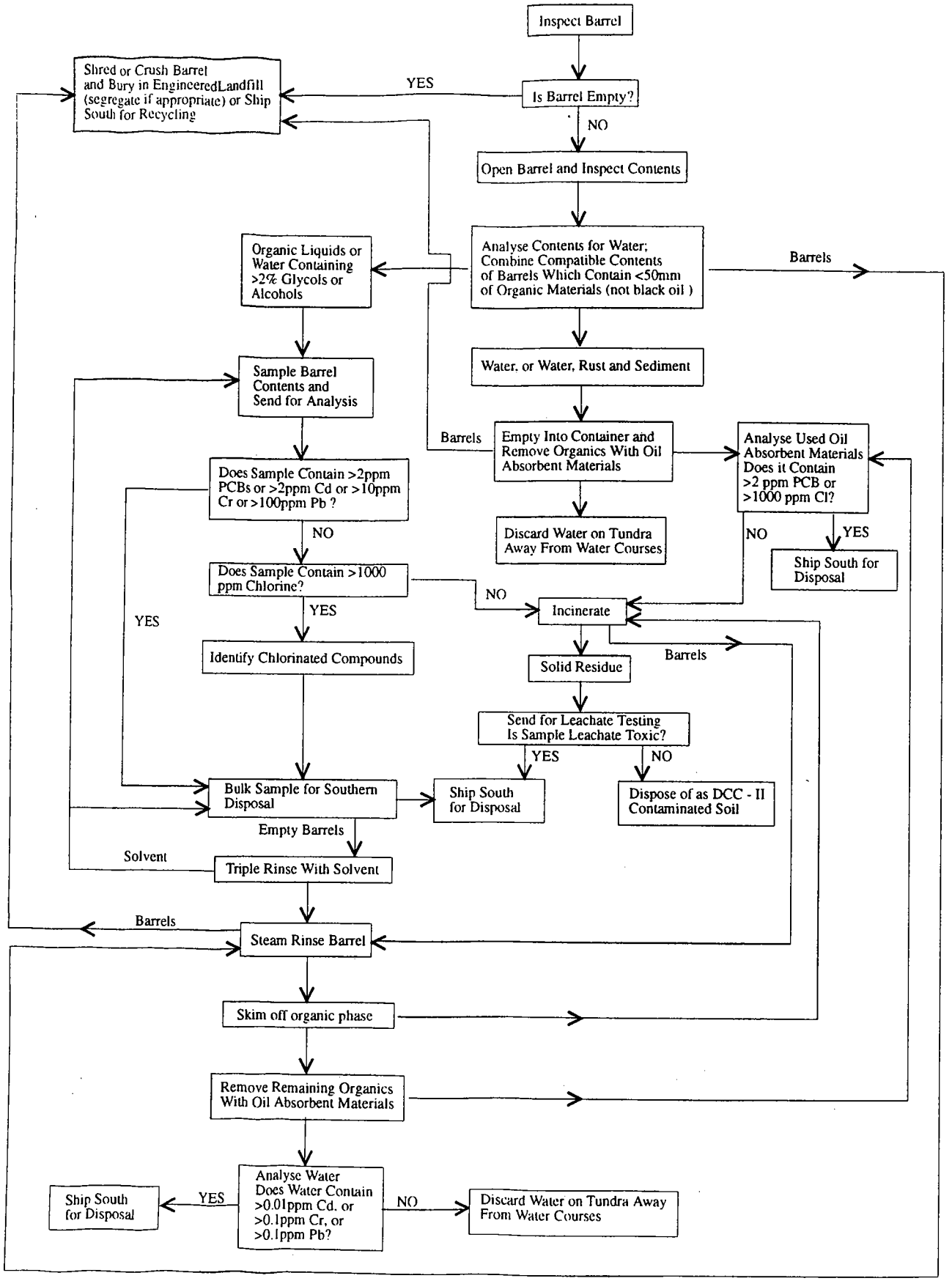
A decontamination procedure should be established at the barrel sampling area(s) to prevent tracking potentially contaminated liquids outside of the sampling area(s).

It is advisable to have one person outside of the sampling area to observe the sampler(s) in case of unexpected hazards, and also to record the samplers' observations.

APPENDIX C

DND DEW LINE CLEANUP BARREL PROTOCOL

FLOW CHART FOR THE DEW LINE CLEAN UP BARREL PROTOCOL



APPENDIX D

MEETING MINUTES – COMMUNITY CONSULTATION

Qikiqtarjuaq Community Consultation on FOX-D Remedial Action Plan

Date: January 29th, 2014 (7:00- 9:00 PM EST)

Location: Qikiqtarjuaq Community School Gymnasium, Qikiqtarjuaq, Nunavut

Present: Janice Lee (PWGSC), Erika Solski (AANDC), Indra Kalinovich (Dillon Consulting), Rosemary Metuq (translator from Qikiqtarjuaq, Nunavut).

The consultation was advertised over the radio and by posters. The original community consultation was scheduled for January 28th, 2014 and was postponed to January 29th, 2014 due to weather. Presentation handouts were printed in English and Inuktitut. Information on AANDC's contaminated sites program were made available in English, French and Inuktitut. All information was presented on a table near the entrance, where attendees could sign in with Janice Lee (PWGSC). Most attendees picked up all available information.

The consultation was attended by 58 individuals from the community, with some additional children. Janice Lee (PWGSC) recorded the names of attendees for record keeping.

The presentation outlined AANDC's contaminated sites program, the bidding and tender process, the applicable guidelines and site criteria to FOX-D, environmental concerns at FOX-D, archaeological areas of interest near the site, the proposed remedial action plan and the project timeline. The presentation was delivered by Erika Solski (AANDC) and Indra Kalinovich (Dillon Consulting).

After the presentation, a question and answer period was held, inviting the community to share stories and any knowledge about activities (be it traditional or related to the former DEW Line) with AANDC. The community was invited to share any concerns and ask any questions with respect to the proposed remedial activities for FOX-D.

Community Questions and Comments
(Gamailee Nookiguak to Erika Solski):
<<in the powerpoint presentation to the community, there was a slide during the archaeological impact assessments that contained a photograph of an old snowmobile toy made of wood >>

I used to camp up there in the late 1960s and made that toy snowmobile out of power corp shop (*wood*). I remember camping there in the spring, often. At the time, it was the furthest camp from the community of Qikiqtarjuaq. I would like the co-ordinates of the toy location and would like my toy back.

(Johnny Kooneeliusie to Indra Kalinovich): I worked for Parks Canada during the clean-up in the 1980s. I was involved with the clean-up. The large Doppler building and all the site was pushed out onto the ice for ocean disposal. I know the ice disposal location.

General Comments
There were a number of general comments and questions from community members about where to submit applications for work and when the work going to start. AANDC and Dillon Consulting re-iterated the bidding and tender process and that site mobilization activities were tentatively scheduled for 2015. Once the contract was won, a separate contractor other than AANDC would be arranging for employment. There would likely be a second community consultation after the contract was won – in winter of 2015.

APPENDIX E

SUMMARY TABLES

TABLE 1
LEAD PAINT SAMPLING
FOX-D KIVITOO DEW LINE SITE, NU

Sample ID [1]	Location	Paint Source	Colour	Total Lead Concentration (mg/kg)	Leachable Lead (mg/L)	Condition
RDL					*0.10*	
LP-01	Lower Site Former POL Tank Area	Plywood	White	796 [2]	<0.10	poor condition
LP-02	Upper site, APEC 1A and 1B	Diesel Tank	Silver	100000 [3]	**46.10**	good condition
LP-03	Upper Site, APEC 2	Radio Antenna	White/ Orange	49000 [4]	0.24	poor condition
Northwest Territiories Environmental Protection Act [5]						
Minimum concentration of lead in paint considered lead-based		-	-	600 mg/kg	-	
Transportation of Dangerous Goods Regulation (SOR/2001-245, Amended 2012-12-05)[5]						
Minimum leachable lead concentration considered hazardous		-	-	-	5	

Notes:
RDL = Reportable Detection Limits

1. Samples obtained on August 10, 2013 by Katey Miller.
2. Laboratory detection limit for Lead is 3.0 mg/kg.
3. Laboratory detection limit for Lead is 300 mg/kg.
4. Laboratory detection limit for Lead is 60 mg/kg.
5. As specified in the Abandoned Military Site Protocol (Volume 1, Main Report, December 2008).

- Lead-based Paint.
BOLD - Exceeds TDGA Leachate Quality Criteria

TABLE 2
BULK ASBESTOS CONTENT
FOX-D KIVITOO DEW LINE SITE, NU

Sample ID [1]	Sample Description	Source/ Location	Bulk Asbestos Content [2, 3]												
			Asbestos Type						Asbestos Content	Other Content					
			Actinolite	Amosite	Anthophylilite	Chrysotile	Crocidolite	Tremolite		Cellulose	Glass Fibres	Cellulose and Glass	Hair	Filler	Filler and Tar
									0.50%	0.50%	0.50%	0.50%		0.50%	0.50%
AS-01	White, Friable, poor condition	Pipe Insulation, in northern slope landfill area - APEC 9	ND	ND	ND	60-80	ND	ND	-	ND	ND	-	ND	20-40	-
AS-02	White/grey, non friable, good condition	Wall board, at former warehouse area - APEC 4	ND	ND	ND	10-30	ND	ND	-	ND	ND	-	ND	70-90	-

Sample ID [1]	Sample Description	Source	Asbestos Identification	Asbestos Identification (%) [4]	Total Asbestos (%)
AS-03	White/ brown, non friable, good condition	Floor tile, at former warehouse area - APEC 4	Non-detected	0	<0.1
AS-03	Black fibrous backing, non friable, good condition	Floor tile, at former warehouse area - APEC 4	Chrysotile	30	1.7

Notes:
ND = Not detected
1. Samples obtained on August 10, 2013 by Katey Miller.
2. Bulk asbestos content expressed as a percentage (%) volume fibre found/submitted (%vol/vol).
3. Analyzed via Polarized Light Microscopy (PLM)
4. Analyzed via Transmission Electron Microscopy (TEM).

- Asbestos Containing Material (ACM)

TABLE 3
DRUM INVENTORY
FOX-D KIVITOO DEW LINE SITE, NU

Number	Location	Description	Contents	Sample ID
001	Outfall	yellow, intact.	empty	
002	Outfall	yellow	empty	
003	Northeast summit slope	intact, brown and rusty.	rocks	
004	Northeast summit slope	intact, brown and rusty.	rocks	
005	Northeast summit slope	intact, brown and rusty.	rocks	
006	Northeast summit slope	intact, brown and rusty.	rocks	
007	Northeast summit slope	intact, green and rusty	1/8 liquid	
008	Northeast summit slope	intact, brown and rusty.	rocks	
009	Northeast summit slope	intact, brown and rusty.	empty	
010	Northeast summit slope	old paint can (5 gallon)	filled with dried grey chips (concrete)	
011	Northeast summit slope	rusty	empty	
012	Northeast summit slope	5 gallon paint can rusty	empty	
013	Northeast summit slope	green with rust	empty	
014	Northeast summit slope	green with rust	empty	
015	Northeast summit slope	green with rust	empty	
016	Northeast summit slope	green with rust	empty	
017	Northeast summit slope	green & rusty	empty	
018	Northeast summit slope	green & rusty	thin layer liquid across bottom, not enough to sample	
019	Northeast summit slope	rusty brown	1/4 full, spout at drainage pathway, no smell to liquid, no colour. Just water.	
020	Northeast summit slope near bottom	brown rusty	empty	
021	North slope of summit	green & rusty, cap on.	empty	
022	East of North slope dump	rusty brown	empty	
023	North slope dump	green with rust, caps off	1/5 full	
024	North slope dump	green, rusty, caps off	1/5 full	
025	North slope dump	rusty brown, lid off	empty	
026	North slope dump	lid cut open, rusty brown	empty	
027	North slope dump	lid cut open, rusty brown	empty	
028	North slope dump	lid cut open, rusty brown	empty	
029	North slope dump	lid cut open, rusty brown	empty	
030	North slope dump	green with rust, lid cut off	empty	
031	North slope dump	yellow with rust	empty	
032	North slope dump	green with rust (rusted fuel)	empty	
033	North slope dump	green with rust (rusted fuel)	empty	
034	North slope dump	green with rust (rusted fuel)	empty	
035	North slope dump	green with rust (rusted fuel)	empty	
036	North slope dump	green with rust (gasoline)	empty	
037	North slope dump	rusted	empty	
038	North slope dump	intact, green paint with rust. Top main cap open. Writing: CCC 5B US 165552	rusty orange water, sediment at bottom. 1 phase. 1/10 full.	2013-142
039	North slope dump	green, lid cut off	empty	
040	North slope dump	yellow, lid cut off,	empty	
041	North slope dump	green, rust, (gasoline)	empty	
042	North slope dump	rusty, cut off lid	empty	
043	North slope dump	good condition, rusty (green or yellow?), 1 puncture on side, top open.	1 phase, rusty orange water with black sediment. 1/10 full.	2013-147
044	North slope dump	brown ,rusty green with splashes of red paint	empty	
045	North slope dump	brown, rusty, open at the top	empty	
046	North slope dump	once green, rusted, lid cut off	empty	
047	North slope dump	green, rusted plug open	empty	
048	North slope dump	green, rusted	empty	
049	North slope dump	rusty brown, shadow at bottom	empty	
050	North slope dump	green, rusted	rocks	
051	North slope dump	yellow, rusted	rocks	
052	North slope dump	top cut open	has water	
053	North slope dump	green paint, rusty, top cut open	clear liquid, transparent, one pahse, slight yellow tinge. No sheen	2013-151
054	North slope dump	green with rust, lid cut open	empty	
055	North slope dump	green with rust, lid cut open	empty	
056	North slope dump	green with rust, sealed	empty	
057	North slope dump	black/blue, rusted (gasoline), sealed	empty	
058	North slope dump	yellow with rust, intact open	one phase, murky, brown-orange sediment. Putrid smelling.	2013-144
059	North slope dump	green with rust, yellow writing. Buried, labelled 'automotive'. Class C 9130-264-6216	sheen on water, sediment on bottom. 1 phase, rusty orange water.	2013-152
060	South Slope (down from warehouse foundations)	blue, rusted, cap off	empty	
061	South Slope (down from warehouse foundations)	rusty, lid off	empty	
062	South Slope (down from warehouse foundations)	rusty, cap off	empty	
063	South Slope (down from warehouse foundations)	green, rusted, lid cut off	empty	
064	South Slope (down from warehouse foundations)	cap open and pointed upstream	(has some liquid, water)	
065	South Slope (down from warehouse foundations)	green, cap off	empty	
066	South Slope (down from warehouse foundations)	green	empty	
067	South Slope (down from warehouse foundations)	brown, rusty, cap off	empty	
068	South Slope (down from warehouse foundations)	green, rusted	empty	
069	South Slope (down from warehouse foundations)	green, rusted	empty	
070	South Slope (down from warehouse foundations)	open at top	empty	
071	South Slope (down from warehouse foundations)	green, open,		
072	South Slope (down from warehouse foundations)	green, sealed	has some liquid.	
073	South Slope (down from warehouse foundations)	green, rusted, cap on	empty	
074	South Slope (down from warehouse foundations)	green, rusted	empty	
075	South Slope (down from warehouse foundations)	green, rusted	empty	
076	On top of summit	green barrel, open at top, rusted	empty	

Notes:

1. Drum inventory and sampling conducted on August 6, 2013 by Indra Kalinovich.
2. A minimum of 50 drums/barrels were marked as debris.
3. A total of 5 samples of were collected from liquid drums. Laboratory results identified the liquid as water for each sample.

TABLE 4
SUMMARY HAZARDOUS MATERIALS
FOX-D KIVITOO DEW LINE SITE, NU

Type	Description	Location	Photo	Estimated Area (m^2)	Estimated Volume (m^3)	Estimated Weight	Methodology	Comments
Asbestos [1]	Insulation on pipes	APEC 9 - Northern Slope Dump Site	1, 2	7.87	0.54	0.54 kg	Calculations based on field measurements and visual observations	Exposed pipe insulation observed scattered within the dump site. Poor condition, friable. Sample AS-01 (Table 2).
	Wallboard	APEC 4 - Warehouse Foundation	4, 5, 6	0.93	0.43	0.43 kg	Calculations based on field measurements and visual observations	Wallboard observed at the foundation of the former warehouse. Generally in good condition, non-friable. Sample AS-02 (Table 2).
	Floor tile	APEC 4 - Warehouse Foundation	4, 5, 6	4.65	0.35	0.35 kg	Calculations based on field measurements and visual observations	Floor tile observed at the foundation of the former warehouse. Good condition, non-friable. Sample AS-03 (Table 2).
Lead Paint [2]	White paint on plywood	near APEC 12 - Beach POL and Landing Area	7, 8, 9	13.83	0.0018	0.022 kg	Calculations based on field measurements and visual observations	Unclear if building where sample was taken is apart of the subject property. Sample LP-01 (Table 1). Non-hazardous (<5 mg/kg).
	Silver paint on POL tanks and Transfer tank	APEC 1A Transfer Tank APEC 1B - POL Tanks	10, 11, 12, 13, 14	227.33	0.029	0.35 kg	Calculations based on field measurements and visual observations	Same paint on the POL tanks and the transfer tank. Sample LP-02 (Table 1). Hazardous (>5 mg/kg).
	White/ Orange paint on radio antenna	APEC 2 - Antenna	15, 16, 17, 18	11.94	0.0015	0.018 kg	Calculations based on field measurements and visual observations	Includes area of paint splattered on rocks adjacent to antenna. Sample LP-03 (Table 1). Non-hazardous (< 5mg/kg).
PCBs [3]	Transformer in landfill	APEC 9 - Northern Slope Dump Site	36	0.5	0.25	1.96 metric tonnes	Calculations based on field measurements and visual observations	PCBs confirmed during previous investigations. Volume and weight includes entire metal cabinet with transformer and PCB oil.
Battery Remains	Batteries	APEC 7 - Stain #2	19, 20	0.72	0.22	0.29 metric tonnes	Calculations based on field measurements and visual observations	Weight calculated using an estimated weight of 80 lbs per battery. Batteries found scattered within APEC 7 - Stain #2.

Notes:
1. Estimated density of 1 $kg/m^{3.}$
2. Density of 12 kg/m^3 (as complete paint matrix).
3. Density of 7850 kg/m^3 (cast iron).

TABLE 5
SUMMARY NON-HAZARDOUS MATERIALS
FOX-D KIVITOO DEW LINE SITE, NU

Type	Description	Location	Photo #	Estimated Area (m^2)	Estimated Volume (m^3)	Estimated Weight (Metric Tonne)	Methodology	Comments
Metal [1]	Drums	Upper and Lower Sites	3, 23, 24, 30	153.1	1.5	11.80	- Volume based on dimensions of a typical 205 L steel drum: diameter 0.57 m, height 0.84 m, and thickness 0.01 m.	- 76 steel drums were observed scattered throughout the upper and lower sites. Refer to Drum Inventory table for exact locations (Table 3). - Does not include suspected buried or partially buried drums.
	Tanks	APEC 1A - Transfer Tank APEC 1B - POL Tanks	10, 14	227.3	17.3	136.00	- Calculations based on field measurements and visual observations.	- Tanks include the POL tanks at the upper site and the transfer tank at the upper site.
	Pipes/Drains	APEC 1B - POL Tanks APEC 3 - Burnt Building Remains APEC 12 - Landing Area	28	28.7	0.2	1.6	- Calculations based on visual observations and survey data.	- Pipes/drains include the valve at the former POL tanks at the Lower site and the underground pipes at the burnt remains and the POL tanks area at the upper site.
	Radio Antenna	APEC 2 - Antenna	15, 16, 17, 18	11.94	1.8	14.1	- Calculations based on field measurements and visual observations.	
	Cabinets	APEC 9A - Dump Site	22, 23, 37	3.5	1.8	13.72	- Calculations based on field measurements and visual observations.	- Includes the metal cabinets within the dump site and the metal cabinets located 20 - 25 m northeast of the dump site.
Concrete [2]	Concrete Foundation	APEC 6 - Former Garage (Upper Site)	25, 26	160.1	256.2	594.4	- Calculations based on visual observations and survey data.	- Staining observed on the concrete foundation.
	Concrete Foundation	APEC 4 - Warehouse Foundation (Upper Site)	4, 5, 6	122.5	215.4	499.7	- Calculations based on visual observations and survey data.	
	POL Tank Foundation (2 foundations)	APEC 1B - POL Tanks (Upper Site)	13	29	32.5	75.4	- Calculations based on visual observations and survey data.	
	Concrete Anchors (3 anchors)	APEC 2 - Antenna (Upper Site)	34	33.3	100.0	232	- Calculations based on visual observations and survey data.	
	Concrete Foundation at Construction Camp	APEC 11A - Construction Camp (Lower Site)	15, 17	70.9	43.9	101.8	- Calculations based on visual observations and survey data.	
	Former POL Tank Foundation (2 foundations)	APEC 12 - Barge Landing (Lower Site)	27, 29	29	32.5	75.4	- Calculations based on visual observations and survey data.	
	Thrust Blocks (3 blocks)	APEC 12 - Barge Landing (Lower Site)	27, 28	1.12	1.7	3.9	- Calculations based on visual observations and survey data.	
	Valve Thrust Blocks (2 blocks)	APEC 12 - Barge Landing (Lower Site)	27, 28, 29	3	1.8	4.2	- Calculations based on visual observations and survey data.	
Landfill/Buried debris [3]	Landfill	APEC 9 - Dump Site (Upper Site)	3, 21, 22, 23, 24	2287.9	6095.1	-	- Calculations based on visual observations and survey data.	- Exposed and partially buried metal waste, drums, metal cabinets, PCB transformer and asbestos observed within the dump site.
	Landfill	APEC 10 - Dump Site (Upper Site)	35	367.1	550.7	-	- Calculations based on visual observations and survey data.	- Landfill area not identified in previous reports. - Exposed and partially buried metal waste and drums observed within the dump site.
	Landfill (Metal Waste)	APEC 11A - Construction Camp Landfill (Lower Site)	30, 31, 32, 33	2713.7	4885.0	-	- Calculations based on visual observations and survey data.	- Landfill area not identified in previous reports. - Exposed and partially buried metal waste and drums observed in landfill.
	Landfill (Unknown Waste)	APEC 11A - Construction Camp Landfill (Lower Site)	30, 31, 32, 33	5081	8793.0	-	- Calculations based on visual observations and survey data.	- Landfill area not identified in previous reports.
	Construction Camp Area	APEC 11A - Construction Camp (Lower Site)	35	1155.8	577.9	-	- Calculations based on visual observations and survey data.	- Surface staining.
	Fuel Drum Cache	APEC 11B - Construction Camp (Lower Site)	30, 35	109.5	219.0	-	- Calculations based on visual observations and survey data.	- Partially buried drums visible.
TOTALS				**12588.46**	**21827.25**	**1764.02**		

Notes:
1. Density of cast iron 7850 kg/m^3.
2. Average concrete density 2320 kg/m^3.
3. Unknown density for landfill areas. Unable to calculate weight.

APPENDIX 6:

FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Environmental Impact Assessment of the FOX-D Remedial Action Plan Kivitoo, NU

PUBLIC WORKS AND GOVERNMENT SERVICES

November 2014

FOX-D (Kivitoo) DEW Line Site: Environmental Impact Assessment Screening Report
Kivitoo, NU

PUBLIC WORKS AND GOVERNMENT SERVICES

13-7942

Project Manager:
Douglas Bell P. Geo

Submitted by:

DILLON CONSULTING LIMITED

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(in reply, please refer to)
Our File: 13-7942

DILLON CONSULTING

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November 7, 2014

Northern Contaminated Sites
Public Works and Government Services Canada
Suite 420, Greenstone Building, 5101 – 50th Avenue
Yellowknife, Northwest Territories X1A 3Z4

Attention: Ms. Janice Lee
Project Manager

RE: Environmental Impact Assessment – FOX-D

Dear: Ms. Lee

Please find enclosed one (1) digital copy of the above mentioned report and six (6) hard copies. If you have any questions or comments, please feel free to contact either Douglas Bell, M.Sc., P.Geo., or Indra Kalinovich, Ph.D., C.Chem. E.I.T., at 204-453-2301.

Yours truly,

DILLON CONSULTING LIMITED

Doug Bell, M.Sc., P.Geo
Partner

MAM/jar

Attached:

O:\PROJECTS\FINAL\137942\Reports\Fox-D EA\Final\FOX-D EA Final Report _11.07.2014.docx

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1.0 INTRODUCTION

Aboriginal Affairs and Northern Development Canada (AANDC) has responsibility for most federal lands in the North. Through the Northern Contaminated Sites Program (NCSP), AANDC is responsible for managing contaminated properties that are no longer maintained by the original occupant. The former FOX-D (Kivitoo) Intermediate Distant Early Warning (DEW) line site in Nunavut, a former military base, is one of these sites. The FOX-D site was constructed in 1957 and operated until October 1963.

On behalf of AANDC, Public Works and Government Services Canada (PWGSC) retained Dillon Consulting Limited (Dillon) to complete a Phase III Environmental Site Assessment (ESA), a Remedial Action Plan (RAP), and an Environmental Impact Assessment (EIA) of the RAP for the former military base FOX-D. A Heritage Resource Impact Assessment (HRIA) was also completed by Golder Associates Ltd. (Golder) in 2013 on behalf of Dillon. Field work necessary to complete these phases of this project was undertaken in August of 2013.

Section 12.2.4 of the Nunavut Land Claims Agreement (NLCA) requires that the Nunavut Impact Review Board (NIRB) screen project proposals based on defined criteria. Project proposals are provided to NIRB by regulatory agencies as part of the overall project approval process. This EIA was undertaken in accordance with these legislative requirements.

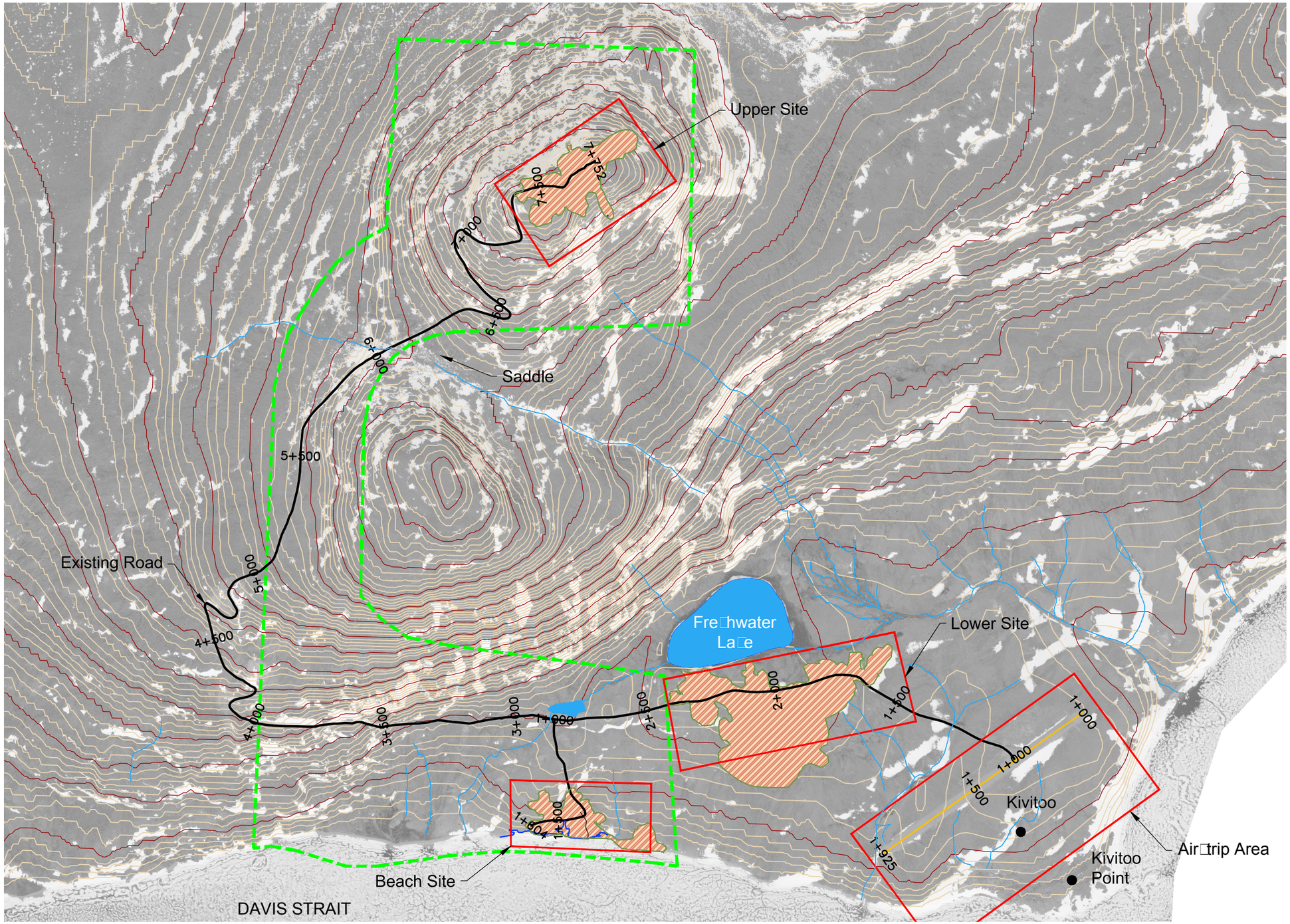
2.0 PROJECT CONTEXT

DEW stations were established in the Canadian North post World War II as a first line of defense for North America against potential enemy aircraft. Over 50 sites were positioned along the same latitude covering 3,000 miles across the North. First developed in 1957, several sites were abandoned in 1963 with the advent of more modern technology. Many of the abandoned sites became the responsibility of Parks Canada, the federal department which undertook initial decommissioning. Parks Canada managed the sites until 1992 when the custody of the facilities transferred to the former Indian and Northern Affairs (INAC) (INAC has since been renamed to Aboriginal Affairs and Northern Development Canada (AANDC)). Figure 1 is the identified property boundary which demarcates Inuit-owned versus Crown-owned land. The FOX-D site and affected area encompasses both properties. AANDC has taken on ownership for remediating the FOX-D Site.

The sites were operated as former military bases with infrastructure to support the operation of the activities. Although generally inaccessible by road, the sites were serviced by aircraft and where possible supply vessels. Camp installations were provided for military personnel to permit year round occupation in what would be considered inhospitable conditions. Fuel storage was provided to heat the buildings as well as support any land-based motorized vehicles. Other hazardous materials were commonly used without a full understanding of the potential environmental effects. Following 1963, the sites were left unattended until Parks Canada initiated removal of building and structures.

Through the Federal Contaminated Sites Action Plan (FCSAP), the federal government is addressing numerous contaminated sites in the north which have been abandoned by previous occupants. The primary goal of the plan is to ensure protection of the natural environment from contamination arising from previous federal government led initiatives. Borne out of the FCSAP, NCSP is funded to remediate contaminated sites to reduce and eliminate, where possible, the risks to human health and the environment (Northern Contaminated Sites Program – Progress Report 2005-2010, AANDC, 2010). Emphasis has been on high priority sites, many of which are in Nunavut (AANDC website).

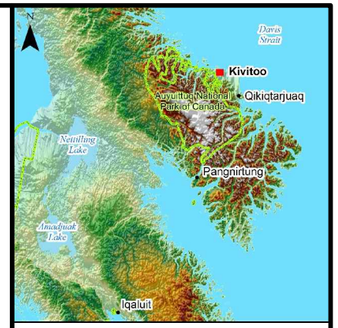
Implementation of the program has initiated the development of protocols and procedures specific to conducting projects in the north. An overarching initiative is the implementation of an Environment, Health and Safety (EH&S) policy and the development of standard operating procedures. Through the EH&S, all staff working in the north receive regular training to ensure consistency in project delivery. In addition to the policy and the operating procedures, a number of protocols have been developed and are being implemented for the removal of contaminated materials from abandoned sites. An example is the Abandoned Military Site Remediation Protocol (AMSRP) DEW Line Cleanup (DLCU) Barrel Protocol developed for safe and complete removal of any barrels including the contents (INAC, 2009). Outlining the procedures for identifying and validating potential contamination in the barrels, the protocol provides specific details on ultimate removal of the contents and structures.



FINAL

0 300 600 Metres 900 1200 1500

1:15000



LEGEND

- Crown Land
- Water
- Area of Disturbance/Worked Area
- Road
- Drainage Pathway
- Airstrip
- 25m Index Contour
- 5m Contour

NOTES:

1. Imagery: 1:20,000 Scale Imagery, 1948. National Air Photo Library (NAPL).
2. Contours are supplied from NRCAN, derived from 1:60,000 stereo pair imagery.
3. Survey Completed by KGS Group, August 2013

NO	YY/MM/DD	DESCRIPTION	BY
0			

REVISIONS / ISSUE

KGS GROUP CONSULTING ENGINEERS

DILLON CONSULTING

ENVIRONMENTAL SITE ASSESSMENT
FOX-D

PROJECT SITE OVERVIEW

APRIL 2014 | FIGURE 1 | REV 2

G:\GIS\137942 FOX-D EA\05-Environmental\03-Reports\137942-05-03-FIG 1.dwg

Identified as a high priority site, the FOX-D Intermediate DEW Line site has been the subject of number of studies and investigations since the mid-1980s. Phase I – III environmental site assessments have been conducted and, in response, a RAP has been prepared which will guide the ultimate clean-up of the site. Prior to implementation of the plan, AANDC must complete an EIA to determine if any adverse environmental impacts will occur from site remediation. PWGSC has been identified as the primary contact to execute the studies and initiate the work.

The approach taken to this EIA is based on the understanding that the various applicable policies, protocols and procedures will be in place at the time that the remediation project is initiated. Recognizing that these procedural documents have been put in place to protect the biophysical and socioeconomic environment, the impact evaluation will focus on those potential interactions where there are no established protocols.

Within the lease-limits and the surrounding area, the FOX-D Kivitoo site has been previously disturbed in some well-defined, discrete areas, while in other areas the debris field is scattered and poorly defined. Few natural features, wildlife habitats or traditional uses remain within the area of disturbance, although natural features do occur within the lease limits and surrounding areas. The removal of contaminated material, physical hazards such as building debris, impacted soils as well as the Class C dumps, and Tier I and Tier II impacted soils will occur within the well-defined impacted areas. This includes the planned waste transfer area or Waste Handling Facility (WHF), construction camp and airstrip upgrades. The proposed Soil Treatment Area for hydrocarbon-impacted soils and cleanup of the scattered debris field will occur on lands that are less well defined, yet have been disturbed in the past to some level. The scope of this assessment therefore reviews the magnitude and significance of the additional environmental effects resulting from the cleanup activities, beginning from a common base where the existing conditions of the cleanup sites are previously disturbed and that new disturbances to the existing natural features will be very limited and narrow in scope.

3.0 PROJECT INFORMATION

3.1 Project Location

The FOX-D site is located on the Davis Strait at 67° 57' 01" N latitude and 64° 55' 04" W longitude on the northeast side of the Cumberland Peninsula and the northeast coast of Baffin Island (**Figure 2**). It is located on the highest of an east-west series of hills at an elevation of approximately 450 metres above sea level (masl). To the south, a coastal plain extends toward the ocean; the airstrip and the beaching area are located on this plain and a freshwater lake is situated at the base of the hill. For the purpose of reporting, the FOX-D site has been separated into two distinct areas connected along a gravel access road:

- The Upper Site, located on the crest of a hill 447 masl north; and,
- The Lower Site, located on a coastal plain to the south of the Upper Site and between sea level and 60 masl. Ancillary to the two main sites, a beach site is located at the mouth of the Kivitoo Harbour adjacent the Lower Site and an airstrip is located approximately 2 km east of the beach site.

The site is accessible by air and water as there are no defined roads leading to the area.

3.2 Project Overview

The DEW Line was an integrated chain of more than 50 radar and communication stations stretching 3,000 miles from the northwest coast of Alaska to the eastern shore of Baffin Island. The purpose of the DEW Line was to provide the United States and Canada with the earliest possible warning of the approach of airborne objects over the polar region (Lackenbauer et al, 2005).

FOX-D was an Intermediate DEW Line Site constructed in 1957 and operated until October 1963. The facility covered two distinct areas: the Upper Site and the Lower Site. After military operations ceased in 1963, the site became part of the Auyuittuq National Park and was under management of Parks Canada until 1992, when custody of the site was transferred to AANDC. During the period 1973 and 1983 Parks Canada managed a clean-up of both the Upper and Lower Sites which included the removal of all structures to their foundations, except for three tanks left in place at the Upper Site.

The majority of the original facilities at FOX-D have been demolished and partially buried. Based on the August 2013 site inspection, the following have been identified at the Upper Site:

- Transfer Tank;
- Petroleum, Oil and Lubricant (POL) Tanks;
- Antenna;
- Burnt Building Remains;
- Warehouse Foundation;
- Two Distinct Soil Stains in Former Garage;
- Burnt Debris; and,
- Dump Site.

The following have been identified at or adjacent to the Lower Site:

- Two POL Tanks;
- A Beach (barge) Landing Area;
- Drum Storage; and,
- An Airstrip.

Refer to **Figure 2** for the detailed drawing identifying the above infrastructure locations.

The Environmental Services Group (ESG) of the Royal Roads Military College in Victoria, BC conducted investigations on environmental conditions at former military stations in Canada's North on behalf of the federal government. As part of this study, a Phase I ESA was prepared of the FOX-D site in August 1994. A total of 70 soil samples and 36 plant samples were collected for evaluation of contaminants, potential migration pathways, and potential impacts on the terrestrial food chain. Soils were sampled and analysed for polychlorinated biphenyls (PCBs), metals, pesticides, polyaromatic hydrocarbons (PAHs). Plant samples were analysed for PCBs and metals. Data from previous assessments conducted by ESG (1994) and Franz Environmental Inc. (2011) (Phase II ESA) indicate that hydrocarbon, PCBs and metals contamination exists on the former DEW Line site.

In 2013, Dillon prepared a Phase III ESA which confirmed the previous assessments and in accordance with the National Classification System for Contaminated Sites (NCSCS) which is a method for evaluating contaminated sites based on their current or potential adverse impact on human health and the environment. Based on this assessment, the FOX-D site scored 87.9. According to the NCSCS Guidance Document (2008), for all scores ranked greater than 70, this site is classified as a "*Class 1: High Priority for Action*" site which requires remediation and clean-up to address existing concerns (CCME, 2008d)

Based on the outcome of the Phase III ESA, Dillon prepared a RAP. The RAP provides a conceptual remediation design and preliminary specifications for cleanup of the FOX-D site. In preparing the RAP, the AMSRP (INAC, 2009) was used which ensures that all legal requirements, health and safety issues, Territorial and Federal requirements, and standard environmental issues are considered.

The primary objectives, as outlined in the AMSRP (INAC 2009) for addressing site remediation are:

- Restore the site to an environmentally safe condition;
- Prevent the migration of contaminants into the Arctic ecosystem;
- Remove physical hazards for the protection of human health and safety; and,
- Implement a cost effective remediation solution.

In accordance with these objectives, evaluation of the various remedial options for the FOX-D site was completed using a systematic process to identify parameters against which to rank the options. A decision-making matrix based on the Kepner-Tregoe process was used and is presented in detail in the RAP report. **Table 3-1** provides a summary of the outcome of the process and the environmental issues.

Table 3-1 Summary of issues at FOX-D and the proposed remedial actions

Environmental Concern	Site Assessment Findings	Recommended Remediation Method
PCB[a]/Lead Amended Paint Products	Approximately 0.031 m^3 of PCB[a]/lead amended paint materials were discovered on site (not including metal)	Dismantle contaminated paint items and ship off-site to a licenced disposal facility.
Metals Contaminated Soils	193 m^3 of soils with concentrations of Cu, Cd, and Zn, which exceed the DCC Tier II criteria were identified on-site. This volume includes material that is co-contaminated with PAHs and PHCs.	Excavate, containerize, and label soils that exceed DCC Tier II criteria and dispose off-site at an appropriately licensed facility.
Petroleum Hydrocarbon Contaminated Soils	Approximately 3,205 m^3 of hydrocarbon contaminated soil in exceedance of the INAC Abandoned Military Site Remediation Protocol for PHC Soils.	Screen PHC Type B soils and treat in on-site constructed biological and/or aeration treatment unit (3,005 m^3). Excavate PHC Type A soils (200 m^3) and place into containers, and ship off-site to a licensed disposal facility.
Non-Hazardous Materials	Approximately 14,834 m^3 of non-hazardous debris consisting of heavy equipment, barrels, scrap metal, scrap wood, concrete, electrical equipment and plumbing parts to be handled and shipped off-site.	All buried and partially buried debris in Class B dumps (APEC 11) should be excavated, sorted and separated into different waste types where it is safe and practical to do so, and disposed off-site in an appropriate licensed facility. Buried debris that is inaccessible for excavation in Class C dumps (APECs[e] 9 and 10) should be buried and re-stabilized in-situ. Rocks and concrete foundations from APECs[e] 1-4 to be used as rip-rap and fill in void space at APEC 9. All other debris is to be consolidated, packaged and shipped off-site to an appropriate licenced disposal facility.
Hazardous Materials	Approximately 1.82 m^3 of hazardous materials were identified at the site. These materials consisted of lead acid batteries (0.22 m^3) and asbestos containing materials (1.32 m^3). There is potentially 0.25 m^3 of PCB[a] materials deposited in a buried transformer in APEC[e] 9.	All hazardous materials will be removed, containerized, labeled and shipped off-site to be disposed at a licensed facility.

Environmental Concern	Site Assessment Findings	Recommended Remediation Method
Water in Barrels	Analysis of collected water in the abandoned barrels indicates that the dissolved metals meet DLCU[f] barrel protocol.	Disposal on the ground will be permitted once water has been polished with an absorbent material. Additional sampling of more barrels during remediation program is required. Disposal will follow the INAC DLCU Barrel Protocol.
Structures	Upper Site POL[g] Tanks (2) Upper Site Transfer Tank (1) Concrete Foundations	All non-hazardous materials and debris from Upper Site structures buildings shall be demolished to their foundations and removed for off-site disposal.

Notes:
[a]PCB – Polychlorinated biphenyl, [b]DCC - Defence Construction Canada, [c]PHCs - Petroleum Hydrocarbons, [d]PAHs – Polycyclic Aromatic Hydrocarbon, [e]APEC – Area of Potential Environmental Concern, [f]DLCU – DEW Line Cleanup , [g]POL – Petroleum Oil and Lubricants

A detailed discussion of the disposal options is provided in the RAP. For the purposes of this EIA, and with input received from PWGSC, the disposal options have been grouped into three primary methods: disposal off-site, disposal on-site and soil treatment (biological and/or aeration). Each of these methods is carried through the impact assessment process to identify the potential for significant adverse effects.

3.3 Regulatory Environment

Due to the nature of the site remediation activities, the project is subject to various federal, and territorial acts, regulations and guidelines. For this reason, the AMSRP (INAC, 2009) was developed to provide a consistent approach for designing RAPs for abandoned military sites. This protocol was designed to address all legal requirements, health and safety issues, territorial and federal requirements, and standard environmental issues. A summary of some of the typical environmental legislation and guidelines used for remedial action procedures as well as other general federal and territorial legislation requirements is provided below on **Table 3-2.** It should be noted that other legislation requirements may become more apparent during the life of the project activities and consultation with regulatory authorities will be required throughout the process to ensure adherence to all proper legislation and guidelines.

Table 3-2 Summary of applicable legislation, authorizations and guidelines

Legislation/Guidance Document	Responsible Authority or Department	Description or Potential Trigger/Authorization
FEDERAL LEGISLATION, GUIDELINES AND PERMITS		
Species at Risk Act (SARA)	Environment Canada	Commits the federal government, provinces and territories to establish complementary legislation and programs to protect Canada's species at risk. Obliges the Minister responsible for an activity to protect species at risk. Activities that may harm, harass or disturb a listed species, or its critical habitat, may require a SARA Permit. Recovery Strategies may be in place for species listed on Schedule 1 of the *Act*.
Fisheries Act	Fisheries and Oceans Canada (DFO)	Aims to provide for the sustainability and ongoing productivity of commercial, recreational and Aboriginal fisheries. The four factors to be taken into account by the Minister in decision-making (e.g., issuing authorizations) or making regulations are: • The contribution of the relevant fish to the on-going productivity of commercial, recreational or Aboriginal fisheries; • Fisheries management objectives; • Whether there are measures and standards to avoid, mitigate or offset serious harm to fish that are part of a commercial, recreational or Aboriginal fishery; and, • The public interest. Taken together, these provide a framework and direction to the Minister and Fisheries and Oceans Canada staff for decision-making, developing regulations and implementing the regulatory regime and program.
Freshwater Intake End-of-Pipe Fish Screen Guidelines, 1995	Fisheries and Oceans Canada (DFO)	Freshwater Intake End-of-Pipe Fish Screen Guidelines (DFO) provide instructions for the protection of anadromous and resident fish where freshwater is extracted from fish-bearing waters.
Migratory Birds Convention Acts(MBCA) and Regulations	Environment Canada	Effects on migratory birds or their habitat
Canadian Environmental Protection Act	Environment Canada/Health Canada	Accidents or spills leading to potential pollution or impacts to the environment and human health

Legislation/Guidance Document	Responsible Authority or Department	Description or Potential Trigger/Authorization
Canadian Environmental Protection Act -PCB Regulations	Environment Canada	Waste remediation and landfill guideline (2011)
Industrial Treated Wood Users Guidance Document	Environment Canada	Management of treated wood (2004)
Canada Labour Code	Human Resources and Skills Development Canada	Provides direction on safety issues to ensure that all projects must be conducted in a safe manner and ensure that no environmental aspects infringe on the safety of a federal site, workers or occupants
Canada Shipping Act	Transport Canada	Applies to all Canadian territorial waters and fishing zones. Arctic shipping in Canada is governed by several pieces of legislation. Principally these are the *Arctic Waters Pollution Prevention Act* and its regulations, the *Canada Shipping Act 2001*, the *Marine Liability Act*, the *Marine Transportation Security Act*, the *Coasting Trade Act* and the *Canada Labour Code*, as well as the *Charts and Nautical Publications Regulations, 1995*, and *Navigation Safety Regulations* made pursuant to the *Canada Shipping Act*. These acts and regulations were created to enhance safety and to protect life, health, property and the marine environment. It is the responsibility of ship owners and operators to ensure that they comply with all applicable acts and regulations.
Arctic Waters Pollution Prevention Act	Transport Canada	Act to prevent pollution of areas of the arctic waters adjacent to the mainland and islands of the Canadian arctic
Transportation of Dangerous Goods Act	Transport Canada	The Act applies to all shipping and handling dangerous goods, offering for transport and transporting of dangerous goods by any means of transport whether or not the goods originate from or are destined for any place or places in Canada.
Nunavut Land Claim Agreement	Aboriginal Affairs and Northern Development Canada	Use, management and conservation of land, water, and resources of Nunavut and identifies the need to complete an environmental impact assessment for specific projects.

Legislation/Guidance Document	Responsible Authority or Department	Description or Potential Trigger/Authorization
Territorial Lands Act	Aboriginal Affairs and Northern Development Canada	Provides the authority for administering and protecting lands under the direct control of the Minister of AANDC. The following regulations are pursuant to this Act: • The *Territorial Lands Regulations* provide regulatory control for maintaining sound environmental practises for any land use activities on Territorial lands. • The land use permits are under the authority of the *Territorial Land Use Regulations*. For Crown land in Nunavut the application acceptance and issuance process is the responsibility of AANDC. Class "A" permits are screened by NIRB. Class "B" are distributed amongst a Land Advisory Committee for comments. *The Territorial Quarrying Regulations* establish the procedures for extracting Crown-owned limestone, granite, slate, marble, gypsum, loam, marl, gravel, sand, clay or stone from Territorial lands.
Navigable Waters Protection Act[1]	Transport Canada	Supports the regulation of works constructed or placed in, on, over, under, through, or across, navigable waters in Canada.
Canada Shipping Act, 2001	Transport Canada	Shipping and navigation considerations
Abandoned Military Site Remediation Protocol, 2005	Aboriginal Affairs Northern Canada (Formerly Indian and Northern Affairs Canada)	Guiding principles for the remediation of the contaminated sites under the control of AANDC (INAC)
DEW Line Cleanup Protocol, 1993	Department of National Defence	Criteria for a specific limited set of contaminants for the effective remediation of the DEW Line sites
DEW Line Cleanup Barrel Protocol, 2005	Aboriginal Affairs Northern Canada (Formerly Indian and Northern Affairs Canada)	For determination of correct disposal method for barrels and their contents in accordance with the DEW Line Cleanup standard.

Legislation/Guidance Document	Responsible Authority or Department	Description or Potential Trigger/Authorization
TERRITORIAL LEGISLATION AND GUIDELINES		
Nunavut Wildlife Act	Government of Nunavut (Environment)	Established comprehensive regime for the management of wildlife and habitat in Nunavut, including the conservation, protection and recovery of species at risk, in a manner that implements provisions of the Nunavut Land Claims Agreement respecting wildlife, habitat and the rights of Inuit in relation to wildlife and habitat.
Nunavut Environmental Protection Act	Government of Nunavut (Environment)	Responsible for ensuring that Nunavut's environment is protected, promoted and enhanced, while encouraging responsible development through input and direction into various permit applications
Nunavut Environmental Right Act	Government of Nunavut (Environment)	Establishes a right to a healthy environment and provides the people of Nunavut the means to protect the environment by authorizing public prosecutions for violations of the Act.
Nunavut Fire Prevention Act	Government of Nunavut	Implementation of fire safety and fire prevention.
Nunavut Territorial Archaeological Sites Regulation	Government of Nunavut	Responsible for protection of Nunavut's archaeological and paleontological heritage
Nunavut Waters and Surface Rights Tribunal Act	Government of Nunavut	Responsible for regulating entry and access to lands, for determining rights of, and compensation payable to, the titleholder and for determining the amount for wildlife compensation claims in the Nunavut Settlement Area.
Environmental Guideline for Waste Lead and Waste Paint	Government of Nunavut	Lead paint waste guideline (2011)
Environmental Guideline for Waste Paint	Government of Nunavut	Waste paint guideline (2010)
Environmental Guideline for Mercury-Containing Products and Waste Mercury	Government of Nunavut	Mercury disposal guideline (2010)
Environmental Guideline for the General Management of Hazardous Waste	Government of Nunavut	Reference and waste guidelines (2010)

Legislation/Guidance Document	Responsible Authority or Department	Description or Potential Trigger/Authorization
Environmental Guideline for the Burning and Incineration of Solid Waste	Government of Nunavut	Guidelines for incineration considerations (2012)
Environmental Guideline for Waste Asbestos	Government of Nunavut	Guideline required for handling and abatement (2011)
Environmental Guideline for Waste Batteries	Government of Nunavut	Guideline and disposal options (2011)
Environmental Guideline for Waste Solvent	Government of Nunavut	Waste solvent disposal options (2011)
Water Licence	Nunavut Water Board	All uses of water and disposal of waste into water, with the exception of domestic or emergency use, require NWB approval. This includes municipal activities, mining exploration activities, mining operations, camps, etc. • Permits require that all waste disposal locations, including sewage treatment systems, grey water discharge areas, and fuel storage areas be located a minimum of 31 m from the high water mark of any water body or drainage course.
Land Use Permit	Nunavut Impact Review Board, Lands Advisory Committee and AANDC (see Territorial Lands Act description above)	Class "A" permits are screened by NIRB. Class "B" are distributed amongst a Land Advisory Committee for comments.

Notes: *[1]The Navigable Waters Protection Act will be replaced by the Navigation Protection Act (anticipated in spring 2014)*

3.3.1 Scope of Assessment

In accordance with Section 12.5.2 of the Nunavut Land Claim Agreement (NCLA) and the Terms of Reference issued by PWGSC (May 2013), the EIA shall include consideration of:

- Project description, including the purpose and need for the project;
- Anticipated ecosystem and socio-economic effects impacts of the project;
- Anticipated effects of the environment on the project;
- Identify steps for contingency plans to avoid and mitigate adverse impacts;
- Identify steps to optimize benefits of the project, with specific consideration being given to expressed community and regional preferences as to benefits;
- Identify steps to compensate adversely affected interests by the project;
- Identify a monitoring program to ensure the protection of ecosystem functions and reduction of socio-economic impacts;
- Identify the interests in lands and waters which has been secured, or seeks to secure;
- Identify options for implementing the proposed remediation activities; and,
- Identify any other matters that NIRB considers relevant.

The scope of the assessment shall consider potential environmental effects on the following environmental components:

- Atmospheric Environment (air quality and climate);
- Physical Environment (geomorphology, soils, groundwater);
- Aquatic Environment (freshwater and marine environments);
- Terrestrial Environment (vegetation, wildlife and wildlife habitat);
- Protected Areas and Species (protected natural areas and species at risk);
- Socio-Economic and Land Use (community, traditional land use, archaeological and culturally important areas); and,
- Human Environment (health and safety).

3.3.2 Purpose/Rationale and Need for the Project

As the custodian of most federal lands in the North, AANDC has responsibility, through the NCSP, to manage contaminated properties that are a liability to the Crown. As part of the INAC AMSRP (INAC, 2009) and responsibility through the NCSP, the purpose of the project is to remediate the FOX-D former military base in compliance with the protocol. This EIA is designed to evaluate the potential for impacts arising from the remediation activities and to identify appropriate mitigation, if required, to address and minimize significant adverse effects.

3.3.3 Project Alternatives

3.3.3.1 Alternatives to the project

The proposed remediation project is being driven by regulatory requirements. As such, the only alternative is the Null or Do Nothing approach which may result in prolonged environmental impacts and continued risk exposure. Maintaining the site in its current state was not considered a viable alternative to the proposed project.

3.3.3.2 Alternative means for carrying out the project

Evaluation of the various remedial options as part of the RAP was completed using a systematic process that identifies parameters by which to rank the options, and the relative importance of those parameters. A decision-making matrix based on the Kepner-Tregoe process was used. The detailed options analysis is reflected in the RAP.

Upon further review of the results of the RAP analysis, the decision has been taken to render the site clean by removing the majority of the debris, regardless of level of contamination. The remaining debris, already located in a prior disposal site, will be stabilized and capped.

3.4 Project Scope

For the purpose of this EIA, the project is defined as the physical works related to the site preparation, the construction specifically-designed for the implementation of the remedial activities, as well as the decommissioning and ultimately the closure of the FOX-D site.

The main project components for this project include:

- Site Preparation and Construction;
- Site Remediation Activities; and,
- Site Closure.

The project components are summarized below.

3.4.1 Site Preparation and Construction Activities

Successful implementation of the recommended remedial actions will require logistical coordination of various on-site elements as outlined below.

3.4.1.1 Infrastructure, Roads and Site Access

Infrastructure/Roads - The Upper and Lower Sites and ancillary areas are connected by an existing access road, established at the time the DEW Line site was operational. The access road varies in width from less than 5 m to greater than 6 m and has a variety of grades depending on the terrain (KGS, 2013). Due to lack of upkeep and erosion, some portions of the existing road will require repair and upgrading. Areas requiring rebuilding, regrading and significant drainage control are shown on **Figure 2** as "heavy regrading". The remainder of the road will require some patching and topping up (medium grading) and/or localized grading (light grading). All of this repair work can be completed using existing fill from

the main station area and borrow material from the borrow source areas shown on **Figure 2**. General photos of the various site areas are included in **Appendix A**.

An extension of the road to the Upper Site will be constructed on the northern side of the hill for access to the existing dump site, identified as APEC 9. A single lane road will be constructed to accommodate heavy equipment traffic and a turn-around loop will be constructed at the dump site. To construct the road, the alignment will be graded to achieve evenness of the surface and then will be built up with the placement and compaction of fill material from the borrow area. There will be no excavation to prepare the road. Road surface contouring will provide for adequate storm water drainage and in low lying areas, small diameter pipe will be installed below the road surface to provide for proper drainage if required. No major watercourses will be crossed in the completion of this project. Upon site closure, the road will be decommissioned with the extra fill material scraped off the surface and the area being re-contoured to the previous state. Access roads already existing will remain.

Borrow Source Development – Borrow sources for granular material will be required for the construction of the road and for general site grading purposes. Borrow material shall be drawn preferentially from the main station area gravel source. The sand and gravel borrow sources are estimated to contain approximately 42,200 m^3, which will be adequate for the remedial activities. Borrow sources (identified in **Figure 2**) will be developed in accordance with the AMSRP (INAC, 2009) and upon closure, will be re-contoured.

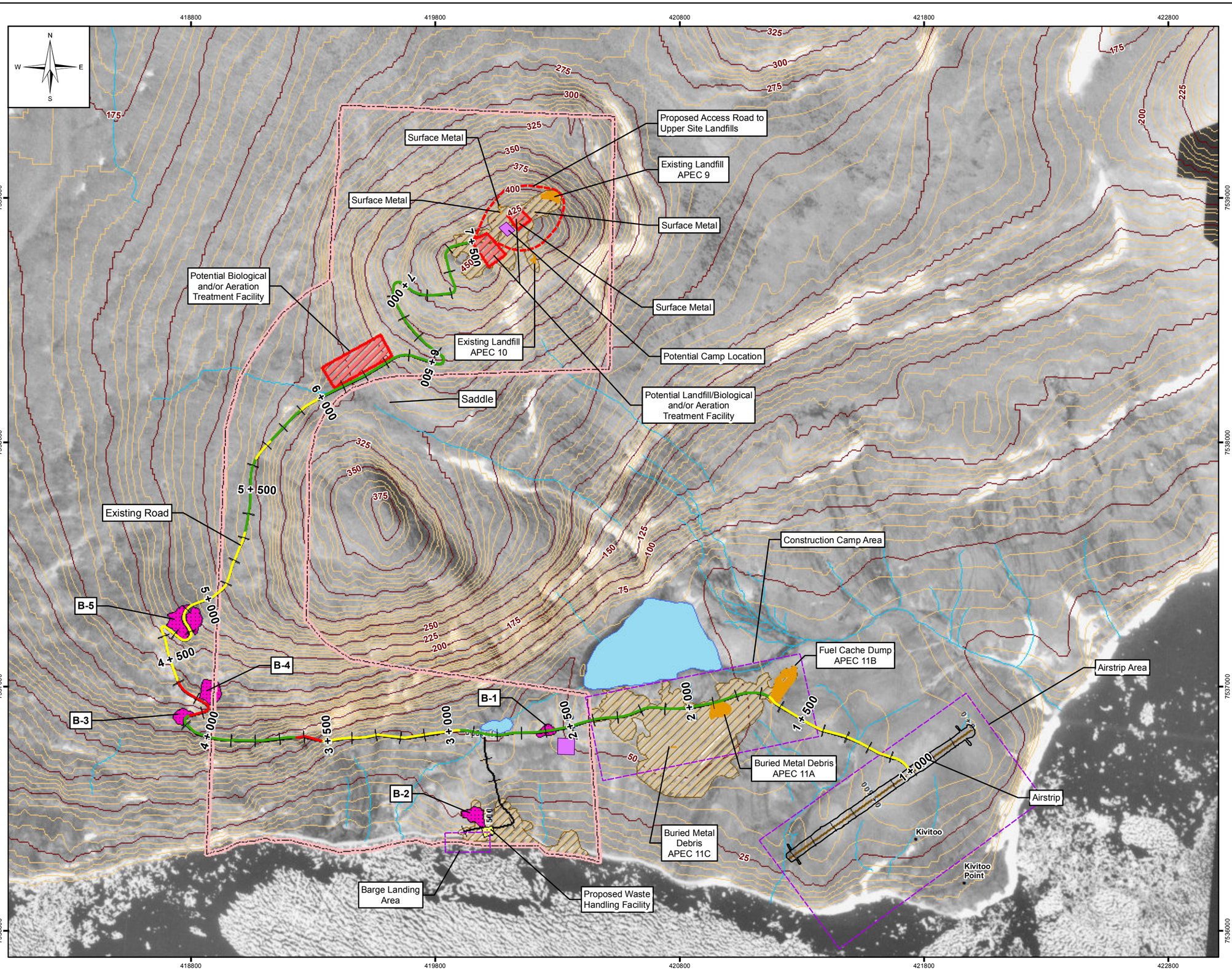
Table 3-3 Borrow Source Location and Description

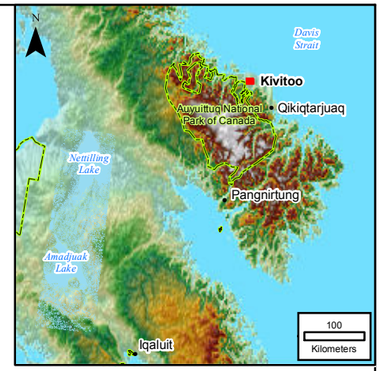
Borrow Source	Location	Estimated Volume of Material (m^3)	Description
B1	(2+600) main road	9,000	Cleaner gravel, (less boulders/cobbles)
B2	(500) Barge road	3,000	Cleaner gravel, (less boulders/cobbles)
B3	(4+125) main road	3,200	Clean ggravel, higher amount boulders/cobbles
B4	(4+250) main road	10,000	Generally cleaner sands and gravel (some boulders/cobbles)
B5	(4+800) main road	17,000	Mixed sand, gravel and cobbles.

Storm water Management – Where necessary, work areas will be protected from storm water influences by low profile drainage channels and silt control fencing to re-direct water away from the working areas of the site. Activities in borrow pits close to the marine environment (such as B2) should be restricted to not closer than 30 m from the shoreline, are to be protected with sediment control fencing and should be revegetated upon closure.

Airstrip – The Kivitoo airstrip is located on Inuit Owned Land (IOL), 1.2 km east of the Crown Land property boundary, southeast of the Lower Site. The site has suitable areas for both helicopter and fixed wing aircraft landing (**Figure 1**). The airstrip may require modifications to meet current Transport Canada standards. It is anticipated that the Kivitoo airstrip will remain intact once the clean-up work is completed. All movement to and from the site will take place via sealift, with support and re-supply service provided by helicopter and/or fixed wing aircraft.

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LEGEND:

- Proposed Access Road to Upper Site Landfill
- Light Grading
- Medium Grading
- Heavy Grading
- Drainage Pathway
- 5 m Contour
- 25 m Index Contour
- Crown Land
- Existing Landfills
- Freshwater Lake
- B-1 Potential Borrow Areas
- Area of Disturbance/Worked Area
- Proposed Waste Handling Facility
- Potential Camp Location
- Potential Landfill/Biological and/or Aeration Treatment Facility

NOTES:

1. Imagery: 1:20,000 scale imagery, 1948. National Air Photo Library (NAPL).
2. Contours are supplied from NRCAN, derived from 1:60,000 stereo pair imagery.
3. APEC 9 and APEC 10 located at Upper Site identified as Class C landfills.
4. APEC 11A, APEC 11B and APEC 11C at former construction camp identified as Class A landfills.

FINAL

200 0 200 400 600
Metres

SCALE: 1:15,000 METRIC 11"x17"

All units are metric and in metres unless otherwise specified.
Transverse Mercator Projection, NAD 1983, Zone 20
Elevations are in metres above sea level (MSL)

NO.	YY/MM/DD	DESCRIPTION	BY
2	14/11/03	RE-ISSUED WITH REVISED FINAL ENVIRONMENTAL ASSESSMENT	AMH

REVISIONS / ISSUE

KGS GROUP CONSULTING ENGINEERS

DILLON CONSULTING

HAZARDOUS MATERIALS ASSESSMENT
SITE SURVEY & GEOTECHNICAL SERVICES
FOX D DEW LINE SITE BAFFIN ISLAND

PROPOSED SITE PROJECT INFRASTRUCTURE AND REMEDIATION ACTIVITIES

NOVEMBER 2014 | FIGURE 2 | REV: 2

FileName: P:\Projects\2013\13-0163-002\Dwg\GIS\MXDs\Dillon_EA_Report\Rev2\13-0163-002-F02_Rev2.mxd
11"x17" PLOT SCALE 1:1

Beach Landing -The majority of the waste will be shipped off site to an approved, licensed, waste disposal facility. To accommodate the movement of waste from the site, the existing barge landing area (**Figure 2**), will be repaired where necessary. It is not anticipated that there will be any reconstruction of the barge landing in the marine environment. While ships will be moored offshore in the fjord, the site will be accessed by barges.

Waste Handling Facility - A WHF will be developed to receive and sort all waste from the site. The WHF area shall be near the barge landing area as shown on **Figure 2** surrounded by a temporary road to provide access to vehicles and equipment required in the delivery, sorting and transport of the site waste. Located at the Lower Site inland and away from the shore, this area will be bermed and underlain with an engineered liner which will have fill cover to protect the liner integrity. Surface water will also be controlled and directed around the pad by way of low profile ditching.

Areas within the overall facility will be designated for specific functions. Any liquids collected from the Upper and Lower Sites will be stored in containers in the WHF, clearly labelled and capped. In particular, a fluids handling area will designed with an engineered liner to prevent the migration of contaminants resulting from any accidental spills.

Existing Dumps - The existing Class C dumps located at the Upper Site have been identified in the RAP as APECs 9 and 10. Although no construction is required for these sites, during the project materials will be moved and relocated within the areas on designated roads as per the AMSRP.

Soil Treatment Area - An area below the summit of the Upper Site, referred to as the "saddle", has been identified for a Soil Treatment Area for remediation of petroleum contaminated soils. This area will encompass 6,000 m^2 and will be constructed above grade. As well, the area will be bermed to control runoff and the potential for movement of soil from the influence of winds.

Construction Camp - Although the community of Qikiqtarjuaq is nearby, the ability to house and efficiently mobilize workers to the Site from this community is not deemed to be feasible. The on-site camp will be large enough to support approximately 20 site workers and approximately three to five camp staff (**Figure 2**). Due to the harsh weather conditions, activities on-site will only occur during the summer months (i.e., June to September); therefore the camp will only be operational during this time. The camp will include a potable water source available from the lake, sewage collection, and waste collection. Fuel required to operate the camp and to complete remedial activities will be stored on-site in accordance with applicable Territorial legislation and licenses. The associated disposal of sewage, grey water, and waste disposal at the camp will be conducted in accordance with a Water Use License and Land Use Permit as noted on **Table 3-2**.

All non-hazardous solid waste generated from the operation of the camp will be incinerated on-site. The ash will be collected and at the end of each construction season will be shipped off-site to an approved disposal facility. All hazardous wastes will be shipped off-site.

In the event of an emergency at the camp site, an emergency shelter (separate from the camp) will be available on-site and used as a muster station. This shelter may be comprised of tents that are set up on an as-need basis.

Facilities will include:

- Sleeping quarters;
- Office (contains communications area);
- Kitchen and dining area;
- Bathroom and showers;
- Laundry facilities;
- First aid facilities (may depend on the number of workers);
- Incinerator;
- Mechanics and equipment area that would have a petroleum and lube containment area, tanks and drums;
- Water supply and pumps;
- Diesel powered generator and back-up; and,
- Emergency shelter.

It is anticipated that potable water sources will be obtained from the freshwater lake located adjacent the FOX-D site. A water sample was collected by Dillon from the freshwater lake and submitted for routine potable and total metals analysis in 2013. Results for major ion and total metals in the water sample were found to be below the *Health Canada Guidelines for Canadian Drinking Water Quality (HC, 2012).* If it is determined that the lake is suitable to supply potable water for the on-site activities, on-going monitoring of this potable water source would be conducted during remediation. Contingencies for water supply will include filters, and a supply of bottled water.

3.4.2 Site Remediation Activities

The primary objective of the remediation activities is to create a site clear of any contamination which may pose a hazard to wildlife and/or humans. To achieve this objective, three disposal methods will be employed at the site: shipment off-site to an approved facility, stabilization and containment on-site in an existing area, and biological treatment and aeration for soil remediation.

The disposal options described in detail in the RAP (**Table 3-1**) were evaluated further relative to being able to meet the intent of leaving the site as clean as possible. Recognizing this, the majority of the waste will be shipped off-site. Of the total volume of hazardous and non-hazardous material including soil, 58 % will be shipped off-site and of the remaining 42%, 15% will be treated (soil) and 27% will be left in place in the existing dump site. A detailed description of the waste types and volumes is provided in the *Dillon 2013 Phase III ESA and RAP* documentation. The disposal methods will be implemented in accordance with the applicable protocols and legislation governing these activities in the northern environment as outlined in **Table 3-2**.

3.4.2.1 Transfer to Waste Handling Facility for Off-site Disposal

Materials which will be removed from the FOX-D site to an off-site location approved for the specific disposal/treatment method include hazardous and non-hazardous materials. It is generally understood that the off-site waste disposal locations are located in Québec. All materials for off-site transport will be collected by truck and assembled in the Waste Handling Facility (WHF) for packaging. Collection and movement around the sites will be executed in accordance with specific operating procedures designed to minimize environmental impact.

Hazardous Materials

Fluorescent Lights and Lead-Acid Batteries

Hazardous materials such as fluorescent lights and batteries at the Upper and Lower Sites will be transported to the WHF for sorting and packaging. These materials will be containerized and labelled in accordance with the *Transportation of Dangerous Goods Act* and the AMSRP (INAC, 2009) protocol and shipped to an off-site approved facility.

Asbestos Containing Materials

Asbestos poses an inhalation hazard requiring special handling precautions and disposal methods. Asbestos containing material is located throughout the remaining structures and within the buried debris piles. Asbestos was found in floor tiles, pipe insulation, fire door insulation, transit board, and vermiculite insulation. Asbestos containing materials will be properly abated, in accordance with applicable regulations, prior to any demolition activities. The asbestos-containing materials will be transported to the WHF, packaged and then shipped to an off-site approved disposal facility.

Contaminated Barrels

Barrels located at the site will be addressed in accordance with the *DLCU Barrel Protocol* (INAC, 2009). The barrels will be collected and located to the WHF where the contents of filled barrels will be inspected and tested. Liquids will be removed using absorbent materials. Once empty, the barrels will be prepared for shipping to an offsite approved disposal facility. The absorbent materials will be sorted and packaged according to the degree of contamination prior to being shipped off-site.

Polychlorinated Biphenyls (PCBs) and Lead Containing Paint

PCB and lead paint abatement consists of removing the contaminated paint from the substrate. This is accomplished by physical scrapping, chemical stripping, sand blasting and various other abrasive physical removal techniques. As the paint fragments contain lead and or PCBs, abatement methods will be conducted in a manner that protects the worker and the environment from potential contamination. Paint removed from barrels will be collected and removed off site to a licenced disposal facility for hazardous waste. Given the materials on-site, no current plans are in place for removing paint prior to shipping.

Buildings and Infrastructure

All existing buildings and infrastructure will be inspected for potential hazardous materials. Any identified hazardous materials will be removed prior to demolition of the building or structure where feasible. If removal is possible during demolition, workers will wear the necessary protective equipment to manage potential risks. Demolition waste material will be transported to the WHF for sorting and removal to an approved facility off-site. Likewise, hazardous waste materials will be transported to the WHF for sorting, segregation and shipping off-site to an approved facility. Foundations will be removed in the same manner; however, clean concrete waste will be put in the existing on-site APEC-9 Class C landfill as per the AMSRP.

Metal Contaminated Soil

A number of areas have been identified with Type A soil contamination. Soils containing heavy metals and PCBs will be excavated to a depth of 0.3 m and transported by truck to the WHF. These soils will be containerized for removal to an off-site, approved disposal facility.

Non-hazardous Materials

Approximately 21,827 m^3 of non-hazardous materials are estimated to exist at the FOX-D site as summarized on **Table 3-2**.. All non-hazardous material, except for the material identified at APEC 9, will be collected and relocated to the WHF where it will be sorted, packaged or containerized and then shipped off-site to an approved facility. Approximately 14,834 m^3 of non-hazardous debris consisting of heavy equipment, barrels, scrap metal, scrap wood, concrete, electrical equipment and plumbing parts to be handled and shipped off-site. Remaining non-hazardous materials in Class C dumps will not be handled.

Wood Waste

Wood waste associated with previous buildings and structures which may be contaminated with paint will be collected and located to the WHF for sorting, packaging and removal.

Debris

At various locations throughout the FOX-D site, metal, plastic, concrete, and rubber have been identified. These materials will be collected in trucks and transported to the WHF for sorting to off-site disposal, packaging and removal.

Physical hazards (buildings, structures)

All physical hazards such as dilapidated buildings and unspecified garbage (broken glass) will be collected and transported to the WHF for sorting to disposal, packaging and removal. Where required, areas will be raked to ensure all pieces have been collected.

3.4.2.2 On-site Disposal

The Phase III ESA identified APEC 9 at the Upper Site as an area where there had been previous dumping (**Figure 2**). The estimated volume of material exceeds any other area at the FOX-D site. Some of the waste was exposed and easily identified as being metal cabinets, metal waste, drums and asbestos-

containing materials. Based on the soil sample results and visual inspections, the buried debris areas at both APECs 9 and 10 are classified as Class "C" landfills in accordance with the AMSRP (INAC, 2009). A Class C landfill is situated in a stable location, with no contaminant release. Class C landfills can be left in place and if needed, additional granular material can be placed to prevent erosion and promote proper drainage.

The large volume of material precludes complete removal from APEC 9. Hazardous materials (Class B material, including asbestos) will be removed. Class C material (Inert non-hazardous material) will be arranged in the dump and covered with borrow material. This process will be executed over a number of shallow lifts to ensure complete coverage of the material, filling the voids and spaces, and to reduce the potential for leachate generation.

3.4.2.3 Soil Treatment Area

Type B Hydrocarbon impacted soils will be excavated to a depth of 0.3 m and relocated to the Soil Treatment Area in the saddle area as identified in **Figure 1**. Type B Hydrocarbon impacted soils will be rotated regularly (on-site) to allow for vaporization of the volatile organic compounds. Regular (i.e., weekly) testing will be completed to monitor residual levels of petroleum products. Once the concentration of petroleum has reduced to meet the *DLCU Criteria* (INAC, 2009) for contaminated soil, the Soil Treatment Area will be decommissioned with the remaining soil levelled and stabilized.

The Soil Treatment Area site will be accessed from the access road leading to the Upper Site. The contaminated soil will be placed at the Soil Treatment Area early during the site clean-up process to permit maximum time for remediation. Equipment will be dedicated to the Soil Treatment Area to minimize the potential for cross contamination of other sites.

3.4.2.4 Operation of Camp

The camp will be operated during the summer months (June to September). All waste will be collected and stored to eliminate the potential for predators, off-shore migration and legacy issues. Procedures for dealing with human waste collection and disposal will meet water licence requirements and will be determined by the selected contractor. Fresh water will be withdrawn from the lake with appropriate screens and filters to eliminate the potential for fish impingement. The water will be tested regularly (i.e., weekly) following the *Health Canada Drinking Water Quality Guidelines* (2012). All food and supplies will be brought to the site by aircraft or by ship. Waste disposal will be determined by the selected contractor.

All heavy equipment will be stored on a dedicated pad when not in use on-site. Fuel and hydraulic fluids will be stored in a designated area and in accordance with applicable legislation. Refuelling of equipment will follow standard operating procedures in compliance with territorial and federal guidelines. Emergency clean-up materials and a spill kit will be maintained on-site at all times.

3.4.3 Site Closure and Re-Contouring

Site closure will logically commence at the Upper Site. The existing Class C dumps (APECs 9 and 10) will be capped with a minimum of 0.5 m of clean material taken from the existing borrow sites

(as identified in **Table 3-3**, above). As the activities are completed on the Upper Site, the previously disturbed areas will be re-contoured to allow for regrowth where possible. The new portion of road leading to the APEC 9 area will be removed and the area contoured to its original elevations. To eliminate the risk of erosion, all sloped areas will be protected with riprap.

Following remediation of the petroleum contaminated soils in the Soil Treatment Area; the site will commence closure operations. Following the treatment period, the Soil Treatment Area will be decommissioned by levelling the soils to their original grades to encourage regrowth where possible. Remediated hydrocarbon soil will be used as a capping material for site recontouring.

At the Lower Site, the WHF will be deconstructed with the liner removed and packaged for shipment off site. The Lower Site will be re-contoured to allow for drainage. Slopes will be stabilized with riprap. The beach landing will remain intact to permit final site closure. No deconstruction will take place of the ramp of this previously existing structure.

The construction camp will likely be the last component of the project to be deconstructed. All materials, waste products and equipment will be removed by sealift. The area will be contoured to the original elevations as needed.

3.4.3.1 Post Demobilization Revegetation

3.4.4 Project Schedule

The project schedule is subject to contract award. The actual schedule will be refined and finalized when the contract is awarded and a contractor is in place. Assuming the project is tendered in the summer of 2015, the following is a proposed schedule for the remediation of the FOX-D site:

- Community meetings (Winter 2015);
- Permitting (Winter 2015 to Spring 2016);
- Bidders site meeting (Summer 2015);
- Contract tender (Summer 2015);
- Contract award (Fall 2015);
- Mobilization (Summer 2016);
- Year one Remedial Activities (Summer 2017);
- Year two Remedial Activities (Summer 2018);
- Demobilization (Summer 2018); and,
- Sea-lift Demobilization of Equipment (Summer/Fall 2019).

4.0 DESCRIPTION OF EXISTING ENVIRONMENT

4.1 Atmospheric Environment

4.1.1 Climate

Environment Canada's (EC) closest weather reporting station to FOX-D is located in Iqaluit, Nunavut (Latitude 63°45' N and Longitude 68°33' W) and is situated at an elevation of 33.50 masl approximately 500 km south of FOX-D. According to the *Canadian Climate Normals* (1971 to 2000) recorded at the Iqaluit weather station, the annual daily mean temperature is -9.8°C with daily mean temperatures ranging from -26.6°C (January) to 7.7°C (July). The daily maximum temperatures range from -22.5°C (January) to 11.6°C (July), and daily minimum temperatures range from -32.2°C (February) to 3.7°C (July). The extreme temperature range is from -45.6°C (February) to 25.8°C (July). In general, precipitation falls primarily as snow during the winter months, with the greatest snowfalls occurring in October, November and April. Rainfall dominates during the summer season, with overall levels of precipitation peaking in July and August. Annually, the average precipitation level is about 412 mm. Average wind speeds recorded at Iqaluit are fairly constant throughout the year, ranging from approximately 12 to 17 km per hour and are most frequently coming from the northwest (EC, 2013). Refer to **Table 4-1** for a summary of the climate normals.

Table 4-1 Canadian Climate Normals Summary for Iqaluit, Nunavut (1971-2000) [1]

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Average Temperature (°C)	-26.6	-28	-23.7	-14.8	-4.4	3.6	7.7	6.8	2.2	-4.9	-12.8	-22.7	-9.8
Daily Maximum (°C)	-22.5	-23.8	-18.8	-9.9	-0.9	6.8	11.6	10.3	4.7	-2	-8.9	-18.5	-6
Daily Minimum (°C)	-30.6	-32.2	-28.6	-19.6	-7.8	0.3	3.7	3.3	-0.4	-7.7	-16.7	-26.9	-13.6
Rainfall (mm)	0.1	0	0	0.2	2.8	24.7	59.2	64.8	41.5	4.5	0.5	0	198.3
Snowfall (cm)	22.8	16.8	25.3	32.4	25.1	9.8	0.1	0.8	13.7	34.9	32.4	21.7	235.8
Precipitation (mm)	21.1	15	21.8	28.2	26.9	35	59.4	65.7	55	36.7	29.1	18.2	412
Windspeed (km/h)	15	14.8	14.1	15.8	17.3	15.3	12.4	13.9	15	17.6	17.6	15.4	15.4
Most Frequent Direction	NW	NW	NW	NW	NW	SE	SE	SE	SE	NW	NW	NW	NW

[1] Data acquired from Environment Canada's National Climate Archive

4.1.2 Air Quality

The "*Environmental Guideline for Ambient Air Quality establishes standards for common air contaminants in ambient air throughout Nunavut. Numeric standards for fine particulate matter, total suspended particulate, nitrogen dioxide, sulphur dioxide and ground level ozone are adopted under the Guideline*" (Government of Nunavut, 2011a).

The Government of Nunavut Department of Environment's (NDE) Environmental Protection Division (EPD) is the primary agency responsible for the management of air contaminants. The *Environmental Protection Act* provides the Government of Nunavut with authority to implement measures to preserve, protect and enhance the quality of the natural environment. Environment Canada (EC) partners with the EPD to operate a National Air Pollution Surveillance (NAPS) Network air monitoring station in Iqaluit, with long term plans to establish monitoring stations at other key locations in Nunavut (Government of Nunavut, 2011a). There was no data available for Nunavut.

Ambient air quality standards are to be used to assess the impact emissions from proposed and existing sources that may have impacts on the environment. **Figure 3**, obtained from the Government of Nunavut, Environmental Guideline for Ambient Air Quality provides a listing of standards that have been adopted for use in Nunavut and will assist with regional air quality management planning and as benchmarks for reporting on the state of air quality in the project areas.

Figure 3 Ambient Air Quality Standards [1]

Parameter	Standard ($\mu g/m^3$)*	Standard (ppb)**
Fine Particulate Matter		
24 hour average	30	
Total Suspended Particulate		
24 hour average	120	
Annual geometric mean***	60	
Nitrogen Dioxide		
1 hour average	400	213
24 hour average	200	106
Annual arithmetic mean****	60	32
Sulphur Dioxide		
1 hour average	450	172
24 hour average	150	57
Annual arithmetic mean****	30	11
Ground Level Ozone		
8 hour average		65

* By weight - micrograms per cubic metre
** By volume - parts per billion
*** The average of the logarithmic values of a data set converted back to a base 10 number
**** The sum of all the numbers of a data set divided by the count of all the numbers
All ambient air quality standards are references to standard conditions of 25 degrees Celsius and 101.3 kilopascals

[1] Obtained from the Government of Nunavut, Environmental Guideline for Ambient Air Quality, http://env.gov.nu.ca/sites/default/files/guideline_-_ambient_air_quality_2011.pdf

4.2 Physical Environment

During the summer of 2013, as part of a collaborative, interdisciplinary team with Dillon, KGS Group completed a geotechnical and geophysical field investigation program at the former FOX-D site where 42 test pits were investigated for subsurface conditions (KGS, 2013). In addition to the test pitting program dynamic cone penetration testing (DCP) was completed adjacent to 19 of the 42 test pits to estimate the *in-situ* California Bearing Ratio (CBR) and bearing capacity along the road, airstrip and at potential landfill sites. This section provides a summary of the results of this report provided by KGS Group. Additional information provided by other background documents and website searches were also used to characterize the general physical environment of the FOX-D site.

4.2.1 Physiography

The FOX-D site is located north of the Pangnirtung Upland Ecoregion which is part of the Northern Arctic and occupies the lower coastal uplands of Baffin Island surrounding Cumberland Sound. The area is characterized by its rapid rise from sea level and consists of a belt of deeply dissected, crystalline Archean aged rocks. The general aspect consists of broad, gently warped, old erosion surfaces created by the erosion along joint systems, and zones of weakness (Smith *et al*. 1998).

The topographic survey was performed by KGS (2013) to delineate the entire property including the Upper Site, Lower Site, access road, airstrip, barge landing area, Soil Treatment Area and borrow source areas. All survey information was completed in Universal Transverse Mercator (UTM) NAD 83 CSRS and NAD83 Zone 20 projection and the CGVD28 for elevation datum. All topographical survey capture was completed using Global Positioning System (GPS) RTK style surveying. Interim geodetic control benchmarks were established using known geodetic control monuments found on the Canadian Spatial Reference System (CSRS) and were verified by having a GPS receiver collect static data during the field investigation program. The static data was then post-processed using available data from the Canadian Active Control System (CACS) to determine more accurate geodetic locations.

Through these investigations it was determined that the Lower Site is situated on a relatively flat coastal plain approximately 50 m above sea level and the Upper Site, situated at the top of a plateau, is approximately 425 to 450 masl.

4.2.2 Bedrock Geology

According to the geophysical report (KGS, 2013), bedrock within the northern portion of the Cumberland Peninsula is dominated by the Proterozoic aged rocks of the Cumberland Batholith. The site has been mapped as charnockite, enderbite and granoenderbite which are igneous and/or metamorphic rocks typically associated with granulite facies metamorphism (high pressure and high temperature). The bedrock at the site was observed to be primarily brown to rust in colour and highly weathered in appearance.

4.2.3 Permafrost

The FOX-D site is located in the zone of continuous permafrost which is defined as those areas where 90% to 100% of the soil and rock remains at a temperature continuously below 0^{o}C for a period of at least two years. Overburden material at the site consists of till and granular deposits that are free of ground ice (KGS, 2013).

In order to estimate the depth to permafrost and/or bedrock at both the Upper and Lower Sites at the FOX-D site, geophysical investigations were conducted by KGS using ground penetrating radar (GPR) surveys and test pitting. Evidence of permafrost was not observed in the overburden soils during the test pitting program. Results of the GPR survey at the FOX-D site indicated that the depth to permafrost is approximately 1.4 to 1.5 m below grade. Local expertise, (H. Alookie, pers. comm. 2013), suggested that the typical depth to permafrost in this area is approximately 1.5 m.

4.2.4 Surficial Geology and Geomorphology

According to the ESG (2010) report, many coastlines are characterized by wide flat plains that extend up to 10 km inland. Following their release from the crushing weight of glacial ice, they have rebounded over the past few thousand years. Ancient beach terraces that now lie far from shore testify to the uplifting. Some shorelines are closely paralleled by lines of "boulder barricades" pushed there by sea ice carried ashore by strong tides and storm waves (ESG, 2010).

The east coast of Baffin Island is dominated by the Arctic Cordillera which is characterized by sharp peaks and ridges. The Penny Ice Cap, located west of the site, is a remnant of the last ice age which forms a 6,500 m± high barrier on the Cumberland Peninsula in an area of deep fjords and glaciated valleys. Regionally, the overburden is dominated by till deposits overlying bedrock (KGS, 2013).

The surficial geology at the FOX-D site is dominated by marine deposits consisting of deltaic gravel, sand and silt which formed during times of glaciation when sea level was relatively higher (KGS, 2013). These accumulations are thick (>10 m) and surround till material found at higher elevations. The till is reported to be 1 to 2 m thick and consists of varying amounts of gravel, sand, clay and outcrops of ice-moulded bedrock. The ESG 2010 report identifies the higher elevations in the middle of the peninsula contains diamictic glacial till derived from bedrock consisting of two distinct ranges of grain sizes: pebbles to boulders and sand to silt. An end or lateral moraine ridge separates the hilltop till from the near-shore marine deposits (ESG, 2010).

The FOX-D site morphology is characterized by hummocks, low rolling hills, one freshwater lake, and raised beaches composed of coarse-grained gravel over bedrock. Regional overland drainage from the FOX-D site is generally eastward to the Davis Strait.

4.2.5 Hydrogeology and Groundwater

Groundwater resources are permanently bound above the permafrost layer which acts as an aquitard; however, small amounts of interflow occur during the warmer months of the year. In general, precipitation and snow melt do not penetrate the ground to support groundwater resources, but drain quickly to the nearest receiving water body (ESG, 2010).

4.3 Aquatic Environment

4.3.1 Freshwater Environment

As noted during the August 2013 field investigations, the FOX-D site contains an ephemeral stream, freshwater lake and several surface water drainages located within the areas of the proposed project activities (**Figure 4**).

Ephemeral Stream (Outlet to the Freshwater Lake)

At the time of the field investigations, an ephemeral stream was identified as the outlet to the freshwater lake which drained from the lake to Davis Strait, part of the Arctic Ocean. This stream is characterized as having intermittent flow with connectivity to the ocean at periods of high flow during the melting season (July/August). The channel varies in width, (1-4 m) and consists of sandy substrates with large boulder gardens between well-defined banks. A thick overhanging moss layer provides cover for small fish along the steam's edges. During the investigation, one small Arctic char (*Salvelinus alpinus*) fry was observed under the moss cover near the mouth of the lake.

Freshwater Lake

The freshwater lake is located adjacent to the Lower Site, south of the Upper Site **(Figure 4**). The lake is approximately 250 m wide x 600 m long, or roughly 15 ha, and is identified as being a shallow, permanent lake with sandy substrates and some boulders. The lake collects runoff from the surrounding lands and mountain side during the spring/summer melt. At the time of the site survey (August 2013), the lake had limited connectivity to the ocean located 1.5 km downstream. Year round connectivity does not exist; therefore fish passage capability is infrequent.

The freshwater lake is assumed to have been used as a potable water source for hunters and trappers in the area. A water sample was collected by Dillon and analyzed for routine potable water parameters, PCBs, major ions and total metals (copper, nickel, cobalt, chromium, cadmium, lead, zinc and arsenic) (Dillon, 2013). Results for major ion and total metals in the water sample were found to be below the *Health Canada Guidelines for Canadian Drinking Water Quality* (2012) and the CCME Guidelines for the protection of aquatic life.

Fish and Fish Habitat

Arctic Char (*Salvelinus alpinus*) has the most northerly distribution of any of the freshwater fish and is the only fish species found on Baffin Island. It breeds in fresh water, and populations can be either landlocked or anadromous. According to H. Alookie (pers. comm., August 2013), the wildlife monitor from the community of Qikiqtarjuaq, Arctic char is the only fish species that inhabits the freshwater lake. This population of char is normally landlocked and may migrate to the ocean only after spawning occurs (H. Alookie, August 2013, pers. comm.).

Proposed Access Road to Upper Site Landfills

Existing Landill APEC 9

Potential Biological and/or Aeration Treatment Facility

Upper Site

Potential Camp Location

Potential Biological and/or Aeration Treatment Facility

Existing Landill APEC 10

Saddle

SOIL and WATER SAMPLE LOCATONS

SOIL and WATER SAMPLE LOCATONS

B-5

Existing Road

B-4

B-3

Ephemeral Stream

B-1

B-2

Fuel Cache Dump APEC 11B

Buried Metal Debris APEC 11A

Air□trip

Buried Metal Debris APEC 11C

Barge Landing Area

DAVIS STRAIT

Proposed Waste Handling Facility

Kivitoo

Kivitoo Point

Air□trip Area

SOIL and WATER SAMPLE LOCATONS

Fre□hwater La□e

5+500

6+000

4+500

3+500

3+000

2+500

2+000

1+500

1+000

1+925

0 300 600 Metre□ 900 1200 1500

1:15000

FINAL

Davis Strait

Kivitoo

Qikiqtarjuaq

Auyuittuq National Park of Canada

Nettilling Lake

Pangnirtung

Amadjuak Lake

Iqaluit

LEGEND

- Crown Land
- Water
- Area of Di□tur□an□e/Wor□ed Area
- Propo□ed Wa□te Handling Fa□ility
- Potential Soil Treat□ent Area
- Borrow Area□
- Potential Ca□p Lo□ation
- Road
- Drainage Pathway□
- Air□trip
- 25□ Inde□Contour
- 5□ Contour
- Te□tpit Lo□ation
- Water Sa□ple
- Wildlife E□iden□e
- Arti□Char O□□er□ation

NOTES:

1. I□agery: 1:20,000 S□ale I□agery, 1948. National Air Photo Li□rary (NAPL).
2. Contour□are □upplie□fro□ NRCAN, deri□ed fro□ 1:60,000 □tereo pair i□agery.
3. Sur□ey Co□pleted □y KGS Group, Augu□t 2013

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REVISIONS / ISSUE

KGS GROUP CONSULTING ENGINEERS

DILLON CONSULTING

ENVIRONMENTAL SITE ASSESSMENT
FOX-D

PROJECT SITE OVERVIEW

NOVEMBER 2014 | FIGURE 4 | REV. 0

G:\GIS\137942 FOX-D EA\05-Environmental\03-Reports\137942-05-03-FIG 4.dwg

Surface Water Drainage

The surface water drainage patterns noted throughout the FOX-D site are a result snow melt thaw during the summer months (July and August). They are located in stiff till or are controlled by bedrock; therefore erosion and deposition are not important factors in their morphology.

During the investigations of the surface water drainages, water samples were obtained from two surface water areas in the Lower Site (**Figure 4**) and analyzed for BTEX/TPH and total metals (copper, nickel, cobalt, chromium, cadmium, lead, zinc, and arsenic. One of the surface water locations was determined to have heavy metal contamination and exceeding the CCME FWAL guidelines for lead. Refer to **Appendix B** for the water quality analytical results. It should be noted that the volumes of surface water where the exceedances were noted are minimal. Removal of the source contamination (buried barrels) would likely address this exceedance issue

Based on observations made during the 2013 site visit, there are no areas of site activities exhibiting signs of erosion as a result of existing site drainage. None of the soil types identified are particularly prone to erosion.

4.3.1 Marine Environment

The FOX-D beaching area is located within a fjord-like embayment which is protected from wave action. The inner portion of the embayment is very shallow and is fed by a small stream. The beach area consists of cobble, sand and boulders with sparse vegetation. . A defined, pre-existing beach landing area includes sand filled ramps leading from the shoreline. No permanent structures exist at the beach head other than the sand ramps.

According to Fisheries and Oceans Canada Canadian tides and water level data information at Qikiqtarjuaq (Broughton Island) (67.5167º N 64.0667º W) (Station 3980), a mean tidal range at Kivitoo, is between 0 to 1 m.

During an underwater debris assessment performed in 1995 by ESG SCUBA divers, water depths within 1 km of the shoreline were generally less than 60 m on the southern side of Kivitoo point. The shoreline steepens dramatically on the east side of the point. Substrates of the seabed were characterized as being coarser sediment with abundant boulders and cobbles (Bright *et al.*, 1995). During these investigations, no observations were identified.

A large number of soft-shell clams as well as other invertebrate species such as brittle starfish (*Ophiuroidea sp.*), saltwater clam (*Mya truncata)* and sea urchins (*Echinoidea sp.*) (Bright *et al.*, 1995) were noted by the ESG SCUBA divers during their 1995 investigations.

4.4 Vegetation

The FOX-D site is characterized by sparse and stunted vegetation which is typical of the Pangirtung Upland Ecoregion. Plant species are perennial due to the limited germination during the brief summers. Only the hardiest species can survive due to its dry climate, permafrost, calcareous soils, and gale force winter winds. Moss and lichen thrive in this ecosystem and the vegetation is generally characterized by a cover of dwarf tundra vegetation such as dwarf birch (*Betula glandulosa*), willow (*Salix sp.*), northern Labrador tea (*Rhododendron tomentosum*), *Dryas spp.*, and *Vaccinium spp*. Tall dwarf birch, willow, and alder occur in less exposed areas and wet areas are dominated by willow and sedge (ESG, 1996). On August 7, 2013, a site vegetation survey was undertaken. The investigation areas were divided into three survey areas: the "Upper Site", the "Lower Site" and the "Beach/Coastal Area" (**Figure 4**).

The Upper Site consists of exposed rocks and boulders with little soil to support vegetative growth. Arctic poppy (*Papaver radicatum*) was the most abundant flowering plant observed. Less dominant plant species in this area also included: moss campion (*Silene acaulis*), river beauties (*Chamerion latifolium*) and tufted saxifrage (*Saxifraga cespitosa*). Map lichens (*Rhizocarpon* spp.) were noted covering many of the exposed rocks and Bigelow's sedge (*Carex bigelowii*), reindeer lichen (*Cladnia* spp.) and various mosses were found growing sparsely in the shallow sandy soils found between the rocks.

The Lower Site vegetation consisted of a more diverse community and provided a fairly continuous vegetative cover in the undisturbed areas between the road and the freshwater lake. Arctic willows (*Salix arctica*) along with Arctic lousewort (*Pedicularis dasyantha*), Arctic poppy, mountain sorrel (*Oxyria digyna*), nodding saxifrage (*Saxifraga cernua*), river beauties, yellow oxytope (*Oxytropis oxyphylla*) were observed in these areas. An abundance of Arctic cottongrass (*Eriophorum callitrix*) and sedges (*Carex sp.*) were noted in the deeper sandy soils surrounding the freshwater lake. The airstrip and construction camp in this area consisted of a large disturbed sandy area with limited to no vegetation growth.

The Beach/Coastal Areas vegetation communities located between the gravel roadway and the coastline had deeper hummocky soils allowing for more diverse vegetation dominated by Arctic willows as well as Arctic white heather (*Cassiope tetragona*), Arctic chickweed (*Stellaria humifusa)*, Arctic wintergreen (*Pyrola grandiflora*) and Arctic cottongrass. Closer to the coastline, more species were observed, including: Arctic mountain avens (*Dryas integrifolia*), Arctic parrya (*Parrya arctica*), mountain sorrel, moss campion, nodding saxifrage, pygmy buttercup (*Ranunculus pygmaeus*), river beauties, spider saxifrage (*Saxifraga flagellaris*), sedges, and tufted saxifrage.

During the site investigations, there were no plant species at risk or species of conservation concern identified in the vicinity of the proposed project activities. A listing of all plant species observed along is provided on **Table 4-2**.

Table 4-2 Plant Species observed at the FOX-D site, August, 2013

Scientific name	Common name
Carex bigelowii	Bigelow's sedge
Cassiope tetragona	Arctic white heather
Chamerion latifolium	River beauty
Dryas integrifolia	Arctic mountain avens
Eriophorum callitrix	Arctic cottongrass
Oxyria digyna	Mountain sorrel
Oxytropis oxyphylla	Yellow oxytope
Papaver radicatum	Arctic poppy
Parrya arctica	Arctic parrya
Pedicularis dasyantha	Arctic lousewort
Pyrola grandiflora	Arctic wintergreen
Ranunculus pygmaeus	Pygmy buttercup
Salix arctica	Arctic willows
Saxifraga cernua	Nodding saxifrage
Saxifraga cespitosa	Tufted saxifrage
Saxifraga flagellaris	Spider saxifrage
Silene acaulis	Moss campion

4.5 Wildlife and Wildlife Habitat

Base mapping, aerial photographs and historical reports were used to provide a preliminary assessment of habitat at the FOX-D site. Habitat types were confirmed in the field through the study area assessment.

During various field visits to the site, observations of animal signs (actual sightings as well as auditory detections, tracks, bones, scat, and dens/nests) were documented. General wildlife habitat conditions were also noted to indicate the type of wildlife that the study area has the potential to support. Additional historical information was provided by H. Alookie, Wildlife Monitor from Qikiqtarjuaq during the 2013 site visit.

The Northern Arctic Ecozone's extreme cold, harsh soils and limited plant communities are reflected in the relatively low diversity and abundance of mammals. Of the approximately 200 species of mammals found in Canada, fewer than 20 occur in this ecozone. There are few insect species and a total absence of reptiles and amphibians (ESG 1996).

4.5.1 Birds

According to Smith *et al*. (1998), in the spring, thousands of migrant birds are seen along the Davis Strait. Snow Goose (*Chen caerulescens*), Brant (*Branta bernicla*), and Canada Geese (*Branta canadensis*) will nest in moist wetlands that line coastal areas and river valleys. Eider (*Somateria mollissima*) and Oldsquaw (*Clangula hyemalis*) will nest beside small ponds on the grassy tundra areas. These areas also support a number of shorebirds, including the black-bellied plover (*Pluvialis squatarola*), Ruddy

Turnstone (*Arenaria interpres*), and Red Phalarope (*Phalaropus fulicarius*). Other species such as the Hoary redpolls (*Carduelis hornemanni*), Horned Larks (*Eremophila alpestris*), and Snow Buntings (*Plectrophenax nivalis*) need very little vegetation cover for nesting and thus can survive in the sparse arctic landscape (Smith *et al*. 1998).

According to H. Alookie (pers. comm., August, 2013), the Snow Goose and Canada Goose have been seen breeding along the shoreline in the vicinity of the FOX-D site. Although no geese were observed during the site visit, signs (droppings and feathers) of Canada Goose and Canada Loon were observed around the shoreline of the lake and the coastal beach. Other bird species observed during the site visit included Black-bellied Plovers (*Pluvialis squatarola*), Lapland longspur (*Calcarius lapponicus*), a Rock Ptarmigan (*Lagopus muta*) and a Snow Bunting. A mating pair of Red-throated Loons (*Gavia stellate*) was observed on the nearby freshwater lake. A Peregrine Falcon (*Falco peregrinus*) was also noted flying over the area. A summary of the bird species known to occur or observed in the area is provided on **Table 4-3**.

Table 4-3 Bird species observed within the area of the FOX-D site

Scientific name	Common name
Falco peregrinus	Peregrine Falcon
Calcarius lapponicus	Lapland Longspur
Gavia stellate	Red-throated Loon
Lagopus muta	Rock Ptarmigan
Plectrophenax nivalis	Snow Bunting
Pluvialis squatarola	Black-bellied Plover

4.5.2 Small Mammals

The Arctic lemming (*Dicrostonyx torquatus*) is one of the only small mammals hardy enough to survive the harsh climate of this region. The Arctic lemming will seek protection from frigid winter temperatures under a protective blanket of snow and is active all winter, scurrying through tunnels to well-stocked food chambers (ESG, 1996).

During the site investigation surveys in August 2013, several Arctic hare (*Lepus articus*) and Arctic lemmings were observed, including a small lemming den located at the Upper Site (**Figure 4**). There were no other small mammal observations located at the Lower Site or the Coastal (beach) Area.

4.5.3 Large Mammals

Polar bears are known to frequent the area of the FOX-D site in the summer where they will rest during their long trips along the coast. During the site investigations in August, 2013, several polar bears were observed over the course of several days by the field crew.

Barren-ground caribou on Baffin Island are in a state of decline and populations are at a historic low (Gunn *et al*. 2011). In the 1950's, caribou herds used to frequent the FOX-D area during their long

migrations. The lack of adequate food sources in the area is thought to contribute to the diminishing size of the caribou populations at present time (E. Kopalie, pers. comm., August, 2013). Currently the closest caribou herd can be found approximately 200 km north of the FOX-D area (E. Kopalie, pers. comm., August 2013).

A listing of all species observed during the site investigation surveys are summarized on **Table 4-4**.

Table 4-4 Wildlife Species Observed within the area of the FOX-D site

Scientific name	Common name
Dicrostonyx torquatus	Arctic lemming
Lepus arcticus	Arctic hare
Ursus maritimus	Polar Bear
Pusa hispida	Ring Seal
Balaena mysticetus	Bowhead Whales
Monodon monoceros	Narwhal
Odobenus rosmarus	Walrus

4.6 Species at Risk

A search of the federal Species at Risk Act (SARA) Public Registry (EC, 2011) showed there were no federally-listed vegetation species expected within the FOX-D area based on the known distribution and habitat requirements of the species listed for the region. Wildlife species including birds and mammals listed on Schedule 1 of the SARA and by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) were identified as potentially being within the area. **Table 4-5** provides a list of possible species at risk that could be found around the FOX-D site.

Table 4-5 Potential occurrence of species listed under the *Species at Risk Act* (*SARA)*

Scientific Name	Species	Species Type	COSEWIC Status	*SARA* Status	Known to occur in the area of the FOX-D site (Y/N)
Ursus maritimus	Polar bear	Mammal	Special Concern	Special Concern	Y
Histrionicus histrionicus	Harlequin Duck	Bird	Special Concern	Special Concern	N
Pagophila eburnea	Ivory Gull	Bird	Endangered	Endangered	N
Falco peregrinus	Peregrine Falcon	Bird	Special Concern	Special Concern	Y
Balaena mysticetus	Bowhead whale	Marine Mammal	Special Concern	Special Concern	Y – off the coast
Monodon monoceros	Narwhal	Marine Mammal	Special Concern	Special Concern	Y – off the coast
Odobenus rosmarus	Walrus	Marine Mammal	Special Concern	Special Concern	Y – off the coast

Polar Bear and Peregrine Falcon were observed at the FOX-D site during the 2013 site visit. Although these species have been identified in the area, according to the draft Nunavut Land Use Plan data files, there are no sensitive polar bear habitats or migrations routes in this area. Peregrine Falcons were noted flying over the site but no nesting habitat was noted in the area. Peregrine habitually nest on cliffs or elevated promontories, which are not represented at the FOX-D site. Both species, therefore, may frequent the area, and may come into contact with workers or equipment, but appear to have no critical habitats occurring within the limits of the project. No other species at risk were observed in the immediate vicinity of the proposed project activities, nor are anticipated.

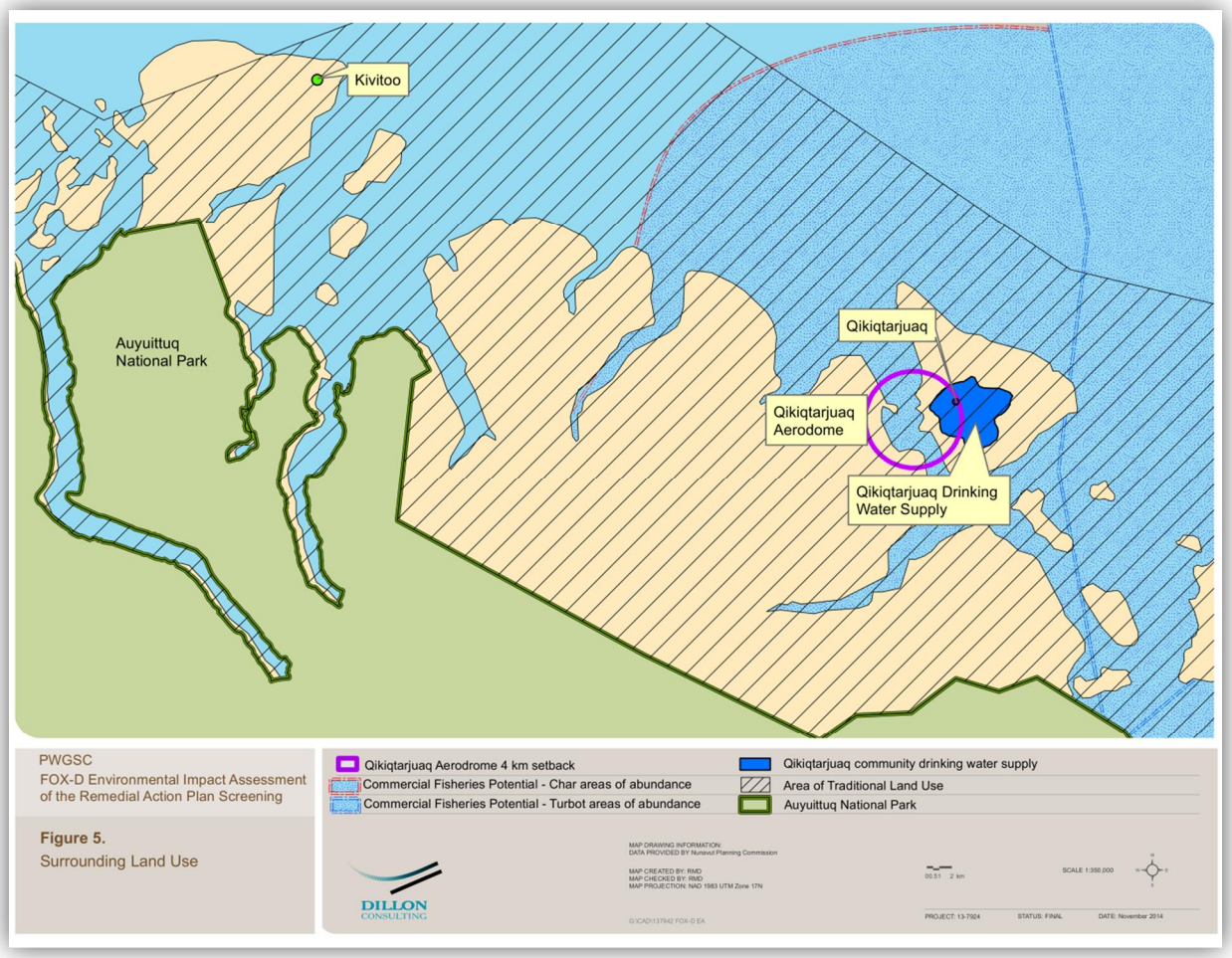
4.7 Protected Areas

Auyuittuq National Park is located approximately 15 km southwest of the FOX-D site and Kivitoo (**Figure 5**). Kivitoo was formerly within Auyuittuq National Park and was under the management of Parks Canada. In 1992, management of the site reverted to INAC (AANC).

The Park covers over 19,000 km^2 and includes the highest peaks of the Canadian Shield, the Penny Ice Cap, marine shorelines along coastal fiords, and Akshayuk Pass. This area is a traditional travel corridor used by the Inuit for thousands of years. The national park was established in 1976 through the Nunavut Land Claims Agreement. Inhabited and influenced by a number of different peoples, the park possesses abundant cultural heritage resources.

The park receives on average 500 visitors each year who enjoy hiking, mountaineering, climbing, ski touring, glacier travel, guided snowmobile visits, dog team trips, boating and, more recently via cruise ship expeditions (Auyuittuq National Park of Canada Management Plan, 2010).

Figure 5 Land use in the area of the FOX-D site.



4.8 Socio-Economic and Cultural Environment

4.8.1 Population

The FOX-D site is located near Kivitoo, which was formerly an Inuit camp and whaling station. The area was abandoned when the settlement was moved approximately 50 km southeast to nearby Qikiqtarjuaq (previously known as Broughton Island) in the 1950s (Golder, 2013).

Qikiqtarjuaq is located on the west coast of the Arctic Ocean, in the Davis Strait, and is the closest community to FOX-D. According to Statistics Canada 2011 census, the population of this community is approximately 520 people. The median age is 25.5 years old.

4.8.2 Land Use

Baffin Island has a long and rich history with evidence of human habitation dating back several centuries (Golder, 2013). Traditional land uses related directly to the subsistence lifestyle, with the population moving in response to the seasons and available resources. An HRIA which provides more detail on the history of land uses was prepared by Golder in 2013 in support of the remediation.

The FOX-D site is situated in an area designated as Traditional Land Use (Nunavut Land Use Plan, 2000). Currently under review, a draft revised plan was released in 2012 the draft for review and comment. Although yet to be approved and implemented, the draft plan shows that the project area will continue to be characterized as a traditional land use area and that any development or projects should consider cultural values (Nunavut Planning Commission, 2011).

4.8.3 Economy

Historically, the people of Nunavut maintained a subsistence lifestyle. According to the 2011 Census (Stats Canada, 2011), fishing and hunting are not recorded as primary economic drivers. The people derive their incomes from construction and the provision of support services.

4.8.4 Historic and Culturally Significant Areas

According to the Golder 2013 HRIA report, ten heritage resource sites were recorded in the area in either the Nunavut database or the Canadian Museum of Civilization (CMC) database. The sites include stone features, semi-subterranean houses, a historic whaling station, and a lithic scatter site. These sites are all well-defined and located outside of, and away from, the Lower Site. Within 300 m of the project site, two graveyards have been identified: one is a whaler's graveyard and the other is an Aboriginal people's graveyard (**Figure 4**). There is no intent to conduct any project activities in close proximity to these cultural heritage sites.

5.0 COMMUNITY CONSULTATION

A community consultation was scheduled for January 28, 2014, but was postponed and rescheduled to January 29, 2014 due to weather. The event was advertised locally over the radio and by posters. Presentation handouts were printed in English and Inuktitut. Information on AANDC's contaminated sites program were made available in English, French and Inuktitut. All information was presented on a table near the entrance. A sign-in sheet was also provided.

The consultation was attended by 58 individuals from the community of Qikiqtarjuaq. A presentation was given outlining:

- AANDC's contaminated sites program;
- The bidding and tender process;
- The applicable guidelines and site criteria relevant to the FOX-D site;
- Environmental concerns at FOX-D;
- Archaeological areas of interest near the site; and,
- The proposed remedial action plan and the project timeline.

The presentation was delivered in English by Erika Solski (AANDC) and Indra Kalinovich (Dillon), and translated to Inukitut in real-time. Hard copies of the translated presentation were also available at the door.

After the presentation, a question and answer period was held. Participants were invited to share stories and any knowledge about activities (be it traditional or related to the former DEW Line) with AANDC. There were a number of general comments and questions from community members about where to submit applications for work and when the work was going to start. AANDC and Dillon re-iterated the bidding and tender contracting process, and that site mobilization activities were tentatively scheduled for 2015. Once the contract is awarded, a separate contractor other than AANDC would be arranging for employment. A second community consultation has been tentatively scheduled for winter of 2016 after the contract has been awarded.

In accordance with the NIRB, employment opportunities for local community members and Inuit must be considered. The successful contractor will be required to provide the necessary training to both local and non-local employees. Local knowledge will be obtained from Inuit workers and the local community.

6.0 EVALUATION OF ENVIRONMENTAL IMPACTS

6.1 Approach to the Assessment of Environmental Impacts

Those aspects of the biophysical and socioeconomic environments deemed to have specific value to the ecosystem are identified as Valued Ecosystem Components (VEC) or Valued Socioeconomic Components (VSC's). VEC's and VSC's have been identified for this project based on their intrinsic value to the ecosystem, heritage and culture, protection afforded by legislation, and professional judgement. For the purposes of this project, the following have been identified as a VEC/VSC:

- Climate and Air quality;
- Permafrost;
- Fish and Fish Habitat;
- Marine Environment;
- Vegetation;
- Terrestrial Wildlife;
- Birds/Bird Habitat;
- Species at Risk;
- Community;
- Traditional Land Use; and,
- Heritage Resources/Culturally Important Areas.

A central feature of the EIA process is to identify the anticipated impacts on the environmental components resulting from the site preparation, construction, remediation and closure activities of the proposed project. The approach taken involves identifying the potential for the Project Activities to interact with the existing Valued Environmental and Socioeconomic Components which are present at the project location. This step is shown in a simple matrix format (**Table 6-1**). Following this identification of potential interactions, the effect of the interaction is evaluated with consideration of the time in which it may occur and the space in which it may occur (**Tables 6-2 – 6-8**). Mitigation is identified for each effect and the significance of the residual impact is established. The significance of the effect was evaluated using the following questions as a guide:

- What is the magnitude of the effect?
- What is the geographic extent of the effect?
- What is the duration (short or long term) and frequency of the effect?
- How does the net effect compare to the existing environment? Does it represent a substantive or order of magnitude negative change in baseline conditions?
- Is there a substantive public, government or agency concern?
- What is the ecological and/or social context for the effect?
- Is the effect permanent or reversible?

6.2 Project Interaction Matrix

The project components identified in Section 2 are indicated under "Project Activities" on **Table 6-1**. The valued ecosystem/socioeconomic components (VEC's/VSC's) of the existing environment identified in **Section 5.1** are indicated under "VECs". Only the VEC's/ VSC's related to the previously disturbed areas are considered, as the natural features within the lease limits have been previously scoped out. Within the concerned areas of disturbance, this is the initial screening to determine if an interaction between a project activity and a valued environmental component has the potential to result in an effect on the environment. Those activities indicated with a "P" are identified as those project activities which may cause a potential effect on the previously disturbed environment.

In addition to evaluating the environmental effects of the project on the environment, it is also necessary to consider those impacts which may arise as a result of the environment affecting the project activities due to naturally occurring events like severe weather, floods and nuisance wildlife. A significant adverse effect of the environment on the project may result in damage to infrastructure, resulting in interruption of the project schedule. The effects of the environment on the proposed project are addressed within the matrix table (**Table 6-1**) as "E" and are discussed further in **Section 8.0**.

Table 6-1 Project Interaction Matrix

VECs (Valued Ecosystem Components)		Project Activity										
		Site Preparation and Construction				Site Remediation Activities				Site Closure		Accidents/ Malfunctions and Unplanned Events
		Infrastructure Roads and Site Access	Waste Management	Barge Landing	Construction Camps	Waste Handling Facility	On-site Disposal	Soil Treatment Activities	Operation of Camps	Site Recontouring	Demobilization	
Atmospheric Environment	Climate and Air Quality		P						P			P
Physical Environment	Permafrost	P						P				P
Aquatic Environment	Fish and Fish Habitat											P
	Marine Environment			P/E		P/E						P
Terrestrial Environment	Vegetation	P			P					P		P
	Birds/Bird Habitat											P
	Terrestrial Wildlife								E			P
	Species at Risk								E			P
Socio-Economic Environment	Community	P	P	P	P	P	P	P	P	P	P	P
Land Use	Traditional Land Use											P
	Heritage Resources/ Culturally Important Areas			P	P	P			P			P

Notes: "P" = Potential effect of project on environment, “E” – Potential of environment to effect project; Blank = No interaction with project activities

6.3 Potential Effects

As indicated on **Table 6-1**, few interactions are anticipated. The project will take place on previously disturbed land and when executed, will follow all applicable protocols and regulatory requirements.

An analysis of the potential effects of the interactions identified on **Table 6-1** is presented on **Table 6-2** to **Table 6-8**. For each of these effects, proposed mitigation, and predicted residual effects were determined. The predicted residual effect assumes that each of the recommended mitigation measures are implemented as recommended. The significance of the residual effect is based upon an evaluation of the effect's magnitude, geographic extent, duration/frequency, irreversibility and ecological context.

Table 6-2 Impacts and Mitigation on Air Quality

Climate and Air Quality				
Project Activity	**Potential Impact**	**Impact Rating**	**Mitigation**	**Residual Impacts**
Site Preparation and Construction N/A **Site Remediation Activities** Waste Management Soil Treatment Activities Operation of Camps **Site Closure** N/A	Off gas from soil treatment activities Incineration of non-hazardous camp waste	Direction: Negative Scope: Local Duration: Short-term Frequency: Intermittent Magnitude: Negligible Probability: High Significance: Insignificant	- Contractors are to ensure that construction equipment is well maintained - Burning of debris on-site will follow the Government of Nunavut *Environmental Guideline for the Burning and Incineration of Solid Waste (2012)*.	No

Table 6-3 Impacts and Mitigation on Permafrost

Permafrost				
Project Activity	**Potential Impact**	**Impact Rating**	**Mitigation**	**Residual Impacts**
Site Preparation and Construction Infrastructure Roads and Site Access **Site Remediation Activities** Soil Treatment Activities **Site Closure** N/A		Direction: Negative Scope: Local Duration: Short-term Frequency: Intermittent Magnitude: Negligible Probability: High Significance: Insignificant	- Road upgrades shall be constructed and used in a manner protect the vegetated areas protecting the permafrost soil from thermal or physical damage - Crews shall be restricted to using machinery (i.e., construction equipment, ATVs and vehicles) to the existing roads to avoid impacting the rutting and causing potential damage to the permafrost - Materials shall not be stored directly on unprotected ground surfaces - Disturbed areas shall be reseeded to minimize the risk of erosion	No

Table 6-4 Impacts and Mitigation on Marine Environment

Marine Environment				
Project Activity	**Potential Impact**	**Impact Rating**	**Mitigation**	**Residual Impacts**
Site Preparation and Construction Barge Landing **Site Remediation Activities** Waste Handling Facility **Site Closure** N/A	Disturbance to beach area along the shoreline from heavy equipment use and use of the waste handling facility. Activities may result in debris and deleterious substances affecting marine water quality.	Direction: Negative Scope: Local Duration: Short-term Frequency: Intermittent Magnitude: Negligible Probability: High Significance: Insignificant	- Work will be scheduled to avoid periods of heavy precipitation. Erosion control structures (temporary matting, geotextile filter fabric) are to be used, to prevent erosion and release of sediment and/or sediment laden water. - Equipment will be cleaned of sediments and washed with freshwater prior to being mobilized to the project site. - A floating silt curtain should be installed around the work sites to prevent suspended solids and/or debris from entering the marine environment. The stability of the silt curtain is to be monitored on a daily basis to ensure it is functioning as intended. - Borrow areas near the shoreline (e.g. B2) require a minimum setback of 30 m from the top of the bank will be required to minimize erosion and sedimentation. Appropriate erosion and sediment control measures will also be installed in these areas. - Workers shall be restricted to using machinery (i.e., construction equipment, ATVs and vehicles) to the existing roads to avoid impacting the beach area.	No

Table 6-5 Impacts and Mitigation on Vegetation

Vegetation				
Project Component	**Potential Impact**	**Impact Rating**	**Mitigation**	**Residual Impacts**
Site Preparation and Construction Infrastructure Roads and Site Access **Site Remediation Activities** Construction Camps **Site Closure** Site Recontouring	Plant mortality or permanent displacement of plants Introduction of invasive species Long term bare ground results in wind erosion of covering soil and potential permafrost degradation.	Direction: Negative Scope: Entire site. Duration: Long-term Frequency: Throughout Construction Period. Magnitude: Large Probability: High Significance: Insignificant	- Cleaning and inspecting construction equipment prior to transport from elsewhere to ensure that no plant matter is attached to the machinery. Vehicles should be pressure washed to clean vehicles prior to transport to avoid the introduction/transfer of invasive species. - Contractors to limit the amount of vegetation removal to the extent possible. - Reseeded with local species where feasible. Reseeding with agronomic cover crops (grasses) undesirable. - Movement of equipment and vehicles outside of the access roads shall be minimized and avoided to prevent damage to the vegetation or underlying soils/permafrost.	Not expected to affect plant species at a population level. Regraded areas will be stabilized with riprap and could be reseeded to further control wind erosion losses of soil cover.

Table 6-6 Impacts on the Community

Project Component	Potential Impact	Impact Rating	Mitigation	Residual Impacts
Site Preparation and Construction All Project Activities **Site Remediation Activities** All Project Activities **Site Closure** All Project Activities	Economy	Direction: Positive Scope: Life of project Duration: Long-term Frequency: Throughout Construction Period. Magnitude: Moderate Probability: High Significance: Significant	- Employment and local business opportunities in the region are to be maximized as much as possible.	Capacity building for the community through work experience, economic stimulus and training opportunities

Table 6-7 Impacts on the Heritage Resources/ Culturally Important Areas

Project Component	Potential Impact	Impact Rating	Mitigation	Residual Impacts
Site Preparation and Construction Barge Landing Construction Camps **Site Remediation Activities** Waste Handling Facility Operation of Camps **Site Closure** N/A	Disruption of Burial Sites	Direction: Positive Scope: Life of project Duration: Long-term Frequency: Throughout Construction Period. Magnitude: Moderate Probability: High Significance: Significant	- The burial site locations will be fenced off to avoid any potential disruption or destruction of these sites - Workers will avoid any disruption to the burial sites - If a suspected site is discovered during the project activities, the crew will not disturb the site and will contact the Department of Culture, Language, Elders and Youth for further mitigation and protection measures.	Capacity building for the community through work experience and training opportunities

Table 6-8 Potential Impacts the Environment has on Project

Marine Environment and Wildlife				
Project Component	**Potential Impact**	**Impact Rating**	**Mitigation**	**Residual Impacts**
Site Preparation and Construction Infrastructure Roads and Site Access **Site Remediation Activities** Waste Handling Facility **Site Closure** Site Recontouring	Severe storm events leading to flooding Increase in Nuisance Wildlife	Direction: Negative Scope: Entire site. Duration: Long-term Frequency: Throughout Construction Period. Magnitude: Large Probability: High Significance: Significant	- Project personnel will monitor weather forecast for storm events and protect the loss of equipment through proper storage on site - Any material lost or destroyed as a result of wave or storm action is to be immediately recovered or restored by the project personnel when safe to do so. - General camp food will be properly stored to discourage wildlife - A dedicated wildlife monitor(s) will be on site at all time - Project personnel shall be properly trained in bear safety - Project personnel are not to feed, injure or harass local wildlife - Food waste and camp garbage will be properly stored in sealed containers	No

7.0 ACCIDENTS, MALFUNCTIONS AND UNPLANNED EVENTS

Potential accidents, malfunctions and unplanned events associated with the activities of this project may include:

- Release of hazardous materials (e.g., fuel, hydrocarbons) to undesignated areas;
- Failure of erosion and sediment control measures;
- Health and safety; and,
- Fire and explosion.

This section outlines standard mitigation measures that will be applied for those VEC's/VSC's identified on **Table 6-1** to reduce potential environmental effects from accidents, malfunctions and unplanned events.

Chemical and Fuel Spills

Accidental events involving equipment, aircraft or marine vessels could range from minor fuel spills to catastrophic disasters, such as crashes or explosions. Malfunctions or accidents may result in spills of hydrocarbons or other substances during construction and operation of the project. Such spills may contaminate soils and, through runoff, contaminate the freshwater and/or marine environments. Contaminants may adversely affect surface water quality, fish and fish habitat, and wildlife habitat.

An emergency spill response plan will be implemented to provide guidance on containing and remediating releases of hazardous materials into sensitive environments. With preventive and mitigative measures and the low probability of spills, the effects of accidental spills of contaminants during construction are considered not significant.

In the event of a catastrophic disaster, resources available beyond the project site will be required. While such an event is not planned, it is anticipated that pending the severity, the project schedule may be impacted. Any environmental effect will likely be localized.

Erosion and Sediment Control Failure

An erosion and sediment control plan will be prepared prior to on-site activities. Rain falls very infrequently, so runoff impacts into the freshwater lake system or the marine environment are not expected to be a significant source of deleterious substances affecting water quality. Temporary erosion controls will be installed prior to disturbance and will be properly maintained throughout construction until recontouring is completed. Of greater concern is the period of snow melt in the late spring/early summer. Monitoring of the sediment and erosion controls and repairing the damage occurring over the winter will be the key time for control of sediments entering the drainage system.

Long term wind erosion effects may result in significant losses of the cover soil from the landfill site(s) and disturbed areas unless revegetation occurs within a reasonable time frame. Rip rap is proposed as the final cover material, however, some level of revegetation of these areas will also be important to re-establish wildlife habitats and traditional land uses. Plants will be very slow (many decades long) to regenerate and therefore an advanced, detailed revegetation blended with the rip rap solution, will need to

be prepared in advance, to ensure the landfill caps remain in place, yet provide sustainable, ecological functions over the long term.

Permafrost

As discussed in **Section 3.2.3** the depth to permafrost at the FOX-D site is approximately 1.4 to 1.5 m below grade. Excavation proposed on site is not to exceed 0.3 m. Any excavation beyond 0.3 m is considered an unplanned event and thus may result in an impact to the permafrost layer. Permafrost degradation can occur when the thermal barrier is removed and the top layer is exposed to the elements. All employees will be aware of the excavation limits to prevent accidental impacts to the permafrost layer. If accidental excavation or permafrost exposure occurs, excavated areas shall be backfilled immediately with granular fill and further work in that area will cease until further impacts can be assessed. Where feasible, reseeding of disturbed areas with native species should be considered to provide additional protection. Plants will aid in the stabilization of soil, the primary barrier to permafrost.

Health and Safety

To ensure the safety of all personnel on site, a site specific health and safety plan will be created and will include all necessary precautions while working on the FOX-D site including but not limited to:

- Safe handling, containment and transportation of hazardous material and contaminated soil and water;
- Personnel working on-site will be trained in the requirements of the Workplace Hazardous Materials Information System (WHMIS) program;
- Proper preparations in dealing with extreme weather conditions and events;
- Proper first aid, bear safety awareness training and wilderness survival training; and,
- Proper protocol and safety procedures for polar bear and other wildlife encounters;
    - Implement a wildlife management strategy that includes noise abatement;
    - Pre-disturbance surveys, avoid active nesting structures when present, and if species of concern are present remove structure once nesting is complete;
    - Bear proof containers for domestic waste;
    - Wildlife Monitors will be kept on-site for safety of site workers; and,
    - Bear deterrent will be kept at all sites.

Project personnel will be properly trained in the cultural heritage resources and traditional uses of the land.

Fires and Explosions

Accidental fires and explosions could potentially be caused during construction or remedial activities. During construction, sources of fire include hot exhaust or equipment, discarded cigarettes, or sparks.

8.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

The environmental effects on the project may be defined as any change to the project that may be caused by the environment. Typical effects considered in describing the environmental effects on the project include climatic events such as flooding, fog, heavy precipitation, and frost. For this project, potential environmental effects on the proposed project include the following:

- Extreme Weather; and,
- Nuisance Wildlife.

8.1 Extreme Weather

Planning and design of the project activities has considered extreme weather criteria and the potential delay or loss of equipment due to extreme weather events, primarily heavy rainfall, storm surges or sub-zero temperatures (during the summer months).

Storm surge along the coast and at the barge landing have the potential to cause permanent damage and/or loss of gear in the marine environment area for the duration of the construction project. The issues have been considered as part of the project plans and are deemed mitigable through design, location selection, standard operating, and maintenance and repair procedures. Weather conditions will be assessed on a daily basis to determine the potential risk of climate on the project activities and worker safety. With regard to storm surges, advisory and warning bulletins are issued by Environment Canada when there is a potential for or likelihood of coastal flooding events. Such bulletins typically include a meteorological description of the event, information on coastlines most likely to be affected, a discussion of complicating factors such as ocean waves and pack ice, and an assessment of the severity of the event.

The contractor will be required to ensure that proper material management and construction measures are employed including:

- Monitoring extended weather forecasts to schedule activities to avoid significant storm events;
- Ceasing activities during significant storm events; and,
- Increasing monitoring and inspection of sediment control devices immediately after a storm event.

8.2 Nuisance Wildlife

The proposed project activities, in particular the camp operations, have the potential to create an abundance of human-produced waste. Human-produced waste can create a higher potential for wildlife attraction which is one of the major problems with polar bears. This interaction has the potential to cause effects on-site personnel, the camp infrastructure and equipment associated with the project activities. Human waste such as human food, food waste, garbage, water or wastewater, sewage and petroleum-based products may attract bears or other wildlife to areas of human use.

Bears or other wildlife that become conditioned to feeding on human- produced attractants are considered to be "food-conditioned". Food-conditioning in bears compromises both human and bear safety and needs to be strictly avoided. Even a low rate of exposure to human food or garbage can reinforce behaviour in bears that leads to conflicts with people. Proactive management and control of potential attractants is one of the most important ways to ensure safe interaction between people and bears (Parks Canada, 2005).

Based on Parks Canada Polar Bear Safety Plan (2005), the following mitigation is recommended to provide a deterrent to nuisance wildlife and more specifically polar bears which may access the site during the project activities.

- Except as otherwise provided in these Regulations, no person shall touch or feed wildlife or entice wildlife to approach by holding out or setting out decoys or any such devices, foodstuffs or bait of any kind;
- No person shall discard or dispose of or deposit garbage anywhere in a work zone except in such places and at such times and under such conditions as the superintendent may authorize;
- Bears will be denied access to all unnatural food sources, such as human food, garbage, sewage, pet food, domestic animal food, and grain spills;
- All project personnel will be informed of proper food storage and garbage handling procedures;
- Where garbage receptacles are provided or permitted, "bear proof" garbage containers will be used where practicable; and,
- All non-natural attractants used or produced by project personnel will be incinerated or removed from the site.

9.0 RESIDUAL EFFECTS AND CUMULATIVE EFFECTS

The residual impacts to the area are positive, as reclamation of the land will create job opportunities, and restore the environment to safe levels for wildlife and generations to come. Cumulative effects are changes to the environment that are caused by an action in combination with other past, present and future human actions. The proposed remediation of the FOX-D site will aid in restoring the area to as close to pre-disturbed conditions as possible. With the removal of hazardous material, remediation of impacted soils, and mitigation measures to aid in preventing further environmental consequences, no adverse cumulative effects are anticipated from related project activities.

It is anticipated that the area will be frequented by hunters who gain access by aircraft. Continued operation of the airstrip will permit this access. Clean-up of the site will reduce the potential risks of contamination to human health, wildlife and the coastal environment.

There may be increased pressure on wildlife populations although the site investigations indicate that caribou populations are declining and are no longer frequent in the area. Polar Bear are protected under federal legislation and are not to be harmed through the project activities. No adverse cumulative effects are therefore anticipated from present and anticipated future activities.

10.0 STATEMENT OF LIMITATIONS AND METHODOLOGY

This EIA has been prepared in accordance with the agreed scope of work between AANDC and PWGSC. The conclusions presented herein are based on information gathered by federal coordination, report reviews and site visit(s). Should significant changes to the project scope and location occur, this EIA should be revisited to ensure compliance with regulatory requirements and consideration of potentially new interactions with Valued Ecosystem Components.

11.0 PART IV RECOMMENDATIONS AND SIGN-OFF

EIA Report prepared by:

Gay Drescher, MES MCIP RPP

DILLON CONSULTING LIMITED

Signature	Date

12.0 LIMITATIONS

This report was prepared exclusively for the purposes, project and site location(s) outlined in the report. The report is based on information provided to, or obtained by Dillon Consulting Limited as indicated in the report, and applies solely to site conditions existing at the time of the site investigation(s). Dillon Consulting Limited's report represents a reasonable review of available information within an agreed work scope, schedule and budget. It is therefore possible that currently unrecognized contamination or potentially hazardous materials may exist at the site(s), and that the levels of contamination or hazardous materials may vary across the site(s). Further review and updating of the report may be required as local and site conditions, and the regulatory and planning frameworks, change over time.

This report was prepared by Dillon Consulting Limited for the sole benefit of our Client (Public Works and Government Services Canada). The material in the report reflects Dillon Consulting Limited's judgment in light of the information available to Dillon Consulting Limited at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Dillon Consulting Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Respectfully Submitted:

DILLON CONSULTING LIMITED

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APPENDIX A

Site Photos



Picture 1: View of Airstrip



Picture 2: View of Freshwater Lake from above



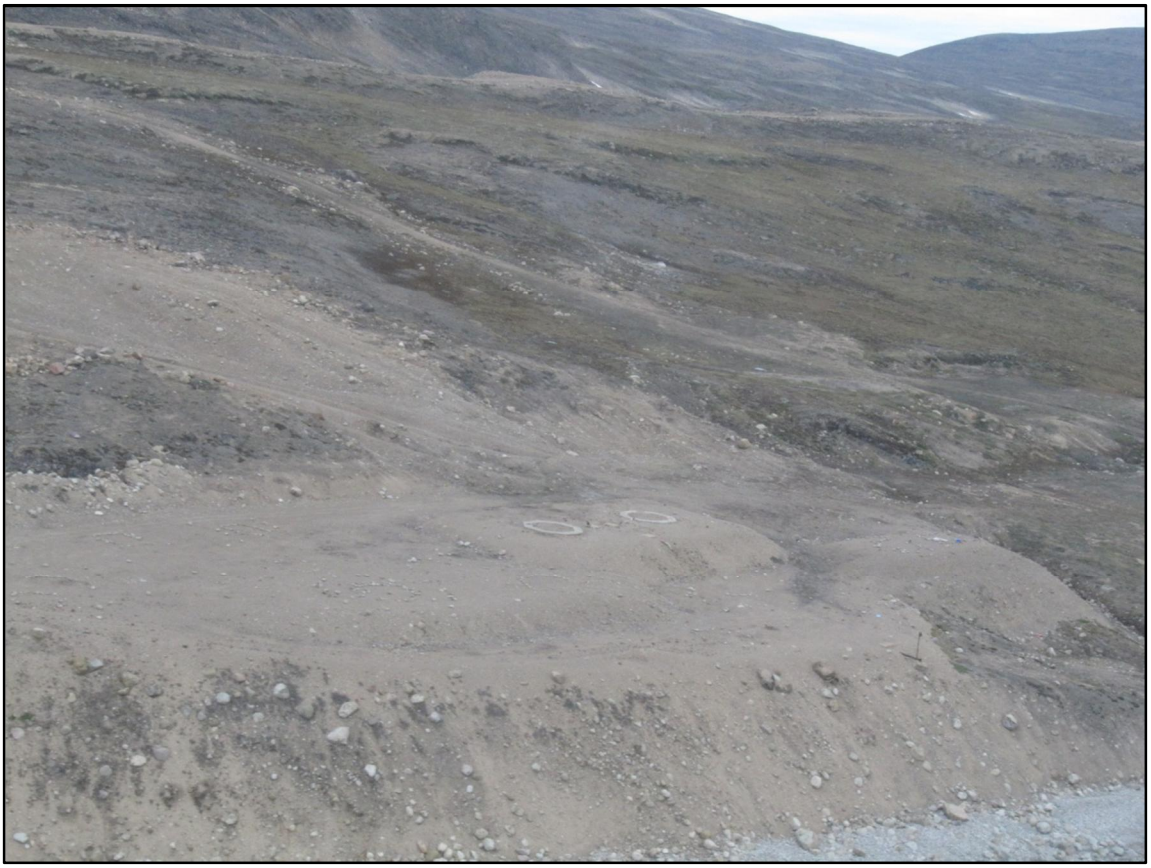
Picture 3: View of Lake



Picture 4: View of Road Section Heading Uphill from Freshwater Lake to Summit



Picture 5: Shelter along Coast



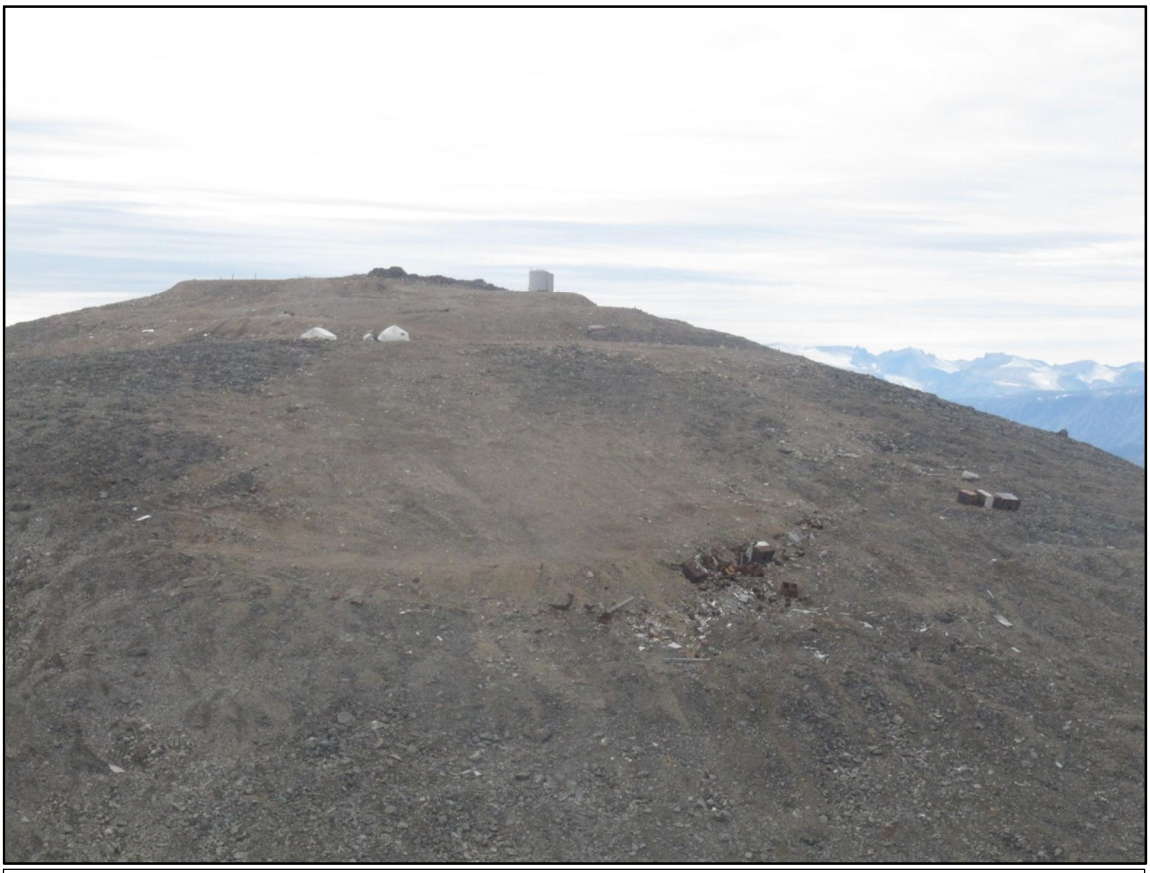
Picture 6: Large Gravel Borrow Area



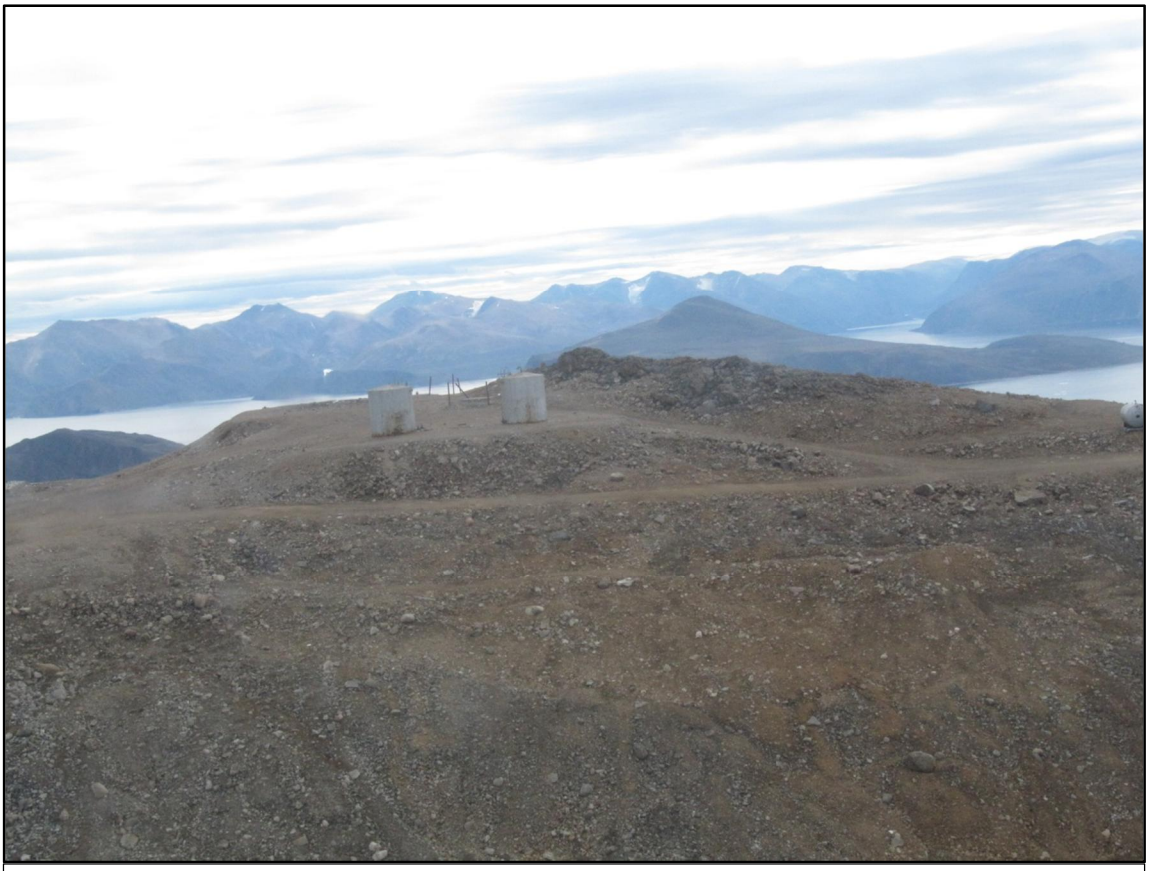
Picture 7: Coastline East of the Site



Picture 8: View of Hill From the East



Picture 9: Close Up View of Summit from the North



Picture 10: View of Summit from the North



Picture 11: View of Lake from the West



Picture 12: Arctic Poppy at Summit (Upper Site)



Picture 13: Sedge at Upper Site.



Picture 14: Close-Up of Sedge at Upper Site



Picture 15: Fox Skull at Upper Site



Picture 16: Map Lichen and Rock Tripe at Upper Site



Picture 17: East View from Upper Site



Picture 18: Lemming Droppings Near Den (Upper Site)



Picture 19: View of Upper Site from North



Picture 20: Seal bone.



Picture 21: East View of Upper Site, Looking Over Antenna



Picture 22: Arctic Heather (Upper Site)



Picture 23: Walrus Bone Found Near Antenna



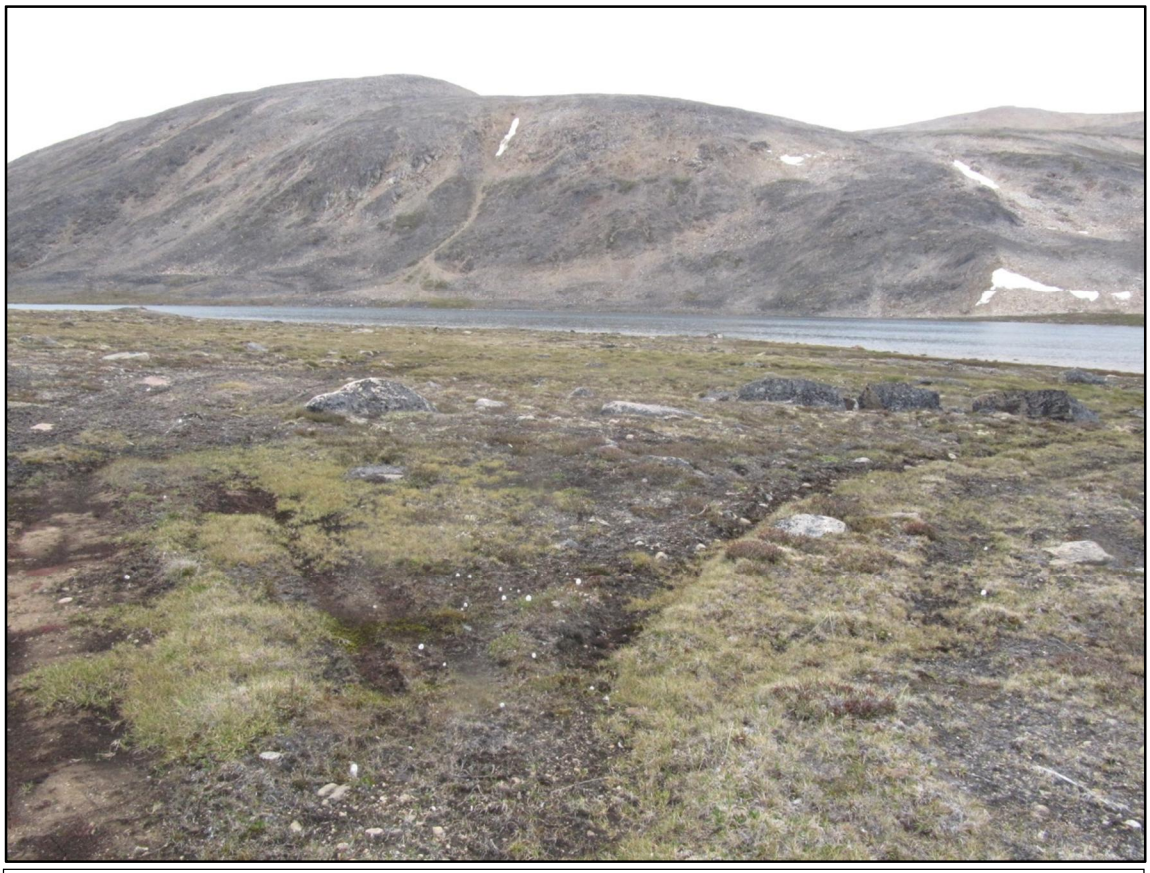
Picture 24: Arctic Sorrel at Lower Site near Freshwater Lake



Picture 25: River Beauty (Dwarf Fireweed) on Lower Site, near Freshwater Lake



Picture 26: Cottongrass between Freshwater Lake and Gravel Road



Picture 27: View of Lake and Mountain Looking North from Road



Picture 28: Goose Droppings near Freshwater Lake



Picture 29: Loon on Freshwater Lake



Picture 30: Two Loons on Freshwater Lake



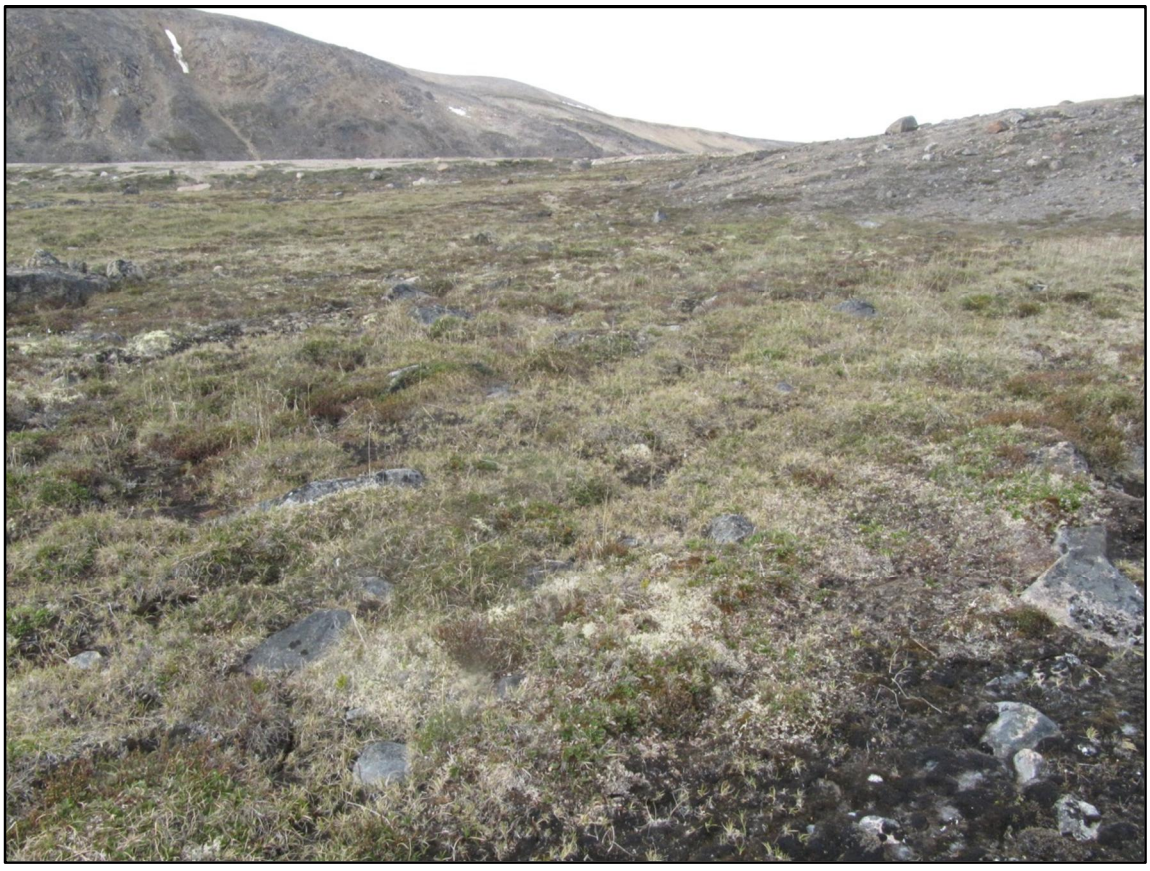
Picture 31: Stream Exiting Freshwater Lake to the East



Picture 32: Gravel Access Road, Looking West



Picture 33: Arctic Wintergreen (near coastline)



Picture 34: Typical Undisturbed Landscape Between Road and Ocean



Picture 35: WP 104, Old Walrus Skull and Bones



Picture 36: WP 104, Walrus Skull



Picture 37: Arctic Chickweed at Lower Site



Picture 38: Nodding Saxifrage



Picture 39: WP105 Thule tent Ring



Picture 40: WP 105, Walrus Bones



Picture 41: WP 105, Walrus Skull



Picture 42: WP 105, Walrus Bones (2)



Picture 43: WP 106, Seal Bone



Picture 44: WP 106, Seal Vertebrae



Picture 45: WP 106, Seal Skull



Picture 46: WP 106, Whale Baleen



Picture 47: WP 107, Modern Tent Ring



Picture 48: WP 108, Whaler Cemetary



Picture 49: WP 108, Whaler Cemetary



Picture 50: WP 109, Seal Carcass



Picture 51: WP 110, Polar Bear Bones



Picture 52: WP 111, Polar Bear Spine



Picture 53: WP 112, Fresh Seal Carcass



Picture 54: Lapland Longspur



Picture 55: Lapland Longspur 2



Picture 56: Gravel Borrow Pit Area Facing South



Picture 57: Inuit Burial Tomb



Picture 58: Inuit Burial Tomb 2



Picture 59: Modern Tent Ring on Gravel Area



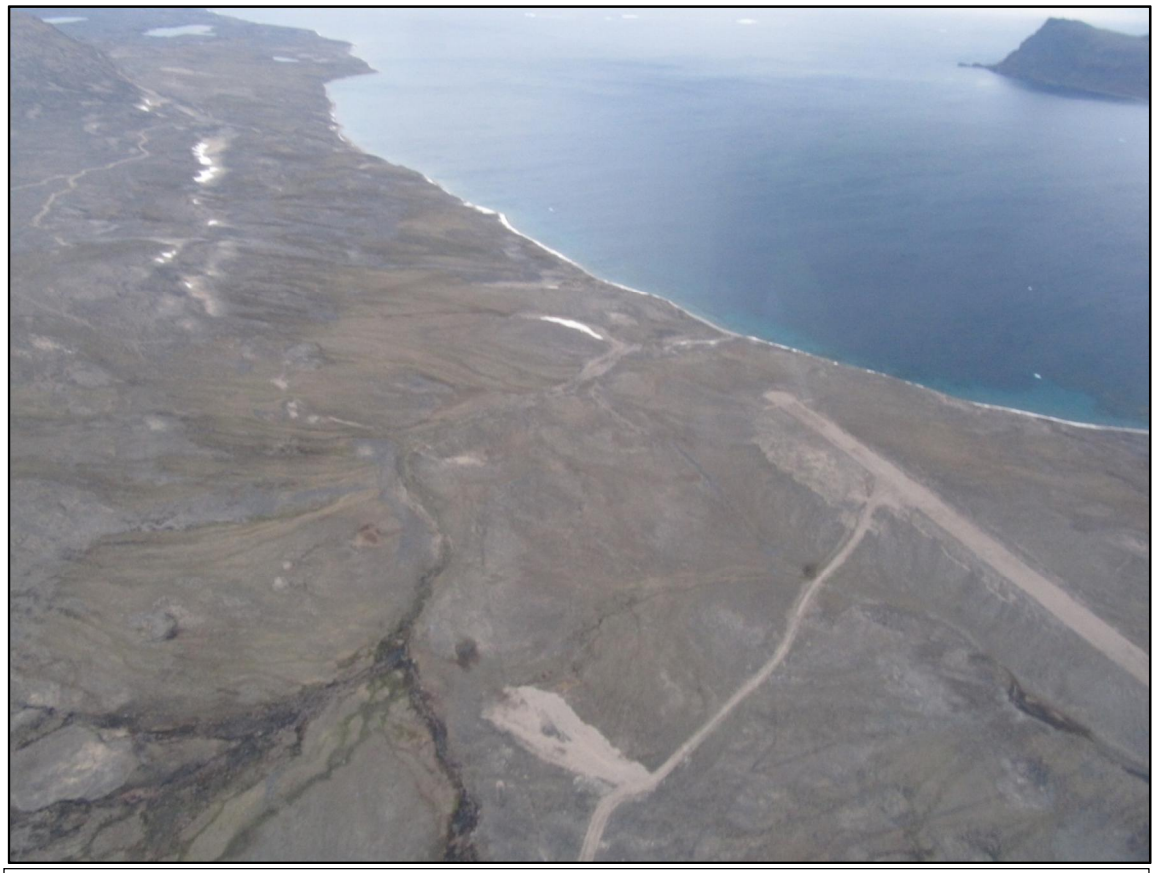
Picture 60: WP 113, Arctic Hare Mandible



Picture 61: WP 113, Goose Bones



Picture 62: Hunting Shack on Shoreline



Picture 63: Aerial View of Stream

APPENDIX A

SITE PHOTOGRAPHS (2013)





Photo 1 - Aerial view of road section requiring light grading.



Photo 2 - Typical road requiring light grading.



Photo 3 - Typical material used to construct road. TP23 (Station 5+800).

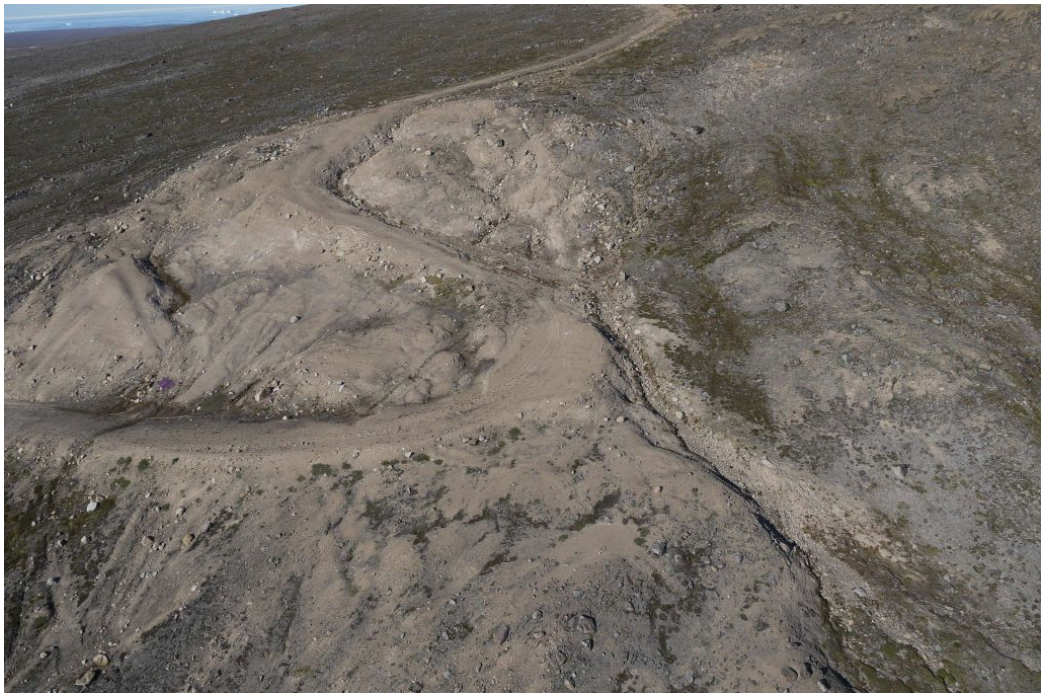


Photo 4 - Aerial view of road requiring medium grading and potential borrow area near Station 4+700.



Photo 5 - Typical road requiring medium grading.

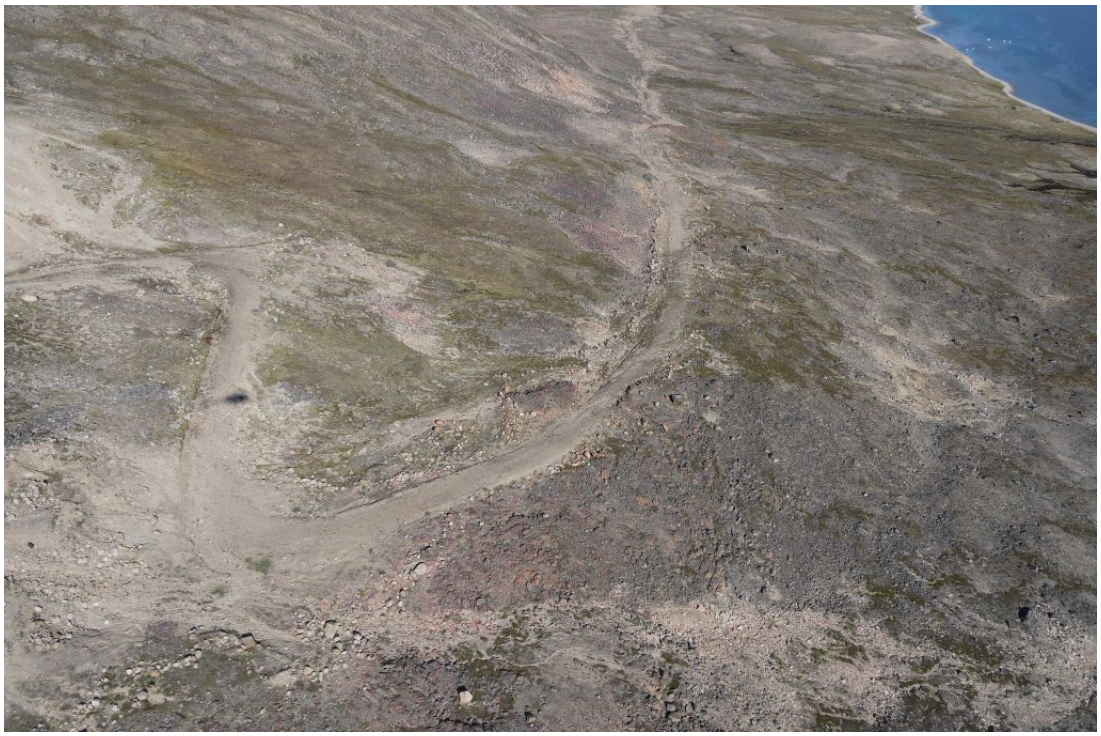


Photo 6 - Aerial view of the road requiring heavy grading and potential borrow area near Station 4+100.



Photo 7 - Typical road requiring heavy grading.



Photo 8 - Typical road requiring heavy grading.



Photo 9 - Aerial view of airstrip (looking southeast).



Photo 10 - View of airstrip looking towards the northeast (upslope).



Photo 11 - Southwest view of airstrip down slope.



Photo 12 - Typical boulder on airstrip.



Photo 13 - Typical material used to construct airstrip (TP34).



Photo 14 - Aerial view of Upper Site. Potential Non-Hazardous Landfill and/ or Landfarm areas. Note potential borrow material present at Upper Site.



Photo 15 - Aerial view of the Potential Landfarm located in the saddle.



Photo 16 - Typical material in Potential Landfarm in saddle (TP25).



Photo 17 - Aerial view of the barge landing area, proposed waste transfer area and borrow area.

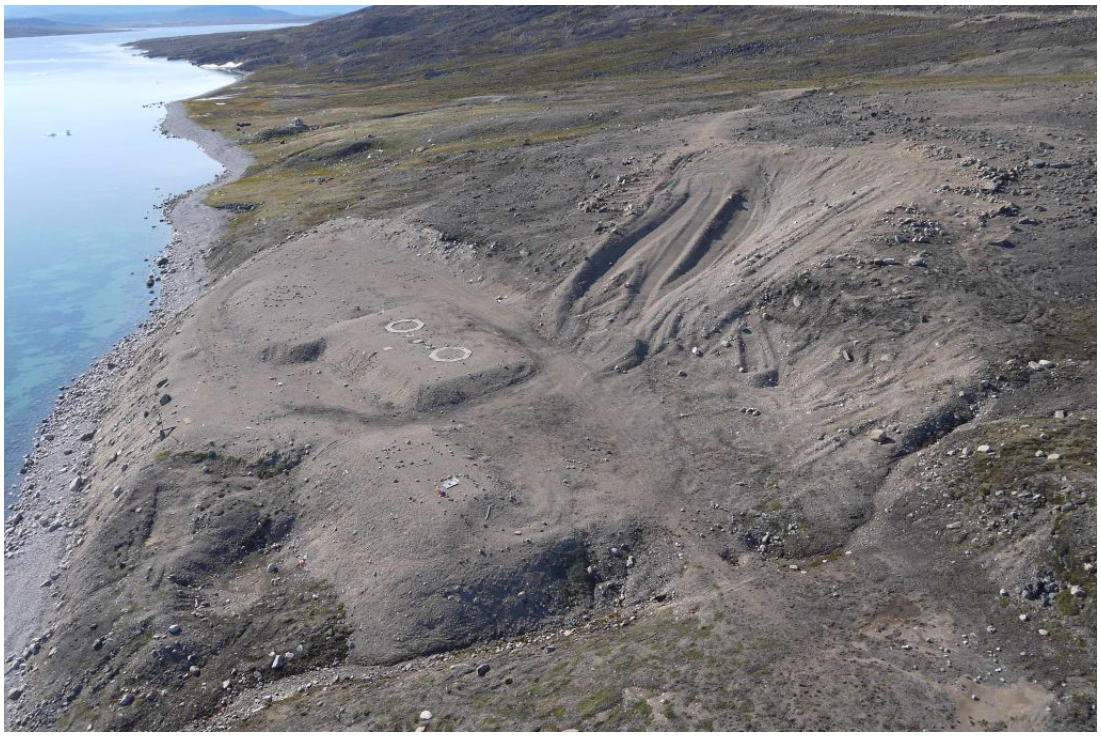


Photo 18 - Aerial view of the barge landing area, proposed waste transfer area and borrow area.



Photo 19 - Aerial view of Existing Landfill APEC 9 (Upper Site).

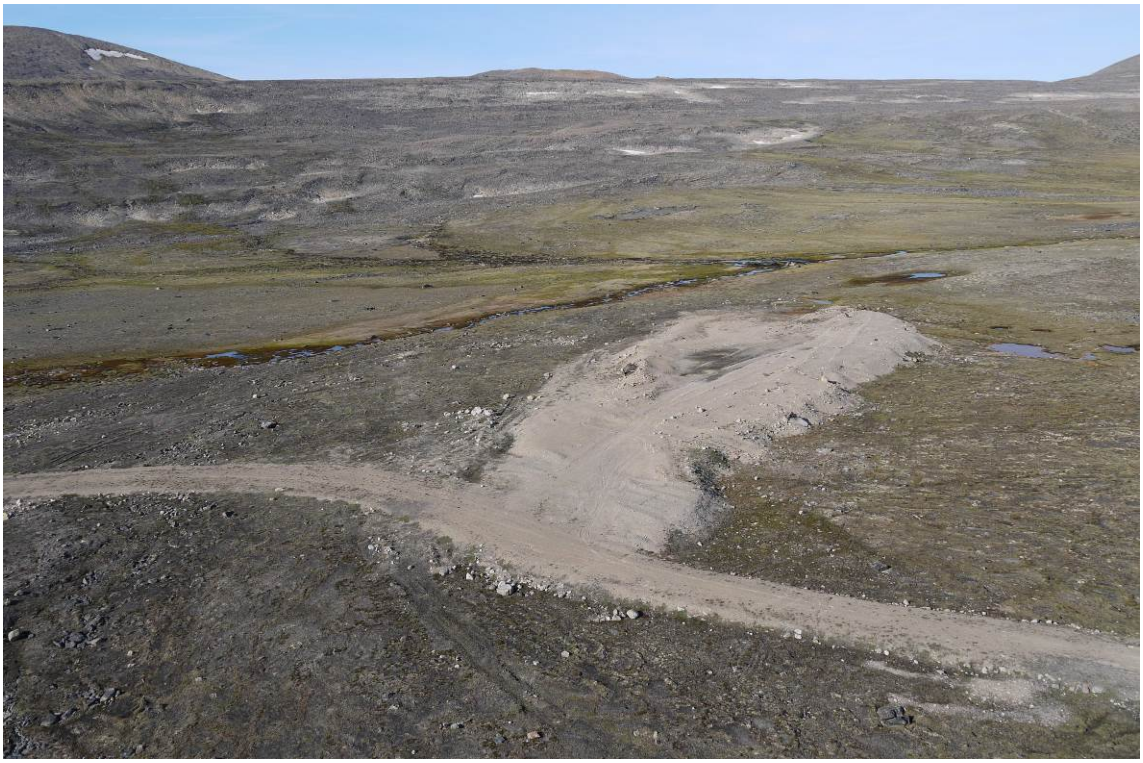


Photo 20 - Aerial view of Fuel Cache Dump APEC 11B (former construction camp area).

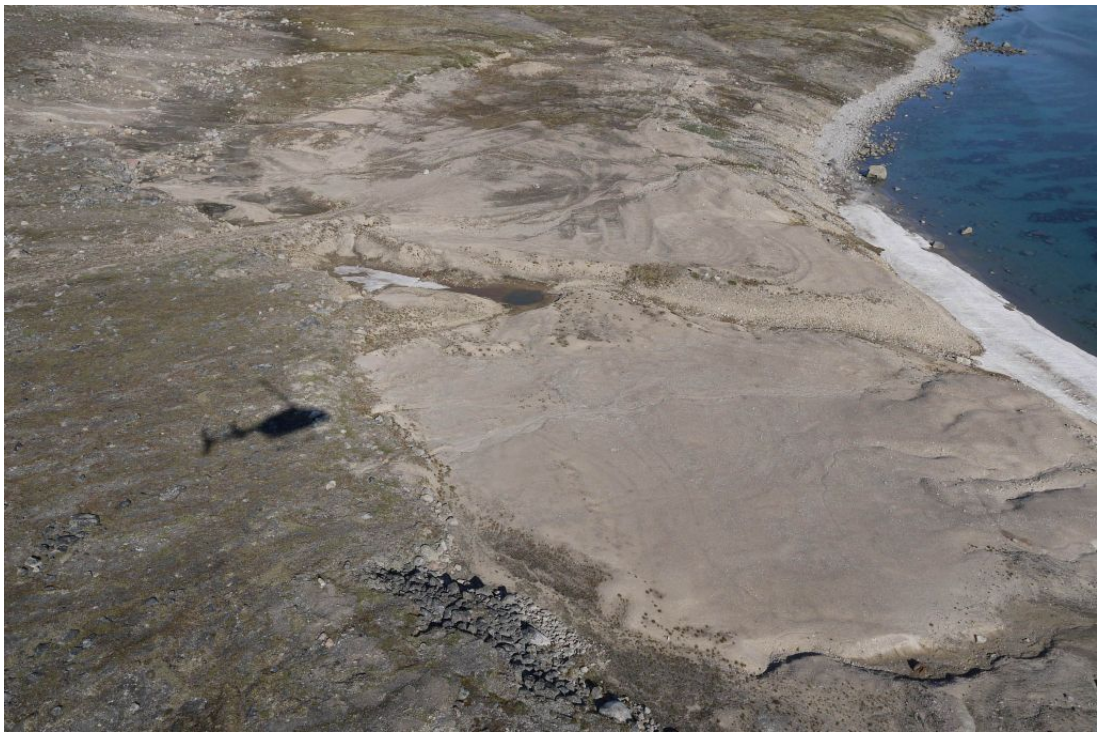


Photo 21 - Aerial view of the potnetial borrow area south of the airstrip.



Photo 22 - Aerial view of the borrow area south of the airstrip and access road to the borrow area.

APPENDIX B

Water Quality Analytical Results

TABLE 1
PETROLEUM HYDROCARBONS AND POLYCHLORINATED BIPHENYLS IN POTENTIAL WATER SOURCES
FOX-D - KIVITOO, NUNAVUT

Sample ID	Potential Water Source Location	Date	Parameter [1]	
			Total Petroleum Hydrocarbons	Total PCBs
2013-203	Freshwater Lake	11-Aug-13	-	<0.1
2013-205	Freshwater Lake	11-Aug-13	-	<0.1
2013-331	Freshwater Lake	11-Aug-13	<0.1	<0.1
2013-338	Freshwater Lake	11-Aug-13	<0.1	<0.1
HC-CDWQ [3]				
Drinking Water Quality			-	-
CCME [2]				
Freshwater Aquatic Life			-	-

Notes:
EQL = Estimated Quantitation Limit = Lowest level of the parameter that can be quantified with confidence.
"-" = No Data

1. All concentrations in micrograms per litre (µg/L).
2. CCME - Canadian Council of Ministers of the Environment. Canadian Environmental Quality Guidelines 1999. Updated November 2012.
   Chapter 2 - Community Water
   Chapter 4 - Aquatic Life
   MAC - Maximum Acceptable Concentration
   AO - Aesthetic Objective
3. Health Canada - Canadian Drinking Water Quality Guidelines (HC-CDWQ). Updated August 2012.

	- Exceedance of HC-CDWQ Criteria
BOLD	- Exceedance of CCME Criteria

TABLE 2
GENERAL WATER QUALITY
FOX-D - KIVITOO, NU

Sample ID	Potential Water Source Location	Date	E. Coli (CFU/100 mL) [11]	Total Coliform (1 CFU/100mL) [11]
DRINKING_S_1	Freshwater Lake	19-Aug-13	0	0
DRINKING_S_2	Freshwater Lake	19-Aug-13	0	0
HC-CDWQ [2]				
Drinking Water			None Detectable per 100 mL (MAC) [6]	None Detectable per 100 mL (MAC) [7]
CCME / Health Canada [3]				
Freshwater Aquatic Life			-	-

Notes:

	- Exceedance of HC-CDWQ Guidelines
Bold	- Exceedance of CCME Guidelines

TABLE 3
METALS IN POTENTIAL WATER SOURCES
FOX-D FORMER DEW LINE STATION, KIVITOO, NUNAVUT

Sample ID	Potential Water Source Location	Date	Cadmium	Chromium	Cobalt	Copper	Lead	Nickel	Zinc
2013-263	Freshwater Lake	11-Aug-13	<0.001	<0.005	<0.003	<0.005	<0.010	<0.005	<0.010
2013-267	Freshwater Lake	11-Aug-13	<0.001	<0.005	<0.003	<0.005	<0.010	<0.005	<0.010
HC-CDWQ [2]									
Drinking Water			0.005 (MAC)	0.05 (MAC)	-	1.0 (AO)	0.010 (MAC)	-	5 (AO)
CCME[3]									
Freshwater Aquatic Life			(8)	0.0089 (III), 0.001 (VI)	-	(8)	(8)	(8)	0.03

Notes:
"-" = No Data

1. All values are expressed in milligrams per litre (mg/L).
2. Health Canada - Canadian Drinking Water Quality Guidelines (HC-CDWQ). Updated August 2012.
   MAC - Maximum Acceptable Concentration
   AO - Aesthetic Objectives
   OG - Operational Guideline
3. CCME - Canadian Council of Ministers of the Environment. Canadian Environmental Quality Guidelines, 1999. Updated November 2012.
   Guidelines for Canadian Drinking Water Quality.
   Chapter 2 - Community Water (Health Canada - Canadian Drinking Water Quality Guidelines)
4. This is an operational guidance value, designed to apply only to drinking water treatment plants using aluminum-based coagulants.
   The operational guidance value of 0.1 mg/L applies to conventional treatment plants, and 0.2 mg/L applies to other types of treatment systems.
5. Total aluminum should not exceed 0.005 mg/L in waters with a pH below 6.5.
   The concentration of total aluminum should not exceed 0.1 mg/L in waters with a pH greater or equal to 6.5.
6. Short-term exposure (24 to 96 hours) concentrations which indicate potential for severe effects during transient events
   (spill events to aquatic receiving environments and infrequent releases of short-lived/non-persistent substances).
   These are NOT protective guidelines.
7. Long-term exposure guideline that protects all forms of aquatic life for indefinite exposure periods (>7d exposures for fish and invertebrates, 24h exposures for aquatic plants and algae).
8. For the following equations, hardness is expressed as $CaCO_3$ in mg/L and the guideline is in µg/L. **Cadmium** Guideline = 10^{0.86[log(hardness)] - 3.2} µg/L;
   Copper Guideline = e^(0.8545[ln(hardness)]-1.465) * 0.2 µg/L; **Lead** Guideline = e^(1.273[ln(hardness)]-4.705) µg/L; **Nickel** Guideline = e^(0.76[ln(hardness)]+1.06) µg/L
9. If trigger ranges for total phosphorous are exceeded, the potential exists for an environmental impact. If trigger range is not exceeded,
   but TP is more than 50% above baseline values, the potential exists for an environmental impact.
   Trigger ranges (µg/L): ultra-oligotrophic
   oligotrophic

	- Exceedance of HC-CDWQ Criteria
BOLD	- Exceedance of CCME Criteria

APPENDIX 7:

ARCHAEOLOGICAL IMPACT ASSESSMENT

May 2014

ARCHAEOLOGICAL IMPACT ASSESSMENT

FOX-D DEW Line Site, Kivitoo

This document contains sensitive information about Heritage Resources that is protected under provisions of Access to Information and Protection of Privacy Act. *This information is to be used to assist in planning the proposed project only. It is not to be disseminated, and no copies of this document are to be made without written permission of Department of Culture and Heritage, Government of Nunavut.*

Submitted to:
Department of Culture and Heritage
Government of Nunavut
P.O Box 301
Igloolik, Nunavut
X0A 0L0

FINAL REPORT

Report Number: 13-1379-0026 / NAP 2013-031A

Distribution:

1 Copy Dillon Consulting Ltd
1 Copy Culture and Heritage
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1 Copy Canadian Museum of Civilization
3 Copies Golder Associates Ltd.

Golder Associates

EXECUTIVE SUMMARY

During August of 2013, Golder Associates Ltd. (Golder) conducted an Archaeological Impact Assessment on behalf of Dillon Consulting Ltd. (Dillon) working for Public Works and Government Services Canada (PWGSC) and Aboriginal Affairs and Northern Development Canada (AANDC) in conjunction with a Phase III Environmental Site Assessment Remedial Action Plan for the Former FOX-D Distant Early Warning (DEW) Line site, Kivitoo, Nunavut. All required field work was conducted under Nunavut Archaeologists Permit 2013-031A issued by the Department of Culture and Heritage, Government of Nunavut to Brent Murphy of Golder.

The FOX-D site and the former community of Kivitoo are located approximately 60 km northwest of the community of Qikiqtarjuaq on Baffin Island. FOX-D was constructed at Kivitoo Point in 1957 and is made up of an Upper and Lower sites that operated until 1963. The Upper Site included a continuous wave tower, a main building train, a warehouse, a garage, two 75,700 litre POL tanks, and a small building that may have been an Inuit house. The Lower Site is located on a coastal plain to the south of the Upper Site. It once consisted of two POL tanks, a beach landing area, drum storage and an airstrip. A freshwater lake, borrow source areas and a construction camp area were also present at the lower site. The Upper and Lower sites are connected by a 4 km access road.

Low-level aerial reconnaissance of the site area was conducted in order to assess the locations of all structures and debris requiring further investigation and to identify areas of archaeological potential. Lack of vegetation and sedimentation enabled surface examination of the facility areas to adequately assess for the presence of cultural materials. During the study four previously recorded archaeological sites MlDc-7, MlDc-8, MlDc-9 and MlDc-17 were revisited and two previously unrecorded sites, MlDc-19 and 20, were documented as per the Nunavut Archaeological and Palaeontological Sites Regulations. In addition several land use sites were documented. All of the archaeological sites are thought to have moderate to high significance and it is recommended that any impacts to the sites be avoided. There are no plans to disturb any of the sites recorded or revisited during the current study during the remediation of the FOX-D DEW Line site.

By conducting this AIA, it is recommended that Dillon, PWGSC, and AANDC have fulfilled the requirements of the current program in their attempts to identify the potential for impact to heritage resources resulting from the proposed remediation of the FOX-D DEW Line site. The AIA included the participation of Losie Audiakiak and Johnny Kooneeliusie from Qikijtarjuaq, who acted as bear monitors and participated in the identification and recordation of the heritage resource sites.

Study Limitations

Golder has prepared this document in a manner consistent with that level of care and skill exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this document. No warranty, express or implied, is made.

This document, including all text, data, tables, plans, figures, drawings, and other documents contained herein, has been prepared by Golder for the sole benefit of Dillon, PWGSC, AANDC and the Department of Culture and Heritage, Government of Nunavut. It represents Golder's professional judgement based on the knowledge and information available at the time of completion. Golder is not responsible for any unauthorized use or modification of this document. All third parties relying on this document do so at their own risk.

The factual data, interpretations, suggestions, recommendations and opinions expressed in this document pertain to the specific project, site conditions, design objective, development, and purpose described to Golder by Dillon and are not applicable to any other project or site location. The study incorporated traditional knowledge, where available, but was not specifically designed to address issues of traditional aboriginal use of the project area and does not constitute a traditional use study. In order to properly understand the factual data, interpretations, suggestions, recommendations, and opinions expressed in this document, reference must be made to the entire document.

This document, including all text, data, tables, plans, figures, drawings, and other documents contained herein, as well as all electronic media prepared by Golder are considered its professional work. Dillon may make copies of the document in such quantities as are reasonably necessary for those parties conducting business specifically related to the subject of this document or in support of, or in response, to regulatory inquiries and proceedings. Electronic media is susceptible to unauthorized modification, deterioration, and incompatibility and therefore no party can rely solely on the electronic media versions of this document. Both parties are bound by the Nunavut Archaeological Sites Data Base Licence Agreement and Section 19 of the *Access to Information and Protection of Privacy Act, 1994*. As per sections 5 and 6 of the Licence Agreement it is agreed that the site data is to be used for the project specified and will not be made public unless site positions are randomized and the map scale is 1:2,000,000 or less. This report is not to be made public on regulatory or other public websites.

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INTRODUCTION

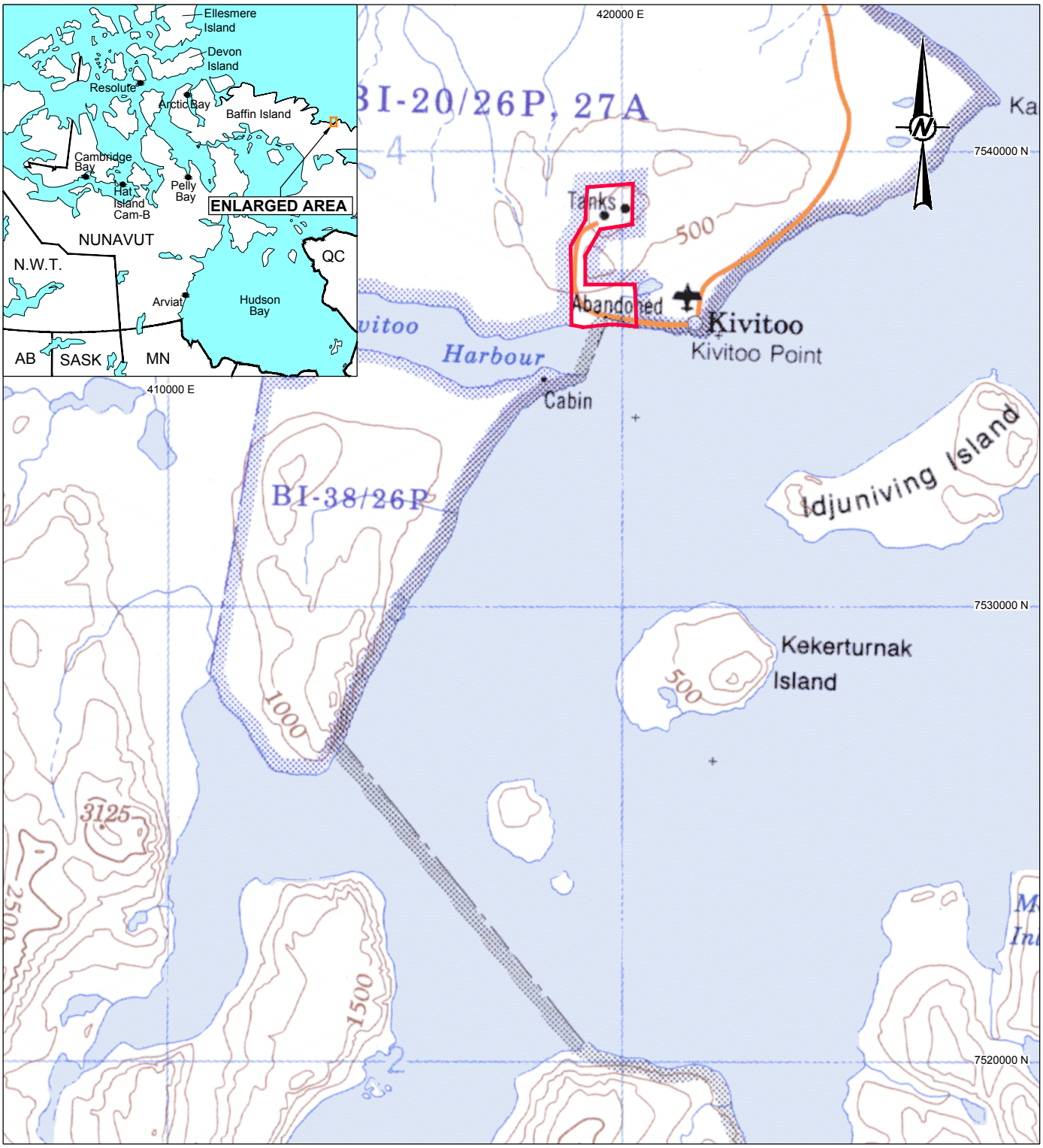
During August of 2013, Golder Associates Limited (Golder) conducted an Archaeological Impact Assessment (AIA) on behalf of Dillon Consulting Ltd. (Dillon) working for Public Works and Government Services Canada (PWGSC) and Aboriginal Affairs and Northern Development Canada (AANDC) in conjunction with a Phase III Environmental Site Assessment Remedial Action Plan for the Former FOX-D Distant Early Warning (DEW) Line site (the Project), Kivitoo, Nunavut. All required field work was conducted under Nunavut Archaeologist Permit 2013-031A issued by the Department of Culture and Heritage, Government of Nunavut (CH-GN) to Brent Murphy of Golder.

Low-level aerial reconnaissance of the Project area was conducted in order to assess the locations of all structures and debris requiring further investigation and to identify areas of archaeological potential. Pedestrian reconnaissance over areas with moderate to high archaeological potential was conducted; the spacing of the area traversed varied depending on terrain. Lack of vegetation and sedimentation enabled surface examination of the facility areas to adequately assess for the presence of cultural materials. If an area was assessed as having high potential with vegetation coverage the area was subject to shovel testing.

The AIA was intended to identify any artifacts or heritage resource areas that were impacted by the construction and operation of FOX-D DEW Line site as well as any future impacts associated with remediation activities, for instance, proposed borrow sources, landfarm, landfill, camp, and road locations.

Location

The FOX-D DEW Line site and the former community of Kivitoo are located approximately 60 km northwest of the community of Qikiqtarjuaq, Nunavut on the southeast coast of Baffin Island on the Davis Strait (Figure 1). The FOX-D DEW Line site was constructed at Kivitoo Point in 1957 and comprised an Upper and Lower site that operated until 1963. The Upper Site included a continuous wave tower, a main building train, a warehouse, a garage, two 75,700 litre POL tanks, and a small building that may have been an Inuit house. The Lower Site is located on a coastal plain to the south of the Upper Site. It once consisted of two POL tanks, a beach landing area, drum storage and an airstrip. A freshwater lake, borrow source areas and a construction camp area were also present at the lower site (Figure 2). The Upper and Lower Site are connected by a 4 km access road (Plates 1, 2 and 3). The site operated until October of 1963. After military operations at the site ceased the site became part of the Auyuittuk National Park and under the management of Parks Canada until 1992 when custody of the site was transferred to AANDC.



LEGEND

PROJECT AREA

REFERENCES

TOPOGRAPHIC MAP 026/P OBTAINED FROM Canmatrix © 1986. HER MAJESTY THE QUEEN IN RIGHT OF CANADA. DEPARTMENT OF NATURAL RESOURCES.
DATUM: NAD27 PROJECTION: UTM ZONE 20.
REPROJECTED TO DATUM: NAD83 PROJECTION: UTM ZONE 20.

PROJECT

FOX-D DEW LINE SITE, KIVITOO

TITLE

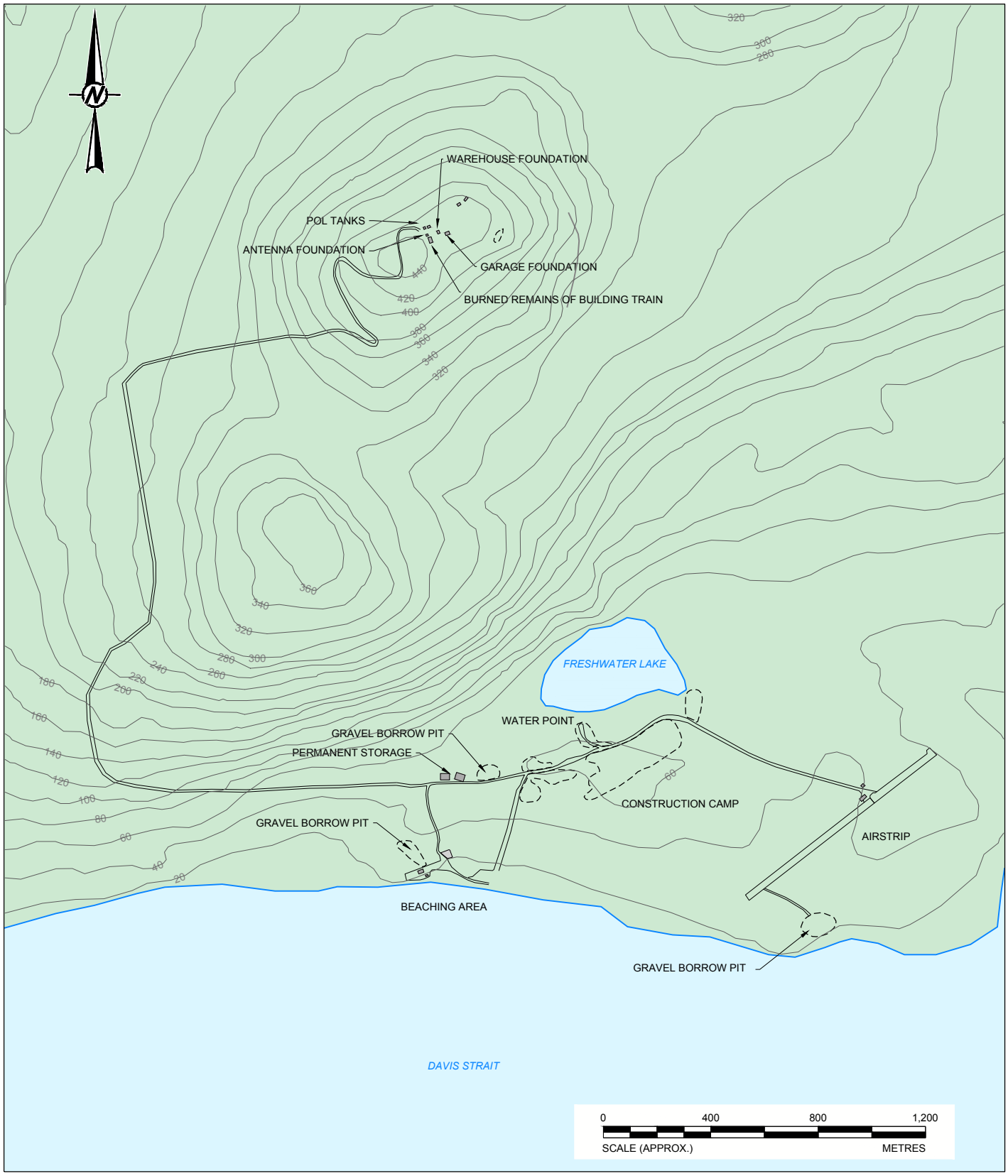
FOX-D PROJECT LOCATION

Golder Associates

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CADD	BTM	2013-11-28		
CHECK	BM	2014-05-28		
REVIEW	DB	2014-05-28		

FIGURE: 1

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LEGEND

- CONTOUR (METRES)
- ROAD
- WATERCOURSE
- AREA OF DUMP, GRAVEL BORROW AREA, OR WORKED AREA
- WATERBODY

REFERENCES

ALBERTA NTDB DIGITAL DATA OBTAINED FROM GEOMATICS CANADA, AUGUST 2001.
MAPSHEET 26P015 DATUM: NAD83 PROJECTION: UTM ZONE 20

PROJECT

FOX-D DEW LINE SITE, KIVITOO

TITLE

SITE LOCATION MAP

Golder Associates

PROJECT No.	13.1379.0026 .1400		FILE No.	13137900261400A002
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CADD	BTM	2013-11-25		
CHECK	BM	2014-05-28		
REVIEW	DB	2014-05-28		

FIGURE: 2

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Plate 1: View west of Kivitoo showing runway, freshwater lake and construction camp location



Plate 2: View northwest of upper site with PLO in the background



Plate 3: View south of road between upper and lower sites, with Beaching area in the centre of the photograph

Potential Impacts

The potential impacts to heritage resources around the FOX-D Dew Line site are dependent upon the proximity of those resources to the remediation activities that will be conducted to remove the remnants of the former site. Heritage resource sites are non-renewable resources that may be located at or near ground level or may be deeply buried. Prehistoric or precontact archaeological sites are those sites which contain features, artifacts, or ecofacts reflecting the use of a given land base by people prior to European influences and technologies. Features are non-portable articles that indicate a human modification of the local environment such as hearths, pits, tent rings, stone cairns, and Inuksuit. Artifacts are portable items that have been modified by people at some time in the past. These include such items as projectile points, stone flaking debris, and cut and modified bone. Ecofacts are naturally occurring items such as preserved plant remains or pollen that can aid in the interpretation of archaeological sites. Historic archaeological sites include the features, artifacts, and ecofacts relating to the past few hundred years of human occupation. These sites are typically identified by the presence of buildings or structural remains, but may include any site that has evidence of historic use of the landscape.

Alteration of the landscape can result in the damage or complete destruction of all or portions of historic resource sites. These alterations often involve the displacement of artifacts resulting in the loss of valuable contextual information or may involve the destruction of the artifacts and features themselves resulting in complete information loss. These losses are permanent and irreversible. Primary, secondary, and tertiary impacts are possible with any new development. Remediation can be considered a new development in this context if it impacts previously undisturbed areas during operation.

Primary impacts include those disturbances resulting immediately from a project. The primary impact zone is the area within the remediation footprint including access roads, temporary work zones, borrow areas, and landfills. Individual sites are likely to be affected to varying degrees if they are located within the development area. Artifact context is fundamental to interpretation of archaeological sites. By disturbing the context in which artifacts and features are recovered, interpretations of heritage resources sites and, ultimately, past lifeways are affected negatively.

Secondary impacts can occur when the support services or additional access required by development adversely affects heritage resources outside the primary target areas. The Project should have no secondary effect on heritage resources.

Tertiary impacts are the results of project induced changes in demography and land use patterns. Increased rates of intentional and unintentional impacts can be expected as a result of increased visitation to an area if the project were large enough to affect regional population bases. Tertiary impacts are anticipated to be very low for this Project, especially because changes to the site through remediation will probably only negatively affect the visitation rates.

The study detailed in this report is intended to identify areas of possible impact and to determine whether the current Project will disturb those heritage resources located in proximity to the development.

Project Objectives

The objective of the Project is to ensure that heritage resources are not inadvertently impacted by the proposed clean-up and remediation activities. Specifically the purpose of this AIA is to:

- conduct a pre-impact assessment of the proposed remediation areas;
- identify any archaeological sites within proposed remediation areas (if present);
- make recommendations to CH-GN, Dillon, and PWGSC to mitigate or avoid those sites;
- make recommendations on surveillance and monitoring; and
- prepare a draft final report to be reviewed by Dillon and PWGSC, followed by a final report for distribution as required and submission to CH-GN.

PHYSICAL AND CULTURAL SETTING

Environmental Context

An understanding of past environmental conditions and the environmental factors that shape human approaches to subsistence and settlement patterns enables archaeologists to not only locate sites, but also to provide more accurate interpretations of individual sites. The physical aspects of the environs (topography, drainage, climate, and soils) as well as resource availability (flora, fauna, lithic materials, and water) are prime criteria for the identification of site location and function. Assessments of universal cultural activities related to site location, travel within and through variable terrain, and resource exploitation are key components of any archaeological site analysis.

The anthropological theory of environmental determinism suggests that, to a great extent, environmental factors condition human behavioural and cultural adaptations, or patterns of behaviour. The environment has likely

influenced many of the activities that contribute to the character of the regional prehistoric record. All available environmental variables must be considered as indicators of prehistoric use of the landscape.

The regional environment influences where specific activities and occupation are located in a pattern of seasonal movements according to the availability of resources: a seasonal round. The variables of archaeological site distribution can be identified and combined into useful criteria for suggesting the potential of an environment to hold heritage resources that includes a wide variety of landforms frequently associated with coastlines and lake shores, river banks, eskers and kames, and bedrock knolls in Arctic environs. Distribution patterns partially reflect environmental opportunities presented to human groups as well as cultural preferences demonstrated by site location. Topography influences much human activity including travel, communication, resource catchments, dwelling locations and eventually constrains human activity areas to defined localities. Based on existing heritage resources, the environment is a key factor in human settlement patterns.

Regional Environment

Prior to contact with Europeans, the environment in which the people of North America lived strongly influenced their culture and economy. The people who inhabited the North took advantage of the seasons and all the resources that were available.

Baffin Island is part of the Canadian Shield, an old erosion surface of Precambrian rocks. Specifically, the northeast coast is mountainous and framed by numerous fjords, inlets, cliffs, eroded sandstone valleys and intricate alpine glaciers flowing to the sea (Collignon 2005). Hundreds of small islands surround the coast. The vegetation is diverse by sparse and dwarfed with sedges, saxifrage, dryas, Arctic willows, cottongrass, broad-leafed willows, herbs and Arctic poppies being the most common plants of the 350 species recorded on the island. Caribou, wolf, Arctic fox, lemming, Arctic hare, and polar bears are the most common land mammals on the island while sea mammals include walrus and several species of seals and whales are found in coastal waters.

The FOX-D DEW Line site area is characterized by a beach landing area that is at sea level with the actual DEW Line Site being located on a high volcanic plateau up to 440 m above sea level (masl) surrounded by steep slopes. The beach landing is connected to the station by a 4 km road that was cut into a steep valley with several switch backs. During the study wildlife that was observed near the station area included a polar bear, and various birds. Although the volcanic plateau area is sparsely vegetated with some moss the lower area, especially in wet areas near the beach are heavily vegetated with sedges, willows and many flowering plants, grasses and rushes.

Heritage Resources

Archaeology is the study of human history through the material remains of culture, often referred to as heritage resources. The ultimate goal in archaeology is to describe the cultures and events responsible for the creation and deposition of the remains at a given archaeological site. As such, archaeologists use material remains to determine the nature and age of cultural occupations at a site. Artifacts, ecofacts and features deposited into the natural environment, along with their inter-relationships, are the integral parts that make up an archaeological site. The Nunavut Archaeological and Palaeontological Sites Regulations (2003) define heritage resources as: "but not limited to, archaeological and historical sites, burial grounds, palaeontological sites, historical buildings and cairns."

Predating the arrival of Europeans, precontact archaeological sites are comprised of artifacts, features, and residues of native origin typically characterized by modified bone and stone, and stone structures. Historic sites are those structures, features, and objects of European influence that date to as early as contact with the Europeans but can also represent more recent activity of more than 50 years. Depending on the context, sites less than 50 years old may be considered to represent traditional land use and are identified to document continued use and occupation of an area to the present time. A key component of the historic period record are the sites, artifacts, and affiliated resources relating to post-contact Aboriginal people's use of the landscape. These include both archaeological sites and objects such as standing and collapsed cabins, campsites, graves, and traditional sites and resources, such as special places, hunting and plant collecting areas, traplines and their associated remains, oral traditions, and documents. These latter resources are usually identified through consultation procedures such as Traditional Use Studies (TUS), Inuit Qaujimajatuqangit (IQ) or other forms of community consultations.

Heritage resources are non-renewable and are susceptible to alteration, damage, and destruction by construction and development activities. The value of heritage resources cannot be measured in terms of individual artifacts or biological specimens; rather the value of these resources lies in the integrated information which is derived from the relationship of the individual artifacts and fossil specimens, associated features, spatial relationships (distribution), and contextual situations. Interpretation of heritage resource materials, and the ability to interpret the significance of particular sites in a landscape, is based on an understanding of the nature of the relationship between individual archaeological and palaeontological materials, as well as the sediments and strata within which they are contained. As such, removal or mixing of cultural or fossil bearing sediments results in the permanent loss of information basic to the understanding of these resources. As a result, heritage resources are increasingly susceptible to destruction and depletion through disturbance.

Areas north of the tree line are characterized by extremely slow rates of soil development and sediment accumulation. Accordingly, at repeatedly occupied sites, there is little chance of distinguishing occupations relating to different periods within the 5,000 year record of human occupation in the region without recovering a diagnostic indicator. Some areas of high sediment deposition rates are present within the study area, but these are not the typical scenario.

The lack of temporally diagnostic artifacts, the absence of materials suitable for radiocarbon dating, and the natural mixing of shallow archaeological deposits serve to limit the definition of the recognized prehistory for the region. In contrast, extant documents, records, and oral testimony provide a firmer basis for understanding the historic period of the region.

Cultural Chronology

Many of the archaeological materials in the project area represent human activity after the ice sheet receded from Baffin Island about 5,000 years before present (BP). Soon afterward the Arctic was colonized by peoples archaeologists referred to as the Arctic Small Tool tradition (ASTt) with Southwestern Baffin Island, Melville Peninsula, Southampton Island, and the northern portion of Quebec being considered to be part of the core area of ASTt Culture Development.

Early Arctic Small Tool Tradition (4200 BP to 2800 BP)

The ASTt represents a widespread cultural manifestation that covers all of the Canadian Arctic as well as parts of Alaska and Greenland. The early ASTt is typically thought to date between approximately 4,200 and 2,800 BP (McGhee 1990). It includes the Denbigh Flint complex in northern Alaska, the Independence I culture of the Canadian High Arctic, the Inuvik Phase, the Pre-Dorset culture in Arctic Canada, and the Sarqaq culture in Greenland. It is thought that the ASTt relates to a separate migration of peoples from Siberia and does not appear to be related to the preceding Palaeo-Arctic tradition, known from areas further south in Nunavut. As the name implies, the toolkit of the ASTt is comprised of lithic artifacts that are finely made and smaller than tools of similar function and age from elsewhere in North America. These include microblades and microcores, burins, gravers, small side and end scrapers, side and end blades, and bipointed (arrow) and triangular (harpoon) projectile points (Wright 1995). The region was first inhabited by the Pre-Dorset approximately 4,200 BP, supported by archaeological sites identified at Mansel Island, Lake Harbour, Frobisher Bay, and Pond Inlet (Desrosiers 2005:193.). Prior to this inhabitation, a large ice sheet had covered the island until its melting 5,000 years ago (Desrosiers 2005:193). In Alaska Early ASTt appears to have developed into the cultures of the Norton tradition while in Canada it developed into the Late ASTt or the Dorset culture. Dorset groups are identified in the archaeological record, between 2,500 and 600 BP. The regions of Southwestern Baffin Island, Melville Peninsula, Southampton Island, and northern Quebec are considered the central regions of Pre-Dorset and Dorset cultural development (Desrosiers 2005:193).

Dorset Culture (2,500 BP to 600 BP)

The Dorset culture of the Canadian Arctic are best known for miniature carvings, Dorset appears to have been a more successful adaptation to the conditions of the north than the preceding ASTt cultures from which it developed. This is demonstrated by the huge area occupied by Dorset groups and by evidence that they had perfected winter hunting on the sea ice. Cooler conditions in the northern hemisphere around 3,000 BP resulted in expansion of the sea ice and a shift away from terrestrial hunting of caribou and hunting of sea mammals from boats in open water to a procurement of sea mammals from coastal edges and sea ice. This is evidenced in the archaeological record with a shift away from bow hunting to harpoon and spear hunting (McGhee 1990). Artifacts recovered from sites representing this period are more diverse and “reflect a richer and more secure way of life than that of earlier Palaeo-Eskimos or Pre-Dorset.” including the establishment of permanent winter villages (McGhee 1990).

Thule or Neo-Eskimo groups entered the area during the final 200 years of the Dorset occupation of the area. These two archaeologically distinct cultures may have coexisted in the region, but the character of this relationship is unclear (McGhee 2001, 2009; Wright 1999).

Thule (800 BP to 400 BP)

The Thule tradition dates from approximately 800 to 400 BP and is derived from the Norton tradition in northern Alaska. More specifically, Thule grows out of the Old Bering Sea and Punuk traditions, which have numerous similarities to Thule cultural assemblages. These assemblages suggest subsistence based on maritime resources such as seals and whales that were hunted from kayaks or umiaks as identified by harpoon floats. Thule represented a new kind of adaptation to the Arctic environment, based on the hunting of large sea mammals in open water through the use of drag floats attached to the harpoon line. Large skin boats and the use of dogs to pull large sleds were other Thule innovations. Winters were spent in sometimes large communities of semi-subterranean houses, subsisting on a stored surplus obtained most typically by hunting bowhead whales. The introduction of Thule into the Canadian Arctic is noted by a distinct change in a number of cultural markers from the Dorset culture. The earliest Thule occupations currently recognized are on islands in the Bering Strait and exhibit an almost complete reliance on maritime resources; however, later sites demonstrate that both maritime and terrestrial resources were utilized (McGhee 1990). Climatic changes following the thirteenth century likely caused the Thule to modify their way of life into that of the various historic Inuit groups.

Historic Inhabitants

Historic use of the project area is identified with the 'Baffin Eskimo'. This group inhabited the southern two-thirds of Baffin Island and some of the nearby islands off its shores (Kemp 1984:464). The remaining northern region of the Island is inhabited by the Iglulik (Kemp 1984:464). The island region that is inhabited by the Baffin Eskimo is characterized by freshwater systems located in the central interior and mountainous areas in the northeast and southwest (Kemp 1984:464). The region was first inhabited by the Pre-Dorset approximately 4,200 BP, supported by archaeological sites identified at Lake Harbour, Frobisher Bay, and Pond Inlet (Desrosiers 2005:193). Prior to this inhabitation, a large ice sheet had covered the island until its melting 5,000 BP (Desrosiers 2005:193). Dorset groups are identified in the archaeological record following this, between 2,500 and 600 BP. The regions of southwestern Baffin Island, Melville Peninsula, Southampton Island, and northern Quebec are considered the central regions of Pre-Dorset and Dorset cultural development (Desrosiers 2005:193). Thule groups entered the area during the final 200 years of the Dorset occupation of the area. These two archaeologically distinct cultures coexisted in the region, but the character of this relationship is unclear. Much of the information known of the historic Thule, or Baffin Eskimo, is based on the ethnographic recordings of Franz Boas from the late 1800's. At this time, Boas recognized seven distinct regional populations within the Baffin Eskimo area (Kemp 1984:464). These populations were "linked together by [bilateral] kinship and the mutual use of hunting and territory, to form larger territorial and social groupings...bands" (Kemp 1984:464). Importantly, by the time of Boas' ethnography the Baffin Eskimo possessed many European goods, which influenced and altered the traditional life-ways of the local groups.

European contact with the Baffin Eskimo populations began in the 16th Century with the Frobisher Expedition (Kemp 1984:467), whose task it was to find the North West Passage (Desrosiers 2005:193). However, previously Baffin Bay had been explored by the Norse (Heinrichs 2005:191). During the 10th Century these Norseman built settlements on Greenland and perhaps Newfoundland but little evidence remains of where and how far they had actually travelled as these same settlements collapsed during the 13th Century. Baffin Bay was next explored and recorded by John Davis in 1587. European interaction gradually increased with the rise of European whale hunting; whaling stations began operating throughout the eastern arctic in the 1880's (Kemp 1984:466). Such whaling activities around Davis Strait originated in the 1700's, but it was not until the 1850's

that all the inhabitants of the Cumberland Sound and Davis Strait regions were in contact with whalers (Kemp 1984:466). The whaling industry was eventually eclipsed by fur trapping in 1910 (Kemp 1984:474). Also at this time Anglican missionaries entered the region (Kemp 1984:474).

The Baffin Eskimo have historically utilized a vast array of subsistence resources, including marine, terrestrial, avian, and freshwater game; however, the wolf was sought but not utilized for subsistence (Kemp 1984:467). A vast array of tools was used for hunting, such as plugs to stop the bleeding of seals that made it easier for their transport. Bird nets were also constructed and used to ensnarl various avian species (Kemp 1984:468). Hunting weapons included breathing-hole harpoons that had compound elements, and single-curve bows (Kemp 1984:69). Metal, along with driftwood, antler, bone, and stone, were used in the construction of these implements. In addition, Baffin Eskimo technology allowed for water transportation via kayaks and umiaks, or women's boats (Kemp 1984:469); the form of the kayaks was not consistent throughout the Baffin Eskimo area. Dog sleds were used as well. These sleds were the dominant method of transportation until the 1960's when snowmobiles were introduced (Kemp 1984:469). With these forms of transportation, the Baffin Eskimo interacted with neighbouring groups such as those from northern Quebec (Kemp 1984:465). However, this interaction did not occur regularly.

Different subsistence resources were procured based on the season. For instance, seals (particularly ringed seal) were hunted along the floe-edge during the spring months, and caribou herds were hunted during the fall in the interior and coastal regions (sometimes with the aid of drives) (Kemp 1984:467-468). As this instance suggests, Baffin Eskimo mobility was seasonal and influenced by the location of what game they were pursuing. As a rule, Baffin Eskimo groups resided primarily in the coastal regions. It was the caribou that pulled groups into the interior, whereby three particular lakes were favoured as hunting locals: Nettling, Amadjuak, and Sylvia Grinnel Lakes (Kemp 1984:468). During these interior hunts, if excess caribou meat was produced, then it would be cached at these interior locations and retrieved at times of food stress during the winter months (Kemp 1984:468). In addition to there being differences in subsistence procurement based on seasonality, there were also differences in dwellings. Winter dwellings were commonly snow houses, although occasionally early and abandoned Thule houses were reused through the addition of roofs (Kemp 1984:470). In contrast to the winter, skin tents were utilized during the warmer months. These tents varied in form and size depending on how far they were to be transported and their use (Kemp 1984:470). A further seasonal distinction is found in Baffin Eskimo clothing; only caribou skin was used for winter clothing, and seal skin was used in addition to caribou for summer clothes (Kemp 1984:470).

Kivitoo

As early as 1750, the Dutch had 41 whaling vessels patrolling the waters of the Davis Strait in a single year (Anders et al 1967). In the summer whalers stopped at Kivitoo to trade with Inuit who travelled there from Broughton Island (now Qikiqtarjuaq) and Padloping to trade. At this time Kivitoo did not support a year-round economy, whalers returned annually to trade, acquire fresh water, and bury their dead.

With the declined in the use of whale oil in the late 19th century fewer whalers visited Kivitoo. However, with the growing market for fur the Sabellum Trading Company established a trading post at Kivitoo in 1911. The post was managed by an Inuk named Niaqutsiaq who was hired by the Sabellum Trading Company (Dictionary of Canadian Biography, n.d.). Niaqutsiaq, who was later found to be mentally ill, abused his power and in 1922 ordered hunters to kill two fellow Inuit. He then tried to kill an Inuk woman, but was murdered by her husband

Kidlapik. RCMP visiting the settlement the next year recommended that no legal action be taken against Kidlapik. The Sabellum Trading Company at Kivitoo was later sold to the Hudson Bay Company, and closed around 1926 (Usher 1971).

In 1955, Kivitoo was chosen be an intermediate site along the DEW line. At this time the RCMP reported that Inuit were "loitering" around the Kivitoo site, as well as in Padloping (Johnson, 1955). Historian Philip Goldring (2008) suggests that at this time that the Inuit wanted to see what the newcomers were planning, and assumed that strangers would be willing to share their abundant foodstuffs as the whalers had done. The Inuit were also willing work for the construction crews working on the DEW Line sites. During this time the construction work at Kivitoo provided Inuit with income that was invested in the hunting economy and the first motor-powered boats on the north coast appeared (Goldring, 2008). After FOX-D was abandoned some of the Inuit moved from Kivitoo to Broughton Island.

In 1963 the six remaining families from Kvitoo were relocated to Qikiqtarjuaq after Nowyakbik, a 63-year old camp boss at Kivitoo, his son Peterosee and sons-in-law Poisey and Joanasee got caught in a storm after leaving the Hudson Bay Company post at Broughton Island on dog sled resulting in the death of Nowyakbik, Peterosee and Poisey and the amputation of Joanasee's legs. Historian Kenn Harper states this action was taken by the government for humanitarian reasons because the people of Kivitoo would not be able to survive with the loss of four of their hunters. Inuit remember that they were forced to move to Qikiqtarjuaq but assured that they would later be allowed to return to Kivitoo. The houses at Kivitoo were bulldozed and buried shortly after the relocation (Gleeson, 1999).

Heritage Studies

Prior to the current assessment of the FOX-D DEW Line site assessment, ten heritage resources sites have been recorded in the vicinity of the Project in the Nunavut or Canadian Museum of Civilization (CMC) database. The sites include stone features sites (MlDc 1, 2, 3, 7, 8 and 18) semi-subterranean houses (MlDc-9 and 15) a historic whaling station (MlDc-17) and a lithic scatter site (MlDc-6).

Site MlDc-1 was first reported by McKenzie-Pollock (1969). At that time, a series of tent rings, caches and other stone structures were observed on Kangeeak Point, on the terrace approximately 200 yards back from the sea. A few scattered caribou bones and a number of modern tent rings were also located on this point. Site MlDc-2 was also first reported by McKenzie-Pollock (1969). At that time, two tent rings, one circular and one rectangular, were observed south of Kangeeak Point, just south of second Lake. McKenzie-Pollock collected a piece of worked bone from the surface in the circular tent ring. She opened two, 2 foot by 3 foot test units in one of the rings excavated to a depth of 8 inches. A thong and distal seal bone fragments were recovered from just below the turf in the excavation.

Site MlDc-3 is a prehistoric campsite consisting of two meat caches, two tent rings and two Thule-type semi-subterranean houses (McKenzie-Pollock 1969). The site is located in the first bay south of the large inlet south of the abandoned settlement of Kivitoo, opposite south tip of Idjiniving Island. In 1973 the site was revisited. It was mapped and excavations of the two Thule-style houses were undertaken. These excavations established that these structures were utilized during the early post Euro-American contact period (Schledermann 1973).

Site MlDc-6 is a lithic scatter with ASTt artifacts. The site is located on the south side of inlet just south of abandoned settlement of Kivitoo, halfway down inlet on low lying grassy area on point. In 1969, McKenzie-

Pollock reported that the site had been extensively looted, with the turf having been stripped off an area 200 by 300 feet revealing a stony layer with soil underneath. Flakes were found among the stones just below turf and the cultural material was inferred to continue below the stones. In addition, eight artifacts were given to McKenzie-Pollock by the mother of an Inuit who had removed them from the site. McKenzie-Pollock also observed a modern tent ring in the site area. In 1972, Schledermann revisited the site and identified a 40 year old grave nearby. He conducted salvage work on the lithic scatter and identified un-eroded areas of the site near the pebble beach at approximate 5 masl. In 1975, Sabo revisited the site and described it as “well-trashed”. He observed a number of modern tent rings and a pile of lumber.

Site MlDc-7 consists of eight stone cairns that were interpreted as possible burials. It is located on a point out from the historic location of Kivitoo. In 1969, McKenzie-Pollock observed eight stone cairns; all are long and narrow and are fairly heavily lichen covered. In one cairn, human bones were exposed. In 1972, Schledermann visited the area, mapping site MlDc-7, 8 and 9 on August 24. He determined that the features were occupied during the contact period. Sabo visited area of the abandoned settlement of Kivitoo in 1975, in particular the north side of Kivitoo inlet between the settlement and an abandoned whaling station. He noted that while there are numerous archaeological sites in the area, there are more Borden numbers than sites. He feels that there is no basis for separating McKenzie-Pollack's MlDc-7, 8, 9 into discrete components. That the Kivitoo area can be best characterized as having seen fairly continuous, intermittent occupation from the late Thule era right up to present day (McCartney and Sabo 1975). In August 2008, the site area was visited by students as part of the Students on Ice - International Polar Year Arctic Expedition. Permit was issued to Jesse Tungilik, IPY Project Assistant & Youth Coordinator (CMC 2012).

Site MlDc-8 is located on a point just east of old airstrip at the abandoned settlement of Kivitoo, 200 yards south of MlDc-7. In 1969, McKenzie-Pollock observed two large stone house remains with caches to the northeast of each foundation. She indicates that these are much larger than houses normally encountered in cultures of Eastern Arctic and that they may be quaggi or singing houses (McKenzie-Pollock 1969). Schledermann revisited the site on August 24, 1972 and determined that the houses were occupied during the contract period (Schledermann 1973). At that time, the site was still being used by people from Broughton as a hunting camp and most of original tent ring boulders have been re-oriented numerous times. Old house ruins were often turned into meat caches obliterating the original outlines. Test excavation of two stone houses indicated they were occupied at a time when Euro-American whalers were operating in area. In 1975, Sabo visited the abandoned settlement of Kivitoo inlet between the settlement and an abandoned whaling stationand felt that there is no basis for separating McKenzie-Pollack's MlDc-7, 8, 9 into discrete components. That the Kivitoo area can be best characterized as having seen fairly continuous, intermittent occupation from the late Thule era right up to present day (McCartney and Sabo 1975). In August 2008, the site area was visited by students as part of the Students on Ice - International Polar Year Arctic Expedition. Permit was issued to Jesse Tungilik, IPY Project Assistant & Youth Coordinator (CMC 2012).

Site MlDc-9 is located on the south side of the point out from Kivitoo airstrip 250 yards south of the two large stone houses (MlDc-8 site area). In 1969, McKenzie-Pollock observed four large circular house foundations, with entrance passageways with lintel stones preserved. Walrus, whale and caribou bones were scattered in area and a number of modern tent rings were also in the area. Schledermann visited the site area in 1972 and mapped the features. Sabo visited the area in 1975and felt that there is no basis for separating McKenzie-Pollack's MlDc-7, 8, 9 into discrete components. That the Kivitoo area can be best characterized as having seen fairly continuous, intermittent occupation from the late Thule era right up to present day

(McCartney and Sabo 1973). In August 2008, the site area was visited by students as part of the Students on Ice - International Polar Year Arctic Expedition. Permit was issued to Jesse Tungilik, IPY Project Assistant & Youth Coordinator (CMC 2012).

Site MlDc-15 is located on the north shore of a small peninsula on the east coast of the Kivitung Peninsula, about 2 miles west from Kivitoo. In 1972, Schledermann observed a more "recent" Thule winter site with shallow house outlines of boulders and sleeping platforms only slightly raised above the central floor area. There were, in addition, several tent rings and caches in the area. The six houses were probably occupied simultaneously and judging from the amount of iron fragments in and around the houses, the site belonged fairly well within contact times (Schledermann 1973). In 1975, Sabo revisited the site area and observed several “quarmat” structures from the contact period (McCartney & Sabo 1975).

Site MlDc-17 is located on the east side of a small stream about one mile west of the abandoned settlement of Kivitoo. There is confusion over the parameters and contents of this site and over the distance between the whaling station and the abandoned settlement of Kivitoo. Schledermann reported an old historic whaling station and an Eskimo graveyard (1973). In correspondence with L. Konotopetz, he added that the Eskimo graveyard consisted of 2 or 3 unmarked graves and that the whaling station included a hut and boilers as well as the abandoned settlement of Kivitoo. Sabo and Elliot visited the site but did not forward reports to the ASC. Phillips visited the site and photographed the whalers' hut and rendering vats as well as a whalers' graveyard. The remains of two lean-tos were found in association with the hut. The cemetery contained seven rock-outlined mounds, six with markers, dating 1866-1907. One of her recommendations was to accurately record the "jumble of structural remains and artifact deposits" (1980). Park warden R. Breneman observed the site in 1984 and reported the graveyard in the same condition as described by Phillips (1980). Konotopetz surveyed Auyuittuq National Park in 1985 but was unable to visit the site. He also recommended that features be more accurately recorded. In August 2008, the site area was visited by students as part of the Students on Ice - International Polar Year Arctic Expedition. Permit was issued to Jesse Tungilik, IPY Project Assistant & Youth Coordinator (CMC 2012).

Site MlDc-18 is located about 1.5 miles west of Kivitoo, along the shore. In 1972, Schledermann observed four stone house ruins. In 1973, Kemp returned to the site and collected lithics, ceramics, metal bone, shell, wood and glass artifacts.

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METHODOLOGY

Field Inventory and Assessment

Archaeological field studies are conducted with the intent of identifying significant heritage and cultural resources that might be affected by the Project. Locations identified for assessment are investigated using a combination of surface and subsurface investigation techniques. Surface techniques include pedestrian reconnaissance of areas that are not water saturated or poorly suited for occupation, and visual inspection of any fortuitous subsurface exposures that might be present. Subsurface techniques include placement of shovel tests or test units in area assesses as having high archaeological potential and covered by vegetation.

Site evaluation is based on assessment of physical attributes, including site size, depth and character of deposits, assemblage density, and diversity and current condition. Consideration is also given to traditional significance reported by local community representatives assisting on the project, to cultural historic context and to relative frequency in the region. Sites or areas of traditional significance that are not considered archaeological sites are also recorded in detail. These results are included in written submissions to CH-GN as required by the permit to conduct the AIA.

Heritage Feature/Structure Evaluation

Evaluations of heritage features and standing structures are completed for features/structures that are observed during the investigations. These evaluations consider perceived heritage resource value and community cultural value as well as the predicted impact from the proposed program. Disturbed sites with limited cultural remains would be assigned lower archaeological resource values than undisturbed sites, large sites with large amounts of cultural material, complex sites, and multicomponent sites. Undisturbed multicomponent sites would be assigned the highest heritage resource value.

Community input plays a role in the evaluation of site value and the inclusion of a member of the local community on the field crew when possible aids discussions regarding site significance.

Reporting and Conservation

Analysis of collected artifacts includes consultation with a professional conservator regarding specific conservation requirements; cleaning, cataloguing, identification, inventory, and description of each individual piece for inclusion in the final report. GPS site information is provided to CH-GN and the Canadian Museum of Civilization for archival purposes and is used for mapping features and important aspects of each identified site, but is not included in the final versions of the report. Archaeological site maps and photographs are prepared as digital files. Based on the cultural material collected and site observations, a recommendation regarding final site disposition relative to future projects is made.

Upon completion of the field components, a final permit report on the archaeological studies is prepared on behalf of Dillon for review by CH-GN. This report includes a Project description, environmental setting, cultural and archaeological context for the project area, field methodology, and the results of the field reconnaissance. All identified sites are documented on appropriate site inventory forms.

The following recommendations are employed:

Avoidance by 30 m is recommended, if feasible, at all archaeological sites.

Documentation is undertaken as a mitigative option of sites, as a method of protecting the heritage resource from future undocumented impacts due to increased personnel activity in the vicinity.

Sites at immediate risk of disturbance, or if the location of a site conflicts with project cleanup activities, (depending on their scientific significance) sites will be photographed, mapped, and test excavations conducted and collections made if warranted.

Community Consultation

Consultation regarding the Project was undertaken in January of 2014 with the community of Qikiqtarjuaq. During the permit application process the community was consulted by means of letter from the Permit Holder and the Inuit Heritage Trust Incorporated (IHTI) was in contact with the community. Copies of permit reports are typically submitted to the hamlet(s) situated closest to the Project.

RESULTS

Upon completion of the field component and the artifact curation, a draft report was prepared. This final permit report on the AIA will be forwarded to Dillon for review, and then submitted to CH-GN for review. The report includes a project description, the environmental setting, the historical and archaeological context for the Project area, field methodology, and the results of the field reconnaissance. The report also includes descriptive data on the sites, artifacts, and features identified, as well as detailed information on the nature, content, and significance of the artifacts and features identified. Cultural material that was recovered was inventoried, described, and discussed within the report text to aid in evaluation of scientific and interpretive value. All identified sites have been documented on appropriate site inventory forms.

If required, a summary of the findings will be prepared for inclusion in a screening document.

The following workplan was followed:

Avoidance has been recommended where feasible at all sites assigned high archaeological resource value (this to include all constructed features: burials, tent rings, caches, hunting blinds, hearths).

Collection and documentation has been undertaken as a mitigative option of sites with low archaeological resource value and as a method of protecting the heritage resource from future undocumented impacts due to increased personnel activity in the vicinity.

Acceptable methods of mitigation were discussed with CH-GN and the Territorial Archaeologist, and may lead to a recommendation for detailed mapping, collection, and/or test excavations at those sites assigned high archaeological resource value that cannot be avoided by the remediation project.

A management plan for required mitigation, monitoring, or surveillance relative to the proposed remediation will be developed as part of the contracted services deliverable to PWGSC. This includes site mitigation, additional survey of any project re-locates required due to site avoidance, and verification of those heritage sites located outside the proposed development activity area that should remain outside re-located areas.

Field Results

The AIA assessment included all of the areas of moderate to high archaeological potential that has been disturbed by the FOX-D DEW Line site as well as areas identified as having potential for future borrow sources or dumps. The disturbed areas that were surveyed included the entire Upper and Lower site areas. The Upper Site included the main building train, a warehouse, a garage (Plate 4), two 75,700 litre POL tanks, wave tower (Plate 5) and a small building that may have been an Inuit house. The Lower Site consisted of gravel borrow areas, a freshwater lake (Plate 1), construction camp location, a beaching area (Plate 6) and two POL tank foundations (Plate 7). Previously undisturbed areas that were examined included the periphery of all the impacted areas.



Plate 4: View west of garage foundation with PLO tanks in the background on Upper Site.



Plate 5: View south of antennae on the Upper Site with road to Lower Site in the background.



Plate 6: View west Lower Site with beaching area and gravel borrow area in centre of photo and whaler's graveyard (MlDc-17) in the foreground to the right.



Plate 7: View south beaching area showing POL foundations from gravel borrow area.

During the survey previously recorded sites MlDc-7, 8, 9, and 17 were revisited and two new sites, MlDc-19 and MlDc-20 were identified and recorded. The sites include five stone features sites (MlDc-7, 8, 9, 19 and 20) a historic whaling graveyard, debris (MlDc-17) and Inuit graveyard and graves (MlDc-19). In addition to the heritage sites, two land use sites consisting of the historic house remains of the community of Kivitoo and modern stone tent rings around the beaching area of FOX-D were observed.

Revisited Heritage Resource Sites

During the survey of the project area and surrounding area four previously recorded archaeological sites, MlDc-7, 8, 9 and 17, were recorded and documented as per the *Nunavut Archaeological and Palaeontological Sites Regulations* (Government of Nunavut 2003).

MlDc-7

MlDc-7 was originally recorded by McKenzie-Pollock (1969) as consisting of eight stone cairns that were interpreted as burials. They are located on a point east form the historic location of Kivitoo facing east and south. During the original investigation the cairns were described as being long and narrow and fairly heavily lichen covered with one of the cairns having human remains exposed. The general area was revisited several times (Schledermann 1973 and McCartney and Sabo 1975) but MlDc-7 was not commented on specifically except to note that sites MlDc-7, 8 and 9 should be compressed into one site representing a fairly continuous, intermittent occupation from the late Thule era until the present day (McCartney and Sabo 1975).

During the current study MlDc-7 was revisited and all eight of the cairns were recorded. The cairns might be better characterized as open caches and are located on an upper beach in a boulder field east of the house remains associated with Kivitoo and 450 m southeast of the runway. The stone features range from 2 m to 3 m in diameter and 0.25 to 1 m deep (Table 1: Plates 8, 9 and 10). Most of the features are open and empty with the exception of some scrap lumber, tin cans and seal bone scattered around the site area. As reported by McKenzie-Pollock (1969) one of the features does have human remains associate with it. Two femurs, a tibia, several ribs and a scapula fragment are scattered within and around one of the stone features. Other than the possible addition of some of the debris the site has not changed since originally recorded. Although there are no indications of age it is assumed that MlDc-7 is contemporaneous with Kivitoo. MlDc-7 is thought to have high heritage resource significance and it is recommended that any impacts to the site be avoided. There are no plans to disturb MlDc-7 during the remediation of the FOX-D DEW Line site.

Table 1: Features observed at MlDc-7

Feature	Description	Size
Feature 1	Cache with wood and seal bone	3 m diameter, 1 m deep
Feature 2	Cache with human remains	3 m diameter, 1 m deep
Feature 3	Cache built around a large boulder	3 m diameter, 50 cm deep
Feature 4	Cache with seal bone beside it	2.5 m diameter, 80 cm deep
Feature 5	Open cache	3 m diameter, 30 cm deep
Feature 6	Open cache	3 m diameter, 30 cm deep
Feature 7	Open cache on ridge, some wood and a solder-top can	2 m diameter, 25 cm deep
Feature 8	Cache, heavily lichened, seal skull in it	3 m diameter, 50 cm deep
	Possible open cache	3 m diameter

Table 1: Features observed at MlDc-7

Feature	Description	Size
	Possible open cache, appears disturbed	
	Possible open cache, appears disturbed	



Plate 8: MlDc-19 Feature 1.



Plate 9: View south of Feature 5, MlDc-19.



Plate 10: View south of Feature 8, MlDc-19.

MlDc-8

MlDc-8 was originally recorded by McKenzie-Pollock (1969) as two large stone house remains with associated caches. The stone features were interpreted as being much larger than houses normally encountered in cultures of the Eastern Arctic and that they may be quaggi or singing houses. Schledermann revisited the site in 1972 and may have tested the features, however, in his report the sketch map and site description (Schledermann 1973:23 and 28) may actually be McKenzie-Pollock's site MlDc-9 or an amalgamation of the two sites as there are four stone features and no mention of the unusual size of the features. The result of the testing was the interpretation that the features were occupied during the historic period. During the 1972 study Schledermann stayed at Kivitoo with an Inuit family who was there hunting and proposed that because the area was still being used by people from Broughton Island (Qikiqtarjuaq) as a hunting camp and most of the original tent ring boulders had been re-oriented numerous times. MlDc-8 was also revisited by McCartney and Sabo (1975) who did not comment specifically on the site except to note that sites MlDc-7, 8 and 9 should be compressed into one site representing a fairly continuous, intermittent occupation from the late Thule era until the present day.

During the current study MlDc-8 was revisited and both of the stone features recorded (Table 2). The first feature is 5.5 m in diameter, made up of more than 120 stones and has a cairn associated with it. The stones are very well sodded in and have quite a bit of lichen cover. McKenzie-Pollock described the feature as having a 12' 8" (3.86 m) tunnel entrance with a large cache of boulders north east of the entrance tunnel. The cache is still present but evidence of the remainder of the tunnel is no longer apparent (Plate 11). The second stone feature was described as also having a cache associated with it but without a clear centre passage (McKenzie-Pollock 1969). During the revisit a second large (5.5 m) stone circle was recorded which is believed to be the second feature recorded by McKenzie-Pollock (1969). The feature no longer includes a cache and is made up of more than 50 stones and is 7 m from the first feature (Plate 12). Although there are no indications of age it is assumed that MlDc-8 is contemporaneous with Kivitoo. MlDc-8 is thought to have moderate to high heritage resources significance and it is recommended that any impacts to the site be avoided. At this time there are no plans to disturb MlDc-8 during the remediation of the FOX-D DEW Line site.

Table 2: Features observed at MlDc-8

Feature	Description	Size
Feature 1	Ring of 120 or more stones	5.5 m diameter
Feature 2	Ring of 50 or more stones	5.5 m diameter



Plate 11: View north of Feature 1, MlDc-8.



Plate 12: View east of Feature 2, MlDc-8 with Feature 1 in the background.

MlDc-9

MlDc-9 was originally recorded by McKenzie-Pollock (1969) as four large circular house foundations, with entrance passageways with lintel stones preserved, located on the south side of the point out from Kivitoo airstrip 250 yards south of the two large stone houses (MlDc-8 site area). She described the sites as having walrus, whale and caribou bones scattered around and a number of modern tent rings were also in the area. Schledermann revisited the site in 1972 and tested the features and it is believed this is the site that he described and sketched in his 1973 report (Schledermann 1973:23 and 28) or is an amalgamation of MlDc-8 and MlDc-9. The result of the testing was the interpretation that the features were occupied during the historic period. During the 1972 study Schledermann stayed at Kivitoo with an Inuit family who was there hunting and proposed that because the area was still being used by people from Broughton Island (Qikiqtarjuaq) as a hunting camp that most of the original tent ring boulders had been re-oriented numerous times. MlDc-9 was also revisited by McCartney and Sabo (1975) who did not comment specifically on the site except to note that sites MlDc-7, 8 and 9 should be compressed into one site representing a fairly continuous, intermittent occupation from the late Thule era until the present day.

During the current study MlDc-9 was revisited and 10 stone features were observed including seven stone circles, two caches and one hunting blind (Table 3). The site is approximately 100 m east/west by 80 north/south and 30 m west of MlDc-8. All of the stone features appear to be contemporaneous with the DEW Line site or more recent. The seven stone circle sites range from 3.5 m to 5 m in diameter with some being quite dispersed and one having sod built up around it (Plates 13, 14 and 15). The two caches are 1.5 and 2.5 m in diameter respectively with the first one having some seal bones around it and the second being filled with modern debris (Plate 16). The hunting blind is modern. There is modern debris all over the site area, some appears to be from the DEW Line Site but most of it is associated with the historic occupation at Kivitoo (Plate 17). This is believed to be MlDc-9 as reported by Schledermann as the location 250 yards south of the two large stone houses (MlDc-8 site area) as reported by McKenzie-Pollock (1969) would place the sites in the water. MlDc-9 is thought to have moderate heritage resources significance and it is recommended that any impacts to the site be avoided. There are no plans to disturb MlDc-9 during the remediation of the FOX-D DEW Line site.

Table 3: Features observed at MlDc-9

Feature	Description	Size
Feature 1	Modern stone feature, square, composed of 65 stones	3.5 by 4.0 m
Feature 2	Modern stone feature, square, with metal fragments and mammal bone fragments	5.0 by 4.5 m
Feature 3	Modern stone feature, square, with metal and wood fragments near by	3.0 by 4.0 m
Feature 4	Modern stone circle with toy skidoo, canvas and metal food tins	
Feature 5	Cache with modern debris	2.5 m diameter
Feature 6	Modern stone feature, square	4.0 by 5.0 m
Feature 7	Modern stone circle with wood and sea mammal bones	5 m diameter
Feature 8	Cache with some sea mammal bone	1.5 m diameter
Feature 9	Hunting blind	
Feature 10	Stone-lined, cut sod square	4.0 by 5.0 m



Plate 13: View south of Feature 6, MlDc-9.



Plate 14: View north of Feature 10, MlDc-9.



Plate 15: View south of Feature 7, MlDc-9.



Plate 16: View south of Feature 5, MlDc-9.



Plate 17: Toy snowmobile found in inside Feature 4, MlDc-9.

MlDc-17

MlDc-17 was originally recorded by Schledermann (1973) as an old historic whaling station and an Inuit graveyard located on the east side of a small stream about one mile west of the abandoned settlement of Kivitoo. The site data from the CMC database also states that there is confusion over the parameters and contents of this site, over the distance between the whaling station and the abandoned settlement of Kivitoo and that Schledermann reported an old historic whaling station and an Inuit graveyard. In correspondence with L. Konotopetz, Schledermann stated that the Inuit graveyard consisted of two or three unmarked graves and that the whaling station included a hut and boilers as well as the abandoned settlement of Kivitoo. Phillips visited the site and photographed the whalers' hut and rendering vats as well as a whalers' graveyard. The remains of two lean-tos were found in association with the hut. The whaler's cemetery contained seven rock-outlined mounds, six with markers, dating 1866-1907. One of her recommendations was to accurately record the "jumble of structural remains and artifact deposits". Park warden R. Breneman observed the site in 1984 and reported the graveyard in the same condition as described by Phillips. In August 2008, the site area was visited by students as part of the Students on Ice - International Polar Year Arctic Expedition (CMC 2012).

During the current study MlDc-17 was revisited and the whaler's graveyard and the previously reported boilers were recorded. The site extends over an area of approximately 250 m north/south by 1200 m east/west and is divided by a small stream and the beaching area of FOX-D. East of the small stream the whaler's graveyard is made up of six graves surrounded by a white fence that is approximately 8 m north/south by 22 m east/west (Plates 18 and 19). Five of the graves have wooden markers with writing indicating that the graveyard was used between 1866 and 1907, the sixth grave has only a wooden cross. The grave markers and graveyard fence

have all been painted in the last 20 years or so. A short description of the grave markers can be found in Table 4. Also east of the small stream there is a modern camp that was recently damaged by a polar bear (Plate 20) and the beaching area of the FOX-D site (Plate 6).

Table 4: Whaler's Grave Markers

Grave	Description
1	"In Memory of John Bain Aged 52 Native of Wick who died on board SS Diana Oct the 21 1907"
2	"Sacred to the memory of James Hopkins seamen native of Perlican NFLD Age 22 Died on board SS Eagle Sept. 9 1891"
3	"In memory of Link Late who died August 186 on board the ndrew of Cape Hooper Aged 21 year Sheatlan"
4	"In Memory Robert Couper Firemen who died on board the SS Novazembla September 30 Aged 29 years 1896"
5	"Sacred to the memory of Will Brown of Dundee second mate of SS Esquimaux Who Died Sept 17 1866 aged 31"
6	Cross with no inscription



Plate 18: View northwest of whaler's graveyard, MlDc-17.



Plate 19: View north of Grave 3, whaler's graveyard, MlDc-17.



Plate 20: View east of modern hunting camp with whaler's graveyard in the background.

West of the small stream are the previously reported boilers. There are 14 of the boilers along the beach and in the small stream (Plate 21). Previous researchers have referred to these as both boilers and rendering vats. Although their use is not clear they appear to have been used to hold a liquid – either whale oil or water. Of the 14 boilers, 11 are made of iron, riveted and welded 48" square with a single 20" opening that is slotted and threaded to be sealed (Plate 22). The remaining three are smaller and made out of galvanized steel, 38" square (Plate 23). The boilers are spread out over an area of 70 m east/west by 40 m north/south close to a cabin and several debris dumps. The cabin is quite dilapidated with most of the east and west walls missing and the floor having been broken by frost heaves (Plate 24 and 25). The cabin is 5 x 5 m and is framed out of dimensional lumber suggesting that it is not associated with the whaling activities and is more than likely the house that Sabo mentions as having been occupied until around 1960 (Sabo 1975:58). The debris around the house and boilers includes can dumps, miscellaneous pieces of electronics from the DEW Line site and modern outboard motor parts and sea mammal faunal remains (Plates 26 and 27). No other evidence of whaling activities were observed during the current study.



Plate 21: View northeast of boilers with cabin in the background, MlDc-17.



Plate 22: Detail of the closure on the boilers.



Plate 23: View south of galvanized steel boilers in the stream, MlDc-17.



Plate 24: View east of cabin.



Plate 25: Photo of the interior of the cabin showing dimensional lumber framing and cast iron stove.



Plate 26: View north of debris dump with cans and faunal remains with cabin in the background.



Plate 27: Photo of debris that someone has placed on and around one of the galvanized boilers.

The previously recorded site MlDc-17 is made up of a whaler's grave yard and debris that may be associated with whaling activities and more recent use. The site extends over an area of area is approximately 250 m north/south by 1,200 m east/west and is divided by a small stream and the beaching area of FOX-D. The beaching area for FOX-D has been quite extensively disturbed with the beaching area extending from the POL tanks along the shore to the whaler's grave yard (Plates 6 and 7). There is a strong possibility that evidence of both the whaling activities and prehistoric use of the area were disturbed by the construction of the DEW Line site. MlDc-17 is thought to have high heritage resource significance and it is recommended that any impacts to the site be avoided. There are no plans to disturb MlDc-17 during the remediation of the FOX-D DEW Line site outside of those areas included in the site that have been already extensively impacted by the FOX-D DEW Line site.

Newly Recorded Heritage Resources Sites

During the survey of the project area and surrounding area two previously unrecorded archaeological sites, MlDc-19 and 20, were recorded and documented as per the *Nunavut Archaeological and Palaeontological Sites Regulations* (Government of Nunavut 2003).

MlDc-19

During the current study, 17 Inuit graves were observed within and west of the historic Kivitoo Whaling Camp (MlDc-17). Twelve of which are on the same landform with the other five spread out over 630 m east/west across the site area (Table 5). The main cemetery is located 130 m north of the high water mark on a flat bench 780 m west of the beaching area of the FOX-D DEW Line Site (Plate 28). The remaining five graves are east of the main cemetery with two side by side north of the cabin (440 m from the main graveyard) and the remaining three between the cabin and the Whaler's graveyard (600 m east of the main graveyard) 120 m, 250 m and 320 m north of the high water mark, respectively (Plate 29). Thirteen of the graves have a modern grave marker with a metal name plate and painted wooden crosses (Plate 30) and half of the graves appear to have been children (130 cm or less in length). Johnny Kooneeliusie explained that in 1999 people who had been resettled from Kivitoo to Qikiqtarjuaq had returned to erect the new grave markers. Although there are no dates associated with the grave markers most of the coffins that are exposed are made of laminated wood and thought to either be contemporaneous with the FOX-D DEW Line site or post-date it. More information on the graves may be available during the community consultation associated with the Project.

MlDc-19 is thought to have high heritage resource significance and it is recommended that any impacts to the site be avoided. There are no plans to disturb MlDc-19 during the remediation of the FOX-D DEW Line site.

Table 5: Features Observed at MlDc-19

Feature	Location	Size & Description
Grave 1	Cemetery	50 x 110 cm, stone lined, cross has been broken, stone were whitewashed, buried – no evidence of a coffin
Grave 2	Cemetery	45 x 110 cm, also a small stone line square 30 x 38 cm around the marker that has a possible rib bone sticking out of the peat
Grave 3	Cemetery	70 x 200 cm, grave marker broken, may have been disturbed by animals, stone lined, wooden casket appears to be collapsing, casket is partially buried
Grave 4	Cemetery	60 x160 cm, stone lined, buried, casket is collapsing, rodent hole along eastern edge

Table 5: Features Observed at MIDc-19

Feature	Location	Size & Description
Grave 5	Cemetery	60 x 250 cm, depression, not stone lined,
Grave 6	Cemetery	80 x 150 cm, stone lined, buried with lots of peat on top
Grave 7	Cemetery	25 x 55 cm, stone lined, covered in peat with casket on the ground, wooden casket can be seen between the stones on all sides
Grave 8	Cemetery	53 x 29 cm, older grave marker without any writing, casket made of laminated wood secured by a wire
Grave 9	Cemetery	29 x 63 cm, older cross grave marker without any writing, casket made of laminated wood with some paint visible
Grave 10	Cemetery	80 x 170 cm, stone lined covered in moss, wooden box with plastic flowers on top, laid on surface, laminated wood with metal strapping, evidence of rodent activity
Grave 11	Cemetery	55 x 175 cm, stone lined, covered in moss, laid on the ground, top of coffin has collapsed, wood is de-laminating
Grave 12	Cemetery	47 x 67 cm, stone lined, partially covered in moss, on the surface, laminated wood coffin with metal strapping
Grave 13	Isolated	66 x 110 cm, stone lined, laminated wood coffin that is coming apart, partially covered in peat, partially buried
Grave 14	Isolated	50 x 60 cm, stone lined, sod covered, cannot see any of the coffin, buried, modern grave marker is on the ground
Grave 15	Isolated	34 x 80 cm, stone lined and stone covered, on the ground, coffin is falling apart,
Grave 16	Isolated	30 x 130 cm, stone covered, has corrugated roof sheet covering it, can't see any wood
Grave 17	Isolated	180 x 45 cm, stone lined, on the surface, coffin has collapsed, covered in moss, made of scrap wood and has some blue and white paint still visible



Plate 28: View southeast of main graveyard with boilers and cabin the background.



Plate 29: View west of single grave.



Plate 30: View west of three graves in main graveyard showing grave markers and coffins.

MlDc-20

MlDc-20 is a stone feature site that is made up of seven house features and two caches (Table 6). The site is spread along the shore 250 east/west between 25 and 40 m from the high water mark and 180 m east of the whaler's graveyard (MlDc-17). Although these features are close to MlDc-17 they are not described in any of the previous research from the area and therefore were considered a newly recorded site. MlDc-20 is more than 1 km west of the previously recorded sites MlDc-7, 8 and 9.

Table 6: Features Observed at MlDc-20

Feature	Description	Size
House Feature 1	Deeply buried stones make ring difficult to discern, excavated entry, one fragment of sea mammal bone	5 x 8 m
House Feature 2	Excavated entry, piece of stoneware observed nearby	5 x 7 m
House Feature 3	Well sodded, lots of mammal remains, solder top tin can, a bit dispersed	5 x 4 m
House Feature 4	Bit dispersed, sea mammal remains, centre feature dug out	4 m diameter
House Feature 5	Entry passage, dug into bank, 50+ stones	4 x 6 m
House Feature 6	Entry passage, dug into bank, 23+ stones	4 x 6 m

Feature	Description	Size
House Feature 7	Excavated entry, raised sleeping platform, sea mammal remains, 90+ stones	4 x 1.5 m
Cache 1	Dispersed cache, whale bone and bird bone, 60+ stones	1.5 m diameter
Cache 2	Dispersed cache, sea mammal remains, 55+ stones	2 m diameter

The stone features are in three groups along the shore of two house features with excavated entries, two stone circles and three houses with excavated entries and two caches that are 70 and 100 m apart, respectively. From east to west Features 1 and 2 are house features with excavated entry ways that are 5 m wide and 7 and 8 m long with the entry ways oriented toward the water (Plate 31). There are several pieces of sea mammal bone and one large piece of stoneware from the base of a vessel beside Feature 2.



Plate 31: View north of Feature 2, MlDc-20.

Feature 3 and 4 are 70 m from Features 1 and 2 and are a rectangular stone outline and a stone circle. Feature 3 is rectangular and 5 x 4 m in size made up of more than 75 stones (Plate 32). Feature 4 is made up of more than 60 stones in a 4 m diameter and appears to have the centre dug out. There are sea mammal faunal remains around both features including a walrus skull and mandible as well as a solder dot tin can.



Plate 32: View south of Feature 3, MlDc-20.

Features 5 through 9 are located 100 m east of Features 3 and 4 and include three house features with excavated entry ways and two caches. The three house features are all approximately 4 m wide and 6 m wide, are located close to the beach and have been dug into the shore (Plate 33, 34 and 35). There are two walrus skulls close to Feature 6 and some butchered bone close to Feature 7 (Plate 36). Features 8 and 9 are open caches to the west of the house features. Feature 8 is 1.5 m in diameter with some whale bone and bird bone associated with it. Feature 9 is 2 m in diameter and has some small pieces of sea mammal bone inside.

With the exception of the stoneware sherd there were no obvious indications of age, however the architecture of the house features with the excavated entry passages would suggest they predate FOX-D DEW Line and date to the early whaling period or before. MlDc-20 is thought to have moderate to high heritage resources significance and it is recommended that any impacts to the site be avoided. There are no plans to disturb MlDc-20 during the remediation of the FOX-D DEW Line site.



Plate 33: View south of Feature 5, MIDc-20.



Plate 34: View south of Feature 6, MIDc-20.



Plate 35: View south of Feature 7, MIDc-20.



Plate 36: Sea mammal bone with cut marks, MIDc-20.

Land Use Site

Land use sites represent evidence of human use of the land within the past 50 years; typically but not exclusively Inuit. They are not assigned Borden numbers, there is no obligation to report them and they are not afforded protection under law. Therefore, there is no requirement to make accommodations for them during non-traditional land use planning. However, they are important to note because as time passes, should these sites not be disturbed, they will qualify as archaeological sites; they provide important information about changes in land use and technology and they may indicate the presence of other valued environmental components for which it is prudent for land developers to be aware of these sites.

The Project area does contain several modern tent rings and hearth features both around the historic location of Kivitoo and the FOX-D beaching area (Plates 37 and 38). During the present study there were five modern stone circles at Kivitoo and 18 stone circles and three hearths around the FOX-D DEW Line Site beaching area.



Plate 37: View south of a modern stone tent ring at Kivitoo.



Plate 38: View west of a modern stone circle on the beaching area of FOX-D.

SUMMARY AND RECOMMENDATIONS

During August of 2013, Golder conducted an AIA on behalf of Dillon working for PWGSC and AANDC in conjunction with a Phase III Environmental Site Assessment Remedial Action Plan for the former FOX-D DEW Line site, Kivitoo, Nunavut. All required field work was conducted under Nunavut Archaeologists Permit 2013-031A issued by the CH-GN to Brent Murphy of Golder.

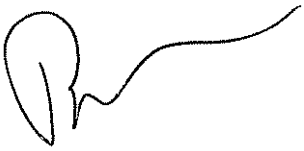
All areas of potential disturbance were surveyed for heritage resources. The FOX-D DEW Line site is made up of an Upper and Lower site. The Upper Site included a continuous wave tower, a main building train, a warehouse, a garage, two 75,700 litre POL tanks, and a small building that may have been an Inuit house. The Lower Site is located on a coastal plain to the south of the Upper Site. It once consisted of two POL tanks, a beach landing area, drum storage and an airstrip. A freshwater lake, borrow source areas and a construction camp area were also present at the lower site. The Upper Site and Lower Site are connected by a 4 km access road.

During the study four previously recorded archaeological sites MlDc-7, MlDc-8, MlDc-9 and MlDc-17 were revisited and two previously unrecorded sites, MlDc-19 and MlDc-20, were documented as per the Nunavut Archaeological and Palaeontological Sites Regulations. In addition two land use sites were documented. MlDc-7 consists of eight stone caches located on an upper beach in a boulder field east of the house remains associated with Kivitoo. There are human remains associated with one of the caches but they do not all appear to be burials. MlDc-8 is made up of two unusually large stone circles with associated caches and MlDc-9 consists of 10 stone features including seven stone circles, two caches and one hunting blind. MlDc-17 is made up of a whaler's graveyard and debris that may be associated with whaling activities and more recent use. MlDc-19 is an Inuit graveyard and individual graves. MlDc-20 is a stone feature site that is made up of seven house features and two caches. All of the archaeological sites are thought to have moderate to high significance and it is recommended that any impacts to the sites be avoided. There are no plans to disturb any of the sites recorded or revisited during the current study during the remediation of the FOX-D DEW Line site.

By conducting this AIA, it is recommended that Dillon Consulting Ltd., Public Works and Government Services Canada, and Aboriginal Affairs and Northern Development Canada have fulfilled the requirements of the current program in their attempts to identify the potential for impact to heritage resources resulting from the proposed remediation of the FOX-D Distant Early Warning Line site. The AIA included the participation of Losie Audiakiak and Johnny Kooneeliusie from Qikijtarjuaq, who acted as bear monitors and participated in the identification and recordation of the heritage resource sites.

Report Signature Page

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APPENDIX A

Photograph Log

Table 1: Photograph Log

Number	Borden Number (if applicable)	Comment
13-031A photo1		View west of Kivitoo showing runway, freshwater lake and construction camp
13-031A photo2		View west of Kivitoo runway
13-031A photo3		View west of Kivitoo runway
13-031A photo4		View west of lake, construction camp
13-031A photo5		View south of construction camp
13-031A photo6		Inuit cemetery
13-031A photo7		View north of old cabin and whaling station
13-031A photo8		View north off beach lower POL tanks
13-031A photo9		Aerial view of whaler's cemetery
13-031A photo10		Aerial view of whaler's cemetery
13-031A photo11		View northeast of Kivitoo from the air
13-031A photo12		View northwest of Kivitoo from the air
13-031A photo13		View north of Kivitoo from the air
13-031A photo14		View northeast of Kivitoo from the air
13-031A photo15		View north of Kivitoo from the air
13-031A photo16		View north of Kivitoo from the air
13-031A photo17		View south of dump off the top of the upper site area
13-031A photo18		View south of dump off the top of the upper site area
13-031A photo19		View south of dump off the top of the upper site area
13-031A photo20		View southeast of upper PLO tanks
13-031A photo21		View northeast of road to upper site
13-031A photo22		View northwest of upper site with PLO in the background
13-031A photo23		View northwest of upper site with PLO in the background
13-031A photo24		View northwest of upper site with dump in the foreground
13-031A photo25		View south of dump off the top of the upper site area
13-031A photo26		View south of upper area with project tents
13-031A photo27		View south of PLO tanks
13-031A photo28		View south of road between upper and lower sites
13-031A photo29		View south of road between upper and lower sites
13-031A photo30		View south of road between upper and lower sites
13-031A photo31		View south of road between upper and lower sites
13-031A photo32		View south of road between upper and lower sites
13-031A photo33		View south of road between upper and lower sites
13-031A photo34		View east along road showing lake
13-031A photo35		View east along road showing lake
13-031A photo36		View northeast of construction camp and lake
13-031A photo37		View north of construction camp and lake
13-031A photo38		View north of construction camp and lake
13-031A photo39		View north of lower PLO tanks
13-031A photo40		View north of beach landing and whaler cemetery

Table 1: Photograph Log

Number	Borden Number (if applicable)	Comment
13-031A photo41		View west of whaler's cemetery and modern cabin
13-031A photo42		View south off whaler's cemetery
13-031A photo43		View south of upper site from the tents
13-031A photo44		Photo of dump
13-031A photo45		View southwest from tents of upper site
13-031A photo46		Helicopter and small fuel kegs
13-031A photo47		View northeast across the upper station
13-031A photo48		Batteries near the garage foundation
13-031A photo49		View west of garage foundation
13-031A photo50		View north of warehouse foundation
13-031A photo51		View north of warehouse foundation
13-031A photo52		View south of the remains of the burned module train
13-031A photo53		View south of antenna
13-031A photo54		View south of antenna
13-031A photo55		View south of antenna
13-031A photo56		View south of the access road
13-031A photo57		View northeast near antenna area - foundation
13-031A photo58		View northwest of POL tanks
13-031A photo59		Antenna foundation with POL tanks in the background
13-031A photo60		Detail of antenna
13-031A photo61		View south of antenna
13-031A photo62		View southwest of water tank
13-031A photo63		View north of upper POL tanks
13-031A photo64		Detail of walrus bone
13-031A photo65		Detail of walrus bone
13-031A photo66		Detail of walrus bone
13-031A photo67		Detail of walrus bone
13-031A photo68		Detail of walrus bone
13-031A photo69		Detail of walrus bone
13-031A photo70		View east of POL tanks
13-031A photo71		Detail of water tank
13-031A photo72		Dump along access road
13-031A photo73		Dump along access road
13-031A photo74	MlDc-19	View south of feature 3 site 1
13-031A photo75	MlDc-19	View north of feature 3 site 1
13-031A photo76	MlDc-19	View south of feature 3 site 1
13-031A photo77	MlDc-19	View north of feature 3 site 1
13-031A photo78	MlDc-19	View south of feature 3 site 1
13-031A photo79	MlDc-19	Overhead view of feature 3 site 1
13-031A photo80	MlDc-19	Overhead view of feature 3 site 1

Table 1: Photograph Log

Number	Borden Number (if applicable)	Comment
13-031A photo81	MlDc-19	Overhead view of feature 3 site 1
13-031A photo82	MlDc-19	View south of feature 3 site 1
13-031A photo83	MlDc-19	View south of feature 4 site 1
13-031A photo84	MlDc-19	View south of feature 4 site 1
13-031A photo85	MlDc-19	Overhead view of feature 4 site 1
13-031A photo86	MlDc-19	Overhead view of feature 4 site 1
13-031A photo87	MlDc-19	Overhead view of feature 4 site 1
13-031A photo88	MlDc-19	View south of feature 4 site 1
13-031A photo89	MlDc-19	Faunal remains near feature 4 site 1
13-031A photo90	MlDc-19	Solder top can near feature 3 site 1
13-031A photo91	MlDc-19	Walrus mandible near features 3 and 4 site 1
13-031A photo92	MlDc-19	Walrus mandible near features 3 and 4 site 1
13-031A photo93	MlDc-19	Overhead view of feature 4 site 1
13-031A photo94	MlDc-19	Overhead view of feature 4 site 1
13-031A photo95	MlDc-19	Walrus bone close to feature 4 site 1
13-031A photo96	MlDc-19	Walrus bone close to feature 4 site 1
13-031A photo97	MlDc-19	Walrus bone close to feature 4 site 1
13-031A photo98	MlDc-19	View north of feature 5, site 1
13-031A photo99	MlDc-19	View south of feature 5, site 1
13-031A photo100	MlDc-19	View south of feature 5, site 1
13-031A photo101	MlDc-19	View north of feature 5, site 1
13-031A photo102	MlDc-19	View south of feature 5, site 1
13-031A photo103	MlDc-19	Overhead shot of feature 5, site 1
13-031A photo104	MlDc-19	Overhead shot of feature 5, site 1
13-031A photo105	MlDc-19	View north of feature 5, site 1
13-031A photo106	MlDc-19	View north of feature 5, site 1
13-031A photo107	MlDc-19	View northeast of feature 5, site 1
13-031A photo108	MlDc-19	View west of feature 5, site 1
13-031A photo109	MlDc-19	View north of feature 6, site 1
13-031A photo110	MlDc-19	View south of feature 6, site 1
13-031A photo111	MlDc-19	View north of feature 6, site 1
13-031A photo112	MlDc-19	Overhead shot of feature 6, site 1
13-031A photo113	MlDc-19	Overhead shot of feature 6, site 1
13-031A photo114	MlDc-19	Overhead shot of feature 6, site 1
13-031A photo115	MlDc-19	Overhead shot of feature 6, site 1
13-031A photo116	MlDc-19	Overhead shot of feature 6, site 1
13-031A photo117	MlDc-19	View south of feature 6, site 1
13-031A photo118	MlDc-19	View south of feature 6, site 1
13-031A photo119	MlDc-19	View north of feature 7, site 1
13-031A photo120	MlDc-19	View south of feature 7, site 1

Table 1: Photograph Log

Number	Borden Number (if applicable)	Comment
13-031A photo121	MlDc-19	View south of feature 7, site 1
13-031A photo122	MlDc-19	Butchered walrus bone associated with feature 7
13-031A photo123	MlDc-19	Butchered walrus bone associated with feature 7
13-031A photo124	MlDc-19	Butchered walrus bone associated with feature 7
13-031A photo125	MlDc-19	Butchered walrus bone associated with feature 7
13-031A photo126	MlDc-19	View north of feature 7, site 1
13-031A photo127	MlDc-19	Overhead shot of feature 7, site 1
13-031A photo128	MlDc-19	Overhead shot of feature 7, site 1
13-031A photo129	MlDc-19	View north of feature 7, site 1
13-031A photo130	MlDc-19	View north of feature 7, site 1
13-031A photo131	MlDc-19	View north of feature 7, site 1
13-031A photo132	MlDc-19	View south of feature 7, site 1
13-031A photo133	MlDc-19	View south of feature 7, site 1
13-031A photo134	MlDc-19	View west of features 7 and 6, Site 1
13-031A photo135	MlDc-19	Feature 8 (Cairn)
13-031A photo136	MlDc-19	Feature 8 (Cairn)
13-031A photo137	MlDc-19	Feature 8 (Cairn)
13-031A photo138	MlDc-19	Feature 8 (Cairn)
13-031A photo139	MlDc-19	Feature 9 (Cairn)
13-031A photo140	MlDc-19	Feature 9 (Cairn)
13-031A photo141	MlDc-19	Feature 9 (Cairn)
13-031A photo142	MlDc-19	View west of Feature 8 and 9
13-031A photo143	MlDc-19	View west of Feature 8 and 9
13-031A photo144	MlDc-19	View north of Feature 2 site 1
13-031A photo145	MlDc-19	View north of centre passage feature 2, site 1
13-031A photo146	MlDc-19	View south of feature 2, site 1
13-031A photo147	MlDc-19	View north of Feature 2 site 1
13-031A photo148	MlDc-19	Overhead of feature 2 site 1
13-031A photo149	MlDc-19	Overhead of feature 2 site 1
13-031A photo150	MlDc-19	Overhead of feature 2 site 1
13-031A photo151	MlDc-19	View north of Feature 2 site 1
13-031A photo152	MlDc-19	View east of feature 2 site 1
13-031A photo153	MlDc-19	View west of features 1and 2 site 1
13-031A photo154	MlDc-19	Centre passage feature 1 site 1
13-031A photo155	MlDc-19	Centre passage feature 1 site 1
13-031A photo156	MlDc-19	Detail of large piece of stone wear - plate?
13-031A photo157	MlDc-19	Detail of large piece of stone wear - plate?
13-031A photo158	MlDc-19	Detail of large piece of stone wear - plate?
13-031A photo159	MlDc-19	View north of feature 1 site 1
13-031A photo160	MlDc-19	View south of feature 1 site 1

Table 1: Photograph Log

Number	Borden Number (if applicable)	Comment
13-031A photo161	MlDc-19	View east of feature 1 site 1
13-031A photo162	MlDc-19	View east of feature 1 site 1
13-031A photo163	MlDc-19	Overhead shot of feature 1 site 1
13-031A photo164	MlDc-19	Overhead shot of feature 1 site 1
13-031A photo165	MlDc-17	Whaler John Bain grave marker
13-031A photo166	MlDc-17	Whaler John Bain grave marker
13-031A photo167	MlDc-17	Whaler James Hopkins
13-031A photo168	MlDc-17	Whaler James Hopkins
13-031A photo169	MlDc-17	Whaler Link Late (?)
13-031A photo170	MlDc-17	Whaler Link Late (?)
13-031A photo171	MlDc-17	Whaler Link Late (?)
13-031A photo172	MlDc-17	Whaler Robert Cooper
13-031A photo173	MlDc-17	Whaler Robert Cooper
13-031A photo174	MlDc-17	Whaler Will Brown
13-031A photo175	MlDc-17	Whaler Will Brown
13-031A photo176	MlDc-17	Unmarked grave
13-031A photo177	MlDc-17	View northwest of whaler's grave yard
13-031A photo178	MlDc-17	View northeast of whaler's grave yard
13-031A photo179	MlDc-17	View northeast of whaler's grave yard
13-031A photo180	MlDc-17	View northeast of whaler's grave yard
13-031A photo181	MlDc-17	View northeast of whaler's grave yard
13-031A photo182	MlDc-17	View north of whaler's graveyard
13-031A photo183	MlDc-17	View south of whaler's graveyard
13-031A photo184	MlDc-17	View southwest of whaler's graveyard
13-031A photo185	MlDc-17	View north of unmarked grave
13-031A photo186	MlDc-17	View north of Robert Cooper and Will Brown's graves
13-031A photo187	MlDc-17	View northwest of the easternmost graves
13-031A photo188		Modern tent ring wpt 26
13-031A photo189		Modern tent ring wpt 27
13-031A photo190		Modern tent ring wpt 28
13-031A photo191		Modern tent ring wpt 29
13-031A photo192		Modern tent ring wpt 30
13-031A photo193		Sea lift platform
13-031A photo194		Sea lift platform
13-031A photo195		View west of modern cabin
13-031A photo196		View east of modern cabin
13-031A photo197		Modern tent ring wpt 33
13-031A photo198		Modern tent ring wpt 34
13-031A photo199		Modern tent ring wpt 35
13-031A photo200		Modern tent ring wpt 36

Table 1: Photograph Log

Number	Borden Number (if applicable)	Comment
13-031A photo201		Modern tent ring wpt 37
13-031A photo202		Modern tent ring wpt 38
13-031A photo203		Modern tent ring wpt 39
13-031A photo204		Modern tent ring wpt 42
13-031A photo205		Modern tent ring wpt 43
13-031A photo206		Modern ring wpt 45
13-031A photo207		View south of POL tank foundations
13-031A photo208		View east of beaching area
13-031A photo209		View east of beaching area
13-031A photo210		Photo of gravel borrow area north of POL
13-031A photo211		View west from POL tank area
13-031A photo212		View west from POL tank area
13-031A photo213		View north of Kivitoo from the air
13-031A photo214		View west of beaching area from the air
13-031A photo215		View west of beaching area from the air
13-031A photo216		View west of beaching area from the air
13-031A photo217		View west of beaching area from the air
13-031A photo218		View west of beaching area from the air
13-031A photo219		View west of beaching area from the air
13-031A photo220		View west of beaching area from the air
13-031A photo221		View west of beaching area from the air
13-031A photo222		View west of beaching area from the air
13-031A photo223		View west of beaching area from the air - with whaler's graveyard
13-031A photo224		View west of beaching area from the air - with whaler's graveyard
13-031A photo225		View west of beach landing area with Whaler's graveyard
13-031A photo226		View west of beaching area from the air with modern cabin in foreground
13-031A photo227		View west of beaching area from the air with POL foundations and gravel borrow in the foreground
13-031A photo228		View west of beaching area from the air with POL foundations and gravel borrow in the foreground
13-031A photo229		View west of beaching area from the air with POL foundations and gravel borrow in the foreground
13-031A photo230		View west of beaching area from the air with POL foundations and gravel borrow in the foreground
13-031A photo231	MlDc-17	View north of Inuit Graveyard
13-031A photo232	MlDc-17	View north of Inuit Graveyard
13-031A photo233	MlDc-17	View east of Inuit Graveyard
13-031A photo234	MlDc-17	View east of Inuit Graveyard
13-031A photo235	MlDc-17	View east of Inuit Graveyard
13-031A photo236	MlDc-17	View south of Inuit Graveyard
13-031A photo237	MlDc-17	View south of Inuit Graveyard

Table 1: Photograph Log

Number	Borden Number (if applicable)	Comment
13-031A photo238	MlDc-17	View north of graves 1 and 2 wpt 50
13-031A photo239	MlDc-17	Detail of graves 1 and 2 wpt 50
13-031A photo240	MlDc-17	Detail of grave 1 marker
13-031A photo241	MlDc-17	Detail of grave 1 marker
13-031A photo242	MlDc-17	Detail of stones between grave markers 1 and 2
13-031A photo243	MlDc-17	Detail of stones between grave markers 1 and 2
13-031A photo244	MlDc-17	Detail of stones between grave markers 1 and 2
13-031A photo245	MlDc-17	Detail of stones between grave markers 1 and 2
13-031A photo246	MlDc-17	Detail of stones between grave markers 1 and 2
13-031A photo247	MlDc-17	View north of grave 3, wpt 51
13-031A photo248	MlDc-17	Detail of grave 3
13-031A photo249	MlDc-17	Detail of grave 3
13-031A photo250	MlDc-17	View south of grave 3
13-031A photo251	MlDc-17	Detail of grave marker - grave 3
13-031A photo252	MlDc-17	Detail of grave 3
13-031A photo253	MlDc-17	View north of graves 4 and 5 - wpt 52
13-031A photo254	MlDc-17	View north of graves 4 and 5 - wpt 52
13-031A photo255	MlDc-17	Detail of grave 4
13-031A photo256	MlDc-17	Detail of grave 4
13-031A photo257	MlDc-17	Detail of grave 4
13-031A photo258	MlDc-17	View north of graves 4 and 5 - wpt 52
13-031A photo259	MlDc-17	View northwest of graves 4 and 5
13-031A photo260	MlDc-17	Detail of grave 5 marker
13-031A photo261	MlDc-17	Detail of grave 5 marker
13-031A photo262	MlDc-17	View north of grave 6 - wpt 53
13-031A photo263	MlDc-17	View west of grave 6
13-031A photo264	MlDc-17	Detail of grave marker - grave 6
13-031A photo265	MlDc-17	View south of grave 6
13-031A photo266	MlDc-17	View north of grave 7 - wpt 54
13-031A photo267	MlDc-17	Detail of grave 7
13-031A photo268	MlDc-17	Detail of grave 7
13-031A photo269	MlDc-17	Detail of grave 7
13-031A photo270	MlDc-17	Detail of grave 7 - marker
13-031A photo271	MlDc-17	View north of graves 8 and 9 - wpt 55
13-031A photo272	MlDc-17	View north of graves 8 and 9 - wpt 55
13-031A photo273	MlDc-17	Detail of grave 8
13-031A photo274	MlDc-17	Detail of grave 8
13-031A photo275	MlDc-17	Detail of grave 8
13-031A photo276	MlDc-17	Detail of grave 9
13-031A photo277	MlDc-17	Detail of grave 9

Table 1: Photograph Log

Number	Borden Number (if applicable)	Comment
13-031A photo278	MlDc-17	Detail of grave 9
13-031A photo279	MlDc-17	Detail of graves 8 and 9
13-031A photo280	MlDc-17	View north of graves 10, 11 and 12
13-031A photo281	MlDc-17	View north of grave 10 - wpt 56
13-031A photo282	MlDc-17	Detail of grave 10
13-031A photo283	MlDc-17	Detail of grave 10
13-031A photo284	MlDc-17	Detail of grave 10
13-031A photo285	MlDc-17	Detail of grave 10 - marker
13-031A photo286	MlDc-17	Plastic flower stock from grave 10
13-031A photo287	MlDc-17	View north of grave 11 - wpt 57
13-031A photo288	MlDc-17	Detail of grave 11
13-031A photo289	MlDc-17	Detail of grave 11
13-031A photo290	MlDc-17	Detail of grave 11
13-031A photo291	MlDc-17	Detail of grave 11 - marker
13-031A photo292	MlDc-17	View north of grave 12 - wpt 58
13-031A photo293	MlDc-17	View north of grave 12
13-031A photo294	MlDc-17	View west of graves 10, 11 and 12
13-031A photo295	MlDc-17	Detail of grave 12
13-031A photo296	MlDc-17	Detail of grave 12
13-031A photo297	MlDc-17	Detail of grave 12 - marker
13-031A photo298	MlDc-17	View south of graveyard
13-031A photo299	MlDc-17	View south of grave yard
13-031A photo300	MlDc-17	View south of grave yard
13-031A photo301	MlDc-17	View south of grave yard
13-031A photo302	MlDc-17	View south of grave yard
13-031A photo303		Sea mammal bone
13-031A photo304		Sea mammal bone
13-031A photo305		Sea mammal bone
13-031A photo306	MlDc-17	View north of grave yard
13-031A photo307	MlDc-17	View north of grave yard
13-031A photo308		Modern tent ring - wpt 60
13-031A photo309		Modern tent ring - wpt 60
13-031A photo310		Modern box hearth - wpt 61
13-031A photo311		Modern box hearth - wpt 61
13-031A photo312		Modern box hearth - wpt 61
13-031A photo313		Modern box hearth - wpt 61
13-031A photo314		Modern box hearth - wpt 61
13-031A photo315		Modern tent ring - wpt 62
13-031A photo316		Modern tent ring - wpt 62
13-031A photo317		Modern tent ring - wpt 62

Table 1: Photograph Log

Number	Borden Number (if applicable)	Comment
13-031A photo318		Modern tent ring - wpt 62
13-031A photo319		Toy gun
13-031A photo320		Modern hearth - wpt 63
13-031A photo321		Modern tent ring - wpt 64
13-031A photo322		Modern hearth - wpt 65
13-031A photo323	MlDc-17	View north of graves 13 and 14 wpt 66
13-031A photo324	MlDc-17	View north of graves 13 and 14 wpt 66
13-031A photo325	MlDc-17	View north of grave 13
13-031A photo326	MlDc-17	Detail of grave 13
13-031A photo327	MlDc-17	Detail of grave 13
13-031A photo328	MlDc-17	Detail of grave 13
13-031A photo329	MlDc-17	Detail of grave 13
13-031A photo330	MlDc-17	Detail of grave 13 - grave marker
13-031A photo331	MlDc-17	View north of grave 14
13-031A photo332	MlDc-17	View north of grave 14
13-031A photo333	MlDc-17	Detail of grave 14
13-031A photo334	MlDc-17	Detail of grave 14 - marker
13-031A photo335	MlDc-17	View north of grave 15 - wpt 67
13-031A photo336	MlDc-17	View north of grave 15 - wpt 67
13-031A photo337	MlDc-17	View north of grave 15 - wpt 67
13-031A photo338	MlDc-17	Detail of grave 15
13-031A photo339	MlDc-17	Detail of grave 15 - marker
13-031A photo340	MlDc-17	Detail of grave 15
13-031A photo341	MlDc-17	Detail of grave 15
13-031A photo342	MlDc-17	View north of grave 16 - wpt 68
13-031A photo343	MlDc-17	View north of grave 16
13-031A photo344	MlDc-17	View west of grave 16
13-031A photo345	MlDc-17	Detail of grave 16 - marker
13-031A photo346	MlDc-17	Detail of grave 16
13-031A photo347	MlDc-17	View north of grave 17 - wpt 69
13-031A photo348	MlDc-17	View northeast of grave 17
13-031A photo349	MlDc-17	Detail of grave 17
13-031A photo350	MlDc-17	Detail of grave 17
13-031A photo351	MlDc-17	Detail of grave 17
13-031A photo352	MlDc-17	Detail of grave 17 - marker
13-031A photo353	MlDc-17	View north of grave 17
13-031A photo354	MlDc-17	View north of grave 17
13-031A photo355		View north of camp - wpt 70
13-031A photo356		View north of camp - wpt 70
13-031A photo357		View west of camp

Table 1: Photograph Log

Number	Borden Number (if applicable)	Comment
13-031A photo358		Detail of camp - canvas
13-031A photo359		Detail of camp - nails - both cut and wire
13-031A photo360		View south of camp
13-031A photo361		View east of camp
13-031A photo362		Oven door at camp
13-031A photo363		Interior floor and sewing machine
13-031A photo364		Stove and interior
13-031A photo365		Interior detail
13-031A photo366		Interior detail
13-031A photo367		Interior detail - cardboard insulation
13-031A photo368		Page from 1958 catalogue
13-031A photo369		Random things on large stone in front of camp
13-031A photo370		Dump with faunal remains and tin cans
13-031A photo371		Large tool
13-031A photo372		Square Boilers
13-031A photo373	MlDc-17	Detail of boiler
13-031A photo374	MlDc-17	Detail of boiler
13-031A photo375	MlDc-17	Detail of boiler
13-031A photo376	MlDc-17	Detail of boiler
13-031A photo377	MlDc-17	View east of boilers
13-031A photo378	MlDc-17	View northeast of boilers
13-031A photo379	MlDc-17	View northeast of boilers
13-031A photo380	MlDc-17	View north of boilers
13-031A photo381	MlDc-17	Detail of boiler
13-031A photo382	MlDc-17	View north of boilers
13-031A photo383	MlDc-17	View east of boilers
13-031A photo384	MlDc-17	Detail of whale bone
13-031A photo385	MlDc-17	Detail of modified boiler
13-031A photo386	MlDc-17	Detail of modified boiler
13-031A photo387	MlDc-17	View west of boilers
13-031A photo388	MlDc-17	Steel boiler with faunal remains on top and part of a boat engine
13-031A photo389	MlDc-17	Steel boiler with faunal remains on top and part of a boat engine
13-031A photo390	MlDc-17	Steel boiler with faunal remains on top and part of a boat engine
13-031A photo391	MlDc-17	Walrus skulls on a rock
13-031A photo392		Engraved stone - wpt 73
13-031A photo393		Engraved stone - wpt 73
13-031A photo394		View north of location of engraved stone
13-031A photo395		View east of location of engraved stone
13-031A photo396		View east of location of engraved stone
13-031A photo397		View south of galvanized steel boilers

Table 1: Photograph Log

Number	Borden Number (if applicable)	Comment
13-031A photo398	MlDc-17	Detail of galvanized boiler with repair
13-031A photo399	MlDc-17	Random debris on a rock - DEW line stuff as well as a leg hold trap
13-031A photo400	MlDc-17	Boiler with white paint "Elijah E6-630"
13-031A photo401		Antenna base - wpt 77
13-031A photo402		View west across Kivitoo from wpt 77
13-031A photo403	MlDc-7	Cache 1 with some wood in it - wpt 78
13-031A photo404	MlDc-7	Cache 1 with some wood in it - wpt 78
13-031A photo405	MlDc-7	Cache 2 with bone
13-031A photo406	MlDc-7	Detail of bone in Cache 2
13-031A photo407	MlDc-7	Detail of bone in Cache 2
13-031A photo408	MlDc-7	Detail of bone in Cache 2
13-031A photo409	MlDc-7	Detail of bone in Cache 2
13-031A photo410	MlDc-7	Detail of bone in Cache 2
13-031A photo411	MlDc-7	Detail of bone in Cache 2
13-031A photo412	MlDc-7	Detail of bone outside of Cache 2
13-031A photo413	MlDc-7	Detail of bone outside of Cache 2
13-031A photo414	MlDc-7	Detail of bone outside of Cache 2
13-031A photo415	MlDc-7	Detail of bone outside of Cache 2
13-031A photo416	MlDc-7	View east of Cache 2
13-031A photo417	MlDc-7	Solder top can near Cache 2
13-031A photo418	MlDc-7	View east of Cache 3
13-031A photo419	MlDc-7	View north of Cache 3
13-031A photo420	MlDc-7	Detail of bone in Cache 2
13-031A photo421	MlDc-7	View north of Cache 4
13-031A photo422	MlDc-7	View east of Cache 4
13-031A photo423	MlDc-7	Detail Cache 4
13-031A photo424	MlDc-7	View southeast of Cache 4
13-031A photo425	MlDc-7	View east of Cache 5
13-031A photo426	MlDc-7	View east of Cache 5
13-031A photo427	MlDc-7	View south of Cache 5
13-031A photo428	MlDc-7	Natural cache looking stones - Wpt 84
13-031A photo429	MlDc-7	Natural cache looking stones - Wpt 84
13-031A photo430	MlDc-7	Natural cache looking stones - Wpt 85
13-031A photo431	MlDc-7	Natural cache looking stones - Wpt 85
13-031A photo432	MlDc-7	Seal bone
13-031A photo433	MlDc-7	Natural cache looking stones - wpt 86
13-031A photo434	MlDc-7	Natural cache looking stones - wpt 86
13-031A photo435	MlDc-7	Natural cache looking stones - wpt 86
13-031A photo436	MlDc-7	View north of Cache 6 wpt 87
13-031A photo437	MlDc-7	View north of Cache 6 wpt 87

Table 1: Photograph Log

Number	Borden Number (if applicable)	Comment
13-031A photo438	MlDc-7	View north of Cache 6 wpt 87
13-031A photo439	MlDc-7	View north of Cache 7 - wpt 88
13-031A photo440	MlDc-7	Detail of Cache 7
13-031A photo441	MlDc-7	Solder top can associated with Cache 7 wpt 88
13-031A photo442	MlDc-7	Solder top can associated with Cache 7 wpt 88
13-031A photo443	MlDc-7	View north of Cache 8 wpt 89
13-031A photo444	MlDc-7	View west of Cache 8 wpt 89
13-031A photo445	MlDc-7	Seal skull outside of Cache 8
13-031A photo446	MlDc-7	View south of Cache 8
13-031A photo447		Modern tent ring - wpt 90
13-031A photo448		Modern tent ring - wpt 91
13-031A photo449		Modern tent ring - wpt 92
13-031A photo450		Modern tent ring - wpt 92
13-031A photo451		Modern tent ring - wpt 92
13-031A photo452		DEW line debris
13-031A photo453		Modern tent ring - rectangular - wpt 93
13-031A photo454		Modern tent ring - wpt 94
13-031A photo455	MlDc-8	View north of large tent ring - feature 1 - wpt 95
13-031A photo456	MlDc-8	View west of large tent ring - feature 1 - wpt 95
13-031A photo457	MlDc-8	View south of large tent ring - feature 1 - wpt 95
13-031A photo458	MlDc-8	View south of cairn at entrance of feature 1
13-031A photo459	MlDc-8	View north of large tent ring - feature 1 - wpt 95
13-031A photo460	MlDc-8	Detail of centre feature in feature 1
13-031A photo461	MlDc-8	View south of large tent ring - feature 2 - wpt 96
13-031A photo462	MlDc-8	View southeast of large tent ring - feature 2 - wpt 96
13-031A photo463	MlDc-8	View east of MlDc-8 with feature 2 in the foreground
13-031A photo464	MlDc-8	View northeast of feature 2
13-031A photo465	MlDc-8	Detail of centre feature, feature 2
13-031A photo466	MlDc-9	Modern stone ring - wpt 97 - south
13-031A photo467	MlDc-9	Modern stone ring - wpt 97 - east
13-031A photo468	MlDc-9	View stone ring - wpt 99 - south
13-031A photo469	MlDc-9	View stone ring - wpt 99 - south
13-031A photo470	MlDc-9	Debris
13-031A photo471	MlDc-9	Modern stone ring - wpt 100 - south
13-031A photo472	MlDc-9	Detail - toy snowmobile
13-031A photo473	MlDc-9	Detail - toy snowmobile
13-031A photo474	MlDc-9	Detail - toy snowmobile
13-031A photo475	MlDc-9	Modern cache with debris - wpt 101
13-031A photo476	MlDc-9	Modern cache with debris - wpt 101
13-031A photo477	MlDc-9	Modern cache with debris - wpt 101

Table 1: Photograph Log

Number	Borden Number (if applicable)	Comment
13-031A photo478	MlDc-9	Modern cache with debris - wpt 101
13-031A photo479	MlDc-9	Modern tent ring - wpt 102- south
13-031A photo480	MlDc-9	Modern tent ring - wpt 102 - west
13-031A photo481	MlDc-9	Modern tent ring - wpt 102 - west
13-031A photo482	MlDc-9	Modern tent ring - wpt 103
13-031A photo483	MlDc-9	Modern tent ring - wpt 103
13-031A photo484	MlDc-9	Cache - wpt 74
13-031A photo485	MlDc-9	Cache - wpt 74
13-031A photo486	MlDc-9	View east across Kivitoo
13-031A photo487	MlDc-9	Modern hunting blind - wpt 104
13-031A photo488	MlDc-9	Stone ring - modern wpt 105

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At Golder Associates we strive to be the most respected global company providing consulting, design, and construction services in earth, environment, and related areas of energy. Employee owned since our formation in 1960, our focus, unique culture and operating environment offer opportunities and the freedom to excel, which attracts the leading specialists in our fields. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees who operate from offices located throughout Africa, Asia, Australasia, Europe, North America, and South America.

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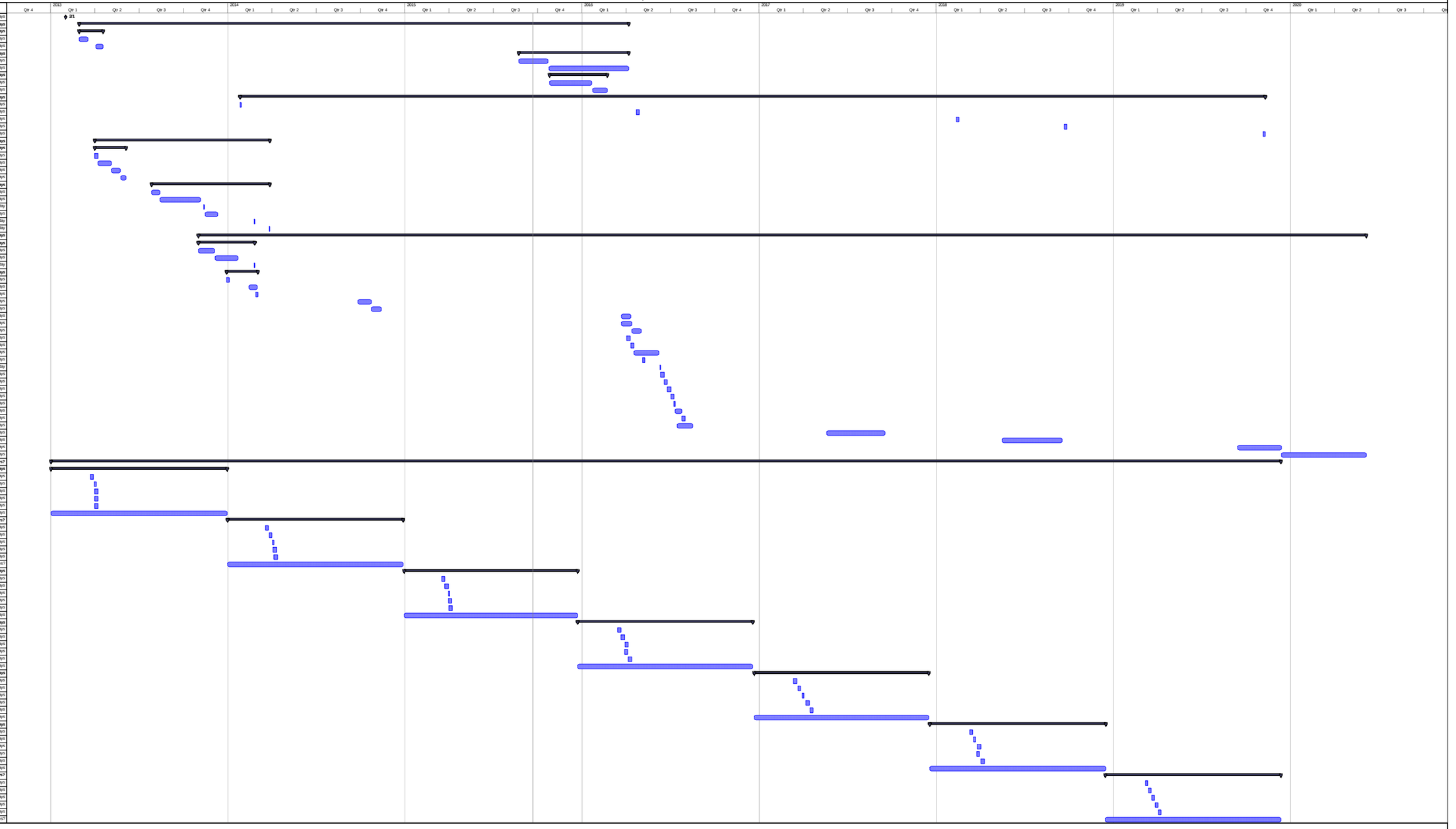
APPENDIX 8:

PROJECT SCHEDULE

FOX-D Kivitoo

Remediation Project

ID	Task Name	Duration
1	**1 Care and Maintenance**	0 days
2	**2 Regulatory Approvals**	**817 days**
3	**2.1 Archaeological permit for Site Assessment**	**36 days**
4	2.1.1 Prepare documents	12 days
5	2.1.2 Regulatory Review	11 days
6	**2.2 NIRB Screening Land and Water Use Permit for Site Rem.**	**164 days**
7	2.2.1 Prepare documents	44 days
8	2.2.2 Regulatory Review	120 days
9	**2.3 Quarry Permits & PCB Storage Area Permits**	**87 days**
10	2.3.1 Prepare documents	64 days
11	2.3.2 Regulatory Review	23 days
12	**3 Consultation**	**1526 days**
13	3.1 Presentation of Draft RAP in Qikiqtarjuaq	3 days
14	3.2 Pre-Remediation Community Meeting (Mobilization)	5 days
15	3.3 Post Construction Yr 1 and pre construction Yr 2 Community Meeting	5 days
16	3.4 Post Construction Yr 2 Final Community Meeting	5 days
17	3.5 Final Community Closeout Meeting (Demobilization)	5 days
18	**4 Site Investigation and Assessment**	**260 days**
19	**4.1 Preparations for Site Assessment**	**47 days**
20	4.1.1 Initial Information review by AANDC and PWGSC PMs	5 days
21	4.1.2 Develop TOR for all site assessment, and solicit proposals	20 days
22	4.1.3 Evaluate and award Contract for Site Assessment	14 days
23	4.1.4 Gap Analysis and Work Plan Dev. for Phase III ESA and Engrg.	8 days
24	**4.2 Site Assessment**	**176 days**
25	4.2.1 Conduct Site Assessment (ESA, Geotech and Archaeological)	14 days
26	4.2.2 Complete Reporting	60 days
27	4.2.3 Obtain Draft Reports	1 day
28	4.2.4 Report Review	20 days
29	4.2.5 Finalize Reporting	1 day
30	4.2.6 Environmental Impact Assessment	1 day
31	**5 Site Remediation**	**1737 days**
32	**5.1 RAP Development and Cost Estimates**	**85 days**
33	5.1.1 RAP Development	25 days
34	5.1.2 Internal Review	35 days
35	5.1.3 Finalize RAP	1 day
36	**5.2 Prepare Site Remediation Tender documents**	**47 days**
37	5.1.1 Retain Consultant to prepare spec documents (Same contract as Phase 3)	4 days
38	5.1.2 Have Contracting review 66% spec documents	13 days
39	5.1.3 Submit Form 9200	4 days
40	**5.3 Review of tender documents**	20 days
41	**5.4 Tender document edits**	15 days
42	**5.5 Prepare and submit RMP and PAAA**	13 days
43	**5.6 Procurement Plan Review and Approval**	15 days
44	**5.7 Contracting Services Procurement Plan**	15 days
45	**5.8 Provide Advanced Notification to Land Claims Offices**	5 days
46	**5.9 Post RFP on www.buyandsell.gc.ca**	5 days
47	**5.10 Tender Period**	40 days
48	**5.11 Bidder's Meeting**	4 days
49	**5.12 Tender close**	1 day
50	**5.13 Bid Evaluation**	5 days
51	**5.14 Make Recommendation to AANDC to Award**	5 days
52	**5.15 Clarification and negotiation with proposed Contractor**	5 days
53	**5.16 Prepare contract request and regional approval docs.**	5 days
54	**5.17 Approval to award (if $10 million with PAAA & GST)**	2 days
55	**5.18 Obtain documents from Contractor**	10 days
56	**5.19 Contract Award**	5 days
57	**5.20 Mobilization (Sealift to FOX-D)**	25 days
58	**5.21 Site Restoration Activities (Year 1)**	87 days
59	**5.22 Site Restoration Activities (Year 2)**	88 days
60	**5.23 Demobilization (Sealift FOX-D to South)**	65 days
61	**5.24 Final Comp. Report, Reg Reports & AANDC Proj. Closure**	126 days
62	**7 Project Management**	**1829 days?**
63	**7.1 Site Assessment Year**	**262 days**
64	Submit detailed site assessment work plan to HQ	5 days
65	Amend the existing SSA	5 days
66	Update PP&A	5 days
67	Update liability estimates	5 days
68	Performance Report	5 days
69	Variance Reporting (6X per year)	262 days
70	**7.2 Development of Design Drawings, Specifications and RFP**	**261 days?**
71	Submit detailed remediation work plan	5 days
72	Amend the existing SSA	5 days
73	Update PP&A	3 days
74	Update liability estimates	5 days
75	Performance Report	5 days
76	Variance Reporting (6X per year)	261 days?
77	**7.3 Permitting and Contracting Year**	**260 days**
78	Submit detailed remediation work plan	5 days
79	Amend the existing SSA	5 days
80	Update PP&A	3 days
81	Update liability estimates	5 days
82	Performance Report	5 days
83	Variance Reporting (6X per year)	260 days
84	**7.4 Mobilization**	**261 days**
85	Submit annual work plan	5 days
86	Amend the existing SSA	5 days
87	Update the PP&A	5 days
88	Update liability estimates	5 days
89	Performance Report	5 days
90	Variance Reporting (6X per year)	261 days
91	**7.5 Year 1 Remediation**	**260 days**
92	Submit annual work plan	5 days
93	Amend the existing SSA	5 days
94	Update the PP&A	3 days
95	Update liability estimates	5 days
96	Performance Report	5 days
97	Variance Reporting (6X per year)	260 days
98	**7.6 Year 2 Remediation**	**261 days**
99	Submit annual work plan	5 days
100	Amend the existing SSA	5 days
101	Update the PP&A	5 days
102	Update liability estimates	5 days
103	Performance Report	5 days
104	Variance Reporting (6X per year)	261 days
105	**7.7 Demobilization**	**261 days?**
106	Submit annual work plan	4 days
107	Amend the existing SSA	5 days
108	Update the PP&A	5 days
109	Update liability estimates	5 days
110	Performance Report	5 days
111	Variance Reporting (6X per year)	261 days?



Project: Work Program Schedule
Date: 9/21/15 4:00 PM

Task — Summary — Rolled Up Milestone — Split — Project Summary — Inactive Task — Inactive Summary — Duration-only — Manual Summary — Finish-only

Milestone — Rolled Up Task — Rolled Up Progress — External Tasks — Group By Summary — Inactive Milestone — Manual Task — Manual Summary Rollup — Start-only — Progress

APPENDIX 9:

QIKIQTANI INUIT ASSOCIATION – ACCESS TO INUIT OWNED LAND PERMIT

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Qikiqtani Inuit Association

QIKIQTANI INUIT ASSOCIATION

APPLICATION FOR ACCESS TO INUIT OWNED LAND

Office use only

Category	Application No:	Accepted By:	Date Accepted:

To be completed by all applicants

1. Applicant's name and mailing address (Full name, no initials or abbreviations)

Aboriginal Affairs and Northern Development Canada

10th floor, 25 Eddy Street

Gatineau, QC

K1A 0H4

Telephone no.
819-934-1188

Fax no

2. Head Office address

Same as above

Telephone no.

Fax no.

3. Field supervisor and address if different from above

Telephone no.

4. Other personnel list (Subcontractors or contractors to be used)

Mark Yetman, Senior Project Officer, Contaminated Sites, Aboriginal Affairs and Northern Development Canada, 819-934-1188

Michael Westlake, Project Officer, Contaminated Sites, Aboriginal Affairs and Northern Development Canada, 819- 994-6773

Giselle Cotta- Project Manager- Public Works and Government Services Canada, (780) 497-3839

Total no. of personnel: 30 people max No. of person days: 5400

5. Location of activities by map coordinates. Attach **ORIGINAL** maps and sketches.

MAX Latitude	67°56'3.42"N	MAX Longitude	64°53'24.56"W
MIN Latitude	67°56'3.42"N	MIN Longitude	64°53'24.56"W
Map Sheet No:	026P15	Inuit Land Parcel No:	

Coordinate of camp (if applicable) Lat.—67°56'3.42"N- Long 64°53'24.56"W

NOTE: Please specify projection, datum, and digital format. Please provide the data as an Arc Info cover, ArcView Shape file or an .E00 file.

6. Periods of operation; including periods of seasonal shut down and periods for restoration.

Construction
Proposed Start Date: July/2016 (month/year) Proposed Completion Date: September/2016 (month/year)

Operation
Proposed Start Date: July/2017 (month/year) Proposed Completion Date: October/2018 (month/year)

Closure
Proposed Start Date: June/2019 (month/year) Proposed Completion Date: August/2019 (month/year)

Post - Closure
Proposed Start Date: September/2019 Proposed Completion Date: March/2020

7. Period of access required (up to one or two years for licenses, depending on license level, up to five years for residential/recreational leases and level I and II commercial leases, and up to forty years for level III commercial leases)	Start date: July 2016	Completion Date: October 2018

8. Other rights, licenses, permits or leases related to this application. Provide proof of rights or indicate if in the process of applying for rights.

☐ NTI Subsurface Right	☐ NRI Research License	☐ CWS Permit
☐ DIAND Subsurface Right	☐ RWED Tourism License	☐ Other
x NWB Water License	☐ Explosives Permit	Specify:
#		

9. TYPE OF LAND USE ACTIVITY

Check off the appropriate land use activities.

Mining/Oil & Gas	***Construction:***	***Tourism:***
☐ Staking and Prospecting	☐ Camp	☐ Tourism facility
☐ Exploration (geophys-grd/air)	☐ Building	☐ Outfitting
☐ Drilling (diamond/ice, etc)	☐ Winter road	☐ Other
☐ Mine (open pit, underground)	☐ All Season road	
☐ Bulk fuel storage	☐ Quarrying	
☐ Other:	☐ Other:	

Municipality:	***Research:***	***Other:***

☐ Bulk Storage ☐ Residential Building ☐ Commercial Building ☐ Other:	☐ Wildlife/fish/birds/marine ☐ Survey (grd/aerial/collars) ☐ Collection of species ☐ Research Station ☐ Other :	☐ Commercial harvest ☐ Recreational Camp X Contaminated site remediation

10. TYPE OF WATER USE

Select the kind of project for which you will use the water, and the type of water use

Undertaking	***Water Use:***
☐ Advanced Exploration	X To Obtain Water
☐ Exploration Drilling	☐ To Modify the bed or bank of water course
☐ Industrial	☐ To Alter the flow of, or store water
☐ Mine Development	☐ To Cross the Watercourse
☐ Power	☐ To Divert the Watercourse
☐ Remote/Tourism	☐ Flood Control
☐ Other:	☐ Other:

11. QUANTITY OF WATER INVOLVED

Please include the quantity of water to be used during the Land Use activity

4.7 m^3/day

115 Litres/day/person x 30 people (max) = 3,450 Litres/day
1,250 Litres/day for miscellaneous activities (ex. washing equipment and drums)

4.7 m^3/day x 180 days (maximum) = 846 m^3

Quantity of water to be used:	**141** m^3 **-423** m^3	m^3/year
Quantity to be returned:	**0** m^3 **Returned to source**	m^3/year

12. WASTE

Describe the type of waste produced by the activity

- ☐ Bulky Items/Scrap metals
- x Grey water
- ☐ Hazardous
- x Sewage
- ☐ Sludge
- ☐ Solid waste
- ☐ Waste Oil
- ☐ Other:

Describe: Water is to be used for camp operation and all waste water will be disposed of properly in a sewage lagoon. This system will consist of two independently operated temporary lagoons. Each lagoon will have an individual capacity for 45 days of wastewater storage or one half of the duration of the construction season, whichever is more. Maximum fluid depth will not exceed one metre. The location of the lagoons will be a minimum of 100 metres from the construction camp or other temporary facilities and drainage paths, and downwind of the construction camp (based on the prevailing wind direction). Discharge criteria will be as follows:

- Biological Oxygen Demand (BOD) – 80 mg/kg
- Total Suspended Solids (TSS) – 100mg/kg
- Fecal Coliforms – 1 x 104 CFU/100 mL
- pH – 6.0 to 9.0
- Oil and Grease – no visible sheen

13. LAND USE PERMIT

Select Land Use Permit You have been Issued

x DIAND	date expected	Fall 2016
☐ Qikiqtani Inuit Association	date expected	
☐ Commissioner	date expected	
☐ Department of Environment	date expected	

14. IMPACT

Predicted environmental impacts of undertaking and proposed mitigation measures (direct, cumulative impacts)

Please see "Environmental Impact Assessment of the FOX-D Remedial Action Plan Kivitoo, NU" which can be found in Appendix 7.

Describe:

NPC conformity check ***NIRB Screening***	*****PLEASE NOTE QIA TO FORWARD APPLICATION TO NPC & NIRB***

15. *Proposed Time Schedule*

X Same as the Land Use

☐ Check for **Annual Work,** specify the days of operation [Leave unchecked for multi year work]
Start day [ ] Completion date [ ]

16. On a separate **page, provide a NON-TECHNICAL project summary**. This should include a non-technical description of the project proposal, no more than 300 words, in **English and Inuktitut**. The project description should outline the project activities and their necessity, method of transportation, any structures that will be erected, expected duration of activity and alternatives considered. If the proposed activity fits into any long-term developments, please describe the projected outcome of the development for the area and its timeline.

17. Attach a detailed project description as outlined in APPENDIX A.

18. Land Use Application Fees:

☐	Land Use License I Inuit $0 Non-Inuit $250.00
☐	Land Use License II $500.00
☐	Land Use License III $1000.00
☐	Residential/Recreational Lease Inuit $0 Non-Inuit $250.00
X	Exemption Certificate $0
☐	Commercial Lease I $500.00
☐	Commercial Lease II $2500.00
☐	Commercial Lease III $5000.00
☐	Right of Way Agreement $500

Land use fees: # of hectares used @ $50.00/hectare = $_____

Note: The land use fee is for the amount of land used on an annual basis.

19. Water Application Fees:

Water License Application type:

☐	For Land Use license Class I the corresponding *Water Application fee is* **$50.00** per year plus **$ 1** for Water use charge, *Volumetric fee*, **Total $51** every year
☐	For Land Use License Class II the corresponding *Water Application fee is* **$250.00** every year plus **$ 1** for Water use charge, *Volumetric fee*, **Total $251.00** every year
☐	For Land Use License III The corresponding *Water Application fee* is **$500.00** every 2 years and **$26.35/1000m^3** for Water Use charge *Volumetric fee.* **Total $276.35** every year
☐	For Commercial Lease I The corresponding *Water Application fee is* **$50.00** and **$ 26.35 /1000m^3** for Water use charge, *Volumetric fee*. **Total $76.35** every year
☐	For Commercial Lease II The corresponding *Water Application fee is* **$500.00** and **$ 26.35 /1000m^3** for Water use charge, *Volumetric fee*. **Total $526.35** every year
☐	For Commercial Lease III, The corresponding *Water Application fee is* **$5000.00** and **$ 26.35 /1000m^3** for Water use charge, *Volumetric fee*. **Total $5026.35** every year

Water Use Fee [Volumetric fee]: # volume water use ($\underline{m^3}$) * $26.35/1000m^3 = $ _____

Note: The water application type is related to the Land use application type. A water Protection fee will be charged according to the type and stage of the development project.

20. a) The Applicant request a Certificate of Exemption ☒

or

b) The Applicant agrees to be bound by terms and conditions to be attached to the Inuit Land User License or Lease ☐

Sign name in full: _____ 2015-09-21

Signature Date

APPENDIX A

All applicants must provide a detailed project description that includes ALL of the following:

1. Outline project activities, their necessity, their expected duration and alternatives considered. If the proposed activity fits into any long-term developments, describe the projected outcome of the development for the area and its timeline.

Please see attached Remedial Action Plan which can be found in Appendix 6.

2. Schedule of activities including both operations and shutdowns.

Please see attached schedule which can be found in Appendix 9

3. Provide a preliminary plan showing the location of the lands proposed to be used and an estimate of their area in hectares. The preliminary plan should show the approximate location of all:

   i) existing or new lines, trails, rights-of-way and cleared areas proposed to be used in the exercise of the Right;

See Remedial Action Plan in Appendix 6.
See the Nunavut Impact Review Board Part 2 form which is found in Appendix 4.

   ii) buildings, campsites, air landing strips, air navigation aids, fuel and supply storage sites, waste disposal sites, excavations, ponds, reservoirs and other works and places proposed to be constructed or used during the exercise of the Right;

See Remedial Action Plan in Appendix 6.
See the Nunavut Impact Review Board Part 2 form which is found in Appendix 4.

   iii) manmade structures and works, including bridges, dams, ditches, highways, roads, transmission lines, pipelines, survey lines and monuments, air landing strips; all topographical and natural features, including eskers, rivers, streams, lakes, inland seas and ponds; and all areas of biological interest, including wildlife and fish habitat, specifically, calving, denning, spawning or nesting areas, identified in consultation with the NWMB, RWO, or HTO, as appropriate, that may be affected by the exercise of the Right; and

See Remedial Action Plan in Appendix 6.
See the Nunavut Impact Review Board Part 2 form which is found in Appendix 4.

   iv) the accurate location of all carving stone, archaeological sites, and archaeological specimens.

See Archeological Assessment in Appendix 8.

4. Provide a list of structures that will be erected.

Temporary camp to support remedial activities.

5. Equipment to be used, indicating type and number, size and ground pressure and proposed use. Include all drills, pumps, vehicles etc.

See the Nunavut Impact Review Board Part 2 form which is found in Appendix 4.

6. Fuels to be used, capacity of containers and number of litres. Include diesel, gasoline, aviation fuel, propane and other fuel types. Describe method of fuel transfer.

See the Nunavut Impact Review Board Part 2 form which is found in Appendix 4.

7. Provide a copy of fuel spill contingency plan.

Fuel spill contingency plan will be developed once a contractor is in place.

8. Describe the methods of transportation.

See Remedial Action Plan in Appendix 6
See the Nunavut Impact Review Board Part 2 form which is found in Appendix 4.

9. Indicate the components of the environment that are near the project area, as applicable. Include the type of species, the important habitat area (calving, staging, denning, migratory pathways, spawning, nesting etc.), and the critical time periods (calving, post-calving, spawning, nesting, breeding etc.). Also, include information on eskers, communities, and historical/archaeological sites.

Please see “Environmental Impact Assessment of the FOX-D Remedial Action Plan Kivitoo, NU” which can be found in Appendix 7.

10. Summary of potential environmental, wildlife and resource impacts and mitigation measures to be used. Describe the effects of the proposed program on lands, water, flora and fauna.

Please see “Environmental Impact Assessment of the FOX-D Remedial Action Plan Kivitoo, NU” which can be found in Appendix 7.

11. Reclamation cost analysis for advanced exploration activities.

N/A

Proposed reclamation plan, that includes, but is not limited to the proposed methods and procedures for the progressive:

See Remedial Action Plan in Appendix 6.

i) removal of all structures, equipment, and other manmade debris;

ii) rehabilitation of the area to its previous standard of human utilization and natural productivity;

iii) replacement of overburden and soil;

iv) grading of the area back to is natural contours; and

v) re-establishment, to the extent possible, of flora.

Include information about on going site remediation throughout the duration of the project.

12. Indicate the number of Inuit to be employed, the Inuit firms to be contracted, and the socio-economic benefits to the area.

The contract for remedial activities will contain an Aboriginal Opportunities Considerations (AOC) clause that requires the contractor to maintain a target level of Inuit employment on the project (and applies a penalty if the contractor fails to meet the target level). On past similar projects the Inuit employment level in the AOC has been in the range of 60-70%. The AOC also sets a target level of Inuit subcontracting. Past similar projects have had minimum Inuit subcontracting levels of 60-80%.

In addition to the above requirements, COMMERCIAL LEASE APPLICANTS must provide the following information:

N/A

- If the land is surveyed, state the lot and block number. If unsurveyed, state the size of the parcel and general area. Provide a detailed description and detailed sketch of the area applied for.
- Describe the type of commercial use.

In addition to the above requirements, RESIDENTIAL/RECREATIONAL LEASE APPLICANTS must provide the following information:

N/A

- If the land is surveyed, state the lot and block number. If unsurveyed, state the size of the parcel and general area. Provide a detailed description and detailed sketch of the area applied for.
- For what purposes will the land be used? Describe any buildings or improvements on this land. What is the value of the improvements on the land and who is the owner of the improvements.
- Provide a list of improvements planned for construction, the value of these improvements and within how many months of the effective date of the lease these improvements be finished.

In addition to the above requirements, QUARRY LICENSE or QUARRY CONCESSION AGREEMENT applicants must provide the following information:

N/A

- A description by meters and bounds of the land applied for;

- The name of the specified substances that the applicant desires to remove from the area; and
- A sketch showing clearly the position of the parcel in relation to a survey monument, prominent topographical feature or other known point and shown in its margin, copies of the markings on the posts or cairns.
- If for commercial use, the description shall contain an affidavit sworn by the applicant setting forth:

  i) that the land contains material of the kind applied for in merchantable quantities;

  ii) that the volume of specified substances are required for a project that has been approved by the appropriate level of government; and

  iii) that the applicant has obtained a contract for the delivery of those Specified Substances.

Please prepare this project description on a separate sheet of paper and attach it to your application form marked as APPENDIX A. Return the original, signed and dated application form, with attached APPENDICES A and all ORIGINAL maps of the area to QIA Lands Office at Box 1340, Iqaluit, NU, X0A 0H0.

APPENDIX 10:

ABORIGINAL AFFAIRS AND NORTHERN DEVELOPMENT CANADA – LAND USE PERMIT

APPLICATION FOR LAND USE PERMIT

***Privacy Act* Statement**
The information you provide in this document is collected under the authority of the *Territorial Land Use Regulations* for the purpose of responding to your application for land use permit. Information on individuals is used by Aboriginal Affairs and Northern Development Canada Land Administration employees who need to know the information in order to respond to your request and/or the program requirements. We share the information you give us with First Nations, Aboriginal groups and Inuit, Territorial and Federal Government Expert Agencies and Public Government Institutions. The personal information will be retained 6 years after the last administrative use and then destroyed. Individuals have the right to the protection of and access to their personal information under the *Privacy Act* http://lois.justice.gc.ca/en/P-21/index.html.

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Application Fee	Land Use Fee	General Receipt No.	Date (YYYYMMDD)	Class	Permit Number

To be completed by all applicants ▶ ● New Application ○ Amendment

1. Applicant's Name and Mailing Address (Full name, no initials)

Mark Yetman
Senior Project Officer
Aboriginal Affairs and Northern Development Canada

Facsimile Number: 819 934-9229
Telephone Number: 819 934-1188

2. Head Office Address

10th floor, 25 Eddy Street
Gatineau, QC
K1A 0H4

Facsimile Number:
Telephone Number:

Field Supervisor	Radio Telephone	E-Mail Address	Telephone Number

3. Other Personnel (Subcontractor, Contractors, Company Staff, etc.)

Michael Westlake - Project Officer - Contaminated Sites, Aboriginal Affairs and Northern Development Canada, 819-994-6773

Total ▶

4. Qualifications
Refer to Section 21 of the *Territorial Land Use Regulations*
a(i) ☐ a(ii) ☐ a(iii) ☐ b ☐ c ☑

Number(s) exploration permit mineral claims (If applicable)
N/A

5. a) Summary of Operation (Describe purpose, nature and location of all activities.)
Refer to Section 22(2)(b) of the *Territorial Land Use Regulations* (Use last page of form if necessary.)

FOX-D (Kivitoo) was an Intermediate Distant Early Warning (DEW) Line Site constructed in 1957 and operated until October 1963. The site is located on the Davis Strait. The site is located 50 km to the west of the nearest community, Qikiqtarjuaq, Nunavut, at approximately 67° 57' 01" N latitude and 64° 55' 04" W longitude. The principle activity is the remediation of this contaminated site. Additional details are provided in the Remediation Action Plan which can be found in appendix 6.

b) Please indicate if a camp is to be set up (Use last page to provide details.)

A temporary camp will be used for remediation activities.

6. Summary of potential environmental and resource impacts
(Describe the effects of the proposed program on land, water, flora and fauna and related socio-economic areas.)
(Use separate pages if necessary.)

The project is not expected to have negative impacts on land, water, flora or fauna. Please see attached "Environmental Impact Assessment of the FOX-D Remedial Action Plan Kivitoo, NU" which can be found in appendix 7.

7. Proposed Restoration Plans (Please use last page if required.)

A Remedial Action Plan has been prepared for this project. Please see appendix 6.

8. Other rights, licences or permits related to this permit application (Mineral claims, Yukon timber permits, water licences, etc.) (Please use last page if required.)

Nunavut Water Board - Water License (Appendix 2)
Kitikmeot Inuit Association – Access to Inuit Owned Land Permit (Appendix 10)
Nunavut Impact Review Board Part 1 and 2 (Appendix 3 and 4)

Roads ▶ ◯ Is this to be a pioneered road? ◯ Has the route been laid out or ground truthed?

9. Proposed Disposal Methods (Please use last page if required.)

a) Garbage	b) Sewage (Sanitary and Grey Water)
non-hazardous incinerated on-site	sewage lagoon
c) Brush and Trees	d) Overburden (Organic soils, waste material, etc.)
N/A	

10. Equipment (Includes drills, pumps, etc.) (Please use last page if required.)

Type and Number	Size	Proposed Use
Excavator(s)		repair roads/remove soils for treatment
front end loader(s)		repair roads/consolidate materials
Haul truck		moving materials
crusher		to develop on-site aggregate materials
incinerator		incinerate non-hazardous materials
Dozer(s)		move materials/ repair roads
11. Fuels	Number of Containers	Capacity of Containers
☑ Diesel	approximately 220 barrels	205L
☑ Gasoline	Approximately 25 barrels	205L
☑ Aviation Fuel	Approximately 25 barrels	205L
☑ Propane	approximately 8 containers	960kg
☐ Other: _____		

12. Containment Fuel Spill Contingency Plans (Please attach separate contingency plan if necessary.)
A Containment Fuel Spill Contingency Plan will be developed once a contractor is hired.

13. Methods of Fuel Transfer (To other tanks, vehicles, etc.)
An electric pump will be used to transfer fuel from the drums into the equipment or tank. All fuel transfers will be supervised and spill kits will be readily available to address any spills.

14. Period of Operation (Includes time to cover all phases of project work applied for, including restoration.)

Construction

Proposed Start Date: ___July/2016__ Proposed Completion Date: _____September/2016___

Operation

Proposed Start Date: ____July/2017__ Proposed Completion Date: _October/2018

Closure

Proposed Start Date: _____June/2019 Proposed Completion Date: _____August/2019_____

15. Period of Permit (Up to two years, with maximum of one year extension.)	Start Date (YYYY-MM-DD)	Completion Date (YYYY-MM-DD)
	2016-07-01	2018-10-31

16. Location of activities by map co-ordinates (Attach maps and sketches.)

	Degrees	Minutes	Seconds		Degrees	Minutes	Seconds
Minimum Latitude ▶	67	55	41.33N	Minimum Longitude ▶	64	51	1.34W
Maximum Latitude ▶	67	57	42.31N	Maximum Longitude ▶	64	57	58.30W

Map Sheet Number

026P15

17. Applicant (Print Full Name)	Signature	Date (YYYY-MM-DD)
MARK YETMAN		2015-09-21

18. Fees

○ Class **A** - $150.00 ○ Class **B** - $150.00 ▶		$150.00
Land Use Fees: Less than or equal to 2 hectares ▶	$50.00	$ 50.00
For each additional hectare over 2 hectares or portion of a hectare ▶	X $50.00 =	
Total application and land use fees ▶		

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19. Calculation of area involved (Includes access, staging areas, airstrips, campsites, etc.)

Total Area (Ha)	Less than or equal to 2 hectares	Total (For Fee Calculation)

20. Application Checklist

- ☐ a) Application Signed and Dated
- ☐ b) Fees Attached
- ☐ c) Map Included
- ☐ d) Address and Telephone Number
- ☐ e) Screening Report
- ☐ f) Timber Permit Applied for - Yukon
- ☐ g) Fees Attached
- ☐ h) Lease Applied for

Remarks (Please use last page if additional space is required.)

Accepted by	Date (YYYYMMDD)

21. Additional Information (Attach additional pages if necessary.)

10. - water truck to haul water to camp
    - waste compactor
    - drum crusher
    - All-terrain vehicles with trailers
    - generators for remedial activities
    - packer to ensure compaction is appropriate with the natural terrain
    - other equipment as appropriate by the contractor