MEMO

To	Josée Peron		
From	Brian Geddes, Renata Wood		
Tel	403-387-1639	**AMEC File No.**	VM00605.TAR3
Fax	403-248-2188	**cc**	Patricia Randall
Date	25 July 2013		Dean Wall, Serge Chevrier
Subject	**Mount Nansen 2013 Site Investigation – Borrow Area Plan**		

1.0 INTRODUCTION

AMEC has been requested to identify potential off-site borrow requirements for the Mount Nansen Remediation Project (MNRP). It is understood that the main reasons for this request are:

- to facilitate discussions regarding permits for any site investigation associated with off-site borrow;
- to identify if any existing highways borrow sources would be available for use; and
- to identify if there is a need for an archaeological sweep in advance of any investigation of potential off-site borrow areas and to carry such work if required.

The following memorandum outlines the requirements for off-site borrow, presents potential borrow locations, and summarizes a path forward with regards to off-site borrow. It should be noted that this memorandum does not attempt to estimate the total amount of borrow that may be required for the MNRP.

Note as well that the purpose of this memo was to address the action item from the kick off meeting related only to fine grained borrow sources in support of developing cover design options. The intent is that sand and coarser borrow would be obtained from already disturbed areas / existing borrow areas.

The on-site areas near the dam and north of the dam where sand and “shale” were sourced have been included in the test pitting program. These are not fine grained borrow sources and, therefore, were not included in this memo.

2.0 DESCRIPTION OF CONCEPTUAL BORROW REQUIREMENTS

A key component of the selected Option 4 remediation plan for the MNRP is the construction of a low infiltration cover over the backfilled Open Pit. Often such covers would include a low permeability soil layer that would act as a barrier to flow. Surficial soils at the site, however, are dominated by coarse grained glaciofluvial outwash and colluvium deposits. No significant source of near surface fine grained material has been located on-site. The cover options

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conceptually considered have, therefore, included a synthetic barrier system and various store and release or capillary break systems that require only coarser grained material (Golder 2010[1]). If a source of fine grained material (preferably clay or clayey silt) can be located in reasonable proximity to the mine site, a barrier system incorporating a low permeability soil layer could be an attractive solution. It should be noted that all of the cover systems will require coarse grained borrow. Coarse grained borrow is planned to be sourced on-site from alluvial deposits and/or waste rock.

2.1 Potential Borrow Locations

A terrain mapping and materials search was completed (EBA 2009[2]) and included a desktop study and field truthing. The study identified two potential sources of glaciolacustrine silt. Both sites are located around Rowlinson Creek approximately 25 km east of the Mount Nansen Site, within 2 km of the Mount Nansen Road. Unfortunately, no ground truthing was completed by EBA at these two sites. The attached Figure 1 illustrates the location of these two potential borrow sites. Ground truthing of these sites is proposed as part of the 2013 field program.

AMEC has reviewed the terrain mapping and materials search report and noted that the report focused on locating glaciolacustrine deposits. It was not clear if any modern lacustrine or fluvial deposits were considered. Such deposits may exist within reasonably close proximity to the site as shown in Figure 1. AMEC plans to carry out an air photo review of this area to investigate this possibility. If warranted, ground truthing of these areas would be carried out during the 2013 field program.

First Nations and quartz claim areas have been received. Air photos in those areas will be cursorily reviewed for completeness. Borrow areas in those areas would be considered only in discussions with AAM as a last resort and if there was significant clear benefit to the project.

To AMEC's knowledge, Victoria Creek does not have fine grained borrow and it, therefore, was not included in this assessment. It is understood that the Victoria Creek borrow material was screened to produce gravel for dam construction; however, no significant amount of information regarding the unscreened gradation or even the specific location of the borrow area has been located in the reports. AMEC has located 1 grain size curve for the Victoria Creek borrow material indicating that the material has 25% fines. This may provide a suitable material for certain types of cover systems (e.g., store and release). If additional data regarding the Victoria Creek borrow is available, please advise. If not and/or if the available information is limited, this area should be investigated as part of the 2013 program.

[1] Golder. 2010. "Conceptual Assessment of Low Infiltration Cover Options for the Mt. Nansen Project, Yukon." Report to Lorax Environmental Services Ltd., dated 1 October 2010.

[2] EBA. 2009. "Mt Nansen Mine Reclamation Terrain Mapping and Materials Search." Report to Yukon Government, dated September 2009.

The general approach to the off-site borrow investigation has changed on the basis of these initial assessments. Initially, due to schedule and timing constraints, the plan was to characterize all of the possible borrow sites in advance of design and the investigations were suggested as per the recommendations in the EBA borrow search report. In light of the difficult access, this approach is being changed. These areas will only be investigated if it appears that there is good potential for fine grained borrow and if the development of those borrow sources would provide a clear benefit to the project. If a clear benefit to borrow development is identified, a simplified ground truthing via hand auger, Pionjar or other methods would be carried out either through a helicopter supported program or by foot. The permitting plan would then include full delineation and characterization as part of borrow development.

2.2 Approximate Volume of Borrow Material Required

The volume of fine grained borrow required is conceptually estimated to be 100,000 m^3 to 200,000 m^3 based on:

- 1 m thick layer of compacted fine-grained material;
- Open Pit area of approximately 45,000 m^2 (Lorax 2011[3]);
- allowance for surface slope;
- possibility of an expanded area requiring cover (e.g., additional waste rock, additional tailings dam material, possible landfill material); and
- allowance for waste, material compaction, etc.

If one assumes that the depth of borrow is in the order of 3 to 5 m thick, the required borrow area would be in the order of 150 m by 150 m to 260 m by 260 m.

The volume of required borrow referenced above is a conservative rough estimate. It assumes that there is a 1 m thick layer of fine grained material over an area that could be up to 90,000 m^2. This area is double that shown in the Lorax report to account for the possibility that the cover area is expanded because of an on-site landfill, etc. Allowing for bulking and wastage results in a volume in the order of 100,000 m^3 to 200,000 m^3.

Borrow area estimates are as follows:

- maximum area based on required volume of 200,000 m^3 and a 3 m deep useable borrow source, then an area about 260 x 260 m would be needed (260*260*3=202,800 m^3); and
- minimum area based on a required volume of 100,000 m^3 and a 5 m deep useable borrow, then an area about 150 x 150 m is needed (150*150*5=112,500 m^3).

[3] Lorax. 2011. “Mount Nansen Options for Closure”, Report to Yukon Government, dated July 2011.

3.0 PATH FORWARD

The following path forward is proposed with regards to off-site fine grained borrow:

- air photo review of the two potential borrow locations identified by EBA near Rowlinson Creek (see Figure 1) to confirm interpretation and identify access route;
- carry out test pits and field reconnaissance at the two potential borrow areas;
- air photo review of the areas shown in Figure 1 within 5 to 18 km of the site; and
- if warranted based on the air photo review, carry out field reconnaissance and test pitting at any other potential locations of fine grained material identified.

It is understood that permits may be required to carry out test pitting outside the Mount Nansen order in council (OIC) boundary and that such permits will be obtained by AAM.

4.0 CLOSURE

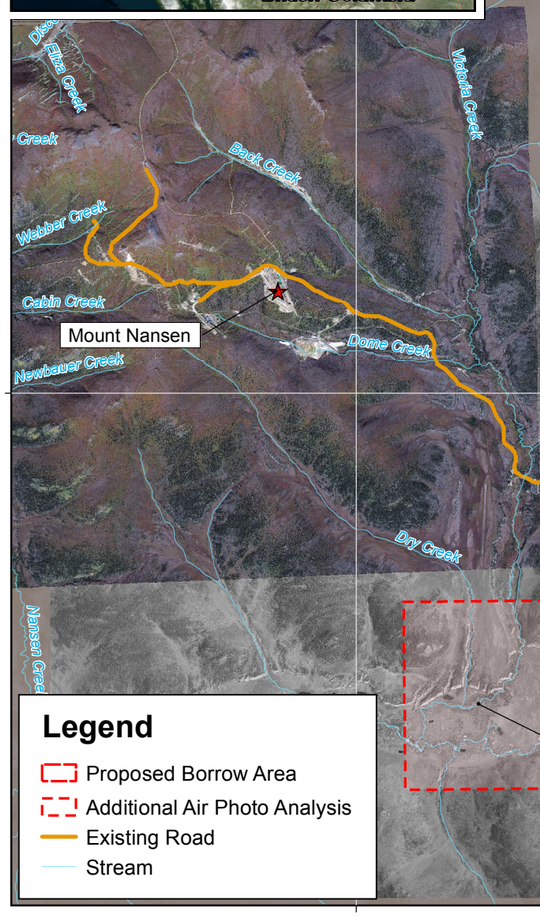
This memorandum is an interim document in the design process. It is based on the information available at the time of writing.

Submitted by:

Brian Geddes, P.Eng.
Senior Design Engineer
AMEC Environment & Infrastructure

BG/jm
Attachments:
Figure 1 – Proposed Borrow Areas

Figure



390000 400000 410000

6890000 6880000

N

Access Road to Mount Nansen

Access to Borrow Area 1 (Detailed alignment to be confirmed)

Proposed Borrow Area 1

Access to Borrow Area 2 (Detailed alignment to be confirmed)

Proposed Borrow Area 2

Fowlinson Creek

Approximate area for additional air photo analysis

Access Road to Mount Nansen

Approximate area for additional air photo analysis

Nisling River

Legend

- Proposed Borrow Area
- Additional Air Photo Analysis
- Existing Road
- Stream

DRAFT

NOTE:
THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE AMEC ENVIRONMENT & INFRASTRUCTURE MEMO NO. VM00605 DATED JULY 2013.

FIRST NATIONS LAND CLAIMS AND QUARTZ CLAIMS WILL BE CONSIDERED PRIOR TO SELECTING ANY POTENTIAL AREAS FOR INVESTIGATION.

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km

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Associated Engineering / amec

DRAWN BY	KC
CHECKED BY	RW
DATUM	NAD83
PROJECTION	UTM Zone 8
SCALE	1:85,000

PROJECT: MOUNT NANSEN REMEDIATION PROJECT

TITLE: POTENTIAL BORROW AREAS

DATE	JULY 2013
PROJECT NO	VM00605
REV. NO	A
FIGURE NO	1

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25/07/2013