AJAX Soils Review
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April 10, 2016

This document reviews the following Appendices in the Ajax Environmental Impact Study. I have focused on the soils, geology and landform portions of the report. I have used screen captures for maps, tables and text sections that are to large to re-type. The documents were copy protected and text could not be copied and pasted.

Outline

1. Web site documents missing
2. Appendix 3 – E - Baseline Soil Characterization Study
3. Appendix 10.1 - Air Quality Technical Data Report
4. Appendix 3 – E - Baseline Soil Characterization Study
5. Appendix 6.2.D – Potential Influence of Blasting in Aberdeen
6. Appendix 6.2.A – Baseline Report Geology, Landforms and Soils
7. Appendix 6.6.A – Baseline Ground Water Hydrology 1934 pages
8. Mt Poly Failure
9. Appendix 3 - I – Geotechnical Report - Mine Site infrastructure
10. Edith Lake Fault
11. Depth of the Pit

1. Web site documents missing

In compiling this report I was provided with the initial data by an organization I had agreed to assist in evaluating the soils component of this project. I was asked to do a presentation at Thompson Rivers University on April 6, 2016. I was advised to use the latest data posed for public access. I discovered first, that not all files, especially the large ones would down load and second, only the Appendices for Chapter 3 were present. Figure 1 is from the http://a100.gov.bc.ca/appsdata/epic/html/deploy/epic_document_362_39700.html

Project Information Centre (e-PIC)

Ajax Mine Project

Type:	Typical EA Process (Active and Complete)	**Status:**	Under Review
Category:	Mining	**Pre-application Start Date:**	2011/02/25

Under Review >> Application and Supporting Studies

Folder:	Application Appendices Chapter 3 received January 18, 2016	**Date Posted:**	2016/01/18

Document File	File Size	Format
Appx3-A Ajax Geochemical Characterization Study	46,879 KB	PDF
Appx3-B Geochemical Source Terms for Ajax Mine Components	2,363 KB	PDF
Appx3-C Ajax Project Open Pit Geotechnical Slope Design Parameters	12,964 KB	PDF
Appx3-D Tailings Storage Facility Design Report	1,564 KB	PDF
Appx3-D (Part 2) - Tailings Storage Facility Design Report Drawings - received 5 February 2016.	41,209 KB	PDF
Appx3-E Baseline Soil Characterization Study	15,900 KB	PDF
Appx3-F Jacko Lake and Peterson Creek Downstream Pond Engineering ? Preliminary Design	5,601 KB	PDF
Appx3-G Ajax Pit Lake Model Report	3,906 KB	PDF
Appx3-H Baseline Vegetation Characterization Study	2,677 KB	PDF

Figure 1 Screen capture showing appendices for Chapter 3 only.

Missing are the following chapter appendices:

Chap 4 (17);
Chap 6 (28);
Cited Appendices in Chapter 6 - 6.2-F & 6.2-G are missing;
Chap 7 (2);
Chap 8 (3);
Chap 9 (3);
Chap 10 (3);
Chap 11 (2);
Chap 15 (6);
Chap 17 (9).

How can the public be assured all data was made public?

2. Appendix 3 – E - Baseline Soil Characterization Study

A series of Figures (2 - ***follow with my comments after each one. The yellow highlighted text is the focus of my comments.

> ### 3.2 Field Soils Assessment
>
> Soil inspections were conducted at 526 sites over approximately 1,705 ha of lands associated with the Project. During field investigations, the depth and thickness of soil horizons, soil colour, texture, structure and consistence were described, as were geological materials and landforms, topography, soil drainage, coarse fragment percentage, and vegetation community characteristics. Chemical and physical analyses were completed on selected samples to provide information on soil nutrient regime, metals concentrations, and physical characteristics relevant to water and nutrient holding capacity, erosivity and suitability as plant growth media.

Figure 2 There is no map showing 526 sites in this appendix. Nor is there any reference as to where a map showing the location of these sites is to be found. Texture, apart from 32 discussed later in this report, were not done according to the Canadian System of Soil Classification textural classes. Structure was never done in any of the soils sections examined in other appendices. Consistence was not done. Coarse fragment percentages were not done except for 32 samples in the report.

> #### 3.2.2 Field Investigation Methods
>
> Three types of site inspections were conducted during this study:
>
> **Soil Pits**
> At each full inspection site, the soil profile was investigated according to criteria described in the *Canadian System of Soil Classification* (1998). Soil characteristics recorded at inspection sites included:
>
> - A, B, C horizon type and depth;
> - soil texture by manual (field) test procedures;
> - coarse fragment content;
> - structure and consistence;
> - colour identification using Munsell soil colour charts (completed intermittently);
> - mottles, including appropriate mottle descriptors;
> - presence or lack of carbonates (via 10% Hydrochloric acid test (HCl)); and
> - other pertinent features required to aid in soil classification and/or description.
>
> Site and soil characteristics were later used to determine parent material groupings and soil classification to the subgroup and association levels.

Figure 3 There is no map showing where full inspection sites were done and what the pit depths were. Only the letters A, B and C are used. Horizon types, Ah, Bm, Ck etc. are not used and are only found in the Soils of the Ashcroft Map Area report (1992). There is no evidence that soil hand textures were ever done. Every texture encountered in all soil bore holes, machine dug pits or scratch pits were either silts or sands or gravels. Clay was rarely reported. Mottles were never recorded and would have occurred in wet sites. Soil classification to the subgroup and association levels were taken directly from the Soils of the Ashcroft Map Area (1992).

Scratch Pits

At each scratch pit site, the soil profile was investigated to the beginning of the C horizon. Soil characteristics recorded at inspection sites included:

- A, B, C1 horizon types and depths;
- soil texture by manual (field) test procedures;
- coarse fragment content;
- structure and consistence;
- colour identification using Munsell soil colour charts (completed intermittently);
- presence/absence of mottles;
- presence/absence of carbonates (via 10% Hydrochloric acid test (HCL)); and
- other pertinent features required to aid in soil classification and/or description.

Figure 4 This may be referring to the pits that were sampled and discussed later. 32 pits were analyzed for texture and coarse fragments and are discussed later. Hand texturing was not done. Structure and consistence were not done nor were mottles identified. Carbonates do not appear to have been done in the field. The scratch pit soils were never classified or described according to the Canadian System of Soil Classification (CSSC) (1998).

- photographs of each site including soil profiles and surrounding vegetation, terrain, etc.

Figure 5 There were no photographs in this appendix.

3.2.3 Laboratory Methods

Soil samples from representative soil horizons (excluding very thin, discontinuous horizons) across the Project area were collected in appropriate containers, stored in coolers and delivered to ALS Global Laboratories for processing and analysis. The following analyses were completed on 17 samples collected between 2012 and 2014:

Organic Matter
Particle Size
Texture
Leachable Anions & Nutrients
Total Kjeldahl Nitrogen
Organic / Inorganic Carbon
CaCO3 Equivalent
Inorganic Carbon
Total Organic Carbon
Cation Exchange Capacity
Calcium (Ca)
Conductivity Sat. Paste
Magnesium (Mg)
Potassium (K)
SAR
% Saturation
Sodium (Na)
Metals concentrations

An additional 36 sites were sampled in 2015 in order to supplement baseline metals concentration data. Twenty sites were analyzed for metals, while the remaining 16 sites were analyzed for metals, pH, cation exchange capacity, electrical conductivity and sodium adsorption ratio.

Figure 6 This was done and is the only useful information regarding soils I have found in the sections I have reviewed. My findings using the data provided are discussed later.

3.2.5 Soil Map Unit (SMU) Classification

Soil and site inspection data was classified to the soil association level and correlated with the mapped bioterrain and surficial geology information in order to categorize the Project site into seven broad SMU according to their physical and spatial characteristics.

Figure 6 The soil association levels are taken directly from the Soils of Ashcroft report! The 7 SMU's contain the old soil terminology discussed in Figure 9.

4.0 RESULTS AND DISCUSSION

4.1 Existing Soil Survey Information

Soils within the Project area were surveyed and described in *Soils of the Ashcroft Map Area* (Young et al, 1992). Twelve soil polygons comprised of seven distinct soil associations and components were identified within the Project (Figure 1). A summary of the typical physical and chemical characteristics and capability ratings of the soil associations identified within the Project area is provided in Table 1.

Figure 8 This report used the Canada Dept. of Agriculture. 1974 revised. The System of Soil Classification for Canada; Publications 1455. Ottawa. 255 pp. and the Canada Soil Survey Committee. 1978. The Canadian System of Soil Classification. Research Branch Canada Dept. of Agriculture, Publication 1646. Ottawa. 164 pp. The Soils of Ashcroft report uses outdated terms that do not appear in the Canadian System of Soil Classification (1998) as claimed in **Figure 3**.

Andrew (AD)
Sandy loam to gravelly textured Degraded Eutric Brunisols developed on gently rolling to hilly ablation moraine deposits, and generally occurring on drier southern aspects at lower elevations. Moderately to exceedingly stony. Dominated by grasses, forbs and shrubs.

Frances (FS)
Sandy loam to silt loam moderately alkaline Carbonated Black and/or Orthic Humic Regosols developed on fluvial deposits. Generally stone-free. Dominated by grass and forb vegetation.

Figure 9 Degraded and Carbonated are terms not used in the Canadian System of Soil Classification (1998). These terms carry over into Chapter 6. It seems clear that the authors of this appendix took all the soils information from the Ashcroft report.

Table 1. Typical characteristics of soil associations identified on the Ajax Project

Characteristics*	Andrew (AD)	Aylmer (AY)	Frances (FS)	Glimpse (GS)	Timber (TM)	Trapp Lake (TP)	Tullee (TE)
Parent Material	Moraine (Till)	Moraine (Till)	Fluvial	Fluvio-glacial	Moraine (Till)	Moraine (Till)	Moraine (Till)
Classification	Degraded Eutric Brunisol	Orthic Black Chernozem	Carbonated Black/Orthic Humic Regosol	Orthic Dark Brown Chernozem	Degraded Eutric Brunisol	Orthic/Lithic Dark Brown Chernozem	Orthic Black Chernozem
Texture	SL - LS	SL - LS	SL - SiL	LS	SiL - SiCL	SiL - SiCL	SiL - SiCL
Drainage	Well	Well	Moderate - Well	Rapid - Well	Well	Well	Well
Coarse fragments	Moderate - High	Moderate - High	Nil - Slight	Moderate - High	Slight - Moderate	Slight - Moderate	Slight - Moderate

Figure 10 The wording of the table caption suggests that the consultants did the work when this material is taken from the soils of Ashcroft Report.

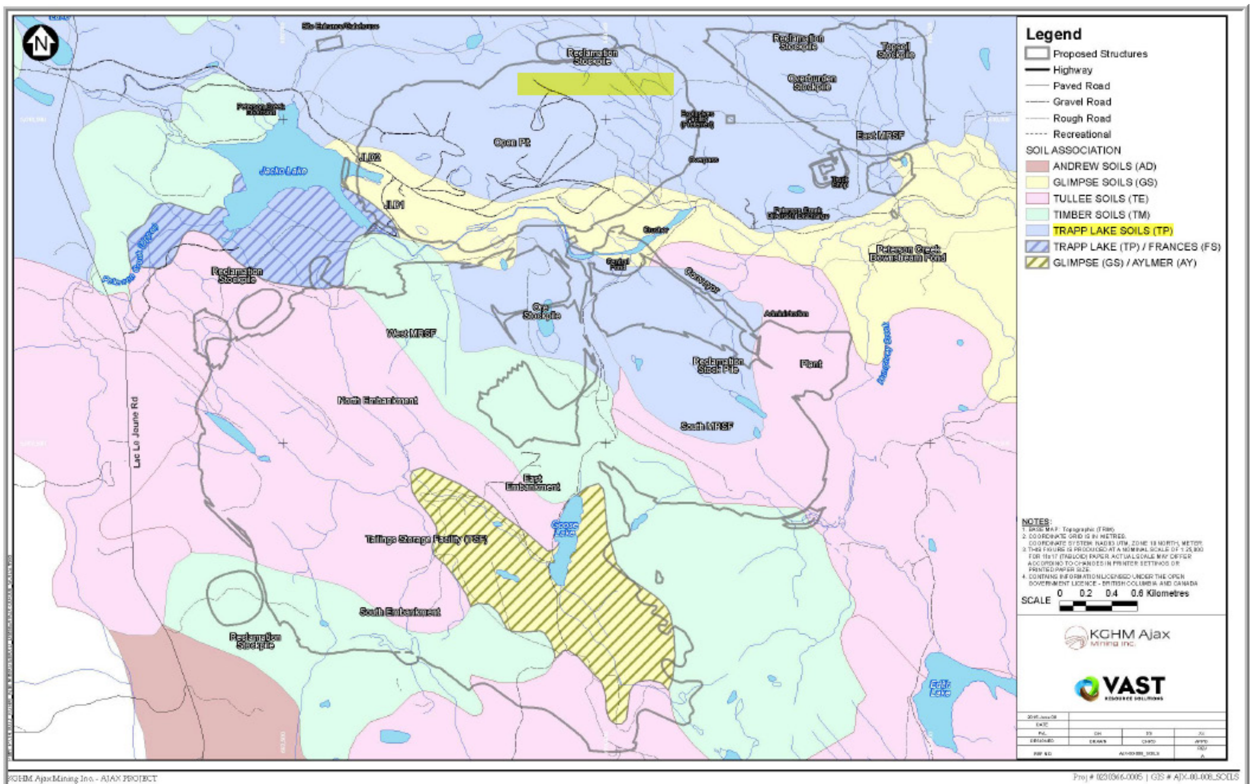


Figure 1. Soil associations within the Ajax Project site

Figure 10 The boundaries are identical to the Soils of Ashcroft Map sheet. They have merged soil associations of the same name and lost the soil association component the landform classification component and slope class component. This map has been generalized and detail has been lost. The Trapp Lake Soils (TP) highlighted in yellow in the Legend and blue at the top of the map containing the yellow highlight is an amalgamation of three TP units with different soil associations, landforms and slope class components. Why generalize the soils information when soils detail for this assessment should be at it highest level? The soils of Aschroft Report is a reconnaissance level report and generalized to begin with as shown in **Figure 11**.

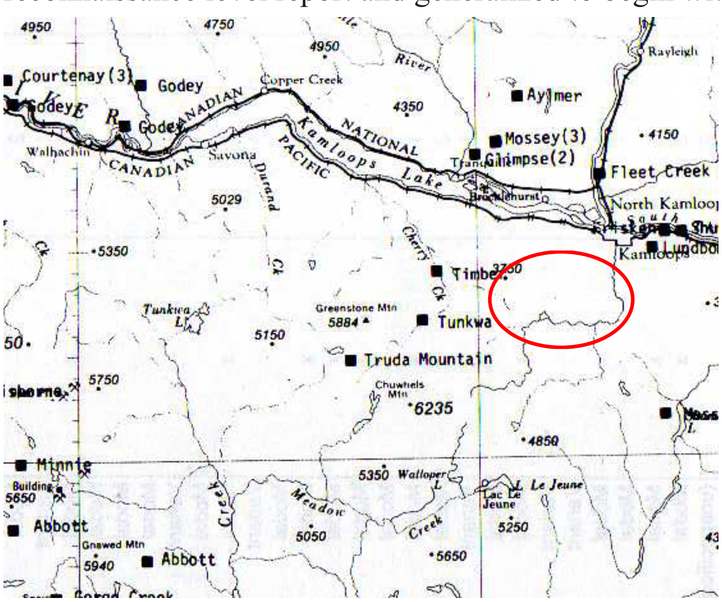
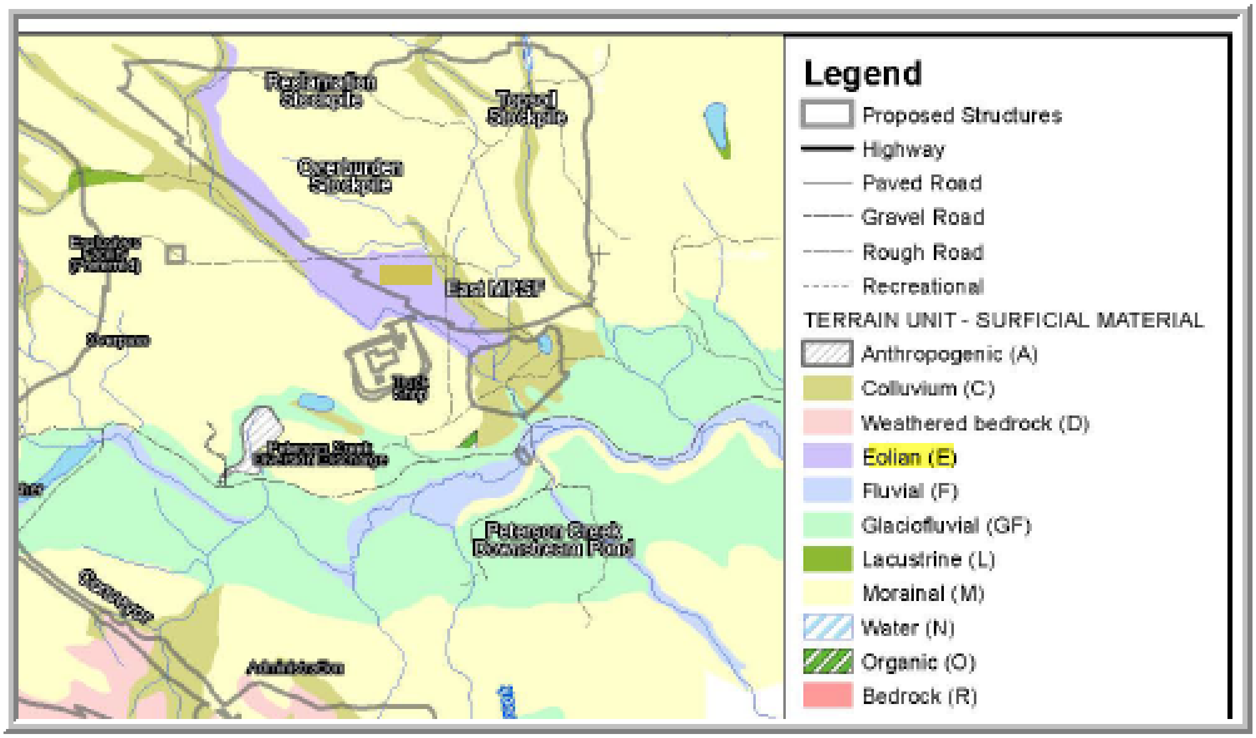


Figure 11 The map scale is 1:100,000. The square boxes are soil sample sites. There are no soil pits in Ajax study area (red ellipse). The soil mapping was done using aerial photographs and extrapolation of soil information from sites located, often, may kilometers away.

There is no evidence that any soil classification work was done but it was taken from the Soils of Ashcroft report.



deposition. In some instances there are accumulations of 1.5 metres of silt textured soil material with little or no coarse fragments. Brunisols are found in areas dominated by forest vegetation. They typically have a fragile, dusty, thin A horizon overlying a thicker, compact B horizon with loam to silt loam textures

Figure 12 This a portion of Figure 2 from Appendix 3 - E. The Eolian (wind blown silt from the "large glacial lacustrine benches") has the overburden stockpile sitting on top of it. Silt is highly mobile in water and is susceptible to erosion by water even at depth. Placing the overburden on this material is hazardous since the water that flows in existing streams and ground water may be forced to move in different directions that could lead to sub surface erosion and collapse of the stockpile.

4.3 Field Soil Characterization

In total 526 soil inspections were completed within the Project area to determine baseline soil characteristics. The target survey intensity level of SIL 1 was achieved, with an average of one inspection per 4.4 ha, sufficient for baseline soil mapping at the anticipated 1:5000 production scale. The following soil types, described in accordance with the Canadian System of Soil Classification, were identified:

- Orthic Dark Brown Chernozems
- Orthic Black Chernozems
- Eutric Brunisols (Degraded, Lithic)
- Carbonated Black and/or Orthic Humic Regosols
- Calcareous Anthropogenic materials associated with the former Afton mine operations

Figure 13 Where are these 526 soil inspection sites? They are not shown in this appendix. I have not found in any appendices any information where these sites are located. The Degraded and Calcareous terms are from the 1974 and 1978 classification systems not the 1998 as claimed. This raises questions on what was really done or more importantly the credibility of this report.

Table 2. Identified soil map units (SMU) for the Ajax Project

Soil Map Unit (SMU)	Represented Soil Associations and Components	Area (ha)	Total Volume (m3)	Average A horizon depth (cm)	Average B horizon depth (cm)
1	FS11, GS1	80.0	296,493	17.5	19.6
2	GS1, GS3	155.9	560,924	15.1	20.9
3	AY1, TP1, TE1, TE2	930.6	3,660,794	17.5	21.8
3K	AY1, TP1, TE1, TE2	110.7	409,691	20.3	16.7
4	AD2, TM5, TE4	167.2	613,846	13.9	22.8
5	AD2, TM5, TP5	80.3	287,515	20.3	15.5
6	n/a	157.7	n/a	n/a	n/a
99	n/a	22.6	n/a	n/a	n/a

Figure 14 The represented soil association and components are from the Soils of Ashcroft report and are not produced via the methods claimed in this report. The average horizon depths were obtained in the field. From this data the total volumes of top soil were determined for mine reclamation

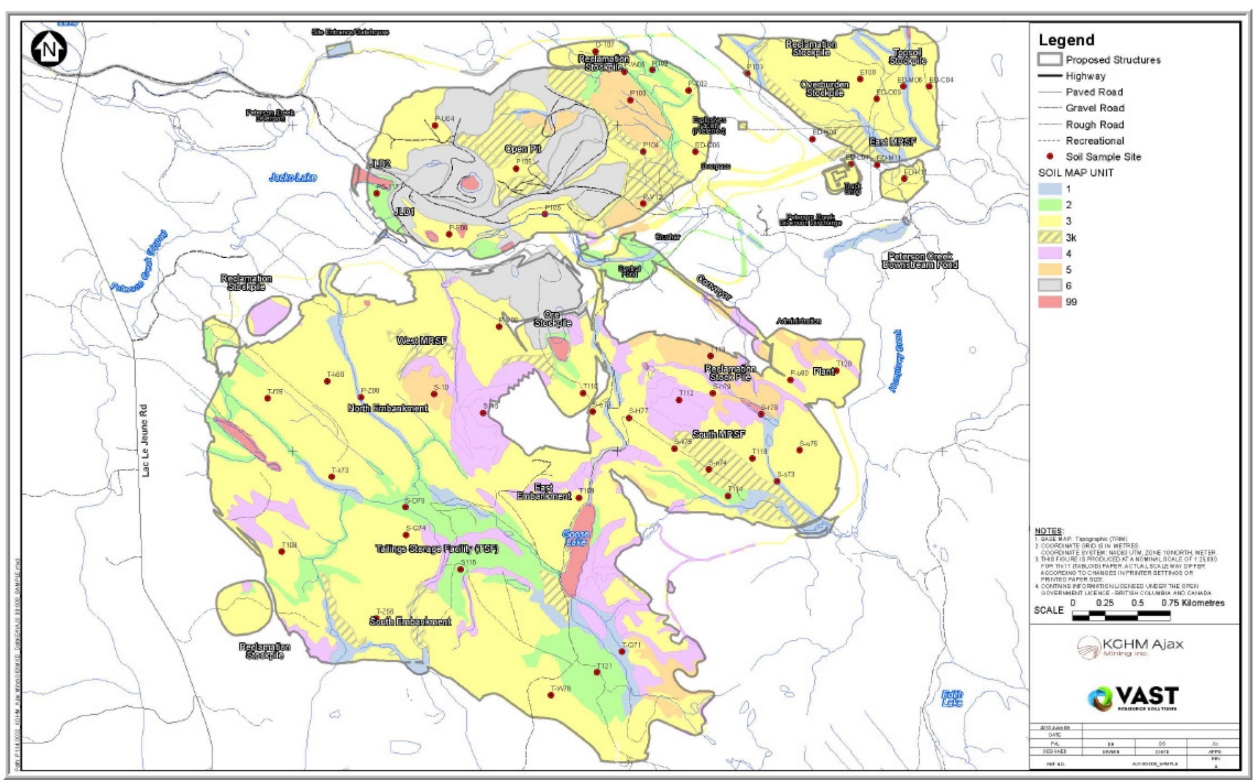


Figure 15 The red sample sites used to determine depth, lab textures and elemental composition.

RESULTS OF ANALYSIS	U 1			SMU 5
Sample ID	S-S73 A	S-S73 B	P-W05 A	P-W05 B
Date Sampled	24-AUG-14	24-AUG-14	20-OCT-12	20-OCT-12
Time Sampled	00:00	00:00	14:00	14:00
ALS Sample ID	L1508663-9	L1508663-10	L1229569-44	L1229569-45
Matrix	Soil	Soil	Soil	Soil
Physical Tests				
Loss on Ignition @ 375 C	10.7	3.4	12.3	2.7
Organic Matter	8.7	3.0	9.8	2.4
pH (1:2 soil:water)	7.06	7.69	6.89	7.56
Particle Size				
% Gravel (>2mm)	11.6	7.49	5.63	2.72
% Sand (2.0mm - 0.063mm)	17.3	16.2	23.7	14.2
% Silt (0.063mm - 4um)	61.6	60.3	61.6	59.6
% Clay (<4um)	9.50	16.0	8.91	23.5
Texture	Silt loam	Silt loam	Silt loam	Silt loam

Figure 16 There were 53 sample sites. Of those 32 soil texture analysis were done. The method was not given. 22 soil textures were silt loam. The average percent silt in the 22 silt loam textures was 53%. The average percent silt in all 32 sample was 47.5%

1. Average coarse fragment content is 13.5% for all 32 samples

2. 4,796,000 m^3 of top soil is going to be removed

3. 4,796,000 m^3 * 13.5% = 647,460 m^3 of coarse fragments (CF) (Particles > 2 mm)

4. 4,796,000 m^3 - 647,460 m^3 CF = 4,148,540 m^3 of soil (texture is % sand, silt and clay) (particles =< 2 mm)

5. The average % silt from all silt values is 47.5%.

6. 4,148,540 m^3 * 47.5% = **1,970,557 m^3 of silt** in the A and B horizons only.

There will be 5,959,837 m^3 of overburden removed. What geologists, in this case, refer to as overburden to a soil scientist is the C horizon. The C horizon is the parent material. Through soil forming processes the A and B horizons develop from the C horizon. Therefore the texture of the C horizon will have the same texture as the A and B. Based on our 47.5% silt from the A and B and 13.5% coarse fragments from the same two horizons we can calculate the % Silt in the overburden.

1. Average coarse fragment content is 13.5% for all 32 samples

2. 5,959,837 m^3 of C horizon (overburden) soil is going to be removed

3. 5,959,837 m^3 * 13.5% = 804,580 m^3 of coarse fragments (CF) (Particles > 2 mm)

4. 5,959,837 m^3 - 804,580 m^3 CF= 5,155,257 m^3 of soil (texture is % sand, silt and clay) (particles =< 2 mm)

5. The average % silt from all silt values is 47.5%.

6. 5,155,257 m^3 * 47.5% = **2,422,970 m^3 of silt** in the C horizon (over burden).

7. **1,970,557 m^3 of silt** (A and B) + **2,422,970 m^3 of silt** (C) = **4,393,527 m^3** of silt

8. A loam textured soil weighs 1.28 tons / m^3

9. **4,393,527 m^3 *** 1.28 tons / m^3 = **5,623,714 tons of silt**

This volume and weight of silt will be piled where? On the City of Kamloops border with Aberdeen **Figure 17**.

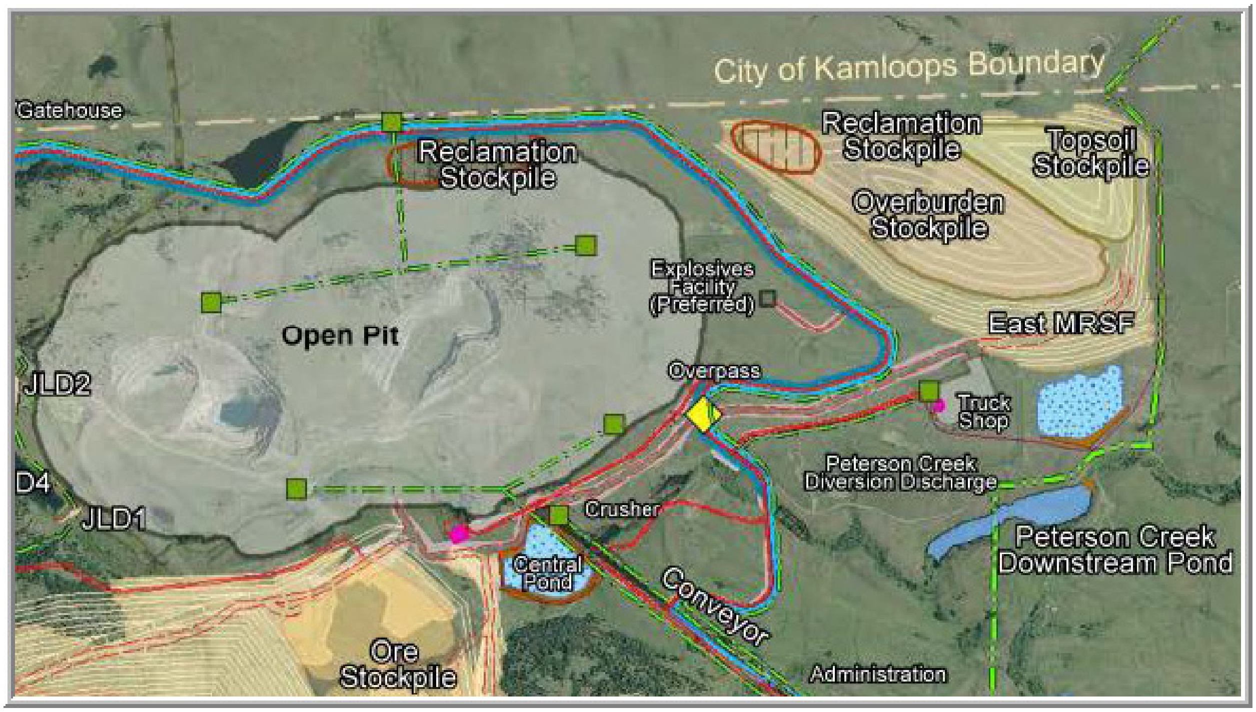


Figure 17 Reclamation, topsoil and overburden stock piles containing **4,393,527 m^3** of silt or **5,623,714 tons of silt** are located on the city boundary waiting to be blown into Aberdeen and the city.

However, the volume of topsoil and overburden to be stripped is significantly lower than the 16 Mt + 8 Mt of overburden and 30 Mt of topsoil (54 Mt total) to be piled on the EMRSF (Figure 20) from page 2 of Appendix 10.1-A Air Quality Technical Data Report. I will calculate the % silt using this figure data. I will do the best I can using information from the Ajax reports to calculate the tons of silt being created for each activity.

There is so much confusion and reporting of different figures in various places in these documents that trying to make sense and figure out what is exactly going on confusing and frustrating and clearly demonstrates incompetence on the author's parts not to coordinate and cross reference information.

5	Unpaved roads	Silt = 5% for haul roads Silt = 4.3% for access road W = mean vehicle weight
8	Bulldozing	Silt = 1.3% for rock Silt = 6.9% for ore Silt = 4.1% for pit M = moisture = 4%
9	Wind erosion	Silt = 1.3% for rock Silt = 11% for tailings Silt = 4% for ore p = 152 (days with precip/snow on ground) f = 17.7 % (wind more than 5.4 m/s)

Figure 18 This information is found in **Appendix E of Appendix 10 Air Quality Technical Data Report. Table E - 3 page 332.**

Silt = 5% for haul roads
Silt = 4.9% for access roads

Silt = 1.3% for rock
Silt = 6.9% for bulldozing ore
Silt = 4.1% for pit

Silt = 1.3% for rock
Silt = 11% for tailings
Silt = 4.0% for ore

Table 16-6: Life-of-Mine Production Schedule

Year	Waste (kt)	ROM Ore To Mill (kt)	ROM Ore To Stockpile (kt)	Total ROM (kt)	Re-handle Ore (kt)	Overburden Re-handle (kt)	Total Moved (kt)
-2	11,481	0	278	11,759	0	0	11,759
-1	31,685	5,500	1,781	38,966	1.440	0	40,406
1	66,111	20,692	3,620	90,422	3.033	0	93,456
2	79,676	22,907	6,486	109,070	818	0	109,888
3	63,996	23,606	18,474	106,076	119	7,300	113,495
4	86,509	16,736	6,302	109,547	6,989	5,234	121,769
5	73,788	14,276	3,063	91,127	9,449	2,000	102,577
6	68,775	21,552	4,307	94,634	2,173	3,500	100,307
7	83,672	23,725	110	107,507	0	0	107,507
8	83,520	23,702	792	108,015	23	0	108,037
9	83,949	22,945	0	106,894	780	0	107,674
10	71,394	23,718	2,529	97,641	7	0	97,674
11	72,608	23,725	2,310	98,643	0	0	98,643
12	64,299	23,725	4,290	92,314	0	0	92,314
13	59,387	19,916	0	79,303	3,809	0	83,112
14	70,918	9,073	10	80,000	14,653	0	94,653
15	43,068	23,712	11,131	77,910	14	0	77,924
16	9,878	23,014	1,213	34,104	711	0	34,816
17	5,443	17,075	0	22,518	6,650	0	29,168
18	0	0	0	0	16,028	0	16,028
Total	**1,130,156**	**359,598**	**66,695**	**1,566,449**	**66,695**	**18,034**	**1,641,178**

Note: ROM = run of mine; kt = thousand tonnes

Figure 19 This table is found on page 128 of the KGHM Ajax Project NI 43 - 101 Technical Report Feasibility Study Update. Effective Date February 19, 2016. There is data in this table not included in the Application so the data is not admissible and the government agencies are not required to review this study as it is not in the original application. There is another 18,034,000 tons of overburden/topsoil not included, in the application, that will be added to the East Waste Rock Dump in years 3 to 6. Also the ore low and medium grade rehandling was not included in the Application. With the silt values from **Figure 18** we can still calculate some volumes.

Using data provided in **Figure 17** and **Figure 18** we can make some silt volume estimates from a number of sources. I cannot calculate the volume OD silt generated by bulldozing and vehicle traffic.

The additional 18,034,000 tons additional topsoil and overburden will be added in years 3 - 6 (Figure 19)

1. Average coarse fragment content is 13.5% and silt content for top soil and overburden is 47.5%.

2. 18,034,000 tons additional topsoil and overburden will be added in years 3 - 6

3. 18,034,000 tons * 13.5% = 2,434,590 tons coarse fragments

4. 18,034,000 tons - 2,434,590 m^3 CF = 15,599,410 tons of soil

6. 15,599,410 tons * 47.5%= **7,409,720 tons of silt** in the top soil and overburden will be added to the East Waste Rock Dump in years 3 to 6.

The 54,000,000 tons of topsoil and overburden report in Figure 20

1. Average coarse fragment content is 13.5% and silt content for top soil and overburden is 47.5%.

2. 54,000,000 tons topsoil and overburden from **Figure 20**

. 54,000,000 tons * 13.5% = 7,290,000 tons coarse fragments

4. 54,000,000 tons - 7,290,000 m^3 CF = 46,710,000 tons of soil

6. 46,710,000 tons * 47.5%= **22,187,250 tons of silt** in the top soil and overburden will be added to the East Waste Rock Dump

Silt generated from waste rock. (Figure 19)

1. 1,130,156,00 tons * 1.3% for rock = **14,692,028 tons of silt**

Silt generated from ore re-handling (not included in mill feed in (Figure 19).

1. 66,695,000 tons * 4.0% for ore = **2,667,800 tons of silt**

Introduction
August 24, 2015

Mine rock will be hauled via haul truck to the mine rock storage facilities (MRSFs). Mine rock will not be crushed by the primary crusher. A dozing and spreading system will fill the proposed MRSF as indicated below:

- Main Embankment 1,012 masl (year -2) – 1,060 masl (year 17) – receives a total of 161 Mt
- East Embankment 975 masl (year -1) 1,060 masl (year 8) – receives a total of 17 Mt
- South Embankment
- South MRSF (SMRSF) (421 Mt of mine rock), final elevation 1,235 masl
- East MRSF (EMRSF)(57 Mt of mine rock), final elevation 1,030 masl
- TSF MRSF 915 masl (year -2) – 1,095 masl (year 17) – Receives a total of 226 Mt
- 16 Mt will be in the overburden stock pile on the north side of the EMRSF, final elevation 990 m
- 8 Mt will be at the reclaim stock pile at the northeast edge of the pit

A total of 30 Mt of topsoil will be stored in the Topsoil Stockpile collocated to the southeast of the EMRSF.

Figure 20 This data is from page 2 of Appendix 10.1 Air Quality Technical Data report. There are 54 Mt of topsoil and overburden that is far higher than the tonnage reported in Appendix 3 - E.

Silt generated from Mill feed and Ore to Stockpile (Figure 19).

1. 359,598, 000 tons to mill + 66,695,000 tons to stock = 426,293,000 tons

2. 426,293,000 tons * 4.0% for ore = **17,051,720** tons of silt

Silt generated from tailings pond 11% is too low and unrealistic. A professional estimate is more like 40% and it will probably be higher.

1. 426,293,000 tons of ore will go to the mill. 1% will be concentrated.

2. 426,293,000 tons * 1% = 4,262,930 tons of concentrate

3. 426,293,000 tons - 4,262,930 tons of concentrate = 422,030,070 tons to tailings pond

4. 422,030,070 tons * 40% silt for tailings (Figure 18) = **168,812,028** tons of silt

Silt generated from bulldozing ore

1. Total bulldozing of ore including re-handling is 492,988,000 tons from Figure 19

2. 492,988,000 tons * 6.9% for bulldozing ore = **34,016,172** tons of silt

Silt Totals in Tons

From Appendix 3 - E	**7,594,271 tons of silt**
Additional topsoil	**7,409,720 tons of silt**
The 54,000,000 tons of topsoil and overburden	**22,187,250 tons of silt**
Silt generated from waste rock.	**14,692,028 tons of silt**
Silt generated from ore re-handling	**2,667,800 tons of silt**
Silt generated from Mill feed and Ore to Stockpile	**17,051,720** tons of silt
Silt generated from tailings pond	**168,812,028** tons of silt
Silt generated from bulldozing ore	**34,016,172** tons of silt
Total	**274,430,989 tons of silt**

I read some where that the mine life was to be 20 years but have also heard that the life is 23 years.

274,430,989 tons of silt / 20 years / 365 /days/year = 37,593 tons of silt will be produced on average per day

These figures do not include silt created by blasting and hauling!

Tons per day were for operations and construction were calculated from the tables in Figures 20A and 20B

37,593 tons of silt / day + 432 tons silt / day for construction + 1,714 tons / day for operations = 39,739 tons silt / day. (Is blasting included in this?) .

A loam textured soil weighs 1.28 tons / m^3

In cubic meters that is 39,739 tons / 1.28 tons / m^3 = 31,046 m^3 silt / day

An average bath tub filled 5 times = 1 m^3 5 * 31,046 m^3 is equal to filling your bath tub **155,230** times in one day.

Table 4-5 Construction Hourly, Daily and Annual Total Emission Rates (tonnes/year)

Source Group or Activity	Time Duration	Emission Rates (tonnes/year)					
		TSP	PM_{10}	$PM_{2.5}$	SO_2	NO_X	CO
Open Pit	Hourly	-	-	-	0.3	169.3	116.5
	Daily	99.0	54.8	12.1	0.2	168.4	112.7
	Annual	54.4	25.8	6.0	0.1	89.9	60.7
Ore Storage/ Processing	Hourly	-	-	-	0.1	50.5	45.0
	Daily	88.7	56.0	10.6	0.1	50.5	45.0
	Annual	66.6	39.6	7.3	0.06	31.3	27.8
MRSF/ Overburden/ Reclamation Stockpiles	Hourly	-	-	-	0.2	101.1	90.0
	Daily	84.5	47.2	11.7	0.2	101.1	90.0
	Annual	74.7	39.7	8.9	0.1	62.7	55.6
Roads	Hourly	-	-	-	0.6	307.5	259.2
	Daily	332.5	94.2	19.9	0.4	242.4	193.8
	Annual	193.4	55.2	12.0	0.3	143.2	119.3
Total	**Hourly**	**-**	**-**	**-**	**1.2**	**628.5**	**510.7**
	Daily	**604.6**	**252.2**	**54.3**	**1.0**	**562.5**	**441.5**
	Annual	**389.2**	**160.2**	**34.2**	**0.6**	**327.2**	**263.3**

NOTES:
"-" = not applicable
All emission rates presented here are based on rates in grams per second (see **Appendix E**). For averaging periods less that 24-hour the hourly emission rates are used, for the 24-hour averaging period the daily emission rates are used, for the annual averaging period the annual emission rates are used.

Figure 20A I'm not sure how this table works. How can the construction daily rate be 99 tons / day and the annual rate be 54.4 tons for open pit. How can roads be 332.5 tons per day and annual be 193.4 tons?

Open pit and roads construction daily silt rates make sense with the numbers calculated on the page 14 and have been added to the daily silt level

1. 99 tons / day + 332.5 tons / day = **432 tons silt / day** for roads and pit construction

Having to search, calculate through different documents tables etc. attests to the convoluted nature on how information is presented in this entire report.

Table 4-6 Operations Hourly, Daily and Annual Emission Rates (tonnes/year)

Source Group or Activity	Time Duration	Emission Rates (tonnes/year)					
		TSP	PM_{10}	$PM_{2.5}$	SO_2	NO_X	CO
Open Pit	Hourly	-	-	-	1.3	665.9	444.4
	Daily	524.0	339.6	63.3	0.8	662.4	429.5
	Annual	301.8	193.2	40.7	0.7	517.3	331.8
Ore Storage/ Processing	Hourly	-	-	-	0.1	58.9	50.7
	Daily	143.7	78.3	15.0	0.1	58.9	50.7
	Annual	117.0	60.1	9.2	0.08	42.5	37.5
MRSF/ Overburden/ Reclamation Stockpiles	Hourly	-	-	-	0.2	118.1	101.7
	Daily	80.0	46.5	12.3	0.2	118.1	101.7
	Annual	69.1	38.3	9.8	0.2	85.2	75.2
Tailings Beach	Hourly	-	-	-	0.0	0.0	0.0
	Daily	77.6	36.6	5.6	0.0	0.0	0.0
	Annual	32.2	15.3	2.3	0.0	0.0	0.0
Roads	Hourly	-	-	-	1.1	797.5	561.8
	Daily	1189.9	329.3	60.7	1.0	732.2	495.9
	Annual	697.2	197.5	41.7	0.8	577.7	392.2
Total	**Hourly**	**-**	**-**	**-**	**2.7**	**1,640**	**1,159**
	Daily	**2,015**	**830.3**	**156.9**	**2.2**	**1,572**	**1,078**
	Annual	**1,217**	**504.4**	**103.6**	**1.7**	**1,223**	**836.8**

NOTES:

"-" = not applicable

All emission rates presented here are based on rates in grams per second (see **Appendix E**). For averaging periods less that 24-hour the hourly emission rates are used, for the 24-hour averaging period the daily emission rates are used, for the annual averaging period the annual emission rates are used.

Figure 20B I'm not sure how this table works. How can the operations daily rate be 524 tons / day and the annual rate be 302 tons for open pit. How can roads be 1190 tons per day and annual be 697 tons?

Open pit and roads daily operation silt rates make sense with the numbers previously calculated and have been added to the daily silt level

1. 524 tons / day + 1190 tons / day = 1**714 tons / day** for roads and pit for operations have been added to the daily silt volume on page 14.

Having to search, calculate through different documents tables etc. attests to the convoluted nature on how information is presented in this entire report.

Chemical analysis was done for metals in Appendix 3 - E. The results are sumarized here. Also presented is comparison metal analysis work done at Thompson Rivers University **(Figures 21 and 22).**

	CCME Soil Quality Guidelines *		Avg. Crustal		
Metals (ppm)	Agriculture	Industrial	Abundance **		
Aluminum (Al)			82,300	20100	21900
Antimony (Sb)	20	40	0.2	0.35	0.53
Arsenic (As)	12	12	1.8	7.07	7.45
Barium (Ba)	750	2000	425	188	221
Beryllium (Be)	4	8		0.52	0.43
Bismuth (Bi)			0.0085	<0.20	<0.20
Boron (B)	2	no data	10	5.5	8.2
Cadmium (Cd)	1.4	22	0.15	0.165	0.147
Calcium (Ca)			41,500	9260	11300
Chromium (Cr)	64	87	102	41.0	55.3
Cobalt (Co)	40	300	25	14.2	17.9
Copper (Cu)	63	91	60	70.2	108
Iron (Fe)			56,300	30100	42300
Lead (Pb)	70	600	14	5.16	4.47
Lithium (Li)				9.7	9.4
Magnesium (Mg)			23,300	8410	11500
Manganese (Mn)			950	705	811
Mercury (Hg)	6.6	50	0.085	0.0217	0.0322
Molybdenum (Mo)	5	40	1.2	0.80	0.75
Nickel (Ni)	50	50	84	35.1	54.3
Phosphorus (P)			1,050	1090	956
Potassium (K)			20,850	3290	2940
Selenium (Se)	1	2.9	0.05	0.27	0.25
Silver (Ag)	20	40	0.075	<0.10	0.11
Sodium (Na)			23,550	360	304
Strontium (Sr)			370	113	86.2
Thallium (Tl)	1	1	0.85	0.130	0.093
Tin (Sn)	5	300		<2.0	<2.0
Titanium (Ti)			5,650	988	1100
Uranium (U)	23	300	2.7	0.556	0.428
Vanadium (V)	130	130	120	98.1	153
Zinc (Zn)	200	360	70	61.9	61.9
Zirconium (Zr)				8.3	5.5

Figure 21 This is a portion of the metal analysis from Appendix B pg 28 from Appendix 3 - E. Elements that were above Canadian Council of Ministers (CCME) guidelines for baseline metals. Elements are highlighted in yellow if they are over the Above Agriculture use guidelines and in orange if they are over the Industrial use guidelines.

The following were over the Agriculture use guidelines; boron, chromium, copper, nickel, vanadium.

The following were over the Industrial use guidelines; chromium, copper, nickel, vanadium.

Cadmium and Zinc were below guidelines.

Jmaiff, Lindsay. 2014. Determination of the concentration and distribution of Cd, Cu, Fe, Mo, Pb, and Zn in the soil of twenty-six different sites located in Kamloops, British Columbia, Canada. The results of this study are presented next **(Figure 22)**.

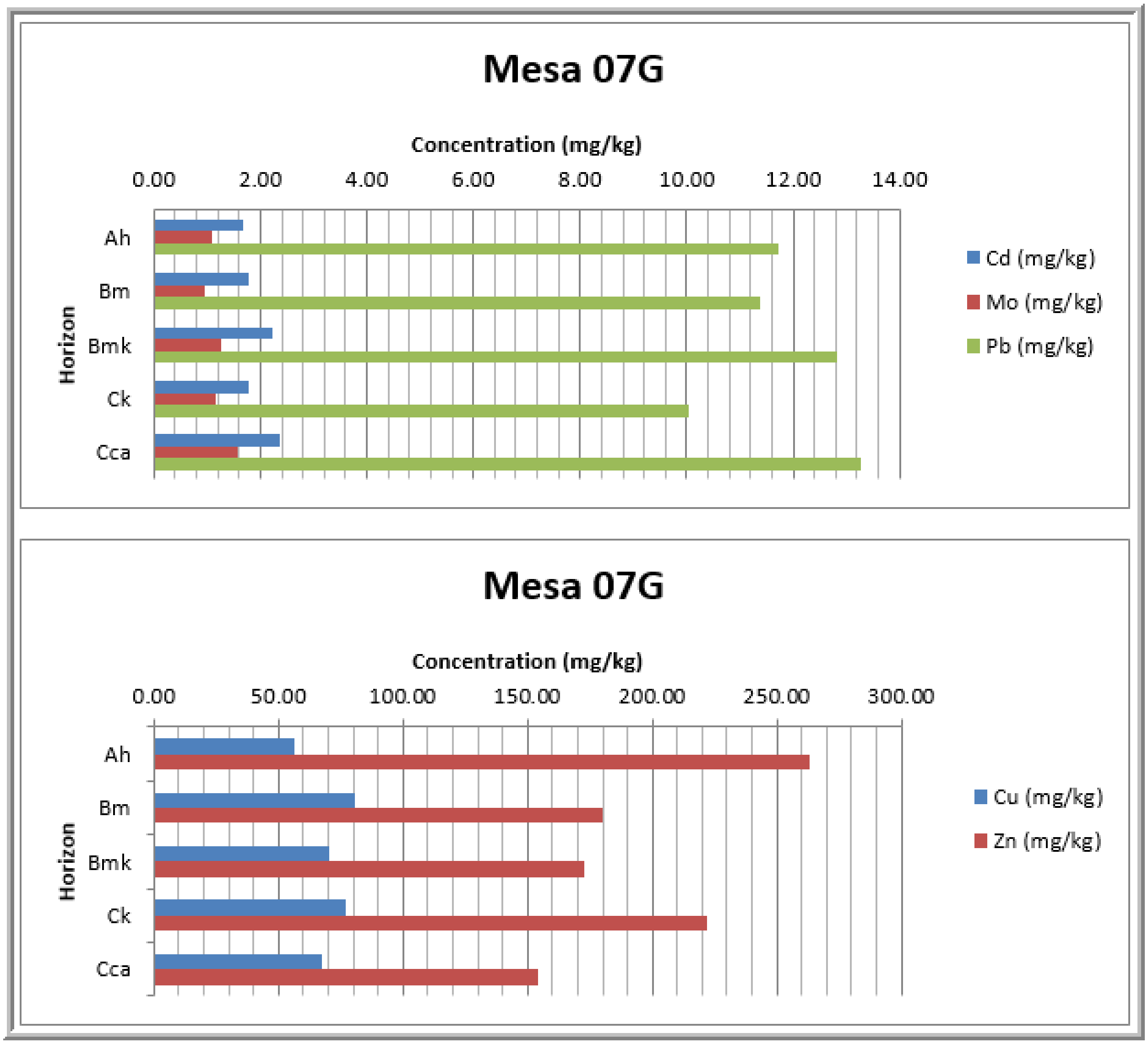


Figure 22 This is one set of graphs for two sites. The sites were located around Kamloops. Lindsay's results showed that copper was above both the Agriculture and industrial limits **(Table 1)**. Cadium and zinc were above the Agriculture limits while the data from Appendix 3 - E showed values below the agriculture limits. The question is why the discrepancy. At TRU we do not have the equipment to run the other elements. However, a source of funding may be available to complete the work.

	Ag	Ind	Parts Per Million or mg/kg
Cd	1.4	22	26 samples above Ag – 26 below Ind (2.0 – 8.1)
Cu	63	91	1 below Ag – 25 above Ag – 20 above Ind (70 – 1000)
Mo	5	40	25 below Ag – 1 above Ag (1.6 – 3.8)
Pb	70	600	26 below Ag (13 – 38)
Zn	200	360	3 below Ag (169 - 185) – 23 above Ag (210 – 348)

Table 1 Lindsay Jamiff elemental analysis results. Ajax should have done work outside the mine area to establish a true metal baseline for Kamloops

This section deals with the slide hazard in Aberdeen

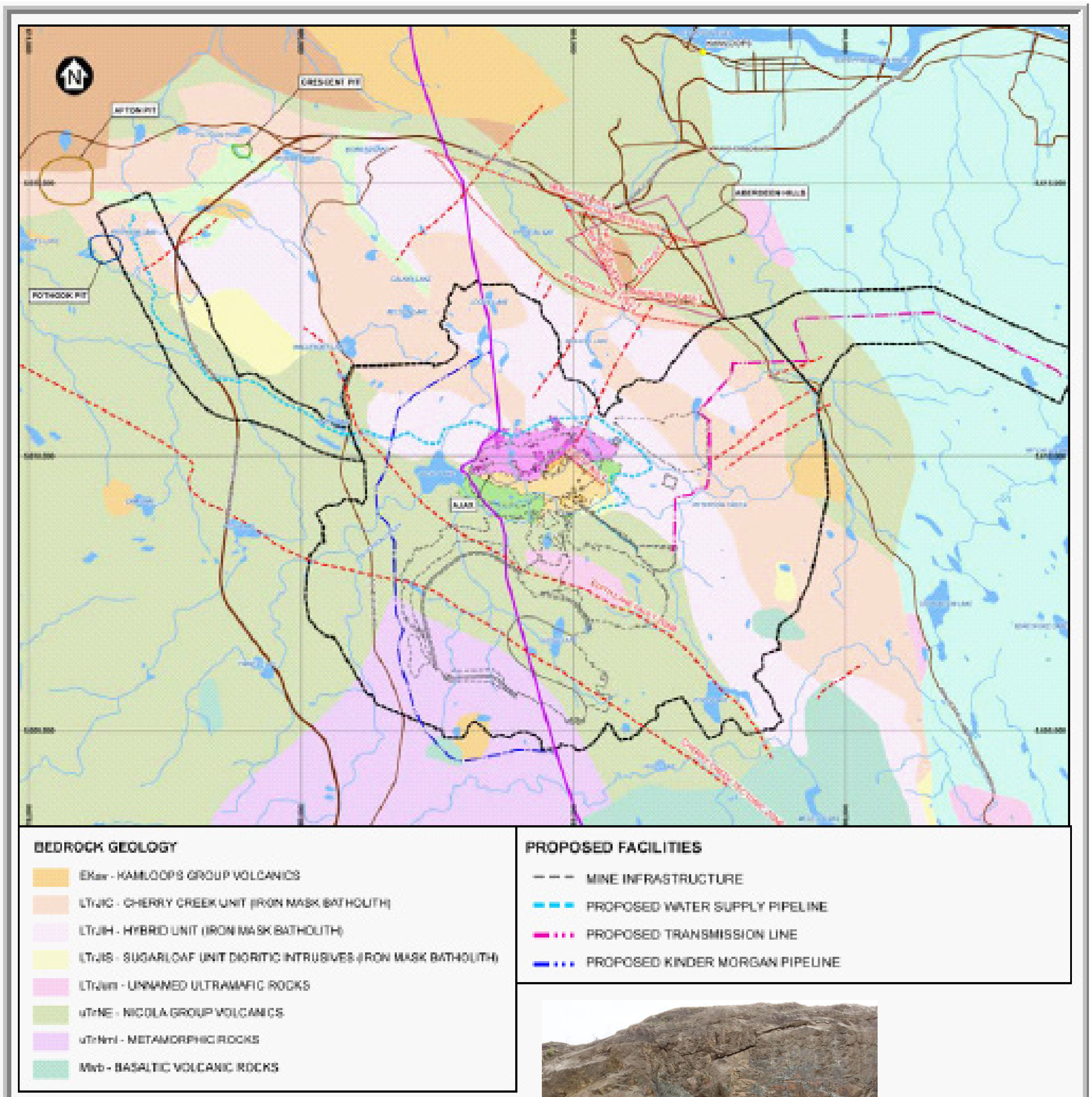


Figure 23 The Kamloops Group and the picrite unit of the Nicola Group are historically prone to landslides. The Kamloops Group occurs in the Aberdeen Hills subdivision. The slides are bounded by a network of faults. There are a number of faults that connect the mine site with the fault system in Aberdeen. **Figure 23** shows a fault above Costco and shows that water moves along fault zones.

Figure 23a Fault above Costco in Kamloops showing water moving through it. The photograph was taken April 5, 2016.

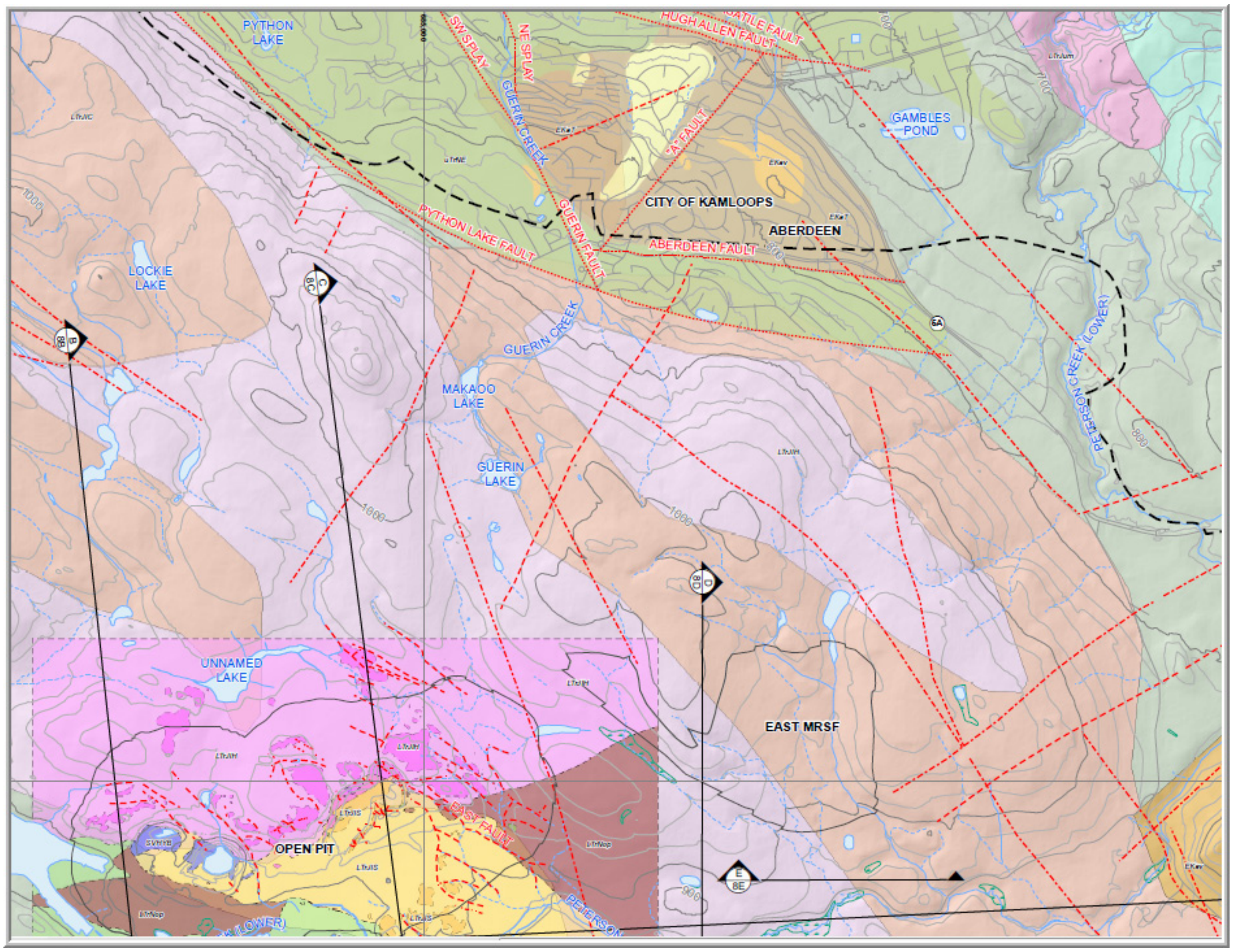


Figure 24 This map shows the faults in more detail and shows a swarm of faults in the pit area.

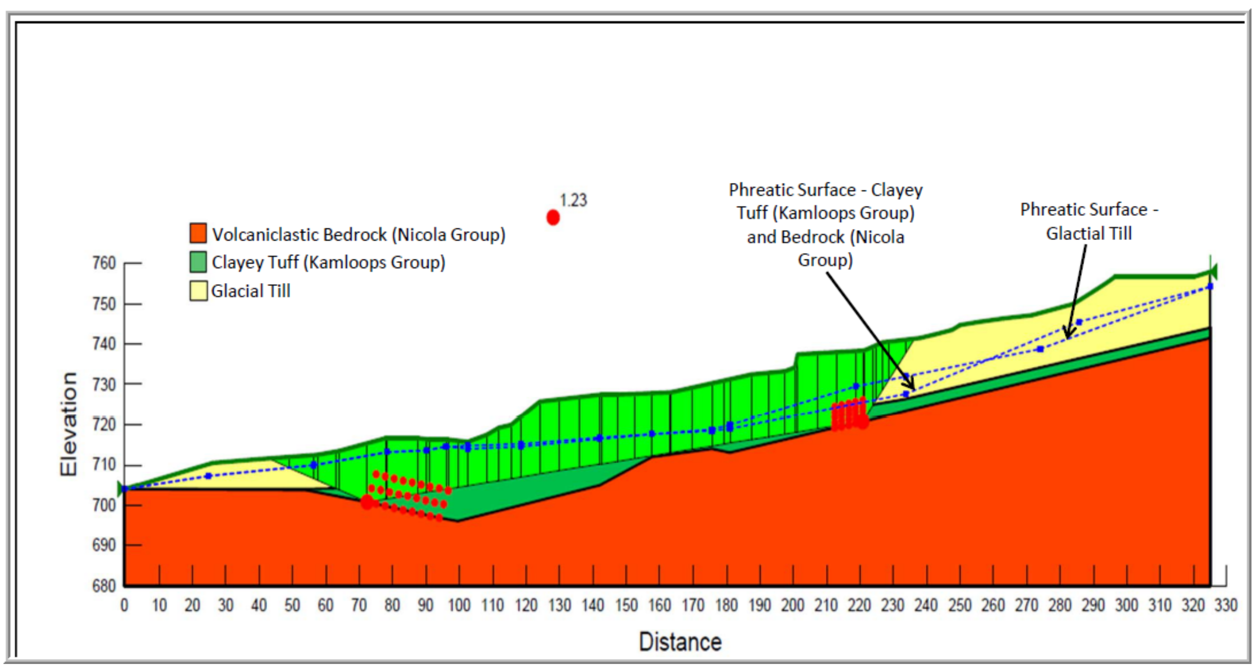


Figure 25 Kamloops group - montmorillonite shrink swell clay is unstable.

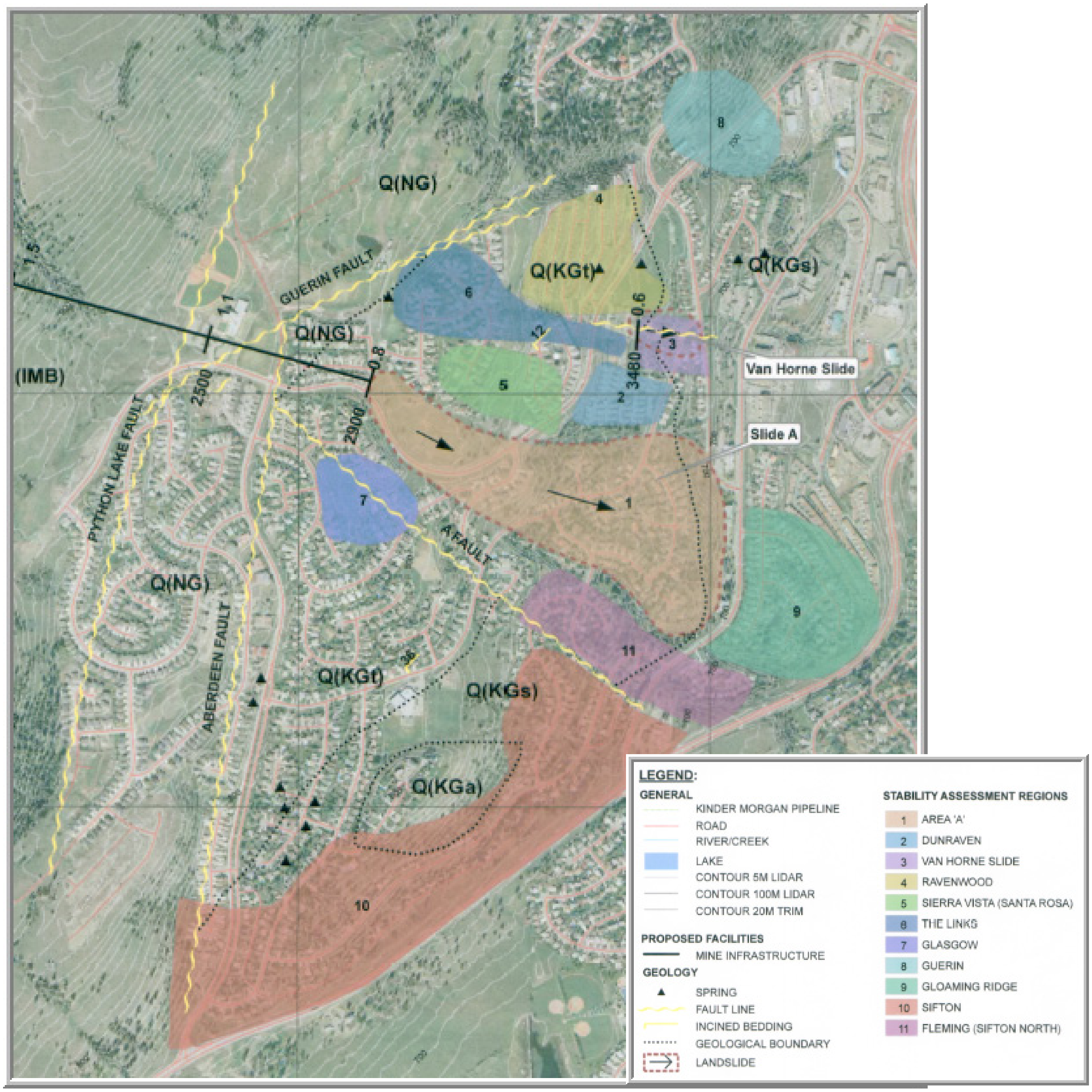


Figure 26 The fault and slide map showing the Aberdeen slides. There are 6 slides. Five developed in the past 30 years. Initially there were 11 wells established to drain the water. Now there are now 30. Appendix 6.2-D discusses the effects of blasting and pore water pressure. There does not appear to be a discussion between the relationship to faults and water? There are also natural springs in the area.

I have lived in Kamloops since 1979 and as a soils specialist and from experience have observed in many places around the city that when development takes place the ground water flow often changes direction.

The Following statements were taken from Appendix 6.2.D. The highlighted sentences raise concerns with regard to uncertainty. The modelling was not done using the data from a full production blast.

Kamloops Group – Tertiary - Tranquille Formation (Tuffaceous Member - KGt): The succeeding tuffaceous member consists of bedded, brown-weathered, tuffaceous wacke with interbedded shale and siltstone, and light grey to buff, crudely bedded felsic tuff. The fine-grained units are intensively weathered to soft montmorillonite-rich clays. The beds generally have the same northeast dip direction and similar dips as the natural slopes.

Slope stabilization measures have been implemented in the Van Horne Stability Region since 1996. These measures comprise about half the de-watering wells in the Aberdeen Hills area. However, the results of the slope stability analyses undertaken indicate the Van Horne Stability Region has not met the stability target FoS of 1.3. The installed pumping well system is required to work effectively in a continuous manner in order to maintain large scale slope stability in this area. Golder's 2009 report indicates that the impact of pumped wells in reducing ground water pressures within the Van Horne Stability Region is hampered by the low permeability of the ground, resulting in the piezometric levels remaining relatively high. The report also concludes that it is unlikely that the target FoS can be achieved without a significant increase in the number of operating wells. Golder recommends that an alternate long-term mitigation strategy that is not reliant upon continuous close monitoring be identified and implemented.

The methodology used to determine the PPVc value for the Van Horne Stability Region in relation to the proposed production blasting assumes a blast vibration of 30 Hz. Considering that frequency measurements of 8 to 12 Hz were made at a distance of 500 m during the Orica trial blast and that the distance of the Van Horne Stability Region to the proposed Open Pit (approximately 3.5 km), it is possible that blast vibrations will have attenuated to frequencies lower than 30 Hz at the Van Horne Stability Region. The published methodology used in this assessment (Wong and Pang, 2000) does not account for blast frequencies of <30 Hz; nonetheless, it is possible to gauge the expected influence of using a frequency of 15 Hz on the PPVc by determining the difference in the output K_a value for the single degree of freedom model. For the single degree of freedom model, the output K_a value is determined from a plot of K_a vs. S/H for a horizontal bedrock model, where S= shear wave velocity and H = slope height. At the S/H value (5 s^{-1}), there is negligible change in K_a and, hence, a negligible change in PPV_c when the input frequency reduces from 30 Hz to 15 Hz for the single degree of freedom model. Based upon this comparison, the output K_a value and PPV_c values obtained with the multi-degree of freedom model are unlikely to change significantly for the lower far-field frequencies.

7 – RECOMMENDATIONS

It is recommended that the limitations and uncertainties described above be managed by setting conservative alarm levels for blast vibrations and excess PWP and by undertaking monitoring throughout production blasting as part of an adaptive management plan that facilitates immediate changes to the blast design to account for the possibility of these levels being exceeded.

In conclusion, there is not expected to be any significant adverse effect of the proposed production blasting for the Ajax Project on the existing slopes in the Aberdeen Hills area. Inevitably, there are some limitations with the method of assessment used in this study as well as the method used in the City of Kamloops' risk management plan. The former limitations are, to some extent, countered by the fact that the use of the pseudo-static approach tends to produce somewhat conservative results when applied to blast vibration scenarios since blast vibrations are characterized by relatively high frequencies compared with earthquakes (as discussed in Wong and Pang, 2000). However, considering the relatively large distance from the Open Pit, the production blast vibration frequencies at the Van Horne Stability Region might be somewhat less than the interpreted value of 30 Hz. The published methodology used in this study does not account for undertaking analyses for frequencies of < 30 Hz.

The slide hazard raises concerns. Human lives are at stake. Is it worth the risk? Especially tsince the van Horne slide has not met the FoS stability requirement.

This section looks at soil scatch pit sampling and the results. **Figure 27**shows the way point location map. It also has other unidentified sample sites, black and white circles. Where is the data from these sites.

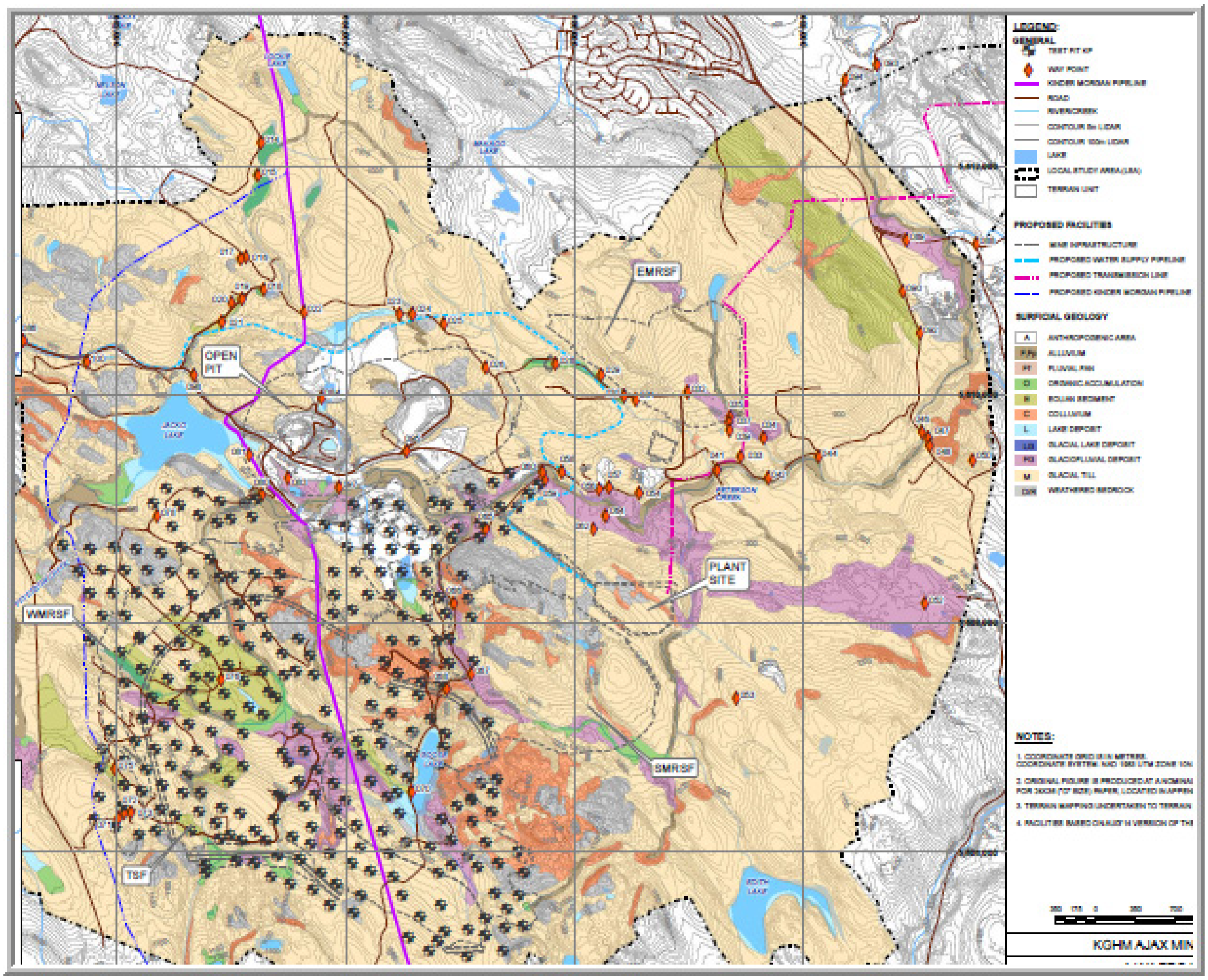


Figure 27 The way points for the information shown in **Figure 26** are red diamonds. 75 scratch pits were done. They were not classified to the Canadian System of Soil Classification (1998) texture class names

Field Truthing Location	Description
WP 1	Exposure in 7 m high roadside Cut Slope: Hard brown grey SILT, some sand, some subangular to subrounded fine to coarse gravel, trace subrounded cobbles (Till)
WP 2	Exposure in 5 m high roadside Cut Slope: Hard brown grey SILT, some sand, some subangular to subrounded fine to coarse gravel, trace subrounded cobbles (Till). Gully erosion.
WP 3	Dense brown SILT, some sand, some subangular to subrounded fine to coarse gravel, trace subrounded cobbles (Till)
WP 4	Stiff grey brown gravelly SILT, trace sand, trace subrounded cobbles; gravel is subangular to subrounded and fine to coarse (Till)
WP 6	Pit to 0.4 m: 0 to 0.3 m: Stiff, friable, dark grey organic SILT with many roots, 0.3 to 0.4 m: Stiff light grey friable SILT (Glacial Lake Deposit?)
WP 8	Pit to 0.5 m: Firm to stiff dark grey friable SILT with many roots.
WP 10	Dense brown SILT, some fine sand, some subrounded to subangular fine to coarse gravel, trace cobbles (Till)
WP 11	Very stiff brown grey SILT, some fine sand, some subrounded to subangular fine to coarse gravel (Till)

Figure 28 There were 75 sample sites taken along roads. 31 sites were classified as silt and 34 sites were sand. Incorrect CSSC (1998) soil terms were used such as dense, stiff, very stiff, some sand, organic silt, trace cobbles, some gravel, etc. The legend for these terms was found in **Appendix 6.6-A** and not in **Appendix 6.2.A** where they belonged. The legend is shown in **Figure 29.** This lead to confusion when legends and figure captions are no included in reports. It is clear that hand texturing was not done. Clay is rarely mentioned in any soils documents I have looked at. This information is useless from a soil classification standpoint.

	Soil Description	SPT 'N' Value	Field Test/Identification
Cohesive Soils	Very Soft	<2	Easily penetrated several inches by fist
	Soft	2 - 4	Easily penetrated several inches by thumb
	Firm	4 - 8	Can be penetrated by thumb with moderate effort
	Stiff	8 - 15	Can be penetrated by thumb but only with great effort
	Very Stiff	15 - 30	Readily indented by thumbnail
	Hard	>30	Indented with difficulty by thumbnail
Granular Soils	Very Loose	0 - 4	None
	Loose	4 - 10	Easily penetrated by 13 mm rod pushed by hand
	Compact	10 - 30	Easily penetrated by 13 mm rod driven by hammer
	Dense	30 - 50	Penetrated by 13 mm rod driven by hammer
	Very Dense	>50	Penetrated few cm's by 13 mm rod driven by hammer

Figure 29 This is not the CSSS 1998 consistence legend. The CSSC consistence classes use some of the same terms (very soft, soft, firm and loose). Otherwise I had no idea if the surveyors knew what they were doing.

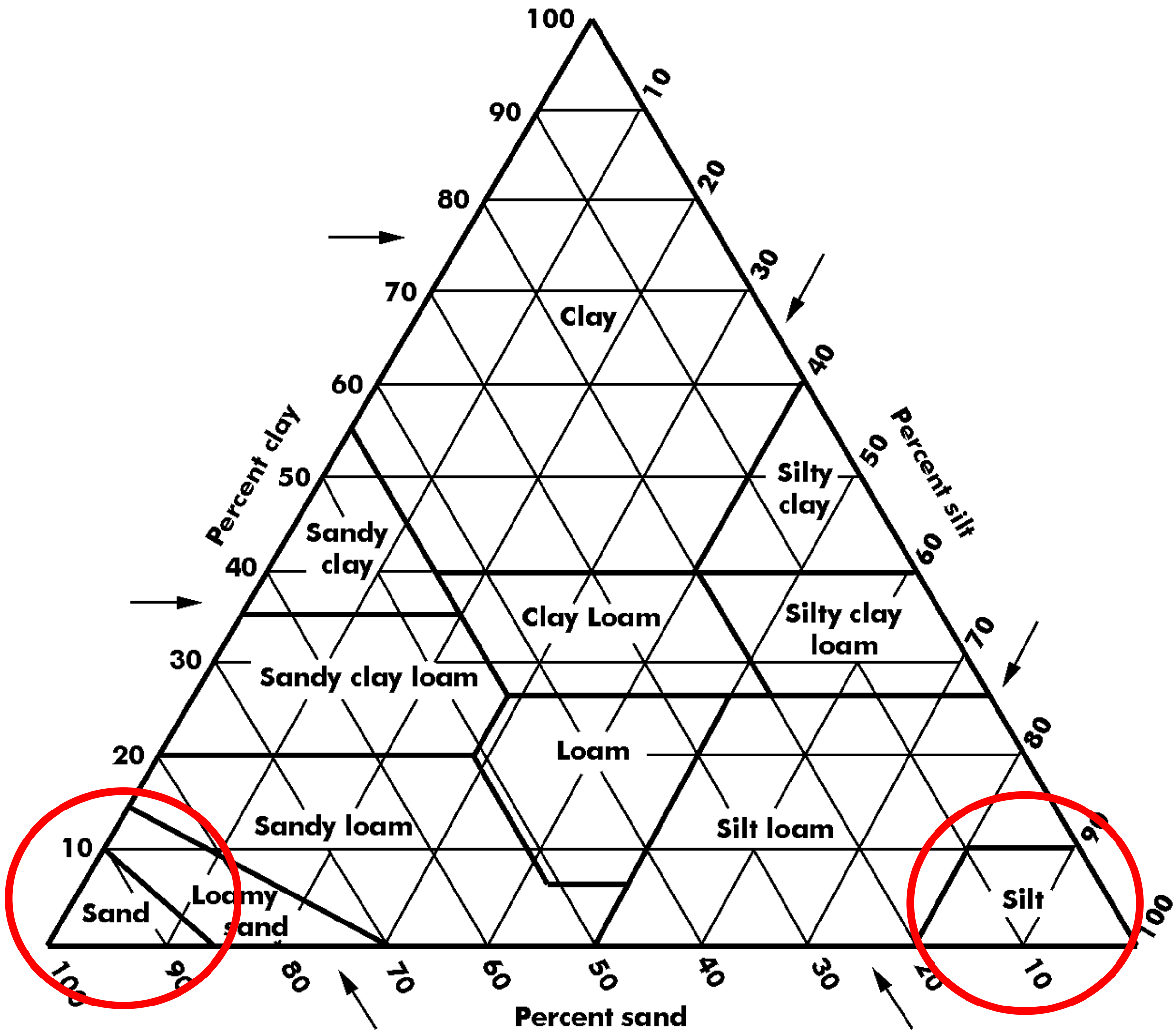
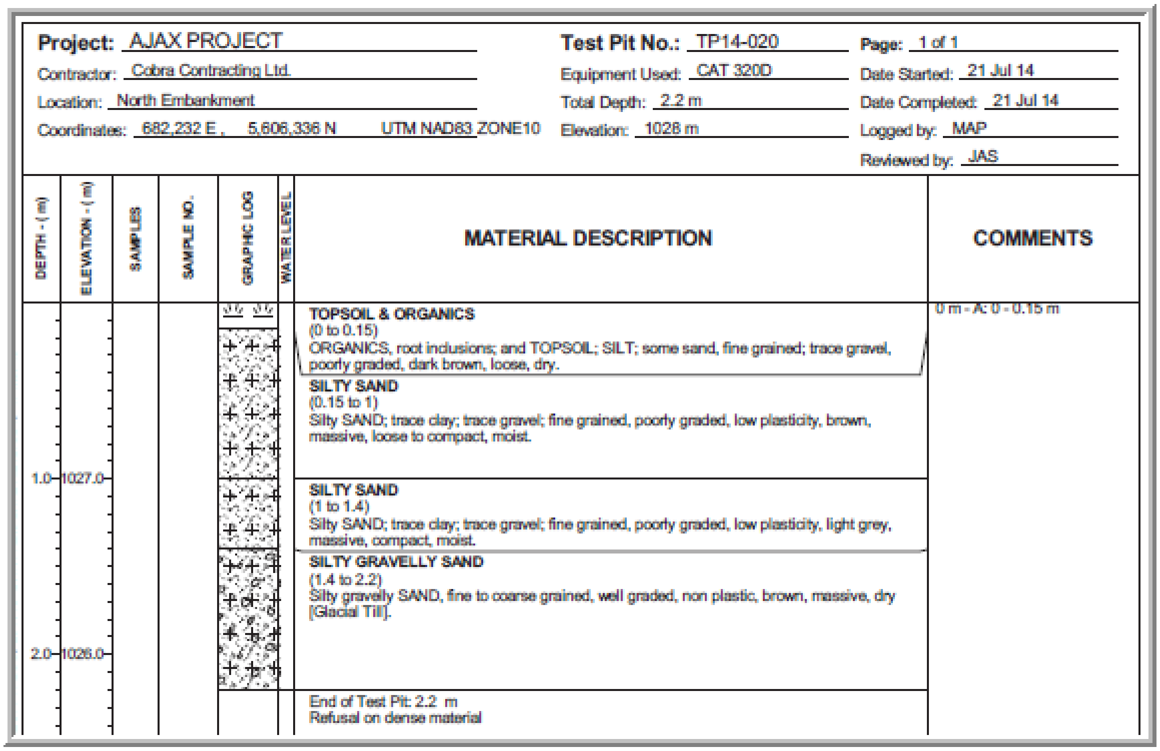


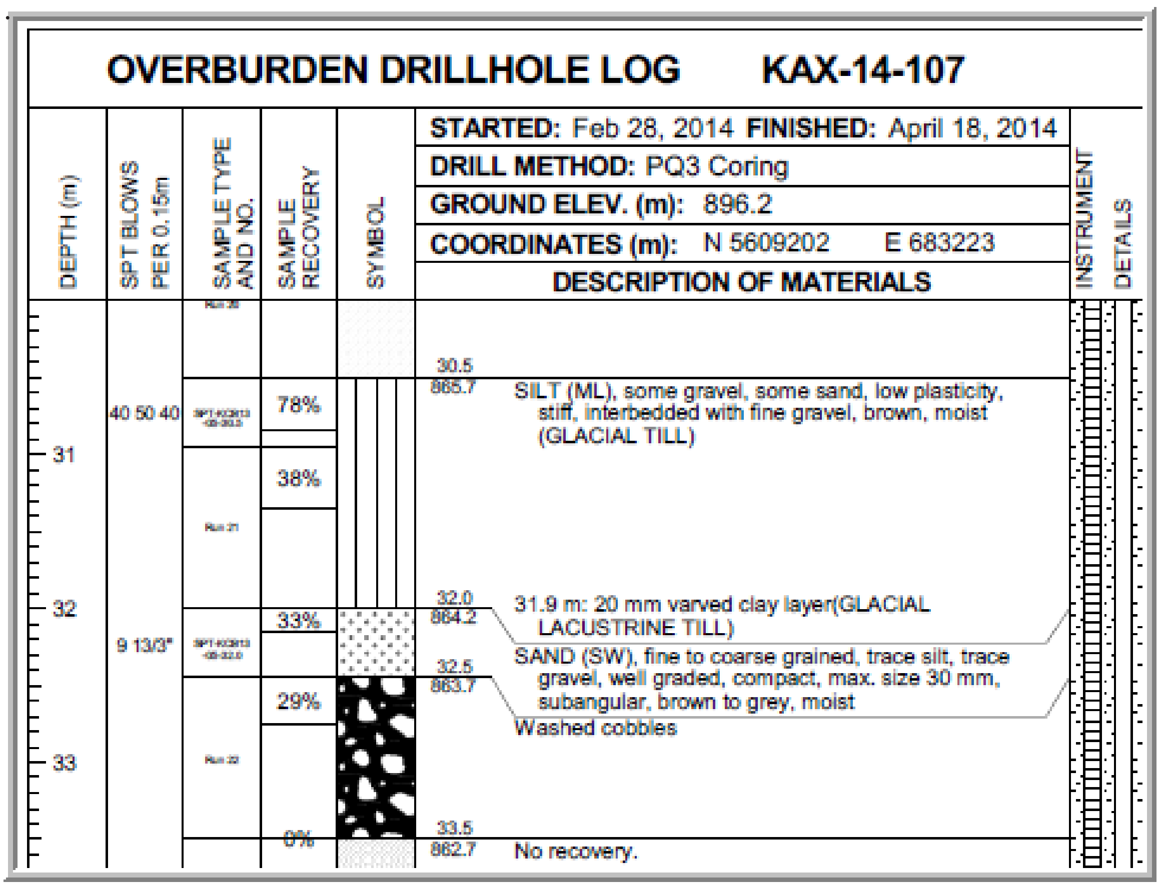
Figure 30 The soil textures reported in Appendix 6.2.A and from 383 test pits and over burden bore holes in Appendix 6.6.A were reported as follows: Silt, Silty Sand, Clay Sand, Silty Gravelly Sand, Gravelly Sandy Silt, Trace Clay, Sandy Silt, Silty Sand Gravel, Sand and Silt, Sandy Gravel and any combination of these words. These are not correct texture terms. They do not follow CSSC classification texture class names. There are no percentages given so there was no idea how much silt there would be in the topsoil and overburden. Nor was the percent sit in the topsoil and overburden ever given. Was this to hide the amount of silt present in these materials. Using the texture percentages from Appendix I was able to calculate the percent silt in the over burden and top soil and the volume as we have seen is immense. From the 75 scratch pit sites the 383 test pits (**Figure 30)** and bore hole tests **(Figure 31)** (I never counted how many there were) every texture was either a sand or a silt (red circles) and this is an impossibility. It absurd and clearly demonstrates that no one involved in these studies has any concept of what soil texture is or how to determine it. It just looks like guess work to me,



Project: AJAX PROJECT
Contractor: Cobra Contracting Ltd.
Location: North Embankment
Coordinates: 682,232 E , 5,606,336 N UTM NAD83 ZONE10
Test Pit No.: TP14-020
Equipment Used: CAT 320D
Total Depth: 2.2 m
Elevation: 1028 m
Page: 1 of 1
Date Started: 21 Jul 14
Date Completed: 21 Jul 14
Logged by: MAP
Reviewed by: JAS

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL & ORGANICS (0 to 0.15) ORGANICS, root inclusions; and TOPSOIL; SILT; some sand, fine grained; trace gravel, poorly graded, dark brown, loose, dry.	0 m - A: 0 - 0.15 m
						SILTY SAND (0.15 to 1) Silty SAND; trace clay; trace gravel; fine grained, poorly graded, low plasticity, brown, massive, loose to compact, moist.	
1.0	1027.0					**SILTY SAND** (1 to 1.4) Silty SAND; trace clay; trace gravel; fine grained, poorly graded, low plasticity, light grey, massive, compact, moist.	
						SILTY GRAVELLY SAND (1.4 to 2.2) Silty gravelly SAND, fine to coarse grained, well graded, non plastic, brown, massive, dry [Glacial Till].	
2.0	1026.0					End of Test Pit: 2.2 m Refusal on dense material	

Figure 30 Test pit description with incorrect texture terms.



OVERBURDEN DRILLHOLE LOG KAX-14-107

STARTED: Feb 28, 2014 FINISHED: April 18, 2014
DRILL METHOD: PQ3 Coring
GROUND ELEV. (m): 896.2
COORDINATES (m): N 5609202 E 683223

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE AND NO.	SAMPLE RECOVERY	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
		Run 20				
	40 50 40	SPT-KCR13-08-30.5	78%		30.5 865.7 SILT (ML), some gravel, some sand, low plasticity, stiff, interbedded with fine gravel, brown, moist (GLACIAL TILL)	
31		Run 21	38%			
32	9 13/3"	SPT-KCR13-08-32.0	33%		32.0 864.2 31.9 m: 20 mm varved clay layer(GLACIAL LACUSTRINE TILL)	
					32.5 863.7 SAND (SW), fine to coarse grained, trace silt, trace gravel, well graded, compact, max. size 30 mm, subangular, brown to grey, moist	
33		Run 22	29%		Washed cobbles	
			0%		33.5 862.7 No recovery.	

Figure 31 Overburden log. Note the glacial lacustrine.

The Upper GLU was found to be preconsolidated prior to embankment construction, but became normally consolidated under the loads applied by construction of the Perimeter Embankment. That is, it had experienced prior consolidation and strengthening under loads in its geological past, but not under the loads associated with the Perimeter Embankment, which created the normally consolidated state. Under these conditions, the Upper GLU was compressible and susceptible to undrained failure. This condition had not been recognized in the design of the TSF.

CONCLUSIONS

The Panel concluded that the dominant contribution to the failure resides in the design. The design did not take into account the complexity of the sub-glacial and pre-glacial geological environment associated with the Perimeter Embankment foundation. As a result, foundation investigations and associated site characterization failed to identify a continuous GLU layer in the vicinity of the breach and to recognize that it was susceptible to undrained failure when subject to the stresses associated with the embankment.

FIGURE D6.4.1: INTERPRETED GEOTECHNICAL STRATIGRAPHIC UNITS

Major Stratigraphic Unit	Stratigraphic Sub-Unit
Upper Till	
Upper Glaciolacustrine (Upper GLU)	
Lower Tills	Lower Basal Till
	Lower Glaciolacustrine (Lower GLU)
	Glaciofluvial
	Lower Basal Till
Weak Bedrock	

Figure 32 The Mt Poly tailings failure resulted from the failure of the Upper Glacial Lacustrine unit. These same units exist under glacial tills in the EMRSF and SMRSF rock dumps as shown in the following figures. This is a concern because ground water may shift and saturate these sediments which could lead to failure.

5 – OVERBURDEN AND TOPSOIL STOCKPILES STABILITY ANALYSIS

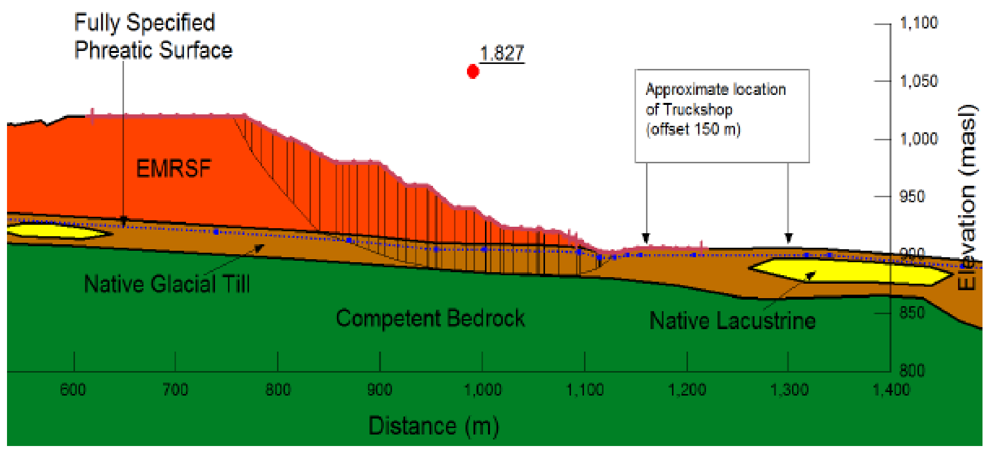
5.1 GENERAL

Stability analyses were undertaken to determine typical stockpile slopes and heights. The location of the overburden and topsoil stockpiles had not been finalized at the time of writing this report, and therefore typical foundation conditions were used in the stability analyses. The stratigraphy was modelled as 30 m of glacial till overlying competent bedrock, assuming flat topography. No glaciolacustrine material was assumed to be present within the stockpile foundations. The presence of glaciolacustrine or other weak layers in the stockpile foundation may significantly influence the stability.

Figure 33 Statement from **Appendix 3 - I – Geotechnical Report - Mine Site infrastructure**

M:\1\01\00246\26\A\Data\Task 900 - Mine Site Infrastructure Geotechnical Site Investigation\WF44 - Slope Stability\Appendix\Rev 0\[RESULTS - MRSF.xls]Figure F4.9 Print 27-05-15 9:03 AM

Unit	Unit Weight (kN/m^3)	Effective Friction Angle (deg)	Effective Cohesion (kPa)	Pore Pressure Response (B̄)
	MRSF Materials			
Mine Rock	21	See Note 1		0
Controlled Rock Fill (TSF Embankment)	21	See Note 1		0
	Foundation Materials			
Native Sand and Gravel	19	35	0	0
Native Glacial Till	20	34	0	0.4
Native Glaciolacustrine	18	14	0	0.4
Fresh Bedrock	Impenetrable			



NOTES:
1. A RELATIONSHIP FOR FRICTION ANGLE AND EFFECTIVE STRESS WAS DEVELOPED FOR THE ROCKFILL MATERIALS, BASED ON PUBLISHED INFORMATION ON THE SHEAR STRENGTH PROPERTIES OF ROCKFILL (LEPS, 1970).
2. PHREATIC SURFACE WAS FULLY SPECIFIED BASED ON 2014 SITE INVESTIGATION DATA.

REV	DATE	DESCRIPTION	PREP'D	REV'D
0	15APR'15	ISSUED WITH REPORT VA101-00246/26-9	JTO	SB

KGHM AJAX MINING INC.
AJAX PROJECT
SECTION 4: EAST MINE ROCK STORAGE FACILITY END OF CONSTRUCTION STABILITY ANALYSIS

Knight Piésold CONSULTING | P/A NO. VA101-00246/26 | REF. NO. 9 | FIGURE F4.9 | REV 0

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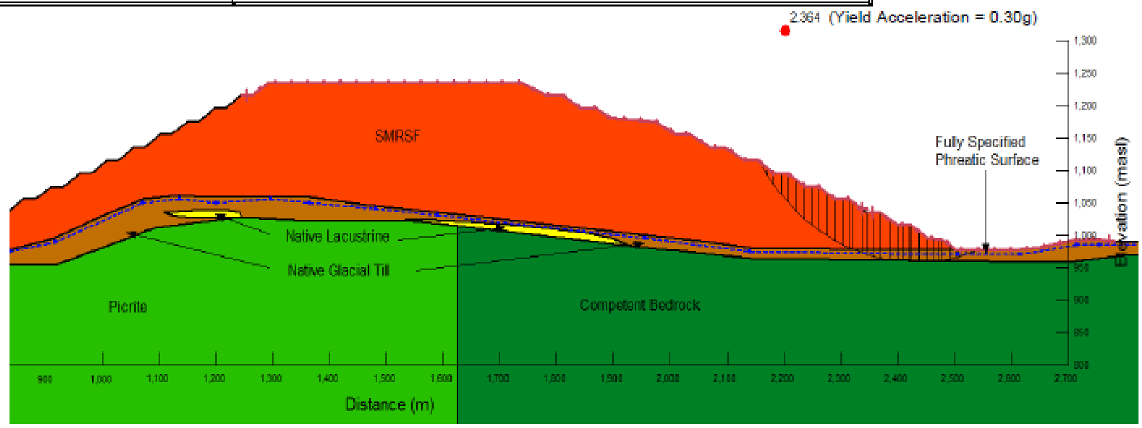
Figure 34 Cross section of EMRSF showing glacial lacustrine under glacial till. Cross sections locations are found on page 763 of **Appendix 3 - I – Geotechnical Report - Mine Site infrastructure**.

M:\1\01\00246\26\A\Data\Task 900 - Mine Site Infrastructure Geotechnical Site Investigation\WF44 - Slope Stability\Appendix\Rev 0\[RESULTS - MRSF.xls]Figure F4.6 Print 27-05-15 9:03 AM

Unit	Unit Weight (kN/m^3)	Effective Friction Angle (deg)	Effective Cohesion (kPa)	Pore Pressure Response (B)
	MRSF Materials			
Mine Rock	21	See Note 1		0
Controlled Rock Fill (TSF Embankment)	21	See Note 1		0
	Foundation Materials			
Native Sand and Gravel	19	35	0	0
Native Glacial Till	20	34	0	0
Native Glaciolacustrine	18	14	0	0
Picrite[2]	21	See Note 2		
Fresh Bedrock	Impenetrable			



NOTES:
1. A RELATIONSHIP FOR FRICTION ANGLE AND EFFECTIVE STRESS WAS DEVELOPED FOR THE ROCKFILL MATERIALS, BASED ON PUBLISHED INFORMATION ON THE SHEAR STRENGTH PROPERTIES OF ROCKFILL (LEPS, 1970).
2. A RELATIONSHIP FOR NORMAL STRESS AND SHEAR STRESS WAS DEVELOPED FOR THE PICRITE, BASED ON THE INTACT ROCK STRENGTH, USING THE GENERALIZED HOEK-BROWN CRITERION.
3. PHREATIC SURFACE WAS FULLY SPECIFIED BASED ON 2014 SITE INVESTIGATION DATA.

REV	DATE	DESCRIPTION	PREP'D	REV'D
0	15APR'15	ISSUED WITH REPORT VA101-00246/26-9	JTO	SB

KGHM AJAX MINING INC.
AJAX PROJECT
SECTION 2: SOUTH MINE ROCK STORAGE FACILITY POST-CLOSURE STABILITY ANALYSIS

Knight Piésold CONSULTING | P/A NO. VA101-00246/26 | REF. NO. 9 | FIGURE F4.6 | REV 0

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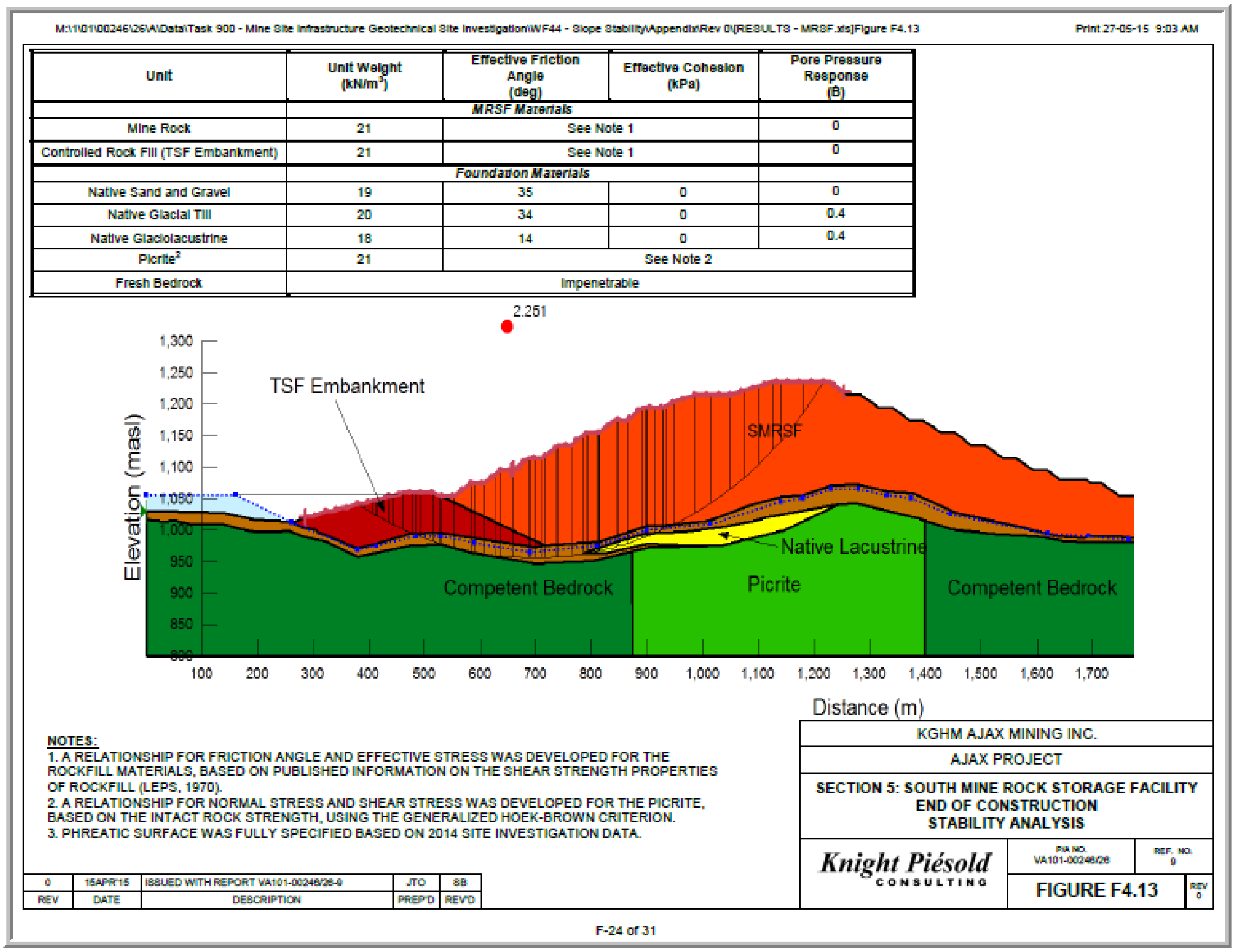
Figure 35 Cross section of SMRSF showing glacial lacustrine under glacial till. Cross sections locations are found on page 763 of **Appendix 3 - I – Geotechnical Report - Mine Site infrastructure**.



M:\1\01\00246\26\A\Data\Task 900 - Mine Site Infrastructure Geotechnical Site Investigation\WF44 - Slope Stability\Appendix\Rev 0\[RESULTS - MRSF.xls]Figure F4.13 Print 27-05-15 9:03 AM

Unit	Unit Weight (kN/m³)	Effective Friction Angle (deg)	Effective Cohesion (kPa)	Pore Pressure Response (B̄)
	MRSF Materials			
Mine Rock	21	See Note 1		0
Controlled Rock Fill (TSF Embankment)	21	See Note 1		0
	Foundation Materials			
Native Sand and Gravel	19	35	0	0
Native Glacial Till	20	34	0	0.4
Native Glaciolacustrine	18	14	0	0.4
Picrite[2]	21	See Note 2		
Fresh Bedrock	Impenetrable			

NOTES:
1. A RELATIONSHIP FOR FRICTION ANGLE AND EFFECTIVE STRESS WAS DEVELOPED FOR THE ROCKFILL MATERIALS, BASED ON PUBLISHED INFORMATION ON THE SHEAR STRENGTH PROPERTIES OF ROCKFILL (LEPS, 1970).
2. A RELATIONSHIP FOR NORMAL STRESS AND SHEAR STRESS WAS DEVELOPED FOR THE PICRITE, BASED ON THE INTACT ROCK STRENGTH, USING THE GENERALIZED HOEK-BROWN CRITERION.
3. PHREATIC SURFACE WAS FULLY SPECIFIED BASED ON 2014 SITE INVESTIGATION DATA.

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SECTION 5: SOUTH MINE ROCK STORAGE FACILITY END OF CONSTRUCTION STABILITY ANALYSIS

Knight Piésold CONSULTING

P/A NO. VA101-00246/26 REF. NO. 9

FIGURE F4.13 REV 0

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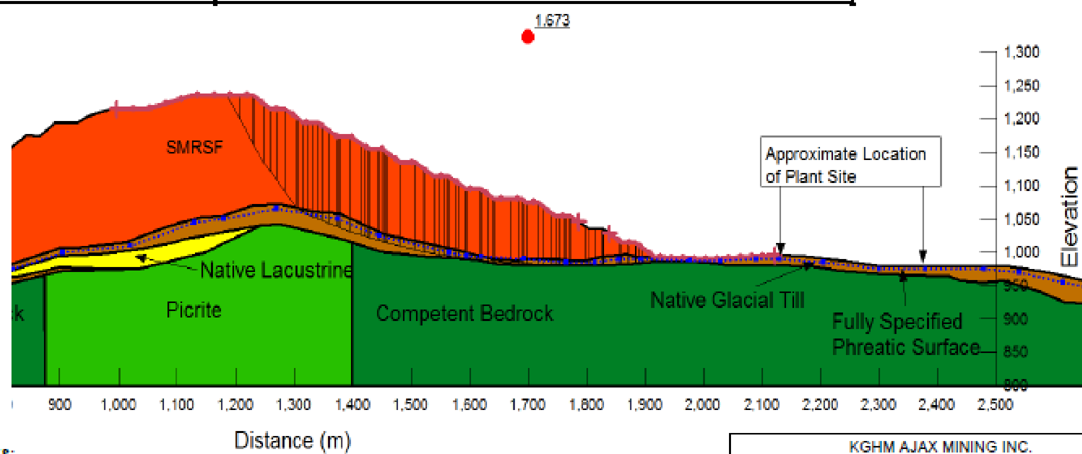
Figure 36 Cross section of SMRSF showing glacial lacustrine under glacial till. Cross sections locations are found on page 763 of **Appendix 3 - I – Geotechnical Report - Mine Site infrastructure**.

M:\1\01\00246\26\A\Data\Task 900 - Mine Site Infrastructure Geotechnical Site Investigation\WF44 - Slope Stability\Appendix\Rev 0\[RESULTS - MRSF.xls]Figure F4.11 Print 27-05-15 9:03 AM

Unit	Unit Weight (kN/m³)	Effective Friction Angle (deg)	Effective Cohesion (kPa)	Pore Pressure Response (B̄)
	MRSF Materials			
Mine Rock	21	See Note 1		0
Controlled Rock Fill (TSF Embankment)	21	See Note 1		0
	Foundation Materials			
Native Sand and Gravel	19	35	0	0
Native Glacial Till	20	34	0	0.4
Native Glaciolacustrine	18	14	0	0.4
Picrite[2]	21	See Note 2		
Fresh Bedrock	Impenetrable			



NOTES:
1. A RELATIONSHIP FOR FRICTION ANGLE AND EFFECTIVE STRESS WAS DEVELOPED FOR THE ROCKFILL MATERIALS, BASED ON PUBLISHED INFORMATION ON THE SHEAR STRENGTH PROPERTIES OF ROCKFILL (LEPS, 1970).
2. A RELATIONSHIP FOR NORMAL STRESS AND SHEAR STRESS WAS DEVELOPED FOR THE PICRITE, BASED ON THE INTACT ROCK STRENGTH, USING THE GENERALIZED HOEK-BROWN CRITERION.
3. PHREATIC SURFACE WAS FULLY SPECIFIED BASED ON 2014 SITE INVESTIGATION DATA.

REV	DATE	DESCRIPTION	PREP'D	REV'D
0	15APR'15	ISSUED WITH REPORT VA101-00246/26-9	JTO	SB

KGHM AJAX MINING INC.
AJAX PROJECT
SECTION 5: SOUTH MINE ROCK STORAGE FACILITY END OF CONSTRUCTION STABILITY ANALYSIS

Knight Piésold CONSULTING | P/A NO. VA101-00246/26 | REF. NO. 9 | **FIGURE F4.11** | REV 0

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Figure 37 Cross section of SMRSF showing glacial lacustrine under glacial till. Cross sections locations are found on page 763 of **Appendix 3 - I – Geotechnical Report - Mine Site infrastructu**re.

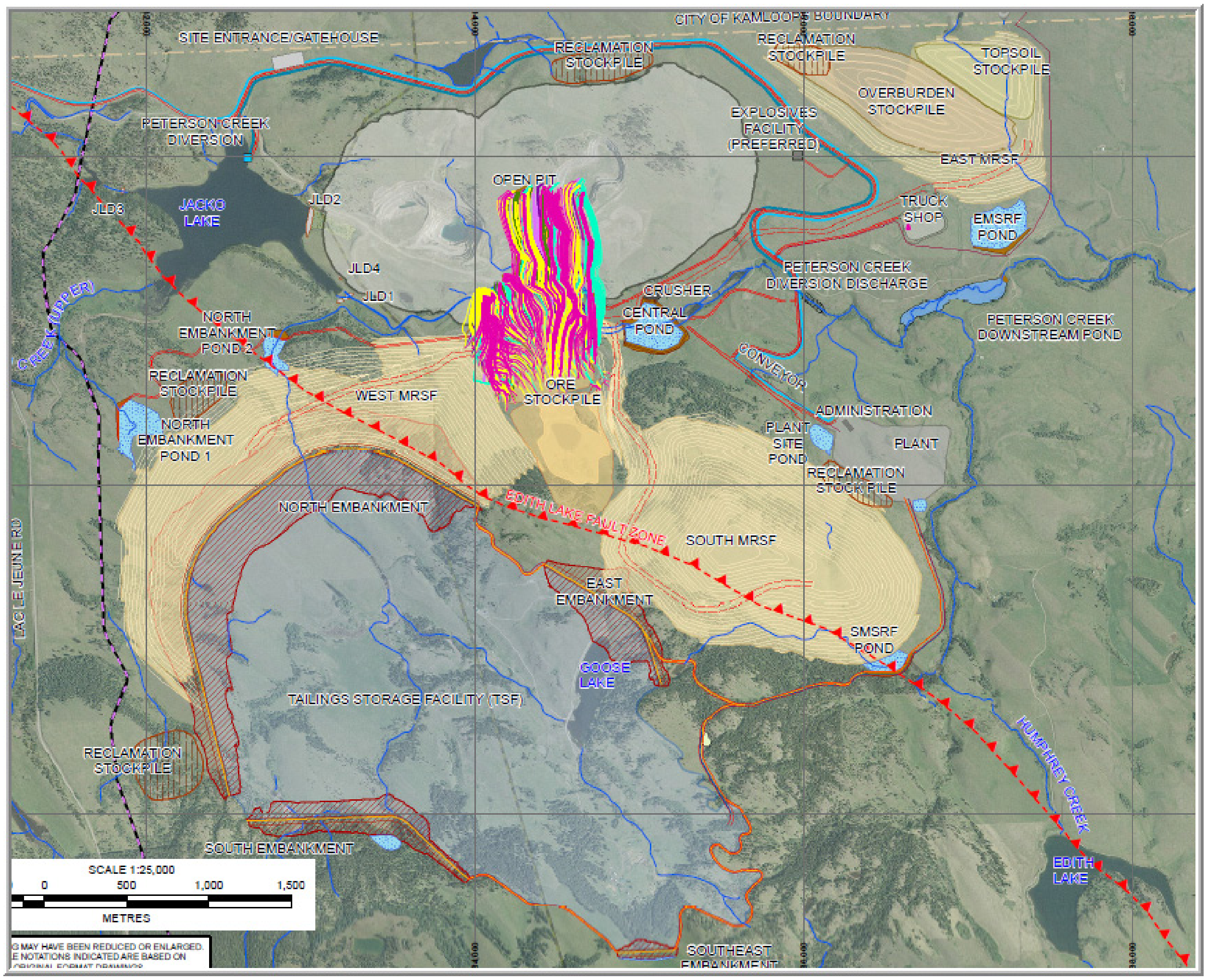

Figure 38 What will the impact of the weight of tailings and rock have on the Edith lake fault? How will the weight affect ground water movement? How much leachate will move into the fault. The method to determine the amount of leachate through 50 cm or 1 metre containers is flawed and not close to representative of what is going to pass through 80 or more metres of rock.

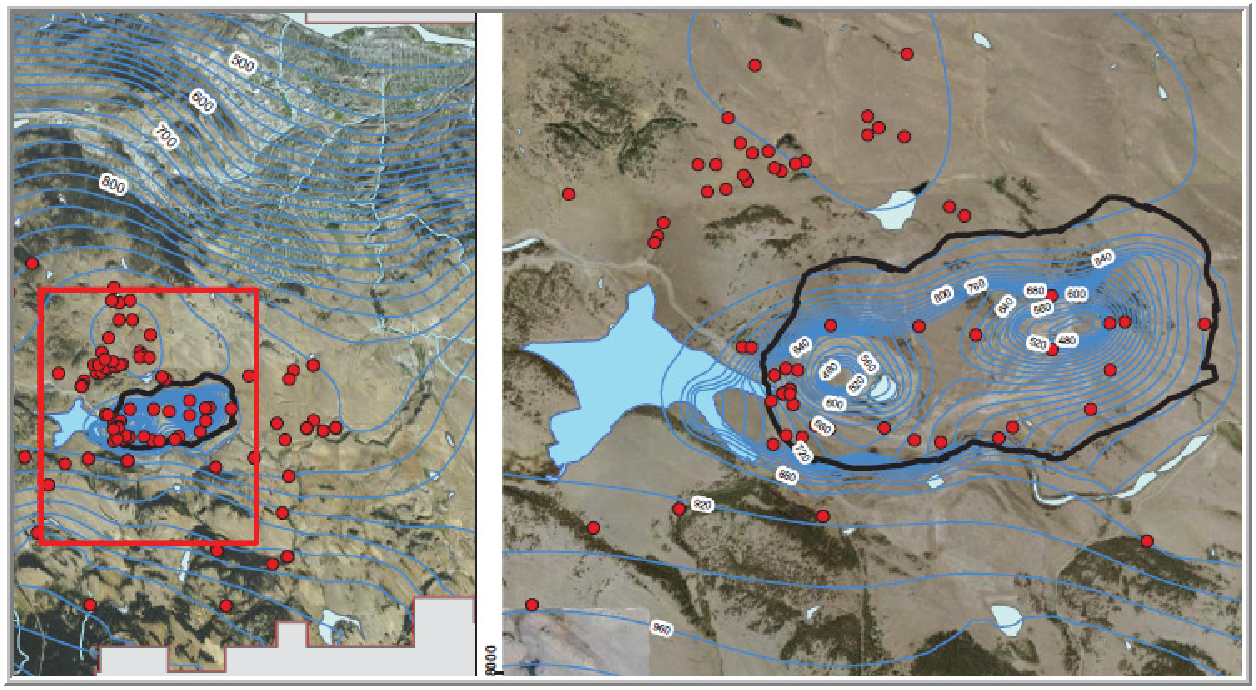

Figure 39 The depth of the pit will be at the same elevation as the switchback on the Summit bypass. How can Jacko lake not drain into the west pit? When the mine closes and becomes a lake how much water will make its way through the fault systems to the Aberdeen slides?