



A TETRA TECH COMPANY

August 14, 2013

Yukon Zinc Corporation  
Suite 701, 475 Howe Street  
Vancouver, British Columbia V6C 2B3

ISSUED FOR USE  
EBA FILE: W14103229-01

**Confidential**

**Attention:** Mr. Robin McCall, M.M.M., R.P.Bio.  
Wolverine Mine – Environmental Superintendent

**Subject:** 2013 Annual Observations of the On-site Earth Structures  
Wolverine Mine Site, South Eastern Yukon

## 1.0 INTRODUCTION

As requested by Yukon Zinc Corporation (YZC), EBA, A Tetra Tech Company operating as EBA Engineering Consultants Ltd. (EBA) has completed the 2013 annual observations of the earth structures located throughout the Wolverine Mine site (shown on Figure 1). YZC identified the following areas that required a stability review:

1. Industrial Complex – cut and fill slopes.
2. Industrial Complex Surface and Underground Water Treatment Sumps (1, 2 and 5) - liners and slopes.
3. Industrial Complex Diversion Ditch 1 – cut and fill slopes.
4. Industrial Complex Collection Ditches (2, 3, 4 and 5) – liners, cut and fill slopes.
5. Mine Camp Pad Area including upper generator and potable water treatment pad, sewage treatment plant pad, and treated effluent pond – liner, cut and fill slopes.
6. Waste Rock and Ore Storage Facility including seepage collection sump and ore waste stockpile contained within the facility – liners, cut and fill slopes.
7. Land Treatment Facility (Hydrocarbon Contaminated Material) including runoff collection sump – liners and fill slopes.
8. Vent Raise and Propane Tank Pad – cut slopes.
9. Truck Shop Pad – cut and fill slopes.

Authorization to proceed with this work was received from Robin McCall by way of e-mail dated June 26, 2013.

## 2.0 SCOPE OF SERVICES

It is understood that YZC requires annual observations of structures, works, and installations at the site as per Quartz Mining License QML-0006.

EBA's scope of service for these annual observations was as follows:

- Completed a visual observation of the earth structures associated with each area of interest.
- Compiled a photo log for each area of interest.
- Prepared an observation report with a brief statement about the status and stability conditions for each area of interest, including any recommendations for remedial action.

### 3.0 FIELD INSPECTION

The field observations were completed by Mr. Chad Cowan, P.Eng. of EBA on July 9 and 10, 2013. The following is a brief summary of the observations detailing any stability issues including a few photos of each area.

### 4.0 INDUSTRIAL COMPLEX

During the site visit there were no new construction activities in this area of interest. EBA observed the cut and fill slopes for the Mill, Fuel Tank Farm and Genset Pad locations.

The 1:1 (H:V) design cut slopes in the bedrock for these areas are considered stable (Photo 1).

EBA observed the fill slope along the south western sides of the Mill, Fuel Tank Farm and Genset Pad locations (Photos 2 and 3). The fill slopes associated with the fill placement are considered stable and are constructed as per the 2:1 (H:V) design. As noted in previous annual inspection reports there are still some noticeable erosion channels (shown on Figure 1) along the south western side of the Mill fill that were created as a result of historical seasonal rainfall run-off events. Last year proper perimeter berms and site grading was completed and maintained throughout the year by YZC to divert surface runoff towards designated drainage ditches (Ditches 2 and 5). The erosion channels show no evidence of increasing in width and depth, but they should still be filled in with coarse grained material.

EBA observed the Mechanically Stabilized Earth (MSE) wall (Photo 4) that is situated along the western portion of the south western side of the Mill fill and the north and east sides of the crusher building and there were no signs of bulging or noticeable zones of failure.



**Photo 1**

The backslope between the Genset Pad and Mill location. (July 9, 2013)



**Photo 2**

The NW fill slope of the Tank Farm and Genset Pads. (July 9, 2013)



**Photo 3**

The fill slope of the Mill location. (July 9, 2013)



**Photo 4**

The MSE wall along the toe of the Mill fill. (July 9, 2013)

## 5.0 INDUSTRIAL COMPLEX SURFACE AND UNDERGROUND WATER TREATMENT SUMPS (1, 2 AND 5)

The foundations for Sumps 1, 2 and 5 were observed. Both Sumps 1 and 5 were being used for waste water and sediment storage from underground and run-off water from Ditches 2 and 5. Sump 1 (Photo 5) was full and it was not possible to see the entire condition of the liner. Sump 5 was only partially full and the liner was in good condition (Photo 6). During the site visit Sump 2 was not in service and was being reconstructed (Photo 7).

The foundation conditions noted in the 2012 annual observation report for Sumps 1 and 5 remain the same. There was still some noticeable settlement along the key trenches of Sump 1 as the backfill material was not compacted during original construction.



**Photo 5**

Sump 1 almost full of underground mine water. (July 9, 2013)



**Photo 6**  
Sump 5 full of underground waste water. (July 9, 2013)



**Photo 7**  
Sump 2 being reconstructed. (July 9, 2013)

## 6.0 INDUSTRIAL COMPLEX DIVERSION DITCH 1 AND COLLECTION DITCHES 2, 3, 4 AND 5

During the 2013 site visit and as noted during the 2012 site visit there were sections of diversion Ditch 1 that were lined with non-woven geotextile but for the most part the ditch remains unlined. There were small amounts of debris or slough from the upper slope deposited in the bottom of the ditch. In the future this material may have to be removed to allow for continuous water flow along the ditch bottom. As noted in previous observation reports the tension cracks and areas of settlement along the upper portion of the ditch embankment (Photo 8) were still noticeable. The tension cracks should be monitored and filled in as required to reduce the amount of water infiltration which may lead to instability of the embankment. The areas of settlement should also be graded to match the upper and lower sections of the ditch embankment.

Ditch 2 was observed and only a portion of the collection ditch along the lower section between the Mill building location and the lower by pass road was lined. The inlet end of the culvert coming from the upper mill pad had been damaged and should be repaired to reduce the possibility of the inlet end plugging off (Photo 9).

At the time of the site visit Ditch 3 liner had been replaced with a new liner but was not being used. Water from Ditch 2 was being pumped into Sump 5 as Sump 2 was being repaired and could not receive run-off water from Ditch 3. Tension cracks and areas of settlement noted during the 2012 site visit have been repaired (Photo 10).

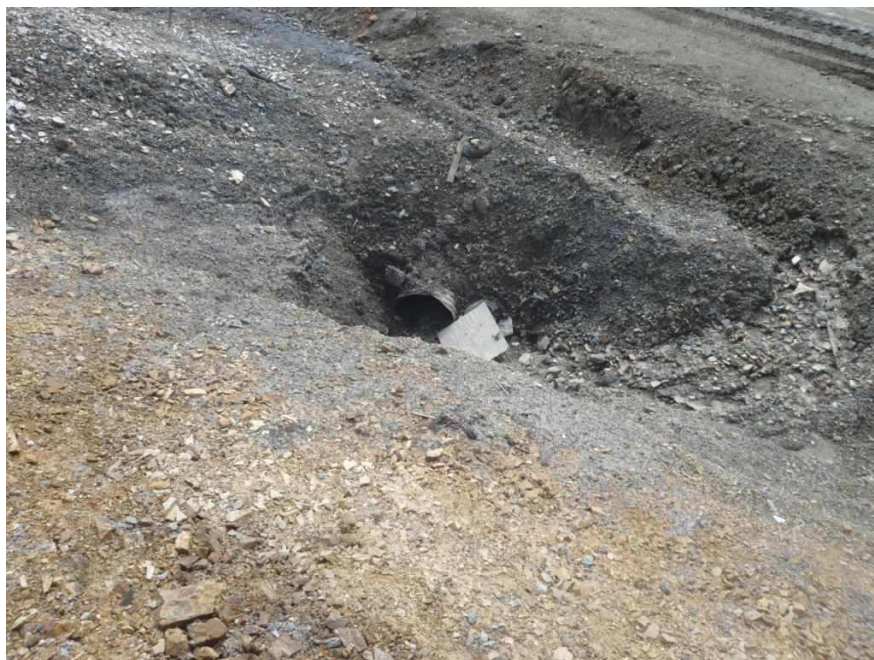
As noted in previous observation reports there were still many small tears or punctures of the liner along both side slopes of Ditch 4. The base of the liner appeared to be undamaged but the side slopes still require repair. There were other areas along of the ditch that require repair. There was numerous tension cracks and areas of settlement located along the crest and downslope side of the ditch (Photo 11), and erosion channels throughout the downslope side that require filling in to reduce the amount of water infiltration, which may lead to instability of the embankment (Photo 12). A portion of the northern end of the downslope side of Ditch 4 where there was noticeable settlement had been repaired (Photo 13). Fill material was placed along the areas of settlement to meet original design grades.

Ditch 5 was observed and the discharge end of the culvert located at the bottom of the MSE wall was almost completely plugged restricting run-off flow towards Sump 2 (Photo 14).



**Photo 8**

Tension cracks and depression of an upper portion of the Ditch 1 embankment. (July 9, 2013)



**Photo 9**

The inlet end of the culvert from the upper mill pad to the lower section of Ditch 2. (July 9, 2013)





**Photo 10**

The reconstructed Ditch 3. (July 9, 2013)



**Photo 11**

The NW end of Ditch 4 at the tension cracks along the downslope side. (July 9, 2013)



**Photo 12**

Looking SE at an erosion channel along Ditch 4 that requires repair. (July 9, 2013)



**Photo 13**

Looking SE from the NW end of Ditch 4 at the reconstructed downslope berm. (July 9, 2013)



**Photo 14**

The discharge end of the Ditch 5 culvert the rock and debris should be removed. (July 9, 2013)

## **7.0 MINE CAMP PAD AREA INCLUDING UPPER GENERATOR AND POTABLE WATER TREATMENT PAD, SEWAGE TREATMENT PLANT PAD AND TREATED EFFLUENT POND**

The 2:1 cut and 1.5:1 fill slopes for the camp pad, upper generator and water treatment pad, sewage treatment plant pad, and the treated sewage effluent pond were observed and the slopes were considered stable (Photos 15 and 16).

There were some noticeable tension cracks and erosion channels along the perimeter of the fill slope of the camp pad. Similar cracks and erosion channels were noted in previous observation reports (Photo 17). As mentioned in the previous reports these areas should be monitored and repaired as required.

During the 2012 site visit the treated effluent pond, which is no longer being used as originally intended was half full of precipitation runoff, allowing for only partial visual observation of the liner (Photo 18). There were no indications of slumping or bulging of the liner. The perimeter exterior fill slopes were also reviewed and there were no noticeable signs of instability.



**Photo 15**

The backslope of the camp pad. (July 9, 2013)



**Photo 16**

The downslope side of the camp pad. (July 9, 2013)



**Photo 17**

One of the erosion channels along the downslope side of the camp pad. (July 9, 2013)



**Photo 18**

The former sewage effluent pond for the camp. (July 9, 2013)

## 8.0 TEMPORARY WASTE ROCK AND ORE STORAGE FACILITY

The cut and fill slopes in the facility were observed and considered stable (Photo 19). The collection sump was also observed and at the time was full of runoff water (Photo 20).



**Photo 19**

The Waste Rock and Ore Stockpile. (July 9, 2013)



**Photo 20**

The Ore Stockpile area water run-off collection sump. (July 9, 2013)

## 9.0 LAND TREATMENT FACILITY (HYDROCARBON CONTAMINATED MATERIAL) INCLUDING RUNOFF COLLECTION SUMP

The berms and the liner of the land treatment facility (LTF) were observed and there was no noticeable deterioration of the berms or damage to the exposed liner (Photo 21). The LTF was about 50% full of hydrocarbon contaminated material and the collection sump was about 25% full of seasonal run-off (Photo 22).



**Photo 21**

The containment area of the LTF. (July 9, 2013)



**Photo 22**

The LTF sump half full. (July 9, 2013)

## 10.0 VENT RAISE AND PROPANE TANK PAD

The 2:1 cut slopes for the vent raise and propane tank pad were observed and were considered stable (Photos 23 and 24). The vent raise back slope is showing some signs of erosion and should be monitored for instabilities at the top of the slope.



**Photo 23**

The backslope of the vent raise. (July 9, 2013)



**Photo 24**

The backslope behind the propane tank pad. (July 9, 2013)



## 11.0 TRUCK SHOP PAD

The 2:1 cut and fill slopes for the truck shop pad were observed and all of the slopes were considered stable (Photos 25 and 26).



**Photo 25**

The downslope of the truck shop pad. (July 9, 2013)



**Photo 26**

The backslope behind the truck shop pad. (July 9, 2013)

## 12.0 CONCLUSIONS

EBA has concluded that all of the tension cracks, sloughing, erosion channels, damage to liners and areas of settlement associated with the on-site earth structures pose no significant risk to the environment or human health and safety. These areas of interest still require frequent monitoring (monthly) and repairs as required. Collection Ditch 4 will require repair to the tears and punctures in the liners, and filling of the tension cracks, areas of settlement and erosion channels prior to freshet in Spring 2014 to avoid possible complete failure of the ditch embankments. A summary of recommendations is presented in the following Table 1:

**Table 1 – Summary of Recommendations from 2013 Inspection**

Item Description	Recommended Maintenance	Status
Mill Area	Fill erosion channels with coarse grained material	
Water Treatment Sump 1	Settlement in geomembrane anchor/key trench – monitor and repair as necessary	
Ditch 1	Fill tension cracks and areas of settlement along berm	
Ditch 3	Repair liner, fill tension cracks, areas of settlement and erosion channels, and clean out culvert from Ditch 3 to Sump 2	completed summer of 2012
Ditch 4	Repair liner, fill tension cracks, areas of settlement and erosion channels	NW portion has been repaired
Ditch 5	Clean out discharge towards Sump 2	
Camp Area	Monitor tension cracks and erosion channels – repair as necessary	

### 13.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Yukon Zinc Corporation and their agents. EBA Engineering Consultants Ltd. operating as EBA, A Tetra Tech Company, does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Yukon Zinc Corporation, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in the General Conditions attached.

### 14.0 CLOSURE

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

Sincerely,  
EBA, A Tetra Tech Company

Reviewed by:



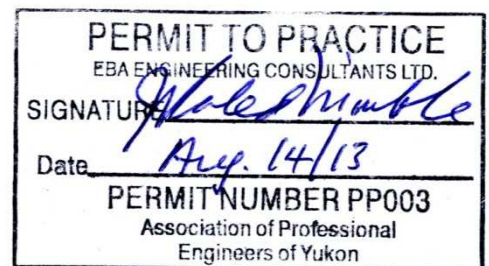
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Attachments:

EBA Geotechnical Report General Conditions  
Figure 1: Site Plan Showing Location of On-site Earth Structures



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# GENERAL CONDITIONS

## GEOTECHNICAL REPORT

This report incorporates and is subject to these “General Conditions”.

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### 1.0 USE OF REPORT AND OWNERSHIP

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

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

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

### 2.0 ALTERNATE REPORT FORMAT

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

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

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

### 3.0 ENVIRONMENTAL AND REGULATORY ISSUES

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

### 4.0 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

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

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

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

### 5.0 LOGS OF TESTHOLES

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

### 6.0 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

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

## 7.0 PROTECTION OF EXPOSED GROUND

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

## 8.0 SUPPORT OF ADJACENT GROUND AND STRUCTURES

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

## 9.0 INFLUENCE OF CONSTRUCTION ACTIVITY

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

## 10.0 OBSERVATIONS DURING CONSTRUCTION

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

## 11.0 DRAINAGE SYSTEMS

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

## 12.0 BEARING CAPACITY

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

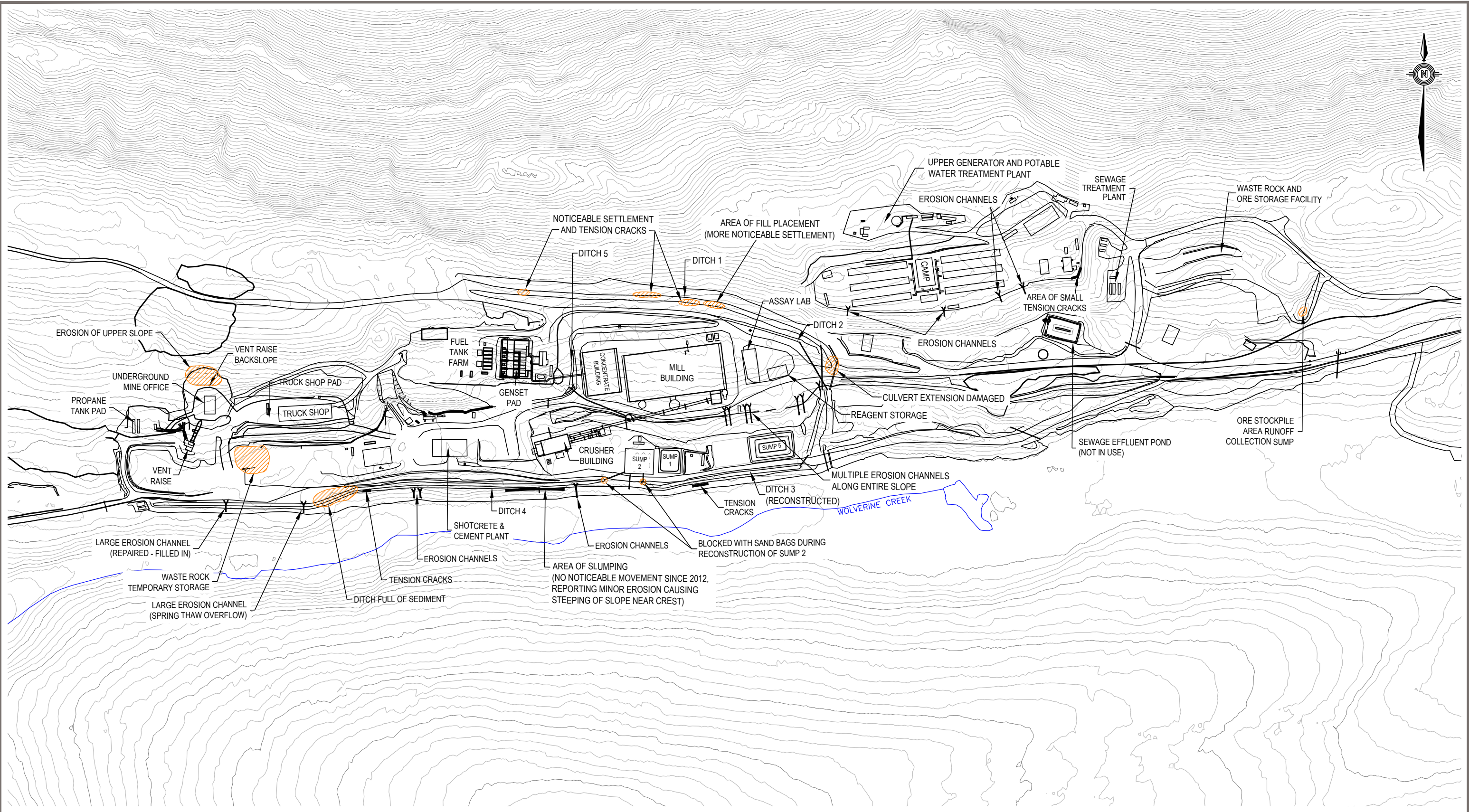
## 13.0 SAMPLES

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

## 14.0 INFORMATION PROVIDED TO EBA BY OTHERS

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

Q:\Whitehorse\Data\0201\Drawings\Campbell Hwy\W14103229-01 Wolverine Mine 2013 Annual Observation Report\W14103229-01 Annual Report 2013.dwg [FIGURE 1] August 13, 2013 - 1:03:58 pm (BY: BUCHAN, CAMERON)



<b>LEGEND:</b> - TENSION CRACKS - EROSION CHANNEL - WATER COURSE - AREAS OF INTEREST (APPROXIMATE)	<b>STATUS</b> ISSUED FOR USE	 	<b>WOLVERINE MINE ANNUAL OBSERVATION REPORT</b> <b>WOLVERINE MINE, SOUTH EASTERN YUKON</b>				<b>Figure 1</b>										
			<b>SITE PLAN SHOWING ON-SITE EARTH STRUCTURES</b>														
 Scale: 1: 4 000 (metres)		<table border="1"> <tr> <td>PROJECT NO.</td> <td>DWN</td> <td>CKD</td> <td>REV</td> </tr> <tr> <td>W14103229-01</td> <td>CB</td> <td>CPC</td> <td>0</td> </tr> </table>		PROJECT NO.	DWN	CKD	REV	W14103229-01	CB	CPC	0	<table border="1"> <tr> <td>OFFICE</td> <td>DATE</td> </tr> <tr> <td>EBA-WHSE</td> <td>August 13, 2013</td> </tr> </table>		OFFICE	DATE	EBA-WHSE	August 13, 2013
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