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CLOSURE PLANNING TECHNICAL STUDIES – KENO HILL, YUKON

TECHNICAL FACT REPORT

As part of the reclamation and closure of the UKHM site, a comprehensive closure plan for the existing state of the mine (ESM Reclamation Plan) will be developed and undergo a screening and licensing process. In order to obtain a positive technical screening and water license, significant technical backup and studies are required to support the assumptions and strategies developed for the ultimate reclamation and closure option selected. Any options considered for closure require additional technical input. This project is the first phase of field investigations and technical data gathering for developing the reclamation and closure plan.

This closure planning technical fact report is designed to be continually updated as closure planning progresses. The fact report will become the central location for all technical backup and support required to develop the ESM Reclamation Plan.

The table of contents outlines the contents of each of the attachments to the fact report.

Table 1 summarizes the scope of work and tasks for the 2006 closure planning technical studies and identifies where the particular task within the work plan is presented.

Table of Contents

Attachment A	Site Wide Water Quality Database
Attachment B	Aerial Photography and Orthophotos
Attachment C	Weather Station
Attachment D	Assessment of Waste Rock Geochemistry
Attachment E	Mine Hydrogeological Model
Attachment F	Preliminary Valley Tailings Groundwater Loading and Contaminant Mass Balance Report
Attachment G	Updated Site Wide Water Quality Mass Balance Model
Attachment H	Adit Discharge Contaminant Fate Analysis
Attachment I	Preliminary Soils Characterization Study Report
Attachment J	Soils Characterization and Drilling Report

Table 1. Closure Planning Research Studies

CLOSURE PLANNING STUDY TASK LIST – 2006 WORK PLAN	STATUS
Task 1 - Water Quality Data Review and Sitewide Model	
Comprehensively review the current water quality database and add any additional data from others;	Complete – See Attachment A
Combine the data contained in the revised workbook with flow monitoring data to generate an updated site-wide water and loading balance for the mine site and its receiving streams.	Complete – See Attachment G
Prepare associated mapping products to support reporting.	Complete – See Attachment G
Maintain the site-wide database and loading balance.	In Progress
Task 2 - Additional Water Sampling and Flow Monitoring and Meteorological Data Collection	
Examine the complete water quality database and loading balance to identify any important gaps that can be filled or significant trends that can be verified by further field work in 2006.	Complete – See Attachment F, G
Ensure that routine flow monitoring occurs during all water quality data collection surveys.	Ongoing
Install automated flow monitoring equipment at other key adit locations (Silver King, Bellekeno and other possible sites (ie No Cash 500).	Daily manual monitoring in place
Examples of possible objectives include seep surveys of source areas, confirmation of loading balances around the Mackeno tailings, investigations of trends along the No Cash, Silver King, Onek, Sadie Ladue/ Wernecke, and Keno 700 discharge paths, and collection of samples from the standard receiving water stations for low detection limit analyses. No additional sampling or flow monitoring programs will be undertaken as part of this work until the available data is comprehensively reviewed and approved by Yukon.	No Cash, Onek Completed – See Attachment H
Install automated meteorological station (temperatures, precipitation, solar radiation, wind speed and direction) and accompanying data logger on Galena Hill and tie station with existing YG snow course.	Equipment Purchased – See Attachment C

CLOSURE PLANNING STUDY TASK LIST – 2006 WORK PLAN	STATUS
Task 3 - Soils Characterization	
Review previous drilling, excavation and construction programs to extract information on permafrost distribution across the mine site. This review should include integration of local research and studies undertaken by Chris Burns.	See Attachment I
Correlate this information with slope aspect and ground cover to identify factors that control permafrost distribution.	See Attachment I
Undertake an air photo reconnaissance to determine surficial terrain and indications of physical conditions, surficial geology & ice rich permafrost in certain areas.	Complete – See Attachment I
Generate preliminary maps, at an appropriate scale, to indicate results of the above tasks.	Complete – See Attachment I
Where the presence of permafrost could impact current conditions or limit closure options, recommend site specific investigations. These site specific investigations could include drilling, hydraulic testing, and installation of monitoring wells and collection and analysis of groundwater samples. The permafrost investigation will focus on the current treatment locations including Galkeno 300, 900 and Valley Tailings.	Complete – See Attachment J
Task 4 - Assessment of Waste Rock and Tailings Geochemistry	
Sample material from the external waste rock storage areas and analyze for standard acid base accounting (paste pH, S, SO4, NP, AP, NNP, total ICP metals); metal leachate test work and geochemical stability using commonly accepted standards and practices.	In Progress – See Attachment D
Review to identify rock types for further characterization and testwork	In progress
Results compiled for closure assessment.	Results not received
Task 5 - NND and Community Workshop	
Conduct a community workshop to seek the views and comments from the First Nation and Mayo residents. As appropriate, other stakeholders will be invited to participate. The objective is to understand the concerns of these persons and identify closure objectives early in the development of the reclamation and closure plan.	Not complete

CLOSURE PLANNING STUDY TASK LIST – 2006 WORK PLAN	STATUS
Develop poster and other information material (ie newsletter) to support community consultations.	Complete – no consultation done
Compile and summary results of community consultations and issues identification for closure.	Not complete
Elsa Tailings Groundwater (Task identified in Baseline Environmental Assessment but has Closure Planning requirements as well)	
Investigate the Elsa Tailings groundwater regime to provide some understandings of the magnitude of groundwater contaminant pathways associated with the tailings.	Complete – See Attachment F
Compile and review the available stratigraphic data, review the Porcupine Creek and diversion flow data, review the available groundwater quality data and development of a preliminary groundwater loading balance.	Complete – See Attachment F
If the preliminary groundwater loading balance indicates that the groundwater pathways could be significant, prepare recommendations for additional field investigations that would be required for future follow-up as part of the closure planning requirements.	Complete – See Attachment F
Minewater (Task identified in Baseline Environmental Assessment but has Closure Planning requirements as well)	
Prepare a hydrogeological model for the minesite in an effort to better understand the potential for future changes in minewater discharge points, quantities and quality, such as occurred at the Galkeno 300 adit in 1997. The model will be preliminary in nature (i.e. no mathematical groundwater model will be required). However, it will be essential to understand the interconnectedness of the mine workings including underground workings, veins, faults, surface topography and likely flow pathways.	Complete – See Attachment E
Prepare a geometric model of the mineworkings to cover areas of environmental interest, such as No Cash and Galkeno sites, and any man-made, surface of geologic structures that could influence minewater flow.	In Progress

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Closure Planning Technical Studies – Keno Hill, Yukon

Water Quality Data Review

Project Objective

Comprehensively review the current water quality database and add any additional data from others;

Maintain the site-wide database and loading balance

Methodology

The sampling programs that have been carried out at the site over the last several years provide a good basis for assessing water quality impacts and trends. A database has been compiled by Access Consulting Group in the form of an EXCEL workbook (the "workbook"). The workbook did not however contain water quality sampling data from other regulatory agencies that has been completed over the past several years. Flow monitoring data was also not included in the water quality database which makes an overall site loading balance not as accurate as possible.

The water quality database has been updated with all of the available and known water quality analysis from the various sources and time periods. Historic water monitoring has used a variety of monitoring station ID's. All of these historic station numbers have been organized and matched with a new common set of KV numbers for each station location. For example, Christal Creek @ Keno Highway has been monitored in the past using several station ID's including S-18, UK6, LES 6, ACG-WQ-05, NPG-05 and KV-6. A table of conformance has been developed and organizes all historic station numbers.

The EXCEL workbook with the water quality database is attached. The database will continued to be updated on a monthly basis as water quality monitoring continues at site.

Information Gaps

Based on the current water quality monitoring program carried out by ERDC under the Care and Maintenance Contract and the preliminary site-wide water and loading balance, a number of additional stations are recommended for monitoring to properly update and close the sitewide water and loading balance. The recommended additional monitoring locations are presented in Table 1.

Keno Hill Mines - Proposed Stations to be Included in Water Quality Monitoring Program for Receiving Waters

Station #	Description	Rationale	Frequency	Parameters
LES-66	Natural spring along Duncan Creek road (may also be a separate site by the old Mackeno tailings as well)	Inflow to Christal Creek (above KV-6). Background load model input	Quarterly	pH, Conductivity, flow, Metals
LES-30 / S2	UN Adit	Inflow to Christal Creek (between KV-6 & KV-7). Update seasonal flows - load model	Quarterly	pH, Conductivity, flow, Metals
LES-34	Erickson Gulch at Road to Luck Queen	Inflow to Christal Creek (between KV-6 & KV-7); not been updated 2006 loading model	Quarterly	pH, Conductivity, flow, Metals
LES-63	Sandy Creek at Highway	Inflow to South McQuesten River (between KV-1 and KV-2); not been updated 2006 loading model	Quarterly	pH, Conductivity, flow, Metals
KV-21	No Cash Creek at Keno Highway	Inflow to South McQuesten River (between KV-1 and KV-2); not been updated 2006 loading model	Quarterly	pH, Conductivity, flow, Metals
LES-76	Star Creek at Keno Highway	Inflow to South McQuesten River (between KV-1 and KV-2); not been updated 2006 loading model	Quarterly	pH, Conductivity, flow, Metals
LES-10	Haldane Creek at South McQuesten Road	Inflow to South McQuesten River (between KV-4 and KV-5); not been updated 2006 loading model	Quarterly	pH, Conductivity, flow, Metals
LES-73	Seepage at toe of #3 dam	Inflow to Flat Creek; not been updated 2006 loading model	Quarterly	pH, Conductivity, flow, Metals
LES-57	Galena Creek at mouth (just upstream of Flat Creek) **OR** LES-11B/ACG-WQ-02 Galena Creek downstream of Silver King adit	Inflow to Flat Creek; not been updated 2006 loading model	Quarterly	pH, Conductivity, flow, Metals
LES-11	Galena Creek upstream of Silver King adit (ACG-WQ-01)	Inflow to Flat Creek;not been updated 2006 loading model	Quarterly	pH, Conductivity, flow, Metals
LES-67	Porcupine Gulch at Calumet Road Crossing	Inflow to Flat Creek; not been updated 2006 loading model	Quarterly	pH, Conductivity, flow, Metals
LES-45	Brefalt Creek upstream of Porcupine Diversion	Inflow to Flat Creek; not been updated 2006 loading model	Quarterly	pH, Conductivity, flow, Metals
LES-46	Flat Creek upstream of Porcupine Diversion	Final Flat Creek inflow (Husky influence); not been updated 2006 loading model	Quarterly	pH, Conductivity, flow, Metals
LES-8	Flat Creek at Keno Highway	Background station for Flat Cr; not been updated 2006 loading model	Quarterly	pH, Conductivity, flow, Metals
LES-52	Thunder Gulch upstream of Bellekeno adit	Inflow to Lightning Creek (above KV-41); not been updated 2006 loading model	Quarterly	pH, Conductivity, flow, Metals
KV-39	Hope Gulch upstream Lightning Creek; not been updated 2006 loading model	Inflow to Lightning Creek (above KV-41); not been updated 2006 loading model	Quarterly	pH, Conductivity, flow, Metals

2006 UKHM WQ Master Database Information Sheet

1. All WQ sample sites are listed by KV number on each tab.
2. Tab number two - WQ ToC. This is the entire Table of Concordance for the Keno Hill site with all available site numbering and naming found
3. Sites with extensive data that could not fit onto 1 tab were put on two or more tabs. These tabs are identified by the KV#- followed by a dash then 1, 2 or 3 depending on the amount of site data needed to display.
4. This database represents all lab related WQ data for the Keno Hill site with the exception of Extractable Metals which can be found on Historic WQ Data Extractable Metals.xls
5. Tabs with a D following the KV number denote daily/weekly data from the Elsa lab

Any red text denotes an cell(s) needing attention

LES	Labarge Environmetal Services
ACG	Access Consulting Group
ALEXCO	Alexco Resource Corp.
EPS	
UKHM	United Keno Hill Mines
DIAND	

TAB #	TAB CONTENTS	GENERAL INFO
REF	Lab Reference numbers for data found in this excel sheet	
Read	Information on this database	
ToC	Table of Concordance	
SiteInfo	Information on each site with GPS locations	
B1	Blank Worksheet NEW	not in use yet - NWL is arranging the data to suit this sheet
B2	Blank Worksheet Monthly data	
B3	Blank Worksheet Daily data	
KV6D	Internal - daily/weekly data for Christal Creek @ Keno Highway	
KV7D	Internal - daily/weekly data for Christal Creek @ Hanson Road	
KV10D	Internal - daily/weekly data for Valley Tailings Pond #1 Decant	
KV11D	Internal - daily/weekly data for Valley Tailings Pond #2 Decant	
KV12D	Internal - daily/weekly data for Valley Tailings Pond #3 Decant	
ACG-WQ-01D	Internal - daily/weekly data for Galena Creek u/s from Silver King Adit	
ACG-WQ-02D	Internal - daily/weekly data for Galena Creek d/s from Silver King Adit	
KV13D	Internal - daily/weekly data for Silver King Adit	
KV14D	Internal - daily/weekly data for Silver King Treatment Pond #2 Decant	
KV16D	Internal - daily/weekly data for Christal Creek 600 m d/s Silver Trail Highway	
KV27D	Internal - daily/weekly data for Galkeno 300 Adit	
KV28D	Internal - daily/weekly data for Galkeno 300 Treatment Pond Decant	
KV29D	Internal - daily/weekly data for Culvert 4	
KV30D	Internal - daily/weekly data for Christal Creek 825 m d/s Silver Trail Highway	
KV31D	Internal - daily/weekly data for Galkeno 900 Adit	
KV32D	Internal - daily/weekly data for Galkeno 900 Treatment Pond Decant	
KV42D	Internal - daily/weekly data for Bellekeno 600 Adit	
KV43D	Internal - daily data for Bellekeno 600 Treatment Pond Decant	
KV44D	Internal - weekly data for Bellekeno 600 Seep	
KV45D	Internal - weekly data for Onek Adit	
KV1	Monthly data for South McQuesten River u/s Christal Creek	
KV2	Monthly data for South McQuesten River @ Pumphouse tab 1 of 2	data from 1969 to 1993
KV2-2	Monthly data for South McQuesten River @ Pumphouse tab 2 of 2	data from 1994 to present
KV3	Monthly data for South McQuesten River u/s Flat Creek	
KV4	Monthly data for South McQuesten River d/s Flat Creek	
KV5	Monthly data for South McQuesten River 9 km downstream Flat Creek	
KV6	Monthly data for Christal Creek @ Keno Highway	
KV7	Monthly data for Christal Creek @ Hanson Road	
KV8	Monthly data for Christal Creek @ mouth	
KV9	Monthly data for Flat Creek u/s South McQuesten River	
KV10	Monthly data for Valley Tailings Pond #1 Decant	
KV11	Monthly data for Valley Tailings Pond #2 Decant	
KV12	Monthly data for Valley Tailings Pond #3 Decant	
KV13	Monthly data for Silver King Adit	
KV14	Monthly data for Silver King Treatment Pond #2 Decant	
KV15	Monthly data for South McQuesten River at Bridge below Haggart Creek	
SiteB	Monthly data for Christal Creek 50 m u/s of KV-16	samples are no longer taken at this location
KV16	Monthly data for Christal Creek 600 m d/s Silver Trail Highway	
KV17	Monthly data for Husky South West Adit	
KV18	Monthly data for Bermingham Adit	
KV19	Monthly data for Ruby Adit	
KV20	Monthly data for No Cash 500 Adit	
KV21	Monthly data for No Cash Creek @ Keno Highway	
KV27	Monthly data for Galkeno 300 Adit	
KV28	Monthly data for Galkeno 300 Treatment Pond Decant	
KV29	Monthly data for Silver Trail Culvert #4	
SiteC	Monthly data for Flow from Culvert #5 before confluence with Christal Creek	samples are no longer taken at this location
KV30	Monthly data for Christal Creek 825m d/s Silver Trail Highway	
KV31	Monthly data for Galkeno 900 Adit	
KV32	Monthly data for Galkeno 900 Treatment Pond Decant	
KV33	Monthly data for Keno 700 Adit	
KV34	Monthly data for Lucky Queen Adit	
KV35	Monthly data for Sadie Ladue Adit	
KV36	Monthly data for Flame and Moth	one data set from 1999 discharge from the North Trench
KV37	Monthly data for Lightning Creek u/s Hope Gulch	
KV38	Monthly data for Lightning Creek u/s Thunder Gulch	
KV39	Monthly data for Hope Gulch u/s Lightning Creek	
KV40	Monthly data for Charity Gulch u/s Lightning Creek	
KV41	Monthly data for Lightning Creek u/s bridge @ Keno City	
KV42	Monthly data for Bellekeno 600 Adit	
KV43	Monthly data for Bellekeno 600 Treatment Pond Decant	
KV44	Monthly data for Bellekeno 600 Seep	
KV45	Monthly data for Onek Adit	
KV47	Monthly data for Porcupine Diversion Ditch	
ACG-WQ-01	Monthly data for Galena Creek upstream Silver King Adit	
ACG-WQ-02	Monthly data for Galena Creek downstream Silver King Adit	

TAB #	TAB CONTENTS	GENERAL INFO
LES1b	Monthly data for South McQuesten River upstream of Christal Creek	
LES 8	Monthly data for Flat Cr @ Keno Highway	
LES10	Monthly data for Haldane Cr @ South McQuesten Road	
LES31b	Monthly data for Galkeno 900 decant Pond # 2	
LES44	Monthly data for Bermingham Pit	
LES46	Monthly data for Flat Creek upstream Porcupine Diversion	
LES48	Monthly data for Hope Gulch	
LES51	Monthly data for Combined Seepages in Porcupine Diversion u/s Brefalt Creek	
LES59	Monthly data for Buried Tails Seepage (Elsa side)	
LES60	Monthly data for Exposed Tails Seepage (Pond side)	
LES67	Monthly data for Porcupine Gulch @ Calumet Rd Crossing	
LES69	Monthly data for Flat Creek midway between tailings and Husky S.W.	
LES77	Monthly data for Husky Mine Shaft	
LES78	Monthly data for Seep along road to G900, 80m from adit	
S2	Monthly data for UN Adit	
S-16	Monthly data for Elsa Adit	
NCC1	Monthly data for No Cash Creek 35 md/s Hwy, #1	Limited data
NCC2	Monthly data for No Cash Creek 500 m d/s Hwy, #2	Limited data
NCC3	Monthly data for No Cash Creek in wetland, 800 m d/s Hwy	Limited data
NCC4	Monthly data for No Cash Creek just u/s Ditch, 1.4 km d/s Hwy	Limited data
STN06	Monthly data for Christal Creek d/s of Paddy Mine	1 set of data Dec 2003
CUL2	Monthly data for Silver Trail Culvert #2	1 set of data Jan 2004

TAB	SITE DESCRIPTION	GENERAL INFO	GPS WAYPOINT	NORTHING	EASTING
KV-1	South McQuesten River u/s Christal Creek		KV1		
KV-2	South McQuesten River @ Pumphouse		KV2		
KV-3	South McQuesten River u/s Flat Creek		KV3		
KV-4	South McQuesten River d/s Flat Creek		KV4		
KV-5	South McQuesten River 9 km downstream Flat Creek		KV5		
KV-6	Christal Creek @ Keno Highway		KV6		
KV-7	Christal Creek @ Hanson Road		KV7		
KV-8	Christal Creek @ mouth		KV8		
KV-9	Flat Creek u/s South McQuesten River		KV9		
KV-10	Valley Tailings Pond #1 Decant		KV10		
KV-11	Valley Tailings Pond #2 Decant		KV11		
KV-12	Valley Tailings Pond #3 Decant		KV12		
KV-13	Silver King Adit		KV13		
KV-14	Silver King Treatment Pond #2 Decant		KV14		
KV-15	South McQuesten River at Bridge below Haggart Creek		KV15		
SiteB	Christal Creek 50 m u/s of KV-16	no longer a sample location	SiteB		
KV-16	Christal Creek 600 m d/s Silver Trail Highway		KV16		
KV-17	Husky South West Adit		KV17		
KV-18	Bermingham Adit		KV18		
KV-19	Ruby Adit		KV19		
KV-20	No Cash 500 Adit		KV20		
KV-21	No Cash Creek @ Keno Highway		KV21		
KV-27	Galkeno 300 Adit		KV27		
KV-28	Galkeno 300 Treatment Pond Decant		KV28		
KV-29	Silver Trail Culvert #4		KV29		
SiteC	Flow from Culvert #5 before confluence with Christal Creek	no longer a sample location data from Jan04 - Jun05	SiteC		
KV-30	Christal Creek 825m d/s Silver Trail Highway		KV30		
KV-31	Galkeno 900 Adit		KV31		
KV-32	Galkeno 900 Treatment Pond Decant		KV32		
LES 31b	Galkeno 900 Decant Pond #2	no longer exsists	LES 31b		
KV-33	Keno 700 Adit		KV33		
KV-34	Lucky Queen Adit		KV34		
KV-35	Sadie Ladue Adit		KV35		
KV-36	Flame and Moth	Water samples taken in North Trench 1999	KV36		
KV-37	Lightning Creek u/s Hope Gulch		KV37		
KV-38	Lightning Creek u/s Thunder Gulch		KV38		
KV-39	Hope Gulch u/s Lightning Creek		KV39		
KV-40	Charity Gulch u/s Lightning Creek		KV40		
KV-41	Lightning Creek u/s bridge @ Keno City		KV41		
KV-42	Bellekeno 600 Adit		KV42		
KV-43	Bellekeno 600 Treatment Pond Decant		KV43		
KV-44	Bellekeno 600 Seep		KV44		
KV-45	Onek Adit		KV45		
KV-47	Porcupine Diversion Ditch		KV47		
S-16	Elsa Adit		S16		
LES1b	South McQuesten River upstream of Christal Creek		LES1b		
LES10	Haldane Cr @ South McQuesten Road		LES10		
LES51	Combined Seepages in Porcupine Diversion u/s Brefalt Creek		LES51		
LES59	Buried Tails Seepage (Elsa side)		LES59		
LES60	Exposed Tails Seepage (Pond side)		LES60		
LES67	Porcupine Gulch @ Calumet Rd Crossing		LES67		
LES69	Flat Creek midway between tailings and Husky S.W.		LES69		
LES78	Seep along road to G900, 80m from adit		LES78		
S2	UN Adit		S2		

Keno Hill Water Quality Database Table of Conformance						
Old UKHM #	UKHM #	LES SITE #	ACG #	NPG #	**KV#**	**SITE DESCRIPTION**
S-21	UK1	LES 1			**KV-1**	South McQuesten River u/s Christal Creek
S-10	UK2	LES 2			**KV-2**	South McQuesten River at Pumphouse
S-26	UK5	LES 3			**KV-3**	South McQuesten River u/s Flat Creek
S-11	UK3	LES 4			**KV-4**	South McQuesten River d/s Flat Creek
		LES 5			**KV-5**	South McQuesten River 9 km downstream Flat Creek
S-18	UK6	LES 6	ACG-WQ-05	NPG-05	**KV-6**	Christal Creek @ Keno Highway
S-19	UK7	LES 7 & LES			**KV-7**	Christal Creek @ Hanson Road
	UK8	LES 7B			**KV-8**	Christal Creek @ mouth
S-9	UK9	LES 9	ACG-WQ-09		**KV-9**	Flat Creek u/s South McQuesten River
			ACG-WQ-08a		**KV-10**	Valley Tailings Pond #1 Decant
			ACG-WQ-08b		**KV-11**	Valley Tailings Pond #2 Decant
S-1	UK13	LES 72	ACG-WQ-08c		**KV-12**	Valley Tailings Pond #3 Decant
S-13	UK14	LES 12	ACG-WQ-03b	NPG-03	**KV-13**	Silver King Adit
S-13A		LES 12A	ACG-WQ-03		**KV-14**	Silver King Treatment Pond #2 Decant
	UK4				**KV-15**	South McQuesten River at Bridge below Haggart Creek
			ACG-WQ-11 Site		**KV-16**	Christal Creek 600 m d/s Silver Trail Highway
S-17	UK15	LES14			**KV-17**	Husky South West Adit
S-3	UK24	LES 18			**KV-18**	Bermingham Adit
S-15	UK17	LES 19			**KV-19**	Ruby Adit
S-4	UK25	LES 20			**KV-20**	No Cash 500 Adit
		LES 21			**KV-21**	No Cash Creek @ Keno Highway
S-27	UK27	LES 32			**KV-27**	Galkeno 300 Adit
			ACG-WQ-12		**KV-28**	Galkeno 300 Treatment Pond Decant
	UK27a		ACG-WQ-10		**KV-29**	Silver Trail Culvert #4
			ACG-WQ-11 Site		**KV-30**	Christal Creek 825m d/s Silver Trail Highway
S-5	UK20	LES 31 or	ACG-WQ-04b	NPG-04	**KV-31**	Galkeno 900 Adit
S-20		LES 31B	ACG-WQ-04a		**KV-32**	Galkeno 900 Treatment Pond Decant
S-6	UK21	LES 38			**KV-33**	Keno 700 Adit
S-14	UK28				**KV-34**	Lucky Queen Adit
S-7	UK26	LES 35			**KV-35**	Sadie Ladue Adit
					KV-36	Flame and Moth
S-22	UK11	LES 37			**KV-37**	Lightning Creek u/s Hope Gulch
		LES STN38			**KV-38**	Lightning Creek u/s Thunder Gulch
		LES 48			**KV-39**	Hope Gulch u/s Lightning Creek
		LES STN37			**KV-40**	Charity Gulch u/s Lightning Creek
S-24	UK12	LES 41			**KV-41**	Lightning Creek u/s bridge @ Keno City
S-12	UK18	LES 39	ACG-WQ-07b		**KV-42**	Bellekeno 600 Adit
S-12a		LES 39A	ACG-WQ-07	NPG-07	**KV-43**	Bellekeno 600 Treatment Pond Decant
S-5A	UK18A	LES 39B	ACG-WQ-07c		**KV-44**	Bellekeno 600 Seep
S-8	UK19	LES 40	ACG-WQ-06	NPG-06	**KV-45**	Onek Adit
S-23	UK10	LES 47			**KV-47**	Porcupine Diversion Ditch
S-16						Elsa Adit
			ACG-WQ-10a			Hillside above Culvert 4 on the Silver Trail Highway
			ACG-WQ-11 Site			Flow from Culvert #5 before confluence with Christal Creek
			ACG-WQ-11 Site			Christal Creek 50 m u/s of Site A (KV-16)
		LES 1B				South McQuesten River just u/s Christal Creek **not KV-1**
		LES 8				Flat Cr @ Keno Highway
		LES 10				Haldane Cr @ South McQuesten Road
		LES 11A				Galena Creek upstream Elsa Road
		LES 11	ACG-WQ-01	NPG-01		Galena Creek upstream Silver King adit
		LES 11B	ACG-WQ-02	NPG-02		Galena Creek downstream Silver King adit
S-2		LES 30				UN Adit
		LES 31B				Galkeno 900 decant Pond # 2
		LES 31C				Galkeno 900 seep below Pond # 1
		LES 31D				Galkeno 900 seep below Pond #2
		LES 31 F				Galkeno 900 Seep near Swamp effluent
		LES 31G				Galkeno 900 flow along old path 5m u/s Christal L.
	UK23	LES 31H				Galkeno 900 Seep below wetland access road
		LES 34				Erickson Gulch @ Road to Lucky Queen
		LES42				Tailing Pond # 3 water
		LES44 or				Bermingham Pit
		LES 45				Brefault Cr upstream Porcupine Diversion
		LES 46				Flat Cr upstream Porcupine Diversion

Keno Hill Water Quality Database Table of Conformance						
Old UKHM #	UKHM #	LES SITE #	ACG #	NPG #	**KV#**	**SITE DESCRIPTION**
		LES 48				
		LES 51				Combined Seepages in Porcupine Diversion u/s Brefalt Creek
		LES 52				Thunder Gulch upstream Bellekeno Adit
		LES 53				Old Galkeno freshwater pumphouse water
		LES 54				Thunder Gulch downstream Bellekeno Adit
		LES 55				Inflow to south end of Christal Lake
		LES 56				Christal Lake
		LES 57				Galena Creek @ mouth (just upstream of Flat Creek)
		LES 58				Mystery Creel (approximately 1 km upstream of S-10)
		LES 59				Buried Tails Seepage (Elsa side)
		LES 60				Exposed Tails Seepage (Pond side)
		LES 61				Small flow into Christal Creek. parallel to Highway @ S-18 near
		LES 62				Small flow into Christal Creek. @ S-18, farthest from road
		LES 63				Sandy Creek @ Highway
		LES 64				Unnamed Creek 60m towards Elsa on Keno Highway from Hanson
		LES 65				Galkeno 300 Seep below power line along Highway
		LES 66				Spring along Duncan Cr Road
		LES 67				Porcupine Gulch @ Calumet Rd X-ing
		LES 68				Flat Creek @ Ballpark Rd X-ing
		LES 69				Flat Creek midway between tailings and Husky S.W.
		LES 70				Flat Creek between Husky S.W. and Galena
		LES 71				Flat Creek d/s Galena Creek
		LES 73				Seepage at toe of #3 dam
		LES 74				Husky Southwest flow 500 m d/s Adit
		LES 75				Seepage along road between Galkeno 300 & Duncan Creek Rd.
		LES 76				Star Creek @ Keno Highway
		LES 77				Husky Shaft
		LES 78				Seep along road to Galkeno 900, 80 m from Adit clearing
		W1				Dublin Gulch (downstream of confluence with Stewart Gulch)
		W2				Haggart Creek (upstream of confluence with Ironrust Creek)
		W3				Ironrust Creek (upstream of confluence with Haggart Creek)
		W4				Haggart Creek (downstream of confluence with Dublin Gulch)
		W5				Haggart Creek (upstream of confluence with Lynx Creek)
		W6				Lynx Creek (upstream of confluence with Haggart Creek)
		W7				Haggart Creek (downstream of confluence with Ironrust Creek)
		W8				Dublin Gulch (downstream of confluence with Olvie Gulch)
		W9				Lower Eagle Pup
		W10				Lower Stuttle Gulch
		W11				Fisher Gulch (upstream of confluence with Haggart Creek)
		W12				Stewart Gulch (upstream of confluence with Dublin Gulch)
		W12(96)				Dublin Gulch (immediately upstream of Haggart Creek)
		W12A(96)				Haggart Creek (upstream of confluence with Dublin Gulch)
		W13				Upper Lynx Creek
		W14				Lower Bawn Bay Gulch
		NCC1				No Cash Creek 35 md/s Hwy, #1
		NCC2				No Cash Creek 500 m d/s Hwy, #2
		NCC3				No Cash Creek in wetland, 800 m d/s Hwy
		NCC4				No Cash Creek just u/s Ditch, 1.4 km d/s Hwy
		LES 21A				No Cash Creek u/s Adit, above old wood culvert
		LES 22				No Cash Creek upstream Hwy (1.4 km NW of Keno Highway)
		LES 22A				No Cash Creek just u/s of confluence with old ditch
		LES STN25				Flat Creek upstream Galena Creek

A Member of Alexco Resource Group
 # 3 Calcite Business Centre, 151 Industrial Road
Whitehorse, Yukon Y1A 2V3
PHONE (867) 633-4881 **FAX** (867) 633-4882

Baseline Environmental Assessment
Closure Planning Technical Studies – Keno Hill, Yukon

Aerial Photography and Orthophotos

Project Objective

Complete new color aerial photos of the UKHM properties and prepare orthophotos for closure planning and baseline environmental assessment purposes.

Methodology

Alexco Resource Corp. contracted Aero Geometrics to fly and deliver new 1:10 1000 color photographs of the UKHM district and to prepare orthophotos. The attached CD contains the following:

- 2006 Airphoto CCW's
- Autocad drawings
- Ascii dem files

The files are in Ermapper and ECW format. TIF files can be provided as necessary. The photos attached are georeferenced photos.

A Member of Alexco Resource Group
 # 3 Calcite Business Centre, 151 Industrial Road
Whitehorse, Yukon Y1A 2V3
PHONE (867) 668-6463 **FAX** (867) 667-6680
www.accessconsulting.ca

Closure Planning Technical Studies – Keno Hill, Yukon

Weather Station

Project Objective

Install automated meteorological station (temperatures, precipitation, solar radiation, wind speed and direction) and accompanying data logger on Galena Hill and tie station with existing YG snow course.

Status

ERDC has purchased and will install in spring 2007 an Onset HOBO Datalogging Weather Station. This 3m mast station will be installed on Galena Hill above the Hector Adit (see Figure 1 below).

The station is equipped with the following sensors:

- Air temperature;
- Relative humidity;
- Barometric pressure;
- Rainfall;
- Windspeed and direction;
- Solar radiation; and
- Soil temperature.

Sensors relay 15 minute average values to the logger, which records and stores the readings every 15 minutes continuously. Parameter readings can be displayed in many commonly accepted units of measure. Data will be downloaded from the station monthly and will be integrated into the Site Environmental Database for closure planning purposes.

Specifications and details on the HOBA Weather Station are attached.

outdoor

HOBO® Weather Station & HOBO Micro Station

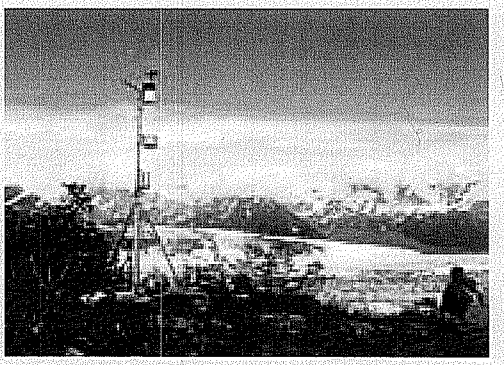
AWARD-WINNING TECHNOLOGY
AE50
HOBO® WEATHER STATION
HOBO® WATER TEMP PRO

The AE50 award-winning HOBO Weather Station and HOBO Micro Station data loggers offer easy configuration and dependable research-grade measurements at a reasonable cost. Choose either the 4-input HOBO Micro Station for its small size and low price, or the 15-channel HOBO Weather Station for maximum expandability.

Both loggers are easily configured with Onset's wide range of plug-in smart sensors or input adapters for third-party sensors, pages 32 to 34. Complete your system with remote communications options, mounting tripods and accessories

Common Features:

Smart sensors simply plug in and are ready for logging—no calibration or complex wiring
Runs for one year on 4 user-replaceable AA batteries (typical)
HOBOware® (Windows and Mac) software for system launch, data analysis and file export
Flexible remote download options are easy to connect, and provide on-demand or automated data offload.
Select only the measurements and data logger size you need
Up to 15 inputs
Scalable to a variety of applications—choose from 2-m or 3-m tripods, or mount the Micro Station on a 2x4 for monitoring microclimates
Large 512K memory for long-term deployments
Optional data transmission (with Remote Site Manager software) via email or to an internet FTP site (active mode). Pager wireless option sends alert messages via cell phone text message or email
Loggers and sensors undergo rigorous environmental testing
Low-battery warnings
Non-volatile EEPROM memory retains data even if batteries fail
Detailed specifications for every sensor

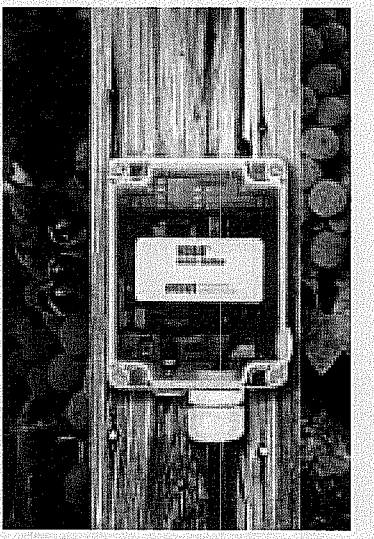


The HOBO Weather Station is well suited to long-term deployments in remote sites.

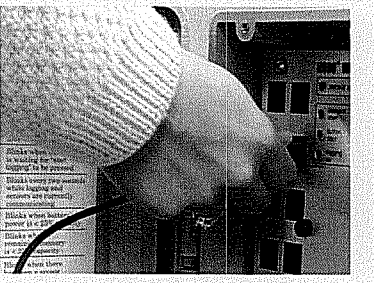
Smart sensors are specified for total accuracy—no hidden error terms
Flexible mounting—each sensor can be positioned at correct height to meet industry standards
Sensor mounting accessories provide proper spacing to avoid interference and insure good accuracy

Smart Sensors

Temperature
Temperature/RH
Wind Speed & Direction
Wind Speed
Rainfall
Soil Moisture
Solar Radiation
PAR
Barometric Pressure (for Weather Station only)
Leaf Wetness
4-20 mA Input Adapter
Voltage Input Adapter
Pulse Input Adapter



The HOBO Micro Station's small size is perfect for microclimate monitoring.



Expanding or reconfiguring the HOBO Weather Station or HOBO Micro Station is as simple as plugging in, or unplugging, smart sensors.

onset

outdoor

Common Specifications:

Memory: 512K non-volatile data storage

Memory Modes: Stop when full, Wrap around when full

Logging Interval: 1 second to 18 hours, user-specified interval

Battery Life: 1 year typical use (up to 10 sensors with 10-min or longer logging interval)

	Approximate Battery Run Times		
Sampling Interval	1 to 4 sensors	5 to 10 sensors	10 to 15 sensors
1 minute	12 months	9 to 12 months	7 to 10 months
10+ minutes	12 months	12 months	9 to 12 months

Operating Range and Battery Type: Four standard AA alkaline batteries included (for operating conditions -20° to 50°C (-4° to 122°F)); optional AA lithium batteries available (for operating conditions -40° to 70°C (-40° to 158°F)); Note – when selecting batteries, keep in mind that the logger can be up to 17°C (30°F) hotter than ambient if it is in full sun.

Time Accuracy: 0 – 2 seconds for the first data point and +/-5 seconds per week at 25°C (77°F)

Data Type: Supports measurement averaging for sensors with this feature

Logger Start Modes: Immediate, Push-button, or Delayed start options

Operational Indicators: 7 LEDs provide logging and network status

Data Offload Options: Current reading while logging; offload data while logging or when stopped

Offload Speed: 2 1/2 minutes for full 512K offload

Sensor network cable length: 100 meters (328 ft) maximum

HOBOware compatible

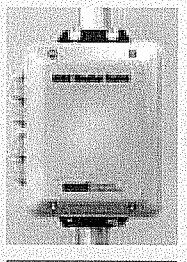
Compliant with all relevant directives in the European Union (EU)

U- Shuttle compatible

BoxCar®Pro-compatible

HOBO Weather Station

up to 15 inputs for maximum system flexibility



10 sensor inputs, expandable to 15 with optional 1-to-2 sensor adapters

Logger Size/Weight: 18 x 23 x 10 cm (7 x 9 x 4"); 0.9 kg (2 lbs)

Data Communication: RS-232 via internal jack or weatherproof external connector

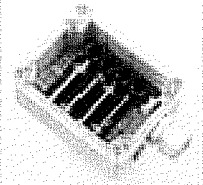
Mounting: Mast 4.1 cm (1 5/8" maximum diameter), available 2- and 3-meter tripods, or post mount

Enclosure & Access: Weatherproof, hinged door secured by four screws

Has room for up to 10 voltage or 4-20mA input adapters

HOBO Micro Station

compact and low-cost



4 sensor inputs (up to 15 measurement channels possible, as some sensors provide more than 1 measurement)

Logger Size/Weight: 8.9 x 11.4 x 5.4 cm (3.5 x 4.5 x 2.125"); 0.5 kg (1 lb)

Data Communication: RS-232 via internal jack accessed through removable weatherproof plug; Optional Adapter Cable (CABLE-HWS-F) required for connection to Onset remote communications accessories or Weatherproof Communications Cables.

Mounting: Mount on flat surface 3.5" or wider; optional mounting kit for use on 4.1-cm- (1 5/8") diameter masts

Enclosure & Access: Weatherproof; cover secured by four screws

Has room for up to 2 voltage or 4-20mA input adapters

onset

HOBO Weather Station and HOBO Micro Station Ordering

Description	Part No.
HOBO Weather Station Logger	H21-001
HOBO Weather Station Data Logger & Smart Sensor Kit (see details pg 35)	H21-SYS-A
HOBO Micro Station Logger	H21-002
HOBO Micro Station Mast Mounting Kit	M-MKA
HOBO Micro Station Grounding Wire (required for use with Wind Speed/Direction sensor or tripod mounting)	CABLE-HWS-G
Micro Station Adapter Cable (includes Grounding Wire)	CABLE-HWS-F
Lithium Batteries	HWSB-LI

Software & Communication

HOBOware software and a Serial Interface Cable are required for operation of HOBO Weather Station loggers. For use with USB ports a USB-Serial Adapter is also required (pg 49).*

HOBOware (Windows) Software	BHW-PC
HOBOware (Mac) Software	BHW-MAC
Serial Interface Cable	CABLE-PC-3.5
USB-Serial Adapter	CABLE-USB232
HOBO U-Shuttle (optional)	U-DT-1

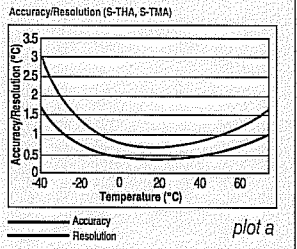
*The HOBO Weather Station and HOBO Micro Station are also compatible with BoxCar® Pro 4.3 software.

Weatherproof Comm. Cable	
2 m	CABLE-HWS2
17 m	CABLE-HWS17

outdoor
Smart Sensor Specifications

Temperature/RH* (Part # S-THA-M0XX)

Measurement Ranges: -40° to 75°C (-40° to 167°F); 0 to 100% RH from 0° to 50°C (32° to 122°F)
Accuracy: ± 0.7° @ 25°C (1.3° @ 77°F); (see plot a)
± 3% RH over the range of 0° to 50°C (32° to 122° F);
± 4% in condensing environments 0° to 30°C (32° to 86°F)
Resolution: 0.4° @ 25°C (0.7° @ 77°F); 0.5% RH @ 25°C (77°F)
Drift: < 0.1°C (0.2°F) temp per year (typical); ± 1% RH per year; additional reversible RH drift up to 3% can occur when average RH exceeds 70%
Environment: RH sensor designed for outdoor environments with cyclical high/low humidity levels. Intermittent condensation permitted at temperatures <30°C (86°F). Operation outside stated limits, or repeated sensor saturation will cause premature sensor failure. Protect sensor from rain, splashing, mist and airborne chemicals such as salt and ammonia.
Temperature Sensor Operating Range: -40° to 75°C (-40° to 167°F)
Response time: Temp: 8 minutes, RH: 5 minutes— typical to 90% in 2 m/sec airflow
Data channels: 2
Measurement averaging: No
Housing: Stainless steel
Dimensions: 1.6 cm x 8.6 cm (0.625" x 3.5")
Cable lengths: 2 m, 6 m, 17 m (6.5', 20', 56')
Weight: 60 g, 140 g, 370 g (2 oz, 5 oz, 13 oz)



plot a

8-bit Temperature* (Part # S-TMA-M0XX)

Measurement Range: -40° to 75°C (-40° to 167° F)
Accuracy: ± 0.7° @ 25°C (1.3° @ 77°F) (see plot a)
Resolution: 0.4° @ 25°C (0.7° @ 77°F)
Drift: < 0.1°C (0.2°F) per year
Environment: Sensor tip and cable rated for 1-year immersion in fresh water ≤50°C (122°F)
Response time: < 2 minutes typical to 90%, in 2 m/sec airflow
Data channels: 1
Measurement Averaging: No
Housing: Stainless steel sensor tip
Dimensions: 0.7 x 3.8 cm (0.28 x 1.5")
Cable lengths: 2 m, 6 m, 17 m (6.5', 20', 56')
Weight: 90 g, 140 g, 300 g (3.3 oz, 5.2 oz, 11.2 oz)-varies with length

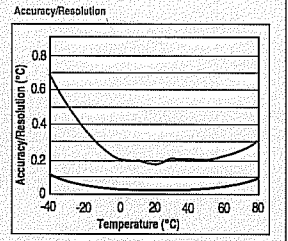


Note: Radiation Shield (M-RSA) strongly recommended for use in sunlight.(pg. 34.)

12-Bit Temperature* (Part # S-TMB-M0XX)

Measurement Range: -40° to 75° C (-40° to 167° F)
Accuracy: ± 0.2° C from 0° to 50° C (±0.36° F from 32° to 122° F)
Resolution: 0.03° C from 0° to 50° C (±0.054° F from 32° to 122° F) (see plot b)
Drift: < 0.1° C (0.2° F) per year
Environment: Sensor tip and cable rated for 1-year immersion in fresh water ≤ 50° C (122°F)
Response Time: < 2 minutes typical to 90% in 2 m/sec airflow
Data channels: 1
Measurement Averaging: Yes
Housing: Stainless steel sensor tip
Dimensions: 0.7 x 3.8 cm (0.28 x 1.5")
Cable Lengths: 2 m, 6 m, 17 m (6.5', 20', 56')
Weight: 90 g, 140 g, 300 g (3.3 oz, 5.2 oz, 11.2 oz)—varies with cable length

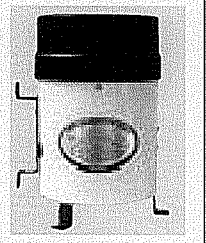




plot b

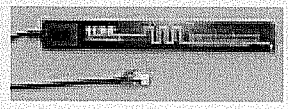
Rainfall (0.01": Part # S-RGA-M00X, 0.2 mm: S-RGB-M00X)

Mechanism: Tipping bucket, stainless steel shaft with brass bearings
Measurement Range: 10 cm/hr or 0 to 5" per hour, maximum 4000 tips per interval
Resolution: 0.2 mm (RGB) and 0.01" (RGA) models
Calibration Accuracy: ±1.0% at up to 20 mm/hour or up to 1"/hour
Calibration: Annual calibration; calibrate in field by user or return to factory
Data channels: 1
Housing: Aluminum housing and collector
Dimensions: 22.8 x 15.4 cm (9 high x 6" diameter), 154 mm (6.06") receiving orifice
Cable lengths: 2 m, 6 m (6.5', 20')
Weight: 1 Kg (2 lbs)
Note: Comes with side bracket for post or tripod mount and feet for surface mount.



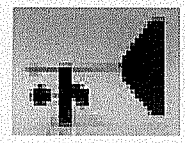
Soil Moisture (Part # S-SMA-M003)

Measurement Range: 0 to 0.405 m^3/m^3 volumetric water content (0 to 40.5 %)
Accuracy: ±0.031 m^3/m^3 (±3%) for most soils, 0° to 50°C (32° to 122°F); ±0.011 m^3/m^3 (±1%) with soil-specific calibration
Resolution: 0.0004 m^3/m^3 (0.04%)
Environment: -40° to 50°C (-40° to 122°F)
Data channels: 1
Measurement Averaging: Yes
Service Life: 3-5 years typical
Probe Dimensions: 25.4 x 3.2 x 0.15 cm (10 x 1.25 x 0.06 ")
Cable length: 3.0 m (9.8 ft)
Weight: 112 g (4 oz)



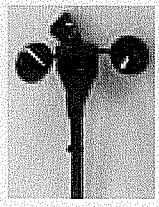
Wind Speed & Direction (Part # S-WCA-M003)

Measurement Range: 0-44 m/s (0-99 mph), Direction 0-358°, 2° dead band
Speed Accuracy: greater of ± 0.5 m/s (1.1 mph) or ±4% of reading
Direction Accuracy: ±5°
Resolution: 0.19 m/s, Direction 1.4 degrees
Starting threshold: ≤0.5 m/s, (1.1 mph)
Distance constant: 3 m (9.8'), Direction: 0.8 m (2.6')
Measurements: Average wind speed and direction, highest 3-second gust
Data channels: 3
Housing: Anodized aluminum and stainless steel, fiberglass reinforced thermoplastic cups, shielded stainless steel ball bearings, wind vane with metal bushings
Service Life: 2 to 5 year life typical
Dimensions: 317 x 419 cm (12.5" x 16.5")
Cable length available: 3 m (9.8')
Weight: 700 g (1.5 lbs)
Note: Survival to 54 m/sec (120 mph). Cross arm recommended for mounting (pg. 34).



Wind Speed (Part # S-WSA-M003)

Measurement Range: 0 to 45 m/s (0 to 100 mph)
Accuracy: ± 1.1 m/s (2.4 mph) or ± 4% of reading, whichever is greater
Resolution: 0.38 m/s
Starting threshold: ≤1 m/s (2.2 mph)
Distance constant: 3 meters (9.8')
Measurements: Average wind speed and highest 2 second gust in logging interval
Data channels: 2
Housing: 3 cup anemometer with TEFLON® bearings, hardened beryllium shaft
Service Life: > 5 year life typical
Dimensions: 19.0 x 8.1 cm (7.5 x 3.2")
Cable length available: 3 m (10')
Weight: 300 g (10 oz)
Note: Survival to 120 mph (54 m/sec). Cross arm (pg 34) or pole mount recommended (2x hose clamps required for pole mount)



Barometric Pressure for HOBO Weather Station (Part # S-BPA-CM10)

Measurement Range: 660 mb to 1070 mb (19.47 to 31.55 inHg)
Accuracy: ± 1.5 mbar (0.044 inHg) over full pressure range at 25°C (77°F); additional temperature induced error of ± 2.5 mbar (0.074 inHg) over –10° to 60°C (14° to 140°F)
Resolution: 0.1 mbar (0.003 inHg)
Drift: Typical ± 0.6 mb (0.018 inHg) per year, maximum < 2.5 mb (0.074 inHg) per 6 months
Measurement: Average over logging interval, user-defined sampling interval from 1 second
Data channels: 1
Dimensions: 4.5 x 4.8 x 1.6 cm (1.75 x 1.88 x 0.63")
Cable lengths available: 10 cm (4")
Weight: 30 g (1 oz)
Note: Use inside logger enclosure to protect from direct exposure to the weather.



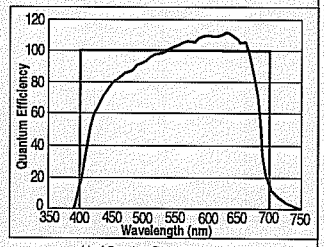
onset

Photosynthetically Active Radiation (PAR) (Part # S-LIA-M003)



Measurement Range: 0 to 2500 μmol/m^2/sec,
Spectral Range: 400 to 700 nm
Accuracy: ± 5 μmol/m^2/sec or ± 5%, whichever is greater in sunlight. Additional temperature induced error ± 0.75 μmol/m^2/sec/degree C from 25°C. Cosine corrected 0—80 degrees; Azimuth Error < 2% error at 45 degrees, 360 degree rotation.
Resolution: 2.5 μmol/m^2/sec
Drift: < ± 2% per year
Calibration: factory recalibration
Measurement: average over logging interval, user-defined sampling interval from 1 second
Data channels: 1

Quantum Efficiency Curve (S-LIA-M003)



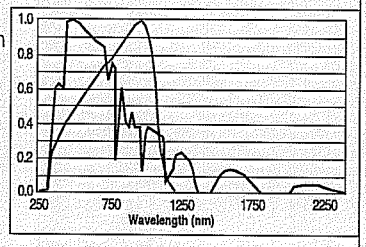
Housing: anodized aluminum housing with acrylic diffuser and O-ring seal
Dimensions: 4.1 cm height x 3.2 cm diameter (1.63 x 1.25")
Weight: 120 g (4 oz)
Cable lengths available: 3 m (9.8')
Note: Light sensor bracket (M-LBA) and light sensor level (M-LLA) recommended

Silicon Pyranometer (Solar Radiation) (Part # S-LIB-M003)



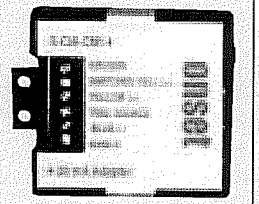
Measurement Range: 0 to 1280 W/m²
Accuracy: ± 10 W/m² or ± 5%, whichever is greater in sunlight. Additional temperature induced error ± 0.38 W/m² /°C from 25°C (0.21 W/m² /°F from 77°F)
Resolution: 1.25 W/m²
Spectral Range: 300 to 1100 nm
Cosine Response Error: ± 5%, 0-70 degrees, ± 10%, 70-80 degrees (from vertical)
Azimuth Error: <± 2% error at 45 degrees from vertical, 360 degree rotation
Drift: <± 2% per year

Response Curve



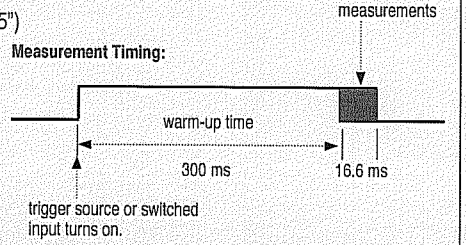
Calibration: factory recalibration available
Measurement: average over logging interval, user-defined sampling interval from 1 second
Data channels: 1
Housing: anodized aluminum housing with acrylic diffuser and O-ring seal
Dimensions: 4.1 cm high x 3.2 cm diameter (1.63" x 1.25")
Weight: 120 g (4 oz)
Cable length available: 3 m (9.8')
Note: Light sensor bracket (M-LBA) and light sensor level (M-LLA) recommended.

12-bit 4-20mA Input Adapter (Part # S-CIA-CM14)

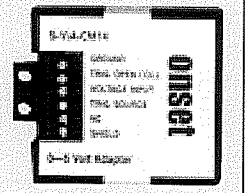


Measurement Range: 4-20 mA
(measures down to 0 mA to detect error conditions)
Measurement Accuracy: ±40μA ±0.3% of reading
Resolution: 4.93 μA
Measurement Averaging: yes
Input impedance: 124 ohms
Differential input
Choice of non-switched or switched input to save external battery power
Sensor Trigger Source: Voltage: 2.5 V ±2.4%; maximum current: 1 mA
Trigger Timing:
Warm-up Time: 300 ms ±3% (fixed)
Measurement Time:
16.6 ms ±3% to filter out 60 Hz noise
Data channels: 1
Dimensions: 4.5 x 4.8 x 1.6 cm (1.8 x 1.9 x 0.6")
Weight: 25 g (0.88 oz)
Cable length:14 cm (5.5")

Measurement Timing:

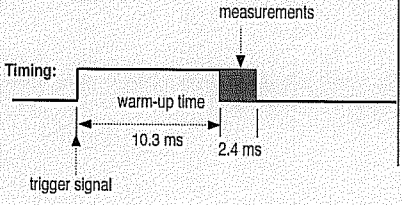


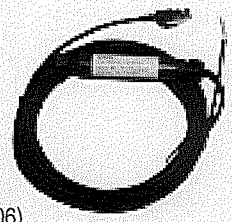
12-bit Voltage Input Adapter (Part # S-VIA-CM14)



Measurement Range: 0-5 V DC
Measurement Accuracy: ±10mV ±0.3% of reading
Resolution: 1.221 millivolts
Measurement Averaging: yes
Input impedance: 1 megohms
Sensor Trigger Open Collector: maximum sink current: 115 mA; 30 V max
Sensor Trigger Source: Voltage: 2.5 V ±2.4%; maximum current: 1 mA
Trigger Timing:
Warm-up Time: 10.3 ms ±3% (fixed)
Measurement Time: 2.4 ms ±3%
Data channels: 1
Dimensions: 4.5 x 4.8 x 1.6 cm (1.8 x 1.9 x 0.6")
Weight: 25 g (0.88 oz)
Cable length:14 cm (5.5")

Measurement Timing:





Pulse Input Adapters

(Part #'s S-UCA-M006 and S-UCB-M006)
The Pulse Input Adapters are ideal for connecting a wide range of sensors with pulse outputs such as tipping-bucket rain gauges, flow meters, power meters and gas meters. These adapters count the number of pulses per logging interval.

Electronic Switch Version (S-UCA-M006)

Compatibility: electronic switch closures, such as FET or open-collector outputs, or CMOS-level logic signals
Maximum input frequency: 120 Hz (120 pulses per second)
Lockout time: 45 μs ±10%
Preferred pulse polarity*: active low

Contact Closure Version (S-UCB-M006)

Compatibility: contact closures, such as tipping-bucket rain gauges or reed switches
Maximum input frequency: 2 Hz (2 pulses per second)
Lockout time (for switch debounce): 327 ms +/-10%
Preferred switch type*: normally-open

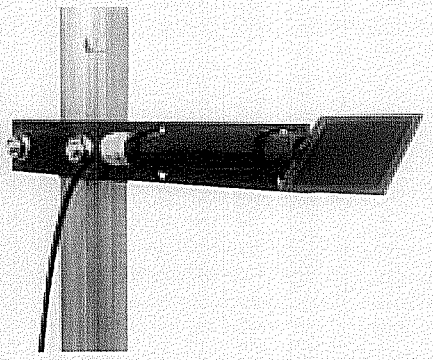
Measurement Range: 0-4093 counts per logging interval (data must be exported for conversion to other units)
Minimum pulse width: 1 ms
Maximum input voltage: 3.6V
Minimum input voltage: -0.3V
Logic levels: low ≤ 0.6V; high ≥2.7V
Edge detection: falling edge
Input/Output impedance: 100 kilohms
User connection: 2-wire input (24 AWG wire; 2 wire nuts included)
Cable length: 6.5m (21 ft)
Weight: 310 g (11 oz)
Data Channels: 1

* Pulses of opposite polarity can be used, but battery usage rate will be higher.

All smart sensors are CE compliant when used with H21-00X loggers

outdoor
Smart Sensor Specifications

Leaf Wetness—NEW (Part # S-LWA-M003)

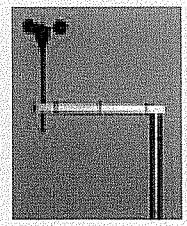


Measurement Range: 0 (dry) to 100% (wet)
Sensor Type: Capacitive Grid
No coating required
Interchangeability between sensors
(over the range 10-90%): ± 10%
Repeatability: ± 5%
Resolution: 0.59%
Stability: < ± 5% per year
Operating Range: -40° to 70°C, (-40° to 158°F)
Data channels: 1
Measurement averaging: No
Dimensions:
Sensor plate: 4.7 x 5.1 cm (1.8 x 2.0")
Tube: 12.2 cm length x 1.8 cm diameter (4.8" x 0.7")
Cable length: 3m (9.8')
Weight: 127 g (4.5 oz) for sensor, and 290 g (10.2 oz) with mounting bracket
Mounting bracket:
20 cm long (8")
Sensor can be positioned at any angle between 0° and 90° degrees (vertical).
For mounting on Onset tripods or masts 3.2 to 4.1 cm (1 1/4 to 1 5/8"), Cross Arms (Part # M-CAA or M-CAB), or flat surfaces. U-bolt and tie-wraps included.

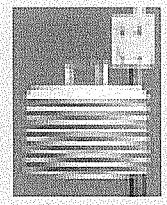
Sensor Mounting Accessories

Smart Sensor Extension Cables (Part # S-EXT-M0XX)
Use individually or connected together to optimize sensor placement. Weatherproof cables available in 5, 10 and 25 m lengths with anti-snag RJ11 connectors. A weatherproof housing is required for outdoor connections (Part# S-EXT-CASE).

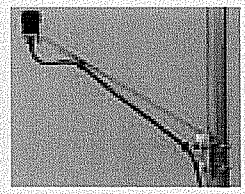
Cross Arm (Half: Part # M-CAB; Full: M-CAA)
For use with Onset tripods or masts (pg 35), the cross arm assures unobstructed wind measurement. Half cross arm (49 cm or 19.2") provides mounting for one wind sensor. Full cross arm (91 cm or 36") offers additional sensor mounting hole/clamp.



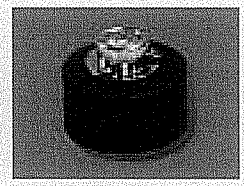
Solar Radiation Shield (Part # M-RSA)
Preassembled for quick deployment, the solar radiation shield is recommended for temperature and RH measurement accuracy in locations exposed to direct or reflected solar radiation. Mounts on tripods, masts or flat vertical surfaces.



Light Sensor Bracket (Part # M-LBA)
The light sensor bracket is designed for use with tripods, masts or flat surfaces. Use to avoid obstructions and shadows that could affect your PAR or solar radiation measurements. Includes levelling screws.



Light Sensor Level (Part # M-LLA)
Simply drop the light sensor level over the PAR or solar radiation sensor to determine if the sensor is level. Purchase one for use on any number of light sensors.



onset

Smart Sensor Ordering

Description	Part No.
Temperature/RH Sensor	
2 m cable	S-THA-M002
6 m cable	S-THA-M006
17 m cable	S-THA-M017
12-Bit Temperature	
2 m cable	S-TMB-M002
6 m cable	S-TMB-M006
17 m cable	S-TMB-M017
8-Bit Temperature	
2 m cable	S-TMA-M002
6 m cable	S-TMA-M006
17 m cable	S-TMA-M017
Wind Speed/Direction	S-WCA-M003
Wind Speed	S-WSA-M003
Rain Gauge (.01")	
2 m cable	S-RGA-M002
6 m cable	S-RGA-M006
Rain Gauge (0.2 mm)	
2 m cable	S-RGB-M002
6 m cable	S-RGB-M006
Soil Moisture Sensor	S-SMA-M003
Leaf Wetness Sensor	S-LWA-M003
PAR Sensor	S-LIA-M003
Silicon Pyranometer	S-LIB-M003
Barometric Pressure	S-BPA-CM10
4-20 mA Adapter*	S-CIA-CM14
0-5 VDC Adapter*	S-VIA-CM14
Pulse Input Adapter	
Electronic Switch	S-UCA-M006
Contact Closure	S-UCB-M006
Leaf Wetness Smart Sensor w/ bracket	S-LWA-M003
1-to-2 sensor adapter for Weather Station	S-ADAPT

Sensor Mounting Accessories

Smart Sensor Extension Cables (optional for use individually or combined)	
5 m length	S-EXT-M005
10 m length	S-EXT M010
25 m length	S-EXT-M025
Weatherproof Connection Housing *(required for outside connections)*	S-EXT-CASE
Half Cross Arm *(recommended for use with wind sensors)*	M-CAB
Full Cross Arm *(recommended for use with wind sensors if additional sensor mounting area desired)*	M-CAA
Solar Radiation Shield *(for use with temperature and temp/RH sensors)*	M-RSA
Light Sensor Bracket *(for mounting PAR or solar radiation sensors on masts or flat vertical surfaces)*	M-LBA
Light Sensor Level *(recommended for installing PAR and solar radiation sensors)*	M-LLA

Note: HOBO® Micro Station has 4 sensor inputs. HOBO Weather Station has 10 inputs, expandable to 15. Use of more than 10 sensors in a HOBO Weather Station requires one 1-to-2 sensor adapter for each sensor over 10. Both loggers have a 15 data channel maximum. For quantities over 99, call for pricing.
** Sensor cables should be shielded, 3.2 to 3.8mm diameter (0.125 to 0.15")*

outdoor

HOBO® Weather Station Tripods & Kits

HOBO Weather Station Kits include our most popular Weather Station components pre-packaged for your ordering convenience.

HOBO Weather Station Data Logger & Smart Sensor Kit

A basic "starter" system, this kit incorporates the HOBO Weather Station Data Logger, Temperature/ RH (S-THA-M002) and Wind Speed and Direction smart sensors (S-WCA-M003). This Kit includes recommended sensor mounting accessories; the Half Cross Arm (M-CAB) for the Wind Speed and Direction smart sensor and the Solar Radiation Shield (M-RSA) for the Temperature/RH sensor. Additional smart sensors can be added and will be recognized by the logger when plugged in. Software is sold separately.

2 Meter Tripod

Cross Arm height range: 1.72 to 2.13 m (5.6' to 7')
Leg Height (to top of legs): 0.81 m (2.7')
Mast Diameter: 4.1 cm (1.63")
Tripod footprint: 51 cm (20")
Weight: 12.8 lbs.
Maximum slope: not adjustable for sloping surfaces

Note: Cross Arms, logger, sensors and radiation shield sold separately—or see Weather Station Kit above

Complete 2-Meter Tripod Kit

Everything you'll need for a 2-meter tripod configuration of the HOBO Weather Station or HOBO Micro Station. The Kit includes a 2-meter tripod (M-TPB), Grounding Kit (M-GKA), Guy Wire Kit (M-GWA), 1/2" Stake Kit (M-SKA) for guy wires, 1/4" Stake Kit for tripod (M-SKB) and Mast Level (M-MLA).



2 and 3-meter tripods available in convenient kits, or order mounting components individually.

3 Meter Tripod

Cross arm height range: 2.74 to 3.20m (9 to 10.5')
Leg height (to top of legs): 1.32 m (4.3')
Mast diameter: 4.1 cm (1.63")
Tripod footprint: 91 cm (3')
Weight: 28 lbs.
Maximum slope: 13 degrees for installation on moderately uneven ground

Note: Cross arms, logger, sensors and radiation shield sold separately—or see Weather Station Kit at left.

Complete 3-Meter Tripod Kit

This kit includes everything needed for a 3-meter tripod for your HOBO Weather Station or HOBO Micro Station. The 3-meter tripod (M-TPA) accommodates moderately sloping terrain. The Kit includes Grounding Kit (M-GKA), Guy Wire Kit (M-GWA), ½" Stake Kit (M-SKA) and Mast Level (M-MLA).

onset

HOBO Weather Station Kits & Accessories Ordering

HOBO Weather Station Kits

Description	Part No.
HOBO Weather Station Data Logger & Smart Sensor Kit	H21-SYS-A

HOBOware software and a Serial Interface Cable are required for operation of HOBO Weather Station loggers. For use with USB ports, a USB-Serial Adapter is also required

HOBOware (Windows) Software	BHW-PC
HOBOware (Mac) Software	BHW-MAC
Serial Interface Cable	CABLE-PC-3.5
USB-Serial Adapter	CABLE-USB232
HOBO U-Shuttle (optional)	U-DT-1

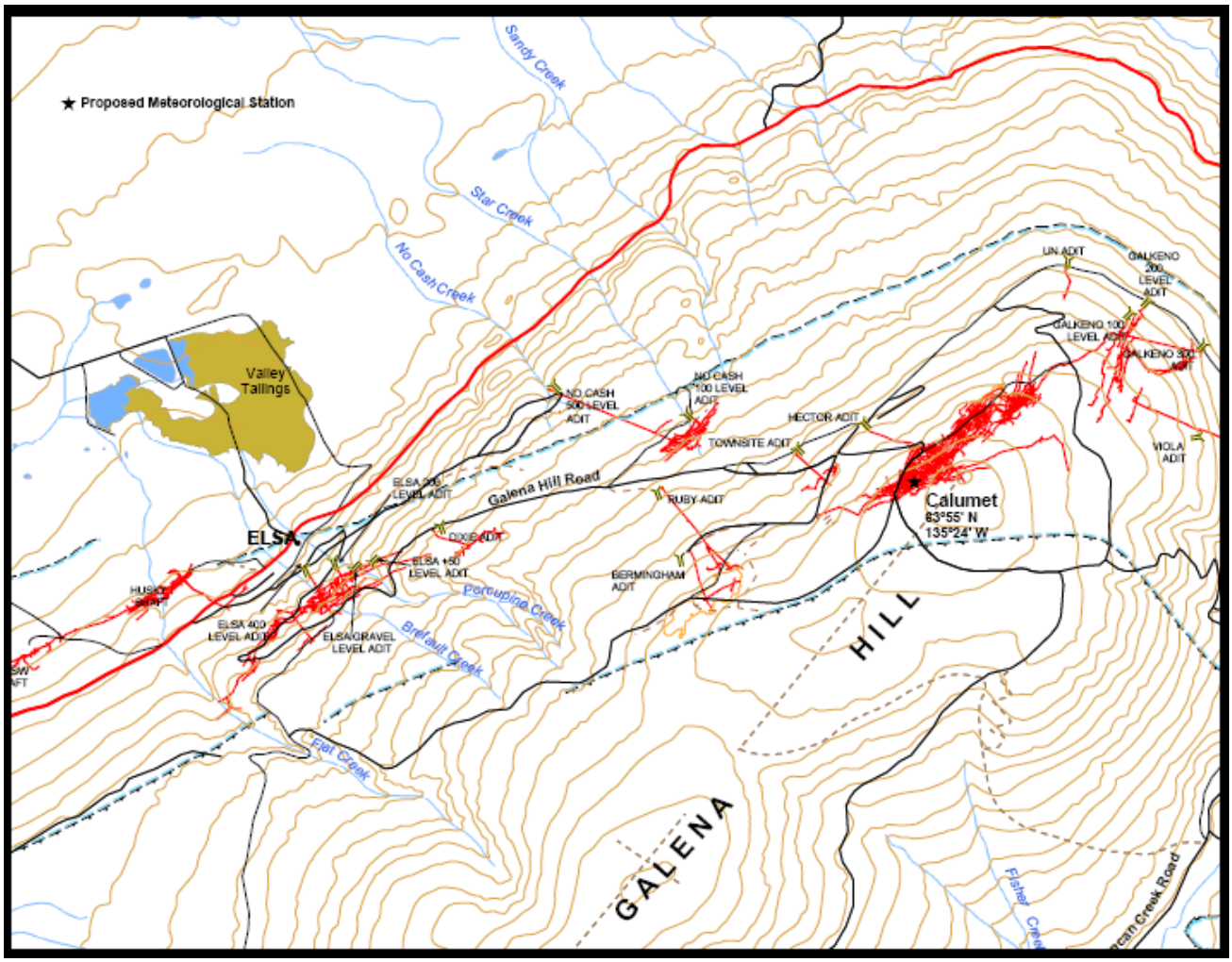
*The HOBO Weather Station and HOBO Micro Station are also compatible with BoxCar® Pro 4.3 software.

Description	Part No.
Complete 3-Meter Tripod Kit	M-TPA-KIT
Complete 2-Meter Tripod Kit	M-TPB-KIT

Tripods/Masts and Accessories

2 m Tripod with Mast (1/4" Stake Kit recommended)	M-TPB
3 m Tripod with Mast (1/2" Stake Kit recommended)	M-TPA
3 m Mast (1 5/8" diameter)	M-MPA
1.5 m Mast	M-MPB
Guy Wire Kit	M-GWA
(for locations with winds > 50 mph or mounting rain gauge on tripods; requires 1/2" stake kit for use with 2 m tripod or 3 m mast)	
1/4" Stake Kit	M-SKB
1/2" Stake Kit	M-SKA
Grounding Kit	M-GKA
(recommended for locations prone to lightning; does not provide protection from direct strikes)	
Mast Level	M-MLA
(recommended for installing masts or tripods)	

Figure 1. Recommended Location of Weather Station



A Member of Alexco Resource Group
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Closure Planning Technical Studies – Keno Hill, Yukon

Assessment of Waste Rock Geochemistry

Project Objective

A number of geochemical samples were previously collected from waste rock piles and tailings in support of previous assessments. There are a number of samples that exist in storage collected by the previous mine owner in the 1995 Site Characterization Report. These samples should be assessed for suitability and submitted for testwork to characterize and assess long term geochemical stability of various waste rock piles. If these samples are not adequate, additional samples will be collected from the various WRSA's. Samples will be characterized by lithology, documented, shipped to a laboratory and analyzed.

Methodology

As part of the baseline environmental assessment conducted by Access Mining Consultants in 1996, R. McIntyre conducted a comprehensive waste rock dump and pit wall rock sampling program, shortly before UKHM encountered financial difficulties. Due to unfortunate corporate circumstances therefore, these samples were never sent to the laboratory for analysis. Since that time, the sample pails have been stored in their original plastic 20 litre sample pails on pallets in a warehouse.

Access revisited those samples in August 2006 and verified sample & container integrity, and re-documented the samples that were deemed intact, uncompromised & therefore suitable for analytical testing. Some of the original pails had been opened & re-sampled by unknown parties, and therefore deemed compromised & were discarded. To further characterize and assess the long term geochemical stability of various waste rock piles, these seventy-five x 20 litre pails were be shipped to Chemex Labs in Vancouver for static ABA testing using the Modified Sobek method, and Metals Leachate testing.

Please see Table 1 for a list of samples. Sample results have not been received and verified. Once the ABA results are available, they will be included with the historic geochemistry database available for the property and recommendations for follow-up work will be presented, based on the results of the recent testwork as well as the entire data set.

Table 1. Waste Rock Dump Sample Inventory Whitehorse Trans-Shipment - January 08, 2007			
Mine/dump location	**No. of 20 L Pails**	**Sample ID**	**Sample Description**
DIXIE Adit dump			
	1	95UKHDD01	grey fine gr. mat'l, minor >3", 3" rusty bands every 12"
	1	95UKHDD02	brownish & grey fine gr. mat'l (broken schist, some fragments, grey qtzite)
	1	95UKHDD03	grey fine gr. mat'l, rusty bands (6") every 14", sample from 8' depth
BERMINGHAM pit wall			
	1	95UKHBP01	thin bedded qtzite, rusty weathering; North wall of pit
	2	95UKHBP02	thick bedded blocky, rusty weathering qtzite; manganese staining (?); above old brim. Shaft; N. wall pit
	2	95UKHBP03	thick bedded, blocky qtzite, buff weathering, some minor graphitic schist talus; N. wall pit
	2	95UKHBP04	rusty weathering, blocky qtzite, minor schist; 70%>4", 10%>8"
	2	95UKHBP06	graphitic schist, platy talus on South pit wall, 1/2" x 8" pieces
	2	95UKHBP07	sericitic schist, platy to blocky talus on S. pit bench
BERMINGHAM pit dump			
	2	95UKHBD01	fine grained ore stockpile (1/2">x<3"), rusty weathering, 70% "soil" fraction mat'l
	2	95UKHBD02	fine grained ore stockpile (1/2">x<3"), rusty weathering, 70% "soil" fraction mat'l
	1	95UKHBD03	ore and colluvium (?) scraped from floor of ore stockpile area
	1	95UKHBD04	graphitic schist
	1	95UKHBD05	ore and colluvium (?) scraped from floor of ore stockpile area
	1	95UKHBD06	buff weathering, blocky qyzite
RUBY adit dump			
	2	95UKHRD01	grey - black fine grained qtzite rubble, iron stain banding (on only, 6" thick, dipping 45')
	2	95UKHRD02	grey - black fine grained qtzite rubble, weak iron stain banding (on only, 6" thick, dipping 45')
	2	95UKHRD03	grey - black fine grained qtzite rubble, iron stain banding (on only, 6" thick, dipping 45')
CALUMET 1-14 pit dump			
	2	95UKHCD01	buff weathering, altered (?) qtzite, rusty fractures
	2	95UKHCD02	buff weathering, blocky qtzite, rusty fracturing, possible some vein mat'l (15%)
HUSKY SW			
	1	95UKHWD01	very pyritic grey qtzite
CALUMET 1-15 pit wall			
	1	95UKHCP01	graphitic schist, platy talus (1/2" thick x 6-10" long)
	2	95UKHCP02	grey blocky qtzite, maroon fractures, >60%+4"
CALUMET 1-15 pit dump			
	2	95UKHCD04	grey blocky qtzite, maroon weathering on fractures
	2	95UKHCD03	ore stockpile scrapings mixed and some colluvium, minor buff weathering qtzite w/ rusty fractures
MILLER pit dump			
	2	95UKHMD01	greenish-grey fine grained qtzite, rusty weathering on fracture surfaces, some pyrite casts

Table 1. Waste Rock Dump Sample Inventory Whitehorse Trans-Shipment - January 08, 2007			
Mine/dump location	**No. of 20 L Pails**	**Sample ID**	**Sample Description**
HECTOR adit dump			
	1	95UKHHD01	grey qtzite rubble, mixed with debris; top of dump
	2	95UKHHD02	grey qtzite rubble, mixed with debris; top of dump
	1	95UKHHD03	green sercite schist rubble, woody debris & fines; toe of dump
SIME 6 pit wall			
	2	95UKHSP01	grey, platy graphitic schist; 1/4" thick x 4-10" long
	2	95UKHSP02	buff weathering , blocky qtzite, some rusty fracture surfaces
SIME 4 pit wall			
	1	95UKHSP03	thick bedded, grey massive qtzite, some pyrite casts, all surfaces iron stained
SIME 35 pit wall			
	2	95UKHSP04	very fine grained schist, some Fe stain
	2	95UKHSP05	
SIME 4 & 6 pits wall			
	1	95UKHSD01	clean buff qtzite, 4" blocks, minor oxidation on 50% of fracture surfaces
ONEK pit			
	2	95UKHOP01	grey, clean qtzite mixed with schist - Fe staining laminar in schist
ONEK pit dump			
	1	95UKHOD01	greenstone, blocky 3" x 7" pieces and chips
	1	95UKHOD02	buff weathered qtzite, rusty fractures
	2	95UKHOD03	grey platy graphitic schist, 1/2" x 7"
KENO 700 adit dump			
	1	95UKHKD01	grey qtzite, qtz bands
	1	95UKHKD02	green seritic schist
UN adit dump			
	2	95UKHUD01	mixture grey graphitic schist and buff weath. qtzite, 30" + 3" 70" <3"
TOWNSITE adit dump			
	2	95UKHTD01	buff weathering qtzite, 10% >3", mostly fine fraction, some oxidation
	2	95UKHTD02	grey qtzite with serecite schist, 10% > 3", mostly fine fraction
BELLEKENO adit dump			
	2	95UKHLD01	dark grey pyritic qtzite, qtz stringers abundant
SILVER KING pit dump			
	1	95UKHVD01	mixed grey and buff qtzite, minor schist, some sandsize particles
GALKENO 900			
	1	95UKGK901	grey, fine gr. Schist
TOTAL # of SAMPLE SITES:	47		
TOTAL # of 20 L PAILS	74		

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Baseline Environmental Assessment
Closure Planning Technical Studies – Keno Hill, Yukon

Mine Hydrogeological Model

Project Objective

Prepare a hydrogeological model for the minesite in an effort to better understand the potential for future changes in minewater discharge points, quantities and quality, such as occurred at the Galkeno 300 adit in 1997. The model will be preliminary in nature (i.e. no mathematical groundwater model will be required). However, it will be essential to understand the interconnectedness of the mine workings including underground workings, veins, faults, surface topography and likely flow pathways.

Prepare a geometric model of the mineworkings to cover areas of environmental interest, such as No Cash and Galkeno sites, and any man-made, surface of geologic structures that could influence minewater flow.

Methodology

Initial models of the Silver King, Husky, Galkeno and Bellekeno mine workings with partial surfaces have been produced.

The three dimensional (3D) surfaces of the models have been created using the 2 metre digital elevation model (DEM) generated by Aero Geometrics Ltd. from the aerial photography flown in 2006. The initial 3D models of mine workings have been generated by the Alexco Resources Corp (Alexco) geological staff. The 3D mine workings are only initial and can only be used for demonstrative purposes and can not be regarded as accurate.

The 3D models were created using Autocad Map 3D 2007 and these drawings are attached as a DVD disk. The base surface data from Aero Geometrics Ltd. including autocad drawings, DEM's and airphotos (in ECW geo-referenced format) are included in the DVD.

Updating of the models of the mine workings is ongoing. Engineering plans and sections are being digitized along with the survey data. The combined digitized plans and survey information is being used to create as accurate as possible models of the mine workings in Autocad drawings.

Silver King (Figures 1, 2 and 3):

Figure 1 shows the Silver King workings looking from the south to the north and showing the underside of the surface. Also, it is not possible to distinguish between the historic and new workings, except for the ramp (new) and the 75 and 50 levels (historic). Figure

2 shows the area looking to the southwest with transparency turned off to allow viewing of the Portal, Galena Creek and the Open Pit. Figure 3 is the same as Figure 2, with transparency turned on, showing the relative location of the new and historic workings.

The Silver King mine is comprised of two distinct parts, the historic and new workings (Figures 2 and 3). The new workings are accessed via the 100 level adit. The adit extends from a portal north of the Silver Trail Highway on the west side of Galena Creek. The 100 level adit accesses the workings on the 100 and 50 Level which will be open (subject to any falls) and the ramp to the 300 level. This ramp and the 300 level workings will be flooded and draining via the 100 level adit.

The historic workings are comprised of three levels (100, 200 and 300) that were accessed via shaft(s) located in what is now the Open Pit north of the Silver Trail Highway. These workings will be filled by water to the water table and do not drain to surface. The water table may be deflated in this area due to the draining of the new workings via the 100 level adit. The historic 50 level does not appear to be connected to the rest of the historic levels (this may change as working plans and sections are digitized) and drains via a portal in Galena creek.

Husky (Figures 4 to 7):

Figure 4 shows the area from the Husky Mine to the Husky SW Mine, looking to the southwest showing the surface topography and infrastructure. The Husky and Husky SW mine are connected on the 250 level, however the initial 3D model for Husky SW is not yet complete. Figure 5 is a close up of the Husky Mine area (non transparent), with Figure 6 showing the same area with the surface transparent. Figure 7 shows the Husky workings and surface looking to the Northwest. Note that the Husky shaft is not shown.

The Husky and Husky SW workings are both accessed by shafts and are connected by a drift at the 250 level. The workings are totally flooded to the water table, with some drainage occurring from the Husky shaft. With both workings flooded to the top or near to the top of both shafts, any dewatering of either workings would have to dewater both workings to the 250 Level.

Galkeno (Figures 8 to 11):

Figure 8 looks to the northwest and shows the Galkeno workings including the 900 level with a non transparent surface. This figure shows the 200 and 300 portals and the open pits along the Sime vein above the Sime Workings. Figure 9 shows the same as Figure 8 with a transparent surface showing how the Sime and McLeod workings interconnect and that there is no connection to the 900 level except by the Sime and McLeod vein/faults.

Figure 10 shows the Galkeno workings looking to the north with a nontransparent surface. This figure shows the open pits above the Sime Workings very clearly and Figure 11 shows the same with a transparent surface.

These figures also show where the Hector Calumet and Galkeno Mines connect.

The Hector Calumet and Galkeno Mines are joined by an internal shaft connecting the Galkeno 300 level adit and the Hector Calumet 775 level drift. The shaft is approximately 65 feet in depth and for water to flow from the Galkeno Mine to the Hector Calumet, the Galkeno 300 Adit would have to be completely plugged.

The rail elevation of the Hector Calumet 775 level at the internal connecting shaft is 4125 feet and the Hector Calumet 400 level adit is approximately at 4465 feet. This means that a 340 foot head of water would have to be backed up behind a plug of the Galkeno 300 Adit to cause water to discharge from the Hector Calumet 400 Level Adit.

The majority of water entering the Hector Calumet Mine would preferentially discharge through the Galkeno 300 Adit. The Hector Calumet Mine is unlikely to be flooded past the 775 level.

A small bulkhead in the Galkeno 300 Adit designed to divert water into the Sime or McLeod workings would not impede any water flowing from the Hector Calumet Mine through the internal connecting shaft.

Water diverted into the Sime or McLeod workings would have to flow through the Sime or McLeod vein/fault systems between the Galkeno 500 Levels (3800 ft) and the Galkeno 900 Level (3255 ft) as there are no connecting workings. The water would have to flow through a vertical change of approximately 545 feet.

Bellekeno (Figure 12 to 16):

Figure 12 shows the Bellekeno Mine looking to the south with a non transparent surface. The 600 level workings and below are shown as 3D objects, while level 100 to 500 are shown as backs only, located at the approximate elevation of the level. The figure shows the surface from the 600 portal (above the confluence of the Thunder Gulch and Lighting Creek to the top of Sourdough Hill, showing access roads and the Backfill Hole site. Figure 13 shows the same view with a transparent surface.

Figure 14 is looking southwest with a transparent surface, down the trend of the 6-48 drift and the majority of the workings. This figure also shows the cross drifts on the 100 level that were extended southerly to test sub-parallel vein/faults.

Figure 15 is looking northwest with a nontransparent surface and shows the trend of each level to extend further to the southwest, indicating the plunge of the known mineralized zones. Figure 16 is the same as Figure 15 but with a transparent surface.

The Bellekeno workings should be open and un-flooded to the 600 level, with all water draining via the 600 portal. The 600 level adit is blocked by a cave-in before the intersection with the 6-48 drift. The amount of water backed up behind this cave-in is unknown, but is likely to be only minor based upon the current and historic water flow. The workings below the 600 level are most likely flooded.

Keno Hill Mines

Preliminary Valley Tailings Groundwater Mass Loading and Contaminant Mass Balance Report

Prepared by:

Elsa Reclamation Development Company Ltd.

March 2007

ALEXCO

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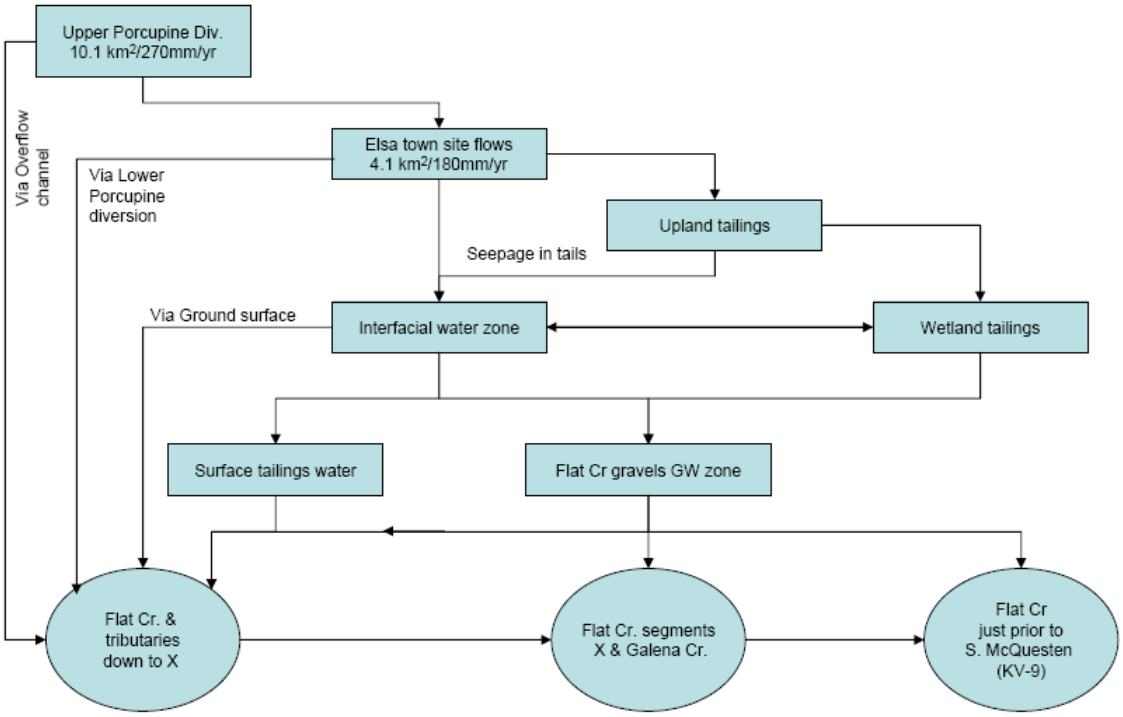
1.0 BACKGROUND

In preparation for the development of a Reclamation and Closure Plan for the United Keno Hill Mines district, Elsa Reclamation and Development Company Ltd. (ERDC) began initial closure planning studies in 2006. Closure planning will consider among other things long-term water management and treatment options for the Valley Tailings Area (VTA). In support of closure planning for the VTA, a preliminary mass loading and contaminant mass balance has been completed for the VTA. Vital to a scientifically supportable determination of the best closure practices to be employed for the tailings, are 1) an understanding of the mass loading and water balances within and around the tailings within the Flat Creek drainage; 2) an improved understanding of the subsurface areas surrounding the tailings; and 3) a measure of the significance that contaminant loading from this area presents to the overall contaminant loading from the Keno Hill district.

In addition to the closure planning studies requirements, this report also serves as documentation and support necessary for establishing the pre-existing baseline conditions in the Baseline Environmental Assessment.

Each of the study objectives are addressed through separate parallel efforts. This report derives water and mass balances for specific nodes within and around the tailings as presented in Figure 1. A separate technical report that focused on the subsurface conditions around the tailings through borehole sampling techniques has been prepared and submitted under separate cover. The overall mass balance for surface waters in the district has been updated from the 1995 Site Characterization Report (SCR, Attachment B) to reflect the ongoing sampling efforts that have been continuous since that time. Special emphasis has been placed both in this report and in the overall site wide mass balance (presented in Excel spreadsheet format) on the new understanding that the groundwater seepage from tailings represents a significant load which is far greater than the surface loading posed by decant discharges.

FIGURE 1. VTA PATHWAY MODEL



2.0 CONTAMINANT LOADING

Inspection of the groundwater database prepared by Access Consulting (January 2007) reveals that waters passing through the Porcupine and Flat Creek basins accumulate significant loadings of dissolved salts, dissolved zinc, other soluble contaminants and total metal levels during the traverse around and through the tailings areas. Figure 2 and Figure 3 show the conceptual hydrological model for the Valley Tailings along with a cross–section of the same hydrological model. Examples of these loadings can be seen from Figure 4, Figure 5 and Figure 6 below, depicting a flow diagram for the Elsa tailings and pertinent concentrations for sulfate, silicon and zinc.

Site Investigation
and Improvements
Special Projects
United Keno Hill Minesite

Closure Planning
Technical Studies

Elsa Reclamation
and
Development Company

ALEXCO

Legend

- Flow Indicator
- Public Road
- Surface Water (actual and potential)
- Pipe
- Building
- Contour line (1m interval)
- Model Element
- Subcatchment Boundary
- Groundwater Flow
- Surface Water Flow

Scale: 1:20,000
(when plotted on 11x17 inch sheet)

0 265 530 1,060 Meters
0 270 540 1,080 Yards

Figure 2
Conceptual Hydrological Model

ELSA TAILINGS

ACCESS CONSULTING GROUP

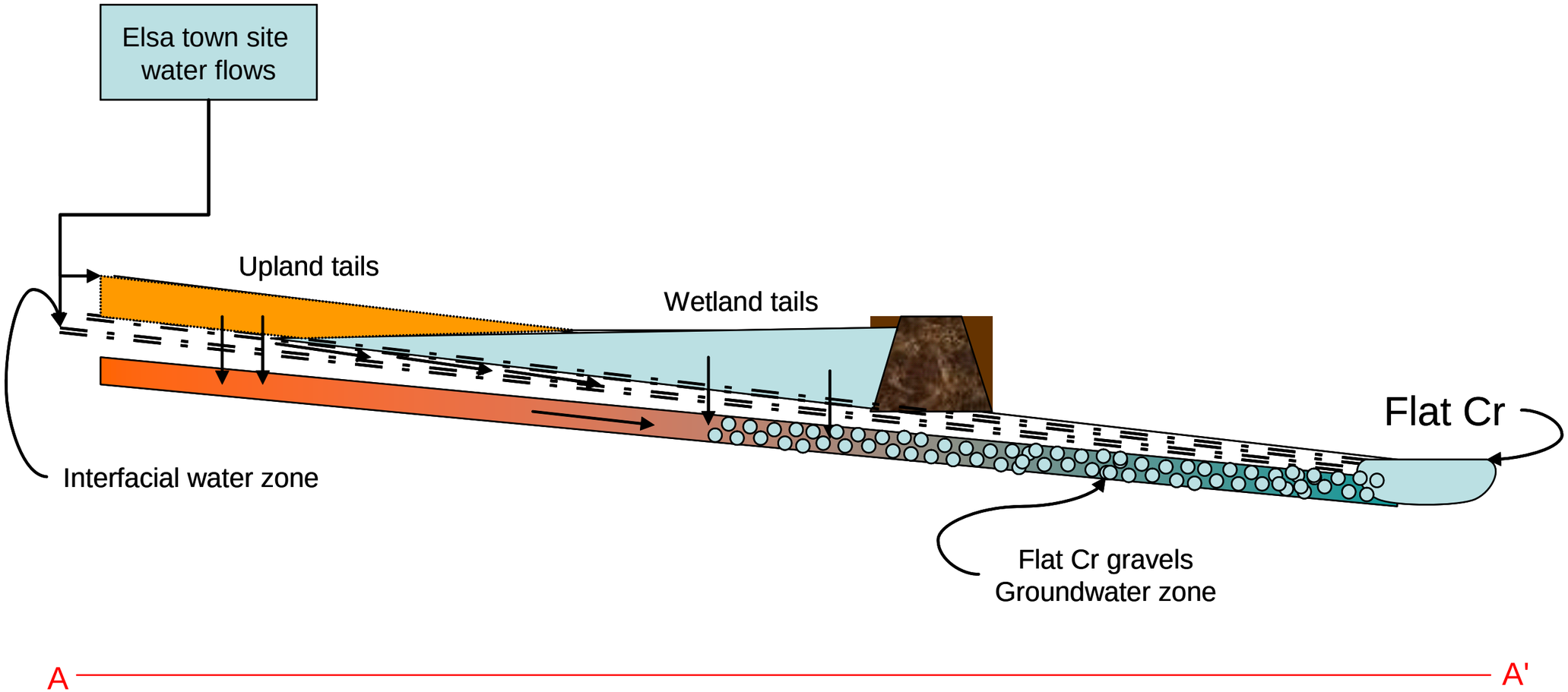
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Date: March 2007

File: D:\Project\AllProjects\ALEX-05-01\gis\mxd\UKHM\ClosurePlan2007\ElsaTailings_ConceptualModel\Fig2_ElsaTailings_ConceptualModel.mxd

*2006 aerial photograph obtained from Geodesy Remote Sensing Inc., Calgary Alberta. Flown 13,14 September 2006.

Section A-A’



Site Investigation
and Improvements
Special Projects
United Keno Hill Minesite

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Technical Studies

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ALEXCO

Scale:
N.T.S.

Figure 3
Conceptual Hydrological Model
Cross Section

ELSA TAILINGS

ACCESS CONSULTING GROUP

Drawn by: RG/HD	Checked by: DC/BT/RLM
Date: March 2007	

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FIGURE 4. SULFATE LOADING

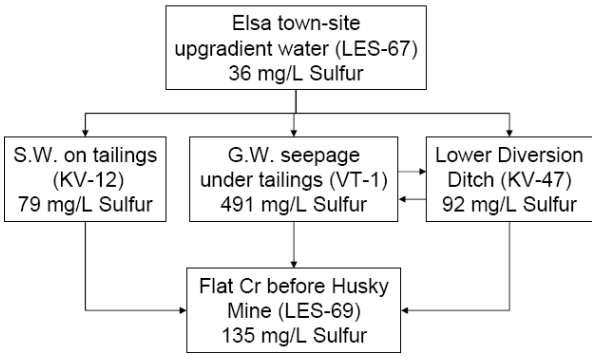


FIGURE 5. SILICON LOADING

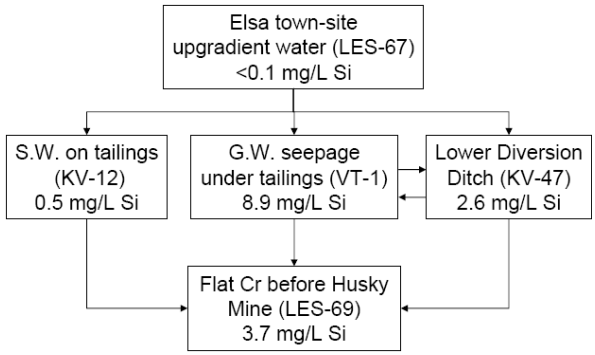
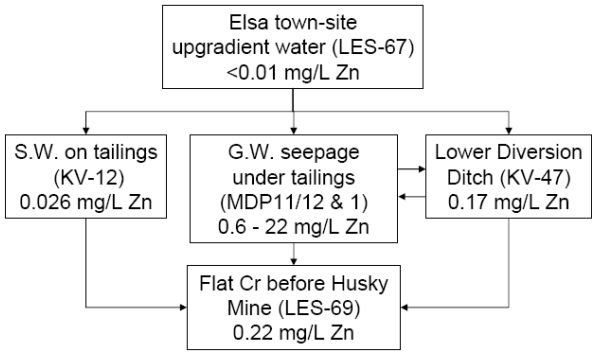


FIGURE 6. ZINC LOADING



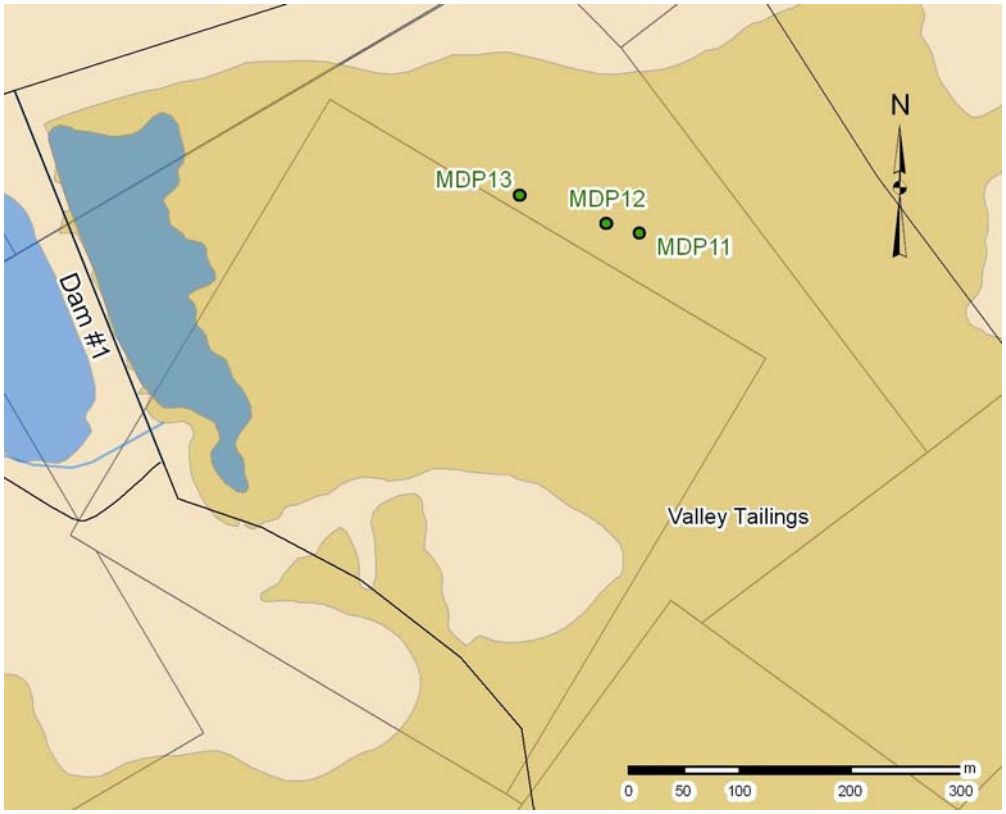
Station LES-67 represents the fresh upgradient water entering the VTA. KV-12 is the decant from tailings dam #3. Station KV-47 is the Porcupine Lower Diversion Ditch. Station LES-69 is Flat Creek midway between tailings dam #3 and Husky Southwest. These figures indicate that significant contaminant loading is occurring around tailings into Flat Creek and that the chemical load emanating from tailings are potentially naturally attenuating in some areas (examples are in VT1 and MDP-12 at less than 0.5 PPM Zn with high levels of sulfate and silicon) while in other areas the contaminant load rate (either concentration or flow velocity) and availability of natural organic carbon content are not matched to allow for natural attenuation in other areas (as in MDP1 with zinc over 20 PPM).

2.1 FIELD WORK

A review of previous site characterization work led to Appendix E of the 1995 SCR prepared by Access and specifically to trenches and pits constructed in November 1995 across the upper tailings areas to determine depths and other physical properties. That report suggested that significant flows of water transmits at the interfacial plane beneath tailings and above the original terrain. A separate aerial review and inspection of the site demonstrates that portions of the tailings were revegetating without active management while other areas appeared barren of vegetation.

To investigate both observations, Alexco personnel manually installed (August 2006) drive-point stainless steel (316L) piezometers and extracted by bailing and sampling the first water encountered at depth (after 3 volumes were evacuated from the piezometer column) for analysis of soluble and total loadings of contaminants. Details on the piezometer installation and sampling program are included in Attachment A. These locations were marked with Garmin GPS and identified with MDPxx at various locations. Four drive points were placed in the upper tailings area, two located in a barren area, one in a partially vegetated area and one in a more lush area of vegetation. These areas are located in the plan view maps (Figure 7, Figure 9) as well as in the photographs below (Figure 8).

FIGURE 7. DRIVE POINT PIEZOMETER LOCATIONS



The pertinent locations are MDP 11, 12, 13 (in the upper tailings across the vegetation line), and MDP 1, further below and down-gradient of tailings dam #3.

Excerpts of the analytical data for each location and a previously installed location (VT1) are shown in the Table 1.

TABLE 1. DRIVE POINT PIEZOMETER RESULTS

IDENTIFIER	ZINC (DIS)	SULFUR	SILICON
MDP11	0.571	397	3.26
MPD12	0.382	478	2.21
MDP13	0.564	120	1.93
MDP1	22.0	452	9.4
VT1	0.017	491	8.86

While it might be expected that vegetative cover would decrease the concentration of redox-sensitive constituents such as sulfate and zinc, this hypothesis was not readily supported from the data. It is interesting that soluble levels of silicon as a measure of overall weathering decrease consistent with this hypothesis in the areas with the increasing levels of vegetation from MDP 11 < 12 < 13.

FIGURE 8. LOCATION OF MDP 11, 12 AND 13

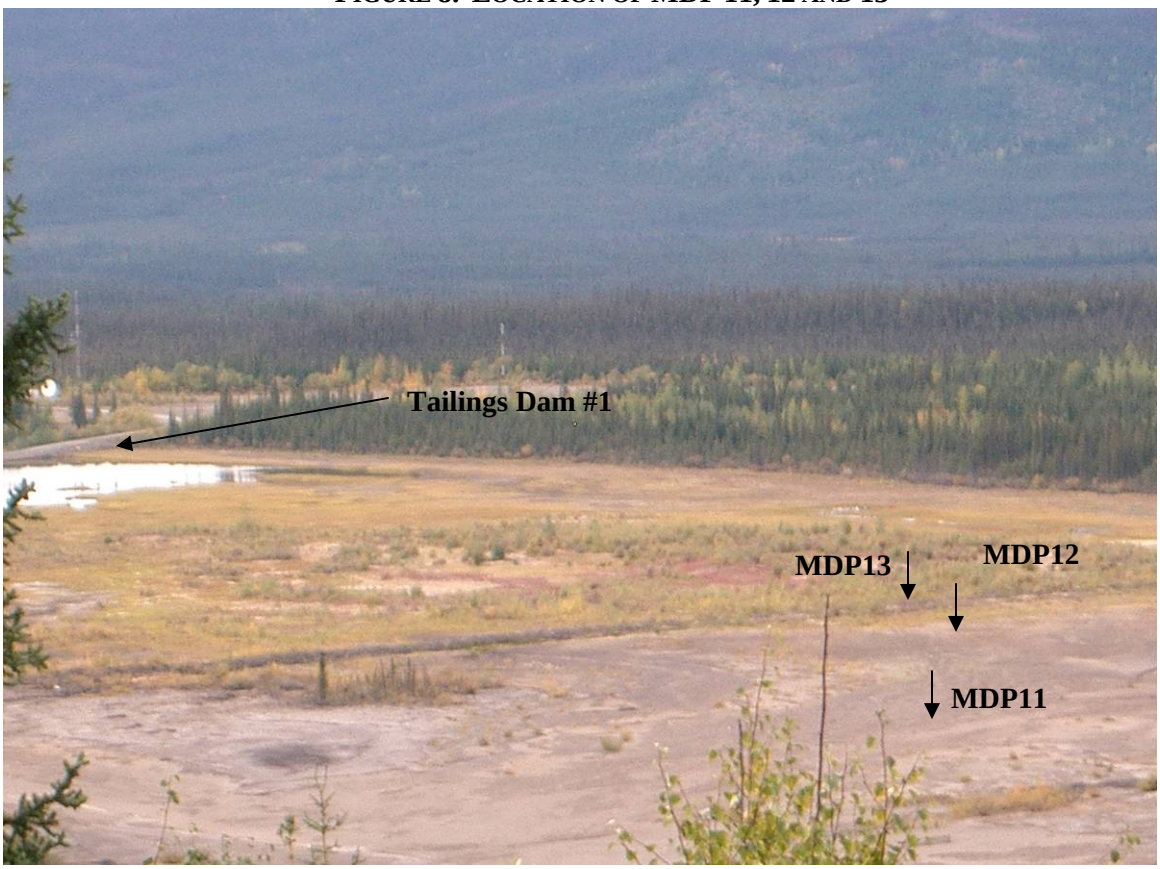
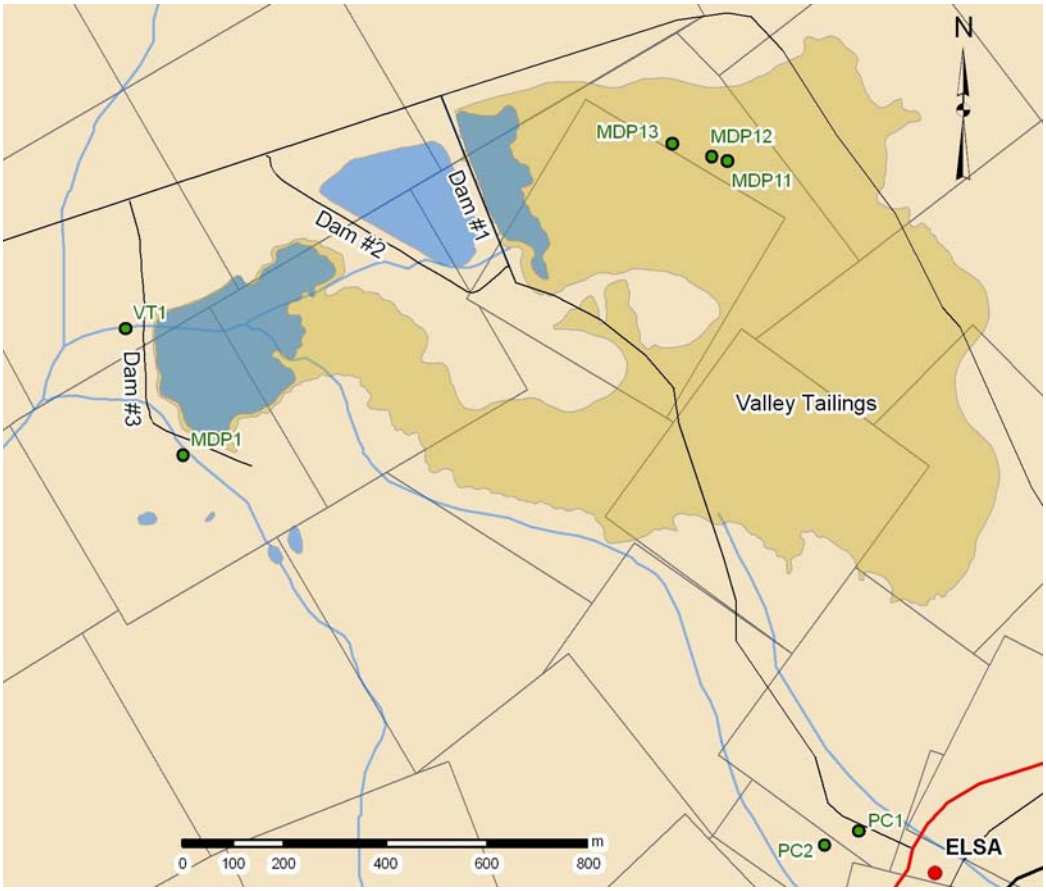


FIGURE 9. DRIVE POINT PIEZOMETER AND OTHER STATION LOCATIONS



One manual drive point location was selected to assess a theory that significant soluble contamination was short-circuiting around the tailings beyond dam #3 and was avoiding anaerobic processes that would tend to immobilize metals prior to emergence via seepage into Flat Creek. This location (MDP1) found significant and high levels of contaminants in the groundwater contamination, with soluble (dissolved) zinc over 22 mg/L, and near saturation levels of calcium and sulfate (Ca = 420 & Sulfate = 1360 ppm for $Q_{sat} = 1.5x10^{-4}$ while K_{sp} is ~ $2.5x10^{-4}$ for a log of saturation index of -0.22). In a natural system this level of saturation indices ($|\log(Q/K)| < 0.5$) points to likely controls on solubility from gypsum minerals in substantial and intimate contact with water (Stumm & Morgan, 1996).

While location VT1 did not encounter these high levels of contamination, VT1 is installed in an area that receives water from beneath anoxic zones (beneath water cover) and in an area of noted biogenic sulfide and boggy plant matter (peat) deposits. It can be postulated that there are zones of more-than-sufficient natural organic carbon to persistently mineralize zinc, while other areas may have been overwhelmed / depleted in labile (easily reactive) organic carbon. MDP1 is a possible example of the latter "overwhelmed" condition, while VT1 of the naturally reductive (carbon-rich) condition.

Due to the potential for high variability in zones around and beneath the tailings, *we will recommend that a systematic study be devised to assess the organic levels, metals/sulfate contamination and groundwater flow velocities along transects up-gradient (within the upper tailings) and down-gradient between MDP1 and VT1. The purpose of this type of study will be to determine how closure strategies can be implemented to enhance natural processes already*

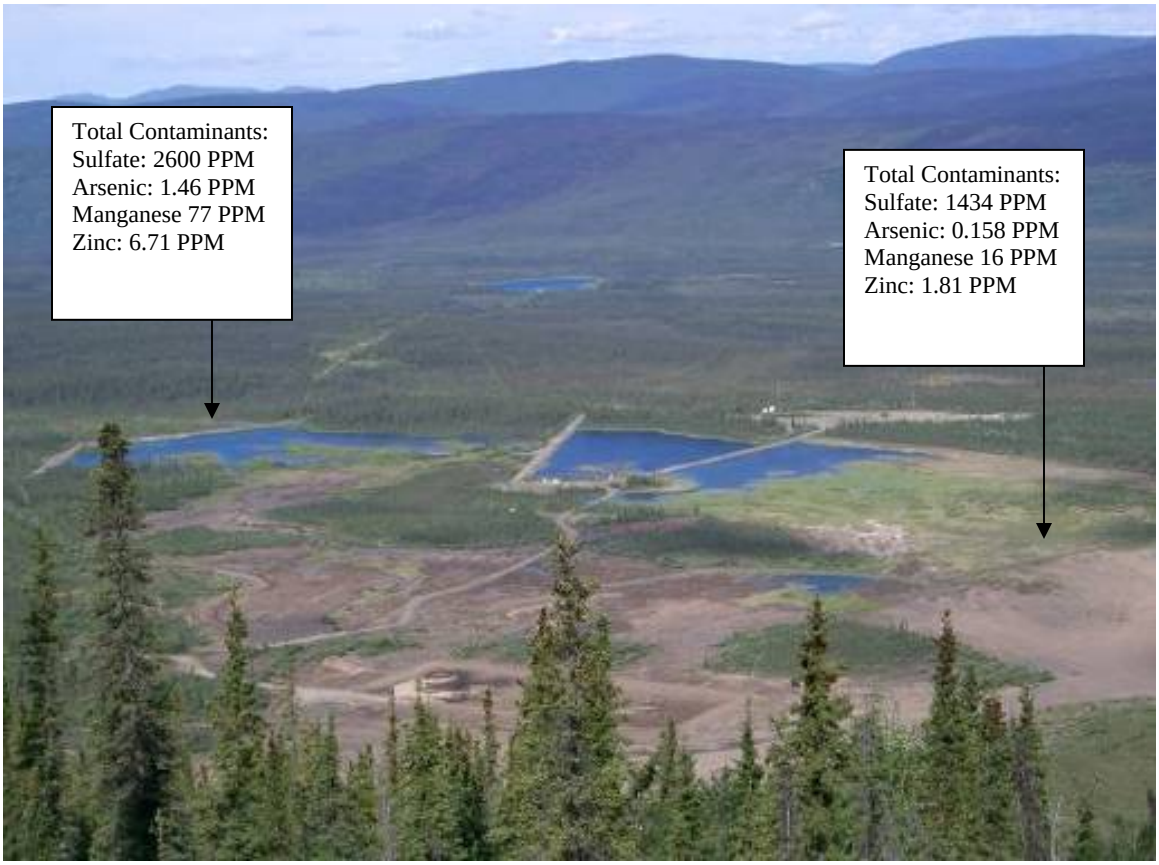
ongoing in the groundwater/tailings system, and to provide a baseline for measuring the effectiveness of various types of cover systems and treatment methodologies to reduce the magnitude of surface water loading from groundwater transport pathways once the selected closure methods are deployed in final closure.

Another data concern that was identified once sample results were received was the striking variance between total and dissolved metals in these sample locations.

By way of example, zinc levels in VT1 were 0.017 mg/L (dis) and 6.71 mg/L (tot). Another trend in the total contaminant levels that was not consistently observed in the dissolved contaminant levels was the general increase in contaminants recovered under 'total' analyses moving down-gradient. It is not clear if this trend was an artifact of the sampling method (drive points are installed, sampled and then removed all in one day), or a more fundamental consideration (colloidal Fe/Mn contaminant particles for example persisting as a transport mechanism for other contaminants far further than would generally be expected). *Sampling and a filtration study on samples taken from permanently installed well points and drive points* should be undertaken to identify any possible contamination concerns with the sampling protocol for drive point piezometers.

A trend of increasing contamination with gradient was observed in each sampled area as shown in Figure 10.

FIGURE 10. CONTAMINATION TREND VTA



From the sample analyses available at this time the conclusion is supported that arsenic, sulfate and zinc are all mobile in the saturated tailings interface beneath and down gradient from the Valley Tailings, and the mass load of contaminants from the un-reclaimed Valley Tailings are a source of contaminant loading in the McQuesten River Valley.

2.2 MASS BALANCE ON FLAT CREEK LOADING

Water balance assumptions are critical to closing a balance on any mass contaminant. For this area, a critical assumption is to assess the quantity of water discharged from the surface of the tailings annually during freshet. For purposes of this preliminary balance, the data for discharge flow measured at the Dam #3 decant flume was averaged using the geometric mean on all data points, and then divided by 6 to represent the two months when flow occurs out of all months in the year. This estimate yielded an average of flow at 6.6 liters/second while flow occurs, and a total discharge ~ 35,000 m^3/year.

The entire catchment area of the Elsa tailings was estimated in the 1995 Site Characterization Report as capturing and discharging 774,000 m^3/year, based on Mean Annual Runoff (MAR) and rainfall / precipitation for the area parameterized for the mean elevation for the catchment basin under study. From inspection of these two figures, and the total catchment of Flat Creek at LES-69 generating more than 3,501,000 m^3/year from the same assumptions (with feed from the Upper Porcupine basin generating as much as 2,700,000 m^3/year of the total in Flat Creek), it is observed that a significant flow remains to be quantified.

2.2.1 Tie Elements

While our focus is on the contaminants of environmental concern, because of their environmental impact, zinc and other heavy metals are often non-conservative and therefore do not serve as good tracers of flow. Elements that can serve to tie mass load balances to flows are termed ‘tie elements’, and typically are selected when they are known to have little perturbation in the system from redox, pH or other reactions, and correlate with the processes being studied. Silicon was selected as such an element, as it is non-redox sensitive in the aqueous stability range (for voltage potentials ranging between 0 – 1.22 volts S.H.E.), and occurred at reliably detectable levels due to weathering of fine particles in tailings.

2.2.2 Contact with Tailings

The assumption was made that kinetics of contact with tailings was not limiting, and that equilibrium was achieved at all points. Also, that no other significant source of contamination exists beyond that assessed in the ‘background’ analyses conducted on Upper Porcupine gulch waters containing 0.01 ppm zinc, 0.1 ppm silicon and 36 ppm sulfur.

TABLE 2. RESULTS OF FLAT CREEK MASS BALANCE

Station	Flow, k m3/yr	Conc – S (mg/l)	Mass (kg)
LES-67 as background	2727	36	98172
KV-12 (decant)	35	79	2740.4
VT1 (GW)	761	491	373733.4
KV-47 (ditch)	-22	92	-2010.8
LES-69 (Flat Creek)	3501	135	472635
		Conc – Si (mg/l)	
LES-67 as background	2727	0.1	272.7
KV-12 (decant)	35	0.48	16.6
VT1 (GW)	1719	8.86	15231.4
KV-47 (ditch)	-980	2.62	-2567.1
LES-69 (Flat Creek)	3501	3.7	12953.7
		Conc – Zn (mg/l)	
LES-67 as background	**2727**	**0.01**	**27.2**
KV-12 (decant)	**35**	**0.0258**	**0.89**
"GMV" (GW)	**533**	**1.3**	**692.4**
KV-47 (ditch)	**207**	**0.1723**	**35.6**
LES-69 (Flat Creek)	**3501**	**0.216**	**756.2**
		Conc – Zn (mg/l)	
LES-67 as background	2727	0.01	27.2
KV-12 (decant)	35	0.0258	0.89
MDP1 (GW)	28	22	605.4
KV-47 (ditch)	712	0.1723	122.6
LES-69 (Flat Creek)	3501	0.216	756.2
		Conc – Zn (mg/l)	
LES-67 as background	2727	0.01	27.2
KV-12 (decant)	35	0.0258	0.89
MDP11-12 (GW)	1510	0.57	860.9
KV-47 (ditch)	-771	0.1723	-132.8
LES-69 (Flat Creek)	3501	0.216	756.2

Five model runs were conducted wherein a solute balance was completed and solved using a system of three equations on the Elsa Tailings / Flat Creek receiving system. Of these runs, it might appear at first that sulfur and silicon balances were a waste of time given that they constrain the lower Porcupine diversion to negative flow values in order to achieve a balance. However, this model result is extremely important in that both models require the greatest flow from the tailings groundwater to achieve balance i.e. more than 100% of the catchment entering the tailings needs to leave as groundwater to achieve a balance on sulfur or silicon loading. In fact, this result places a more likely requirement that we attribute to tailings groundwater higher loads and that tailings impacts seep from beneath tails into the lower Porcupine Diversion rather than, as has been suggested previously, from the diversion into the tailings area.

Three models for zinc were solved using the same system of equations based upon different values for zinc as the output concentration in groundwater. The choices of input values to the

model ranged from the value measured at VT1 (0.017 ppm Zn), to 0.38 – 0.57 ppm Zn at MDP11-13 and 22 ppm at MDP1. In our judgment, none of these values reflects the overall flow state beneath and from tailings, based on consistent values of silicon and sulfate with highly variable values for zinc.

The model likely closest to the actual case (in the authors opinion) is the 'GMV' model for zinc; which uses the geometric mean value of zinc concentrations at 1.3 ppm in the seepage (substantially greater than VT1 at 0.017, higher than 0.57 in the MDP 11-13 area, but much lower than 22 ppm observed in MDP1). The reason we judge this to be the most likely case is that a) it does not require negative flow values, and b) it is likely that sulfur and silicon are both reactive to some extent either through gypsum saturation or silica precipitation. Nevertheless, these factors do not change the order of magnitude conclusion that groundwater seepage from beneath Elsa Tailings represents more than 70% of the water flow and more than 90% of the zinc contamination that arrives into the Flat Creek ecosystem.

2.3 RECOMMENDATIONS

Based on the results of the 2006 research study, additional follow-up work is required to better understand the groundwater regime within the VTA and update and finalize the groundwater mass balance and contaminant loading model. The following tasks are recommended for completion in 2007:

1. *Conduct a synoptic sampling event for all pertinent surface and groundwater points within the Flat Creek basin at least twice in 2007 for zinc, sulfate, conductivity and for selected tie elements, and use these data points to update and close the mass balance on each synoptic event for each analyte.*
2. *Recommend that a systematic study be devised to assess the organic levels, metals/sulfate contamination and groundwater flow velocities along transects up-gradient (within the upper tailings) and down-gradient between MDP1 and VT1. The purpose of this type of study will be to determine how closure strategies can be implemented to enhance natural processes already ongoing in the groundwater/tailings system, and to provide a baseline for measuring the effectiveness of various types of cover systems and water treatment methodologies to reduce the magnitude of surface water loading from groundwater transport pathways once the selected closure methods are deployed in final closure.*
3. *A follow-up to this study is the evaluation of the impact of modified organic carbon levels on soluble metals levels in hot-spots found to be transmitting from tailings to surface waters via interfacial and ground water pathways.*
4. *A filtration and lab analysis study on selected samples taken to identify if and the extent to which colloidal particles (iron / manganese hydrous oxides for example) are substantially involved in the transport of lead, zinc and other contaminants within groundwater or surface water.*

ATTACHMENT A

Valley Tailings Groundwater Sampling Program Summer 2006

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Baseline Environmental Assessment Report – Keno Hill, Yukon

Valley Tailings Groundwater Sampling Program Summer 2006

Project Objective

- To intersect and sample groundwater flowing through the valley tailings.

Site Selection Rationale

- With direction from Green World Science it was decided to place two piezometers upstream and two downstream of the observed linear vegetation feature west of the first valley tailing pond Plates 1 and 2.
- Surveyed potential sampling locations by walking the entire length of the vegetation feature looking up and downstream for low lying areas and or indications of water near surface.
- Possible install locations were selected by driving in a piezometer to test the presence of water. If water was found, the well was then purged to check the recharge rate. This was used to determine if water was flowing or stagnant. If the water was found to be flowing a piezometer was installed.

Equipment Used

- The valley tailings consist of the ideal "soil" type for the placement of direct push equipment as they are non compact, fine grained. This along with ease of use and installation is why the Solinst model 615 N drive point piezometer was chosen for this sampling program.
- The 12 inch Solinst model 615 N drive point piezometer is the first section of the well. It is attached to a three foot section of ¾ inch galvanized pipe by way of a threaded end. If the groundwater is at a depth greater than 4 feet additional sections are added with the use of couplers between sections of pipe. See Plate 3.
- A manual side hammer, as shown in Plate 4, was used to physically drive the piezometer into the ground. The impact drive head, as shown in Plate 3, is attached to end section of pipe provide the surface which the slide hammer strikes.
- Water sampling was performed with sections of high density polyethylene WaTerra tubing with 3/8 inch Delrin® self tapping foot valves. These sections of tubing were left in place after use.

Installation Technique

- The Solinst model 615 N drive point was attached to one end of the ¾ pipe by twisting it onto the threaded end. The impact drive head was attached in the same way to the other end.
- Using the manual side hammer the section of pipe with the drive point was pounded into the ground. Once in the ground the impact drive head was removed and a coupler was installed to allow for additional sections of pipe to be fit. The addition of a coupler and a section of pipe allow the depth of the well to be increased.

Sampling Technique

- The ground water sampling was carried out in accordance with ASTM standard D 4448-01 Standard Guide for Sampling Ground-Water Monitoring Wells.
- With the well depth known tubing was cut to length and a self tapping foot valve installed. The water was drawn out of the well by rapidly plunging the tubing up and down within the piezometer. The well was purged three times before samples were taken.
- Sample bottles were rinsed three times before taking samples for Total and Dissolved Metals and Routine parameters.
- Once sampling was complete a threaded cap was installed on the exposed end to prevent contamination and a steel ID tag was fixed to the pipe for ease of follow up sampling if required

Results

- The results from laboratory analysis of the August 11, 2006 sampling are included in Table 1.

D. Desmarais/R.McIntyre March 2007



Plate 1 - Sample location MDP12 upstream of linear vegetation feature



Plate 2 - Sample location MDP10 downstream of linear vegetation feature



Plate 3 - two pipe sections with coupler and impact drive head



Plate 4 - Manual slide hammer

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Closure Planning Technical Studies – Keno Hill, Yukon

Updated Site Wide Water Quality Mass Balance

Objective

Update the site wide water and loading balance based on new information including the updated water quality database and the preliminary Valley Tailings groundwater mass loading and contaminant mass balance.

Methodology

Based upon the focused analysis of the water and mass balance around the Valley Tailings (Attachment F), ERDC has amended the previously submitted site-wide mass balance to reflect the significant differences assumed in the previous tailings analysis and our current understanding of the tailings loading model. The preliminary Valley Tailings groundwater mass loading and contaminant mass balance shows the vast majority of load entering Flat Creek is from the seepage of water through the tailings impoundment rather than from surface waters discharging tailings and diverted through the Porcupine Diversion.

Previous models in both 1996 and 2006 assumed that the tailings decant was the primary source of the metal loading to Flat Creek. Analysis of the contaminant loads in Flat Creek and in groundwater and other known surface flows for sulfate and silicon (as tie elements), as well as for zinc, leads to the conclusion that groundwater is the most significant source of contaminant loading both volumetrically and for mass load, to Flat Creek.

A significant change has also been made to the format of the mass balance originally presented in Appendix X-1 of the Site Characterization Report (1996). This change is the merger of Element 6 (Elsa Tailings) with Element 7 (Porcupine Creek Diversions, Upper and Lower). This combination of elements into one balance element was required due to the lack of any other explanation of the significant concentrations in Porcupine Diversion (KV-47) that have been observed – around 0.2 PPM zinc. It is hypothesized that the Porcupine Diversion actually functions more as an ‘Interfacial Water’ seepage point allowing a direct path to surface water from beneath the tailings areas. This hypothesis is supported by the observed zinc concentrations, and further by the high levels of silicon and sulfate also reporting to both the Porcupine Diversion and to Flat Creek.

If, as is hypothesized, there is a substantial cross-connection between the tailings area and the Porcupine Diversion, then keeping elements 6 & 7 separate is un-warranted.

The aggregate result of these changes is to reduce the overall amount of contaminant load ascribed to non-point sources termed ‘catchment runoff’ from elements 6 - 9. The

goal of any functioning mass balance is to reduce to the maximum extent possible the amount of unknown loads ascribed to uncharacterized areas.

The amount of error in a mass balance can be quantified as the square root of the sum of squared errors, where errors (or unknowns) are defined to be catchment runoff or non-point source loading otherwise required to make the water balance close. The total error measured in the 1996 mass balance model for elements 6-9 was 1100 kg of zinc, while in 2006 this had increased to 1634 kg of zinc. After making the corrections to the model required by our new understanding of the tailings loading pathways and magnitudes, the overall amount of error in the attached model has been reduced to 703 kg per year of zinc. This leads to the conclusion that accounting for the new information presented in the Valley Tailings groundwater mass loading and contaminant mass balance, a significant portion of the unknown load to Flat Creek has been identified.

It should be pointed out that while model error is defined to be any deviation that requires the use of the “catchment runoff” fudge-factor, metal attenuation through bio-geochemical precipitation of metals is a valid on-going process observed at and about the Keno Hill district, and would show up as an increase in the measurement of model error from this factor.

Table 1 presents the results of the updated site wide water quality mass balance. Figure 1 summarize the mass balance schematically. Figure 2 is the location of the various elements within the mass balance.

Table 3 Mass Loading Update and Comparison - Total Zinc

Table 1

Element 1, Christal Creek above Station KV-6			Zinc (total)
INFLOWS		**2006 Updated**	**Source of Data/Comment (2006 Data)**
Catchment runoff (excluding runoff into open pits)	Flow (1000m3)	1822	Estimated using regional hydrology study
	Concentration (mg/L)	-0.45	Computed (load divided by flow)
	Load (kg)	-816	Computed (load at KV-6 - loads at adits and spring)
Discharge from Galkeno 900 Adit after treatment	Flow (1000m3)	117	Average of measured flows (UKHM/Govt/LES data)
	Concentration (mg/L)	0.13	Average observed concentrations at KV-32
	Load (kg)	15	Computed (flow times concentration)
Discharge from Onek Adit	Flow (1000m3)	10	Average of measured flows (UKHM/Govt/LES data)
	Concentration (mg/L)	89	Average observed concentration at KV-45
	Load (kg)	886	Computed (flow times concentration)
Discharge from natural spring	Flow (1000m3)	79	Average of two spot measurements taken in 1995
	Concentration (mg/L)	5	Average observed concentration at LES-66
	Load (kg)	395	Computed (flow times concentration)
Totals	Flow (1000m3)	2127	Computed (total of all inflows to element)
	Concentration (mg/L)	0.61	Computed (load divided by flow)
	Load (kg)	1296	Computed load at Station KV-6
OUTFLOWS		**2006 Total**	**Source of Data/Comment (2006 Data)**
Flow at Station KV-6	Flow (1000m3)	2127	Computed (total of all inflows to element)
	Concentration (mg/L)	0.23	Average observed concentration at KV-6
	Load (kg)	481	Computed (flow times concentration)

Element 2, Christal Creek between Stations KV-7 and KV-6			Zinc (total)
INFLOWS		**2006 Total**	**Source of Data/Comment (2006 Data)**
Runoff from incremental catchment (excluding runoff into open pits)	Flow (1000m3)	8173	Estimated using regional hydrology study
	Concentration (mg/L)	-1.41	Computed (load divided by flow)
	Load (kg)	-11520	Computed (load at KV-7 - loads at KV-6 and adits)
Flow from outlet of Element 1 (i.e., flow at Station KV-6)	Flow (1000m3)	2127	From Element 1
	Concentration (mg/L)	0.23	From Element 1
	Load (kg)	481	From Element 1
Discharge from Galkeno 300 Adit after treatment	Flow (1000m3)	347	Average from 2006 data
	Concentration (mg/L)	38.40	Average observed concentration at KV-27 and KV-28 based on treatment 6/7 of time
	Load (kg)	13325	Computed (flow times concentration)
Discharge from UN Adit	Flow (1000m3)	22	Average of measured flows (UKHM/Govt/LES data)
	Concentration (mg/L)	0.09	Concentration observed in 1997
	Load (kg)	2	Computed (flow times concentration)
Totals	Flow (1000m3)	10777	Computed (total of all inflows to element)
	Concentration (mg/L)	2.27	Computed (load divided by flow)
	Load (kg)	13807	Computed load at Station KV-7
OUTFLOWS		**2006 Total**	**Source of Data/Comment (2006 Data)**
Flow at Station KV-7	Flow (1000m3)	10313	Computed (total of al linflows to element)
	Concentration (mg/L)	0.22	Average observed concentration at KV-7
	Load (kg)	2288	Computed (flow times concentration)

Element 3, Sandy Creek above Higway 2			Zinc (total)
INFLOWS		**2006 Total**	**Source of Data/Comment (2006 Data not updated)**
Catchment runoff (excluding runoff into open pits)	Flow (1000m3)	650	Estimated using regional hydrology study
	Concentration (mg/L)	0.50	Average of two grab samples
	Load (kg)	325	Computed load at LES-63
OUTFLOWS		**2006 Total**	**Source of Data/Comment (2006 Data not updated)**
Flow at Station LES-63	Flow (1000m3)	650	Computed (total of all inflows to element)
	Concentration (mg/L)	0.50	Average of two grab samples
	Load (kg)	325	Computed (flow times concentration)

Element 4, No Cash Creek above Highway 2			Zinc (total)
INFLOWS		**2006 Total**	**Source of Data/Comment (2006 Data)**
Runoff from incremental catchment (excluding runoff into open pits)	Flow (1000m3)	606	Estimated using regional hydrology study
	Concentration (mg/L)	-0.40	Computed (load divided by flow)
	Load (kg)	-242	Computed (load at KV-21 minus loads at adits)
Discharge from Bermingham Adit	Flow (1000m3)	62	Average of measured flows (UKHM/Govt/LES data)
	Concentration (mg/L)	4.41	Average observed concentration at KV-18
	Load (kg)	273	Computed (flow times concentration)
Discharge from Ruby 400 Adit	Flow (1000m3)	48	Average of measured flows (UKHM/Govt/LES data)
	Concentration (mg/L)	1.63	Average observed concentration at KV-19
	Load (kg)	78	Computed (flow times concentration)
Discharge from No Cash 500 Adit	Flow (1000m3)	137	Average of measured flows (UKHM/Govt/LES data)
	Concentration (mg/L)	17.6	Average observed concentration at KV-20
	Load (kg)	2407	Computed (flow times concentration)
Totals	Flow (1000m3)	637	Computed (total of all inflows to element)
	Concentration (mg/L)	4.33	Computed (load divided by flow)
	Load (kg)	2758	Computed load at Station KV-21
OUTFLOWS		**2006 Total**	**Source of Data/Comment (2006 Data)**
Flow at Station KV-21	Flow (1000m3)	637	Computed (total of all inflows to element)
	Concentration (mg/L)	3.95	Average of 2 samples from 2003 and 2005
	Load (kg)	2516	Computed (flow times concentration)

Table 3 Mass Loading Update and Comparison - Total Zinc

Element 5, South McQuesten River between KV2 and KV1			**Zinc (total)**
INFLOWS		**2006 Total**	**Source of Data/Comment (2006 Data)**
Runoff from incremental catchment (excluding runoff into open pits)	Flow (1000m3)	4855	Estimated using regional hydrology study
	Concentration (mg/L)	-1.53	Computed (load divided by flow)
	Load (kg)	-7407	Computed (load at KV-2 - loads at 4 u/s stations)
Flow of South McQuesten River at Station KV-1	Flow (1000m3)	109480	Estimated using regional hydrology study
	Concentration (mg/L)	0.07	Average observed concentration at KV-1
	Load (kg)	7883	Computed (flow times concentration)
Flow from outlet of Element 2 (i.e., flow at Station KV-7)	Flow (1000m3)	10313	From Element 2
	Concentration (mg/L)	0.22	From Element 2
	Load (kg)	2288	From Element 2
Flow from outlet of Element 3 (i.e., flow at Station LES-63)	Flow (1000m3)	650	From Element 3
	Concentration (mg/L)	0.50	From Element 3
	Load (kg)	325	From Element 3
Flow from outlet of Element 4 (i.e., flow at Station KV-21)	Flow (1000m3)	637	From Element 4
	Concentration (mg/L)	3.95	From Element 4
	Load (kg)	2516	From Element 4
Totals	Flow (1000m3)	125934	Computed (total of all inflows to element)
	Concentration (mg/L)	0.10	Computed (load divided by flow)
	Load (kg)	13011	Computed load at Station KV-2
OUTFLOWS		**2006 Total**	**Source of Data/Comment (2006 Data)**
Flow at Station KV-2	Flow (1000m3)	125934	Computed (total of all inflows to element)
	Concentration (mg/L)	0.04	Avg. observed concentrations for complete record
	Load (kg)	5604	Computed (flow times concentration)

Element 6&7, Flat Cr above Husky impacts (LES-69)			**Zinc (total)**
INFLOWS		**2006 Total**	**Source of Data/Comment (2006 Data)**
Catchment runoff	Flow (1000m3)	1	Should be ~ zero to reflect that mass balance is closed
	Concentration (mg/L)	0.00	Computed
	Load (kg)	0	Computed checksum
Decant at Station KV-12	Flow (1000m3)	35	Computed (catchment runoff minus seepage)
	Concentration (mg/L)	0.026	Avg. observed conc. at KV-12
	Load (kg)	1	Computed (flow times concentration)
Seepage from Dam No. 3	Flow (1000m3)	533	No data available
	Concentration (mg/L)	1.30	gw mass balance
	Load (kg)	692	Computed (flow times concentration)
Porcupine diversion + other creek inputs to tailings area (Brefalt etc)	Flow (1000m3)	2727	Catchment sources based on regional hydro study
	Concentration (mg/L)	0.01	Estimated background concentrations
	Load (kg)	27	Computed load from gw
Seepage impacts from tailings	Flow (1000m3)	207	Estimated using adjusted flat cr mass bal / gw study
	Concentration (mg/L)	0.17	Measured in diversion ditch
	Load (kg)	36	Computed load from gw
Totals	Flow (1000m3)	3502	Estimated using adjusted flat cr mass bal / gw study
	Concentration (mg/L)	0.22	Sum of above elements
	Load (kg)	756	Computed load from gw
OUTFLOWS		**2006 Total**	**Source of Data/Comment (2006 Data)**
Flow at Station LES-69 (Flat Cr before Husky)	Flow (1000m3)	3501	Computed (total of all inflows to element)
	Concentration (mg/L)	0.22	LES-69 data
	Load (kg)	756	Computed (flow times concentration)

Element 8, Galena Creek above the mouth			**Zinc (total)**
INFLOWS		**2006 Total**	**Source of Data/Comment (2006 Data)**
Runoff from incremental catchment (excluding runoff into open pits)	Flow (1000m3)	2559	Estimated using regional hydrology study
	Concentration (mg/L)	0.06	Computed (load divided by flow)
	Load (kg)	166	Computed (load at LES-57 minus loads at adit)
Discharge from Silver King Adit (after treatment)	Flow (1000m3)	245	Average of measured flows (UKHM/Govt/LES data)
	Concentration (mg/L)	0.18	Average observed concentration at KV-13
	Load (kg)	44	Computed (flow times concentration)
Totals	Flow (1000m3)	245	Computed (total o fall inflows to element)
	Concentration (mg/L)	0.18	Computed (load divided by flow)
	Load (kg)	44	Computed load at Station LES-57
OUTFLOWS		**2006 Total**	**Source of Data/Comment (2006 Data)**
Flow at Station LES-57	Flow (1000m3)	2764	Computed (total of all inflows to element)
	Concentration (mg/L)	0.08	2004 measurement in Galena Cr. d/s of SK adit "ACG-WQ-
	Load (kg)	210	Computed (flow times concentration)

Table 3 Mass Loading Update and Comparison - Total Zinc

Element 9, Flat Creek above Station KV-9 and below Porcupine Creek Diversion Channel			Zinc (total)
INFLOWS		**2006 Total**	**Source of Data/Comment (2006 Data)**
Runoff from incremental catchment	Flow (1000m3)	5304	Estimated using regional hydrology study
	Concentration (mg/L)	-0.13	Indicates demonstrable attenuation in/adjacent to Flat Cr
	Load (kg)	-681	Computed (load at KV-9 - loads at u/s stations & adits)
Discharge from Husky SW Adit	Flow (1000m3)	104	Average of measured flows (UKHM/LES data)
	Concentration (mg/L)	0.94	Average observed concentration at KV-17
	Load (kg)	98	Computed (flow times concentration)
Flow from outlet of Element 6 & 7 (both decant and seepage)	Flow (1000m3)	3501	From Element 6
	Concentration (mg/L)	0.216	From Element 6
	Load (kg)	756	From Element 6
Flow from outlet of Element 8 (i.e., flow at Station LES-57	Flow (1000m3)	2764	From Element 8
	Concentration (mg/L)	0.08	From Element 8
	Load (kg)	210	From Element 8
Totals	Flow (1000m3)	6369	Computed (total of all inflows to element)
	Concentration (mg/L)	0.17	Computed (load divided by flow)
	Load (kg)	1064	Computed load at Station KV-9
OUTFLOWS		**2006 Total**	**Source of Data/Comment (2006 Data)**
Flow at Station KV-9	Flow (1000m3)	11674	Measured at Station KV-9
	Concentration (mg/L)	0.033	Avg. observed concentration
	Load (kg)	382	Computed (flow times concentration)

Element 10, South McQuesten River between Stations KV-4 and KV-2			Zinc (total)
INFLOWS		**2006 Total**	**Source of Data/Comment (2006 Data)**
Runoff from incremental catchment	Flow (1000m3)	4783	Estimated using regional hydrology study
	Concentration (mg/L)	0.001	Computed (load divided by flow)
	Load (kg)	5	Computed (load at KV-9 - loads at u/s stations & adit)
Flow from outlet of Element 5 (both decant and seepage)	Flow (1000m3)	125934	From Element 5
	Concentration (mg/L)	0.045	From Element 5
	Load (kg)	5604	From Element 5
Flow from outlet of Element 9 (i.e., flow at Station KV-9)	Flow (1000m3)	11674	From Element 9
	Concentration (mg/L)	0.033	From Element 9
	Load (kg)	382	From Element 9
Totals	Flow (1000m3)	137608	Computed (total of all inflows to element)
	Concentration (mg/L)	0.04	Computed (load divided by flow)
	Load (kg)	5987	Computed load at Station KV-4
OUTFLOWS		**2006 Total**	**Source of Data/Comment (2006 Data)**
Flow at Station KV-4 d/s Flat Creek confluence w. McQuesten	Flow (1000m3)	142391	Measured
	Concentration (mg/L)	0.042	KV-4 data
	Load (kg)	5991	Computed (flow times concentration)

Element 11, South McQuesten River between Stations KV-5 and KV-4			Zinc (total)
INFLOWS		**2006 Total**	**Source of Data/Comment (2006 Data)**
Runoff from incremental catchment	Flow (1000m3)	19000	Estimated using regional hydrology study
	Concentration (mg/L)	-0.11	Computed (load divided by flow)
	Load (kg)	-2076	Computed (load at KV-5 minus loads at u/s stations)
Flow of Haldane Creek at Station LES-10	Flow (1000m3)	17760	Estimated using regional hydrology study
	Concentration (mg/L)	0.08	Average of samples collected up to 1995.
	Load (kg)	1352	Computed (flow times concentration)
Flow from outlet of Element 10 (i.e., flow at Station KV-4)	Flow (1000m3)	142391	From Element 10
	Concentration (mg/L)	0.042	From Element 10
	Load (kg)	5991	From Element 10
Totals	Flow (1000m3)	160151	Computed (total of all inflows to element)
	Concentration (mg/L)	0.046	Computed (load divided by flow)
	Load (kg)	7343	Computed load at Station KV-5
OUTFLOWS		**2006 Total**	**Source of Data/Comment (2006 Data)**
Flow at Station KV-5	Flow (1000m3)	179151	Computed (total of all inflows to element)
	Concentration (mg/L)	0.029	Average of 1994 to 2006 dataset
	Load (kg)	5267	Computed (flow times concentration)

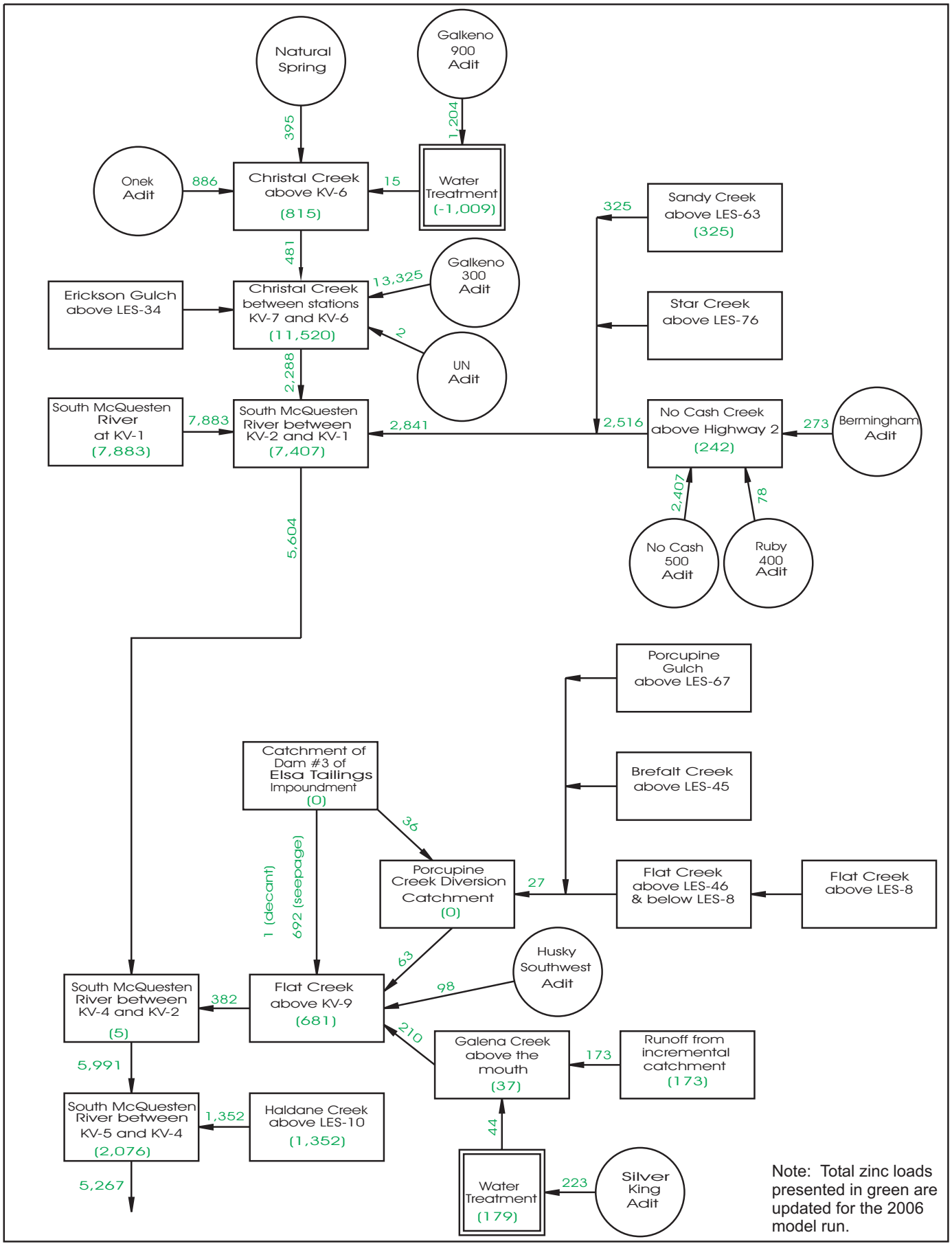


Figure 1 Current Average Annual Total Zinc Mass Loading Balance Schematic (2006) Minesite Drainages within the South McQuesten Watershed

Keno Hill Mines 2006 Mass Loading for Total Zinc

Legend

Topography

- Town
- Silver Trail
- Secondary Road
- Limited-use road
- Trail
- Watercourse
- Waterbody

Mine Workings

- Valley Tailings
- Adit
- Shaft (to surface - connection to underground not determined)

- First Nation Settlement Land
- Model Element - South McQuesten Watershed
- Model Element - Lightning Creek Drainage

Notes:
This map is for illustrative purposes only.
This is not a legal document.
National Topographic Data Base (NTDB) compiled by Natural Resources Canada at a scale of 1:50,000. Cadastral data compiled by Natural Resources Canada. Reproduced under license from © Her Majesty the Queen in Right of Canada, Department of Natural Resources Canada. All rights reserved.
Projection: UTM Zone 8 NAD83
NTS Sheet 105M/13 and 105M/14

Elsa Reclamation & Development Company Ltd.

ACCESS CONSULTING GROUP

ELSA RECLAMATION & DEVELOPMENT COMPANY LTD.

PROJECT PROPOSAL & WATER LICENCE APPLICATION

KENO HILL MINES 2006 MASS LOADING FOR TOTAL ZINC

Drawn By: HD	Date: March 2007	**FIGURE 2**
Checked by: DC	File: D:\Projects\AllProjects\ALEX-05-01\gis\mxd\LKH\MWaterLicenseFall06\AmmendJan07\Fig_MassLoading_Mar07.mxd	

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Closure Planning Technical Studies – Keno Hill, Yukon

Contaminant Loading and Transport Pathways Investigation – Onek and No Cash 500

Objective

Based on measured loads of zinc and other contaminants from the No Cash 500 and Onek adits, considerably higher loads of contaminants should be measured at downgradient stations in both Christal Creek (KV-6) and Flat Creek. The mode of contaminant reduction should be investigated to confirm that geochemical attenuation and reduction is occurring and accounts for the negative variance in estimated versus actual contaminant load in Christal Creek and Flat Creek.

Methodology

Onek Adit

A review of the mass balance for the Christal Creek and Flat Creek areas was undertaken to determine potential areas of fugitive flows that might require mitigation or treatment during closure. It was observed during this review process that significant "sinks", or negative sources, were highly active and effective in the Christal Creek and McQuesten valleys at removing known loadings of zinc after characterization, but prior to tabulation at the next mass balance element. By way of example, all known sources of contamination were characterized upstream of sampling location KV6 on Christal Creek and together cumulatively account for 1286 kg/yr of dissolved zinc loading expected to be observable in Christal Creek at that location, while the load of zinc actually measured to be in the receiving creek at KV6 is measured at 481 kg/yr. This observation requires confirmation as to the mechanisms controlling such geochemical attenuation processes, prior to finalizing the mass balance for this area and declaring the mass balance satisfactorily closed.

The balance at this element is excerpted from the Site-Wide Mass Balance (2007, see Closure Planning Technical Studies - Appendix G)

Table 1. Element 1 Site Wide Mass Balance - 2006

Element 1, Christal Creek above Station KV-6		
INFLOWS		
Catchment runoff (excluding runoff into open pits) –if positive load is required to achieve balance then there are other sources, there are chemical sinks if a negative load is required.	Flow (1000m3)	1822
	Concentration (mg/L)	**-0.44**
	Load (kg)	**-805**
Discharge from Galkeno 900 Adit after treatment	Flow (1000m3)	217
	Concentration (mg/L)	0.022
	Load (kg)	5
Discharge from Onek Adit	Flow (1000m3)	10
	Concentration (mg/L)	88.6
	Load (kg)	886
Discharge from natural spring	Flow (1000m3)	79
	Concentration (mg/L)	5.0
	Load (kg)	395
Totals	Flow (1000m3)	2127
	Concentration (mg/L)	0.60
	Load (kg)	1286
OUTFLOWS		
Flow at Station KV-6	Flow (1000m3)	2127
	Concentration (mg/L)	0.23
	Load (kg)	481

As the difference is so large between 0.6 PPM postulated in the creek at KV6 and the actual concentration is measured at 0.23 PPM, this difference is not likely attributable to analytical error or flow measurement error alone.

A field study was therefore undertaken during June – August 2006 to delineate the pathways for contaminant loading from the largest known source of loading in this area, from its source at the Onek Adit to Christal Creek.

Walking across seepage areas along Christal Creek it was observed that significant flows of relatively higher conductivity waters were traversing the power line accessway which was cleared and constructed in a relatively down-hill direction west by northwest from Onek Adit and parallel to the Keno City highway. A field conductivity meter, Garmin GPS and a shovel were the primary field tools for further delineation of the shallow groundwater flow and observed surface seepage pathways.

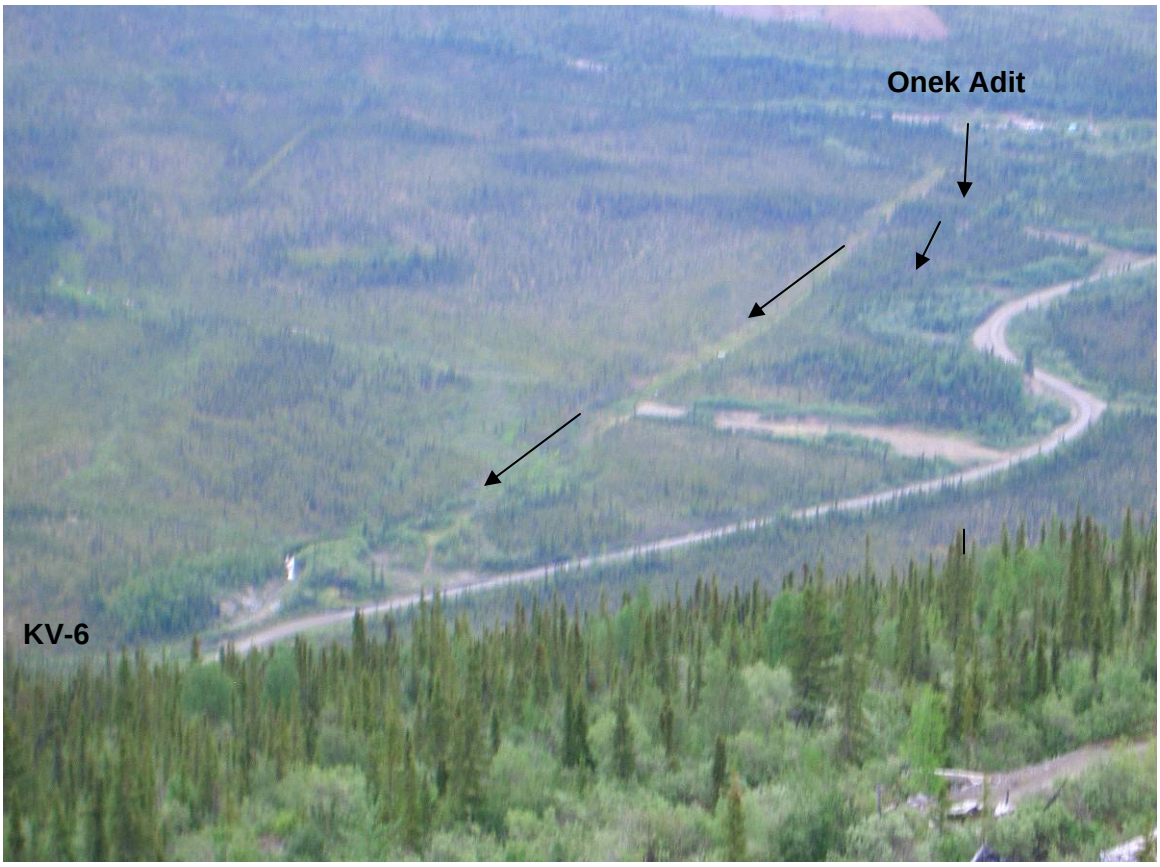


Figure 1. View of Onek adit and observed seepage pathways toward Christal Creek (view from G300).

With Onek adit discharging low flows but high metal loads (cadmium = 2.0 mg/l and zinc = 90 mg/l), mapping of the highest conductivity seepage for several locations where seepage was observed to spring out of the hillside, and then observed to percolate back into the soils, was undertaken. Samples were collected from these high conductivity areas for metals analysis to determine if loading of high salt waters was actually attenuated in the process of traverse from the adit to the creek as required to make the mass balance close to a reasonable level of certainty. Alternatively, if high metals were observed in these high conductivity waters, then it would have pointed to the need to more carefully analyze the method of sampling and the water balance about KV6 to determine if there were sources of significant dilution that were unknown.

Thirty test pits were hand dug to groundwater, and two manually-driven piezometers were located within shallow groundwater, in the effort to fully define the transport of high conductivity water from the Onek Adit. Of these locations, eight were sampled for zinc, other metals (including cadmium, iron, manganese, silicon) and for major ions of interest. Ions of interest particularly included sulfate and bicarbonate.

It was also noted, that for Kirchoff's laws to be followed for charge balance within the adit fluids, that conductivity would be a conservative tracer of adit fluid.

Plotting conductivity (y-axis) against distance from the Onek Adit yields the following graph, from which we can calculate the level of dilution from surrounding surface and ground waters:

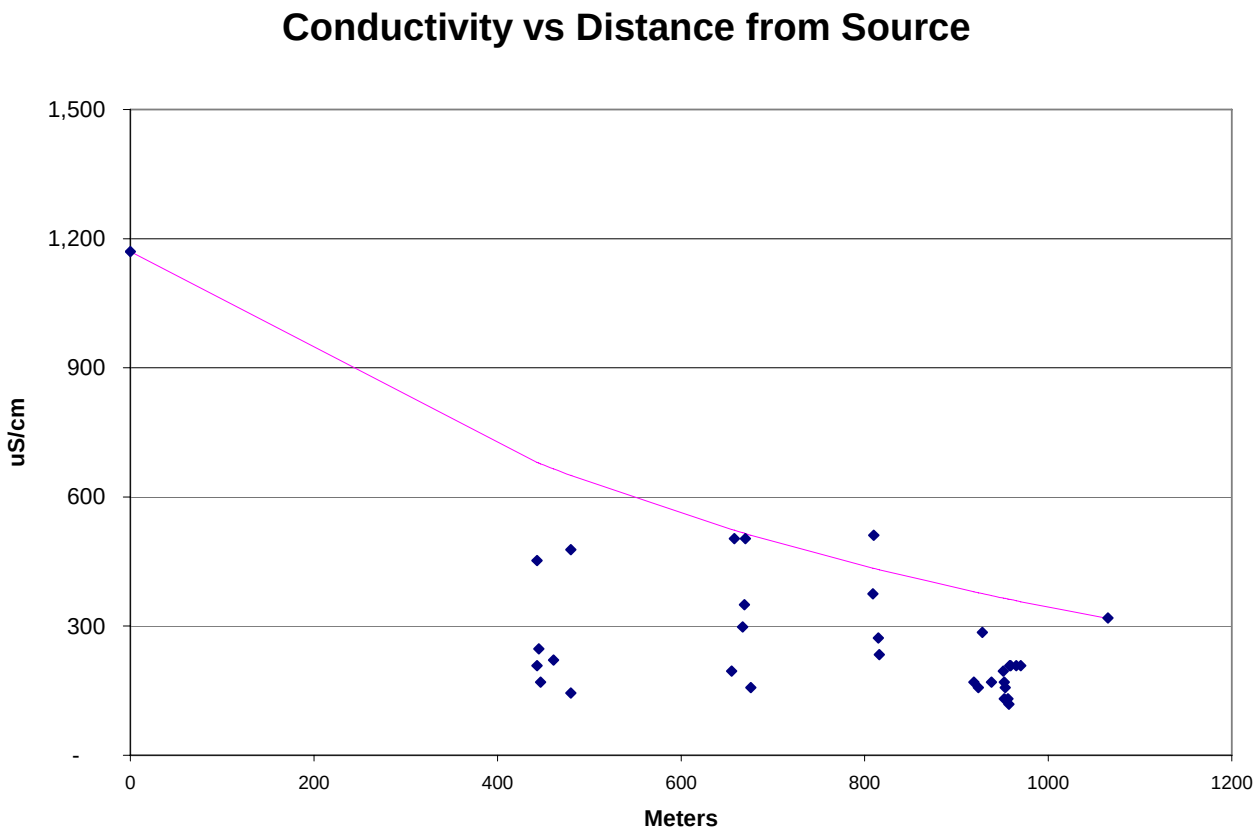


Figure 2. Conductivity versus Distance Onek Adit

The dilution rate constant for this data set is approximately 0.12%/meter using log-linear regression on the peak observed conductivity along each transect across the seepage faces.

From this observed level of dilution and following conservative mixing rules, predicted dissolved zinc concentrations from a feed concentration of about 90 PPM are shown in Figure 3, along with the actual measured dissolved concentrations for zinc sampled from the highest conductivity waters for each transect:

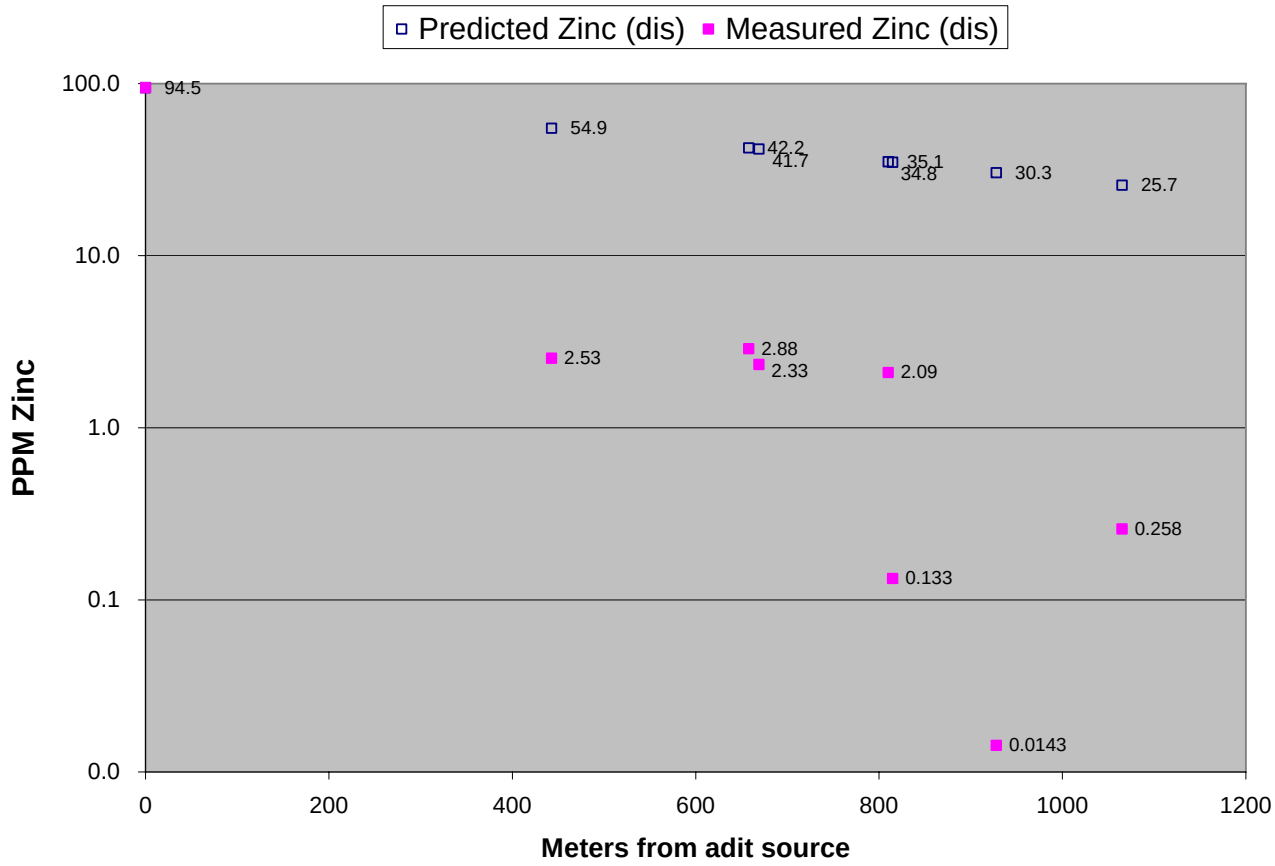


Figure 3. Predicted versus Measured Zn from Onek Adit

The substantial deviation of observed zinc concentrations, by more than 10-fold less than the predicted values, leads to a conclusion that the level of attenuation required in the mass balance model is well supported. For this conclusion to be un-supported would have required that conductivity to be non-linearly correlated to salt content coming from the Onek adit, or that some other source of salty water would have to exist in the area. For such a source to exist would require substantial positive deviation in the sulfate balance for the same area. While a small positive deviation does occur, it is only indicative of the balance being off by 19%, rather than the required deviation of orders of magnitude. It is likely that this source of positive deviation actually occurs from Galkeno 900, where anaerobic conditions may encourage similar attenuation mechanisms making it a higher sulfate/low zinc loading source to the mass balance model.

If geochemical attenuation is occurring, there has to be an ion transfer process operative to conserve charged ions within the fluid. Furthermore, such a replacement ion must result from a process that would reasonably be anticipated to adsorb, precipitate or exchange with zinc. During our field exploration program, many locations were found where sulfide precipitates or sulfide odors were observed. An example of such a location is shown in Figure 4 below along with a sample of sediment cut from the bog edge:



Figure 4. Observed Sulfide Precipitates – Downgradient from Onek Adit

No Cash 500

The No Cash 500 adit is a loading source of zinc to the district, but for the mass balance to close, requires that No Cash 500 or other sources be dramatically attenuated, similar to what is occurring at Onek.

Figure 5. No Cash Elements Mass Balance

Element 4, No Cash Creek above Highway 2		
INFLOWS		**2006 Total**
Runoff from incremental catchment (excluding runoff into open pits)	Flow (1000m3)	606
	Concentration (mg/L)	-0.40
	Load (kg)	-242
Discharge from Bermingham Adit	Flow (1000m3)	62
	Concentration (mg/L)	4.41
	Load (kg)	273
Discharge from Ruby 400 Adit	Flow (1000m3)	48
	Concentration (mg/L)	1.63
	Load (kg)	78
Discharge from No Cash 500 Adit	Flow (1000m3)	137
	Concentration (mg/L)	17.6
	Load (kg)	2407
Totals	Flow (1000m3)	637
	Concentration (mg/L)	4.33
	Load (kg)	2758
OUTFLOWS		**2006 Total**
Flow at Station KV-21	Flow (1000m3)	637
	Concentration (mg/L)	3.95
	Load (kg)	2516
Element 5, South McQuesten River between KV2 and KV1		
INFLOWS		**2006 Total**
Runoff from incremental catchment (excluding runoff into open pits)	Flow (1000m3)	4855
	Concentration (mg/L)	-1.53
	Load (kg)	-7407
Flow of South McQuesten River at Station KV-1	Flow (1000m3)	109480
	Concentration (mg/L)	0.07
	Load (kg)	7883
Flow from outlet of Element 2 (i.e., flow at Station KV-7)	Flow (1000m3)	10313
	Concentration (mg/L)	0.22
	Load (kg)	2288
Flow from outlet of Element 3 (i.e., flow at Station LES-63)	Flow (1000m3)	650
	Concentration (mg/L)	0.50
	Load (kg)	325
Flow from outlet of Element 4 (i.e., flow at Station KV-21)	Flow (1000m3)	637
	Concentration (mg/L)	3.95
	Load (kg)	2516
Totals	Flow (1000m3)	125934
	Concentration (mg/L)	0.10
	Load (kg)	13011
OUTFLOWS		**2006 Total**
Flow at Station KV-2	Flow (1000m3)	125934
	Concentration (mg/L)	0.04
	Load (kg)	5604

The mass balance for Elements 4 and 5 (No Cash 500, South McQuesten elements) is presented in Table 1. Within this mass balance node (4-5), No Cash 500 is the largest load within the element, representing more than 87% of the total zinc load from Element 4.

A field sampling and analysis program was conducted for the No Cash 500 area in July and August 2006, whereby observed surface seepage was mapped, numerous test pits were hand-dug (nine of which intercepted groundwater), and four manually driven piezometers were installed to shallow groundwater.

These sample locations reveal an interesting phenomenon that the conductivity actually increased somewhat from the No Cash 500 adit to the point that all water had seeped into the ground below the adit. The postulated reason for this slight increase (from 759 to 890 uS/cm), is that each ferric ion leaving the adit hydrolyzes to form three protons (H^+), and then, upon leaching through the waste pile below the adit, these protons exchange with potassium, magnesium and calcium in the gangue minerals.

This hydrolytic process is visually observable in Figure 6 below.



Figure 6. Ferricrete formation below No Cash Adit

The iron and manganese precipitates (ferricrete) in this area are several feet thick, and sequentially armor off areas of infiltration, forcing infiltration into areas further down-gradient. This is a directly observable process that is likely to account for some geochemical removal of contaminants, although as will be discussed below, sampling beneath the waste area has indicated significant zinc loading in the groundwater and in the creek below the confluence of these impacts on further down-gradient.

Figure 7 below shows the results of sampling in groundwater and surface waters from test pits and piezometers down-gradient of the No Cash 500 adit.

Contaminant transport from No Cash

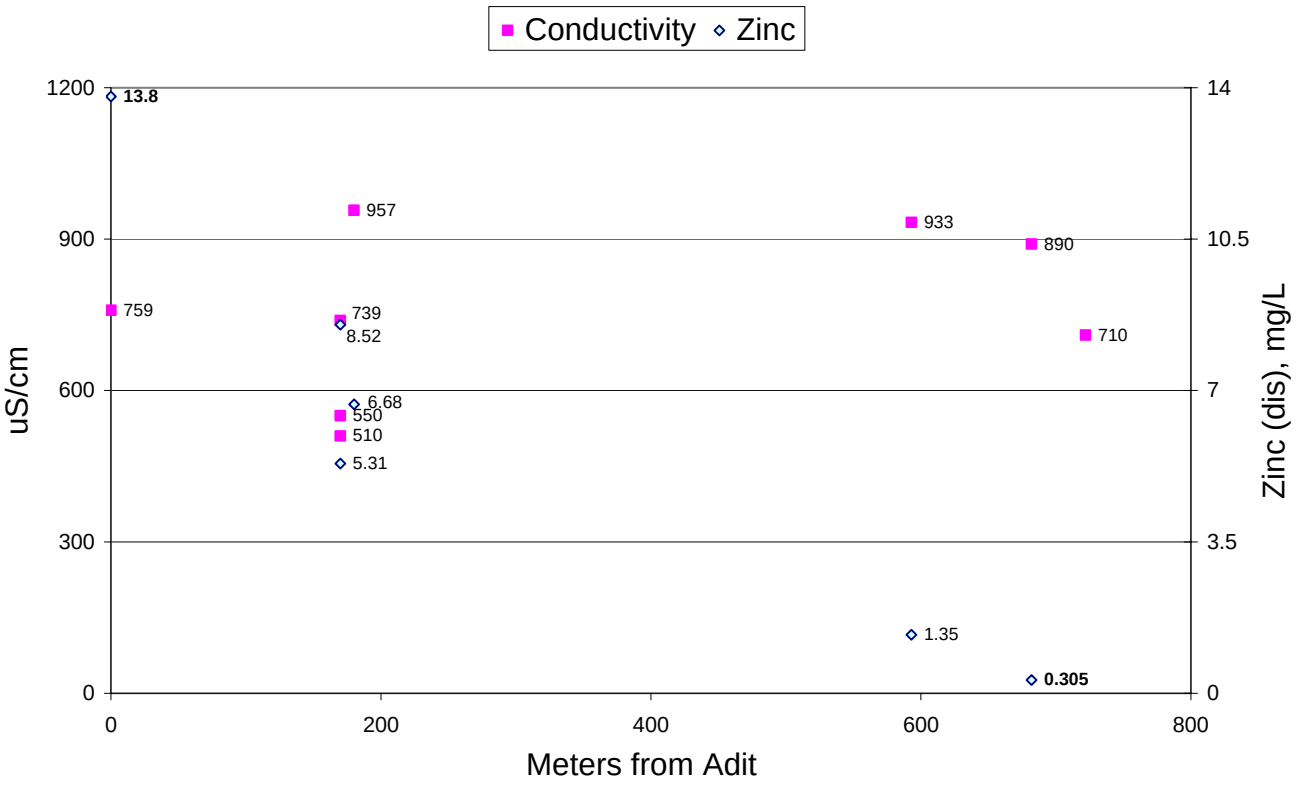


Figure 7. Contaminant Level versus distance from No Cash

As can be observed from inspection of the figure above, conductivity rises as the water passes through the waste rock pile until about 170 - 180 meters down gradient, while zinc drops to about 8.5 PPM, and then adit water eventually reaches the receiving environment to achieve an overall mixture of about 550 uS/cm total conductivity, with zinc about 5.3 PPM. While this surface equilibration occurs, metal and salt loading apparently passes from beneath the adit dump into groundwater paralleling the creek and traveling in heavily-metal stained gravel beds left in old creek channels.

These loads then continue to join No Cash Creek in discrete seepage events both above and below the highway crossing, culminating in a large area of seepage about 300 meters below the road when the topographic gradient flattens significantly. Interestingly, the seepage emitted at this area fully 800 meters down gradient of the No Cash 500 adit carries the same salt concentration ~ 750 - 900 uS/cm conductivity, but only 0.3 PPM zinc.

The evidence suggests that infiltrating seepage, after entering groundwater, does not encounter a significant amount of dilution at all before reaching the valley bottom, while zinc drops in concentration from over 13 PPM to about 0.3 PPM, or more than 98% reduction. Visual representation of this area is shown in Figure 8 and Figure 9. Figure 8 shows significant seepage rates analyzing over 800 us/cm with only 0.3 mg/l Zn and 204 mg/l bicarbonate. Visible sulfide in sediments with accompanying odors was evident at the time of this inspection.



Figure 8. Location near sample point MDP3



Figure 9. Vestigial gravel channel down gradient of No Cash 500 adit

While ferricrete formation can be credited with reducing zinc concentrations from 13 mg/l to about 8 mg/l (dissolved), the remaining load would not have been removed by iron/manganese co-precipitation after this point due to the extremely low levels of iron and manganese measured in MPD2 & 3 of about 0.08 PPM.

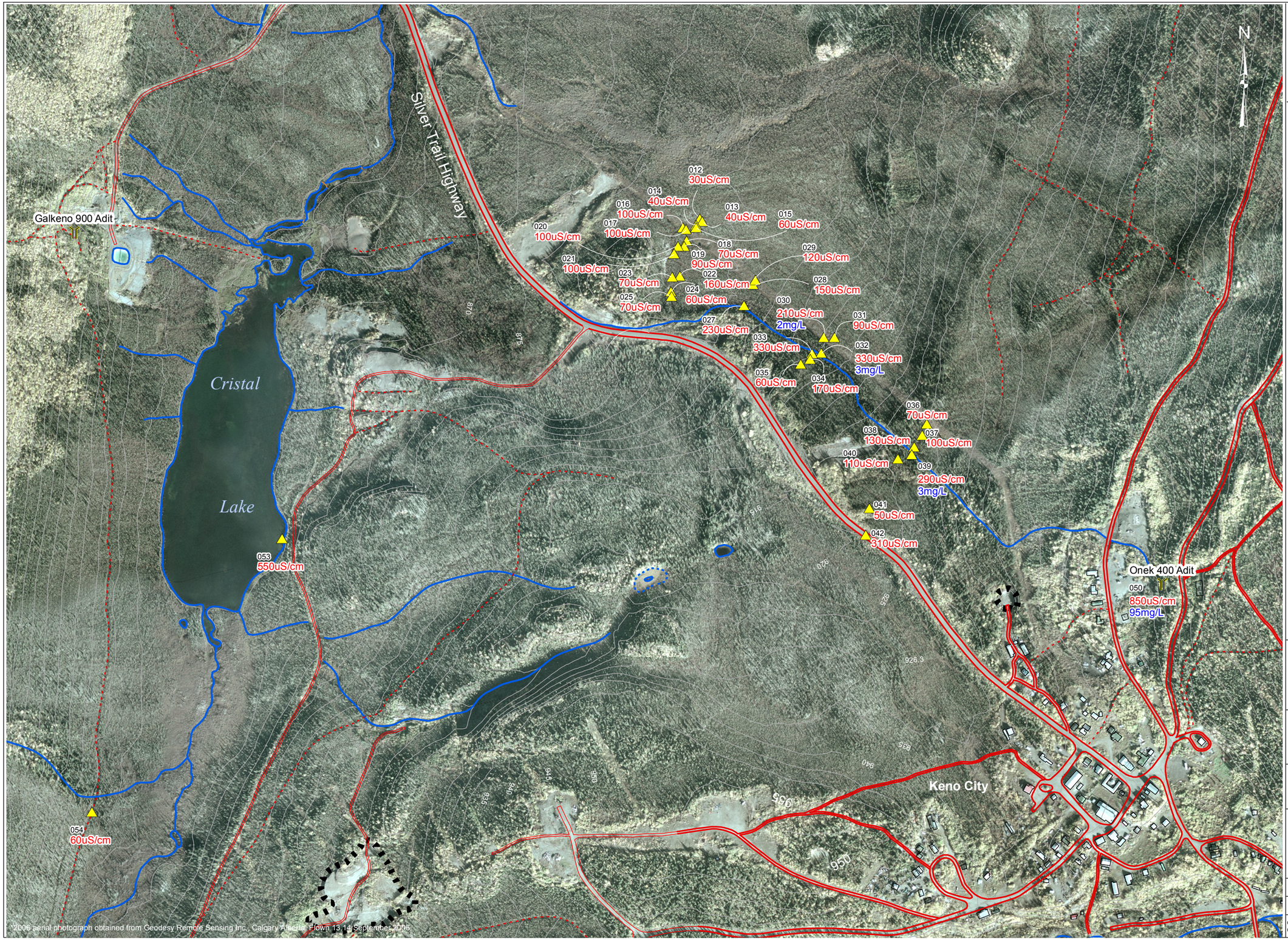
Analysis of the residual concentrations of bicarbonate in the fluid collected in groundwater seepage at MDP 2 & 3 shows high levels of bicarbonate between 122 and 204 PPM.

Conclusion

From the above field observations and laboratory analyses, it is our conclusion that, at both No Cash 500 and Onek, naturally occurring organic materials are breaking down under anaerobic sulfate reducing conditions, precipitating zinc as a sulfide mineral from concentrations as high as 90 PPM at Onek and under steep hydraulic gradients such as exist at No Cash 500, and in both cases result in groundwater and surface water seepage high in bicarbonate concentrations and substantially devoid of zinc loading.

Further similar investigations should be initiated at other adits within the property.

The results and locations of the conductivity and zinc sampling investigation for both Onek and No Cash are shown in Figure 10, Figure 11 and Figure 12



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Legend

- Test location
  - 00 Sample location number
  - 00 Conductivity value
  - 00 Zinc concentration value
- Adit location
- Public Road
- Exploration roads
- Trails
- Cutlines
- contours, Continuous
- Streams and Lakes
- Swampy area
- Pit
- Pipe

Scale: 1:6,000
(when plotted on 11x17 inch sheet)

0 70 140 280 Meters
0 75 150 300 Yards

Contaminant Loading and
Transport Pathways Investigation
Onek and No Cash 500

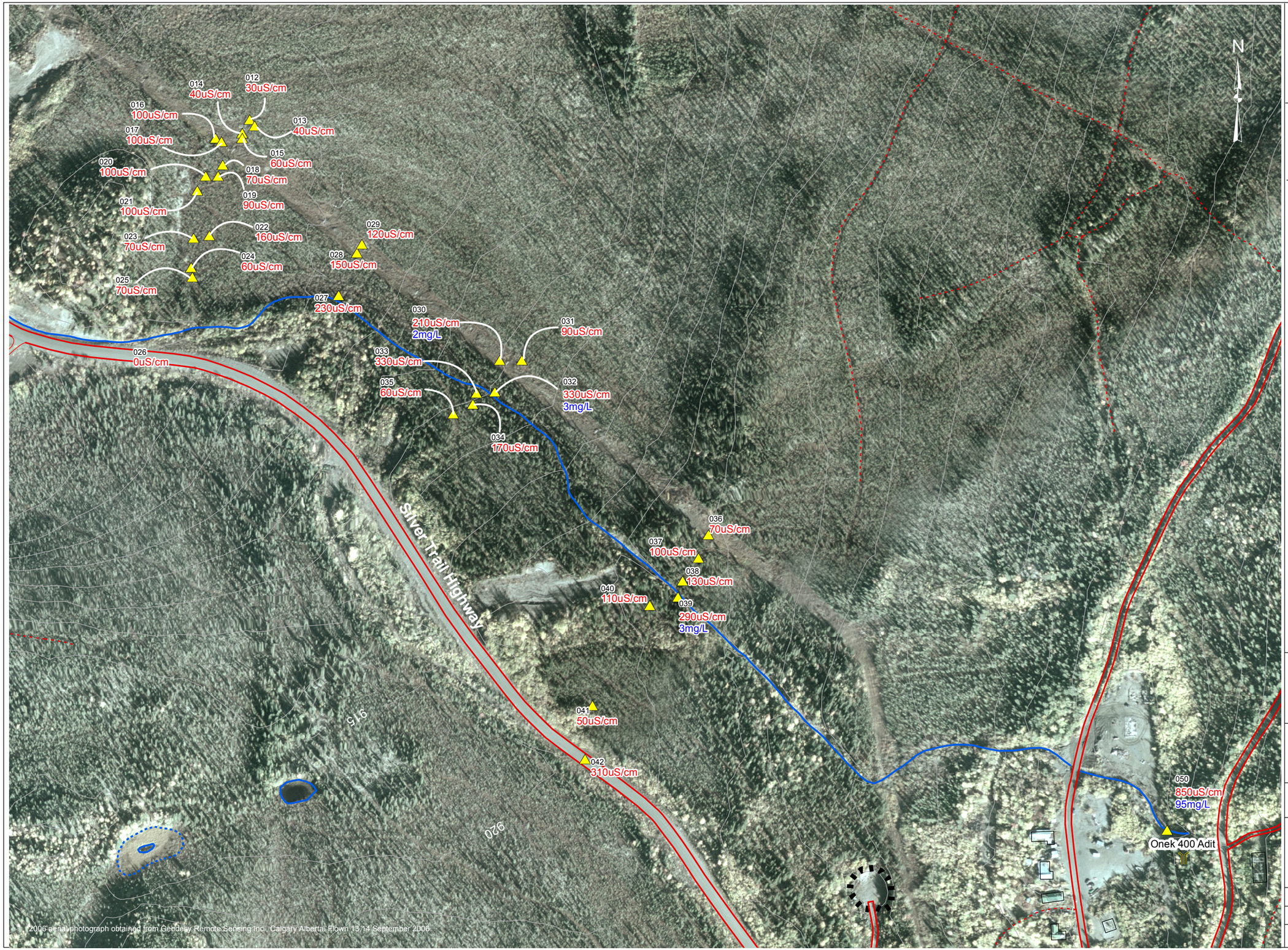
Cristal Lake and West of Keno City

Figure 10

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Drawn by: RG	Checked by: JH
Date: March 2007	

Our File: Dawson\D\Project\AllProjects\ALEX-05-01\gis\mxd\UKHM\ClosurePlan2007\Groundwater_Seepage\GWS_map2_CristalLake_KenoCity.mxd



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Legend

- Test location
  - 00 Sample location number
  - 00 Conductivity value
  - 00 Zinc concentration value
- Adit location
- Public Road
- Exploration roads
- Trails
- Cutlines
- contours, Continuous
- Streams and Lakes
- Swampy area
- Pit
- Pipe

Scale: 1:3,000
(when plotted on 11x17 inch sheet)

0 35 70 140 Meters
0 35 70 140 Yards

Contaminant Loading and Transport Pathways Investigation

Onek and No Cash 500

Area Northwest of Onek Adit

Figure 11

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Date: March 2007	

Our File: Dawson\D\Project\AllProjects\ALEX-05-01\gis\mxd\UKHM\ClosurePlan2007\Groundwater_Seepage\gws_map1_west_of_Onek.mxd



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Development Company

Legend

- Test location
  - 00 Sample location number
  - 00 Conductivity value
  - 00 Zinc concentration value
- Adit location
- Public Road
- Exploration roads
- Trails
- Cutlines
- contours, Continuous
- Streams and Lakes
- Swampy area
- Pit
- Pipe

Scale: 1:6,000
(when plotted on 11x17 inch sheet)

0 80 160 320 Meters
0 87.5 175 350 Yards

Contaminant Loading and
Transport Pathways Investigation
Onek and No Cash 500

No Cash Adit Area

Figure 12

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Drawn by: RG | Checked by: JH

Date: March 2007

Our File: Dawson\D\Project\AllProjects\ALEX-05-01\gis\mxd\UKHM\ClosurePlan2007\Groundwater_Seepage\gws_map3_NoCash.mxd

Elsa Reclamation and Development Company Ltd.

Preliminary Soils Characterization Study Report
United Keno Hill Mines Property

ACCESS CONSULTING GROUP

Date: March 07

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1.0 Introduction

The United Keno Hill Mines property is located North of Mayo, Yukon Territory on the Silver Trail Highway (Figure 1). The property is found south of the McQuesten River and spreads over the slopes of Galena, Keno, Sourdough and Bunker Hills (Figure 2).

The following is a report on the preliminary soil characterization study conducted in the winter of 2007. For the study 6 key water treatment locations on the United Keno Hill Mines Property were selected for the identification of potential unfrozen gravel deposits and permafrost zones. Analysis for this report was applied in a desktop setting. Digital and analogue aerial photographs used for the study were flown in September of 2006. Newly created and existing spatial data describing topographical features and elevation was also used for this study.

A map set was produced for each of the six study areas. The maps can be found in the Appendix.

2.0 Methodology

2.1 *Selected Sites*

The selected study areas, possibly involved in closure planning and reclamation activities, were identified by Green World Sciences as those sites currently undergoing water treatment and sites possibly requiring water treatment. The proposed treatment methods could possibly utilize unfrozen gravel deposits existing in close proximity to each location for in-situ treatment of effluent exiting mine infrastructure.

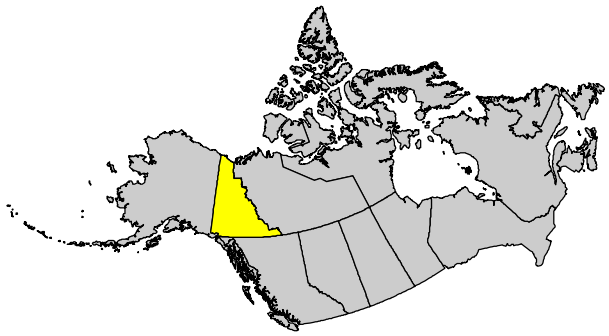
The following is a brief description of the geography and surficial geology for each selected study area.

2.1.1 Silver King Adit Area

The Silver King adit is located on the North facing slope of Galena Hill on the West side of Galena Creek north of the Silver Trail Highway. The site consists of the Silver King Adit to the north of the highway and the 75 Level Adit located up-gradient to the South of the highway just to the west of Galena Creek (Figure 2).

Surficial geology noted by the GSC for the Silver King adit study area consists of exposed bedrock and moraine veneers up to 2 feet thick in the upper slopes of Galena Hill. Moraine blankets are encountered to the West of the adit area while moving down slope and northward toward Flat Creek. The surficial geology





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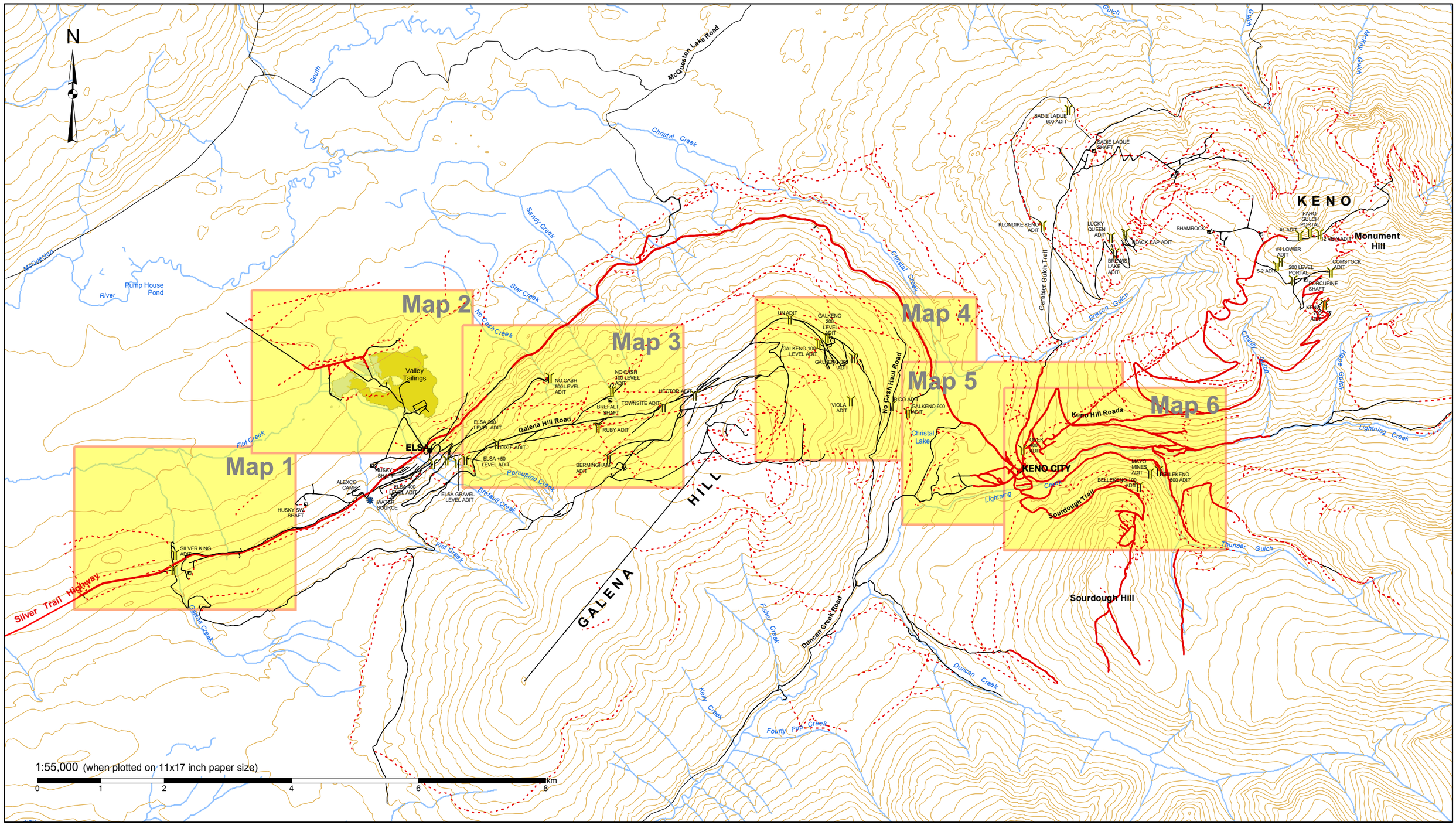
Site Investigation and Improvements
Special Projects United Keno Hills

Closure Planning Technical Studies

Soils Characterization Study

Drawn By: HD/RG	Figure 1
Checked By: RM/DC/BT	Date: March 2007

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Closure Planning
Technical Studies

Site Investigation and Improvements
Special Projects
United Keno Hill Mines Property

Property Layout

Legend

Topography
- Town
- Public Road
- Exploration Road
- Trail
- Watercourse
- Waterbody

Mine Workings
- Adit
- Shaft (to surface - connection to underground not determined)

Areas of Interest
- 2007 Soils Characterization Study Areas

Notes:
This map is for illustrative purposes only.
This is not a legal document.
Topographic data current as of September 2006.
Projection: UTM Zone 8N NAD83
NTS Sheet 105M/13 and 105M/14

Figure 2

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Drawn By: RG | Date: March 2007

Checked by: RM\DC\BT | File: D:\Project\AllProjects\ALEX-05-01\gis\mxd\UKHM\Closure Plan\Soils Characterization\Fig2.mxd

covering the Galena Creek discharge area and the immediate McQuesten River Valley consists of alluvial material with the presence of fens (Map 1B, Appendix).

2.1.2 Valley Tailings Area

The EIsa tailings (Valley Tailings), East of the Silver King site, is located in the Flat Creek valley bottom below the Elsa mill site. The major accumulation of tailings is upstream from the main stem of Flat Creek in a swampy area draining into Flat Creek. Porcupine Creek passes through the tailings area. An additional area of older tailings is perched on the hillside above the valley bottom south of Porcupine Creek and just below the highway to Keno City. The total surface area of the impoundment is approximately 185 acres (75 ha).

GSC data for the Valley Tailings study area notes veneers of moraine material up to 2 feet thick with some exposed bedrock nearly surrounding the tailings area. Alluvial plain material is noted to the west, existing under Flat Creek. Alluvial fan material with fens can be found less than 300 metres to the East. Deposits of glaciofluvial complex can be found less than 1000 metres to the North (Map 2B, Appendix).

Boreholes BH-01, BH-02 and BH-03 were drilled at 3 locations in this study area (Appendix, Map 2A,B). BH-01, drilled about 100 feet from Tailings Dam #1, indicated sandy gravel from 0-8 feet, a more finely grained material from approximately 8-32 feet and increasing gravel from 32-44 feet. The hole was suspended at 68 feet. No permafrost was encountered during drilling and the hole remained dry after 24 hours.

BH-02 was drilled near the crest of Tailings Dam #3. Drilling rates were better than BH-01, and recovery was low at this location. It is presumed this is due to the *observable, but too large to recover cobbles and gravels* (ERDC, 2007). No permafrost was encountered while drilling at this location. This hole was drilled to a depth of 62 feet.

BH-03 was drilled immediately downstream of the Tailings Dam #3 within approximately 100 feet of Flat Creek. Samples at this location were sands and gravels with poor recovery and large cobbles observable in the borehole walls. This hole partially collapsed before it could be completely cased. Water was encountered at 4 feet immediately after withdrawing the drill steel. The rapid influx of water and collapse of material making up the borehole walls indicates good pore space and thus very good infiltration conditions (ERDC, 2007)

2.1.3 No Cash Adits Area

The No Cash adits are located on the north aspecting slope of Galena Hill. This site is to the West of the Valley Tailings on the South side of the Silver Trail highway. The 500 Level adit is closer to the highway and down slope of the 100 Level adit. The Galena Hill Road is up slope of the adits (Figure 2).

The No Cash Study area is mainly underlain by moraine materials with colluvial blankets and veneers ranging from 2 to 30 feet thick. Moraine material with some exposed bedrock can be found north of the 100 Level adit area. Alluvial fan material is noted further down slope, on the north side of the Silver Trail Highway. Glaciofluvial material is also noted to the West of the adit areas in and around Porcupine Gulch (Map 3B, Appendix).

2.1.4 Galkeno 300 and 900 Adits Area

The Galkeno 300 and 900 adits are found on the East face of Galena Hill. The 300 Level adit is up slope and to the West of the 900 Level portal. Cristal Lake and Cristal Creek are to the East of this site. Cristal Creek flows from Cristal Lake and feeds into the South McQuesten River. The Galena Hill Road runs nearly adjacent to both sites and to the South of this area. The No Cash Haul Road runs between the sites (Figure 2).

The Galkeno 300 and 900 Level Adits study area is underlain mainly by moraine material in the form of colluvial veneers, blankets and lenses with some exposed bedrock. To the East, zones of glaciofluvial material are noted. Alluvial complexes are noted by the GSC as being present in the area to the South of Cristal Lake (Map 4B, Appendix).

Borehole drilling immediately Northeast of the Galkeno 900 adit (Appendix, Map 4A,B) indicated a high composition of cobbles on the borehole wall. Water poured into the newly drilled hole (BH-04) infiltrated the ground at a rate of more than 90 gallons in 30 minutes indicating the existence of good pore space in the subsurface (ERDC, 2007).

2.1.5 Onek Adit Area

The Onek 400 Level Adit area is North of Keno City between the Gambler Gulch Trail and the Keno Hill Roads. This area is mainly found on the West toe of Keno Hill and Cristal Lake and Cristal Creek can be found to the West (Figure 2).

The Onek Adit study area is underlain by morainal blankets and veneers with exposed bedrock to the West, and glaciofluvial material to the East and south. The morainal material ranges in thickness from 2 to 30 feet, and the glaciofluvial

material ranges from 2-50 feet. There is an alluvial deposit noted south of Cristal Lake (Map 5B, Appendix).

2.1.6 Bellekeno Adits Area

The Bellekeno Adits are situated on the Northeast slope of Sourdough Hill, East of Keno City. The 600 Level Adit can be found just to the West of Thunder gulch down slope of the 100 Level adit. The Mayo Mines adit is found between the Bellekeno portals. The Sourdough Trail runs along the upper slopes to the Southwest of the site (Figure 2).

The Bellekeno Adits study area is underlain mainly by colluvium with exposed bedrock. This material is described by the GSC as being up to 2 feet thick. The Northwest region of the study area consists of morainal blankets and veneers that range in thicknesses of 2 to 30 feet (Map 6B, Appendix).

2.2 Data Utilized and Created

2.2.1 Aerial Photography

Digital aerial photographs were taken on September 13 and 14 of 2006 by Geodesy Remote Sensing Inc. (GRS). The plane was flown at altitudes of 8,000 feet and 10,000 feet. The pilot and navigator was Derek Brown, and the photographer was Bill Firth. The digital images were captured at a quality to produce a sub-decimetre pixel resolution.

Analogue photography was captured in conjunction with the digital imagery by GRS. The average scale for these photos is 1:10,000.

The digital photographs were orthogonally corrected and spatially projected using computer software algorithms and digital elevation model (DEM) data to align with existing geographic information system (GIS) and computer aided design (CAD) data. Imagery was then grouped or mosaiced to cover the property with 8 tiles.

2.2.2 Computer Aided Design Data

CAD data was digitized by Aero Geometrics (AG) from the digital aerial imagery over the fall of 2006. The data was divided into 8 tiles to match the orthorectified imagery. Using specialized software, a 1 metre resolution DEM was extracted from the imagery. Contour lines were then interpolated from the DEM at an interval of 1 metre. Data was also created for, exploration roads, trails, cut lines, trenches, mine infrastructure, surface water features and public roads.

2.2.3 Geographic Information System Data

2.2.1.3 Existing Data

A geodatabase (GDB) of surficial geology data for NTS Sheet 105M was supplied by Geological Survey of Canada (GSC). The spatial data contained in the GDB provided surficial units, unit materials, typical thickness, a description of the unit's landforms and general comments. Feature classes provided were points, polylines and polygons. Accompanying tables of unit descriptors and unit modifiers were also contained in the GDB. Of the data provided, polygon data was utilized most commonly during this study.

The Canadian Department of Indian and Northern Affairs (DIAND) Yukon Placer Activity Map (Lipovsky, P., et al. 2001) was used to determine glacial movement in and around the study area. Glacial limits and features resulting from glacial activity can be excellent sources of coarsely grained material.

The study area was affected by the McConnell advance (ca. 22 Ka) to the North and the Reid advance (ca. 200 Ka) to the South. The McConnell advance moved from east to west and flowed into to the McQuesten River valley terminating, in the immediate area, around the base of Mt. Haldane (Lipovsky, P., et al. 2001). A tongue from this advance also flowed South between Galena Hill and Keno Hill into the Cristal Creek valley (gulch?). This advance terminated at the base of Sourdough Hill resulting in potential morainal deposits on the North face of Sourdough Hill, the East face of Galena Hill and the West face of Keno Hill. Deposits originating from the McConnell advance can also be found along North aspecting slopes on Galena Hill an on East facing hillsides on the Eastern side of the property.

A tongue from the Reid advance was advancing in the study area and flowed West from the higher elevations in the Gustavus Range. This much older flow appears to have affected the upper portions of Galena Hill, Keno Hill and Bunker Hill.

Areas in the overlapping region between the McConnell and Reid advances are good candidates for morainal deposits.

2.2.1.3 Digitizing of Surficial Geology Units

All data digitized for the purposes of this study was taken from the orthophotos. The resulting polygons were created when the photo was analysed at a scale of 1:2,500. GSC surficial geology polygons were also draped over the photos to gain more insight into the geomorphology not distinguishable in the aerial imagery alone.

Areas delineated were of two types: potential gravel deposits and potential existence of permafrost. Areas were delineated using a combination of vegetation cover type, landform features, aspect of slope, degree of slope and existing digital data and maps.

Trembling Aspen trees were the main species used to identify potential gravel deposits. Trembling Aspen prefer to grow on well-drained, moist, sandy or gravelly loams (CFS, 2007). Stands of aspen were easily identified in the imagery because of their bright yellow leaf colour common during September. Stands found growing on landforms such as drumlins and eskers were delineated as gravel deposits. Stands found on steeply sloping terrain with South, West or East aspects were also targeted. This type of terrain typically provides the best drainage and sun exposure and thus helps to prevent the occurrence of frozen gravel during the warmer months.

Aspen trees are a known pioneering species. Areas where the terrain was historically disturbed can often exhibit stands of aspen. Regions where obvious road and trial construction or other clearing had occurred were not delineated as potential gravel deposits.

Cover types were again used to assist in the identification of poorly drained soils. Stands of Black Spruce are *frequently found in cold, poorly drained areas, such as swamps and bogs, along with sphagnum mosses and horsetails* (GBC, 2001). Terrain with a low degree of slope can drain more slowly allowing for the formation of permafrost. Shallowly sloping terrain, lacking vegetation, or with trees exhibiting extremely stunted growth were delineated as potential areas where permafrost could be encountered. Areas with trees exhibiting “drunken” appearance, or sagging and leaning behaviour due to inadequate root support in ice rich soils were also targeted. Materials potentially containing permafrost are described in the GSC dataset. These units contain a high percentage of fines and are considered to offer poor percolation and therefore can retain water in their pore spaces. This trapped water can form permafrost lenses.

Ground features indicating freeze thaw process can also be a good indicator of soil moisture content in northern climates. Features targeted in this study include slope slumping and other mass movement due to soil liquefaction. Any indications of thermokarst topography were also noted as possible permafrost.

Surficial geology data from GSC was used to compare and confirm selected potential sites of gravel deposits. Comparisons were made spatially by overlaying the GSC data with gravel and permafrost polygons digitized from the air photos. Materials in each study area that were noted by the GSC as containing confirmed permafrost zones, or those with properties allowing moisture retention were also targeted.

2.2.1.3 Soils Characterization Maps

Data delineated from using the above methods was recorded in ESRI shapefile format. Two maps were created for each of the 6 sites. Map A for each site shows the potential gravel and permafrost units overlaying the September 2006 imagery. Map B shows a spatial comparison between the digitized gravel and permafrost units and the GSC surficial data.

3.0 Conclusions

In comparing digitized potential gravel and permafrost units to glacial movement maps and existing GSC surficial data it was determined that forest cover types are a good indicator for underlying surficial geology. Stands of Trembling Aspen identified as possibly growing on coarsely grained material fell within the regions identified by the GSC as containing morainal, colluvial or glaciofluvial material. These types of materials are well known to harbour gravel deposits.

In the Silver King study area, potential gravel deposits were delineated from the aerial imagery in the upper reaches of the Galena Creek discharge area and at the locations of possible drumlins on the face Galena Hill. This was supported by the GSC data and the DIAND map. Permafrost was delineated, in the immediate area, as potentially existing on the lower slopes of Galena Hill (Map 1A, Appendix).

Potential Gravel deposits for the Valley Tailings study area were delineated on possible drumlins existing mainly to the North and East. The largest deposits possibly harbouring gravel lenses are found on the closest large hill to the North of the tailings, and less than 250 metres Northeast of Elsa, to the southeast. Possible zones of permafrost were delineated, in the immediate area to the East of the tailings. Additional zones of potential permafrost were noted to the North and downstream of the Tailings Area on the South side of Flat Creek (Map 2A, Appendix). Borehole results from this study area are consistent with the aerial photo interpretation and GIS data.

The No Cash study area exhibits potentially interconnected gravel deposits running sub-parallel to the Silver Trail Highway on its South side. Potential gravel deposits were also delineated on the North side of Porcupine Gulch less than 1000 metres to the Southwest of the No Cash adits (Map 3A, Appendix).

Areas of potential permafrost delineated in the Galkeno 300 and 900 Adits study area were noted in areas North of the 300 Level Adit on the hill face. Other possible zones were noted between the above and Viola Adit, and on the Southwest hillside. Areas of potential gravel were noted running along the East slopes between the Rico and 900 Level adit. These deposits are likely related to

the McConnell glacial advance (Map 4A, Appendix). Borehole results from this study area are consistent with the aerial photo interpretation and GIS data.

The Onek Adit study area harbours possible gravel deposits to the south of the Onek 400 Level pit on the North side of the Lightning Creek. These deposits run sub-parallel to the creek. Gravel deposits also potentially exist between Cristal Lake and Keno City. Possible gravel is also noted along Erikson Creek to the North and in isolated patches to the south. A large zone of potential permafrost was noted to the north of the adit and pit area. This feature appears to encompass the North and East portions of the study area and exists mainly in morainal and glaciofluvial material.

The Bellekeno Adits study area exhibits potential deposits of gravel on the North side of Lightning Creek. These units run sub-parallel to Lightning Creek and are possibly interconnected. Isolated gravel lenses possibly exist on Sourdough Hill on the south side of Lightning Creek less than 500 metres upstream, and in the upper reaches of Thunder Gulch. Potential zones of permafrost exist in this study area on the South face of Keno Hill, and on the North slope of Sourdough Hill. Zone of potential permafrost were also delineated on the slopes to either side of Thunder Gulch.

Further verification of surficial geology unit through field investigation activities will be required.

4.0 References

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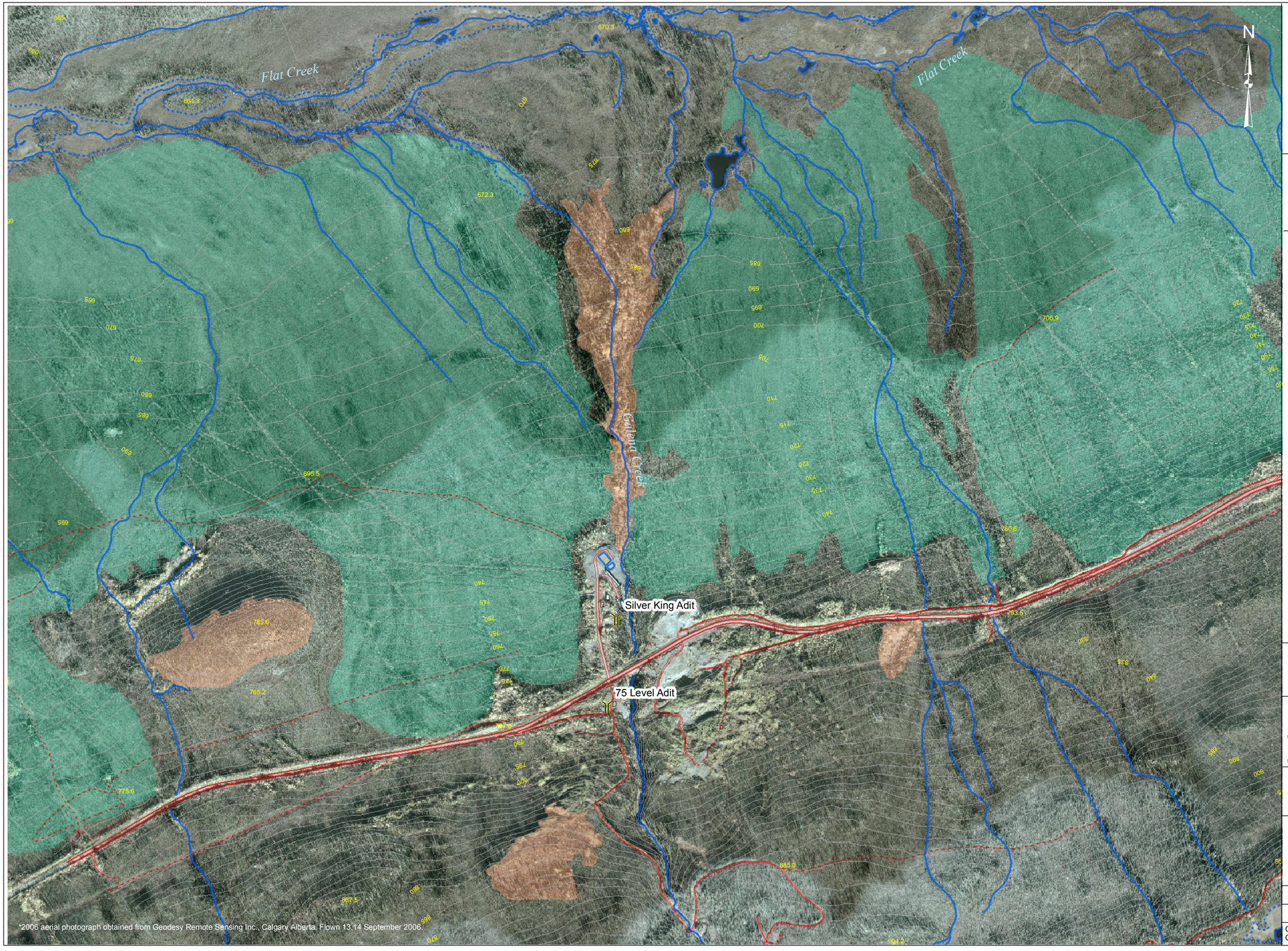
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APPENDIX



Site Investigation and Improvements
Special Projects
United Keno Hill Mines Property

Closure Planning
Technical Studies

Elsa Reclamation
and
Development Company

Legend

- Potential ice rich permafrost
- Potential gravel deposit

* NOTE: Areas delineated are subject to field investigation.

- Public Road
- Exploration roads
- Trails
- Cutlines
- Contour
- Surface water (actual and potential)
- Swampy area
- Pit
- Pipe
- Adit location

Soils Characterization Study

Scale: 1:10,000
(when plotted on 11x17 inch sheet)

0 125 250 500 Meters
0 125 250 500 Yards

Map 1A Silver King Adit Area

ACCESS CONSULTING GROUP

Drawn by: RG	Checked by: DC/BT/RLM
Date: March 2007	

Our File: Dawson\D\Project\AllProjects\ALEX-05-01\gis\mxd\UKHM\ClosurePlan2007\Soils_Characterization\Map1A_SilverKing.mxd

Site Investigation and Improvements
Special Projects
United Keno Hill Mines Property

Closure Planning
Technical Studies

Elsa Reclamation
and
Development Company

Legend

- Potential ice rich permafrost
- Potential gravel deposit

* NOTE: (i) Areas delineated are subject to field investigation.
(ii) Legend for Geological Survey of Canada Surficial Geology data can be found on the back of this map.

- Public Road
- Exploration roads
- Trails
- Cutlines
- Contour
- Surface water (actual and potential)
- Swampy area
- Pit
- Pipe
- Adit location

Notes:
This map is for illustrative purposes only.
This is not a legal document.
Surficial Geology data (described on back) compliled by the Geological Survey of Canada. at a scale of 1:50,000.
Topographic data current as of September 2006.
Projection: UTM Zone 8N NAD83
NTS Sheet 105M/13 and 105M/14

Soils Characterization Study

Scale: 1:10,000
(when plotted on 11x17 inch sheet)

0 135 270 540 Meters
0 135 270 540 Yards

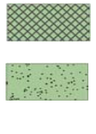
Map 1B Silver King Adits Area

ACCESS CONSULTING GROUP

Drawn by: RG | Checked by: DC/BT/RLM

Date: March 2007

Our File: Dawson\D\Project\AllProjects\ALEX-05-01\gis\mxd\UKHM\ClosurePlan2007\Soils_Characterization\Map1B_SilverKing.mxd

	Name	Material	Approximate Thickness (feet)	Landform	General Conditions
	Alluvial complex (alluvial fans, plains and terraces)	Silt, sand, gravel.	2-30	Various	See Ap, At, Af as applicable
	Alluvial fan with fens	Alluvial fan (Mainly coarse gravel in steeply sloping fans; sand, silt, and organic layers in gently sloping fans.), Fen (an area of wetland fed by ground water and runoff, containing organic material below the waterline)	Alluvial fan (2-30)	Alluvial fan (Gently to steeply sloping fans occur where high gradient tributary streams meet lower gradient trunk streams; closely spaced fans merge to form fan aprons), Fen (see material)	Streams on fans are subject to sudden and damaging changes of course; fans comprising mainly gravel may be permafrost free or if perennially frozen are thaw stable; fans comprising mainly of silt are typically perennially frozen
	Alluvial plain with fens	Alluvial plains of rivers typically have 1 to 3 m of silt overlying gravel; small streams have various thickness of silt, sand, and gravel. Fen (an area of wetland fed by ground water and runoff, containing organic material below the waterline)	5-30	Flat to gently irregular, commonly with distinct meander scrolls and oxbow lakes; old floodplain surfaces of large streams commonly have irregular thermokarst ponds (Apk), Fen (see material)	Flooding common to infrequent; permafrost common; silt layer is generally ice rich and unstable when thawed.
	Colluvial deposits with Morainal veneers and Bedrock at surface	Colluvial (unconsolodated material), Morainal veneers (glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix)	Colluvial deposits (0-2), Morainal deposits (0-2)	Colluvium is gently to moderately sloping, conforming to topography of subjacent bedrock. Moraine veneers are gently to highly irregular, conforming to irregularities of subjacent bedrock; locally has subparallel ice-marginal channels which typically are incised to or into bedrock (Mv-C).	Occurrence of permafrost sporadic; engineering capabilities and limitations determined in part by lithology and topography of subjacent bedrock.
	Colluvial veneer with exposed bedrock	Gently to moderately sloping, conforming to topography of subjacent bedrock; periglacial features, including small solifluction lobes, sorted polygons, and felsenmeer are conspicuous and widespread above treeline (1280 to 1370 m; 4200 to 4500 ft.).	0-2		
	Glaciofluvial complex (glaciofluvial plains, terraces and hummocky or ridged deposits) with Moraine complex (Morainal fans, plains and terraces)	Glaciofluvial complex (gravel, sand), Morainal complex (Glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix)	Glaciofluvial complex (2-50), Morainal complex (2-50)	Glaciofluvial complex (Various; includes areas that would be classed as Glaciofluvial plains or terraces except for presence of kettles), Morainal complex (Gently to highly irregular, conforming to irregularities of subjacent bedrock; locally has subparallel ice-marginal channels which typically are incised to or into bedrock)	Glaciofluvial complex (Permafrost not common but where present the deposits are mostly thaw stable; constitute main source of aggregate for construction purposes; good drainage and soil stability make the units suitable for location of most types of facilities; areas of Gp, Gt), Morainal complex (Occurrence of permafrost sporadic, prevalent on most northerly facing slopes, less common on southerly facing slopes. Suitable for conventional cut-and-till road construction where permafrost is absent or ground ice content low).
	Moraine complex (Morainal fans, plains and terraces)	Morainal complex (Glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix)	Morainal complex (2-50)	Gently to moderately sloping, conforming to topography of subjacent bedrock; commonly with subparallel ice-marginal channels or with postgalcial gullying.	Occurrence of permafrost sporadic, prevalent on most northerly facing slopes, less common on southerly facing slopes. Suitable for conventional cut-and-till road construction where permafrost is absent or ground ice content low
	Moraine with Colluvial veneers and Colluvial blankets	Morainal material (glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix), Colluvial material (Any of the deposits described above, plus bedrock detritus, modified and/or intermixed as a result of downslope movement of material; texture ranges from coarse blocky bedrock detritus of mountain tops to clayey or silty diamicton of lower slopes)	Moraine (2-30), Alluvial fan (2-30)	Moraine (Gently to moderately sloping, conforming to topography of subjacent bedrock; commonly with subparallel ice-marginal channels (Mb-C) or with postgalcial gullying), Colluvial veneers and blankets (Gently to moderately sloping, conforming to topography of subjacent bedrock; periglacial features, including small solifluction lobes, sorted polygons, and felsenmeer are conspicuous and widespread above treeline.	
	Morainal blanket with morainal veneer	Glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix.	Morainal blanket (2-30), Morainal veneer (0-2)	Flat to gently sloping or undulant.	Occurrence of permafrost sporadic, prevalent on most northerly facing slopes, less common on southerly facing slopes. Suitable for conventional cut-and-till road construction where permafrost is absent or ground ice content low; high ground ice content m
	Morainal veneer	Morainal veneer (Glacial till consisting of pebbles, cobbles, and boulders in silty sand matrix.)	Morainal complex (2-50)		
	Morainal veneer with exposed bedrock	Glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix.	0-2	Gently to highly irregular, conforming to irregularities of subjacent bedrock; locally has subparallel ice-marginal channels which typically are incised to or into bedrock.	Occurrence of permafrost sporadic; engineering capabilities and limitations determined in part by lithology and topography of subjacent bedrock.
	Morainal veneer with colluvial material and exposed Bedrock	Morainal veneer (Glacial till consisting of pebbles, cobbles, and boulders in silty sand matrix.), Colluvial material (unsorted, unconsolodated material)	2-50	Morainal veneer (Hummocks and ridges with slopes to 30 degree and relief to 20 m (exceptionally 40 m) superposed on level to moderately steep surfaces)	Few data on distribution of permafrost; vegetation cover suggests general absence of permafrost or presence of unusually thick active layer; locally affords suitable road location sites and constitutes source of well drained common fill.
	Bedrock terrace with evidence of rock slides				
	Unknown material		Unknown		

Site Investigation and Improvements
Special Projects
United Keno Hill Mines Property

Closure Planning
Technical Studies

Elsa Reclamation
and
Development Company

Legend

- Potential ice rich permafrost
- Potential gravel deposit

* NOTE: Areas delineated are subject to field investigation.

- Public Road
- Exploration roads
- Trails
- Cutlines
- Contour
- Surface water (actual and potential)
- Swampy area
- Pit
- Pipe
- Adit location
- Overburden dillhole location

Soils Characterization Study

Scale: 1:10,000
(when plotted on 11x17 inch sheet)

0 135 270 540 Meters
0 135 270 540 Yards

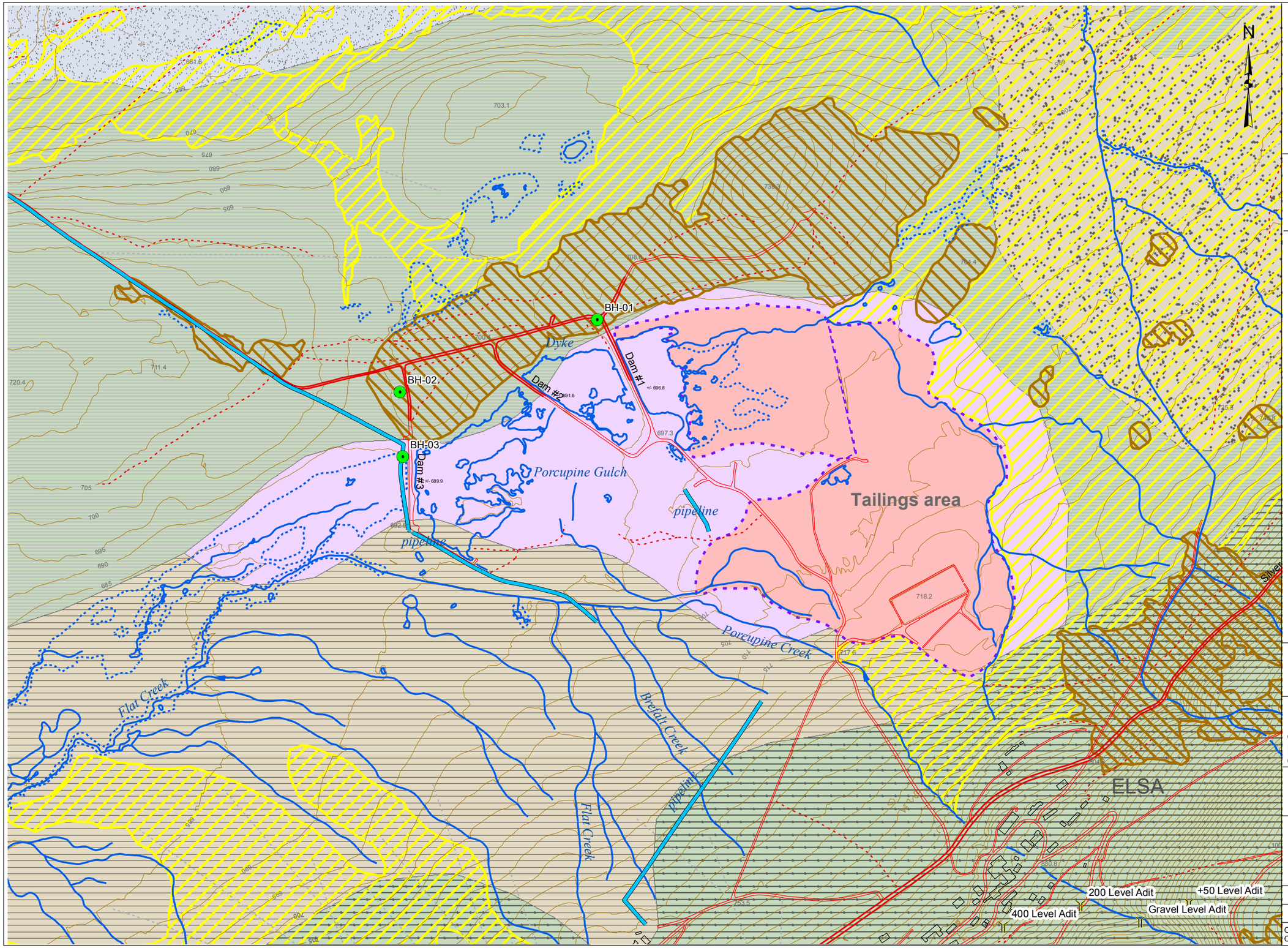
Map 2A Valley Tailings Area

ACCESS CONSULTING GROUP

Drawn by: RG	Checked by: DC/BT/RLM
Date: March 2007	

Our File: Dawson\D\Project\AllProjects\ALEX-05-01\gis\mxd\UKHM\ClosurePlan2007\Soils_Characterization\Map2A_ValleyTailings.mxd

*2006 aerial photograph obtained from Geodesy Remote Sensing Inc., Calgary Alberta. Flown 13,14 September 2006.



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Legend

- Potential ice rich permafrost
- Potential gravel deposit

* NOTE: (i) Areas delineated are subject to field investigation.
(ii) Legend for Geological Survey of Canada Surficial Geology data can be found on the back of this map.

- Public Road
- Exploration roads
- Trails
- Cutlines
- Contour
- Surface water (actual and potential)
- Swampy area
- Pit
- Pipe
- Adit location
- Overburden drillhole location

Notes:
This map is for illustrative purposes only.
This is not a legal document.
Surficial Geology data (described on back) compiled by the Geological Survey of Canada.
at a scale of 1:50,000.
Topographic data current as of September 2006.
Projection: UTM Zone 8N NAD83
NTS Sheet 105M/13 and 105M/14

Soils Characterization Study

Scale: 1:10,000
(when plotted on 11x17 inch sheet)

0 135 270 540 Meters
0 135 270 540 Yards

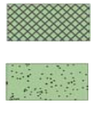
Map 2B Valley Tailings Area

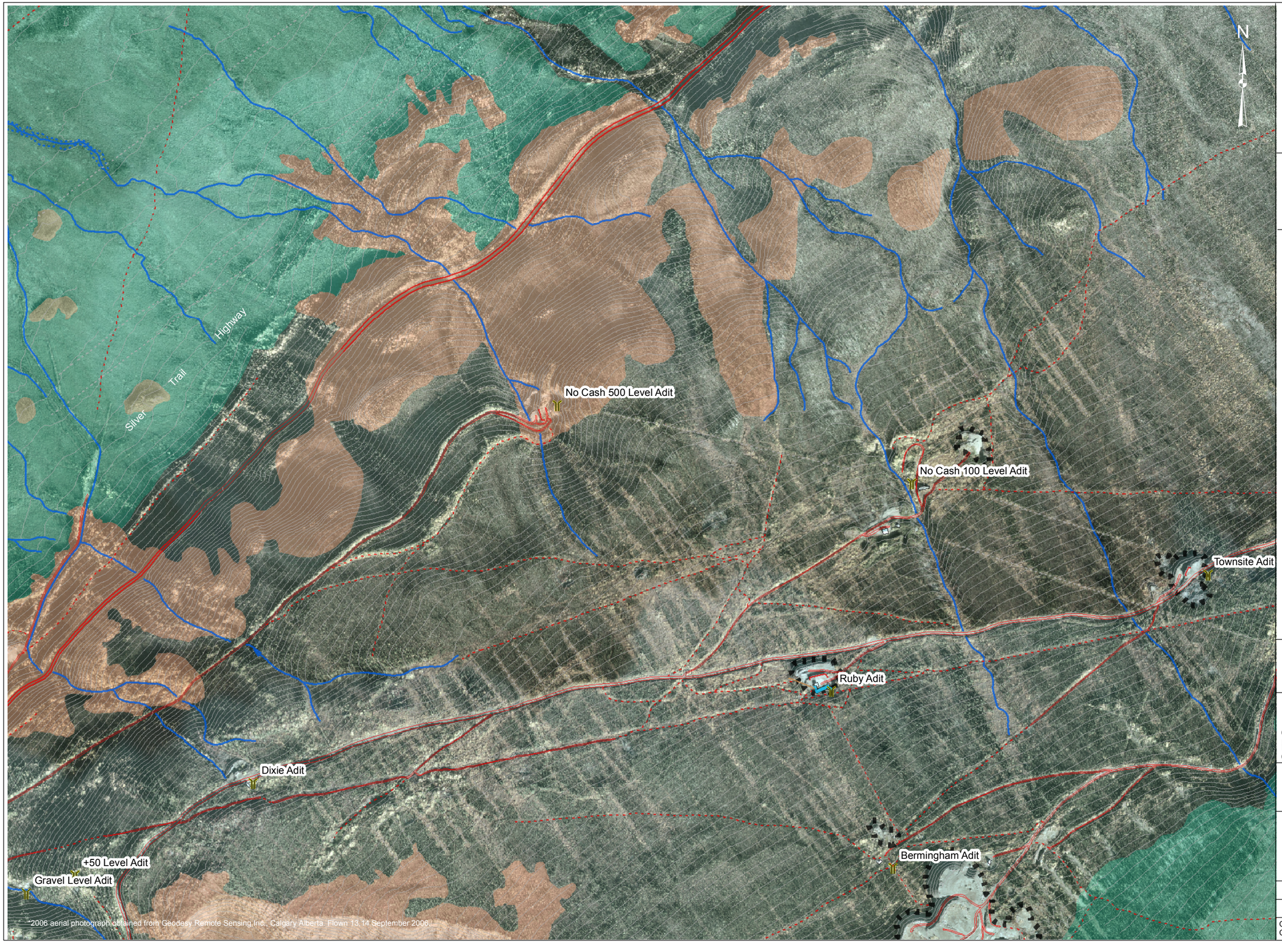
ACCESS CONSULTING GROUP

Drawn by: RG | Checked by: DC/BT/RLM

Date: March 2007

Our File: Dawson\D\Project\AllProjects\ALEX-05-01\gis\mxd\UKHM\ClosurePlan2007\Soils_Characterization\Map2B_ValleyTailings.mxd

	Name	Material	Approximate Thickness (feet)	Landform	General Conditions
	Alluvial complex (alluvial fans, plains and terraces)	Silt, sand, gravel.	2-30	Various	See Ap, At, Af as applicable
	Alluvial fan with fens	Alluvial fan (Mainly coarse gravel in steeply sloping fans; sand, silt, and organic layers in gently sloping fans.), Fen (an area of wetland fed by ground water and runoff, containing organic material below the waterline)	Alluvial fan (2-30)	Alluvial fan (Gently to steeply sloping fans occur where high gradient tributary streams meet lower gradient trunk streams; closely spaced fans merge to form fan aprons), Fen (see material)	Streams on fans are subject to sudden and damaging changes of course; fans comprising mainly gravel may be permafrost free or if perennially frozen are thaw stable; fans comprising mainly of silt are typically perennially frozen
	Alluvial plain with fens	Alluvial plains of rivers typically have 1 to 3 m of silt overlying gravel; small streams have various thickness of silt, sand, and gravel. Fen (an area of wetland fed by ground water and runoff, containing organic material below the waterline)	5-30	Flat to gently irregular, commonly with distinct meander scrolls and oxbow lakes; old floodplain surfaces of large streams commonly have irregular thermokarst ponds (Apk), Fen (see material)	Flooding common to infrequent; permafrost common; silt layer is generally ice rich and unstable when thawed.
	Colluvial deposits with Morainal veneers and Bedrock at surface	Colluvial (unconsolodated material), Morainal veneers (glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix)	Colluvial deposits (0-2), Morainal deposits (0-2)	Colluvium is gently to moderately sloping, conforming to topography of subjacent bedrock. Moraine veneers are gently to highly irregular, conforming to irregularities of subjacent bedrock; locally has subparallel ice-marginal channels which typically are incised to or into bedrock (Mv-C).	Occurrence of permafrost sporadic; engineering capabilities and limitations determined in part by lithology and topography of subjacent bedrock.
	Colluvial veneer with exposed bedrock	Gently to moderately sloping, conforming to topography of subjacent bedrock; periglacial features, including small solifluction lobes, sorted polygons, and felsenmeer are conspicuous and widespread above treeline (1280 to 1370 m; 4200 to 4500 ft.).	0-2		
	Glaciofluvial complex (glaciofluvial plains, terraces and hummocky or ridged deposits) with Moraine complex (Morainal fans, plains and terraces)	Glaciofluvial complex (gravel, sand), Morainal complex (Glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix)	Glaciofluvial complex (2-50), Morainal complex (2-50)	Glaciofluvial complex (Various; includes areas that would be classed as Glaciofluvial plains or terraces except for presence of kettles), Morainal complex (Gently to highly irregular, conforming to irregularities of subjacent bedrock; locally has subparallel ice-marginal channels which typically are incised to or into bedrock)	Glaciofluvial complex (Permafrost not common but where present the deposits are mostly thaw stable; constitute main source of aggregate for construction purposes; good drainage and soil stability make the units suitable for location of most types of facilities; areas of Gp, Gt), Morainal complex (Occurrence of permafrost sporadic, prevalent on most northerly facing slopes, less common on southerly facing slopes. Suitable for conventional cut-and-till road construction where permafrost is absent or ground ice content low).
	Moraine complex (Morainal fans, plains and terraces)	Morainal complex (Glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix)	Morainal complex (2-50)	Gently to moderately sloping, conforming to topography of subjacent bedrock; commonly with subparallel ice-marginal channels or with postgalcial gullying.	Occurrence of permafrost sporadic, prevalent on most northerly facing slopes, less common on southerly facing slopes. Suitable for conventional cut-and-till road construction where permafrost is absent or ground ice content low
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	Morainal blanket with morainal veneer	Glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix.	Morainal blanket (2-30), Morainal veneer (0-2)	Flat to gently sloping or undulant.	Occurrence of permafrost sporadic, prevalent on most northerly facing slopes, less common on southerly facing slopes. Suitable for conventional cut-and-till road construction where permafrost is absent or ground ice content low; high ground ice content m
	Morainal veneer	Morainal veneer (Glacial till consisting of pebbles, cobbles, and boulders in silty sand matrix.)	Morainal complex (2-50)		
	Morainal veneer with exposed bedrock	Glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix.	0-2	Gently to highly irregular, conforming to irregularities of subjacent bedrock; locally has subparallel ice-marginal channels which typically are incised to or into bedrock.	Occurrence of permafrost sporadic; engineering capabilities and limitations determined in part by lithology and topography of subjacent bedrock.
	Morainal veneer with colluvial material and exposed Bedrock	Morainal veneer (Glacial till consisting of pebbles, cobbles, and boulders in silty sand matrix.), Colluvial material (unsorted, unconsolodated material)	2-50	Morainal veneer (Hummocks and ridges with slopes to 30 degree and relief to 20 m (exceptionally 40 m) superposed on level to moderately steep surfaces)	Few data on distribution of permafrost; vegetation cover suggests general absence of permafrost or presence of unusually thick active layer; locally affords suitable road location sites and constitutes source of well drained common fill.
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	Unknown material		Unknown		



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Development Company

Legend

- Potential ice rich permafrost
- Potential gravel deposit

* NOTE: Areas delineated are subject to field investigation.

- Public Road
- Exploration roads
- Trails
- Cutlines
- Contour
- Surface water (actual and potential)
- Swampy area
- Pit
- Pipe
- Adit location

Soils Characterization Study

Scale: 1:10,000
(when plotted on 11x17 inch sheet)

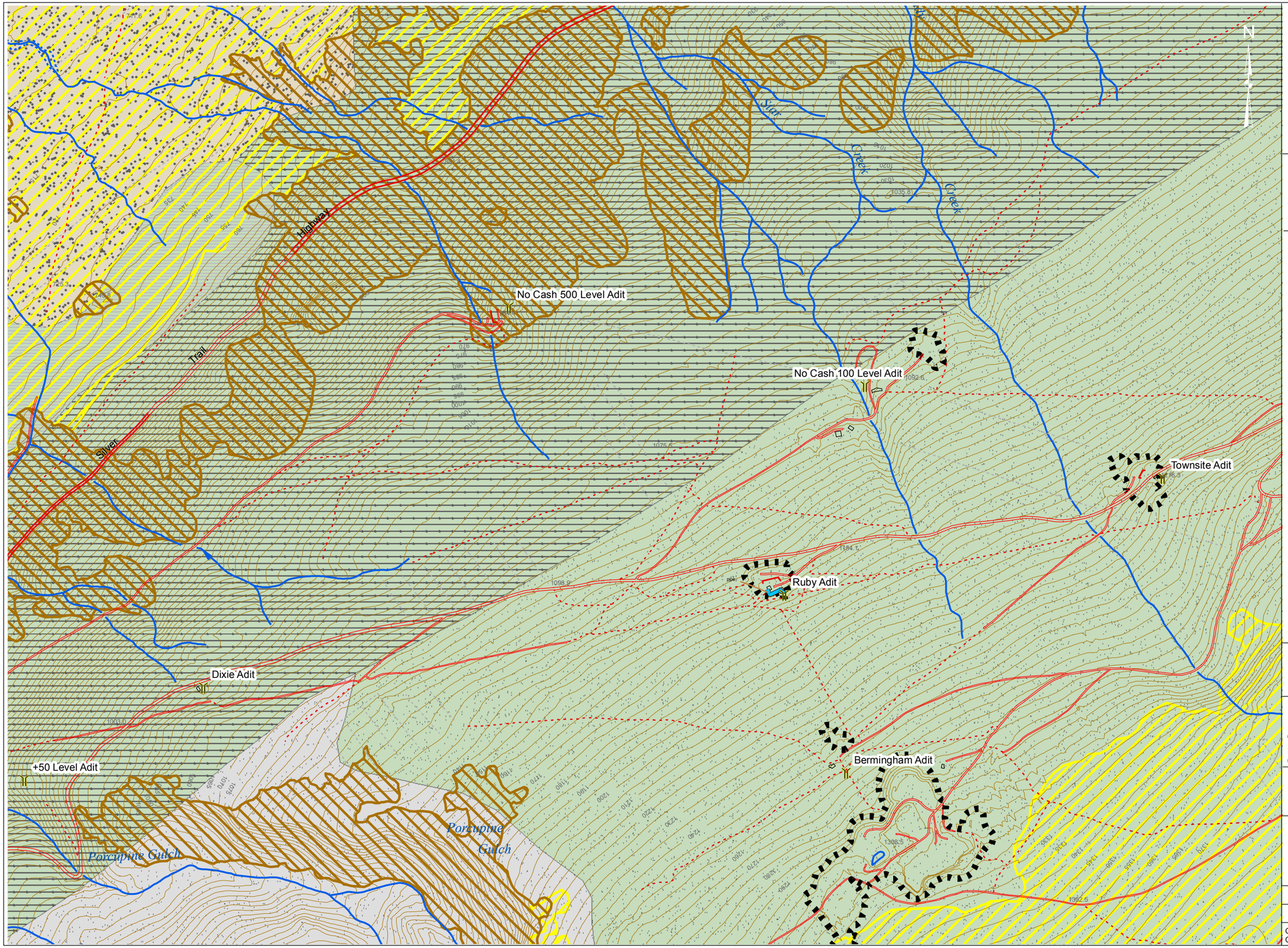
0 135 270 540 Meters
0 135 270 540 Yards

Map 3A No Cash Adits Area

ACCESS CONSULTING GROUP

Drawn by: RG	Checked by: DC/BT/RLM
Date: March 2007	

Our File: Dawson\D\Project\AllProjects\ALEX-05-01\gis\mxd\UKHM\ClosurePlan2007\Soils_Characterization\Map3A_NoCash.mxd



Site Investigation and Improvements
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Legend

- Potential ice rich permafrost
- Potential gravel deposit

* NOTE: (i) Areas delineated are subject to field investigation.
(ii) Legend for Geological Survey of Canada Surficial Geology data can be found on the back of this map.

- Public Road
- Exploration roads
- Trails
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- Surface water (actual and potential)
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Notes:
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Topographic data current as of September 2006.
Projection: UTM Zone 8N NAD83
NTS Sheet 105M/13 and 105M/14

Soils Characterization Study

Scale: 1:10,000
(when plotted on 11x17 inch sheet)

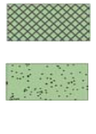
0 135 270 540 Meters
0 135 270 540 Yards

Map 3B No Cash Adits Area

ACCESS CONSULTING GROUP

Drawn by: RG	Checked by: DC/BT/RLM
Date: March 2007	

Our File: Dawson\D\Project\AllProjects\ALEX-05-01\gis\mxd\UKHM\ClosurePlan2007\Soils_Characterization\Map3B_NoCash.mxd

	Name	Material	Approximate Thickness (feet)	Landform	General Conditions
	Alluvial complex (alluvial fans, plains and terraces)	Silt, sand, gravel.	2-30	Various	See Ap, At, Af as applicable
	Alluvial fan with fens	Alluvial fan (Mainly coarse gravel in steeply sloping fans; sand, silt, and organic layers in gently sloping fans.), Fen (an area of wetland fed by ground water and runoff, containing organic material below the waterline)	Alluvial fan (2-30)	Alluvial fan (Gently to steeply sloping fans occur where high gradient tributary streams meet lower gradient trunk streams; closely spaced fans merge to form fan aprons), Fen (see material)	Streams on fans are subject to sudden and damaging changes of course; fans comprising mainly gravel may be permafrost free or if perennially frozen are thaw stable; fans comprising mainly of silt are typically perennially frozen
	Alluvial plain with fens	Alluvial plains of rivers typically have 1 to 3 m of silt overlying gravel; small streams have various thickness of silt, sand, and gravel. Fen (an area of wetland fed by ground water and runoff, containing organic material below the waterline)	5-30	Flat to gently irregular, commonly with distinct meander scrolls and oxbow lakes; old floodplain surfaces of large streams commonly have irregular thermokarst ponds (Apk), Fen (see material)	Flooding common to infrequent; permafrost common; silt layer is generally ice rich and unstable when thawed.
	Colluvial deposits with Morainal veneers and Bedrock at surface	Colluvial (unconsolodated material), Morainal veneers (glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix)	Colluvial deposits (0-2), Morainal deposits (0-2)	Colluvium is gently to moderately sloping, conforming to topography of subjacent bedrock. Moraine veneers are gently to highly irregular, conforming to irregularities of subjacent bedrock; locally has subparallel ice-marginal channels which typically are incised to or into bedrock (Mv-C).	Occurrence of permafrost sporadic; engineering capabilities and limitations determined in part by lithology and topography of subjacent bedrock.
	Colluvial veneer with exposed bedrock	Gently to moderately sloping, conforming to topography of subjacent bedrock; periglacial features, including small solifluction lobes, sorted polygons, and felsenmeer are conspicuous and widespread above treeline (1280 to 1370 m; 4200 to 4500 ft.).	0-2		
	Glaciofluvial complex (glaciofluvial plains, terraces and hummocky or ridged deposits) with Moraine complex (Morainal fans, plains and terraces)	Glaciofluvial complex (gravel, sand), Morainal complex (Glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix)	Glaciofluvial complex (2-50), Morainal complex (2-50)	Glaciofluvial complex (Various; includes areas that would be classed as Glaciofluvial plains or terraces except for presence of kettles), Morainal complex (Gently to highly irregular, conforming to irregularities of subjacent bedrock; locally has subparallel ice-marginal channels which typically are incised to or into bedrock)	Glaciofluvial complex (Permafrost not common but where present the deposits are mostly thaw stable; constitute main source of aggregate for construction purposes; good drainage and soil stability make the units suitable for location of most types of facilities; areas of Gp, Gt), Morainal complex (Occurrence of permafrost sporadic, prevalent on most northerly facing slopes, less common on southerly facing slopes. Suitable for conventional cut-and-till road construction where permafrost is absent or ground ice content low).
	Moraine complex (Morainal fans, plains and terraces)	Morainal complex (Glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix)	Morainal complex (2-50)	Gently to moderately sloping, conforming to topography of subjacent bedrock; commonly with subparallel ice-marginal channels or with postgalcial gullying.	Occurrence of permafrost sporadic, prevalent on most northerly facing slopes, less common on southerly facing slopes. Suitable for conventional cut-and-till road construction where permafrost is absent or ground ice content low
	Moraine with Colluvial veneers and Colluvial blankets	Morainal material (glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix), Colluvial material (Any of the deposits described above, plus bedrock detritus, modified and/or intermixed as a result of downslope movement of material; texture ranges from coarse blocky bedrock detritus of mountain tops to clayey or silty diamicton of lower slopes)	Moraine (2-30), Alluvial fan (2-30)	Moraine (Gently to moderately sloping, conforming to topography of subjacent bedrock; commonly with subparallel ice-marginal channels (Mb-C) or with postgalcial gullying), Colluvial veneers and blankets (Gently to moderately sloping, conforming to topography of subjacent bedrock; periglacial features, including small solifluction lobes, sorted polygons, and felsenmeer are conspicuous and widespread above treeline.	
	Morainal blanket with morainal veneer	Glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix.	Morainal blanket (2-30), Morainal veneer (0-2)	Flat to gently sloping or undulant.	Occurrence of permafrost sporadic, prevalent on most northerly facing slopes, less common on southerly facing slopes. Suitable for conventional cut-and-till road construction where permafrost is absent or ground ice content low; high ground ice content m
	Morainal veneer	Morainal veneer (Glacial till consisting of pebbles, cobbles, and boulders in silty sand matrix.)	Morainal complex (2-50)		
	Morainal veneer with exposed bedrock	Glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix.	0-2	Gently to highly irregular, conforming to irregularities of subjacent bedrock; locally has subparallel ice-marginal channels which typically are incised to or into bedrock.	Occurrence of permafrost sporadic; engineering capabilities and limitations determined in part by lithology and topography of subjacent bedrock.
	Morainal veneer with colluvial material and exposed Bedrock	Morainal veneer (Glacial till consisting of pebbles, cobbles, and boulders in silty sand matrix.), Colluvial material (unsorted, unconsolodated material)	2-50	Morainal veneer (Hummocks and ridges with slopes to 30 degree and relief to 20 m (exceptionally 40 m) superposed on level to moderately steep surfaces)	Few data on distribution of permafrost; vegetation cover suggests general absence of permafrost or presence of unusually thick active layer; locally affords suitable road location sites and constitutes source of well drained common fill.
	Bedrock terrace with evidence of rock slides				
	Unknown material		Unknown		

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Un Adit
200 Level Adit
100 Level Adit
Gelkeno 300 Adit
Gelkeno 900 Adit
VIOLA ADIT
RICO ADIT
BH-04
Highway
Silver Trail
Creek
Cristal Lake
+/-859.3
Beaver dam
Pipeline

Legend

- Potential ice rich permafrost
- Potential gravel deposit

* NOTE: Areas delineated are subject to field investigation.

- Public Road
- Exploration roads
- Trails
- Cutlines
- Contour
- Surface water (actual and potential)
- Swampy area
- Pit
- Pipe
- Adit location
- Overburden drillhole location

Soils Characterization Study

Scale: 1:10,000
(when plotted on 11x17 inch sheet)

0 130 260 520 Meters
0 130 260 520 Yards

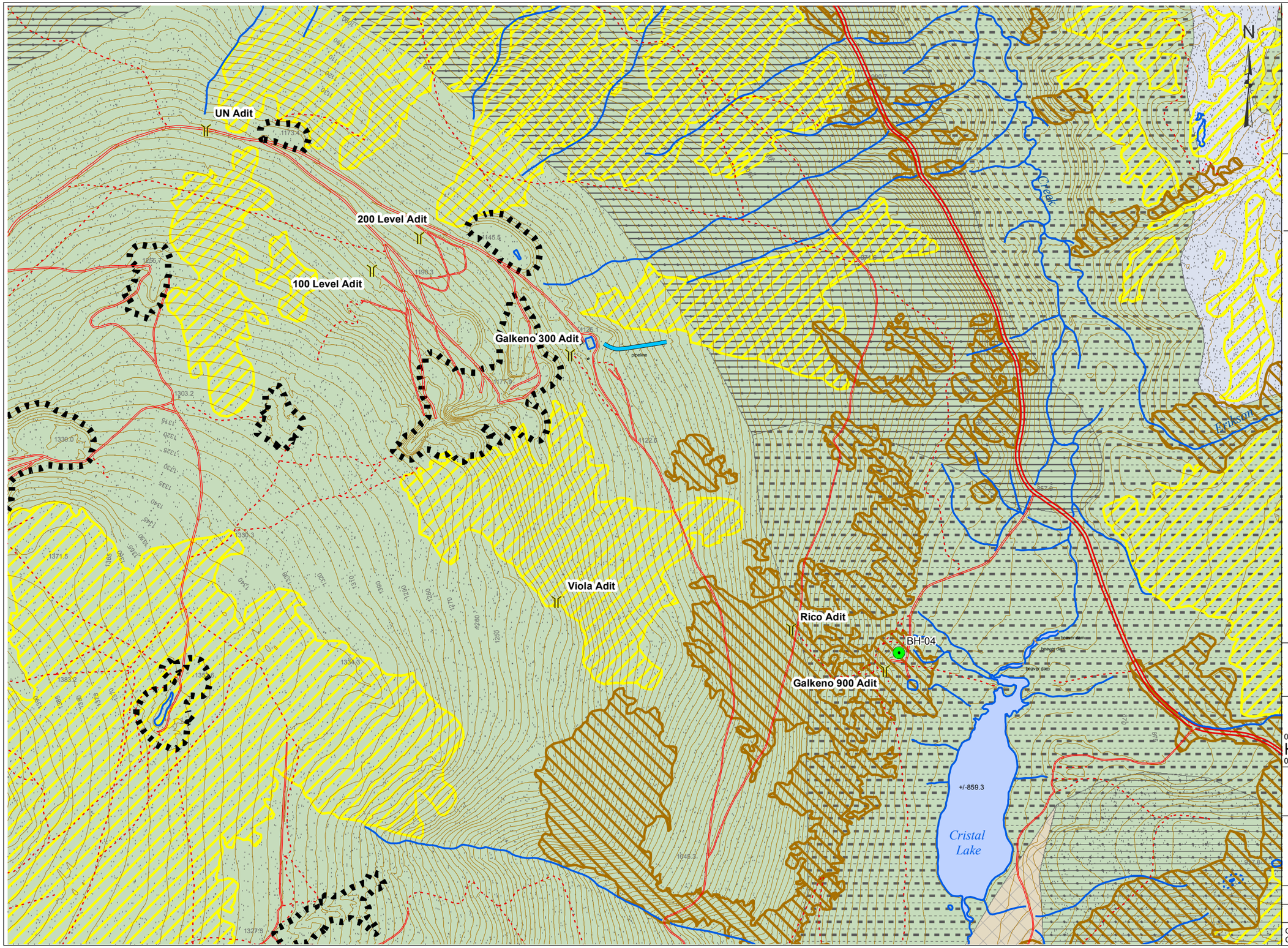
Map 4A Galkeno 300 & 900 Adits Area

ACCESS CONSULTING GROUP

Drawn by: RG	Checked by: DC/BT/RLM
Date: March 2007	

Our File: Dawson\D\Project\AllProjects\ALEX-05-01\gis\mxd\UKHM\ClosurePlan2007\Soils_Characterization\Map4A_G300_G900.mxd

*2006 aerial photograph obtained from Geodesy Remote Sensing Inc., Calgary Alberta. Flown 13-14 September 2006.



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Legend

- Potential ice rich permafrost
- Potential gravel deposit

* NOTE: (i) Areas delineated are subject to field investigation.
(ii) Legend for Geological Survey of Canada Surficial Geology data can be found on the back of this map.

- Public Road
- Exploration roads
- Trails
- Cutlines
- Contour
- Surface water (actual and potential)
- Swampy area
- Pit
- Pipe
- Adit location
- Overburden drillhole location

Notes:
This map is for illustrative purposes only.
This is not a legal document.
Surficial Geology data (described on back) compiled by the Geological Survey of Canada.
at a scale of 1:50,000.
Topographic data current as of September 2006.
Projection: UTM Zone 8N NAD83
NTS Sheet 105M/13 and 105M/14

Soils Characterization Study

Scale: 1:10,000
(when plotted on 11x17 inch sheet)

0 135 270 540 Meters
0 135 270 540 Yards

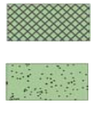
Map 4B Galkeno 300 & 900 Adits Area

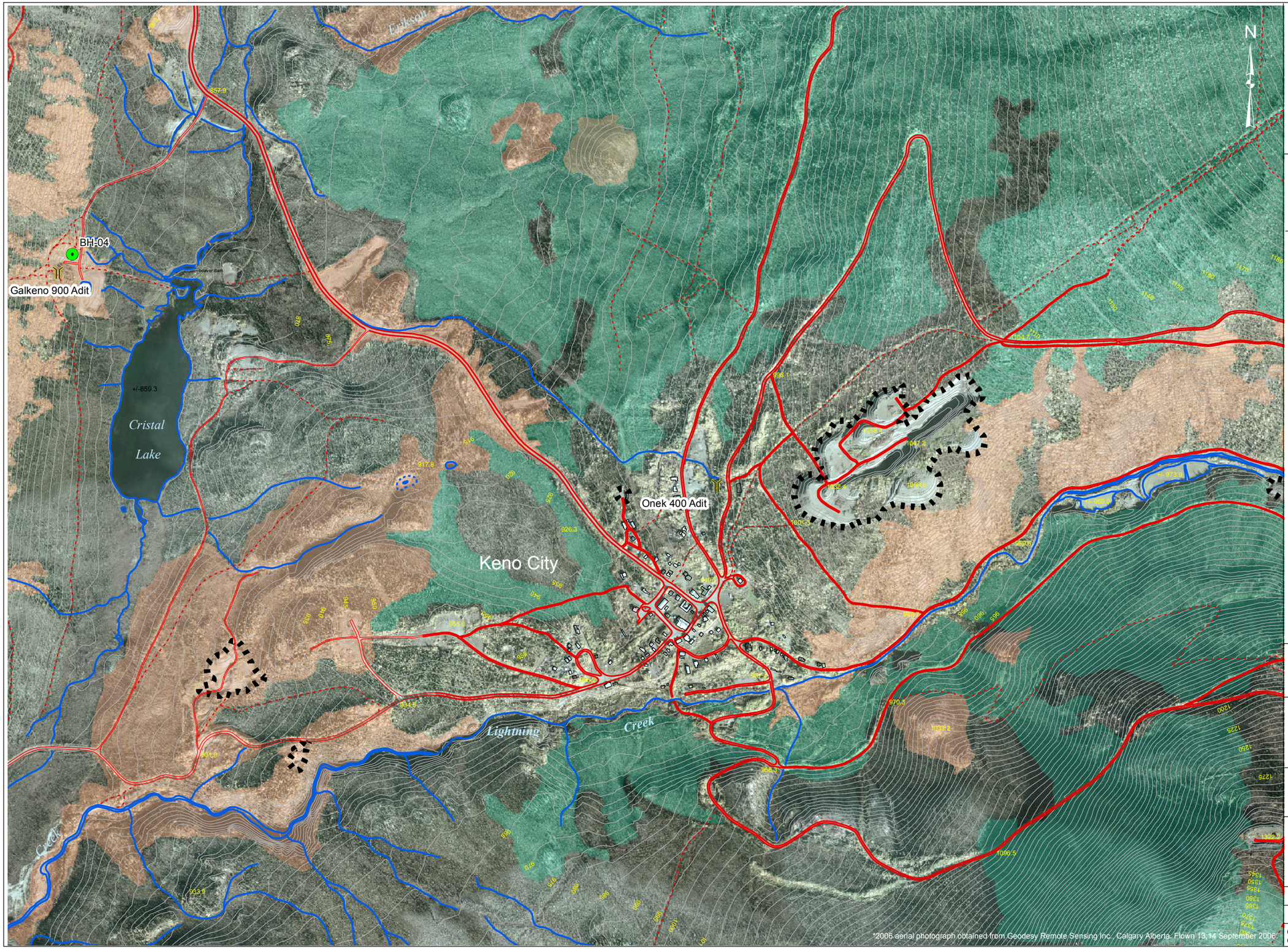
ACCESS CONSULTING GROUP

Drawn by: RG | Checked by: DC/BT/RLM

Date: March 2007

Our File: Dawson\D\Project\AllProjects\ALEX-05-01\gis\mxd\UKHM\ClosurePlan2007\Soils_Characterization\Map4B_G300_G900.mxd

	Name	Material	Approximate Thickness (feet)	Landform	General Conditions
	Alluvial complex (alluvial fans, plains and terraces)	Silt, sand, gravel.	2-30	Various	See Ap, At, Af as applicable
	Alluvial fan with fens	Alluvial fan (Mainly coarse gravel in steeply sloping fans; sand, silt, and organic layers in gently sloping fans.), Fen (an area of wetland fed by ground water and runoff, containing organic material below the waterline)	Alluvial fan (2-30)	Alluvial fan (Gently to steeply sloping fans occur where high gradient tributary streams meet lower gradient trunk streams; closely spaced fans merge to form fan aprons), Fen (see material)	Streams on fans are subject to sudden and damaging changes of course; fans comprising mainly gravel may be permafrost free or if perennially frozen are thaw stable; fans comprising mainly of silt are typically perennially frozen
	Alluvial plain with fens	Alluvial plains of rivers typically have 1 to 3 m of silt overlying gravel; small streams have various thickness of silt, sand, and gravel. Fen (an area of wetland fed by ground water and runoff, containing organic material below the waterline)	5-30	Flat to gently irregular, commonly with distinct meander scrolls and oxbow lakes; old floodplain surfaces of large streams commonly have irregular thermokarst ponds (Apk), Fen (see material)	Flooding common to infrequent; permafrost common; silt layer is generally ice rich and unstable when thawed.
	Colluvial deposits with Morainal veneers and Bedrock at surface	Colluvial (unconsolodated material), Morainal veneers (glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix)	Colluvial deposits (0-2), Morainal deposits (0-2)	Colluvium is gently to moderately sloping, conforming to topography of subjacent bedrock. Moraine veneers are gently to highly irregular, conforming to irregularities of subjacent bedrock; locally has subparallel ice-marginal channels which typically are incised to or into bedrock (Mv-C).	Occurrence of permafrost sporadic; engineering capabilities and limitations determined in part by lithology and topography of subjacent bedrock.
	Colluvial veneer with exposed bedrock	Gently to moderately sloping, conforming to topography of subjacent bedrock; periglacial features, including small solifluction lobes, sorted polygons, and felsenmeer are conspicuous and widespread above treeline (1280 to 1370 m; 4200 to 4500 ft.).	0-2		
	Glaciofluvial complex (glaciofluvial plains, terraces and hummocky or ridged deposits) with Moraine complex (Morainal fans, plains and terraces)	Glaciofluvial complex (gravel, sand), Morainal complex (Glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix)	Glaciofluvial complex (2-50), Morainal complex (2-50)	Glaciofluvial complex (Various; includes areas that would be classed as Glaciofluvial plains or terraces except for presence of kettles), Morainal complex (Gently to highly irregular, conforming to irregularities of subjacent bedrock; locally has subparallel ice-marginal channels which typically are incised to or into bedrock)	Glaciofluvial complex (Permafrost not common but where present the deposits are mostly thaw stable; constitute main source of aggregate for construction purposes; good drainage and soil stability make the units suitable for location of most types of facilities; areas of Gp, Gt), Morainal complex (Occurrence of permafrost sporadic, prevalent on most northerly facing slopes, less common on southerly facing slopes. Suitable for conventional cut-and-till road construction where permafrost is absent or ground ice content low).
	Moraine complex (Morainal fans, plains and terraces)	Morainal complex (Glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix)	Morainal complex (2-50)	Gently to moderately sloping, conforming to topography of subjacent bedrock; commonly with subparallel ice-marginal channels or with postgalcial gullying.	Occurrence of permafrost sporadic, prevalent on most northerly facing slopes, less common on southerly facing slopes. Suitable for conventional cut-and-till road construction where permafrost is absent or ground ice content low
	Moraine with Colluvial veneers and Colluvial blankets	Morainal material (glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix), Colluvial material (Any of the deposits described above, plus bedrock detritus, modified and/or intermixed as a result of downslope movement of material; texture ranges from coarse blocky bedrock detritus of mountain tops to clayey or silty diamicton of lower slopes)	Moraine (2-30), Alluvial fan (2-30)	Moraine (Gently to moderately sloping, conforming to topography of subjacent bedrock; commonly with subparallel ice-marginal channels (Mb-C) or with postgalcial gullying), Colluvial veneers and blankets (Gently to moderately sloping, conforming to topography of subjacent bedrock; periglacial features, including small solifluction lobes, sorted polygons, and felsenmeer are conspicuous and widespread above treeline.	
	Morainal blanket with morainal veneer	Glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix.	Morainal blanket (2-30), Morainal veneer (0-2)	Flat to gently sloping or undulant.	Occurrence of permafrost sporadic, prevalent on most northerly facing slopes, less common on southerly facing slopes. Suitable for conventional cut-and-till road construction where permafrost is absent or ground ice content low; high ground ice content m
	Morainal veneer	Morainal veneer (Glacial till consisting of pebbles, cobbles, and boulders in silty sand matrix.)	Morainal complex (2-50)		
	Morainal veneer with exposed bedrock	Glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix.	0-2	Gently to highly irregular, conforming to irregularities of subjacent bedrock; locally has subparallel ice-marginal channels which typically are incised to or into bedrock.	Occurrence of permafrost sporadic; engineering capabilities and limitations determined in part by lithology and topography of subjacent bedrock.
	Morainal veneer with colluvial material and exposed Bedrock	Morainal veneer (Glacial till consisting of pebbles, cobbles, and boulders in silty sand matrix.), Colluvial material (unsorted, unconsolodated material)	2-50	Morainal veneer (Hummocks and ridges with slopes to 30 degree and relief to 20 m (exceptionally 40 m) superposed on level to moderately steep surfaces)	Few data on distribution of permafrost; vegetation cover suggests general absence of permafrost or presence of unusually thick active layer; locally affords suitable road location sites and constitutes source of well drained common fill.
	Bedrock terrace with evidence of rock slides				
	Unknown material		Unknown		



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Legend

- Potential ice rich permafrost
- Potential gravel deposit

* NOTE: Areas delineated are subject to field investigation.

- Public Road
- Exploration roads
- Trails
- Cutlines
- Contour
- Surface water (actual and potential)
- Swampy area
- Pit
- Pipe
- Adit location
- Overburden drillhole location

Soils Characterization Study

Scale: 1:10,000
(when plotted on 11x17 inch sheet)

0 130 260 520 Meters
0 130 260 520 Yards

Map 5A Onek Adit Area

ACCESS CONSULTING GROUP

Drawn by: RG	Checked by: DC/BT/RLM
Date: March 2007	

Our File: Dawson\D\Project\All\Projects\ALEX-05-01\gis\mxd\UKHM\ClosurePlan2007\Soils_Characterization\Map5A_Onek.mxd

*2006 aerial photograph obtained from Geodesy Remote Sensing Inc., Calgary Alberta. Flown 13,14 September 2006.

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Closure Planning
Technical Studies

Elsa Reclamation
and
Development Company

Legend

- Potential ice rich permafrost
- Potential gravel deposit

* NOTE: (i) Areas delineated are subject to field investigation.
(ii) Legend for Geological Survey of Canada Surficial Geology data can be found on the back of this map.

- Public Road
- Exploration roads
- Trails
- Cutlines
- Contour
- Surface water (actual and potential)
- Swampy area
- Pit
- Pipe
- Adit location
- Overburden drillhole location

Notes:
This map is for illustrative purposes only.
This is not a legal document.
Surficial Geology data (described on back) compiled by the Geological Survey of Canada.
at a scale of 1:50,000.
Topographic data current as of September 2006.
Projection: UTM Zone 8N NAD83
NTS Sheet 105M/13 and 105M/14

Soils Characterization Study

Scale: 1:10,000
(when plotted on 11x17 inch sheet)

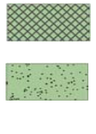
0 135 270 540 Meters
0 135 270 540 Yards

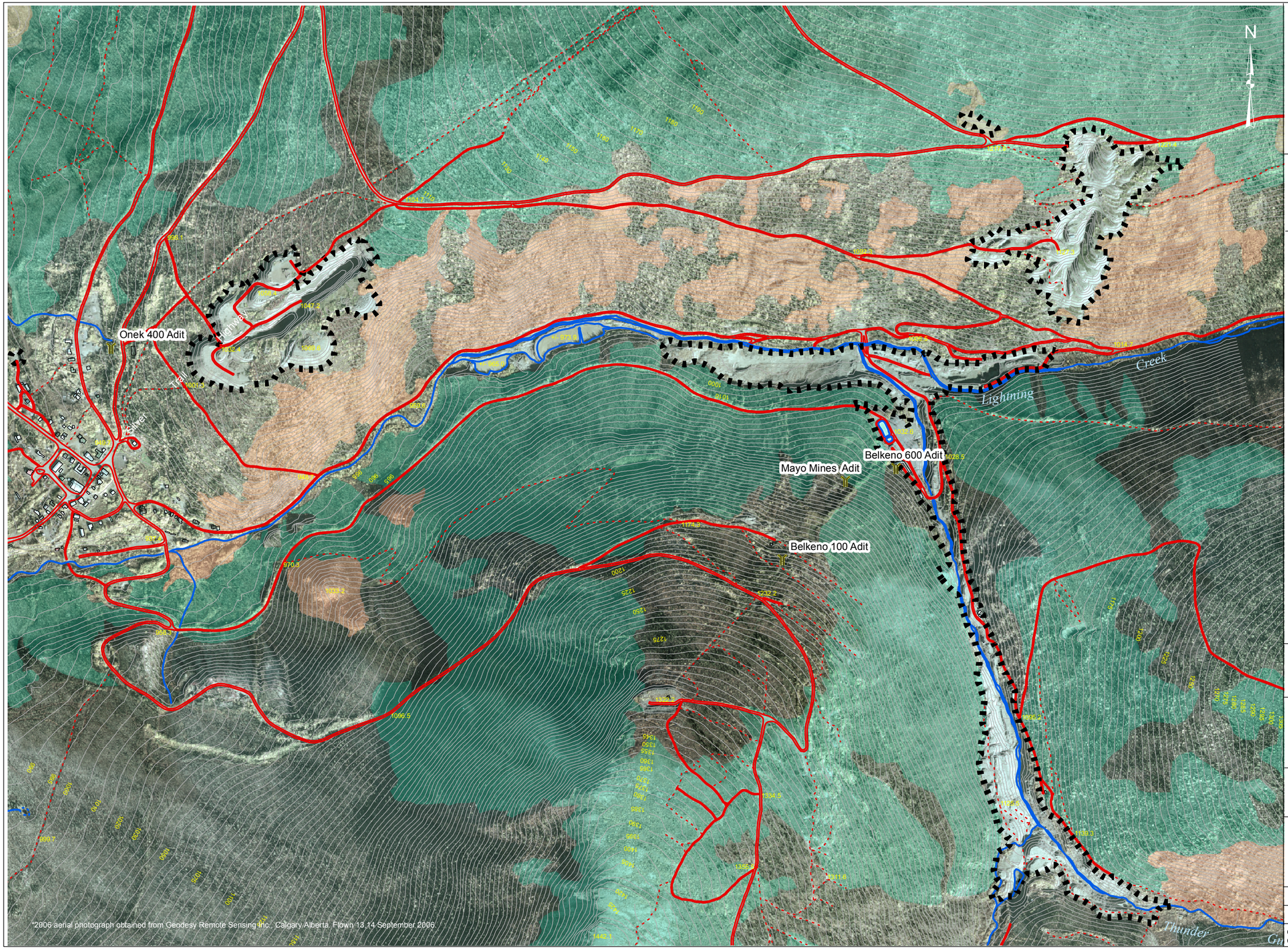
Map 5B Onek Adit Area

ACCESS CONSULTING GROUP

Drawn by: RG	Checked by: DC/BT/RLM
Date: March 2007	

Our File: Dawson\D\Project\AllProjects\ALEX-05-01\gis\mxd\UKHM\ClosurePlan2007\Soils_Characterization\Map5B_Onek.mxd

	Name	Material	Approximate Thickness (feet)	Landform	General Conditions
	Alluvial complex (alluvial fans, plains and terraces)	Silt, sand, gravel.	2-30	Various	See Ap, At, Af as applicable
	Alluvial fan with fens	Alluvial fan (Mainly coarse gravel in steeply sloping fans; sand, silt, and organic layers in gently sloping fans.), Fen (an area of wetland fed by ground water and runoff, containing organic material below the waterline)	Alluvial fan (2-30)	Alluvial fan (Gently to steeply sloping fans occur where high gradient tributary streams meet lower gradient trunk streams; closely spaced fans merge to form fan aprons), Fen (see material)	Streams on fans are subject to sudden and damaging changes of course; fans comprising mainly gravel may be permafrost free or if perennially frozen are thaw stable; fans comprising mainly of silt are typically perennially frozen
	Alluvial plain with fens	Alluvial plains of rivers typically have 1 to 3 m of silt overlying gravel; small streams have various thickness of silt, sand, and gravel. Fen (an area of wetland fed by ground water and runoff, containing organic material below the waterline)	5-30	Flat to gently irregular, commonly with distinct meander scrolls and oxbow lakes; old floodplain surfaces of large streams commonly have irregular thermokarst ponds (Apk), Fen (see material)	Flooding common to infrequent; permafrost common; silt layer is generally ice rich and unstable when thawed.
	Colluvial deposits with Morainal veneers and Bedrock at surface	Colluvial (unconsolodated material), Morainal veneers (glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix)	Colluvial deposits (0-2), Morainal deposits (0-2)	Colluvium is gently to moderately sloping, conforming to topography of subjacent bedrock. Moraine veneers are gently to highly irregular, conforming to irregularities of subjacent bedrock; locally has subparallel ice-marginal channels which typically are incised to or into bedrock (Mv-C).	Occurrence of permafrost sporadic; engineering capabilities and limitations determined in part by lithology and topography of subjacent bedrock.
	Colluvial veneer with exposed bedrock	Gently to moderately sloping, conforming to topography of subjacent bedrock; periglacial features, including small solifluction lobes, sorted polygons, and felsenmeer are conspicuous and widespread above treeline (1280 to 1370 m; 4200 to 4500 ft.).	0-2		
	Glaciofluvial complex (glaciofluvial plains, terraces and hummocky or ridged deposits) with Moraine complex (Morainal fans, plains and terraces)	Glaciofluvial complex (gravel, sand), Morainal complex (Glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix)	Glaciofluvial complex (2-50), Morainal complex (2-50)	Glaciofluvial complex (Various; includes areas that would be classed as Glaciofluvial plains or terraces except for presence of kettles), Morainal complex (Gently to highly irregular, conforming to irregularities of subjacent bedrock; locally has subparallel ice-marginal channels which typically are incised to or into bedrock)	Glaciofluvial complex (Permafrost not common but where present the deposits are mostly thaw stable; constitute main source of aggregate for construction purposes; good drainage and soil stability make the units suitable for location of most types of facilities; areas of Gp, Gt), Morainal complex (Occurrence of permafrost sporadic, prevalent on most northerly facing slopes, less common on southerly facing slopes. Suitable for conventional cut-and-till road construction where permafrost is absent or ground ice content low).
	Moraine complex (Morainal fans, plains and terraces)	Morainal complex (Glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix)	Morainal complex (2-50)	Gently to moderately sloping, conforming to topography of subjacent bedrock; commonly with subparallel ice-marginal channels or with postgalcial gullying.	Occurrence of permafrost sporadic, prevalent on most northerly facing slopes, less common on southerly facing slopes. Suitable for conventional cut-and-till road construction where permafrost is absent or ground ice content low
	Moraine with Colluvial veneers and Colluvial blankets	Morainal material (glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix), Colluvial material (Any of the deposits described above, plus bedrock detritus, modified and/or intermixed as a result of downslope movement of material; texture ranges from coarse blocky bedrock detritus of mountain tops to clayey or silty diamicton of lower slopes)	Moraine (2-30), Alluvial fan (2-30)	Moraine (Gently to moderately sloping, conforming to topography of subjacent bedrock; commonly with subparallel ice-marginal channels (Mb-C) or with postgalcial gullying), Colluvial veneers and blankets (Gently to moderately sloping, conforming to topography of subjacent bedrock; periglacial features, including small solifluction lobes, sorted polygons, and felsenmeer are conspicuous and widespread above treeline.	
	Morainal blanket with morainal veneer	Glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix.	Morainal blanket (2-30), Morainal veneer (0-2)	Flat to gently sloping or undulant.	Occurrence of permafrost sporadic, prevalent on most northerly facing slopes, less common on southerly facing slopes. Suitable for conventional cut-and-till road construction where permafrost is absent or ground ice content low; high ground ice content m
	Morainal veneer	Morainal veneer (Glacial till consisting of pebbles, cobbles, and boulders in silty sand matrix.)	Morainal complex (2-50)		
	Morainal veneer with exposed bedrock	Glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix.	0-2	Gently to highly irregular, conforming to irregularities of subjacent bedrock; locally has subparallel ice-marginal channels which typically are incised to or into bedrock.	Occurrence of permafrost sporadic; engineering capabilities and limitations determined in part by lithology and topography of subjacent bedrock.
	Morainal veneer with colluvial material and exposed Bedrock	Morainal veneer (Glacial till consisting of pebbles, cobbles, and boulders in silty sand matrix.), Colluvial material (unsorted, unconsolodated material)	2-50	Morainal veneer (Hummocks and ridges with slopes to 30 degree and relief to 20 m (exceptionally 40 m) superposed on level to moderately steep surfaces)	Few data on distribution of permafrost; vegetation cover suggests general absence of permafrost or presence of unusually thick active layer; locally affords suitable road location sites and constitutes source of well drained common fill.
	Bedrock terrace with evidence of rock slides				
	Unknown material		Unknown		



Site Investigation and Improvements
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Legend

- Potential ice rich permafrost
- Potential gravel deposit

* NOTE: Areas delineated are subject to field investigation.

- Public Road
- Exploration roads
- Trails
- Cutlines
- Contour
- Surface water (actual and potential)
- Swampy area
- Pit
- Pipe
- Adit location

Soils Characterization Study

Scale: 1:10,000
(when plotted on 11x17 inch sheet)

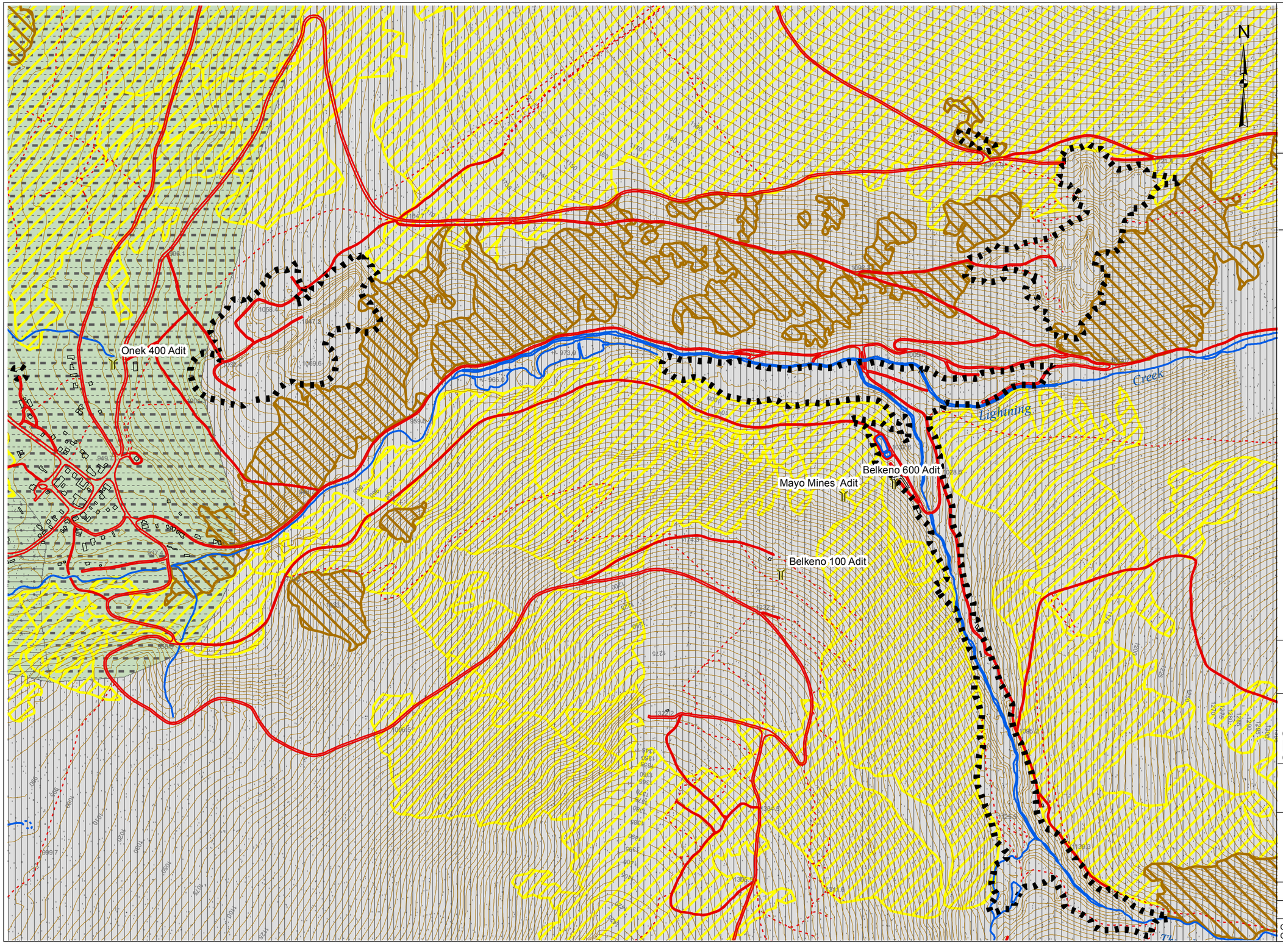
0 135 270 540 Meters
0 135 270 540 Yards

Map 6A Bellekeno Adits Area

ACCESS CONSULTING GROUP

Drawn by: RG	Checked by: DC/BT/RLM
Date: March 2007	

Our File: Dawson\D\Project\AllProjects\ALEX-05-01\gis\mxd\UKHM\ClosurePlan2007\Soils_Characterization\Map6A_Bellekeno.mxd



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and
Development Company

Legend

- Potential ice rich permafrost
- Potential gravel deposit

* NOTE: (i) Areas delineated are subject to field investigation.
(ii) Legend for Geological Survey of Canada Surficial Geology data can be found on the back of this map.

- Public Road
- Exploration roads
- Trails
- Cutlines
- Contour
- Surface water (actual and potential)
- Swampy area
- Pit
- Pipe
- Adit location

Notes:
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This is not a legal document.
Surficial Geology data (described on back) complilied by the Geological Survey of Canada. at a scale of 1:50,000.
Topographic data current as of September 2006.
Projection: UTM Zone 8N NAD83
NTS Sheet 105M/13 and 105M/14

Soils Characterization Study

Scale: 1:10,000
(when plotted on 11x17 inch sheet)

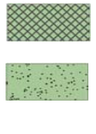
0 135 270 540 Meters
0 135 270 540 Yards

Map 6B Bellekeno Adits Area

ACCESS CONSULTING GROUP

Drawn by: RG	Checked by: DC/BT/RLM
Date: March 2007	

Our File: Dawson\D\Project\AllProjects\ALEX-05-01\gis\mxd\UKHM\ClosurePlan2007\Soils_Characterization\Map6B_Bellekeno.mxd

	Name	Material	Approximate Thickness (feet)	Landform	General Conditions
	Alluvial complex (alluvial fans, plains and terraces)	Silt, sand, gravel.	2-30	Various	See Ap, At, Af as applicable
	Alluvial fan with fens	Alluvial fan (Mainly coarse gravel in steeply sloping fans; sand, silt, and organic layers in gently sloping fans.), Fen (an area of wetland fed by ground water and runoff, containing organic material below the waterline)	Alluvial fan (2-30)	Alluvial fan (Gently to steeply sloping fans occur where high gradient tributary streams meet lower gradient trunk streams; closely spaced fans merge to form fan aprons), Fen (see material)	Streams on fans are subject to sudden and damaging changes of course; fans comprising mainly gravel may be permafrost free or if perennially frozen are thaw stable; fans comprising mainly of silt are typically perennially frozen
	Alluvial plain with fens	Alluvial plains of rivers typically have 1 to 3 m of silt overlying gravel; small streams have various thickness of silt, sand, and gravel. Fen (an area of wetland fed by ground water and runoff, containing organic material below the waterline)	5-30	Flat to gently irregular, commonly with distinct meander scrolls and oxbow lakes; old floodplain surfaces of large streams commonly have irregular thermokarst ponds (Apk), Fen (see material)	Flooding common to infrequent; permafrost common; silt layer is generally ice rich and unstable when thawed.
	Colluvial deposits with Morainal veneers and Bedrock at surface	Colluvial (unconsolodated material), Morainal veneers (glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix)	Colluvial deposits (0-2), Morainal deposits (0-2)	Colluvium is gently to moderately sloping, conforming to topography of subjacent bedrock. Moraine veneers are gently to highly irregular, conforming to irregularities of subjacent bedrock; locally has subparallel ice-marginal channels which typically are incised to or into bedrock (Mv-C).	Occurrence of permafrost sporadic; engineering capabilities and limitations determined in part by lithology and topography of subjacent bedrock.
	Colluvial veneer with exposed bedrock	Gently to moderately sloping, conforming to topography of subjacent bedrock; periglacial features, including small solifluction lobes, sorted polygons, and felsenmeer are conspicuous and widespread above treeline (1280 to 1370 m; 4200 to 4500 ft.).	0-2		
	Glaciofluvial complex (glaciofluvial plains, terraces and hummocky or ridged deposits) with Moraine complex (Morainal fans, plains and terraces)	Glaciofluvial complex (gravel, sand), Morainal complex (Glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix)	Glaciofluvial complex (2-50), Morainal complex (2-50)	Glaciofluvial complex (Various; includes areas that would be classed as Glaciofluvial plains or terraces except for presence of kettles), Morainal complex (Gently to highly irregular, conforming to irregularities of subjacent bedrock; locally has subparallel ice-marginal channels which typically are incised to or into bedrock)	Glaciofluvial complex (Permafrost not common but where present the deposits are mostly thaw stable; constitute main source of aggregate for construction purposes; good drainage and soil stability make the units suitable for location of most types of facilities; areas of Gp, Gt), Morainal complex (Occurrence of permafrost sporadic, prevalent on most northerly facing slopes, less common on southerly facing slopes. Suitable for conventional cut-and-till road construction where permafrost is absent or ground ice content low).
	Moraine complex (Morainal fans, plains and terraces)	Morainal complex (Glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix)	Morainal complex (2-50)	Gently to moderately sloping, conforming to topography of subjacent bedrock; commonly with subparallel ice-marginal channels or with postgalcial gullying.	Occurrence of permafrost sporadic, prevalent on most northerly facing slopes, less common on southerly facing slopes. Suitable for conventional cut-and-till road construction where permafrost is absent or ground ice content low
	Moraine with Colluvial veneers and Colluvial blankets	Morainal material (glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix), Colluvial material (Any of the deposits described above, plus bedrock detritus, modified and/or intermixed as a result of downslope movement of material; texture ranges from coarse blocky bedrock detritus of mountain tops to clayey or silty diamicton of lower slopes)	Moraine (2-30), Alluvial fan (2-30)	Moraine (Gently to moderately sloping, conforming to topography of subjacent bedrock; commonly with subparallel ice-marginal channels (Mb-C) or with postgalcial gullying), Colluvial veneers and blankets (Gently to moderately sloping, conforming to topography of subjacent bedrock; periglacial features, including small solifluction lobes, sorted polygons, and felsenmeer are conspicuous and widespread above treeline.	
	Morainal blanket with morainal veneer	Glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix.	Morainal blanket (2-30), Morainal veneer (0-2)	Flat to gently sloping or undulant.	Occurrence of permafrost sporadic, prevalent on most northerly facing slopes, less common on southerly facing slopes. Suitable for conventional cut-and-till road construction where permafrost is absent or ground ice content low; high ground ice content m
	Morainal veneer	Morainal veneer (Glacial till consisting of pebbles, cobbles, and boulders in silty sand matrix.)	Morainal complex (2-50)		
	Morainal veneer with exposed bedrock	Glacial till consisting of pebbles, cobbles, and boulders in a clayey silt to silty matrix.	0-2	Gently to highly irregular, conforming to irregularities of subjacent bedrock; locally has subparallel ice-marginal channels which typically are incised to or into bedrock.	Occurrence of permafrost sporadic; engineering capabilities and limitations determined in part by lithology and topography of subjacent bedrock.
	Morainal veneer with colluvial material and exposed Bedrock	Morainal veneer (Glacial till consisting of pebbles, cobbles, and boulders in silty sand matrix.), Colluvial material (unsorted, unconsolodated material)	2-50	Morainal veneer (Hummocks and ridges with slopes to 30 degree and relief to 20 m (exceptionally 40 m) superposed on level to moderately steep surfaces)	Few data on distribution of permafrost; vegetation cover suggests general absence of permafrost or presence of unusually thick active layer; locally affords suitable road location sites and constitutes source of well drained common fill.
	Bedrock terrace with evidence of rock slides				
	Unknown material		Unknown		

Keno Hill Mines

Soils Characterization and Drilling Report

Prepared by:

Elsa Reclamation Development Company Ltd.

March 2007



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1.0 BACKGROUND

In preparation for the development of a Reclamation and Closure Plan for the United Keno Hill Mines district, Elsa Reclamation and Development Company Ltd. (ERDC) began initial closure planning studies in 2006. Closure planning will consider long-term water management and treatment options for water exiting certain underground adits as well as the Valley Tailings Facility (VTF). One of the closure strategies to explore is the discharge of surface waters from the VTF as well as the adits into the ground using an engineered trench or series of vertical wells for further amendment and treatment using in-situ biological technologies. This strategy would require a lack of permafrost in the underlying soils as well as suitable infiltration rates to accept the injected waters. Alternatively, an ex-situ biological treatment system is another strategy and process to consider and explore at Keno Hill. Ex-situ technologies rely on construction of an external engineered system using gravels to promote biological reduction of metals. In addition to in-situ and ex-situ biological technologies, conventional technologies such as High Density Sludge water treatment systems should be explored and further advanced for consideration and comparison. As part of this initial investigation, ERDC completed borehole drilling at select UKHM locations in an effort to characterize soils and gravels and to assess permeability for possible in-situ treatment and secondly to determine a location of potential gravel borrow sources if ex-situ treatment is advanced. The drilling program was designed to test the concept, not prove out the design basis. Five separate boreholes were drilled over the period August 21-24, 2006 using a Becker-Hammer drill supplied and operated by Glacier Dredge Contracting in Whitehorse, Yukon. This report summarizes the findings of the investigation. Project oversight and management was provided by Mr. Joe Harrington, Alexco Resource Corp. All boreholes were manned and logged by NovaGold geologists Heather Brown and Christine Han.

In addition to the closure planning project, this report also serves as useful information and documentation of the existing baseline environmental conditions within the VTF and other adit locations where drilling and soils characterization were completed. It is recommended that this report also be appended to the Baseline Environmental Assessment.

2.0 VALLEY TAILINGS SOILS CHARACTERIZATION RESULTS

Three borings were advanced around the tailings ponds and the locations are shown in Figure xx. None of these borings encountered bedrock at depths of 46, 68, and 36 feet total depths and no permafrost was encountered. The logs of these boreholes are attached in Table 2 at the end of this report. A medial moraine exists northwest of Tailings Dam 1 (upper tailings). Based on the borehole drilling results, it is observed that this esker (see Figure 1) lies to the down gradient western edge of an exposed bedrock knoll, which apparently dips to the west and is covered with a veneer of gravel and till. The thickness of this overlying gravel till deposit varies from 0 feet (at exposed bedrock directly north of the eastern edge of the Valley Tailings Facility) to about 46 feet at the edge of Tailings Dam 1, to at least lower than 68 feet at the northern edge of Tailings Dam 3. This increasing soil thickness, when corrected for ground surface elevations, indicates that bedrock is dipping about 2.6% to the west over the interval from Tailings Dam 1 – 3 as measured by depth of refusal with the Becker hammer drill.

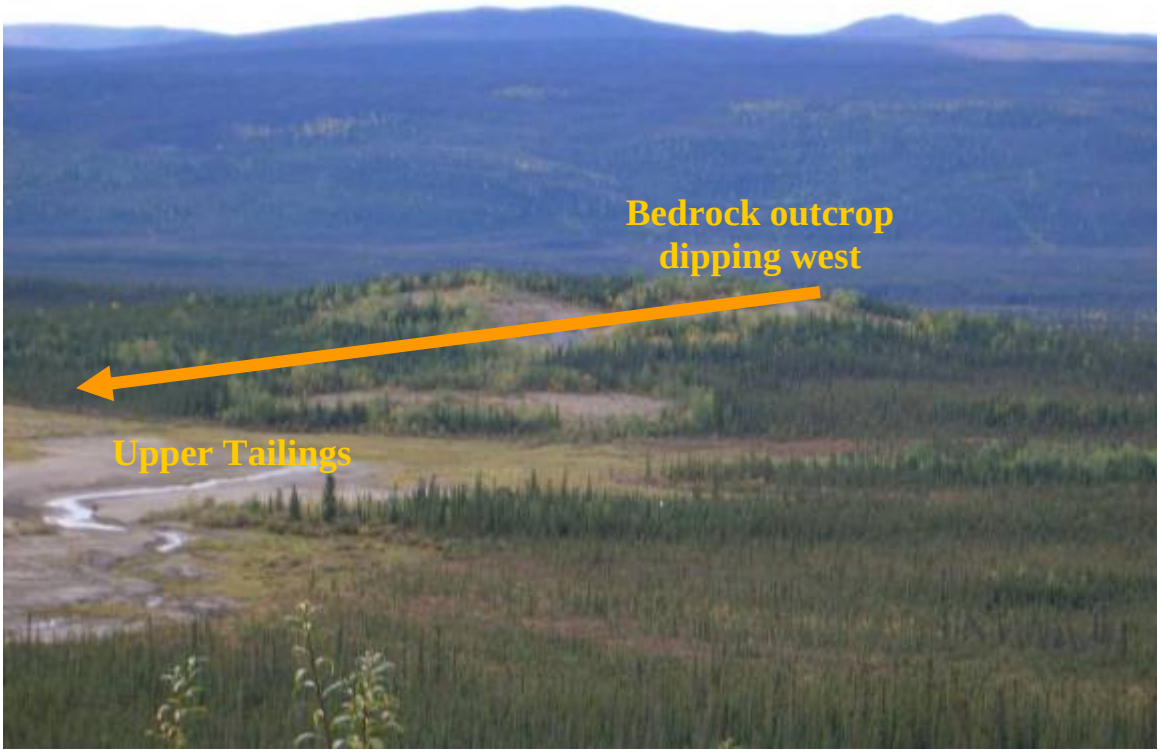


FIGURE 1. BEDROCK OUTCROP VALLEY TAILINGS

Historic drilling information has been reviewed as part of this investigation. Data from Bema Gold exploration drilling completed in the 1980's indicates depths of gravel and cobble filled alluvium in the range of one hundred feet (22 – 43 meters) to the west of this area in the McQuesten Valley west of Flat Creek. The recent drilling results are consistent with the Bema exploration results. A summary of the drill log for an adjacent Bema drill hole is included as Figure 2.

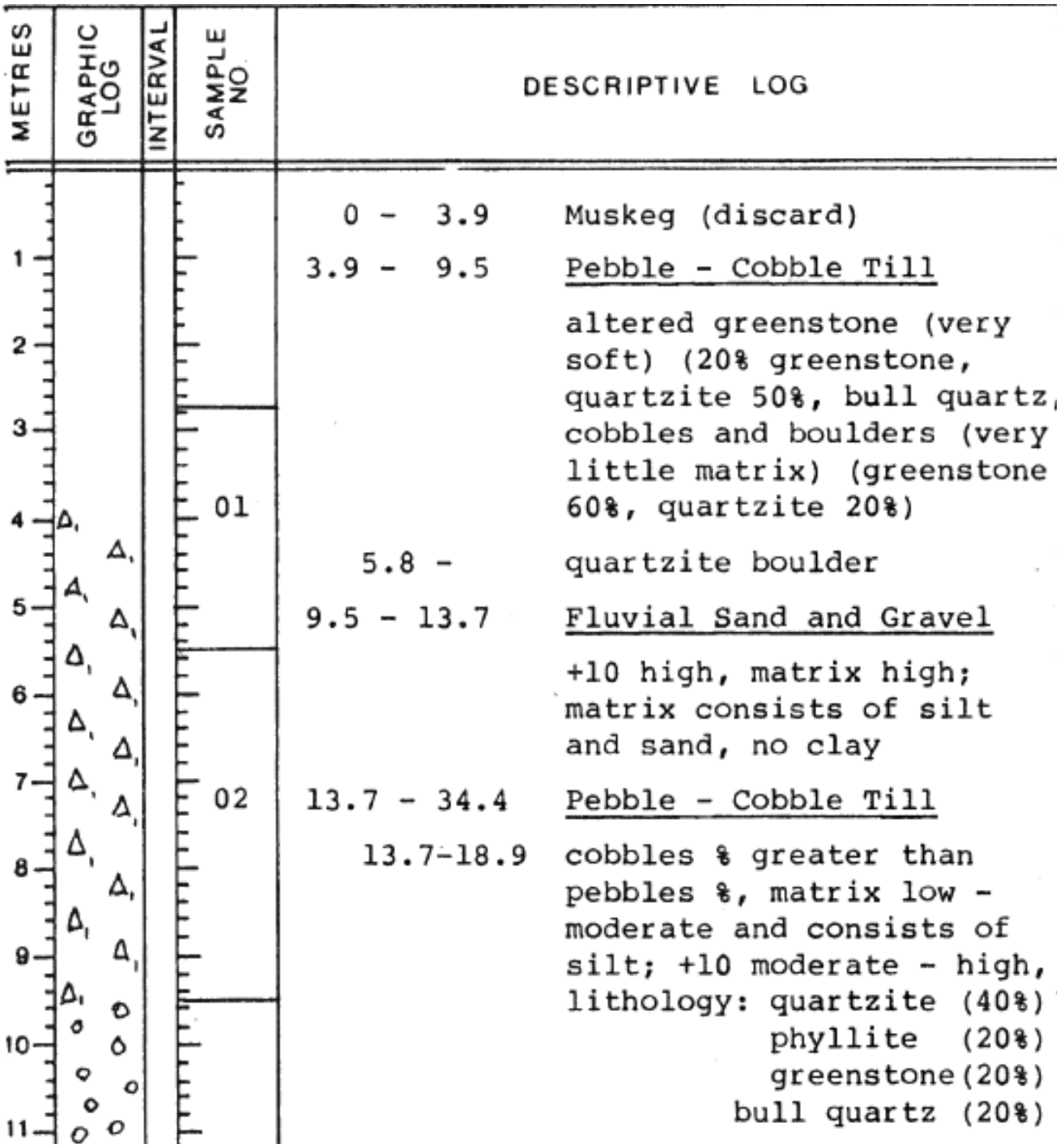


FIGURE 2. EXCERPT FROM BEMA DRILLING LOGS.

2.1 VALLEY TAILINGS DRILL HOLE RESULTS

Becker Bore Hole #1 was located adjacent (~100') to Tailings Dam #1 to the northwest on the edge of the noted esker. The location of BH-01 is shown on Figure 12. A picture of the drill at the BH-01 location is shown in Figure 3.

The logging of this borehole indicates gravel and sandy till at 0-8 feet, harder matrix at 8 – 32 feet, easier drilling and increasing gravel at 32 – 44 feet and refusal at 46 feet touching greenstone bedrock. The hole was dry and remained dry after 24 hours with no permafrost encountered throughout the hole.



FIGURE 3. BECKER BORE HOLE #1 (WITH SAMPLES IN FOREGROUND)

Becker Bore Hole #2 was located near the crest of Tailings Dam #3. The location of BH-02 is shown on Figure 12 and a picture of the drill at station BH-02 is presented in Figure 4. Drilling was much easier compared to BH-01, with little sample recovery due to cobbles until 24 feet. The bits on the Becker Hammer drill were switched from BH-01 to BH-02 to try to get better rates of drilling, but the second bit seemed to get lower recovery. It is presumed that the lower recoveries were due to observable, but too large to recover cobbles and gravels. The inside diameter of the drill steel is 2 ½". This hole did not reach refusal at 68 feet, but drilling became harder at 62 feet, and was over 100 blows per foot. The hole was suspended at 68 feet. No permafrost was encountered throughout the hole.

After withdrawing the steel, it was noted that the hole was filling rapidly with water, to a depth of about 20 feet (46 feet of saturation). Water was not noted during drilling. Due to raveling and collapse noted, an attempt was made to immediately case the hole with available 1.25 inch PVC pipe. Approximately 56 feet of pipe was installed of which the bottom 18 feet was perforated with ¼ inch holes. After casing, the hole was filled with water and then the filled condition maintained to determine an estimate of infiltration. The results of the infiltration test are presented in Table 1.

TABLE 1. BOREHOLE #2 INFILTRATION RATES

Time	Elapsed Time	Gallons Added	Rate, GPD	Cumulative Rate
1:48:00	0:00:00	30		
2:40:00	0:52:00	10	277	277
3:22:00	1:34:00	7	240	260
3:31:00	1:43:00	4	640	294
6:45:00	4:57:00	13	96	165

An estimate of superficial infiltration velocity under static head can be calculated as the ratio of flow per unit area of wall. This yields ~ 2.8 cm/sec.

This is likely a conservative estimate given that we were unable to timely support the wall of the hole, so that fines were weakened by inflows and settled into the lower strata, filling the bottom of the borehole with silt (which was observed by sounding with a rod) and likely reducing the permeability of these areas.



FIGURE 4. BECKER BORE HOLE #2

Becker Bore Hole #3 was located immediately downstream of Tailings Dam #3 in the area adjacent (~100') to Flat Creek to test the extent of permafrost in this area. The location of BH-03 is shown in Figure 12 and the drill is shown next to station BH-03 in Figure 5. No permafrost was observed to a final depth of 36 feet. Samples were substantially sandy gravels, with very poor recoveries and observable cobbles at the wall of the hole. Immediately after withdrawing the drill steel, an attempt was made to place a fully perforated PVC pipe, but water was encountered at 4 feet and a fully occluded cobble - plugged hole collapsed at 11.5 feet. Exploration of this plug with a steel rod indicated that it was gravel packing which could not be penetrated due to the large size of the supporting cobbles.

The rapid influx of water and subsequent collapse of running sands, gravels and cobbles indicates very good infiltration conditions for either deeper injection in this area or for shallow trench disposal of tailings decant waters or to intercept metal loads emanating from beneath tailings.

It also appeared in this hole that the high compressions from the drill rig excluded water intrusion to the hole during drilling, but immediately after the pressure is released, the holes filled with water.

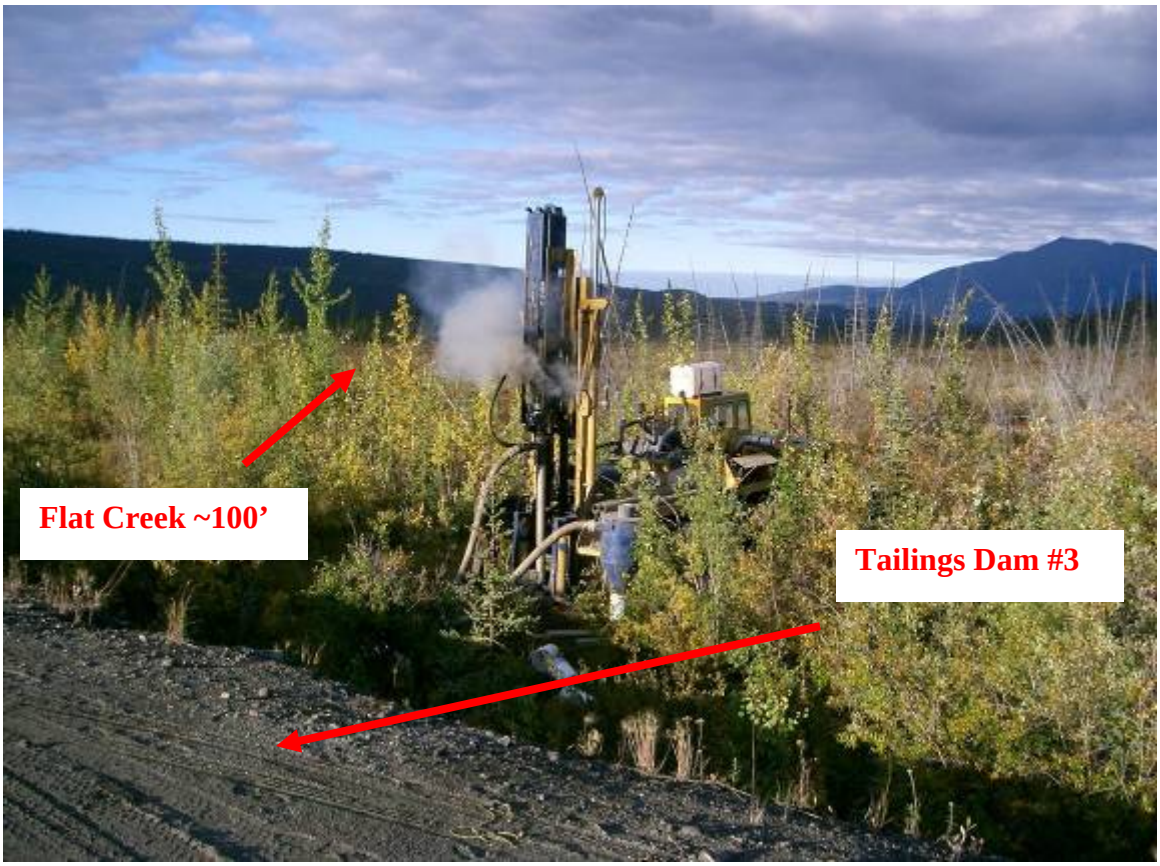


FIGURE 5. BECKER BORE HOLE #3

2.2 GALKENO 900 DRILLING RESULTS

Becker Bore Hole #4 was located to the immediate northeast of the adit opening to Galkeno 900. The location of BH-04 is shown on Figure 13. This hole was selected to initially assess the

strategy of injecting Galkeno 900 adit water and further amendment and in-situ treatment. Drilling was relatively easy, with very poor recoveries until 16 feet depth (less than 10% recovery), increasing to about 30 % recovery to the bottom of the hole.

An attempt was made to measure the infiltration rate for this hole, but it would not maintain standing water long enough to measure rates of inflow. The 27 foot deep hole near Galkeno 900 took more than 90 gallons in 30 minutes, with a drilled capacity of less than 40 gallons (about 1.5 gallons per foot). After casing and filling the annulus with gravel, the water level continued to drop at more than 2 feet per minute. It is estimated that this borehole was infiltrating more than 4 gpm continuously.

While pouring water into this hole, it was noted that the wall rock is principally cobble as evident after water eroded the compacted skin of soil around the edge of the hole.

A photo of this observation is shown as Figure 6. The photo was taken at a depth of about 1 foot into the hole.



FIGURE 6. BECKER BORE HOLE #4

2.3 TAILINGS POND ESKER

The esker located north of the tailing ponds (area of interest shown in blue north of tailing ponds on attached Figure 12) is a possible location for gravel source in the ex-situ treatment strategy option.

Backhoe trenching would ideally be used for assessment of these gravel sources. However based on contractual obligations between ERDC and Government of Yukon, ERDC is not permitted to do trenching or other major disturbance until Final Closing has occurred. Therefore, we have provided the results of previous trenching and clearing activities as evidence that sufficient gravel zones with suitable infiltration characteristics can be obtained. Figure 7 and Figure 8 demonstrate the availability of gravel sources for potential ex-situ treatment options.

Source #1 (located near Tailings Dam 1): This area was previously excavated to an approximate depth of 20 feet and has an extent of at least 4 acres per GPS mapping. BH-01 was located at the southwestern end of this gravel pit.



FIGURE 7. 4 ACRE GRAVEL BORROW AREA NORTH OF TAILINGS DAM #1

Source #2 (located northwest of Tailings Dam #3): Additional trenches and gravelly placers are observable throughout the area, which have been extensively mined for gold and or to support Yukon Transportation Maintenance activities.



FIGURE 8. BELLEKENO PLACER MINE AREA

2.4 HANSEN LAKE ROAD BOREHOLE

Becker Bore Hole #5 was completed to a depth of 24 feet adjacent to the gravel borrow area between the Hansen Lake Road turnoff and Christal Creek. The location of BH-05 is shown on Figure 13. Within this gravel pit area, there is substantial evidence of excess cobbles. Figure 9, Figure 10 and Figure 11 demonstrate the characteristics of the gravel source located at the Hanson Lake Road.



FIGURE 9. GRAVEL PILES HANSON LAKE ROAD



FIGURE 10. GRAVEL FINES PILE HANSON LAKE ROAD



FIGURE 11. COBBLE PILE REJECTS HANSON LAKE ROAD

3.0 CONCLUSIONS

Based on the drill results and visual observations made during the field program, the following general conclusions can be made:

- Substantial quantities of gravel are available for ex-situ treatment reactor construction. The tenure of these gravel sources would require further investigation to determine the ability to access and use.

- The observed lack of permafrost in drill holes, especially in the area of the Valley Tailings and Galkeno 900 indicates good potential for injection of waters for further in-situ treatment.

- Pilot level demonstration of injection treatment technologies (injection amendment/treatment of previously treated water containing lowered levels of zinc such as at Galkeno 300 decant followed by injection of increasingly contaminated water) is recommended as follow-up for 2007.

TABLE 2. BOREHOLE DRILL LOGS

Alexco Resource Corp.			Overburden Drilling Log			08V 0474827,7088753	Date: August 28, 2006	Logged By: Heather Brown
Hole ID	From (ft)	To (ft)	Permafrost %	Gravel %	Till %	Description		
BH 01	0	8	0	20-30	70-80	Medium-dark greyish brown, sandy till with various stones/boulders (0.5cm-7cm); subangular-subrounded.		
BH 01	8	15	0	15-20	80-85	Light greyish-beige brown, silty till with various stones/boulders (0.5-7cm). Subrounded, higher clay silt fraction than above.		
BH 01	15	20	0	10	90	Light to medium greyish brown till, very fine grained, silty, increasing clay fraction, minor gravel component. 0.5-5cm stones; subrounded. Hit large boulder at ~20ft.		
BH 01	20	25	0	15	85	Light to medium grey/yellow-brown, fluvial till, very fine grained to fine grained. Silty but with decreasing clay and increasing sand. Doesn't clump together as easily. Boulders and stones are mainly subrounded to rounded with occasional subangular.		
BH 01	25	27	0	20	80	As described above (20-25ft) but with increasing percentage of gravel. Mostly rounded to subrounded. ~0.5-7cm. Increasing silt than above as clumping occurs more easily.		
BH 01	27	32	0	15	85	Light to medium blue/brown grey fine grained silty till; clumping still occurs but sandy portion of till has slightly increased. Pebbles are smaller on average (0.5-3cm) with rare larger pieces likely broken off of a larger boulder. Most gravel is still subrounded and this is likely a fluvial or glaciofluvial till.		
BH 01	32	35	0	20-25	80	As described above (27-32ft) but without increasing gravel component. Almost all rounded. Averaging in size from 0.5-5cm.		
BH 01	35	43	0	20-25	80	Blueish brown-grey, silty to sandy (~15%) till with subrounded-rounded, occasionally angular pebbles and stones (~0.5-5cm). The clay fraction is still high but less clumping (adhesion) occurs. The silt is likely a fluvial to glacial fluvial sample. Very fine grained white mica and rare very fine grained pyrite is present in minor amounts thru-out.		
BH 01	43	46	0	20-25	80	As described above (35-43) but less fine grained, more sandy-silty. Higher % of stones (0.5-1cm) thru-out versus larger sized gravel.		

Notes from Driller (Glen): Granular gravel from 0-7ft. Easy drilling. From 7-32ft, harder drilling, better recovery. From 32-46ft, Harder drilling than above. At 46ft, hit bedrock or a boulder. Most probably bedrock.

Alexco Resource Corp.			Overburden Drilling Log			08V 0474287, 7088555	Date: August 31, 2006	Logged By: Christine Hann
Hole ID	From (ft)	To (ft)	Permafrost %	Gravel %	Till %	Description		
BH 02	0	8	0	20	80	Medium - light brown/grey fine grained silty till. Stone range in size from 0.5cm to 3cm. Most stones are rounded to subrounded. Very poor recovery (~10% - therefore, ~90% unrecovered cobble)		
BH 02	8	16	0	20	80	Medium - light brown/grey, fine grained silty till. Stones are larger in size, averaging ~4cm; ranging from 0.5-7cm. Till seems to clump together. Recovery is ~50% (~50% unrecovered cobble). Slightly oxidized.		
BH 02	16	24	0	~5-10	~90-95	Very fine grained, light brown/grey silty-clay rich till. Increasing amounts of clay, decreasing gravel/stones. Till tends to clump. Angular to subangular stones thru-out. Ranging in size from 0.5-3cm.		
BH 02	24	32	0	~10-15	~85-90	Very fine grained, light-medium grey, silty, increasingly clay rich till. Increasing # of stones averaging in size from 2-3cm. More rounded-subrounded stones ranging in size from 0.5-3cm. ~40% recovery (~60% unrecoverable cobble)		
BH 02	32	40	0	~5-10	~90-95	As above. Slighly lighter grey/blue-grey in color. Subrounded to subangular pebbles with rare, angular stones. Seems to be of fluvial nature. Clay like till with less clumping. Stone size is ~2-3cm on average, ranging from 0.5-3cm. ~30% recovery (~70% unrecoverable cobble.		
BH 02	40	48	0	20	80	Slightly darker grey in color (than above). Still very fine grained, silty/clay like til. Rounded to subrounded stones increasing in abundance and size. Average size is 3cm, stones range in size from 0.5-4cm. Recovery is ~60% (~40% unrecoverable Cobble		
BH 02	48	56	0	15	85	As above. Slightly fewer stones/gravel. Increasingly angular. Good recovery ~85% (15% unrecoverable cobble)		
BH 02	56	64	0	15	85	As above. Good recovery ~90% (~10% unrecoverable cobble)		

Notes from Driller (Glen): From 0-45ft, soft, easy drilling. From 45-64ft, hard to drill (broke a pipe). Didn't reach bedrock

Alexco Resource Corp.			Overburden Drilling Log			0474294+/-3, 7088378+/-4	Date: August 31, 2006	Logged By: Christine Hann
Hole ID	From (ft)	To (ft)	Permafrost %	Gravel %	Till %	Description		
BH 03	0	8	0	5	95	Medium brown, fine sandy till. Some pebbles ranging in size from 0.2-3cm. Rounded. Very poor recovery (~80% cobble)		
BH 03	8	18	0	40-50	50-60	Medium brown, sandy-silty till with stones/gravel; sub-rounded to subangular. Ranging in size from 0.1cm-6cm. ~45% recovery (~55% unrecoverable cobble)		
BH 03	18	26	0	70	30	Increasing gravel/stones, coarser till material. Sub-angular stones (0.5-7cm). Dark brown-grey in color.		
BH 03	26	30	0	20	80	Light-medium grey, fine grained, silty till (increasing clay, decreasing gravel. Stones range from 0.5-8cm. Better recovery (less cobble ~10%)		
BH 03	30	34	0	20	80	Light to medium grey, fine grained, silty till. More larger stones than above (1cm-8cm). Stones are sub-angular to subrounded. Increasing roundness and clay-like material. Probably a fluvial environment. ~70% recovery (30% unrecovered cobble. Avg stone size (~4-5cm)		
BH 03	34	36	0	30-40	60-70	Light-medium grey, very fine grained, silty till. Stones decrease in size. Average size ~2-3cm. Stones range in size from 0.5-4cm. Till is clay-like and often clumps.		

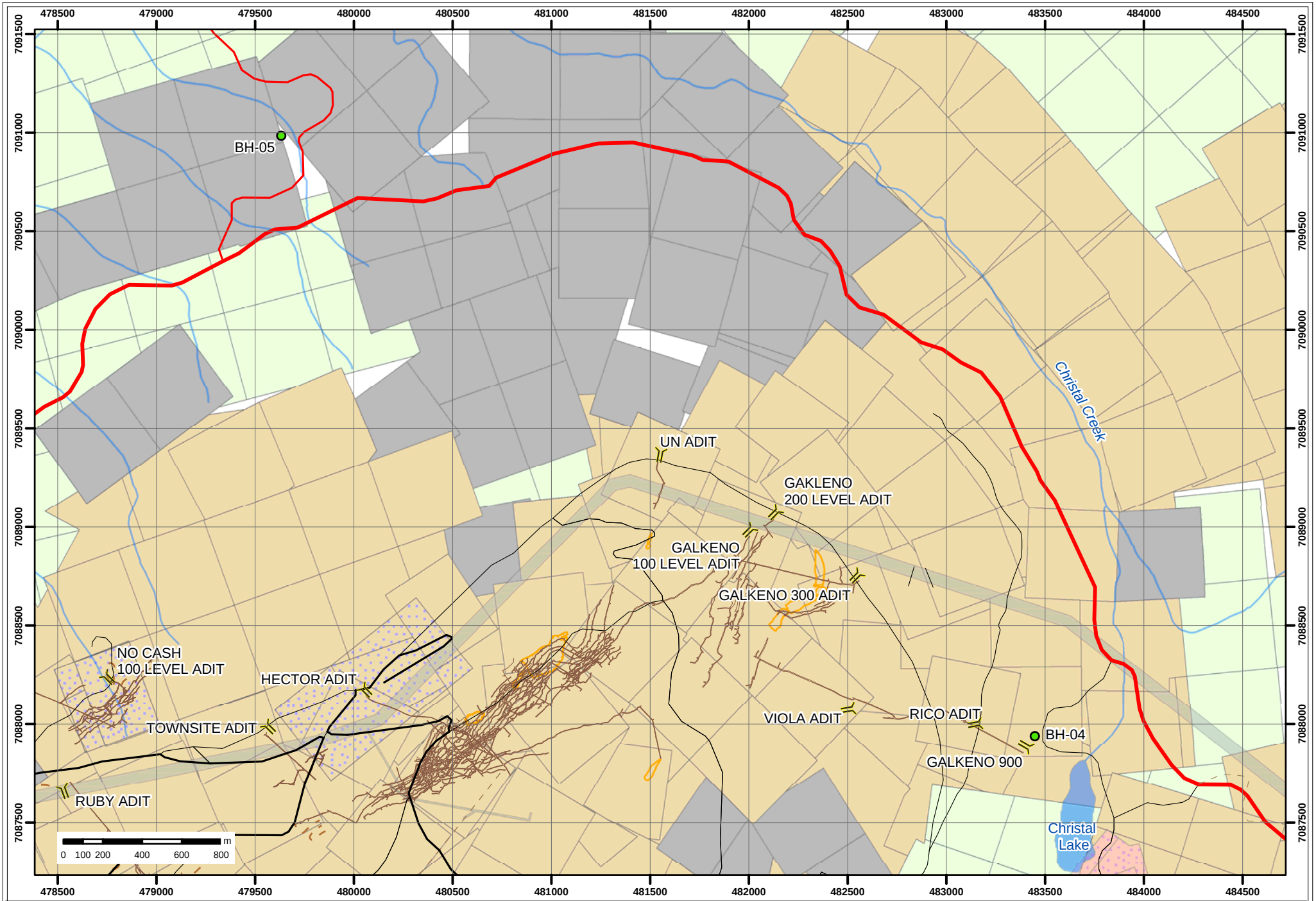
Notes from Driller (Glen): Down stream of dyke. No drill stability. All easy drilling until the end of hole. Stopped because couldn't get the casing out. Didn't hit bedrock

Alexco Resource Corp.			Overburden Drilling Log			08V 0483448, 7087938	Date: August 31, 2006	Logged By: Christine Hann
Hole ID	From (ft)	To (ft)	Permafrost %	Gravel %	Till %	Description		
BH 04	0	8	0	5	95	Fine grained, light to medium brown till. Clay like (soft to touch). Stones range in szie from 0.5-4cm, averaging ~1cm. Mostly subangular to subrounded. Slightly oxidized. Poor recovery (Mostly unrecoverable cobble)		
BH 04	8	16	0	5	95	Very fine grained, medium-dark brown clay like till. ~15% recovery (85% unrecoverable Cobble)		
BH 04	16	24	0	10	90	Very fine grained, caly light, light brown-grey till. Sub angular to subrounded. Stones range in size from 0.5-10cm, averaging about 1cm. The larger stone probably part of a boulder that was hit at ~18ft. Recovery ~70%.		
BH 04	24	27	0	15	85	Very fine grained, clay like till. Light grey with a little light brown, slightly oxidized till as well. Increased number of small gravel/stones which range in size from .1-6cm. Averaging in size at about 1-2cm. Better recovery ~75%.		

Notes from Driller (Glen): Galkeno. 27ft to bedrock. Hit boulder at 18ft (white/black granite)

Alexco Resource Corp.			Overburden Drilling Log			08V 0479632, 7090984	Date: August 31, 2006	Logged By: Christine Hann
Hole ID	From (ft)	To (ft)	Permafrost %	Gravel %	Till %	Description		
BH 05	0	8	0	10	90	Very fine grained, medium to dark brown, silty to clay like till. Gravel is angular to subangular. Till is often stuck together in clumps that fall apart when touched. Gravel/stones are from 0.5-3cm. Average size ~1cm. Slightly Oxidized		
BH 05	8	16	0	20	80	Very fine grained, partially oxidized, partly unoxidized. Stones/gravel increase in sixe. Sub-angular-sub-rounded, ranging rom .5-7cm. Averaging in size ~2cm.		
BH 05	16	24	0	10	90	As above, but with more larger stones/gravel. Sub-angular to sub-rounded. Very clay rich. This piles hasn't been oxidized and is more grey in color. Till is a little coarser grained than above. Gravel ranges from 1-7cm in size. Most stones are larger (5-6cm). Till is sandier; decrease in clay.		

Notes from Driller (Glen): Easy drilling. Nice gravel at 21ft. Started to get harder clay before bedrock. At 24', reached bedrock (retrieve pieces in sample). Drilled ~2ft into bedrock.



Legend

- Borehole
- Town
- Adit
- Silver Trail
- Duncan Creek Road, Hanson Lake Road, South McQuesten River Road
- Keno Hill Roads, Galena Road
- Limited-use road
- Trail
- Watercourse
- Underground Workings
- Pit
- Valley Tailings
- Powerline Easement
- Waterbody

United Keno Hill Mines

- UKHM Quartz Claim
- 650399 BC Ltd. Quartz Claim
- Crown Grant

Placer/Land Interest over United Keno Hill Mines Claims

- Land Disposition on United Keno Hill Mines Claim
- Placer Claims on United Keno Hill Mines Claims
- Fee Simple Title on United Keno Hill Mines ClaimS

Other Mineral/Placer/ Land Interest

- Land Disposition
- Placer Claims and Leases
- Fee Simple Title
- Quartz Claim

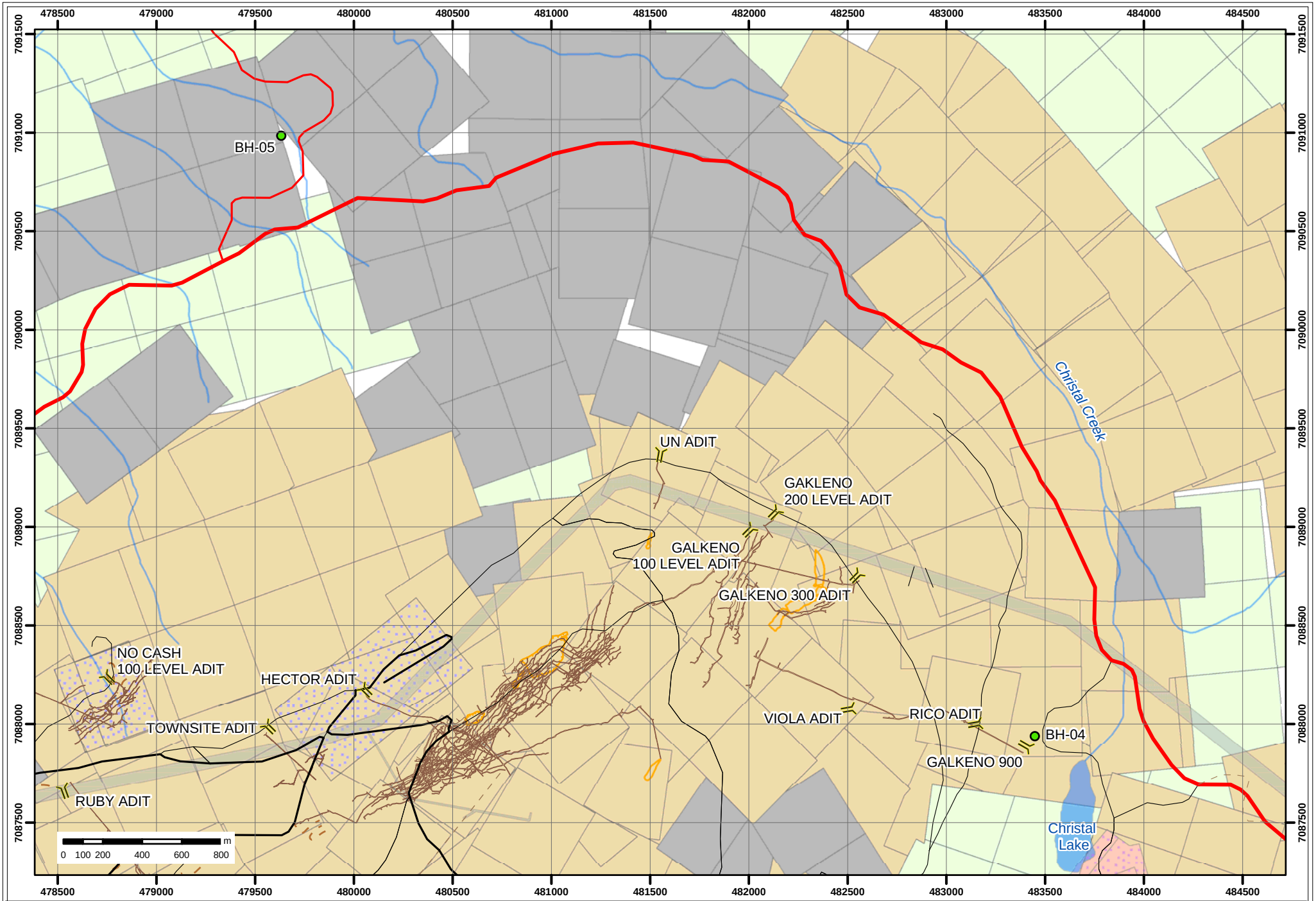
UTM Zone 8 NAD83

August 2006
Borehole Locations
Galkeno 900/Hanson Road

FIGURE 13

ALEXCO

ACCESS MINING & INFRASTRUCTURE GROUP



Legend

- Borehole
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