Memorandum

Date: June 6, 2011

To: Kelly Boutilier, Licensing Officer, Yukon Water Board

From: Jim Harrington, ERDC

Subject: Proposed Silver King Dewatering Activities

Pursuant to ERDC's Care and Maintenance Water Use Licence QZ06-074, Clause 35, please accept this letter as a notice of a minor modification to the water collection and treatment system at the Silver King site. To this end, Alexco Resource Corp., through its subsidiary Keno district care and maintenance company, Elsa Reclamation and Development Company (ERDC), proposes to undertake temporary dewatering of the Silver King 100 adit and related activities under its existing Type B Water Licence (QZ06-074). This notification provides context for the proposed activity, outlines the dewatering plan and discusses its advantages and management of potential risks associated with the activities.

1. Background

The discovery of significant mineralization around Silver King occurred in 1912. A number of operators mined both underground and from surface pits during ensuing decades. The workings on the 1, 2 and 3 veins were developed through shafts several decades before the adit was developed in the early 1980s to access silver resources on the 4 vein and the ramp was driven in the 1990s to access the 5 and 6 veins. The upper portion of the 1, 2 and 3 veins were mined from the surface in the late 1980s as an open pit.

The last operator of the Silver King mine was United Keno Hill Mines Ltd, which produced a considerable amount of silver from the mine during the 1980s. The Silver King mine was closed

when UKHM ceased operations in the district due to rising costs, production shortfalls and declining silver prices. During the UKHM exploration work in the mid-1990s to evaluate re-opening the Keno District, a surface and underground drilling and development program was reinstated between May 1994 and April 1995, during which the Silver King mine was dewatered. After this program, the mine was allowed to re-flood and has remained flooded and free draining from the 100 level adit.

Through ERDC, Alexco undertakes care and maintenance activities at the Silver King site. Alexco also conducts exploration on Silver King and its other Keno properties through its subsidiary production mining company, Alexco Keno Hill Mining Corp. The Silver King site, like many in the Keno Hill District, is subject to multiple planning and maintenance initiatives and their subsequent authorizations; planning for activities at the Silver King site is therefore a complicated process. The care and maintenance activities at the site present a backdrop for both closure planning and further development planning. To this end, efficiencies between the planning and maintenance programs are being sought and potential conflicts are being identified for consideration and discussion.

In the draft closure options report, the Silver King mine is identified as having several long term water treatment options. Two options under consideration are in situ mine pool treatment, and active water treatment with a sub-option of seasonal water treatment where the mine pool could act as a wintertime reservoir where no treatment would occur, and an active treatment period during spring, summer, and fall. For both of these options, a refined understanding of the mine pool hydrogeology would be beneficial in two ways: understanding the mine reactive volumes would help in situ mine pool treatment, and understanding the total volume and refill rate of a dewatered mine pool will help assess the extent that wintertime storage could allow for seasonal water treatment operation.

1.1 Silver King Hydrology and Water Quality

Water flow through the 100 Adit (see figures in Appendix 1) and out of the portal occurs at a seasonally varying rate between approximately 4 and 12 L/s (346 m^3/d and 1,037 m^3/d, respectively). A summary of historical flow data from the Silver King mine is presented below as Table 1, while a graph showing Silver King discharge between June 2006 - December 2010 is shown on Figure 2.

Table 1 Statistical Summary of Historical Flow Measurements from Silver King Adit at KV-14, January 1994 – February 2011

Average	6.20 L/s	535.7 m^3/d
Count	899	-
Minimum	1	-
Maximum	12.96 L/s	1119.7 m^3/d
Standard Deviation	1.90 L/s	164.2 m^3/d
1st Quartile	4.85 L/s	419.0 m^3/d
Median	6.25 L/s	540.0 m^3/d
3rd Quartile	7.25 L/s	626.4 m^3/d

Much of the seasonal variation in water outflow is assumed to be the result of meteoric waters flowing into the historic workings via the open pit. The available maps do not indicate any direct connection between the development for veins 1, 2 and 3 and the adit or ramp, but it is assumed there is hydrological connection.

A lime addition water treatment plant was constructed prior to the dewatering program for underground exploration and development by UKHM in 1994-1995. Water has been treated from the Silver King mine since that time. An upgrade to the water treatment system was conducted by ERDC during 2007 as a result of condition 37 of Water Use License QZ06-074 requiring that all settling ponds be lined with an impermeable membrane. Two new lined settling ponds were constructed to meet this requirement.

A wooden cofferdam was constructed by UKHM to create an intake for the pipe which conveys water from the 100 adit to the water treatment ponds. In addition to this constructed barrier, site investigations have shown that groundfall behind the cofferdam has formed additional barriers in the adit. The cofferdam and groundfall barriers are impounding water to a depth of one or more meters, and the plywood coffer dam is in poor repair and is of questionable integrity.

2. Dewatering Plan

The proposed dewatering activities include:

- Dewatering the Silver King 100 level adit to enable removal of historic cofferdams and groundfall; and

- Dewatering the existing underground workings down to 790m elevation if possible.

2.1 Procedure

Alexco proposes to lower the mine water pool initially several meters below the adit level. A borehole was installed in the 1980s to deliver backfill to the underground workings. This borehole is open with water in the bottom. ERDC will use a well sounder to confirm the elevation of water in the borehole and a saline tracer to confirm a hydrologic connection with the adit. If the connection exists, a well pump will be installed in the borehole with discharge line run to the existing water treatment plant. The pump will be used to lower the mine water pool as far below the adit level as possible, eliminating flow out through the portal and significantly reducing the volume of water impounded behind the ground fall(s). Once the water level is below the adit level additional time will be allowed to dry out the fallen rock as much as practical. A mining contractor will then proceed to rehabilitate 350 meters of the adit by digging through the fallen ground and installing additional support as required. Sludge from behind the coffer dam will be vacuum pumped or removed mechanically and managed according to the District Sludge Management Plan – specifically, it will be deposited in the pre-existing sludge cells in the Valley Tailings Area. Removed rockfall from the adit will be relocated to the Silver King Pit, across the Silver Trail Highway to the south, or the former sludge pond areas near the existing treatment ponds.

In the event that a hydrogeological connection does not exist and/or the borehole pump is not feasible, Alexco proposes to drill a dewatering hole to the 790 level to intersect a stope on the lowest level of the mine, allowing complete dewatering of the mine.

alternatively to sequentially pump down the impounded water behind each ground fall as encountered. A mining contractor would be used to rehabilitate the adit up to the first ground fall and then place a suction line over the top of the fall, or drive a drain pipe through the fallen rock, to lower the water level behind the fallen ground. This process would be repeated as often as necessary until the adit was repaired for the full 350 meter distance to the top of the ramp.

Dewatering the mine may increase TSS levels in the discharged water. The suspended solids will be managed by the addition of ferric iron to aid settling of the suspended solids. An alternative may be to add a multimedia filter, similar to that installed at Bellekeno 625, or clarifier similar

to what is located at Galkeno 300, to remove suspended solids and thereby ensure water quality discharge standards are met.

Dewatering the mine through the existing borehole or through a new borehole is preferred both for rehabilitation efficiency and less suspended solids generated which will improve water quality compliance. In either option the dewatering rates can be managed at a rate that would allow the treatment plant to be operated in compliance with water quality standards. A summary of mine dewatering is provided as Table 2. Based on three-dimensional reconstruction of historical mine drawings, approximate volume estimates have been prepared and are estimated in Table 2.

Table 2 Water volume estimates

	Estimated % of Total	L/sec	L/hour	m^3/day	m^3	days
Mine Outflow at KV-14	100%	6.2	22,320	536		
Mine Inflows	100%	6.2	22,320	536		
Groundwater Inflows	70%	4.3	15,624	375		
Precipitation/Infiltration via Open Pit (averaged over year)	20%	1.2	4,464	107		
Infiltration from Galena Creek (Well + 75 level Adit) (averaged over year	10%	0.6	2,232	54		
Mine Dewatering						
Base Flows		6.2	22,320	536		
Pumping Rate above base flows		5.0	18,000	432		
Treatment Capacity		15.0	54,000	1,296		
Dewatering Rate		11.2	40,320	967.7		
Underground Pool Volumes and Duration of Dewatering						
Impounded by Cofferdams					6,000	14
Remaining 100 Level					6,000	14
Below 100 Level					40,000	93
Total					52,000	120

The mine would be held in a dewatered state for a period of up to one year to determine the true base flow in the dewatered state. This determination of base flow in a dewatered state after an equilibrium condition has been achieved will be used to determine the annual dewatering potential for seasonal treatment. In addition, this will help Alexco determine what dewatering requirements might be experienced if Silver King is mined in the future. Water quality information that is already routinely collected will be used to compare the water quality

effects of dewatering the mine. After a year of holding the mine in a dewatered state, the mine would be allowed to refill and the fill curve studied to understand volumes by level. Water quality samples will be collected during the re-filling to understand any potential effects from the dewatering project.

2.2 Rationale and Implications

1. The proposed dewatering activities to clean out sludge and groundfalls on the 100 level and to study the mine hydrogeology relates to both care and maintenance of the Silver King mine pool water treatment system and closure planning for the Silver King site. If advanced exploration is undertaken, a WUL will be applied for to treat water from Silver King that is affected by exploration and development activities. The initial dewatering has several expected benefits for current water treatment systems operation and for closure planning: Reducing existing risks associated with uncontrolled release (resulting in bypass of the current treatment facility) of impounded water and sludge to the receiving environment as a result of failure of the cofferdam or rockfalls;

2. Lowering metal levels in mine discharge during the dewatering program;

3. Developing water storage capacity that could be used should the water treatment plant operation be interrupted for any period of time; and

4. Developing a better understanding of mine inflows, and recharge rates. This information will be used for development of closure planning options under the Keno District Closure Plan. For instance, the relative amount of mixing with the 1,2, and 3 veins with the 4, 5, and 6 veins is unknown, as is the recharge rate from the surface pit workings. Similarly the connection of Galena Creek to the more recent workings area on the 4, 5, and 6 veins is also unknown. Inspection of water inflows in the area where the 100 level workings intersects Galena Creek may provide insight about where and how surface waters recharge the mine workings.

Metal levels are expected to decrease once the Silver King mine is dewatered. This is because recharge water contact with mineralized material is minimized as the mine is dewatered. By way of comparison, recent experience with the Bellekeno dewatering further substantiates that metals concentrations decrease as a result of dewatering. Before dewatering began, Alexco correctly predicted that metals concentrations would decrease during dewatering of the

Bellekeno mine, where total zinc (as the primary element of concern) was reduced from an average of about 7 mg/L zinc to approximately 1 mg/L after dewatering (see Figure 3). Current metal concentrations from Silver King drainage are significantly lower than Bellekeno metal concentrations prior to dewatering (Figure 4). Based on a similar proportional reduction in metal levels at Silver King, minimal treatment for metals may be required for mine water while it is in a dewatered state. Lower metal concentrations in mine discharge will benefit care and maintenance by lowering the amount of lime needed for water treatment.

Pumping down the mine pool will create an underground storage capacity, which may be particularly useful during freshet or periods of high surface inflow. This would allow for additional storage of untreated water while treatment operations/equipment are modified or repaired and create additional redundancy to the system. The Silver King mine, with apparent significant inputs from surface flows, exhibits significant variance in flow rates in response to these inputs (i.e. freshet or storm events), as compared with other mine pools in the district which recharge only from ground water.

There is an estimated 5,000 to 7,000 m^3 of water impounded behind the ground fall(s) in the Silver King adit, which poses some risk of uncontrolled release. Another aspect of the proposed program which will benefit care and maintenance activities is a reduction of mine water inflows. These inflows are accepted to be comprised of at least three sources, including: (1) groundwater inflows, (2) precipitation/infiltration of meteoric runoff via hydraulic connection with the open pit and subsidence areas, and (3) possible infiltration from Galena Creek via a groundwater well, fractures or vein structures that are exposed in the Galena Creek bottom, and possibly direct inflows through the 75 level adit. Estimates of the approximate percentage of total inflows from these sources are shown above in Table 2. In order to reduce mine inflows to Silver King, Alexco proposes to construct, using ditching and berms, as appropriate, a earthen diversion structure above the Silver King open pit/subsidence areas to divert meteoric runoff water around the site to Galena Creek to the west and around the site to the east (see Appendix 1). An estimate of 20% of total mine inflows has been assigned to mine recharge from meteoric runoff based on the approximate area of the recharge basin multiplied by the mean annual runoff for the district.

The possibility of hydraulically sealing the 75 level adit and well and/or other methods of reducing infiltration from Galena Creek to ground are currently being investigated through the district closure plan. If mine development plans are advanced, the need for hydraulic seals to prevent inflow of water from Galena Creek through the 75 level will be further assessed. Direct

assessment of surface inflows into the mine workings from visual inspection of the underground workings in the area of the Galena Creek will be possible as dewatering is accomplished. An estimate of 10% of mine inflow has been assigned to mine recharge from infiltration from Galena Creek, but as an instantaneous rate it is possible that Galena Creek direct recharge may provide much of the spike in water flows observed around storm events or during freshet.

Because of increased hydraulic gradients created by mine dewatering, a temporary increase in natural inflow from groundwater is expected. The amount of sustained increase after a new equilibrium has been established is one question that will be answered by this dewatering test. An increase in flows has been experienced as a result of dewatering the Bellekeno Mine but determining the amount of flow increase is somewhat confounded by the additional development area which has periodically encountered localized drainage, which has tended to dissipate with time. We believe that the amount of flow reduction that results from the proposed water diversions around the pit may be nearly equivalent to any amount of increased sustained groundwater recharge due to lowering the pool elevations, thus we do not believe any sustained increase of flows will be realized due to these offsetting effects.

Dewatering the Silver King mine pool will aid in development of closure options for the District Wide Closure Plan, providing valuable information on mine inflows and recharge rate curves. Mine pool treatment is among the options currently being considered for closure of Silver King (and other mines in the district), and this information will be valuable for this planning, and if Silver King becomes a mine again, mine pool treatment may be part of its final closure.

A permanent engineered intake structure will be constructed in the 100 level adit as an intake for the water treatment system when the mine ceases to be dewatered. The exact design of this feature cannot be determined until the area has been dewatered and the underground conditions are assessed.

3. Regulatory and Assessment Context

Water sourced from the Silver King 100 adit is managed pursuant to the existing Water Licence QZ06-074. ERDC proposes that the Silver King dewatering activities described in this memo (dewatering to the 790 level) are not inconsistent with the assessment of – and activities covered by – the existing licence. The application for QZ06-074 included discussion of the requirement for the development of a district Closure Plan, and the implications for this on the

proposed care and maintenance activities. The environmental assessment by YESAB of the project proposal contemplated, among others, the following accessory activities that complemented principal activities related to water use and treatment:

- Removal and clean up of infrastructure related to adits, adit structure facilities
- Waste water treatment studies and test programs related to potential closure design options

These were then subsequently included in the Water Use Licence Application for QZ06-074.

Alexco and ERDC recognize that dewatering of the Silver King workings while development activities are generating new waste is beyond the scope of care and maintenance activities and related closure studies and therefore it is conservative to assume will require a new Type B Water Use Licence. An application for this with supporting information will be submitted separately if Alexco determines that advanced exploration activities will be pursued.

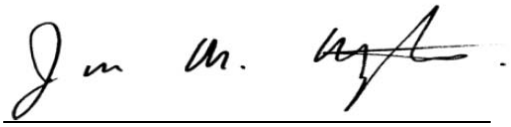
The Keno Hill District Adaptive Management Plan (AMP) was developed as per clause 22 of QZ06-074, and updated in February 2009 under QZ07-078 to include measures for dewatering the Bellekeno Mine. Adaptive management measures for the proposed dewatering activities have been incorporated into this revised Keno District AMP, which is attached to this memo. This plan anticipates potential risks associated with the dewatering activities, and presents staged responses in an adaptive management framework should various situations be encountered.

4. Certification

Should you have any questions regarding this report, or if you require further information, please contact the undersigned, or Scott Keesey at Access Consulting Group in Whitehorse, Yukon, at (867) 668-6463.

Respectfully submitted,

Elsa Reclamation and Development Corp.



James (Jim) Harrington,

VP Environment, Alexco Resource Corp.

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D. Buyck, Lands Manager, NND-FN
A. Kyle, Mine Licensing Officer, YG EM&R
J. Berkers, INAC

Internal cc: B. Thrall
T. Fudge
E. Allen
D. Petkovich
S. Keesey
R. Schneider
S. Davidson

5. Figures

Figure 1

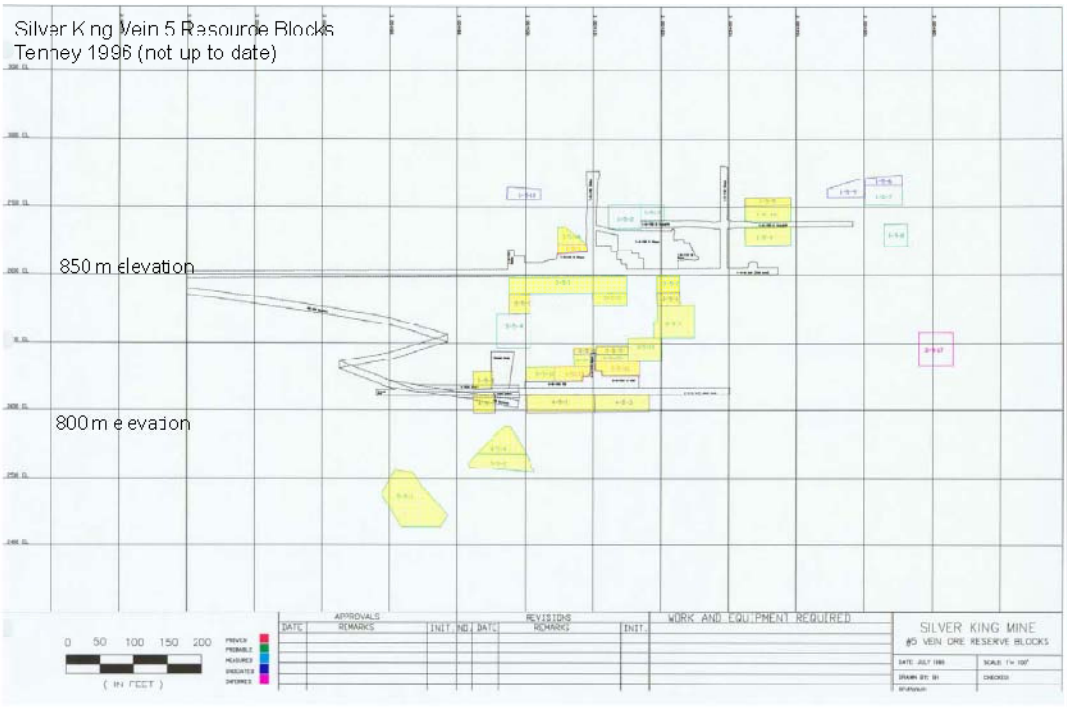

Figure 2

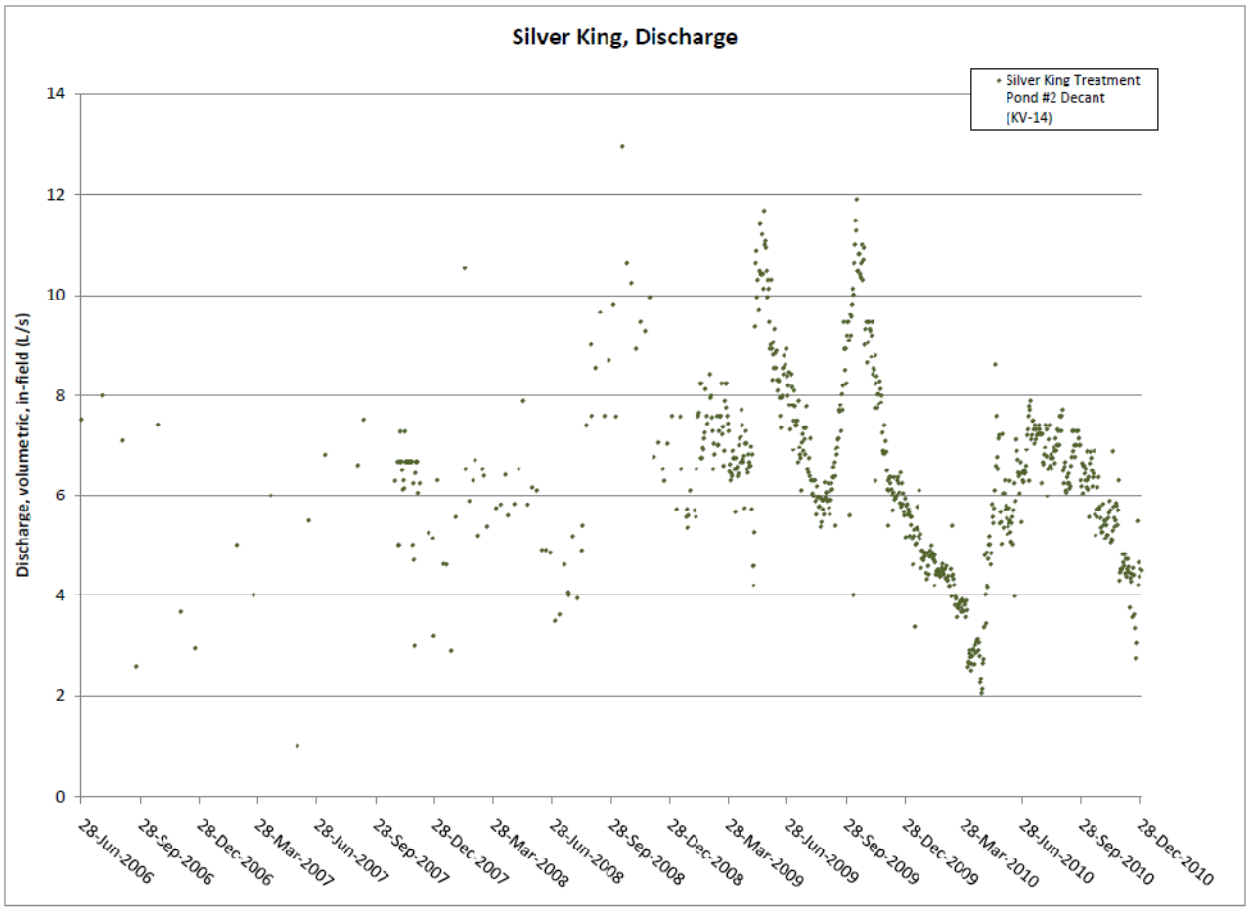

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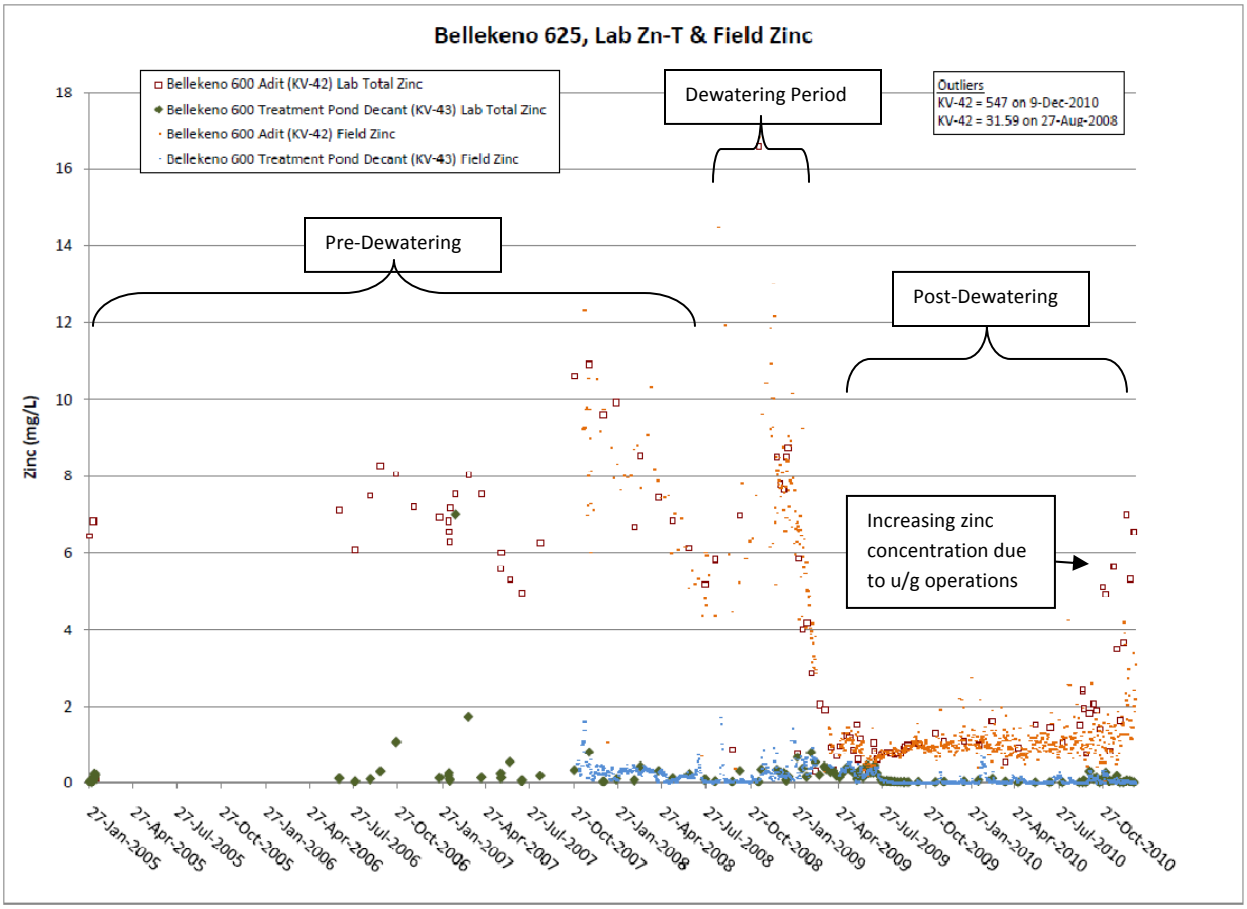
Figure 3


Bellekeno 625, Lab Zn-T & Field Zinc
Bellekeno 600 Adit (KV-42) Lab Total Zinc
Bellekeno 600 Treatment Pond Decant (KV-43) Lab Total Zinc
Bellekeno 600 Adit (KV-42) Field Zinc
Bellekeno 600 Treatment Pond Decant (KV-43) Field Zinc
Dewatering Period
Outliers
KV-42 = 547 on 9-Dec-2010
KV-42 = 31.59 on 27-Aug-2008
Pre-Dewatering
Post-Dewatering
Increasing zinc concentration due to u/g operations
Zinc (mg/L)
0
2
4
6
8
10
12
14
16
18
27-Jan-2005
27-Apr-2005
27-Jul-2005
27-Oct-2005
27-Jan-2006
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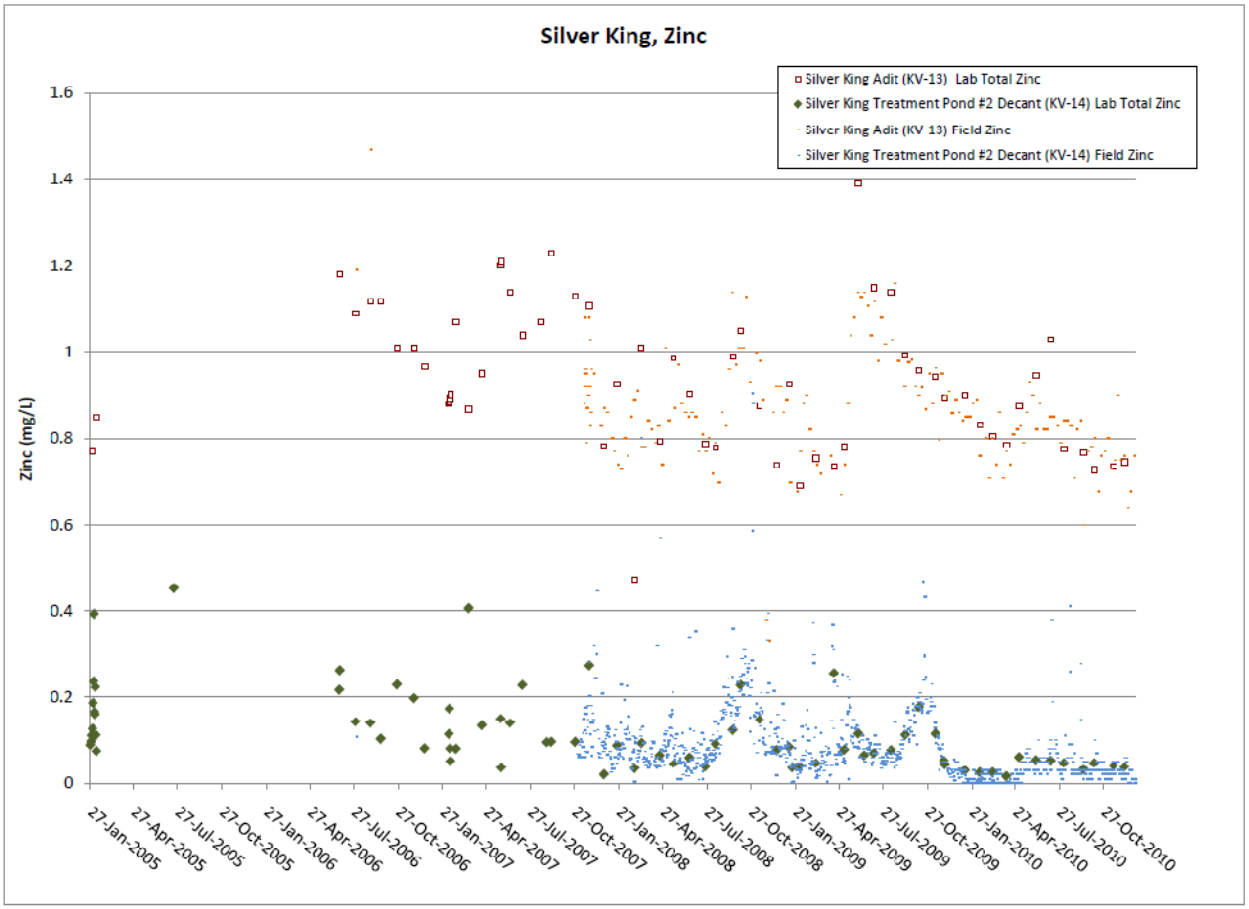
27-Oct-2010

Figure 4


Silver King, Zinc
Silver King Adit (KV-13) Lab Total Zinc
Silver King Treatment Pond #2 Decant (KV-14) Lab Total Zinc
Silver King Adit (KV-13) Field Zinc
Silver King Treatment Pond #2 Decant (KV-14) Field Zinc
Zinc (mg/L)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
27-Jan-2005
27-Apr-2005
27-Jul-2005
27-Oct-2005
27-Jan-2006
27-Apr-2006
27-Jul-2006
27-Oct-2006
27-Jan-2007
27-Apr-2007
27-Jul-2007
27-Oct-2007
27-Jan-2008
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27-Jul-2008
27-Oct-2008
27-Jan-2009
27-Apr-2009
27-Jul-2009
27-Oct-2009
27-Jan-2010
27-Apr-2010
27-Jul-2010
27-Oct-2010

APPENDIX 1

Preliminary Engineering Design Memorandum

Head Office

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May 31st, 2011

Carola Scheu
Manager
Yukon Water Board

Troy Searson
Water Inspections Officer
YG Water Resources

License Number: QZ06-074
Subject: Minor Modification – Silver King Dewatering

I have reviewed the Proposed Silver King Dewatering Activities Memorandum developed by Elsa Reclamation and Development Corp (ERDC). In addition, on May 26th, I visited the Silver King mine to measure distances and create a preliminary schematic, complete with pump and pipe flow calculations, to accompany this modification. As part of this effort, I've identified the pumping and control equipment needed to ensure that the discharged water meets the standards listed in Part E, line 25 of water license QZ06-074. This letter captures the preliminary engineering design work needed to implement this modification.

Per Section 2.1 of the Memorandum, Alexco plans to initially access the Silver King mine pool through an existing borehole that was established in the 1980s. On May 26th, the distance from the ground surface to water through this borehole was measured at 33.34 metres. Since the overall goal is to dewater the mine pool down to the 790 Level, a second borehole may be needed if the first borehole does not connect to the required depth. Figure 1 shows a screen capture of the second proposed borehole in blue extending to the 790 Level.

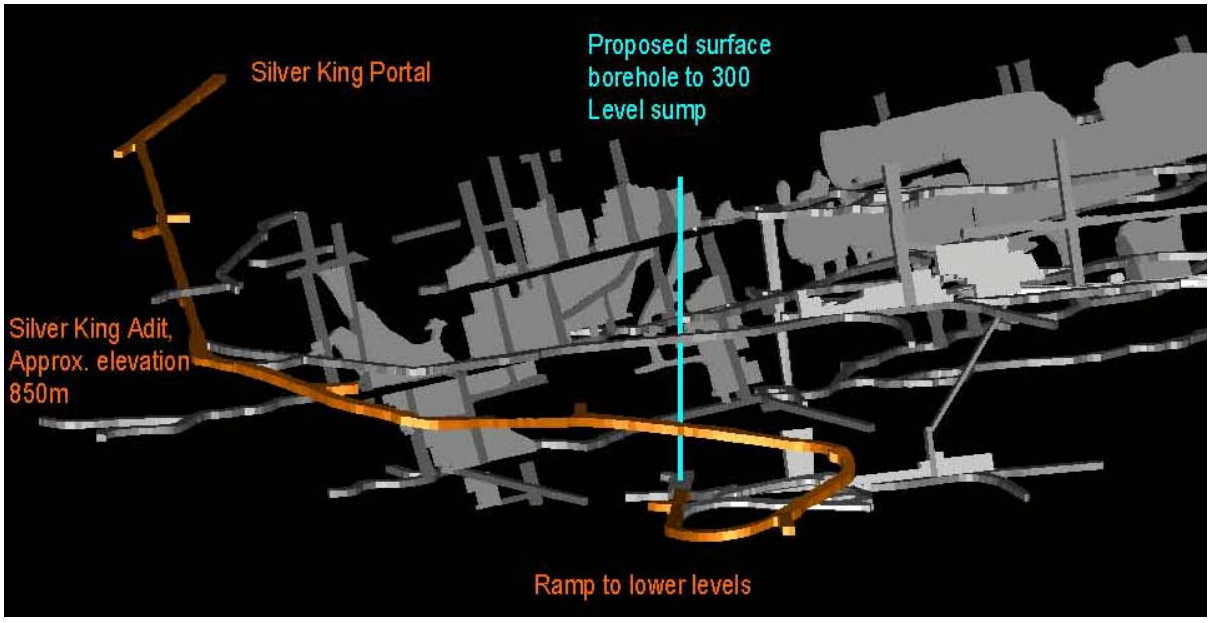

Figure 1 - Proposed Borehole

The estimated distance of the proposed borehole from the ground surface to the 790 Level is between 100 and 110 metres. This elevation gain, known as the static head, is incorporated in the pump calculations on page six of the included schematic. This elevation gain will be used when sizing the submersible pump. In addition, as stated in Table 2 of the Memorandum, the maximum treatment capacity of the existing Water Treatment Facility is 15 lps (Litres per Second). Therefore, assuming that a hydrogeological connection exists between the adit discharge and the borehole, eventually all water from the Silver King mine will be transported to the treatment facility through the dewatering system. This will allow the Silver King adit to be rehabilitated by the removal of the existing wooden coffer dam and fallen ground. Alexco plans to operate the dewatering system at a flow rate between 12 to 15 lps.

The submersible pump needed to dewater the mine pool could be powered in one of three ways. Roughly 250 metres to the northwest of the existing borehole is a powerpole that has a transformer connected to grid power. In addition, roughly 350 metres to the northwest of the existing borehold is the Silver King electric sub-station that also contains grid transformers. At both these locations, Alexco should have access to sufficient grid power for the selected submersible pump. As a final option, Alexco could decide to use a diesel powered generator to power the submersible pump since the dewatering duration is minimal.

For this application, a minimum of 3" inside diameter HPDE pipe is recommended for transporting the collected water to the water treatment facility. Page four of the included schematic shows the suggested piping path for transporting the collected water from the borehole to the treatment facility. The total distance between these two locations is roughly 590 metres. Page 5 of the included schematic shows a process flow sheet where the mine water is pumped via a submersible pump to ground surface, and then piped to the water treatment facility. Because the water treatment facility is located roughly 60 metres in elevation lower than the ground surface of the existing borehole, water will flow via gravity once it is pumped from the mine. These discharge flow calculations are shown on page eight of the included schematic.

It is recommended that a throttling valve and a flow meter be installed at the discharge of the dewatering system to control the incoming flow rate and balance the Silver King adit drainage water with the pumped mine water so that the combined total is limited to the maximum capacity of the treatment facility, or 15 lps. This will allow the treatment operators to carefully control incoming flow rates and maintain treatment compliance. It is assumed that eventually all drainage from the Silver King adit will be slowed and then eliminated as the mine pool level is lowered.

The distance from ground surface to the current water level in the mine was recently measured at 33.34 metres. Therefore, when the system first begins operation, dewatering may occur by siphoning water from the mine pool since the water treatment location is much lower than the current water level. Page five of the included schematic shows a manually operated valve located at the ground surface near the borehole that could be opened if needed to allow air into the system and break the siphon.

ALEXCO

As stated in Section 2.1 of the Memorandum, there is a possibility that dewatering the mine may increase the Total Suspended Solids (TSS) levels in the collected water. If TSS decreases or minimally changes, Alexco will run the system as it is currently. If it increases, settling aids, such as ferric iron and flocculant, should be added at the rapid mix tank. These changes should improve settling in Pond 1 and Pond 2 prior to discharge. If the TSS levels drastically increase, Alexco should stop dewatering and install either a clarifier or a Multi-Media Filter (MMF) to aid in TSS removal. In the past, Alexco has worked with Met-Chem Inc. for the design and purchase of a clarifier and Yardney Water Management Systems, Inc for the design and purchase of a MMF. Both these vendors have been contacted, and the lead-time for this equipment ranges between 5 to 10 weeks.

If you have any questions regarding this information, please feel free to contact me.

Sincerely,

PROFESSIONAL ENGINEER YUKON TERRITORY ERIC J. LANCASTER

5/31/2011

Eric J. Lancaster, P. Eng

Project Manager
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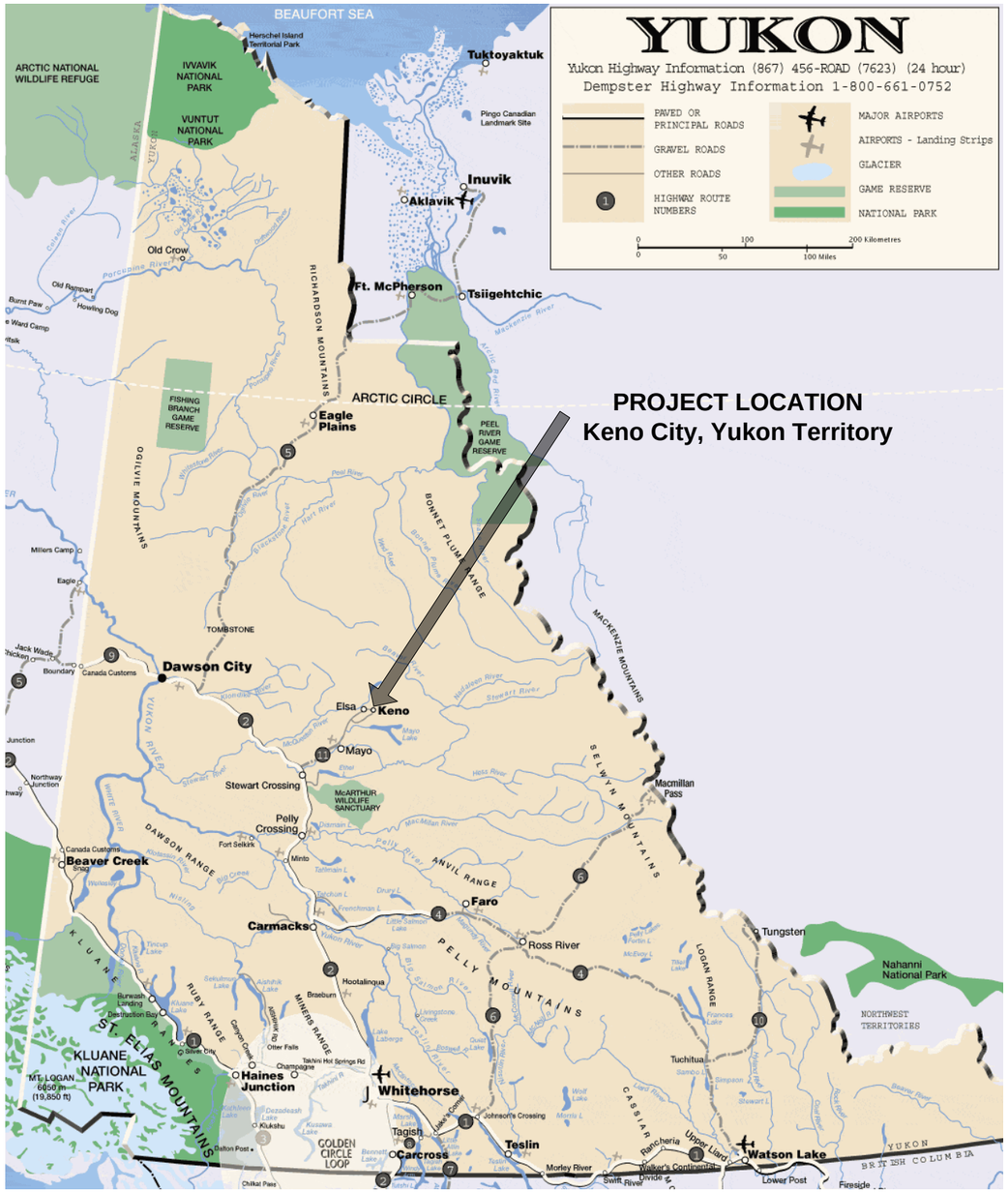
D. Buyck, Manager, Lands, FN NND ,
A. Kyle, Mine Licensing Officer, YG EM&R
J. Berkers, INAC

Internal cc: B. Thrall,
T. Fudge
J. Harrington,
R. Schneider,
S. Davidson,
S. Keesey,

Attachments:

Silver King Dewatering Schematic

REV.	DESCRIPTION	DATE	BY
A	INITIAL RELEASE	5/31/11	EJL



LOCATION MAP

SCALE: NONE

DESCRIPTION: COVER SHEET

ALEXCO

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88 Inverness Circle East, Suite N - 102
Englewood, CO 80112
Main Office: 303.862.3929
www.alexcoresource.com

Scope:
Modification to the existing water license for the dewatering of Silver King to the 790 Level.

Silver King Dewatering
Care and Maintenance Minor Modification

Alexco Resource US Corp
Water Transfer System Designer: Eric Lancaster, PE - Project Manager
Reviewer: Jim Harrington - President Engineering

Rev. Date	SIZE	FSCM NO	DWG NO	REV
5/31/2011	B		3110-01	A
NOT TO SCALE	SCALE N/A		SHEET 1	

REV.	SHEET	DATE	BY
A	2	5/31/11	EJL

LIST OF DRAWINGS

DISCIPLINE	SHEET NO.	TITLE	REVISION NO. & DATE
GENERAL	1	COVER SHEET	
	2	LIST OF DRAWINGS	
	3	CONDITIONS OF WATER LICENSE	
	4	PROPOSED PIPING LAYOUT	
MECHANICAL	5	PROPOSED PROCESS FLOW SHEET	Rev. A (TBD)
	6	PIPING AND INSTRUMENTATION LEGEND	ALL DRAWINGS
	7	DEWATERING PUMP CALCULATIONS	
	8	DISCHARGE FLOW CALCULATIONS	
REFERENCES	9	APPENDICIES / DATASHEETS	

DESCRIPTION
LIST OF DRAWINGS

REV.	SHEET	DATE	BY
A	3	5/31/11	EJL

Silver King
Water Specifications

Conditions of Water License QZ06-074

PART E - EFFLUENT QUALITY STANDARDS		
		Water License
Item #	**Parameter**	**Maximum Concentration in a Grab Sample Measured in mg/L**
1	pH	6.0 - 9.5 pH Units
2	Suspended Solids	25.0 mg/L
3	Arsenic (total)	0.50 mg/L
4	Cadmium (total	0.05 mg/L
5	Copper (total)	0.30 mg/L
6	Lead (total)	0.20 mg/L
7	Nickel (total)	0.50 mg/L
8	Silver	0.10 mg/L
9	Zinc	0.50 mg/L

DESCRIPTION
CONDITIONS OF WATER LICENSE

REV.	SHEET	DATE	BY
A	4	5/31/11	EJL

DESCRIPTION

PROPOSED PIPING LAYOUT

REV.	SHEET	DATE	BY
A	5	5/31/11	EJL

Silver King Dewatering Schematic

Manual Anti-Siphon Valve

Power from Genset or Grid

Silver Trail Highway

Estimated ground contour

Smaller Culvert

Galena Creek

100 – 110 Metres

Silver King 790 Level

Ferric Iron (if necessary)

Flocculant (if necessary)

Silver King Adit Discharge

60 Metre elevation difference

DESCRIPTION

PROCESS FLOW SHEET

REV.	SHEET	DATE	BY
A	6	5/31/11	EJL

PRIME MOVERS FOR MOTOR DRIVEN EQUIPMENT


SUBMERSIBLE PUMP


AGITATOR OR MIXER


METERING PUMP

INSTRUMENT LINE SYMBOLS

PNEUMATIC LINE

120V A/C 1-PHASE

240V A/C 1-PHASE

575V A/C 3-PHASE

PIPE LINE DESIGNATIONS


3" HDPE


3" OR 4" PIPE

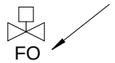

ADIT PIPELINE


LIME SLURRY TUBING

PIPING ACCESSORIES AND DETAILS


90° IPS Tee

SYMBOLS FOR VALVE ACTION IN THE EVENT OF ACTUATOR POWER FAILURE



SYMBOL LOCATED BY VALVE – USED ONLY WHERE NECESSARY TO INCREASE UNDERSTANDING OF THE SYSTEM.

FO = FAIL OPEN

FC = FAIL CLOSED

FL = FAIL LOCKED

FI = FAIL INDETERMINATE (LAST POSITION)

INSTRUMENTATION

LEVEL SENSOR/ FLOAT SWITCH


FLOW METER


CONTROL PANEL


PROGRAMMABLE LOGIC CONTROLLER

PRESSURE GAUGE

VALVE SYMBOLS


GATE


GLOBE


BALL


BUTTERFLY


CHECK

ADDITIONAL COMPONENTS


LIME MIX TANK


LIME SLURRY STORAGE TANK

DESCRIPTION

PIPING & INSTRUMENTATION LEGEND

REV.	SHEET	DATE	BY
A	7	5/31/11	EJL

CALCULATIONS BASED ON 3" INSIDE PIPE DIAMETER

Total Flow Rate (lps)	Total Flow Rate (gpm)	Velocity (m/sec)	Dynamic Head Loss (m)	Dynamic Head Loss (ft)	Total Head Loss (m)	Total Head Loss (ft)	Max Pressure @ Pump Head (psi)
1.00	15.85	0.22	0.11	0.37	110.08	361.17	161.593
2.00	31.70	0.44	0.41	1.33	110.38	362.13	162.022
3.00	47.55	0.66	0.86	2.82	110.83	363.62	162.688
4.00	63.40	0.88	1.46	4.80	111.43	365.60	163.574
5.00	79.25	1.10	2.21	7.25	112.18	368.05	164.673
6.00	95.10	1.32	3.10	10.16	113.07	370.96	165.976
7.00	110.95	1.54	4.12	13.52	114.09	374.32	167.478
8.00	126.80	1.76	5.28	17.32	115.25	378.12	169.176
9.00	142.65	1.97	6.56	21.54	116.54	382.34	171.065
10.00	158.50	2.19	7.98	26.18	117.95	386.98	173.141
11.00	174.35	2.41	9.52	31.23	119.49	392.03	175.402
12.00	190.20	2.63	11.18	36.69	121.16	397.49	177.846
13.00	206.05	2.85	12.97	42.56	122.94	403.36	180.469
14.00	221.90	3.07	14.88	48.82	124.85	409.62	183.270
15.00	237.75	3.29	16.91	55.47	126.88	416.27	186.247

Constants	
Inside Diameter of Pipe (in)	3
Distance from Pump to Water Treatment (m)	584
Elevation Gain from 790 Level to Surface (m)	110
Hazen-Williams Roughness Constant - plastic	130

SYSTEM WILL BE OPTIMIZED TO FLOW BETWEEN 12 TO 13 LPS, WITH A MAXIMUM FLOW RATE OF 15 LPS.

CALCULATIONS BASED ON 4" INSIDE PIPE DIAMETER

Total Flow Rate (lps)	Total Flow Rate (gpm)	Velocity (m/sec)	Dynamic Head Loss (m)	Dynamic Head Loss (ft)	Total Head Loss (m)	Total Head Loss (ft)	Max Pressure @ Pump Head (psi)
1.00	15.85	0.12	0.03	0.09	110.00	360.89	161.469
2.00	31.70	0.25	0.10	0.33	110.07	361.13	161.575
3.00	47.55	0.37	0.21	0.69	110.18	361.49	161.739
4.00	63.40	0.49	0.36	1.18	110.33	361.98	161.957
5.00	79.25	0.62	0.55	1.79	110.52	362.59	162.228
6.00	95.10	0.74	0.76	2.51	110.74	363.31	162.550
7.00	110.95	0.86	1.02	3.34	110.99	364.14	162.920
8.00	126.80	0.99	1.30	4.27	111.27	365.07	163.339
9.00	142.65	1.11	1.62	5.31	111.59	366.11	163.805
10.00	158.50	1.23	1.97	6.46	111.94	367.26	164.317
11.00	174.35	1.36	2.35	7.70	112.32	368.50	164.875
12.00	190.20	1.48	2.76	9.05	112.73	369.85	165.478
13.00	206.05	1.60	3.20	10.50	113.17	371.30	166.125
14.00	221.90	1.73	3.67	12.04	113.64	372.84	166.816
15.00	237.75	1.85	4.17	13.68	114.14	374.48	167.550

Constants	
Inside Diameter of Pipe (in)	4
Distance from Pump to Water Treatment (m)	584
Elevation Gain from 790 Level to Surface (m)	110
Hazen-Williams Roughness Constant - plastic	130

DESCRIPTION
DEWATERING PUMP CALCS

REV.	SHEET	DATE	BY
A	8	5/31/11	EJL

Total Flow Rate (lps)	Total Flow Rate (gpm)	Velocity (m/sec)	Dynamic Head Loss (m)	Dynamic Head Loss (ft)	Total Head Loss (m)	Total Head Loss (ft)
1.00	15.85	0.22	0.62	2.05	-59.36	-194.75
2.00	31.70	0.44	2.25	7.38	-57.73	-189.42
3.00	47.55	0.66	4.77	15.64	-55.22	-181.16
4.00	63.40	0.88	8.12	26.65	-51.86	-170.15
5.00	79.25	1.10	12.28	40.29	-47.70	-156.51
6.00	95.10	1.32	17.21	56.47	-42.77	-140.33
7.00	110.95	1.54	22.90	75.13	-37.08	-121.67
8.00	126.80	1.76	29.32	96.21	-30.66	-100.59
9.00	142.65	1.97	36.47	119.66	-23.51	-77.14
10.00	158.50	2.19	44.33	145.44	-15.65	-51.36
11.00	174.35	2.41	52.89	173.52	-7.09	-23.28
12.00	190.20	2.63	62.14	203.86	2.15	7.06
13.00	206.05	2.85	72.07	236.44	12.08	39.64
14.00	221.90	3.07	82.67	271.22	22.68	74.42
15.00	237.75	3.29	93.94	308.19	33.95	111.39

BALANCED FLOW RATE BASED ON CALCULATED ELEVATION DIFFERENCE AND DYNAMIC HEAD LOSS

Constants	
Inside Diameter of Pipe (in)	3
Inside Diameter of Pipe (in) @ Pump	4
Elevation Gain from 790 Level to Surface (m)	110
Distance from Pump to Water Treatment (m)	584
Estimated Elevation Difference (m)	60
Hazen-Williams Roughness Constant - plastic	130

DESCRIPTION
DISCHARGE FLOW CALCS

REV.	SHEET	DATE	BY
A	9	5/31/11	EJL

APPENDICIES / DATASHEETS

DESCRIPTION
APPENDICIES / DATASHEETS

APPENDIX 2

Keno Hill Silver District

Adaptive Management Plan – 2011 Update

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KENO HILL SILVER DISTRICT

ADAPTIVE MANAGEMENT PLAN – 2011 UPDATE

PREPARED BY:

JUNE 2011

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1. INTRODUCTION

1.1 BACKGROUND

The Keno Hill Silver District, inclusive of Galena Hill, Sourdough Hill, and Keno Hill, is located in the vicinity of Elsa and Keno City, Yukon, approximately 354 km due north of Whitehorse (please see Figure 1-1). From the first discovery of silver in July, 1903 extensive exploration and prospecting led to numerous commercial open pits and underground mining operations throughout the property; however, due to falling silver prices, commercial production of the property was suspended on January 9, 1989.

Two companies, AMT Canada Inc. and Nevada Pacific Gold, respectively, attempted to commence operations on the property since that time. However, each company ceased to be involved with the project and, as such, the Court appointed PricewaterhouseCoopers Inc. as Interim Receiver and Receiver-Manager of United Keno Hill Mines Limited and UKH Minerals Limited (collectively known as "UKHM") on April 6, 2004. Subsequently, through a selection process Alexco Resource Corp. (Alexco) became the preferred purchaser of the UKHM assets (June 24, 2005). In February 2006, following negotiation of a Subsidiary Agreement between the Government of Canada, the Government of Yukon and the Company, the Supreme Court of Yukon approved the purchase of the assets of UKHM by Alexco through its wholly owned subsidiary, Elsa Reclamation & Development Company Ltd. (ERDC). In December, 2007, Alexco registered the vesting order at the Mayo Mining Recorder Office, the Yukon Land Title Office and the Yukon Lands Branch. This action brought to “Final Close” the acquisition by ERDC of the assets of UKHM, and followed the granting of Water Use Licence QZ06-074 to ERDC by the Yukon Water Board on November 14, 2007. WUL QZ06-074 specifically addresses environmental care and maintenance activities in the district.

In January 2008, Alexco Resource Corp. applied for a Water Use Licence and a Class 4 Mining Land Use Approval to authorize advanced exploration activities in the Keno Hill Silver District. The Class 4 Approval (LQ00240) was issued on June 17, 2008 followed by Water Use Licence QZ07-078 on October 3, 2008 which addresses water usage for the purpose of advanced exploration and preliminary development activities at the Bellekeno Mine in the Keno Hill Silver District.

Under the Care and Maintenance Water Use Licence (QZ06-074) an Existing State of Mine Closure Plan (Closure Plan) is being developed for the district to address long term site liabilities and technical studies relating to ultimate closure are ongoing.

In 2010, Alexco through its mine production subsidiary Alexco Keno Hill Mining Corp, received a Type A Water Licence and Quartz Mining Licence for production from the Bellekeno Mine and processing ore at the Flame and Moth site. Type A Water Licence QZ09-092 as per Clauses 90 and 91, requires a separate Adaptive Management Plan (AMP) which is based on the Keno Hill District AMP but is customized for specific activities and developments of the Bellekeno Undertaking.

Additional advanced exploration and potentially dewatering activities are currently planned by Alexco at the past producing Onek, Lucky Queen, and Silver King mines. At the request of Government of Yukon Water Resources, an update of this Adaptive Management Plan has been prepared to address adaptive management measures for these locations specifically, and in addition, address adaptive management for underground activity and dewatering in more general terms for district wide past producing mines and adits which are licenced under QZ06-074, or QZ07-078.

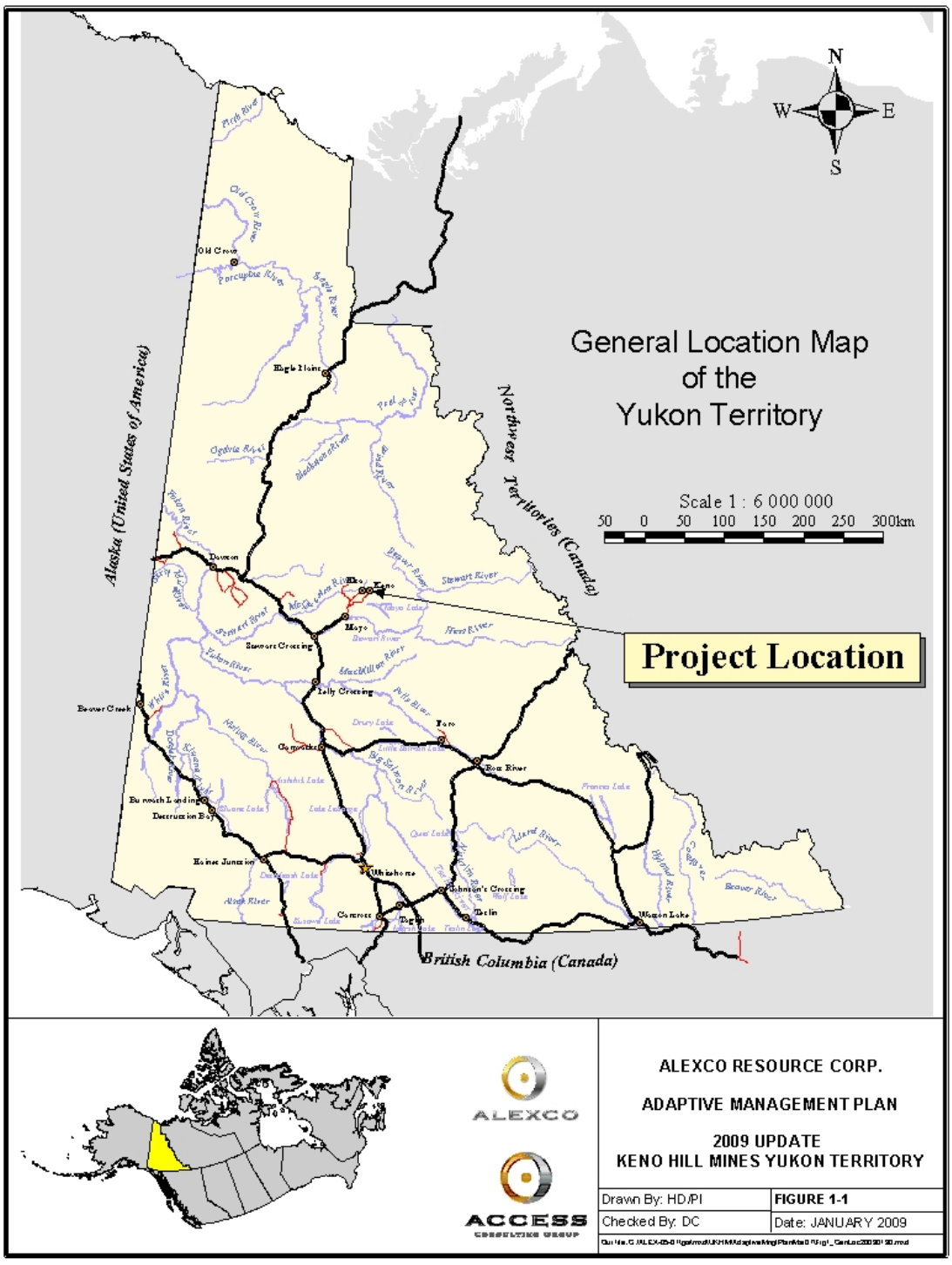
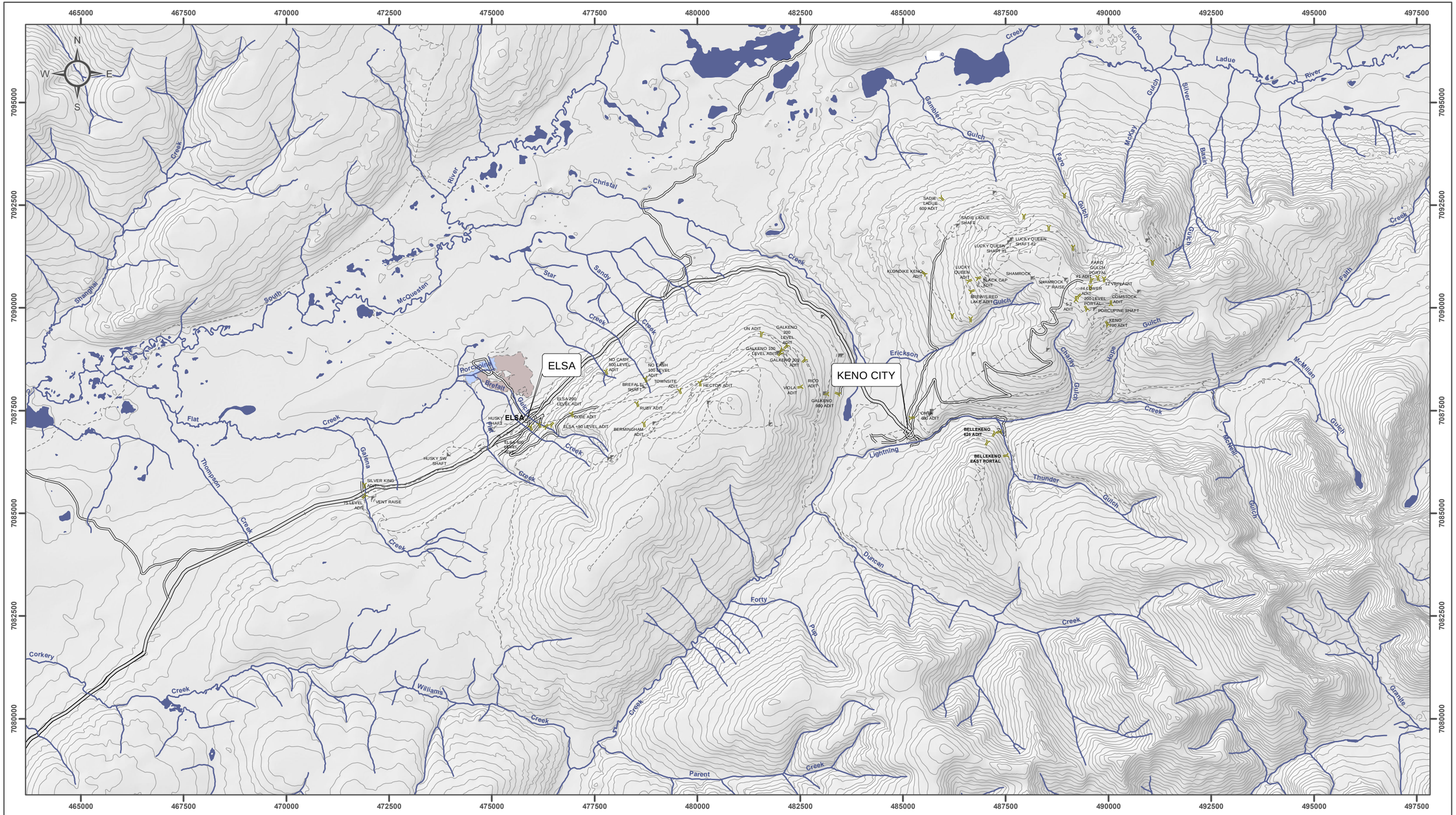


Figure 1-1 Site Location Map Within Yukon

1.2 HISTORIC MINE WORKINGS

Historic mine workings are routinely inspected to ensure public health and safety and continued site security; monitored for site changes or damage; and sampled periodically for flow and water quality. Older mine workings are monitored on a weekly basis during open water season with results of inspections documented and corrective action taken if required. Winter inspections are limited to accessible sites. Figure 1-2 shows an overview of the property with the mine workings.

The Keno Hill Silver District has a rich and detailed history with many of the older workings dating back to the early 1920's. A complete description of site workings is provided in the report entitled, "UKHM Site Characterization Report", (Access Mining Consultants Ltd., 1996). Chapter 5 – Site Description, of this report provides a detailed description of the entire Keno Hill Silver District mine site developments, including history, type of development and infrastructure, and site plans and figures. The reader is referred to this report for a complete description of development activities undertaken at the old mine workings located on the property. A summary of historic development at each of the mines at the Keno Hill Silver District is provided in Table 1-1.



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 underlicense from Her Majesty the Queen in Right of Canada, Department of Natural Resources Canada. All rights reserved.

Datum: NAD 83; Map Projection: UTM Zone 8N

1:85,000 (when printed on 11 x17 inch paper)

0 0.5 1 2 3 4 5 Kilometers

- Adit
- Shaft
- ValleyTailings
- Highway
- Local
- Trail
- Watercourse
- Waterbody

ACCESS CONSULTING GROUP

FIGURE 1-2

PROPERTY OVERVIEW

DRAWN BY MD	MARCH 2011	VERIFIED BY EA

I:\ALEX-05-01\gis\mxd\UKHM\Overview_Maps\Property_Overview_20110329.mxd

Table 1-1 Summary of Historic Development

Summary of Development								
Mine	**Open Pit**	**Underground # levels**	**Shafts, Raises Portals, Adits**	**Bldgs and Equip.**	**Rock Piles waste, ore**	**Mill Tailings**	**Other**	**Adit Discharge & Drainage**
Galena Hill								
Bermingham	2 178,512 t mined	3 for 250 ft depth 7,754 t mined	8 shaft 1 adit	3 bldg @adit	3 continuous 1,000,000t@pit 7,000@adit			KV-18 No Cash Creek drainage
Calumet	3 108,547 t mined	1300 ft depth extensive UG, many lev,2.6Mt	1 shaft 1 adit	none	3@pits,1@adit 1,110,000@pits 198,000t@adit		head of tramway town removed	No discharge
C-structure	1 2,392 t	0			1 28,000 t			No discharge
Dixie		1 23,872 t	1 adit 1 shaft	1 bldg	1 @ adit 19,800 t			No discharge
Elsa		7@+50,100,200 200,400,525,650 &775; 491,009t	6 adits 1 internal shaft >2 raises		3 51,650 t	mill & dams existing + old tlgs	existing town	No discharge
Galkeno		6@100,200,300 400,500,900	5 adits 2 internal shaft 1 external shaft	old bldgs	4 total 171,400t	3,000 to 5,000 t old mill removed	treatment plus ponds 900 level	KV-27 Galkeno 300 level Adit Christal Creek and Lake KV-31 Galkeno 900 level Adit Christal Creek and Lake
Husky		4@125, 250,375 &450; 429,367 t	1 shaft	H.frame	1WR 4,600 t			
Husky SW		3 @ 250, 400, &530; 10,461 t	1shaft	H.frame, blast.	1WR, 1Ore 17,000 t			KV-17 Husky SW Adit No discharge
Miller	1 9,263 t	1 in open pit minimal prdn.	1 old shaft (open pitted)		1 @ pit 63,000 t			
No Cash		4@100,200,300 300 & 500 levels 166,530 t mined	1 raise, 1 shaft 2 adits	h. frame, bldg	1 138,100@500L 6,500 @ 100 L		tram station	KV-20 No Cash 500 level Adit
Ruby		1 @400 level 40,652 t mined	1 raise, 1 adit	1 bldg	1 WR, cribbing 29,800 t		power, tracks	KV-19 Ruby Adit
Silver King	1 6,631 t mined	3 for 325 ft 200,982 t mined	2 shafts, 4 adits 3 raises		2 rock, 1 ore 43,000t@adit 120,000t@pit		treatment plus ponds	KV-13 Silver King Adit Flat Creek drainage
Sime	3 47,304 t	0 (see Galkeno)			3 450,000 t			
Townsite		1 adit 18,570 t	1 adit 1 raise	1 bldg	1 14,300 t		cribbing one bldg	Seasonal discharge
UN		1 adit (no ore mined)	1A		1 3,200 t			Seasonal discharge

Table 1-1 Summary of Historic Development (Continued)

Summary of Development								
Mine	**Open Pit**	**Underground # levels**	**Shafts, Raises Portals, Adits**	**Bldgs and Equip.**	**Rock Piles waste, ore**	**Mill Tailings**	**Other**	**Adit Discharge & Drainage**
Sourdough Hill								
Bellekeno		9 40,502 t mined	4 adits	@625 portal	4 63,950 t		treatment	KV-42 Bellekeno 600 Adit Lightning Creek drainage
Keno Hill								
Black Cap	1 47,497 t	2 ? 1,079 t	2 adits		1 390,000 t @ pit			
Flame & Moth	1 1,590 t	1 (small)	1 adit		1 small		remaining reserves	KV-36 Flame & Moth No discharge
Comstock-Keno Porcupine	1 4,253 t	3 22,863 t ?	3 adits 1 raise	2 @portals	2 1@pit, 1@UG 6,500 t			
Keno 700 & Shamrock "J"		8 283,517 t	4 adits, 2 shafts several raises	several	2 42,100 t total		several veins mined, old camp	KV-33 Keno 700 level Adit Lightning Creek drainage
Lucky Queen	1 (small pit)	4 123,530 t mined	1 shaft, 1 adit	1 @500 portal	2 66,900 t			KV-34 Lucky Queen Adit Cristal Creek drainage
Onek	1 62,254 t	4 for 400 ft 33,036 t	2 shafts 1 adit		3; 7,500 @ adit 600,000 t @ pit			KV-45 Adit flow to ground Cristal Creek drainage
Sadie Ladue		6 244,330 t mined	1 adit	1	2 44,000 t	1	loadout	KV-35 Sadie Ladue 600 level Adit
Shamrock	2 5,035 pit + UG	3	1 shaft 2 adits	shaft bldg	2 9,000 t			No discharge
Valley Tailings							3 ponds	KV-12 Pond #3 decant Flat Creek drainage

1.3 ALEXCO ACTIVITIES

Alexco and its subsidiary companies are undertaking care and maintenance, exploration and development, and closure studies in the Keno Hill Silver District which includes various activities:

Principal activities:

- surface drilling and advanced underground exploration with view to mine development;
- direct use of water for camp purposes and quartz mining undertakings;
- direct use of water and wastewater for lime mixing operations;
- deposit of waste into water and receiving environment;
- waste rock storage;
- construction and upgrades to access roads;
- operation and maintenance of existing five wastewater treatment facilities and associated settling ponds using lime treatment (Silver King 100, Galkeno 900, Galkeno 300 and Bellekeno 625 adits and the Valley Tailings Area);
- deposit of waste as lime treatment sludge;
- construction of earthworks and erosion control protection;
- storage of wastewater in the treatment settling ponds and Valley Tailings Area; and
- maintenance of existing diversion channels (Porcupine Creek) and ditches.

Accessory activities:

- maintenance and operation of site infrastructure related to water treatment systems and access roads;
- site security and maintenance of site facilities and structures for public health and safety;
- transport of milk of lime solutions to treatment sites;
- periodic desludging of treatment settling ponds and transportation or pumping to sludge storage areas which are periodically decanted;
- mine dewatering for care and maintenance purposes and to advance underground exploration or development;
- water sampling (effluent and receiving waters);

- waste rock analysis and classification;
- environmental monitoring, inspections and sample programs, including monitoring and inspection of physical structures;
- removal of blockages that have formed naturally or cofferdams that have been constructed as temporary structures to avoid uncontrolled discharge of mine pool water;
- removal and clean up of infrastructure related to adits, adit structures and facilities;
- wastewater treatment studies and test programs related to potential closure design options; and
- operation, inspection and maintenance of the Valley Tailings Area.

1.4 PLANS IN PLACE

The Company recognizes that there are waters and physical workings at the Keno Hill Silver District that could potentially become an environmental risk or hazard that do not yet require immediate attention. The development of a Keno Hill District Closure Plan is intended to address these water discharges and workings which require further intervention over the long term.

Several plans and monitoring programs are currently in place pursuant to existing licences and approvals and provide the basis and grounding for this AMP. Some of the plans that have been prepared pursuant to Water Licences QZ06-074 and QZ07-078, and the Class 4 Mining Land Use Approval to guide the management of activities and monitoring associated with site care and maintenance as well as advanced exploration and preliminary development include:

- Waste Rock Management Plan (January 2008);
- Sludge Management Plan Revision No.1 (May 2008);
- Waste Rock Metals and Acid Base Accounting Testing Plan (October 2008);
- Physical Inspection and Reporting Plan (October 2008);
- Flow Monitoring Plan (October 2008); and
- Mine Wall Testing Plan (October 2008).

However, to address risks or hazards over the short term, an adaptive management strategy is provided in the event conditions change and/or degrade to the point where management actions are required or proposed company undertakings, such as exploration activities in and around various mine workings that have potential to influence conditions. This document has therefore been developed and provides detailed AMP implementation protocol for the company's operations at the Keno Hill Silver District.

2. ADAPTIVE MANAGEMENT PLAN OVERVIEW

2.1 ADAPTIVE MANAGEMENT PLAN OBJECTIVES

An adaptive management plan (AMP) is a management tool designed to guide responses to unforeseen or contingency events respecting for example, water quality and quantity and physical conditions of site workings and infrastructure. The adaptive management approach will provide for assessment of mitigation measures and their effectiveness, and guide the orderly implementation of responses. Since it is difficult to predict the specific environmental condition that may arise which requires a response from management, the AMP does not necessarily provide specific detailed descriptions of responses to a situation. The AMP provides a range of possible responses to use as a guide to respond to specific environmental conditions encountered. Management should use the information provided in the AMP and adapt the appropriate response from this guide, which is the sole purpose of an AMP.

The AMP framework encompassing active Company management includes:

- routine inspection and environmental monitoring, maintenance and reclamation;
- routine assessment of monitoring and performance data;
- performance thresholds for implementation of appropriate levels of responses for planned contingency measures; and
- reporting of monitoring results and actions.

Results of the monitoring programs (Section 1.4 – Plans in Place), will be assessed on an ongoing basis to determine if any negative trends in water quality, quantity or other parameters are occurring. If the results indicate that there are no negative environmental impacts, then the frequency and length of monitoring and maintenance would continue as usual. Adaptive management will be implemented to respond to negative trends observed through the monitoring programs.

2.2 AMP EVENTS SUMMARY

A number of "events" have been identified which represent potential environmental conditions that would require a management response, if they were to occur:

1. **Change in Water Quality or Quantity**
    a. Significant change in water quality
        i. Water treatment facilities/ licenced effluent discharges
        ii. Untreated adit discharges
        iii. Mine water quality significantly altered during or subsequent to dewatering
        iv. Receiving water quality significantly altered during or subsequent to dewatering mine dewatering
    b. Significant increase or decrease in monitored flow occurs
        i. Dewatered mine water quantity significantly altered during or subsequent to dewatering
    c. Currently monitored water flow stops
    d. New water flow is observed
    e. Water flow path changes
2. **Non-AML Waste Rock Disposal Area(s) Seepage Exhibits AML**
    a. Waste Rock Disposal Area(s) (including where used for road and general construction) runoff trending to AML conditions
3. **Sludge Storage Area Effectiveness Compromised**
    a. Seepage Observed Near Sludge Storage Area
    b. Sludge Storage Area Approaching Capacity
4. **Physical Instabilities**
    a. Area of Significant Subsidence is Observed
    b. Rock Fall or Landslide Occurs Within a Monitored Area
    c. Structure Failure or Portal Collapse
5. **Site Security Compromised**
    a. Gate, Fence or Sign Damaged

The AMP response for each of these events is described individually in subsequent sections while Table 2-1 at the end of this section provides a summary of the approach to

AMP events. This table describes a narrative trigger, indicators and response thresholds, monitoring locations and parameters.

2.3 AMP APPROACH

For each AMP event a methodical approach is provided:

1. Description of the event and possible environmental consequences - Addresses issues or information that trigger the AMP;
2. Location of possible event occurrence – Identifies specific working site locations if applicable to event;
3. Monitoring requirements – Identifies the parameters to be monitored, frequency and means for monitoring each parameter;
4. Specific indicators and thresholds - Defines the conditions when management actions should be taken. There may be a series of indicators and staged thresholds for an individual event; and
5. Approach to responses –Description of the approach to responses including a simplified flow chart to guide the implementation process if any specific thresholds have been crossed.

Table 2-1 Overall AMP Summary

EVENT	NARRATIVE TRIGGER	INDICATORS	THRESHOLDS	MONITORING LOCATIONS	MONITORING PARAMETERS
1. CHANGE IN WATER QUALITY OR QUANTITY					
a. Significant change in water quality	Water Treatment Facilities Decline in effluent pH noted or effluent quality trending towards possible exceedence of standards or exceeds licenced standards.	pH, Total zinc, ammonia, TSS	Treated effluent: pH <8.0; OR Total Zinc > 0.40 mg/L and pH <6.5 for two consecutive days; OR Ammonia > 4.0 mg/L and pH > 9.0 for two consecutive days; OR Effluent quality standards exceeded.	Water Treatment Facilities	Routine in-situ, on-site total zinc, external multi-element ICP, hardness, pH, conductivity, TSS, ammonia (Bellekeno), LT50
	Untreated Adit Discharges Routine site inspections indicate noticeable change in water clarity or declining pH or increasing conductivity. Contaminant concentrations display a statistically significant sustained increase over historical water quality database.	Visual observation of clarity, in-situ pH & conductivity, total cadmium, total zinc	Site inspection: pH < 6.5 or conductivity >2,000 μS/cm; OR Increase of 2X or more in total Cd/Zn load or conductivity when compared to the average for the previous 24 months	Untreated Adit Discharges including KV-17, KV-18, KV-19, KV-20, KV-33, KV-34, KV-35, KV-36, KV-45 and KV-53	Routine in-situ, external multi-element ICP, hardness, pH, conductivity, TSS
b. Adit discharge or treated effluent, quantity increases or decreases	Observed or measured flows display a sustained and statistically significant increase or decrease over historical flow database	Flow and water quality (total zinc, pH and conductivity) and stream type - fish bearing	Increase/decrease in flow of 2X or more when compared to the average for the previous 24 months AND threshold for Event 1 a) or b) as applicable also exceeded	Site-wide flow monitoring	same as indicators
c. Flow stops from adit discharge	Water flowing from historical workings stops	Flow, ice plug formation	25% of adit opening filled with ice	Adit and treatment locations	same as indicators
d. New water flow is observed	Previously dry site exhibits flow and effects down gradient water quality and loadings	Flow and water quality (Total zinc, pH and conductivity)	Adit flows for 30 l/s for 7 day period	Site-wide mine workings	same as indicators
e. Water flow path changes	Flow path of mine working discharge changes path from historically known channel and enters a new watercourse	Flow and water quality (Total zinc, pH and conductivity)	Flow path changed and enters a new watercourse	Adit and treatment locations	same as indicators

EVENT	NARRATIVE TRIGGER	INDICATORS	THRESHOLDS	MONITORING LOCATIONS	MONITORING PARAMETERS
2. WASTE ROCK SEEPAGE EXHIBITS AML					
a. Waste rock seepage or runoff trending to AML conditions	Seepages from waste rock disposal areas or from works constructed or upgraded with non AML material show significant decline in pH and/or an increase in conductivity OR approaching licenced discharge standards	pH, conductivity	Significant decline in pH between measurements or pH <7.0 and/or conductivity showing a significant increasing trend or >2000 μS/cm; OR indicators approaching licenced standards for Onek waste rock storage area	Waste rock disposal areas and works or upgrades constructed from non-AML material	Routine multi-element ICP
3. SLUDGE STORAGE AREA EFFECTIVENESS COMPROMISED					
a. Seepage observed near sludge storage areas	Routine inspection of sludge storage area shows seepage	Total zinc, pH	pH >8.5 and total zinc > 1.0 mg/L	Sime Pit, Sime Waste Dump, Valley Tailings sludge storage cell	Same as indicator
c. Sludge storage area approaching capacity	Sludge storage area approaching minimum freeboard of 1.0 meter below the decant point	Visual observation of freeboard	Freeboard is at 1.5 meter below decant point	Sime Pit, Sime Waste Dump, Valley Tailings sludge storage cell	Same as indicator
4. PHYSICAL INSTABILITIES					
a. Area of significant surface subsidence has occurred	An observed subsidence has exposed an opening to surface or resulting in slope failure	Visible slope failure, ground subsidence or opening on surface	Opening to underground workings or area of subsidence effects public safety or down gradient environment	Site-wide	same as indicators
b. Rock fall or landslide is observed that effects road right-of-way or intrudes into stream	An observed rock fall or landslide effects a road right-of-way, infrastructure or intrudes into stream	Mine source material movement	Source material effects road or stream	Site-wide	same as indicators
c. Structure failure or portal collapse	A building, engineered structure or portal is seen to be failing (settling, excessive erosion)	Visual observation	Structure near public access	Site-wide	same as indicators
5. SITE SECURITY COMPROMISED					
a. Security gate, fence, sign damaged	Public health and wildlife safety measure damaged or removed	Sign, fence, gates, locks	Security feature damaged, removed, or compromised	Site-wide	same as indicators

3. CHANGE IN WATER QUALITY OR QUANTITY

Results of water quality and quantity monitoring are assessed on an ongoing basis to determine if significant changes are occurring and an adaptive management response is required. The following sections describe what constitutes a significant change to water quality or quantity and associated responses that would be implemented.

3.1 SIGNIFICANT CHANGE IN WATER QUALITY

3.1.1 Description

All data for current water sample stations in the Keno Hill Silver District are stored in an EQWin database that allows water quality to be tracked at each site such that conditions can be identified at any point in the season. In this way parameters can be seen to be fluctuating from the normal, and reaching levels where management is required to respond. Set point triggers can be placed in the database so that response parameters are flagged for notification and action.

3.1.2 Locations

Water quality is monitored from discharging adits and water treatment facilities for potential effects to the receiving environment including loading of down gradient waters. .

Water Treatment Facilities:

- KV12 - Valley Tailings Pond #3 Decant;
- KV14 - Silver King Treatment Pond #2 Decant;
- KV28 - Galkeno 300 Treatment Pond Decant;
- KV32 - Galkeno 900 Treatment Pond Decant; and
- KV43 - Bellekeno 625 Treatment Pond Decant.

Adits:

- KV17 - Husky South West;
- KV18 - Bermingham Adit;
- KV19 - Ruby Adit;

- KV20 - No Cash 500 Adit;
- KV33 - Keno 700 Adit;
- KV34 - Lucky Queen Adit;
- KV35 - Sadie Ladue Adit;
- KV36 - Flame and Moth Adit;
- KV45 - Onek Adit;
- KV53 - UN Adit;
- KV66 - Klondike Keno Adit;
- KV67 - Keno 200 Adit;
- KV68 - Brewis Red Lake Adit; and
- KV74 - Bellekeno East Adit.

3.1.3 **Monitoring Requirements**

Regular water sampling has been conducted at several sites in the Keno Hill Silver District where regular water flow is expected either continuously or at various times of the year. This monitoring program coincides with required monitoring under Water Licences QZ06-074 and QZ07-078.

Specific parameters monitored will be compared to specific thresholds to determine if they have been breached. Monitoring requirements will change should one of the AMP thresholds be triggered. This could include more frequent monitoring of grab samples at the station location as well as more frequent monitoring of the receiving environment, including down gradient receiving waters or down gradient piezometers located below the site or workings where the trigger was initiated.

3.1.4 **Specific Thresholds**

Specific thresholds for the different categories of monitoring stations that will initiate a response are provided in the following sections.

3.1.4.1 Water Treatment Facilities/ Licenced Effluent Discharges

Water quality data from treatment facilities and other effluent discharges (Bellekeno East decline or Onek Pit Waste Rock Storage Facility) will be assessed to determine if the following thresholds have been exceeded:

- Daily sampling result for pH less than 8.0 units at a water treatment facility decant;
- Daily sampling result for zinc or ammonia trending toward possible exceedence of discharge standard:
    - Total zinc > 0.40 mg/l and pH < 6.5 units for two consecutive days; or
    - Ammonia > 4.0 mg/l and pH > 9.0 for two consecutive days (applies to Bellekeno only); and
    - TSS > 20 mg/l for two consecutive days.
- Sample result exceeds effluent quality standard (Table 3-1).

Table 3-1 Licenced Effluent Quality Standards

Parameter	Maximum Concentration in a Grab Sample (mg/L)
pH	6.5 to 9.5 pH Units
Suspended solids	25.0
Ammonia Nitrogen*	5.0
Arsenic (Total)	0.50
Cadmium (Total)	0.05
Copper (Total)	0.30
Lead (Total)	0.20
Nickel (Total)	0.50
Silver (Total)	0.10
Zinc (Total)	0.50

* Ammonia nitrogen standard applies to Water Licence QZ07-078 only (Bellekeno 625, Bellekeno East, Onek Pit Waste Rock Storage Facility)

3.1.4.2 Untreated Adit Discharges

Old mine workings adit discharge quality will be assessed to determine if thresholds are triggered indicating that a significant increase in metals loading or conductivity is occurring:

- Field measurements will be implemented during routine weekly site inspections (during open water season). The following represent thresholds for these inspections:
    - noticeable change in water clarity;

  - pH appears to be significantly declining between measurements or dropping below 6.0; and
  - conductivity shows a significant increasing trend or conductivity above 2,000 μS/cm.

- A monitoring result at an adit discharge sample location whereby there is an increase of two-times (2X) or more in metal load for total cadmium or total zinc when compared to the average loading for the previous 24-months' water quality data for that site, along with discharge concentrations for the site which are at or greater than those concentrations provided elsewhere on the property as licenced effluent quality standards. For example, if the load (kg/yr) for these parameters increases by two-times or more when compared to the average for the previous 24 months, but the data does not exceed licenced discharge standards, the AMP is not triggered. Similarly, if water quality data exceeds licenced effluent quality standards but does not result in an increase of two-times or more in metal load when compared to the average for the previous 24 months, the AMP is not triggered (See No Cash 500 Example below). Both conditions must be met for the AMP to be triggered;

- A monitoring result at an adit discharge sample location whereby there is an increase of two-times (2X) or more in conductivity (measured externally by an accredited lab) when compared to the average conductivity for the previous 24-months' water quality data for that site.

<u>No Cash 500 Adit Cadmium, Zinc & Conductivity Examples</u>

Using the No Cash 500 Adit (monitoring station KV-20) as an example, an average total cadmium concentration of 0.131 mg/L is calculated for 6 sample events during 2007 and 2008. At an observed average discharge of 7.3 L/s this computes to total cadmium loading of 29 kg/yr. Therefore, while licenced discharge standards provided elsewhere on the property for total cadmium are 0.05 mg/L, the AMP would only be triggered if the total cadmium also exceeded 29 kg/yr by two times or more (≥ 58 kg/yr).

Continuing with the No Cash 500 Adit as an example, an average total zinc concentration of 12.2 mg/L is calculated for the 6 sample events in 2007 and 2008. At an observed average discharge of 7.3 L/s this computes to a total zinc loading of 2,709 kg/yr. Therefore, while

licenced discharge standards provided elsewhere on the property for total zinc are 0.50 mg/L, the AMP would only be triggered if total zinc also exceeded 2,709 kg/yr by two times or more (≥ 5,418 kg/yr).

At the No Cash 500 Adit, an average conductivity of 951 µs/cm (external lab analyses) is calculated for 6 samples collected between October 24, 2006 and September 10, 2007. The AMP would therefore be triggered if conductivity exceeded the average of 895 µs/cm by two times or more (≥ 1790 µs/cm).

3.1.4.3 Mine Water Quality Significantly Altered During or After Dewatering

The same thresholds provided for adit discharges (section 3.1.4.2) would apply to any adits which are being or have been actively dewatered in order to determine if mine water quality had been significantly altered after dewatering:

- A monitoring result whereby there is an increase of two-times (2X) or more in metal load for total cadmium or total zinc when compared to the average loading for the 24-months' water quality data prior to dewatering, along with discharge concentrations for the site which are at or greater than those concentrations provided elsewhere on the property as licenced effluent quality standards. Both conditions must be met for increased monitoring to be triggered; or

- A monitoring result whereby there is an increase of two-times (2X) or more in conductivity (measured externally by an accredited lab) when compared to the average conductivity for the previous 24-months' water quality data prior to dewatering.

3.1.4.4 Receiving Water Quality Significantly Altered During or Subsequent to Dewatering

Receiving water quality down gradient of mine adits which are being or have been actively dewatered will be assessed to determine if it has been significantly altered during or subsequent to dewatering the mine. Water quality data from established monitoring stations downstream of the adit which is being dewatered will be used in this assessment. As with adit discharge thresholds, metals loading and conductivity will be tracked to determine if receiving water quality has been significantly altered:

- A monitoring result whereby there is an increase of two-times (2X) or more in metal load for total cadmium or total zinc when compared to the average loading for the 24-months' water quality data prior to dewatering; or

- A monitoring result whereby there is an increase of two-times (2X) or more in conductivity (measured externally by an accredited lab) when compared to the average conductivity for the previous 24-months' water quality data prior to dewatering.

3.1.5 **Approach to Responses**

As per the general approach to the AMP, a staged response to a change in water quality will be implemented if one of the thresholds is breached. Triggered responses are outlined below for the different types of monitoring stations and may be specific to the particular threshold that was breached. For example, an exceeded threshold could indicate the potential for a 'low risk' event or a 'high risk' event which in turn triggers an appropriate level of response.

3.1.5.1 Water Treatment Facilities/ Licenced Effluent Discharges

For water treatment facilities the following responses will occur if daily effluent sampling at the decant results in a pH less than 8.0 units OR an effluent quality standard for zinc, ammonia or TSS is near to exceedence;

- routine system monitoring and inspections;
- ensure system power and site operations;

- operate back up power if necessary;
- verify lime slurry tank volumes and flow rate;
- adjust lime addition rate;
- verify system pH;
- verify internal sampling and analytical results;
- re-sample and analyze;
- replace or repair system equipment;
- review need for settling pond desludging and desludge pond;
- consider need to send samples for outside analyses and/or analytical equipment maintenance.

For water treatment facilities the following responses will occur if an effluent quality standard is exceeded;

- maintenance or repairs to the water treatment facility to improve system performance; and
- consider the need for capital improvements and implement.

Additional responses specific to the Tailings Dams:

- routine dam monitoring and inspections;
- ensure decants structure free flowing;
- daily water levels measured and verified;
- geotechnical inspection as appropriate; and
- structural repairs or maintenance identified and remedial action taken.

Response specific to P-AML Waste Rock Storage Facilities

- geotechnical inspection prior to and during construction, design as per approved design;
- routine monitoring and inspections as per Physical Inspection and Reporting Plan;
- no discharge from Waste Rock Storage Facilities – runoff collected and transported to existing treatment facility.

3.1.5.2 Adit Discharge

For adit discharges, initial responses can include a number of mitigative measures such as ditching, berming, or pumping water, or whatever alternative is needed as to not degrade the quality of water nearby. A comprehensive analysis will be performed by the laboratory to verify the accuracy of monitoring information. Additional samples will be sent to the lab to ensure quality control. Included in the lab testing will be a LT50 bioassay toxicity test for acute lethality.

The next step will be to document and re-affirm the flow path of the watercourse above where the sample was taken and the down gradient environment. This is to determine if the cause of the trigger is a variation in the flow path which has allowed water to flow through an area which could be the source of new metal loading. Areas that may be suspect to loading will be documented for further analysis.

The next step will be to perform a comprehensive analysis of samples taken at the sampling stations in the drainage area down gradient of the site in question. At certain old mine workings (No Cash 500 adit and Onek adit), down gradient piezometers have been installed to track effects to the local receiving environment. Additional drive point piezometers could be installed at other locations based on continued tracking of adit discharge flow paths. Results of 2007 monitoring of adit flow paths tracked most flows to receiving waters, however, if flow goes to ground and is not observed to enter receiving waters, additional piezometers may be installed. Results from piezometers would be analysed to determine the extent of the groundwater contamination, if any. The purpose of this analysis will be to aid in the identification of potential down gradient environmental effects. This will also allow a determination of the extent of the higher contamination levels and will dictate the extent of the response measures. If deemed necessary, monitoring frequency will be increased to help pinpoint the cause of the trigger in the effluent discharge and include additional groundwater, seepage or surface water sampling in the receiving environment.

Technical experts and regulatory agencies will be consulted to determine temporary mitigation measures which can be implemented to control the flow of contaminants, if occurring, into nearby watercourses or groundwater while a mitigation plan is developed. Once a mitigation or

treatment plan is developed, construction of any required facilities and implementation of any required work plans will then proceed according to any directives returned by the Yukon Water Board. These plans should allow water quality to return to normal levels by securely preventing the noted contaminants from proceeding any further past the treatment point, much like the treatment sites at Galkeno 300 or Bellekeno 625. The water treatment plans will be designed such that treatment can proceed for an undetermined length of time until the final Closure Plan can be implemented.

3.1.5.3 Mine Water Quality Significantly Altered During or After Dewatering

Should mine water quality (and/or quantity – see Section 3.2.5.3) be significantly altered during or after dewatering of any district mine, a period of weekly monitoring would continue until water quality has stabilized.

If the mine water quality affects the water treatment facility performance and thresholds are being exceeded (Section 3.1.4.1) then dewatering can be reduced or shut down until modifications to the treatment facility are made (Section 3.1.5.1).

3.1.5.4 Receiving Water Quality Significantly Altered During or Subsequent to Mine Dewatering

Should water quality in receiving environment waters be significantly altered during or subsequent to dewatering of any district mine, the monitoring frequency of downstream monitoring stations would increase from quarterly monitoring to monthly and then to weekly if the event were to persist. Water quality measurements and data analysis will be interpreted in an attempt to determine the cause of the altered receiving water quality. Dewatering and treatment facility operations would be reviewed and treatment facility performance assessed. In the case of untreated adit discharges, the need to install or upgrade treatment facilities would be assessed.

Once water quality is no longer considered significantly altered from pre-dewatering conditions, water quality monitoring at quarterly intervals will be resumed.

3.1.6 **Significant Change in Water Quality AMP Summary**

Table 3-2 provides a summary of the AMP for a significant change in effluent quality from the water treatment facilities including specific thresholds and actions to be taken in order of priority. Table 3-3 provides the AMP summary for a significant change in adit discharge quality as well receiving water quality as a result of mine dewatering.

Table 3-2 Significant Change in Effluent Quality AMP Summary

SPECIFIC THRESHOLD	ACTIONS TAKEN IN ORDER OF PRIORITY
Daily sampling result pH < 8.0 at a water treatment facility decant; OR Total zinc > 0.40 mg/L and pH < 6.5 units for two consecutive days; OR Total ammonia > 4.0 mg/L and pH > 9.0 for two consecutive days (Bellekeno only); OR	Routine system monitoring and inspections; Ensure system power and site operations; Operate back up power if necessary; Verify lime slurry tank volumes and flow rate; Adjust lime addition rate; Verify system pH; Verify internal sampling and analytical results; Re-sample and analyze; Replace or repair system equipment; Review need for settling pond desludging and desludge pond; Consider need to send samples for outside analyses and/or analytical equipment
Sample result exceeds effluent quality standard. →	Reduce dewatering rate to maintenance level or stop mine de-watering (if necessary) Consider need for capital improvements and implement

Table 3-3 Significant Change in Adit Discharge/Receiving Water Quality AMP Summary

SPECIFIC THRESHOLD	ACTIONS TAKEN IN ORDER OF PRIORITY				
ADITS Field measurement during routine weekly site inspections: - noticeable change in water clarity; - pH appears to be significantly declining between measurements or drops below 6.0; - conductivity shows significant increasing trend or conductivity above 2,000 µS/cm. OR Increase of 2X or more in metal load for total zinc / cadmium when compared to the average loading for the previous 24 months, AND exceeds licenced discharge standards for the parameters provided elsewhere on the property; OR Increase of 2X or more in conductivity (lab measurement) when compared to average for previous 24 months.	Initial response if necessary to ditch/ berm/ pump water or take necessary measures to prevent degradation of nearby waters.				
	Additional sample sent to lab*				
	Re-affirm Flow Path	Flow path has changed	Document areas suspect to loading		
		Flow path has not changed			
				Analyze data	Implement mitigation or treatment plan
	Sample downstream sites				
	Continue weekly dewatering monitoring for Bellekeno until water quality stabilizes	Reduce or shut down dewatering if Bellekeno water treatment facility affected	Make modifications to Bellekeno water treatment facility		
RECEIVING ENVIRONMENT WATER Increase of 2X or more in metal load for total zinc / cadmium when compared to the average loading for the previous 24 months prior to dewatering; OR Increase of 2X or more in conductivity (lab measurement) when compared to average for previous 24 months prior to dewatering.	Increase receiving water quality monitoring to monthly, then weekly if event persists	Analyze/interpret data to determine cause	Review dewatering and treatment facility operations/performance		

***Toxicity tests include acute toxicity testing.**

3.2 SIGNIFICANT INCREASE OR DECREASE IN MONITORED FLOW OCCURS

3.2.1 Description

For every currently monitored site where water flow occurs, the volume of water flowing from the source is measured or estimated and compared with historical observations for that particular site. The flow data is recorded and maintained in the EQWin water quality database. Much like the responses for water flow ceasing completely, a significant increase or decrease in a monitored flow can be an indication of problems or issues further upstream. Therefore, responses should be in place for irregularities observed in flows with a reasonably predictable flow history.

3.2.2 Locations

Discharge from adits and water treatment facilities is measured to prevent significant adverse effects to the receiving environment including loading of down gradient waters.

Water Treatment Facilities:

- KV14 - Silver King Treatment Pond #2 Decant;
- KV28 - Galkeno 300 Treatment Pond Decant;
- KV32 - Galkeno 900 Treatment Pond Decant; and
- KV43 - Bellekeno 625 Treatment Pond Decant.

Adits:

- KV17 - Husky South West;
- KV18 - Bermingham Adit;
- KV19 - Ruby Adit;
- KV20 - No Cash 500 Adit;
- KV33 - Keno 700 Adit;
- KV34 - Lucky Queen Adit;
- KV35 - Sadie Ladue Adit;
- KV36 - Flame and Moth Adit;
- KV45 - Onek Adit;
- KV53 - UN Adit;

- KV66 - Klondike Keno Adit;
- KV67 - Keno 200 Adit;
- KV68 - Brewis Red Lake Adit; and
- KV74 - Bellekeno East Adit.

3.2.3 **Monitoring Requirements**

All water treatment and old mine adits at the Keno Hill Silver District where regular water flow is expected are monitored either continuously or at various times of the year during water quality sampling events. Monitoring schedules coincide with the requirements of the Water Licences and data necessary for closure planning.

3.2.4 **Specific Thresholds**

The specific thresholds that will indicate a significant change in discharge and initiate an adaptive management response are outlined below. For reference, average flow for each of the locations listed above is provided in the following Table 3-4.

Table 3-4 Average Flow for 2007- 2011 – Treatment Sites Decants and Adit Discharge

Site	Description	2007-2011 Average Flow L/s	N (# samples)	Max	Min
Water Treatment Facilities					
KV14	Silver King Treatment Pond #2 Decant	6.3	863	13.0	1
KV28	Galkeno 300 Treatment Pond Decant	10.8	1189	30.5	7.5
KV32	Galkeno 900 Treatment Pond Decant	2.7	843	9.8	0.4
KV43	Bellekeno 625 Treatment Pond Decant	4.0	970	10.5	0.0
Adits					
KV17	Husky South West	0.4	8	1.6	0.1
KV18	Bermingham Adit	1.9	10	5.0	0.3
KV19	Ruby Adit	1.0	8	3.0	0.3
KV20	No Cash 500 Adit	5.5	8	8	2.5
KV33	Keno 700 Adit	3.4	7	5.5	1.3
KV34	Lucky Queen	None	0		
KV35	Sadie Ladue Adit	7.6	9	15	0.5
KV36	Flame and Moth	None	0		
KV45	Onek Adit	1.16	9	3.2	0.5
KV53	UN Adit	0.4	3	0.75	0.75
KV66	Klondike Keno Adit	Dry	0		
KV67	Keno 200 Adit	None	0		
KV68	Brewis Red Lake Adit	Dry	0		
KV74	Bellekeno East Adit	None	0		

3.2.4.1 Decrease in Discharge

- Noticeable decrease in adit discharge since last inspection.
- A monitoring result at a sampling site whereby there is a decrease of two-times (2X) or more in water flow when compared to the average flow for the previous 24-months' data for that site.

3.2.4.2 Increase in Discharge (other than increase due to a de-watering activity).

- Noticeable increase in adit discharge since last inspection;
- A monitoring result at a sample site whereby there is an increase of two-times (2X) or more in water flow when compared to the average flow for the previous 24-months' data for that site; AND
- Average metal loading (total zinc/cadmium) has increased by two-times (2X) or more when compared to the average loading for the previous 24-month's water quality data for that site, along with discharge concentrations for the site which are at or greater than those concentration limits provided elsewhere on the property as licenced discharge standards (see Section 3.1 Significant Change in Water Quality); OR
- A monitoring result at a sampling site whereby there is an increase of two-times (2X) or more in conductivity (measured externally by the lab) when compared to the average conductivity for the previous 24-months' water quality data for that site (see Section 3.1 Significant Change in Water Quality).

3.2.5 **Approaches to Responses**

As per the general approach to the AMP, a staged response to a significant increase or decrease in an observed water flow will be implemented if a threshold is breached. For adit discharges, initial responses can include a number of mitigative measures such as ditching, berming, or pumping water, or whatever alternative is needed as to not degrade the quality of water nearby and receiving environment.

3.2.5.1 Decrease in Discharge

The initial response to a significant decrease in flow rate will be to examine the flow path upstream from the observed location of the flow decrease. Normally, this will consist of examining the adit from where the water flow originates from. This will determine if the decrease in water flow is due to an ice plug forming or a cave-in has occurred that has blocked a portion of the flow. If the cause of the reduced flow is the formation of an ice plug in the adit, monitoring will be increased until such time as the flow returns to normal or until the ice plug causes the water flow to cease, at which time the AMP for flow stopping (Section 3.3) will be triggered.

If the reduced water flow is due to a cave-in either at the entrance of an adit or further into the adit, then regular monitoring will be implemented as removal of the material impeding on the flow may be difficult to removal due to safety or other concerns.

Depending on the nature of the flow reduction, inspection frequency may increase and water quality sampling may be conducted to assist with the assessment of the potential causes or implications of the decreased flow.

3.2.5.2 Increase in Discharge

The response to a significant increase in the flow rate will be to increase inspection frequency and to document the path of the water flow (photo's and GPS survey). It is entirely possible that the path of the water flow could have changed due to the increase of water flow, which may have caused the water to breach it's banks or to accelerate the erosion of certain portions of the side banks. Areas of particular concern when documenting the flow path should include flows through waste rock piles, flows into other underground mine workings, and flows into other watercourses or near site infrastructure. Documentation should be sufficient enough so that if the water flow has indeed changed course, it can be accurately displayed on a site map. Refer to Section 3.5 for a staged response to a change in flow path.

The next step of the response to a significant increase in water flow is to obtain a grab sample and to perform a comprehensive analysis of the water. This analysis is important as it will

determine whether the increase in flow is also contributing to metals loading or contamination to a nearby watercourse or local groundwater levels, which will in turn determine the severity or impact the increased flow will have on the surrounding environment, and whether a mitigation program will have to be implemented at this location. If metal concentrations are found to be of concern, and the flow path does not intersect with a potential fish bearing stream, then the site will be subject to continual monitoring. Downstream or down gradient locations should be monitored to ensure that the flow path does not eventually reach fish bearing waters.

If the flow path does deposit loading into a fish bearing stream or creek, an assessment of mitigation or treatment options will be performed and an appropriate mitigation plan will be implemented after consultations with technical experts and regulatory agencies.

The next step of the response is to determine the physical stability of the environment along the flow path. The most common area to suffer physical instability due to water flows will be waste rock piles, followed by steep embankments with loose soil. If either short or long term stability is threatened, then mitigative measures will have to be addressed and could consist of redirection of the flow.

3.2.5.3 Mine Water Quantity Significantly Altered After Dewatering

Dewatering of the Bellekeno Mine is a licenced activity pursuant to Water Licence QZ07-078. Schedule A, Part V of the Water Licence provides a compliance monitoring schedule during and for 12 weeks following dewatering Bellekeno Mine. A 12 week compliance monitoring schedule for treatment sites modeled after Schedule A, Part V of QZ07-078 will be used for dewatering of any other mine adit. Should mine water quantity (and/or quality – see Section 3.1.4.3) be significantly altered after dewatering of any mine, the period of weekly monitoring outlined in the QZ07-078 for the adit (pre-treatment) and treatment facility effluent (post-treatment) would continue until water quantity has stabilized.

Water quality analysis would be conducted as per the Water Licence with continued daily flow monitoring to assess implications to the treatment facility. The treatment facility may require modification to handle increased flows or dewatering may need to be stopped to ensure treatment facility performance and that effluent quality standards are achieved.

3.2.6 **Significant Increase or Decrease in Flow AMP Summary**

Table 3-5 provides a summary of this AMP event including specific thresholds and actions to be taken in order of priority.

Table 3-5 Significant Increase or Decrease in Monitored Flow AMP Summary

SPECIFIC THRESHOLD	ACTIONS TAKEN IN ORDER OF PRIORITY					
Noticeable increase/decrease in adit discharge since last routine weekly site inspection; Increase of 2X or more in water flow when compared to the average flow for the previous 24 months; AND Metal loading (total Zn/Cd) has increased by 2X or more when compared to average loading for the previous 24 months and discharge standards for these parameters at other locations on the property are exceeded; OR There is an increase of 2X or more in conductivity when compared to the average for the previous 24 months.	Initial response if necessary to ditch/ berm/ pump water or take necessary measures to prevent degradation of nearby waters and receiving environment.					
	Document flow path	Flow enters fish bearing waters	Initiate monitoring of water quality and flow	Water quality exceeds effluent regulations	Initiate mitigation or treatment plan	
				Water quality does not exceed effluent regulations		Continue monitoring of water quality and flow until regular flow resumes
		Flow does not enter fish bearing waters				Initiate monitoring of water quality and flow until regular flow resumes
		Flow poses risk to physical stability or infrastructure downstream or water treatment system		Complete mitigative design for areas of potential physical instability. Review and assess effects to water treatment facility. Revise dewatering strategy and/or treatment system		Implement physical instability preventative measures. Review treatment system performance and make adjustments to system
Decrease of 2X or more in water flow when compared to the average flow for the previous 24 months	Examine flow path upstream from observed area	Formation of ice plug evident				Increase monitoring of ice plug until AMP Event 2 (flow stops) triggered
		Evidence of cave-in or collapse		Immediate mitigative measures unnecessary		Increase monitoring for physical stability issues

3.3 CURRENTLY MONITORED WATER FLOW STOPS

3.3.1 Description

When the expected water flow is interrupted, this could be the result of a few situations. The interruption could be the result of low precipitation levels leading up to the observed event. An inlet for water hydraulically linked to the subject adit could have been intentionally or unintentionally sealed, an underground cave-in or subsidence could have occurred thereby stopping sufficient water from entering the workings to create the expected water flow.

Another situation could be the formation of an ice plug in the adit. The formation of an ice plug could result in a build-up of water pressure behind the plug. If the water pressure becomes too much for the ice plug, the plug may release water. This could lead to a release of water into the receiving environment.

Cessation of active dewatering also can also stop flows for a period of time, but is controlled by site personnel.

3.3.2 Locations

Water Treatment Facilities:

- KV14 - Silver King Treatment Pond #2 Decant;
- KV28 - Galkeno 300 Treatment Pond Decant;
- KV32 - Galkeno 900 Treatment Pond Decant; and
- KV43 - Bellekeno 625 Treatment Pond Decant.

Adits:

- KV17 - Husky South West;
- KV18 - Bermingham Adit;
- KV19 - Ruby Adit;
- KV20 - No Cash 500 Adit;
- KV33 - Keno 700 Adit;
- KV34 - Lucky Queen Adit;

- KV35 - Sadie Ladue Adit;
- KV36 - Flame and Moth Adit;
- KV45 - Onek Adit;
- KV53 - UN Adit;
- KV66 - Klondike Keno Adit;
- KV67 - Keno 200 Adit;
- KV68 - Brewis Red Lake Adit; and
- KV74 - Bellekeno East Adit.

3.3.3 **Monitoring Requirements**

All treated adit discharges and old mine workings at the Keno Hill Silver District where regular water flow is expected either continuously or at various times of the year are inspected and sampled on a regular basis. Monitoring schedules coincide with the requirements of the Water Licences and reflect the data necessary for closure planning.

3.3.4 **Specific Thresholds**

The specific thresholds that will initiate the adaptive management response will be as follows:

- A currently monitored flow ceases or is reduced by more that 50% of the historical average flows during a period of the year when flow has been historically present.

3.3.5 **Approach to Responses**

As per the general approach to the AMP, a staged response to an interruption in the water flow at adits where flow should be observed will be implemented if this trigger is activated.

The initial response to the trigger will be a more thorough inspection of the adit. This may involve looking deeper into the adit, and looking for evidence of the formation of an ice plug or cave in. If physical inspection of the underground workings is not possible, then evidence of adit ice formation or cave in near surface will be conducted.

If an ice plug has formed and impeded the constant flow of water, the next step will be the determination of the extent of the ice plug. If the ice plug consumes less than 25% of the adit opening where it is located, then increased monitoring of the ice plug will be necessary to observe whether the ice plug develops into a larger plug or whether it has reached the extent of its formation and will recede once the seasonal increase in the temperature occurs. This inspection will also include linkages to other developments including vent raises and shafts and their status (i.e. are they closed to prevent air movement).

If the ice plug consumes more than 25% of the adit opening where it is located, then it has to be determined whether the adit contains or requires heat trace. If heat trace is present, then an inspection of the electrical system will be required as the presence of ice in this amount will likely be an indicator that the heat trace is not working. The first components to inspect are electrical connections making sure that all connections are clean and are firmly in contact. If all contacts are satisfactory, then the unit should be checked for external damage and any damaged parts should be replaced. If the electrical connections are all good and there is no evidence of external damage, arrangements should be made to have a qualified repair technician look at the unit and repair.

De-icing measures need to be implemented for adits with an ice plug forming in them in order to bring the ice formation under control whether or not the adit contains a heat trace. The process of de-icing will consist of utilizing a heated steam point to thaw a number of holes into the ice block that has formed in the adit. The holes should be sufficient to enable the establishment of adit flow. Once the holes are generated, steam pipes will operate until the ice blockage has been reduced to enable adit flows.

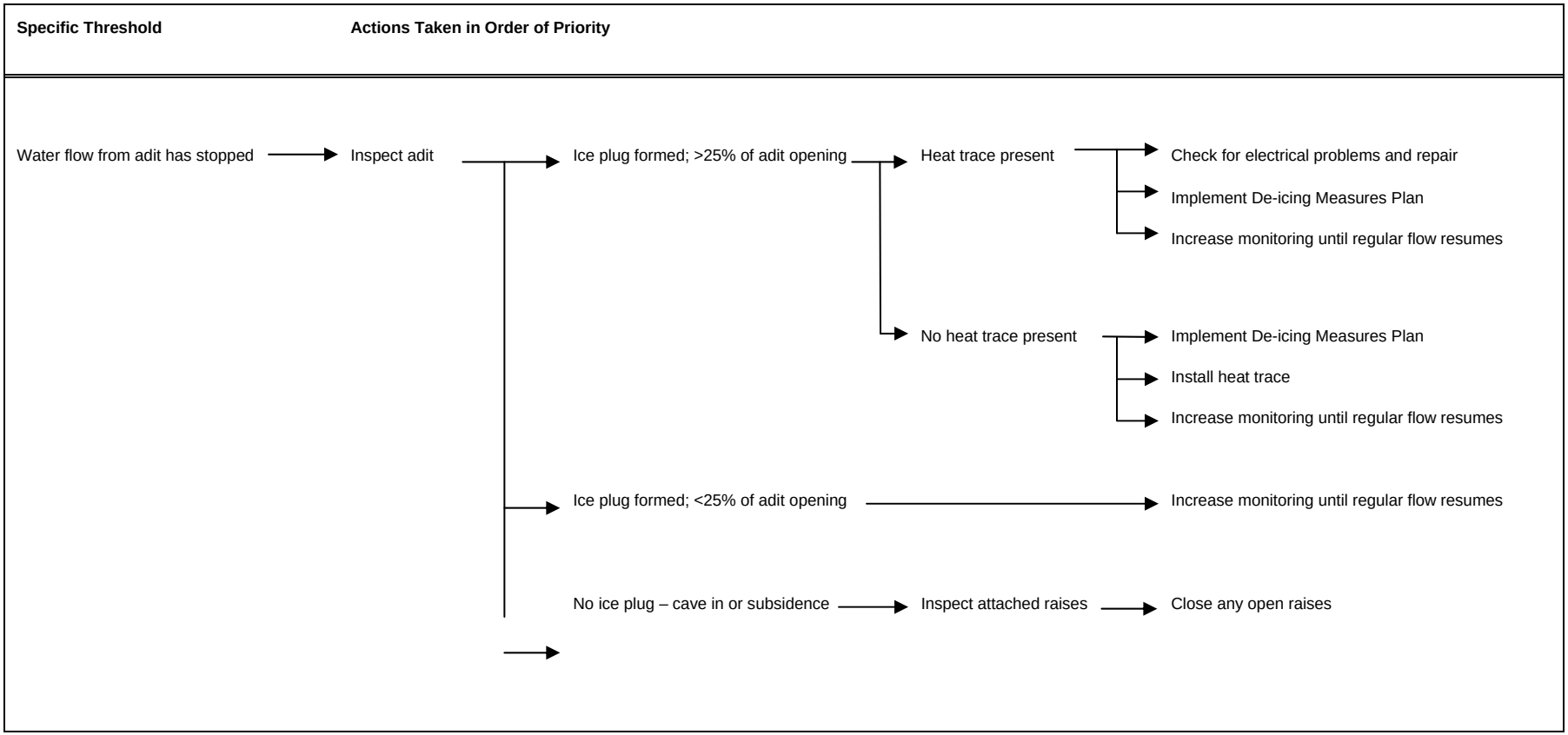
If the adit is not equipped with a heat trace, then heat trace could also be installed in order to prevent the long term build-up of another ice plug once the de-icing measures have been completed.

In both cases, the monitoring of these locations should be increased to ensure that the staged response has been adequate to mitigate the consequential effects of the event.

3.3.6 **AMP Summary for Monitored Flow Stops**

Table 3-6 provides a summary of this AMP event including specific thresholds and actions to be taken in order of priority.

Table 3-6 AMP Summary for Monitored Flow Stops



3.4 NEW WATER FLOW IS OBSERVED

3.4.1 Description

Although the site caretakers are aware of the majority of water flows exiting from the underground workings at the Keno Hill Silver District, there is always the possibility that a water flow can be generated from a previously dry location, or a location that was previously undisclosed or undiscovered.

The environmental consequences of a new water flow being generated on the property is the potential exposure of humans, wildlife or down gradient stream, including fish bearing streams to potentially increase levels of contaminants (metals, sediments) that could be contained in the flow. Another consideration is the affect of the water flow on physical characteristics of the environment, such as soil erosion or permafrost degradation, which could negatively impact the surrounding environment.

3.4.2 Locations

Site wide based on routine inspection throughout the property.

3.4.3 Monitoring Requirements

Since it is impossible to predict where a new flow of water is going to be generated, there can be no specific monitoring requirements to observe new water flows prior to their existence. New water flows would be observed during routine monitoring of known sites, either during travels from site to site, or upon inspection of the sites themselves. Generally there is daily travel and site inspections from one end of the district to the other as part of the operation of the water treatment facilities.

3.4.4 Specific Thresholds

The specific thresholds that will initiate an adaptive management response will be as follows:

- A water flow is observed with a flow greater than 30 L/sec, persists for at least 7 days and is observed to influence other site workings, facilities, infrastructure or property, or drains to a downstream receiving water that is fish bearing. This flow is considered adequate as it

allows for the winter season when glaciation occurs at numerous locations and is a normal site occurrence.

3.4.5 **Approach to Responses**

As per the general approach to the AMP, a staged response to a sighting of a new water flow will be implemented if the trigger is activated.

The initial response to the trigger will be to document the path of the new water flow. Areas of particular concern when documenting the flow path should include flows through waste rock piles, flows into other underground mine workings, and flows into other watercourses. Documentation (photo's and GPS survey) should be sufficient enough so that the new water flow can be accurately displayed on a site map.

The next step of the response to a new water flow is to obtain a sample for water quality from the water flow and to perform a comprehensive analysis of the water. This analysis is important as it will determine whether the new flow will contribute high metal loading or contamination to a nearby watercourse or to the local groundwater levels, which will, in turn, determine the severity or impact the new water flow will have on the surrounding environment, and whether a specific mitigation treatment program will have to be implemented at this location. If metal concentrations are found to be of concern, and the flow path does not affect human resources or intersect with a potential fish bearing stream, then the site will be subject to continual monitoring. Downstream locations would be monitored to ensure that the flow path does not eventually reach fish bearing waters either through an unobserved flow or through groundwater.

If the flow path does deposit loading into a fish bearing stream or creek, an assessment of mitigation measures or water treatment options will be performed and an appropriate plan will be implemented after consultations with technical experts and regulatory agencies.

The next step of the response is to determine the physical stability of the environment along the new flow path. The most common area to suffer physical instability due to water flows will be waste rock piles, followed by steep embankments with loose soil. If either short or long term stability is threatened, then mitigative measures will have to be addressed and could consist of redirection of the flow.

3.4.6 **AMP Summary for New Water Flow**

Table 3-7 provides a summary of this AMP event including specific thresholds and actions to be taken in order of priority.

Table 3-7 AMP Summary for New Water Flow

SPECIFIC THRESHOLD	ACTIONS TAKEN IN ORDER OF PRIORITY			
Flowing water is observed at a previously dry site - >30 L/s for 7 days	Document the flow path	Identify areas of metal loading or physical instability (long or short term)	Complete mitigative design for areas of potential physical instability	Implement physical instability preventative measures
	Initiate monitoring of water quality and flow	Water quality does not exceed effluent guidelines		Continue regular monitoring of water quality
		Water quality exceeds effluent guidelines and does not enter fish bearing waters		Initiate monitoring of downstream sampling locations
		Water quality exceeds effluent guidelines and enters fish bearing stream		Implement mitigation or treatment program

3.5 WATER FLOW PATH CHANGES

3.5.1 **Description**

Although the flow path of most of the major water contributing adits are previously documented and rarely change their course, there is the possibility that, due to some unforeseen circumstances, such as an unusually large or long freshet period, above average precipitation, or the displacement of soil or rock due to landslides or rock falls, the flow path of any one of these sites could be altered.

An altered flow path may not have any effect on the surrounding environment other than the path's own displacement, but an altered flow path may also become a hazard if it causes physical instability of soil or rock due to erosion, interferes with property or public infrastructure such as roads or highways, or acts as a conduit for potential contaminates to be deposited in fish bearing creeks or streams. In these cases management will have to step in and intervene and respond in order to prevent a possible detrimental effect on the surrounding environment or infrastructure.

3.5.2 **Locations**

Water Treatment Facilities:

- KV12 - Valley Tailings Pond #3 Decant;
- KV14 - Silver King Treatment Pond #2 Decant;
- KV28 - Galkeno 300 Treatment Pond Decant;
- KV32 - Galkeno 900 Treatment Pond Decant; and
- KV43 - Bellekeno 625 Treatment Pond Decant.

Adits:

- KV17 - Husky South West;
- KV18 - Bermingham Adit;
- KV19 - Ruby Adit;
- KV20 - No Cash 500 Adit;
- KV33 - Keno 700 Adit;

- KV34 - Lucky Queen Adit;
- KV35 - Sadie Ladue Adit;
- KV36 - Flame and Moth Adit;
- KV45 - Onek Adit;
- KV53 - UN Adit;
- KV66 - Klondike Keno Adit;
- KV67 - Keno 200 Adit;
- KV68 - Brewis Red Lake Adit; and
- KV74 - Bellekeno East Adit.

3.5.3 **Monitoring Requirements**

Since it is almost impossible to predict when a change in the path of flow of water is going to occur, there can be no specific monitoring requirements to observe these changes prior to their existence. Change in flow paths will be observed during the routine monitoring of known sites, either during travels from site to site, or upon inspection of the sites themselves.

3.5.4 **Specific Thresholds**

The specific thresholds that will initiate the action plan will be as follows:

- When the previously documented flow path is observed to have significantly deviated from this path and entered a stream.

3.5.5 **Approach to Responses**

As per the general approach to the AMP, a staged response to a change in a flow path will be implemented if one of the triggers is activated.

The initial response is to determine new sampling points along the flow path, which will be determined based on areas where it is possible for the new water path to collect and disperse contaminants. This phase of the response should also consider current sampling points that may be affected, including downstream receiving water sites and down gradient piezometers.

Once these points are chosen, grab samples will be taken at the appropriate sites and sent out for water quality analyses and possibly toxicity tests if entering fish bearing streams. If receiving water test results or piezometer water quality test results show high or unacceptable levels of loading, an assessment of mitigation or treatment options will be performed and an appropriate strategy will be implemented after consultations with technical experts and regulatory agencies.

Following this analysis, the next step will be to inspect the entire length of the flow path and to document this path (photographs and GPS survey) and any areas of significance, such as areas where physical stability may be of concern or areas where the path now intersects another watercourse or water body. This will help determine if the new path now presents metal loading potential to a stream whether fish bearing or not that was previously unaffected by this water flow.

After documenting the flow path, areas of instability will be investigated that may have been identified during the inspection of the new flow path. These areas may include waste rock piles or slopes with loose soil or gravel cover or effects to site infrastructure. An assessment of the possible long term effects of water flow through these areas of instability will be performed and, if necessary, temporary mitigative measures will be designed and implemented until the final Closure Plan can be implemented. Construction of any required facilities (ditches, berms, rip rap channels) and implementation of any required work plans will then proceed according to any directives returned by the Yukon Water Board.

3.5.6 **AMP Summary for Change in Water Flow Path**

Table 3-8 provides a summary of this AMP event including specific thresholds and actions to be taken in order of priority.

Table 3-8 AMP Summary for Change in Water Flow Path

SPECIFIC THRESHOLD	ACTIONS TAKEN IN ORDER OF PRIORITY			
.				
Flow path change to a new stream	Document the entire flow path	Identify areas of metal loading or physical instability (long or short term)	Complete mitigative design for areas of potential physical instability	Implement physical instability preventative measures
	Determine new water sampling locations	Initiate monitoring of water quality and flow	Water quality does not exceed effluent guidelines	Continue regular monitoring of water quality
			Water quality exceeds effluent guidelines/does not enter fish bearing waters	Initiate monitoring of downstream sampling locations
			Water quality exceeds effluent guidelines/enters fish bearing stream	Implement mitigation or treatment program

4. NON-AML WASTE ROCK EXHIBITS AML SEEPAGE

As mentioned previously in Section 1.4 (Plans in Place) a number of plans are in currently in place with respect to waste rock management and monitoring:

- Waste Rock Management Plan (January 2008);
- Waste Rock Metals and Acid Base Accounting Testing Plan (October 2008); and
- Mine Wall Testing Plan (October 2008).

The efficacy of these plans has been demonstrated through advanced exploration, development and production at the Bellekeno Mine. Although Alexco has a high level of confidence in the ability of these plans to accurately predict drainage chemistry and accurately designate waste rock appropriately, the following sections pertain to the possibility for acidic or metal leachate (AML) to occur as a result of seepage or runoff though waste rock disposal areas or areas where waste rock designated as non-AML has been used as a construction material. In addition, seeps from historic (unsegregated) waste rock piles are also considered.

4.1 WASTE ROCK SEEPAGE/RUNOFF TRENDING TO AML CONDITIONS

4.1.1 Description

Waste rock seeps/runoff will be monitored to determine if water quality is trending to AML conditions and an adaptive management response is required.

4.1.2 Locations

- An observed seep has historically been monitored below Bellekeno 625 (KV-44).

- A recently established water quality monitoring station exists at the Onek Waste Rock Storage Facility (KV-78) to monitor runoff.

- Any seepage from works constructed or upgraded with non-AML material, which currently includes Bellekeno East and Bellekeno powerline roads. Other Bellekeno East

waste rock management areas as defined in the Waste Rock Management Plan are also monitored for drainage or seeps.

- Any other roads, facilities or structures built from non-AML material to be constructed under existing or anticipated licenses.

4.1.3 **Monitoring Requirements**

Specific monitoring requirements for the Bellekeno 625 seep (KV-44) and Onek Waste Rock Storage Facility (KV-78) are outlined in the Water Licence QZ07-078. Monthly field measurements of pH, temperature and conductivity in will be taken between May and October, and flow at KV-44 will also be estimated. Samples will also be collected on an annual basis for KV-44 and a quarterly basis for KV-78 and sent to an external laboratory for the full suite of water quality analyses.

As per the Waste Rock Management Plan, any waste rock drainage or seeps observed between May and October will be monitored for estimated flow volume and basic field parameters of pH and conductivity. Evidence of sulphide oxidation such as snow melt areas or the presence of sulphide oxidations products will also be noted.

One geomembrane-lined lysimeter $\geq 5m^3$ will be installed in both AML (Onek Waste Rock Storage Area) and non-AML storage areas (Bellekeno power line road). Drainage volume will be monitored, with field parameters (pH and conductivity) measured on a monthly basis from May to October. Providing there is sufficient quantity of drainage, a full suite of water quality analyses will be conducted at least twice per year.

4.1.4 **Specific Thresholds**

Field measurements of pH and conductivity will be monitored to determine if the following specific thresholds have been breached due to AML:

- pH significantly declining between measurements or dropping below 7.0; and/or
- conductivity showing a significant increasing trend or conductivity above 2,000 μS/cm.

As the Onek Waste Rock Storage Facility is a licenced effluent discharge point, specific thresholds and adaptive management responses are discussed in Section 3 – Significant Change in Water Quality or Quantity (Sec 3.1.4.1 and 3.1.5.1).

4.1.5 **Approach to Responses**

Initial responses to an observed waste rock seep or runoff trending to AML conditions can include further inspection of the waste rock source material to ensure that the rock types used for construction are acceptable and mitigative measures such as ditching, berming, or pumping water, rock removal or whatever alternative is required to prevent degradation to the quality of water nearby. A full suite of water quality analysis will be performed by an external laboratory to verify the accuracy of field measurements.

The location of seepage or runoff will be documented with photos and GPS.

Downstream or down gradient locations should be monitored to ensure that AML runoff does not eventually reach fish bearing waters. If water quality analyses indicates runoff does deposit loading into a fish bearing stream or creek, the initial response of ditching, berming, pumping or selective waste rock removal to prevent this would be implemented. Once the seepage/runoff is diverted or removed, measures would be taken to prevent the AML from occurring. This may include removing the material responsible for producing the AML runoff and transporting it to a Potentially-AML Waste Rock Storage Facility, installing a cover or water diversion system, or possibly collection and treatment of the runoff (i.e. Onek Waste Rock Storage Facility).

Weekly monitoring at the location trending to AML conditions would be implemented until seepage/runoff stops for two consecutive weeks or thresholds are not triggered for two consecutive months.

4.1.6 **AMP Summary for Waste Rock Seepage/Runoff Trending to AML Conditions**

Table 4-1 provides a summary of this AMP event including specific thresholds and actions to be taken in order of priority.

Table 4-1 AMP Summary for Waste Rock Seepage Trending to AML Conditions

SPECIFIC THRESHOLD	ACTIONS TAKEN IN ORDER OF PRIORITY		
pH significantly declining between measurements or dropping below 7.0; and/or conductivity showing an increasing trend or conductivity above 2,000 µS/cm	Prevent degradation of surface waters →	confirmatory sample to external Lab →	downstream / down gradient monitoring
	Inspect rock types to ensure suitable for construction →	document seepage with photos & GPS →	Cover installation
		→	Selective waste rock removal
		→	Ditching and diverting seepages
		→	Collect & treat runoff

5. SLUDGE STORAGE AREA EFFECTIVENESS COMPROMISED

As mentioned previously in Section 1.4 (Plans in Place) a Sludge Management Plan Revision No.1 (May 2008) is currently in place. The following sections pertain to the potential for the effectiveness of sludge storage areas mentioned within this plan to become compromised.

5.1 SEEPAGE OBSERVED NEAR SLUDGE STORAGE AREA

5.1.1 Description

Any seepage observed in the vicinity of the sludge storage areas will be monitored to determine if it is resulting from sludge deposition.

5.1.2 Locations

Sludge storage areas will be routinely monitored for seepage:

- Sime Pit;
- Sime Waste Dump; and
- Valley Tailings Sludge Storage Cell.

5.1.3 Monitoring Requirements

Specific monitoring requirements for the Sime Pit are outlined within the Sludge Management Plan. Among these monitoring requirements are visual daily inspection reports of the facility and sludge status and inspection for seeps in the immediate vicinity of the Galkeno 300 treatment system, which could provide an indication of decant water from the Sime Pit.

Similarly, visual inspections will be conducted of the Sime Waste Dump and Valley Tailings Sludge Storage Cell when these facilities are in use.

5.1.4 Specific Thresholds

Any new identified seeps will be monitored and analyzed onsite for the pH and zinc thresholds:

- pH > 8.5 and zinc > 1.0 mg/L.

5.1.5 **Approach to Responses**

Seepage observed in the vicinity of the sludge storage areas will be documented with photos and monitored weekly for flow, field pH and zinc. A full suite of water quality analysis will be performed by an external laboratory to verify the accuracy of field measurements. The flow path will be documented and an assessment of the down gradient environment conducted to determine if flow is reaching surface waters and whether or not they are fish bearing. If seepage is depositing a load into a fish bearing stream or creek, ditching, berming or pumping may be implemented to prevent this. Alternative sludge storage area would be assessed and use of the current one would cease. Other pit locations could be investigated for potential sludge storage areas including the Upper Sime Pit and Hector Calumet Pits.

The Sludge Management Plan would be revised to incorporate any new sludge storage areas and implemented.

5.1.6 **AMP Summary for Seepage Near a Sludge Storage Area**

Table 5-1 provides a summary of this AMP event including specific thresholds and actions to be taken in order of priority.

Table 5-1 AMP Summary for Seepage Near a Sludge Storage Area

SPECIFIC THRESHOLD	ACTIONS TAKEN IN ORDER OF PRIORITY		
ph > 8.5 and zinc > 1.0 mg/L →	monitor weekly for flow, pH and zinc →	confirmatory sample to external Lab →	downstream / down gradient monitoring & photo documentation
		→	if depositing to fishing bearing waters - ditching /diverting seepage
		→	assess alternative locations
		→	cease use of sludge storage area
		→	Revise Sludge Management Plan & implement

5.2 SLUDGE STORAGE AREA APPROACHING CAPACITY

5.2.1 **Description**

Sludge storage areas will be monitored daily during use to ensure sufficient capacity.

5.2.2 **Locations**

Sludge storage locations are outlined in the Sludge Management Plan:

- Valley Tailings Area Sludge Storage Cells;
- Sime Waste Dump; and
- Sime Pit.

5.2.3 **Monitoring Requirements**

Visual inspection of freeboard in the sludge storage areas. Specific monitoring requirements for the Sime Pit are outlined within the Sludge Management Plan. Among these monitoring requirements are visual daily inspection reports of the facility and sludge status including freeboard.

Similarly, visual inspections will be conducted of the Sime Waste Dump and Valley Tailings Sludge Storage Cell when these facilities are in use.

5.2.4 **Specific Thresholds**

Freeboard is approaching capacity: 1.5 m. A minimum freeboard of 1.0 m below the decant point will be maintained.

5.2.5 **Approach to Responses**

Determine if there is seepage from the sludge storage area as per the visual inspection (Section 5.1).

An investigation would be conducted of the ability to increase the facility capacity by increasing berm height for example.

Alternative sludge storage area would be assessed and use of the current one would cease Other pit locations could be investigated for potential sludge storage areas including the Upper Sime Pit and Hector Calumet Pits.

The Sludge Management Plan would be revised to incorporate any new sludge storage areas and implemented.

5.2.6 **AMP Summary for Sludge Storage Area Approaching Capacity**

Table 5-2 provides a summary of this AMP event including specific thresholds and actions to be taken in order of priority.

Table 5-2 AMP Summary for Sludge Storage Area Approaching Capacity

SPECIFIC THRESHOLD	ACTIONS TAKEN IN ORDER OF PRIORITY	
Freeboard approaching capacity = 1.5 m →	check for seepage	
→	Investigate ability to increase facility capacity →	assess alternative locations
	→	cease use of sludge storage area
	→	Revise Sludge Management Plan & implement

6. PHYSICAL INSTABILITIES

The following sections pertain to potential physical instabilities that may be encountered in the Keno Hill Silver District.

6.1 AREA OF SIGNIFICANT SUBSIDENCE IS OBSERVED

6.1.1 Description

There are many documented cases of underground workings in the area, and even some underground workings that are undocumented. In a number of these workings, the stopes came very close to the surface of the ground, leaving a very thin crown pillar. Over time, some of these crown pillars started to weather and sag with age, creating instability on the surface. This aging of the crown pillar is usually defined by a large depression in the ground, and in some cases, can expose an opening leading to the underground workings.

These depressions do not have to be very deep in order to cause concern. Subsidence on the surface is an indicator that the crown pillar is failing, and there is no good way to determine what the risk is of that pillar catastrophically failing. The risk to human safety is magnified when the subsidence occurs in an area of human use or a right-of-way used by vehicles and equipment, which can accelerate the failure of the crown pillar.

Subsidence can also be observed as a result of slope failure or erosion, which could potentially effect the down gradient environment, particularly surface water. Slope failure could eventually result in a rock fall or landslide (Section 6.2) or lead to structure failure or portal collapse (Section 6.3).

6.1.2 Locations

Site wide based on routine inspection throughout the property and as outlined in the *Physical Inspection and Reporting Plan* prepared pursuant to Water Licence QZ07-078 by Access Consulting Group in October 2008.

6.1.3 Monitoring Requirements

Since it is almost impossible to predict when or where surface subsidence will occur, there can be no specific monitoring requirements to observe these areas prior to their existence, therefore any observations of subsidence throughout the Keno Hill Silver District will be noted. Maintenance personnel will routinely observe subsidence in the course of their daily site activities.

6.1.4 Specific Thresholds

The specific thresholds that will initiate an adaptive management response include:

- A depression with defined edges is noted in the ground with the potential to create a public safety concern;
- A cave-in has occurred allowing access to the underground workings of a mine site;
- Break in soil/ slope creep/ sediment transport observed from physical structure with perceived potential to effect nearby structures or down gradient surface water.

6.1.5 Approaches to Responses

As per the general approach to the adaptive management plan, a staged response to an observed area of subsidence will be implemented if the threshold is triggered.

The initial response to observing an area of subsidence will be to prevent a hazard to public health and safety and minimize sediment transport to surface waters. This could include installation of barriers such as dykes or silt fencing or construction of diversion ditches or berms. If necessary physical removal or physical repair of structure to remediate. Access to the area would be limited using fencing, barricades, or signage to alert the public and other maintenance personnel to the danger that may exist.

The next stage of the response will be to locate, if possible, diagrams or information pertaining to any underground workings in the area. This will help determine if the cause of subsidence is due to the collapse of a crown pillar or other underground workings.

If there are no underground workings in the area, then it is possible that the subsidence would be due to liquefaction of soil near the surface and may not be a cause for concern. The break or depression will be filled in with soil and monitored to see if the subsidence continues. If the depression continues to appear after soil mounding, then further investigation by a mining engineer may be warranted, particularly if there is a risk to the stability of a nearby structure.

If the subsidence can be attributed to underground workings, the next stage in the response will be to develop an adequate design to counter the negative effects of the subsidence. This will be done in consultation with a mining engineer. This design could include mounding and the use of certain layers of soil or aggregate of specific sizes or physically capping the area such as a shaft. Any physical repairs to slopes or embankments would involve an assessment in consultation with a mining engineer before hand.

This measure will also be implemented if the subsidence exposes an opening to the underground workings. Mining engineers will be consulted in order to devise a plan to adequately cover the opening to prevent access to the underground workings.

The final stage will be to implement the design at the area of the subsidence and to monitor the area to watch for signs of continued subsidence at or around the previously identified area of subsidence.

6.1.6 **AMP Summary for Area of Significant Subsidence**

Table 6-1 provides a summary of this AMP event including specific thresholds and actions to be taken in order of priority.

Table 6-1 AMP Summary for Area of Significant Subsidence

SPECIFIC THRESHOLD	ACTIONS TAKEN IN ORDER OF PRIORITY					
Area of subsidence has exposed opening to underground workings		Review available underground mine workings				
Area of subsidence effects public safety	Close off area around subsidence with delineating markers or fence	Review available underground mine workings	Underground mine workings confirmed	Design structurally sound cover for subsidence	Implement design	Continued monitoring
Break in soil/ slope creep/ sediment transport from physical structure	Prevent sediment transport to surface waters		No evidence of underground workings	Fill in depression and monitor for further subsidence	Subsidence continues	Consult with mining engineer

6.2 ROCK FALL OR LANDSLIDE OCCURS WITHIN MONITORED AREA

6.2.1 Description

There are a number of potentially unstable slope and rock/soil depositions throughout the Keno Hill Silver District generated by the numerous mine workings and associated activities that have occurred there over the past 100 years. Instabilities exist in places such as pit walls, many of which are in a state of ravelling. Trenching into steep slopes can often leave an unstable rock wall that could fail due to timely erosion. Waste rock piles can possibly shift due to changes in foundation conditions. Even access roads with sections that have been cut or blasted through rock can suffer wall failure given the right circumstances.

Most areas where there exists the possibility of a rock fall or landslide present minimum risk to human or equipment safety. Even though it is remote or unlikely, a significant amount of material can potentially block access to a site. Soil movement can also impede on certain water flows, thereby changing the flow path and initiating an event noted in Section 3.5 of this AMP - Water Flow Path Changes.

6.2.2 Locations

Site wide based on routine inspection throughout the property.

6.2.3 Monitoring Requirements

Since it is almost impossible to predict when or where a rock fall or a landslide will occur, there can be no specific monitoring requirements to observe these areas prior to their existence. As with Section 6.1 (Area of Significant Subsidence), the monitoring information required is observations of instability or subsidence throughout the Keno Hill Silver District. Maintenance personnel will routinely observe soil or earth movement in the course of their daily site activities.

6.2.4 Specific Thresholds

The specific thresholds that will initiate an adaptive management response include:

- A rock fall or landslide has blocked access to a previously monitored site.

- A rock fall or landslide has blocked access to a roadway previously used by the public.
- A rock fall or landslide has blocked or re-directed the flow of water of a documented stream or watercourse.
- Liquefaction of a waste rock pile foundation has caused waste rock to migrate closer to a watercourse.

6.2.5 Approaches to Responses

As per the general approach to the adaptive management plan, a staged response to the presence of a rock fall or a landslide will be implemented if a threshold is breached.

The initial response to observing a rock fall or a landslide will be to determine if it impedes on a right-of-way or a water flow path. If the debris impedes on a right of way, access to the area will be limited using fencing, barricades, or signage to alert the public and other maintenance personnel to the debris' presence.

The next stage of the response will be to examine the area to assess the possibility of further erosion of the originating slope. This task may require the services of a registered engineer. If warranted, a plan will be developed to prevent future erosion in the area.

The final step in the response to debris from a rock fall or a landslide impeding on a right-of-way will be to remove the debris, likely with heavy machinery, and transporting it to an isolated waste pile where the debris will not affect any watercourse or physical stability.

If the rock fall or landslide debris enters a watercourse, then water quality testing will be implemented. This will be done to determine if the presence of the rock in the water is contributing any metal loading to the water. If the loading in the water is found to be effected by the source material, then a mitigation plan will be developed and implemented in consultation with technical experts and regulatory agencies until such time as the debris can be removed from the watercourse, and water levels return to their historical norm.

If the metal loading is determined to be not affected by the source material, then no mitigation treatment plan will be necessary, and the debris can be removed from the watercourse.

The final stage will be to continue monitoring water quality at that location for a period of time until it is determined that the rock fall or landslide had no lingering effects on the water quality.

6.2.6 **AMP Summary for Rock Fall or Landslide**

Table 6-2 provides a summary of this AMP event including specific thresholds and actions to be taken in order of priority.

Table 6-2 AMP Summary for Rock Fall or Landslide

SPECIFIC THRESHOLD	ACTIONS TAKEN IN ORDER OF PRIORITY					
Rock Fall or landslide is Observed	Rocks intrude on right-of-way	Post warning to local traffic	Explore possibility of future rock falls in the area	Implement preventative measures if warranted		Remove intruding rocks with heavy equipment
	Rocks intrude on water flow	Initiate monitoring of water quality and metal leachate testing	Metal loading in source material	Develop and initiate mitigation or treatment plan		
			Metal loading not in source material		Remove rocks or soil from stream or creek bed	Continue water quality monitoring of site

6.3 STRUCTURE FAILURE OR PORTAL COLLAPSE

6.3.1 Description

With advanced exploration and preliminary development taking place in the Keno Hill Silver District, new structures are constructed on site to support these activities. Additionally, the extensive amount of activity in the Keno Hill Silver District in the past century has left behind numerous buildings and mining related structures in various states of disrepair. Although many of these workings are in sparse areas, a number of structures and portals exist in areas where the public can access them easily. In some cases, local literature even encourages the public to attend these sites to observe their historical value.

It is therefore imperative that structures and buildings in those areas frequented by the public that are considered structurally unsafe be dismantled and demolished in an appropriate manner. This type of practice will ensure that the danger to public safety is eliminated.

6.3.2 Locations

Site-wide based on routine inspection throughout the property and specifically:

- Water treatment facility settling ponds and adits;
- Valley Tailings Area;
- New waste rock storages areas and road at Bellekeno;
- Historic mine workings and structures (waste rock load out dumps); and
- Old building and structures throughout the property.

6.3.3 Monitoring Requirements

The monitoring information required includes physical inspections of structures in the Keno Hill Silver District for failure or collapse. Maintenance personnel will routinely observe buildings of concern in the course of their site activities.

6.3.4 Specific Thresholds

The specific thresholds that will initiate the action plan will be as follows:

- Failure of engineered structure or mining component (i.e. water treatment facility settling ponds, Valley Tailings Area dams and decants structures, roads, waste rock dumps);
- A supported structure, building, or portal opening in the vicinity of a public access or point of interest that effects public safety partially collapses;
- A supported structure, building, or portal opening in the vicinity of a public access or point of interest that effects public safety collapses completely.

6.3.5 Approaches to Responses

As per the general approach to the adaptive management plan, a staged response to a structure or portal partially failing or collapsing will be implemented if the threshold is triggered.

The initial response to a building or structure partially failing or collapsing will be to limit access to the area using fencing, barricades, or signage to alert the public and other maintenance personnel to the danger that may exist. The structural failure will be documented and an assessment made of the potential effects to worker and public health and safety and the surrounding environment.

Investigation by a mining or geotechnical engineer may be warranted, particularly if an engineered mining component is at risk of failure (mine portal, tailings dam or settling pond). Recommendations from the engineers will be implemented as required and if warranted engineering plans or designs may be required and developed for implementation in consultation with regulatory authorities.

The response to failure of a historic structure will be to implement consultations with the local community, First Nation of Nacho N'yak Dun and the Heritage Resources Branch of the Yukon Government to determine if the structure should be preserved as an artefact or whether the structure can be torn down and disposed of to eliminate the hazard it poses. If it can be demonstrated that there is no public health and safety concern, Heritage Resources may

determine that the structure should be kept for historical purposes. Access to the area will continue to be limited until such time as the structure is returned to a physically stable state.

If authorisation is given to remove the structure, then a plan will be developed to ensure that the removal of the structure takes place without incident. This plan may include the use of an excavator to pick at the remains and filling any open portals with rock in accordance with *Mine Safety Regulations* to close off access to any underground workings.

6.3.6 **AMP Summary for Structure Failure or Portal Collapse**

Table 6-3 provides a summary of this AMP event including specific thresholds and actions to be taken in order of priority.

Table 6-3 AMP Summary for Structure Failure or Portal Collapse

SPECIFIC THRESHOLD	ACTIONS TAKEN IN ORDER OF PRIORITY				
Building structure near public access collapses →	Erect barriers to prevent public access →	For historic structures - consult with locals and YG for heritage value →	Request to keep structure for heritage values →		Keep barriers erected until heritage takes over responsibility
			No heritage value →	Design plan to remove structure and close portals →	Implement removal plan
Failure of engineered structure or mining component →	Erect barriers to prevent public access →	Assess potential effects to worker and public safety and environment →	Investigation by mining or geotechnical engineer may be warranted →	Implement recommendations from engineers as required	

7. SITE SECURITY COMPROMISED

7.1 GATE, FENCE OR SIGN DAMAGED

7.1.1 Description

Due to the vast history of mining in the Keno Hill Silver District, there exist a large number of mine workings where hazards to public safety exist. In order to alleviate these hazards, depending on the type of hazard and its accessibility, structures, gates, fences, or signs have been erected to prevent the public from entering these areas or draw their attention to the hazard.

Over the course of time, some of these deterrents may suffer damage or fatigue which impedes on their ability to perform as a safety deterrent. The most likely scenario is for the item to have fallen down, however, the items performance may have been degraded by weather erosion or possibly at the hands of vandals.

7.1.2 Locations

Site wide based on routine inspection throughout the property.

7.1.3 Monitoring Requirements

Since it is almost impossible to predict when or where a gate, fence, or sign will be damaged, there can be no specific monitoring requirements to observe these circumstances prior to their existence. The monitoring information required is observations of damage to any of these safety features throughout the Keno Hill Silver District. Maintenance personnel will be familiar with the placement of gates, signs, and fences around the property and thus, during their routine site activities will be able to observe when one of these features requires attention.

7.1.4 Specific Thresholds

The specific thresholds that will initiate the action plan will be as follows:

- A gate is found open outside of a scheduled visit by authorised site personnel.

- A gate post is found to be damaged such that the gate is sufficiently disabled to prevent access to the site by authorised site personnel.
- A gate post is found to be damaged such that the gate no longer prevents unauthorised access to a site of concern.
- A fence is found to be damaged such that it no longer prevents unauthorised access to a site of concern.
- A fence or structure is found to be damaged such that it no longer prevents unauthorised access to a site of concern.
- The placard of a sign has been damaged either by environmental conditions or by vandalism such that the sign is no longer effective in relaying the information intended.
- A sign post has been damaged to an extent where the sign is in a position which renders it ineffective in relaying the information intended.

7.1.5 **Approaches to Responses**

As per the general approach to the adaptive management plan, a staged response to any one of the above circumstances will be implemented if the threshold is triggered.

The initial response to a gate being found open or a fence being damaged and allowing access to the site will first trigger an examination of the area in question in order to ascertain whether trespassers are in the vicinity and may have initiated the condition of the gate or fence. If trespassers are found and do not appear to impose a risk to the site personnel, they will be cordially escorted off the property and the gate will be locked. If site personnel feel that there may be a risk in confronting the trespassers, then the appropriate authorities will be contacted immediately and requested to attend to the situation. If the lock on the gate has been damaged or tampered with, it will be replaced in a timely fashion.

If the gate is found to be damaged such that in no longer prevents unauthorised personnel from accessing a site, then the same measures above will be implemented. Once the trespassers have been escorted off site or the area is deemed to not contain any trespassers, the gate will be repaired or replaced in a timely fashion to ensure it will prevent access to the site by unauthorised personnel.

If the placard of a sign has been damaged either by environmental conditions or by vandalism, or the sign post is broken such that the sign is no longer effective in relaying the information intended, then maintenance personnel should note this at the time of observation and this information should be passed on to the project manager.

7.1.6 **AMP Summary for Damage to Gate, Fence or Sign**

Table 7-1 provides a summary of this AMP event including specific thresholds and actions to be taken in order of priority.

Table 7-1 AMP Summary for Damage to Gate, Fence or Sign

SPECIFIC THRESHOLD	ACTIONS TAKEN IN ORDER OF PRIORITY					
Gate not closed. →	Examine area of concern for trespassers →	Trespassers found →	Escort off of property →	Examine gate →	Gate is not locked →	Lock gate.
		No trespassers found →			Gate structure is broken →	Repair gate
					Gate has fallen over →	Create more adequate foundation for gate.
Fence cut or knocked down →	Examine area of concern for trespassers →	Trespassers found →	Escort off of property →	Examine fence →	Fence is cut →	Repair or replace fence.
		No trespassers found →			Fence is knocked down →	Create more adequate base for fence poles.
Sign is not visible →	Examine sign →	Face of sign disfigured or faded →				Replace sign placard
		Sign post broken →				Replace sign post and remount sign placard.
		Sign post has come out of foundation →				Create more adequate foundation and replant sign.

8. REPORTING PROCEDURE

The Keno Hill Silver District Remediation Manager will be ultimately responsible for implementation of the AMP. Site personnel including the District Manager, Support Services Manager, Exploration Manager, First Aid Manager and Development Manager will also be aware of the AMP and monitoring and inspection requirements. Site treatment operations personnel who conduct the daily inspections will report directly to the Remediation Manager who will work with other site Managers as appropriate to implement the AMP responses. The Data Manager will report to the Environmental Services Manager and Remediation Manager who will support and work directly with site Managers. Should an AMP event be triggered Alexco Senior Management will be appraised and involved in AMP responses as appropriate.

AMP triggered events will be documented and responses reported as part of the monthly water licensing reports. Should an incident occur that triggers an AMP event, this will be reported to the Water Board within 10 days of the occurrence as required under the licences. Monthly reports are provided to the Water Board, YG EMR, Water Resources and the First Nation of Nacho N'yak Dun. The Annual Report will also summarize all AMP events and responses and any revisions to the AMP made as part of the AMP annual review.

9. CERTIFICATION

Should you have any questions regarding this report, or if you require further information, please contact the undersigned at Access Consulting Group in Whitehorse, Yukon, at (867) 668-6463.

Respectfully submitted,

ACCESS CONSULTING GROUP
A registered trade name for Access Mining Consultants Ltd.

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