



Designated Office Evaluation Report

Keno Hill Silver District Lucky Queen and Onek Deposit Production Project Assessment 2011-0315

Proponent: Alexco Keno Hill Mining Corp.

Assessment Completion Date: August 6, 2012

Mayo Designated Office

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EXECUTIVE SUMMARY

Alexco Keno Hill Mining Corp. has proposed to mine two new silver/lead/zinc deposits within the Keno Hills Silver District. The two deposits, Lucky Queen and Onek are respectively located, 4 km and 500 m northeast of Keno City, approximately 50 km northeast of Mayo. The proposed project involves the underground development and mining of Lucky Queen and Onek deposits, and milling the ores at the existing Keno District Mill, which is licenced and operated under Alexco Keno Hill Mining Corp's existing licences. The proponent is seeking an amendment to their Type A Water Use Licence and Quartz Mining Licence to support development of these two new deposits.

The project will entail extraction and processing up to 150,000-250,000 tonnes of ore from Lucky Queen and Onek respectively. The project will include construction and decommissioning of all underground mine workings, non-acid generating and metal leaching waste rock storage, potential acid generating and metal leaching waste rock storage, water use and a water treatment facility, a power line, fuel storage, a new access route and increased camp.

The Mayo Designated Office assessed whether the project would result in any significant adverse environmental, socio-economic, health or heritage effects. During the assessment process members of the public, environmental organizations, the First Nation of Na Cho Nyak Dun and territorial and federal governments submitted 53 comments. Further comments were submitted during the assessment by the Technical Working Group created to assist the Mayo Designated Office in determining the project effects, and scope of project. Based on the comments submitted during the two Seeking Views and Information periods, and through comments submitted by the Technical Working Group, the following valued components have been identified for assessment:

- Water Resources
- Fish and Fish Habitat
- Wildlife and Habitat
- Terrain Stability and Soils
- Human Health
- Community
- Air Quality
- Acoustic Quality
- Visual Quality
- Heritage Resources

With the exception of Fish and Fish Habitat and Heritage Resources, all valued components considered within this report were determined to be significantly adversely effected by the proposed project; such that additional mitigation was required. Mitigations proposed by the proponent in addition to those recommended by the assessor are considered adequate to eliminate, reduce or control the significant adverse effects of the project.

The Mayo Designated Office, pursuant to section 56(1) b of the *Yukon Environmental and Socio-economic Assessment Act (YESAA)*, recommends to the decision bodies that the project be allowed to proceed, subject to specified terms and conditions, as it has determined that the project will have significant adverse environmental or socio-economic effects in or outside the Yukon that can be mitigated by those terms and conditions.

THE TERMS AND CONDITIONS OF THE RECOMMENDATIONS ARE AS FOLLOWS

1. In discussion with regulators and experts, the proponent shall install sufficient groundwater monitoring wells in order to estimate to a high degree the hydraulic conductivity of all potentially impacted aquifers, the groundwater flow directions, vertical and horizontal hydraulic gradients, and the potential flux of contaminants in groundwater on all receptors.
2. The proponent shall prepare a conceptual groundwater model for the site. In preparing the conceptual groundwater model the proponent shall include reasonably foreseeable potential inputs and outputs of water to the backfilled underground workings for operations and post-closure.
3. The proponent shall provide to regulators an analysis and review of all information regarding interactions between the project activities and groundwater resources and flow, including mapping, prior to licensing to establish a baseline for current conditions, including determining the direction of groundwater flow.
4. The proponent shall provide information to regulators on the fate and transport of groundwater constituents that may result in a downstream impact on receiving waters from the new workings at Onek; the results of this information and discussion shall be incorporated into the Adaptive Management Plan.
5. The proponent shall ensure that the Adaptive Management Plan identifies measures that will be taken to minimize inflows into underground workings to mitigate against long-term groundwater quality effects; the proponent shall provide clear methodology for the selection of measures.
6. The proponent shall ensure that N-AML waste rock with elevated zinc content used as construction and upgrade materials is set back an appropriate distance from surface water to avoid impacts; and shall establish appropriate maximum zinc content for the use of these materials for construction purposes.

7. The proponent shall demonstrate to regulators that conductivity is an appropriate surrogate for monitoring N-AML trends, in particular changes to zinc and cadmium in seepage (i.e.; correlation between conductivity and zinc and/or cadmium concentrations) prior to undertaking activities in relation to N-AML.
8. The proponent shall provide a detailed mass load model description to regulators that would allow for a more comprehensive review of the mass load model for the Christal Creek drainage prior to further permits or authorizations being sought.
9. Geochemical confirmation testing for the Lucky Queen and Onek proposed waste rock should be completed and results should be reported to regulators to allow waste rock and predictive loadings provided by the proponent to be re-evaluated and updated throughout the mine life, and appropriate mitigations to be included in the Adaptive Management Plan.
10. The results from ongoing research programs for the District Closure Plan should be applied to the project and included in subsequent revisions of the Reclamation and Closure Plan. The assumptions used for waste rock sources in the predictive loadings model for Christal Creek for closure scenarios should be updated as the understanding of cover performance improves.
11. In the event that land disturbing activities occur between the core breeding period of May 1st and July 31st, prior to clearing, or disturbing the proponent must plan to avoid disturbing or destroying nests of birds listed under the *Migratory Birds Convention Act*. Contact the Canadian Wildlife Service, Whitehorse, for information on considerations related to determining the presence of nest.
12. The proponent shall ensure that in subsequent years, land disturbing activities that have the potential to affect migratory bird nests occur outside of the core breeding period of May 1st and July 31st.
13. The proponent shall keep all equipment in good working condition and regularly inspect for leaks.
14. The camp area shall be enclosed with electric fencing with attention given to camp design (as outlined in the Guidelines for Industrial Activity in Bear Country) in order to avoid attracting bears. The proponent shall report any incidents involving wildlife to the Mayo Conservation Officer (867-996-2202).
15. The proponent shall ensure that during winter months breaks in snow-banks on main access roads are created in order to facilitate wildlife crossing and exiting the road.
16. Employees shall fill out AKHM's posted wildlife log, this log shall be summarized and provided to regulators quarterly, listing wildlife collisions/mortality as well as sightings.
17. Project staff shall be made aware of collared pika, including how to identify the animal and key signs of habitat.
18. The proponent shall not disturb or destroy confirmed collared pika colonies, and no work shall be conducted within a recommended distance. The proponent shall consult with Yukon Environment wildlife experts to establish a reasonable recommended distance.

Rationale: While the pika is a Species of Special Concern under COSEWIC, it is afforded no specific protection. As this animal is not as obvious or well known as some other mammals, there is a potential that project staff would not be aware of pika or their vulnerability to habitat alteration. With this in mind, it is vital that these animals be identified and protected during project activities.

19. Upon the identification of (other than known) colonies for collared pika, the proponent should report the occurrence to the Yukon Conservation Data Centre for advice on further mitigation.
20. Flat Creek camp compound shall be fenced and gated.
21. The proponent shall follow the *Yukon Mineral and Coal Exploration Best Management Practices and Regulatory Guide* (<http://www.yukonminers.ca/Industry/BMPs.aspx>) while conducting all project activities.
22. The proponent shall install effective erosion control measures before starting work to prevent degradation of soil.
23. All vegetative material and organic material will be stockpiled and spread over disturbed areas after work is completed to allow for re-vegetation.
24. The proponent shall test for permafrost prior to work in an area to determine a better understanding of the permafrost layer.
25. The proponent shall avoid work in areas of permafrost.
26. The proponent shall ensure the project proceeds in a manner that incorporates all recommendations issued from the "Human Health Impact Study" commissioned by Yukon Government, Environmental Health Branch.
27. On a quarterly basis the proponent shall discuss with regulators, the First Nation of Na Cho Nyak Dun and the community of Keno City the results of their groundwater monitoring program; constituents of concern for domestic water quality, and measures taken; the results shall inform the adaptive management plan.
28. The proponent, in discussion with Highways and Public Works, shall ensure regular maintenance of Silver Trail Highway to maintain a standard suitable for visitor traffic.
29. The proponent shall improve public safety measures along primary and secondary roads in the area. Full stops and an enforceable speed limit for haul trucks shall be implemented, and monitored with reporting provided to regulators. The reports shall identify the number of complaints received, any interactions between project traffic and local or visitor traffic, and remedial actions taken to address the concerns.
30. Hazardous waste shall be removed from the project location, and disposed of through Environment Yukon's Special Waste Program. In the interim, hazardous waste shall be stored in bear-proof containers so as not to be attractants to wildlife.
31. All petroleum based solid waste (plastic, Styrofoam etc) generated by this project shall be removed from the site and deposited at an approved solid waste facility.

32. The proponent shall install clearly labelled signage to show active mining roads, tourism routes and sites; and heritage features as well as signage identifying appropriate safety precautions for the public entering an active mining area.
33. The proponent shall consider popular viewing locations such as Black Cap Mountain and established interpretative sites when finalizing traffic routing and volume plans, with the intent to reduce impact to public access. Access to established locations shall be maintained via a reasonable route and shall be finalized in discussion with FNNND and Keno City residents, as well as regulators.
34. Any substantive change to traffic volumes, patterns or routing for the project shall be discussed prior to changes with the community of Keno City and FNNND in addition to regulators. The proponent shall make best efforts to create a mutually beneficial co-existence of mining, tourism and traditional lifestyles.
35. The proponent shall work with local residents and First Nation community members to develop the proposed Keno City Socio-economic Mitigation Plan that outlines not only the necessary measures to maintain quality of life, but also the needs of each group in terms of land usage. This shall be completed prior to closure, and implemented in such a way as to incorporate recommendations into closure plans.
36. The proponent shall amend their dustfall monitoring program to include measurement of total particulate per volume of air for selected size fractions and undertake chemical analyses should the total dust per volume of air exceed health based mass per volume benchmarks.
37. Any dust measurement conducted by the proponent needs to be comparable to the Yukon Ambient Air Quality Standards. The "simple TSP (dustfall) monitoring" that is mentioned does not allow for this direct comparison of results.
38. The proponent shall ensure ore trucks are covered and windscreens are used to reduce airborne contaminants.
39. The proponent shall ensure that all machinery has mufflers in place that are designed to reduce emissions and particulate.
40. The proponent shall make best efforts to reduce their use of diesel generators; except in warranted circumstances (e.g. power failure).
41. The proponent shall use low sulphur and low aromatic fuel.
42. The proponent shall reduce idling of all company vehicles and project related traffic on site, and shall report their efforts and adaptive management measures annually to Yukon Government, Environment.
43. There shall be no movement of ore or waste rock to or from the Onek site between the hours of 1900 and 0700.
44. The proponent shall install broadband beepers on the machinery onsite to prevent irritation and nuisance noise from backup beepers.

45. As per Section 110 of the YESAA, the proponent shall conduct effects monitoring of noise emissions in relation to impacts to local businesses. Noise monitoring shall be undertaken quarterly with results provided to residents, YG Tourism and Culture Branch, and YESAB. Results of monitoring will be compared to the baseline established for a similar sized community without industry, from the Comprehensive Sound Study for Keno City 2012. Based on the results of the monitoring and in discussion with the above-listed parties, additional mitigation measures, or adaptive management strategies shall be identified and implemented.
46. The proponent shall work closely with the residents of Keno City to determine appropriate noise monitoring stations that will, at minimum, include the most impacted residence (R4), and the Keno City Campground, in addition to two other locations that have been previously monitored as described in the table below.

Residence	GPS Location	Description
R01	N63.90827 W135.29599	East end Residence, north side of Lightning Creek road
R02	N63.91019 W135.29968	Residence, east side of Sign Post road
R03	N63.91023 W135.30205	Town Center, north from the Snack Bar
R04	N63.91239 W135.30376	Residence, west side of Wernecke Road, closest to the previously proposed Onek Sign Post portal location
R05	N63.90851 W135.30993	Residence, about 850m east from the Mill

47. The proponent shall provide residents with a means to formally complain of noise disturbance; and the proponent shall identify to residents the measures that shall be taken to respond to noise complaints.
48. The proponent shall prohibit use of engine retarder brakes within 500m of the Keno City Campground.
49. The proponent shall ensure all haul trucks, as well as machinery onsite at Onek is equipped with noise-limiting mufflers.
50. Should the Yukon Government Human Health Impact Study include mitigations in regards noise effects, these mitigation measures shall be included in the Quartz Mining Licence amendment.
51. The proponent shall work with government and stakeholders, as well as the First Nation of Na Cho Nyak Dun in drafting and developing a local area plan that meets the needs of AKHM while simultaneously acknowledging values of importance to the community of Keno City, and FNNND that must be preserved.

Rationale: Local area planning is considered a form of land use planning on behalf of unincorporated or rural areas outside of municipalities for both private and Crown land. Local area planning can also include First Nation Settlement Land if undertaken jointly with First Nations. Land

use plans are policy documents that guide development and land use in a particular area. They contain maps that show how lands are to be designated or classified and contain policies outlining how the land in each of these areas may be used. It is thought that a local area plan may assist Keno City residents and AKHM reach agreement on where and how to protect values associated with tourism and local economy and quality of life, while also acknowledging areas suitable for further mining development.

52. The proponent shall ensure that access along roads and trails for the purpose of project activities does not result in unnecessary rutting or increased levels of garbage and litter along the routes.
53. The proponent shall ensure new clearings for and around industrial infrastructure are limited to ensure visual disturbance is minimal, and the affected footprint, including berms, ditches, ponds and portal pads will be re-vegetated with seed mixture to promote re-growth in disturbed areas.
54. The proponent shall work with the residents of Keno City to ensure that aesthetic factors, which are a key part of Keno's image and appeal, are maintained.

Issued by the Mayo Designated Office on August 6, 2012.

For more information please contact:

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Manager

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ACRONYMS

AKHM	<i>Alexco Keno Hill Mining Corp.</i>
BYPASS	<i>Keno City Bypass Road</i>
COSEWIC	<i>Committee on the Status of Endangered Wildlife in Canada</i>
DSTF	<i>Dry Stack Tailings Facility</i>
FNNND	<i>First Nation of the Na-cho Nyak Dun</i>
LFN	<i>Low-Frequency Noise</i>
N-AML	<i>Non-Acid Metal Leaching</i>
P-AML	<i>Potential-Acid Metal Leaching</i>
RCP	<i>Reclamation Closure Plan</i>
SVI	<i>Seeking Views and Information</i>
TWG	<i>Technical Working Group</i>
UKHM	<i>United Keno Hill Mines</i>
WRDA	<i>Waste Rock Dump Area</i>
WRSF	<i>Waste Rock Storage Facility</i>

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PART A. INTRODUCTION

The following sections present background information for this project and the assessment. This information includes details of the project; the environmental and socio-economic setting of the project area; and a description of the requirement for an assessment. Part A also has a discussion on the scope of the assessment, which includes the identification of values potentially affected by the project.

1.0 PROJECT DESCRIPTION

1.1 PROPONENT INFORMATION

The proponent for the proposed project is Alexco Keno Hill Mining Corp (AKHM). AKHM is a wholly owned subsidiary of Alexco Resource Corp. (Alexco) and has been incorporated for operation and mineral extraction in the Keno Hill Silver District. Access Consulting Group acted as the agent to the proponent during the assessment process. The primary contact for the project was Mr. Brad Thrall, Chief Operating Officer for AKHM. Contact information for the proponent is as follows:

200 Granville Street
Suite 1150
Vancouver, BC V6C 1S4

1.2 GEOGRAPHICAL CONTEXT

The proposed project is located 452km north of Whitehorse, and approximately 50 km northeast of the Village of Mayo, within Central Yukon. The Lucky Queen and Onek deposits are located within the Keno Hills Silver District, 4 km and 500 m, respectively, from Keno City. Both deposits are located within the traditional territory of the First Nation of Na Cho Nyak Dun (FNNND). Table 1 provides project location details and coordinates, while Figure 1 below illustrates the two deposit locations.

Coordinates:		First Nations Territories Involved: First Nation of Na Cho Nyak Dun
Onek	63° 54' 57" N 135° 18' 18" W	
Lucky Queen	63° 57' 14" N 135° 15' 11" W	
Watershed(s) and Drainage Region: Yukon River-Stewart River-Beaver River		Nearby Water Body: South McQuesten River

Table 1.

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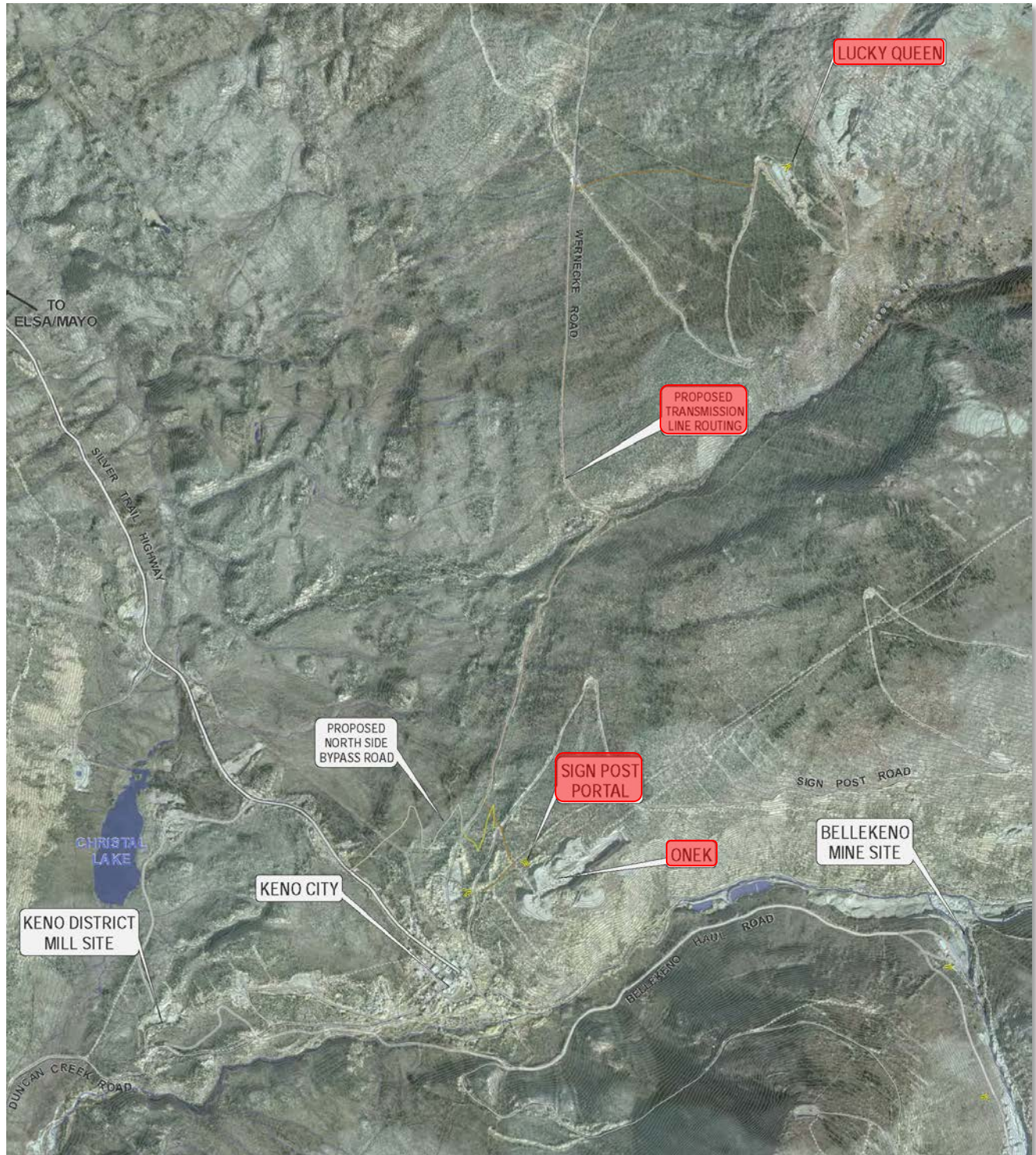


Figure 1. Proposed project location and existing infrastructure of Bellekeno Mine. Text boxes highlighted are proposed activities/facilities. (Image modified from project proposal)

1.3 HISTORY OF PROJECT

Various operators, most significantly United Keno Hill Mines (UKHM), have operated mines in the Keno Hills Silver District since 1913. The main operations ceased in 1988. In early 2001, the Government of Canada declared the site abandoned and placed the site under “care and maintenance”. This involved lime treatment to reduce metals at various adit discharges and the Valley Tailings Facility to prevent further environmental degradation¹.

In order to make the mine site viable for the private sector, the federal government agreed to limit the liability to any potential purchaser. Financial responsibility for the existing historical liability would remain with the federal government. In July 2005, Alexco was chosen as the preferred purchaser, and the sale was approved in 2006. Once Alexco obtained a water licence for care and maintenance of the site (QZ06-074), in November 2007, final conveyance of ownership was granted to the company. Alexco now has sole ownership of the site while the federal government retains financial liability for the environmental impacts resulting from work done on the site prior to devolution. Under the Subsidiary Agreement between Alexco and Aboriginal Affairs and Northern Development Canada, any new liabilities arising from the issuance of licences or permits for new work at the site will not be added to the federal government's liability but will be the responsibility of Alexco.² The proposed Bellekeno Mine was reviewed by the Mayo Designated Office and recommended to proceed with terms and conditions in June, 2009).

LUCKY QUEEN

The Lucky Queen deposit was originally mined by Treadwell Yukon Limited from 1927-1932 when reserves were thought to be exhausted. The Lucky Queen vein and strike extensions were explored intermittently throughout the 1950's, 1960's, 1970's and early 1980's. Between 1985 and 1987 UKHM constructed an 1800 m long exploration drift, which was designed to intersect the ore structure beneath the historic mine workings. The company faced insolvency prior to completing the work, and further exploration work of the Lucky Queen strike was undertaken by AKHM. By the time exploration under UKHM ceased at the Lucky Queen deposit approximately 62,000 tonnes (t) of waste rock had been deposited on surface at the historic waste rock dump.³

ONEK

In 1922, the Onek Mining Company Ltd. explored the core Onek claims via a number of underground workings and open cuts. From 1950-1952, UKHM re-opened the workings and developed an additional adit, driving rises into historic workings for approximately 400 m at the 400 level. All mining at Onek ceased in 1965 until 1980 when a 20-40 m open pit was developed above the historic underground

¹ YOR 2009-0030-122-1

² YOR 2009-0030-122-1

³ Personal communication

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workings. The historic Onek site consists of two adjoining open pits and 400 level adit with various mine workings in-between the surface expression of mining and lowest level of underground mining. Given the historic nature of the site there are existing waste rock dumps containing over 600,000 t. Additionally, there are low-grade ore stockpiles that were never processed. The pit and historic workings are hydraulically connected via the Fisher shaft; and as such the 400 level adit drains water both from the historic pit, and the underground workings.⁴

1.4 PROJECT DETAILS

1.4.1 Overview

The proposed project involves underground development and mining at the Lucky Queen and Onek deposits, and milling the ores at the existing Keno District Mill. Construction and initial development at both sites is anticipated to commence in the latter part of 2012. Production is anticipated to start in 2013. With the proposed tonnage of ore from Lucky Queen and Onek being added to the existing tonnage from Bellekeno, the current authorized tonnage cap of 613,000 t would be reached by the third quarter of 2015.

It is important to note that no change in the currently licenced tonnage of ore, waste rock or tailings deposition is proposed. AKHM proposes to continue to operate within the authorized quantities and to incorporate Lucky Queen and Onek into the mining activities already licenced under Water Licence QZ09-092, and Quartz Mining Licence QML-0009. The following are the authorized quantities for each activity:

- The maximum annual production rate will not exceed 400 t/day (QML-0009);
- Ore from Bellekeno, Lucky Queen and Onek will not exceed a combined total tonnage of 613, 000 t (QML-0009);
- Tailings from Bellekeno, Lucky Queen and Onek will not exceed a combined total tonnage of 322,000 t in the Dry Stack Tailings Facility (QZ09-92);
- Waste rock tonnage deposited on surface or underground, removed from Bellekeno, Lucky Queen and Onek, will not exceed a total combined tonnage of 500,000 t (QML-0009);
- Potential Acid Metal Leaching (P-AML) waste rock from Bellekeno, Lucky Queen and Onek will not exceed a total combined tonnage of 125,000 t (QML-0009).⁵

The existing disturbances and facilities from historic mining operations at both Lucky Queen and Onek are captured under the care and maintenance of the Keno Hills Silver District, which falls under the purview of the federal government. These sites are monitored and maintained under the Type B Water

⁴ YOR #2011-0315-002-1, p.23

⁵ YOR #2011-0315-002-1, p.12

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Licence QZ06-074 (currently under review by YESAB, project #2012-0141) and as such, unless they form part of AKHM's new production unit, they remain federal responsibility⁶.

1.4.2 Mining Methods

Both Lucky Queen and Onek will be put into production as underground mines. Three mining methods determined to be suitable for different aspects of mining Lucky Queen and Onek are:

- Mechanized overhand and underhand cut and fill;
- Shrinkage stoping; and,
- Longhole stoping.

These methods were selected based on their suitability and competence at mining the various rock compositions that will be encountered at Lucky Queen and Onek. Similarly, a variety of drills will be required for drilling onsite, and drilling will be done with a combination of jumbo, micro-jumbo and handheld drills.⁷

LUCKY QUEEN

The Lucky Queen deposit will be accessed via the historic 500 level adit, which will be rehabilitated. New underground workings will be established, including a new drift from the 500 level adit (located 1800 m along the adit) to the deposit. Waste rock and ore will be hauled out of the 1800 m long adit at the 500 level using small (7 t) underground mine trucks. Once at surface the mine trucks will dump their ore and waste rock loads onto a concrete pad below the trestle, (Figure 2) which will then be loaded into open 15 t haul trucks to be taken to the Keno District Mill.⁸ N-AML waste rock will be transported from underground directly to the N-AML waste rock disposal area or temporarily stored below the trestle. P-AML waste rock and ore may be temporarily stored below the trestle for up to 30 days.



Figure 2. Lucky Queen trestle area at portal pad for 7 t mine trucks to dump their load. (Image from proponent)

⁶ Personal communication; March 23, 2012

⁷ *Ibid.* p. 24

⁸ Personal communication; July 20, 2012

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ONEK

Access to the Onek deposit will be via the new Onek 990 portal and 234 m decline. Onek will use 15 t trucks to haul waste rock and ore underground to the temporary underground storage/transfer area, where it will be temporarily stored and transferred. Ore and waste rock will then be brought to surface from the underground temporary storage area using conventional haul trucks (<20 t). The trucks will haul the waste rock to either the Bellekeno non-acid metal leaching (N-AML) or potential-acid metal leaching (P-AML) dumps, and the ore to the Keno District Mill for processing.

Both Lucky Queen and Onek will have support facilities onsite, this includes plant services, trailers, and the miners' dry area. Additional facilities onsite at each deposit location are described further below.

1.4.3 Waste Rock Management

It is estimated that a total of 124,000 and 137,000 t of waste rock will be produced at Lucky Queen and Onek, respectively, over the life of production at the two sites. According to the proponent, the rock encountered at Lucky Queen and Onek will be managed according to the existing Waste Rock Management Plan approved under QML-0009. This plan has a three-tiered categorization and management approach:

1. *Non-Acid Metal Leaching Waste Rock (N-AML)*: Rock of non-economic grade with no significant potential for the generation of metal leach, or net acidity. The composition of the major waste rock lithologies at Lucky Queen are anticipated to be 65% N-AML. Similarly, at Onek, the waste rock is anticipated to be 65% N-AML rock. Rock classified as N-AML will be used for general construction purposes or stored in designated Waste Rock Disposal Areas (WRDA).
 - a. Lucky Queen will have a N-AML Waste Rock Disposal Area onsite ⁹ (see Figure 3)
 - b. Onek will use the licenced Bellekeno N-AML WRDA, as well as for backfill. A new N-AML WRDA at Onek will not be required. (See Figure 4) ¹⁰
2. *Potential-Acid Metal Leaching (P-AML)*: Waste rock and mineralized waste rock of no economic interest will be stored in designated, lined P-AML Waste Rock Storage Facility (WRSF), built according to a previously approved design. Waste rocks of no economic interest generally do not contain sufficient concentrations of silver, zinc or lead to warrant processing of the rocks. Due to the increased likelihood of acid-generation or metal leaching, all such rock will be considered P-AML and will stored in the designated WRSFs, or used as rock backfill.
 - a. It is anticipated that Onek will use the licensed Onek P-AML WRSF for initial development of the decline and contingency storage; thereafter, all P-AML generated from Onek will be placed in the licenced Bellekeno temporary P-AML WRSF (and placed underground in Bellekeno and/or Onek at the end of the project).

⁹ YOR #2011-0315-002-1; p.38

¹⁰ YOR #2011-0315-095-1; p.3

3. *Mineralized Rock and Ore*: Material that contains significant silver, zinc or lead minerals (i.e. ore) may be temporarily stockpiled on surface at Lucky Queen; and underground at the Onek mine site prior to being transported to the Keno District Mill. The quality of the ore will be confirmed on surface (at Lucky Queen) and underground (at Onek), which will determine whether the rock is hauled for processing at the mill, or added to the P-AML material. These mineralized rocks and ore will be stockpiled at the mine sites for a maximum of 30-days at both sites.¹¹

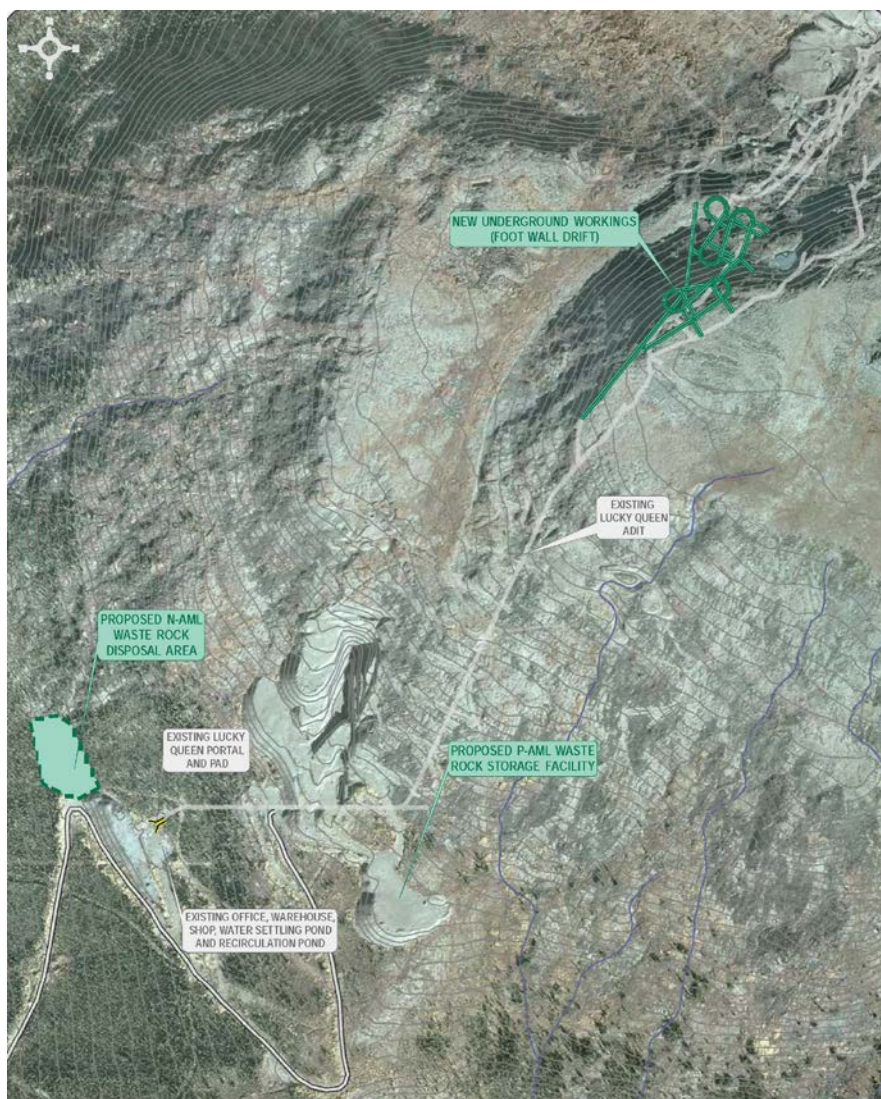


Figure 3. Waste rock dumps for Lucky Queen site, proposed sites are highlighted in green. Existing are in white text boxes. (Image from project proposal)

Lucky Queen

Approximately 80,000 t of N-AML waste rock will be produced, and either used as construction material or placed in a new WRDA located next to the existing historic dump at Lucky Queen (Figure 3). The total area for the WRDA at Lucky Queen is anticipated to be 800 m². As the WRDA is adjacent to, but not overlapping with the historic waste dump, the waste rock area will require an additional 0.75 hectares to

¹¹ YOR #2011-0315-095-1; p.38

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be cleared; and will accommodate a total volume of 30,000 m³ of waste rock.¹² N-AML waste rock will be used for general construction purposes and surface capping of the existing site access roads. The WRDA will be sloped to convey precipitation around the WRDA to ditches along the perimeter; this water will be directed to infiltrate to ground.

Approximately 43,175 t of material that is considered P-AML will be stored in the WRSF at Lucky Queen. Due to comments received during the Seeking Views and Information (SVI) periods, AKHM has designed the WRSF to be located further northwest than what is indicated in Figure 3. The primary reason for relocation was concern regarding Erickson Gulch and potential contamination of a drinking water supply. While the proponent has indicated that impacts from the P-AML WRSF are not anticipated the facility is now located wholly within the Lucky Queen drainage area which reports to the Christal Creek drainage.¹³ A new storage facility, approximately 5000 m² in area, will be built to the same design standards as those that were accepted for the Bellekeno Mine. According to AKHM the underground workings will support a significant portion of the P-AML being returned underground as backfill.¹⁴ Precipitation that enters the P-AML WRSF will migrate through the WRSF and be collected for water quality monitoring and treated, if required, before discharging to ground.

Onek

Approximately 90,500 t of N-AML waste rock will be produced and deposited at the licensed, Bellekeno WRDA¹⁵. The N-AML waste rock will be used for general construction purposes and surface capping of new and existing access roads. AKHM anticipates using approximately 19,500 m³ of a combination of fill from the cuts for the Keno City Bypass road (Bypass road), Onek generated N-AML, or as required, use of historic Onek N-AML from WRDA (Figure 4).¹⁶ The WRDA will be sloped to convey precipitation around the WRDA to ditches around the perimeter; this water will be directed to infiltrate to ground.

Approximately 1,320 m³ of N-AML waste rock from development of the 234 m decline will be used to build the Onek 990 portal pad. Bellekeno N-AML waste rock will be used for constructing the section of access road from the bridge to the Bellekeno Haul road, approximately 4,800 m³. Initial development of the Onek mine support facilities bench will use Bellekeno N-AML waste rock approximately, 13,500 m³ in total will be required. After initial development and establishment of the Onek bridge, Onek or Bellekeno N-AML waste rock may be used for maintenance, upgrades or general construction purposes.

¹² *Ibid.* Appendix E; p.3

¹³ YOR #2011-0315-083-1; p.2

¹⁴ YOR #2011-0315-002-1; p.41

¹⁵ YOR #2011-0315-095-1; p.3

¹⁶ *Ibid.* p.5

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Approximately 46,500 t P-AML¹⁷ waste rock may be added to the existing, licensed temporary WRSF for Bellekeno. The existing Onek P-AML WRSF will be used for initial development, and as a contingency option. The licensed P-AML WRSF was assessed and licenced under the Bellekeno advanced exploration program (QZ07-078). No additional clearing or disturbance is required to support the storage of the P-AML. The P-AML WRSF will be built to the same design standards as those that were approved

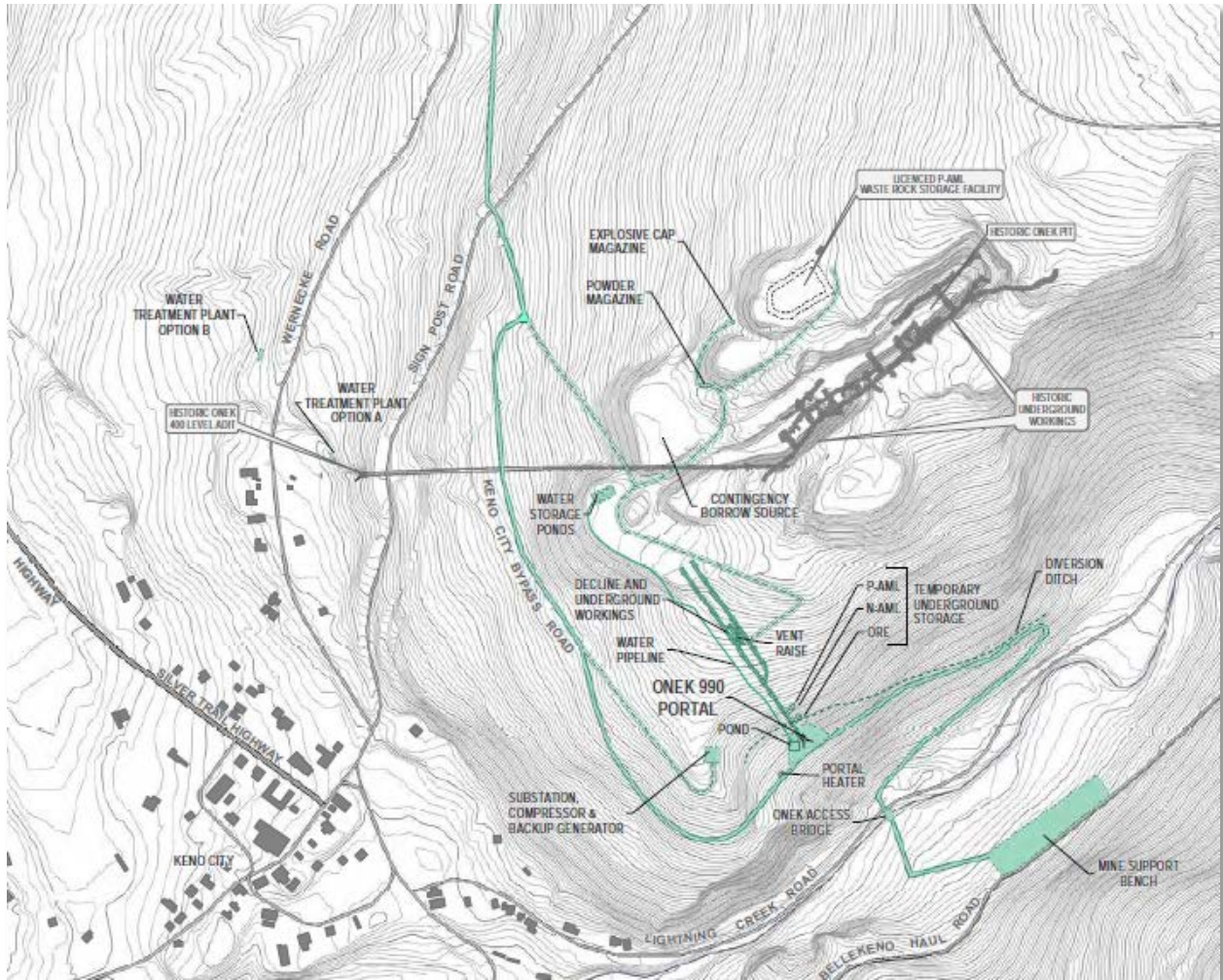


Figure 4. Image of Onek 990 proposed facility locations and existing waste rock dumps. (Image from 990 project proposal)

for the Bellekeno Mine. Similar to Lucky Queen, the underground workings will support a significant portion of the P-AML being returned underground as backfill. All water will be collected from the existing WRSF and directed towards a collection point in order for sampling and analysis to occur prior to being treated, if required, before discharging to ground.

¹⁷ YOR #2011-0315-095-1; p.3

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1.4.4 Milling and Tailings Management

Tailings produced from the processing of the ore and mineralized rocks will be brought to the Keno District Mill. The Keno District Mill and operations were assessed during the Bellekeno Mine assessment, and licenced under QML-0009 and QZ09-092. Ore from Bellekeno, Onek and Lucky Queen will be milled together and the composite tailings deposited in the previously assessed and licenced Dry Stack Tailings Facility (DSTF).

There will be no increase in the planned tonnage throughput or volumes processed from the currently licenced operations. Considering that there is no change in the volume, or method for processing the tailings, nor are there any proposed modifications to the mill itself, these components will not be scoped into this assessment. The addition of new ore sources to the DSTF will however, be considered in this assessment, particularly in regards to potential impacts to water quality. Based on testing conducted on bulk tailings from Lucky Queen and Onek, the tailings are anticipated to be non-acid generating.¹⁸

1.4.5 Water Use

An increase in water use of 183 m³/day is anticipated in order to support Lucky Queen and Onek development and production, as well as the additional personnel required at the Flat Creek Camp. The annual total is projected at 66,795 m³/annum.

LUCKY QUEEN

Lucky Queen will require 56.25 m³ of water per day during production. The proponent estimates that mining at a maximum production rate of 150 t per day will require approximately 45 m³ of water/day. However, AKHM has included a 25% contingency should additional water be required onsite, and is therefore indicating that 56.25 m³/day will suffice. Historically and currently, the Lucky Queen adit discharges water. Approximately 86.4 m³/day (annual average) is anticipated to discharge from the Lucky Queen adit. During production, the remaining 30.15 m³/day (86.4 m³/day minus 56.25 m³/day) will be directed to the settling pond and ultimately discharged to ground. The water sources include meteoric water, a groundwater supply well located near the adit portal, and water re-used from the settling pond.¹⁹

ONEK

The underground development of Onek will require up to 112.5 m³ of water per day. When mining at a maximum production rate of 300 t per day, the daily water usage is anticipated to be 90 m³/day. However, AKHM has included a 25% contingency should additional water be required onsite, and is therefore indicating that 112.5 m³/day will suffice. The water sources include the treated Onek 400 level

¹⁸ YOR #2011-0315-095-1; p.45

¹⁹ YOR #2011-0315-095-1; p.62

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discharge, meteoric water, Lightning Creek (previously licenced), a groundwater well located near the adit portal, and water re-used from the settling pond.²⁰

There will be a collection pond at the Onek 990 portal pad that will be used primarily for the development of the 234 m decline, but will remain in place during operations for recycling and additional water storage purposes. The lined temporary collection pond will be approximately 15 m³ with a 2" HDPE pipe running to larger water storage ponds (200 m³) on the historic dump. Development and mining water will be pumped to the storage ponds on the historic Onek waste rock dump and stored to re-use or discharge to ground, or directed to the Onek 400 water treatment plant for treatment if required.²¹ A second 2" HDPE pipe will be placed adjacent to the first to pass water for recycling from the large storage ponds down to the collection pond at the 990 portal.

Once the decline is driven underground sumps will be used to manage the water encountered underground. The Onek workings are all above the groundwater table and will only collect meteoric infiltrated water. At closure the water storage pond will be decommissioned. The berms will be regraded as part of reclamation. Diversion ditches will be placed around the pond to ensure runoff from the site does not enter the collection pond.²² No discharge is anticipated from Onek.

WATER TREATMENT PLANT

A water treatment plant is proposed for the discharge from the Onek 400 level adit, connected with the historic underground workings at the site. There are two options for the design of the Onek 400 water treatment plant considering it's close proximity to residents (Figure 5). In both options, the water treatment plant facilities will be located within insulated sea cans with the exception of the holding pond/tank located outside the building. The primary source of noise from the water treatment plant will be the 5Hp submersible water pump and the 3Hp compressor, which will run continuously.

In Option 1, the foundation of the facilities would be excavated so the water treatment plant building and discharge holding pump would be slightly below ground level. A berm will be built along the west and south sides of the excavation to deflect noise. The alternative Option 2 will consist of holding tanks with no new excavation necessary; however some clearing would be required to accommodate the facility. The surrounding ground that has been previously disturbed will be scarified and re-seeded to eventually establish a vegetation barrier to dampen noise and improve site aesthetics.²³

²⁰ YOR #2011-0315-002-1; p.63

²¹ YOR #2011-0315-095-1; p.4

²² YOR #2011-0315-021-1; p.1

²³ YOR #2011-0315-083-1; p.3

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The plant will be a standard skid mounted automated lime addition tank and pump, similar to the plant currently operating at Galkeno 300. The plant will be in sea cans, with a fenced sediment pond system or clarification and sludge pressing system to capture materials containing metals.²⁴ It is anticipated that sludge will be similar in composition to the sludge currently being produced at the Bellekeno mine treatment plant; therefore, AKHM will be depositing the sludge in the Valley Tailings Area at the same location as the sludge from the Bellekeno mine treatment plant.

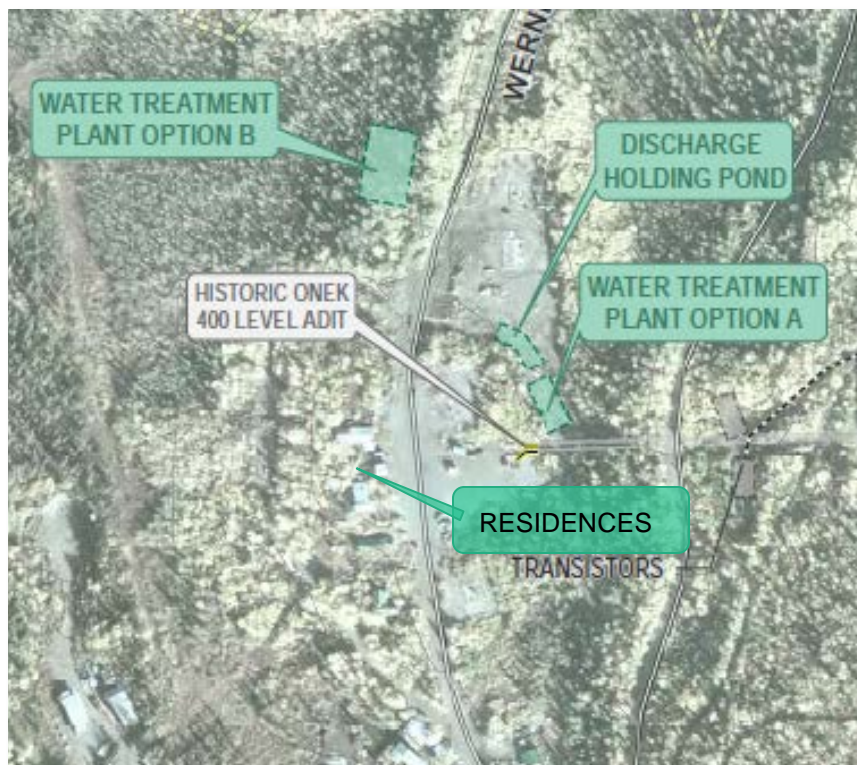


Figure 5. Proposed Locations for the Onek 400 Water Treatment Plant. (Image modified from project proposal)

FLAT CREEK CAMP

The camp will require additional personnel and associated increases in infrastructure and water usage to support the additional personnel. It is anticipated that for an additional 50 people 14.25 m³/day will be required, increasing the total volume of water to 57 m³/day from 42.75 m³/day.²⁵ Currently domestic water is retrieved via a pipeline from a cistern in Flat Creek. AKHM is proposing to augment water supply to the camp by drilling a groundwater well near the old water storage building.

1.4.6 Transport & Access Roads

AKHM is proposing to construct a new access road, the Bypass road that will extend from Wernecke road, crossing Sign Post road, along the historic Onek power line, to the 990 portal pad, and down to the Onek access bridge, to connect with the existing Bellekeno haul road (Figure 6). During mine development at both Onek and Lucky Queen, before the Bypass road is established, traffic will be routed through Keno City for approximately 4-5 months. The Bypass road will be 2.1 km long and 6-9 m wide to accommodate passing mine traffic. It will be developed with cut and fill construction, and will use either

²⁴ YOR #2011-0315-002-1; p.71

²⁵ YOR #2011-0315-002-1; p.63

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existing N-AML rocks from Onek or the Bellekeno operations, or fill from the Bypass road cuts to construct the roadway.²⁶ There will be stop signs to stop mine traffic at the intersections with Wernecke road, Sign Post road and Lightning Creek road. Signage warning of crossing mine traffic will be installed in both directions from the intersection, in accordance with regulatory requirements. Appropriate line-of-sight distances will be maintained to ensure crossing trucks and approaching traffic on the Wernecke road are able to see each other. The Bypass road will be a radio controlled road accessible to mine traffic only. Signs will be installed at the road access points prohibiting public traffic from traveling on it. The maximum speed limit will be 40 km/h, reduced to 20 km/h at blind corners and road crossings.

The volume of traffic through Keno City prior to the Bypass road being completed is presented in Table 2.

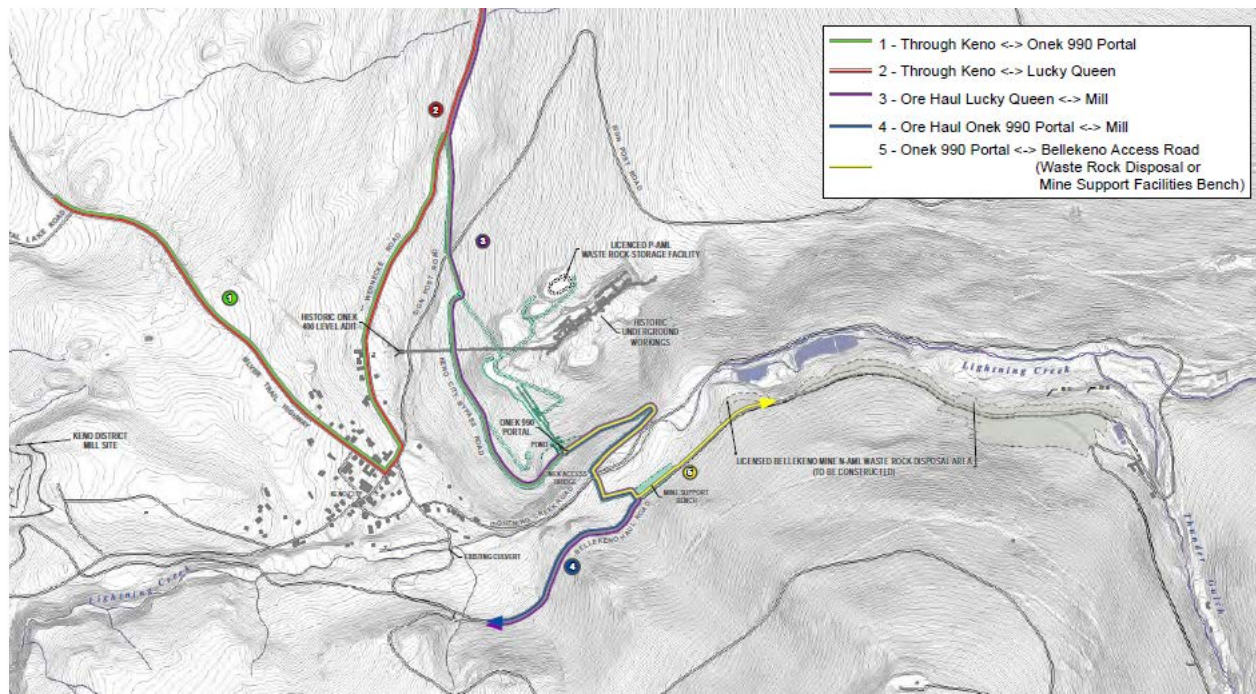


Figure 6. Image of various mine access routes between Lucky Queen, Onek and the mill. (Image from 990 project proposal.)

²⁶ YOR #2011-0315-095-1; p.16

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Vehicle Type	Average Traffic Volume (roundtrips/week)
Lucky Queen	
Light Truck	45
Water truck	2
Sewage truck	2
Semi trailer loads (mining equipment, building supplies, construction equipment, etc)	3
Grader	1
Onek	
Light Truck	50
Water truck	1
Sewage truck	1
Semi trailer loads (mining equipment, building supplies, construction equipment, etc)	3
Grader	1
Dump truck (hauling P-AML waste rock to Onek WRSF)	5
Total	114

Table 2. Average Traffic Volume through Keno City prior to Bypass Rd.

(Table from proponent's proposal)

During mine production, haul truck, and heavy traffic from Lucky Queen and Onek will be routed along the Bypass road to/from the Bellekeno haul road. Light truck traffic from Lucky Queen will continue to be routed through Keno City during mine operations, see Table 3 for anticipated volumes of traffic during mine operations.

Vehicle Type	Route				
	Keno City to 990 Portal	Keno City to Lucky Queen	Ore Haul Lucky Queen to Mill	Ore Haul Onek to Mill	Onek 990 Portal to Bellekeno Haul Rd.
Light truck	7	28	-	-	80-100
Water truck	-	2	-	-	1
Sewage truck	-	2	-	-	1
Grader	1	1	-	-	2
Semi trailer loads	-	7	-	-	-
Ore haul truck	-	-	25	-	-
Dump truck	-	-	-	49	28
Total (roundtrips/week)	8	40	25	49	112-132

Table 3. Average Traffic Volumes (roundtrips/week). *(Modified from proponent's proposal)*

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It is anticipated that 16 roundtrips/day, or 5,840 roundtrips/year of ore haul truck traffic will travel along the Bellekeno haul road with Lucky Queen and Onek operating, representing a 60 % increase in haul traffic from current levels.²⁷ The proponent will be using 15 t dump trucks to haul the ore from the mine sites to the mill. Ore haulage will primarily occur between the hours of 7am-7pm daily; however, the proponent has indicated that there may be occasion where haulage outside of those hours is necessary.²⁸ Culverts will be installed to facilitate appropriate drainage at the Wernecke road, Lightning Creek road, Bellekeno haul road and Sign Post road crossings. The cleared vegetation and topsoil will be stacked along the road right-of-way for road reclamation.

1.4.7 Onek Access Bridge

The proponent proposes to install a clear-span bridge across Lightning Creek in order to connect the Bypass road with the existing Bellekeno haul road. The bridge will be a single-lane, steel girder prefabricated bridge, approximately 9 m long and 4.4 m wide. The bridge is designed to have flow capacity of a 1:100 year flood event, and capable of supporting 100 t. A 6.5 m road width will be on the north and south sides of the bridge, and two overflow culverts will be installed within the 1:100 year flood event zone. The banks and riparian area will be cleared with a brush mower or pushed aside with a dozer. Any trees larger than 10 centimeters in diameter will be salvaged for use. The abutments and placement is done away from water, from either side of Lightning Creek, therefore no in-water works are required. The proposed bridge is 1.1 km upstream of the existing AKHM Lightning Creek bridge, and 586 m upstream of an existing (non-AKHM) culvert.

Decommissioning measures will involve removal of the clear span bridge, abutments and culverts. The access roads will be decommissioned, regraded and re-sloped. All disturbed areas will be scarified and re-vegetated. The banks will be stabilized through revegetation and strategic placement of the existing rip rap.²⁹

²⁷ YOR #2011-0315-095-1; p.15

²⁸ YOR #2011-0315-002-1; p.28

²⁹ YOR #2011-0315-095-1; p.20

1.4.8 Power Line

The power requirements for Lucky Queen and Onek are 750 kW (19,710 MWh/yr) and 300 kW (6,570 MWh/yr) respectively. The larger power requirements at Lucky Queen reflect the additional ventilation requirements. Electrical power will be supplied at Lucky Queen initially by diesel generator and eventually replaced by grid power. A backup diesel generator will remain onsite in case of power outages. The power line will follow the Wernecke road right-of-way from the Onek substation site to the Lucky Queen mine site (Figure 7).³⁰ The proponent will have grid power established at Onek prior to underground development, with a compressor, substation and portal heater all located on the portal pad.³¹ A diesel generator at Onek will provide backup power.

1.4.9 Fuel Storage

Fuel storage is required onsite at both the Lucky Queen and Onek. The primary purpose of the fuel storage is to supply

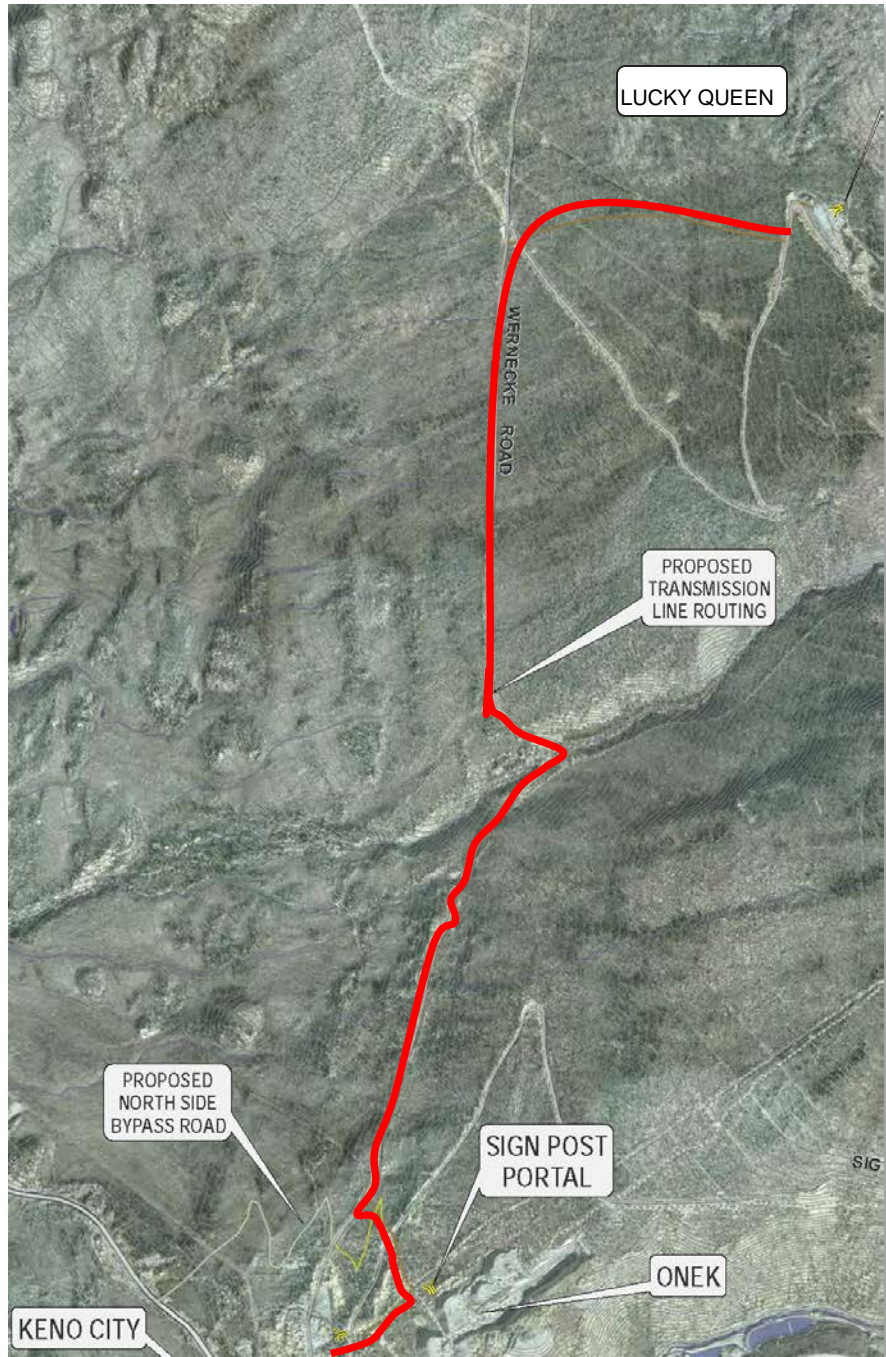


Figure 7. Proposed transmission line route (Red) from Onek mine site and substation to Lucky Queen. (Image modified from project proposal)

³⁰ YOR #2011-0315-002-1; p.33

³¹ YOR #2011-0315-095-1; p.5

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the necessary diesel to power the Lucky Queen generator as well as the mine equipment at both sites. At Lucky Queen, up to 30,600 L of diesel will be stored in two Envirotanks; the 28,500 L main tank and the 2,100 L tank will be positioned on the portal pad. The diesel fuel for Onek operations will be stored on the historic Onek waste rock dump and will have the same volume and configuration of diesel stored.

1.4.10 Waste Management

AKHM will manage project domestic and construction/industrial waste as per the existing and approved waste management plan that currently exists for the Bellekeno Mine.

1.4.11 Camp Facilities

The currently licenced Flat Creek camp facilities will require the expansion of existing septic and water systems to accommodate the additional 50 personnel required to support the development and operation of the Lucky Queen and Onek mine sites. Currently the camp is permitted to operate a septic system for 148 people. The proponent intends to increase the camp capacity to 200 people, however no additional footprint is required as sufficient space exists to accommodate new camp trailers.³²

1.4.12 Explosives Use & Storage

Explosives will be used in mining operations at both sites. Onsite manufacturing will not be required. At Lucky Queen, up to 4,500 kg of explosives will be stored in an appropriate location on the portal bench. Up to 9,000 kg of explosives will be stored on the existing WRDA at Onek. Explosives use, transport, handling, storage and disposal is governed by the Yukon *Occupational Health and Safety Act*, Blasting Regulations and Occupational Health & Safety Regulations, and the *Transport of Dangerous Goods Act*.

The blasting product will be ammonium nitrate/fuel oil (ANFO) and augmented with stick powder where needed. Detonators will be non-electric and tied in with detonator cord. Powder and cap magazines will be located on surface and proximal to the respective portals for Lucky Queen and Onek. The explosive magazines will be located at appropriate distances away from the portals and other buildings as dictated by regulations. Explosives and detonators will be conveyed to the working headings on an as-needed-basis and transported via approved day boxes. Excess explosives will be returned to the magazine at the end of the shift. A log book will be maintained in the magazine as required by regulations.

³² YOR #2011-0315-002-1; p.34

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1.4.13 Decommissioning

Decommissioning activities at both Lucky Queen and Onek will be subject to AKHM's amended Reclamation and Closure Plan for the Bellekeno Mine. Modifications and updates to the existing, approved plan will be required to include new disturbance areas, and new "production units" that the proponent will be bringing online with the development of Lucky Queen and Onek. The closure plan contains the following primary objectives:

- incorporating progressive reclamation where possible;
- providing slope stabilization and erosion control on linear and non-linear disturbances;
- ensuring long-term chemical stability of the waste rock storage areas and components;
- constructed from waste rock to minimize effects to downstream aquatic resources;
- ensuring the long term physical stability of materials placed into the dry stack tailings facility;
- ensuring the long-term physical stability of key structures such as the dry stack tailings facility, portals, waste rock storage facilities, and access roads;
- conducting post closure monitoring of the site and adaptive management to assess effectiveness of closure measures for the long term;
- ensuring land use commensurate with surrounding lands;
- ensuring meaningful participation of the FNNND;
- ensuring cost effectiveness; and
- realizing a walk-away closure scenario.

The proponent's objective is to ensure that these closure principles and objectives ensure both physical stability and chemical stability of the site in the long term.³³

As part of mine site closure, the removal of structures will restrict and disable access to the mine sites. Water management and treatment at Lucky Queen and Onek are not anticipated in the long term. As part of an adaptive management response, if identified, the proponent has indicated that a bioreactor would be installed at Lucky Queen to meet the proposed effluent quality standards if required as part of the water licence monitoring.³⁴ The portal sites at both Lucky Queen and Onek will be re-contoured and scarified to facilitate re-vegetation and drainage.

At Onek, P-AML waste rock will be placed back into the underground mine as backfill; and the portal entrance will be blocked with rock fill. This will allow air and water to continue to move through the

³³ YOR #2011-0315-002-1; p.92

³⁴ YOR 2011-0315-045-1; Table 7-1

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opening, as well as the movement of rock walls. All buildings and surface facilities will be removed from site including fuel tanks and liners. A final site assessment will document any soil contamination that remains to be treated post-deconstruction. Any contaminated soils will be transferred to the Land Treatment Facility at Elsa to be remediated for reuse.

It should be noted that the project decommissioning activities and potential effects have been reviewed in light of AKHM's conceptual Reclamation and Closure Plan (RCP) for the project³⁵ which builds on the preliminary RCP developed for the Bellekeno mine and mill. The project conceptual RCP will be integrated with the Keno Hill District Closure and Reclamation Plan, and as such is subject to rigorous assessment and review through that process.

MANAGEMENT OF WASTE ROCK AREAS

Waste rock placement protocols will be developed with closure measures in mind to ensure that at closure, when all waste rock is in place, minimal re-contouring will be necessary.

The final P-AML WRSF at Lucky Queen and Onek will be re-contoured as necessary to ensure long-term stability. The facilities will be covered with a total 0.5 m depth cover. In the bottom portion consisting of low permeability borrow material to minimize infiltration of meteoric water. The top portion of the cover shall consist of growth medium that will be seeded to promote vegetative growth. In the event that water accumulates in the bottom of the P-AML before cover placement, the proponent proposes that it will be pumped using a vacuum truck and transported to a water treatment plant for treatment.

In order to further increase stability and improve aesthetics, AKHM will re-contour the N-AML WRDAs by pulling the crests back with an excavator followed by scarification and re-vegetation of the flat surface of the N-AML WRDA. The final overall (crest-to-crest) slope of the N-AML WRDA will be 3H:1V.

1.5 PROJECT SCOPE

The scope of the project for this assessment has been determined to be as follows:

	Lucky Queen	Onek
Ore Tonnages	Extraction of up to 150,000 t	Extraction of up to 250,000 t
Mining Development	Rehabilitation, construction and decommissioning of adit and underground mine workings including development of drift off historic 500 level adit	Construction and decommissioning of new portal, adit and underground mine workings

³⁵ YOR #2011-0315-044-1

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Mining Operations	<ul style="list-style-type: none"> • Addition of composite tailings (mixture of Bellekeno, Onek and Lucky Queen tailings) to existing Dry Stack Tailings Facility • Composite tailings paste backfill to Bellekeno, Lucky Queen or Onek underground workings 	
P-AML Waste Rock Storage	<p>Construction, operation and decommissioning of 44,000 t P-AML Waste Rock Storage Facility.</p> <p>Underground backfill.</p>	<p>46,500 t P-AML to be placed in licenced Bellekeno Temporary P-AML Waste Rock Storage Facility, and construction, operation and decommissioning of the licenced Onek P-AML WRSF to be used for development of decline and contingency placement option.</p> <p>Underground backfill.</p>
N-AML Waste Rock Disposal	<p>Use as construction material.</p> <p>Construction, operation and decommissioning of new 80,000 t N-AML Waste Rock Disposal Area.</p> <p>Underground backfill.</p>	<p>Use as construction material.</p> <p>90,500 t N-AML waste rock to be placed at licenced Bellekeno N-AML Waste Rock Disposal Area.</p> <p>Underground backfill.</p>
Water Treatment	<p>Construction and operation of water treatment plant at historic Onek 400 level adit to treat discharge</p>	
Water Use and Management	<p>Use of to 56.25 m³/day from underground workings, infiltration and contingency water sources of groundwater well and Lightning Creek. Discharging up to 91.4 m³/day; 29.15 m³/day during normal operating conditions.</p> <p>Operation of water storage/settling pond (200 m³)</p>	<p>Use of up to 112.5 m³/day from underground workings, treated historic Onek 400 level adit discharge; contingency water sources include a groundwater well and Lightning Creek.</p>
	<p>Construction and development of water storage/settling pond (200 m³)</p>	<p>Construction and development of water storage/settling pond (200 m³) and a temporary water collection pond (15 m³)</p>
	<p>Flat Creek camp expansion- construction, operation and decommissioning of groundwater well for additional extraction of 14.3 m³/day</p>	
Access/Ore Transport	<ul style="list-style-type: none"> • Construction (cut and fill), maintenance and decommissioning Keno City Bypass road (~2.1 km long; 6-9 m wide) (~15,000m³ of material) and Onek 990 Portal Pad (~4500m³ of material) constructed from cut fill or Onek and Bellekeno N-AML • Upgrade and decommissioning of existing mining roads/trails • Use of existing roads/trails • Transportation of ore 	

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Footprint extension	New N-AML Waste Rock Disposal Area (~8000 m ²)	Onek 990 Portal pad and Mine Support Facilities Bench development; 1,320 m ² and 4,500 m ² respectively
Power	Power supplied by diesel generator; eventual establishment of grid power connection through spur transmission line.	Power supplied by grid power through installation of spur transmission line and upgrade to existing transformer. Backup diesel generator.
Fuel Storage	Up to 30,600 L stored in two Envirotanks: 28,500 L main storage tank and 2,100 L day tank	Up to 30,600 L stored in two Envirotanks: 28,500 L main storage tank and 2,100 L day tank
Auxiliary Facilities	<ul style="list-style-type: none"> • All ancillary water control structures (e.g. berms, ditches) • Operation of Lucky Queen portal bench facilities (temporary ore stockpile, plant services, miners' dry area, offices, trailers, portal, fuel and explosives storage) • Operation of Onek auxiliary facilities (plant services, miners' dry area, offices, trailers) on Mine Support Facilities Bench (4,500m²) located on south side of Lightning Creek along Bellekeno Haul road • Expansion of Flat Creek camp to accommodate additional personnel, including septic system upgrade and expansion (increase from 148 to 200 people) • Storage and use of explosives 	

The temporal scope for the project is to the longest permit (Quartz Mining Licence #QML-0009) which is set to expire in 2025, and is currently being amended to include the Lucky Queen and Onek activities. The project activities have the potential to interact with the environment for a period that is longer than the duration of the licence, therefore project activities have been scoped for the duration of interaction between environment and facilities/activities for Lucky Queen and Onek.

2.0 ENVIRONMENTAL AND SOCIO-ECONOMIC SETTING

The following is an overview of information pertaining to the environment directly involved in the Lucky Queen and Onek development and operations. For more in-depth background information on the environmental and socio-economic setting within the Keno Hill Silver District, but external to the areas affected by this project, please refer to the Bellekeno Mine Evaluation Report.³⁶

2.1 BIOLOGICAL ENVIRONMENT

The Keno Hill Silver District supports a variety of wildlife including ungulates, fur-bearers, small mammals, upland game birds and waterfowl. Moose are the most important subsistence animal in the area.

³⁶ #2009-0030-0124-1

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Repeated survey work over the last 15 years indicates a healthy, stable moose population that has reached a maximum level of harvest in recent years. Woodland caribou are not presently found in the immediate study area with the exception of the appearance, in summer, of fewer than 10-12 Woodland caribou scattered in very small groups in the Mt. Hinton and Bunker Hill areas.³⁷

Woodland caribou, grizzly bears, migratory birds, and pika have all been granted special status under federal legislation, and as such are considered in more detail within this assessment. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) identifies the above species as species of 'Special Concern'. This definition is understood to encompass wildlife species that may become threatened or endangered due to a combination of biological characteristics and identified threats. Additionally, given the cultural importance of moose for harvesting, they have also been included in the discussion regarding potential project effects.

WOODLAND CARIBOU

Woodland caribou are not present within the project area. Occasional caribou have been sighted within the reaches of Mayo Lake and Fraser Falls.³⁸

BEARS

The grizzly and black bear are common in the Keno Hills Silver District; although the grizzly bear is listed as an animal of 'Special Concern' according to COSEWIC.

MIGRATORY BIRDS

The district is the seasonal home to numerous migratory birds during the migration and breeding season. While the Canada goose and trumpeter swan are abundant within the area, several species including the tundra swan, the greater white-fronted goose, the snow goose and brant pass through the area on their way north to Arctic breeding grounds.³⁹ The common nighthawk, the rusty blackbird and the olive-sided flycatcher are listed as threatened or 'Special Concern' by COSEWIC.

COLLARED PIKA

At the most recent meeting of COSEWIC in November 2011, the collared pika was identified as a species of Special Concern. Reasons identified for this designation were the pika's restricted habitat type, which is scattered small boulder fields in alpine meadows of mountainous regions of Yukon, Northwest Territories, northern British Columbia.⁴⁰

³⁷ YOR #2011-0315-002-1; p.9

³⁸ YOR 2009-0030-122-1

³⁹ YOR 2009-0030-122-1

⁴⁰ COSEWIC, 2012

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MOOSE

Considered one of the ecoregion's most important sustenance animals, moose are prevalent within the Keno Hills Silver District. The wetlands associated with the Pumphouse road, South McQuesten River and Elsa tailings are primary calving and post-calving ranges.⁴¹

FLAT CREEK

Fish utilization in Flat Creek, has been reported as being low subsequent to assessments performed in 1994 and 1995. In 1995, Arctic grayling, burbot, and slimy sculpin were recorded during summer and fall investigations with no fish observed during spring investigations. During 2006, no fish were captured in the spring with a few slimy sculpin caught in August. Throughout the summer, the lower reach of the creek had been colonized by slimy sculpin, burbot, Arctic grayling and northern pike. Juvenile Arctic grayling were more common in 1995 than in 2006.⁴² Historically cadmium and zinc concentrations have been above the Canadian Environmental Water Quality Guidelines, but below the Canadian Drinking Water Quality Guidelines.⁴³

LIGHTNING CREEK

Lightning Creek continues to undergo significant channel changes as a result of placer mining. For this reason, the sample location used in 1995 could not be revisited in 2006 and two new locations were selected to allow more representative sampling of Lightning Creek. These sites were revisited in 2008. In 1995, the reach of Lightning Creek surveyed extended from just downstream of Keno City to approximately 200 m above the confluence with Thunder Gulch, which was being placer mined. Adult Arctic grayling were found upstream of turbid water from Thunder Gulch and sub-adult Arctic grayling were observed in the turbid waters downstream of Thunder Gulch.

In 2006, two new stations were situated adjacent to the Keno City campground and just upstream of the confluence with Duncan Creek. Both sites had been placer mined in the past and have manmade channels. The fast flowing waters of the site by the campground contained Arctic grayling while the slower waters of the site by the confluence with Duncan Creek had greater species diversity with slimy sculpin, round whitefish, and Arctic grayling common in August and September.

In 2008, no fish were observed in Lightning Creek adjacent to the Keno City campground while slimy sculpin and Arctic grayling were observed upstream of the confluence with Duncan Creek.

⁴¹ YOR 2009-0030-122-1

⁴² YOR #2009-0030-124-1; p. 14

⁴³ YOR #2011-0315-033-1; p.73

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The latest fisheries effort in June, 2012, by Access Consulting and Minnow Environmental captured eight slimy sculpins and four Arctic grayling.⁴⁴ All the fish were caught in an area that included the proposed Onek bridge crossing location and downstream.

The streambed is comprised of a mixture of alluvial and reworked glaciofluvial sediments varying from silt to boulder size, typical of a moderate to high gradient Yukon stream. The stream bed has been reworked by placer mining activity, and is located immediately downstream from instream settling ponds. The riparian area consists of regenerated willow and dwarf birch up to several inches in diameter. The banks are vegetated by a mixture of willow, and dwarf birch with some grasses, grading into black spruce with a thick matt of moss moving away from the stream bank.⁴⁵

CHRISTAL LAKE CATCHMENT

Christal Creek flows northwest from Christal Lake for approximately 22 km before it flows into the South McQuesten River. The proposed Lucky Queen mine development is within the Christal Creek drainage area. There is no direct surface water connection between the Lucky Queen adit and Christal Creek although the topography of the area drains in the direction of Christal Creek watershed and thus it is thought that Lucky Queen waters eventually report there.⁴⁶

Water chemistry and aquatic resources in the creek have been heavily influenced by previous mining activities. Christal Creek receives input water from Galkeno 900 adit, Galkeno 300 adit, and seepages-both surface and groundwater from historic workings on the west face of Keno Hill. Christal Creek shows metal loading from historic mine operations, and use of Christal Lake as a receptor, as such, the proponent has installed monitoring sites within the catchment area to determine where exceedances occur.

Slimy sculpin was the only fish species recorded in Christal Creek at the Keno road crossing in 1995, and 2006, and were observed in relative abundance. In 2008, no fish were captured at this location. At the time the proponent noted this was due to an extended period of precipitation where all streams in September 2008, were experiencing high, fast flow with increased turbidity during the investigation, which had some impact on the effectiveness of sampling at the time. Additional sampling will be undertaken for the waterways in 2012, as required under the Environmental Effects Monitoring studies required for the Bellekeno Mine licensing. Historically cadmium and zinc concentrations have been above the Canadian Environmental Water Quality Guidelines.⁴⁷

⁴⁴ Personal communication; July, 31, 2012; Access Consulting.

⁴⁵ YOR #2011-0315-095-1; p.22

⁴⁶ YOR #2011-0315-0124-1; p.1.3

⁴⁷ YOR #2011-0315-033-1; p.73

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ERICKSON GULCH

As a non-fish bearing, mountainous creek, Erickson Gulch is located along the western slope of Keno Hill. The vegetation consists of black spruce forest with abundant willow undergrowth. Poplar, aspen and birch are also common. Erickson Gulch is a narrow valley with canyons, large outcrops and talus boulder fields. Given the steep terrain of Erickson Gulch and the natural fish barriers, no fish have been found within the water course.

2.2 PHYSICAL ENVIRONMENT

The Keno Hills Silver District lies within the Yukon Plateau – North Ecoregion, just south of the Wernecke Mountains. The terrain consists of concordant, rolling, upland areas separated by wide valleys with an east-west orientation. Many valleys include peatlands, palsas, fens and meadows of sedge tussocks. Upper slopes may be covered with scree material, with treeline occurring at 1,350 to 1,500 m. The area has been influenced by the latest glaciations but shows more subtle evidence of an earlier event as well. Regional permafrost is irregularly distributed and its occurrence is dependent upon the elevation, hillside exposure, depth of overburden, soil types, amount of vegetative cover, and presence of flowing underground and surface water. At high elevations and on slopes with a northern exposure it is generally present.⁴⁸

Mean annual temperatures in this ecoregion are near -5°C, but there is a strong seasonal variability accentuated by difference of elevation. Mean January temperatures range from below -30°C in the lower valleys to above -20°C over the higher terrain. This gradient is dramatically reversed by July as mean temperatures in the lower valley floors of 15°C drop to near 8°C over the higher terrain. Extreme temperatures in the lower valley floors have ranged from -62°C to 36°C. Over higher terrain the extremes are more moderate. Frost can occur at any time of the year but is less likely from mid-June to late July.

Precipitation is relatively moderate showing an increase over eastern sections as a result of upslope conditions over the higher terrain of the east. Annual amounts range from near 300 mm in a minor rain shadow along the Tintina Trench, especially near Ross River, to near 600 mm over the higher terrain of the eastern sections. Amounts are fairly low from December through May, being only 2 to 30 mm per month. The wettest period is during July and August, with monthly amounts of 40 to 80 mm from rain showers and thunderstorms. Winds are generally light, and only moderate to strong in association with thunderstorms or unusually active weather systems.⁴⁹

Mayo and Ross River are representative climate stations in the lower valley floors. Elsa and Sheldon Lake (Twin Creeks) are good indicators for the valley floors in the higher terrain.

⁴⁸ YOR #2011-0315-002-1; p.9

⁴⁹ Smith, 2004

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The South McQuesten and North McQuesten rivers are major tributaries to the Stewart River. From its headwaters near Keno City in west central Yukon, the South McQuesten River flows some 150 km to its confluence with the Stewart River, which eventually discharges into the Yukon River. The major tributaries to the South McQuesten River include Christal Creek, Flat Creek Haldane Creek, and Galena Creek.

There is a long history of mineral exploration and mine development in the McQuesten River watershed. Silver-lead-zinc mineralization was first discovered in the vicinity of Galena Creek in 1906. Since that time, many small silver deposits have been mined. In addition, a number of larger mining operations have been established in the area. Collectively, these historic mining activities have resulted in a diversity of pits, adits, tailings piles, and waste rock dumps throughout the basin. The available water quality data indicate that surface run-off from abandoned mine sites and/or discharges of leachate from abandoned waste rock piles are releasing contaminants into surface waters within the South McQuesten River basin, including Christal Creek, Flat Creek, Galena Creek, and the South McQuesten River mainstream. In particular, the levels of zinc in receiving water systems represent a potential concern for the fish and aquatic organisms that utilize or potentially utilize habitats within the watershed.⁵⁰

2.3 SOCIO-ECONOMIC ENVIRONMENT

The Lucky Queen and Onek sites lie within the traditional territory of the FNNND and near the communities of Keno City and Mayo. The area has been shaped by mineral development over the past hundred years. Silver and lead ore deposits were discovered on Keno Hill in the early 1900s and the area has since seen fluctuating levels of ongoing quartz and placer mining and exploration. Today, the area supports not only mineral development, but also tourism, recreation, traditional pursuits, as well as the local people.

Keno City is a small community situated at the end of the Silver Trail Highway with a population of roughly 20 permanent residents. Keno City was primarily developed to support historic mining activities in the area, and has fluctuated in size throughout its history. Today, it is a quiet community with residences, a few small businesses, the Keno City Mining Museum, and the Keno City Alpine Interpretive Centre.

The community of Mayo is located approximately 50 km southwest of the project site. Mayo has a population of roughly 450 and serves as a distribution and service centre for the surrounding area. Services offered in the community often support mineral development, tourism and other activities. Mayo is also the administrative centre for the FNNND. In addition to being a tourist destination, the community is a base for wilderness and mining tourism, canoeing, hiking, big-game hunting and fly-in fishing.⁵¹

⁵⁰ YOR #2009-0030-124-1; p. 13

⁵¹ YOR #2011-0315-002-1; p.9

2.3.1 Comprehensive Cooperation and Benefits Agreement with the First Nation of Na cho Nyak Dun

The proposed project occurs within the traditional territory of the self-governing FNNND. The FNNND have held a Final Agreement since May 29, 1993. The proponent has a signed Comprehensive Cooperation and Benefits Agreement with FNNND that “recognizes both Alexco’s mineral rights as well as FNNND’s aboriginal rights and sets out rights, obligations and opportunities for both parties”.⁵² The two parties have established a framework within which implementation of the Agreement occurs. Environmental matters are discussed earlier and in-depth, allowing comprehensive discussions between the two parties regarding any proposed amendments or new undertakings by the proponent.

3.0 REQUIREMENT FOR AN ASSESSMENT

An assessment by the Designated Office is required under the following circumstances:

An activity is proposed to be undertaken that is listed in Schedule 1 of the Assessable Activities, Exceptions and Executive Committee Projects Regulations (Activity Regulations) and not excepted. The proponent proposes to undertake activities listed in Part 9 Item 3 of the Activity Regulations, specifically:

“Direct use of water”

The project is being undertaken in the Yukon; and

An authorization or the grant of an interest in land by a government agency, independent regulatory agency, municipal government, or first nation is required for the activity to be undertaken.

Decision bodies and authorizations have been identified based on information in the project proposal and information submitted to the Mayo Designated Office during the assessment. A list of the decision body(s) and authorizations required for the project can be found in Table 4 below.

Decision Body	Authorization(s) Required	Act or Regulation
	Water Use License Amendment	<i>Yukon Waters Act</i> <i>Waters Regulation</i>
YG, EMR-Mineral Resources Branch	Quartz Mining Licence Amendment (QML-0009)	<i>Quartz Mining Act</i>

Table 4 Decision Body(s) and Authorizations Required

⁵² YOR #2011-0315-002-1; p.99

4.0 SCOPE OF THE ASSESSMENT

The scope of the assessment identifies the matters considered in an assessment. It is determined by considering the activities described in the scope of the project (identified in section 1.5) and, based on consideration of the matters set out in section 42(1) of YESAA, identifying the valued environmental and socio-economic components (values) that may be affected by project activities. Views and information submitted during the assessment help to identify values and potential effects of the project to these values.

4.1 CONSIDERATION OF COMMENTS RECEIVED

The volume of comment submissions considered by the Designated Office numbered 53 submissions. During the first round of SVI, 35 comments were received. During the second round of SVI, 18 comments were received. The majority of submissions were from Keno City residents and various levels of government, although comment submissions were also received by individuals and organisations across the Yukon. A detailed account of who submitted comments is available on the YESAB Online Registry (YOR) located at www.yesab.ca/registry, or a list of submissions is available in Appendix C. The Designated Office categorized the comments according to potential effects, and identified areas of common concern. The comment submissions provide either a personal or a technical view of the following:

- Assessment of Potential Environmental Effects
 - Surface and groundwater quality
 - Water use and waste deposit
 - Water management and monitoring
 - P-AML/N-AML
 - Geochemical testing and characterization
 - Air Quality (emissions)
 - Wildlife (habitat)
- Assessment of Potential Health Effects
 - Domestic water quality (metal contamination)
 - Noise (industrial vs. residential)
 - Air Quality (sources, amounts and nature of dust)
 - Employee safety
 - Public Health
- Assessment of Potential Socio-economic Effects
 - Community (sense of place)

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- Local economy
- Quality of Life (recreation and trail use)
- Impacts to tourism
- Sound and visual aesthetics
- Assessment of Potential Heritage/Historic Effects
 - Heritage Assessment

There were comment submissions that were in the end considered irrelevant to the assessment; these submissions were outside the project scope or already requirements under legislation.

The Bellekeno Mine is operated by AKHM in the same vicinity as the proposed Lucky Queen and Onek mines, and the three are expected to use the same mill and processing areas, as well as all infrastructure and facilities. As such, the Designated Office considers the information contained within the 2009 assessment of the Bellekeno Mine as relevant to the current proposed project. In particular, the Evaluation Report and Decision Document are both acknowledged to contain valuable background, analysis, and mitigations. Where the Designated Office has been made aware of mitigations or proponent commitments that were not successfully met from the Bellekeno Mine assessment, these areas have been further explored in this assessment.

4.2 CONSIDERATION OF ALTERNATIVES

The Sign Post portal for Onek was located at Lot 960, approximately 500 m from Keno City. It was initially developed in the summer of 2011, but further work was necessary. The portal pad development involved a footprint extension of ~9,300 m² as well as the establishment of a new N-AML WRDA and the construction of a new P-AML WRSF at Onek. As part of the haul truck routing, a bypass road was to be built, taking approximately three months to complete. Traffic from Onek was expected to increase from the current rates to accommodate development of the Sign Post portal pad and decline.

Early in the assessment the proponent's plan for Sign Post portal encountered resistance from the residents of Keno City. In a signed letter to the proponent, residents expressed their concerns with the portal option, stating that the close proximity of the portal to their community would result in significant adverse socio-economic effects. These effects included a decrease in their quality of life and in tourism to the town and surrounding area as well as, an increase in noise and dust pollution, and groundwater and traffic concerns.

The "Sign Post portal for Onek" and associated activities, were originally scoped into the project for ore extraction. Later in the assessment process, AKHM introduced an alternative option as the "Onek 990 portal". The Onek 990 portal option was developed in response to questions and concerns raised by Keno residents and input from regulators over the course of the assessment. Following the closure of the Additional SVI period, AKHM identified their preferred option as being the Onek 990 portal option; as such, the Sign Post portal option was no longer carried through the assessment.

4.3 CONSIDERATION OF SIGNIFICANCE

In order to mitigate a potential adverse effect, the Designated Office must first find significance. In addressing what may constitute a “significant” adverse effect, the Designated Office considered the following factors:

Magnitude: This refers to the magnitude of the effect. Low magnitude effects may have no impact, while high magnitude effects do have an impact.

Probability: The likelihood that an adverse effect will occur.

Geographic Extent: This refers to the extent of change over the geographic area of the proposed project. The geographic extent of effects can be local or regional. Local effects may have a lower impact than regional effects.

Duration and Frequency: This refers to the length of time the effect lasts and how often the effect occurs. The duration of an effect can be short term or long term. The frequency of an effect can be frequent or infrequent. Short term and/or infrequent effects may have a lower impact than long term and/or frequent effects.

Reversibility: This refers to the degree to which the effect is reversible. Effects can be reversible or permanent. Reversible effects may have lower impact than irreversible or permanent effects.

Context: This refers to the ability of the environment to accept change. For example, the effects of a project may have an impact if they occur in areas that are ecologically sensitive, with little resilience to imposed stresses.

4.4 CONSIDERATION OF CUMULATIVE EFFECTS

With regards to cumulative effects, subsection 42(1)(d) of the *Yukon Environmental and Socio-economic Assessment Act* (YESAA) instructs Designated Offices to consider:

42(1)(d) the significance of any adverse cumulative environmental or socio-economic effects that have occurred or might occur in connection with the project or existing project in combination with the effects of

- i. Other existing projects for which proposals have been submitted under subsection 50(1), or
- ii. Other existing or proposed activities in or outside Yukon that are known to the designated office, executive committee or panel of the Board from information provided to it or obtained by it under the Act.

In the situation where the Designated Office determined that there would be no residual effects of the proposed project on a specific value then a cumulative effects assessment (for that value) was not necessary. Similarly if it was determined that the project effects would result in a significant adverse effect that could not be mitigated, then the benefit of a cumulative effects assessment becomes redundant and therefore not conducted.

CONSIDERATION OF VALUED ENVIRONMENTAL AND SOCIO-ECONOMIC COMPONENTS (VESEC)

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Based on the comments received, information provided and information available, the Designated Office identified the following values for consideration in this assessment:

- Water Resources
- Fish and Fish Habitat
- Wildlife and Habitat
- Terrain Stability and Soils
- Human Health
- Community
- Air Quality
- Acoustic Quality
- Visual Quality
- Heritage Resources

PART B. EFFECTS ASSESSMENT AND REASONS FOR RECOMMENDATION

The following sections present the effects assessment of project activities related to values identified in Section 4.0. This part of the report considers in the assessment of each valued component, the previous assessment conducted on AKHM's Bellekeno Mine, specifically the Recommendations⁵³ issued and the Decision Document.⁵⁴ Numerous mitigations and proponent commitments are found within the previous assessment to address effects to the valued components considered throughout Part B. Where the Designated Office has been made aware that commitments or mitigations were not sufficient, or have not been implemented from AKHM's Bellekeno Mine, the Designated Office has considered them further. Each section includes an overview, an analysis of how project activities may affect values and, where relevant, measures to mitigate significant adverse effects. Part B ends with a conclusion of the effects assessment.

5.0 WATER RESOURCES

5.1 OVERVIEW

This section describes impacts to water quality and quantity in regards to both groundwater and surface water. Water quality and quantity are interwoven in the discussion of potential effects to water resources; and as such, are presented together. Water quantity is understood to encompass the volume of all available surface water and groundwater sources in the affected Christal Creek and Lightning Creek watersheds.

Metal leaching and acid rock drainage are considered one of the primary potential impacts to water resources, and as such are considered in this section. Metal leaching and acid rock drainage consider sulphide minerals and their alteration products, which occur primarily because of contaminant release from sulphidic geological materials. This occurs through their increased exposure to air and water; constituents of concern can be released to the environment in concentrations that the environment is incapable of neutralizing. Acid may be generated by the exposure of sulphidic geologic materials, and over time that can lower the pH of water. As the water passes over other geologic materials it can adversely impact drainage chemistry by increasing element solubility, and increase weathering reactions releasing contaminants of concern.

The following analysis will consider the effects from both Lucky Queen and Onek and where necessary distinguish between the two sites. For ease of reading, this section will describe direct and indirect discharge to surface and groundwater, including impacts based on waste rock storage and classification. Discussion of fish and fish habitat is in the subsequent section.

⁵³ YOR 2009-0030-124-1

⁵⁴ YOR 2009-0030-0126-1

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The Designated Office has considered the following project activities to have the potential to affect water resources:

- Construction phase: waste rock classification and storage above ground and water management;
- Operations phase: waste rock classification and storage above and below ground, including paste backfill, management of historic Onek 400 discharge, and water management.

In general the reclamation and decommissioning for P-AML and N-AML waste rock storage facilities includes: use for general construction, access road repairs and surface capping, mine backfill, and re-contouring, scarification and re-vegetation of storage piles. See Section 1.4.13 for further decommissioning and reclamation details.

As described by the proponent, the annual hydrologic character of the project site is defined by relatively high peak flows associated with spring freshet (i.e. snow melt), followed by relatively low peak flows associated with summer rainfall events. Attenuating base flows extend through autumn to freeze-up.

5.2 PROJECT EFFECTS

The range of effects from project activities that could affect water resources valued components include:

- Direct/Indirect Discharge to Surface Water: Potential metal leaching and acid rock drainage, increase in total suspended sediments, through waste rock storage, or water management, or through infiltration through underground mine working; may result in constituents of concern, change in quantity of water
- Direct/Indirect Discharge to Groundwater: Potential metal leaching and acid rock drainage through waste rock storage, or water management, or through infiltration through underground mine working; may result in constituents of concern.

Critical to understanding the potential effects to surface and groundwater quality and quantity is predicting what the loadings for the constituents of concern would be with the development of mines at Lucky Queen and Onek.⁵⁵ The proponent provided an analysis that indicated that the development of the Lucky Queen and Onek deposits could result in increased loadings of zinc and cadmium to the Christal Creek drainage, primarily as a result of additional waste rock storage.⁵⁶ This conclusion was supported by independent review and report conducted by YESAB's consultant Ecomatrix.⁵⁷

⁵⁵ YOR #2011-0315-0124-1; p.2.11

⁵⁶ YOR #2011-0315-0103-1; Tables 1-4

⁵⁷ YOR #2011-0315-1-0124-1

5.2.1 Direct/Indirect Discharge to Surface Water

Surface water from both Lucky Queen and Onek (as well as Erickson Gulch) flow toward Christal Creek. For this reason, the focus of discussion of potential effects will be related to Christal Creek. Water chemistry and aquatic resources in Christal Creek have been influenced by previous mine and milling operations including tailings deposition and adit discharge. Historic adits that continue to discharge to the Christal Creek drainage include Galkeno 300 and 900 adits on the northeastern and eastern faces of Galkeno Hill, respectively, in addition to the Lucky Queen and Onek 400 adits. Since Christal Creek is expected to be affected by historic and ongoing activities it is appropriate to compare expected changes to water quality to established background conditions for the region as a basis for assessing potential effects on water resources for the project.⁵⁸

Guidelines identified by the proponent included the Canadian Water Quality Guidelines (CWQG) for the Protection of Freshwater Aquatic Life, with values from British Columbia (BCWQG) selected in cases where a CWQG was lacking, and Provincial Water Quality Objectives for Ontario were chosen in the absence of both CWQG and BCWQG. The calculated background concentrations for substances identified as being higher than guidelines include: aluminum, cadmium, copper, iron, phosphorus, sulphate and zinc. In 2011, the baseline concentrations of arsenic, cadmium, lead, sulphate and zinc in Christal Creek exceeded both background and water quality guidelines in Christal Creek. Based on water quality analysis two constituents of concern in Christal Creek have been identified by the proponent: cadmium and zinc.

In addition to monitoring these specific constituents of concern, AKHM has proposed to monitor pH, suspended solids, ammonia nitrogen, arsenic, cadmium, copper, lead, nickel, radium-226, silver and zinc in water from the Lucky Queen and Onek adits. Direct discharge from mine operations, or facilities into surface water can significantly affect water quality, especially in consideration of the already elevated background for the constituents of concern and other parameters. Additionally, surface water may be impacted indirectly by groundwater discharge that does not attenuate concentrations or loadings prior to reaching the receiving surface water body.

5.2.2 Groundwater Quality & Quantity

The Lucky Queen and Onek mines are above the groundwater level and not expected to produce long-term mine pool and discharge. The proponent does not anticipate water management and treatment for the post-closure period.

The Proponent has provided general statements as to the proposed mining methods that may be used to mitigate potential effects on water quantity by limiting the interaction between water and the underground workings, such as mining “off the vein” through host rock, shotcreting and cement backfill.

⁵⁸ YOR 2011-0315-0124-1; p.1.5

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LUCKY QUEEN

Groundwater flow and quality for Lucky Queen was not included in the project proposal as AKHM assumes that groundwater flow will generally conform with the topography of the area, and flow in the direction of Christal Creek.

During the first SVI period Environment Canada commented: *“Though the proponent recognizes that there is impact to groundwater, especially at Onek 400, and proposes for a groundwater investigation and monitoring program to be implemented at both mine sites, it would have been valuable during this screening if such baseline would have been presented as part of this application to properly assess water balance predictions.”*⁵⁹

ONEK

In 2010, the proponent initiated investigations into impacts of historical mining from the Onek 400 adit on groundwater resources. The results from the 2010, investigation served to inform groundwater flow and quality. The results were based on observations in October 2010, and March 2012, and describe current conditions.

Groundwater monitoring indicates that nine parameters may exceed Canadian Drinking Water Quality Guidelines in groundwater within the Christal Creek drainage these include: antimony, arsenic, cadmium, iron, manganese, uranium, zinc, sulphate and total suspended solids.⁶⁰ Of these parameters, AKHM suggests that elevated levels of cadmium and zinc may be related to historic mining activities. Based on mapping done by the proponent, and according to the proponent, groundwater flow direction is generally southwest from the Onek 400 adit, and then northwest; and not towards any of the Keno City water wells.⁶¹ However, given the placement of existing monitoring wells, and given the relatively new collection of information (2010) there remains concern with appropriately identifying groundwater flow and regime within the area. There is insufficient information to assert with certainty that groundwater from project activities will not flow towards existing private water wells, or will not adversely affect potential future uses for groundwater within Keno City⁶² and as such, additional monitoring, mapping and mitigations will be required.

ONEK 400 WATER TREATMENT

The historic Onek discharge generally infiltrates to ground within 50 m from the adit opening during low flow, and may travel several hundreds of metres during spring and early summer. There is a hydraulic connection between the open pit and the Onek 400 adit. Flows from the Onek 400 adit are presumed to

⁵⁹ YOR #2011-0315-057-1; p.6

⁶⁰ YOR #2011-0315-035-1; Appendix O, Table 4.

⁶¹ YOR #2011-0315-035-1; Appendix O, p.3

⁶² YOR #2011-0315-0124-1; p.1.5

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be dependent on inflows to a backfilled shaft within the pit. Spikes in water concentrations of constituents of concern, such as cadmium and zinc, are correlated with higher flows that flush the accumulated weathering products from the underground workings.⁶³ Baseline environmental studies provided by the proponent have identified the Onek 400 adit discharge as a major metal loading source in the Christal Creek watershed. The proponent is proposing to install a water treatment plant similar to the five other plants currently in use in the Keno Hills Silver District; further information is described in Section 1.4.5. The proponent intends to actively treat water at the site until water quality from Onek 400 allows a more passive water treatment technique, such as bioreactors.

Cadmium and zinc have been identified as constituents of potential concern in the Christal Creek drainage because of the elevated frequency and magnitude of exceedance of those constituents relative to background conditions and guideline values that are protective of aquatic life. The elevated levels of contaminants combined with contaminants from new workings could result in significant adverse effects to the water quality in the project area. With water treatment cadmium and zinc loads are expected to decrease to meet effluent release standards. The uptake of adit water for Onek operations is anticipated to result an overall reduction in the other constituents entering the Christal Creek drainage, which may beneficially effect water quality within the Christal Creek drainage.

5.2.3 N-AML & P-AML Storage and Classification

The proposed waste rock classification (as presented in Section 1.4.3) could allow for elevated concentrations of zinc and lead in the waste rock drainage. This could contribute to additional loadings in surface water or groundwater from runoff and seepage from N-AML waste rock storage facilities during short term snowmelt and precipitation events and over the long term. Although some attenuation of constituents in runoff and seepage by the soils can be anticipated from release to ground, the receiving soils may become less effective over the long-term as the uptake capacity of the soils is exceeded, thereby allowing constituent loadings to report to groundwater, surface water or both over the long term.⁶⁴

In addition to using N-AML for general construction and storing it above ground, the proponent has indicated that it may also be used in underground backfill for both Lucky Queen and Onek. A significant portion of the P-AML waste rock is proposed to be disposed of as backfill at Lucky Queen and Onek (or Bellekeno). Backfill material has the potential to produce soluble oxidation and leaching products that may in turn impact both groundwater and surface water quality by introducing concentrations of metals leached from the backfill material.⁶⁵

Generally, placement of waste rock that has the potential for acid rock drainage or metal leaching below water is an effective way of mitigating potential impacts. However, seeing as Lucky Queen and Onek

⁶³ YOR #2011-0315-033-1; p.70

⁶⁴ YOR #2011-0315-0124-1; p.2.4

⁶⁵ YOR #2011-0315-0124-1; p.2.6

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underground workings are anticipated to be above water level, acid generation and metal leaching may not be mitigated.⁶⁶ The proponent has indicated that by introducing cement into the backfill it will increase the alkalinity of water percolating through the structure.

During the first SVI period Environment Canada commented: *“Information regarding the physical and chemical stability of the paste backfill is absent. Typically this type of information, which is based on creating and testing synthesized tailings backfill to develop an optimized mix, precedes actual placement of the paste backfill product such that potential metal release can be predicted in case specific mitigation were to be warranted. In the present scenario it is expected the paste backfill will be alkaline. Under alkaline or elevated pH conditions, some metals and metalloids (such as some arsenic minerals) are preferentially leached or released. Additionally, this type of testing results in an understanding of not only long term chemical stability but also long term physical stability (and hence aspects of permeability) for these materials. The importance of providing this information in advance of placement of tailings backfill is evident.”*⁶⁷

It is recognized that the quality of waters seeping into the underground workings will be affected by contact with mine walls and backfill materials. Additionally, runoff from the waste rock piles could contain water with elevated metal concentrations that will enter the groundwater system, potentially increasing loadings of various constituents in the environment.

PROPONENT KEY COMMITMENTS:

For a full list of the proponent’s commitments, please refer to Appendix A-Table of Commitments.

MONITORING AND ADAPTIVE MANAGEMENT PLAN

- The conceptual Adaptive Management Plan (AMP) will include an “event” for monitoring N-AML waste rock piles and their seepages and stipulated adaptive management measure to be undertaken if an increasing trend in acid generation or metal leaching is detected (#17).
- One geomembrane lined lysimeter, each, will be installed in the N-AML storage area adjacent to the Lucky Queen Waste Rock Disposal Area. Drainage volumes will be monitored, with field parameters (pH and conductivity) measured on a monthly basis from May-October. Providing there is sufficient quantity of drainage, a full suite of water quality analysis will be conducted at least twice a year:
 - Thresholds that initiate adaptive management include declining pH and/or increasing conductivity trends, or conductivity greater than 2,000 µS/cm;
 - Inspection of waste rock sources, water quality analysis performed by an external laboratory, location and identification of seepage or runoff, removal of material, installation of a cover or water diversion system (#18).

⁶⁶ YOR #2011-0315-0124-1; p. 2.6

⁶⁷ YOR #2011-0315-057-1

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- Alexco will monitor seepages from the bypass and onsite access roads, and mine infrastructure built with N-AML material, and implement adaptive management responses, if required, as outlined in the approved AMP (#16).
- Integration of the Christal Creek Loadings Model into the AMP (#5).
- Response to new exceedences in the receiving environment is triggered if the concentration at the site exceeds a designated water quality benchmark, and if the mass loadings from the mine activities exceed 10% of the mass load for the constituent causing the exceedence (#4).

GROUNDWATER MONITORING

- Groundwater near N-AML waste rock disposal areas will be monitored for total zinc quarterly (#41).
- Alexco proposes to install two new groundwater monitoring wells—one down gradient of the new Onek workings and one down gradient of the Lucky Queen workings and N-AML WRDA (#43).

ONEK 400 WATER TREATMENT

- Collection and active treatment of any residual discharges to meet the proposed effluent release standards (#45).
- Alexco commits to ensuring the Onek 400 treatment system is operational prior to mining production at Onek (#47).

WASTE ROCK MANAGEMENT

- During operations, all waste rock will be immediately classified and moved to the appropriate disposal area or storage facility depending on type (#6).
- P-AML waste rock will be stockpiled at mine site for a maximum of 30 days, and then stored in a designated Waste Rock Storage Facility or used as rock backfill underground (#1).

SIGNIFICANCE:

The proponent's commitments, combined with non-discretionary legislation and the terms and conditions of existing approvals should address many of the potential risks for adverse effects on water resources from waste rock stored on surface. Waste rock characterization, segregation, and ongoing surface water and groundwater monitoring described in the Adaptive Management Plan for the project, will be essential components to prevent, identify and resolve potential problems.

The primary pathway for significant adverse effects to water resources will be from runoff from the waste rock storage areas and discharge from the Lucky Queen adit. Discharge from the Onek 990 adit is not anticipated during operations or post-closure.⁶⁸ Treatment of the existing discharge from Onek 400 has been considered in determining the significance of adverse effects. Managing and treating the Onek 400 adit water is expected to result in important decreases in cadmium and zinc loadings to the Christal Creek

⁶⁸ YOR #2011-0315-0124-1; p.2.10

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drainage. However, the new Lucky Queen and Onek mines are expected to result in long-term incremental increases in cadmium and zinc loadings from additional waste rock storage at the two mine sites. When the activities related to the Lucky Queen and Onek deposits and the treatment of the historic Onek 400 adit are considered together, total loadings are expected to be reduced from the current levels. Given the variability of project effects inherent to this type of project, it is critical to consider adaptive management based on monitoring, and ensure that an appropriate monitoring program, informed by results, and discussions with regulators is established to inform that adaptive management.

Based on the above and in consideration of the high magnitude, long duration, and medium probability of the project effects in regards to water resources, the Designated Office has determined that the project will result in significant adverse effects to water resources such that additional mitigation is required.

MITIGATIONS:

The following mitigation measures are specified to eliminate, reduce or control significant adverse effects of the project relating to water resources.

GROUNDWATER

1. In discussion with regulators and experts, the proponent shall install sufficient groundwater monitoring wells in order to estimate to a high degree the hydraulic conductivity of all potentially impacted aquifers, the groundwater flow directions, vertical and horizontal hydraulic gradients, and the potential flux of contaminants in groundwater on all receptors.
2. The proponent shall prepare a conceptual groundwater model for the site. In preparing the conceptual groundwater model the proponent shall include reasonably foreseeable potential inputs and outputs of water to the backfilled underground workings for operations and post-closure.
3. The proponent shall provide to regulators an analysis and review of all information regarding interactions between the project activities and groundwater resources and flow, including mapping, prior to licensing to establish a baseline for current conditions, including determining the direction of groundwater flow.
4. The proponent shall provide information to regulators on the fate and transport of groundwater constituents that may result in a downstream impact on receiving waters from the new workings at Onek; the results of this information and discussion shall be incorporated into the Adaptive Management Plan.
5. The proponent shall ensure that the Adaptive Management Plan identifies measures that will be taken to minimize inflows into underground workings to mitigate against long-term groundwater quality effects; the proponent shall provide clear methodology for the selection of measures.

WASTE ROCK MANAGEMENT

6. The proponent shall ensure that N-AML waste rock with elevated zinc content used as construction and upgrade materials is set back an appropriate distance from surface water to

avoid impacts; and shall establish appropriate maximum zinc content for the use of these materials for construction purposes.

7. The proponent shall demonstrate to regulators that conductivity is an appropriate surrogate for monitoring N-AML trends, in particular changes to zinc and cadmium in seepage (i.e.; correlation between conductivity and zinc and/or cadmium concentrations) prior to undertaking activities in relation to N-AML.
8. The proponent shall provide a detailed mass load model description to regulators that would allow for a more comprehensive review of the mass load model for the Christal Creek drainage prior to further permits or authorizations being sought.
9. Geochemical confirmation testing for the Lucky Queen and Onek proposed waste rock should be completed and results should be reported to regulators to allow waste rock and predictive loadings provided by the proponent to be re-evaluated and updated throughout the mine life, and appropriate mitigations to be included in the Adaptive Management Plan.
10. The results from ongoing research programs for the District Closure Plan should be applied to the project and included in subsequent revisions of the Reclamation and Closure Plan. The assumptions used for waste rock sources in the predictive loadings model for Christal Creek for closure scenarios should be updated as the understanding of cover performance improves.

5.3 RESIDUAL EFFECTS

Of paramount importance in considering the potential residual effects from the project activities on water resources is the operation of the Onek 400 water treatment plant. Given that the proponent has committed to operating the water treatment plant prior to commencing operations at Onek, the residual impact from Lucky Queen and Onek facilities and activities is anticipated to be low. Should the proponent not be able to meet their commitment in regards to the operation of the Onek 400 water treatment plant, the outcome of this section of the assessment would be substantially different.

The mitigation measures listed above as well as the proponent's commitments are considered adequate to reduce the significant adverse effects to a level that any residual effect to water resources is likely to be low in significance.

6.0 FISH AND FISH HABITAT

6.1 OVERVIEW

As previously stated, potential impacts on fish, have been considered in light of the fact that the Bellekeno Mine mitigations and commitments were developed to mitigate any potential impacts from the proposed operations. In considering potential effects to fish and fish habitat the assessor has remained focused primarily on those project activities that may directly affect fish and fish habitat. Further information on water quality and quantity for both surface and ground water can be found in Section 5. The background information for water use is described in Section 1.4.5, the background for the Lightning Creek crossing is discussed in Section 1.4.7.

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The Designated Office has considered the following project activities to have the potential to affect fish and fish habitat:

- Construction phase: clearing/grubbing, topsoil stripping, levelling/grading, ditching and berming, road and bridge construction, portal pad construction, transportation, fuel storage, accidents/malfunctions;
- Operation phase: temporary surface storage of low-grade ore, waste rock classification and storage, camp operations, fuel storage and use, vegetation clearing, and groundwater withdrawal.

6.2 PROJECT EFFECTS

The range of effects from project activities that could affect fish and fish habitat valued components include:

- Habitat Loss or Destruction: direct disturbance or removal of riparian vegetation;
- Direct/indirect mortality: withdrawal that affects stream flow, direct or indirect input of sediments or other deleterious substance

6.2.1 Habitat Loss or Destruction

Riparian vegetation is recognized as providing cover from predators, regulating temperature, providing food input, and providing bank stability. There is potential for direct impact to riparian vegetation along Lightning Creek where the proponent is proposing to install a clear-span bridge. Despite committing to not fording the creek, the installation of the bridge abutments, and bridge approaches within the riparian area of Lightning Creek will remove that area as viable riparian vegetation. All other watercourses within the project area (Christal Creek, Christal Lake, Erickson Gulch, and Flat Creek) do not have any proposed project activities that may directly affect riparian vegetation either through removal or disturbance. An increase in sediment load may result in an increase in the total suspended solids in a watercourse and alter the chemistry of the water body.

In general, the deposition of fine sediment in stream ecosystems is detrimental to aquatic organisms. The effects of increased sediment loads and increased turbidity levels may overtime affect flow and water quality to the point where food sources are diminished and habitat rendered unsuitable for the existence of fish and fish reproduction.

6.2.2 Direct/Indirect Mortality

As described in Section 5, the background water quality for the Keno Hills Silver District is heavily influenced by previous mining operations. Zinc is one of the most prevalent contaminants in the drainage waters from site, and is known to be toxic to fish and other aquatic life. The toxic effects of zinc on fish can vary from damaging gill surfaces to accumulation in tissues.

Fish studies conducted by AKHM for the Bellekeno Mine have found Arctic grayling, slimy sculpin, round whitefish, northern pike, Arctic lamprey, chinook salmon, burbot, longnose sucker, least cisco and lake

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chub within Flat Creek, Lightning Creek or Christal Creek.⁶⁹ Preliminary information on recent fish and fish habitat studies indicates that slimy sculpin and Arctic grayling have been found within Lightning Creek in the reach of the proposed Onek bridge crossing. The proponent has indicated that as part of the proponent's permit under the Metal Mining Effluent Regulations, they must conduct annual surveys, as such it is anticipated that results will be available to inform the Water Board process.⁷⁰

As an additional contingency water source, AKHM proposes to source up to 112.5 m³/day from Lightning Creek at the same withdrawal location as is currently licenced. Based on the previous Bellekeno Mine assessment, and existing flows within Lightning Creek, the licence currently sets a maximum combined rate of up to 245 m³/day from Lightning Creek and other sources for use in mining operations⁷¹.

Removing water from a water body via a pump, as is the case for water withdrawals associated with the project, has the potential to cause death or injury to fish if they come in contact with an operating pump. Individual fish may become entrained or entrapped. The removal of water may also result in a reduction of suitable fish habitat. This loss of habitat can occur when there is a change in stream flow resulting from the decrease or removal of water from a tributary. Such changes can alter the creek temperature and chemistry; change the rate and volume of food delivery transport downstream; or cause the potential acceleration of sediment deposition and create access limitations to fish.

Project infrastructure construction, disruption or exposure of permafrost, road use and maintenance would increase disturbance of soils potentially leading to sediment transfer to streams, altering the water quality and affecting fish, fish habitat, and primary productivity in the watercourses. Furthermore the storage of fuel, accidents or malfunctions may result in impacts to water quality which may cause mortality.

The proponent has proposed a list of twelve water quality parameters that are required to be met prior to release, (as based on the CWQG, BCWQG and Provincial Water Quality Objectives for Ontario) from Lucky Queen and Onek. These include cadmium and zinc, as well as, pH, suspended solids, ammonia nitrogen, arsenic, copper, lead, nickel, radium-226, silver and acute toxicity to fish.⁷²

AKHM is proposing to augment water supply to the camp that is currently sourced directly from Flat Creek by drilling a groundwater well near the old water storage building, it is unknown if there is a hydrologic connection between Flat Creek and groundwater, therefore groundwater extraction has the potential to impact surface water flows.

⁶⁹ YOR #2009-0030-0124-1; p.30

⁷⁰ Personal communication with proponent, July 20, 2012.

⁷¹ YOR #2011-0315-033-1; p.81

⁷² YOR #2011-0315-033-1; p.97

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PROPONENT KEY COMMITMENTS:

For a full list of the proponent's commitments, please refer to Appendix A-Table of Commitments.

- The measures outlined in MS10-029 will be adhered to:
 - Construction shall be carried out from July 1 to April 15, in accordance with the timing window recommended by DFO for the existing Lightning Creek Bridge .
 - Temporary sediment control, such as silt fences or temporary diversion berms, will be installed, monitored and maintained to prevent sediment runoff into the creeks.
 - Machinery will be operated above the ordinary high water mark to the extent possible and in a manner that minimizes disturbance to the banks of the watercourse.
 - No fuel will be stored (including tidy tanks in trucks) within 30 m of any waterbody.
 - DFO's Operational Statements for *Clear Span Bridges* will be adhered to (#50).

SIGNIFICANCE:

In rendering a significance determination the Designated Office has taken into consideration the non-discretionary legislation, and proponent's commitments. The nature of the activities occurring nearby or within riparian areas, in addition to activities that may result in direct/indirect mortality, are mitigated by the proponent. Ensuring that machinery is kept out of riparian areas, and ensuring that fording the river does not occur greatly reduce the significance of adverse effects. Therefore, based on the low magnitude, short duration, and low probability of project effects in regards to fish and fish habitat, the Designated Office has determined that the project will not result in significant adverse effects to fish and fish habitat.

MITIGATION:

No additional mitigation required.

7.0 WILDLIFE AND WILDLIFE HABITAT

7.1 OVERVIEW

Woodland caribou, grizzly bears, migratory birds, and pika have all been granted special status under federal legislation, and as such are considered in this section. For example:

- Woodland Caribou - Federal species of Special Concern, *Species At Risk Act/* Committee on the Status of Endangered Wildlife in Canada (COSEWIC)
- Grizzly bears - Federal species of Special Concern, COSEWIC
- Migratory Birds - *Protected under the Yukon Wildlife Act* and the (Federal) *Migratory Birds Convention Act*
- Collared Pika - Federal species of Special Concern, COSEWIC

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In addition to those species granted special status under legislation, moose are also considered in this section, primarily due to the cultural importance of moose for harvesting.

The Designated Office has considered the following project activities to have the potential to affect wildlife and wildlife habitat:

- Construction phase: clearing/grubbing, levelling/grading, blasting, road construction, portal pad construction, power line installation, transportation;
- Operation phase: mine and camp operations, fuel storage, traffic, blasting, vegetation clearing.

7.2 PROJECT EFFECTS

The range of effects from project activities that could affect wildlife and wildlife habitat valued components include:

- Direct/Indirect Mortality: Human-caused mortality, including potential lethal control of problem wildlife, exposure to lethal substances, and increased collisions between wildlife and humans;
- Habitat Loss or Destruction: disturbances leading to habitat loss, destruction of habitat or abandonment;

7.2.1 Direct/Indirect Mortality

WOODLAND CARIBOU

Woodland caribou are not present within the project area with the exception of 10-12 Woodland caribou scattered throughout the Mt. Hinton and Bunker Hill areas observed during mid-summer months. Occasional caribou have been sighted within the reaches of Mayo Lake and Fraser Falls.⁷³ The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) identifies the caribou as a species of 'Special Concern'. Caribou may be affected by project activities that include increased traffic, blasting (indirectly), as well as via potential exposure to lethal substances, such as petroleum fuel spills.

BEARS

The grizzly bear is listed as an animal of 'Special Concern' according to COSEWIC; the grizzly and black bear are common in the Keno Hills Silver District. Improperly handled waste and debris may attract scavenging wildlife to camps and other areas frequented by humans. This poses a significant safety concern to bears and humans alike. The likelihood of camp visitations by bears increases over the duration of camp activity as animals are conditioned to human presence. Once accustomed, wildlife in general, and bears in particular are often undeterred by routine activity or noise. Generally, any odorous substance is a strong bear attractant, which can include both ingestible and hazardous materials (i.e. food, fuel, etc). Should bears become nuisance or a threat to humans, lethal action may be taken leading

⁷³ YOR 2009-0030-122-1

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to direct mortality. Additionally, the ingestion of injurious or lethal doses of contaminants such as petroleum fuels and lubricants released into the environment through malfunctioning equipment, spills or accidents may result in injury or mortality to bears. See Section 9, Human Health for further discussion on attractants and risk of bears.

MIGRATORY BIRDS

The district is the seasonal home to numerous migratory birds during the migration and breeding season. While the Canada goose and trumpeter swan are abundant within the area, several species including the tundra swan, the greater white-fronted goose, the snow goose and brant pass through the area on their way north to Arctic breeding grounds.⁷⁴ Twelve birds of prey including the peregrine falcon have been observed in the area; and three species of birds including the common nighthawk, the rusty blackbird and the olive-sided flycatcher are listed as threatened or 'Special Concern' by COSEWIC. Disturbance of existing waste rock piles, or clearing for project components, as well as increased traffic may directly lead to increased bird mortality.

COLLARED PIKA

At the most recent meeting of COSEWIC in November 2011, the collared pika was identified as a species of Special Concern. Reasons identified for this designation were the pika's restricted habitat type, which is scattered small boulder fields in alpine meadows of mountainous regions of Yukon, Northwest Territories, northern British Columbia.⁷⁵ According to Environment Yukon, the pika has been described as "truly an edge animal: using the jumbled rocks on the fringe of the talus slope for its protective home and using the nearby vegetative slopes for its food supply. Both the collared and rocky mountain pika live only on the margins of talus slopes where vegetation is nearby—usually within five metres of its home".⁷⁶ Disturbance of existing waste rock piles or increased mine activities within the alpine environment of Lucky Queen may lead to direct mortality of pika.

MOOSE

Considered one of the ecoregion's most important sustenance animals, moose are prevalent within the Keno Hills Silver District. The wetlands associated with the Pumphouse road, South McQuesten River and Elsa tailings are primary calving and post-calving ranges.⁷⁷ Increased traffic may lead to increased collisions between moose and humans, which may result in direct mortality. Furthermore, moose may be impacted (indirectly) by blasting, and as well as via potential exposure to lethal substances. It is not anticipated that increased harvesting of moose will occur as a result of the Bypass road as it does not

⁷⁴ YOR 2009-0030-122-1

⁷⁵ COSEWIC, 2012

⁷⁶ Yukon Government, Environment (n.d.). *Yukon Mammals, Collared Pika Characteristics*. Retrieved from: <http://www.env.gov.yk.ca/wildlifebiodiversity/mammals/pika.php>.

⁷⁷ YOR 2009-0030-122-1

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provide access into prime moose habitat, and furthermore, it is a radio controlled roadway on the periphery of Keno City.

7.2.2 Habitat Loss or Destruction

Habitat loss may occur either by destruction, or by its functional removal, whereby wildlife avoid a certain area due to noise and visual disturbance associated with use of heavy equipment and increased human presence. Bears are not considered as there is limited loss from project activities to potential bear habitat, and they do not react as adversely to human presence as other species, which are discussed below.

WOODLAND CARIBOU

Although uncommon in the Keno Hills Silver District, Woodland caribou are particularly sensitive to disturbances caused by continuous human activity. Caribou are likely to reduce the use of their functional range when it overlaps with human activity making them increasingly vulnerable to predation from humans and other wildlife alike as they group into larger aggregations within smaller areas. While the proposed project activities are not within core habitat for the Woodland caribou, project activities such as blasting, that generate noise or visual disturbances will cause caribou to avoid the area.

MIGRATORY BIRDS

Various species of migratory and non-migratory bird species common to the Yukon may be found within the project area; nesting and breeding during the spring/summer months. Generally, it is recommended that no land clearing or disturbance occur between May 1 and July 31 to avoid disruption. The *Migratory Birds Convention Act* does not provide for any incidental take of migratory birds, as such proponents must not engage in any activity that will violate the Migratory Birds Regulations.

Alteration to habitat by project activities such as vegetation clearing, grubbing, levelling/grading, blasting, road construction, power line installation, or construction of the Onek portal pad can destroy potentially important habitat areas, or disturb nests.

Given the multi-year nature of the project, the proponent can plan to conduct any project activities that may potentially affect birds outside of the bird-breeding period. If this is not achievable, point counts would reduce the potential of bird mortality during project activities and ensure the proponent maintains compliance with the non-discretionary legislation.

COLLARED PIKA

Pikas live in colonies that can sometimes be identified through a 'haystack' that forms at the centre point of a colony.⁷⁸ These 'haystacks' are a collection of greenery that provide food year around for the pika, as they do not hibernate over winter. Disturbance to this food cache has the potential to adversely affect

⁷⁸ COSEWIC, 2012

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their overwinter survival rate. Mining development activities in and around pika colonies have the potential to disturb their limited edge habitat, and may result in the loss of habitat within the project area.

MOOSE

Unlike caribou, moose have a high tolerance and tendency towards human activity as it often increases the likelihood of suitable browsing grounds (i.e. twigs, leaves, shrubs and other land and water plants) and decreases the chance of predation, as predators may avoid areas of human activity. Sensory disturbance from construction activities, vehicle traffic, and increased human presence may negatively impact cow moose during late pregnancy and calving time; causing them to avoid the project area; or expend energy during “flight” response that is detrimental during pregnancy.

PROPONENT KEY COMMITMENTS:

For a full list of the proponent’s commitments, please refer to Appendix A-Table of Commitments

- The Traffic Management Plan will be updated as part of project licensing (#22).
- There will be stop signs to stop mine traffic at the intersection with Sign Post road, Wernecke road, Lightning Creek road and the Silver Trail Highway (#52).
- Spill Contingency Plan will be applied (#21).

SIGNIFICANCE:

The Designated Office considered the proponent's commitments in combination with non-discretionary legislation in determining significance. As described above, the project activities have the potential to affect wildlife and wildlife habitat by direct/indirect mortality or by habitat loss or destruction. While the operations are primarily underground, there is sufficient activity and disturbance above-ground that effects may occur. As such, based on the low magnitude, medium term duration, and irreversibility (in consideration of mortality) of the project effects in regards to wildlife and wildlife habitat, the Designated Office has determined that the project will result in significant adverse effects to wildlife and wildlife habitat such that additional mitigation is required.

MITIGATION:

The following mitigation measures are specified to eliminate, reduce or control significant adverse effects of the project relating to wildlife and wildlife habitat.

11. In the event that land disturbing activities occur between the core breeding period of May 1st and July 31st, prior to clearing, or disturbing the proponent must plan to avoid disturbing or destroying nests of birds listed under the *Migratory Birds Convention Act*. Contact the Canadian Wildlife Service, Whitehorse, for information on considerations related to determining the presence of nest.
12. The proponent shall ensure that in subsequent years, land disturbing activities that have the potential to affect migratory bird nests occur outside of the core breeding period of May 1st and July 31st.

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13. The proponent shall keep all equipment in good working condition and regularly inspect for leaks.
14. The camp area shall be enclosed with electric fencing with attention given to camp design (as outlined in the Guidelines for Industrial Activity in Bear Country) in order to avoid attracting bears. The proponent shall report any incidents involving wildlife to the Mayo Conservation Officer (867-996-2202).
15. The proponent shall ensure that during winter months breaks in snow-banks on main access roads are created in order to facilitate wildlife crossing and exiting the road.
16. Employees shall fill out AKHM's posted wildlife log, this log shall be summarized and provided to regulators quarterly, listing wildlife collisions/mortality as well as sightings.
17. Project staff shall be made aware of collared pika, including how to identify the animal and key signs of habitat.
18. The proponent shall not disturb or destroy confirmed collared pika colonies, and no work shall be conducted within a recommended distance. The proponent shall consult with Yukon Environment wildlife experts to establish a reasonable recommended distance.

Rationale: While the pika is a Species of Special Concern under COSEWIC, it is afforded no specific protection. As this animal is not as obvious or well known as some other mammals, there is a potential that project staff would not be aware of pika or their vulnerability to habitat alteration. With this in mind, it is vital that these animals be identified and protected during project activities.
19. Upon the identification of (other than known) colonies for collared pika, the proponent should report the occurrence to the Yukon Conservation Data Centre for advice on further mitigation.

The following mitigations are commitments the proponent has not yet implemented, but that are considered important in mitigating significant adverse effects to wildlife and wildlife habitat.

20. Flat Creek camp compound shall be fenced and gated.⁷⁹

7.3 RESIDUAL EFFECTS

The mitigation measures listed above as well as the proponent's commitments are considered adequate to reduce the significant adverse effects to a level that any residual effect will be negligible.

⁷⁹ YOR #2009-0030-0124-1; p.103

8.0 TERRAIN STABILITY AND SOILS

8.1 OVERVIEW

The Keno Hills Silver District is characteristic of terrain consisting of concordant, rolling, upland areas. Upper slopes that may be covered with scree material while valleys include peatlands, palsas, fens and meadows of sedge tussocks. The area has been influenced by the glaciations, and permafrost is irregularly distributed.⁸⁰

The Designated Office has considered the following project activities to have the potential to affect terrain stability and soils:

- Construction phase: vegetation clearing, grubbing, leveling/grading, blasting, road construction, portal pad and settling pond construction, and bridge crossing;
- Operation phase: waste rock storage, mine and camp operations, and fuel storage

8.2 PROJECT EFFECTS

The range of effects from project activities that could affect terrain stability and soil valued components includes:

- Reduced soil stability: erosion and soil slumping
- Degradation of permafrost: Increasing surface temperatures by storage of materials above permafrost laden soils, exposure of permafrost to the surface.

8.2.1 Reduced Soil Stability

Project activities within the construction and operations phases will expose underlying soils potentially resulting in soil erosion and slumping. Once fragile root systems that hold soils in place are disturbed, erosion processes may accelerate by wind, and slope and surface run-off, thus altering surface geology or change existing drainage and runoff patterns.

There is potential for direct impact on soil stability along the proposed Bypass road where the proponent intends to clear vegetation and remove topsoil during road construction. Despite a proponent commitment to stockpile vegetation and topsoil from the construction, improper separation and failure to maintain the integrity of the removed vegetative material during project activities may compromise re-vegetative efforts by denuding the nutrient value of the soil, reducing the ability of the site to regenerate naturally and further contributing to long-term erosion. Best practices and procedures to prevent erosion and soil degradation can be found in the *Yukon Mineral and Coal Exploration Best Management*

⁸⁰ YOR #2011-0315-002-1; p.9

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Practices and Regulatory Guide. This guide is primarily for small-scale quartz exploration; however, certain procedures can be adapted for larger scale quartz projects as well.

8.2.2 Degradation of Permafrost

Permafrost is discontinuous in the district where its precise location is controlled by microclimatic factors. As such, the project area is likely underlain by it.⁸¹ Project activities that expose underlying soils to the natural elements expose areas of permafrost to the external environment, where it becomes liable to thawing and soil instability, releasing materials that have been previously locked in place. The effects of seasonal freezing and thawing of the exposed soils (including root and seed stocks) may lead to the deterioration of such stocks rendering them unsuitable for natural re-vegetation.

Furthermore, permafrost that is present in poorly or unconsolidated material may become damaged and lead to slumping and/or retrogressive thaw slides. There is potential for direct impact on permafrost layers along Lightning Creek where the proponent is proposing to clear vegetation and topsoil to install a clear-span bridge. Bridge abutments will be placed in the ground, potentially causing additional damage to the permafrost layer, resulting in soil sloughing towards the creek. Should permafrost be found within the banks of Lightning Creek as the layers slough, erosion may continue as additional permafrost is exposed.

PROPONENT KEY COMMITMENTS:

For a full list of the proponent commitments, please refer to Appendix A- Table of Commitments

- Appropriate waste management infrastructure (e.g. diversions and berms) will be established to ensure site runoff is managed and erosion or ground instability is avoided (#37).
- Reclamation and closure objectives include incorporating progressive reclamation; providing slope stabilization and erosion control on linear and non-linear disturbances (#24).
- At closure, roads will be re-sloped and scarified, culverts removed and seeded in areas where necessary (#29).
- The portal sites at both Lucky Queen and Onek will be re-contoured and scarified to facilitate re-vegetation and drainage (#26).

SIGNIFICANCE:

The reduction of soil stability and the increase of melting permafrost combined with subsequent impacts such as retrogressive thaw slides, limited ability of vegetation to regenerate and deterioration of seed stocks may result in potentially large, irreversible physical changes to the environment. In addition, once soil stability is compromised or permafrost starts to degrade, the likelihood of recovering the valued

⁸¹ *Smith et al, 2004*

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component would be limited, and in the case of AKHM, restoration of disturbed areas would be unlikely to occur to acceptable conditions prior to the cessation of mining activities.

The Designated Office has given consideration to the proponent's commitments as well as existing legislation in determining the significance of project effects to terrain stability and soils. Given the medium duration and medium probability of the project effects, and the sensitive context of the area (having discontinuous permafrost), the Designated Office has determined that there are significant adverse effects to terrain stability and soils, and as such additional mitigation is necessary.

MITIGATION:

The following mitigation measures are specified to eliminate, reduce or control significant adverse effects of the project relating to terrain stability and soils. This mitigation ensures that any residual effects of this project will not be significant and adverse.

21. The proponent shall follow the *Yukon Mineral and Coal Exploration Best Management Practices and Regulatory Guide* (<http://www.yukonminers.ca/Industry/BMPs.aspx>) while conducting all project activities.
22. The proponent shall install effective erosion control measures before starting work to prevent degradation of soil.
23. All vegetative material and organic material will be stockpiled and spread over disturbed areas after work is completed to allow for re-vegetation.
24. The proponent shall test for permafrost prior to work in an area to determine a better understanding of the permafrost layer.
25. The proponent shall avoid work in areas of permafrost.

8.3 RESIDUAL EFFECTS

The above-noted mitigation is intended to ensure that any residual effects of this project will not be significant and adverse.

9.0 HUMAN HEALTH

9.1 OVERVIEW

This section describes impacts to employee and public safety as they pertain to mine construction and operations. Employee and public health concerns are interwoven in the discussion of potential effects to human health and are presented together.

The Designated Office has considered the following project activities to have potential to affect human health:

- Construction phase: blasting and drilling, temporary storage of waste rock above ground, road construction, and power line installation

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- Operations phase: mine and camp operations, including extraction and storage of ore, transportation and storage of waste rock, water use, water management and treatment, and storage of explosives

9.2 PROJECT EFFECTS

The range of effects from project activities that could affect human health valued components includes:

- Employee health and safety: direct and indirect impacts to employees onsite.
- Public health and safety: direct and indirect effects to traffic volumes, domestic water quality and trail use
- Camp Safety: bear attractants

9.2.1 Employee Health and Safety

The practice of underground mining has inherent safety risks associated with it. Major risks to workers when working underground include collapse of the adit structure or blockage within the portal. Indirect effects of infrastructure collapse include:

- Isolating workers from possible escape routes;
- Production of particulate matter and related air quality effects;
- Injury to the worker with potential long term disability;
- Death of underground workers⁸²

Other risks to mine employees include drilling, storage and use of explosives, and chemicals. Activities such as blasting or drilling may lead to the accumulation of particulate matter such as rock dust and diesel exhaust. These particulate matters will reduce air quality adversely affecting human health. Refer to Section 11.0, Air Quality for further discussion. The project involves the continued use of explosives and drills to facilitate underground excavation. Storing, transporting, handling and detonating explosives are also safety risks to both workers and the public. Effects can be serious and include death, injury or health failings.

There are a number of chemicals used on site including petrochemicals, milling reagents, and lime. There is potential for direct impact on worker health at the water treatment facilities where the proponent is proposing to use lime for the treatment of adit discharges (it is also used to treat mill and dry stack tailings). The chemical component of lime is calcium hydroxide. It poses a risk to employees who handle and prepare slurry for water/discharge treatment. Lime can cause ulceration and burns upon contact. It will also induce nausea, vomiting, abdominal pain and diarrhoea if inadvertently ingested. The powder

⁸² YOR #2009-0030-0124-1; p.85

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form can act as a severe irritant, and over exposure can result in pain, redness and skin rashes.⁸³ Any such health effects attributable to exposure to lime (or other toxic chemicals), without the proper occupational precautions, would be considered significant and adverse.

9.2.2 Public Health and Safety

The majority of mining operations are remote, and have limited interaction with the public. However, components of the Lucky Queen and Onek mine sites are deeply integrated with Keno City in terms of proximity and use of public infrastructure (i.e. roads).

There is potential for direct impact to public health where proposed activities and operations could present additional contaminants into the domestic water supply, vegetation or wildlife of Keno City and surrounding area, thereby resulting in adverse effects to human health. These concerns have led to the development of two health impact studies, one by the proponent and the other by Yukon Government. There is also potential for direct impact on public health and safety along the Wernecke road, Sign Post road, and the proposed Bypass road where the proponent is proposing to transport ore, waste rock and lime. Increased mine haul traffic will amplify dust conditions as well as the likelihood for traffic-related accidents; thereby, posing a risk to health and safety of the public.

The air quality section addresses concerns around dust while concerns around traffic-related accidents, and domestic drinking water are accounted for within this section.

HUMAN HEALTH IMPACT ASSESSMENT

Given concerns expressed by community members and experts alike about human health of long-term residents, the proponent submitted a Human Health Risk Assessment for Residents of Keno City (HHRA), which was prepared by SENES Consultants Limited. The HHRA was conducted for exposure of year-round residents of Keno City to constituents in the surrounding environment due to historical mining activity in the area. The assessment evaluated whether exposures at identified contaminant levels have the potential to pose health risks to the community.⁸⁴ After consideration of receptors such as food consumption, water intake, soil intake, inhalation rates, and dermal contact intake rates, the assessment concluded that the residents of Keno City are not currently at risk from consuming drinking water, local berries and locally harvested moose or fish. Although, the report does caution residents to limit their consumption of moose organ meat in order to avoid risk from cadmium exposure. The report also suggests that exposure to soil from inhalation or direct contact with dust is not a concern.

There were data gaps identified within the confines of this report, and many residents expressed dissatisfaction with the level of information provided. As such, the Department of Health and Social Services has contracted Habitat Health Impact Consulting Inc to perform an independent Human Health

⁸³ YOR #2009-0030-0124-1; p.87

⁸⁴ SENES Consultants Limited, March 2012. *Final Draft Report: Human Health Risk Assessment For Residents of Keno City, Yukon*

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Impact Assessment for Keno. According to comments provided by Yukon Government, “the study will identify potential health impacts associated with mine development in the area as well as any data gaps that limit the understanding of the overall health impacts of the activities”.⁸⁵ This impact report is yet to be completed, but is expected by end of 2012. The completion of this study will provide certainty around human health. This report is expected to provide key recommendations to regulators for AKHM’s continued operations, and the Designated Office anticipates that recommendations from this report will be included in the licence amendments. Currently, there are outstanding risks to health around the contamination in water, vegetation, soil and wildlife that have yet to be addressed, and have the potential to present adverse effects to human health.

DOMESTIC WATER QUALITY

Drinking water quality is one of the primary concerns for public health. Health Canada points to groundwater monitoring results, which indicate elevated cadmium, manganese and zinc levels exceeding the Canadian Drinking Water Quality Guideline (CDWQG). They also question the sufficiency of treatment (i.e. iron cartridge filter and chlorination), but cannot determine adequacy because of limited data.⁸⁶ Incomplete or deficient data is noted with similar comments submitted from the Yukon Conservation Society (YCS) who suggest that in terms of groundwater contamination, there are insufficient studies to determine whether the Onek project, in particular, will have a negative impact on the groundwater table, and subsequent drinking water quality.⁸⁷ There is potential for direct impact to drinking water quality downstream of the historic Onek 400 adit where water flowing from workings may affect the quality of groundwater in the area. As explained in Section 5, Water Resources, the proponent has attempted to identify the groundwater regime and flow within the vicinity of Keno City; however, concerns persist as to the adequacy of the characterization, and level of detail. Despite the AKHM’s commitment not to interact with historic workings, blasting, drilling and temporary storage of waste rock at both portal locations may negatively impact the quality of groundwater, which is a potential human health hazard if contaminated water is consumed. Many residents of Keno previously grew their own food. One couple in particular received a grant from the Yukon Government to grow natural health-food products.⁸⁸ Due to the project activities, and subsequent uncertainty of ground water and drinking water quality, they have stopped growing food.

Drinking water quality can also be affected by improper sewage disposal, domestic waste and grey water. Yukon Government Health and Social Services warned that the current Flat Creek camp sewage disposal system is set up for 148 rather than 200 people. Sewage disposal can be particularly dangerous and easily result in contamination of soil and water sources through inadequate waste handling and treatment.

⁸⁵ YOR 2011-0315-106-1

⁸⁶ YOR 2011-0315-079-1 May 11, 2012

⁸⁷ YOR 2011-0315-069-1 May 8, 2012

⁸⁸ YOR 2011-0315-070-1 May 9, 2012

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Human waste is known to be a vector for a number of pathogens such as E.Coli bacteria and parasites like Giardia spp. Transmission occurs with the consumption of untreated or unfiltered water from contaminated sources such as creeks. In some strains of bacteria, effects can range from minor illness to death. Parasites like Giardia, which causes “beaver fever” move through the environment using humans and wild animals, specifically their waste, as the distribution system. As such, improper or inadequate sewage disposal may result in decreasing water quality, and negatively affecting human health.

TRAFFIC RELATED ACCIDENTS

The mine and its associated infrastructure are easily accessible for the public using existing roads. According to comments provided by Yukon Government, Environment Branch, Sign Post road and the surrounding trails are a highlight for visitors to Keno City. Several hundred visitors hike marked trails in the project area to view and learn about alpine wildlife and wildlife flowers. While most visitor activity occurs outside the proposed mining activity, there are accessible trails throughout the region, and it is easy for visitors to inadvertently enter active mining roads or sites. Given the increasing level of industrial activity, including vehicular traffic, there is an inherent concern for public safety. Despite proponent’s previous commitments to enforce speed limits, the increased traffic volumes and high speeds of haul trucks related to work at Lucky Queen and Onek have many local residents and tourists concerned about road safety. Furthermore, increased industrial traffic results in deterioration of roads, and risks associated with collisions.

9.2.3 Camp Safety

Flat Creek camp will be undergoing an expansion in camp size however; the footprint of the camp will not change as there is currently sufficient space to accommodate the expansion. The Designated Office recognizes that the Flat Creek expansion could have an impact on sewage disposal and drinking water as it relates to groundwater as described above. This section specifically addresses waste and related bear attractants.

The camp increase from 148 to 200 people may lead to improper management of garbage and other waste produced by the camp. An unsuccessful waste management system has the potential to lead to unsanitary conditions and provide an attractant to scavenger animals.

Waste and debris that is handled improperly may attract bears and other wildlife to areas frequented by humans. This poses a significant safety concern to wildlife and humans alike. Habituated bears that are successful at procuring garbage as a food source are particularly at risk. There is potential for direct impact on human health at Flat Creek camp where the proponent is proposing to increase the size of their camp. Bears commonly utilize valley bottom and stream corridors as travel routes as well as alpine and sub-alpine areas. Long-term camps are usually situated in similar settings, and have a higher likelihood of encountering a bear visitation than a short-term camp, regardless of waste management procedures. If bears are not adequately deterred from camp, or if they receive food rewards, the likelihood of encountering bears further increases; thus, increasing the potential for harm to humans or wildlife alike.

Proper attractant management does not only require the proper handling of food and garbage, but also petroleum-based products. Environment Yukon notes that even small amounts of fuel (e.g. jerry can)

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and/or waste oil attract bears if not properly managed. The likelihood of having petroleum-based products around the project area is high. The need to refuel frequently and the potential for fuel spillage all indicate that improper management of fuel will lead human-wildlife conflict, resulting in a decline in camp safety.

PROPONENT KEY COMMITMENTS:

For a full list of the proponent commitments, please refer to Appendix A- Table of Commitments.

- Alexco has in place a Health & Safety Policy and both will continue to be adhered to during the course of operations at Onek and Lucky Queen (#71).
- A safety coordinator specific for the underground operation will ensure all workers are orientated to all aspects of the work site including hazard identification, protective equipment requirements and that medical and health requirements are followed according to legislation (#75).
- Alexco proposes to install two new groundwater monitoring wells – one down gradient of the new Onek workings and one downgradient of the Lucky Queen workings and N-AML WRDA (#43).
- Alexco commits to ensuring the Onek 400 treatment system is in operation prior to mining production at Onek (#47).
- The Traffic Management Plan will be updated as part of project licensing (#22).
- Alexco will construct a bypass road to route most mine traffic around the community, and ensure interference with local community is minimal (#45).
- Signage installed along Silver Trail Highway warning of mine traffic and turning trucks as well as site access roads to Lucky Queen and Onek prohibiting the public from entering the mine site and warning of dangers (#49 & #53).
- AKHM will manage project waste as per the existing and approved Waste Management Plan that currently exists for the Bellekeno operations (#20).

SIGNIFICANCE:

In determining significance, the Designated Office has considered proponent commitments and non-discretionary legislation. It has been proven over time that interaction between mining activities, waste rock storage, and groundwater has resulted in significant adverse effects to groundwater and surface water within the Christal Creek drainage. While the proponent has provided mitigation measures, and commitments to prevent new workings from interacting with historic workings, there remains a possibility that proposed activities and operations could present additional contaminants into the domestic water supply (groundwater) of Keno City. As described in Section 5.0, the proponent has provided numerous commitments to address potential impacts to both surface water and groundwater that are considered relevant to this discussion. Under Section 5, there are mitigations that the Designated Office has determined are required to mitigate for significant adverse effects to groundwater and surface water. It is anticipated that measures described in Section 5.0 will be applicable to this section, and will help mitigate effects within this section. Further mitigations captured within section 9.0 on Wildlife will help to address

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health and safety concerns around bear attractants, especially if the Guidelines of Industrial Activity in Bear Country are to be followed. However, consideration of potential effects to employee and public health and safety warrant further dialogue and mitigations. Based on the medium magnitude, medium duration, medium probability and socio-economic context of the effects, the Designated Office has determined the proposed project will result in significant and adverse effects to human health and safety such that additional mitigation measures are required.

MITIGATIONS:

The following mitigation measures are specified to eliminate, reduce or control significant adverse effects of the project relating to human health.

26. The proponent shall ensure the project proceeds in a manner that incorporates all recommendations issued from the “Human Health Impact Study” commissioned by Yukon Government, Environmental Health Branch.
27. On a quarterly basis the proponent shall discuss with regulators, the First Nation of Na Cho Nyak Dun and the community of Keno City the results of their groundwater monitoring program; constituents of concern for domestic water quality, and measures taken; the results shall inform the adaptive management plan.
28. The proponent, in discussion with Highways and Public Works, shall ensure regular maintenance of Silver Trail Highway to maintain a standard suitable for visitor traffic.
29. The proponent shall improve public safety measures along primary and secondary roads in the area. Full stops and an enforceable speed limit for haul trucks shall be implemented, and monitored with reporting provided to regulators. The reports shall identify the number of complaints received, any interactions between project traffic and local or visitor traffic, and remedial actions taken to address the concerns.
30. Hazardous waste shall be removed from the project location, and disposed of through Environment Yukon’s Special Waste Program. In the interim, hazardous waste shall be stored in bear-proof containers so as not to be attractants to wildlife.
31. All petroleum based solid waste (plastic, Styrofoam etc) generated by this project shall be removed from the site and deposited at an approved solid waste facility.

9.3 RESIDUAL EFFECTS

The mitigation measures listed above as well as the proponent’s commitments are considered adequate to reduce the significant adverse effects to a level that any residual effect will be negligible.

10.0 COMMUNITY

10.1 OVERVIEW

The region surrounding the proposed project is known to be highly mineralized and silver mining has been the principle industry in the area for more than a century, and First Nations people are known to have traveled throughout the Keno Hills Silver District for hundreds if not thousands of years. The three closest communities to the project are (listed in order of proximity) Keno City, Elsa and Mayo located on the Silver Trail Highway, which have supported silver mining throughout the twentieth century. In the context of this assessment, community refers to both the actual community as well as the social significance attributed to those communities.

10.1.1 Keno City

The nearest community to the project is Keno City. Keno City is home to approximately 20 permanent residents, and is located in the heart of the historic Keno Silver Mining District. This community has lived through many “boom and bust” cycles since the first discovery of silver ore in 1919. Active exploration and mining in the hills around Keno has once again brought more people to the area. Keno City has developed a tourism industry and become a destination for visitors both local and abroad. A Mining Museum draws many tourists to town in the summer months and Keno City offers a variety of accommodation, a Snack Bar and a pub to facilitate growing demand as the area is also well known for its hiking and other recreational activities. The Keno City community maintains a campground and a number of tourist businesses.

10.1.2 Elsa

Elsa, once a thriving mining community, replete with recreational facilities, churches and bars has become a working ghost-town. AKHM's primary administrative center is located in Elsa, as well as a variety of their other facilities including Flat Creek Camp. Elsa is currently undergoing planned demolition of buildings that pose a public safety hazard, as well as rehabilitation of some facilities, and removal of hazardous materials from the area and buildings (e.g. asbestos). There is not really a “community” within Elsa so to speak, as people living there are currently employees of AKHM.

10.1.3 Mayo

The community of Mayo serves as a distribution and service centre for the surrounding area. It is also the administrative centre for the FNNND. In addition to being a base for mining tourism, it is also a destination for wilderness tourism including canoeing, hiking, big-game hunting and fly-in fishing. The economy of Mayo is linked to the provision of services to the people of Mayo and the surrounding areas. One third of the jobs in the community are related to government services including First Nation and

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territorial administration.⁸⁹ Placer mining and mineral exploration also provide an economic base for the community. Tourism is a growing industry. Accommodation, food services, recreation services (i.e. guiding and outfitting) and retail (catering to tourists) provide work for local residents.

10.1.4 First Nation of Na Cho Nyak Dun

The project is located within the traditional territory of the First Nation of Na Cho Nyak Dun (FNNND). Members of FNNND carry out a variety of fish and wildlife harvesting and other traditional activities within their traditional territory, including hunting, trapping, berry picking and the collection and use of various plants.

In cooperation with industry, the Na Cho Nyak Dun Development Corporation is establishing a number of training, work and apprenticeship programs in the community. As part of this, the proponent and FNNND announced that they had entered into a Negotiation Agreement relating to the activities of Alexco's wholly owned subsidiary, Elsa Reclamation and Development Company Ltd. ("ERDC") on and around the former United Keno Hill Mine property (September 25, 2007). The Negotiation Agreement provided for the negotiation and settlement of two further agreements between Alexco and the FNNND: Exploration Cooperative Agreement and Impact Benefit Agreement.

In 2008, FNNND also released an engagement process and a set of best practices codes for industry within the Traditional Territory of the FNNND. Guiding Principles towards Best Practices Codes for Mineral Interests within FNNND Traditional Territory has been prepared for mineral exploration and mining companies who are planning activities on lands within the Traditional Territory of FNNND.⁹⁰

The Designated Office has considered the following project activities to have the potential to affect community:

- Construction phase: levelling/grading and clearing, storage of ore or waste rock, cut and fill for access road construction; blasting
- Operation phase: mine and camp operations, extraction of ore, hauling, blasting, waste rock management.

10.2 PROJECT EFFECTS

The range of effects from project activities that could affect community valued components include:

- Local Economy: business, property prices, and tourism
- Sense of Place: pursuit of activities, and quality of life
- First Nations: social or economic opportunities, impact to traditional or cultural values.

⁸⁹ YOR #2011-0030-0124-1

⁹⁰ YOR 2009-0030-124-1

10.2.1 Local Economy

As noted in the overview above, business in Keno City is closely related to tourism and recreation as well as mining. This link between tourism, recreation and mining was recognized in the 2009 Bellekeno Mine assessment as recommendations and proponent commitments reflected the need and desire to work with the local community to establish mining- heritage tourism opportunities; and to provide financial contribution to establish mining heritage tourism opportunities or facilities. There is an overwhelming sense from Keno City residents that mining and tourism do not coexist well together, and this is having a negative effect on the local economy.

According to comments provided by YG, Tourism Branch, tourism requires a consistent and sustained investment of time and money in product development and marketing in order to be successful. Since 2001, Yukon Government has invested \$440,325 in the development of the mining museum in Keno City. Keno City businesses have developed new products and worked with other businesses, organizations and governments to raise the profile of Keno City as a tourism destination, and to diversify the economy. Keno City businesses aimed at tourists include Sourdough Cafe, Keno City Hotel, Blue Roof Studio, Keno Snack Bar, and Silver Moon Bunkhouse. These businesses can benefit from mining, but for the majority, tourism is crucial. The industrialization of Keno with more large-scale mining activity will result in uncertain future business prospects for these businesses.⁹¹

Aside from actual businesses that draw tourism, the scenery, wildlife and accessible outdoor activities are strong visitor attractants to the Keno Hills Silver District. YG Tourism Branch notes: “Numerous trails and rough roads support a variety of soft adventure activities, and visible historic artifacts and wildlife viewing opportunities make the area an interesting destination for hikers and mountain bikers”. Other guided and self-guided activities include fishing, canoeing and dog-mushing. Of particular interest for outdoor and wildlife-viewing enthusiasts are the interpretive sites for Beringian butterflies, marmots and pika along the Sign Post road. This area is the primary viewing site in Yukon, and road construction or maintenance could interrupt public access, hindering the local economy dependent upon tourists and researchers interested in such sites. In the summer of 2004, just over 35,000 tourists stopped in region, and over 8,000 visitors participated in outdoor activities.⁹² Many of these visitors used Keno City as a base for exploring the surrounding area, but anecdotal information from the summer of 2011, indicated condition of the roads and associated safety concerns were factors for visitors considering a visit to Keno City. Increased noise from ore haul traffic also affected visitor use and enjoyment of Keno City’s campground. Should these factors diminish tourism to the region the local economy will be negatively affected.

Mining is generally a “boom and bust” industry with some positive financial benefits to nearby communities. In the case of Keno City, most residents (even those supportive of mining) have suggested that the benefits are not apparent. For instance, one resident pointed out that wages paid by AKHM are

⁹¹ YOR 2011-0315-068-1 May 8, 2012

⁹² YOR 2011-0315-106-1 July 16, 2012

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considerably lower than other mining operations, and this deters locals from seeking work with the company. In addition, the company's nearby proximity has not helped to increase or maintain property values. The project includes a camp as the primary residence for employees that are not residents of Keno City and Mayo, and therefore does not require additional housing in the communities so there is no long-term property investment necessary on part of the proponent.⁹³ As stated above, project activities may have a direct and negative impact on tourist satisfaction, which will indirectly affect business in Keno City and Mayo by decreasing property values and decreasing accommodation rental; thus negatively affecting the local economy.

"Sense of Place" refers to a perceived notion on how Keno City residents understand and interact with their community and the surrounding environment. This perceived notion of place is particularly important to Keno City residents.

Some comments from residents indicated that their "sense of place" was defined by the nature of mining and its presence within the community. They recognized that mining is a proud aspect of their history.

The majority of comments provided by residents alluded to a common "sense of place" wherein their community is peaceful, and quiet with interesting mining history and accessible wilderness or recreational pursuits. They feel that there is no benefit to having the mine close to their community.

There is potential for direct impact on one's "sense of place" with the extraction of more ore from Onek 990 and Lucky Queen adits as well as the construction and use of new haul roads. Clearing and levelling new ground may decrease the aesthetic value of the area; while increased noise levels from industrial activities and haul traffic will be unavoidable, and change the patterns and behaviours of residents. These effects are not distinctly health related. Rather they speak to how a person's quality of life may be affected.

Many comments from Keno City residents refer to a marked decrease in their quality of life, which results in a diminished "sense of place". The peace and quiet that residents associate with their small remote community as well as the recreational appeal of easily accessible hiking, skiing, and snowmobiling trails has diminished with increasing traffic and associated noise and dust.⁹⁴ Although the proponent has previously committed to the development of an Access Management Plan, it is scoped in as part of mine closure. In the interim, public access to trails once accessed by outdoor or wildlife-viewing enthusiasts may be blocked or damaged. As such, residents may not enjoy their town, their homes or their backyards nor identify with the perceived "sense of place" as they did before; again potentially resulting in a loss in the quality of life.

⁹³ YOR 2009-0030-124-1

⁹⁴ YOR 2011-0315-061-1 May 4, 2012

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10.2.2 First Nation of Na Cho Nyuk Dun

Historically, the FNNND utilized the project area to pursue traditional activities such as fish and wildlife harvesting and hunting, trapping, berry picking and the collection and use of various plants. Activities associated with mining that may have an effect on the traditional lifestyle pursuits of the FNNND include clearing of the land and earthworks associated with mining, as well as blasting, hauling and increased industrial activity. The FNNND has entered into several negotiations and contracts with the proponent to ensure that FNNND are included in opportunities within the mining sector. Best Management Practices have also been drafted to ensure that the FNNND have a say in the management of their traditional territory, and preservation of their traditional and cultural values. Such endeavours minimize the impact that project activities could have on the FNNND to partake in economic opportunities associated with the mine or undertake traditional livelihood options.

Despite these negotiations and contracts, concerns remain around the protection of plants and animals used by FNNND for cultural or traditional purposes. There is potential for direct impact to FNNND and their ability to undertake traditional lifestyle choices where the proponent is planning to clear vegetation and establish new haul roads, restrict movement on roads, or increase project related traffic. Despite previous disturbance, the project will reduce wildlife and plant habitat of those animals and plants utilized by FNNND citizens for harvesting purposes and traditional pursuits.

PROPONENT KEY COMMITMENTS:

For a full list of proponent commitments please refer to Appendix A-Table of Commitments.

- An Access Management Plan will be developed for the local area as part of the mine closure (#54).
- Development and implementation of the Keno City socio-economic mitigation plan to address and mitigate potential effects as identified by the community and to maintain quality of life presently experienced by the community (#55).
- Alexco will work with tourism and heritage representatives and the community to develop a sign to be installed along the Silver Trail Highway to Keno and within Keno that shows a road/trail map of the area indicating the roads that are in active mining use, identifies key tourist features, and lists general safety precautions and traffic management procedures for active roads (#57).
- Alexco will construct a bypass road to route most mine traffic around the community, and ensure interference with local community is minimal (#45).

SIGNIFICANCE:

In determining significance, the Designated Office considered proponent commitments and non-discretionary legislation. Unless adverse effects are mitigated, project activities will result in reduced visitation with direct economic impacts to existing and developing tourism businesses in Keno. Impacts will be both short and long-term in duration. Proponent commitments to develop and implement the Keno

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City socio-economic mitigation plan will reduce effects of the proposed project on the local economy, especially tourism.

Given the projected length of the project and the proximity of the activities to local residents and tourist attractions or services, the effect on community is likely to be direct, and negative. Based on the medium magnitude, the medium duration and frequency and socio-economic context (Keno City in particular) of the project effects, the Designated Office has determined that the proposed project will result in significant adverse effects such that additional mitigation measures are required.

MITIGATION:

The following mitigation measures are specified to eliminate, reduce or control significant adverse effects of the project relating to community.

32. The proponent shall install clearly labelled signage to show active mining roads, tourism routes and sites; and heritage features as well as signage identifying appropriate safety precautions for the public entering an active mining area.
33. The proponent shall consider popular viewing locations such as Black Cap Mountain and established interpretative sites when finalizing traffic routing and volume plans, with the intent to reduce impact to public access. Access to established locations shall be maintained via a reasonable route and shall be finalized in discussion with FNNND and Keno City residents, as well as regulators.
34. Any substantive change to traffic volumes, patterns or routing for the project shall be discussed prior to changes with the community of Keno City and FNNND in addition to regulators. The proponent shall make best efforts to create a mutually beneficial co-existence of mining, tourism and traditional lifestyles.

The following mitigations are commitments the proponent has not yet implemented, but that are considered important in mitigating significant adverse effects to community.

35. The proponent shall work with local residents and First Nation community members to develop the proposed Keno City Socio-economic Mitigation Plan that outlines not only the necessary measures to maintain quality of life, but also the needs of each group in terms of land usage. This shall be completed prior to closure, and implemented in such a way as to incorporate recommendations into closure plans.

10.3 RESIDUAL EFFECTS

The mitigation measures listed above as well as the proponent's commitments are considered adequate to reduce the significant adverse effects to a level that any residual effect will be negligible.

11.0 AIR QUALITY

11.1 OVERVIEW

The proposed Project is expected to generate atmospheric emissions, primarily from fossil fuel combustion and fugitive dust sources from project facilities or activities.

The Designated Office has considered the following project activities to have the potential to affect air quality:

- Construction phase: project related traffic, generators, compressors, blasting, clearing, levelling/grading and road building.
- Operations phase: traffic, waste rock storage, blasting, generators, compressors, road maintenance, and tailings facility.

The proponent currently has dustfall monitoring stations as required from the Bellekeno Mine assessment. The dustfall monitoring locations were selected in consideration of the prevailing wind directions and the location of sensitive receptors (Keno City). During the spring and summer months dust monitoring will occur approximately every month while during the winter/spring months a longer sampling period is used.

11.2 PROJECT EFFECTS

The range of effects from project activities that could affect air quality valued components include:

- Airborne particles: including impacts from dust and fugitive emissions
- Greenhouse Gas emissions: exhaust from project related facilities and activities, including but not limited to traffic.

11.2.1 Airborne Particles

Air quality is important for people at and near the proposed mine site given that it is a primary determinant for their quality of life and their interaction with the environment. Effects on air quality from mining activities are important given that some substances emitted by mine activities, such as oxides of nitrogen and sulphur, dust, and other fine particulates can be transported well beyond the immediate mine site and can potentially contribute to acid deposition.

Comparative analysis of the Bellekeno tailings with the Lucky Queen and Onek tailings indicate that the Bellekeno tailings have elevated concentrations of arsenic, cadmium, lead and silver when compared to the Lucky Queen and Onek tailings.⁹⁵ However, Onek has higher concentrations of copper manganese, nickel and zinc.

⁹⁵ YOR #2011-0315-0125-1; p.2

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While primary combustion products are mainly carbon dioxide and water vapour, small amounts of oxides of nitrogen, particulate matter, carbon monoxide and volatile organic compounds are also produced. In addition, if the fuel consumed by equipment and vehicles contains sulphur compounds, then there will be small quantities of sulphur dioxide will be emitted.

The Yukon Ambient Air Quality Standards apply to sulphur dioxide, ground level ozone, carbon monoxide and nitrogen dioxide gases as well as total suspended and fine particulate matter. Measurements of particulate matter for the purpose of compliance monitoring are generally expressed in terms of mass and are typically measured over a 24 hour sampling period. These are used to determine the acceptability of emissions from proposed and existing development. Particulate matter is unique among atmospheric constituents in that it is not defined on the basis of its chemical composition. Therefore it may include a broad range of chemical species. The air quality standards for particulate matter are based on studies demonstrating adverse effects on cardio-respiratory health from inhalation. These standards do not take into account the potential for airborne particulate matter to cause health effects related to chemical toxicity.

EXISTING LICENCE QML-0009

Dustfall monitoring and measurements were a requirement listed in the Bellekeno Mine Decision Document.⁹⁶ The Decision Document went on to state that should dustfall measurement indicate Total Suspended Particulate (TSP) concentrations greater than 150 micrograms/m³ (based on BC Air Quality Objectives and Standards) at the fence line, the proponent will conduct more sophisticated monitoring. The proponent modified this within their dustfall monitoring program to reflect two-phase dustfall monitoring, rather than what was stipulated in the Decision Document. Dustfall deposition rates are not measured in the same units as the BC Air Quality Objectives and Standards.

Rather than using the BC Air Quality Objectives and Standards Level A criteria for TSP as a trigger for the second phase of the monitoring program the proponent selected dustfall limits from the Pollution Control Objectives for the Mining, Smelting and Related Industries of BC (1979) as the trigger. A dustfall deposition rate in excess of 1.7 mg/(100 cm²*d) at the edge of the mill site triggers phase 2 of the monitoring program, which includes TSP monitoring.⁹⁷

A dustfall measurement based on mass per area using deposit dust gauges employed at this site provides a total dust deposition rate and not necessarily the total amount of airborne dust. Fine particulate settles more slowly than total particulate (if it settles at all) and the dust gauge does not account for this. Fine particulate may also travel further and is more likely to cause health impacts than larger particulate matter that will settle more rapidly. For this reason, health based air quality standards are set based on mass of particulate per volume of air. Air standards are also typically specific to the size of particles since

⁹⁶ YOR #2009-0030-0126-1

⁹⁷ YOR #2011-0315-0125-1; p.5

smaller particles can travel deeper into the lungs and have a greater propensity to cause adverse health effects as a result. The 1979 BC dustfall trigger level does not take these considerations into account.⁹⁸

To put this into context, the 1979 BC dustfall value is equivalent to Alberta's Ambient Air Quality Guidelines for 30-day average dustfall of 53 mg/100 cm² as a guideline for residential and recreational areas and less than the 30-day average for commercial and industrial area is 158 mg/ 100 cm² (5.3 mg/100 cm²).⁹⁹ The measurements originally suggested were for 24-hr volumes. Recently, the Yukon Government has established its own Yukon Ambient Air Quality Standards (2010) that while similar to BC Air Quality Objectives and Standards, do represent slightly different values. YG Ambient Air Quality Standards provide for 120 micrograms/m³ TSP, and specifies 30 micrograms/m³ as 24-hr averages. With regard to the project location, wind patterns and local inversions, there is the potential for the environment to support the travel of airborne particulate. An increase in airborne particles has the potential to impact human health in regards to breathing and lungs, with smaller particulate travelling deeper into the lungs. Impacts to lungs can lead to a variety of health concerns, some of which can be quite serious, and as such, any changes in airborne particulate must be considered as potentially adverse.

11.2.2 Greenhouse Gas Emissions

Greenhouse gases (GHGs) emitted from combustion exhaust gases contributes to total volume of planetary GHGs emissions, which have been implicated with climate change. The proponent is intending to increase the overall traffic within the project area by approximately 60% over the course of construction and operations for Lucky Queen and Onek. This increase does not take into account the potential operation of additional generators and compressors as well as other machinery that would emit GHGs. The proposed project location is situated within a valley that may experience inversions during the winter months that would contain the GHGs, as well as the airborne particulate within the valley, potentially impacting air quality. While the potential GHG emissions may lead to increased frequency of poorer air quality within the area of Keno City, GHGs also interact at a broader scale with general climate change and worldwide concerns regarding air quality and change to climate leading to impacts to human health. While these effects on air quality from the proposed project may be small outside the immediate area of the mine, they still contribute to the total volume of planetary GHGs.

The proponent has made no commitments in regards to reducing GHGs.

PROPONENT KEY COMMITMENTS:

For a full list of proponent commitments please refer to Appendix A-Table of Commitments.

⁹⁸ YOR #2011-0315-0125-1; p.5

⁹⁹ YOR #2011-0315-0125-1; p.6

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- It is anticipated that TSP monitoring devices (either a continuous duty, constant flow air monitoring system or a discrete, gravimetric sampler) will be in place and operational by August 15, 2012 (#58).
- Alexco will adhere to Environment Yukon's Ambient Air Quality Standards under the Environment Act. These standards for TSP are set at 120 µg/m³ for a 24-hour average, and 60 µg/m³ as an annual geometric mean. Results from TSP monitoring will be compared to the Ambient Air quality Standards under the Environment Act (#67).

SIGNIFICANCE:

The Designated Office has considered the proponent commitments and non-discretionary legislation in determining the significance. With regard to the potential adverse effects from the proposed project and activities to air quality, the commitments provided by the proponent are considered inadequate for both airborne particulate, as well as GHGs. While it is recognized that GHGs are a relatively new concept in the Yukon, the monitoring and establishment of Air Quality Standards specific to the Yukon provide some guidance on levels to be achieved and standards to be met. Given the proponent's stated intention of continuing operations within the Keno Hills Silver District for years to come, it would be incumbent upon AKHM to implement measures that are proactively addressing potential air quality issues. Therefore, in consideration of the medium magnitude, the medium duration, and high probability of the project effects in terms of air quality, the Designated Office has determined that the proposed project will result in significant adverse effects, such that additional mitigation measures are required.

MITIGATION:

The following mitigation measures are specified to eliminate, reduce or control significant adverse effects of the project relating to air quality.

36. The proponent shall amend their dustfall monitoring program to include measurement of total particulate per volume of air for selected size fractions and undertake chemical analyses should the total dust per volume of air exceed health based mass per volume benchmarks.
37. Any dust measurement conducted by the proponent needs to be comparable to the Yukon Ambient Air Quality Standards. The "simple TSP (dustfall) monitoring" that is mentioned does not allow for this direct comparison of results.
38. The proponent shall ensure ore trucks are covered and windscreens are used to reduce airborne contaminants.
39. The proponent shall ensure that all machinery has mufflers in place that are designed to reduce emissions and particulate.
40. The proponent shall make best efforts to reduce their use of diesel generators; except in warranted circumstances (e.g. power failure).
41. The proponent shall use low sulphur and low aromatic fuel.

42. The proponent shall reduce idling of all company vehicles and project related traffic on site, and shall report their efforts and adaptive management measures annually to Yukon Government, Environment.

11.3 RESIDUAL EFFECTS

It is anticipated that the mitigations in combination with the proponent commitments will mitigate significant adverse effects. It is possible that further requirements and obligations will be imposed by permitting authorities; and ongoing monitoring and follow up will assist in determining the effectiveness. Therefore, any residual effects to air quality from this project are not likely to be significant and adverse.

12.0 ACOUSTIC QUALITY

12.1 OVERVIEW

The proposed Project is expected to generate increased noise and disturbance during construction, and operations.

The Designated Office has considered the following project activities to have the potential to affect acoustic quality:

- Construction phase: project related traffic and machinery, generators, compressors, blasting, clearing, levelling/grading and road building.
- Operations phase: project related traffic and machinery, haulage, blasting, generators, compressors, road maintenance.

The proposed project is looking to increase overall activities within the Keno Hills Silver District, primarily at Lucky Queen and Onek. The two areas are within proximity of Keno City therefore, the consideration of impacts to acoustic quality are of paramount importance. In addition, AKHM anticipates project-related traffic to increase by 60%, (refer to Section 11). During the SVI periods, residents raised concerns regarding the potential noise increase within the community of Keno City due to project activities. The Designated Office commissioned an independent noise study to be conducted to assist the Designated Office in better understanding the existing baseline conditions, and to predict how Lucky Queen and Onek activities would impact the baseline. The results of the Comprehensive Sound Study¹⁰⁰ and Noise Impact Assessment¹⁰¹ can be found on the YOR.

The baseline considered all existing operations occurring within a 2 km radius of Keno City, and included multi-day field measurements as well as future modelling scenarios for both the Sign Post portal option and the Onek 990 portal option. The field-measurements were taken at five residences within Keno City

¹⁰⁰ YOR #2011-0315-0126-1

¹⁰¹ YOR #2011-0315-0127-1

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in order to determine what the existing baseline was with Bellekeno operations occurring. The baseline included consideration of inputs from the crusher and mill operations, despite the fact that these components are not within the scope of the current proposed project. It was deemed necessary to include these factors into the baseline in order to gain a better understanding of what the existing baseline was, and how Lucky Queen and Onek activities would affect that baseline.

Noise is usually defined as “unwanted sound”, which indicates that it is not just the physical sound that is important to consider, but also the human reaction to the sound that leads to the perception of a sound as noise.¹⁰² It implies that the calculation of noise is not merely objective, but also a subjective matter. The most common measure is the A-weighting scale, which is based on the sensitivity of human hearing at moderate levels; this scale reflects the low sensitivity to sounds of very high or very low frequencies. For the purposes of this report, the discussion regarding noise will be described as dBA. Generally a sound level is considered to be perceptible to the human ear along the following scale:

- A 3-dB change is just perceptible,
- A 5-dB change is clearly perceptible, and
- A 10-dB change is perceived as being twice or half as loud.¹⁰³

As a general rule, a doubling of the potential impact will lead to a 3 dB increase in noise. For example, the doubling of traffic in the proponent’s proposal will result in approximately a 3 dB increase in noise, which is just perceptible to the human ear.¹⁰⁴

The baseline for representative Keno City sound station locations ranged between 33 dBA to 36 dBA during the daytime; and 28 dBA to 32 dBA during the night.

12.2 PROJECT EFFECTS

The range of effects from project activities that could affect acoustic quality valued components include:

- Quality of Life: the interaction of project activities with quality of life for residents and tourists alike
- Human Health: unwanted sound generation related to project activities causing irritability or health impacts.

Based on the Comprehensive Sound Study existing baseline and Noise Impact Assessment modelling future operations at Lucky Queen and Onek (for both Sign Post portal and Onek 990) it is expected that only minor noise level increases will be experienced by Keno City residents from Lucky Queen and Onek sites. The most impacted residence was anticipated to see an increase of 2 dBA above existing baseline conditions for the Sign Post portal option. However, considering that option is no longer being pursued,

¹⁰² YOR #2011-0315-0127-1; Appendix A

¹⁰³ YOR #2011-0315-0127-1; p.1

¹⁰⁴ YOR #2011-0315-0127-1; p.1

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the noise generation effects from the Onek 990 portal and the Bypass road are important to consider. In considering all the factors that influence sound (weather, topography, prevailing wind direction/speed, etc.) it is anticipated that the Bypass road to access the Onek 990 portal will in fact have a lesser noise emission level than the 2 dBA predicted for the Sign Post portal option. Information in the Noise Impact Assessment indicated that a 1 dBA increase is anticipated from the proposed project activities, and Onek 990 portal.

With regards to the generation of noise, the top daytime emitters of noise as perceived at the most impacted residence are the following:

Crusher in full operation	29 dBA
Mill Dry Stack Tailings Facility Excavator	25 dBA
Onek Water Treatment Plant	22 dBA

The total anticipated ambient levels are 34 dBA, this level is considered to represent what the approximate noise levels would be in a similar sized, rural community. The ambient levels exclude any noises generated by the proponent's existing activities. The facility noise is anticipated to be 32 dBA during daytime operations, and as such, the two levels combine for an anticipated total of 36 dBA.¹⁰⁵ Based on the understanding provided above, that a 3 dBA increase is barely perceptible, an increase to 36 dBA is still considered to be low noise emissions.¹⁰⁶ The residents of Keno City raised increased noise generation from Lucky Queen and Onek activities as a key concern, and viewed it in terms of effects to quality of life effects as well as effects to local businesses via predicted changes to tourism from increased noise generation.

The proponent has provided a variety of mitigation measures to address noise impacts and concerns, not the least of which is moving the portal from the previous Sign Post location to the new Onek 990 location. Additional commitments include ensuring the transmission line is operational prior to commencing works at Onek 990 to prevent use of diesel generators (except in backup situations, such as power outages).

LOW FREQUENCY NOISE

Low Frequency Noise (LFN) has the potential to impact humans as over time it becomes a source of irritation and nuisance, particularly if the LFN is of an intensity sufficient to cause vibration. The LFN analysis that was conducted revealed that there were very limited LFN occurrences, and of those, none were at or above the 20 decibels, an Alberta standard, generally considered to be the threshold for measuring impacts.¹⁰⁷ In order for a LFN to cause impact to humans there must be a tonal component

¹⁰⁵ YOR #2011-0315-0127-1; p.18

¹⁰⁶ YOR #2011-0315-0127-1; p.12

¹⁰⁷ Personal communication; Patching Associates, July 24, 2012

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associated with the LFN, and the measurement of the LFN must be at or greater than the 20 decibels.¹⁰⁸ The baseline studies indicate that currently there is no potential for low frequency noise impacts from existing operations, and that LFN levels are relatively low, it is anticipated that even with future operations it is unlikely that LFN impacts would occur, the LFN for Keno City will be very similar to what it is currently.

12.2.1 Quality of Life

Once constructed, the Bypass road would reduce industrial traffic through the community, across the Sign Post road and along the Silver Trail Highway resulting in potentially reduced noise concerns for visitors and tourism businesses. The proposed underground transfer station, temporary storage and more limited above-ground activities at the Onek 990 site could further reduce potential noise impacts. However, the potential increase in industrial traffic along Bellekeno Haul road, directly adjacent to the Keno City Campground may further adversely affect tourism within the community.

During the first SVI period, the Yukon Government, Tourism and Culture Branch, provided the following comment:

“Increased noise impacts associated with blasting, drilling... and other industrial activity at the Onek site; increased traffic in and around the community and increased production at the mill site will continue to impact visitor enjoyment. Most activities are proposed to take place during the day when visitors are most active.”¹⁰⁹

The report commissioned by the Designated Office was required to measure the existing baseline conditions, including facility noises to determine what baseline existed within the community. A further requirement was to determine what the difference was between Keno City, and a hypothetical similar sized community without industrial activity. In order to do this assessment the consultant measured the baseline, which included facility noise, and through their equipment were able to isolate facility generated noise versus the background ambient noise (local noise, wildlife, creeks, wind, etc.). In this manner they were able to consider the impacts to the community in comparison to a similar sized community without industrial activity. Based on the work undertaken, Keno City is experiencing noise levels that are considered to marginally increased over other rural residential settings.¹¹⁰ However, in consideration of the concerns citizens have with the existing baseline noise levels, and given the lack of baseline information pre-AKHM mining operations in regards to baseline for noise; this topic warrants further analysis and mitigation. Furthermore, noise emissions, and their effects are often a subjective or perceived effect; very much depending on the person being affected. The residents have indicated that the AKHM operations currently impact their well-being and quality of life, and while baseline and

¹⁰⁸ Personal communication; Patching Associates, August 2, 2012.

¹⁰⁹ YOR #2011-0315-0062-1

¹¹⁰ YOR #2011-0315-0126-1; p.6

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projections indicate that the levels do not indicate that this should be the case, there remains the perception that there is an effect. Keno City is a remote location, with a small community, and as such, it is not appropriate to compare the community to standards for larger urban centers, or for industrial areas. As such, it may be warranted to apply additional mitigation to reduce the perceived, and therefore potential effect to residents, and seek methods to improve quality of life for residents of Keno City in regards to noise generation.

In addition to potential impacts to residents, there is concern that noise emissions from existing activities in combination with proposed project activities may result in direct effects to tourism, as tourists no longer seek to recreate in the vicinity of Keno City. This is particularly relevant when considering the proximity of the Keno City Campground to the Bellekeno Haul road, and the proposed Bypass road and Onek bridge crossing. The campground will not essentially be surrounded on all sides by mine activity. And while Lightning Creek may effectively mitigate some of the mine noise emissions, there remains the possibility for adverse effects to tourists. This in turn may lead to indirect adverse effects to the quality of life from noise emissions to the residents of Keno City.

12.2.2 Human Health

The potential impacts from noise generation can include but are not limited to, disturbed sleep patterns, irritation and nuisance. The residents of Keno City currently identify noise generation from the AKHM activities as causing a diminishment in their quality of life and associated enjoyment as the noise prevents them from spending time outdoors in their gardens, or in the vicinity of project activities. The report findings in regards to noise impacts indicate that currently, under existing operations the noise impact is low, and will marginally increase (by approximately 1 dBA at the most impacted residence) and remain barely perceptible or imperceptible to humans. As previously described the Comprehensive Sound Study was able to distil the measured noise levels; the facility in combination with ambient noise levels; and the measured background noises (non-AKHM related). Table 5 below describes this relationship:

Residence	Measured (dBA)		Residual Including Other Facility* (dBA)		Measured Ambient** (dBA)	
	Day	Night	Day	Night	Day	Night
R02	35	32	35	30	35	28
R03	41	37	33	28	27	26
R04	47	41	36	32	34	30

Table 5. Table of measured noise levels at representative residences over the period of 5-days.
(Table modified from Comprehensive Sound Study)

*Residual Including Other Facility is a combination of facility and ambient noise minus short-term, non-facility sounds.

** The measured ambient level is taken as the background sound level of the same community located in an area without industrial activity.

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As can be seen in Table 5, night-time noise levels are relatively low for the facility and ambient combined levels. They are measured at 32 dBA, at the most impacted residence, which is comparative to the 30 dBA for night-time levels for the measured ambient (background noise level for a similar sized community without industrial activity). There is a 2 dBA increase in noise measured in the night-time, which according to noise experts is a barely perceptible increase in noise level generated. As such, it is anticipated that existing night-time noise levels generated by proposed project activities should not impact community residents sleep patterns, or cause nuisance noise over night-time hours. Lucky Queen and Onek projects and activities are anticipated to increase the night-time noise emissions at the most impacted residence to by 1 dBA. Day-time impacts from Lucky Queen and Onek noise emissions are anticipated to be 1 dBA above existing baseline in downwind conditions. 1 dBA is well below the level considered to be the level at which humans can perceive a change in noise emissions.

However, there may be concerns for short-term, spiked noise levels, such as noise from drilling, or back-up beepers that are not reflected in the table above, and that may cause abrupt awakening, or restless sleep patterns. Over time if these disturbances persist, or are with sufficient frequency, they can lead to health impacts such as fatigue, irritability and other more severe impacts. Therefore, while the overall, general noise produced by night-time operations at the AKHM mines is not expected to cause interference in sleep or health, there may be activities or occasions not monitored that lead to short-term spikes in disturbance, which in turn may lead to short-term health effects from noise.

PROPONENT KEY COMMITMENTS:

For a full list of proponent commitments please refer to Appendix A-Table of Commitments

- Grid power will be supplied to Onek prior to portal construction and Onek development (#47).
- The compressor will be housed in a sound dampening enclosure. The vent fan will have inlet and exhaust sound dampeners, and will decrease noise by about 10 dBA (#62).
- Although not directly related to the proposed project, AKHM has committed to enclosing the crushing plant at the mill; thereby reducing the overall noise levels.
- Blasting near the surface at Onek will only be conducted during the dayshift period (7am to 7pm) and a community notification protocol will be developed (#60).
- Alexco proposes to avoid the use of engine breaks *within 1 km* of the center of Keno City to mitigate noise associated with mine traffic, and to incorporate mine traffic management protocols into the Traffic Management Plan under QML-0009 (#51).

SIGNIFICANCE:

In summary, the potential project effects on acoustic quality were considered having regard to the proponent commitments and non-discretionary legislation. Based on the concerns regarding impacts to quality of life, including impacts to tourists resulting in further indirect impacts to residents of Keno City the significance of these potential effects is considered in the context of: the medium duration, high probability and socio-economic context. The project effects may adversely interact with acoustic quality,

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and as such, the Designated Office has determined that the proposed project will result in significant adverse effects to acoustic quality of the area; such that mitigation measures are required.

MITIGATIONS:

The following mitigation measures are specified to eliminate, reduce or control significant adverse effects of the project relating to acoustic quality.

43. There shall be no movement of ore or waste rock to or from the Onek site between the hours of 1900 and 0700.
44. The proponent shall install broadband beepers on the machinery onsite to prevent irritation and nuisance noise from backup beepers.
45. As per Section 110 of the YESAA, the proponent shall conduct effects monitoring of noise emissions in relation to impacts to local businesses. Noise monitoring shall be undertaken quarterly with results provided to residents, YG Tourism and Culture Branch, and YESAB. Results of monitoring will be compared to the baseline established for a similar sized community without industry, from the Comprehensive Sound Study for Keno City 2012. Based on the results of the monitoring and in discussion with the above-listed parties, additional mitigation measures, or adaptive management strategies shall be identified and implemented.
46. The proponent shall work closely with the residents of Keno City to determine appropriate noise monitoring stations that will, at minimum, include the most impacted residence (R4), and the Keno City Campground, in addition to two other locations that have been previously monitored as described in the table below.

Residence	GPS Location	Description
R01	N63.90827 W135.29599	East end Residence, north side of Lightning Creek road
R02	N63.91019 W135.29968	Residence, east side of Sign Post Road
R03	N63.91023 W135.30205	Town Center, north from the Snack Bar
R04	N63.91239 W135.30376	Residence, west side of Wernecke Road, closest to the previously proposed Onek Sign Post portal location
R05	N63.90851 W135.30993	Residence, about 850m east from the Mill

47. The proponent shall provide residents with a means to formally complain of noise disturbance; and the proponent shall identify to residents the measures that shall be taken to respond to noise complaints.
48. The proponent shall prohibit use of engine retarder brakes within 500m of the Keno City Campground.
49. The proponent shall ensure all haul trucks, as well as machinery onsite at Onek is equipped with noise-limiting mufflers.

50. Should the Yukon Government Human Health Impact Study include mitigations in regards noise effects, these mitigation measures shall be included in the Quartz Mining Licence amendment.

12.3 RESIDUAL EFFECTS

The proposed project has the potential to impact residents and tourists alike via effects to the acoustic quality experienced within the vicinity of Keno City. The mitigation measures listed above are intended to minimize and avoid potential effects to the extent possible, however, after application of the mitigation measures there may remain a significant residual effect. This is primarily due to the nature of noise disturbance being a highly subjective and often personal measure. What is noise to one individual may not be considered noise to another, what is considered a tolerable level for one, may not be considered tolerable to another. As such, there is a potential for a significant adverse residual effect.

12.4 CUMULATIVE EFFECTS

In consideration of a residual effect, in combination with other projects in the area, primarily other exploration activities, mining, placer mining, and local traffic and industry, there may be a potential for a cumulative effect. The projects considered as part of cumulative effects are illustrated on Figure 8. Table 6 below summarizes the projects considered in further detail.

Name	YESAB	Type of Activity
Bellekeno Mine	2009-0030 2008-0039	Mining and Exploration
Alexco Care and Maintenance	2012-0141	Care and Maintenance
Nabob and Harper Claims	2012-0158	Quartz Exploration
Keno Lightning	2012-0043	Quartz Exploration
Thunder Gulch and Lightning Creek	Pre-YESAA	Placer
Duncan Creek Placer	2008-0171	Placer
Erickson Gulch Placer	2011-0310	Placer

Table 6. Projects scoped within cumulative effects assessment.

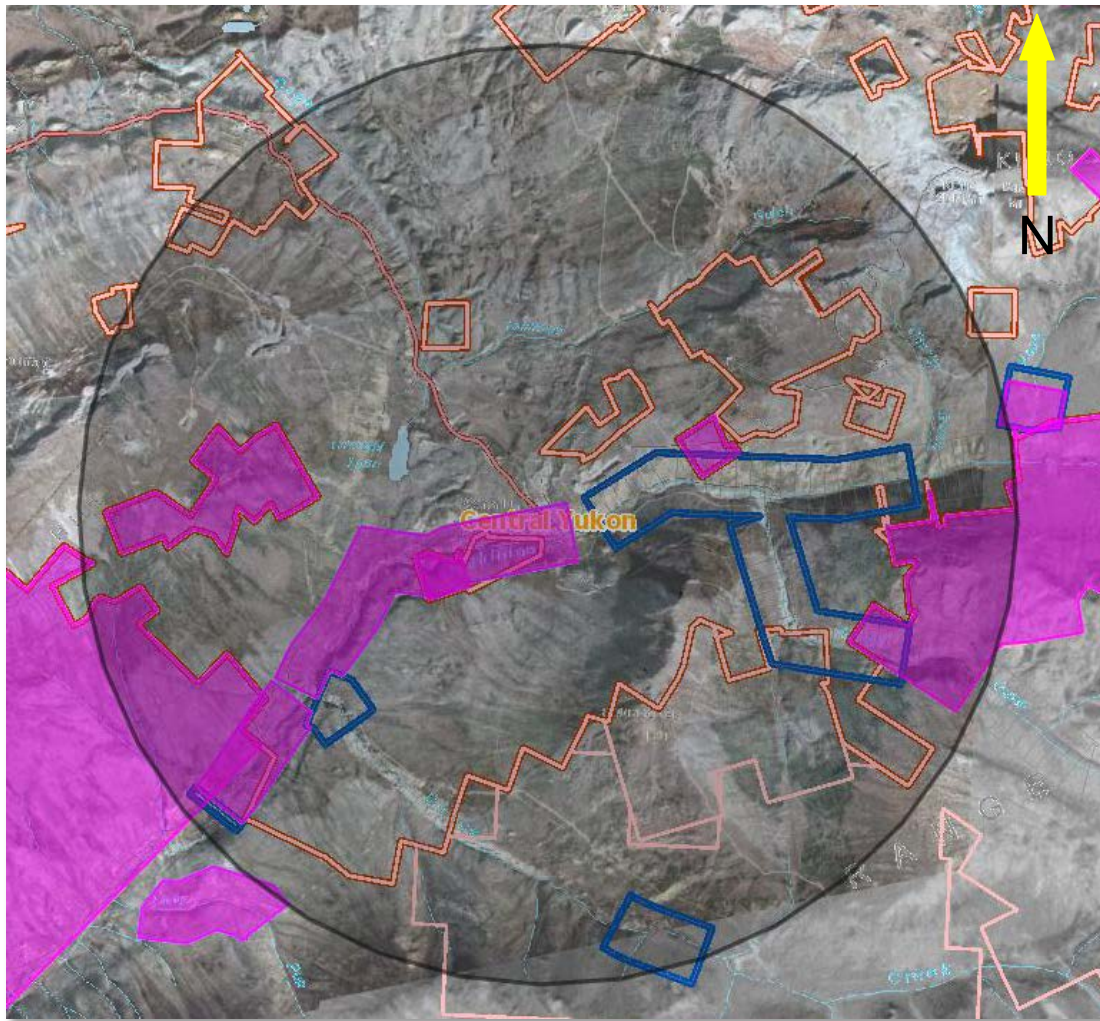


Figure 8. Image of 5 km buffer overlay and projects (in pink) considered as part of cumulative effects to acoustic quality.

The geographic extent for the consideration of existing or reasonably certain to proceed projects has been limited to approximately 5 km from Keno City. This distance was considered adequate to consider exiting the zone of influence from AKHM's operations; and was seen as a reasonable distance that someone would use trails surrounding Keno City. The zone of influence for AKHM activities has been limited to approximately 2 km from Keno City; however, effects may continue to be experienced (by humans) beyond that 2 km zone as a result of other activities. This constitutes a cumulative effect that is additive in nature which means that the proposed project effects plus the nearest existing activity effects in addition to the second nearest actives equals a cumulative effect. Therefore, a 5 km radius was considered as a conservative measure to indicate any potential interactions of adverse cumulative effects.

The projects scoped into the cumulative effects section are projects that the Designated Office is aware of through previous reviews, or that have acquired a land lease. Those projects that do not have a lease in place have not been considered with the exception of Erickson Gulch Placer, as it is anticipated that a

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lease will be imminently forthcoming. In order to consider potential cumulative effects to acoustic quality from Lucky Queen and Onek operations in conjunction with existing projects in the area, it is imperative to understand how this information has been considered.

The noise impact study commissioned by the Designated Office considered a buffer of 2 km from Keno City for noise inputs, anything beyond 2 km was considered sufficiently distant so as to not interact with project components and to attenuate over the distance to Keno City.¹¹¹ It was also considered an adequate distance to consider existing Bellekeno operations as well as exploration activities being undertaken near Keno City in order to establish a baseline for noise. The reports did not consider the cumulative effect of other proponent's within the area and how other point-source noise emissions may cumulatively impact acoustic quality.

Noise attenuates over distance, as well as being influenced by topography, climate, winds, etc. and is therefore challenging to identify what a noise effect may be over any great distance. This section of the assessment does not seek to provide a numerical conclusion on the cumulative effect of noise, but rather to assess how noise cumulatively impacts the Keno City residents outside of the zone of influence (2 km) from AKHM's current and proposed activities. Given the amount of placer and quartz claims in the area considered in the cumulative effects assessment, and given the number of land leases that are currently in place, there is a high potential for project activities to overlap temporally, and possibly spatially with other projects and cause impacts to acoustic quality.

As residents seek to remove themselves from noise sources, they may need to travel further afield as cumulatively they may experience a greater level of noise, not just within Keno City, but also on the peripheries. These inputs may be outside the zone of influence of AKHM's activities, but moving towards the zone of influence of an entirely different operator; for example along Lightning Creek. The noise generated by AKHM may attenuate moving outside the 2 km zone of influence, but placer activity on Lightning Creek would increase heading northwards. As such, it may prove more challenging over time for residents and tourists alike to escape noise, and find a place that offers solitude from the industrial activities in and around Keno City. Based on the large geographic extent of placer, quartz and other industrial activities in the proximity of Keno City, and given the magnitude of the level of activity occurring, as well as the probability of effects occurring; the Designated Office has concluded that the project will result in significant adverse cumulative effects.

MITIGATION:

The following mitigation measures are specified to eliminate, reduce or control significant adverse cumulative effects of the project relating to acoustic quality such that there are no cumulative effects.

¹¹¹ YOR #2011-0315-0126-1

51. The proponent shall work with government and stakeholders, as well as the First Nation of Na Cho Nyak Dun in drafting and developing a local area plan that meets the needs of AKHM while simultaneously acknowledging values of importance to the community of Keno City, and FNNND that must be preserved.

Rationale: Local area planning is considered a form of land use planning on behalf of unincorporated or rural areas outside of municipalities for both private and Crown land. Local area planning can also include First Nation Settlement Land if undertaken jointly with First Nations. Land use plans are policy documents that guide development and land use in a particular area. They contain maps that show how lands are to be designated or classified and contain policies outlining how the land in each of these areas may be used. It is thought that a local area plan may assist Keno City residents and AKHM reach agreement on where and how to protect values associated with tourism and local economy and quality of life, while also acknowledging areas suitable for further mining development.

The above-listed mitigation is intended to render any cumulative effect from industrial activity negligible, as all parties will have a common understanding of future development scenarios, and values identified by residents of Keno City and FNNND will be clearly identified and addressed through the local area plan. Considering all parties will be involved in its drafting, it is anticipated that effects will be mitigated.

13.0 VISUAL QUALITY

13.1 OVERVIEW

The appearance of a town and its surroundings has an aesthetic quality appreciated by residents and visitors alike. Residents often have a sense of pride about their community and how it is presented. This section intends to review potential effects to the visual qualities of the Keno City area.

The Designated Office has considered the following project activities that have potential to affect visual quality:

- Construction phase: construction of adits and portals, vegetation clearing, grubbing and stripping top soil, storage of ore and waste rock, and road and power line construction
- Operations phase: mine and camp operations, transport and storage of ore and waste rock

13.2 PROJECT EFFECTS

The range of effects from the project activities that could affect visual quality valued components include:

- Increased ground disturbance: clearings resulting in exposed and open areas, waste rock piles

13.2.1 Increased Ground Disturbance

As a mining endeavour, this project will have an impact on local aesthetics. Aesthetic factors are a key part of Keno City's image and appeal as a scenic, tranquil community and outdoor recreation destination. There is potential for direct impact on visual quality where the proponent is proposing to establish the

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Onek 990 portal pad as well as the new Bypass road, power line and portal construction.¹¹² These activities involve the clearing of land and movement of earth, which will result in more industrial infrastructure and increased heavy truck traffic. Indirectly, these above effects can further culminate in an increase in off-trail traffic, rutting of the secondary roads and trails as well as visible exposed areas, litter and garbage in the area.

PROPONENT KEY COMMITMENTS:

For a full list of proponent commitments please refer to Appendix A-Table of Commitments.

- Previously disturbed sites will be used for additional P-AML Waste Rock Storage Facilities, thereby minimizing new footprint development (#13).
- The Waste Management Plan from QML-0009 will be implemented for the Lucky Queen and Onek project activities (#20).

SIGNIFICANCE:

In determining significance, the Designated Office considered proponent commitments combined with non-discretionary legislation. The proponent has committed to upholding the Waste Management Plan as per the QML-0009 for Bellekeno operations. This will ensure that any litter waste generated during project activities will be dealt with appropriately. In addition, the recommendations from the Bellekeno Mine assessment state that previously disturbed areas will be used to minimize environmental effects and clearings will be limited around industrial infrastructure to limit the view.

The high level of previous disturbance to the surrounding environment indicates that there would be negligible change to the region. As such, the likelihood that the physical environment would be altered beyond that associated with natural variability in the region is minimal. However, the complexity of the project and its associated activities combined with the large footprint and intrusive nature of the project suggest that the effects to visual quality will occur.

The Designated Office has determined that should measures not be taken to ensure visual quality is maintained, the project will result in significant adverse effects to visual quality.

MITIGATION:

The following mitigation measures are specified to eliminate, reduce or control significant adverse effects of the project relating to visual quality.

52. The proponent shall ensure that access along roads and trails for the purpose of project activities does not result in unnecessary rutting or increased levels of garbage and litter along the routes.

¹¹² YOR 2011-0315-070-1 May 9, 2012

53. The proponent shall ensure new clearings for and around industrial infrastructure are limited to ensure visual disturbance is minimal, and the affected footprint, including berms, ditches, ponds and portal pads will be re-vegetated with seed mixture to promote re-growth in disturbed areas.
54. The proponent shall work with the residents of Keno City to ensure that aesthetic factors, which are a key part of Keno's image and appeal, are maintained.

13.3 RESIDUAL EFFECTS

Residual effects are those effects that remain from the activities after enacting mitigations. The potential residual effects of the proposed project on visual quality include an increase in the disturbed area and the visually obvious industrial infrastructure. Disturbance to the environment, including rutting along roads and trails as well as garbage and litter are also residual effects of the project.

The above-noted mitigation is intended to ensure that any residual effects of this project will not be significant and adverse.

14.0 HERITAGE OR HISTORIC RESOURCES

14.1 OVERVIEW

First Nations people are known to have traveled throughout the Keno Hills Silver District for hundreds if not thousands of years. As such, many historic and/or heritage resources within the traditional territory of the FNNND have not yet been documented. The heritage resources related to First Nations historical use of the land are often physical and intangible markers of First Nation identity.

The area around the proposed project has also experienced over one hundred years of mining activity. The historic resources related to mining are considered valuable to the history of the area for residents and tourists alike.

According to the *Historic Resource Act*, Part 6 Historic Objects and Human Remains –paleontological objects are generally the fossil remains of ancient plants and animals while archaeological objects are abandoned objects that are older than 45 years. Heritage and historic resources exist throughout the Yukon landscape in all terrains. They include cabins, caches, burial sites, bush camps and other man-made structures or objects that have been abandoned and are of greater than 50 years antiquity such as adits and other mine infrastructure. Remains of built heritage in many instances are fragile due to their age and composition.¹¹³ For the FNNND, heritage resources may also include harvestable plants, medicine, migration routes, place names and associated stories. These resources are often imbued with traditional knowledge, and enable members to continue their traditional pursuits.

¹¹³ Yukon Tourism and Culture, 2010. *Yukon Mineral Exploration Best Management Practices for Heritage Resources*; p.3

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At any time throughout the life of the mine, heritage or historic resources could be discovered. The Designated Office has considered the following project activities to have potential to affect heritage resources:

- Construction phase: construction of adits, portals and underground workings, vegetation clearing, grubbing and stripping top soil, road construction, camp extension and establishment of settling ponds
- Operations phase: mine and camp operations

Overlap between heritage or historic resources and project activities associated with AKHM's operations is not continuous in nature. Project activities will take place within a localized footprint and over a limited time during which an activity or results thereof, may cause a disturbance to heritage or historic resources.

14.2 PROJECT EFFECTS

The range of effects from project activities that could affect heritage or historic valued components include:

- Loss or damage of heritage or historic resources: disturbances leading to loss, destruction of heritage or historic resource

14.2.1 Loss or Damage of Heritage or Historic Resources

Many heritage or historic resources are fragile and can be easily damaged. Such damage can be caused by the use of heavy equipment, removal of vegetation and associated earthworks in the construction of new roads or portals. Resources such as burials can be damaged by inadvertently walking over old markers and fences. Some plants and medicines can take decades to grow back following a disturbance as minor as walking through their habitat. Once disturbed or removed, the cultural or scientific value of these resources may be diminished. Inventories of historic or heritage resources are lacking for many regions of the Yukon. Mineral companies can assist in heritage protection and appreciation by adopting historic resources "Best Management Practices for Mineral Exploration".

PROPONENT KEY COMMITMENTS:

One of the key commitments from the Bellekeno Mine assessment was the development of a Heritage Resource Management Plan. The premise of this plan was to protect historic, archaeological and paleontological resources by:

- Developing protocol to be followed during the during discovery of these resources to ensure proper resource protection and reporting; and
- Providing heritage awareness training for employees

For a full list of proponent commitments please refer to Appendix A-Table of Commitments.

SIGNIFICANCE:

Given the proponent has provided the Heritage Resource Management Plan, and in light of non-discretionary legislation, the Designated Office has determined that the proposed project will not result in significant adverse effects to heritage resources.

MITIGATION:

No additional mitigation is required.

15.0 CONCLUSION OF THE ASSESSMENT

The Designated Office has given full and fair consideration to information received during this assessment, as per section 39 of *YESAA*. The Designated Office has also taken into consideration the matters referred to in section 42(1) of *YESAA*.

In conclusion, the Designated Office has recommended to the decision bodies that the project be allowed to proceed, subject to specified terms and conditions, as the project will have significant adverse environmental or socio-economic effects in or outside Yukon that can be mitigated by those terms and conditions.

Appendix A LIST OF KEY MITIGATIONS THE PROPONENT HAS COMMITTED TO UNDERTAKE

The following is a compilation of the key mitigations proposed by the proponent and noted in this report. These mitigations are important because they help to mitigate significant adverse effects of the project. The Designated Office has confidence that the proponent will implement these mitigations and expects that the decision body and regulators will ensure that these activities are undertaken as proposed.

<i>VALUED COMPONENT</i>	<i>ACTIVITY</i>	<i>#</i>	<i>PROPONENT COMMITMENT</i>	<i>REFERENCE</i>
Water Resources	Waste Rock & Ore Stockpile	1.	P-AML waste rock and ore will be stockpiled at the mine sites for a maximum of 30 days.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.28, 47
Water Resources		2.	At Lucky Queen, sloped roof will be constructed over the ore storage pad to reduce precipitation falling over the stockpiled ore material. Cemented rock base will be sloped inwards to collect any meteoric water that may fall on top of the ore material	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.28
Water Resources	Waste Rock & Ore Stockpile	3.	On a weekly basis, the ore stockpile will be inspected for runoff. If runoff is detected, it will be sampled. If the runoff meets the proposed Lucky Queen/Onek Effluent Quality Standards (which are the same as those licenced under QZ09-092), the runoff will be directed to ground. If any parameters exceed EQSs, the runoff will be collected and treated at one of the licenced treatment facilities, and the ore on the pad will be transported to the mill immediately. Thereafter, the stockpile effluent will be monitored regularly and if a trend is detected, appropriate corrective actions will be taken (e.g., additional measures to limit infiltration; the ore will be transported to the mill in less than 30 d). These	Response to YESAB's Follow Up Questions- YOR Document # 2011-0315-098-1

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VALUED COMPONENT	ACTIVITY	#	PROPONENT COMMITMENT	REFERENCE
			measures will be incorporated into the Adaptive Management Plan.	
Water Resources	Waste Rock	4.	Response to new exceedences in the receiving environment is triggered if the concentration at the site exceeds a designated water quality benchmark, and if the mass loadings from the mine activities exceed 10% of the mass load for the constituent causing the exceedence.	
Water Resources	Waste Rock	5.	Integration of the Christal Creek Loadings Model into the AMP	
Water Resources	Waste Rock	6.	During operations, all waste rock will be immediately classified and moved to the appropriate disposal area or storage facility depending on type	
Water Resources	Waste Rock	7.	Geotechnical engineers will inspect sites proposed for N-AML and P-AML waste rock dumps and other major surface facilities prior to development.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.43
Water Resources		8.	Road building material will not be sourced from historic low grade ore stockpiles. Historic low grade ore piles located on top of Onek waste rock dump are able to be visually differentiated due to mineralization.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.53
Water Resources/ Human Health		9.	Alexco will monitor any seepage observed at the tow of the historic dumps used for borrow material.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.53
Water Resources	Waste Rock	10.	P-AML material will be stored in designated WRSF or	Keno Hill Silver District Operations Project

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VALUED COMPONENT	ACTIVITY	#	PROPONENT COMMITMENT	REFERENCE
			used as rock back fill underground.	Proposal Submission to YESAB, p.47, 95
Water Resources	Waste Rock	11.	New storage facilities for P-AML storage will be constructed in accordance with the generic design previously approved as part of Bellekeno Mine licencing.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.43
Water Resources	Waste Rock	12.	An engineer will inspect the site to ensure its geotechnical stability prior to construction of the new P-AML facility	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.51
Water Resources/ Visual Quality	Waste Rock	13.	Previously disturbed sites will be used for additional P-AML Waste Rock Storage Facilities, thereby minimizing new footprint development	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.50
Water Resources/ Terrain Stability & Soils/ Visual Quality	Waste Rock	14.	WRSFs will be covered with a total of 0.5m depth cover consisting in the bottom portion of low-permeability borrow material to minimize infiltration of meteoric water. The top portion of the cover shall consist of growth medium that will be seeded to promote vegetative growth. At closure, covers will be installed over the P-AML facilities to limit infiltration and ensure long-term chemical stability. In the event that water accumulates in the bottom of the P-AML before cover placement, the proponent proposes it will be pumped using a vacuum truck and transported to a water treatment plant for treatment.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.123

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VALUED COMPONENT	ACTIVITY	#	PROPONENT COMMITMENT	REFERENCE
Water Resources	Waste Rock	15.	N-AML material will be used for general construction purposes and surface capping of existing site access roads	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.47, 51-53
Water Resources	Waste Rock	16.	Alexco will monitor seepages from the Bypass road and onsite access roads built with N-AML material, and implement adaptive management responses, if required, as outlined in the approved Adaptive Management Plan.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p52
Water Resources	Waste Rock	17.	The Conceptual Adaptive Management Plan (AMP) will include an “event” for monitoring N-AML waste rock piles and their seepages and stipulated adaptive management measures to be undertaken if an increasing trend in acid generation or metal leaching is detected	
Water Resources	Waste Rock	18.	<p>One geomembrane lined lysimeter, each, will be installed in the N-AML storage area adjacent to the Lucky Queen Waste Rock Disposal Area. Drainage volumes will be monitored, with field parameters (pH and conductivity) measured on a monthly basis from May-October. Providing there is sufficient quantity of drainage, a full suite of water quality analysis will be conducted at least twice a year;</p> <ul style="list-style-type: none"> • Thresholds that initiate adaptive management include declining pH and/or increasing conductivity trends, or conductivity greater than 2,000 µS/cm; 	

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VALUED COMPONENT	ACTIVITY	#	PROPONENT COMMITMENT	REFERENCE
			<ul style="list-style-type: none"> Inspection of waste rock sources, water quality analysis performed by an external laboratory, location and identification of seepage or runoff, removal of material, installation of a cover or water diversion system; 	
Terrain Stability & Soils		19.	Alexco will engage geotechnical engineering consultants to inspect areas where permafrost is encountered that could pose significant geotechnical issues. The geotechnical engineers will advise Alexco as to any modifications to design or operations to ensure mitigation of slumps or failures relating to the presence of permafrost.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.43
Community/ Human Health/ Visual Quality	Waste	20.	AKHM will manage project waste as per the existing and approved Waste Management Plan that currently exists for the Bellekeno operations.	YOR 2011-0315-002-1, p.33/34
Fish & Fish Habitat/ Wildlife & Wildlife Habitat/Human Health	Spills/Contaminated Soil	21.	The Spill Contingency Plan will be applied.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.42
Human Health	Roads	22.	The Traffic Management Plan will be updated as part of project licensing.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.39
Terrain Stability		23.	Cleared vegetation and topsoil from construction of the Bypass road will be stockpiled along the road right-of-	Keno Hill Silver District Operations Project

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VALUED COMPONENT	ACTIVITY	#	PROPONENT COMMITMENT	REFERENCE
& Soils			way for road reclamation.	Proposal Submission to YESAB, p.39
Terrain Stability & Soils	Reclamation	24.	Reclamation and closure objectives include incorporating progressive reclamation; providing slope stabilization and erosion control on linear and non-linear disturbances; and conducting post closure monitoring of the site and adaptive management to assess effectiveness of closure measures for long-term.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.120
	Reclamation	25.	The Conceptual Reclamation and Closure Plan will be revised and updated through the licencing process.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.120
Terrain Stability & Soils/Human Health/Community/Visual Quality	Reclamation	26.	The portal sites at both Lucky Queen and Onek will be re-contoured and scarified to facilitate re-vegetation and drainage. Signage will indicate portal presence.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.122-123
Visual Quality/Acoustic Quality		27.	The surrounding ground that has been previously disturbed will be scarified and re-seeded to eventually establish a vegetation barrier to dampen noise and improve site aesthetics.	YOR #2011-0315-083-1; p.3
Terrain Stability & Soils	Reclamation	28.	Final slope of the WRDA will be 3H:1V	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.123
Terrain Stability	Roads	29.	At closure roads will be re-sloped and scarified,	Keno Hill Silver District Operations Project

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VALUED COMPONENT	ACTIVITY	#	PROPONENT COMMITMENT	REFERENCE
& Soils/ Visual Quality			culverts removed and seeded in areas where erosion control is necessary	Proposal Submission to YESAB, p.123
Community	Reclamation	30.	Closure measures will also ensure land use commensurate with surrounding lands	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.120
Water Resources	Reclamation	31.	At closure, the water storage ponds will be decommissioned. The berms will be regraded as part of reclamation	YOR 2011-0315-021-1, p.1
Water Resources	Reclamation	32.	At closure the DSTF will have a soil cover installed to reduce infiltration, in addition to a bioreactor to provide ongoing long-term water treatment during post-closure period.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.16, 58
Water Resources/ Fish & Fish Habitat/ Community	Roads	33.	At closure as part of road decommissioning, culverts will be removed and natural drainage restored.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.39
Water Resources	Waste Rock	34.	The P-AML waste rock storage facilities will be capped with an impermeable cover upon closure. Before this cap is in place, however, meteoric water may accumulate in these lined facilities. Should the need arise, accumulated water will be periodically pumped using a vacuum truck and transported to a water treatment plant for treatment, if required.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p. 96

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VALUED COMPONENT	ACTIVITY	#	PROPONENT COMMITMENT	REFERENCE
Water Resources	Water Quality/ Soil Protection	35.	The Water Management Plan will be updated to include surface water management for Lucky Queen and Onek.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.85-86
Water Resources/ Terrain Stability & Soils	Roads	36.	Ditching along the road will facilitate appropriate drainage.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.39
Water Resources/ Terrain Stability & Soils		37.	Appropriate water management infrastructure (e.g. diversions, berms) will be established to ensure site runoff is managed and erosion/ground instability is avoided.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.43
Water Resources	Waste Rock	38.	WRDAs will be sloped to convey precipitation to ditches around the perimeter; water will be directed to appropriate locations to infiltrate ground.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.51
Water Resources		39.	The Onek settling pond will be lined with high density polyethylene liner. Diversion ditches will be placed around the pond to ensure run-off from the site does not enter the pond	YOR 2011-0315-021-1, p.1
Water Resources	Groundwater Monitoring	40.	The new Lucky Queen and Onek underground workings will be developed above the groundwater table.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.90, 93

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VALUED COMPONENT	ACTIVITY	#	PROPONENT COMMITMENT	REFERENCE
Water Resources	Groundwater Monitoring	41.	Groundwater near N-AML waste rock disposal areas will be monitored for total zinc quarterly	
Water Resources	Groundwater Monitoring	42.	Four groundwater monitoring wells will be placed downgradient of the licensed Bellekeno N-AML Waste Rock Disposal Area.	Onek 990 Portal Proposal, #2011-0315-095-1; p.24
Water Resources	Groundwater Monitoring	43.	Alexco proposes to install two new groundwater monitoring wells – one down gradient of the new Onek workings and one downgradient of the Lucky Queen workings and N-AML WRDA.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.92
Water Resources		44.	The water storage pond at Onek will be used during mine development and maintained during operations as a contingency water storage pond in case additional water is encountered underground.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.96
Water Resources	Onek 400 Water Treatment	45.	Collection and active treatment of any residual discharges to meet the proposed effluent release standards	
Water Resources		46.	The 500 level adit discharge will be diverted to the storage pond on the pad. Collected water will be monitored. As an adaptive management response, if deteriorating discharge quality is detected, an investigation will be undertaken to ascertain source of deterioration. Appropriate mitigations will be developed. If required, the discharge will be treated at	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.89-90

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VALUED COMPONENT	ACTIVITY	#	PROPONENT COMMITMENT	REFERENCE
			one of the licensed treatment facilities.	
Water Resources	Onek 400 Water Treatment	47.	Alexco commits to ensuring the Onek 400 treatment system is operational prior to mining production at Onek.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.92
Human Health/ Acoustic Quality	Blasting & Chemicals	48.	Alexco will use short blast rounds rather than long blast rounds, maximize blast efficiencies and explosives will be stored above ground in an explosive magazine as per the <i>Yukon Occupational Health and Safety Act</i> Blasting Regulations. If ammonia is elevated during operations from use of explosives, ammonia will be treated using the appropriate technology to achieve the proposed EQS. Proven ammonia removal technologies such as ion exchange as is currently being implemented at Bellekeno 625 are directly applicable to Lucky Queen if required.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.93
Water Resources	Monitoring & Adaptive Management Plan	49.	The 500 level adit discharge will be diverted to the portal pad storage/infiltration pond. The collected water will be monitored regularly during development and production. As an adaptive management response, if deteriorating discharge quality is detected, an investigation will be undertaken to ascertain the source of the deterioration and appropriate mitigations will be developed (as outlined in the Conceptual AMP). If required, the discharge will be treated.	SV & I IR Response- YOR Document 2011-0315-085-1

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VALUED COMPONENT	ACTIVITY	#	PROPONENT COMMITMENT	REFERENCE
Water Resources/ Human Health	Flat Creek Camp	50.	It is assumed that Flat Creek and proposed well site for the Elsa camp could be hydro-geologically connected, therefore, Alexco commits to treating the well water to the same degree as the water currently withdrawn from Flat Creek.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.96
Fish & Fish Habitat/ Heritage Resources	Lightning Creek Bridge	51.	<p>The measures outlined in MS10-029 will be adhered to.</p> <p>Construction shall be carried out from July 1 to April 15, in accordance with the timing window recommended by DFO for the existing Lightning Creek Bridge.</p> <p>Temporary sediment control, such as silt fences or temporary diversion berms, will be installed, monitored and maintained to prevent sediment runoff into the creek.</p> <p>The following fording mitigations will be applied:</p> <p>If minor rutting is likely to occur, stream bank and bed protection methods (e.g. swamp mats, pads) will be used;</p> <p>Fording will occur under low flow conditions and not when flows are elevated due to local rain events or</p>	Onek Deposit Production, Onek 990 Portal Option & Keno City Bypass Road, June 2012, p. 22-23.

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VALUED COMPONENT	ACTIVITY	#	PROPONENT COMMITMENT	REFERENCE
			<p>seasonal flooding;</p> <p>Other than during fording, machinery will be operated above the ordinary high water mark to the extent possible and in a manner that minimizes disturbance to the banks of the watercourse;</p> <p>AKHM's Spill Contingency Plan will be followed in the event of a spill or leak.</p> <p>Machinery is to arrive on site in a clean condition and is to be maintained free of fluid leaks, invasive species and noxious weeds;</p> <p>No fuelling or servicing of equipment will be done within 30m of a water body;</p> <p>No fuel will be stored (including in tidy tanks in trucks) within 30 m of any water body;</p> <p>No debris shall remain within the high-water mark or placed into the stream;</p> <p>DFO's Operational Statements for <i>Clear Span Bridges</i> will be adhered to;</p> <p>DFO's Operational Statements for <i>Stream Fordings</i> will be adhered to (with the exception of timing of fording); and</p> <p>AKHM will complete a Heritage Resources Impact Assessment prior to any ground disturbance for bridge</p>	

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VALUED COMPONENT	ACTIVITY	#	PROPONENT COMMITMENT	REFERENCE
			construction.	
Community	Roads	45.	Alexco will construct a bypass road to route most mine traffic around the community, and ensure interference with local community is minimal	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.35
Community	Power line	46.	Alexco will consult M. Bindig, the owner of the private lot on the Wernecke road, about placement and easements before any power line construction	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.41
Acoustic Quality	Power line	47.	Grid power will be supplied to Onek prior to portal construction and Onek development	
Community/ Acoustic Quality	Blasting	48.	Alexco proposes to work closely with Keno City residents to determine whether underground blasting is affecting them.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.112
Community/ Human Health		49.	Signage will also be posted at site access roads to Lucky Queen and Onek prohibiting the public from entering the mine site and warning of the dangers	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.114
Human Health	Roads	50.	The Bypass road will be a radio controlled road accessible to mine traffic only. The maximum speed limit will be 40km/hr, reduced to 20km/h at blind corners and road crossings	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.39, 114
Human Health/ Acoustic Quality	Haul Trucks	51.	Alexco proposes to avoid the use of engine breaks within 1 km of Keno City to mitigate noise associated	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.111

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VALUED COMPONENT	ACTIVITY	#	PROPONENT COMMITMENT	REFERENCE
			with mine traffic, and to incorporate mine traffic management protocols into the Traffic Management Plan under QML-009.	
Community/ Human Health		52.	There will be stop signs to stop mine traffic at the intersection with Sign Post road, Wernecke road, Lightning Creek road and the Silver Trail Highway.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.39
Community/ Human Health		53.	Signage warning of crossing/turning mine dump trucks (over the highway dump trucks) will be installed along Sign Post road, Wernecke road and the Silver Trail Highway in accordance with the requirements and direction of YG Highways & Public Works Transport Branch officials	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.36, 39
Community	Access	54.	An Access Management Plan will be developed for the local area as part of mine closure	
Community	Quality of Life	55.	Development and implementation of the Keno City socio-economic mitigation plan (QML-0009) to mitigate potential effects and maintain quality of life	
Community/ Acoustic Quality		56.	Ore haulage will primarily occur between the hours of 7am – 7pm daily	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.108, 111
Community		57.	Alexco will work with tourism and heritage representatives and the community to develop a sign to be installed along the Silver Trail Highway to Keno and within Keno that shows a road/trail map of the area indicating the roads that are in active mining use,	SV & I IR Response- YOR Document 2011-0315-085-1.

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VALUED COMPONENT	ACTIVITY	#	PROPONENT COMMITMENT	REFERENCE
			identifies key tourist features, and lists general safety precautions and traffic management procedures for active roads.	
Air Quality	Monitoring	58.	Alexco will continue to implement the Monitoring and Surveillance Plan to help mitigate the effects associated with increased dust emissions under QML-0009.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.111-112
Air Quality	Monitoring	59.	TSP monitoring devices will be in place and operational by August 15, 2012 (anticipated)	
Community/ Acoustic Quality	Blasting	60.	Blasting near the surface at Onek will only be conducted during the dayshift period (7am to 7pm) and a community notification protocol will be developed.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.109
Acoustic Quality		61.	The will be no movement of ore or waste rock to or from the temporary surface storage areas between the hours of 1900 and 0700.	SV & I IR Response- YOR Document 2011-0315-085-1.
Acoustic Quality		62.	The compressor will be housed in a sound dampening enclosure. The vent fan will have inlet and exhaust sound dampeners, will decrease noise by about 10 dBA, slightly lowering the total noise emissions.	SV & I IR Response- YOR Document 2011-0315-085-1. Onek will be connected to the power grid so no generator will be required
Human Health		63.	A small building will be constructed over the vent raise at Lucky Queen and Onek. Signage will be installed around the vent raise warning of the hazard. The vent raise provides additional ventilation to the underground workings and functions as an emergency escape. Personnel will need to access the vent raise	SV & I IR Response- YOR Document 2011-0315-085-1. Onek will be connected to the power grid so no generator will be required

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VALUED COMPONENT	ACTIVITY	#	PROPONENT COMMITMENT	REFERENCE
			only once per week.	
Air Quality/ Visual Quality		64.	Alexco will also control dust by application of water or use of non-petroleum dust suppressants (e.g. calcium chloride); and progressive reclamation measures such as revegetation will be implemented	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.112
Terrain Stability & Soils	Reclamation	65.	Where possible, progressive reclamation measures, such as revegetation, will be implemented to help stabilize the soil and control dust.	Onek Deposit Production, Onek 990 Portal Option & Keno City Bypass Road, June 2012, p. 39.
Human Health		66.	Signage will be installed at the PAML WRSF warning of active use of the facility and indicating locations that are not appropriate/safe for parking.	SV & I IR Response- YOR Document 2011-0315-085-1.
Air Quality	Dust	67.	Alexco will adhere to Environment Yukon’s Ambient Air Quality Standards under the Environment Act. These standards for TSP are set at 120 µg/m ³ for a 24hour average, and 60 µg/m ³ as an annual geometric mean. Results from TSP monitoring will be compared to the Ambient Air quality Standards under the Environment Act.	Response to YESAB’s Follow Up Questions- YOR Document # 2011-0315-098-1
Human Health	Employee Health	68.	Adherence to company’s Health & Safety Policy	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.40
Human Health	Employee Health	69.	All employees will be fully equipped with PPEs standard for working underground, taking into consideration hazards caused by noise level, air born particulates and confined work space	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.40

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VALUED COMPONENT	ACTIVITY	#	PROPONENT COMMITMENT	REFERENCE
<i>Human Health</i>	<i>Employee Health & Safety</i>	70.	New employees will have a site wide and safety orientation and another orientation of the underground work site prior to commencing work.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.40
<i>Human Health</i>	<i>Employee Health & Safety</i>	71.	Alexco has in place a Health & Safety Policy (Appendix B of the Project Proposal) and both will continue to be adhered to during the course of operations at Onek and Lucky Queen.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.40
<i>Human Health</i>	<i>Employee Health & Safety</i>	72.	All personnel and Contractors will meet the standards outlined in the Occupational Health and Safety Legislation, Mine Safety Rules, and Regulations of the Worker's Compensation Board.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.40
<i>Human Health</i>	<i>Employee Health & Safety</i>	73.	Alexco policy requires that all employees (including contractors' employees) have pre-employment medical examinations including a drug and alcohol test. All employees will be fully equipped with the proper personal protective equipment standard for working underground, taking into consideration hazards caused by noise level, air born particulates and confined work space.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.40
<i>Human Health</i>	<i>Employee Health & Safety</i>	74.	Regular safety meetings with supervisors, safety officer and employees are mandated. Any changes in procedures, equipment, or hazards require immediate notification to employees.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.40

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VALUED COMPONENT	ACTIVITY	#	PROPONENT COMMITMENT	REFERENCE
Human Health	Employee Health & Safety	75.	A Safety Coordinator/Officer specific for the underground operation will ensure all workers are orientated to all aspects of the work site including hazard identification, protective equipment requirements and that medical and health requirements are followed according to legislation. That position is also charged with ensuring continued training and skill development for all personnel.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.4
Human Health		76.	The line-of-sight distance requirements of YG Highways & Public Works Transport Branch and the Highway Access/ Works within a Right-of-Way permits will be adhered to in order to ensure public and worker safety.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.39
Community	Trapping	77.	Alexco personnel will be instructed not to disturb trapping equipment or activities.	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.117
Heritage Resources		78.	To mitigate potential effects on heritage resources, Alexco proposes to implement existing Heritage Resources Protection Plan under QML-0009. The plan outlines specific responses and notification protocols and mine site personnel training to protect heritage resources. <ul style="list-style-type: none"> • Develop protocol to be followed during the discovery of these resources to ensure proper resource protection and reporting; and • Providing heritage awareness training for 	Keno Hill Silver District Operations Project Proposal Submission to YESAB, p.118-119

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<i>VALUED COMPONENT</i>	<i>ACTIVITY</i>	<i>#</i>	<i>PROPONENT COMMITMENT</i>	<i>REFERENCE</i>
			employees	

Appendix B LIST OF RELEVANT NON-DISCRETIONARY LEGISLATION APPLICABLE TO THE PROJECT

The following is a notation of the key legislation and associated sections that I believe are relevant to this project. These provisions help to ensure that significant adverse effects do not occur. Note that this list is not intended to be a comprehensive list of all the relevant legislation that applies to this project. Rather it is a reflection of the legislation that was discussed in this report. I have confidence that the proponent will adhere to this legislation, and I expect that the decision body and regulators will enforce the legislation.

Legislation	Key Provisions (by part or section number)
<i>Yukon Waters Act</i> Waters Regulation	
<i>Quartz Mining Act</i> Quartz Mining Land Use Regulations	Part A and B, regarding the removal and re-establishment of the vegetative mat Part C, regarding erosion control and permafrost and prohibiting impacts that result in long-term erosion Part L, regarding the use of vehicles and requiring that they be operated in such a way so as to avoid rutting and gouging and damage to permafrost
<i>Navigable Waters Protection Act</i>	
<i>Occupational Health and Safety Act</i> Yukon Occupational Health and Safety Regulations	
<i>Environment Act</i> Spill Regulations	Section 2-4, respecting spills of substances
<i>Fisheries Act</i>	
<i>Wildlife Act</i>	
<i>Migratory Birds Convention Act</i>	

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Migratory Birds Convention Regulation	Section 6
<i>Public Health and Safety Act</i>	
<i>Species at Risk Act</i>	
<i>Canadian Environmental Protection Act</i>	Metal Mining Effluent Regulations

Appendix C LIST OF SUBMISSIONS MADE BY INTERESTED PERSONS AND OTHERS DURING THE ASSESSMENT

Name of Person or Party	Type of Submission	YOR Document Number	Date Submitted
Seeking Views & Information II			
Yvonne Bessette	Comment Submission	2011-0315-120-1	Jul 23, 2012
Jim Milley	Comment Submission	2011-0315-119-1	Jul 23, 2012
MiningWatch Canada	Comment Submission	2011-0315-118-1	Jul 23, 2012
YG Environment	Communication between YG Environment and Proponent	2011-0315-117-1	Jul 20, 2012
Mike Mancini	Comment Submission	2011-0315-116-1	Jul 20, 2012
Environment Canada	Comment Submission	2011-0315-115-1	Jul 20, 2012
Matthias Bindig	Comment Submission	2011-0315-114-1	Jul 19, 2012
Na-cho Nyak Dun	Comment Submission	2011-0315-113-1	Jul 19, 2012
Insa Schultenkotter	Comment Submission	2011-0315-112-1	July 18, 2012
YG (Community Services, EMR CS&I, EMR Minerals, Environment, Health & Social Services, Heritage Resources, Tourism)	Comment Submission	2011-0315-106-1	Jul 16, 2012
Yukon Conservation Society	Comment Submission	2011-0315-105-1	Jul 16, 2012

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Dirk Rentmeister	Comment Submission	2011-0315-104-1	Jul 16, 2012
Seeking Views & Information I			
Health Canada	Comment Submission	2011-0315-079-1	May 11, 2012
NND	Comment Submission	2011-0315-078-1	May 10, 2012
Stu Withers	Comment Submission	2011-0315-077-1	May 10, 2012
Keno Hill Exploration	Comment Submission	2011-0315-071-1	May 9, 2012
L. Blackburn & M. Bindig	Comment Submission	2011-0315-070-1	May 9, 2012
Yukon Conservation Society	Comment Submission	2011-0315-069-1	May 8, 2012
Jim Milley	Comment Submission	2011-0315-068-1	May 8, 2012
Insa Schultnekotter	Comment Submission	2011-0315-067-1	May 8, 2012
Bob Wagner	Comment Submission	2011-0315-066-1	May 8, 2012
Keno Residents	Comment Submission	2011-0315-064-1	May 8, 2012
Yvonne Bessette	Comment Submission	2011-0315-063-1	May 7, 2012
YG (Community Services, EMR CS&I, EMR Minerals, Environment, Health & Social Services, Heritage Resources, Tourism)	Comment Submission	2011-0315-062	May 7, 2012
Gregory Keitel	Comment Submission	2011-0315-061-1	May 6, 2012

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Richard Brost	Comment Submission	2011-0315-060-1	May 4, 2012
Environment Canada	Comment Submission-supplementary information	2011-0315-059-1	May 3, 2012
Environment Canada	Comment Submission-supplementary information	2011-0315-058-1	May 3, 2012
Environment Canada	Comment Submission	2011-0315-057-1	May 3, 2012
MiningWatch Canada	Comment Submission	2011-0315-054-1	May 1, 2012
Bob Wagner	Comment Submission	2011-0315-053-1	April 30, 2012
Matthias Bindig	Comment Submission	2011-0315-050-1	April 26, 2012
YG (Community Services, EMR CS&I, EMR Minerals, Environment, Health & Social Services, Heritage Resources, Tourism)	Comment Submission	2011-0315-049-1	April 24, 2012
Mayo District Renewable Resources Council	Comment Submission	2011-0315-046-1	April 18, 2012
NND	Comment Submission	2011-0315-042-1	April 4, 2012

Appendix D REFERENCES

The following references are the primary sources used throughout the report. Additional documents sourced can be found on the YESAB Online Registry (YOR).

- Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Date Modified May 7, 2012. Retrieved from http://www.cosewic.gc.ca/eng/sct5/index_e.cfm. [Accessed July 24, 2012]
- Smith, C.A.S., Meikle, J.C. and Roots, C.F. (editors). 2004. Ecoregions of the Yukon Territory: Biophysical Properties of Yukon Landscapes. Agriculture and Agri-Food Canada. Summerland, British Columbia, Canada.
- YOR #2009-0030-0124, Project Assessment 2009-0030
- YOR #2011-0315-0002, Project Proposal 2011-0315
- YOR #2011-0315-0032, Revised Project Proposal 2011-0315
- YOR #2011-0315-0033 Revised Project Proposal Part II 2011-0315
- YOR #2011-0315-0045 Revised Project Proposal Appendix 2011-0315
- YOR #2011-0315-0125 Air Quality Report 2011-0315
- YOR #2011-0315-0126/127 Noise Impact Report 2011-0315
- Yukon Environmental and Socio-economic Assessment Board. 2009. [Interactive maps of biophysical and socio-economic geographic data, May 29, 2009]. Geo-Locator Report for Project Location, Geo-Locator. Retrieved from <http://geolocator.yesab.ca/geolocator/queryFeaturesByCoords.do>