WASTE MANAGEMENT PLAN

KENO HILL SILVER DISTRICT MINING OPERATIONS

July 2018

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1.0 INTRODUCTION

Throughout the course of the Keno Hill Silver District (KHSD) mining operations various forms of waste will be produced and require management to ensure proper disposal under the applicable legislation. As such, the following Waste Management Plan has been prepared to outline the facilities and measures that will be used to manage the waste streams. Because the KHSD mining operations will operate within the context of existing and ongoing care and maintenance and closure planning for the whole Keno Hill Silver District, existing waste management facilities and permits are already in place. However it is anticipated that amendments to existing permits may be required to accommodate wastes generated by mining operations. As the project proceeds and permits are obtained or amended that regulate the management and disposal of waste, this plan will be revised accordingly with approvals appended.

2.0 WASTE MANAGEMENT FACILITIES

2.1 EXISTING WASTE MANAGEMENT FACILITIES AND PERMITS

A number of existing waste management facilities exist on site and are used in support of care and maintenance and closure activities, and will be amended in order to accommodate waste resulting from mining operations (see Figure 1). Permission to mine and "perform activities and construct improvements collateral to mining" which includes use of waste management facilities has been granted by Elsa Reclamation and Development Company Ltd. (ERDC) to Alexco Keno Hill Mining Corp (AKHM) as set out in Quartz Mining Licence QML-0009. ERDC is a wholly owned subsidiary of Alexco, and will accept, handle and dispose of wastes generated by Alexco from Keno Hill Silver District mining operations according to protocol and permits held by ERDC.

- A Commercial Dump Permit # 81-012 (ERDC) and #81-067 (AKHM) is currently held from YG Environment in accordance with the Environment Act Solid Waste Regulations as well as the Public Health and Safety Act. This permit will continue to be used in support of mining operations.

- Alexco currently holds two (2) sewage disposal system permits at Elsa issued by YG Environmental Health Services: an absorption bed permit for the Flat Creek Camp (Permit #3448) in replacement to a septic tank permit (Permit #3012) and an absorption permit for five houses (Permit #3449) in replacement of a septic tank permit (Permit #3246).

- Part 7 of permit # 81-012 includes provisions for air emissions and replaced Air Emissions Permit # 4201-60-026. Permit # 81-012 permits open burning of > 5 kg of solid waste in an incinerator at the Valley Tailings Landfill area and other landfills around the district. This permit is included as Attachment 2.

- Special Waste Permit # 43-049 is currently held from YG Environment in accordance with the *Environment Act* Special Waste Regulations for burning waste oil, generating and/or storing waste batteries, waste oil, waste solvents, and other special wastes.

2.2 VALLEY TAILINGS LANDFILL

An amendment to existing commercial dump permit # 81-012 has been received from Yukon Environment as per the *Solid Waste Regulations*. This permit allows for the disposal and incineration of solid waste at a number of other landfill locations for district wide decommissioning and reclamation. However, the Valley Tailings landfill will be used exclusively to accommodate solid wastes generated during construction, operation, and closure activities of the Keno Hill Silver District mining operations. The location for this waste management area is north of the Elsa near the Valley Tailings Area (see Figure 1).

Alexco has made a corporate commitment to the residents of Keno City that Alexco and its contractors will not use or add to the Keno City solid waste management facility and landfill, which is located approximately 650 m west of Keno City.

2.3 INCINERATOR

Existing Air Emission Permit # 4201-60-026 is being used in accordance with Yukon Environment Act, *Air Emissions Regulations,* in order to incinerate solid waste from the Bellekeno Mine and is being amended to include solid waste from other Keno Hill Silver District mining operations. This facility is located at the Valley Tailings Landfill area (see Figure 1).

The incinerator consists of a burning barrel fabricated from old fuel tanks. Barrels such as these have been successfully utilized in various community dump applications throughout the Yukon as it is a highly efficient method of clean burning waste and mitigating fugitive litter and ash.

Included within the barrels are spark arrestors and ventilation holes. These ventilation holes will create the draft necessary to draw air through the bottom and pull it through to the top of four separate screened stacks. The unit is completely self-contained, requiring no external source of energy to operate.

Onsite managers/operators initiate and monitor the burning of Elsa camp waste on a regular basis.

Refuse originating as camp and office waste, plus warehouse scrap containing some organic wastes are incinerated. Garbage and debris destined for disposal are collected routinely and, prior to incineration, are stored in wildlife proof containers / fenced short term storage areas in a manner which does not attract wildlife to the mine or mill site. Solid wastes are completely incinerated in a manner which minimizes odors and eliminates the attraction of bears and other wildlife to the mine site. Combustible waste containing a fossil fuel by-product shall be drained prior to incineration and that material will be recycled where possible.

The incinerator is located in a remote area approximately 11 km from the nearest community of Keno City. The incinerator is located 2 kilometers north of Elsa camp in a remote location, which will assist in mitigating the impact of emissions on the immediate camp site. The incinerator is set back from the forest edge in an existing clearing, and the incinerator is monitored for proper functioning during use.

Ash from the incinerator is shoveled by heavy machinery (bobcat or loader) on an as needed basis. The ash is transported to and deposited in a constructed trench located adjacent to the burn barrel location. The transportation and deposition of ash waste is dealt with in the solid waste permit.

2.4 LAND TREATMENT FACILITY

A multi-use Land Treatment Facility (LTF) is currently under consideration and will be located in the vicinity of Elsa for the potential collection, storage and treatment of soil and/or liquid contaminated with petroleum hydrocarbons. In the event of a petroleum spill, the Contaminated Site Regulations will be followed and an LTF will be permitted based on analytical results.

2.5 SEWAGE DISPOSAL

Numerous separate locations throughout the Keno Hill Silver District require sewage services in order to accommodate mining development and operations, each of whose specific circumstances are dealt with through terms and conditions of permits obtained under the Public Health and Safety Act. Sewage disposal facilities currently include both permanent and portable facilities.

All disposal facilities will comply with the Public Health and Safety Act, *Sewage Disposal Systems Regulations*. In particular, septic tanks, sewage holding tanks or contained privies will be located at least 15 m from the ordinary high water mark (OHWM) of nearby water bodies; while the soil absorption system (or pit privies) will be located not less than 30 m from the high water level of nearby water bodies. Soil absorption systems are not located where soil conditions are unsuitable for absorption of effluent.

2.5.1 FLAT CREEK CAMP AND ELSA

Alexco currently holds two (2) sewage disposal system permits at Elsa issued by YG Environmental Health Services: an absorption bed permit for the Flat Creek Camp (Permit #3448) in replacement of a septic tank permit (Permit #3012) and an absorption permit for five houses (Permit #3449) in replacement to a septic tank permit (Permit #3246)
A 36-person trailer camp was established in 2006 and a septic system was installed under permits (#3012 and #3246), including septic tanks and absorption bed. However, the absorption bed was not constructed. In 2008, additional trailer units were added to bring the camp capacity to 100-persons. This required the construction of a new absorption bed system, which was built concurrently and was oversized to handle flow equivalents of 150 persons. The camp was further expanded to 150 persons during the summer of 2010. This camp expansion utilized the septic absorption bed system constructed in 2008 under permit number 3448.

2.5.2 DISTRICT MILL SITE

The septic system at the District mill site consists of a holding tank, which will be periodically pumped out and trucked to Flat Creek Camp for disposal.

2.5.3 BELLEKENO, BERMINGHAM LUCKY QUEEN AND ONEK MINE SITES

The septic systems at each mine site will consist of holding tanks, which will be periodically pumped out and trucked to the Flat Creek Camp facilities for disposal.

2.5.4 FLAME & MOTH MINE SITES

The septic systems at the Flame & Moth mine site will consist of holding tanks, which will be periodically pumped out and trucked to the Flat Creek Camp facilities for disposal.

2.6 SEDIMENT CONTROL & EVENTS PONDS

During construction, the accumulated sediment within the sediment control & events ponds will be collected as required and buried below ground away from drainage flow paths and watercourses.

3.0 WASTE STREAMS & SEGREGATION

The types of waste that will be managed at the site include:

- Solid Waste (non-hazardous)
  - Putrescible (i.e. camp refuse)
  - Non-putrescible (i.e. burnable or non-burnable)
- Special wastes (i.e. waste oil, batteries – only to be segregated and stored temporarily)

3.1 SOLID WASTE (NON-HAZARDOUS)

Kitchen / organic waste is temporarily stored in clear plastic bags inside a 10'x10' bear proof steel clad shed (previously an explosives magazine) at the camp site with a 1" thick steel door with heavy clasp for security. The bin is emptied daily and taken to the incinerator for immediate burning.

Waste that is non-burnable, non-hazardous, and non-recyclable will either be temporarily stored in steel bins at the valley tailings landfill area (e.g. construction wastes) or in the steel clad bin at the camp site (e.g. washed out containers for non-hazardous contents). This waste, along with incinerator ash is buried within the dump. Material will periodically be covered with a layer of soil to prevent the loss of waste through wind action.

Used tires requiring disposal and have a rim size of 24.5 inches or greater are buried within the commercial dump at the valley tailings landfill. Used tires requiring disposal with a rim size of 24.5 inches or less will be dealt with in accordance with the Yukon Used Tire Management Program and transported off site to an approved facility.

3.2 SPECIAL WASTE

Any special wastes, as defined by the *Special Waste Regulations* (batteries, used oil, antifreeze, solvents), are collected and stored in specially marked containers and then shipped to an appropriate

treatment or disposal facility. Wildlife-proof rig bins are used to provide segregated storage for solid waste that cannot be burned and special wastes in compliance with *Special Waste Regulations*.

Alexco's wholly owned subsidiary Elsa Reclamation and Development Company holds Special Waste Permit # 43-049 for this project and will comply with the Yukon *Special Waste Regulations* and track wastes through the use of Transportation of Dangerous Goods Waste Manifests. Special wastes generated from the Bellekeno Project will be disposed of in accordance with Special Waste Permit # 43-049. Special Waste Permit # 43-049 includes authorization to use a waste oil burner at the site (in Elsa) as per the *Special Waste Regulations.* Waste oil is burned and used as a source of heat.

A concrete floor will be provided throughout the truck maintenance area and will be sloped towards a dry sump, which will collect any wash solutions and petroleum products that result from the maintenance activities. Oil-absorbent products will also be used on the shop floors.

Any accumulated sump water will be separated and oils will be pumped to the waste oil tank or empty drums. All oily wastes from oil changes, including the sump separation products and absorbent, will be hauled off the site for disposal or recycling in an environmentally acceptable manner or disposed of in the waste oil burner. An oil and water separator is used in the truck shop to capture oil, which is then taken offsite by the oil supplier for disposal or disposed of in the waste oil burner.

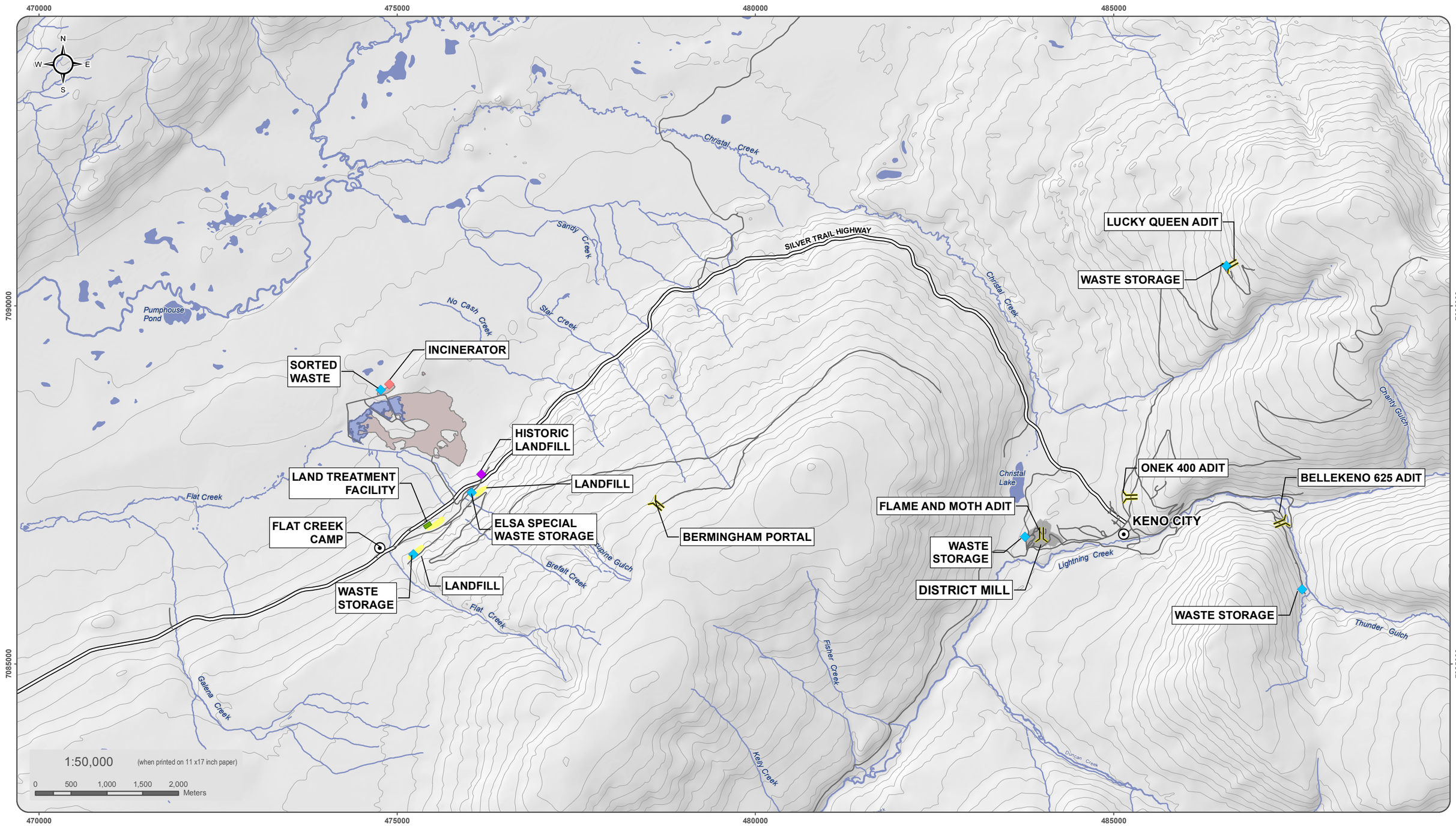
The lubrication bay of the maintenance shop has a vacuum evacuation system for waste oil. Hose reels feed from the lubrication storage area and dispense antifreeze, grease and various grades of oil to the lubrication bay.

3.3 WASTE MANAGEMENT MATRIX

Both controlled / hazardous and non-controlled / non-hazardous materials are dispensed of accordingly. Signage will be in place to assist in proper segregation of wastes. The general projected types of waste expected to be disposed of at the commercial dump for the project are presented in Table 1 while Figure 1 follows and shows the general location for the commercial dump.

Table 1 Waste Management Matrix

Type of Waste Generated	On Site Storage Method	On Site Storage Location	Disposal Method
Non-Controlled Materials			
Incinerator Ash	Open top drums with sealable lids.	N/A	Incinerator ash will be removed from the incinerator with machinery and hauled directly into the dump.
Scrap Steel	N/A	Waste management area	Segregated and recycled or buried.
Wood - Burnable	N/A	Waste management area	Incinerated.
Kitchen /Camp Waste	Clear plastic bags inside 10'x10' steel clad with a 1" thick steel door with heavy clasp for security.	Within camp	Bin shall be emptied daily and taken to the incinerator for immediate burning.
Construction Waste - drywall, glass, insulation, electrical wire, etc. (non hazardous)	Steel bins.	Waste management area	Bins shall have their contents emptied into the dump and buried.
All tires with a rim size of 24.5 inches or greater.	These tires will be taken directly to the ash disposal area.	N/A	These tires will be buried.
All tires with a rim size of 24.5 inches or less.	These tires will be placed in a segregated area within the waste management area.	Shall be stored in a segregated area determined by managers. Location will be clearly labeled.	These tires will be transported off site to a regulated and permitted dump with tire segregation on an as required basis.
Plastic containers - non hazardous contents	Containers will be inside placed 10'x10' steel clad with a 1" thick steel door with heavy clasp for security. Containers shall be washed out completely and not contain any residual.	Within camp	Bin shall be emptied as required and taken to the incinerator for immediate burning.
Metal containers - non hazardous contents	Containers will be inside placed 10'x10' steel clad with a 1" thick steel door with heavy clasp for security. Containers shall be washed out completely and not contain any residual.	Within camp	Bin shall be emptied as required and taken to the dump to have the contents buried.
Glass containers - non hazardous contents	Containers will be inside placed 10'x10' steel clad with a 1" thick steel door with heavy clasp for security. Containers shall be washed out completely and not contain any residual.	Within camp	Bin shall be emptied as required and taken to the dump to have the contents buried.
Controlled Materials			
Batteries	Lined wooden box	Segregated area at waste management area. Clearly labeled.	Batteries will be placed in an upright position within a 4'x4' box. When the 4'x4' box is full, another will be built and the full box shall be shipped off site to the local Waste Management facility in Whitehorse. Appropriate measures will be taken to ensure batteries remain upright during transport (i.e. waste construction wood will be used as filler to take up extra space).
Used Oil	Used oil will be placed in a 300 gallon container located in a bermed area.	Enclosed tanker.	When the container is full, the oil will either be transported to a waste oil burner onsite or management will contact a local supplier to transport oil to a recycling facility offsite.
Fuel Filters	Open top drums with sealable lids.	Waste management area - segregated special waste storage area.	Residual oil and fuel will be drained from filters into waste oil/fuel storage containers.
Antifreeze	Closed top drums with both bungs.	Segregated lined area at waste management area. Clearly labeled. Bungs sealed tight.	When enough drums are gathered up they shall be palletized in similar groups of 4 and banded together for shipment to the local Waste Management facility in Whitehorse.
Solvents	Closed top drums with both bungs.	Segregated lined area at waste management area. Clearly labeled. Bungs sealed tight.	When enough drums are gathered up they shall be palletized in similar groups of 4 and banded together for shipment to the local Waste Management facility in Whitehorse.



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

- Historic Landfill
- Incinerator
- Waste Storage
- Site
- Land Treatment Facility
- Licenced Landfill
- Valley Tailings Pond
- Valley Tailings
- Mill Site Footprint
- Highway
- Road
- Contour (100 feet)

AKHM

Alexco Environmental Group

ALEXCO KENO HILL MINING CORP.
BERMINGHAM

FIGURE 1

WASTE MANAGEMENT FACILITIES

JULY 2018

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4.0 ATMOSPHERIC EMISSIONS

Alexco has implemented the following measures with respect to the control of atmospheric emissions generated as a result of waste management activities:

Fugitive Dust	• Minimize the footprint of waste management activities that may generate fugitive dust; • Use dust suppression measures where necessary to control generated fugitive dust such as watering haul roads and waste management areas (ensuring water quality standards identified for release into receiving waters are met); • Progressively reseed/reclaim disturbed waste management areas that may contribute to fugitive dust as far as possible.
Combustion	• Ensure proper maintenance of vehicles, pumps, compressors, generators, and other equipment used for waste management activities to minimize emissions of polluting gases; • Use low sulphur fuels including diesel fuel with a sulphur content <15 ppm and propane with negligible sulphur content and where appropriate, waste heat recovery and energy efficient techniques will be employed to decrease diesel use. • Ensure that incinerator is well maintained and operated at peak efficiency

More general details regarding dust suppression/management measures and dust modeling which has been undertaken can be found in the Mill Development and Operation Plan and the Dry Stack Tailings Facility Development and Operation Plan, respectively.

5.0 SLUDGE MANAGEMENT

Sludge produced from the Bellekeno mine is currently disposed of in accordance with the district wide Sludge Management Plan under QZ12-053 at the Valley Tailings Area. The Sludge Management Plan has been updated for the designed Bermingham and Flame and Moth water treatment plants.