Alexco Keno Hill Mining Corp.

REVISION 2010-1

OPERATION, MAINTENANCE, AND SURVEILLANCE MANUAL
DRY STACK TAILINGS FACILITY
KENO HILL DISTRICT MILL, YT

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PREPARED BY EBA ENGINEERING CONSULTANTS LTD

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1.0 INTRODUCTION

This Operation, Maintenance, and Surveillance (OMS) manual has been prepared for the Dry Stack Tailings Facility (DSTF) at the Keno Hill District Mill, YT, and acts as a reference document for its operation, maintenance, and surveillance.

Alexco Keno Hill Mining Corp. (Alexco) and EBA Engineering Consultants Ltd. (EBA) have provided representation from site operations personnel and management (Alexco) and the facility designers (EBA), for the formation of the OMS manual development team and completion of the OMS manual.

1.1 OBJECTIVE OF THE OMS MANUAL

The objective of the OMS manual is to define and describe:

- Roles and responsibilities of personnel assigned to the facility;
- Procedures and processes for managing change;
- The key components of the facility;
- Procedures required to operate, monitor the performance of, and maintain the facility to ensure that it functions in accordance with its design, meets regulatory and corporate policy obligations, and links to emergency planning and response; and
- Requirements for analysis and documentation of the performance of the facility.

2.0 ROLES AND RESPONSIBILITIES

2.1 ORGANIZATION, STRUCTURE, AND INDIVIDUAL RESPONSIBILITIES

The operation, maintenance, surveillance or emergency preparedness and response of the DSTF is the responsibility of the Tailings Management Team (TMT). This team is comprised of individuals from Alexco and serves as the lead coordinator of the OMS manual and is ultimately responsible to ensure all aspects of the OMS manual of the DSTF are met. EBA is the facilities designer and acts as a geotechnical consultant for Alexco.

Designated personnel within the TMT, along with their position and responsibilities, are summarized in Table A1, Appendix A.

Responsibility of the TMT and the ongoing operation, monitoring, maintenance, and surveillance of the DSTF falls under Alexco's Keno District General Manager. Furthermore, the General Manager must ensure adequate resources (financial and manpower) are made available to ensure the safe operation of the DSTF. Undertakings at the DSTF must be prioritized and scheduled with the knowledge of the TMT.

2.2 COMPETENCY AND TRAINING

Appropriate training programs are required for all personnel involved in the operation, maintenance, and surveillance of the DSTF, including all its components.

The General Manager and Construction Monitors are required to fully understand and implement the operation, maintenance, and surveillance requirements of the DSTF, and ensure that the design criteria for the facility are followed. This is achieved through consultation with the Alexco VP Engineering and additional consultation with the facility designer and geotechnical consultant, EBA, as necessary.

The Keno Hill District Mill Manager is responsible to ensure Alexco's supervisors and operators understand the operational and maintenance requirements of the DSTF to meet the design criteria for the facility.

All personnel working at the DSTF are to have an appropriate understanding of the OMS manual and their respective roles and responsibilities. Relevant procedures include the Bellekeno Emergency Procedures, the Bellekeno Spill Response Plan, and DSTF Emergency Response Plan. It is the role of the specific supervisor of the personnel to ensure this is the case.

In conjunction to the understanding of the OMS manual, the responsibility of all site personnel to be continually alert of visual queues regarding facility performance must be highlighted. Anything observed to be outside of normal operating parameters, as outlined in this manual, are to be reported immediately to the General Manager.

3.0 OMS MANUAL CONTROL AND UPDATE

This OMS manual is a controlled document, with specified procedures for:

- Distributing, removing and archiving out-of-date materials;
- Filing the manual and supporting documents; and
- Reviewing and updating the manual.

3.1 DISTRIBUTION OF MATERIAL

This OMS manual is to be distributed as follows:

- 1 copy to the Chief Operating Officer;
- 1 copy to the VP Corporate Affairs;
- 1 copy to the General Manager;
- 1 copy to the Mill Manager/Superintendent;
- 1 copy to the Construction Monitor;
- 1 copy to Alexco's Vancouver office;
- 1 copy to Alexco's Whitehorse office;

- 1 copy to Alexco's Elsa office;
- 1 copy to Alexco's Mill Site office; and
- 1 copy to the Geotechnical Consultant (EBA).

Additional copies are to be submitted to all regulatory agencies, as required.

Copies of this manual are to be available to all personnel who are responsible or involved in the operation, maintenance, and surveillance of the DSTF.

The General Manager is responsible for maintaining the record of location of each copy of the OMS manual and to ensure that all copies are updated, as and when required.

Any requests for copies are to be made to the General Manager who will have that name added to the distribution list, providing a numbered copy for the user, and in doing so ensure the recipient receives ongoing updates. No other copies are to be made by the others.

Out-of-date DSTF materials are to be archived by the General Manager. Out-of-date copies of the OMS manual are to be collected by the General Manager and destroyed. Several copies of the most recently superseded versions are to be archived in secure storage as required for legal purposes.

3.2 MANUAL AND SUPPORTING DOCUMENT LOCATION

The original copy of the OMS manual along with the following supporting documents will be stored electronically and/or in the General Manager's office on site. These documents are maintained and under the control of the General Manager.

The following items shall be covered or referenced in the filing system:

- Operation, Maintenance, and Surveillance Manual;
- As-built drawings from original construction and all subsequent construction phases;
- Construction records including performance and construction plans;
- All design data including both original design data and all modifications or revisions;
- All inspections and annual reviews;
- Photographic records;
- Correspondence with facility designers with relevant supporting information; and
- Correspondence with Regulatory Agencies complete with records of compliance and details of any remedial action.

Along with the above referenced documents, the following specific reports dealing with the DSTF will also be stored in the General Manager's office.

Emergency Planning Documents

- A report by Access Consulting Group entitled "Alexco Keno Hill Mining Corp. Bellekeno Project, Monitoring and Surveillance Plan, QML-0009", dated November 2009 and submitted for the Type A Water Use Licence 2009.
- A report by Access Consulting Group entitled "Emergency Response Plan, QML-0009, Bellekeno Project", dated November 2009 and submitted for the Type A Water Use Licence 2009.
- MSDS documentation for any material used within the DSTF.

DSTF Approval Documents

- Assessment of the DSTF conceptual design by the Yukon Environmental and Socioeconomic Assessment Board (YESAB) file number 2009-0030 in which the project was recommended to proceed subject to recommendations.
- A positive Decision Document by Yukon Government on YESAB file number 2009-0030.
- Quartz Mining Licence QML-0009, Issued by Yukon Government – Energy Mines and Resources on November 17, 2009.
- Dry Stack Tailings Facility Construction and Operation Plan – to be submitted.
- Type A Water Licence QZ09-092 Issued by Yukon Water Board.
- Letter from, Environment Canada Re: Bellekeno Mine, Dry Stacked Tailings Facility & Compliance with the Metal Mining Effluent Regulations (MMER).
- Any other relevant approval document that Alexco has received.

Design Reports

- A letter by EBA entitled "Conceptual Mill and Tailings Location – Flame and Moth Pit, Bellekeno Project near Keno City, Yukon", dated April 29, 2009.
- A letter by EBA entitled "Geotechnical Evaluation – Proposed Mill (Option 3) and DSTF, Flame and Moth Site, Keno City, Yukon", dated August 7, 2009.
- A report by EBA entitled "Preliminary Engineering Design and Management Plan, Dry-Stacked Tailings Facility, Bellekeno Mine Mill Site, Yukon", dated January, 2010.
- A letter by EBA entitled "Response to Water Board Questions – Bellekeno Waste Rock Dump", dated April 1, 2010.
- A letter by EBA entitled "Response to Water Board Questions – Water Management Preliminary Designs" dated April 23, 2010.
- A letter by EBA entitled "Inquiry on use of an Engineering Cemented Tailings Foundation for Dry-Stacked Tailings Facility – Bellekeno Mine Mill Site, Yukon", dated June 11, 2010.

Construction Reviews

- N/A

Annual Performance Reviews

- N/A

3.3 REVIEWING AND UPDATING THE MANUAL

This manual is the first published OMS Manual, and in its current form will be referred to as 2010-1.

This manual will be updated every four years or after any significant change to personnel, operations, and/or design criteria.

A current OMS Manual will be in place through the full life cycle of the DSTF through the end of the operating phase and into decommissioning and closure.

Annual tailings management system reviews are to include an evaluation of this OMS manual.

4.0 MANAGING CHANGE

Various changes to the DSTF will occur during the life of the facility. These changes must not compromise the performance of the DSTF or the OMS manual developed for its management. It is the role of the General Manager to incorporate changes to the DSTF design or operating parameters into the OMS manual. Also, it is the responsibility of the General Manager to review, update, and improve the OMS manual on an as needed basis. Overall authorization of changes falls under the responsibility of the TMT.

Changes to the OMS manual may result from the following:

- Completion of the detailed design of the DSTF;
- Evolution of design through capacity changes, operational efficiencies, closure requirements, performance feedback and life-cycle changes;
- Incorporation of as-built records of construction;
- Variation of performance from design;
- Changes in site management organization, facility description, roles and responsibilities, and operating and reporting procedures;
- Suggestions for improvement;
- Succession planning/training; and
- Regulatory change.

In addition to updating this OMS manual on an as needed basis, Alexco commits to the following:

- Assurance that the standards utilized for the facility are consistent with applicable legislation, codes of practice, relevant standards and sound engineering practice;
- Regular reviews of DSTF issues by the TMT;
- Regular updates to all copies of the OMS Manual;
- Appropriate training for all new personnel assigned to tasks dealing with the DSTF; and
- Communication of any changes to the OMS Manual to all relevant personnel.

5.0 FACILITY DESIGN DESCRIPTION

The following sections summarize the design of the DSTF and the background information used for the design. Additional detailed information can be found in the following reports:

- A report by EBA entitled "Preliminary Engineering Design and Management Plan, Dry-Stacked Tailings Facility, Bellekeno Mine Mill Site, Yukon", dated January 2010.
- A letter by EBA entitled "Inquiry on use of an Engineering Cemented Tailings Foundation for Dry-Stacked Tailings Facility – Bellekeno Mine Mill Site, Yukon", dated June 11, 2010.
- A letter by EBA entitled "Response to Water Board Questions – Bellekeno Waste Rock Dump", dated April 1, 2010.
- A letter by EBA entitled "Response to Water Board Questions – Water Management Preliminary Designs" dated April 23, 2010.

5.1 FACILITY OVERVIEW

The DSTF is situated northeast of the Keno Hill District Mill building, southeast of Christal Lake and west of Keno City as shown in Figure 1. The DSTF area covers an area of approximately 2.4 hectares and is designed to provide for storage and confinement of the tailings based on the assumptions in the design reports.

The tailings are deposited off a conveyor stacker outside the mill building. Approximately 60% of the tailings produced will be placed in the DSTF, the remaining 40% will be placed underground as paste backfill. The tailings for the DSTF storage will be hauled from the tailings stockpile directly north of the mill building to the DSTF and mechanically spread and compacted in controlled lifts to form a stacked tailings deposit.

Components of the DSTF include; a drainage blanket for slope under-drainage, a toe runoff collection ditch, surface water diversion berms, conveyance channel and a water collection pond for run-on surface water management, the tailings stack, and the evapo-transpirative cover material. Also included is instrumentation to monitor the foundation performance of the DSTF that consists of groundwater monitoring wells, ground temperature cables, slope inclinometers and survey monuments. The location of the instrumentation is shown in Figure 1 and instrumentation sections and details are shown on Figure 2.

The toe of the DSTF has been located on an area of shallow bedrock at an elevation above that of the collection pond. The DSTF will have an outer slope of 3.5:1 (horizontal:vertical) or 16 degrees and a final stack crest elevation close to 941 m. The tailings will be up to 15 m deep in the central area of the DSTF. Typical cross sections for the DSTF are shown in Figure 3.

5.2 FACILITY COMPONENTS

The DSTF is made up of the components outlined in Table 1 and shown in Figures 1 and 2.

TABLE 1: DSTF COMPONENTS

Components	Details
Drainage Blanket	Located beneath the DSTF, it provides drainage beneath the facility. This will allow any excess water, whether in the stack or freed from thawing permafrost, to drain away and not build up porewater pressures with the tailings.
Outer Diversion Berms (2)	Located along the eastern perimeter of the DSTF and to the northeast of the mill building to promote runoff flow away from the DSTF and mill areas.
Toe Runoff Collection Ditch	Located outside the western and southern tailings stack perimeter to collect runoff surface water and seepage from the drainage blanket and divert it to the conveyance channel.
Conveyance Channel	Intended to route water collected in the collection ditch to the water collection pond.
Water Collection Pond	A lined excavation designed for water retention of up to 2,500 m^3.
Tailings Stack	Mechanically placed and compacted tailings.
Evapo-transpirative Cover Material	Growth medium to be used as cover over the tailings during reclamation of the DSTF.
Instrumentation	Groundwater monitoring wells, slope inclinometers, ground temperature cables and survey monuments for the monitoring of the foundation and sideslope conditions of the DSTF.

5.3 BASIS OF DESIGN AND DESIGN CRITERIA

The basis of design and design criteria for the DSTF are presented in Table 2. Additional background information used to formulate the basis of design and design criteria for the site conditions, climate, hydrology, seismicity, and tailings characteristics are further summarized in Sections 5.4 through 5.8.

TABLE 2: BASIS OF DESIGN AND DESIGN CRITERIA	
Site Characterization	**Details**
DSTF Capacity	123,220 m^3 to accommodate 198,000 tonnes of tailings based on an average placed bulk density of 1605.5 kg/m^3
Approximate Footprint	2.4 ha.
Distance from the Tailings Stockpile at Mill Building to the DSTF	Varies between 150 m and 370 m
Site Conditions	Overburden soils up to 5 m thick consisting of a gravel overlying silt and sand till, overlying bedrock beneath the toe and slope of the stack. Overburden soils are up to 15 m of frozen silt till beneath the crest of the stack. Groundwater not observed but present within the active layer. Permafrost with variable ground ice contents is present in the foundation soils.
Climatic Conditions	Semi-arid but subject to occasional heavy rainstorms. Light snow cover from October to May. Temperature extremes are characteristic.
Hydrology	Peak and average flow rates based on Clearwater Memorandums.
Seismicity	0.138g (10 % probability of exceedance in 50 years, 1/475)
Operating Requirements	**Details**
Life of Mine	4 years
Mill tonnage	Years 1 and 2 = 7.75 dmt/h (dry-metric tonnes per hour), Years 3 and 4= 13.95 dmt/h
Operations	365 days per year
Tailings Tonnage Production	2010 = 13,600 tonnes 2011 = 40,800 tonnes 2012 = 51,600 tonnes 2013 = 73,360 tonnes 2014 = 18,080 tonnes TOTAL = 197,440 tonnes
Tailings Stored in DSTF	2010 = 8,500 m^3 2011 = 25,500 m^3 2012 = 32.250 m^3 2013 = 45,850 m^3 2014 = 11,300 m^3 TOTAL = 123,400 m^3
Tailings Solids Content	83% by mass
Tailings Characteristics	Particle Size Distribution: 4.5% clay, 40 % silt, 55.5 % sand Specific Gravity Determination: 3.95 Moisture Density Relationship: Optimum Moisture Content: 17 %, Standard Proctor Maximum Dry Density: 1690 kg/m^3 Permeability k = 9.65 x 10^{-8} m/s (Assumed based on particle size distribution) Direct Shear Test: Peak Strength: $\theta' = 35.2^o$, $c' = 20.2$ kPa

TABLE 2: BASIS OF DESIGN AND DESIGN CRITERIA (CONT'D)	
Tailings Deposition Procedures	Placement and compaction on a daily basis
Insitu Tailings Dry Density	1606 kg/m^3 based on 95 % of Maximum Dry Density (MDD) (ASTM D698).
Insitu Tailings Moisture Content	Approximately 20 % (gravimetric moisture content, $W_{water}/W_{dry\ soil}$)
Surface Water Management	Drainage blanket for under-drainage of facility Runoff surface water management with the construction of the surface water diversion berms, ditch, conveyance channel and water collection pond Removal of snow during winter operations
Acid-generating Potential	NP/MPA = 2.0 (see PRA/Inspectorate, 2009, Metallurgical Testing of Samples Originating from the Bellekeno Project). Pyrite removal circuit in mill to remove pyrite from tailings and store underground.
Decommissioning, Closure and Reclamation	Recontouring as necessary, placement of evapo-transpirative cover material and revegetating.
Design Criteria	**Details**
Maximum Crest Elevation	937 m
Minimum Slope of Tailings Stack	3.5H:1V
Maximum Height of Tailings Stack	Approximately 25 m
Ultimate Maximum Thickness of Tailings	Approximately 15 m
Tailings Compaction	Compaction in 300 mm lifts or less to at least 95 % MDD.
Thermal Considerations	Design intent is to allow the permafrost within the foundation to thaw at a slow rate to provide time for dissipation of pore pressure resulting from the thaw. Reduced snow cover will result in colder tailings/ground temperatures; therefore, snow should be regularly cleared off the tailings surface. Snow will tend to accumulate on the lower area along the toe of the DSTF due to both natural snow-drifting and intentional snow clearing of the tailings surface. Snow should be cleared away from the toe area to promote deeper seasonal frost penetration into the original ground and to minimize runoff water from the DSTF surface during freshet.
Subgrade Preparation	Trees to be cleared and drainage blanket installed in the same year as tailing placement.
Critical Design Tailings Stack Failure Surface	Deep failure cutting through stack to a receding permafrost interface in the foundation soil.
Design Factors of Safety	Long Term Stability: 1.4, Seismic (Pseudo-static) Stability: 1.3 based on British Columbia Interim Guidelines for Investigation and Design of Mine Dumps (Waste Rock Design Manual)
Seismic Design Criteria	0.138g (10 % probability of exceedance in 50 years, 1/475)
Liquefaction of Tailings Stack	Tailings placed in unsaturated state and compacted to 95 % MDD; therefore, not susceptible to liquefaction.
Closure Design	Climatic and instrumentation monitoring required to complete closure design.

5.4 SITE CONDITIONS

5.4.1 General Surficial Geology

Boreholes drilled within the plan area of the DSTF have determined that bedrock is shallow and overburden thicknesses range from 1.5 m to over 15 m based on exploration drilling. The overburden soils generally comprise glaciofluvial gravels and sand and silt till.

5.4.2 Surface Features

The site in the vicinity of the DSTF slopes generally west at approximately 15% to 20%. There is disturbance in the area from previous surface earthwork and historic mining of the United Keno Hill Mines Flame and Moth Mine site. A trail runs roughly north with a ditch that follows it to convey runoff around the former mine site.

A ridge crosses the site in a north-south direction, sloping approximately 5% to 10% south.

Vegetation in the area consists mostly of mosses and small spruce trees.

5.4.3 Subsurface Conditions

Geotechnical investigations from previous projects undertaken by EBA on or near the site indicate that the subsurface conditions generally comprise one of two general soil profiles:

- Glaciofluvial gravel underlain by bedrock, or
- Silt and sand till underlain by gravel and bedrock.

The gravel was encountered along the ridge in both frozen and unfrozen states. The gravel found to be typically sandy with trace silt, underlain by a thin layer of silt and sand till and then bedrock. Bedrock encountered in the area is competent quartzite.

All silt and sand till encountered was frozen. The till typically contains trace gravel and trace clay, underlain by gravel seams within the till and then by quartzite bedrock.

The anticipated locations of each soil profile are shown in Figure 4.

5.4.4 Groundwater

No groundwater was reported in any of the boreholes drilled within the DSTF footprint. However, shallow groundwater was encountered in BH17 at 1.2 m depth, and a standpipe piezometer was installed at that location to the northwest of the mill.

5.4.5 Permafrost

Permafrost was encountered in boreholes drilled throughout the vicinity of the DSTF, at varying depths. Encountered permafrost ranged from non-visible, non-excess ice to massive ice lenses with volumes ranging from less than 5% to nearly 100% of the total soil volume.

Ground temperature instrumentation was installed in four locations and shows that the permafrost within the DSTF footprint is very warm, approximately -0.2ºC to -0.4ºC. Permafrost is not expected to extend beyond 20 m depth in the DSTF area.

5.4.6 Bedrock

Depths to bedrock (quartzite) are indicated to range from 1.5 m to greater than 15 m based on geotechnical drilling carried out in the preliminary design phase of the DSTF. There is no exposed bedrock within the DSTF.

5.5 CLIMATE

The Keno Hill region has been monitored by at least three meteorological stations. Two stations were maintained by the Atmospheric Environment Service (AES) and were located at Elsa and on the southern area of Keno Hill. A third station was operated for two summers in the Flat Creek catchment near the Elsa town site. Additionally, the AES operate a station at the Mayo Airport. An automated meteorological station (Calumet Weather Station) was installed on Galena Hill in June 2007. The station measures air temperature, relative humidity, barometric pressure, rainfall, wind speed and direction, solar radiation, and soil temperature. A Yukon government monitored snow course station exists in the area.

The property lies in an area of semi-arid climate but is subject to occasional heavy rainstorms. Snow cover is light and covers the area from October to May. Extreme temperatures are common in the area.

The long-term mean climatic data estimated for the Bellekeno site is summarized in Table 3.

TABLE 3: SUMMARY OF MEAN CLIMATIC CONDITIONS AT BELLEKENO

Month	Monthly Air Temperature[a] (°C)	Monthly Wind Speed[b] (km/h)	Daily Solar Radiation[c] (W/m²)
January	-25.7	7.5	10.2
February	-19	8.9	39.0
March	-9.6	10.0	102.0
April	0.9	11.7	180.7
May	8.4	11.8	229.9
June	14	10.8	255.4
July	16	9.5	225.8
August	13.1	9.6	170.1
September	6.4	10.7	99.1
October	-2.9	11.9	41.5
November	-15.9	8.9	14.2
December	-22.3	7.8	5.3

Notes:

(a) based on Climate Normals 1971-2000 at Mayo Airport (Environment Canada website)

(b) based on Climate Normals 1971-2000 for Burwash, Mayo, Watson Lake, and Whitehorse (Environment Canada website)

(c) based on Climatic Normals 1951-1980 at Norman Wells and Whitehorse (Environment Canada, 1982)

5.6 HYDROLOGY

Three hydrologic report documents were reviewed during the design to establish the hydrologic site conditions.

- A memorandum by Clearwater Consultants Ltd. entitled "Memorandum CCL-UKHM-1" submitted to Access Consulting Group on May 16, 2008.
- A memorandum by Clearwater Consultants Ltd. entitled "Memorandum CCL-UKHM-2 - FINAL" submitted to Access Consulting Group on August 20, 2009.
- A memorandum by Clearwater Consultants Ltd. entitled "Memorandum CCL-UKHM-3" submitted to Access Consulting Group on June 4, 2010.

Information found in the 2008 Clearwater memorandum tends to address stream flow data within the Keno Hill District property and is intended for use in site wide water balance and mass loading calculations. The design of any diversion or routing structures should be conducted for a peak instantaneous flow.

The 2009 Clearwater memorandum details an assessment of several return periods and potential volumes of spring freshet runoffs that could be generated by the DSTF and mill areas.

Streamflow data from 2003 – 2007 is analyzed and presented in the 2010 Clearwater memorandum. A comparison of the data with the 1996 hydrology study is also presented along with relevant minesite area catchments.
The 1996 characterization of climate was used in the determination of hydrologic conditions and has been compared with recent datasets and considered to be an accurate representation of site climatic conditions.

5.6.1 Hydrological Conditions

A site analysis was presented in the 2009 Clearwater memorandum estimating the peak flow rates for freshets of three different return periods in the DSTF and mill pad area. The area included in these estimates comprises a total surface area of 0.0627 km^2 and is presented in Figure 5. The peak instantaneous flow rates for the tailings facility are presented in Table 4.

TABLE 4: ESTIMATED FLOOD DISCHARGES AT DSTF AND MILL PAD AREA

Return Period (years)	Peak Instantaneous Flow Rates (m^3/s)	
	Best Estimate[a]	Conservative Estimate[b]
10	0.0074	0.015
100	0.012	0.02
200	0.013	0.021

Notes:

(a) Best estimate based on linear regression equations from Regional analysis.

(b) Conservative estimate based on envelope curves from Regional analysis.

5.7 SEISMICITY

Information regarding seismicity for the Bellekeno Mine was provided by the Canadian Geological Survey Pacific Geosciences Centre. An acceleration of 0.138 g would have a 10% probability of being exceeded in 50 yrs, which equates to an annual probability of exceedance of 1/475. This probability of exceedance was used in the DSTF design.

5.8 TAILINGS CHARACTERISTICS

5.8.1 Tailings Production

The life of mine plan during the design indicated that the total amount of tailings produced would be 328,800 tonnes, with approximately 198,000 tonnes being stored in the DSTF during the mine life. The anticipated tailings production by year and anticipated tailings storage in the DSTF (based on the 2010 EBA preliminary design and start and end dates of September 1, 2010 and April 1, 2014, respectively) are presented in Table 5.

TABLE 5: ANTICIPATED TAILINGS PRODUCTION

Year	Total Production (tonnes)	Total Production (m^3)	Total Placed at DSTF (tonnes)	Total Placed at DSTF (m^3)
2010	22,670	14,170	13,600	8,500
2011	68,000	42,500	40,800	25,500
2012	86,000	53,750	51,600	32,250
2013	122,270	76,420	73,360	45,850
2014	30,160	18,850	18,080	11,300
Total	**329,100**	**205,690**	**197,440**	**123,400**

5.8.2 Tailings Characterization

EBA conducted laboratory testing to evaluate the geotechnical properties of one tailings samples taken from the Elsa Tailings facility. The particle size distribution of the Elsa Tailings is nearly identical to the particle size distribution determined from the proposed Bellekeno Tailings from bench scale testing. A summary of the laboratory test results is presented in Table 6.

TABLE 6: TAILINGS LABORATORY TEST RESULTS	
Type of Test	Results
Particle Size Distribution	Clay: 4%, Silt: 41%, Sand 55% Clay: 5%, Silt: 39%, Sand 56%
Specific Gravity Determination	Specific gravity of solids: 3.95
Moisture Density Relationship	Optimum moisture content: 16.5%, Maximum Dry Density (MDD), standard effort: 1690 kg/m^3
Direct Shear Test	Peak Strength: $\theta' = 35.2°$, $c' = 20.2$ kPa

Note:

The above tests report moisture content as a percentage ratio of the mass of water divided by the mass of dry solids, this is consistent with geotechnical engineering practice.

5.8.3 Acid Generation Potential

Acid-base accounting was conducted by PRA (2009) on tailings samples from LC1 bulk tails, which will be deposited in the DSTF. These tailings were found to have a neutralizing potential (NP) of 43.3 and a Maxiumum Potential Acidity of 22.2, yielding a NP/MPA ratio of 2.0, which PRA concludes make the tailings not likely to be acid-generating. The possibility of acid generation in tailings, because of the large available surface area, will ensure that any acid generated through sulphide oxidation is neutralized quickly in situ by reactive neutralizing constituents.

In addition, a pyrite removal circuit is included in the mill process flowsheet to remove pyrite from the tailings and store underground.

6.0 REGULATORY REQUIREMENTS

6.1 REGULATORY AGENCIES

The regulatory agencies involved in the operation, maintenance, and surveillance of the DSTF include:

Mineral Development, Energy, Mines and Resources

- To the Chief: Director, Mineral Resources, Department of Energy, Mines and Resources, P.O. Box 2703, K-9 Whitehorse, Yukon, Y1A 2C6, (fax) 867.456.3899

Yukon Water Board

- To the Water Board: Yukon Water Board, Suite 106, 419 Range Road, Whitehorse, Yukon, Y1A 3V1, (fax) 867.456.3890

6.2 REGULATORY APPROVAL

The DSTF is authorized with the following documents:

- Letter of approval of "Stack Tailings Facility Construction and Operation Plan" from Yukon Government, Energy Mines and Resources (plan yet to be submitted)
- Water Licence QZ09-092

6.3 REGULATORY REQUIREMENTS

The regulatory requirements for the DSTF are outlined in the following document:

- A letter from Yukon Government Energy, Mines and Resources entitled, "Bellekeno Mine Project QML-0009 – Plan Requirements", dated November 18th, 2009.
- Type A Water Licence QZ09-092 issued by Yukon Water Board
- Quartz Mining Licence QML-0009 issued by Yukon Government – Energy, Mines & Resources

7.0 OPERATION

7.1 OBJECTIVE

Operation of the DSTF comprises of the ongoing construction of the facility and its related components. Construction of the tailings stack itself occurs daily where as the other DSTF components, the drainage blanket, outer diversion berms, toe runoff collection ditches, conveyance channel, water collection pond, instrumentation, and evapo-transpirative cover, are completed on a specific project basis. The timeline for construction of these components is based on the upcoming year's tailings placement plan.

Operations of the DSTF must ensure the following:

- The basis of design remains valid and design criteria are being achieved;
- Changes in the mine plan, milling throughput, and filtering operations are accounted for; and
- Construction planning takes into consideration restrictions on availability of construction materials and time of year construction requirements.

The General Manager and the Construction Monitors are responsible for overseeing the general construction of the DSTF with the support of the geotechnical and environmental consultants, if necessary. The General Manager is in charge of completing day to day tailings placement and compaction and specific component projects as required.

7.2 DSTF CONSTRUCTION PLAN

7.2.1 Design Life Construction Plan

The ultimate footprint of the DSTF and the location of its components are presented in Figure 1. Figure 2 presents the instrumentation details while Figure 3 presents the typical cross sections for the DSTF.

7.2.2 Annual Construction Plan

The anticipated tailings production schedule based on EBA's preliminary design is shown in Table 7.

TABLE 7: TAILINGS PRODUCTION SCHEDULE	
Year	Production (tonnes)
Q4 2010	22,700
2011	67,900
2012	86,000
2013	122,200
Q1 2014	30,000
TOTAL	**328,800**

Table 8 details Alexco's plans for the ongoing construction of the DSTF. The annual construction plan is visually summarized in Figures 6, 7, and 8. The closure footprint of the DSTF can be seen in Figure 9.

TABLE 8: ANNUAL CONSTRUCTION PLAN	
Year	Details
2010	Year 1 excavation and placement of drainage blanket using excavated gravel to year 1 tailings placement extents. Construct outer runoff diversion berms, conveyance channel, year 1 runoff collection ditch and water collection pond. Tailings placement as shown in Figure 6.
2011	Placement of drainage blanket using gravels excavated in year 1 to the extents of year 2 tailings placement. Continue tailings stack expansion to south and east.
2012	Year 3 excavation and placement of drainage blanket using excavated gravel to year 3 tailings placement extents. Construct year 3 runoff collection ditch. Continue tailings stack expansion to north and east. Commence placement of evapo-transpirative cover over tailings placed to the end of year 2.
2013	Year 4 excavation and placement of drainage blanket using excavated gravel to full DSTF extents. Construct year 4 runoff collection ditch. Continue tailings stack expansion to north. Placement of evapo-transpirative cover over tailings placed during year 3.
2014	Continue to place tailings to full extent as shown in Figure 9. Placement of remaining evapo-transpirative cover, revegetate as necessary.
2015	Closure year. Monitoring, recontouring and revegetating DSTF surface as necessary.

7.2.3 Contingency Plan

Daily monitoring and observational approaches are expected to forewarn of potential adverse conditions that may be a result of thaw induced deformation. These include, but are not limited to: excessive tension cracking on the construction surface, visible slope deformation on the downstream sideslope of the waste rock shell, and scarping on the

construction surface, and monitoring of instrumentation. These kinds of observations would trigger geotechnical engineering support and increased measurement frequencies of the instrumentation.

Severity triggers are not easily defined and therefore any conditions and/or trends observed to be uncharacteristic would be handled with urgency to seek a better understanding of risk. Once the risk has been defined, appropriate steps can be engineered and implemented to rectify any nonconformance.

7.3 DSTF CONSTRUCTION COMPONENTS

7.3.1 Drainage Blanket

7.3.1.1 Ground Surface Preparation

Surface preparation within the drainage blanket footprint is limited to the sequential flattening and removal of trees. This must be completed with the standing trees being sheared off just above the ground surface. Minimal disturbance to the ground surface is required to protect the underlying permafrost foundation material. Trees that are removed from the footprint should be subsequently removed from site and may not be burnt on site. Ground surface preparation and drainage blanket placement should take place in the same year as tailings placement.

7.3.1.2 Material Composition and Placement

The drainage blanket is to be constructed with gravel material obtained from excavation near the toe of the DSTF. The drainage blanket is then covered with a properly bedded geosynthetic clay liner to act as a collect any seepage leaving the tailings stack. This material will help prevent tailings and tailings porewater and from infiltrating the coarser gravel material of the drainage blanket. The geosynthetic clay liner shall conform to the minimum specifications presented in Table 9.

TABLE 9: RECOMMENDED MINIMUM GEOSYNTHETIC CLAYLINER PROPERTIES	
Physical Property	Minimum Material Properties (Weakest Principal Direction)
Bentonite Mass per Unit Area	3.67 kg/m^2
Grab Tensile Strength	420 N
Peel Strength	66 N
Hydraulic Conductivity	5x10^{-9} cm/sec max.
Internal Shear Strength at 10 kPa normal stress	24 kPa
Geotextile Component Properties	
Mass per Unit Area (non-woven)	200 g/m^2
Mass per Unit Area (woven)	105 g/m^2
Bentonite Component Properties	
Swell Index	24 ml/2g min.
Moisture Content	12% max.
Fluid Loss	18 ml max.

The gravel material is specified to have a maximum size of 300 mm, and the fines (< 0.080 mm sieve size) content must be less than 5% by weight. It should be placed and compacted in maximum 300 mm lifts. Compaction of this material is achieved with the addition of water and compactive effort from a steel drum vibratory packer. This material must be placed in a manner that will minimize segregation or nesting of coarse particles. The effectiveness of this construction technique will be evaluated in the field by the Geotechnical Engineer and changes to the construction procedure will be made as required. Boulders greater than 300 mm size should be removed from the fill as much as practically possible and pushed to the slope face.

A geocomposite drain is required above the GCL to help alleviate any potential porewater pressure buildup in the tailings stack. The geocomposite drain is to be a sheet of geo-net placed directly on the GCL and a layer of nonwoven geotextile conforming to the properties in Table 10 above the geo-net. The tailings are to be placed and compacted directly over the nonwoven geotextile.

TABLE 10: RECOMMENDED MINIMUM NONWOVEN GEOTEXTILE PROPERTIES	
Physical Property	Minimum Average Roll Value (Weakest Principal Direction)
Thickness – Typical (ASTM D5199)	2.1 mm
Grab Tensile Strength (ASTM D4632)	911 N
Elongation at Failure (ASTM D4632)	50 %
Trapezoidal Tear Strength (ASTM D4533)	378 N
Puncture (ASTM D4833)	578 N
Apparent Opening Size (ASTM D4751)	180 microns
Weight – Typical (ASTM D5199)	271 g/m^2

7.3.2 Outer Diversion Berms

7.3.2.1 Ground Surface Preparation

Surface preparation within the footprint of the outer diversion berms is limited to the sequential flattening and removal of trees. This must be completed with the standing trees being sheared off just above the ground surface. Minimal disturbance to the ground surface is required to protect the underlying permafrost foundation material. Trees that are removed from the footprint should be subsequently removed from site and may not be burnt on site.

7.3.2.2 Material Composition and Placement

The 300 mm gravel material will be used to construct the diversion berms. It must be a well-graded material with a 300 mm maximum aggregate size and a fines content (< 0.080 mm sieve size) limited to about 15%, or as approved by the Engineer.

The 300 mm material for diversion berms should be placed in maximum lift thicknesses of 300 mm and each lift compacted to approximately 95% of MDD.

7.3.3 Conveyance Channel

7.3.3.1 Ground Surface Preparation

Surface preparation within the footprint of the conveyance channel is limited to the sequential flattening and removal of trees. This must be completed with the standing trees being sheared off just above the ground surface. Minimal disturbance to the ground surface is required to protect the underlying permafrost foundation material. Trees that are removed from the footprint should be subsequently removed from site and may not be burnt on site.

7.3.3.2 Material Composition and Placement

The conveyance channel will be constructed from 300 mm gravel material and will not require an excavation. The channel will be lined with a geosynthetic or steel ditch liner. If used, the geosynthetic liner must conform to the material specifications detailed in Table 9. The 300 mm gravel material used to construct the channel must be a well-graded material with a 300 mm maximum aggregate size and a fines content (< 0.080 mm sieve size) limited to about 15%, or as approved by the Engineer.

The 300 mm material for the conveyance channel should be placed in maximum lift thicknesses of 300 mm and each lift compacted to approximately 95% of MDD.

7.3.4 Toe Runoff Collection Ditch

7.3.4.1 Ground Surface Preparation

Surface preparation within the footprint of the runoff collection ditch is limited to the sequential flattening and removal of trees. This must be completed with the standing trees

being sheared off just above the ground surface. Minimal disturbance to the ground surface is required to protect the underlying permafrost foundation material. Trees that are removed from the footprint should be subsequently removed from site and may not be burnt on site.

7.3.4.2 Material Composition and Placement

The toe runoff collection ditch will be a lined excavation into native soils. The ditch will be lined with a nonwoven geosynthetic liner conforming to the material specifications detailed in Table 9. Alternatively, a steel ditch liner may be used or strips of HDPE can be installed in the bottom of the excavated collection ditch.

7.3.5 Water Collection Pond

7.3.5.1 Ground Surface Preparation

Surface preparation within the footprint of the water collection pond is limited to the sequential flattening and removal of trees. This must be completed with the standing trees being sheared off just above the ground surface. Minimal disturbance to the ground surface is required to protect the underlying permafrost foundation material. Trees that are removed from the footprint should be subsequently removed from site and may not be burnt on site.

7.3.5.2 Material Composition and Placement

The water collection pond will be a lined excavation into native soils. The pond will be lined with a geosynthetic liner conforming to the material specifications detailed in Table 9.

7.3.6 Tailings Stack

7.3.6.1 Ground Surface Preparation

All tailings are to be placed on top of the filter material which covers the drainage blanket. Thus, no further surface preparation is required, except the removal of snow, ice or other deleterious material, as necessary.

7.3.6.2 Material Composition and Placement

The composition of the tailings is subject to the milling and filtering processes. Milling operations, particularly the ore crushing and grinding system, are not subject to dramatic changes; therefore, the particle size distribution of the tailings is fairly consistent. Any planned changes in grinding will be monitored closely against tailings particle size distribution, moisture content, and compaction performance. Some variation will be the result of the variability in the host rock ore. The filter system is to produce the dry stack tailings to have a solids content of 83% for the solid-water mixture when delivered to the DSTF.

The tailings surface will be wetted using a water truck if the surface is dry and dust is being created due to trafficking. Equipment is not to make sharp turns or other manoeuvres that may loosen the compacted surface.

The tailings should be placed in maximum lift thicknesses of 300 mm, with each lift compacted to no less than 95% of MDD.

7.3.7 Evapo-transpirative Material

7.3.7.1 Ground Surface Preparation

No ground surface preparation is required prior to the placement of the evapo-transpirative material, except the removal of snow, ice or other deleterious materials, as necessary.

7.3.7.2 Material Composition and Placement

The evapo-transpirative material will consist of gravels previously excavated from near the toe of the DSTF. It must provide a suitable growth medium for revegetation. A progressive reclamation strategy will be followed involving placement of evapo-transpirative material starting in Year 3. The reclamation material should be left loose, graded and revegetated to prevent surface erosion.

7.4 EQUIPMENT USED FOR CONSTRUCTION

Alexco will use equipment readily available on site for all aspects of construction to achieve the design criteria of DSTF. Table 11 lists typical equipment that may be employed in the construction of the DSTF.

TABLE 11: TYPICAL CONSTRUCTION EQUIPMENT

Unit	Use
Cat 966 Wheel Loader	Loading tailings from stockpile at the tailings filter building into the haul truck
Cat D7 Dozer	Spreading of construction material and construction of components
Cat A40 Articulated Rock Truck	Hauling tailings from stockpile to the DSTF
Cat 563 Packer	Packing placed tailings to achieve design criteria
Cat 12G/14G Grader	Clearing and leveling lifts for general erosion control and snow removal

7.5 ADVERSE OPERATING CONDITIONS

Potentially adverse conditions must be accounted for in the operation of the DSTF. These conditions, along with mitigative measures of dealing with them, are as follows.

- High Rainfall
  - Erosion control – grade control and compaction of tailings stack during construction to seal lifts and prevent pooling of water.

  - Compaction – may require drying out material prior to achieving compaction. At the discretion of the Geotechnical Engineer, material requiring additional compactive effort will be moved to less critical areas of the DSTF; i.e. south portion of the placement area away from the ultimate tailings slope, if required.

- High snow accumulation
  - Removal prior to lift placements.
  - Snow dumps will be sited to minimize any erosional impacts during thaw conditions.

- Freezing temperatures
  - Location of placement – east portion of placement area away from the ultimate tailings slope as compaction prior to freezing problematic.
  - Compaction – must be completed prior to the tailings freezing.

- Tailings Characteristics (higher moisture)
  - Location of placement – south portion of placement area away from the ultimate tailings slope
  - Compaction – may require drying out material prior to achieving compaction. At the discretion of the Geotechnical Engineer, material requiring additional compactive effort will be moved to less critical areas of the DSTF; i.e. south portion of the placement area away from the ultimate tailings slope, if required.

7.6 SURFACE WATER MANAGEMENT

Runoff surface water entering the DSTF is managed through the construction of the outer diversion berms, toe runoff collection ditches, the conveyance channel and the water collection pond.

Surface water within the DSTF is managed with the construction of the drainage blanket and ensuring the tailings stack is graded to reduce the potential of surface erosion and direct any surface water to areas in which it can drain away from the facility.

Snow is to be removed from the tailings stack throughout the winter; therefore, the potential for surface water issues during spring thaw will be greatly reduced.

7.7 ENVIRONMENTAL PROTECTION

A paramount consideration in minimizing the damage due to an unforeseen event is the reliance on as many people as possible to be watchful for possible problems or upset conditions at the facility. It is every employee's responsibility to report a suspected spill or uncontrolled release event to their supervisor. This includes suspicious flows of water out of the area, escaping tailings, turbid creek water, etc. The significance of multiple sets of eyes is the reality that time plays a critical role in being able to mitigate an emergency situation, should one arise. The sooner appropriate persons can begin to correct a situation, the less likely it is that severe impacts will follow.

Given that the tailings are placed in an unsaturated state and filter materials are a part of the design to restrict the tailings from transport, it is not likely that any tailings will be released from the DSTF.

7.8 HEALTH, SAFETY, AND SECURITY

The Bellekeno Mine is located in a remote setting approximately 460 km northeast of Whitehorse and is accessed either by land via the North Klondike and Silver Trail highways and the radio controlled Bellekeno access road or by air. The closet airstrip is in the village of Mayo, approximately 60 km west. The mill site is not subject to general public traffic. Access roads from the mill site to and around the DSTF are shown on Figure 1. Established communication throughout the mine site and the DSTF consists of short wave radio.

All personnel working at the DSTF, including contractors, are to have an appropriate understanding of the OMS manual and their respective roles and responsibilities. It is the role of the specific supervisor of the personnel to ensure this is the case. In addition to the general understanding of the OMS manual, it is the responsibility of all personnel involved in the construction of the DSTF to be continually vigilant of changes reflecting facility performance. Anything observed to be outside of normal operating parameters, as outlined in this manual, are to be reported immediately to the General Manager.

The tailings materials themselves contain trace amounts of reagents added in the milling process. These reagents include, but may not be limited to, MIBC (frother), SIBX (collector) 3418A (collector) Zinc Sulphate, Sodium Sulphite, Lime, and Copper Sulphate (regulators). As a general precaution, it is recommended that any worker handling or coming into contact with the tailings wash their hands prior to ingesting any food. Further information regarding these reagents is available in the MSDS compilations found around site and in the General Manager's office.

Workplace safe operating procedures will be in place for those working in the area.

7.9 DOCUMENTATION

The following table identifies the overall responsibilities for operational record keeping completed by Alexco personnel:

TABLE 12: DSTF OPERATIONS DOCUMENTATION

Task	Responsible Party	Information Recipients
Daily Dry Tailings Production	Completed by Mill Operations – under Mill Superintendent	General Manager – copy; Mill Manager – copy; Bellekeno Mill Engineering Server
Daily Construction Activity	Mill Manager	Construction Monitor – copy
Daily Check Sheet	Completed by Construction Monitor	General Manager – copy; Mill Manager – copy; Bellekeno Mine Engineering Server
Monthly Placement As built	Completed by Construction Monitor	General Manager – copy; Mill Manager – copy; Bellekeno Mine Engineering Server
Instrumentation Data	Completed by Construction Monitor	General Manager – copy; Mill Manager – copy; Bellekeno Mine Engineering Server
Construction Photographs	Completed by Construction Monitor	General Manager – copy; Mill Manager – copy; Bellekeno Mine Engineering Server

All consultants' reports are retained in the General Manager's files. Consultants' reports include, but are limited to, the following:

- Particle size distribution testing for construction materials;
- Moisture density relationship testing for construction materials;
- Density testing on placed tailings; and
- Water quality monitoring.

7.10 REPORTING

Any observations through the daily monitoring of the facility that identify significant change in the condition of the facility, or that the design criteria are not being achieved should be reported to the General Manager, the facility designer, and Chief Operating Officer.

Changes to the ongoing operations of the DSTF should be reported to the facility designer and the Chief Operating Officer.

Any environmental changes to the DSTF should be reported to the Chief Operating Officer.

8.0 MAINTENANCE

8.1 OBJECTIVE

The objective of the maintenance program is to maintain the DSTF in accordance with all the performance criteria, legislative requirements, Alexco company standards, and sound operating practices.

Maintenance for the DSTF is limited to the heavy equipment used for the ongoing construction and the DSTF components themselves. Maintenance of the heavy equipment could consist of routine, predictive, and event-driven maintenance and will be managed by the General Manager. Maintenance for the DSTF components is strictly event-driven maintenance and will result from inspections completed by the Construction Monitor, General Manager, or the Mill Manager.

8.2 MAINTENANCE PROCEDURES

A preventive maintenance program is in place for the heavy equipment used by Alexco at the DSTF under the direction of the Site Services Manager. Event-driven maintenance for the heavy equipment would be due to breakdowns or incidents. Whether a piece of equipment is down due to preventive, routine, or event-driven maintenance, other equipment on site can be made available for use at the DSTF as required.

Event-driven maintenance to the DSTF components will be directed by the Construction Monitor or Mill Manager under the consultation of the facility designer and the General Manager. The actual maintenance program completed will depend on the severity of the occurrence.

8.3 DOCUMENTATION

Record keeping and documentation the any heavy equipment maintenance is the responsibility of the Site Services Manager.

Event-driven maintenance for a DSTF component is the responsibility of the Construction Monitor. It involves completion of inspection reports and depending on the severity of the event involves the General Manager and the geotechnical consultant, if necessary. Documentation of any maintenance completed will be used to access the performance of the specific component and determine whether the design, operation, or surveillance of that component must be adjusted.

8.4 REPORTING

Reporting of any heavy equipment maintenance is limited to a specific request by the Site Services Manager to the General Manager.

Inspection reports and any other documentation regarding event-driven maintenance for a DSTF component should be submitted to the facility designer and VP Engineering to determine whether any adjustments to the design, operation, or surveillance are required. The geotechnical consultant may also be contacted, if necessary.

9.0 SURVEILLANCE

9.1 OBJECTIVE

Surveillance involves inspection and monitoring of the operation, structural integrity, and safety of the DSTF, and must be consistent with the life cycle and regulatory requirements of the facility. Surveillance of the DSTF consists of both routine and event-driven activities.

Key surveillance parameters and procedures must be identified for:

- Monitoring the operation, safety, and environmental performance of the DSTF;
- Promptly identifying and evaluating deviations from expected behaviour that affect operation safety, structural integrity, and environmental performance of the facility; and
- Reporting significant observations for response.

The DSTF surveillance program will continue to evolve as the facility changes in design or performance criteria, site conditions and/or the operation it is accommodating.

All personnel working at the DSTF will be involved in surveillance as a routine part of daily activities, maintaining visual awareness of the facility in the course of their regular and/or routine duties, in addition to surveillance-specific site engineering, instrument monitoring, analysis, inspection, periodic review and oversight.

It is the combination of all the regular inspections assisted by the eyes of all site personnel that ensures continued integrity and performance of the facility.

Outside consultants will also be on site periodically inspecting the facility as part of a regular program of expert review.

9.2 RESPONSIBILITY

A number of personnel conduct routine inspections of the DSTF. The Construction Monitor, or his designated replacement is assigned the responsibility of obtaining the monitoring information and preparing a monthly report for the facility designer and geotechnical consultant to review.

9.3 SURVEILLANCE PARAMETERS

Key parameters of surveillance are identified through identifying and describing potential failure modes of the DSTF.

Visual observations of the DSTF can indicate potential failure modes such as:

- Surface – cracking, bulging, depressions, sink holes;
- Seepage – new seepage areas, changes in seepage areas;
- Turbid water in the natural drainages around or downstream of the facility;
- Water or tailings flowing down the stack indicating improper grading; and

- A failure or breach of a component of the facility.

Routine monitoring for ensuring facility performance include:

- Checking for settlement or holes in embankment crest or benches;
- Checking for holes on the surface of the tailings indicating possible piping of material to outside;
- Checking for dust;
- Measuring water levels in monitoring wells located in the foundation soils during operation;
- Measuring ground temperatures using cables in the foundation soils during operation;
- Surveying DSTF components - displacements of survey monuments;
- Measuring slope inclinometers located in the foundation soils;
- Water sampling of Christal Creek; and
- Recording weather conditions.

These parameters are further described in the following sections.

9.4 SURVEILLANCE PROCEDURES

Table 13 summarizes surveillance requirements for the components of the DSTF. These surveillance requirements are the licensed monitoring requirements and conditions regarding the tailings presented in Alexco's Quartz Mining and Water Use licenses.

TABLE 13: OPERATIONAL MONITORING SCHEDULE FOR DSTF

Frequency	Provision	Source/Location	Personnel	Scope	Deliverable
Periodically During Construction	EBA Design Report and Quality Assurance Program	Entire Facility	Engineering Supervision	Follow monitoring and inspection procedures in Quality Assurance Program	Interim Reporting to Site Management with recommendations for construction process
Weekly	EBA Design Report and Quality Assurance Program	Structure of the tailings (toe, dam, tailings, etc.)	Operational personnel	Visual assessment of tailings, diversion berms, collection ditches, conveyance channel and water collection pond.	Daily Log, included in annual report.
Weekly	EBA Design Report and Quality Assurance Program	Tailings final runoff	Operational personnel	Visual inspection for suspended solids and erosion evidence.	Daily Log, included in annual report.

TABLE 13: OPERATIONAL MONITORING SCHEDULE FOR DSTF – CONT'D					
Weekly	EBA Design Report and Quality Assurance Program	Toe runoff collection ditches and conveyance channel	Operational personnel	Visual inspection for failures (possible or occurring) with more frequent checks during spring breakup period	Daily Log, included in annual report.
Weekly	EBA Design Report and Quality Assurance Program	Tailings Material	Operational personnel	Record tailings moisture content	Daily Log, included in annual report.
Weekly	Type A Water Licence Q209-092	Tailings Solids ABA Testing	Operational Personnel	Split a 200-500g sample from the daily 24-dried, metallurgical composite sample and retain in a plastic bag	Send a composite sample once per month to an accredited laboratory, as per Appendix C – evaluate results
Monthly	EBA Design Report	Groundwater Piezometer	Operational Personnel	Record readings and submit to VP Engineering for review	Results included in annual report.
Monthly	EBA Design Report	Ground Temperature Cable	Operational Personnel	Record readings and submit to VP Engineering for review	Results included in annual report.
Monthly	EBA Design Report	Settlement Monument Survey	Qualified Surveyor	Record elevations and submit to VP Engineering for review	Results included in annual report.
Monthly	Type A Water Licence Q209-092	Tailings Seepage	Operational Personnel	Sample and lab analysis of tailings supernatant, inspect for seepage, estimate flow	Representative samples shall be collected for laboratory analyses according to Set A[1] requirements outlined in the WUL.[2]
Monthly	EBA Design Report	Tailings Deposit	Operational Personnel	Confirm design moisture content density is being achieved	Results included in annual report.

TABLE 13: OPERATIONAL MONITORING SCHEDULE FOR DSTF – CONT'D					
Monthly	EBA Design Report	Tailings Disposal Basin	Qualified surveyor	A surface profile of the tailings along the centre line of the tailings disposal basin	Map and written description of profile.[2]
Annually	QML – Section 9.3.2	Tailings Disposal Basin	Professional engineer licensed to practice in the Yukon	Thorough visual assessment and physical inspection of the tailings, review of monitoring data to confirm design assumptions, preparation of inspection report	Representative samples shall be collected for laboratory analyses of grain size distribution, densities and moisture content.[2] Submission of inspection report.
Annually	Type A Water Licence Q209-092	Center Line of Tailings	Operational personnel	Full depth of tailings will be sampled at four stations along the center line.	Samples will be checked in the field for the presence of frozen tailings. Screen analyses will be done in the laboratory as a check on the homogeneity of the tailings and densities and moisture contents will be determined.[2]

Notes:

1 Set A - water quality analysis includes physical parameters, anions, nutrients, dissolved metals, total metals, and total suspended solids (Table 10.2 - WUL Application)

2 All results from the operation monitoring schedule will be included in the annual report to the Water Board

9.5 ADAPTIVE MANAGEMENT

Fundamental to successful adaptive management of the tailings production, handling and placement are triggers for management action. If the tailings handling and deposition is not meeting critical performance objectives according to specific conditions within either the WUL or the QML, the General Manager will be expected to follow Table 14 for appropriate corrective action. Close monitoring of the performance of the DSTF will be critical in determining if and when action will be required. It is expected that improvements will be made to the system on an ongoing basis once initial operating experience has been gained.

TABLE 14: TRIGGERS AND ACTIONS UNDER ADAPTIVE MANAGEMENT FOR TAILINGS MANAGEMENT			
Provision	Monitored Item	Triggers/Thresholds	Action
EBA Design Report	Groundwater Monitoring Wells	Tip @ 1.0 m or 1.7 m depth - Porewater pressure parameter (Ru) exceeds 0.15	Facility designer will review well data. Monitoring and review will be increased to semi-weekly until determined unnecessary.
		Tip @ 1.0 or 1.7 m depth - Porewater pressure parameter (Ru) exceeds 0.25	Facility designer will review existing well data Facility designer will conduct a site visit and determine if tailings placement and/or construction plan requires modification Monitoring and review will be increased to daily until determined unnecessary. Facility designer will determine if additional instrumentation is required. Facility designer will complete analysis of mitigative measures should exceedance continue.
EBA Design Report	Ground Temperature Cables	Temperature > 0°C at 1.5 m depth	Facility designer will review temperature data.
EBA Design Report	Ground Temperature Cables	Temperature > 0°C at 2.0 m depth and greater	Facility designer will review existing temperature data Facility designer will conduct a site visit and determine if tailings placement and/or construction plan requires modification Facility designer will determine if additional instrumentation or analysis is required. Facility designer will complete analysis of mitigative measures should exceedance continue. Alexco to complete survey of area of interest to monitor any future displacement, if any.

TABLE 13: TRIGGERS AND ACTIONS UNDER ADAPTIVE MANAGEMENT FOR TAILINGS MANAGEMENT – CONT.

Provision	Monitored Item	Triggers/Thresholds	Action
EBA Design Report	Survey Monuments and Slope Inclinometers	Displacements greater than 25 mm in any direction	Facility designer will review existing piezometer, temperature, and survey data. Facility designer will conduct a site visit and determine if tailings placement and/or construction plan requires modification. Monitoring and review will be increased to semi-weekly until determined unnecessary. Alexco to complete survey of area of interest to monitor any future displacement, if any. Facility designer will determine if additional instrumentation is required. Facility designer will complete analysis of mitigative measures should exceedance continue.
Water Licence Q209-092	Toe runoff collection ditches, conveyance channel and water collection pond	Presence of abnormal cracking or failure	Report to general manager, take corrective action as required
Water Licence Q209-092	Tailings Runoff	Visible turbidity in runoff and/or excessive erosion evidence	Address runoff at source; report to Water Board within 60 days Apply appropriate runoff, erosion or sediment control measures
Water Licence Q209-092	Tailings Solids	AML potential is indicated	Expand monitoring program Conduct study of options to minimize acid generation

9.6 DOCUMENTATION

Routine reporting of surveillance results is essential to provide time to make adjustments to existing systems or to initiate Emergency Response Plans. It is imperative that any unusual information (outliers) gathered from these undertakings be communicated to the facility designer, the General Manager and Chief Operating Officer.

Document control is vital to ensuring the ongoing performance of the facility. The topic was presented in Section 3.0.

Table 15 identifies the overall responsibilities for surveillance record keeping:

TABLE 15: DSTF SURVEILLANCE DOCUMENTATION		
Task	Responsible Party	Information Recipients
Daily Check Sheet	Completed by Construction Monitor	General Manager – copy; Mill Manager – copy; Bellekeno Mine Engineering Server
Monthly Placement As built	Completed by Construction Monitor	General Manager – copy; Mill Manager – copy; Bellekeno Mine Engineering Server EBA - copy
Instrumentation Data	Completed by Construction Monitor	General Manager – copy; Mill Manager – copy; Bellekeno Mine Engineering Server EBA – copy
Construction Photographs	Completed by Construction Monitor	General Manager – copy; Mill Manager – copy; Bellekeno Mine Engineering Server
ABA Testing	Completed by Geology Dept	General Manager – copy; Mill Manager – copy; Bellekeno Mine Engineering Server
Water Quality Monitoring	Completed by VP Corporate Affairs	General Manager, Mill Manager and Yukon Water Board Original reports located with General Manager

9.7 REPORTING

Observation of any unusual occurrence should be reported immediately to the General Manager, facility designer, and/or the Chief Operating Officer. Unusual occurrences include but are not limited to the following;

- Triggers/Thresholds outlined in Table 13;
- Any seismic event;
- Settlement, cracks or slumping of the tailings stack;
- Slope failure of any of the slopes;
- Abnormal seepage from any of the slopes;
- Increased or high turbidity flow from the drainage blanket; and
- Damage to any component of the DSTF.

All reports are to be maintained by the General Manager and filed in a suitable format and location for easy access by authorized mine personnel, and for review by government agencies. Annual performance reviews will be copied to the regulatory agencies.

The requirements of the consulting geotechnical engineer, other departments, or governmental agencies may dictate certain items that require inspection, monitoring, or reporting.

10.0 EMERGENCY PLANNING AND RESPONSE

10.1 BELLEKENO EMERGENCY PROCEDURES

The mine site has established procedures and response plans detailing in the following reports:

- A report by Access Consulting Group entitled "Alexco Keno Hill Mining Corp. Bellekeno Project, Monitoring and Surveillance Plan, QML-0009", dated November 2009 and submitted for the Type A Water Use License 2009.
- A report by Access Consulting Group entitled "Emergency Response Plan, QML-0009, Bellekeno Project", dated November 2009 and submitted for the Type A Water Use License 2009.
- MSDS documentation for any material used within the DSTF.

These documents provide the detailed plans on actions to be taken in case of an emergency. They also provide notification procedures.

10.2 DSTF EMERGENCY PROCEDURES

Daily visual and routine instrumentation monitoring programs outlined in Tables 12 and 13 are expected to forewarn of potential adverse conditions to the DSTF. Triggers/Thresholds presented in Table 13 must be adhered to and reported on as outlined.

The DSTF has been designed to maintain its structural integrity throughout its operational life; however, a number of conditions can affect the performance of the DSTF. Once the DSTF operations are being completed and instrumentation data is available, the requirement for additional emergency procedures will be reviewed as a part of the annual DSTF performance and OMS manual review.

10.3 ENVIRONMENTAL EMERGENCIES

Environmental emergencies of various natures and their specific response procedures are outlined in the project's Spill Contingency Plan. This document includes immediate response procedures and follow up and notification measures appropriate to the particular nature of the emergency.

10.4 KEY CONTACTS

Key contact information is detailed in Table A2, found in Appendix A.

10.4.1 Climatological Information

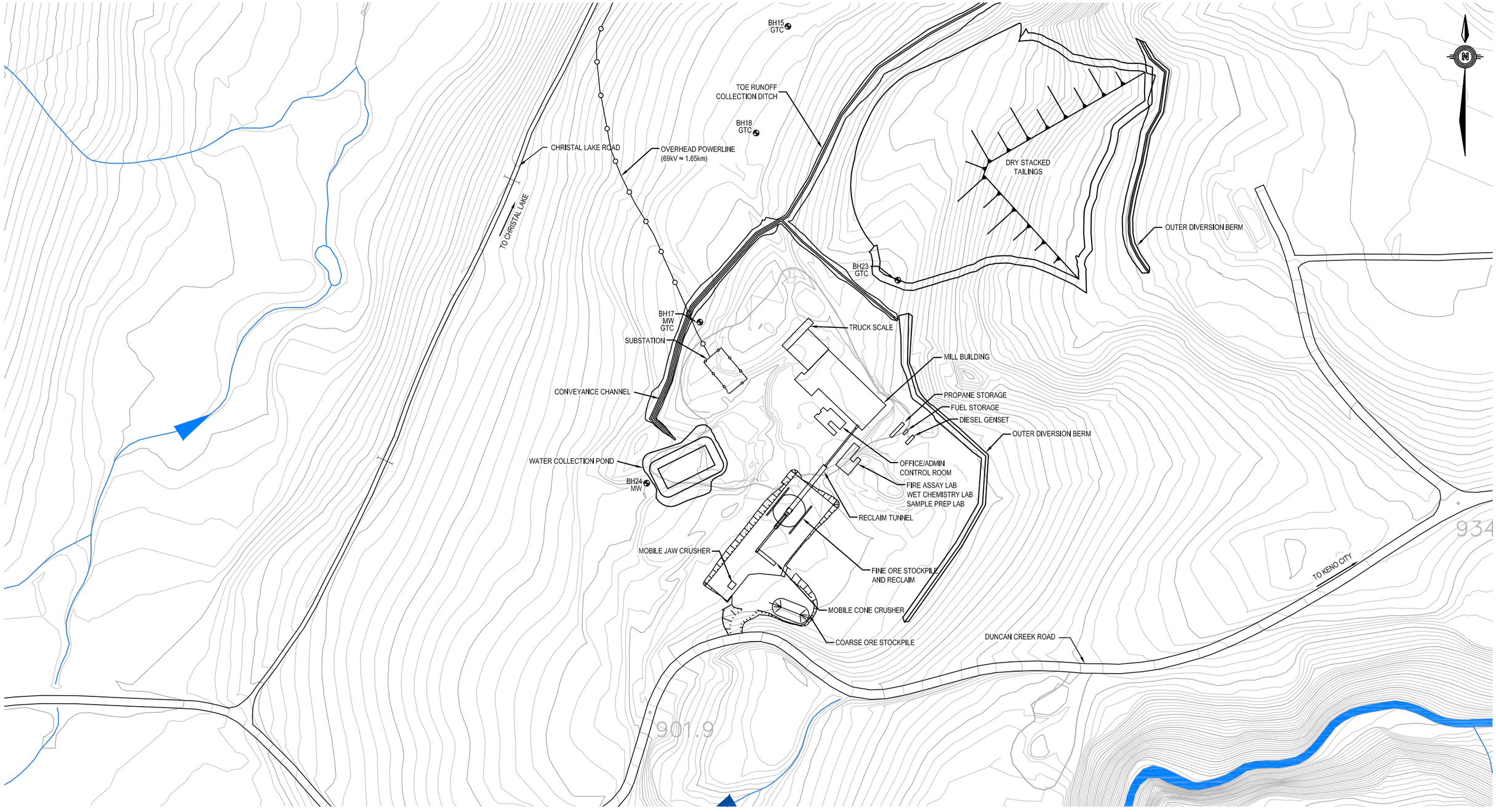
Environment Canada Weather office (weather forecasts):

http://weatheroffice.ec.gc.ca/canada_e.html

Pacific Geoscience Center (earthquake information):

http://www.pgc.nrcan.gc.ca/seismo/table.htm

FIGURES



LEGEND:

- BOREHOLE LOCATION
GTC - GROUND TEMPERATURE CABLE
MW - MONITORING WELL

0 100

Scale: 1: 2 500 (metres)

CLIENT

ALEXCO

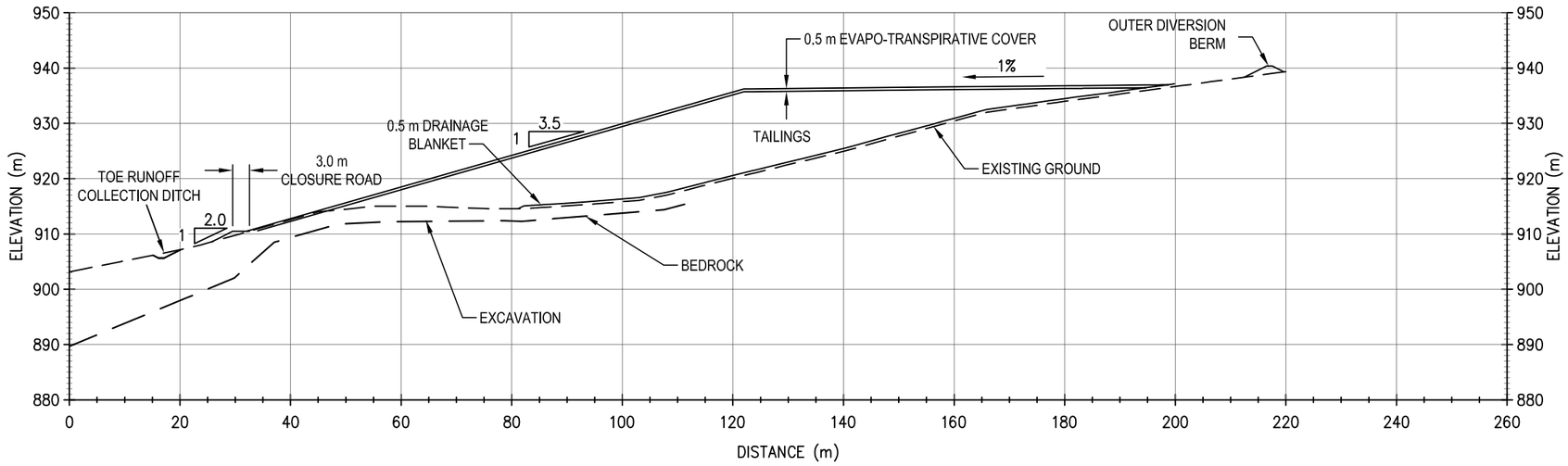
DRY-STACK TAILINGS FACILITY DESIGN
KENO HILL DISTRICT MILL SITE, YUKON

OVERALL MILL SITE PLAN

EBA Engineering Consultants Ltd.

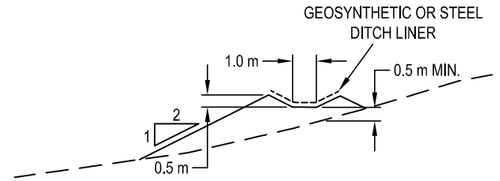
PROJECT NO.	DWN	CKD	REV
W14101178.008	CB	CJD	0
OFFICE: EBA-WHSE	DATE: September 7, 2010		

Figure 1



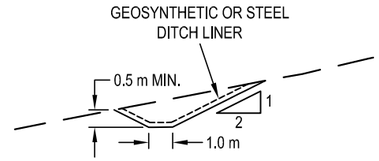
TAILINGS SECTION

SCALE 1:1000



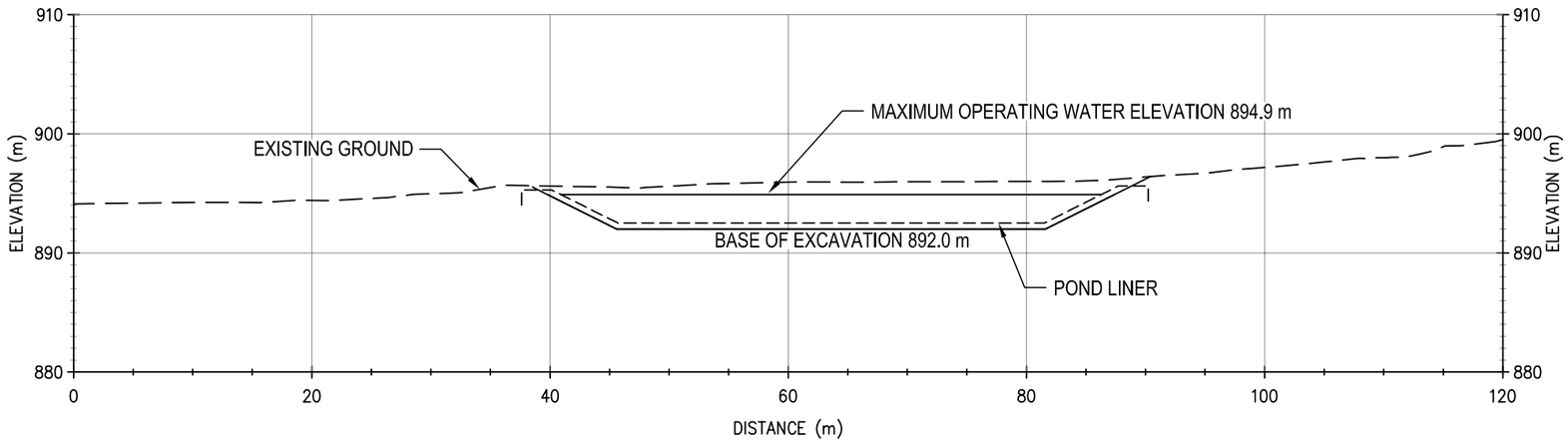
CONVEYANCE CHANNEL SECTION

SCALE 1:250



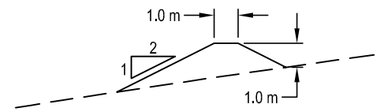
TOE RUNOFF COLLECTION DITCH SECTION

SCALE 1:250



WATER COLLECTION POND SECTION

SCALE 1:500



OUTER DIVERSION BERM SECTION

SCALE 1:250

ISSUED FOR USE

CLIENT

ALEXCO

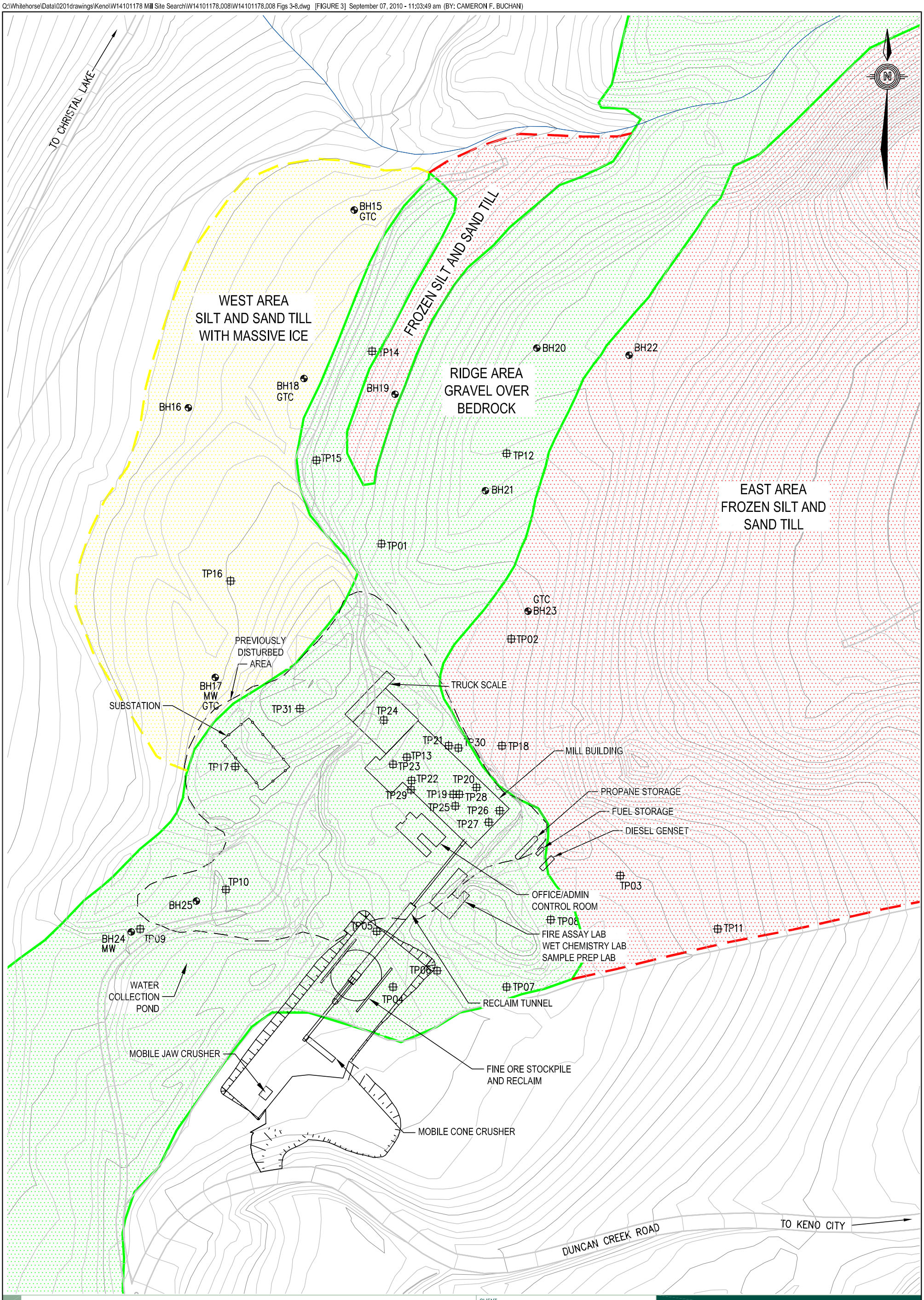
DRY-STACK TAILINGS FACILITY DESIGN
KENO HILL DISTRICT MILL SITE, YUKON

TYPICAL CROSS SECTIONS

EBA Engineering Consultants Ltd.

PROJECT NO.	DWN	CKD	REV
W14101178.008	CB	CJD	0
OFFICE: EBA-WHSE	DATE: September 7, 2010		

Figure 2



LEGEND

- TESTPIT LOCATIONS
- BOREHOLE LOCATIONS
- GTC GROUND TEMPERATURE CABLE
- MW MONITORING WELL

NOTES

1. NTS MAP ZONE 8 M/14 NAD 83
2. CONTOUR INTERVALS - 1.0 m
3. BASE PLAN/DRAWING PROVIDED BY ALEXCO RESOURCES

0 50

Scale: 1: 1 500 (metres)

CLIENT

ALEXCO

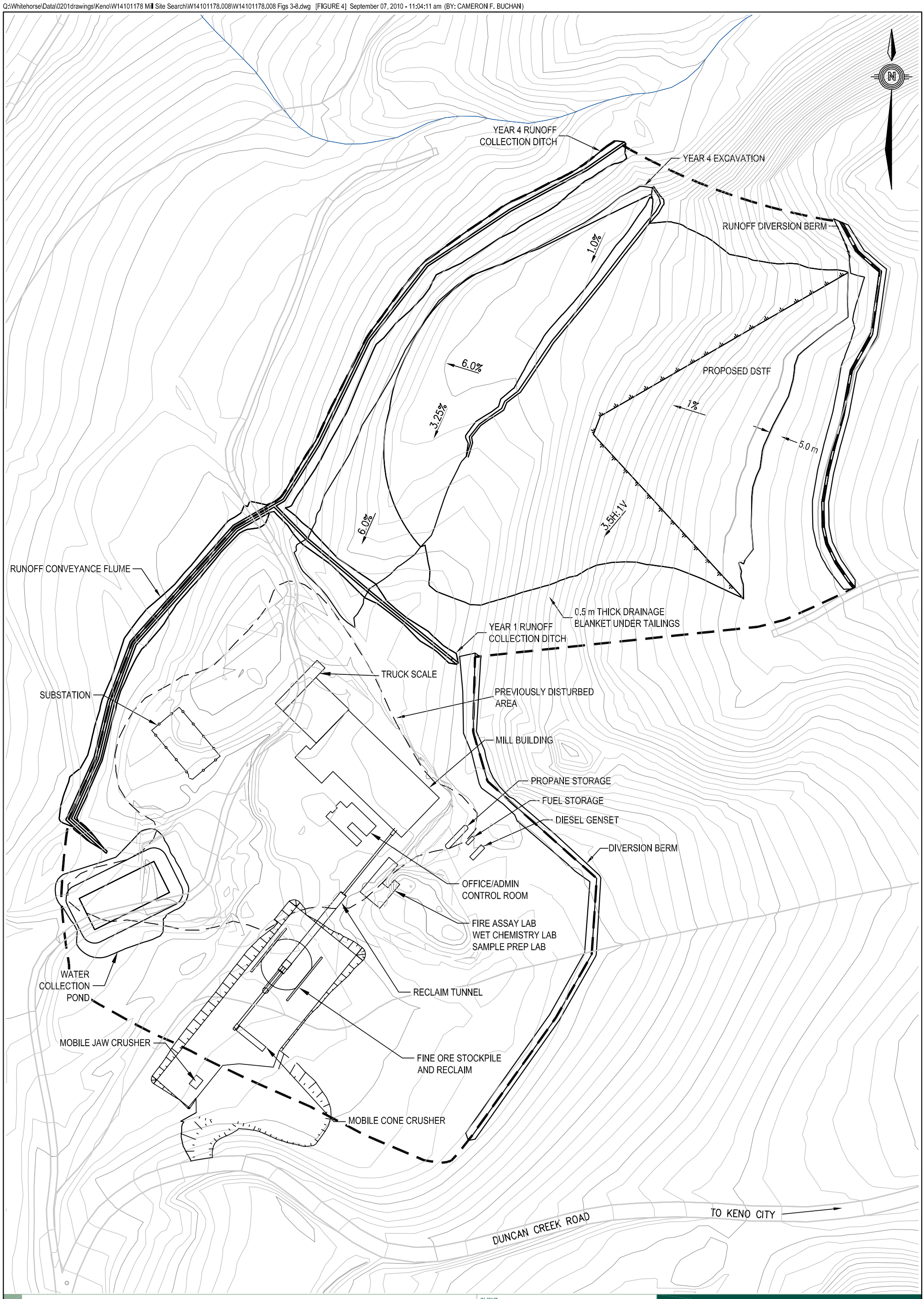
EBA Engineering Consultants Ltd.

DRY-STACKED TAILINGS FACILITY DESIGN
KENO HILL DISTRICT MILL SITE, YUKON

ANTICIPATED SOIL PROFILES

PROJECT NO.	DWN	CKD	REV
W14101178.008	CB	CJD	0
OFFICE: EBA-WHSE	DATE: September 7, 2010		

Figure 3



NOTES

1. NTS MAP ZONE 8 M/14 NAD 83
2. CONTOUR INTERVALS - 1.0 m
3. BASE PLAN/DRAWING PROVIDED BY ALEXCO RESOURCES

0 50
Scale: 1: 1 500 (metres)

CLIENT

ALEXCO

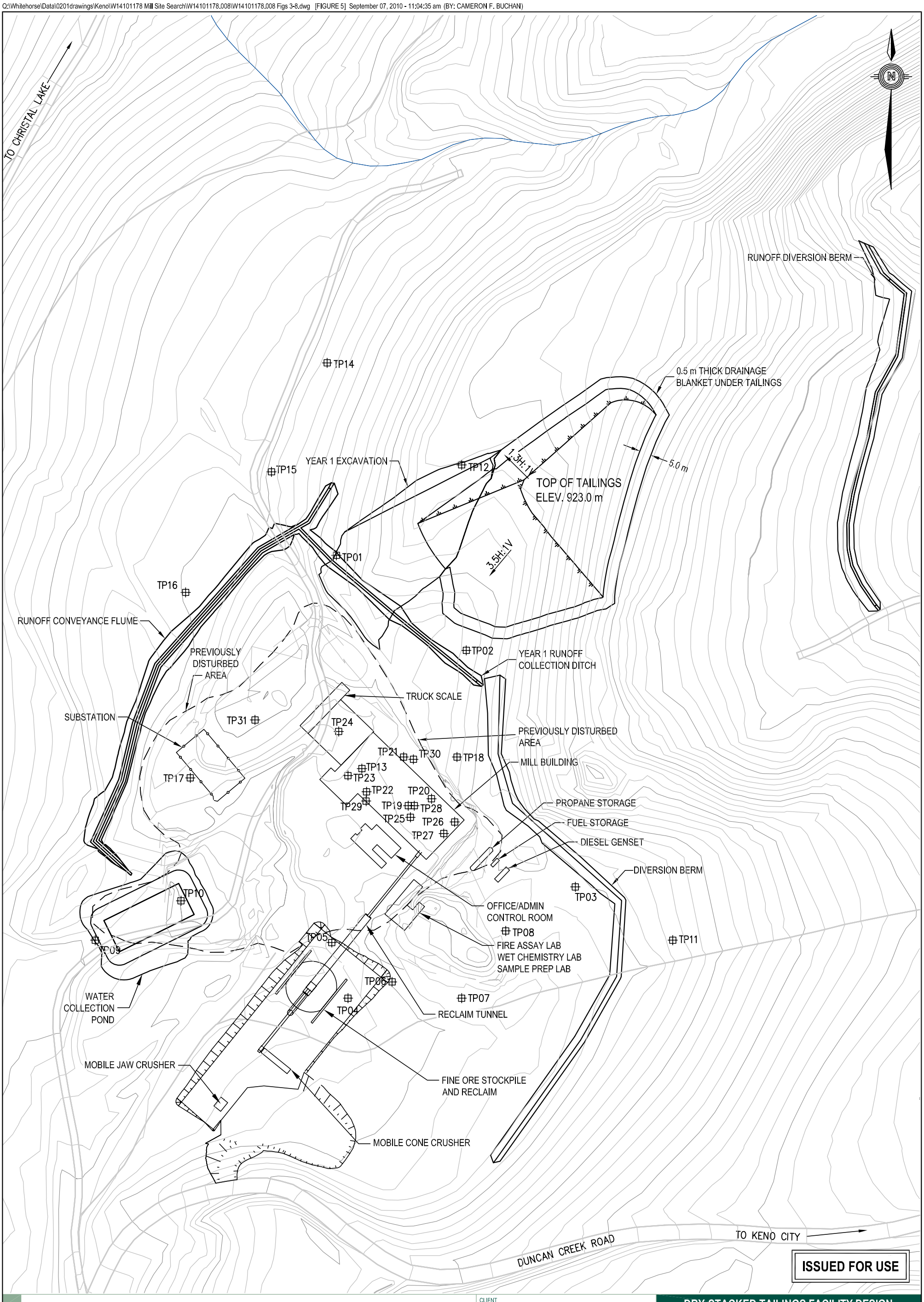
DRY-STACKED TAILINGS FACILITY DESIGN
KENO HILL DISTRICT SITE, YUKON

SURFACE DRAINAGE SUB-CATCHMENT DETAIL

EBA Engineering Consultants Ltd.

PROJECT NO.	DWN	CKD	REV
W14101178.008	CB	CJD	0
OFFICE: EBA-WHSE	DATE: September 7, 2010		

Figure 4



ISSUED FOR USE

LEGEND

- TESTPIT LOCATIONS
- BOREHOLE LOCATIONS

NOTES

1. NTS MAP ZONE 8 M/14 NAD 83
2. CONTOUR INTERVALS - 1.0 m
3. BASE PLAN/DRAWING PROVIDED BY ALEXCO RESOURCES

0 50
Scale: 1: 1 500 (metres)

CLIENT

ALEXCO

DRY-STACKED TAILINGS FACILITY DESIGN
KENO HILL DISTRICT MILL SITE, YUKON

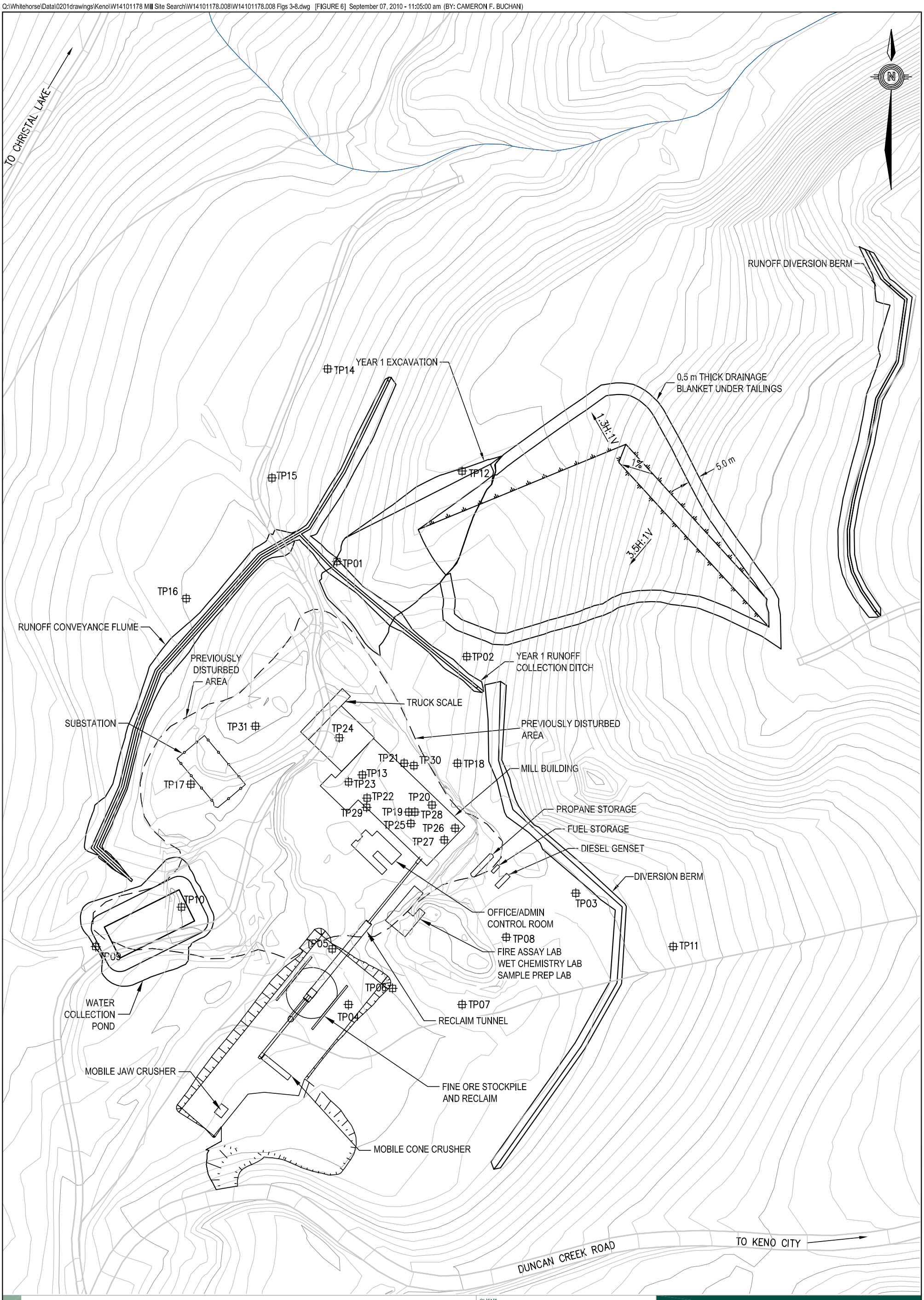
YEAR 1 CONSTRUCTION PLAN

EBA Engineering Consultants Ltd.

PROJECT NO.	DWN	CKD	REV
W14101178.008	CB	CJD	0
OFFICE: EBA-WHSE	DATE: September 7, 2010		

Figure 5

Q:\Whitehorse\Data\0201drawings\Keno\W14101178 Mill Site Search\W14101178.008\W14101178.008 Figs 3-8.dwg [FIGURE 6] September 07, 2010 - 11:05:00 am (BY: CAMERON F. BUCHAN)



LEGEND

- TESTPIT LOCATIONS
- BOREHOLE LOCATIONS

NOTES

1. NTS MAP ZONE 8 M/14 NAD 83
2. CONTOUR INTERVALS - 1.0 m
3. BASE PLAN/DRAWING PROVIDED BY ALEXCO RESOURCES

0 50
Scale: 1: 1 500 (metres)

CLIENT

ALEXCO

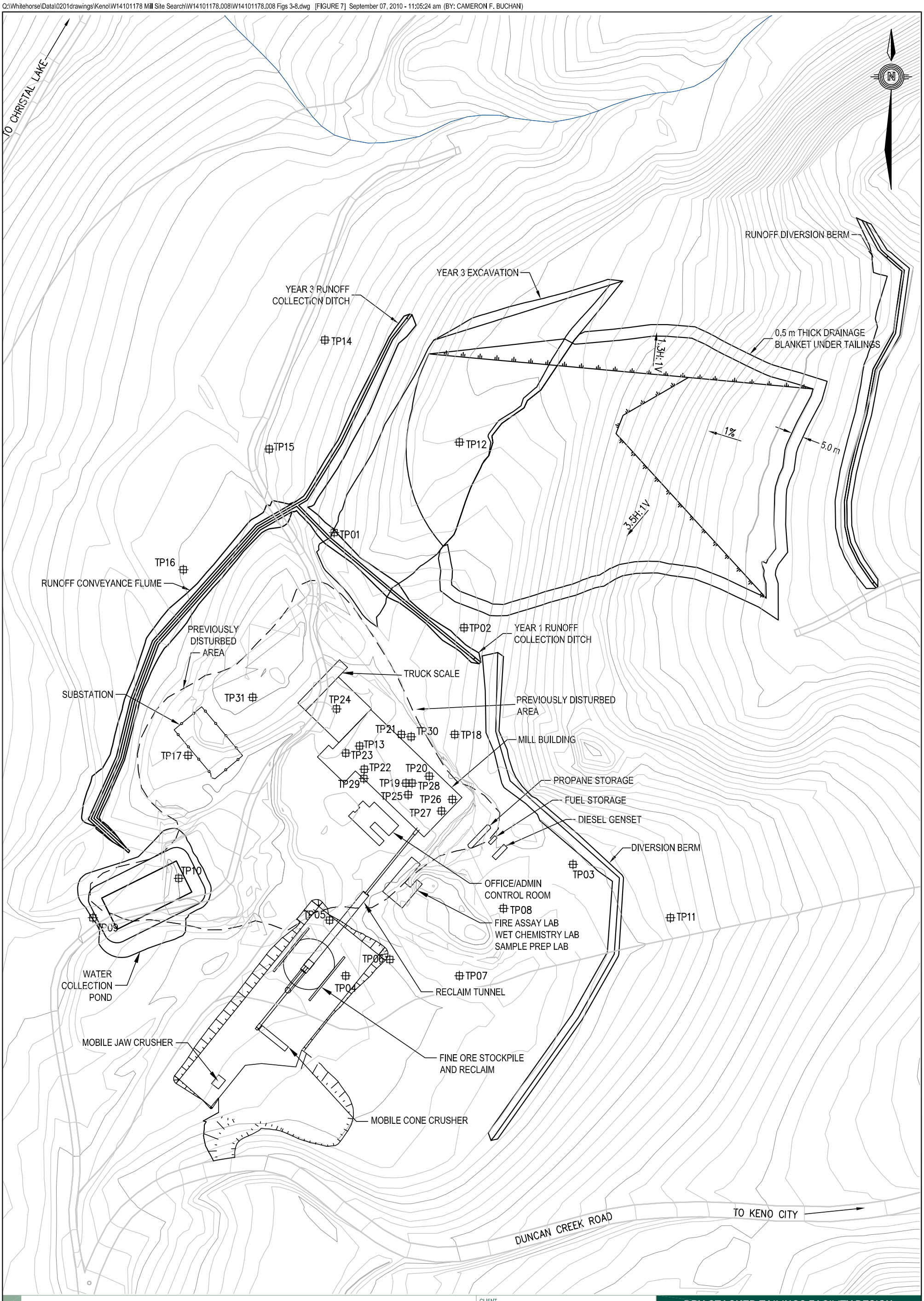
EBA Engineering Consultants Ltd.

DRY-STACKED TAILINGS FACILITY DESIGN
KENO HILL DISTRICT MILL SITE, YUKON

YEAR 2 CONSTRUCTION PLAN

PROJECT NO.	DWN	CKD	REV
W14101178.008	CB	CJD	0
OFFICE: EBA-WHSE	DATE: September 7, 2010		

Figure 6



LEGEND

- TESTPIT LOCATIONS
- BOREHOLE LOCATIONS

NOTES

1. NTS MAP ZONE 8 M/14 NAD 83
2. CONTOUR INTERVALS - 1.0 m
3. BASE PLAN/DRAWING PROVIDED BY ALEXCO RESOURCES

0 50

Scale: 1: 1 500 (metres)

CLIENT

ALEXCO

DRY-STACKED TAILINGS FACILITY DESIGN
KENO HILL DISTRICT MILL SITE, YUKON

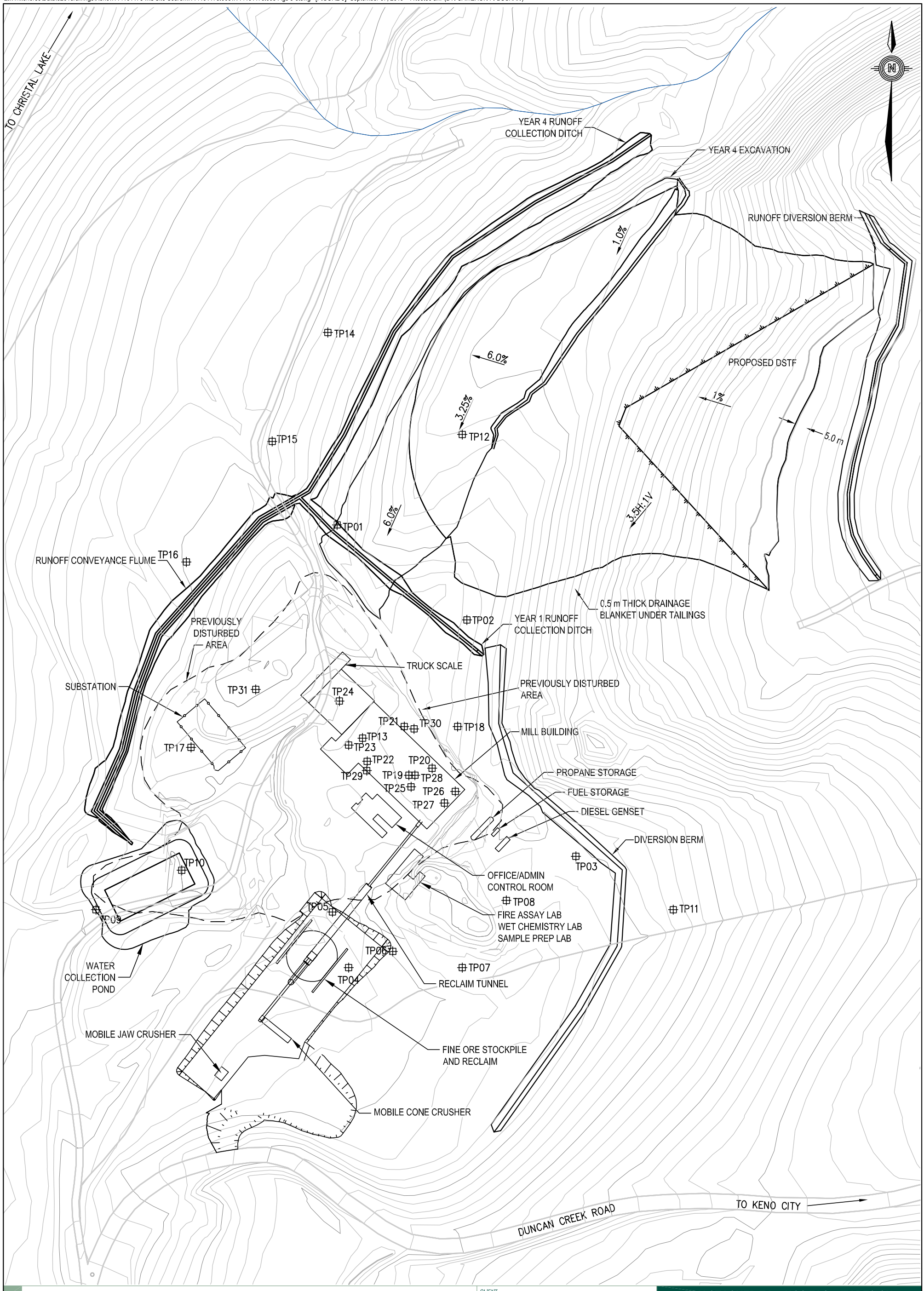
YEAR 3 CONSTRUCTION PLAN

EBA Engineering Consultants Ltd.

PROJECT NO.	DWN	CKD	REV
W14101178.008	CB	CJD	0
OFFICE: EBA-WHSE	DATE: September 7, 2010		

Figure 7

Q:\Whitehorse\Data\0201drawings\Keno\W14101178 Mill Site Search\W14101178.008\W14101178.008 Figs 3-8.dwg [FIGURE 8] September 07, 2010 - 11:05:50 am (BY: CAMERON F. BUCHAN)



LEGEND

- TESTPIT LOCATIONS
- BOREHOLE LOCATIONS

NOTES

1. NTS MAP ZONE 8 M/14 NAD 83
2. CONTOUR INTERVALS - 1.0 m
3. BASE PLAN/DRAWING PROVIDED BY ALEXCO RESOURCES

0 50

Scale: 1: 1 500 (metres)

CLIENT

ALEXCO

EBA Engineering Consultants Ltd.

DRY-STACKED TAILINGS FACILITY DESIGN
KENO HILL DISTRICT SITE, YUKON

YEAR 4 CONSTRUCTION PLAN

PROJECT NO.	DWN	CKD	REV
W14101178.008	CB	CJD	0
OFFICE: EBA-WHSE	DATE: September 7, 2010		

Figure 8

APPENDIX

APPENDIX A –CONTACT LISTS

TABLE A1: DESIGNATED PERSONNEL FOR TMT		
Personnel and Contact Information	Position	Responsibilities
Brad Thrall Phone: 604-633-4888 Fax: 604-633-4887	Chief Operating Officer (COO)	Group coordinator of DSTF, project review and implementation, and budget allocation
Rob McIntyre Phone: 604-633-4888 Fax: 604-633-4887	VP Corporate Affairs	Regulatory compliance permitting requirements, annual environmental reports, water quality and level monitoring
Tim Hall Phone: 867-995-3113	General Manager	Responsible for haul, placement, and compaction of tailings in DSTF, general operations, maintenance, Periodic inspections for quality assurance, annual compliance reporting, geotechnical analysis and risk management of ongoing construction, instrumentation data review
Tom Fudge Phone: 867-995-3113	VP Engineering	Technical oversight for construction, operation and maintenance of DSTF
VACANT Phone: 867-995-3113	Mill Superintendent	Pumping and conveyor operations and maintenance of tailings filter system to tailings stockpile location
VACANT Phone: 867-995-3113	Mill Manager	Together with General Manager, responsible for haul, placement, and compaction of tailings in DSTF, general operations, maintenance, Periodic inspections for quality assurance, annual compliance reporting, geotechnical analysis and risk management of ongoing construction, instrumentation data review
VACANT Phone: 867-995-3113	Construction Monitor	Routine inspections for quality assurance and quality control, data collection, surveying, providing planning direction to construction superintendent
VACANT Phone: 867-995-3113	Safety Manager	Training and/or job hazard analysis are completed as required
VACANT Phone: 867-995-3113	Bellekeno ERT	Emergency preparedness and response

TABLE A2: KEY EMERGENCY CONTACTS	
Personnel and Contact Information	Position
Brad Thrall Phone: 604-633-4888 Fax: 604-633-4887	Chief Operating Officer (COO)
Rob McIntyre Phone: 604-633-4888 Fax: 604-633-4887	VP Corporate Affairs
Tim Hall Phone: 867-995-3113	General Manager
Tom Fudge Phone: 867-995-3113	VP Engineering
EBA Engineering Consultants Ltd – Whitehorse General Numbers: Phone: (867) 668-3068 Fax: (867) 668-4349 Project Manager: Chris Dixon, P.Eng. Work: (867) 668-3068 x241 Project Director: Chad Cowan, P.Eng. Work: (867) 668-3068 x229	Facility Designer
Phone: 867-995-3113	Bellekeno ERT
Phone: 867.633.7952 Fax: 867.456.3899	Yukon Government – EMR, Mineral Resources Branch
Phone: 867-667-3171 Fax: 867-667-3195	Yukon Government – Water Resources Division
Phone: 867-667-5683 Fax: 867-393-6213	Yukon Government – Environmental Programs Branch
Phone: (867) 456-3980 Fax: (867) 456-3890	Yukon Water Board
Phone: (867) 996-2265 Fax: (867) 996-2267	First Nation of Na-cho Nyak Dun