Alexco Keno Hill Mining Corp
Suite 1150-200 Granville Street
Canada V6C 1S4

May 4, 2010

Government of Yukon
Department of Energy, Mines & Resources
P.O. Box 2703 Whitehorse, Yukon Y1A 2C6

Attention
Robert Holmes, Director, Mineral Resources

Subject: Supplemental Information to Mine Construction and Operation Plan, QML-0009

As discussed in our meeting with you on April 20, 2010, we are herewith submitting additional information for the Mine Construction and Operation Plan. This information is provided in support of our request for authorization to construct and use the non-AML Waste Rock Disposal Area (WRDA) on the north flank of Sourdough Hill near Bellekeno 625.

Attached is a letter report from EBA Engineering Consultants Ltd., which presents preliminary designs for the non-AML WRDA. In addition, this letter report confirms the possibility of constructing a potentially-AML Waste Rock Storage Facility (WRSF) as per “Typical Waste Containment Facility Design” on top of the Non-AML WRDA, subject to a site specific geotechnical investigation and design.

Construction of this facility is not expected to commence in 2011. Until construction of this facility begins, non-AML waste rock will continue to be used for road and general site construction purposes.

As a courtesy, we are also submitting a summary of materials handling which we prepared as a table for the Water Board as part of their adequacy review. This table was prepared in order to clarify the fate and handling of all materials produced by the Bellekeno Mine project.

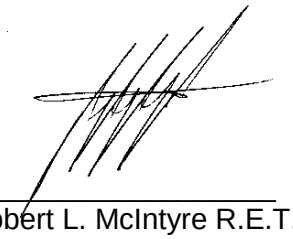
Bellekeno Mine Materials Handling Balance

Material Stream	Total Estimated Tonnage (metric tonnes, rounded to the nearest 1000 tonnes)	Fate/Storage Location	Storage Capacity [Requirement] (metric tonnes)
1. Total Excavated Tonnage (100%)	**1,037,000**	**-**	**-**
A. Total Development Rock (48%)	**500,000**[A]	**-**	**-**
i. Potentially-AML Development Rock (26%)	130,000	100% to U/G (underground) backfill	355,000[B]
ii. Non-AML Development Rock (74%)	367,000	11% for general site construction material	[40,000]
		89%Non-AML WRDA (surface)	360,000 [C]
B. Total Ore (52%)	**537,000**[D]	-	**-**
i. Concentrate to Smelter (22.2%)	119,000	Permanently removed from site	N/A
ii. Total Tailings (77.8%)	418,000	**-**	**-**
a. High Sulphur Tailings (22.9%)	96,000	100% to U/G backfill	355,000[B]
b. Low Sulphur Tailings (77.1%)	322,000	40% to U/G backfill	355,000[B]
		60% to DSTF	209,430[E]

A. Refer to Table 2-1, Main Application Report
B. Assuming 90% utilization, available U/G storage capacity over LOM is anticipated to be approximately 355,000 tonnes. Total utilization of U/G space with a combination of backfill composed of High Sulphur tailings, P-AML Waste Rock and Low Sulphur tailings is 355,000 tonnes. Priority for U/G backfill will be as follows:
    1. High Sulphur Tailings
    2. P-AML Waste Rock
    3. Low Sulphur Tailings
C. Calculated as indicated on Figure 2-2, Main Application Report using a bulk density of 1.8 tonnes/m^3
D. Refer to Table 2-3, Main Application Report
E. Calculated from Table 6 of Preliminary Engineering Design and Management Plan Dry Stacked Tailings Facility, Bellekeno Mine Mill Site, Yukon (Exhibit 1.8.3), assuming bulk tailings density of 1.7 tonnes/m^3

Please do not hesitate to call me at (604) 631-4139 if you have any further questions or to discuss any aspect of this submission.

Sincerely,
ALEXCO KENO HILL MINING CORP.



Robert L. McIntyre R.E.T., CCEP
Vice President, Business Development

Cc external: A. Kyle, YG EM&R, D. Buyck, First Nation of Nacho Nyak Dun, J. Janes, Yukon Water Board
Cc internal: C. Nauman, B.Thrall, D. Hillier, P. Johnson, T. Hall, T. Fudge

Attachment: EBA Letter Re: Waste Rock Facility Designs

April 1, 2010 EBA File: W14101178.003

Alexco Resource Corp.
#3-151 Industrial Road
Whitehorse, Yukon Y1A 2V3

Attention: Mr. Rob McIntyre, Vice President

Subject: Response to Water Board Questions – Bellekeno Waste Rock Dump

1.0 INTRODUCTION

In a meeting held on March 25, 2010 between Alexco Resource Corp. (Alexco) and EBA Engineering Consultants Ltd. (EBA), two concerns raised by the Waster Board specific to the Water License application were discussed. Alexco requested EBA provide further information with regard to the following:

- Bellekeno Waste Rock Dump stability, and,
- The Typical Waste Containment Facility Design.

The concerns related to whether or not any preliminary design work had been completed for the dumps, and furthermore whether a typical Waste Containment Facility could be constructed on top of the waste rock dump, per preliminary plans submitted by Alexco.

2.0 TYPICAL WASTE CONTAINMENT FACILITY DESIGN

EBA completed the design of the Typical Waste Containment Facility as part of the "Typical Waste Containment Facility Design, Keno Hill Silver District, YT Construction Specifications" dated July 2008. The original construction specifications have been attached to this letter and are available in hard copy upon request. The intent is that although this is a generic design, a site specific geotechnical evaluation would be completed at each location proposed for construction, and the design/construction details modified according to site conditions.

It is EBA's opinion that a "Typical Waste Containment Facility" could be constructed on top of the Bellekeno Waste Rock Dump, as it would be a balanced cut and fill construction, adequately set back from the crest of the dump, and specifically designed for this location.

This was always the intent when the generic design was prepared – construction would not occur until a site specific design was completed by EBA, including the collection of site specific geotechnical data.

EBA Engineering Consultants Ltd.
p. 867.668.3068 • f. 867.668.4349
Calcite Business Centre • Unit 6, 151 Industrial Road • Whitehorse, Yukon Y1A 2V3 • CANADA

3.0 WASTE ROCK DUMP STABILITY

EBA completed the conceptual design, stability calculations, potential risks and mitigations, and closure plans for the Non-AML Waste Rock Disposal Area at the Bellekeno site in a letter report entitled "Conceptual Tailings and Waste Rock Management Plans, Bellekeno Project near Keno City, Yukon" dated December 12, 2008.

The section relevant to the stability of the waste rock dump stability (Section 3.0) is copied below and full copies of the original report are available upon request:

3.1 NON-AML WASTE ROCK DISPOSAL AREA

Alexco is proposing to dispose of non-AML waste rock at the Bellekeno site. This section summarizes the geotechnical data collected, design assumptions, conceptual design, stability calculations, potential risks and mitigations, and closure plans for the Non-AML Waste Rock Disposal Area (WRDA) at the Bellekeno site.

3.2 GEOTECHNICAL AND GROUND TEMPERATURE DATA COLLECTED

Five boreholes were drilled, logged and sampled, and one thermistor cable was installed on October 30, 2008, using an air rotary drill rig. A site plan showing the location of the boreholes and thermistor is attached, followed by the borehole logs. The data indicates that subsurface conditions are primarily unfrozen glacial till, however, as this is a north-facing slope and the area has been somewhat disturbed, preliminary modelling was completed assuming that permafrost existed in the slope, and that the failure mechanism would be shearing along the frozen/unfrozen soil boundary. Additional data will need to be collected along the proposed toe of the dump, prior to the detailed design stage.

3.3 NON-AML WASTE ROCK DISPOSAL AREA ASSUMPTIONS

Alexco provided the following assumptions to EBA for use in design of the WRDA:

Total volume of waste rock to be generated: 500,000 dry metric tons (dmt);

Volume of non-AML waste rock will be 75% of the total;

Placed density of the waste rock will be 1800 kg/m3;

Waste Rock used in construction of DSTF can be subtracted from total to be stored; and

Total volume to be stored is 200,000 m3.

EBA's design assumptions are as follows:

An internal friction angle of 36 degrees for waste rock;

The waste rock is cohesionless;

Foundation soils for the waste rock storage facility are permafrost sand and gravel with a bulk unit weight of 2140 kg/m3;

Foundation soils have an undrained shear strength of 10 kPa with an internal friction angle of 28 degrees;

Active layer of the permafrost is 1 m thick and the groundwater surface is 0.5 m above the permafrost boundary, simulating early summer ground conditions;

Shear failure will not occur through the permafrost, but along the frozen/unfrozen boundary; and

The design seismic event was selected to be 1:500 year return period, as recommended in Mined Rock and Overburden Piles Investigation and Design Manual (BC Mine Waste Rock Pile Research Committee, 1991).

3.4 NON-AML WASTE ROCK DISPOSAL FACILITY CONCEPTUAL DESIGN

The waste rock will be hauled from the Bellekeno adit directly to the WRDA. The WRDA will be constructed as a wrap around dump, so the lower benches will be constructed first. The lowest bench will follow the existing road alignment and have a slope to the existing ground surface of 2.5H:1V. The waste rock will be dumped in 10 m benches and allowed to fall to the bench below it at the natural angle of repose of the rock. The stability of the pile was checked using Geostudio 2007 – SlopeW module. The factors of safety calculated for the waste WRDA and the guidelines set forth by the BC Mine Waste Rock Pile Research Committee (1991) are summarized in Table 3. The WRDA will not need re-contouring at closure as the long-term stability of the pile should meet the guidelines. Waste rock piles in the area have been standing at the natural angle of repose without significant stability problems for over 30 years.

TABLE 3: WRDA SLOPE STABILITY FACTOR OF SAFETY SUMMARY

Stability Condition	Factor of Safety	
	Suggested Minimum	Calculated for WRDA
Stability of Surface		
Short Term (during construction)	1.0	1.1
Long-Term (reclamation – abandonment)	1.1	1.1
Deep-Seated Stability		
Short Term (static)	1.1 – 1.3	1.7
Long-Term (static)	1.3	1.7
Pseudo-Static	1.0	1.2

3.5 NON-AML WASTE ROCK DISPOSAL AREA RISKS AND MITIGATIONS

The risks and associated mitigations of the Non-AML WRDA are summarized in Table 4.

TABLE 4: NON-AML WRDA RISK AND MITIGATION SUMMARY

Risk	Design Constraint	Mitigation	Discussion
Deep seated slope failure	Minimum FS = 1.3 (static); 1.0 (pseudo-static 1:500 year event)	Waste rock pile is designed to the applicable guidelines.	Probability of exceedance of the design seismic event is 10% in 50 years.
Surface slope failure	Minimum FS = 1.1 (static)	Waste rock pile is designed to the applicable guidelines.	Surface failures can be repaired without major effort.
Sediment transport	Setback distance of 30 m from water bodies	Pile location minimizes sediment from being transported into adjacent streams.	Sediment picked up by surface runoff can filter out in natural vegetation in the area prior to discharging into receiving water bodies.
Toe liquefaction	Consider liquefaction during preliminary design	The foundation soils not susceptible to liquefaction in frozen state.	Review of liquefaction potential will be conducted for unfrozen soils in detailed design.
Snow and ice buried during pile construction	Operational issue	Operational procedures will be developed to minimize this.	Buried snow and ice can affect the stability and capacity of the facility.
Contaminated waste rock	Operational issue	Waste rock containing contaminants will not be placed in waste rock pile.	Contaminated rock will be placed in the previously constructed contaminated waste rock facility.

3.6 NON-AML WASTE ROCK DISPOSAL AREA CLOSURE

No additional re-contouring will be required at closure for the WRDA. However, the condition of the permafrost beneath the WRDA should be monitored throughout operation and at least 10 years past closure. The requirement for ground temperature monitoring should be reviewed 10 years after closure. An annual geotechnical inspection should be conducted on the WRDA for at least 5 years after closure. The requirement for an annual geotechnical inspection should be reviewed 5 years after closure.

A toe buttress may be required along the alluvial terrace below the toe of the WRDA in the area currently being placer mined. This is necessary to improve the overall stability of the embankment in the event of an earthquake, or other seismic event. Adequate backfilling or re-contouring by the placer miner may alleviate this concern, but this should be re-examined at detailed design and at closure.

4.0 CLOSURE

We trust this letter meets your present requirements. Should you have any questions or comments, please contact the undersigned.

Yours truly,
EBA Engineering Consultants Ltd.

Justin Pigage, EIT
Geotechnical Engineer, Yukon Region
Direct Line: 867.668.2071 x244
jpigage@eba.ca

J. Richard Trimble, FEC, P.Eng.
Principal Consultant, Yukon Region
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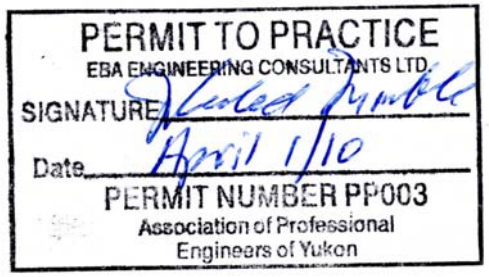
rtrimble@eba.ca



GEOTECHNICAL REPORT – GENERAL CONDITIONS

This report incorporates and is subject to these "General Conditions".

1.0 USE OF REPORT AND OWNERSHIP

This geotechnical report pertains to a specific site, a specific development and a specific scope of work. It is not applicable to any other sites nor should it be relied upon for types of development other than that to which it refers. Any variation from the site or development would necessitate a supplementary geotechnical assessment.

This report and the recommendations contained in it are intended for the sole use of EBA's Client. EBA does not accept any responsibility for the accuracy of any of the data, the analyses or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than EBA's Client unless otherwise authorized in writing by EBA. Any unauthorized use of the report is at the sole risk of the user.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of EBA. Additional copies of the report, if required, may be obtained upon request.

2.0 ALTERNATE REPORT FORMAT

Where EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed EBA's instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by EBA shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of EBA's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except EBA. EBA's instruments of professional service will be used only and exactly as submitted by EBA.

Electronic files submitted by EBA have been prepared and submitted using specific software and hardware systems. EBA makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

3.0 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, EBA has not been retained to investigate, address or consider and has not investigated, addressed or considered any environmental or regulatory issues associated with development on the subject site.

4.0 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems and methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. EBA does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

5.0 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

6.0 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historic environment. EBA does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional investigation and review may be necessary.

7.0 SURFACE WATER AND GROUNDWATER CONDITIONS

Surface and groundwater conditions mentioned in this report are those observed at the times recorded in the report. These conditions vary with geological detail between observation sites; annual, seasonal and special meteorologic conditions; and with development activity. Interpretation of water conditions from observations and records is judgemental and constitutes an evaluation of circumstances as influenced by geology, meteorology and development activity. Deviations from these observations may occur during the course of development activities.

8.0 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

9.0 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

10.0 INFLUENCE OF CONSTRUCTION ACTIVITY

There is a direct correlation between construction activity and structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques are known.

11.0 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, as well as the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

12.0 DRAINAGE SYSTEMS

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

13.0 BEARING CAPACITY

Design bearing capacities, loads and allowable stresses quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition assumed. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions assumed in this report in fact exist at the site.

14.0 SAMPLES

EBA will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

ISSUED FOR USE

LEGEND:

⊕ – BOREHOLE LOCATION

0 50

Scale: 1: 1 500 (metres)

CLIENT

ALEXCO

EBA Engineering Consultants Ltd.

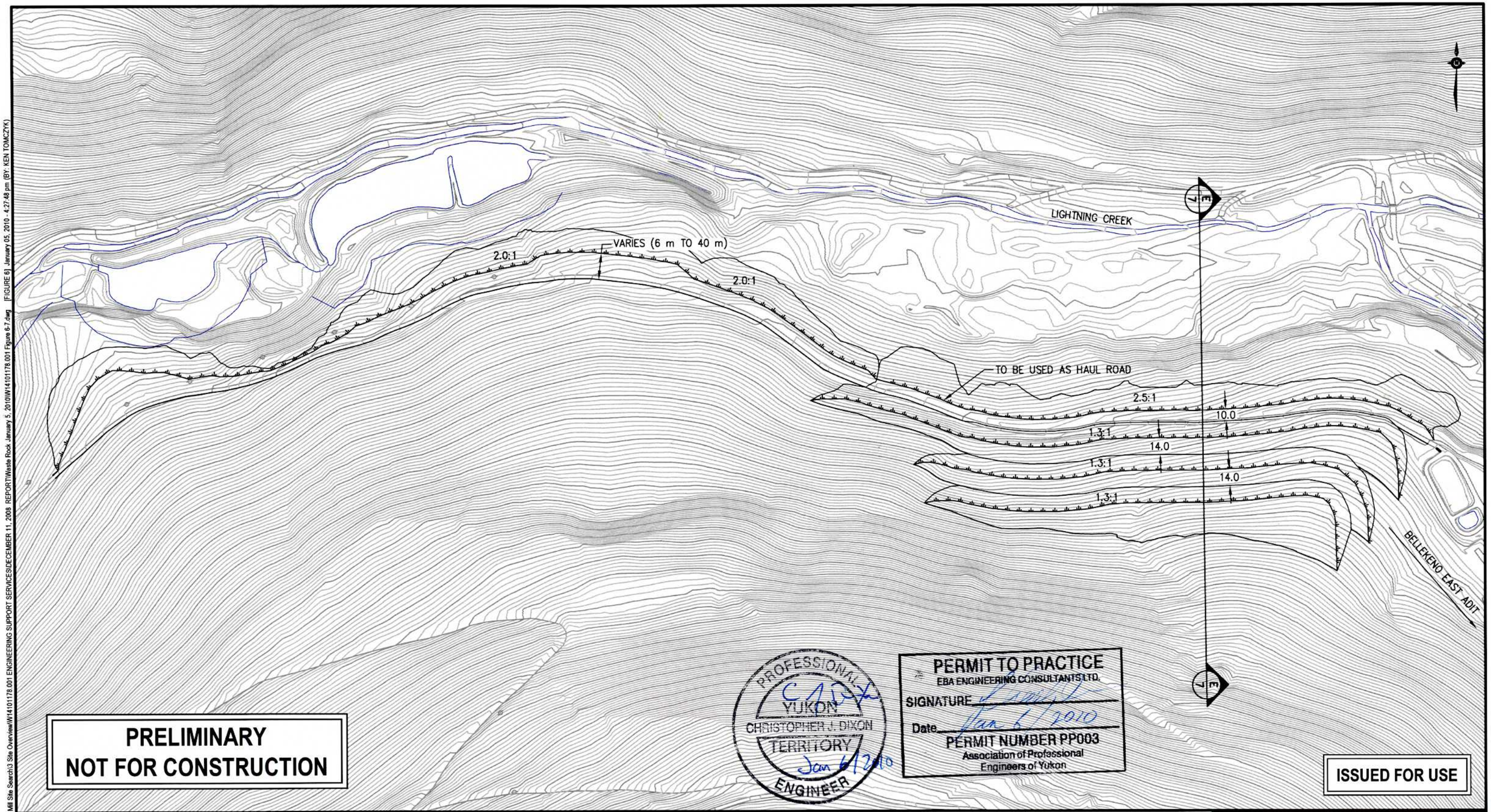
GEOTECHNICAL EVALUATION - POTENTIAL MILL SITES
BELLEKENO PROJECT, YUKON

BELLEKENO BOREHOLE LOCATION PLAN

PROJECT NO.	DWN	CKD	REV
W14101178	KJT	JTP	0
OFFICE: EBA-WHSE	DATE: DECEMBER 4, 2008		

Figure 4

Q:\Whitehorse\Data\0201drawings\Keno\W14101178 Mill Site Search\3 Site Overview\W14101178 GEOTECHNICAL EVALUATION\W14101178 Figure 1,2,3,4.dwg [FIGURE 4] December 08, 2008 - 5:20:25 pm (BY: KEN TOMCZYK)



PRELIMINARY
NOT FOR CONSTRUCTION

PROFESSIONAL ENGINEER
YUKON TERRITORY
CHRISTOPHER J. DIXON
Jan 6/2010

PERMIT TO PRACTICE
EBA ENGINEERING CONSULTANTS LTD.
SIGNATURE
Date Jan 6 2010
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

ISSUED FOR USE

WASTE ROCK VOLUME = 200,000 m³

NOTE:
BASE PLAN PROVIDED BY
ALEXCO RESOURCE CANADA CORP.

0 100
Scale: 1: 3,000 (metres)

THIS DRAWING IS TO BE READ ONLY IN CONJUNCTION WITH REPORT "CONCEPTUAL TAILINGS AND WASTE ROCK MANAGEMENT PLANS - BELLEKENO PROJECT NEAR KENO CITY, YUKON" DATED DECEMBER 12, 2008

CLIENT
ALEXCO

EBA Engineering Consultants Ltd.

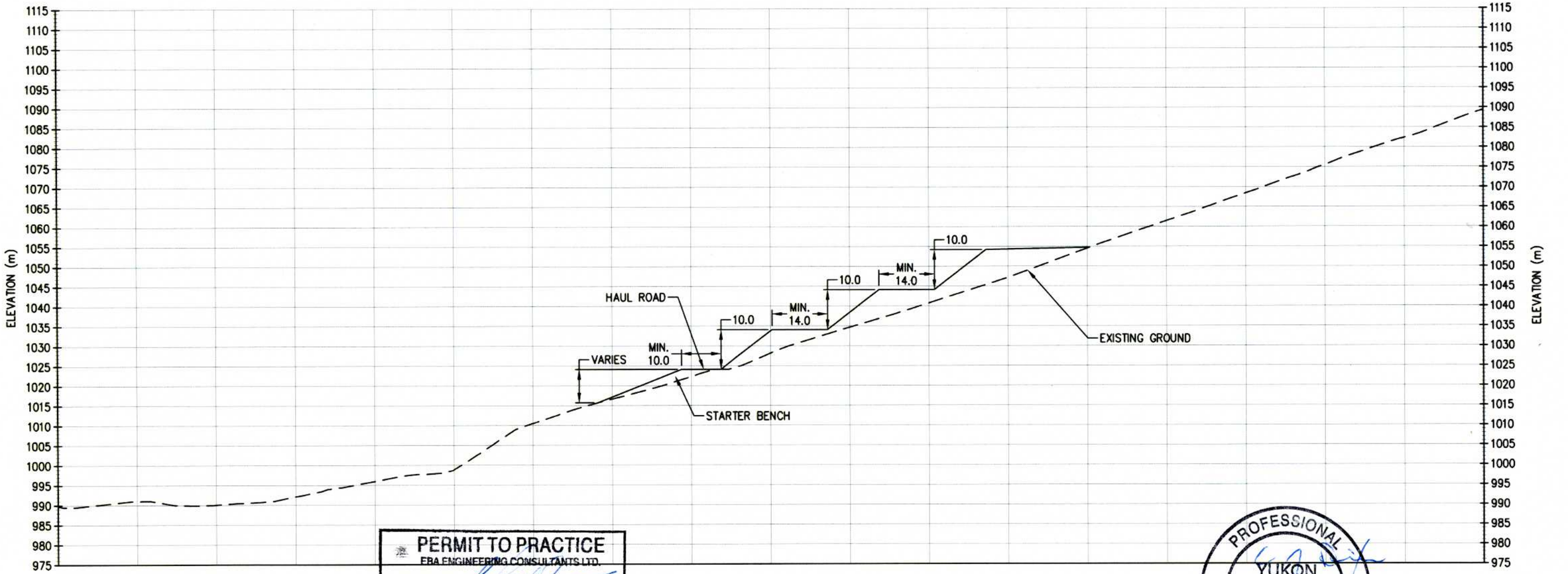
ENGINEERING SUPPORT SERVICES
BELLEKENO MINE PROJECT, YUKON

WASTE ROCK DISPOSAL AREA
PLAN

PROJECT NO	DWN	CKD	REV
W14101178.001	KJT	CJD	2
OFFICE: EBA-WHSE	DATE: January 5, 2010		

Figure 6

Q:\Whitehorse\Data\0201drawings\Keno\W14101178 Mill Site Search\3 Site Overview\W14101178.001 ENGINEERING SUPPORT SERVICESDECEMBER 11, 2008 REPORT\Waste Rock January 5, 2010\W14101178.001 Figure 6-7.dwg [FIGURE 6] January 05, 2010 - 4:27:48 pm (BY: KEN TOMCZYK)



PRELIMINARY
NOT FOR CONSTRUCTION

PERMIT TO PRACTICE
EBA ENGINEERING CONSULTANTS LTD.
SIGNATURE
Date Jan 6/2010
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

E 6 WASTE ROCK PILE PROFILE
SCALE 1:1,000

0 50
Scale: 1: 1,000 (metres)

PROFESSIONAL ENGINEER
YUKON TERRITORY
CHRISTOPHER J. DIXON
Jan 6/2010

ISSUED FOR USE

NOTE
1. ALL UNITS IN METRES UNLESS OTHERWISE NOTED
2. BASE PLAN PROVIDED BY ALEXCO RESOURCE CANADA CORP.

THIS DRAWING IS TO BE READ ONLY IN CONJUNCTION WITH REPORT "CONCEPTUAL TAILINGS AND WASTE ROCK MANAGEMENT PLANS - BELLEKENO PROJECT NEAR KENO CITY, YUKON" DATED DECEMBER 12, 2008

CLIENT
ALEXCO

ENGINEERING SUPPORT SERVICES
BELLEKENO MINE PROJECT, YUKON

WASTE ROCK DISPOSAL AREA
PROFILE

EBA Engineering Consultants Ltd.

PROJECT NO	DWN	CKD	REV
W14101178.001	KJT	CJD	2
OFFICE: EBA-WHSE	DATE: January 5, 2010		

Figure 7

Q:\Whitehorse\Data\0201drawings\Keno\W14101178 Mill Site Search\3 Site Overview\W14101178.001 ENGINEERING SUPPORT SERVICES\DECEMBER 11, 2008 REPORT\Waste Rock January 5, 2010\W14101178.001 Figure 6-7.dwg [FIGURE 7] January 05, 2010 - 4:28:48 pm (BY: KEN TOMCZYK)

Geotechnical Evaluation-Potential Mill Sites	Client: Alexco Resource Canada Corp.	BOREHOLE NO: W14101178-BH11
Bellekeno	Drill Type: 345 Hydraulic Reed Drill (air rotary)	PROJECT NO: W14101178
Keno City, YT	7087115N; 487269E; Zone 8	ELEVATION: 1035m

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | BULK | CRREL CORE | SHELBY TUBE | GRAB CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	LITHOLOGICAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS	Bulk Density(kg/m³) 500 1000 1500 2000; PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80; SILT (%) 20 40 60 80; SAND (%) 20 40 60 80; GRAVEL (%) 20 40 60 80	Elevation (m)
0	SAND - gravelly, silty, well graded, moist, dark grey		1				1035.0
1			2				1034.0
2			3				1033.0
3			4				1032.0
4			5				1031.0
5			6				1030.0
6			7				1029.0
7	- becomes wet		8				1028.0
8			9				1027.0
9	END OF BOREHOLE @ 9.0 m - borehole terminated at driller's recommendation - Instrumentation: GTC 2124						1026.0
10							1025.0

EBA Engineering Consultants Ltd.

LOGGED BY: JTP	COMPLETION DEPTH: 9m
REVIEWED BY: CJD	COMPLETE: 10/30/2008
DRAWING NO: Figure 4	Page 1 of 1

MGP W14101178.GPJ EBA.GDT 08/12/08

Geotechnical Evaluation-Potential Mill Sites	Client: Alexco Resource Canada Corp.	BOREHOLE NO: W14101178-BH12
Bellekeno	Drill Type: 345 Hydraulic Reed Drill (air rotary)	PROJECT NO: W14101178
Keno City, YT	7087131N; 487262E; Zone 8	ELEVATION: 1032m

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | BULK | CRREL CORE | SHELBY TUBE | GRAB CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	LITHOLOGICAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS	Bulk Density(kg/m³) 500 1000 1500 2000; PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80; SILT (%) 20 40 60 80; SAND (%) 20 40 60 80; GRAVEL (%) 20 40 60 80	Elevation (m)
0	SAND - some silt, trace gravel, wet, dark grey, organic inclusions		1				1032.0
1	SAND - silty, damp, dark grey						1031.0
2			2				1030.0
3			3				1029.0
4			4				1028.0
5			5				1027.0
6			6				1026.0
7	- becomes moist		7				1025.0
8			8				1024.0
9	- becomes wet		9				1023.0
10			10				1022.0
11							1021.0
12			11				1020.0
13			12				1019.0
14							1018.0
15			13				1017.0
16							1016.0
17			14				1015.0
18	END OF BOREHOLE @ 18 m - borehole terminated at driller's recommendation						1014.0
19							1013.0

EBA Engineering Consultants Ltd.

LOGGED BY: JTP	COMPLETION DEPTH: 18m
REVIEWED BY: CJD	COMPLETE: 10/30/2008
DRAWING NO: Figure 4	Page 1 of 1

Geotechnical Evaluation-Potential Mill Sites	Client: Alexco Resource Canada Corp.	BOREHOLE NO: W14101178-BH13
Bellekeno	Drill Type: 345 Hydraulic Reed Drill (air rotary)	PROJECT NO: W14101178
Keno City, YT	7087134N; 487153E; Zone 8	ELEVATION: 1028m

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | BULK | CRREL CORE | SHELBY TUBE | GRAB CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	LITHOLOGICAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS	Bulk Density(kg/m³) 500 1000 1500 2000; PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80; SILT (%) 20 40 60 80; SAND (%) 20 40 60 80; GRAVEL (%) 20 40 60 80	Elevation (m)
0	SAND - some gravel, trace silt, wet, dark grey, organic inclusions		1				1028.0
1	SAND - silty, trace gravel, moist, dark grey		2				1027.0
2			3				1026.0
3			4				1025.0
4			5				1024.0
5			6				1023.0
6			7				1022.0
7			8				1021.0
8			9				1020.0
9	- becomes wet		10				1019.0
10							1018.0
11							1017.0
12	END OF BOREHOLE @ 12 m - borehole terminated at driller's recommendation						1016.0
13							1015.0

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LOGGED BY: JTP	COMPLETION DEPTH: 12m
REVIEWED BY: CJD	COMPLETE: 10/30/2008
DRAWING NO: Figure 4	Page 1 of 1

Geotechnical Evaluation-Potential Mill Sites	Client: Alexco Resource Canada Corp.	BOREHOLE NO: W14101178-BH14
Bellekeno	Drill Type: 345 Hydraulic Reed Drill (air rotary)	PROJECT NO: W14101178
Keno City, YT	7087135N; 487041E; Zone 8	ELEVATION: 1020m

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | BULK | CRREL CORE | SHELBY TUBE | GRAB CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	LITHOLOGICAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS	Bulk Density(kg/m³) 500 1000 1500 2000 / PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80 / SILT (%) 20 40 60 80 / SAND (%) 20 40 60 80 / GRAVEL (%) 20 40 60 80	Elevation (m)
0	SAND - some gravel, trace silt, moist, black, organic inclusions		1				1020.0
1	SAND - silty, moist, dark grey		2				1019.0
2			3				1018.0
3			4				1017.0
4			5				1016.0
5	- becomes wet						1015.0
6	END OF BOREHOLE @ 6.0 m - borehole terminated at driller's recommendation						1014.0
7							1013.0
8							1012.0
9							1011.0
10							1010.0

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LOGGED BY: JTP	COMPLETION DEPTH: 6m
REVIEWED BY: CJD	COMPLETE: 10/30/2008
DRAWING NO: Figure 4	Page 1 of 1

MGP W14101178.GPJ EBA.GDT 08/12/08

Geotechnical Evaluation-Potential Mill Sites	Client: Alexco Resource Canada Corp.	BOREHOLE NO: W14101178-BH15
Bellekeno	Drill Type: 345 Hydraulic Reed Drill (air rotary)	PROJECT NO: W14101178
Keno City, YT	7087139N; 487204E; Zone 8	ELEVATION: 1031m

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | BULK | CRREL CORE | SHELBY TUBE | GRAB CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	LITHOLOGICAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS	Bulk Density(kg/m³) 500 1000 1500 2000; PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80; SILT (%) 20 40 60 80; SAND (%) 20 40 60 80; GRAVEL (%) 20 40 60 80	Elevation (m)
0	ORGANICS		1				1031.0
1	SAND - some silt, trace gravel, moist, dark grey		2				1030.0
2			3				1029.0
3	- becomes silty		4				1028.0
4			5				1027.0
5			6				1026.0
6			7				1025.0
7			8				1024.0
8	- becomes wet						1023.0
9							1022.0
10	END OF BOREHOLE @ 10 m - borehole terminated at driller's recommendation						1021.0
11							1020.0

111

EBA Engineering Consultants Ltd.	LOGGED BY: JTP	COMPLETION DEPTH: 10m
	REVIEWED BY: CJD	COMPLETE: 10/30/2008
	DRAWING NO: Figure 4	Page 1 of 1

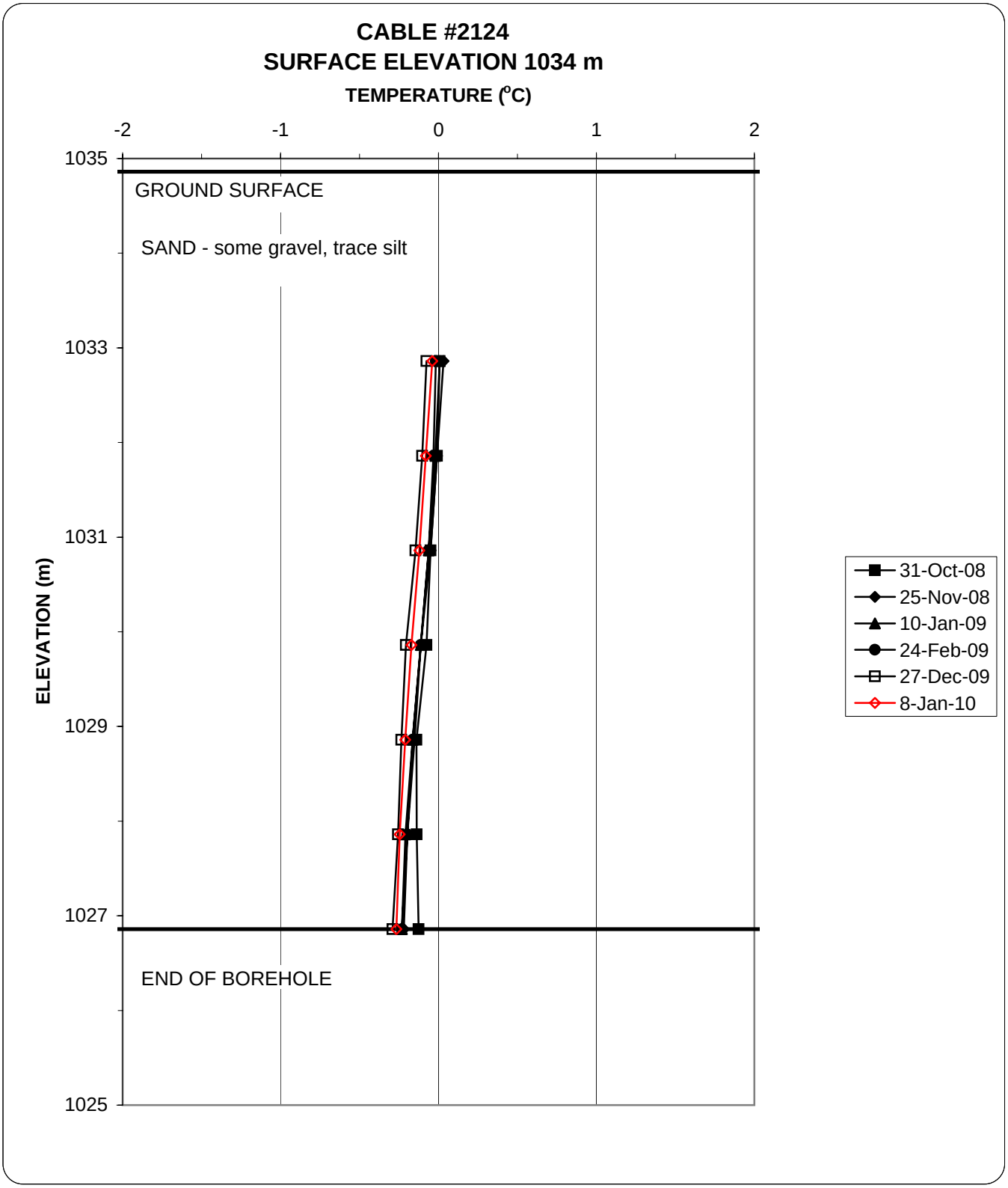

Figure 5
Ground Temperature Profile
Proposed Keno Mill Sites
Borehole #11 - BelleKeno

Alexco Resource Canada Corp.

TYPICAL WASTE CONTAINMENT FACILITY DESIGN
KENO HILL SILVER DISTRICT, YT
CONSTRUCTION SPECIFICATIONS
ISSUED FOR USE

W14101142

July 2008

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Calcite Business Centre • Unit 6, 151 Industrial Road • Whitehorse, Yukon Y1A 2V3 • CANADA

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APPENDICES

Section 1001

DEFINITIONS

DEFINITIONS

1.0 General

.1 Definitions of terms used throughout the Construction Specifications are presented in this Section.

2.0 Definitions

Construction Drawings:	the drawings, as issued for construction, of the Typical Waste Containment Facility Design.
Construction Specifications:	this document.
Contract:	the legal and binding agreement between the Contractor and Alexco Resource Corp. regarding construction of the Waste Containment Facility.
Contractor:	the general contractor responsible for constructing the Waste Containment Facility.
Engineer:	the Professional Geotechnical Engineer registered in the Yukon who is associated with the construction process.
Owner:	Alexco Resource Corp.
Site:	the area in which construction of the Waste Containment Facility or related activity is occurring.
Unsuitable:	not meeting the requirements stated herein or not receiving the Engineer's approval.
Facility:	all components of the Waste Containment Facility.

END OF SECTION

Section 1002

GENERAL

GENERAL

1.0 General

.1 Alexco Resource Canada Corp. intends to construct a containment facility to store waste rock from the Bellekeno advanced underground exploration and development program. As the company advances through the Keno Hill Silver District, it is anticipated further underground exploration and development programs will require similar containment facilities. Therefore, a typical design has been developed to account for the various potential site and construction material conditions.

.2 The Facility is to be located within previously disturbed areas, all of which will be incorporated within a district wide closure plan. This district wide closure plan is required under the water license QZ06-074.

.3 Site specific conditions and Facility location have not been provided or considered. Once Facility location and site specific conditions are known, they must be reviewed by the Engineer. Furthermore, the base of the Facility must be approved by the Engineer prior to fill placement.

.4 The Facility will be lined with a suitable geomembrane. Water in the Facility will flow towards the vertical culvert and pond within the voids of the waste material.

.5 Water in the Facility will be monitored and tested on a regular basis. Based on water quality analysis, the waste water will be extracted via pump truck and discharged to the environment or treated in a designated treatment facility.

.6 Once the Facility reaches its ultimate capacity, the Facility will be capped and reclaimed.

2.0 Scope of Work

.1 The scope of work for the construction of the Facility is as follows:

a. Construct the liner subgrade and berms with Zone B material at the specified grade. This could include cut/fill operations should the foundation material be satisfactory;
b. If required, install a geotextile layer to act as separator for Zone A and Zone B materials;
c. Construct the liner bedding with Zone A material;

d. Install the liner system consisting of a suitable liner material and if required, protective geotextile layers above and below the liner, and a geocomposite reinforcing layer;
e. Place and compact cover material, Zone A material, over the liner system;
f. Install vertical culvert as specified on the Construction Drawings;
g. Place and compact the waste material;
h. Regrade the waste material and place and compact capping material;
i. Install vegetative cover.

END OF SECTION

Section 1003

FILL MATERIALS

FILL MATERIALS

1.0 General

.1 This section describes the construction material specifications for the Waste Containment Facility.

2.0 Reference Standards

.1 The most recent copy of American Society for Testing Materials, ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregate.

3.0 Material Sources

.1 No material of any type shall be borrowed or excavated without the Owner's prior approval.

.2 Pits and quarries shall be maintained and managed in accordance with the requirements set out in the Owner's Land Use and Quarry Permits.

.3 Zone A material shall be obtained from sources approved by the Owner, provided the final product meets the requirements specified herein. Processing may be required to achieve the specified gradation.

.4 Zone B material shall be obtained from sources approved by the Owner, provided the final product meets the requirements specified herein. Processing may be required to achieve the specified gradation.

.5 The parent rock from which all fill materials are derived shall consist of sound, hard, durable material free from soft, thin, elongated or laminated particles and shall contain no unsuitable substances. The potential quarry source shall be approved by the Engineer.

.6 The quarry source for the Facility fill materials shall be inspected by the Engineer throughout material processing to ensure the product meets the requirements stated herein.

4.0 Material Specifications

.1 Zone A Material

The Zone A material shall consist of hard, durable particles, shall be free of roots, topsoil, and deleterious material and shall have a particle size distribution, as measured by ASTM C136, as presented in Table 1003.1.

TABLE 1003.1: ZONE A MATERIAL (10 MM MINUS) - PARTICLE SIZE DISTRIBUTION LIMITS

Sieve Size (mm)	% Passing Fine Limit	% Passing Coarse Limit
10	100	100
5	80	100
2	55	100
0.63	25	65
0.25	10	40
0.08	2	15

.2 Zone B Material

The Zone B material shall be free of roots, topsoil and other deleterious material and shall have a particle size distribution within the limits presented in Table 1003.2.

TABLE 1003.2: ZONE B MATERIAL (200 MM MINUS) - PARTICLE SIZE DISTRIBUTION LIMITS

Sieve Size (mm)	% Passing Fine Limit	% Passing Coarse Limit
200	100	100
100	85	100
50	65	100
25	40	100
5	20	55
2	0	20

END OF SECTION

Section 1004

FILL PLACEMENT

FILL PLACEMENT

1.0 General

.1 The fill placement methods to be used during construction of the Waste Containment Facility are described in this Section.

.2 Construction shall be performed in accordance with the best modern practice and with equipment best adapted to the work being performed. Embankment materials shall be placed so that each zone is homogeneous; free of stratifications; ice chunks, lenses or pockets; and layers of material with different texture grading not conforming to the requirements stated herein.

.3 No fill material shall be placed on any part of the foundation until it has been prepared, as specified herein. Placement of fill material shall conform to the lines, grades and elevations shown on the Construction Drawings.

.4 Embankment construction shall not proceed when the work cannot be performed in accordance with the requirements of the Construction Specifications. Any part of the embankment that has been damaged by the action of rain, snow or any other cause shall be removed and replaced with the appropriate material conforming to the requirements stated herein.

.5 Stockpiling, loading, transporting, placing, and spreading of all materials shall be carried out in such a manner to avoid segregation. Segregated materials shall be removed and replaced with the materials meeting the requirements stated herein.

.6 The Contractor shall remove all debris, vegetation or any other material not conforming to the requirements stated herein. The Contractor shall dispose of these materials in an area approved by the Owner.

2.0 Zone B Material Placement

.1 The Zone B material shall be placed to the design elevation as specified in the Construction Drawings in lifts no greater than 500 mm in uncompacted thickness.

.2 The design elevation for the top of the Zone B berm material shall be no less than 0.5 m above original ground.

.3 Moisture condition and compact using the minimum number of passes established in accordance with section 1006.4.2.

3.0 Zone A Material Placement

.1 The Zone A material shall be placed as bedding for the liner system (minimum 300 mm thick) to the design grade specified in the Construction Drawings.

.2 Subsequent to the liner installation, the Zone A material shall be placed as liner system cover material. The liner system cover material shall be placed to the minimum thickness specified in Table 1004.1 dependent on the type of liner selected.

TABLE 1004.1: RECOMMENDED MINIMUM COVER THICKNESSES

Liner Material	Minimum Required Thickness
Enviro Liner® 4040 (Without Geocomposite)	1.3 m
Enviro Liner® 4040 (With Geocomposite)	0.3 m
HDPE 60	0.3 m
PVC 40 (With Geocomposite)	0.3 m

.3 The Construction Drawings are based on the selection of Enviro Liner® 4040 with the installation of a geocomposite reinforcing material. Other design alternatives are detailed in Section 1007.

.4 Zone A material shall be placed in lifts not exceeding 300 mm in uncompacted thickness. Vehicle traffic is prohibited from maneuvering within the Facility until the cover material has reached the minimum thickness required as specified in Table 1004.1.

.5 Moisture condition and compact with using the minimum number of passes established in accordance with section 1006.4.1.

.6 Equipment with ground pressures higher than 380 kPa should not be permitted inside the Facility once the liner system has been placed. Care is required to provide the appropriate thickness of fill beneath a vehicle when placing material above the liner system to ensure it is not damaged. Traffic in the area should be restricted to low ground pressure equipment.

END OF SECTION

Section 1005

LINER SYSTEM

LINER SYSTEM

1.0 General

.1 The product and installation specifications for the non-woven geotextile, liner systems and geocomposite materials to be used in the Waste Containment Facility are presented in this section.

.2 The liner system will be provided by the Owner and installed by the Contractor.

2.0 Reference Standards

.1 The most recent copy of the following American Society for Testing Materials standards:

a. ASTM D638 Standard Methods for Tensile Properties of Plastics.

b. ASTM D792 Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

c. ASTM D1004 Standard Test Methods for Initial Tear Resistance of Plastic Film and Sheeting.

d. ASTM D1603 Standard Test Methods for Carbon Black in Olefin Plastics.

e. ASTM D1777 Standard Test Methods for Thickness of Textile Materials.

f. ASTM D4533 Standard Test Methods for Trapezoidal Tearing Strength of Geotextiles.

g. ASTM D4632 Standard Test Methods for Grab Breaking Load and Elongation of Geotextile.

h. ASTM D4751 Standard Test Methods for Determining Apparent Opening Size of a Geotextile.

i. ASTM D4833 Standard Test Methods for Index Puncture Resistance for Geotextile, Geomembranes, and Related Products.

j. ASTM D5199 Standard Test Methods for Measuring the Nominal Thickness of Geosynthetics.

k. ASTM D5261 Standard Test Methods for Measuring Mass per Unit Area of Geotextiles.

l. ASTM D5994 Standard Test Methods for Measuring Core Thickness of textured Geomembranes

.2 Federal Test Method

a. FTM Standard 101.

3.0 Materials

.1 Geotextile

a. The non-woven geotextile shall have a weight of 542 g/m^2. The manufacturer shall, prior to shipment of materials, provide to the Engineer a signed manufacturing certification that materials to be shipped to site have test values that meet or exceed the requirements listed in Table 1005.1.

TABLE 1005.1: RECOMMENDED MINIMUM GEOTEXTILE PROPERTIES

Physical Property	Minimum Average Roll Value (Weakest Principle Direction)
Thickness – Typical (ASTM D5199)	3.6 mm
Grab Tensile Strength (ASTM D4632)	1690 N
Elongation at Failure (ASTM D4632)	50 %
Trapezoidal Tear Strength (ASTM D4533)	645 N
Puncture (ASTM D4833)	1070 N
Apparent Opening Size (ASTM D4751)	150 microns
Weight – Typical (ASTM D5261)	542 g/m^2

b. Any visible damage to the shipment of geotextile shall be noted on the freight receipt and project records.

c. Storage of geotextile rolls on site shall be in a secure location that will minimize exposure to the elements, UV light and physical damage.

.2 Enviro Liner® 4040

a. The Enviro Liner® shall be 1.0 mm (40 mil) thick geomembrane or equivalent. The manufacturer shall, prior to shipment of materials, provide to the Engineer a signed manufacturing certification that materials to be shipped to site have test values that meet or exceed the requirements listed in Table 1005.2.

TABLE 1005.2: RECOMMENDED MINIMUM GEOMEMBRANE PROPERTIES

Property	Enviro Liner® 4040
Minimum Average Thickness (ASTM D5994)	1.0 mm
Relative Density (ASTM D792)	0.939
Tensile Strength at Yield (ASTM D638)	26.6 N/mm
Elongation at Yield (ASTM D638)	800 %
Tear Resistance (ASTM D1004)	98 N
Puncture Resistance (FTMS 101)	271 N
Carbon Black Content (ASTM D1603)	2.0 – 3.0 %

b. The liner material supplied under the specifications shall not have any blisters, holes, undispersed raw materials or any signs of contamination or inclusions of foreign matter. Such defects shall be repaired using techniques in accordance with manufacturer's recommendations. Excessive defects may be grounds for rejecting the entire roll of liner.

c. Storage of geomembrane rolls on site shall be in a secure location that will minimize exposure to the elements and physical damage.

d. Enviro Liner® geomembrane is suitable for secondary containment of hydrocarbons and other chemicals, and primary containment of water and water based effluents or as approved by manufacturer.

.3 HDPE Liner

a. The HDPE geomembrane shall be 1.5 mm (60 mil) thick geomembrane or equivalent. The manufacturer shall, prior to shipment of materials, provide to the Engineer a signed manufacturing certification that materials to be shipped to site have test values that meet or exceed the requirements listed in Table 1005.3.

TABLE 1005.3: RECOMMENDED MINIMUM GEOMEMBRANE PROPERTIES

Property	Textured HDPE 60
Minimum Average Thickness (ASTM D5994)	1.5 mm
Relative Density (ASTM D792)	0.94
Tensile Strength at Yield (ASTM D638)	22.0 kN/m
Elongation at Yield (ASTM D638)	12 %
Tear Resistance (ASTM D1004)	187 N
Puncture Resistance (FTMS 101)	480 N
Carbon Black Content (ASTM D1603)	2.0 – 3.0 %

b. The liner material supplied under the specifications shall not have any blisters, holes, undispersed raw materials or any signs of contamination or inclusions of foreign matter. Such defects shall be repaired using welding techniques in accordance with manufacturer's recommendations. Excessive defects may be grounds for rejecting the entire roll of liner.

c. Extrusion resin used for extrusion joining of sheets and for repairs should be HDPE from the same resin batch as the sheet resin. Physical properties must be the same as the liner sheets.

d. HDPE liner is suitable for containment of hydrocarbons and chemicals as well as water and water based effluents or as approved by manufacturer.

e. Storage of geomembrane rolls on site shall be in a secure location that will minimize exposure to the elements and physical damage.

.4 PVC Liner

a. The PVC geomembrane shall be 0.95 mm (38 mil) thick geomembrane or equivalent. The manufacturer shall, prior to shipment of materials, provide to the

Engineer a signed manufacturing certification that materials to be shipped to site have test values that meet or exceed the requirements listed in Table 1005.4.

TABLE 1005.4: RECOMMENDED MINIMUM GEOMEMBRANE PROPERTIES

Property	PVC 40
Minimum Average Thickness (ASTM D5994)	0.95 mm
Tensile Strength at Yield (ASTM D638)	17 N/mm
Elongation at Yield (ASTM D638)	430 %
Tear Resistance (ASTM D1004)	44 N

b. The liner material supplied under the specifications shall not have any blisters, holes, undispersed raw materials or any signs of contamination or inclusions of foreign matter. Such defects shall be repaired using techniques in accordance with manufacturer's recommendations. Excessive defects may be grounds for rejecting the entire roll of liner.

c. PVC liner is suitable for containment of water and water based effluents or as approved by manufacturer. It is not suitable for containment of hydrocarbons.

d. Storage of geomembrane rolls on site shall be in a secure location that will minimize exposure to the elements, UV light and physical damage.

.5 Geocomposite

a. The geocomposite reinforcing material shall be 5 mm (200 mil) thick or equivalent. The manufacturer shall, prior to shipment of materials, provide to the Engineer a signed manufacturing certification that materials to be shipped to site have test values that meet or exceed the requirements listed in Table 1005.5.

TABLE 1005.5: RECOMMENDED MINIMUM GEOCOMPOSITE PROPERTIES

Property	Geo-Comp 5
Minimum Average Thickness (ASTM D5994)	5 mm
Relative Density (ASTM D792)	0.94
Tensile Strength at Yield (ASTM D638)	79 N/cm
Puncture Resistance (FTMS 101)	489 N
Carbon Black Content (ASTM D1603)	2.0 %

b. The geocomposite material supplied under the specifications shall not have defects or any signs of contamination or inclusions of foreign matter. Excessive defects may be grounds for rejecting the entire roll of geocomposite.

4.0 Installation - Enviro Liner® 4040 Design (with Geocomposite)

.1 The liner system consists of the following layers (starting from the top layer):

- Geo-Comp 5 or equivalent geocomposite
- Enviroliner 4040 or equivalent geomembrane

.2 The liner should line the entire surface of the Facility, which includes the crest of the berms, inside slopes, and floor. The geocomposite material is only required on the floor and approach berm of the Facility.

.3 The Contractor shall ensure that the integrity of the liner system and its components are not compromised during construction. Precautions the Contractor may take to avoid damaging the liner system may include, but will not be limited to, providing light plants in the work area to improve visibility or using pylons to mark the lift/liner system interface.

.4 Any damage to the liner system and/or its components shall be repaired as soon as possible. Fill placement shall cease immediately in an area where the integrity of the liner system has been compromised. Fill surrounding the damaged liner system may have to be excavated, without further damaging the integrity of the liner, to permit repairs to be made. Hand excavation shall be used to expose damaged portions of the liner for repair.

.5 The liner system shall be anchored at the top of the berm so that movement downslope does not occur during backfilling at any stage of construction.

.6 The Contractor shall take the necessary steps to ensure that backfilling does not induce tensile stress in the liner system. Care shall be taken to avoid making sharp turns, sudden stops or sudden starts adjacent to the liner system. Non-essential heavy equipment traffic in the immediate vicinity of the liner system shall not be permitted.

Enviro Liner® Installation

.7 The Enviro Liner® should be deployed subsequent to the placement of Zone A bedding material.

.8 The Engineer should walk the liner to observe for any defects caused by on-site equipment and tools. Any liner area showing injury due to excessive scuffing, puncture, or distress from any cause should be replaced or repaired with an additional piece of Enviro Liner® installed as per the manufacturer's specifications over the defective area. All patches should have rounded edges and extend a minimum of 150 mm beyond the affected area.

.9 Low ground pressure equipment should be used to deploy the liner material. No equipment shall be allowed on the liner.

Geocomposite Reinforcing Installation

.10 The geocomposite material should be deployed subsequent to the placement of the Liner.

.11 No equipment is permitted on the liner material during the placing of the geocomposite reinforcing material. The geocomposite reinforcing material must rolled out by hand and the cover material placed in accordance with Section 1004.

Material Quantities

.12 Estimated material quantities required for the lined pad are listed in Table 1005.6

TABLE 1005.6: MATERIAL QUANTITY ESTIMATES

Material	Total Area (m^2)
Enviro Liner® 4040	1900
Geo-Comp 5	905

5.0 Installation - HDPE 60 Design

.1 The liner system consists of the following layers (starting from the top layer):

- HDPE 60 mil or equivalent geomembrane

.2 The liner should line the entire surface of the Facility, which includes the crest of the berms, inside slopes, and floor.

.3 The Contractor shall ensure that the integrity of the liner system and its components are not compromised during construction. Precautions the Contractor may take to

avoid damaging the liner system may include, but will not be limited to, providing light plants in the work area to improve visibility or using pylons to mark the lift/liner system interface.

.4 Any damage to the liner system and/or its components shall be repaired as soon as possible. Fill placement shall cease immediately in an area where the integrity of the liner system has been compromised. Fill surrounding the damaged liner system may have to be excavated, without further damaging the integrity of the liner, to permit repairs to be made. Hand excavation shall be used to expose damaged portions of the liner for repair.

.5 The liner system shall be anchored at the top of the berm so that movement downslope does not occur during backfilling at any stage of construction.

.6 The Contractor shall take the necessary steps to ensure that backfilling does not induce tensile stress in the liner system. Care shall be taken to avoid making sharp turns, sudden stops or sudden starts adjacent to the liner system. Non-essential heavy equipment traffic in the immediate vicinity of the liner system shall not be permitted.

HDPE Liner Installation

.7 The HDPE liner should be deployed subsequent to the placement of Zone A bedding material. The liner should be placed with no horizontal seams on the slopes. Tie-in seams should be located on the floor at a minimum of 1.5 m from the toe of the slopes.

.8 The liner panels shall be welded together along the full length of the seam to the top of the berm.

.9 Both the wedge and the extrusion welding equipment should be qualified by conducting trial seam tests prior to start-up each day and at approximately 4-hour intervals during seaming operations. During the trial seam, the minimum peel and shear strength criteria set by the manufacturer for the 60 mil HDPE geomembrane should be met. The industry-accepted peel and shear strengths for 60 mil HDPE geomembrane are 78 ppi (pounds/inch) and 120 ppi, respectively.

.10 The Engineer should walk the liner to observe for any defects caused by on-site equipment and tools. Any liner area showing injury due to excessive scuffing, puncture, or distress from any cause should be replaced or repaired with an additional

piece of HDPE liner extrusion welded over the defective area. All patches should have rounded edges and extend a minimum of 150 mm beyond the affected area.

.11 Low ground pressure equipment should be used to deploy the liner material. No track-wheel equipment shall be allowed on the liner. Equipment travel on the liner material should be kept to a minimum.

Material Quantities

.12 Estimated material quantities required for the lined pad are listed in Table 1005.7

TABLE 1005.7: MATERIAL QUANTITY ESTIMATES

Material	Total Area (m^2)
HDPE 60 Liner	1900

6.0 Installation - PVC 40 Design

.1 The liner system consists of the following layers (starting from the top layer):

- Geo-Comp 5 or equivalent geocomposite
- PVC 40 mil or equivalent geomembrane

.2 The liner system should line the entire surface of the Facility, which includes the crest of the berms, inside slopes, and floor. The geocomposite material is only required on the floor and approach berm of the Facility.

.3 The Contractor shall ensure that the integrity of the liner system and its components are not compromised during construction. Precautions the Contractor may take to avoid damaging the liner system may include, but will not be limited to, providing light plants in the work area to improve visibility or using pylons to mark the lift/liner system interface.

.4 Any damage to the liner system and/or its components shall be repaired as soon as possible. Fill placement shall cease immediately in an area where the integrity of the liner system has been compromised. Fill surrounding the damaged liner system may have to be excavated, without further damaging the integrity of the liner, to permit repairs to be made. Hand excavation shall be used to expose damaged portions of the liner for repair.

.5 The liner system shall be anchored at the top of the berm so that movement downslope does not occur during backfilling at any stage of construction.

.6 The Contractor shall take the necessary steps to ensure that backfilling does not induce tensile stress in the liner system. Care shall be taken to avoid making sharp turns, sudden stops or sudden starts adjacent to the liner system. Non-essential heavy equipment traffic in the immediate vicinity of the liner system shall not be permitted.

PVC Liner Installation

.7 The PVC liner should be deployed subsequent to the placement of Zone A bedding material.

.8 The Engineer should walk the liner to observe for any defects caused by on-site equipment and tools. Any liner area showing injury due to excessive scuffing, puncture, or distress from any cause should be replaced or repaired with an additional piece of PVC liner installed as per the manufacturer's specifications over the defective area. All patches should have rounded edges and extend a minimum of 150 mm beyond the affected area.

.9 Low ground pressure equipment should be used to deploy the liner material. No equipment shall be allowed on the liner.

Geocomposite Reinforcing Installation

.10 The geocomposite material should be deployed subsequent to the placement of the Liner.

.11 No equipment is permitted on the liner material during the placing of the geocomposite reinforcing material. The geocomposite reinforcing material must rolled out by hand and the cover material placed in accordance with Section 1004.

Material Quantities

.12 Estimated material quantities required for the lined pad are listed in Table 1005.8

TABLE 1005.8: MATERIAL QUANTITY ESTIMATES

Material	Total Area (m^2)
PVC 40 Liner	1900
Geo-Comp 5	905

END OF SECTION

Section 1006

QUALITY ASSURANCE

QUALITY ASSURANCE

1.0 General

.1 The quality assurance testing suggested is described in this section.

2.0 Reference Standards

.1 The most recent edition of the following American Society for Testing Materials standards:

a. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

b. ASTM D698 – Standard -Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))

d. ASTM D4437 – Standard Practice for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geomembranes.

.2 Geosynthetic Research Institute

a. GRI Test Method GM6 – Pressurized Air Channel Test for Dual Seamed Geomembranes.

3.0 Fill Particle Size Testing Requirements

.1 Zone A Material

a. Samples of the Zone A material should be evaluated from locations within the borrow source prior to construction. One sample will be evaluated every 500 m^3 placed during construction to ensure the placed gradation meets the specification stated herein. The required tests and testing frequency for the Zone A material are presented in Table 1006.1.

TABLE 1006.1: TESTING AND FREQUENCY OF ZONE A MATERIAL	
Test	**Test Frequency**
Particle Size Analysis	One (1) test every 500 m^3 during construction.

.2 Zone B Material

a. Samples of the Zone B material will be evaluated from the foundation material within the Facility prior to construction and every 2000 m^3 placed during construction to ensure the placed gradation meets the specification stated herein. The required tests and testing frequency for the Zone B material are presented in Table 1006.2.

TABLE 1006.2: TESTING AND FREQUENCY OF ZONE B MATERIAL	
Test	**Test Frequency**
Particle Size Analysis	One (1) location within the Facility and One (1) test every 2000 m^3 during construction.

4.0 Fill Compaction Testing Requirements

.1 Zone A Material

a. Compact each lift with a minimum of six passes using a large smooth-drum, vibratory compactor. The optimum vibratory frequency and number of passes should be determined during construction using proof-roll tests, which demonstrate optimum compaction. The Engineer should inspect the compaction effort to ensure that this effort results in a density equivalent to about 95% MDD.

.2 Zone B Material

a. Compact each lift with a minimum of six passes using a large smooth-drum, vibratory compactor. The optimum vibratory frequency and number of passes should be determined during construction using proof-roll tests, which demonstrate optimum compaction. The Engineer should inspect the compaction effort to ensure that this effort results in a density equivalent to about 98% MDD.

b. The foundation material (Zone B or subcut material) should also be compacted as specified in section 1006.4.1.

5.0 Geomembrane Testing Requirements

.1 General

a. The Contractor is responsible for obtaining mill certificates from the manufacturer and forwarding them to the Engineer.

b. If applicable, the Contractor shall record all seam parameters (i.e. time, date, operator, welding speed and temperature) on the liner.

c. If applicable, the Contractor shall be responsible for completing the vacuum box testing and pressure testing for the appropriate seams. The Contractor shall mark the test number and parameters on the liner.

d. If applicable, the Contractor shall supply and use a field tensiometer for testing liner seams for shear and peel strength.

e. The Contractor is responsible for maintaining testing records.

f. All coupons and test specimens remain the property of the Owner.

.2 Qualifying Welds

a. Qualifying seams shall be conducted on fragmented pieces of material at the following times:

- At the start of each shift of production seaming, and at 4 hour intervals during production seaming;
- When a new operator or new machine starts welding;
- When a machine is restarted after repairs;
- When welding is stopped for sixty (60) minutes or more;
- When there is a change in the ambient conditions; and
- At the discretion of the Engineer.

b. Qualifying seams shall be 1 m long, and shall be subject to shear and peel testing. The test seam shall meet the minimum requirements stated herein for seam strength, when tested on a field tensiometer. If a qualifying seam fails, the seaming procedure shall be reviewed and the test shall be repeated.

.3 Non-Destructive Testing

a. Test all wedge-welded seams over their full length using a vacuum unit or air pressure test.

- Seam intersections will also be subject to vacuum box testing, regardless of seaming method employed.
- The Contractor shall supply all apparatus and personnel for this type of test.
- The tests shall be witnessed and documented by the Engineer.

b. Clean all seams to permit proper inspection.

c. Repair any seams which fail non-destructive testing in accordance with this Specification. Repairs shall be fully documented by the Contractor.

.4 Vacuum Box Testing

a. Extrusion welded seams should be tested using either vacuum box testing or pick-testing. Vacuum box testing involves placing the extrusion weld under a vacuum. The weld is first coated with a soapy water solution and any holes in a weld would be indicated by a stream of bubbles when vacuum is applied.

b. No leaks shall be permitted while conducting vacuum box testing.

c. Pick-testing is conducted on uneven surfaces where a vacuum cannot be maintained. During pick testing, attention should be paid to the following specific items:

- The width of the weld;
- Weld bond to the underlying geomembrane;
- Joints between three panels ("T" joints);
- Defects such as bubbles created within the weld due to moisture; and
- Textured weld surfaces due to temperature fluctuation in the extrusion welder.

.5 Air Pressure Testing

a. Wedge welded seams should be air-pressure tested over their full lengths using an air pressure test. Air pressure testing involves pressurizing the air channel located between the dual tracks of the seams to a minimum pressure of 40 psi for a period of five minutes.

b. During the test, the air pressure is not allowed to drop more than 4 psi (10% allowance). Any leaks and bubbling in the seams found during the non-destructive tests must be repaired by extruding a patch of HDPE material over the defect.

c. Air pressure testing shall be carried out according to GRI Test Method GM6, Pressurized Air Channel Test for Dual Seamed Geomembranes.

.6 Destructive Testing for Production Seams

a. Cut-out coupons shall be taken at a minimum frequency of one (1) per 150 m of seam, or once per seam. Coupons shall be cut by the contractor at the location directed by the Engineer. Coupons shall generally be taken from a location that does not affect the performance of the liner. All cut-outs shall have rounded corners. Care shall be taken to ensure that no slits penetrate the parent liner.

b. All holes left by cut outs shall be patched immediately.

.7 Testing of Repairs

a. All repairs shall be tested using the Vacuum Box in accordance with test method ASTM 4437.

END OF SECTION

Section 1007

DESIGN ALTERNATIVES

DESIGN ALTERNATIVES

1.0 General

.1 This section provides design alternatives for the Facility should the fill materials available on or near site not adhere to the gradation specifications stated in Tables 1003.1 and 1003.2.

.2 Should Zone A, Zone B or both materials not meet the gradation specifications stated in Tables 1003.1 and 1003.2 then the recommended design alternatives are available in Table 1007.1.

TABLE 1007.1: RECOMMENDED DESIGN ALTERNATIVES FOR GRADATION NON-COMPLIANCE

		Zone B		
		Meets Specifications	Gradation Below Fine Limit	Gradation Above Coarse Limit
Zone A	Meets Specifications	This section does not apply	This section does not apply	See Section 1007.2
	Gradation Below Fine Limit	See Section 1007.2	See Section 1007.2	See Section 1007.2
	Gradation Above Coarse Limit	See Section 1007.3	See Section 1007.3	See Section 1007.4

2.0 Detailed Design Alternatives – Non-Compliance Criteria I

.1 If the fill materials do not comply with gradation specifications as per Table 1007.1 geotextile material is required at the interface between Zone A and Zone B materials.

.2 The geotextile material should be deployed prior to the placement of Zone A material.

.3 The geotextile should be placed with a minimum overlap of 150 mm and connected at the seam by heat bonding. If heat bonding is not available an overlap of 300 mm should be used. Horizontal seams should be kept to a minimum on the side slopes. If a horizontal seam is unavoidable, the overlap shall be capped with a 300 mm wide strip of the same geotextile and heat bonded to the underlying material.

.4 Any tears or holes made in the geotextile should be repaired by placing a patch of geotextile on the defect and held in place by heat bonding. The patch should extend at least 300 mm beyond the damage, in all directions.

3.0 Detailed Design Alternatives – Non-Compliance Criteria II

.1 If the fill materials do not comply with gradation specifications as per Table 1007.1 geotextile material is required above and below the liner system.

.2 The geotextile material should be deployed prior to the deployment of the liner system as well as subsequent to the deployment of the liner system.

.3 The geotextile should be placed with a minimum overlap of 150 mm and connected at the seam by heat bonding. If heat bonding is not available an overlap of 300 mm should be used. Horizontal seams should be kept to a minimum on the side slopes. If a horizontal seam is unavoidable, the overlap shall be capped with a 300 mm wide strip of the same geotextile and heat bonded to the underlying material.

.4 Any tears or holes made in the geotextile should be repaired by placing a patch of geotextile on the defect and held in place by heat bonding. The patch should extend at least 300 mm beyond the damage, in all directions.

4.0 Detailed Design Alternatives – Non-Compliance Criteria III

.1 If the fill materials do not comply with gradation specifications as per Table 1007.1 geotextile material is required above and below the liner system as well as at the interface between Zone A and Zone B materials.

.2 The geotextile material should be placed prior to the placing of Zone A material, prior to the deployment of the liner system as well as subsequent to the deployment of the liner system.

.3 The geotextile should be placed with a minimum overlap of 150 mm and connected at the seam by heat bonding. If heat bonding is not available an overlap of 300 mm should be used. Horizontal seams should be kept to a minimum on the side slopes. If a horizontal seam is unavoidable, the overlap shall be capped with a 300 mm wide strip of the same geotextile and heat bonded to the underlying material.

.4 Any tears or holes made in the geotextile should be repaired by placing a patch of geotextile on the defect and held in place by heat bonding. The patch should extend at least 300 mm beyond the damage, in all directions.

END OF SECTION

Section 1008

OPERATION AND MAINTENANCE

OPERATION AND MAINTENANCE

5.0 General

.1 This section provides a general guideline for the operation and maintenance of the Waste Containment Facility.

6.0 Geomembrane Lined Pad

.1 Structure Maintenance

a. This section refers to the structure as the berm, side slopes, and floor of the Facility.

b. The structure shall be inspected regularly. Attention shall be concentrated on the following:

- Eroded and/or damaged granular slope and floor surfaces and
- Exposed liner material

c. Any identified problems should be repaired immediately. The repair can be conducted by reconstructing the damaged or eroded slopes with a material of similar gradation to Zone A material. Any exposed liner material can be recovered with Zone A material; however, if the liner material is damaged, liner installation personnel shall be retained to repair the liner.

.2 Surface Water Management

a. The Facility is designed to drain all surface water to the installed vertical culvert. Each month, the water lever must be inspected, pumped and disposed of appropriately.

b. The frequency of monitoring must be increased during times of high precipitation or snow melt within the Facility.

7.0 Filling Procedure

.1 The filling procedure for the Facility is as follows:

a. Waste material is not to exceed a height of 3.0 m above the level of the top of the berm unless approved by the Engineer;

b. Waste material is not to be placed higher than relative elevation 0.5 m below the crest of the liner unless approved by the Engineer.

8.0 Closure

.1 Upon reaching capacity the Facility will be capped with material meeting the specifications outlined in Table 1008.1 or as approved by the Engineer.

TABLE 1008.1: CAPPING MATERIAL- PARTICLE SIZE DISTRIBUTION LIMITS

Sieve Size (mm)	% Passing Fine Limit	% Passing Coarse Limit
100	100	100
50	95	100
25	90	100
20	85	100
5	65	90
0.63	35	60
0.08	5	20

.2 The capping material shall have a minimum thickness of 0.5 m.

.3 The vegetative cover must be capable of self-regeneration without continuous dependence on fertilizer or re-seeding.

.4 The vegetative cover must have sufficient density and species diversity to stabilize the surface against the effects of long term erosion.

.5 Closure monitoring should include inspection for any ponding water. If ponded water is present capping material should be added or re-graded.

END OF SECTION

APPENDIX

APPENDIX A CONSTRUCTION DRAWINGS

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NOTES

1. CONTAINMENT FACILITY SIZED FOR 1900 m³ OF GEOMEMBRANE. CONFIGURATION OF BASE AREA CAN BE MODIFIED SHOULD SITE CONDITIONS WARRANT. HOWEVER, SPECIFIED BERM CROSS-SECTION, FILL MATERIALS, LINER SYSTEM AND GENERAL DESIGN CRITERIA MUST BE ADHERED TO.
2. SPECIFIC CONDITIONS AND FACILITY LOCATION HAVE NOT BEEN PROVIDED OR CONSIDERED. ONCE FACILITY LOCATION AND SITE SPECIFIC CONDITIONS ARE KNOWN, THEY MUST BE APPROVED BY THE ENGINEER PRIOR TO CONSTRUCTION.
3. ALL ELEVATIONS ON PLAN ARE FOR TOP OF ZONE B MATERIAL.

REVISIONS						
NUM	DATE	DWN	CKD	APR	DESCRIPTION	

DRAWING STATUS				
NUM	DATE	APR	DESCRIPTION	
A	08/06/25	JPB	ISSUED FOR REVIEW	
B	08/07/08	JPB	ISSUED FOR CONSTRUCTION	

ORIGINAL
SIGNED AND SEALED

Permit: J. Richard Tremble, P.Eng.
Date: July 8, 2008

Seal: Jason Behrens, P.Eng.
Date: July 8, 2008

The signed Professional Seal and Permit to Practice stamps inside on the executed drawing which is held and controlled by EBA Engineering Consultants Ltd.

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EBA Engineering Consultants Ltd.

TYPICAL WASTE CONTAINMENT FACILITY DESIGN
KENO HILL SILVER DISTRICT, YT

ZONE B MATERIAL PLAN & CROSS SECTIONS

PROJECT No.	OFFICE	DES.	CKD	REV	DRAWING
W1410142	WHSE	JTP	JPB	0	WCF-1
DATE:	SHEET No.	APP.	STATUS		
June 25, 2008	1 of 4	DWN	KLT	JRT	B

ISSUED FOR CONSTRUCTION

CROSS–SECTION B

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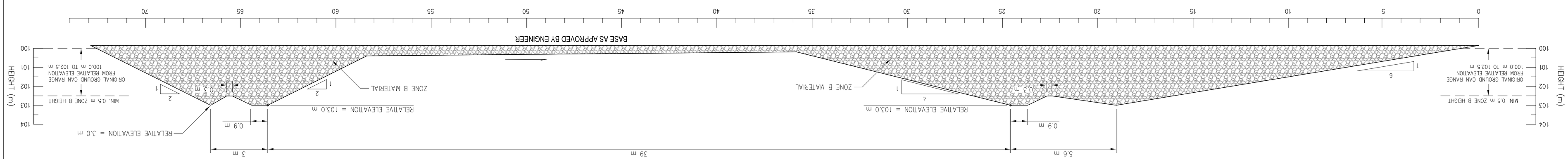

CROSS–SECTION A

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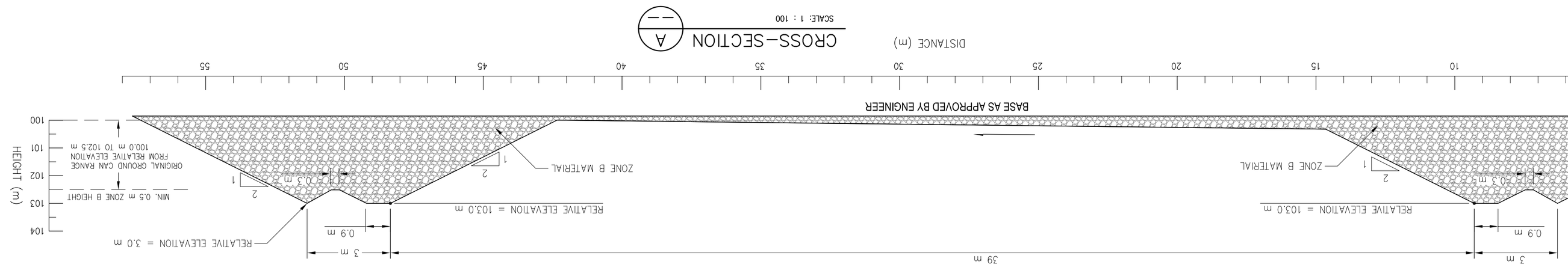

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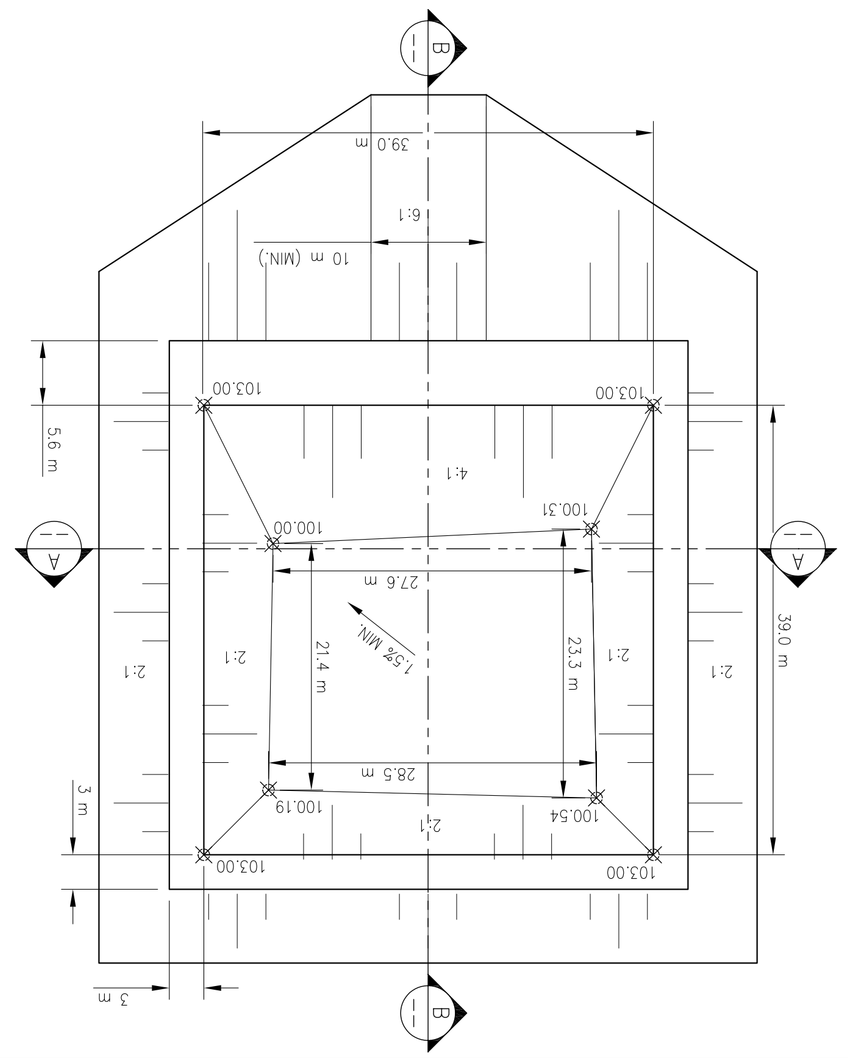
PLAN – ZONE B MATERIAL



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3. ALL ELEVATIONS ON PLAN ARE FOR TOP OF ZONE A MATERIAL.

REVISIONS

NUM	DATE	DWN	CKD	APR	DESCRIPTION

DRAWING STATUS

NUM	DATE	APR	DESCRIPTION
B	08/07/08	JPB	ISSUED FOR CONSTRUCTION
A	08/06/25	JPB	ISSUED FOR REVIEW

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Seal: Jason Berkers, P.Eng. Date: July 8, 2008

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TYPICAL WASTE CONTAINMENT FACILITY DESIGN KENO HILL SILVER DISTRICT, YT

ZONE A MATERIAL PLAN & CROSS SECTIONS

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
W14101142	WHSE	JTP	JPB	0	WCF-2
DATE: June 25, 2008	SHEET No. 2 of 4	DWN KJT	APP JRT	STATUS B	

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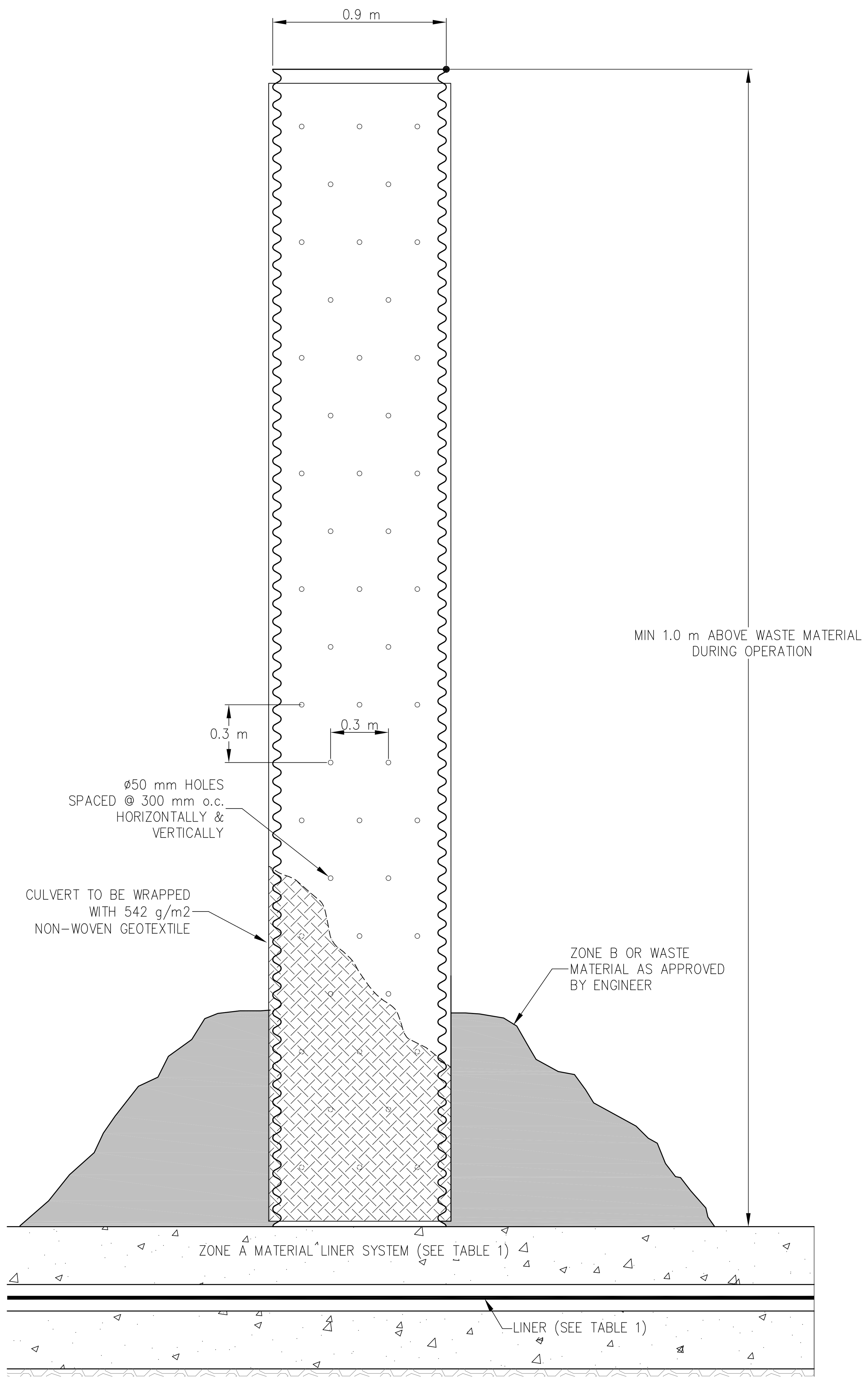
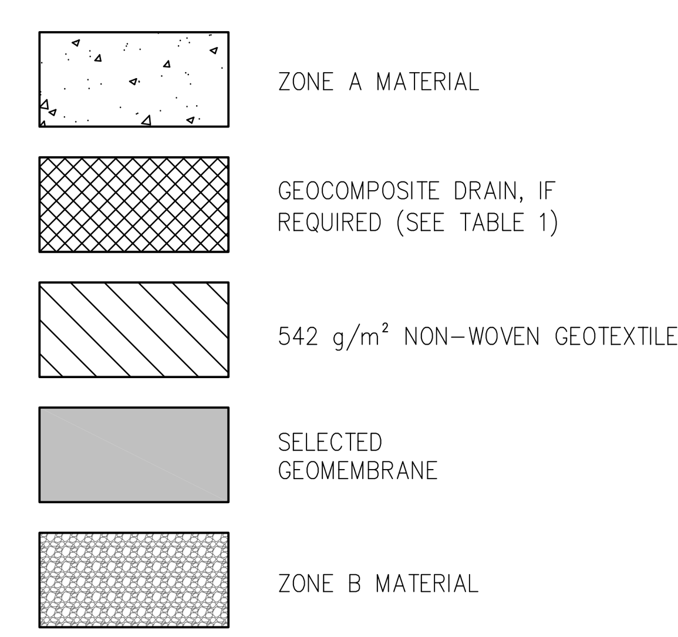


DETAIL 1 – VERTICAL CULVERT (9 / WCF-1)

SCALE: 1 : 20

LINER SYSTEM DETAIL KEY



LINER SYSTEM FLOOR & APPROACH BERM

LINER SYSTEM BERMS

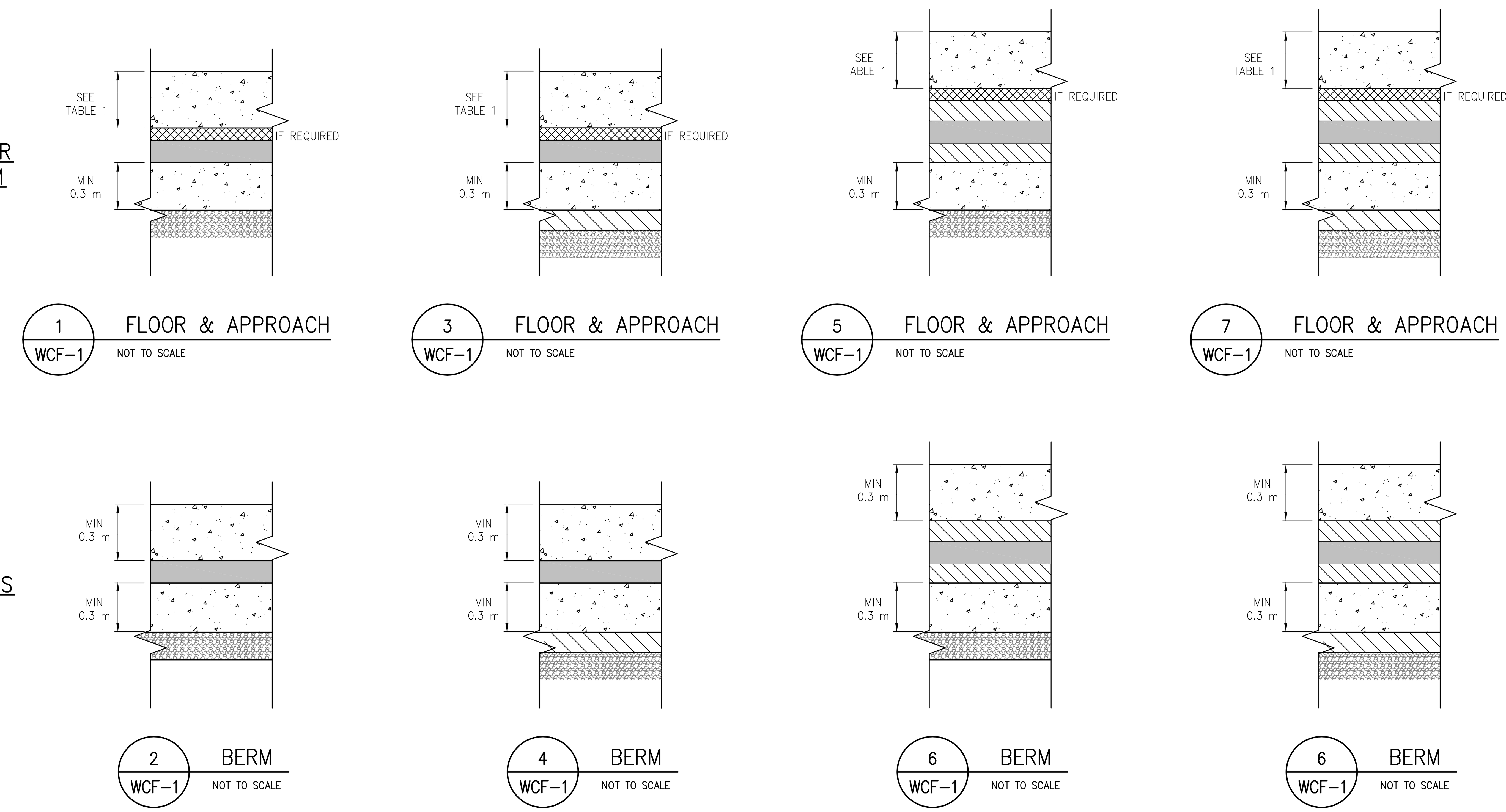


Table 1: Recommended Minimum Cover Thicknesses

Liner Material	Drainage Composite	Minimum Required Thickness
Enviro Liner® 4040 (Without Geocomposite)	Not Required	1.3 m
Enviro Liner® 4040 (With Geocomposite)	Required	0.3 m
HDPE 60	Not Required	0.3 m
PVC 40 (With Geocomposite)	Required	0.3 m

Table 2: Liner System Floor and Approach Berm

		Zone B		
		Meets Specifications	Gradation Below Fine Limit	Gradation Above Coarse Limit
Zone A	Meets Specifications	Detail 1	Detail 1	Detail 3
	Gradation Below Fine Limit	Detail 3	Detail 3	Detail 3
	Gradation Above Coarse Limit	Detail 5	Detail 5	Detail 7

Table 3: Liner System Berm

		Zone B		
		Meets Specifications	Gradation Below Fine Limit	Gradation Above Coarse Limit
Zone A	Meets Specifications	Detail 1	Detail 1	Detail 3
	Gradation Below Fine Limit	Detail 3	Detail 3	Detail 3
	Gradation Above Coarse Limit	Detail 5	Detail 5	Detail 7

Table 4: Zone A Material (10 mm Minus) - Particle Size Distribution Limits

Sieve Size (mm)	% Passing Fine Limit	% Passing Coarse Limit
10	100	100
5	80	100
2	55	100
0.63	25	65
0.25	10	40
0.08	2	15

Table 5: Zone B Material (200 mm Minus) - Particle Size Distribution Limits

Sieve Size (mm)	% Passing Fine Limit	% Passing Coarse Limit
200	100	100
100	85	100
50	65	100
25	40	100
5	20	55
2	0	20

ISSUED FOR CONSTRUCTION

NOTES

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NUM	DATE	DWN	CKD	APR	DESCRIPTION

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B	08/07/08	JPB	ISSUED FOR CONSTRUCTION
A	08/06/25	JPB	ISSUED FOR REVIEW

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Permit: J. Richard Trimble, P.Eng. Date: July 8, 2008

Seal: Jason Berkers, P.Eng. Date: July 8, 2008

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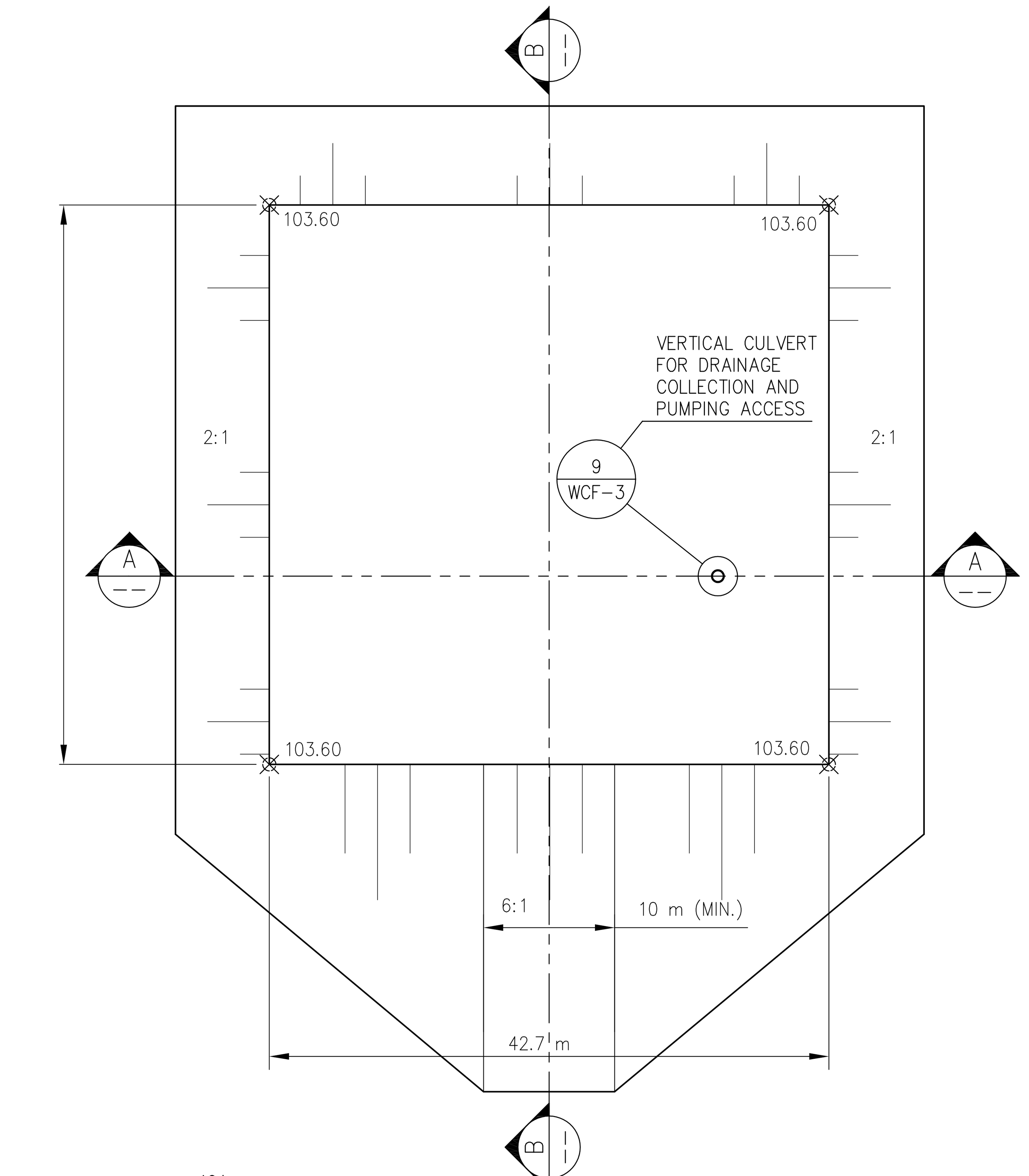
TYPICAL WASTE CONTAINMENT FACILITY DESIGN
KENO HILL SILVER DISTRICT, YT

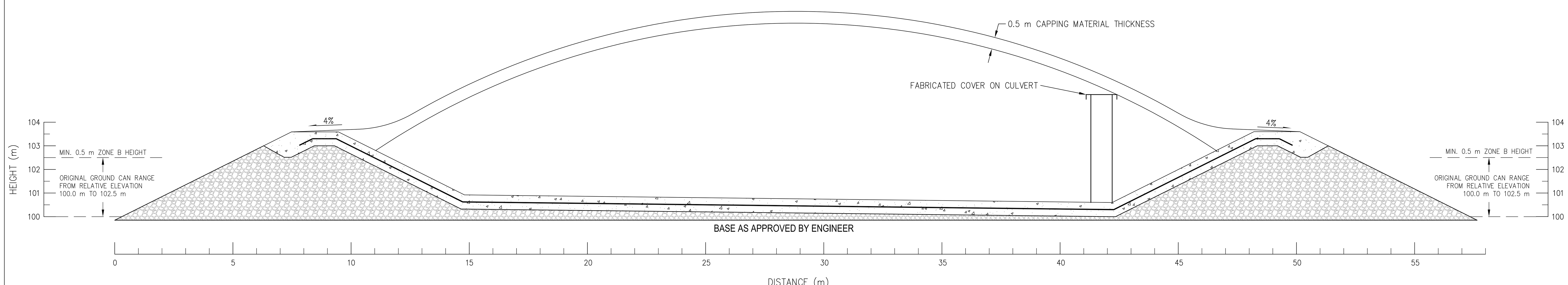
DETAILS

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
W14101142	WHSE	JTP	JPB	0	WCF-3
DATE: JUNE 25, 2008	SHEET No. 3 of 4	DWN KJT	APP JRT	STATUS B	



PLAN – FACILITY CLOSURE

SCALE: 1 : 400



CROSS–SECTION A

SCALE: 1 : 100

CROSS–SECTION B

SCALE: 1 : 100

ISSUED FOR CONSTRUCTION

NOTES

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REVISIONS

NUM	DATE	DWN	CKD	APR	DESCRIPTION

DRAWING STATUS

NUM	DATE	APR	DESCRIPTION
2	08/07/08	JPB	ISSUED FOR CONSTRUCTION
1	08/06/25	JPB	ISSUED FOR REVIEW

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TYPICAL WASTE CONTAINMENT FACILITY DESIGN
KENO HILL SILVER DISTRICT, YT

FACILITY CLOSURE PLAN & CROSS SECTIONS

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
W14101142	WHSE	JTP	JPB	0	WCF-4
DATE: June 25, 2008	SHEET No. 4 of 4	DWN KJT	APP JRT	STATUS B	