

# Cobble Hill Holdings Ltd.

Cobble Hill Holdings Ltd  
101-536 Herald St, Victoria BC V8W1S6  
s.22

COPY

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Jennifer McGuire  
Executive Director

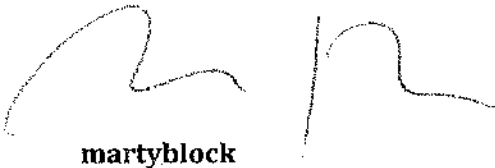
April 18, 2017

**Dear Jennifer McGuire:**

Please find attached complete as built files for the existing infrastructures in place.

Please contact myself or sirm with any concerns or further clarification on any of the items submitted.

**Sincerely,**



martyblock



COPY

WASTE  
RESOURCE MANAGEMENT

460 Stebbings Road  
Shawnigan Lake, BC, V0R 2W3  
Phone: 240.743.0811 Fax: 250.743.0812  
[www.sdm.ca](http://www.sdm.ca)

Date: April 18, 2017

Cobble Hill Holdings Ltd.  
Herald Street Law  
101-536 Herald Street  
Victoria, BC  
V8W 1S6

**ATTN: Marty Block and Mike Kelly**  
Via Hand Delivery

**RE: Spill Prevention Order MO1701**

Dear Mr. Block and Mr. Kelly,

The enclosed binder presents information compiled from various sources specific to PART A: Final Closure bullet number 3 in the amended Spill Prevention Order: MO1701 issued March 15, 2017 for the 460 Stebbings Road Lot 23 Cobble Hill Holding's Ltd. (CHH) site (the "Facility").

The deadline to submit this information was April 17, 2017 as per the March 17, 2017 letter *RE: Input from Ministry staff to be addressed and responded as part of Final Closure Plan pursuant to the amended Spill Prevention Order (SPO) issued by the Minister Polak on March 15, 2017*. CHH formally requested a one-day extension via email to [jennifer.mcguire@gov.bc.ca](mailto:jennifer.mcguire@gov.bc.ca). The extension was accepted.

Enclosed documentation includes:

- Complete up to date "As-Built" plans and specifications of the existing Facility.
- Accompanying certification of "As-Built" documentation by a Qualified Professional as defined in the Landfill Criteria for Municipal Solid Waste, Second Edition, June 2016.

We hope that the enclosed documentation will provide you with suitable supporting data to assess the existing Facility. The remainder of this letter will address points a.) through f.) of Section 1 of the March 17, 2017 letter issued by the Ministry of Environment *RE: Input from Ministry staff to be addressed and responded as part of Final Closure Plan pursuant to the amended Spill Prevention Order (SPO) issued by the Minister Polak on March 15, 2017*.

- 1) Complete up-to-date "As-Built" plans and specifications of the existing Facility.
  - Submitted in enclosed binder.
- a) Previous information referred to a seepage blanket above the bedrock (e.g. Active Earth Engineering Ltd. *Seepage Blanket Details*, dated December 10, 2013; *Environmental Appeal Board decision of March 20, 2015 (para 491 etc.)*; *SHA Feb 2017 closure plan (section 3.2)*). The



WSP Feb 2017 Review (page iv), states that "As built drawings for the PEA do not clearly indicate if a seepage blanket was installed".

- The Seepage Blanket referred to in the documents was clearly indicated in the *Bedrock Integrity Inspection and Risk Assessment* report prepared for Cell 1 (binder page 13, paragraph 2), certified by a Qualified Professional (QP).
  - As seen in the *Test Pit Location Plan* (binder page 16), and the pictures (binder pages 17-19), six test pits were excavated through the Seepage Blanket for the entirety of Cell 1 to determine bedrock quality.
  - Excavation through the Seepage Blanket, shown in the *Bedrock Integrity Inspection and Risk Assessment* May 05, 2016 photos (binder page 22), was further carried out using a second third-party QP to confirm bedrock quality for the westward construction of Cell 1.
  - Please note that while these documents use the term "expansion" for Cells 1B and 1C, these cells were built on the original Cell 1 footprint which exists as shown on the *Test Pit Location Plan* (binder page 16).
- b) *Ministry Inspection Record 27734 dated August 11, 2016, indicated that actual construction of the landfill cell(s) differed from submitted As-Built plans and specifications (e.g. base liner anchor trench was not installed/complete), and requested that accurate As-Built plans and specifications of the facility including cross-section details of the landfill cells be submitted (e.g. "SIRM will submit accurate As-Built cross-section details for PEA Cells 1A, 1B and 1C, certified by a QP, including all details (e.g. leak detection works, all layers, anchor trenches, etc.)").*
- Anchor trenches are not utilized in the completed closed cells. These trenches are used during the preliminary construction of the cell and base liner placement. The anchor trench ensures that the base liner is held in place at the top of the slope during soil deposit.
  - As per the Sperling Hansen Associates letter dated January 30, 2017 (binder page 134, paragraph 1), the top and bottom liner layers of Cell 1 are welded seams of multiple liner sections brought together to make one integral lined cell which ensures that the liners are held in place.
  - Please note that during construction of Cell 1, the liner at the top of the slope was weight supported in place with concrete lock blocks, an alternate method of holding a liner in place, when rock prevented the excavation of the trench dam.
- c) *Brimmell Engineering Ltd. letter re: As-Built for Encapsulation Cell 1C, dated July 4, 2016 (page 2) states: "The narrow, southerly end of the Encapsulation Cell 1C site has yet to be finalized due to a problem with outcropping bedrock on the west side (photo). This report will be updated when the south end has been finalized. Until this is done the contaminated fill is to be kept back at least 1.5 m from the existing south end of the LLDPE liner, and sloped up to the north at 1.5:1."*
- The updated report *SIRM Facility, 460 Stebbings Rd., Shownigan Lake, MEM Permit Q-8-094 & MOE PR-105809, Updated As-Built for Encapsulation Cell 1C* received from Brimmell Engineering Ltd. concludes that construction of Encapsulation Cell 1C meets the standards required by MeM Permit Q-8-094 and MOE Permit PR-105809 (binder page 111).
  - Photos referenced in the *SIRM Facility, 460 Stebbings Rd., Shownigan Lake, MEM Permit Q-8-094 & MOE PR-105809, Updated As-Built for Encapsulation Cell 1C* shows the outcropping bedrock and Cell construction (binder page 111-a, 112-117).



- d) *The WSP Feb 2017 Review states "The size of the Contact Water Pond surveyed in June 2016 is smaller than the as-built size in the Active Earth documents." (page iv).*
- Please note that Sperling Hansen Associates are currently developing the Final Closure Plan which is anticipated to include the complete removal of the Contact Water Pond and structural backfill of the hole. The Permanent Encapsulation Area is currently responsible for the small amount of leachate being generated, i.e. 50 liters per day, which is anticipated to be collected into tanks that protect against receiving water from the weather.
  - Please note that the WSP draft report, *Addendum Review of Contact and Non-Contact Water Management Systems* submitted Feb 20, 2017 assumed a catchment area in their calculations that included the wheel wash and future on-going operations. Due to the cancellation of the Permit, the wheel wash has been eliminated, as well, the Soil Management Area is covered and does not currently produce contact water. The only contact water being produced is from the PEA Cell 1 which is currently producing 50 liters per day, approximately 20 cubic meters per year, and is trending less each day.
- e) *The SIRM letter dated March 9, 2017, and SHA letter dated January 30, 2017 (pages 3 & 5), indicates that the geomembrane cover installation is not fully complete and that additional detailed welding of patches, tie-in to the basal liner, pipe penetration boots, 3rd party review and QA/QC testing, and final inspection/completion report, as well as reinstalling the 'tire-chain' securing system on the crest and side slopes, are required.*
- Sperling Hansen Associates are actively working on the Final Closure Plan with Cobble Hill Holdings, in conjunction with the Facility Operator who have been working to complete the actions stated in the SHA January report. Active plans are being prepared to permanently close the Soil Management Area, proposing to deposit the remaining soil in the Soil Management Area to the PEA. The remaining activities stated in the Sperling Hansen Associates report will also be completed under the Final Closure Plan.
- f) *The SHA January 30, 2017 letter (page 4) also indicates "SIRM constructed an additional contact water lined storage pond near the Water Treatment Plant onsite. The new pond adds approximately 75m<sup>3</sup> of storage capacity for contact water."*
- The additional pond was built as a contingency measure as part of the Ministry of Environment Pollution Prevention Order 108608.
  - The additional pond was not utilized. The liner has been removed and the remaining hole has been structurally backfilled.

Thank you,

  
Todd Mizulik  
Director

Enclosure



## 460 Stebbings Road Lot 23

- Site Plans

- ✓ McElhanney Quarry Mine Plan
- ✓ AES Electrical Distribution Site Plan

RESOURCE MANAGEMENT







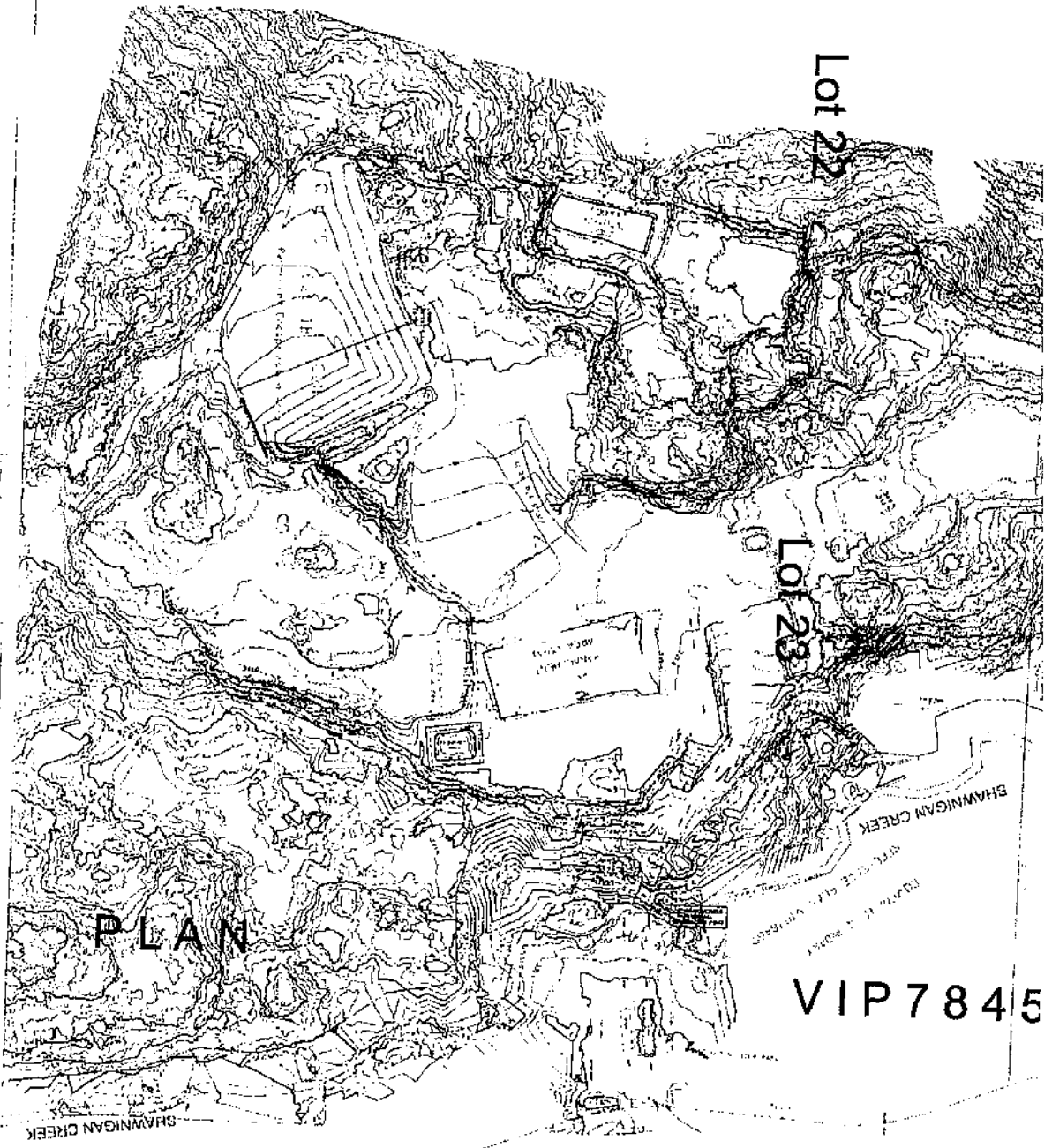


Lot 22

Lot 23

VIP7845

PLAN



Additional survey carried out on the 17th day of April, 2017.  
Surveyed by: [Signature]  
South Coast Surveying and Engineering LTD  
1518 Esplanade Rd, Victoria  
V8W 4P9  
250-885-4306

Revised DATE

Notes:

- Based on MacKenzie Drawing 02799-SK-1
- Additional survey measured by GPS, on August 23, 2016 and April 11, 2017
- GPS survey based on Reference station 38-Esqwack (GCM 600411), and confirmed on GCM 708985

Drawn by: AMV

Project: 456 Birchmount St, L2S 2J3

Date: 7/25/17  
Scale:

Alterra Construction Ltd.  
2158 Johnson Road  
Victoria, BC





## Permanent Encapsulation Area

- Cell 1

- ✓ Active Earth Engineering As-Built Report Cell 1
- ✓ Active Earth Engineering As-Built Report Encapsulation Addendum 1
- ✓ Sperling Hansen Associates Landfill Lined Cell 1 As-Built

RESOURCE MANAGEMENT









July 30, 2015

BC Ministry of Energy and Mines  
1810 Blanshard Street  
Victoria, BC V8W 9N3

and

BC Ministry of Environment  
2080A Labieux Road  
Nanaimo, BC V9T 6J9

**ATTENTION:** Al Hoffman, P.Eng. – Chief Inspector  
AJ Downie – Director, Authorizations - South

**REFERENCE:** As-Built Report - Encapsulation Cell 1  
MOE Permit PR-105809 and MEM Permit Q-8-094  
640 Stebbings Road, Shawnigan Lake, BC

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As required by the Ministry of Energy and Mines (MEM) Permit Q-8-094, and the Ministry of Environment (MOE) Permit PR-105809, Active Earth Engineering Ltd. (Active Earth) has prepared this As-Built report for Encapsulation Cell 1.

Encapsulation Cell 1 is located on southern side of the Site, as shown on the key plan in Figure 1. The cell construction was initiated in early 2014 and completed on July 30, 2015.

This report is comprised of a compilation of information from various sources that pertain to the base construction of Encapsulation Cell 1. The attached Figures 1 and 2 present the as-built details in plan view and cross-section, respectively.

The construction of Encapsulation Cell 1 consisted of the following:

- Native bedrock subbase as described in the bedrock integrity inspection report prepared for Cell 1 and previously submitted to MOE, dated October 10, 2013.
- Minimum of 1m compacted clay placed above the bedrock. The clay varies in thickness and is over 3m thick in some areas. The surface of the clay is sloped at approximately 2% towards the north. The clay was placed and compacted under the supervision of Active Earth and Levelton Consultants. Laboratory and field testing results to confirm clay compaction was achieved to greater than 90% standard proctor are attached. Field density test locations are shown on Figure 1.
- Free-draining sand was placed at a minimum of 0.3m thickness overlying the compacted clay. This sand layer acts as a leak detection layer and protects the liner from potential

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Langley  
Vancouver  
Victoria

Mailing Address:  
105-4343 Tyndall Ave  
Victoria, BC V8N 3R9

Telephone: 250-686-9850  
Facsimile: 778-430-5475  
Website: [www.activeearth.ca](http://www.activeearth.ca)



puncture/damage. The sand layer is hydraulically connected to a perforated piping collection system (comprised of 4 inch diameter perforated schedule 40 PVC pipe, surrounded by clear crush drain rock and wrapped with geotextile) at the north side of the cell. The piping conveys any water to a 2500 gallon holding tank at the northwest corner of the cell (holding tank specs attached);

- A single panel (no field welds) of 40 mil LLDPE synthetic liner was placed over the sand layer. The liner dimensions are 35.5m x 85m. The liner was placed up the berms on the south and east sides of Cell 1. The liner was underlain by a geotextile on the berm slopes to provide protection. The required protection on the base is provided by the underlying sand leak detection blanket. The liner is sloped downward to the north at approximately 2%, towards the toe of the cell. Liner specs and manufacturer QA/QC details are attached.
- A second free-draining sand layer was placed at a minimum of 0.3m thickness overlying the synthetic base liner. This sand layer acts as a leachate collection layer and protects the liner from potential puncture/damage. The sand layer is hydraulically connected to a second perforated piping collection system at the north side of the cell. The leachate collection piping conveys any water to a second 2500 gallon holding tank at the northwest corner of the cell.
- Soil to be encapsulated in Cell 1, will be placed directly upon the second sand layer. A minimum of 0.3m of sand or a geotextile will be placed over the 40 mil liner on the berm slopes as filling progresses.

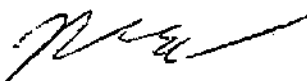
The following documents are attached to this report:

- Photographs of key construction details;
- Active Earth Figures 1 and 2 showing the as-built information for Encapsulation Cell 1;
- Western Tank & Lining Ltd. specifications and QA/QC for 40 mil liner;
- Premier Plastics specifications for 2500 gallon holding tanks;
- Levelton Field Review Report dated April 16, 2014 pertaining to the stability of the rock slopes adjacent to Encapsulation Cell 1; and
- Levelton Laboratory reports for the Grain Size analyses, Proctor tests and field density tests undertaken on the clay utilized in construction of the base liner for Encapsulation Cell 1.

The base construction of Encapsulation Cell 1 is in accordance with the requirements of both the MEM (Q-9-094) and MOE (PR-105809) permits.

Yours truly,

**ACTIVE EARTH ENGINEERING LTD.**



Matt Pye, P.Eng.

July 30/15





August 28, 2015

BC Ministry of Energy and Mines  
1810 Blanshard Street  
Victoria, BC V8W 9N3

and

BC Ministry of Environment  
2080A Labieux Road  
Nanaimo, BC V9T 6J9

**ATTENTION:** Al Hoffman, P.Eng. – Chief Inspector  
AJ Downie – Director, Authorizations - South

**REFERENCE:** Addendum Number 1 – Clarifications and QA/QC Summary  
As-Built Report - Encapsulation Cell 1  
MOE Permit PR-105809 and MEM Permit Q-8-094  
640 Stebbings Road, Shawnigan Lake, BC

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Active Earth Engineering Ltd. (Active Earth) has prepared this Addendum to our previously issued As-Built report for Encapsulation Cell 1, dated July 29, 2015. This letter has been prepared at the request of the Ministry of Energy and Mines (MEM) to provide specific clarifications in order to confirm compliance with MEM Permit Q-8-094, and the Ministry of Environment (MOE) Permit PR-105809 (the "Permits").

As this is an Addendum, information contained within the original report will not be reproduced nor summarized herein. The information provided below is in addition to the information in the July 29, 2015 As-Built report, and there are no corrections required to the information in that report.

The following bullets address the requested clarifications:

- Encapsulation Cell 1 was constructed in general conformance with the design and specifications provided in the Permits and supporting documents including the Technical Assessment Report and the Environmental Procedures Manual, and this construction meets the standards required by the Mines Permit Q-8-094 and Ministry of Environment Permit PR-105809.
- Appropriate Quality Assurance/Quality Control (QA/QC) was carried out during the construction of Encapsulation Cell 1. The details of the QA/QC, including a summary of the liner installation, materials testing and compaction information are provided in the As-

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Langley  
Vancouver  
Victoria

Mailing Address:  
105-4343 Tyndall Ave  
Victoria, BC V8N 3R9

Telephone: 250-686-9850  
Facsimile: 778-430-5475  
Website: [www.activeearth.ca](http://www.activeearth.ca)




Built report. The QA/QC measures employed during construction of the base liner system included:

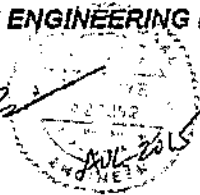
- o Bedrock integrity assessment as described in the October 10, 2013 report;
- o Grain size distribution analysis to determine appropriate clay content for the base liner;
- o Proctor testing of clay sources and field density testing to confirm appropriate compaction of the base liner;
- o Visual inspection, hand measurement and survey to confirm appropriate thickness and slope of the base liner;
- o Inspection and approval of sand used for leak detection and leachate collection blankets to confirm free-draining properties and appropriateness for liner protection;
- o Direction for liner installation procedures and visual inspection of deployed liner for any potential damage;
- o Review of supplier (Western Tank and Lining) factory QA/QC report that documents liner integrity testing;
- o No field welds were utilized for Encapsulation Cell 1 liner; and,
- o Leak detection and leachate collection piping systems were visually inspected during construction.

In summary, the base construction of Encapsulation Cell 1 is in accordance with the requirements of both the MEM (Q-9-094) and MOE (PR-105809) permits.

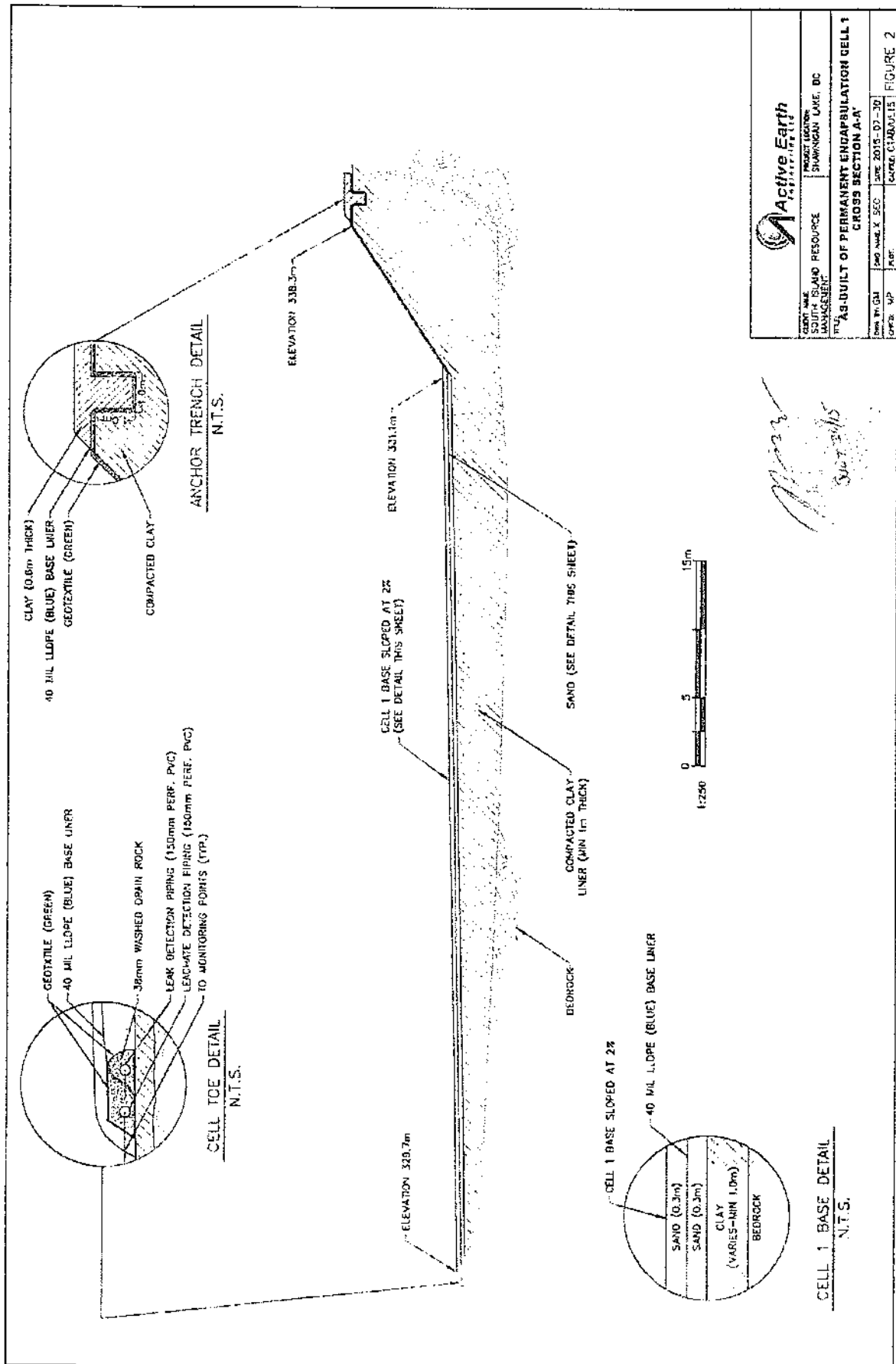
Yours truly,

**ACTIVE EARTH ENGINEERING LTD.**

  
Matt Pye, P.Eng.













# Rock Integrity Seepage Blanket

- Cell 1

- ✓ Active Earth Engineering Rock Integrity Seepage Blanket
- ✓ Brimmell Engineering Rock Integrity Seepage Blanket
- ✓ Active Earth Engineering Soil Containment Area Cross Section Cell 1

RESOURCE MANAGEMENT





December 10, 2013

BC Ministry of Environment  
West Coast Region – Environmental Protection Division  
2080A Labieux Road  
Nanaimo, BC  
V9T 6J9

**ATTENTION:** Luc Lachance, P.Eng. – Senior Environmental Protection Officer

**REFERENCE:** **Seepage Blanket Details**  
**Authorization to Discharge Waste Permit PR-105809**  
**640 Stebbings Road, Shawnigan Lake, BC**

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### ***Introduction***

Active Earth Engineering Ltd. (Active Earth) has revised the design of the Permanent Encapsulation Area to include a Seepage Blanket. The impetus for the design change includes the following:

1. The post-mining condition of the pit bottom; and,
2. Providing a passive drainage pathway for any groundwater seepage that may occur into the base of the pit.

Attached is a revision of Figure 10 from the Technical Assessment Report that illustrates the proposed Seepage Blanket.

### ***Seepage Blanket Details***

The final base of the rock quarry, following blasting and rock extraction, is sharply undulating from the blasting activity, with potential elevation differences up to 2m. The final rock surface is also covered with blast rock debris that has significant permeability<sup>1</sup>.

The final surface of the mined quarry will be leveled with crushed rock produced from the mined rock at the site. The crushed rock will be 150 mm (6 inch) minus. This crush will be placed and compacted to fill depressions and smooth the final surface in preparation for the till layer. A geotextile fabric will be placed over the prepared crush surface to prevent the migration of fines from the till above.

This prepared base will have sufficient permeability to convey any seepage that may occur into the pit bottom from groundwater flow through the underlying or adjacent bedrock. The seepage

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<sup>1</sup> Bedrock Integrity and Risk Assessment, October 10, 2013



will be conveyed through the subsurface towards the west slope and may report to the ephemeral tributary, or may remain below grade as shallow groundwater flow. Any groundwater that enters the Seepage Blanket from below the pit will be considered "non-contact" water, and this water will remain subsurface as groundwater flow while it is on the Site. As such, monitoring for the presence/absence of flow and quality of any groundwater within the Seepage Blanket is not necessarily warranted.

### ***Discussion***

Hydraulic testing performed on the bedrock underlying the quarry has indicated very low hydraulic conductivities. The rock is not capable of transmitting large volumes of water given that any flow will be restricted to fracture planes, which as a whole only comprise approximately 1-2% of the rock mass at the Site. Granular soils by comparison have porosities of 25-30% which allow for larger volumes of water to be transmitted versus rock.

As a result of the hydraulic properties of the rock beneath the quarry, the Seepage Blanket will have significantly greater capacity than necessary to transmit any seepage that may occur. The December 9, 2013 core drilling report<sup>2</sup> details the rate of groundwater seepage anticipated into the pit may range from 0.0003 mm/day to as much as 0.03 mm/day. The higher flow estimates are associated with some discrete areas in near the northwest corner of the Site, where a weathered horizon may daylight. These values indicate that the rate of groundwater flow into the base of the quarry is anticipated to be negligible to very minor (less than 0.3m<sup>3</sup>/day over the entire quarry footprint of nearly 20 acres and including potential increased flow from the weathered horizon).

The potential for groundwater seepage to be impacted by the overlying contaminated soil is very remote. The rate of seepage into the blanket from the rock below is not sufficient to cause any appreciable groundwater mounding within the drainage blanket, such that it may contact the encapsulated soil cells above. The clay base liner also immediately overlies the Seepage Blanket. This limits the potential for impacts to the Seepage Blanket water quality from the overlying permanent encapsulation cells. Consider that, in order for the contaminated soil with the cells to impact groundwater quality within the Seepage Blanket, a number of failures must occur coincidentally as follows:

1. Leachable soils need to bypass the soil quality screening processes in sufficient concentrations and sufficient quantities to be able to generate leachate;
2. The cap liner(s) (30 mil LLDPE) must fail to allow incident precipitation into the cells;
3. Sufficient precipitation must enter into the cells to exceed the soil storage capacity (unsaturated pore space) and must contact the leachable soils and mobilize the contaminants;

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<sup>2</sup> Summary of Core Drilling and Testing Results: MW13-4 and MW13-5, December 9, 2013



4. The leachate collection drainage system must fail to convey the leachate to the Water Treatment Plant;
5. The base synthetic liner (40 mil LLDPE) must fail and allow leachate to drain beneath;
6. The leak detection drainage system must fail to convey the leachate to the Water Treatment Plant; and,
7. The clay till soil liner must fail and allow leachate to drain beneath into the Seepage Blanket.

The above points do not consider the final cap and describe the required conditions to impact water quality within the Seepage Blanket during reclamation activities (i.e. worst-case scenario).

Furthermore, the flow of water within the Seepage Blanket is anticipated to be very minor to negligible, and any leachate volumes would also be minor. The flow within the Seepage Blanket ultimately reports to the ephemeral tributary and is diluted several thousands of times along the flow path to Shawnigan Creek (calculated from baseline monitoring data that has included flow measurements of surface water bodies) and ultimately to Shawnigan Lake where a very large amount of dilution occurs.

It is our opinion therefore, that the risk associated with this flow path (i.e. groundwater seepage into the Seepage Blanket and reporting to the ephemeral tributary) is negligible in consideration of the proposed operations and permit requirements. However, if it is deemed necessary a monitoring well or standpipe can be installed upon completion of the first Permanent Encapsulation Cell to provide assurance of water quantity and quality within the Seepage Blanket.

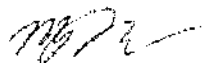
The bedrock inspections required prior to new cell construction within the Permanent Encapsulation Area will also confirm the conditions are as expected and/or allow for design changes to be implemented if necessary.

#### **Closure**

Please contact the undersigned if further information and/or clarification is required.

Yours truly,

**ACTIVE EARTH ENGINEERING LTD.**



Matt Pye, P.Eng.  
Principal, Senior Hydrogeologist

#### **Attachment**

Figure 10 – Soil Containment Area Typical Cross Section (Revised)





October 10, 2013

BC Ministry of Environment  
West Coast Region – Environmental Protection Division  
2080A Labieux Road  
Nanaimo, BC  
V9T 6J9

**ATTENTION:** Luc Lachance, P.Eng. – Senior Environmental Protection Officer

**REFERENCE:** **Bedrock Integrity Inspection and Risk Assessment**  
**Authorization to Discharge Waste Permit PR-105809**  
**640 Stebbings Road, Shawnigan Lake, BC**

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### ***Introduction***

Active Earth Engineering Ltd. (Active Earth) has completed a bedrock integrity inspection and risk assessment, as specified in Section 2.4 of the Permit PR-105809. This report pertains to the first encapsulation cell area as shown on the attached Figure 1.

The purpose of the work is to assess the condition of the bedrock prior to construction of the encapsulation cell. The primary information intended to be collected is the presence/absence of open fractures. The base of the rock quarry following blasting and rock extraction is sharply undulating from the blasting activity. The rock surface is also covered with blast rock debris with thicknesses up to approximately 2m. As such, it is not possible to inspect the entire bedrock surface for presence/absence of fractures, rather spot-checking with randomly located test pits is the only feasible option.

### ***Cell Location***

The location of the first encapsulation cell is shown on the attached Figure 1.

The bedrock surface beneath the initial encapsulation cell is at approximately elevation 328 m-geod, which is above the ultimate pit bottom elevation of 313.5 m-geod. This cell will be relocated in the future and the underlying bedrock will ultimately be mined.

Langley  
Vancouver  
Victoria

Mailing Address:  
105-4343 Tyndall Ave  
Victoria, BC V8N 3R9

Telephone: 250-686-9850  
Facsimile: 778-430-5475  
Website: [www.activesearth.ca](http://www.activesearth.ca)



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### ***Bedrock Integrity Inspection***

The scope of work included excavation of six test pits to expose the underlying bedrock for inspection. The locations of the test pits are shown on the attached Figure 1. Photographs are also included as an attachment.

The rock encountered in all of the test pits was comprised of an igneous intrusive of the Wark Gneiss – Diorite Complex. No limestone or other unexpected rock types were identified.

The general condition of the bedrock at the base of the test pits was consistent with the drilling and other exposed bedrock surfaces across the site. No discernible water-bearing fractures were encountered in the test pits, nor any open fractures as would be apparent from oxidation/mineral precipitation along any joints.

The undulating nature of the post-mining bedrock surface creates low spots for the collection of incident precipitation, as such, some of the test pits had ponded water atop the bedrock surface. The ponding of water in low spots is also indicative of the bedrock surface being low-permeability and relatively unfractured.

### ***Risk Assessment***

The risk of impacts to the groundwater aquifer underlying the Site has been addressed in other reports prepared for the issuance of the permit. The investigations and assessments conducted have concluded that the underlying groundwater is well protected by the low-permeability bedrock at the base of the ultimate pit.

The piezometric pressures beneath the pit are also shown to be above the ultimate pit bottom throughout the year, with upward hydraulic gradients. As such, any open fractures will transmit water up into the pit and there is no pathway for contaminants to migrate downward from the pit bottom into the groundwater.

In addition, multiple protective redundancies are included in the design such as a clay base liner and several synthetic liners, leachate collection and leak detection systems.

The above-described inspections are intended to confirm the rock conditions are as-expected across the Site during pit development.

### ***Summary and Conclusions***

The bedrock encountered in the test pits beneath encapsulation cell 1 was consistent with the rock type and condition identified through previous investigations. No unexpected rock types or discernible fracturing was identified.

Based on the test pit investigations, there are no additional risk management measures required for cell 1.



October 10, 2013

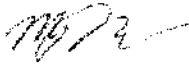
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**Closure**

Please contact the undersigned if further information and/or clarification is required.

Yours truly,

**ACTIVE EARTH ENGINEERING LTD.**



Matt Pye, P.Eng.

Principal, Senior Hydrogeologist



David Kneale, P.Geo.

Principal, Senior Hydrogeologist

**Attachments**

Figure 1 – Encapsulation Cell and Test Pit Location Plan  
Photographs

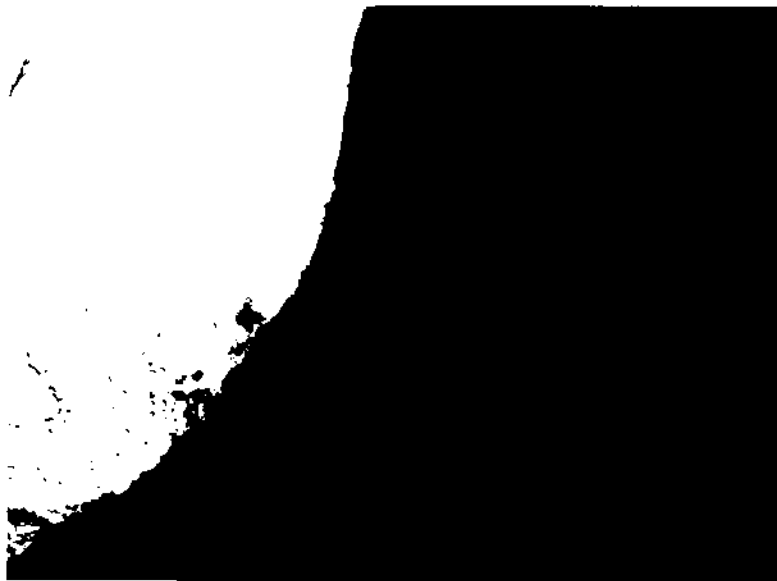






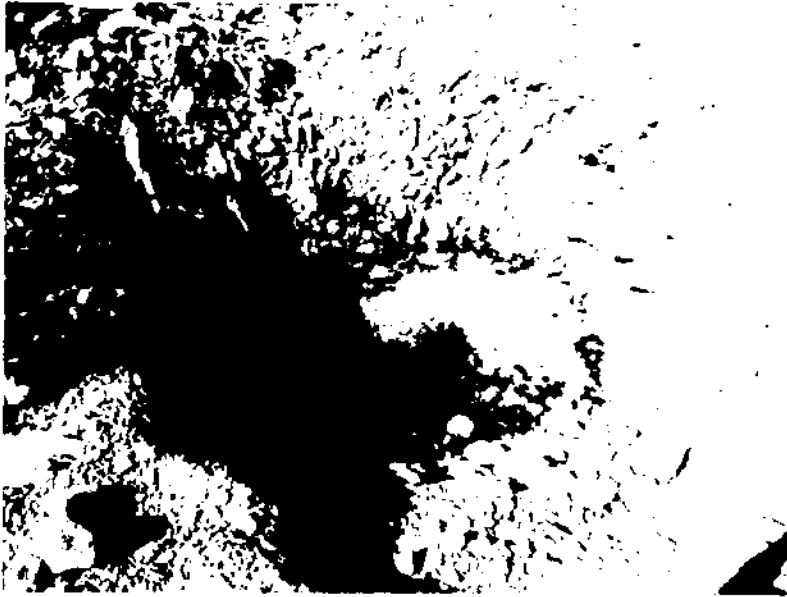


**TP13-1**



**TP13-2**





**TP13-3**

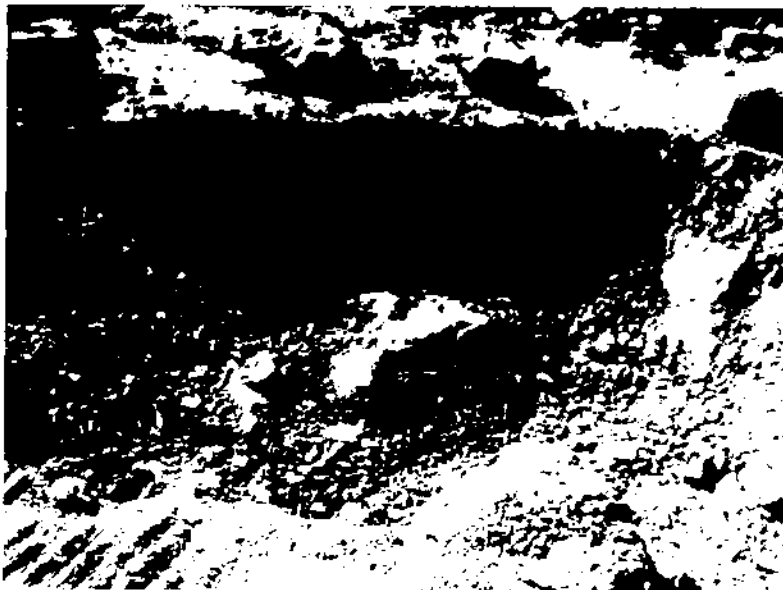


**TP13-4**





**TP13-5**



**TP13-6**



Brimmell Engineering Ltd  
971 Bank Street  
Victoria, BC  
V8S 4B1  
rbrimmell@shaw.ca

South Island Resource Management

May 5/16  
File 15-136

Att: Tom Good:

Re: Bedrock Integrity Inspection and Risk Assessment  
Authorization to Discharge Waste Permit PR-105809  
460 Stebbings Road, Shawnigan Lake, BC

***Introduction***

This letter is further to our site meeting of April 22, 2016. The purpose of this was to assess the condition of the bedrock forming the floor of the quarry across the proposed westward expansion of Encapsulation Cell 1 and thereby confirm the findings of the Active Earth Engineering Ltd. (AAE) bedrock integrity inspection and risk assessment October 2013. Photos are appended including one showing the area of the proposed expansion.

***Bedrock Integrity Inspection***

Two test pits were excavated in the proposed Encapsulation Cell 1 expansion, and the bedrock throughout the quarry has been examined several times during the past year. The rock consists of sound, grey Wark Gneiss, typical of the area. The floor of the quarry is well below the zone of weathering, and the rock is sound, hard and free of open joints. AAE did not find water-bearing fractures either in their test pits or boreholes. During wet weather there is standing water in depressions in the quarry, indicating that the underlying bedrock is of low permeability.

***Risk Assessment***

The risk of impact to the groundwater aquifer has been addressed in past reports prepared for the issuance of the permit. These assessments concluded that the underlying groundwater is protected by the low-permeability bedrock forming the floor of the pit. While impermeability of the bedrock is desirable, the encapsulation cell design does not depend on it. The design incorporates multiple protective measures including clay and synthetic liners, and leachate collection/detection systems.



***Summary and Conclusions***

The bedrock encountered in the test pits within the proposed westward expansion of Encapsulation Cell 1 was found to be consistent with the rock type and condition identified through previous investigations by AAE. No unexpected rock types or open fractures were identified.

I trust that this information meets your present requirements. Please do not hesitate to contact the writer if there are questions.

Yours truly,



Richard Brimmell, P.Eng.  
for Brimmell Engineering Ltd.



SIRM Apr 22 photos



The Encapsulation Cell 1 westward expansion is the triangle indicated by the blue arrow. North is to the right.

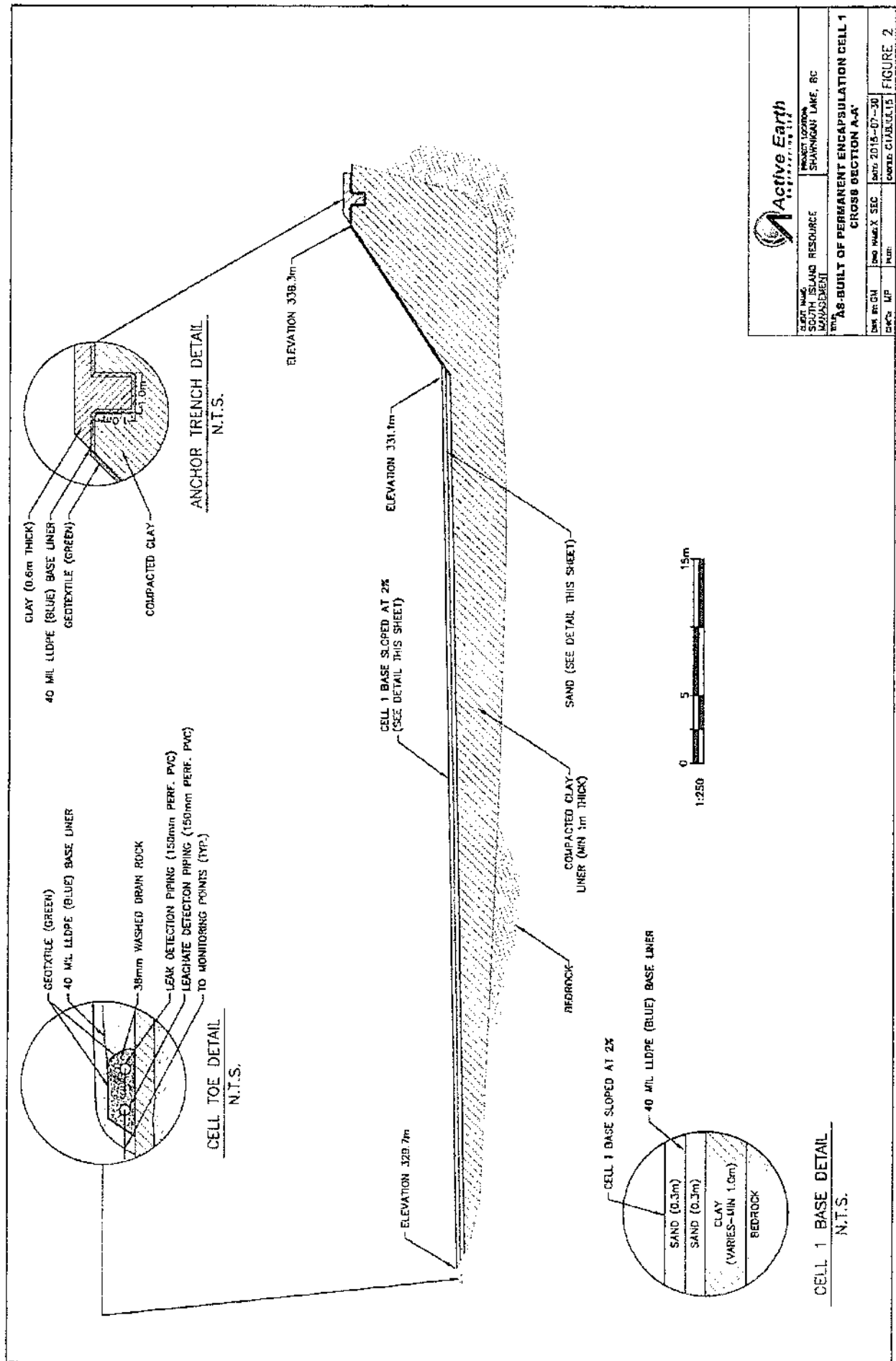


The expansion area, looking south



One of the test holes. There is sound, gneissic bedrock just under the debris at the base of the hole.







## Cell 1 Phase A

- As-Built Quality Assurance & Quality Control

RESOURCE MANAGEMENT







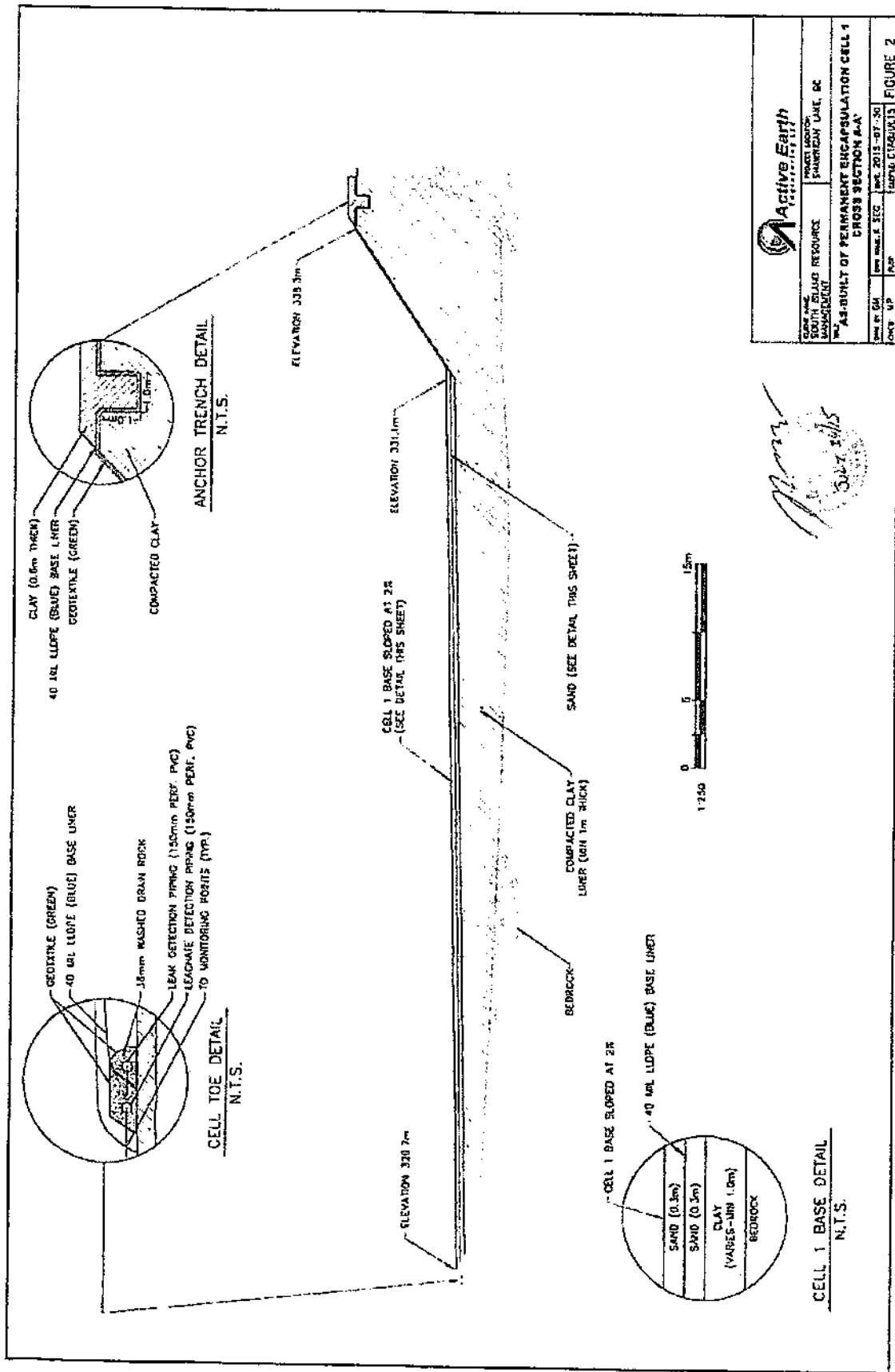






Photo 1 – Looking south at clay berms



Photo 2 – Base sand surface being prepared for liner deployment





Photo 3 – Base sand surface being prepared for liner deployment



Photo 4 – Liner deployment



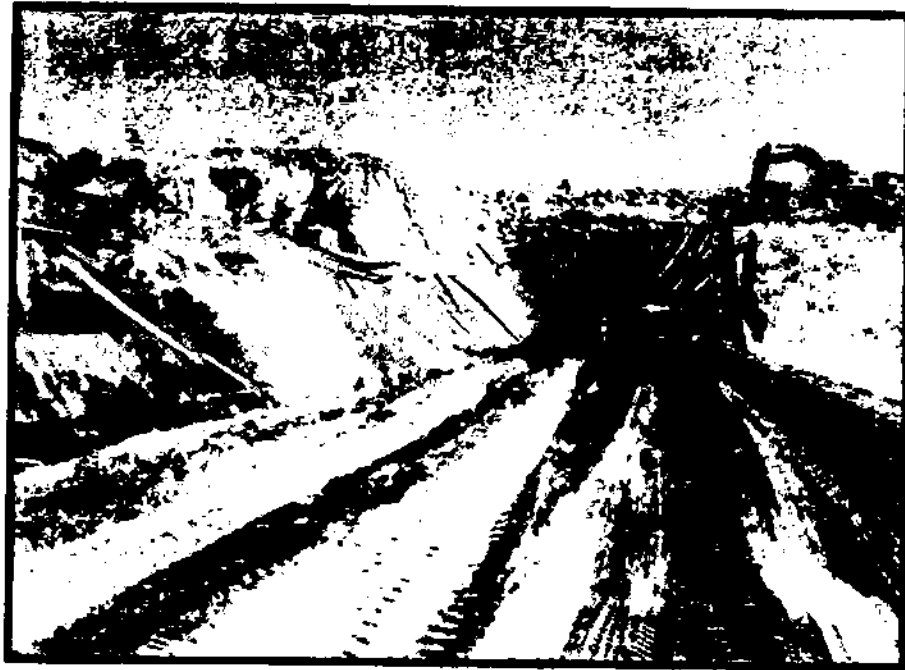


Photo 5 – Placement of Leachate Collection Sand Drainage Blanket



Photo 6 – Looking East at completed Cell 1 berm





Photo 7 – Leak Detection and Leachate Collection Tanks



Photo 8 – Leak Detection and Leachate Collection Piping Systems





Allterra Construction Ltd.  
40mil LLDPE  
Liner #1

376

40 mil LLDPE  
Liner #1

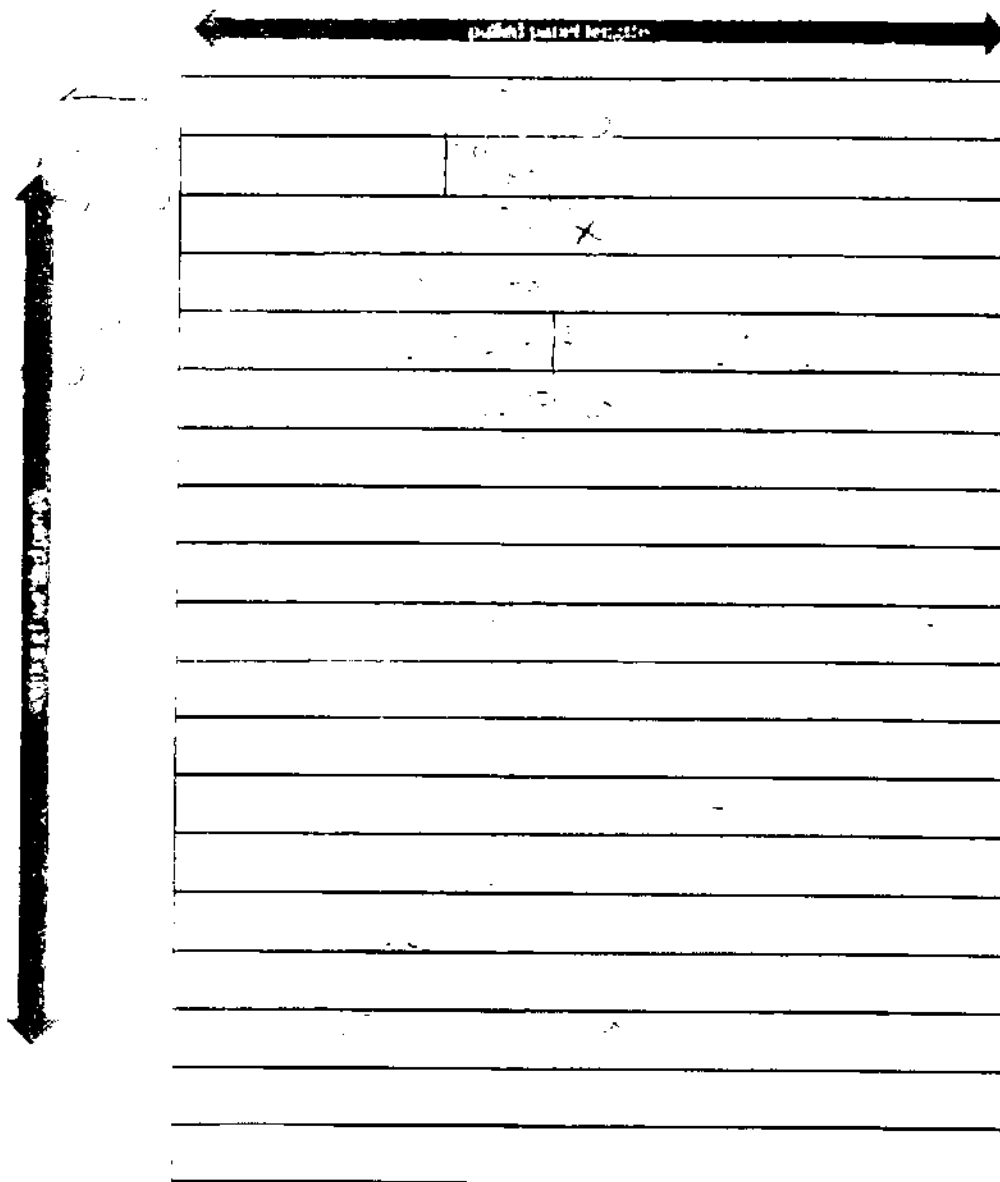
VANCOUVER:  
CALGARY:

12180 Vickers Way, Richmond, BC V6V 1H9T: 604-241-9487 F: 604-241-9485  
105 Stockton PL, Okotoks, AB T1S 1A5 T: 403-938-4361 F: 403-938-4371

1-800-551-4355

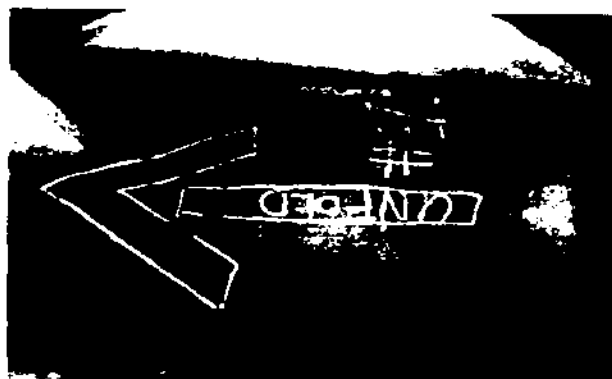
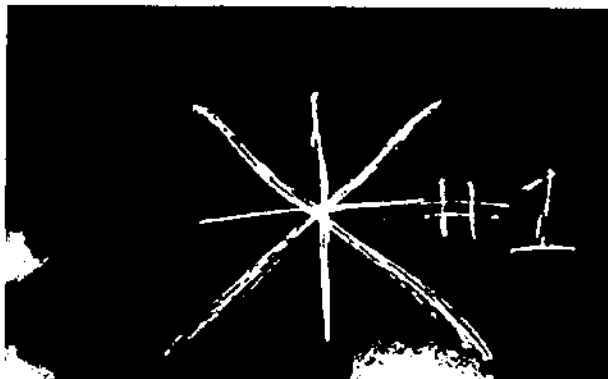


W/D	Size	Material
Customer	CP	Line Number
Material Width	Panel count	





#1





# Liner Quality Control Audit

1

Inspector	s.22	Crew	s.22	Date	06/05/2015
Work Order # L15-042276		Size / Style		Length	Width
				279	121
				RECTANGLE LINER	

PO#	CP-99-M	Customer	Allterra Construction	Liner #	#1
-----	---------	----------	-----------------------	---------	----

Width Calculator (enter for size ordered)									
Liner Length (feet)	Liner width (Feet)	Roll Width (Inches)	Weld Width overlap (Inches)	Calculated Panels Needed	Even Panel no. (rounded up)	Total Width of Even Panels (Feet)	Actual add/subtract	Actual Panel Count	
279	121	267	6	5.563218	6	131	-11'	5.5	
1st panel length verification size/persons					280' 1/2" SN		Finished Length	279.5	Actual Width
								120.125	
Stepped Panel lengths					N/A				
Step inset					N/A				
Secondary measurements (cut welds) NO CUT WELD, 1 EXTRUSION WELD AT W1, 2 EXTRUSION WELDS AT W2, 1 EXTRUSION WELD AT W3, W4 AND W5									
5 PANELS AT 22.3' AND 1 PANELS PULLED 142'X22.3' THEN CUT IN HALF TO MAKE A PANEL 279' 6" X11' 1.5"									
TEAR BACK TEST PERFORMED 20' FROM BEGINNING, MID CENTER, CENTER, MID CENTER, 20' FROM END									
Special Instructions					MARKED CENTER WITH X, DEPLOYMENT ARROW, MARKED #1				
Material		Solmax 40 mil LLDPE 140-7000/K7104			Color Out		BLACK		
Rolling					Folding				
Standard Roll		<input type="checkbox"/>			Standard Fan		<input type="checkbox"/>		
Standard Roll with Webbing		<input checked="" type="checkbox"/>			Butterfly Fold		<input checked="" type="checkbox"/>		
Scroll Rolled center mark W/Webbing		<input type="checkbox"/>			Fan Fold to center 2" web markers		<input type="checkbox"/>		
Core Type Used:		Metal <input checked="" type="checkbox"/>		Cardboard <input type="checkbox"/>		Other <input type="checkbox"/>			
(Standard = mil, size, unroll and unfold arrow)									
Standard Information Written on Item				<input checked="" type="checkbox"/>		Other: MARKED #1			
Packaging Wrap/ Color :				Standard Liner <input checked="" type="checkbox"/>		Other: 1.5X FELT, LLDPE, SX 12 MIL B GRADE			
Standard Package Labeling				<input checked="" type="checkbox"/>		Other: ITL AND WTL LABELS			

Notes



# Wedge/Extrusion Trial

1



12180 Vickers Way  
Richmond BC V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4355

Customer: Alterra Construction PO # CP-99-M  
Production Date: 05/05/2015 Time: 4:45PM  
QA Test Person: s.22 W./O. L15-042276  
Welding Tech: s.22 Crew: s.22

Welder Qualification For Liners: #1 Time Ending: \_\_\_\_\_  
Material Type: Solimax 40 mil LLDPE 140-7000/K7104 Liner Size: 

Length	Width	Style
<u>279</u>	<u>121</u>	<u>RECTANGLE LINER</u>

  
Welder Number: D4 Outside Temp: 61  
Welder Set Temp: 840 Inside Temp: 60  
Welder Set Speed: 899 Timed FPM 16 Sheet Temp: 61  
Extrusion Rod: N/A Welder Set up with bar Y/N N

## Peel Data

	Inside (Lbs)	Outside (Lbs)	Failure Type	Seperation (%)	Comments
1	68	65	SE1	0	PASS
2	65	64	SE1	0	PASS
3	67	65	SE1	0	PASS
4	65	62	SE1	0	PASS
5	68	65	SE1	0	PASS

## Shear Data

	Shear (Lbs)	Elongation (%)	Comments
1	73	200+%	PASS/STE
2	71	200+%	PASS/STE
3			
4			
5			

Notes: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

STE = sample stretch to end of test  
SE1 = sample break in outer edge of seam

SE2= break at seam edge top sheet (extrusion shear only)  
SE3= break at seam edge in bottom sheet (extrusion peel only)



# Wedge/Extrusion Trial

2



12180 Vickers Way  
Richmond BC V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4355

Customer: Allterra Construction PO # CP-99-M

Production Date: 06/05/2015 Time: 5:30AM

QA Test Person: s.22 W./O. L15-042276

Welding Tech: s.22 Crew: s.22

## Welder Qualification For Liners:

#1

Time Ending:

Material Type:	Solmax 40 mil LLDPE 140-7000/K7104	Liner Size:	Length	Width	Style
			279	121	RECTANGLE LINER

Welder Number: D4  
Welder Set Temp: 860  
Welder Set Speed: 999 *Timed FPM* 17  
Extrusion Rod: N/A

Outside Temp: 42  
Inside Temp: 50  
Sheet Temp: 42  
Welder Set up with bar Y/N N

## Peel Data

	Inside (Lbs)	Outside (Lbs)	Failure Type	Seperation (%)	Comments
1	69	71	SE1	0	PASS
2	69	70	SE1	0	PASS
3	69	69	SE1	0	PASS
4	68	69	SE1	0	PASS
5	66	69	SE1	0	PASS

## Shear Data

	Shear (Lbs)	Elongation (%)	Comments
1	71	200+%	PASS/STE
2	70	200+%	PASS/STE
3			
4			
5			

Notes:

STE = sample stretch to end of test  
SE1 = sample break in outer edge of seam

SE2= break at seam edge top sheet (extrusion shear only)  
SE3= break at seam edge in bottom sheet (extrusion peel only)



# Wedge/Extrusion Trial

3



WESTERN TANK  
& LINING LTD.

12180 Vickers Way  
Richmond BC V6V 1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4355

Customer: Allterra Construction PO # CP-99-M

Production Date: 06/05/2015 Time: 5:45AM

QA Test Person: s.22 W./O. L15-042276

Welding Tech: s.22 Crew: s.22

Welder Qualification For Liners:

#1

Time Ending:

Material Type:	Solmax 40 mil LLDPE 140-7000/K7104	Liner Size:	Length	Width	Style
			279	121	RECTANGLE LINER

Welder Number: EXTRUSION  
Welder Set Temp: 400PREHEAT/440 PLASTIC HEAT  
Welder Set Speed: HAND Timed FPM N/A  
Extrusion Rod: SOLMAX LL

Outside Temp: 42  
Inside Temp: 50  
Sheet Temp: 42  
Welder Set up with bar Y/N N/A

## Peel Data

	Inside (Lbs)	Outside (Lbs)	Failure Type	Seperation (%)	Comments
1	73	X	SE3	0	PASS
2	68	X	SE3	0	PASS
3	72	X	SE3	0	PASS
4	68	X	SE3	0	PASS
5	68	X	SE3	0	PASS

## Shear Data

	Shear (Lbs)	Elongation (%)	Comments
1	75	200+%	PASS/STE
2	73	200+%	PASS/STE
3	75	200+%	PASS/STE
4	72	200+%	PASS/STE
5	73	200+%	PASS/STE

Notes:

STE = sample stretch to end of test  
SE1 = sample break in outer edge of seam

SE2= break at seam edge top sheet (extrusion shear only)  
SE3= break at seam edge in bottom sheet (extrusion peel only)



## 3



Page 45 of 245 MOE-2017-71594





WESTERN TANK  
& LINING LTD.

## ASTM D 5199 MATERIAL THICKNESS LLDPE

12180 Vickers Way  
Richmond BC V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4355

Date MFG date	Mil Mfg	Roll ID #	Roll Width	sample area	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	Avg.	QA
5/5/2015 9/14/2014	Solmax 40 mil LLDPE 140- 7000/K7104	5-13692	22.3	PARTIAL	37.7	37.5	37.2	37.2	37.2	37.9	37.4	37.2	37.9	37.4	37.46	s.22
5/6/2015 3/13/2015	Solmax 40 mil LLDPE 140- 7000/K7104	5-13669	22.3	BEGIN	36	36.7	37	37.6	37.4	40.5	37.3	36.7	38.1	38.1	37.54	s.22
5/6/2015 3/14/2015	Solmax 40 mil LLDPE 140- 7000/K7104	5-13691	22.3	BEGIN	35.7	38.6	38.7	38.7	39.2	39.9	39.7	39.8	39.1	37.3	38.67	s.22





# LIST OF GEOMEMBRANE ROLLS

**SOLMAX**

Project Name Abbotsford, BC

Reference Number 108071

Project Number CP-SML15-4

Packing Slip Number 216764

Quality Assurance

Roll Number	Product Code	Resin Lot Number	Manufactured Date	Resin Melt Index 190/2 16 g/10 min D1238	Resin Density g/cc D1505	QIT min D3895	HPOB min D5885	ESCR SP-NC7L hours D5397
5-13668	Solmax 140-7000	CFB810520	13-Mar-15	0.36	0.919	100 > 120		N/A
5-13669	Solmax 140-7000	CFB810520	13-Mar-15	0.36	0.919	100 > 120		N/A
5-13670	Solmax 140-7000	CFB810520	13-Mar-15	0.36	0.919	100 > 120		N/A
5-13671	Solmax 140-7000	CFB810520	13-Mar-15	0.36	0.919	100 > 120		N/A
5-13672	Solmax 140-7000	CFB810520	13-Mar-15	0.36	0.919	100 > 120		N/A
5-13673	Solmax 140-7000	CFB810520	13-Mar-15	0.36	0.919	100 > 120		N/A
5-13674	Solmax 140-7000	CFB810520	13-Mar-15	0.36	0.919	100 > 120		N/A
5-13680	Solmax 140-7000	CFB810520	14-Mar-15	0.36	0.919	100 > 120		N/A
5-13681	Solmax 140-7000	CFB810520	14-Mar-15	0.36	0.919	100 > 120		N/A
5-13684	Solmax 140-7000	CFB810520	14-Mar-15	0.36	0.919	100 > 120		N/A
5-13687	Solmax 140-7000	CFB810520	14-Mar-15	0.36	0.919	100 > 120		N/A
5-13688	Solmax 140-7000	CFB810520	14-Mar-15	0.36	0.919	100 > 120		N/A
5-13689	Solmax 140-7000	CFB810520	14-Mar-15	0.36	0.919	100 > 120		N/A
5-13690	Solmax 140-7000	CFB810520	14-Mar-15	0.36	0.919	100 > 120		N/A
5-13691	Solmax 140-7000	CFB810520	14-Mar-15	0.36	0.919	100 > 120		N/A
5-13692	Solmax 140-7000	CFB810520	14-Mar-15	0.36	0.919	100 > 120		N/A

Quantity (rolls)

16



Project Name : Abbotsford, BC

Reference Number : 108071

Project Number : CP-SML15-4

Packing Slip Number : 216764

Product : Solmax 140-7000

**SOLMAX**  
Quality Assurance

Properties	Thickness average	Geo- membrane Density	Carbon Black Content	Carbon Black Dispersion	Tensile				Tear Resist.	Puncture Resist.	Dimension Stability	Asperity Height in / out
Unit	mm	g/cc	%	Cat 1 and 2	Yield Strength	Elong.	Break Strength	Elong.	N	N	%	mm
Test Method	D5199	D1505/D792	D4218 / D1603	D5596	kN/m	%	kN/m	%	D1004	D4833	D1204	
Frequency	Each roll	1/Lot	1/2 ro	1/10 ro	D6693				1/10 ro	1/10 ro	Cert	N/A
Specification	0.90	≤ 0.930	1.0 - 3.0	Cat. 1 / Cat. 2			31.5	1000	85	298	± 2	
5-13668	MD XD	0.92	0.931	2.49	10/10 Views		34.1 34.9	1021 1152	94 104	354		/
5-13669	MD XD	0.92	0.931	2.53	10/10 Views		34.1 34.9	1021 1152	94 104	354		/
5-13670	MD XD	0.93	0.931	2.53	10/10 Views		34.1 34.9	1021 1152	94 104	354		/
5-13671	MD XD	0.93	0.931	2.55	10/10 Views		34.1 34.9	1021 1152	94 104	354		/
5-13672	MD XD	0.93	0.931	2.55	10/10 Views		37.2 34.3	1166 1163	94 104	354		/
5-13673	MD XD	0.93	0.931	2.29	10/10 Views		37.3 34.3	1166 1163	94 104	354		/
5-13674	MD XD	0.94	0.931	2.29	10/10 Views		37.3 34.3	1166 1163	94 104	354		/
5-13680	MD XD	0.92	0.932	2.42	10/10 Views		36.6 33.8	1145 1156	94 102	353		/
5-13681	MD XD	0.93	0.932	2.53	10/10 Views		36.6 33.8	1145 1156	94 102	353		/
5-13684	MD XD	0.91	0.930	2.54	10/10 Views		33.8 34.3	1076 1121	94 102	353		/
5-13687	MD XD	0.92	0.930	2.45	10/10 Views		36.6 35.5	1176 1165	96 102	363		/
5-13688	MD XD	0.93	0.930	2.45	10/10 Views		36.6 35.6	1176 1165	96 102	363		/
5-13689	MD XD	0.92	0.930	2.57	10/10 Views		36.6 35.6	1176 1165	96 102	363		/
5-13690	MD XD	0.92	0.930	2.57	10/10 Views		36.6 35.6	1176 1165	96 102	363		/
5-13691	MD XD	0.93	0.930	2.38	10/10 Views		36.6 35.6	1176 1165	96 102	363		/
5-13692	MD XD	0.92	0.930	2.38	10/10 Views		35.9 33.5	1127 1143	96 102	363		/



PROPERTY	TEST METHOD	FREQUENCY <sup>(1)</sup>	UNIT	Solmax 140-7000
<b>SPECIFICATIONS</b>				
Thickness (Nominal ± 10%) (11)	ASTM D-5199	Every roll	mm	1.00
Resin Density	ASTM D-1505	Certification	g/cc	< 0.926
Melt Index - 190/2.16 (max.)	ASTM D-1238	Certification	g/10 min	1.0
Sheet Density (8)	ASTM D-1505	1/Batch	g/cc	≤ 0.939
Carbon Black Content (9)	ASTM D-4218	Every 2 rolls	%	2.0 - 3.0
Carbon Black Dispersion	ASTM D-5596	Every 10 rolls	Category	Cat. 1 / Cat. 2
OIT - standard (avg.)	ASTM D-3895	1/Batch	min	100
Tensile Properties (min. avg) (2)	ASTM D-638	Every 5 rolls		
Strength at Break			kN/m	31.5
Elongation at Break			%	1000
2% Modulus (max.)	ASTM D-5323	Per formulation	kN/m	420
Tear Resistance (min. avg.)	ASTM D-1004	Every 10 rolls	N	85
Puncture Resistance (min. avg.)	ASTM D-4833	Every 10 rolls	N	298
Dimensional Stability	ASTM D-1204	Certification	%	± 2
Multi-Axial Tensile (min. avg.)	ASTM D-5617	Per formulation	%	90
Oven Aging - % retained after 90 days	ASTM D-5721	Per formulation		
STD OIT (min. avg.)	ASTM D-3895		%	35
HP OIT (min. avg.)	ASTM D-5885		%	60
UV Resistance - % retained after 1600 hr	GRI-GM-11	Per formulation		
HP-OIT (min. avg.)	ASTM D-5885		%	35
<b>SUPPLY SPECIFICATIONS</b> (Roll dimensions may vary ± 1%)				
Roll Dimension - Width	-		m	6.80
Roll Dimension - Length	-		m	237.7
Area (Surface/Roll)	-		m <sup>2</sup>	1616.4

**NOTES**

- 1 Testing frequency based on standard roll dimensions and one batch is approximately 180,000 lbs (or one railway)
- 2 Elongation is measured with a gage length of 1.5"
- 8 Correlation table is available for ASTM D792 vs ASTM D1505 Both methods give the same results.
- 9 Correlation table is available for ASTM D1603 vs ASTM D4218 Both methods give the same results
- 11 The minimum average thickness is ± 10% of the nominal value

\* All values are nominal test results, except when specified as minimum or maximum

\* The information contained herein is provided for reference purposes only and is not intended as a warranty of guarantee. Final determination of suitability for use contemplated is the sole responsibility of the user. SOLMAX assumes no liability in connection with the use of this information.





SOLMAX INTERNATIONAL  
130-2000 and 140-7000 smooth LLDPE  
150.929 1234  
SOLMAX.COM

Covering the world

**MATERIAL CONFORMITY CERTIFICATE  
ISSUED BY  
THE MANUFACTURER**

Varennnes, October 16<sup>th</sup>, 2014

Ref.: Stock Material  
ATTN: Mr. Clint Powell

To whom it may concern,

Solmax International hereby certifies that 130-2000 and 140-7000 smooth LLDPE geomembrane supplied for the above-mentioned project meets the following:

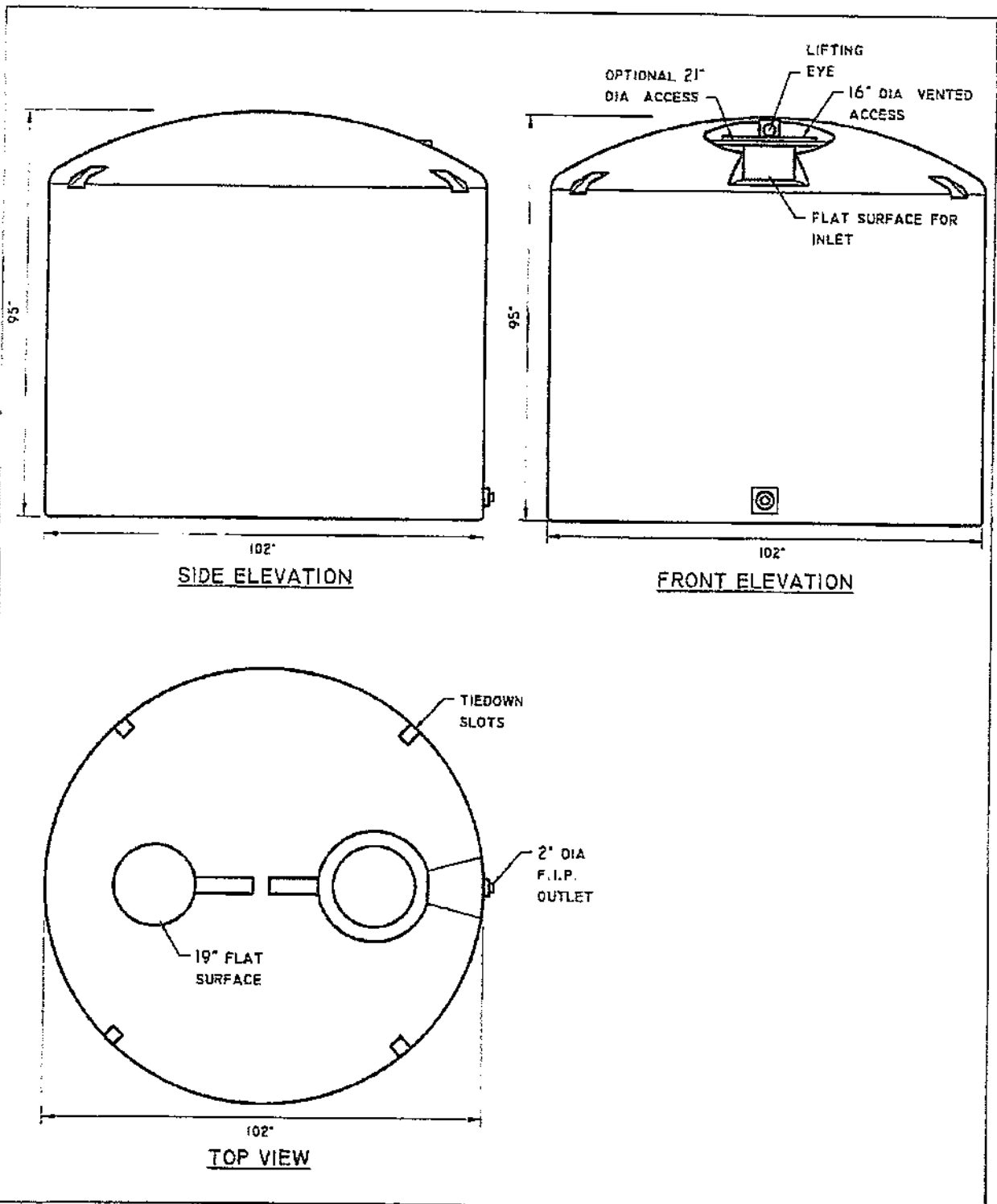
- Axi-Symmetric Break Resistance Strain (min)      ASTM D5617      90 %

Hoping the above information is satisfactory. Do not hesitate to contact us if you require any additional information.

Sincerely,

Chantal Gagnon  
Technical Services  
Solmax International Inc.





**PREMIER**  
PLASTICS

www.premierplastics.com 1-800-661-4473

## VERTICAL WATER TANK

2500 IMP. GALLON - VW2500

3000 US. GALLON - VU3000

POLYETHYLENE

DATE: AUG 2008

SCALE: NTS

DRAWN: SGM

DWG. No. VW2500

REV.





**Levelton Consultants Ltd.**

760 Enterprise Crescent  
Victoria, BC  
Canada V8Z 6R4  
Tel: 250-475-1000  
Fax: 250-475-2211  
E-Mail: victoria@levelton.com

**FIELD REVIEW REPORT**

PROJECT: Soil Containment Cell Construction	Report No: 1	In Attendance:
LOCATION: SIA Quarry – Stebbings Road, Shawnigan Lk	Date: April 16, 2014	Matt Pye
CONTRACTOR: South Island Aggregates	Project No: R714-0514	Adam Miller
OWNER: South Island Aggregates	Time: 11:00 am	Alec Morse
CONTRACT REF: Matt Pye – Active Earth Eng.	Weather: Drizzle/mild	

**OBSERVATIONS/REMARKS/ACTIONS BY: Alec Morse, P.Eng.**

- excavation for Cell #1 of the soil containment area had been carried out prior to the site visit and review of the temporary cut slopes on the west and south sides of the cell was conducted;
- compaction testing of the liner materials was also ongoing at the time of the site visit, the results of which are to be reported separately;
- the cut slopes on the west and south sides of Cell #1 are approximately 8 to 10m in height and mainly consist of intact bedrock following blasting and excavation;
- the bedrock has been scaled to removal loose particles and the remaining bedrock slope is considered stable for cell construction to be ongoing below;
- there were two areas where the crest of the slope consists of overburden, silty sand materials that have been cut steeply above the top of the intact bedrock;
- it is recommended that all soil exposures above the bedrock be sloped at a maximum 2H:1V for appropriate stability;
- following re-shaping of the soil cuts, the temporary cut slopes are considered suitable for authorized personnel to be working within the soil containment cell;
- it is recommended that the stability of the bedrock be reviewed on a semi-annual (twice a year) basis if still exposed.

**LEVELTON CONSULTANTS LTD.**

Distribution:

Active Earth Engineering: Matt Pye – [matt.pye@activeearth.ca](mailto:matt.pye@activeearth.ca)

Page 1 of 1

Per:





LEVELTON CONSULTANTS LTD.

760 Enterprise Crescent  
Victoria, B.C.  
Canada V8Z 6R4  
Tel.: (250) 475-1000  
Fax: (250) 475-2211  
E-mail: victoria@levelton.com

## PROCTOR TEST REPORT

PROJECT: Active Earth

DATE ISSUED: April 15, 2014

CLIENT: Active Earth

ISSUED BY: LCL-Victoria

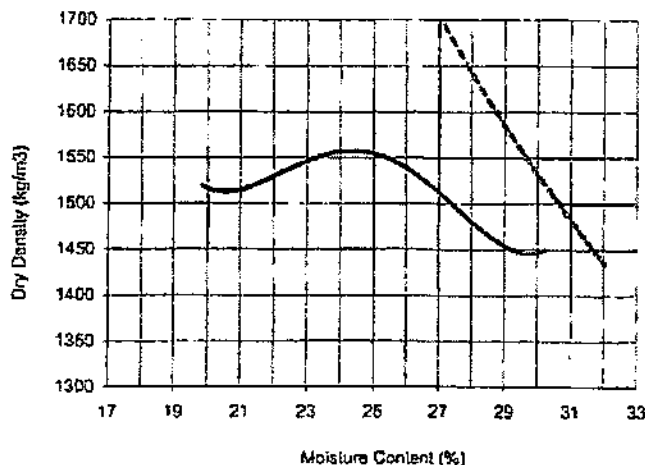
FILE NO.: R714-0514-00

REPORT NO.: 1

Sample Information					
Material Classification: Cell Liner					
Material Description: Fine Sandy Silt					
Date sampled	April 9, 2014	Sampled by	Client	Estimated SG	2.700
Date received	April 9, 2014	Supplier	N/A	Insitu moisture	NA
Sample Source	Client site			Sample Number	1

Test Information						
Trial Number	1	2	3	4	5	Test Standard
Wet Density (kg/m <sup>3</sup> )	1820	1886	1940	1919	1887	Standard
Dry Density (kg/m <sup>3</sup> )	1519	1539	1556	1511	1449	Test Procedure
Moisture Content (%)	19.8	22.6	24.7	27.0	30.2	ASTM D-698 Method C
						Date tested
						April 11, 2014
						Tested by
						GG

Moisture-Density Relationship



Test Result Summary	
Over-size correction method:	ASTM 4718
Retained 19.0mm sieve:	0%
Over-size specific gravity:	2.700
Maximum Dry Density Values	
Uncorrected Value	1567 kg/m <sup>3</sup>
Corrected Value	1667 kg/m <sup>3</sup>
Optimum Moisture Content	
Uncorrected Value	24.5 %
Corrected Value	24.5 %

Distribution	
Active Earth - Matt Pye - matt.pye@activeearth.ca	

Per:   
LEVELTON CONSULTANTS LTD.

This report constitutes a testing service only. No engineering interpretation opinion is expressed or implied. Engineering review and interpretation can be provided on written request.





LEVELTON CONSULTANTS LTD.

780 Enterprise Crescent  
Victoria, B.C.  
Canada V8Z 6R4  
Tel: (250) 475-1000  
Fax: (250) 475-2211  
E-mail: victoria@levelton.com

## PROCTOR TEST REPORT

PROJECT: Active Earth

DATE ISSUED: April 16, 2014

CLIENT: Active Earth

ISSUED BY: LCL-Victoria

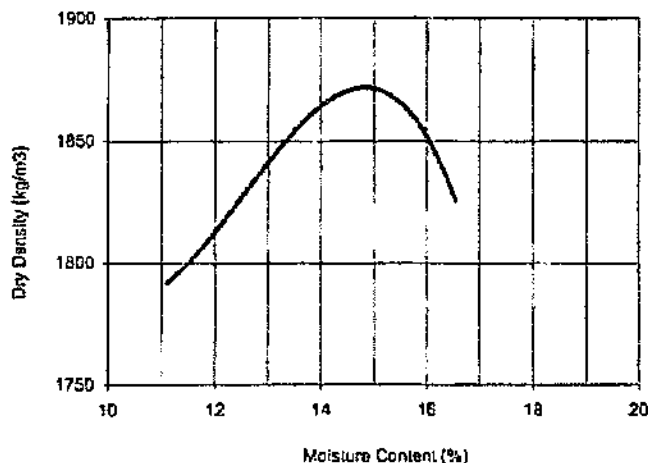
FILE NO.: R714-0514-00

REPORT NO.: 2

Sample Information					
Material Classification: Cell Liner					
Material Description: Return haul clay with gravel					
Date sampled	April 9, 2014	Sampled by	Client	Estimated SG	2.650
Date received	April 9, 2014	Supplier	N/A	Insitu moisture	NA
Sample Source	Client site			Sample Number	2

Test Information							
Trial Number	1	2	3	4	5	Test Standard	Standard
Wet Density (kg/m <sup>3</sup> )	1991	2048	2155	2128		Test Procedure	ASTM D-698 Method C
Dry Density (kg/m <sup>3</sup> )	1792	1823	1868	1826		Date tested	April 14, 2014
Moisture Content (%)	11.1	12.4	15.4	16.6		Tested by	GG

Moisture-Density Relationship



Test Result Summary	
Oversize correction method:	ASTM 4718
Retained 19.0mm sieve:	9%
Oversize specific gravity:	2.700
Maximum Dry Density Values	
Uncorrected Value	1872 kg/m <sup>3</sup>
Corrected Value	1923 kg/m <sup>3</sup>
Optimum Moisture Content	
Uncorrected Value	14.8 %
Corrected Value	13.6 %

Distribution	
Active Earth - Matt Pye - matt.pye@activeearth.ca	

Per:   
LEVELTON CONSULTANTS LTD.

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Levelton Consultants Ltd

1935 Bolinger Road  
Nanaimo, B.C.  
Canada V9S 5W9  
Tel: (250) 753-1077  
Fax: (250) 753-1023

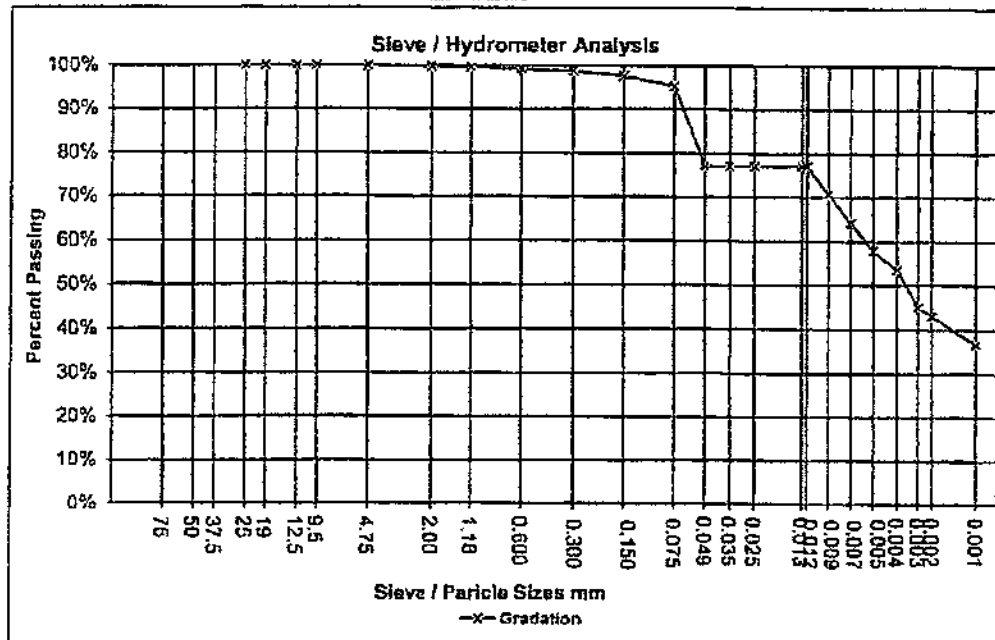
### Grain Size Analysis (Hydrometer)

Client: Active Earth Engineering Ltd  
Project Name: Laboratory Testing  
Site Location: SIA  
Sample Source: N/A  
Comments: Silty Fine Sand with Clay

Job No. R714-0514-00  
Lab No. 3801 A  
Date Tested: April 14, 2014  
Date Sampled: N/A  
Sampled By: Client  
Tested By: IS

Sieve Analysis		Hydrometer Analysis	
Sieve Sizes mm	Percent Passing	Particle Sizes mm	Percent Passing
75			
50			
37.5		0.049	77%
25	100%	0.035	77%
19	100%	0.025	77%
12.5	100%	0.013	77%
9.5	100%	0.012	77%
4.75	100%	0.009	71%
2.00	100%	0.007	64%
1.18	100%	0.005	58%
0.600	99%	0.004	54%
0.300	99%	0.003	45%
0.150	98%	0.002	43%
0.075	95%	0.001	37%

Cobble Sizes: 200 mm to 60 mm  
Gravel Sizes: 60 mm to 2.0 mm  
Sand Sizes: 2.0 mm to 0.06 mm  
Silt Sizes: 0.06 mm to 0.002 mm  
Clay Sizes: Smaller Than 0.002 mm



REMARKS: Tested in accordance with ASTM D-422

REPORTS TO Active Earth Engineering Ltd., Matt Pye

LEVELTON CONSULTANTS LTD.

PER.

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Levelton Consultants Ltd.

1835 Bowfinger Road  
Nanaimo, B.C.  
Canada V8S 5W9  
Tel: (250) 753-1077  
Fax: (250) 753-1023

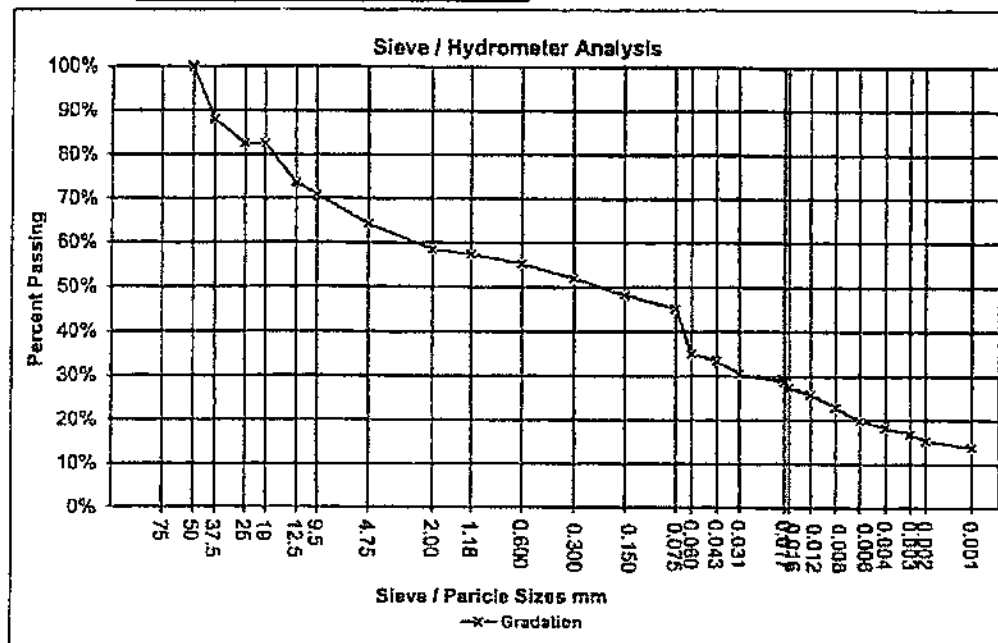
### Grain Size Analysis (Hydrometer)

Client: Active Earth Engineering Ltd  
Project Name: Laboratory Testing  
Site Location: SIA  
Sample Source: Omicron  
Comments: Return haul silty Clay with sand and gravel.

Job No. R714-0514-00  
Lab No. 3801 B  
Date Tested: April 14, 2014  
Date Sampled: N/A  
Sampled By: Client  
Tested By: IS

Sieve Analysis		Hydrometer Analysis	
Sieve Sizes mm	Percent Passing	Particle Sizes mm	Percent Passing
75			
50	100%		
37.5	88%	0.060	35%
25	83%	0.043	33%
15	83%	0.031	30%
12.5	74%	0.017	29%
9.5	71%	0.016	27%
4.75	64%	0.012	26%
2.00	58%	0.008	23%
1.18	57%	0.006	20%
0.600	55%	0.004	18%
0.300	52%	0.003	17%
0.150	48%	0.002	15%
0.075	45%	0.001	14%

Cobble Sizes: 200 mm to 60 mm  
Gravel Sizes: 60 mm to 2.0 mm  
Sand Sizes: 2.0 mm to 0.06 mm  
Silt Sizes: 0.06 mm to 0.002 mm  
Clay Sizes: Smaller Than 0.002 mm



REMARKS: Tested in accordance with ASTM D-422

REPORTS TO: Active Earth Engineering Ltd., Matt Fye

LEVELTON CONSULTANTS LTD

PER:

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780 Enterprise Crescent  
Victoria, BC  
Canada V8Z 6R4  
Tel: (250) 475-1000  
Fax: (250) 475-2211  
E-mail: victoria@levelton.com  
www.levelton.com

## SOIL FIELD DENSITY TEST RESULTS

PROJECT: Materials Testing - SIA  
CLIENT: Active Earth Engineering Ltd.  
MATERIAL CLASSIFICATION: Cell Liner (Return Haul Clay with Gravel)

FILE No.: R714-0514-00  
REPORT No.: 1

DATE: April 16, 2014  
TECHNICIAN: AM

PROCTOR: Standard  
MAXIMUM DENSITY: 1872 kg/m<sup>3</sup>

REQUIRED % PROCTOR: 95 %  
OPTIMUM MOISTURE: 14.8 %

DENSITY EQUIPMENT USED: Nuclear Densometer  
ASTM: D-6938

TEST No.	DATE TESTED	LOCATION Pit East of Crusher	PROBE DEPTH (mm)	IPD WET (kg/m <sup>3</sup> )	W%	CORR. PROCTOR (kg/m <sup>3</sup> )	IPD DRY (kg/m <sup>3</sup> )	% PROCTOR	REMARKS
1	April 16	60 m South from East inside corner of rock face	300	2049	13.7	1923	1002	94	Tests #2 & #4 Corrected
2		15 m South of location #1	300	2180	9.6	2028	1970	97	For 25% oversize
3		20 m West of location #2	300	2053	10.0	1923	1851	87	Tests #1 & #3 Corrected
4		20 m West of location #3	300	2303	12.1	2028	2055	>100	For 9% oversize

DISTRIBUTION:  
Active Earth Engineering: Matt Pys - [matt.pys@activeearth.ca](mailto:matt.pys@activeearth.ca)

LEVELTON CONSULTANTS LTD

Per: \_\_\_\_\_

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760 Enterprise Crescent  
Victoria, B.C.  
Canada V8Z 6R4  
Tel: (250) 475-1000  
Fax: (250) 475-2211  
E-mail: victoria@levelton.com

## PROCTOR TEST REPORT

PROJECT: Active Earth

DATE ISSUED: April 16, 2014

CLIENT: Active Earth

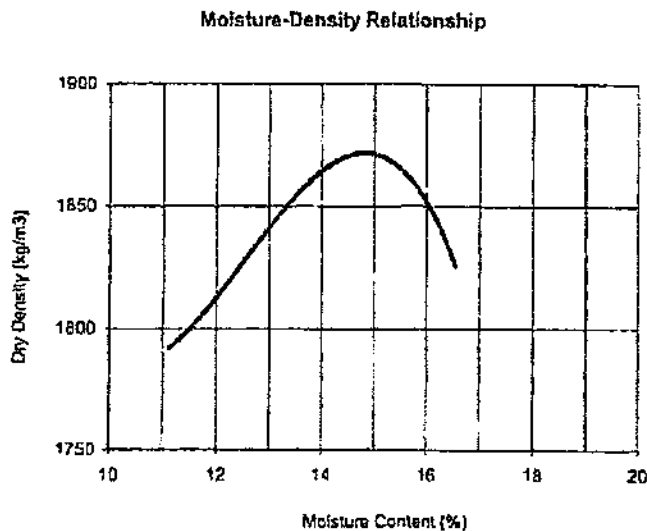
ISSUED BY: LCL-Victoria

FILE NO.: R714-0514-00

REPORT NO.: 2

Sample Information					
Material Classification: Cell Liner					
Material Description: Return haul clay with gravel					
Date sampled	April 9, 2014	Sampled by	Client	Estimated SG	2.650
Date received	April 9, 2014	Supplier	N/A	Insitu moisture	NA
Sample Source	Client site			Sample Number	2

Test Information								
Trial Number	1	2	3	4	5	Test Standard	Standard	
Wet Density (kg/m <sup>3</sup> )	1991	2048	2155	2128		Test Procedure	ASTM D-698 Method C	
Dry Density (kg/m <sup>3</sup> )	1792	1823	1868	1826		Date tested	April 14, 2014	
Moisture Content (%)	11.1	12.4	15.4	16.6		Tested by	GG	



Test Result Summary	
Oversize correction method:	ASTM 4718
Retained 19.0mm sieve:	9%
Oversize specific gravity:	2.700
Maximum Dry Density Values	
Uncorrected Value	1872 kg/m <sup>3</sup>
Corrected Value	1923 kg/m <sup>3</sup>
Optimum Moisture Content	
Uncorrected Value	14.8 %
Corrected Value	13.6 %

Distribution	
Active Earth - Matt Pye - matt.pye@activeearth.ca	

Per:   
LEVELTON CONSULTANTS LTD.

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**Levelton Consultants Ltd.**  
760 Enterprise Crescent  
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Canada V8Z 6R4  
Tel: (250) 475-1000  
Fax: (250) 475-2211  
E-mail: [vicoria@levelton.com](mailto:vicoria@levelton.com)  
[www.levelton.com](http://www.levelton.com)

# SOIL FIELD DENSITY TEST RESULTS

PROJECT: Materials Testing – SIA – Cell #1  
CLIENT: Active Earth Engineering Ltd.  
MATERIAL CLASSIFICATION: 50/50 Mixture of fine sandy silt & silty clay

FILE No.: R714-0514-00  
REPORT No.: 3

DATE: May 14, 2014  
TECHNICIAN: GJP

PROCTOR: Standard  
MAXIMUM DENSITY: 1745 kg/m<sup>3</sup>

REQUIRED % PROCTOR: 95 %  
OPTIMUM MOISTURE: 19.7 %

DENSITY EQUIPMENT USED: Nuclear Densometer  
ASTM: D-6938

TEST No.	DATE TESTED	LOCATION Base clay – 1 m fill depth	PROBE DEPTH (mm)	IPD WET (kg/m <sup>3</sup> )	W%	CORR. PROCTOR (kg/m <sup>3</sup> )	IPD DRY (kg/m <sup>3</sup> )	% PROCTOR	REMARKS
1	May 14	SE Corner	150	1987		1745	1715	98	
2		15 m North of #1	150	1901	17.2		1622	93	
3		30 m North of #1	150	1949	18.7		1642	94	
4		45 m North of #1	150	1996	17.3		1702	98	
5		12 m North & 8 m West of #4	150	1935	16.8		1666	95	
6		15 m South of #5	150	1909	16.6		1638	94	
7		30 m South of #8	150	1980	19.5		1668	96	
8		47 m South of #7	150	2013	19.1		1690	97	
9		8 m West & 4 m South of #9	150	2095	15.2		1819	>100	
10		15 m North of #9	150	1850	16.4		1589	91	
11		30 m North of #9	150	1946	17.5		1657	95	
12			150	1968	17.4		1677	96	

NOTES: Mike (SIA) operator advised that running rubber tired equipment over the clay fill will increase % compaction.  
DISTRIBUTION:

Active Earth Engineering: Mail Pye – [matl.pye@activeearth.ca](mailto:matl.pye@activeearth.ca)

LEVELTON CONSULTANTS LTD

Per: \_\_\_\_\_

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## Cell 1 Phase B

- As-Built Quality Assurance & Quality Control

RESOURCE MANAGEMENT



Brimmell Engineering Ltd  
971 Bank Street  
Victoria, BC  
V8S 4B1  
rbrimmell@shaw.ca

South Island Resource Management

Nov 13/15  
File 15-139

Att: Pete Craig & Doug Harlow

Re: SIRM Facility, 460 Stebbings Rd., Shawnigan Lake  
MEM Permit Q-8-094 & MOE PR-105809  
As-Built for Encapsulation Cell 1B

This letter discusses the westward expansion of Encapsulation Cell 1. The 30 m (east-west) expansion is identified as Cell 1B. An as-built drawing is attached showing the expansion and the locations of Oct 25 density testing. The density test report is also appended, along with Field Review Rpt 3 and several photos. Construction methodology was developed by Active Earth for the existing Cell 1A as summarized in the attached report from them.

Site preparation is described as follows:

- establish a clay liner, graded northward
- establish a continuous clay berm along the north, east and west sides
- place a lift of sand over the clay liner
- install a continuous 40 mil (1 mm) LLDPE liner over the sand layer, up the inside faces of the clay berms and up the slope at the south end
- place a lift of sand over the LLDPE liner
- in conjunction with the above work, install perforated leachate collection and leak detection pipes at the south end connecting to the two existing 2500 gallon tanks

The October 25 density testing on the clay liner showed somewhat variable density, which is a function of the variable material. Consolidation of the clay was assessed visually and found to be good, suitable for the intended usage as an impermeable barrier. The clay liner was compacted in lifts with large, vibratory rollers – one with a padfoot drum the other a smooth drum. The perimeter clay berm was compacted with a hoepacker.

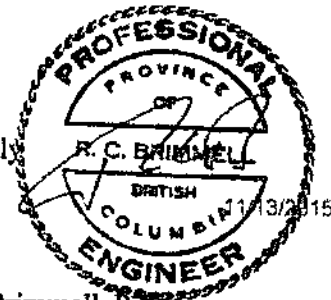


The LLDPE liner was supplied and installed by Western Tank & Lining Ltd. Shop drawings and test results from Western Tank have been reviewed. Seams between road widths, and along the interface with the Cell 1A liner, have been hot-welded. These welds have been examined at several locations and found to be thorough.

The construction meets the standards required by MEM Permit Q-8-094 and MOE Permit PR-105809. Placement and compaction/stabilization of the Cell 1A fill will be monitored by Brimmell Engineering Ltd.

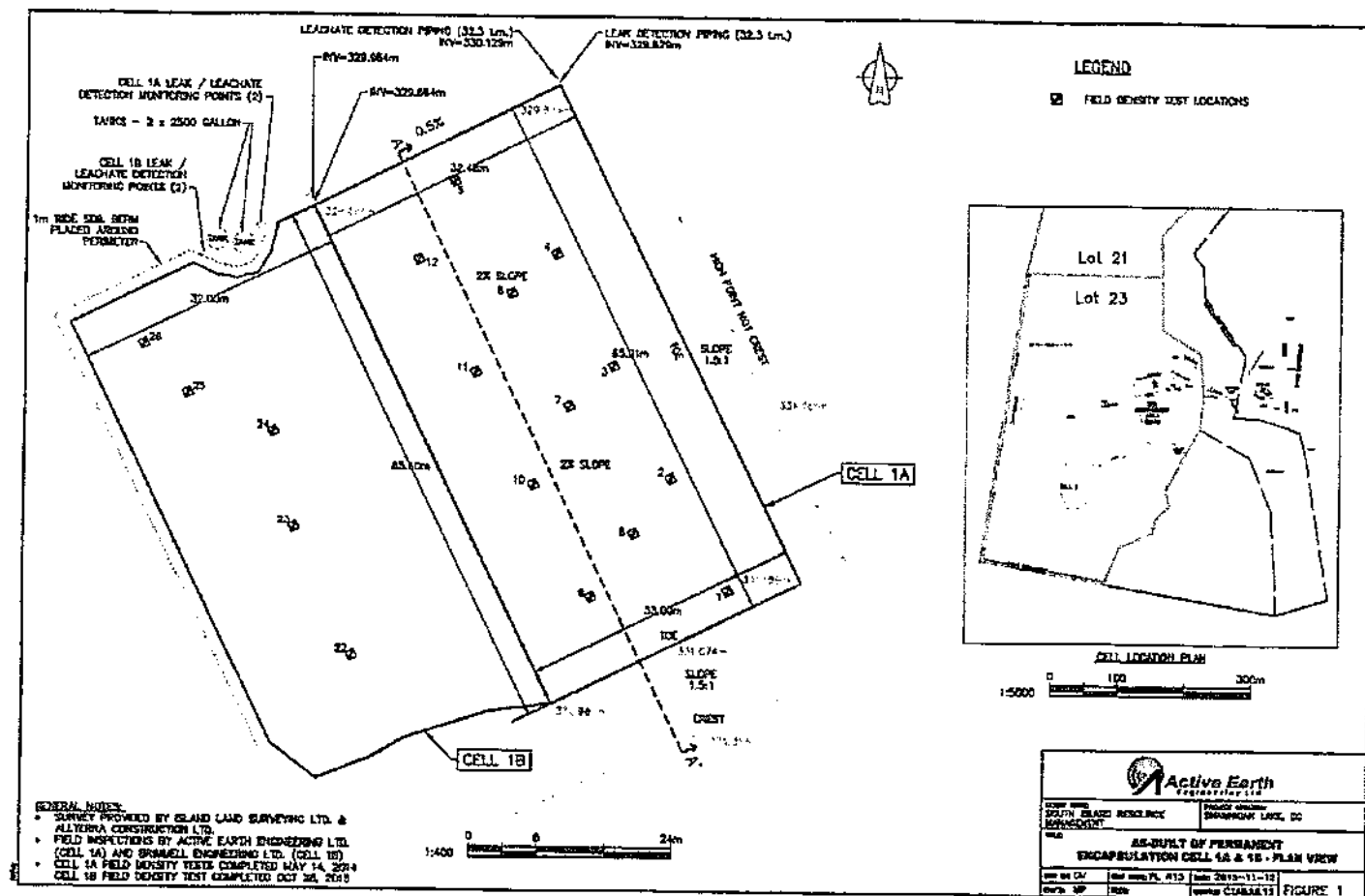
I trust that this information meets your present requirements. Please do not hesitate to contact the writer if there are questions.

Yours truly,



Richard Brimmell, P.Eng.  
for Brimmell Engineering Ltd.









Sheet No. \_\_\_\_\_

## A.S.T.M. D2922

Contractor SIR A

**Compaction Spec. (%)**

### Compaction Equipment

[illegible]

**Nf.**

LOCATION SKETCH

Cell 1A

Cell 1B

22+

23+

24+

25+

26+

Remarks

Distribution	Initials



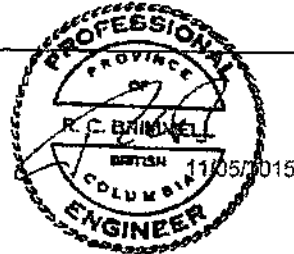
## FIELD REVIEW REPORT

### Brimmell Engineering Ltd.

971 Bank St., Victoria B.C. V8S 4B1

250-889-3080 rbrimmell@shaw.ca

PROJECT: SIRM Quarry LOCATION: 460 Stebbings Rd., Shawnigan Lake CONTRACTOR: SIRM CONTACT: Doug Harlow	No. 3  Dates: Oct 27 & Nov 4/15  Project No: 15-139  Time: various	In Attendance: Richard Brimmell Doug Harlow
ASPECT OF PROJECT REVIEWED: Westward expansion of Encapsulation Cell 1, identified as Cell 1B.		
OBSERVATIONS: The expansion area was reviewed on October 27. The east edge (adjacent to Cell 1A) was previously reviewed and approved by Active Earth. The balance of Cell 1B had been graded with roller-compacted clay. Test pits indicated that the clay was well consolidated but not thick enough. The design calls for 1 m thickness of clay liner. It was recommended that additional clay be placed and compacted. Density tests carried out on the first lift of clay (as seen on October 27) indicated fairly good compaction, with some variability due to variable moisture content and gravel content.  Additional clay has been placed and roller-compacted. The site was reassessed on November 4 and compaction of the clay was assessed visually and with a steel hand probe.		
REMARKS/RECOMMENDATIONS: The clay liner comprising Cell 1B is approved. Placement of the sand layers and membrane may proceed.		
DISTRIBUTION: Doug Harlow Pete Craig		





SIRM Oct/Nov 2015 photos



Test pitting of the clay liner on Oct 27. The clay was found to be well consolidated but not thick enough. Looking north.



The second lift of clay Nov 4. Looking south.





Liner in place on Nov 9 and second sand lift being placed. Looking south.



The boundary between Encapsulation Cells 1A (on left) and 1B. The new liner has been hot-welded to the Cell 1A liner. Looking south.



# Wedge/Extrusion Trial

1



**WESTERN TANK  
& LINING LTD.**

12180 Vickers Way  
Richmond BC V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4355

Customer: **WESTERN TANK** PO # **AS-BCSO84**  
Production Date: **10/22/2015** Time: **10:32 PM**  
QA Test Person: **s.22** W./O. **WO-001050**  
Welding Tech: **s.22** Crew: **s.22**

Welder Qualification For Liners: **#1** Time Ending:

Material Type: **Solmax 40 mil LLDPE 140-7000/K7104** Liner Size: **315 121 RECTANGLE LINER**  
*size expressed in decimal feet*

Welder Number: **D11** Outside Temp: **50**  
Welder Set Temp: **800** Inside Temp: **50**  
Welder Set Speed: **699 Timed FPM 17** Sheet Temp: **50**  
Extrusion Rod: **N/A** Welder Set up with bar Y/N **N/A**

## Peel Data

*test speed is 20 in/min unless otherwise noted*

	Inside (Lbs)	Outside (Lbs)	Failure Type	Seperation (%)	Comments
1	61	64	SE1	0	PASS
2	60	67	SE1	0	PASS
3	72	65	SE1	0	PASS
4	60	65	SE1	0	PASS
5	61	63	SE1	0	PASS

## Shear Data

	Shear (Lbs)	Elongation (%)	Comments
1	67	200+%	PASS/STE
2	69	200+%	PASS/STE
3	69	200+%	PASS/STE
4	72	200+%	PASS/STE
5	66	200+%	PASS/STE

Notes: **Tear Back Results on Sample Weld: GOOD 8**

STE = sample stretch to end of test  
SE1 = sample break in outer edge of seam

SE2= break at seam edge top sheet (extrusion shear only)  
SE3= break at seam edge in bottom sheet (extrusion peel only)



# Wedge/Extrusion Trial

2



12180 Vickers Way  
Richmond BC V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4355

Customer: WESTERN TANK PO # AS-BCS084  
Production Date: 10/22/2015 Time: 6:23PM  
QA Test Person: s.22 W./O. WO-001050  
Welding Tech: s.22 Crew: s.22

Welder Qualification For Liners: #1 Time Ending:

Material Type: Solmax 40 mil LLDPE 140-7000/K7104 Liner Size: Length Width Style  
315 121 RECTANGLE LINER

Welder Number: EXTRUSION Outside Temp: 60  
Welder Set Temp: 400/425 Inside Temp: 60  
Welder Set Speed: HAND Timed FPM N/A Sheet Temp: 60  
Extrusion Rod: SOLMAX LL Welder Set up with bar N/A N/A

## Peel Data

test speed is 20 in/min unless otherwise noted

	Inside (Lbs)	Outside (Lbs)	Failure Type	Seperation (%)	Comments
1	61	X	SE3	0	PASS
2	59	X	SE3	0	PASS
3	59	X	SE3	0	PASS
4	68	X	SE3	0	PASS
5	64	X	SE3	0	PASS

## Shear Data

	Shear (Lbs)	Elongation (%)	Comments
1	60	200+%	PASS/STE
2	60	200+%	PASS/STE
3	66	200+%	PASS/STE
4	60	200+%	PASS/STE
5	63	200+%	PASS/STE

Notes: Tear Back Results on Sample Weld: N/A

STE = sample stretch to end of test  
SE1 = sample break in outer edge of seam

SE2= break at seam edge top sheet (extrusion shear only)  
SE3= break at seam edge in bottom sheet (extrusion peel only)



**WESTERN TANK & LINING LTD.**

12180 Vickers Way  
Richmond, B.C., V6V-1H9  
PHONE (604) 241-9487  
FAX (604) 241-9485

WARRANTY NUMBER	WTL SIRM001
ACCEPTANCE DATE	Nov. 13, 2015
WARRANTY PERIOD	3 Years

**WORKMANSHIP WARRANTY**

PURCHASER/USER	South Island Resource Management
LOCATION OF INSTALLATION	461 Stebbings Road, Shawnigan Lake, B.C.
DESCRIPTION OF INTENDED USE	40 mil LLDPE Landfill Cell Liner

WESTERN TANK & LINING LTD. (the "Installer") warrants to the party named above as the Purchaser/User ("Purchaser") that the tank and/or lining membrane system ("the Liner System") as installed by the Installer will be free from installation-related defects for normal use in approved applications, on the terms and conditions set forth in this Workmanship Warranty (the "Warranty"). This Warranty shall be in effect from the above noted Acceptance Date for the above noted Warranty Period.

The term "normal use" means uses reasonably consistent with the above noted Description of Intended Use, and does not include, among other things, the exposure of the Liner System to harmful chemicals; abuse of the Liner System by machinery, equipment or people; excessive pressures or stresses from any source; subsurface or overburdened soil conditions; and total or differential soil settlements and the effect those settlements may have on the Liner System. The Purchaser acknowledges that the sale of the Liner System is for commercial or industrial use only.

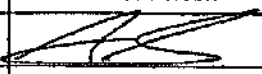
This Warranty does not include damages or defects in the Liner System resulting from: (i) acts of God, casualty or catastrophe, including earthquakes, floods, weather, tornadoes, explosion, war, acts of any public authority, or any other cause beyond the Installer's reasonable control; (ii) faulty materials, or any defects in the workmanship, design or manufacturing of the materials comprising the Liner System; (iii) defects arising on account of third party action; (iv) defects arising from improper maintenance, use, repair, replacement or alteration of the Liner System by the Purchaser; (v) subsidence of the land around the Liner System; or (vi) surface defects in workmanship and materials apparent and accepted by the Purchaser at the date of delivery.

Any claim for an alleged breach of this Warranty must be made in writing, by registered mail or fax, to the President of the Installer at the address above within thirty (30) days of the Purchaser becoming aware of the alleged defect. If the Purchaser fails to deliver notice as required under this Warranty, the defect and all warranties shall be deemed to have been waived and the Purchaser will have no right of recovery against the Installer. Should defects within the scope of the above Warranty occur, the Installer will, at its option, repair or replace the Liner System or defective portion thereof. The Installer will have the right to inspect and determine the cause of any alleged defect in the Liner System and to take appropriate steps to repair or replace the Liner System if a defect exists for which the Installer is liable under the terms of this Warranty. The Installer will not be required to make such repairs and/or replacements until the Purchaser has ensured that the area surrounding the Liner System is clean, dry, and in an unencumbered condition, including without limitation free from all water, dirt, sludge, residuals, and liquids of any kind.

The Installer's liability under this Warranty shall in no event exceed the lesser of: (i) the replacement cost of the Liner System or defective portion thereof; or (ii) the total amount paid by the Purchaser to the Installer in respect of the Liner System. Further, under no circumstances shall the Installer be liable to the Purchaser or any other party for any special, direct, indirect, or consequential damages arising from any defect in the installation of the Liner System. This Warranty is given in lieu of all other possible warranties by the Installer in respect of the Liner System and by accepting delivery of the Liner System, the Purchaser waives all other such possible warranties, except those specifically given.

THE INSTALLER MAKES NO WARRANTY OF ANY KIND OTHER THAN AS EXPRESSLY SET OUT HEREIN, AND HEREBY DISCLAIMS ALL OTHER WARRANTIES, BOTH EXPRESSED AND IMPLIED, OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THIS WARRANTY IS NOT EFFECTIVE AND THE INSTALLER IS NOT BOUND BY THE TERMS HEREOF UNTIL RECEIPT OF FULL AND FINAL PAYMENT FOR THE LINER SYSTEM FROM THE PURCHASER.

I hereby state I have read and understand the above and foregoing Warranty and agree to such by signing hereunder.

	PURCHASER/USER	WESTERN TANK & LINING LTD.
NAME		Andrew Sanderson
SIGNATURE		
TITLE		Project Manager
DATE (dd/mm/yy)		13/11/15



# Liner Quality Control Audit

4

Inspector s.22 Crew s.22 Date 8/14/2015

Work Order # <b>WO-000405</b>	Size / Style	Length <b>280</b>	Width <b>44</b>	Style <b>LINER</b>
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PO# <b>A5-BCS059</b>	Customer <b>WESTERN TANK</b>	Liner # <b>1</b>
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Width Calculator (enter for size ordered) Sizes are expressed in Decimal feet							
Liner Length (feet)	Liner width (Feet)	Roll Width (Inches)	Weld Width overlap (Inches)	Calculated Panels Needed	Even Panel no. (rounded up)	Total Width of Even Panels (Feet)	Actual Panel Count, added or subtracted material width ex: 8 panels + 2', +2' or 9 panels -11' (welds subtracted shown in actual width)
280	44	267	6	2.022989	2	44	2 PANELS
1st panel length verification size/persons					280'6"	Finished Length	282 Actual Width 44
Stepped Panel lengths					NA		
Step inset					NA		
Secondary measurements (cut welds)					NO CUT WELDS		
Seam lip pull checks (non-destructive)					LOOK GOOD		
Special Instructions					NONE		
Material		Solmax 40 mil LLDPE 140-7000/K7104			Color Out		BLACK
Rolling				Folding			
Standard Roll				Standard Fan			
Standard Roll with Webbing				Butterfly Fold			
Scroll Rolled center mark W/Webbing				Fan Fold to center 2" web markers			
Core Type Used:				Other:			
Metal				Cardboard			
Standard Information Written on Item				Other:			
Packaging Wrap/ Color :				Other:			
Standard Package Labeling				Other:			

Notes



# Wedge/Extrusion Trial

1



12180 Vickers Way  
Richmond BC V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4355

Customer: WESTERN TANK PO # AS-BCS059  
Production Date: 8/14/2015 Time: 630PM  
QA Test Person: s.22 W./O. WO-000405  
Welding Tech: s.22 Crew: s.22

Welder Qualification For Liners: #1 Time Ending:

Material Type: Solmax 40 mil LLDPE 140-7000/K7104 Liner Size: 280 44 LINER  
size expressed in decimal feet  
Length Width Style

Welder Number: D-11 Outside Temp: 82  
Welder Set Temp: 800 Inside Temp: 85  
Welder Set Speed: 999 Timed FPM 19 Sheet Temp: 82  
Extrusion Rod: NA Welder Set up with bar Y/N NA

## Peel Data

	Inside (Lbs)	Outside (Lbs)	Failure Type	Seperation (%)	Comments
1	63	58	SE1	0	PASS
2	59	56	SE1	0	PASS
3	59	57	SE1	0	PASS
4	60	62	SE1	0	PASS
5	57	60	SE1	0	PASS

## Shear Data

	Shear (Lbs)	Elongation (%)	Comments
1	63	200+%	PASS/STE
2	63	200+%	PASS/STE
3	62	200+	PASS/STE
4	63	200+	PASS/STE
5	65	200+	PASS/STE

Notes: Tear Back Results on Sample Weld: LOOKED GOOD

STE = sample stretch to end of test  
SE1 = sample break in outer edge of seam

SE2= break at seam edge top sheet (extrusion shear only)  
SE3= break at seam edge in bottom sheet (extrusion peel only)









12180 Vickers Way  
 Richmond BC V6V-1H9  
 Office 604.241.9487 Fax 604.241.9485  
 Toll-Free 1.800.551.4355

## ASTM D 5199 MATERIAL THICKNESS LLDPE

Date MFG date	Mil Mfg	Roll ID #	Roll Width measured	sample area	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	Avg.	QA
8/14/2015 7/1/2015	Solmax 40 mil LLDPE 140- 7000/K7104	2-82143	22.3 22' 3.5"		Test equipment lost in fire, on order										#DIV/0!	s.22



# Liner Quality Control Audit

1

Inspector s.22 Crew Date 29/09/2015

Work Order # WO-000804 Size / Style Length 165 Width 33 Style LNR

PO# CP-202-M Customer Allterra Construction Liner # 1

Width Calculator (enter for size ordered) Sizes are expressed in Decimal feet							
Liner Length (feet)	Liner width (Feet)	Roll Width (Inches)	Weld Width overlap (Inches)	Calculated Panels Needed	Even Panel no. (rounded up)	Total Width of Even Panels (Feet)	Actual Panel Count, added or subtracted material width ex: 8 panels + 2', +2' or 9 panels -11' (welds subtracted shown in actual width)
165	33	267	6	1.517241	2	44	2 PANELS -11'
1st panel length verification size/persons				165'6"	Finished Length	165.5	Actual Width 33
Stepped Panel lengths				NA			
Step inset				NA			
Secondary measurements (cut welds)				NA			
Cross welds:				NONE		Inspected by: GINA	
Seam lip pull checks (non-destructive)				GOOD. 5			
Special Instructions				BUTTERFLY FOLD			
Material				40 MIL LLDPE SOLMAX		Color Out BLACK	
Rolling				Folding			
Standard Roll				<input type="checkbox"/>		Standard Fan	
Standard Roll with Webbing				<input checked="" type="checkbox"/>		Butterfly Fold	
Scroll Rolled center mark W/Webbing				<input type="checkbox"/>		Fan Fold to center 2" web markers	
Core Type Used:				Metal <input type="checkbox"/>		Cardboard <input checked="" type="checkbox"/>	
				Other <input type="checkbox"/>			
(Standard = mil, size, unroll and unfold arrow)							
Standard Information Written on Item				<input checked="" type="checkbox"/>		Other:	
Packaging Wrap/ Color :				Standard Liner <input checked="" type="checkbox"/>		Other:	
				refer to E.I.C for standards			
Standard Package Labeling				<input checked="" type="checkbox"/>		Other:	
				refer to E.I.C for standards			

Notes



# Wedge/Extrusion Trial

1



12180 Vickers Way  
Richmond BC V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4355

Customer: Allterra Construction PO # CP-202-M

Production Date: 29/09/2015 Time: 10:00 PM

QA Test Person: s.22 W./O. WO-000804

Welding Tech: s.22 Crew: s.22

Welder Qualification For Liners: #1 Time Ending:

Material Type:		Liner Size:		size expressed in decimal feet		
				Length	Width	Style
Solmax 40 mil LLDPE 140-7000/K7104				165	33	LNR

Welder Number: D11  
Welder Set Temp: 800  
Welder Set Speed: 999 Timed FPM 22  
Extrusion Rod: NA

Outside Temp: 59  
Inside Temp: 59  
Sheet Temp: 59  
Welder Set up with bar Y/N N

## Peel Data

	Inside (Lbs)	Outside (Lbs)	Failure Type	Seperation (%)	Comments
1	66	62	SE1	0	PASS
2	71	63	SE1	0	PASS
3	69	66	SE1	0	PASS
4	67	62	SE1	0	PASS
5	70	64	SE1	0	PASS

## Shear Data

	Shear (Lbs)	Elongation (%)	Comments
1	62	200+%	PASS/STE
2	66	200+%	PASS/STE
3	67	200+%	PASS/STE
4	66	200+%	PASS/STE
5	73	200+%	PASS/STE

Notes: Tear Back Results on Sample Weld: GOOD 5

STE = sample stretch to end of test  
SE1 = sample break in outer edge of seam

SE2 = break at seam edge top sheet (extrusion shear only)  
SE3 = break at seam edge in bottom sheet (extrusion peel only)









12180 Vickers Way  
 Richmond BC V6V-1H9  
 Office 604.241.9487 Fax 604.241.9485  
 Toll-Free 1.800.551.4355

## ASTM D 5199 MATERIAL THICKNESS LLDPE

Date MFG date	Mil Mfg	Roll ID #	Roll Width measured	sample area	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	Avg.	QA
7/11/2015 9/29/2015	Solmax 40 mil LLDPE 140- 7000/K7104	2-82148	22.3	B	38.4	38.2	38.8	38.9	38.3	37.1	37.4	38.9	40	38.7	38.47	s 22



# Liner Quality Control Audit

5

Inspector	s.22	Crew	s.22	Date	
Work Order #	WO-001050	Size / Style	Length 315	Width 121	Style RECTANGLE LINER
PO#	AS-BCS084	Customer	WESTERN TANK	Liner #	1

Width Calculator (enter for size ordered) Sizes are expressed in Decimal feet							
Liner Length (feet)	Liner width (Feet)	Roll Width (Inches)	Weld Width overlap (Inches)	Calculated Panels Needed	Even Panel no. (rounded up)	Total Width of Even Panels (Feet)	Actual Panel Count, added or subtracted material width ex: 8 panels + 2', +2' or 9 panels -11' (welds subtracted shown in actual width)
315	121	267	6	5.563218	6	131	6 panels - 11', 1 panel at 5'
1st panel length verification size/persons				315'10"		Finished Length	OKs.22 315 Actual Width 123.5
Stepped Panel lengths				N/A			
Step inset				N/A			
Secondary measurements (cut welds)				CUT WELD ON W4 ADDED 5'			
Cross welds:				W2-W3; W3-W4		Inspected by: GINA	
Seam lip pull checks (non-destructive)				GOOD 8			
Special Instructions				CENTER MUST BE MARKED WITH AN X; MARK LINER WITH DEPLOYMENT ARROWS			
Material				40 MIL LLDPE		Color Out BLACK	
Rolling				Folding			
Standard Roll				<input type="checkbox"/>		Standard Fan <input checked="" type="checkbox"/>	
Standard Roll with Webbing				<input checked="" type="checkbox"/>		Butterfly Fold <input type="checkbox"/>	
Scroll Rolled center mark W/Webbing				<input type="checkbox"/>		Fan Fold to center 2" web markers <input type="checkbox"/>	
Core Type Used:				Metal <input checked="" type="checkbox"/>		Cardboard <input type="checkbox"/> Other <input type="checkbox"/>	
(Standard = mil, size, unroll and unfold arrow)							
Standard Information Written on Item				<input checked="" type="checkbox"/>		Other: <input type="checkbox"/>	
refer to E.I.C for standards							
Packaging Wrap/ Color:				WTL Standard Liner <input checked="" type="checkbox"/>		Other: <input type="checkbox"/>	
refer to E.I.C for standards							
Standard Package Labeling				<input checked="" type="checkbox"/>		Other: <input type="checkbox"/>	

Notes WE ADDED A 5' PANEL DUE TO A WELD CUT. INSTEAD OF CUTTING OFF 3' WE JUST LEFT IT ON THE LINER.



# Wedge/Extrusion Trial

1



12180 Vickers Way  
Richmond BC V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4355

Customer: WESTERN TANK PO # AS-BCSO84  
Production Date: 10/22/2015 Time: 10:32 PM  
QA Test Person: s.22 W./O. WO-001050  
Welding Tech: s.22 Crew: s.22

Welder Qualification For Liners: #1 Time Ending:

Material Type: Solmax 40 mil LLDPE 140-7000/K7104 Liner Size: 

size expressed in decimal feet		
Length	Width	Style
315	121	RECTANGLE LINER

Welder Number: D11 Outside Temp: 50  
Welder Set Temp: 800 Inside Temp: 50  
Welder Set Speed: 699 Timed FPM 17 Sheet Temp: 50  
Extrusion Rod: N/A Welder Set up with bar Y/N N/A

## Peel Data test speed is 20 in/min unless otherwise noted

	Inside (Lbs)	Outside (Lbs)	Failure Type	Seperation (%)	Comments
1	61	64	SE1	0	PASS
2	60	67	SE1	0	PASS
3	72	65	SE1	0	PASS
4	60	65	SE1	0	PASS
5	61	63	SE1	0	PASS

## Shear Data

	Shear (Lbs)	Elongation (%)	Comments
1	67	200+%	PASS/STE
2	69	200+%	PASS/STE
3	69	200+%	PASS/STE
4	72	200+%	PASS/STE
5	66	200+%	PASS/STE

Notes: Tear Back Results on Sample Weld: GOOD 8

STE = sample stretch to end of test  
SE1 = sample break in outer edge of seam

SE2= break at seam edge top sheet (extrusion shear only)  
SE3= break at seam edge in bottom sheet (extrusion peel only)



# Wedge/Extrusion Trial

2



**WESTERN TANK  
& LINING LTD.**

12180 Vickers Way  
Richmond BC V6V-1H9

Office 604.241.9487 Fax 604.241.9485

Toll-Free 1.800.551.4355

Customer: WESTERN TANK PO # AS-BCS084

Production Date: 10/22/2015 Time: 6:23PM

QA Test Person: s.22 W./O. WO-001050

Welding Tech: s.22 Crew: s.22

Welder Qualification For Liners: #1 Time Ending:

Material Type: Solmax 40 mil LLDPE 140-7000/K7104 Liner Size: 

size expressed in decimal feet		
Length	Width	Style
315	121	RECTANGLE LINER

Welder Number: EXTRUSION Outside Temp: 60  
Welder Set Temp: 400/425 Inside Temp: 60  
Welder Set Speed: HAND Timed FPM N/A Sheet Temp: 60  
Extrusion Rod: SOLMAX LL Welder Set up with bar: N/A N/A

## Peel Data

test speed is 20 in/min unless otherwise noted

	Inside (Lbs)	Outside (Lbs)	Failure Type	Seperation (%)	Comments
1	61	X	SE3	0	PASS
2	59	X	SE3	0	PASS
3	59	X	SE3	0	PASS
4	68	X	SE3	0	PASS
5	64	X	SE3	0	PASS

## Shear Data

	Shear (Lbs)	Elongation (%)	Comments
1	60	200+%	PASS/STE
2	60	200+%	PASS/STE
3	66	200+%	PASS/STE
4	60	200+%	PASS/STE
5	63	200+%	PASS/STE

Notes: Tear Back Results on Sample Weld: N/A

STE = sample stretch to end of test  
E1 = sample break in outer edge of seam

SE2= break at seam edge top sheet (extrusion shear only)  
SE3= break at seam edge in bottom sheet (extrusion peel only)



# Seam End Coupon Log

3



**WESTERN TANK  
& LINING LTD.**

12180 Vickers Way  
Richmond Bc V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4355

test speed is 20 in/min unless otherwise noted

Customer: WESTERN TANK PO# AS-BCS084

Production Date: 10/22/2015 Crew: s.22

Welder # D11 Operator s.22 Temp/Speed 805-699

Distance in feet 22.3 Timed Sec. 77 Feet per min. 17

QA Test Person: s.22 W./O. WO-001050

Material Type: Solmax 40 mil LLDPE 140-7000/K7104

size in dec. ft. Length Width Style  
Liner Size: 315 121 RECTANGLE LINER Liner # 1

Seam Number	Test # P# / S#	Inside (Lbs)	Outside (Lbs)	Failure Type	Separation (%)	Shear (Lbs)	Elongation (%)	Comments
W1	P1/S1	60	63	SE1	0	69	200+	PASS/STE
W1	P2/S2	65	64	SE1	0	79	200+	PASS/STE
W2	P1/S1	63	62	SE1	0	71	200+	PASS/STE
W2	P2/S2	62	60	SE1	0	70	200+	PASS/STE
W3	P1/S1	58	66	SE1	0	70	200+	PASS/STE
W3	P2/S2	57	59	SE1	0	67	200+	PASS/STE
W4	P1/S1	75	62	SE1	0	68	200+	PASS/STE
W4	P2/S2	60	61	SE1	0	71	200+	PASS/STE
W5	P1/S1	63	67	SE1	0	67	200+	PASS/STE
W5	P2/S2	67	61	SE1	0	74	200+	PASS/STE
W6	P1/S1	64	66	SE1	0	69	200+	PASS/STE
W6	P2/S2	70	66	SE1	0	75	200+	PASS/STE

Notes: 1" STRIPS (20IN/MIN): R# 2-B2432: 67, 76(BROKE), 68, 70

STE = sample stretch to end of test

SE1 = sample break in outer edge of seam

Pull Checks (non-destructive seam lip pulls)

8





**WESTERN TANK  
& LINING LTD.**

## ASTM D 5199 MATERIAL THICKNESS LLDPE

12180 Vickers Way  
Richmond BC V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4355

Date MFG date	Mil Mfg	Roll ID #	Roll Width measured	sample area	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	Avg.	QA
10/22/2015 7/27/2015	Solmax 40 mil LLDPE 140- 7000/K7104	2-82431	22.3' 22' 4"	B	37.6	37.6	37.9	38.7	36.9	39.3	37.2	37.3	38.4	37.2	37.81	s.22
10/22/2015 7/27/2015	Solmax 40 mil LLDPE 140- 7000/K7104	2-82432	22.3' 22' 4"	B	35.8	38.6	36.7	37.4	39.8	38.2	36.7	38.5	38.3	37.4	37.74	s.22
10/22/2015 7/26/2015	Solmax 40 mil LLDPE 140- 7000/K7104	2-82404	22.3' 22' 4"	B	38.4	38.3	36.5	36.7	37.4	37.7	37.5	38.6	37.5	38.1	37.67	s.2

74





**SOLMAX**

# LIST OF GEOMEMBRANE ROLLS

Solmax, 2801 Boul. Marie-Victorin, Varennes, Qc, Canada, J3X 1P7  
Tel: 1-450-929-1234 • Fax: 1-450-929-2547 • www.solmax.com

Project Name: July - Abbotsford, BC

Project Number: CP-SML15-6



Reference Number: 108401

Packing Slip Number: 217375

Roll Number	Product Code	Resin Lot Number	Manufactured Date	Resin Melt Index 190/2.16 g/10 min D1238	Resin Density g/cc D1505	OIT Spec Result min D3895	HPOIT Spec Result min D5885	ESCR SP-NCTL Spec Roll Tested hours D5397
2-82141	Solmax 140-7000	CFD810080	11-Jul-15	0.37	0.918	100 > 120		N/A
2-82143	Solmax 140-7000	CFD810080	11-Jul-15	0.37	0.918	100 > 120		N/A
2-82148	Solmax 140-7000	CFD810080	11-Jul-15	0.37	0.918	100 > 120		N/A
2-82149	Solmax 140-7000	CFD810080	11-Jul-15	0.37	0.918	100 > 120		N/A
2-82150	Solmax 140-7000	CFD810080	11-Jul-15	0.37	0.918	100 > 120		N/A
2-82151	Solmax 140-7000	CFD810080	11-Jul-15	0.37	0.918	100 > 120		N/A
2-82152	Solmax 140-7000	CFD810080	11-Jul-15	0.37	0.918	100 > 120		N/A
2-82154	Solmax 140-7000	CFD810080	12-Jul-15	0.37	0.918	100 > 120		N/A
2-82157	Solmax 140-7000	CFD810080	12-Jul-15	0.37	0.918	100 > 120		N/A
2-82159	Solmax 140-7000	CFD810080	12-Jul-15	0.37	0.918	100 > 120		N/A
2-82160	Solmax 140-7000	CFD810080	12-Jul-15	0.37	0.918	100 > 120		N/A
2-82161	Solmax 140-7000	CFD810080	12-Jul-15	0.37	0.918	100 > 120		N/A
2-82162	Solmax 140-7000	CFD810080	12-Jul-15	0.37	0.918	100 > 120		N/A
2-82163	Solmax 140-7000	CFD810080	12-Jul-15	0.37	0.918	100 > 120		N/A
2-82164	Solmax 140-7000	CFD810080	12-Jul-15	0.37	0.918	100 > 120		N/A
2-82165	Solmax 140-7000	CFD810080	12-Jul-15	0.37	0.918	100 > 120		N/A

Quantity (rolls): **16**





# MANUFACTURING QUALITY CONTROL

Test Results - Rolls

Solmax, 2801 Boul. Marie-Victorin, Varennes, Qc, Canada, J3X 1P7  
Tel: 1-450-929-1234 • Fax: 1-450-929-2547 • www.solmax.com

Project Name : July - Abbotsford, BC

Reference Number : 108401

Project Number : CP-SML15-6

Packing Slip Number : 217375



Product : Solmax 140-7000

Properties	Thickness average	Geo-membrane Density	Carbon Black Content	Carbon Black Dispersion	Tensile				Tear Resist.	Puncture Resist.	Dimension. Stability	Asperity Height in / out
Unit	mm	g/cc	%	Cat. 1 and 2	Yield Strength	Elong.	Break Strength	Elong.	N	N	%	mm
Test Method	D5199	D1505/D792	D4218 / D1603	D5596	kN/m	%	kN/m	%	D1004	D4833	D1204	
Frequency	Each roll	1/Lot	1/2 ro	1/10 ro					1/10 ro	1/10 ro	Cert	N/A
Specification	0.90	≤ 0.939	2.0 - 3.0	Cat. 1 / Cat. 2			31.5	1000	85	298	± 2	
2-82141 MD XD	0.94	0.927	2.60	10/10 Views			39.1 37.3	1224 1260	98 106	351		/
2-82143 MD XD	0.92	0.932	2.55	10/10 Views			38.0 35.9	1225 1250	91 100	351		/
2-82148 MD XD	0.93	0.932	2.58	10/10 Views			37.0 35.6	1200 1176	91 100	351		/
2-82149 MD XD	0.93	0.932	2.58	10/10 Views			37.0 35.6	1200 1176	91 100	351		/
2-82150 MD XD	0.93	0.932	2.79	10/10 Views			37.0 35.6	1200 1176	91 100	351		/
2-82151 MD XD	0.94	0.932	2.79	10/10 Views			37.0 35.6	1200 1176	91 100	351		/
2-82152 MD XD	0.94	0.932	2.62	10/10 Views			38.2 36.3	1199 1244	96 105	360		/
2-82154 MD XD	0.93	0.932	2.61	10/10 Views			38.2 36.4	1199 1244	96 105	359		/
2-82157 MD XD	0.93	0.932	2.61	10/10 Views			39.6 36.5	1256 1276	96 105	359		/
2-82159 MD XD	0.93	0.932	2.56	10/10 Views			39.6 36.6	1256 1276	96 105	359		/
2-82160 MD XD	0.93	0.932	2.66	10/10 Views			39.6 36.6	1256 1276	96 105	359		/
2-82161 MD XD	0.93	0.932	2.66	10/10 Views			39.6 36.6	1256 1276	96 105	359		/
2-82162 MD XD	0.93	0.933	2.59	10/10 Views			38.4 36.1	1257 1265	94 103	359		/
2-82163 MD XD	0.94	0.933	2.59	10/10 Views			38.5 36.1	1257 1265	94 103	359		/
2-82164 MD XD	0.93	0.933	2.56	10/10 Views			38.5 36.1	1257 1265	94 103	359		/
2-82165 MD XD	0.93	0.933	2.56	10/10 Views			38.5 36.1	1257 1265	94 103	359		/





# TECHNICAL DATA SHEET

Geomembrane LLDPE Smooth

Solmax 2801 Boul. Marie-Victorin, Varennes, Qc, Canada, J3X 1P7  
Tel: (450) 929-1234 Fax: (450) 929-2550 www.solmax.com

PROPERTY	TEST METHOD	FREQUENCY <sup>(1)</sup>	UNIT Metric	Solmax 140-7000
<b>SPECIFICATIONS</b>				
Thickness (Nominal $\pm 10\%$ ) (11)	ASTM D-5199	Every roll	mm	1.00
Resin Density	ASTM D-1505	Certification	g/cc	< 0.926
Melt Index - 190/2.16 (max.)	ASTM D-1238	Certification	g/10 min	1.0
Sheet Density (8)	ASTM D-1505	1/Batch	g/cc	$\leq 0.939$
Carbon Black Content (9)	ASTM D-4218	Every 2 rolls	%	2.0 - 3.0
Carbon Black Dispersion	ASTM D-5596	Every 10 rolls	Category	Cat. 1 / Cat. 2
OIT - standard (avg.)	ASTM D-3895	1/Batch	min	100
Tensile Properties (min. avg) (2)	ASTM D-638	Every 5 rolls		
Strength at Break			kN/m	31.5
Elongation at Break			%	1000
2% Modulus (max.)	ASTM D-5323	Per formulation	kN/m	420
Tear Resistance (min. avg.)	ASTM D-1004	Every 10 rolls	N	85
Puncture Resistance (min. avg.)	ASTM D-4833	Every 10 rolls	N	298
Dimensional Stability	ASTM D-1204	Certification	%	$\pm 2$
Multi-Axial Tensile (min. avg.)	ASTM D-5617	Per formulation	%	90
Oven Aging - % retained after 90 days	ASTM D-5721	Per formulation		
STD OIT (min. avg.)	ASTM D-3895		%	35
HP OIT (min. avg.)	ASTM D-5885		%	60
UV Resistance - % retained after 1600 hr	GRI-GM-11	Per formulation		
HP-OIT (min. avg.)	ASTM D-5885		%	35
<b>SUPPLY SPECIFICATIONS</b> (Roll dimensions may vary $\pm 1\%$ )				
Roll Dimension - Width	-		m	6.80
Roll Dimension - Length	-		m	237.7
Area (Surface/Roll)	-		m <sup>2</sup>	1616.4

## NOTES

1. Testing frequency based on standard roll dimensions and one batch is approximately 180,000 lbs (or one railcar).
2. Elongation is measured with a gage length of 1.5'.
8. Correlation table is available for ASTM D792 vs ASTM D1505. Both methods give the same results.
9. Correlation table is available for ASTM D1603 vs ASTM D4218. Both methods give the same results.
11. The minimum average thickness is  $\pm 10\%$  of the nominal value.

\* All values are nominal test results, except when specified as minimum or maximum.

\* The information contained herein is provided for reference purposes only and is not intended as a warranty of guarantee. Final determination of suitability for use contemplated is the sole responsibility of the user. SOLMAX assumes no liability in connection with the use of this information.





2801 BOUL. MARIE-VICTORIN,  
VARENNES (QC) CANADA J3X 1P7  
450.929.1234  
SOLMAX.COM

Covering the world. Protecting the earth.

**MATERIAL CONFORMITY CERTIFICATE  
ISSUED BY  
THE MANUFACTURER**

Varennnes, October 16<sup>th</sup>, 2014

Ref.: Stock Material  
ATTN: Mr. Clint Powell

To whom it may concern,

Solmax International hereby certifies that 130-2000 and 140-7000 smooth LLDPE geomembrane supplied for the above-mentioned project meets the following:

- Axi-Symmetric Break Resistance Strain (min)      ASTM D5617      90 %

Hoping the above information is satisfactory. Do not hesitate to contact us if you require any additional information.

Sincerely,

**Chantal Gagnon**  
*Technical Services*  
Solmax International Inc.



**Western Tank & Lining Ltd**

12180 Vickers Way, Richmond, BC V6V 1H9  
Tel: 604-241-9487 Fax: 604-241-9485

Toll: 800-551-4355

Project: Alterra  
Production Date: Oct 19 2016

## Wedge Seam Log

Seam Number	Welding Tech	Welder Number	Test Method		Pass	Fail	QC Initials	Test Date	Comments
BCS087/BCS059	CL	DT1	Air Lanced		Yes		LL	29-Oct	

0



**Western Tank & Lining Ltd**

12180 Vickers Way, Richmond, BC V6V 1H9

Tel: 604-241-9487 Fax: 604-241-9485

Toll: 800-551-4355

Project: AllterraProduction Date: Tested at the shop in Richmond Oct 20**Wedge Trial**

Time Tested at the shop in Richmond Oct 20 9:44 AM Wedge Temp 430 °C

Welder Number DT 1 Speed 75%

Welding Tech C.L. Drive Pressure 5 turns

Sheet Type 40 mil LD Dwell Pressure 2 springs Front/1 Spring back

Weld Edge(code) S.S.

S.S.-smooth/smooth T.T.-Textured/Textured S.T.-smooth/textured

**Peel Data**

	Onsite (lbs)	Onsite (N)	Failure Type	Separation (%)	Comments
1	57	62	FTB	0	Vise grip peel onsite/ Tensiometer shop
2	53	60	FTB	0	Vise grip peel onsite/ Tensiometer shop
3	64	61	FTB	0	Vise grip peel onsite/ Tensiometer shop
4	61	62	FTB	0	Vise grip peel onsite/ Tensiometer shop
5	59	63	FTB	0	Vise grip peel onsite/ Tensiometer shop

**Shear Data**

	Shear (lbs)	Separation (N)	Comments
1	76	200	Vise grip peel onsite/ Tensiometer shop
2	71	200	Vise grip peel onsite/ Tensiometer shop



**Western Tank & Lining Ltd**

12180 Vickers Way, Richmond, BC V6V 1H8  
Tel: 604-241-8487 Fax: 604-241-9485  
Toll: 800-561-4365

Project: \_\_\_\_\_

Test Date: \_\_\_\_\_

**Destructive Test Record**

Spec Number	DST #	Test Date	Test Time	FTB Y/N	Strength (psi)				Pass	Fail	QA Tech	Comments
					IN	OUT	Shear	Elongator				
ECC0087/ECC008	#1	1-Oct	9:56	Y	62	57			yes	no	LL	test at the shop
			10:01	Y			69	200%	yes	no	LL	test at the shop



**Western Tank & Lining Ltd**

12180 Vickers Way, Richmond, BC V6V 1H9

Tel: 604-241-9487 Fax: 604-241-9485

Toll: 800-551-4355

Project: AllterraProduction Date: Tested at the shop in Richmond Nov 7**Extruder Trial**

Time	<u>Tested at the shop in Richmond Nov 7</u>	<u>10:37</u>	Barrel Temp	<u>245</u>	<u>°C</u>
Welder Number	<u>EXT #3</u>		Preheat Temp	<u>220</u>	<u>°C</u>
Welding Tech	<u>JW</u>		Shoe Style	<u>Teflon</u>	
			Sheet Type	<u>40 mil LD</u>	

**Peel Data**

	Index (psi)	Separation (psi)	Temperature (°C)	Type	Comments
1	62	0		FTB	Vise grip peel onsite/ Tensiometer shop
2	67	0		FTB	Vise grip peel onsite/ Tensiometer shop
3	62	0		FTB	Vise grip peel onsite/ Tensiometer shop
4	60	0		FTB	Vise grip peel onsite/ Tensiometer shop
5	59	0		FTB	Vise grip peel onsite/ Tensiometer shop

**Shear Data**

	Index (psi)	Elongation (%)	Temperature (°C)	Type	Comments
1	69	200			Vise grip peel onsite/ Tensiometer shop
2	71	200			Vise grip peel onsite/ Tensiometer shop



**Western Tank & Lining Ltd**

12150 Vickers Way, Richmond, BC V6V 1H9  
Tel: 604-241-9487 Fax: 604-241-9485

Toll: 800-551-4355

Project: Alterra

Production Date: Oct 19 2015

## Wedge Seam Log

Seam Number	Welding Tech	Welder Number	Test Method	Pass	Fail	QC Initials	Test Date	Comments
BCS084/BCS087	JW	DT1	Air Lanced	Yes		JW	29-Oct	
			0					



**Western Tank & Lining Ltd**

12180 Vickers Way, Richmond, BC V6V 1H9

Tel: 604-241-9487 Fax: 604-241-9485

Toll: 800-551-4355

Project: AltarraProduction Date: Tested at the shop in Richmond Nov 7**Wedge Trial**

Time	<u>Tested at the shop in Richmond Nov 7</u>	<u>10:44 AM</u>	Wedge Temp	<u>430 °C</u>
Welder Number	<u>DT 1</u>		Speed	<u>65%</u>
Welding Tech	<u>JW</u>		Drive Pressure	<u>5 turns</u>
Sheet Type	<u>40 mil LD</u>		Dwell Pressure	<u>2 springs Front/1 Spring back</u>
Weld Edge(code)	<u>S.S.</u>			

S.S.-smooth/smooth T.T.-Textured/Textured S.T.-smooth/textured

**Peel Data**

	Force (lbs)	Force (lbs)	Failure Type	Elongation (in)	Comments
1	60	61	FTB	0	Vise grip peel onsite/ Tensiometer shop
2	59	61	FTB	0	Vise grip peel onsite/ Tensiometer shop
3	60	58	FTB	0	Vise grip peel onsite/ Tensiometer shop
4	61	62	FTB	0	Vise grip peel onsite/ Tensiometer shop
5	59	60	FTB	0	Vise grip peel onsite/ Tensiometer shop

**Shear Data**

	Shear (lbs)	Elongation (in)	Comments
1	69	200	Vise grip peel onsite/ Tensiometer shop
2	70	200	Vise grip peel onsite/ Tensiometer shop



**Western Tank & Lining Ltd**

12180 Vickers Way, Richmond, BC V6V 1H8  
Tel: 604-241-9487 Fax: 604-241-9485  
Toll: 800-651-4355

Project: \_\_\_\_\_

Test Date: \_\_\_\_\_

## Destructive Test Record

Seam Number	DST #	Test Date	Test Time	F70 Y/N	Strength (psi)				Pass	Fail	QA Tech	Comments
					Tensile		Shear					
					IN	OUT	Shear	Elongation				
BC3054/BC3057	#2	8-Nov	10:21	Y	59	54			yes	no	JW	tested at the edge of the pipe joint ends
			10:24	Y			68	200%	yes	no	JW	tested at the edge of the pipe joint ends



## Cell 1 Phase C

- As-Built Quality Assurance & Quality Control

RESOURCE MANAGEMENT



Brimmell Engineering Ltd  
971 Bank Street  
Victoria, BC  
V8S 4B1  
rbrimmell@shaw.ca

South Island Resource Management

July 4/16  
File 15-139

Att: Tom Good, P.Eng.

Re: SIRM Facility, 460 Stebbings Rd., Shawnigan Lake  
MEM Permit Q-8-094 & MOE PR-105809  
As-Built for Encapsulation Cell 1C

This letter discusses the westward expansion of Encapsulation Cell 1. The triangular expansion is identified as Cell 1C, as shown on the attached as-built drawing. Density testing was carried out on June 1, 7 & 15 as summarized on the attached test reports, including sketches of test locations. Photos are also attached along with the results of testing by Western Tank and Liner of the 40 mil LLPDE membrane. Construction methodology was developed by Active Earth for the existing Cell 1A, as summarized in the attached report from them. Integrity of the bedrock underlying the site of Encapsulation Cell 1C was discussed in a report dated May 5/16.

Site preparation is described as follows:

- establish a clay liner, graded northward
- establish a clay liner up the west slope, after it was trimmed/graded to 1.5:1 (hor:vert)
- establish a clay berm across the north side; the east side berm was already in place
- place a lift of sand over the clay liner, including up the slope across the west side
- install a continuous 40 mil (1 mm) LLDPE liner over the sand layer, including up the slope across the west side, and up the inside faces of the north and east side clay berms
- place a lift of sand over the LLDPE liner
- install perforated leachate collection and leak detection pipes at the north end connecting to the two existing 2500 gallon tanks

The density testing on the clay liner showed satisfactory compaction, suitable for the intended usage as an impermeable barrier. The clay liner was compacted in lifts with a large, vibratory roller.



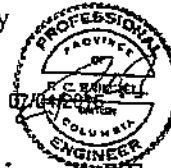
The LLDPE liner was supplied and installed by Western Tank & Lining Ltd. Shop drawings and test results from Western Tank have been reviewed (attached). Seams between road widths, and along the interface with the Cell 1A liner, have been hot-welded.

The narrow, southerly end of the Encapsulation Cell 1C site has yet to be finalized due to a problem with outcropping bedrock on the west side (photo). This report will be updated when the south end has been finalized. Until this is done the contaminated fill is to be kept back at least 1.5 m from the existing south end of the LLDPE liner, and sloped up to the north at 1.5:1.

The construction meets the standards required by MEM Permit Q-8-094 and MOE Permit PR-105809. Placement and compaction and/or stabilization of the Cell 1C fill will be monitored by Brimmell Engineering Ltd.

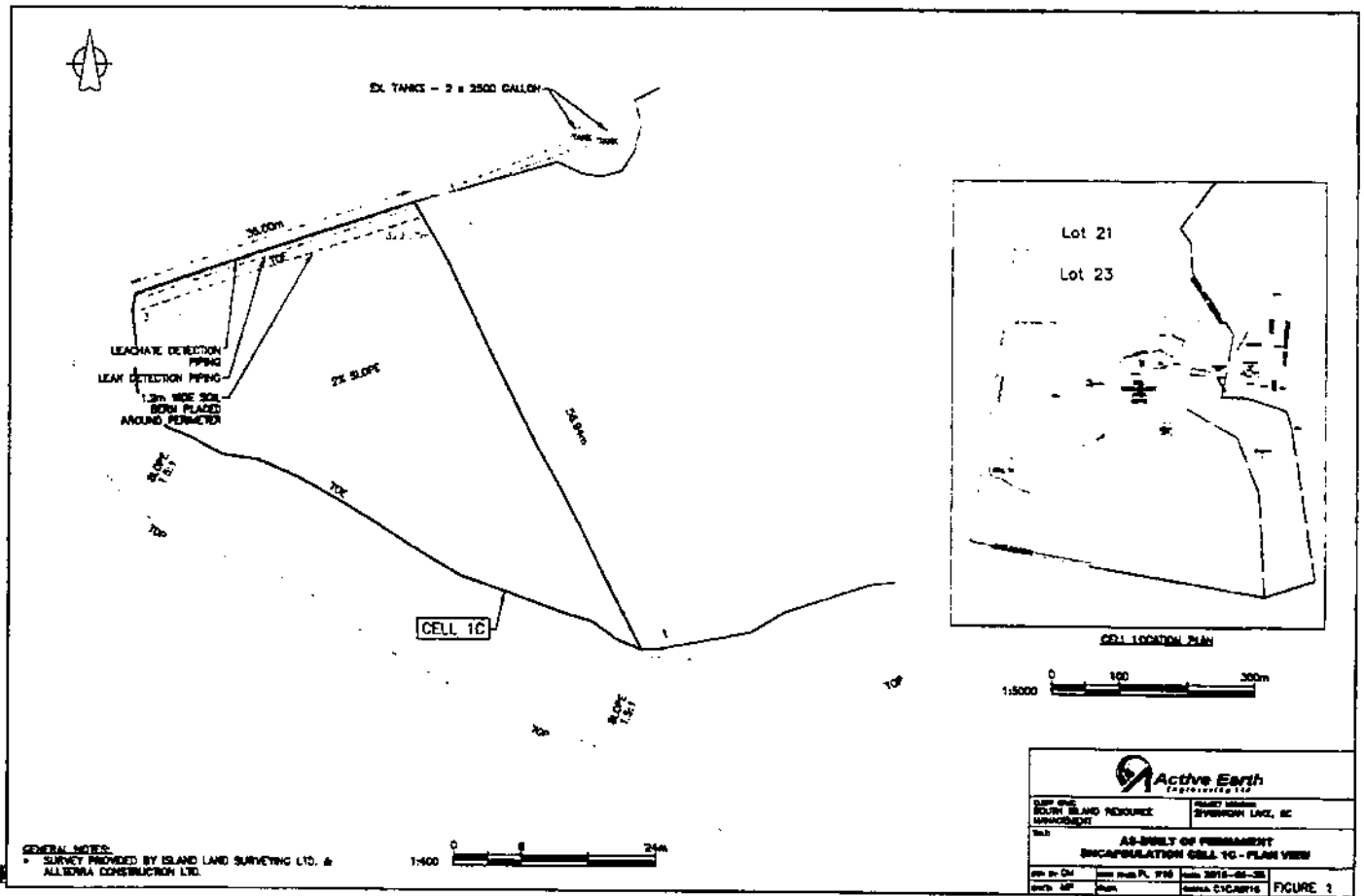
I trust that this information meets your present requirements. Please do not hesitate to contact the writer if there are questions.

Yours truly





Richard Brimmell, P.Eng.  
for Brimmell Engineering Ltd.






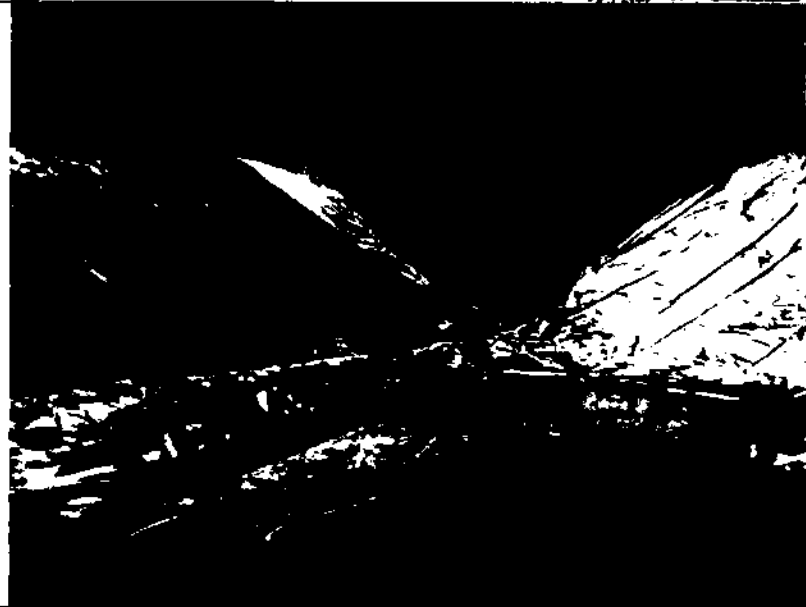


SIRM Encapsulation Cell 1C June 2016 photos

	<p>Clay line partly completed June 1, looking north</p>
	<p>Compaction of clay liner in progress June 15, looking north</p>



SIRM Encapsulation Cell 1C June 2016 photos

	<p>Placement of sand fill over the membrane June 29, looking north</p>
	<p>Installation of the membrane in progress at the south end of Encapsulation Cell 1C on June 29, looking south. The south end of Cell 1C is not yet finalized due to outcropping rock on the west side (red arrow).</p>





# COMPACTION INSPECTION

**ASTM D698**

Project #: 1540558 Phase: 1000  
 Client: Brimmell Engineering  
 Project Title: SIRM - Stebbings Rd Quarry - Cell 1C  
 Sample : SA10 - 1C Liner Clay  
 Source: Stebbings Rd Quarry  
 Sampled by: AB Date Sampled: 1-Jun-16  
 Tested by: AA Date Tested: 3-Jun-16  
 Max p dry: 1715 kg/m<sup>3</sup> Moisture (%): 17.7  
 Field Data: Date of Test: 15-Jun-16 Compaction Spec. (%): 90

Technician AB					
Test #	Probe Depth (mm)	Height Above Grade (m)	Reported Moisture (%)	Reported Dry Density (Kg/m <sup>3</sup> )	% of Max p dry
70	300	1.00	17.9	1642	95.7%
71	300	1.00	16.6	1652	96.3%
72	300	1.00	14.0	1685	98.3%
73	300	1.00	15.4	1763	100.8%
74	300	1.00	15.6	1761	100.7%
75	300	1.00	14.5	1700	99.1%

## REMARKS :

Test #73-74 may have contained a larger percent of oversize material but did appear well compacted

Reported by: AB/AA

Reviewed by:   
D. Mackie

Date: 16 Jun 16

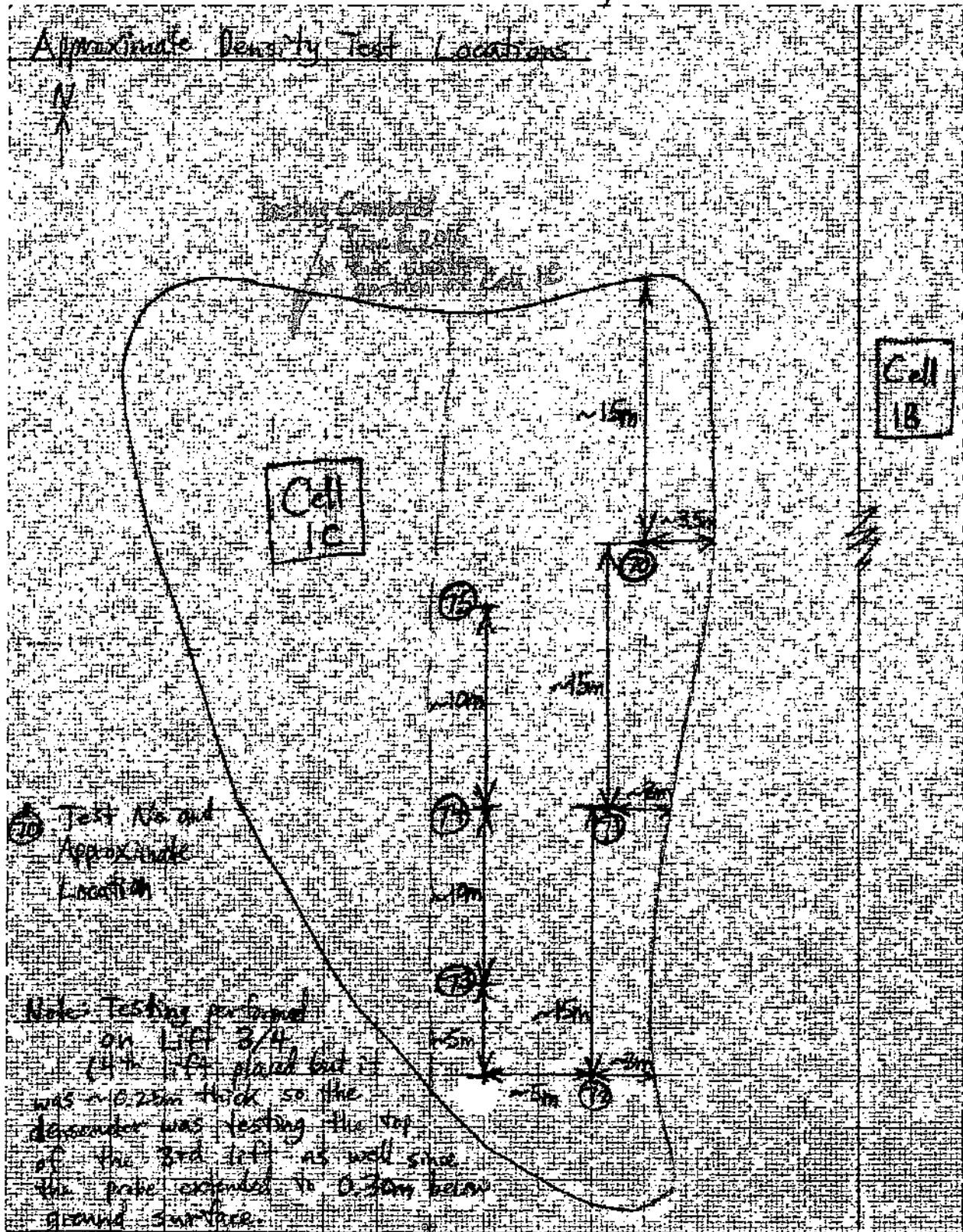
Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other zones/depths. This report constitutes a

**GOLDER ASSOCIATES LTD., 3795 Carey Rd. Victoria, BC, V8Z 6T8, Tel: 250-881-7372 Fax: 250-881-7470**





SUBJECT Brimmell / SIAM - Shawinigan Lake		
Job No. 1540558	Made by Adam Bortolotto Reviewed <i>[Signature]</i>	Date June 15, 2016 Sheet 1 of 1







# COMPACTION INSPECTION

ASTM D698

Project #: 1540558 Phase: 1000  
 Client: Brimmell Engineering  
 Project Title: SIRM - Stebbings Rd Quarry - Cell 1C  
 Sample : SA10 - 1C Liner Clay  
 Source: Stebbings Rd Quarry  
 Sampled by: AB Date Sampled: 1-Jun-16  
 Tested by: AR Date Tested: 3-Jun-16  
 Max  $\rho_{dry}$ : 1715 kg/m<sup>3</sup> Moisture (%): 17.7  
 Field Data: Date of Test: 07-Jun-16 Compaction Spec. (%): 90

Technician AB

Test #	Probe Depth (mm)	Height Above Grade (m)	Reported Moisture (%)	Reported Dry Density (Kg/m <sup>3</sup> )	% of Max $\rho_{dry}$
63	300	0.50	18.0	1635	95.3%
64	300	0.50	16.6	1706	99.5%
65	300	0.75	17.1	1710	99.7%
66	300	1.00	17.2	1682	98.1%
67	300	1.00	17.5	1712	99.8%
68	300	1.00	16.2	1650	96.2%
69	300	1.00	18.5	1611	93.9%

## REMARKS :

Reported by: AB/AA

Reviewed by:

*[Signature]*  
D. MacKie

Date: 16 Jun 16

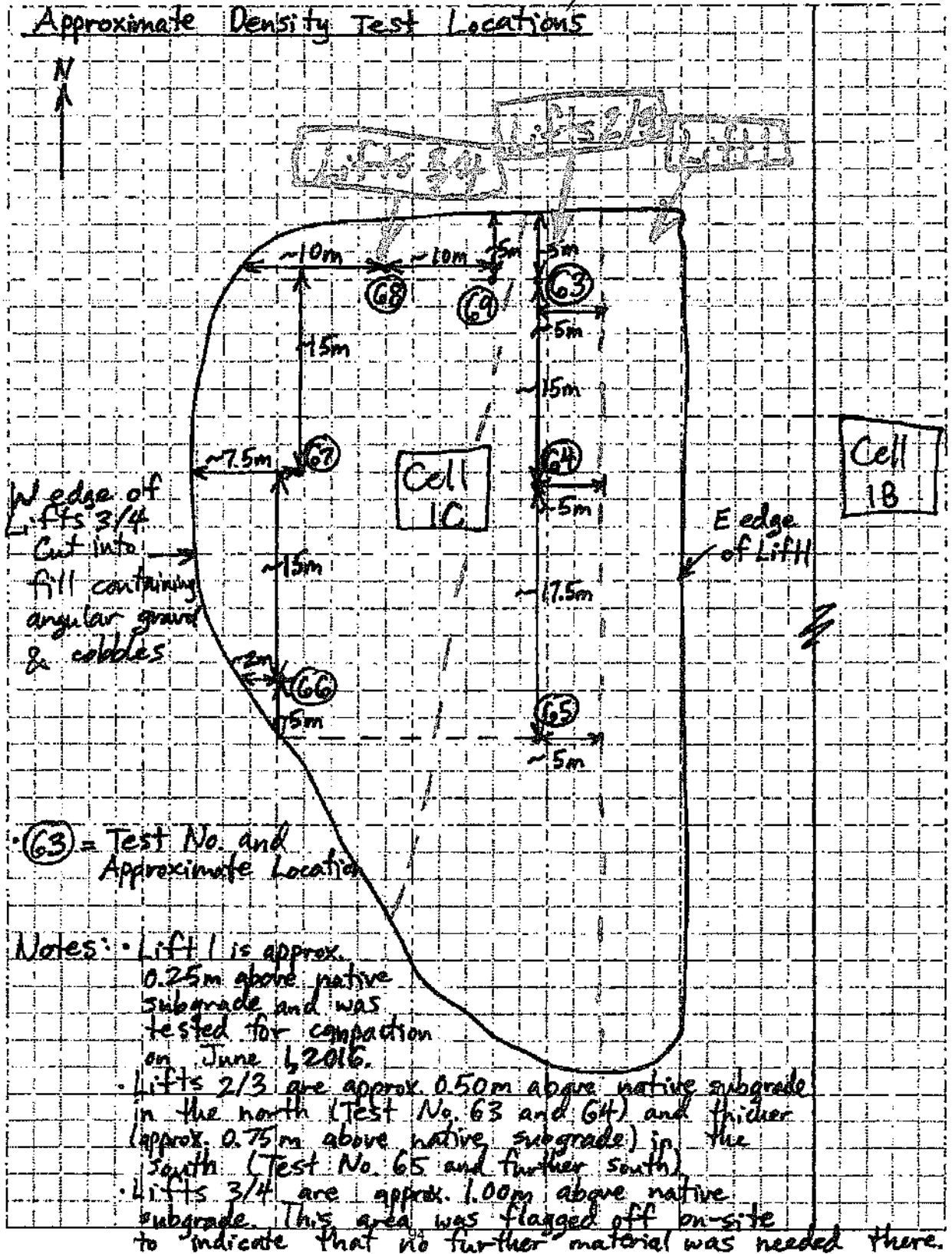
Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other zones/depths. This report constitutes a

GOLDER ASSOCIATES LTD., 3795 Carey Rd. Victoria, BC, V8Z 6T8, Tel: 250-881-7372 Fax: 250-881-7470





SUBJECT Brimmell / SIRM - Shawnigan Lake		
Job No.	Made by Adam Bortone	Date June 7, 2016
1540558	Reviewed	Sheet 1 of 1







# COMPACTION INSPECTION

ASTM D698

Project #: 1540558 Phase: 1000  
 Client: Brimmell Engineering  
 Project Title: SIRM - Stebbings Rd Quarry - Cell 1C  
 Sample : SA10 - 1C Liner Clay  
 Source: Stebbings Rd Quarry  
 Sampled by: AB Date Sampled: 1-Jun-16  
 Tested by: AR Date Tested: 3-Jun-16  
 Max p<sub>dry</sub>: 1715 kg/m<sup>3</sup> Moisture (%): 17.7  
 Field Data: Date of Test: 01-Jun-16 Compaction Spec. (%): 90

Technician AB

Test #	Probe Depth (mm)	Height Above Grade (m)	Reported Moisture (%)	Reported Dry Density (Kg/m <sup>3</sup> )	% of Max p <sub>dry</sub>
57	250	0.25	19.7	1626	94.8%
58	250	0.25	23.2	1544	90.1%
59	200	0.25	20.2	1652	96.3%
60	250	0.25	22.8	1594	93.0%
61	250	0.25	20.1	1671	97.4%
62	250	0.25	19.4	1775	99.5%

## REMARKS :

Test #62 may have contained a larger percent of oversize material but did appear well compacted

Reported by: AB/AA

Reviewed by:  D Mackie

Date: 16 June 16

Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other zones/depths. This report constitutes a

GOLDER ASSOCIATES LTD., 3785 Carey Rd. Victoria, BC, V8Z 6T8, Tel: 250-881-7372 Fax: 250-881-7470





SUBJECT

Brimmell / SIAM - Shannigan Lake

Job No.

1540558

Made by

Adam Bontemps

Date

June 1, 2016

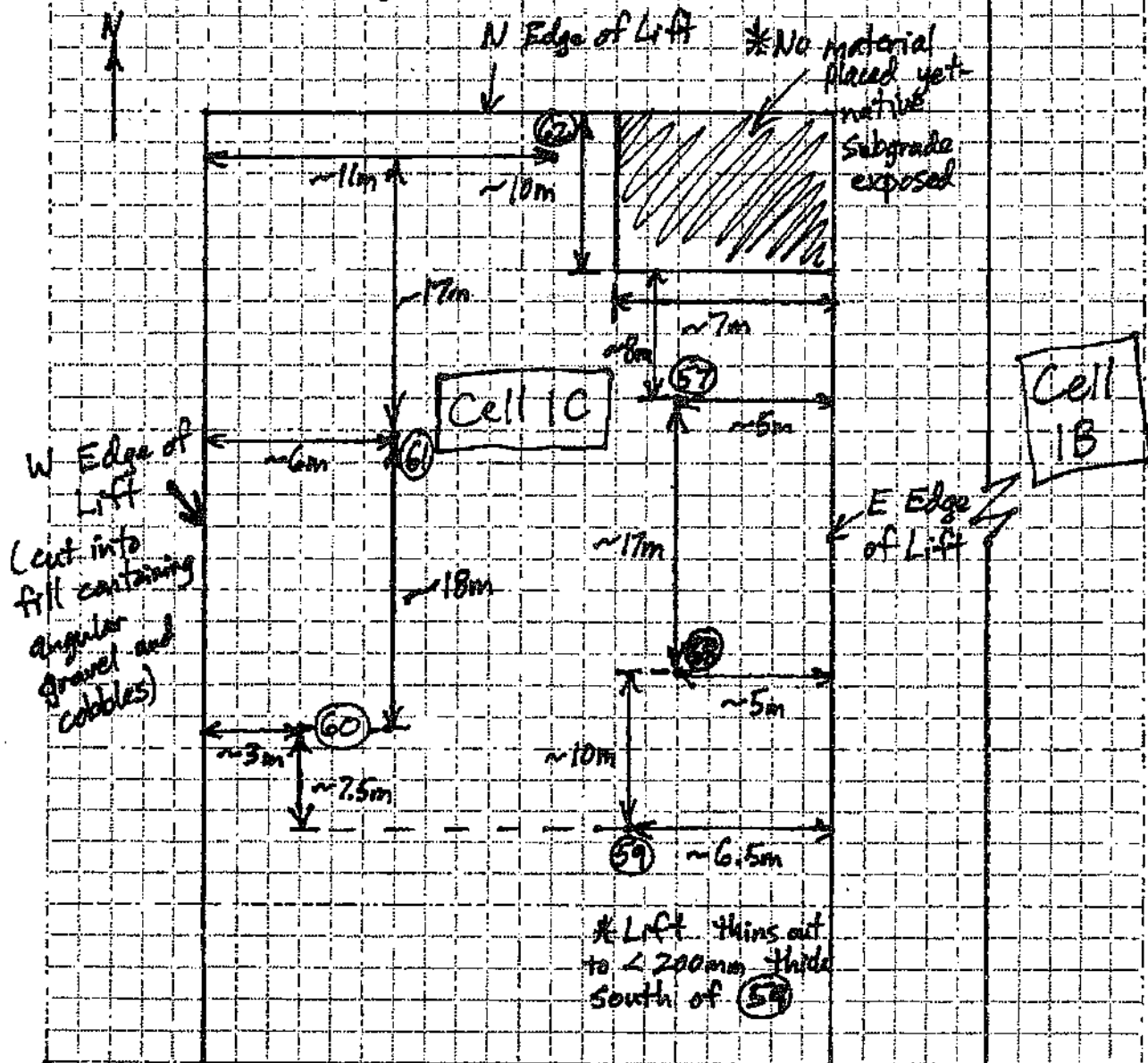
Reviewed

Sheet

of

1

# Approximate Density Test Locations



(60) = Test No. and Approximate Location S Edge of Lift

Note: Lift placed and tested at Cell 1C is approx 0.25m above native subgrade. It is thinner in certain areas (i.e. south of Test No. 59) and no material has yet been placed in certain areas (i.e. north of Test No. 57).





**Laboratory Compaction  
Characteristics of Soil Using  
Standard or Modified Effort  
ASTM D 698 Standard Proctor**

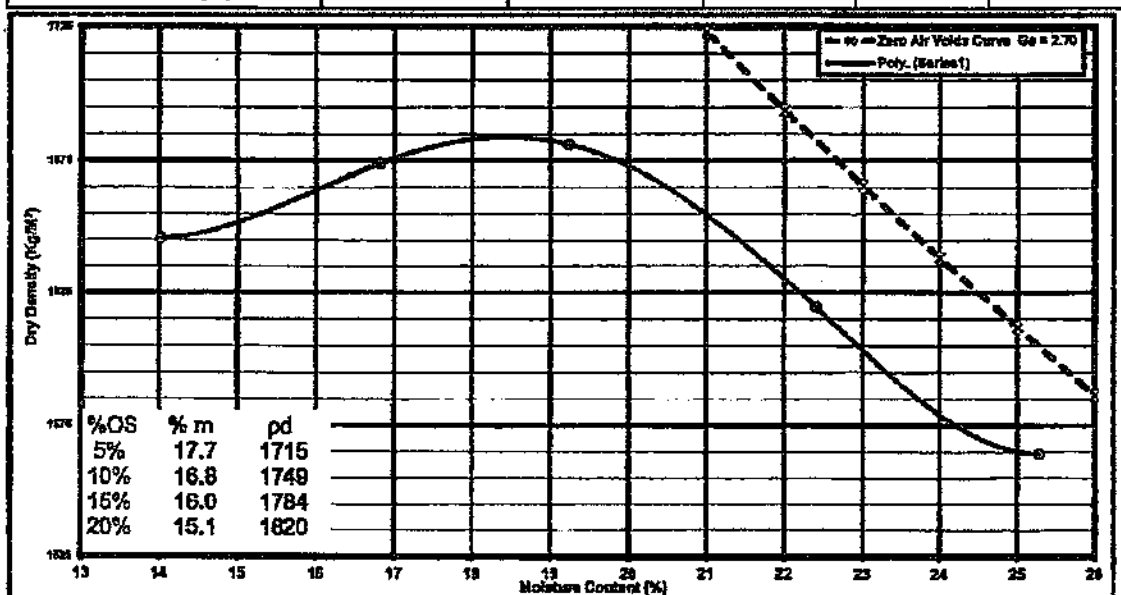
Project #:	1540558	Phase:	1000
Client:	Brimmell Engineering		
Project Title:	SIRM - Stebbins Rd Quarry		
Sample :	SA10 - 1C Liner Clay		
Source:	Stebbins Rd Quarry		
Sampled by:	AB	Date Sampled:	1-Jun-16
Tested by:	AR	Date Tested:	3-Jun-16

**Test Data**

Effort Type	S	Test Method	B	Mould Volume	0.0009390	m <sup>3</sup>
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**Compaction Results**

Trial Number	1	2	3	4	5
Dry Density (Kg/M <sup>3</sup> )	1645.7	1673.9	1681.1	1619.7	1564.2
Moisture Content (%)	14.0	16.8	19.2	22.4	25.3



Uncorrected Optimum Moisture content (%)	18.5	Uncorrected Max Dry Density (Kg/M <sup>3</sup> )	1683
--	------	--	------

**Correction for oversize particles ASTM D 4718**

Max percent oversized (%):	20	Sieve Size	9.5
Percent oversized (%):	5	Percent test fraction (%)	95
Gsc (assumed):	2.7	Gsf (assumed):	2.7
Water content of oversized (%):	1.7	Water content of Test (%):	14.0

**Final results**

Corrected Optimum Moisture content (%)	17.6	Corrected Max Dry Density (Kg/M <sup>3</sup> )	1717
--	------	--	------

Reported by: A. Reid Reviewed By: [Signature] Date: 6-Jun-16

This report contains confidential information and is intended for the use of the client only. It is not to be distributed outside the client's organization. The client is responsible for the proper use of this report. Golder Associates Ltd. is not responsible for the use of this report for any other purpose.

Golder Associates Ltd., 3785 Carey Rd. Victoria, BC, V8Z 6T6, Tel: 250-681-7372, Fax: 250-681-7476



# Wedge/Extrusion Trial

1



12180 Vickers Way  
Richmond BC V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4355

Customer: WESTERN TANK PO # NA  
Production Date: 17/06/2016 Time: 6:35PM  
QA Test Person: s.22 W./O. WO-002587  
Welding Tech: s.22 Crew: s.22

Welder Qualification For Liners: 1 OF 1 Time Ending:

size expressed in decimal feet

Material Type: 40 MIL LLDPE SOLMAX 140-7000 Liner Size: Length Width Style  
210 142 STAIR STEPPED LINER

Welder Number: 11 Outside Temp: 75  
Welder Set Temp: 840 Inside Temp: 75  
Welder Set Speed: 799 Timed FPM 25 Sheet Temp: 75  
Extrusion Rod: NO Welder Set up with bar Y/N NO

## Peel Data

test speed is 20 in/min unless otherwise noted

	Inside (Lbs)	Outside (Lbs)	Failure Type	Seperation (%)	Comments
1	65	60	SE1	0	PASS
2	57	57	SE1	0	PASS
3	60	59	STE	0	PASS
4	57	53	STE	0	PASS
5	56	54	STE	0	PASS

## Shear Data

	Shear (Lbs)	Elongation (%)	Comments
1	62	200+%	STE/PASS
2	59	200+%	STE/PASS
3	58	200+	STE/PASS
4	63	200+	STE/PASS
5	58	200+	STE/PASS

Notes: Tear Back Results on Sample Weld: GOOD

STE = sample stretch to end of test  
SE1 = sample break in outer edge of seam

SE2= break at seam edge top sheet (extrusion shear only)  
SE3= break at seam edge in bottom sheet (extrusion peel only)



WAG-ITL



12180 Vickers Way  
Richmond Bc V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4355

test speed is 20 in/min unless otherwise noted

## Seam End Coupon Log

Customer:	WESTERN TANK		PO#	NA	
Production Date:	17/06/2016		Crew:	s.22	
<i>Welder Settings</i>					
Welder #	11	Operator	s.22	Temp/Speed	840/799
<i>Timed welder speed</i>					
Distance in feet	22.3	Timed Sec.	54	Feet per min.	25
QA Test Person:	s.22	W./O.	WO-002587		
Material Type:	40MILL LLDPE SOLMAX 140-7000				
<i>size in dec. ft. Length Width Style</i>					
Liner Size:	210	142	STAIR STEPPED LINER	Liner #	1

Seam Number	Test # PW / SH	Inside (lbs)	Outside (lbs)	Failure Type	Seperation (%)	Shear (lbs)	Elongation (%)	Comments
W1	P1-S1	58	57	SE1	0	66	200+	PASS/STE
W1	P2-S2	58	58	SE1	0	65	200+	PASS/STE
W2	P1-S1	58	62	SE1	0	68	200+	PASS/STE
W2	P2-S2	57	57	SE1	0	60	200+	PASS/STE
W3	P1-S1	56	57	SE1	0	66	200+	PASS/STE
W3	P2-S2	56	60	SE1	0	65	200+	PASS/STE
W4	P1-S1	60	60	SE1	0	66	200+	PASS/STE
W4	P2-S2	59	60	SE1	0	64	200+	PASS/STE
W5	P1-S1	60	61	SE1	0	62	200+	PASS/STE
W5	P2-S2	59	60	SE1	0	61	200+	PASS/STE
W6	P1-S1	61	64	SE1	0	70	200+	PASS/STE
W6	P2-S2	58	61	SE1	0	66	200+	PASS/STE

Notes:

STE = sample stretch to end of test

SE1 = sample break in outer edge of seam

Pull Checks (non-destructive seam lip pulls)

GOOD

WAG-ITL





WESTERN TANK  
& LINING LTD.

## ASTM D 5199 MATERIAL THICKNESS LLDPE

12180 Vickers Way

Richmond BC V6V 1H9

Office 604.241.9487 Fax 604.241.9485

Toll-Free 1.800.551.4355

Date MFG date	Mil Mfg	Roll ID #	Roll Width measured	sample area	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	Avg.	QA
6/17/16 NA	40MIL LLDPE SOLMAX 140-7000	2-085157	22.3	MIDDLE	36.2	36.7	37	36.6	36.3	39.5	38.9	36.6	40.1	40.2	37.81	s.22
6/17/16 12/14/14	40MIL LLDPE SOLMAX 140-7000	5-11923	22.3 22'4"	BEG.	37.2	37.3	37.1	36.6	37.4	38.5	39.6	37.6	38.1	38.6	37.8	s.22
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# Liner Quality Control Audit

29

W:\G - ITL Quiz

WO QA Testing\Calculator Liner Size Test Toleran

Inspector

s.22

Crew

s.22

Date

17/06/2016

Work Order # WO-002587

Size / Style

Length

Width

Style

210

142

STAIR STEPPED LINER

PO#

NA

Customer

WESTERN TANK

Liner #

1 OF 1

## Width Calculator (enter for size ordered) Sizes are expressed in Decimal feet

Liner Length (feet)	Liner width (Feet)	Roll Width (Inches)	Weld Width overlap (Inches)	Calculated Panels Needed	Even Panel no. (rounded up)	Total Width of Even Panels (Feet)	Actual Panel Count, added or subtracted material width ex: 8 panels + 2', +2' or 9 panels -11' (welds subtracted shown in actual width)
210	142	267	6	6.528736	7	152.75	
1st panel length verification size/persons				210'6" s.22		Finished Length	210.6
						Actual Width	152.75
Stepped Panel lengths				210'6", 183'6", 165'6", 138'6", 107'6", 80'6", 52'6"			
Step inset				NA			
Secondary measurements (cut welds)				NA			
Cross welds:				NA		Inspected by:	NA
Seam lip pull checks (non-destructive)				GOOD			
Special Instructions				NA			
Material				40MIL LLDPE SOLMAX 140-7000		Color Out	BLK
Rolling				Folding			
Standard Roll						Standard Fan	X
Standard Roll with Webbing				X		Butterfly Fold	
Scroll Rolled center mark W/Webbing						Fan Fold to center 2" web markers	
Core Type Used:				Metal		Cardboard	X
						Other	
(Standard = mil, size, unroll and unfold arrow)							
Standard Information Written on Item				X		Other:	
refer to E.I.C for standards							
Packaging Wrap/ Color :				Standard Liner		X	Other:
						FELT, LLDPE, 5X12 MIL WHITE	
refer to E.I.C for standards							
Standard Package Labeling				X		Other:	

Notes



# Wedge/Extrusion Trial

1



**WESTERN TANK  
& LINING LTD.**

12180 Vickers Way  
Richmond BC V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4355

Customer: **WESTERN TANK** PO # **ANDREW**

Production Date: **17/06/2016** Time: **11:00 PM**

QA Test Person: **s.22** W./O. **WO-002588**

Welding Tech: **s.22** Crew: **s.22**

Welder Qualification For Liners: **1 OF 1** Time Ending:

Material Type: **40MIL DST** Liner Size: **69** **132** **LNR**  
*size expressed in decimal feet*  
Length Width Style

Welder Number: **D-11** Outside Temp: **68**  
Welder Set Temp: **860** Inside Temp: **70**  
Welder Set Speed: **699** **Timed FPM** **25** Sheet Temp: **68**  
Extrusion Rod: **NA** Welder Set up with bar Y/N **N**

## Peel Data

*test speed is 20 in/min unless otherwise noted*

	Inside (Lbs)	Outside (Lbs)	Failure Type	Separation (%)	Comments
1	84	84	SE1	0	PASS
2	80	77	SE1	0	PASS
3	85	85	SE1	0	PASS
4	81	77	SE1	0	PASS
5	83	84	SE1	0	PASS

## Shear Data

	Shear (Lbs)	Elongation (%)	Comments
1	96	200+%	PASS/STE
2	99	200+%	PASS/STE
3	97	200+	PASS/STE
4	92	200+	PASS/STE
5	96	200+	PASS/STE

Notes: **Tear Back Results on Sample Weld: GOOD**

STE = sample stretch to end of test  
SE1 = sample break in outer edge of seam

SE2= break at seam edge top sheet (extrusion shear only)  
SE3= break at seam edge in bottom sheet (extrusion peel only)



3



test speed is 23 kV/min unless otherwise noted

Customer:	WESTERN TANK	PO#	ANDREW
-----------	--------------	-----	--------

Welder Settings					
Welder #	D-11	Operator	s.22	Temp/Speed	850/699

QA Test Person: S.22 W/O. WO-002588

Material Type: 40MIL DST SOLMAX 840-7000

size in dec. ft.	Length	Width	Style
Liner Size:	69	132	LNR
			Liner # 1

[illegible]

**Notes:**

**STE = sample stretch to end of test**

SE1 = sample break in outer edge of seam

**Pull Checks (non-destructive seam & puffs)**

**GOD**





WESTERN TANK  
& LINING LTD.

## ASTM D 5199 MATERIAL THICKNESS LLDPE

12180 Vickers Way  
Richmond BC V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4355

Date MFG date	Mil Mfg	Roll ID #	Roll Width measured	sample area	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	Avg.	QA
6/17/16 NA	40 DST SOLMAX 840-7000	1-108270	22.3	BEG.											#DIV/0!	s.22
															#DIV/0!	
															#DIV/0!	
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# Liner Quality Control Audit

7

W:\G - ITL Que .

WO QA Testing\Calculator Liner Size Test Toleran

Inspector

Crew

SHELDON NIGHT SHIFT

Date

17/06/2016

Work Order # WO-002588

Size / Style

Length

69

Width

132

Style

LNR

PO#

ANDREW

Customer

WESTERN TANK

Liner #

1 OF 1

Width Calculator (enter for size ordered) Sizes are expressed in Decimal feet

Liner Length (feet)	Liner width (Feet)	Roll Width (Inches)	Weld Width overlap (Inches)	Calculated Panels Needed	Even Panel no. (rounded up)	Total Width of Even Panels (Feet)	Actual Panel Count, added or subtracted material width ex: 8 panels + 2', +2' or 9 panels -11' (welds subtracted shown in actual width)
69	132	267	6	6.068966	7	152.75	-22.3'
1st panel length verification size/persons					69'8" TK		
Finished Length					69.6		
Actual Width					131.3		
Stepped Panel lengths NA							
Step inset NA							
Secondary measurements (cut welds) NA							
Cross welds: NA Inspected by: NA							
Seam lip pull checks (non-destructive) GOOD							
Special Instructions WELD DIRECTION SHORT WAY							
Material 40 DST SOLMAX 840-7000 Color Out BLK							
Rolling				Folding			
Standard Roll				Standard Fan			
Standard Roll with Webbing				Butterfly Fold			
Scroll Rolled center mark W/Webbing				Fan Fold to center 2" web markers			
Core Type Used: Metal				Cardboard			
				Other			
(Standard = mil, size, unroll and unfold arrow)							
Standard Information Written on Item				Other:			
Packaging Wrap/ Color : Standard Liner				Other: FELT,LLDPE,5X 12 MIL			
Standard Package Labeling				Other:			

Notes



# Wedge/Extrusion Trial

1



12180 Vickers Way  
Richmond BC V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4355

Customer: WESTERN TANK PO # ANDREW

Production Date: 17/06/2016 Time: 12:45 AM

QA Test Person: s.22 W./O. WO-002589

Welding Tech: s.22 Crew: s.22

Welder Qualification For Liners: 1 OF 1 Time Ending:

size expressed in decimal feet

Material Type:	40MIL DST SOLMAX 840-7000	Liner Size:	Length	Width	Style
			46	143	LINER

Welder Number:	D-11	Outside Temp:	65
Welder Set Temp:	860	Inside Temp:	68
Welder Set Speed:	699 Timed FPM 25	Sheet Temp:	68
Extrusion Rod:	NA	Welder Set up with bar N	N

## Peel Data

test speed is 20 in/min unless otherwise noted

	Inside (Lbs)	Outside (Lbs)	Failure Type	Seperation (%)	Comments
1	84	84	SE1	0	PASS
2	80	77	SE1	0	PASS
3	85	85	SE1	0	PASS
4	81	77	SE1	0	PASS
5	83	84	SE1	0	PASS

## Shear Data

	Shear (Lbs)	Elongation (%)	Comments
1	96	200+%	PASS/STE
2	99	200+%	PASS/STE
3	97	200+	PASS/STE
4	92	200+	PASS/STE
5	96	200+	PASS/STE

Notes: Tear Back Results on Sample Weld: GOOD

STE = sample stretch to end of test  
SE1 = sample break in outer edge of seam

SE2= break at seam edge top sheet (extrusion shear only)  
SE3= break at seam edge in bottom sheet (extrusion peel only)



# Wedge/Extrusion Trial

2



12180 Vickers Way  
Richmond BC V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4355

Customer: WESTERN TANK PO # ANDREW  
Production Date: 17/06/2016 Time: 2:00 AM  
QA Test Person: s.22 W./O. WO-002589  
Welding Tech: s.22 Crew: s.22

Welder Qualification For Liners: 1 OF 1 Time Ending:

Material Type: 40MIL DST SOLMAX 840-7000 Liner Size: 

Length	Width	Style
46	143	LINER

Welder Number: EXTRUSION  
Welder Set Temp: PRE-HEAT 400/PLASTIC 425  
Welder Set Speed: Timed FPM  
Extrusion Rod: YES  
Outside Temp: 65  
Inside Temp: 68  
Sheet Temp: 68  
Welder Set up with bar Y/N N

## Peel Data

test speed is 20 in/min unless otherwise noted

	Inside (Lbs)	Outside (Lbs)	Failure Type	Seperation (%)	Comments
1	80	NA	SE1	0	PASS
2	85	NA	SE1	0	PASS
3	87	NA	SE1	0	PASS
4	79	NA	SE1	0	PASS
5	87	NA	SE1	0	PASS

## Shear Data

	Shear (Lbs)	Elongation (%)	Comments
1	87	200+%	PASS/STE
2	89	200+%	PASS/STE
3	94	200+	PASS/STE
4	88	200+	PASS/STE
5	87	200+	PASS/STE

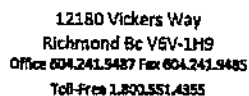
Notes: Tear Back Results on Sample Weld: NA

STE = sample stretch to end of test  
SE1 = sample break in outer edge of seam

SE2= break at seam edge top sheet (extrusion shear only)  
SE3= break at seam edge in bottom sheet (extrusion peel only)



3



### Seam End Coupon Log

size in dec. ft.	Length	Width	Style	Liner #
Liner Size:	46	143	LINER	1

**Notes:**

**GOOD**





WESTERN TANK  
& LINING LTD.

12180 Vickers Way  
Richmond BC V6V-1H9  
Office 604.241.5487 Fax 604.241.5485  
Toll-Free 1.800.552.4355

## ASTM D 5199 MATERIAL THICKNESS LLDPE

Date MFG date	Mil Mfg	Roll ID #	Roll Width measured	sample area	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	Avg.	QA
6/17/16 NA	40 DST SOLMAX 840-7000	1-108270	22.3	BEG.											#DIV/0!	s. 22
															#DIV/0!	
															#DIV/0!	
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# Liner Quality Control Audit

7

W:\G - ITL Que.

WO QA Testing\Calculator Liner Size Test Toleran

Inspector

s.22

Crew

SHELDON NIGHT SHIFT

Date

17/06/2016

Work Order # WO-002589

Size / Style

Length

46

Width

143

Style

LINER

PO#

ANDREW

Customer

WESTERN TANK

Liner #

1

## Width Calculator (enter for size ordered) Sizes are expressed in Decimal feet

Liner Length (feet)	Liner width (Feet)	Roll Width (Inches)	Weld Width overlap (Inches)	Calculated Panels Needed	Even Panel no. (rounded up)	Total Width of Even Panels (Feet)	Actual Panel Count, added or subtracted material width ex: 8 panels + 2", +2" or 9 panels -11" (welds subtracted shown in actual width)
46	143	267	6	6.574713	7	152.75	
1st panel length verification size/persons					46'6" TK		OK TK
					Finished Length	46.6	Actual Width 152.75
Stepped Panel lengths					NA		
Step Inset					NA		
Secondary measurements (cut welds)					NA		
Cross welds:					1 PANEL 5 EXTUSION WELD DONE		Inspected by: s.22
Seam lip pull checks (non-destructive)					GOOD		
Special Instructions					WELD DIRECTION SHORT WAY		
Material					40 DST SOLMAX 840-7000		Color Out BLK
Rolling					Folding		
Standard Roll					Standard Fan		
Standard Roll with Webbing					Butterfly Fold		
Scroll Rolled center mark W/Webbing					Fan Fold to center 2" web markers		
Core Type Used:					Metal	Cardboard	Other
					X	X	
(Standard = mil, size, unroll and unfold arrow)							
Standard Information Written on Item					X	Other:	
Packaging Wrap/ Color :					Standard Liner	Other:	FELT,LLDPE,5X 12MIL WHITE
					X		
Standard Package Labeling					X	Other:	

Notes



Brimmell Engineering Ltd  
971 Bank Street  
Victoria, BC  
V8S 4B1  
rbrimmell@shaw.ca

South Island Resource Management

April 18/17  
File 15-139

Att: Rahim Gaidhar, GIT

Re: SIRM Facility, 460 Stebbings Rd., Shawnigan Lake  
MEM Permit Q-8-094 & MOE PR-105809  
Updated As-Built for Encapsulation Cell 1C

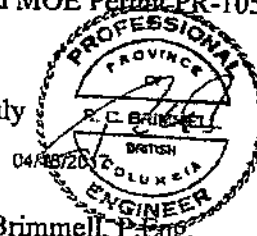
This letter is further to my report of July 4/17, our recent discussions, and receipt of several digital photos.

As of July 4/17 the narrow, southerly end of the Encapsulation Cell 1C wasn't finalized due to a problem with outcropping bedrock on the west side. I didn't carry out site reviews during preparation of this area. The following statements were recently received by email from SIRM, based on field observations by Tom Good, P.Eng. and Gary Isaacson:

- On July 19, 2017, a rock hammer, attached to a 450 excavator, was used to remove the bedrock outcrop noted in the July 4, 2016 As-Built Report from Richard Brimmell (attached).
- Once removal of bedrock was accomplished, 1m of clay and 300 mm of sand were placed and slope grading occurred on the Southernmost slope followed by the placement of base liner and welding to the adjacent cell.
- Following the completion of welding, a 300 mm sand layer was placed on top of the liner before contaminated soil placement.

Based on this statement and the accompanying photos the liner was installed correctly at the narrow, southerly end of Cell 1C. The photos also illustrate the contaminated soil fill being compacted in lifts with a roller. It is therefore concluded that construction of Encapsulation Cell 1C meets the standards required by MEM Permit Q-8-094 and MOE Permit PR-105809.

Yours truly



Richard Brimmell, P.Eng.  
for Brimmell Engineering Ltd.



Figure 1. Approx existing area.









Figure 2. Covering of PEA 1B West slope.

Existing  
ditch liner  
folded up  
and  
welded to  
slope liner

Existing ditch folded up and welded to slope liner



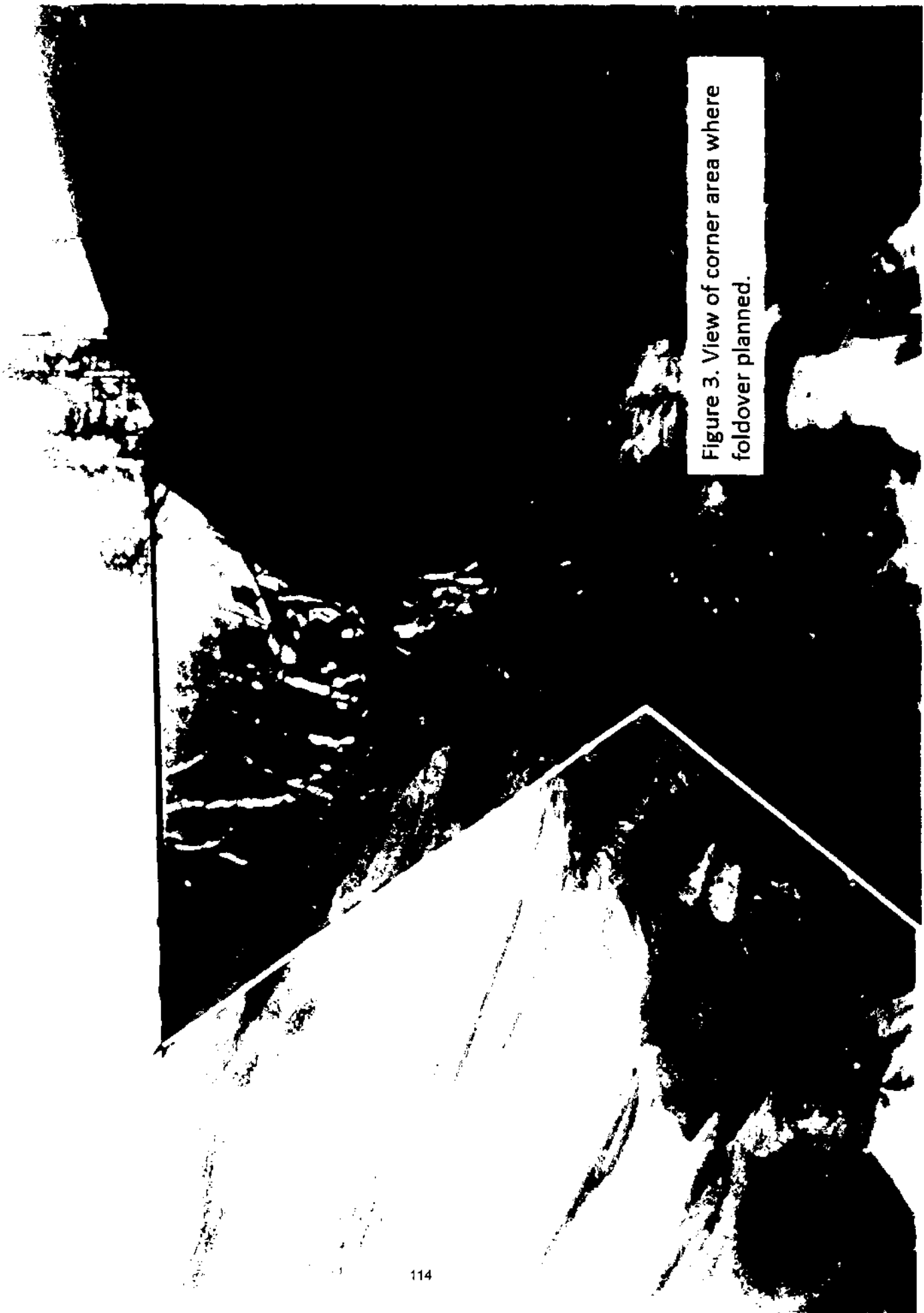


Figure 3. View of corner area where foldover planned.



Figure 4. Rough view of new  
liner coverage.

New liner over 0.3m sand, 1.0

New liner over

previously placed









s.22



## Cell 1

- Contaminated Soil Placement As-Built

RESOURCE MANAGEMENT



# Cell As-Built Information

(Each grid 10m X 10m at base of cell, diminishing at edges based on slopes)

LIFT NUMBER: 1 (0m to 1m above sand liner)



## Schematic of PEA Cell 1 using Environmental Monitoring Grid System

(soil a / soil b : soil a is to north)

	C3	C2	C1	B3	B2	B1	A3	A2	A1
G	FMF	FMF	FMF	HALLO	HALLO	PCT	ENEX/YATES- /1950+	ENEX/YATES- /1950+	ENEX/WP22/19 50+
F	PB	PB	PB	HALLO	HALLO	PCT	1950+	1950+	1950+
E		PB	PB	PCT	PCT	PCT	1950+/4- SOIL	1950+4-SOIL	1950+4-SOIL
D		PB	PB	PCT	PCT	PCT	4-SOIL	4-SOIL	4-SOIL
C		PB	PB	PCT	PCT	PCT	4-SOIL	4-SOIL	4-SOIL
B			FMF	PCT	PCT	PCT	4-SOIL	4-SOIL	4-SOIL
A			FMF	PCT	PCT	PCT	4-SOIL	4-SOIL	4-SOIL

## SOIL KEY

s.21



Cell As-Built Information

(Each grid 10m X 10m at base of cell, diminishing at edges based on slopes)

LIFT NUMBER: 2 (1m to 2m above sand liner)



Schematic of PEA Cell 1 using Environmental Monitoring Grid System

	C3	C2	C1	B3	B2	B1	A3	A2	A1
G	FMF	FMF	FMF	HALLO	HALLO	PCT	ENEX/YATES-	ENEX/YATES-	ENEX/WP22
F	FMF	FMF	FMF	HALLO	HALLO	PCT	YATES-/1950+	YATES-/1950+	WP22/1950+
E		FMF	FMF	PCT	PCT	PCT	1950+	1950+	1950+
D		FMF	FMF	PCT	PCT	PCT	1950+	1950+	1950+
C		FMF	FMF	PCT	PCT	PCT	1950+	1950+	1950+
B			FMF	PCT	PCT	PCT	1950+	1950+	1950+
A			PB	PCT	PCT	PCT	1950+	1950+	1950+

SOIL KEY

s.21



Cell As-Built Information

(Each grid 10m X 10m at base of cell, diminishing at edges based on slopes)

LIFT NUMBER: 3 (2m to 3m above sand liner)



Schematic of PEA Cell 1 using Environmental Monitoring Grid System

	C3	C2	C1	B3	B2	B1	A3	A2	A1
G	FMF	FMF	FMF	HALLO	HALLO	PCT	ENEX/YATES-	ENEX/YATES-	ENEX/WP22
F	PB	PB	PB	HALLO	HALLO	PCT	YATES-	YATES-	WP22
E		PB	PB	PCT	PCT	PCT	3-SOIL	3-SOIL	WP22/3-SOIL
D		PB	PB	PCT	PCT	PCT	3-SOIL	3-SOIL	3-SOIL
C		PB	PB	PCT	PCT	PCT	3-SOIL	3-SOIL	3-SOIL
B			PB	PCT	PCT	PCT	3-SOIL	3-SOIL	3-SOIL
A			PB	PCT	PCT	PCT	3-SOIL	3-SOIL	3-SOIL

SOIL KEY

s.21



# Cell As-Built Information

(Each grid 10m X 10m at base of cell, diminishing at edges based on slopes)

LIFT NUMBER: 4 (3m to 4m above sand liner)



## Schematic of PEA Cell 1 using Environmental Monitoring Grid System

	C3	C2	C1	B3	B2	B1	A3	A2	A1
G	FMF	FMF	FMF	HALLO	HALLO	PCT	ENEX/YATES-	ENEX/YATES-	ENEX/WP22
F	PB	PB	PB	HALLO	HALLO	PCT	YATES-	YATES-	WP22
E		PB	PB	PCT	PCT	PCT	YATES-/3-SOIL	YATES-/3-SOIL	WP22/3-SOIL
D		PB	PB	PCT	PCT	PCT	3-SOIL	3-SOIL	3-SOIL
C		PB	PB	PCT	PCT	PCT	3-SOIL	3-SOIL	3-SOIL
B			PB	PCT	PCT	PCT	3-SOIL	3-SOIL	3-SOIL
A			PB	PCT	PCT	PCT	3-SOIL	3-SOIL	3-SOIL

### SOIL KEY

s.21



# Cell As-Built Information

(Each grid 10m X 10m at base of cell, diminishing at edges based on slopes)

LIFT NUMBER: 5 (4m to 5m above sand liner)



## Schematic of PEA Cell 1 using Environmental Monitoring Grid System

	C3	C2	C1	B3	B2	B1	A3	A2	A1
G	FMF	FMF	FMF	HALLO	HALLO	PCT	YATES-	YATES-	WP22
F	PB	PB	PB	HALLO	HALLO	PCT	YATES-	YATES-	WP22
E		PB	PB	PCT	PCT	PCT	YATES-	YATES-	WP22
D		PB	PB	PCT	PCT	PCT	QFW	QFW	QFW/WP22
C		PB	PB	PCT	PCT	PCT	3-SOIL/QFW	3-SOIL/QFW	3-SOIL/QFW
B			PB	PCT	PCT	PCT	3-SOIL	3-SOIL	3-SOIL
A			PB	PCT	PCT	PCT	3-SOIL	3-SOIL	3-SOIL

## SOIL KEY

s.21



# Cell As-Built Information

(Each grid 10m X 10m at base of cell, diminishing at edges based on slopes)

LIFT NUMBER: 6A (5m to 5.5m above sand liner)



## Schematic of PEA Cell 1 using Environmental Monitoring Grid System

	C3	C2	C1	B3	B2	B1	A3	A2	A1
G	FMF	FMF	FMF	PCT	PCT	PCT	WP22	WP22	WP22
F	PB	PB	PB	PCT	PCT	Pender	WP22	WP22	WP22
E		PB	PB	PCT	PCT	Pender	WP22/WP22-	WP22/WP22-	WP22/WP22-
D		PB	PB	PCT	PCT	PCT/Ewen	WP22	WP22	WP22
C		FMF	FMF	PCT	PCT	PCT/Ewen	WP22	WP22	WP22
B			FMF	PCT	PCT	PCT/Ewen	YATES-	YATES-	YATES-
A			PB	PCT	PCT	PCT/Ewen	YATES+	YATES+	YATES+

### SOIL KEY

s.21



# Cell As-Built Information

(Each grid 10m X 10m at base of cell, diminishing at edges based on slopes)

LIFT NUMBER: 6B (5.5m to 6.0m above sand liner)



## Schematic of PEA Cell 1 using Environmental Monitoring Grid System

	C3	C2	C1	B3	B2	B1	A3	A2	A1
G	FMF	FMF	FMF	PCT	PCT	PCT	PCT	PCT	PCT
F	FMF	FMF	FMF	PCT	PCT	Pender	Pender	PCT	PCT
E		PB	PB	PCT	PCT	Pender	Pender	PCT	/WP22
D		PB	PB	PCT	PCT	Ewen	WP22-	WP22-/WP22	WP22
C		FMF	FMF	PCT	PCT	Ewen	WP22-	WP22-/WP22	WP22
B			FMF	PCT	PCT	Ewen	WP22-	WP22-/WP22	WP22
A			FMF	PCT	PCT	Ewen	YATES-	YATES-/WP22	WP22

## SOIL KEY

s.21



# Cell As-Built Information

[Each grid 10m X 10m at base of cell, diminishing at edges based on slopes)

**LIFT NUMBER:** 7A (6.0m to 6.5m above sand liner)

N



## Schematic of PEA Cell 1 using Environmental Monitoring Grid System

	C3	C2	C1	B3	B2	B1	A3	A2	A1
G	FMF	FMF	FMF	PCT	PCT	PCT	PCT	PCT	PCT
F	FMF	PB	PB	PCT	PCT	Pender	Pender	PCT	PCT
E		PB	PB	PCT	PCT	Pender	Pender	PCT	PCT
D		PB	PB	PCT	PCT	Ewen	Ewen/ PCT	PCT	PCT
C		PB	PB	PCT	PCT	Ewen	Ewen/ PCT	PCT	PCT
B			FMF	PCT	PCT	Ewen	YATES-	YATES-	YATES-
A			FMF	PCT	PCT	Ewen	YATES-	YATES-	YATES-

## SOIL KEY

s.21



**Cell As-Built Information**

(Each grid 10m X 10m at base of cell, diminishing at edges based on slopes)

**LIFT NUMBER: 7B** (6.5m to 7.0m above sand liner)



**Schematic of PEA Cell 1 using Environmental Monitoring Grid System**

	C3	C2	C1	B3	B2	B1	A3	A2	A1
G	FMF	FMF	FMF	PB	PCT	PCT	empty	empty	empty
F	FMF	FMF	FMF	FMF	PCT	Pender	Pender	PCT	PCT
E		PB	PB	FMF	PCT	Pender	Pender	PCT	PCT
D		PB	PB	FMF	PCT	Ewen	Ewen/ PCT	PCT	PCT
C		PB	PB	PB	PCT	Ewen	Ewen/ PCT	PCT	PCT
B			PB	PB	PCT	Ewen	Ewen/ PCT	PCT	PCT
A			PB	PB	PCT	Ewen	Ewen/ PCT	PCT	PCT

**SOIL KEY**

s.21



**Cell As-Built Information**

(Each grid 10m X 10m at base of cell, diminishing at edges based on slopes)

**LIFT NUMBER:** 8 (7.0m to 7.5m above sand liner)

"Empty" cells are due to slope requirements and cannot be filled until new cells built

Schematic of PEA Cell 1 using Environmental Monitoring Grid System



	C3	C2	C1	B3	B2	B1	A3	A2	A1
G	empty	empty	empty	empty	empty	empty	empty	empty	empty
F	PB	PB	PB	FMF	PCT/AT-	Ewen	Ewen	Mix A	empty
E		PB	PB	FMF	PCT/AT+	Ewen	Ewen	PCT	empty
D		PB	PB	FMF	PCT/AT+	Ewen	Ewen	PCT	empty
C		PB	PB	PB	PCT/AT+	Ewen	Ewen	PCT	empty
B			PB	PB	PCT/AT+	Ewen	Ewen	PCT	empty
A			PB	PB	PCT	Ewen	Ewen	PCT	empty

**SOIL KEY**

s.21



# Cell As-Built Information

(Each grid 10m X 10m at base of cell, diminishing at edges based on slopes)

LIFT NUMBER: 9A (8 m to 8.5 m above sand liner)

"Empty" cells are due to slope requirements and cannot be filled until new cells built

Schematic of PEA Cell 1 using Environmental Monitoring Grid System



	C3	C2	C1	B3	B2	B1	A3	A2	A1
G	empty	empty	empty	empty	empty	empty	empty	empty	empty
F	FMF	FMF	FMF	FMF	Ewen	Ewen	Ewen	Ewen	empty
E		FMF	FMF	FMF	Col15+	Col15+/CP	Col15+	Ewen	empty
D		FMF	FMF	FMF	Col15-/Col15+	Col15+	Col15+	Ewen	empty
C		PB	PB	PB	Col15-/Col15+	Col15+	Col15+	Ewen	empty
B			PB	PB	Col15-/Col15+	Col15+	Col15+	Ewen	empty
A			PB	PB	Col15-/Col15+	Col15+	Col15+	Ewen	empty

## SOIL KEY

s.21



# Cell As-Built Information

(Each grid 10m X 10m at base of cell, diminishing at edges based on slopes)

LIFT NUMBER: 9B (8.5 m to 9 m above sand liner)

"Empty" cells are due to slope requirements and cannot be filled until new cells built

Schematic of PEA Cell 1 using Environmental Monitoring Grid System



	C3	C2	C1	B3	B2	B1	A3	A2	A1
G	empty	empty	empty	empty	empty	empty	empty	empty	empty
F	empty	empty	empty	empty	Ewen	Ewen	Ewen	Ewen	empty
E		empty	empty	empty	Col15+	Ewen	Ewen	Ewen	empty
D		empty	empty	empty	Col15-/Col15+	Ewen	Ewen	Ewen	empty
C		empty	empty	empty	Col15-/Col15+	Ewen	Ewen	Ewen	empty
B			PB	PB	Col15-/Col15+	Ewen	Ewen	Ewen	empty
A			PB	PB	Col15-/Col15+	Ewen	Ewen	Ewen	empty

## SOIL KEY

s.21



**Cell As-Built Information**

(Each grid 10m X 10m at base of cell, diminishing at edges based on slopes)

**LIFT NUMBER:** 10 (9 m to 10 m above sand liner)

"Empty" cells are due to slope requirements and cannot be filled until new cells built

Schematic of PEA Cell 1 using Environmental Monitoring Grid System



	C3	C2	C1	B3	B2	B1	A3	A2	A1
G	empty	empty	empty	empty	empty	empty	empty	empty	empty
F	empty	empty	empty	empty	Ewen	Ewen	Ewen	Ewen	empty
E		empty	empty	empty	Ewen	Ewen	Ewen	Ewen	empty
D		empty	empty	empty	Ewen	Ewen	Ewen	Ewen	empty
C		empty	empty	empty	Ewen	Ewen	Ewen	Ewen	empty
B			empty	empty	Ewen	Ewen	Ewen	Ewen	empty
A			empty	empty	Ewen	Ewen	Ewen	Ewen	empty

**SOIL KEY**

s.21



Cell As-Built Information

(Each grid 10m X 10m at base of cell, diminishing at edges based on slopes)

LIFT NUMBER: 11 (10 m to 11 m above sand liner)

"Empty" cells are due to slope requirements and cannot be filled until new cells built

Schematic of PEA Cell 1 using Environmental Monitoring Grid System



	C3	C2	C1	B3	B2	B1	A3	A2	A1
G	empty	empty	empty	empty	empty	empty	empty	empty	empty
F	empty	empty	empty	empty	Ewen	Ewen	Ewen	Ewen	empty
E		empty	empty	empty	Ewen	Ewen	Ewen	Ewen	empty
D		empty	empty	empty	Ewen	Ewen	Ewen	Ewen	empty
C		empty	empty	empty	Ewen	Ewen	Ewen	Ewen	empty
B			empty	empty	Ewen	Ewen	Ewen	Ewen	empty
A			empty	empty	Ewen	Ewen	Ewen	Ewen	empty

SOIL KEY

s.21



## Cell 1

- Closure Report, Quality Assurance, and Quality Control

5307-10-010

# RESOURCE MANAGEMENT





- Landfill Engineering
  - Solid Waste Planning
  - Environmental Monitoring
  - Landfill Fire Control
- 

January 30<sup>th</sup>, 2017

PRJ17002

A.J. Downie, M.Sc., P.Ag.  
Director, Authorizations – South  
Environmental Protection Division  
Ministry of Environment

Email: AJ.Downie@gov.bc.ca

**Re: Cobble Hill Holdings Ltd. - Pollution Prevention Order – File: 108608**

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Dear Mr. Downie,

This letter is intended to outline measures taken by South Island Resource Management (SIRM) for Cobble Hill Holdings Ltd. (CHH) in response to Pollution Prevention Order (PPO) No. 108608 issued on October 12<sup>th</sup>, 2016 by the Ministry of Environment (MoE) for non-compliance with Permit 105809 due to discharge of untreated contact water into the onsite settling pond.

Sperling Hansen Associates (SHA) was contacted by SIRM to provide response to the above-mentioned Pollution Prevention Order (PPO) to provide update on the current status of the Permanent Encapsulation Area (PEA) for which contaminated soil was being landfilled. SHA completed two onsite inspections with SIRM staff during and after the installation of the impermeable cover on the soil landfill cell. Additionally, SIRM has been providing updates on current site conditions since the inspections.

**SHA's Understanding of the Pollution Prevention Order – As Outlined in MoE's PPO**

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Outlined below is a summarized list of details outlined in the PPO addressed by MoE:

- *October 8, 2016 – SIRM report spill of untreated contact water onto Property (DGIR 161899).*
- *Conservation Officer Sergeant Scott Norris confirms that heavy rains result in the erosion of a sand layer on top of the landfill. Eroded sand obstructed the contact water collection ditches and approximately 3,000-6,000 gallons of untreated contact water spilled onto the Property, mixed with non-contact water, flowed into the settling pond and subsequently discharged to the environment.*
- *Subsequent inspections by MoE Compliance staff (IR 30547) determined that CHH was in non-compliance with Permit No. 105809 due to the discharge of untreated contact water into the settling pond.*

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North Vancouver Office  
8-1225 East Keith Road, North Vancouver, British Columbia, V7J 1J3  
Phone (604) 986 7723 Fax (604) 986 7734

Kamloops Office  
1332 McGill Road, Kamloops, British Columbia, V2C 6N6  
Phone (778) 471 7088 Fax (778) 471 7089

[www.sperlinghansen.com](http://www.sperlinghansen.com)





- During inspections, MoE noted that contaminated soil remains onsite in the landfill facility, without a final cover and with sand on the surface of the landfill.
- MoE also noted that winter wet weather season has commenced.

*Pursuant of Section 81 of the Environmental Management Act, [SBC 2003], c. 53 (the "Act") CHH is hereby ordered to comply with the following requirements:*

1. *Immediately take action, under the direction of a Qualified Professional, to continue with implementation of cleanup activities, mitigation measures, site restoration, and management actions in order to prevent any further discharge of untreated contact water to the environment, including the following actions by 11:59 P.M PST on October 12<sup>th</sup>, 2016:*
  - a. *Cover Landfill areas completely with weighted and secured impermeable cover, and provide sufficient weather protection for the cover in order to ensure its effectiveness;*
  - b. *Maintain, and if necessary construct, appropriate lined ditching and/or other collection and conveyance systems to capture all contact water so it can be managed in accordance with Permit 105809; and*
  - c. *Ensure appropriate contingency measures are in place to manage contact water, including but not limited to, provisions of additional onsite storage capacity and arrangement of backup transport for contact water to other authorized facilities, in the event that this is needed.*
2. *Conduct ongoing inspection and monitoring activities at the site as follows:*
  - a. *Conduct ongoing inspection of landfill cover and contact water collection system as needed to ensure they remain in place and functional, and maintain documentation of inspection activities for review by the Director upon request;*
  - b. *Monitor and sample the quantity (24 hr volume in m<sup>3</sup>/day) and quality of effluent discharged from the settling pond outlet (E292898) on a daily basis when there is a discharge from the settling pond, in accordance with procedures and parameters listed in Permit 105809; and*
  - c. *Estimate the flow of the ephemeral creek immediately downstream of the settling pond outlet (site E305365) daily, and collect a daily water quality sample when there is discharge from the settling pond.*

**Summary of SHA's Observations and Notes Based on Two Site Inspections with SIRM staff during the Fall of 2016**

Since the MoE issued the PPO on October 12<sup>th</sup>, 2016, SHA has completed two site inspections (Inspection Reports included in Appendix A).

SHA's first site inspection was completed on October 24 & 25<sup>th</sup>, 2016 by Scott Garthwaite. During the inspection, SIRM and contractors had recently completed the sand cushion subgrade layer in preparation for the 40mil LLDPE geomembrane liner cap. During the installation of the sand subgrade layer, crest elevations were adjusted to ensure minimum 5% grades to side slopes and crest ditches to minimize ponding water. Crest ditches were also completed to allow collected water to be shed efficiently to the northwest corner of the crest before being conveyed to the lined downchute and onto the quarry floor as non-contact disturbed water. The liner cap system was deployed as pre-fabricated / welded panels (3) which were rolled out and unfolded in





place. All pre-fabricated welded panels were tested in the supplier's shop prior to arrival onsite. The liner panels were then welded against one another and to the existing basal liner, in the field, using both extrusion and wedge welding equipment. Prior to field seam welding SHA witnessed quality control qualification welding and testing using a tensometer to manufactures specifications to ensure both shear and peel strengths values were achieved.

At the end of SHA's inspection, more detailed welding was still required and ongoing by SIRM and their subcontractors.

Attached in Appendix A are the Pre-Fab 40 mil LLDPE Liner QA documents completed by Western Tank and Lining (WTL) for which SHA has reviewed and found acceptable. Additionally, record drawings of the landfill and liner extents is presented in Figure 1 in Appendix B.

SHA's second inspection was completed on November 26<sup>th</sup>, 2016 by Scott Garthwaite and Dr. Tony Sperling. At this time, the landfill cap liner system was considered to be 90% completed with minor tie-in welding to the basal liner and several liner patches outstanding. Weighted tire-chain systems on side slopes were in place to secure the cap liner system as well as around the perimeter of the PEA to ensure no wind uplift would occur. All precipitation falling on the PEA was being shed to crest ditches and downchutes before being discharged to the quarry floor as non-contact disturbed water. Perimeter run-on diversion ditches were adequately diverting any run-on water away from the PEA as non-contact water from undisturbed areas. Leachate collected from within the PEA was being collected in reservoirs and pumped to the contact pond before treatment at the Water Treatment System.

SHA conservatively estimates the capped landfill cell (PEA) is shedding 95% of precipitation. While some welding needs to be completed to the liner system, there are no major defects within the 'non-contact water from disturbed area' collection and conveyance system. The liner system will provide an adequate closure system for the cell for up to approximately five years, with direct exposure to ultra-violet radiation.

SHA outlined tasks that were outstanding before the PEA liner completion could be signed off on, which included:

- Additional detailed welding of patches on the crest, tie-in to the basal liner on East and North toe the PEA and pipe boots for which SHA or a qualified professional must be present;
- 3<sup>rd</sup> Party review of welding detail work and quality assurance and control testing of welded seams; and
- Final inspection / completion report summarizing all PEA work including quality assurance and control testing.

Based on SHA's observations of the current management of surface water, both non-contact disturbed water shed off the PEA and contact water generated as leachate within the PEA, the risk to the receiving / surrounding environment is very low.





**Status of Tasks that Required Immediate Action – Based on MoE's Concerns Outlined in the PPO**

Tasks outlined by MoE in the PPO that required immediate attention are outlined below along with their current status as of January 24<sup>th</sup>, 2017, based on the best of SHA's knowledge:

1. *Cover Landfill areas completely with weighted and secured impermeable cover, and provide sufficient weather protection for the cover in order to ensure its effectiveness.*

The landfill area (PEA) has been successfully capped with 40mil LLDPE Geomembrane including a sand cushion layer below. Minor detail work and a tie in to the basal liner remained to be completed at the time of SHA's last inspection, but the cover system was fully operative. It is SHA's opinion that 95% of the precipitation falling on the PEA is being shed as 'non-contact disturbed water' that is being discharged to the quarry floor where it will drain, by gravity, to the onsite settling pond for testing prior to discharge. The liner system is secured with a series of connected 'tire-chains' on all outer slopes and along the perimeter.

2. *Maintain, and if necessary construct, appropriate lined ditching and/or other collection and conveyance systems to capture all contact water so it can be managed in accordance with Permit 105809;*

SIRM and contractors have constructed lined ditches on the completed PEA to ensure efficient collection and conveyance of precipitation falling on the landfill cell. The 'non-contact disturbed water' is being collected and discharged to the quarry floor where it will drain, by gravity, to the onsite settling pond for testing prior discharge. Perimeter run-on ditching is working well to ensure 'non-contact undisturbed water' is collected and directed away from the PEA. All contact water generating leachate is being collected via leachate collection system at the base of the basal liner and conveyed to the storage reservoirs before being pumped to the contact water pond and treated by the Water Treatment Plant, as per the Permit 105809.

3. *Ensure appropriate contingency measures are in place to manage contact water, including but not limited to, provisions of additional onsite storage capacity and arrangement of backup transport for contact water to other authorized facilities, in the event that this is needed.*

In order to provide contingency measures are in place to manage contact water in large storm events, SIRM constructed an additional contact water lined storage pond near the Water Treatment Plant onsite. The new pond adds approximately 75m<sup>3</sup> of storage capacity for contact water. Additionally, SIRM had mobilized four (4) "Baker Tanks" to deal with additional contact water during storm events while the soil landfill remained uncovered. Each storage tank provided approximately 22,000 gal of storage capacity for a total storage capacity of approximately 88,000 gal. Since the PEA geomembrane cap has been in place as of mid-November, the "Baker Tanks" have been de-mobilized.





Given the effectiveness of the PEA geomembrane system, as outlined previously, SHA feels there is sufficient storage onsite to deal with any leachate produced from within PEA.

4. *Conduct ongoing inspection of landfill cover and contact water collection system as needed to ensure they remain in place and functional, and maintain documentation of inspection activities for review by the Director upon request;*

SHA has not completed additional inspection of the landfill, water collection and conveyance systems for status or functionality since being onsite in late November, 2016. However, SIRM has communicated to SHA that they conduct daily inspections and provide daily email (including holidays) updates to the MoE (AJ Downie) with details and status on the environmental control systems in place.

5. *Monitor and sample the quantity (24 hr volume in m<sup>3</sup>/day) and quality of effluent discharged from the settling pond outlet (site E292898) on a daily basis when there is a discharge from the settling pond, in accordance with procedures and parameters listed in Permit 105809;*

SHA has not been contracted to complete monitoring, sampling and tracking of effluent quality and discharge quantity from the onsite settling pond. However, SIRM has communicated to SHA that they provide daily emails (including holidays) updates to the MoE (AJ Downie) with details on monitoring and sampling data as well as discharge quality and tracking.

6. *Estimate the flow of the ephemeral creek immediately downstream of the settling pond outlet (site E305365) daily, and collect a daily water quality sample when there is discharge from the settling pond.*

SHA has not been contracted to complete estimates of flow in the ephemeral creek downstream of the settling pond outlet on a daily basis and collect daily water quality samples during discharge events. However, SIRM has communicated to SHA that they provide daily emails (including holidays) updates to the MoE (AJ Downie) with details of flow estimates and water quality data from the ephemeral creek downstream of the settling pond.

#### **SHA's Professional Opinion on Risk to the Environment Based on Landfill Current Status**

SIRM (and CHH) need to complete the outstanding detailed liner work on the existing PEA including welding of all patches, tie-in to basal liner, pipe penetration booting as well as re-installing the 'tire-chain' securing system on the crest and side slopes of the 40 mil geomembrane liner cap system at the earliest possible date. Although the geomembrane cap provides full coverage, without completing the remaining detailed risk, there is a risk of small amounts of rain water infiltrating through the membrane.

Given the above-mentioned status of the PEA, SHA feels that the liner cap is shedding at least 95% of all clean precipitation as non-contact disturbed water. With that said, the amount of water being introduced into the landfill, with the potential to generate leachate, is quite minimal.





SPERLING  
HANSEN  
ASSOCIATES

Cobble Hill Landfill

QP Letter Addressing Pollution Prevention Order – File 108608

The existing leachate collection system within the PEA is operating efficiently given the small volumes of leachate being generated now that the cap is in place.

SHA was not involved in the construction or quality assurance inspection/program during the installation of the basal liner for the existing PEA, but has no reason to believe it is not functioning as designed. SIRM has confirmed that they have not seen any water quality data downstream of the PEA that suggests deficiencies or breaches in the basal liner system.

In conclusion, based on the data SHA has reviewed and our observations made onsite, we feel that entry of rainfall into the PEA has been minimized. Once the remaining detail welding is completed there will be low risk that water on the surface of the landfill will come in contact with contaminated material within the landfill and that leachate being produced and collected from within the landfill will continue to be managed properly and will not be introduced to the surrounding / receiving environment given the environmental controls in place.

SHA recommends that the PPO be lifted based on written confirmation from CHH that the existing outstanding work items related to the liner system of PEA be completed at the earliest possible date and that SHA be present to ensure the detailed welding work and quality assurance and quality control liner seams, patches and pipe penetration boot testing be completed to industry standards under supervision of a 3<sup>rd</sup> Party professional.

Response Letter Completed by:

Scott Garthwaite  
Sperling Hansen Associates

Report Reviewed By:

Dr. Tony Sperling, P.Eng.



January 30<sup>th</sup>, 2017

Attached:

Appendix A – WTL QAQC Documents for Landfill Cap Pre-Fabricated Liner Panels

Appendix B – Figure 1 – As-built Drawings of Landfill Liner Extents



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## APPENDICES

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**APPENDIX A**  
**Landfill Liner Cap QAQC Documents for Pre-Fabricated Liner Panels**  
**From Western Tank & Lining Ltd.**

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**SOLMAX****LIST OF GEOMEMBRANE ROLLS**Solmax, 2801 Boul. Marie-Victorin, Yverness, Qc, Canada, J3X 1P7  
Tél: 1-450-929-1234 • Fax: 1-450-929-2547 • www.solmax.comProject Name : F3 JUNEReference Number : 109430Project Number : CP-SML16-3Packing Slip Number : 219280

Roll Number	Product Code	Resin Lot Number	Manufactured Date	Resin Melt Index 190/2.16 g/10 min D1238	Resin Density g/cc D1505	OIT Spec Result min D3295	HPOIT Spec Result min D5885	ESCR SP-NCTL Spec Roll Tested hours D5397
<b>F3 1.00 mm Black Smooth</b>								
2-85287	1054997	CGC811250	13-May-16	0.39	0.918	100 > 120		N/A
2-85288	1054997	CGC811250	13-May-16	0.39	0.918	100 > 120		N/A
2-85289	1054997	CGC811250	13-May-16	0.39	0.918	100 > 120		N/A
2-85291	1054997	CGC811250	14-May-16	0.39	0.918	100 > 120		N/A
2-85292	1054997	CGC811250	14-May-16	0.39	0.918	100 > 120		N/A
2-85293	1054997	CGC811250	14-May-16	0.39	0.918	100 > 120		N/A
2-85295	1054997	CGC811250	14-May-16	0.39	0.918	100 > 120		N/A
2-85296	1054997	CGC811250	14-May-16	0.39	0.918	100 > 120		N/A
2-85297	1054997	CGC811250	14-May-16	0.39	0.918	100 > 120		N/A
2-85299	1054997	CGC811250	14-May-16	0.39	0.918	100 > 120		N/A
2-85300	1054997	CGC811250	14-May-16	0.39	0.918	100 > 120		N/A
2-85301	1054997	CGC811250	14-May-16	0.39	0.918	100 > 120		N/A
2-85302	1054997	CGC811250	14-May-16	0.39	0.918	100 > 120		N/A
2-85303	1054997	CGC811250	14-May-16	0.39	0.918	100 > 120		N/A
2-85304	1054997	CGC811250	14-May-16	0.39	0.918	100 > 120		N/A
2-85305	1054997	CGC811250	14-May-16	0.39	0.918	100 > 120		N/A

Quantity (rolls) : **16**



Project Name : F3 JUNE

Reference Number : 109430

Project Number : CP-SML16-3

Packing Slip Number : 219280

Product : 1054997

F3 1.00 mm Black Smooth



Properties	Thickness average	Geo- membrane Density	Carbon Black Content	Carbon Black Dispersion	Tensile				Tear Resist.	Puncture Resist.	Dimension. Stability	Asperity Height in / out
Unit	mm	g/cc	%	Cat. 1 and 2	Yield Strength	Elong.	Break Strength	Elong.	N	N	%	mm
Test Method	D5199	D1505/D792	D4218 / D1603	D5596	kN/m	%	kN/m	%	D1004	D4833	D1204	
Frequency	Each roll		1/2 ro	1/10 ro					1/5 ro	1/5 ro	Certified	N/A
Specification	0.90	≤ 0.939	2.0 - 3.0	Cat. 1 / Cat. 2			23	800	85	215	± 2	
2-85287 MD XD	0.92	0.929	2.50	10/10 Views			33.6 37.5	1070 1286	93 99	343		/
2-85288 MD XD	0.92	0.929	2.44	10/10 Views			36.0 34.9	1150 1180	93 99	343		/
2-85289 MD XD	0.93	0.929	2.44	10/10 Views			36.1 34.9	1150 1180	96 103	342		/
2-85291 MD XD	0.91	0.929	2.48	10/10 Views			37.7 36.6	1213 1270	96 103	342		/
2-85292 MD XD	0.91	0.929	2.41	10/10 Views			36.5 35.9	1214 1251	96 103	342		/
2-85293 MD XD	0.91	0.929	2.41	10/10 Views			36.6 35.9	1214 1251	96 103	342		/
2-85295 MD XD	0.92	0.926	2.61	10/10 Views			33.6 35.7	1085 1236	101 101	350		/
2-85296 MD XD	0.90	0.926	2.50	10/10 Views			35.2 36.7	1168 1259	101 101	350		/
2-85297 MD XD	0.91	0.926	2.50	10/10 Views			35.2 36.8	1168 1259	101 101	350		/
2-85299 MD XD	0.92	0.926	2.55	10/10 Views			35.0 35.2	1167 1243	93 101	349		/
2-85300 MD XD	0.92	0.926	2.51	10/10 Views			37.4 33.3	1209 1088	93 101	350		/
2-85301 MD XD	0.91	0.926	2.51	10/10 Views			37.3 33.3	1209 1088	93 101	350		/
2-85302 MD XD	0.91	0.926	2.59	10/10 Views			34.9 33.3	1197 1141	92 97	336		/
2-85303 MD XD	0.91	0.926	2.59	10/10 Views			34.9 33.3	1197 1141	92 97	336		/
2-85304 MD XD	0.92	0.926	2.40	10/10 Views			36.0 33.2	1163 1213	92 97	336		/
2-85385 MD XD	0.92	0.926	2.40	10/10 Views			36.1 33.3	1163 1213	92 97	336		/



**SOLMAX****LIST OF GEOMEMBRANE ROLLS**Solmax, 2801 Boul. Marie-Victorin, Varennes, Qc, Canada, J3X 1P7  
Tél.: 1-450-929-1234 • Fax: 1-450-929-2547 • www.solmax.comProject Name : F3 Stock - Abbotsford, BCReference Number : 109683Project Number : CP-SML16-5Packing Slip Number : 220104

Roll Number	Product Code	Resin Lot Number	Manufactured Date	Resin Melt Index 190/2.16 g/10 min D1238	Resin Density g/cc D1505	OT Spec Result min D3895	HPOIT Spec Result min D5885	ESCR SP-NCTL Spec Roll Tested hours D5397
<u>F3 1.00 mm Black Smooth</u>								
2-86685	1054997	CGE810400	29-Aug-16	0.34	0.919	100 > 120		N/A
2-86686	1054997	CGE810400	29-Aug-16	0.34	0.919	100 > 120		N/A
2-86687	1054997	CGE810400	29-Aug-16	0.34	0.919	100 > 120		N/A
2-86688	1054997	CGE810400	29-Aug-16	0.34	0.919	100 > 120		N/A
2-86689	1054997	CGE810400	29-Aug-16	0.34	0.919	100 > 120		N/A
2-86690	1054997	CGE810400	29-Aug-16	0.34	0.919	100 > 120		N/A
2-86691	1054997	CGE810400	29-Aug-16	0.34	0.919	100 > 120		N/A
2-86692	1054997	CGE810400	29-Aug-16	0.34	0.919	100 > 120		N/A
2-86694	1054997	CGE810400	29-Aug-16	0.34	0.919	100 > 120		N/A
2-86695	1054997	CGE810400	29-Aug-16	0.34	0.919	100 > 120		N/A
2-86700	1054997	CGE810400	29-Aug-16	0.34	0.919	100 > 120		N/A
2-86705	1054997	CGG810560	30-Aug-16	0.36	0.919	100 > 120		N/A
2-86706	1054997	CGE810410	30-Aug-16	0.34	0.919	100 > 120		N/A
2-86707	1054997	CGE810410	30-Aug-16	0.34	0.919	100 > 120		N/A
2-86709	1054997	CGE810410	30-Aug-16	0.34	0.919	100 > 120		N/A
2-86710	1054997	CGE810410	30-Aug-16	0.34	0.919	100 > 120		N/A

Quantity (rolls) : **16**

Solmax is not a design professional and has not performed any design services to determine if Solmax's goods comply with any project plans or specifications, or with the application or use of Solmax's goods to any particular system, project, purpose, installation or specification.



Solmax, 2801 Boul. Marie-Victorin, Varennes, Qc, Canada, J3X 1P7  
 Tél.: 1-450-929-1234 - Fax.: 1-450-929-2547 - www.solmax.com

Project Name : F3 Stock - Abbotsford, BC

Reference Number : 109683

Project Number : CP-SML16-5

Packing Slip Number : 220104

Product : 1054997

F3 1.00 mm Black Smooth



Properties	Thickness average	Geo-membrane Density	Carbon Black Content	Carbon Black Dispersion	Tensile				Tear Resist.	Puncture Resist.	Dimensional Stability	Asperity Height in / out
Unit	mm	g/cc	%	Cat. 1 and 2	Yield Strength	Elong.	Break Strength	Elong.	N	N	%	mm
Test Method	D5199	D1505/D792	D4218 / D1603	D5596	kN/m	%	kN/m	%	D1004	D4833	D1204	
Frequency	Each roll		1/2 ro	1/10 ro	D6693				1/5 ro	1/5 ro	Certied	N/A
Specification	0.90	≤ 0.939	2.0 - 3.0	Cat. 1 / Cat. 2			23	800	85	215	± 2	
2-86685 MD XD	0.93	0.931	2.45	10 /10 Views			34.1 35.9	898 977	107 113	367		/
2-86686 MD XD	0.96	0.931	2.45	10 /10 Views			34.1 35.9	898 977	107 113	367		/
2-86687 MD XD	0.93	0.931	2.33	10 /10 Views			35.6 36.9	1235 1187	107 113	367		/
2-86688 MD XD	0.92	0.931	2.33	10 /10 Views			35.6 37.0	1235 1187	107 113	367		/
2-86689 MD XD	0.92	0.931	2.88	10 /10 Views			34.9 34.4	1064 1162	107 113	367		/
2-86690 MD XD	0.95	0.931	2.79	10 /10 Views			34.9 34.5	1064 1162	104 109	383		/
2-86691 MD XD	0.95	0.931	2.84	10 /10 Views			35.2 35.7	1091 1137	104 109	383		/
2-86692 MD XD	0.93	0.931	2.84	10 /10 Views			35.2 35.7	1091 1137	104 109	383		/
2-86694 MD XD	0.91	0.931	2.76	10 /10 Views			36.1 35.9	1133 1175	104 109	383		/
2-86695 MD XD	0.93	0.932	2.75	10 /10 Views			34.0 30.6	970 923	99 109	375		/
2-86700 MD XD	0.91	0.932	2.71	10 /10 Views			32.0 35.6	1013 1118	97 102	363		/
2-86705 MD XD	0.91	0.932	2.76	10 /10 Views			34.8 32.6	1029 1031	99 104	366		/
2-86706 MD XD	0.91	0.932	2.76	10 /10 Views			34.9 32.6	1029 1031	99 104	366		/
2-86707 MD XD	0.91	0.932	2.55	10 /10 Views			36.4 33.5	1158 1081	99 104	366		/
2-86709 MD XD	0.91	0.932	2.66	10 /10 Views			35.4 35.0	1115 1180	99 104	366		/
2-86710 MD XD	0.92	0.932	2.66	10 /10 Views			35.4 35.0	1115 1180	98 104	379		/

Solmax is not a design professional and has not performed any design services to determine if Solmax's goods comply with any project plans or specifications, or with the application or use of Solmax's goods to any particular system, project, purpose, installation or specification.



# Wedge/Extrusion Trial

1



12180 Vickers Way  
Richmond BC V6V-1H9

Office 604.241.9487 Fax 604.241.9485

Toll-Free 1.800.551.4355

Customer: WESTERN TANK PD # AS-BCS

Production Date: 2016-10-20 Time: 7:20 PM

QA Test Person: s.22 W./O. WO-003899

Welding Tech: s.22 Crew: s.22

Welder Qualification For Liners: 1 Time Ending:

size expressed in decimal feet

Material Type:	40MIL LLDPE 140-7000	Liner Size:	Length	Width	Style
			114	330	STP LNR

Welder Number:	D-11	Outside Temp:	53
Welder Set Temp:	860	Inside Temp:	55
Welder Set Speed:	999 Timed FPM 19	Sheet Temp:	53
Extrusion Rod:	N	Welder Set up with bar Y/N	N

## Peel Data

test speed is 20 in/min unless otherwise noted

	Inside (Lbs)	Outside (Lbs)	Failure Type	Seperation (%)	Comments
1	71	65	SE1	0	PASS
2	71	64	SE1	0	PASS
3	69	68	SE1	0	PASS
4	66	66	SE1	0	PASS
5	71	74	SE1	0	PASS

## Shear Data

	Shear (Lbs)	Elongation (%)	Comments
1	82	200+%	STE/PASS
2	79	200+%	STE/PASS
3	81	200+	STE/PASS
4	80	200+	STE/PASS
5	81	200+	STE/PASS

Notes: Tear Back Results on Sample Weld: GOOD

STE = sample stretch to end of test  
SE1 = sample break in outer edge of seam

SE2= break at seam edge top sheet (extrusion shear only)  
SE3= break at seam edge in bottom sheet (extrusion peel only)



# Seam End Coupon Log

1



**WESTERN TANK  
& LINING LTD.**

12180 Vickers Way  
Richmond Bc V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4355

test speed is 20 in/min unless otherwise noted

Customer:	WESTERN TANK		PO#	AS-BCS
Production Date:	2016-10-20	Crew:	s.22	
Welder #	D-11	Operator	s.22	
Welder Settings		Temp/Speed	860/889	
Distance in feet	22.3	Timed Sec.	72	Feet per min. 19
QA Test Person:	s.22	W./O.	WO-003899	
Material Type:	ADMIL LLDPE 140-7000			
Size in inches ft.	Length	Width	Style	
Liner Size:	114	330	STP LNR	Liner # 1

Seam Number	Test #	Inside (Lbs)	Outside (Lbs)	Failure Type	Separation (%)	Shear (Lbs)	Elongation (%)	Comments	Seam Number
W1	P1/S1	67	67	SE1	0	77	200+	STE/PASS	W9
W1	P2/S2	61	61	SE1	0	72	200+	STE/PASS	W9
W2	P1/S1	63	61	SE1	0	72	200+	STE/PASS	W10
W2	P2/S2	62	61	SE1	0	70	200+	STE/PASS	W10
W3	P1/S1	67	62	SE1	0	73	200+	STE/PASS	W11
W3	P2/S2	61	63	SE1	0	71	200+	STE/PASS	W11
W4	P1/S1	63	64	SE1	0	71	200+	STE/PASS	W12
W4	P2/S2	62	60	SE1	0	74	200+	STE/PASS	W12
W5	P1/S1	62	63	SE1	0	76	200+	STE/PASS	W13
W5	P2/S2	60	60	SE1	0	72	200+	STE/PASS	W13
W6	P1/S1	66	60	SE1	0	72	200+	STE/PASS	W14
W6	P2/S2	64	62	SE1	0	70	200+	STE/PASS	W14
W7	P1/S1	63	62	SE1	0	73	200+	STE/PASS	W15
W7	P2/S2	65	63	SE1	0	71	200+	STE/PASS	W15
W8	P1/S1	60	59	SE1	0	69	200+	STE/PASS	
W8	P2/S2	56	57	SE1	0	67	200+	STE/PASS	

Notes:

Notes:

STE = sample stretch to end of test

SE1 = sample break in outer edge of seam

Pull Checks (non-destructive seam lip pulls)

GOOD

STE = sample st



## Seam End Coupon Log



**WESTERN TANK  
& LINING LTD.**

12180 Vickers Way  
Richmond Bc V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4355

Test speed is 20 in/min unless otherwise noted

Customer:	WESTERN TANK		PO#	AS-BCS
Production Date:	2016-10-20	Crew:	s.22	
Welder #	D-11	Operator	s.22	Temp/Speed 860/599
Distance in feet	22.3	Timed Sec.	72	Feet per min. 19
QA Test Person:	s.22	W./O.	WO-003899	
Material Type:	40MIL LLDPE 140-7000			
Size in dec. ft.	Length	Width	Style	
Liner Size:	114	330	STP LNR	Liner # 1

Test #	Inside (lbs)	Outside (lbs)	Failure Type	Separation (%)	Shear (lbs)	Elongation (%)	Comments
P1/S1	67	63	SE1	0	75	200+	STE/PASS
P2/S2	61	61	SE1	0	76	200+	STE/PASS
P1/S1	65	64	SE1	0	76	200+	STE/PASS
P2/S2	59	63	SE1	0	76	200+	STE/PASS
P1/S1	63	62	SE1	0	73	200+	STE/PASS
P2/S2	64	72	SE1	0	70	200+	STE/PASS
P1/S1	67	66	SE1	0	78	200+	STE/PASS
P2/S2	66	68	SE1	0	76	200+	STE/PASS
P1/S1	61	68	SE1	0	78	200+	STE/PASS
P2/S2	63	64	SE1	0	84	200+	STE/PASS
P1/S1	66	65	SE1	0	74	200+	STE/PASS
P2/S2	64	64	SE1	0	70	200+	STE/PASS
P1/S1	62	64	SE1	0	74	200+	STE/PASS
P2/S2	62	63	SE1	0	70	200+	STE/PASS

stretch to end of test

SE1 = sample break in outer edge of seam

Pull Checks (non-destructive seam tip pulls)

GOOD





WESTERN TANK  
& LINING LTD.

12180 Vickers Way  
Richmond BC V6V-1H9  
Office 604.241.9487 Fax 604.241.5485  
Toll-Free 1.800.551.4355

## ASTM D 5199 MATERIAL THICKNESS LLDPE

Date MFG date	Mil Mfg	Roll ID #	Roll Width measured	sample area	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	Avg.	QA
10/20/16 8/29/16	40MIL LLDPE SOLMAX	2-86695	22.3	B	39.9	40	36.7	38.6	37.7	38	36.8	37.8	39.9	37.6	38.3	s.22
10/20/16 8/29/16	40MIL LLDPE SOLMAX	2-86691	22.3	B	39.2	38.4	38.2	38.9	35.8	37	43.6	41.3	37.5	37.1	38.8	s.22
10/20/16 8/30/16	40MIL LLDPE SOLMAX	2-86709	22.3	B	38.1	42.4	37.8	36.3	36.5	38.9	38.3	36.9	35.1	36.9	37.82	s.22



# Liner Quality Control Audit

1

Inspector	s.22	Crew	s.22	Date	2016-10-20
Work Order # WO-003899			Size / Style	Length 114	Width 330
				Style STP LNR	

PO#	AS-BCS	Customer	WESTERN TANK	Liner #	1
-----	--------	----------	--------------	---------	---

Width Calculator (enter for size ordered) Sizes are expressed in Decimal feet																	
Liner Length (feet)	Liner width (Feet)	Roll Width (Inches)	Weld Width overlap (Inches)	Calculated Panels Needed	Even Panel no. (rounded up)	Total Width of Even Panels (Feet)	Actual Panel Count, added or subtracted material width ex: 8 panels + 2', +2' or 9 panels -11' (welds subtracted shown in actual width)										
114	330	267	6	15.17241	15	326.75	-4.5' + 5'										
1st panel length verification size/persons					Finished Length	330	Actual Width OK TK 327.25										
Stepped Panel lengths 47'3",56'2",65'6",75'2",75'2",90'8",105'9",114'8",113'3",111'8",109'3",106'97'7",86'9",75'7",65																	
Step inset 9'1",9'4",10'4",15'6",15'1",9'2",1'5"2'5",2'5",3'3",9'7",11'2",11'2",10'7"																	
Secondary measurements (cut welds) 3 CUT WELDS 3RD,4TH & 5TH PANEL DUE TO WRONG PANEL SIZE																	
ADDED 5' PIECE OF MATERIAL.																	
Cross welds: NA				Inspected by: NA													
Seam lip pull checks (non-destructive)				GOOD													
Special Instructions				NA													
<table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">Material 40MIL LLDPE BB 140-7000 SOLMAX</td> <td style="width: 50%;">Color Out BLACK</td> </tr> <tr> <td style="text-align: center;">Rolling</td> <td style="text-align: center;">Folding</td> </tr> <tr> <td>Standard Roll</td> <td>Standard Fan</td> </tr> <tr> <td>Standard Roll with Webbing</td> <td>Butterfly Fold</td> </tr> <tr> <td>Scroll Rolled center mark W/Webbing</td> <td>Fan Fold to center 2" web markers</td> </tr> </table>								Material 40MIL LLDPE BB 140-7000 SOLMAX	Color Out BLACK	Rolling	Folding	Standard Roll	Standard Fan	Standard Roll with Webbing	Butterfly Fold	Scroll Rolled center mark W/Webbing	Fan Fold to center 2" web markers
Material 40MIL LLDPE BB 140-7000 SOLMAX	Color Out BLACK																
Rolling	Folding																
Standard Roll	Standard Fan																
Standard Roll with Webbing	Butterfly Fold																
Scroll Rolled center mark W/Webbing	Fan Fold to center 2" web markers																
Core Type Used:		Metal <input checked="" type="checkbox"/>	Cardboard <input type="checkbox"/>	Other <input type="checkbox"/>													
(Standard = mil, size, unroll and unfold arrow)																	
Standard Information Written on Item <input checked="" type="checkbox"/>				Other:													
Packaging Wrap/ Color : Standard Liner <input checked="" type="checkbox"/>				Other: FELT,LLDPE,5X12MIL WRAP/WHITE													
Standard Package Labeling <input checked="" type="checkbox"/>				Other:													
Notes																	



# Liner Quality Control Audit

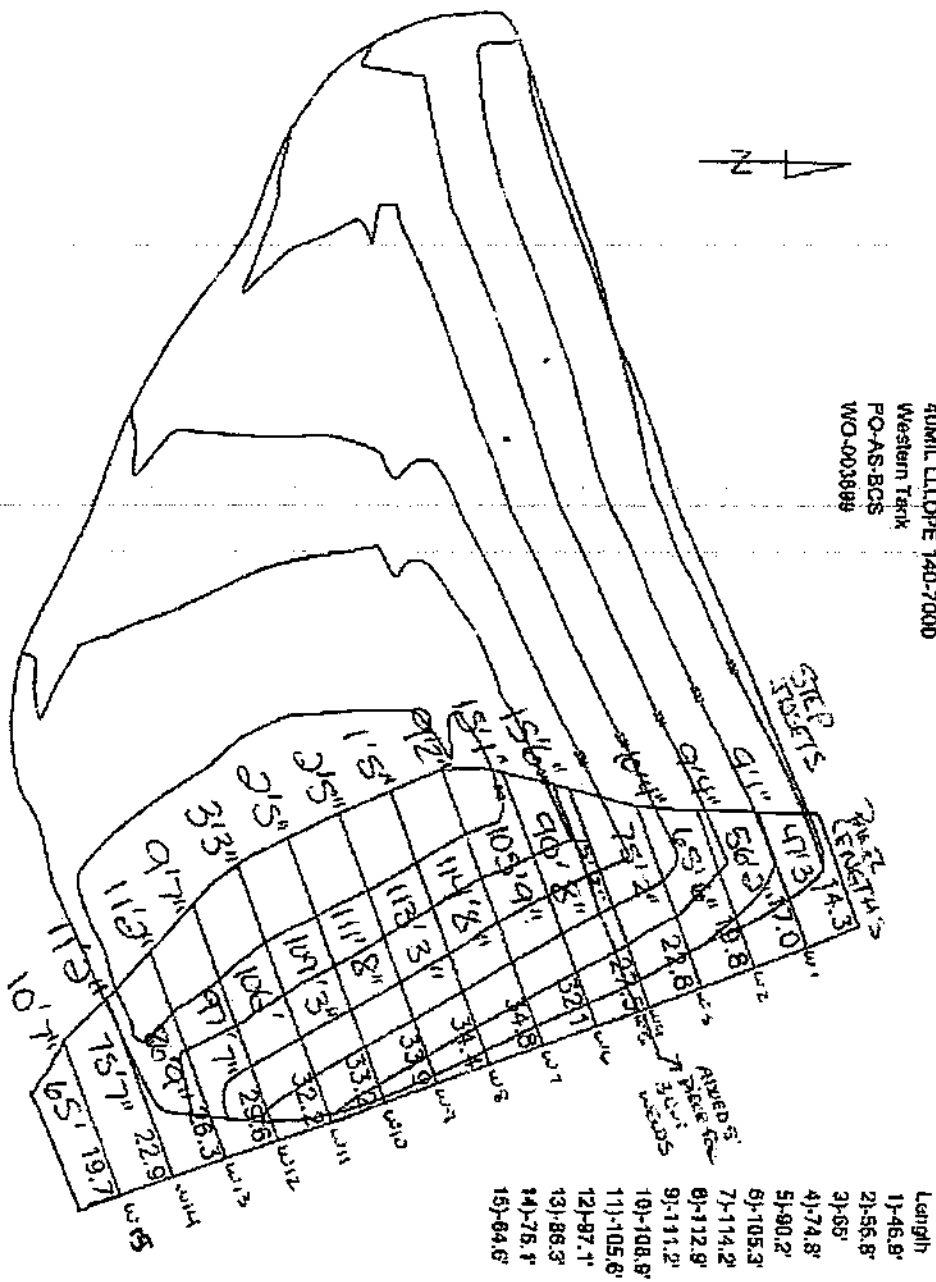
---

2



47

**Width - 330"**



### SIRM PEA Proposed East Liner Elevations and Distances are in Meters



# Wedge/Extrusion Trial

1



**WESTERN TANK  
& LINING LTD.**

12180 Vickers Way  
Richmond BC V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4355

Customer: **WESTERN TANK** PO # **AS-BCS**  
Production Date: **2016-10-20** Time: **12:35 AM**  
QA Test Person: **s.22** W./O. **WO-003900**  
Welding Tech: **s.22** Crew: **s.22**

Welder Qualification For Liners: **1** Time Ending: **size expressed in decimal feet**  
Material Type: **40MIL LLDPE 140-7000** Liner Size: **Length Width Style**  
**140 396 STP LNR**

Welder Number: **D-11** Outside Temp: **44**  
Welder Set Temp: **860** Inside Temp: **50**  
Welder Set Speed: **999 Timed FPM 18** Sheet Temp: **45**  
Extrusion Rod: **N** Welder Set up with bar Y/N **N**

## Peel Data

test speed is 20 in/min unless otherwise noted

	Inside (lbs)	Outside (lbs)	Failure Type	Seperation (%)	Comments
1	70	66	SE1	0	PASS
2	68	63	SE1	0	PASS
3	70	68	SE1	0	PASS
4	65	66	SE1	0	PASS
5	69	65	SE1	0	PASS

## Shear Data

	Shear (lbs)	Elongation (%)	Comments
1	72	200+%	PASS/STE
2	70	200+%	PASS/STE
3	81	200+	PASS/STE
4	78	200+	PASS/STE
5	80	200+	PASS/STE

Notes: **Tear Back Results on Sample Weld: GOOD**

STE = sample stretch to end of test  
SE1 = sample break in outer edge of seam

SE2= break at seam edge top sheet (extrusion shear only)  
SE3= break at seam edge in bottom sheet (extrusion peel only)



# Wedge/Extrusion Trial

2



**WESTERN TANK  
& LINING LTD.**

12180 Vickers Way  
Richmond BC V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4355

Customer: WESTERN TANK PO # AS-BCS  
Production Date: 2016-10-20 Time: 3:30 AM  
QA Test Person: s.22 W./O. WO-003900  
Welding Tech: s.22 Crew: s.22

Welder Qualification For Liners: 1 Time Ending: \_\_\_\_\_

Material Type: 40MIL LLDPE 140-7000 Liner Size: 140 396 STP LNR  
*size expressed in decimal feet*  
Length Width Style

Welder Number: EXTRUSION Outside Temp: 40  
Welder Set Temp: PREHEAT 44/PLASTIC 425 Inside Temp: 50  
Welder Set Speed: NA Timed FPM NA Sheet Temp: 42  
Extrusion Rod: SOLMAX LL Welder Set up with bar Y/N N

## Peel Data

*test speed is 20 in/min unless otherwise noted*

	Inside (Lbs)	Outside (Lbs)	Failure Type	Seperation (%)	Comments
1	69	0	SE1	0	PASS
2	72	0	SE1	0	PASS
3	62	0	SE1	0	PASS
4	59	0	SE1	0	PASS
5	75	0	SE1	0	PASS

## Shear Data

	Shear (Lbs)	Elongation (%)	Comments
1	67	200+%	PASS/STE
2	67	200+%	PASS/STE
3	68	200+	PASS/STE
4	65	200+	PASS/STE
5	71	200+	PASS/STE

Notes: Tear Back Results on Sample Weld: NA

STE = sample stretch to end of test  
SE1 = sample break in outer edge of seam

SE2= break at seam edge top sheet (extrusion shear only)  
SE3= break at seam edge in bottom sheet (extrusion peel only)



# Wedge/Extrusion Trial

3



**WESTERN TANK  
& LINING LTD.**

12180 Vickers Way  
Richmond BC V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4355

Customer: **WESTERN TANK** PO # **AS-BCS**

Production Date: **2016-10-20** Time: **3:40 AM**

QA Test Person: **s.22** W./O. **WO-003900**

Welding Tech: **s.22** Crew: **s.22**

Welder Qualification For Liners: **1** Time Ending:

*size expressed in decimal feet*

Material Type:	40MIL LLDPE 140-7000	Liner Size:	Length	Width	Style
			140	396	STP LNR

Welder Number:	W-7	Outside Temp:	40
Welder Set Temp:	820	Inside Temp:	50
Welder Set Speed:	999 <i>Timed FPM</i> 16	Sheet Temp:	42
Extrusion Rod:	N	Welder Set up with bar Y/N	N

## Peel Data

*test speed is 20 in/min unless otherwise noted*

	Inside (Lbs)	Outside (Lbs)	Failure Type	Seperation (%)	Comments
1	67	69	SE1	0	PASS
2	62	68	SE1	0	PASS
3	67	68	SE1	0	PASS
4	68	63	SE1	0	PASS
5	68	67	SE1	0	PASS

## Shear Data

	Shear (Lbs)	Elongation (%)	Comments
1	73	200+%	PASS/STE
2	68	200+%	PASS/STE
3	69	200+	PASS/STE
4	68	200+	PASS/STE
5	61	200+	PASS/STE

Notes: **Tear Back Results on Sample Weld: GOOD**

STE = sample stretch to end of test  
SE1 = sample break in outer edge of seam

SE2= break at seam edge top sheet (extrusion shear only)  
SE3= break at seam edge in bottom sheet (extrusion peel only)





12180 Vickers Way  
Richmond Bc V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4355

test noted is 20 lb/in unless otherwise noted

## Seam End Coupon Log

1

Customer:	WESTERN TANK		PO#	AS-BCS
Production Date:	2016-10-20	Crew:	s.22	
Welder #	D-11	Operator	s.22	Temp/Speed
		860/399		
Distance in feet	22.3	Timed Sec.	74	Feet per min.
		18		
QA Test Person:	s.22	W./O.	WD-003900	
Material Type:	40MIL LLOPE BB 140-7000 SOLMAX			
Liner Size:	140	396	STP LNR	Liner #
		1		

Seam Number	Test # P# / S#	Inside (Lbs)	Outside (Lbs)	Failure Type	Separation (%)	Shear (Lbs)	Elongation (%)	Comments	Seam Number
W1	P1/S1	70	67	SE1	0	76	200+	STE/PASS	W9
W1	P2/S2	63	64	SE1	0	75	200+	STE/PASS	W9
W2	P1/S1	68	61	SE1	0	72	200+	STE/PASS	W10
W2	P2/S2	65	60	SE1	0	73	200+	STE/PASS	W10
W3	P1/S1	65	62	SE1	0	72	200+	STE/PASS	W11
W3	P2/S2	62	61	SE1	0	73	200+	STE/PASS	W11
W4	P1/S1	64	63	SE1	0	74	200+	STE/PASS	W12
W4	P2/S2	66	60	SE1	0	77	200+	STE/PASS	W12
W5	P1/S1	63	65	SE1	0	74	200+	STE/PASS	W13
W5	P2/S2	61	60	SE1	0	72	200+	STE/PASS	W13
W6	P1/S1	65	59	SE1	0	73	200+	STE/PASS	W14
W6	P2/S2	60	58	SE1	0	72	200+	STE/PASS	W14
W7	P1/S1	59	64	SE1	0	69	200+	STE/PASS	W15
W7	P2/S2	56	63	SE1	0	71	200+	STE/PASS	W15
W8	P1/S1	64	60	SE1	0	68	200+	STE/PASS	W16
W8	P2/S2	57	57	SE1	0	67	200+	STE/PASS	W16

Notes:

Notes:

STE = sample stretch to end of test

SE1 = sample break in outer edge of seam

Pull Checks (non-destructive seam lap pulls)

GOOD

STE = sample st



## Seam End Coupon Log



**WESTERN TANK  
& LINING LTD.**

12180 Vickers Way  
Richmond Bc V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4853

test speed is 20 in/min unless otherwise noted

Customer:	WESTERN TANK		PQ#	AS-BCS
Production Date:	2016-10-20	Crew:	s.22	
Welder #	D-11/D-7	Operator	s.22	Temp/Speed 850/999/820/999
Distance in feet	22.3	Timed Sec	74	Feet per min. 18
QA Test Person:	s.22	W/O.	WO-003900	
Material Type:	40MIL LLDPE 88' 140-7000 SOLMAX			
Liner Size:	140	396	STP LNR	Liner # 1

Test # P# / S#	Inside (lbs)	Outside (lbs)	Failure Type	Separation (%)	Shear (lbs)	Elongation (%)	Comments
P1/S1	67	63	SE1	0	72	200+	STE/PASS
P2/S2	58	62	SE1	0	72	200+	STE/PASS
P1/S1	63	61	SE1	0	70	200+	STE/PASS
P2/S2	59	59	SE1	0	71	200+	STE/PASS
P1/S1	66	65	SE1	0	71	200+	STE/PASS
P2/S2	60	65	SE1	0	72	200+	STE/PASS
P1/S1	61	63	SE1	0	72	200+	STE/PASS
P2/S2	63	61	SE1	0	73	200+	STE/PASS
P1/S1	63	61	SE1	0	70	200+	STE/PASS
P2/S2	58	60	SE1	0	72	200+	STE/PASS
P1/S1	68	65	SE1	0	73	200+	STE/PASS
P2/S2	63	65	SE1	0	74	200+	STE/PASS
P1/S1	68	64	SE1	0	76	200+	STE/PASS
P2/S2	65	63	SE1	0	72	200+	STE/PASS
P1/S1	67	65	SE1	0	72	200+	STE/PASS
P2/S2	69	68	SE1	0	79	200+	STE/PASS

W9-W13 IS FREDDY

W14-W16 IS PAUL

stretch to end of test

SE1 = sample break in outer edge of seam

Pull Checks (non-destructive seam lip pulls)

GOOD



in



12180 Vickers Way  
Richmond Bc V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4355

test speed is 7E k/min unless otherwise noted

Customer:	WESTERN TANK		PO#	AS-BCS
Production Date:	2016-10-20	Crew:	s.22	
Welder Settings				
Welder #	D-7	Operator	s.22	Temp/Speed 820/999
Timed welder speed				
Distance in feet	22.3	Timed Sec	82	Feet per min. 16
QA Test Person:	s.22	W.J.O.	WO-003900	
Material Type:	40MIL LLDPE BB 140-7000 SOLMAX			
size in dec. ft.	Length	Width	Style	
Liner Size:	140	396	STP LNR	Liner # 1

[illegible]

**Notes:**

STE = sample stretch to end of test

SEI = sample break in outer edge of seam

**Pull Checks (non-destructive seam lip pulls)**

**GOOD**





WESTERN TANK  
& LINING LTD.

## ASTM D 5199 MATERIAL THICKNESS LLDPE

12180 Vickers Way  
Richmond BC V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-free 1.800.551.4355

Date MFG date	Mil Mfg	Roll ID #	Roll Width measured	sample area	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	Avg.	QA
10/20/16 8/30/16	40MIL LLDPE SOLMAX	2-86709	22.3	B	38.1	42.4	37.8	36.3	36.5	38.9	38.3	36.9	36.1	36.9	37.82	s.22
10/20/16 8/29/16	40MIL LLDPE SOLMAX	2-86694	22.3	B	36.3	38.8	39.4	39.1	38	35.1	38	37.2	38.9	38.6	37.94	s.22
10/20/16 8/29/16	40MIL LLDPE SOLMAX	2-86690	22.3	M	42.2	43.1	39.7	36.7	38.6	38.8	41.3	39.3	39.8	44.8	40.43	s.22
10/20/16 8/29/16	40MIL LLDPE SOLMAX	2-86685	22.3	B	40.4	37.4	36.6	39.8	36.6	38.8	42.5	37.3	38.1	38.9	38.64	s.22



# Liner Quality Control Audit

1

Inspector	s.22	Crew	s.22	Date	2016-10-20
Work Order #	WO-003900	Size / Style	Length 140	Width 396	Style STP LNR
PO#	AS-BCS	Customer	WESTERN TANK	Liner #	1

Width Calculator (enter for size ordered) Sizes are expressed in Decimal feet							
Liner Length (feet)	Liner width (Feet)	Roll Width (Inches)	Weld Width overlap (Inches)	Calculated Panels Needed	Even Panel no. (rounded up)	Total Width of Even Panels (Feet)	Actual Panel Count, added or subtracted material width ex: 8 panels + 2', +2' or 9 panels -11' (welds subtracted shown in actual width)
140	396	267	6	18.2069	18	392	-3' +3'
1st panel length verification size/persons					Finished Length	140	Actual Width OK TK 392
Stepped Panel lengths 33'2",85'1",124'1",139',140'10",140'2",139'10",138',138',131'8",122'10",111'3",105',100'1",95'7",82'6",74',68'3",59'1"							
Step inset 52'1",39',15'1",1'10",8",1'8",1'10",7'8",9'10",11'7",6'3",5'1",5'6",13'1",8'6",6'3",9'2"							
Secondary measurements (cut welds) 2 CUT WELDS CUT OUT PANEL #7 DUE TO WRONG PULL LENGTH/ADDED 3' PIECE OF MATERIAL							
Cross welds: 3 CROSSWELDS BETWEEN W6 & W7,W14 & W15, W16 & W17/EXTRUSION WELD DONE Inspected by: TK							
Seam lip pull checks (non-destructive) GOOD							
Special Instructions NA							
Material 40MIL LLDPE BB 140-7000 SOLMAX Color Out BLACK							
Rolling				Folding			
Standard Roll				Standard Fan X			
Standard Roll with Webbing				Butterfly Fold			
Scroll Rolled center mark W/Webbing				Fan Fold to center 2" web markers			
Core Type Used: Metal X Cardboard Other							
(Standard = mil, size, unroll and unfold arrow)							
Standard Information Written on Item X Other:							
Packaging Wrap/ Color : Standard Liner X Other: FELT,LLDPE,5X12MIL WRAP/WHITE							
Standard Package Labeling X Other:							
Notes							



# Liner Quality Control Audit

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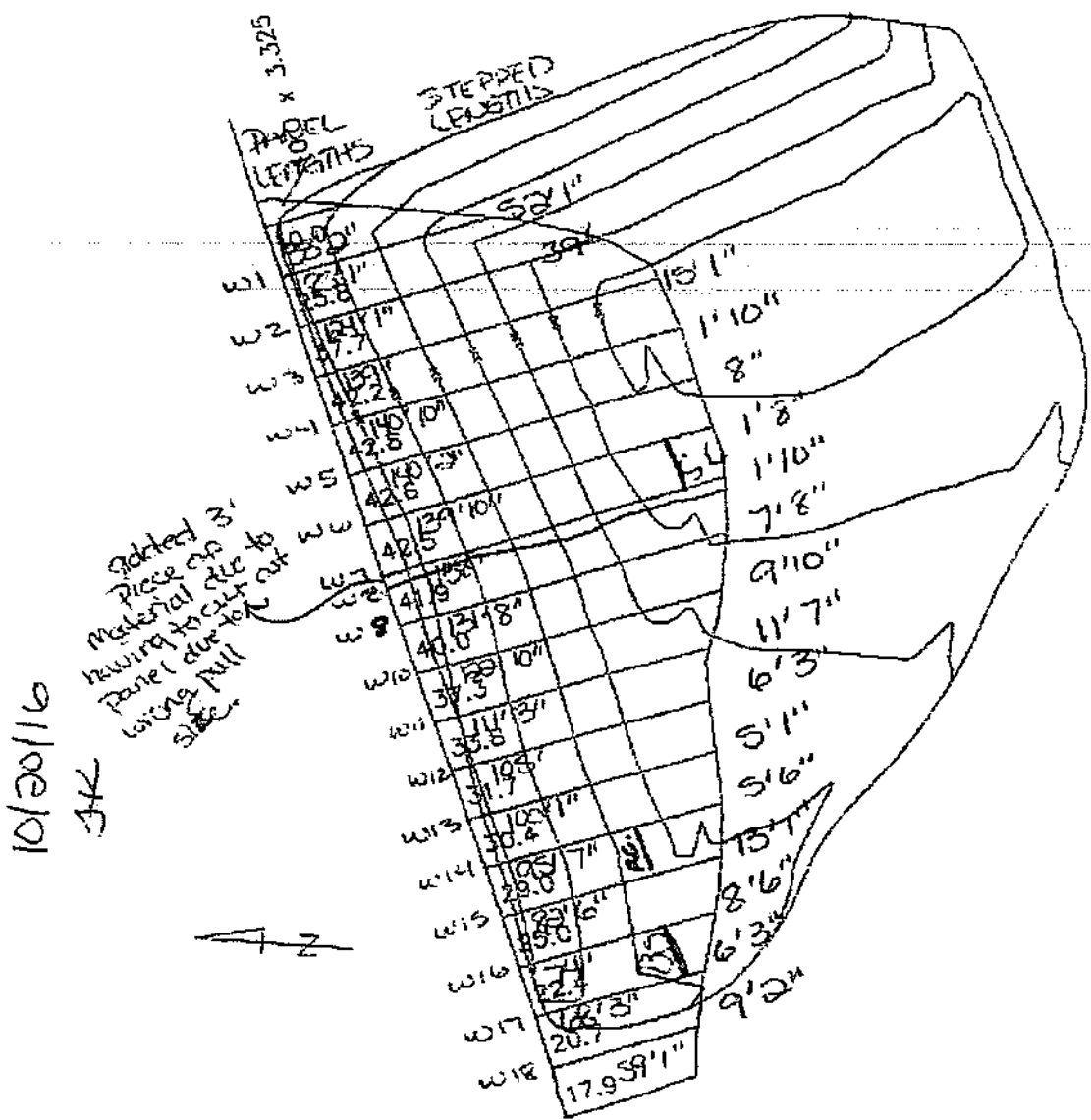
2



#1

10/20/16  
 Western Tank  
 W-003900  
 40MIL LLDPE 140-7000  
 Width: 395"

- Length
- 1)- 32.8'
  - 2)- 84.7'
  - 3)- 123.7'
  - 4)- 138.5'
  - 5)- 140.4'
  - 6)- 130.8'
  - 7)- 139.4'
  - 8)- 137.5'
  - 9)- 131.2'
  - 10)- 122.4'
  - 11)- 110.9'
  - 12)- 104.5'
  - 13)- 99.7'
  - 14)- 95.1'
  - 15)- 82'
  - 16)- 73.5'
  - 17)- 67.9'
  - 18)- 58.7'



SRM PEA Proposed North Liner  
 Elevations and Distances are in Meters



# Wedge/Extrusion Trial

1



12180 Vickers Way  
Richmond BC V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4355

Customer: WESTERN TANK PO # AS-BCS  
Production Date: 2016-10-20 Time: 7:20PM  
QA Test Person: s.22 W./O. WO-003901  
Welding Tech: s.22 Crew: s.22

Welder Qualification For Liners: 1 Time Ending:

Material Type: 40MIL LLDPE 1400-7000 Liner Size: 

size expressed in decimal feet		
Length	Width	Style
190	181	STP LNR

Welder Number: D-7 Outside Temp: 53  
Welder Set Temp: 820 Inside Temp: 55  
Welder Set Speed: 999 Timed FPM 17 Sheet Temp: 53  
Extrusion Rod: N Welder Set up with bar Y/N N

## Peel Data

test speed is 20 in/min unless otherwise noted

	Inside (Lbs)	Outside (Lbs)	Failure Type	Seperation (%)	Comments
1	73	70	SE1	0	PASS
2	60	72	SE1	0	PASS
3	68	71	SE1	0	PASS
4	68	72	SE1	0	PASS
5	71	73	SE1	0	PASS

## Shear Data

	Shear (Lbs)	Elongation (%)	Comments
1	75	200+%	STE/PASS
2	70	200+%	STE/PASS
3	75	200+	STE/PASS
4	73	200+	STE/PASS
5	72	200+	STE/PASS

Notes: Tear Back Results on Sample Weld: GOOD

STE = sample stretch to end of test  
SE1 = sample break in outer edge of seam

SE2= break at seam edge top sheet (extrusion shear only)  
SE3= break at seam edge in bottom sheet (extrusion peel only)



# Wedge/Extrusion Trial

2



WESTERN TANK  
& LINING LTD.

12180 Vickers Way  
Richmond BC V6V-1H9

Office 604.241.9487 Fax 604.241.9485

Toll-Free 1.800.551.4355

Customer: WESTERN TANK PO # AS-BCS

Production Date: 2016-10-20 Time: 7:20PM

QA Test Person: s.22 W/O. WO-003901

Welding Tech: s.22 Crew: s.22

Welder Qualification For Liners: 1 Time Ending:

size expressed in decimal feet

Material Type:	40MIL LLDPE 1400-7000	Liner Size:	Length	Width	Style
			190	181	STP LNR

Welder Number: EXTRUSION  
Welder Set Temp: PREHEAT 400/PLASTIC 425  
Welder Set Speed: NA Timed FPM NA  
Extrusion Rod: SOLMAX LL

Outside Temp: 53  
Inside Temp: 55  
Sheet Temp: 53  
Welder Set up with bar Y/N N

## Peel Data

test speed is 20 in/min unless otherwise noted

	Inside (Lbs)	Outside (Lbs)	Failure Type	Seperation (%)	Comments
1	72	0	SE1	0	PASS
2	68	0	SE1	0	PASS
3	67	0	SE1	0	PASS
4	66	0	SE1	0	PASS
5	67	0	SE1	0	PASS

## Shear Data

	Shear (Lbs)	Elongation (%)	Comments
1	71	200+%	STE/PASS
2	69	200+%	STE/PASS
3	69	200+	STE/PASS
4	69	200+	STE/PASS
5	68	200+	STE/PASS

Notes: Tear Back Results on Sample Weld: NA

STE = sample stretch to end of test

SE1 = sample break in outer edge of seam

SE2= break at seam edge top sheet (extrusion shear only)

SE3= break at seam edge in bottom sheet (extrusion peel only)





12180 Vickers Way  
Richmond Bc V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.351.4355

Test speed is 20 in/min unless otherwise noted

## Seam End Coupon Log

1

Customer:	WESTERN TANK		PO#	AS-BCS
Production Date:	2016-10-20	Crew:	s.22	
Welder #	D-7	Operator	s.22	Temp/Speed
		820/599		
Distance in feet	22.3	Timed Sec.	80	Feet per min.
		17		
QA Test Person:	s.22	W/O.	WO-003901	
Material Type:	40MIL LLDP 140-7000			
size in dec. ft.	Length	Width	Style	
Liner Size:	190	181	STP LINER	
			Liner #	1

Seam Number	Test # PR / SN	Inside (Lbs)	Outside (Lbs)	Failure Type	Separation (%)	Shear (Lbs)	Elongation (%)	Comments
W1	P1/S1	63	63	SE1	0	77	200+	SE1/PASS
W1	P2/S2	62	62	SE1	0	71	200+	STE/PASS
W2	P1/S1	68	67	SE1	0	77	200+	STE/PASS
W2	P2/S2	61	64	SE1	0	77	200+	STE/PASS
W3	P1/S1	66	64	SE1	0	74	200+	STE/PASS
W3	P2/S2	58	58	SE1	0	69	200+	STE/PASS
W4	P1/S1	66	64	SE1	0	73	200+	STE/PASS
W4	P2/S2	61	64	SE1	0	71	200+	STE/PASS
W5	P1/S1	63	60	SE1	0	74	200+	STE/PASS
W5	P2/S2	59	59	SE1	0	74	200+	STE/PASS
W6	P1/S1	65	63	SE1	0	74	200+	STE/PASS
W6	P2/S2	61	58	SE1	0	71	200+	STE/PASS
W7	P1/S1	69	63	SE1	0	77	200+	STE/PASS
W7	P2/S2	64	63	SE1	0	71	200+	STE/PASS
W8	P1/S1	67	70	SE1	0	76	200+	STE/PASS
W8	P2/S2	61	61	SE1	0	75	200+	STE/PASS

Notes:

STE = sample stretch to end of test

SE1 = sample break in outer edge of seam

Pull Checks (non-destructive seam lip pulls)

GOOD





WESTERN TANK  
& LINING LTD.

## ASTM D 5199 MATERIAL THICKNESS LLDPE

12180 Vickers Way  
Richmond BC V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4355

Date MFG date	Mil Mfg	Roll ID #	Roll Width measured	sample area	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	Avg.	QA
10/20/16 5/14/16	40MIL LLDPE SOLMAX	2-85304	22.3	B	37.7	37.8	35.7	37.3	35.5	37.2	37.6	36	37.5	43.1	37.54	s.22
10/20/16 8/30/16	40MIL LLDPE SOLMAX	2-86710	22.3	B	37.5	37.8	42.3	35.2	37.3	36	36.3	37.5	37.5	38.8	37.62	s.22
10/20/16 8/30/16	40MIL LLDPE SOLMAX	2-86705	22.3	B	38.8	39.3	36.4	37.9	36.7	36.8	37.5	38.3	37	40	38.07	s.22



# Liner Quality Control Audit

1

Inspector	S.22	Crew	S.22	Date	2016-10-20
Work Order # WO-003901		Size / Style		Length	Width
				190	181
				STP LNR	
PO#	NA	Customer	WESTERN TANK		Liner # 1

Width Calculator (enter for size ordered) Sizes are expressed in Decimal feet							
Liner Length (feet)	Liner width (Feet)	Roll Width (Inches)	Weld Width overlap (Inches)	Calculated Panels Needed	Even Panel no. (rounded up)	Total Width of Even Panels (Feet)	Actual Panel Count, added or subtracted material width ex: 8 panels + 2', +2' or 9 panels -11' (welds subtracted shown in actual width)
190	181	267	6	8.321839	9	196.25	-17'
1st panel length verification size/persons				190'3" BM	Finished Length	190	Actual Width 179.25
Stepped Panel lengths				156'3", 163'2", 170'1", 176'11", 183'10", 190'9", 188'2", 175'4", 175'4"			
Step Inset				7'6'9", 13'6'6", 6'4", 8'5", 7'6"			
Secondary measurements (cut welds)				NA			
Cross welds: 3 CROSSWELDS BETWEEN W3&W4, W6&W7, CROSSWELD ON PANEL 1, EXTRUSION WELD DONE Inspected by: BM							
Seam lip pull checks (non-destructive)				GOOD			
Special Instructions				PANEL #9 IS A 5' PANEL			
Material 40MIL LLDPE BB 140-7000 SOLMAX Color Out BLACK							
Rolling				Folding			
Standard Roll		<input type="checkbox"/>		Standard Fan		<input checked="" type="checkbox"/>	
Standard Roll with Webbing		<input checked="" type="checkbox"/>		Butterfly Fold		<input type="checkbox"/>	
Scroll Rolled center mark W/Webbing		<input type="checkbox"/>		Fan Fold to center 2" web markers		<input type="checkbox"/>	
Core Type Used:		Metal <input checked="" type="checkbox"/>		Cardboard <input type="checkbox"/>		Other <input type="checkbox"/>	
(Standard = mil, size, unroll and unfold arrow)							
Standard Information Written on Item <input checked="" type="checkbox"/>				Other: <input type="checkbox"/>			
Packaging Wrap/ Color : Standard Liner <input checked="" type="checkbox"/>				Other: FELT, LLDPE, 12MIL WRAP/WHITE			
Standard Package Labeling <input checked="" type="checkbox"/>				Other: <input type="checkbox"/>			
Notes							



# Liner Quality Control Audit



# Wedge/Extrusion Trial

1



12180 Vickers Way  
Richmond BC V6V-1H9

Office 604.241.9487 Fax 604.241.9485

Toll-Free 1.800.551.4355

Customer: WESTERN TANK PO # AS-BCS

Production Date: 2016-10-20 Time: 10:40PM

QA Test Person: s.22 W./O. WO-003902

Welding Tech: s.22 Crew: s.22

Welder Qualification For Liners: 1 Time Ending:

size expressed in decimal feet

Material Type:	40MIL LLDPE 140-7000	Liner Size:	Length	Width	Style
			149	242	STP LNR

Welder Number:	D-7	Outside Temp:	53
Welder Set Temp:	820	Inside Temp:	55
Welder Set Speed:	999 Timed FPM 17	Sheet Temp:	53
Extrusion Rod:	N	Welder Set up with bar Y/N	N

## Peel Data

test speed is 20 in/min unless otherwise noted

	Inside (Lbs)	Outside (Lbs)	Failure Type	Seperation (%)	Comments
1	73	70	SE1	0	PASS
2	60	72	SE1	0	PASS
3	68	71	SE1	0	PASS
4	68	72	SE1	0	PASS
5	71	73	SE1	0	PASS

## Shear Data

	Shear (Lbs)	Elongation (%)	Comments
1	75	200+%	STE/PASS
2	70	200+%	STE/PASS
3	75	200+	STE/PASS
4	73	200+	STE/PASS
5	72	200+	STE/PASS

Notes: Tear Back Results on Sample Weld: GOOD

STE = sample stretch to end of test

SE1 = sample break in outer edge of seam

SE2 = break at seam edge top sheet (extrusion shear only)

SE3 = break at seam edge in bottom sheet (extrusion peel only)



# Wedge/Extrusion Trial

2



12180 Vickers Way  
Richmond BC V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4355

Customer: WESTERN TANK PO # AS-BC5

Production Date: 2016-10-20 Time: 10:40PM

QA Test Person: s.22 W./O. WO-003902

Welding Tech: s.22 Crew: s.22

Welder Qualification For Liners: 1 Time Ending:

Material Type:	40MIL LLDPE 140-7000	Liner Size:	size expressed in decimal feet		
			Length	Width	Style
			149	242	STP LNR

Welder Number: EXTRUSION Outside Temp: 53  
Welder Set Temp: PREHEAT 400/PLASTIC 425 Inside Temp: 55  
Welder Set Speed: NA Timed FPM NA Sheet Temp: 53  
Extrusion Rod: SOLMAX LL Welder Set up with bar Y/N N

## Peel Data

test speed is 20 in/min unless otherwise noted

	Inside (Lbs)	Outside (Lbs)	Failure Type	Seperation (%)	Comments
1	72	0	SE1	0	PASS
2	68	0	SE1	0	PASS
3	67	0	SE1	0	PASS
4	66	0	SE1	0	PASS
5	67	0	SE1	0	PASS

## Shear Data

	Shear (Lbs)	Elongation (%)	Comments
1	71	200+%	STE/PASS
2	69	200+%	STE/PASS
3	69	200+	STE/PASS
4	69	200+	STE/PASS
5	68	200+	STE/PASS

Notes: Tear Back Results on Sample Weld: NA

STE = sample stretch to end of test

SE1 = sample break in outer edge of seam

SE2 = break at seam edge top sheet (extrusion shear only)

SE3 = break at seam edge in bottom sheet (extrusion peel only)





WESTERN TANK  
& LINING LTD.

12180 Vickers Way  
Richmond BC V6V 1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-Free 1.800.551.4355

test speed is 20 in/min unless otherwise noted

## Seam End Coupon Log

1

Customer:	WESTERN TANK	PO#	A5-BC5
Production Date:	2016-10-20	Crew:	s.22
Welder Settings			
Welder #	D-7	Operator	s.22
		Temp/Speed	820/999
Timed welder speed			
Distance in feet	22.3	Timed Sec.	80
		Feet per min.	17
QA Test Person:	s.22	W/O.	WO-003902
Material Type:	40MIL LDPE 140-7000		
size in dec. ft.	Length	Width	Style
Liner Size:	149	242	STP LNR
			Liner # 1

Seam Number	Test # PW / SW	Inside (lbs)	Outside (lbs)	Failure Type	Separation (%)	Shear (lbs)	Elongation (%)	Comments	Seam Number
W1	P1/S1	61	64	SE1	0	77	200+	STE/PASS	W9
W1	P2/S2	65	60	SE1	0	70	200+	SE1/PASS	W9
W2	P1/S1	64	69	SE1	0	75	200+	STE/PASS	
W2	P2/S2	65	62	SE1	0	71	200+	STE/PASS	
W3	P1/S1	74	67	SE1	0	76	200+	SE1/PASS	
W3	P2/S2	65	65	SE1	0	77	200+	SE1/PASS	
W4	P1/S1	71	71	SE1	0	79	200+	STE/PASS	
W4	P2/S2	74	67	SE1	0	77	200+	STE/PASS	
W5	P1/S1	69	69	SE1	0	79	200+	SE1/PASS	
W5	P2/S2	69	67	SE1	0	74	200+	STE/PASS	
W6	P1/S1	67	66	SE1	0	77	200+	SE1/PASS	
W6	P2/S2	62	63	SE1	0	76	200+	STE/PASS	
W7	P1/S1	67	64	SE1	0	74	200+	STE/PASS	
W7	P2/S2	62	61	SE1	0	74	200+	STE/PASS	
W8	P1/S1	70	67	SE1	0	74	200+	STE/PASS	
W8	P2/S2	65	66	SE1	0	74	200+	SE1/PASS	

Notes:

Notes:

STE = sample stretch to end of test

SE1 = sample break in outer edge of seam

Pull Checks (non-destructive seam lip pulls)

GOOD

STE = sample st



## 2



12180 Vickers Way  
Richmond Bc V6V-2H9  
Office 604.241.9457 Fax 604.241.9485  
Toll-free 1.800.551.4355

test speed to 20 in./min unless otherwise noted

Customer:	WESTERN TANK		PO#	AS-8CS
Production Date:	2016-10-20	Crew:	s.22	
Welder Settings				
Welder #	D-7	Operator	s.22	Temp/Speed 820/999
Timed welder speed				
Distance In feet	22.3	Timed Sec	80	Feet per min. 17
QA Test Person:	s.22	W/O	WO-003902	
Material Type:	40MIL LLDPE 140-7000			
size in dec. ft.	Length	Width	Style	
Liner Size:	149	242	STP LNR	Liner # 1

[illegible]

press to end of test

SE1 = sample break in outer edge of seam

**Pull Checks (non-destructive seam lip pulls)**

**GOOD**





WESTERN TANK  
& LINING LTD.

## ASTM D 5199 MATERIAL THICKNESS LLDPE

12180 Vickers Way  
Richmond BC V6V-1H9  
Office 604.241.9487 Fax 604.241.9485  
Toll-free 1.800.551.4355

Date MFG date	Mil Mfg	Roll ID #	Roll Width measured	sample area	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	Avg.	QA
10/20/16 8/30/16	40MIL LLDPE SOLMAX	2-86785	22.3	B	38.8	39.3	36.4	37.9	38.7	36.8	37.5	38.3	37	40	38.07	S.22
10/20/16 8/29/16	40MIL LLDPE SOLMAX	2-86690	22.3	B	42.2	43.1	39.7	36.7	38.6	38.8	41.3	39.3	39.8	44.8	40.43	S.22



# Liner Quality Control Audit

1

Inspector	s.22	Crew	s.22	Date	2016-10-20
Work Order #	WO-003902	Size / Style	Length	Width	Style
			149	242	STP LNR
PO#	AS-BCS	Customer	WESTERN TANK	Liner #	1

Width Calculator (enter for size ordered) Sizes are expressed in Decimal feet							
Liner Length (feet)	Liner width (Feet)	Roll Width (inches)	Weld Width overlap (inches)	Calculated Panels Needed	Even Panel no. (rounded up)	Total Width of Even Panels (Feet)	Actual Panel Count, added or subtracted material width ex: 8 panels + 2', +2' or 9 panels -11' (welds subtracted shown in actual width)
149	242	267	6	11.12644	11	239.75	
1st panel length verification size/persons					149' BM	Finished Length	149 Actual Width OK BM 239.75
Stepped Panel lengths		162'7",149'9",136'11",123'10",108'1",91'8",75'3",59'2",42'9",26'9",10'3"					
Step inset		11'11",13'5",12'5",15'9",15'11",15'7",17',16'6",16'9",16',16'6"					
Secondary measurements (cut welds)		NA					
Cross welds:		NA		Inspected by:		NA	
Seam lip pull checks (non-destructive)		GOOD					
Special Instructions		NA					
Material		40MIL LLDPE BB-140-7000 SOLMAX		Color Out		BLACK	
Rolling				Folding			
Standard Roll		<input type="checkbox"/>		Standard Fan		<input checked="" type="checkbox"/>	
Standard Roll with Webbing		<input checked="" type="checkbox"/>		Butterfly Fold		<input type="checkbox"/>	
Scroll Rolled center mark W/Webbing		<input type="checkbox"/>		Fan Fold to center 2" web markers		<input type="checkbox"/>	
Core Type Used:		Metal <input checked="" type="checkbox"/>		Cardboard <input type="checkbox"/>		Other <input type="checkbox"/>	
(Standard = mil, size, unroll and unfold arrow)							
Standard Information Written on Item		<input checked="" type="checkbox"/>		Other:			
Packaging Wrap/ Color :		Standard Liner <input checked="" type="checkbox"/>		Other:		FELT, LLDPE, 12MIL WRAP/WHITE	
Standard Package Labeling		<input checked="" type="checkbox"/>		Other:			
Notes							



## Liner Quality Control Audit

---

2



1 September

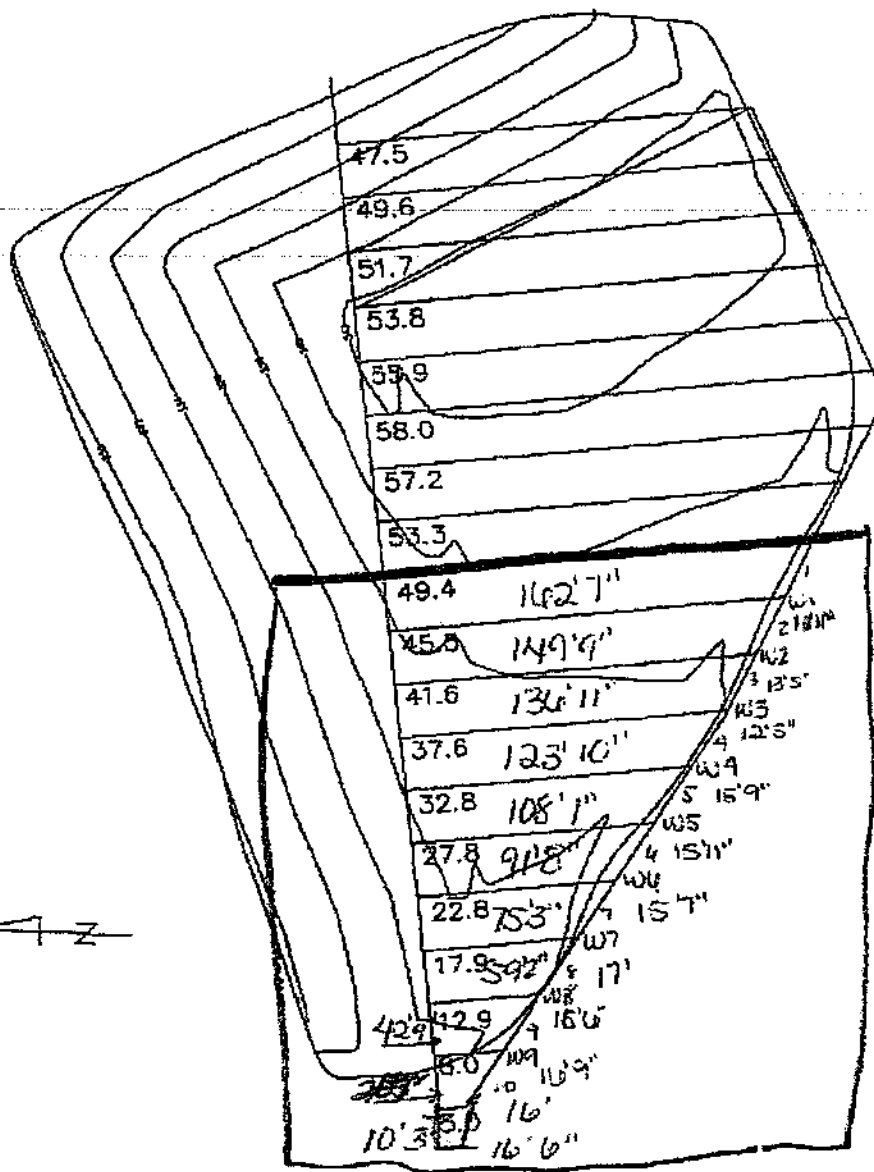
10/20/14

Done

JM

Western Tank  
WO-003902  
QTY: 1  
40MIL LLDPE 140-7000  
Width 242'

Length  
1)-182.1'  
2)-148.3'  
3)-138.5'  
4)-123.4'  
5)-107.6'  
6)-91.2'  
7)-74.8'  
8)-58.7'  
9)-42.3'  
10)-26.3'  
11)-9.8'



SIRM PEA Proposed Top Liner  
Elevations and Distances are in Meters



**WESTERN TANK & LINING LTD.**

12180 Vickers Way

Richmond, B.C., V6V-1H9

PHONE (604) 241-9487

FAX (604) 241-9485

WARRANTY NUMBER	WTL-BCSO
ACCEPTANCE DATE	Nov. 16, 2016
WARRANTY PERIOD	2 Years

**WORKMANSHIP WARRANTY**

PURCHASER/USER	Allterra Construction Ltd.
LOCATION OF INSTALLATION	61 Stebbings Road, Victoria, B.C.
DESCRIPTION OF INTENDED USE	Prefabricated 40 mil LLPDE Liners for Landfill Cover. Installation and field welding by others.

WESTERN TANK & LINING LTD. (the "Installer") warrants to the party named above as the Purchaser/User ("Purchaser") that the tank and/or lining membrane system ("the Liner System") as installed by the Installer will be free from installation-related defects for normal use in approved applications, on the terms and conditions set forth in this Workmanship Warranty (the "Warranty"). This Warranty shall be in effect from the above noted Acceptance Date for the above noted Warranty Period.

The term "normal use" means uses reasonably consistent with the above noted Description of Intended Use, and does not include, among other things, the exposure of the Liner System to harmful chemicals; abuse of the Liner System by machinery, equipment or people; excessive pressures or stresses from any source; subsurface or overburdened soil conditions; and total or differential soil settlements and the effect those settlements may have on the Liner System. The Purchaser acknowledges that the sale of the Liner System is for commercial or industrial use only.

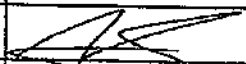
This Warranty does not include damages or defects in the Liner System resulting from: (i) acts of God, casualty or catastrophe, including earthquakes, floods, weather, tornadoes, explosion, war, acts of any public authority, or any other cause beyond the Installer's reasonable control; (ii) faulty materials, or any defects in the workmanship, design or manufacturing of the materials comprising the Liner System; (iii) defects arising on account of third party action; (iv) defects arising from improper maintenance, use, repair, replacement or alteration of the Liner System by the Purchaser; (v) subsidence of the land around the Liner System; or (vi) surface defects in workmanship and materials apparent and accepted by the Purchaser at the date of delivery.

Any claim for an alleged breach of this Warranty must be made in writing, by registered mail or fax, to the President of the Installer at the address above within thirty (30) days of the Purchaser becoming aware of the alleged defect. If the Purchaser fails to deliver notice as required under this Warranty, the defect and all warranties shall be deemed to have been waived and the Purchaser will have no right of recovery against the Installer. Should defects within the scope of the above Warranty occur, the Installer will, at its option, repair or replace the Liner System or defective portion thereof. The Installer will have the right to inspect and determine the cause of any alleged defect in the Liner System and to take appropriate steps to repair or replace the Liner System if a defect exists for which the Installer is liable under the terms of this Warranty. The Installer will not be required to make such repairs and/or replacements until the Purchaser has ensured that the area surrounding the Liner System is clean, dry, and in an unencumbered condition, including without limitation free from all water, dirt, sludge, residuals, and liquids of any kind.

The Installer's liability under this Warranty shall in no event exceed the lesser of: (i) the replacement cost of the Liner System or defective portion thereof; or (ii) the total amount paid by the Purchaser to the Installer in respect of the Liner System. Further, under no circumstances shall the Installer be liable to the Purchaser or any other party for any special, direct, indirect, or consequential damages arising from any defect in the installation of the Liner System. This Warranty is given in lieu of all other possible warranties by the Installer in respect of the Liner System and by accepting delivery of the Liner System, the Purchaser waives all other such possible warranties, except those specifically given.

THE INSTALLER MAKES NO WARRANTY OF ANY KIND OTHER THAN AS EXPRESSLY SET OUT HEREIN, AND HEREBY DISCLAIMS ALL OTHER WARRANTIES, BOTH EXPRESSED AND IMPLIED, OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THIS WARRANTY IS NOT EFFECTIVE AND THE INSTALLER IS NOT BOUND BY THE TERMS HEREOF UNTIL RECEIPT OF FULL AND FINAL PAYMENT FOR THE LINER SYSTEM FROM THE PURCHASER.

I hereby state I have read and understand the above and foregoing Warranty and agree to such by signing hereunder.

	PURCHASER/USER		WESTERN TANK & LINING LTD.	
	NAME		NAME	
		Raymond Lam	Andrew Sanderson	
SIGNATURE				
TITLE		Principal	Project Manager	
DATE (dd/mm/yyyy)			Nov. 15, 2016	



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**APPENDIX B**  
**Landfill Cell – As Built Drawing**

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## Soil Management Area

- Soil Management Area location on Site Plan

- Active Earth As-Built Summary – Soil Management Area
- Quantum Engineering Megadome Structural Inspection
- Soil Management Area Pre-Permit Cancellation (February 23, 2017) Soil Inventory 3,360.51 Metric Tonne

SOUTH ISLAND

RESOURCE MANAGEMENT









October 29, 2013

BC Ministry of Environment  
West Coast Region – Environmental Protection Division  
2080A Labieux Road  
Nanaimo, BC  
V9T 6J9

**ATTENTION:** Luc Lachance, P.Eng. – Senior Environmental Protection Officer

**REFERENCE:** **As-Built Summary – Soil Management Area**  
**Authorization to Discharge Waste Permit PR-105809**  
**640 Stebbings Road, Shawnigan Lake, BC**

---

### ***Introduction***

The design of the Soil Management Area (SMA) for the contaminated soil landfill (the "Facility") is described within the Technical Assessment Report (TAR) prepared by Active Earth Engineering Ltd. (Active Earth) in August 2012. The SMA was designed to control run-off of all "contact water" that consists of precipitation incident to the footprint of the SMA as well as pore water draining from saturated soils. A leak detection system was incorporated into the design to confirm performance of the hydraulic barriers.

To summarize, the SMA construction consisted of the following sequence:

1. Preparation of the subgrade;
2. Construction of the leak detection system;
3. Installation of the man-hole/catch basin and the leak detection system inspection port;
4. Placement of the LLDPE liner;
5. Placement and compaction of roadbase over the liner; and
6. Constructing the final asphalt surface.

In addition to the SMA surface, a water holding pond was constructed as part of the water management infrastructure. This holding pond is sized to handle a 200 year storm plus snowmelt assuming the entire SMA is uncovered.

The location of the SMA and holding pond are shown on the attached Figure 1, and the components are illustrated in the typical section on Figure 2.

---

Langley  
Vancouver  
Victoria

Mailing Address:  
105-4343 Tyndall Ave  
Victoria, BC V8N 3R9

Telephone: 250-686-9850  
Facsimile: 778-430-5475  
Website: [www.activeearth.ca](http://www.activeearth.ca)



The following provides details of the SMA construction.

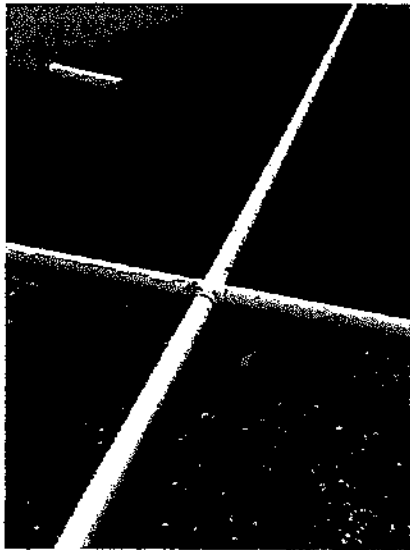
***Preparation of the subgrade***

The subgrade is comprised of native undisturbed bedrock with roadbase crush placed over top. The roadbase was placed and compacted at the appropriate slopes/orientations to form the base of a drainage layer (leak detection system) and to provide the base geometry for the final asphalt surface.

***Construction of the leak detection system***

The leak detection system was constructed with 4 inch diameter perforated PVC pipe placed over the prepared roadbase subgrade. The PVC pipes were tied into the inspection port.

The PVC pipes were covered with a minimum of 0.3m of clear crush, and a geotextile fabric was placed over the clear crush to provide a surface for the synthetic liner and protect it from potential puncture. The photo below shows the leak detection piping with laterals connected to the main central trunk.

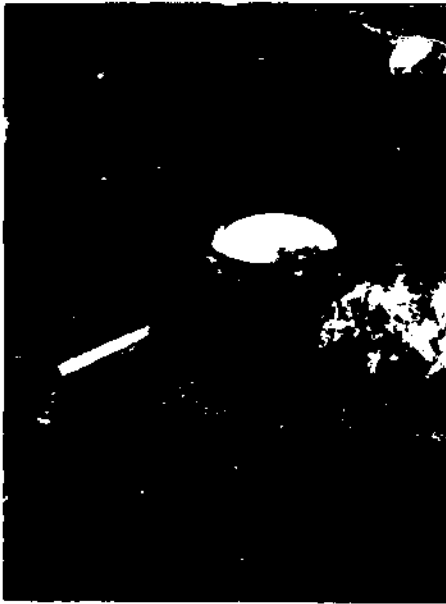


***Installation of the manhole/catch basin and the leak detection system inspection port***

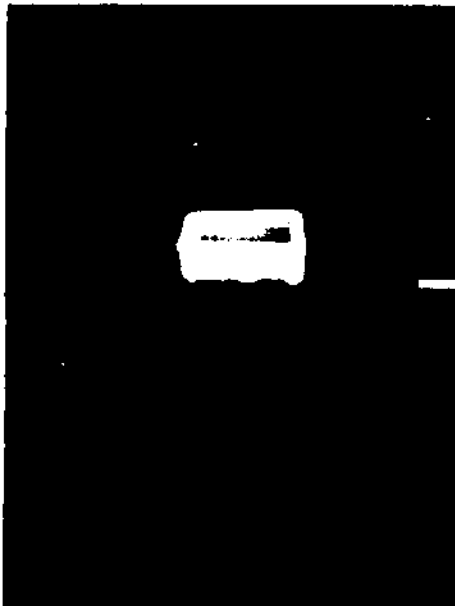
Following preparation of the subgrade and installation of the leak detection piping, the catch basin and leak detection inspection ports were installed.

The catch basin is 3 foot in diameter and comprised of concrete. The base of the catch basin was set and sealed in concrete, and joints of the catch basin were sealed with grout. The following photo shows the catch basin access at ground surface sealed with concrete atop the synthetic liner. The 4 inch PVC pipe connects to the containment reservoir that forms part of the water management system. The containment reservoir reports to the water treatment plant.





The leak detection inspection port is comprised of a 10 inch diameter PVC chamber located at the terminus of the main trunk of the PVC piping. The inspection port is protected by a rectangular concrete box as shown in the photo below. A 4 inch PVC pipe connects to the leak detection inspection port to the manhole; any water present in the leak detection system will report to the manhole.





***Placement of the LLDPE liner***

A single-piece (un-welded) 30 mil LLDPE synthetic liner was placed over the entire SMA, with two openings for the catch basin and inspection port. The two openings were "booted" around the structures and hydraulically sealed by professional liner installers (Western Tank & Lining Ltd.).

The liner was placed with protective geotextile fabric both above and below.



***Placement and compaction of roadbase over the liner***

A minimum 150 mm thick layer of roadbase was placed and compacted above the synthetic liner to provide a surface for asphaltting the SMA.





### ***Constructing the final asphalt surface***

A minimum 75 mm thick asphalt layer was placed over the entire SMA, sloped to direct all incident precipitation to the catch basin.



### ***Construction of the Holding Pond***

The holding pond is 25 m by 25 m for a surface area of 625 m<sup>2</sup>. The pond is 4 m deep with side slopes of 2:1 (H:V), which gives it a capacity of approximately 1,100 m<sup>3</sup>. The holding pond forms part of the Site water management system and is described in the as-built report for that system.

### ***Closure***

Please contact the undersigned if further information and/or clarification is required.

Yours truly,

**ACTIVE EARTH ENGINEERING LTD.**

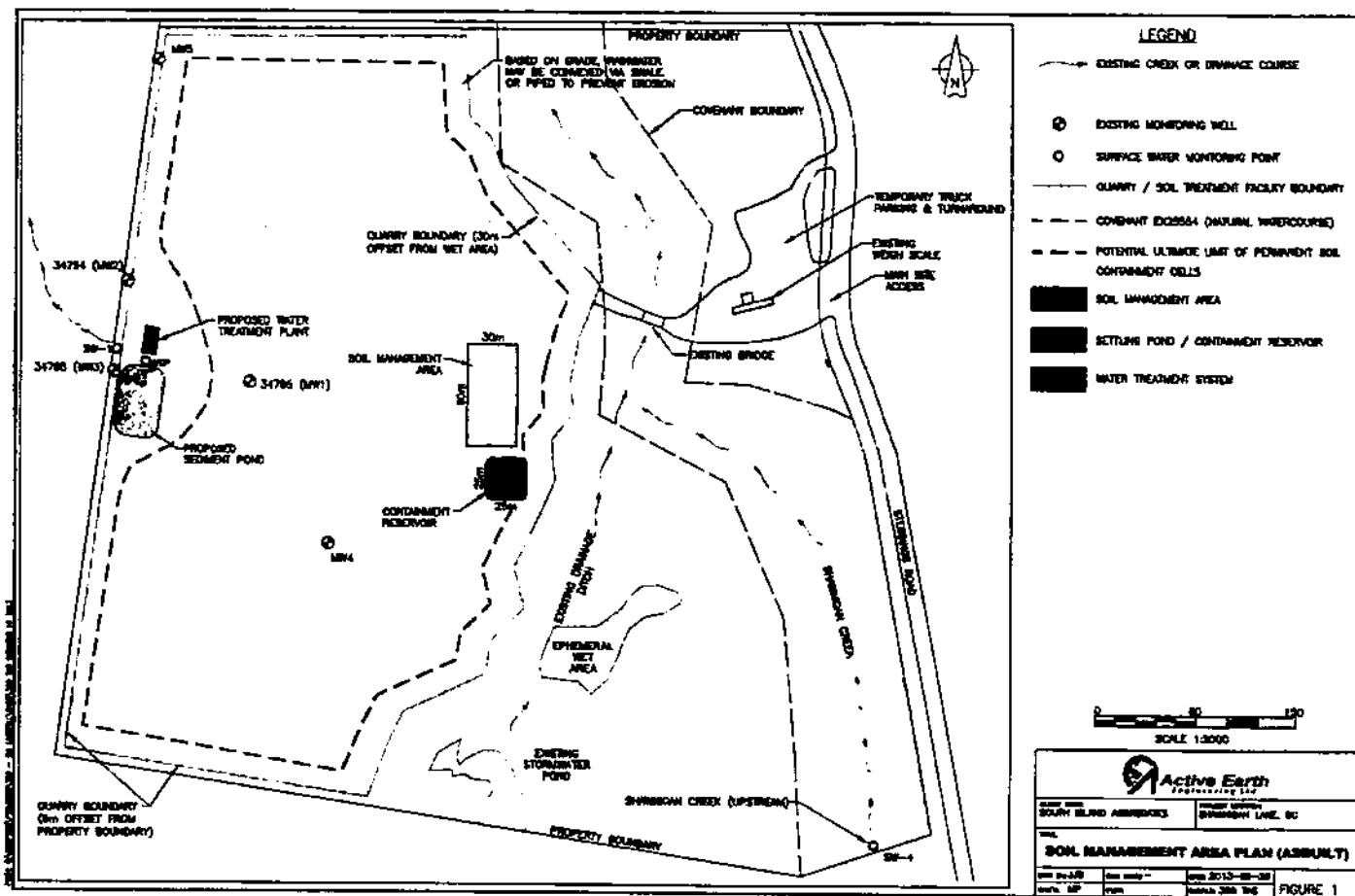
Matt Pye, P.Eng.  
Principal, Senior Hydrogeologist

### **Attachments**

Figure 1 – Soil Management Area Plan (As Built)

Figure 2 – Soil Management Area Typical Cross Section (As Built)











February 29, 2016

File: 13.296

BuildWorks Construction Inc.  
Dirk Kerkhoff  
dirk@buildworks.com

Dear Sir,

**Re: South Island Resource Management – Megadome  
460 Stebbings Road, Shawnigan lake**

Please accept this letter as confirmation that the installation of the MegaDome cover at the above location is complete and the installation generally conforms with the structural requirements specified on the signed and sealed structural drawings provided by Quantum Engineering Ltd. This confirmation is based on a site visit conducted by the undersigned on February 25, 2016 and digital pictures subsequently received from BuildWorks Construction Inc.

The storage space in the MegaDome is being used for the intended purpose of material storage as can be seen in the pictures below.

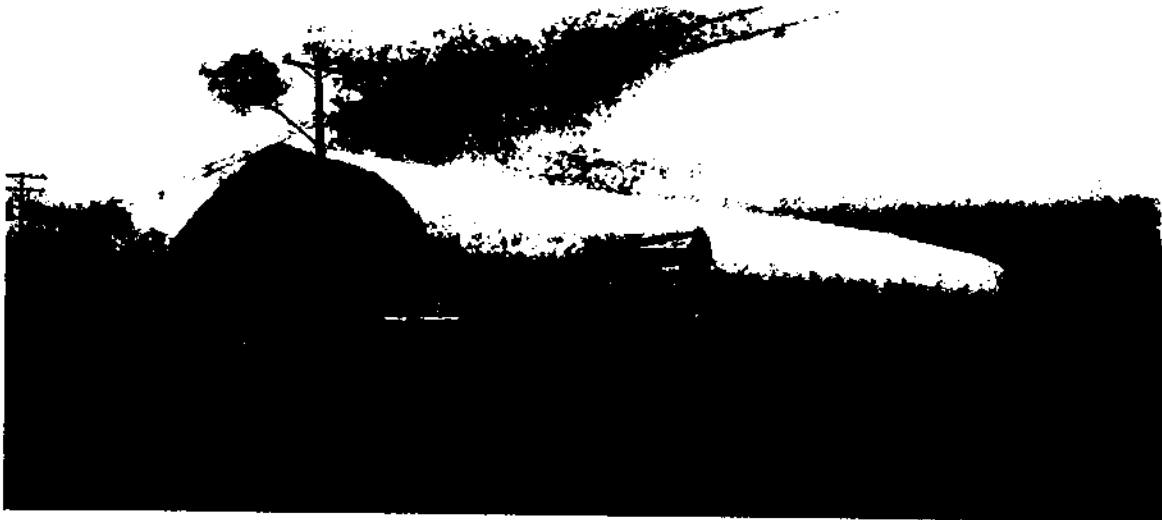


Figure 1: Exterior view of the MegaDome





Figure 2: Second exterior view of the MegaDome

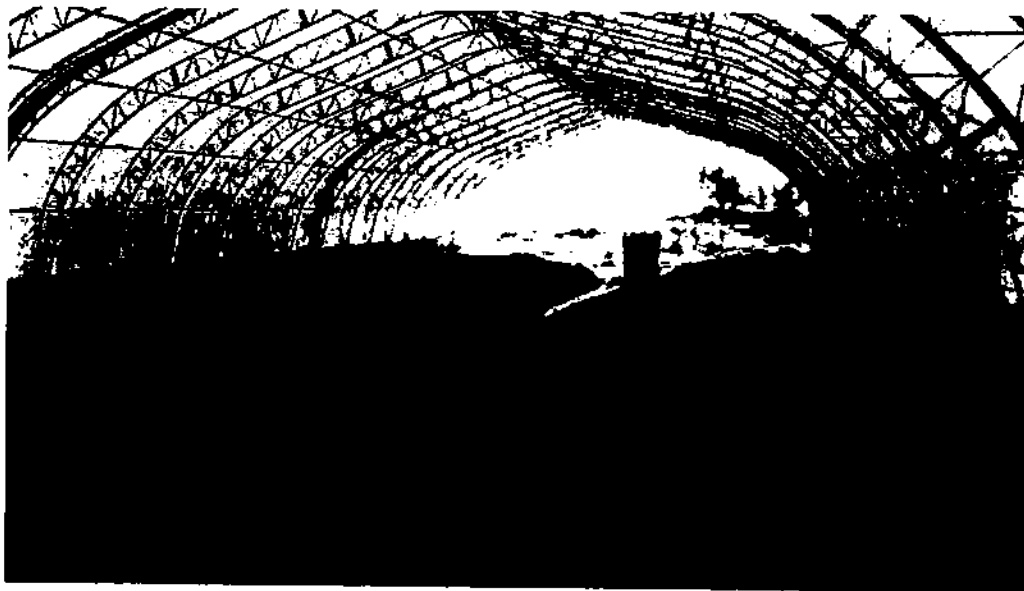


Figure 3: Interior view of the MegaDome

If you have any questions, please do not hesitate to contact the undersigned.

Sincerely,

Quantum Engineering Ltd.

Per,

Joel Kerkhoff, M.Eng., P.Eng.

QUANTUM ENGINEERING LTD.



# Soil Management Area

## SOIL MANAGEMENT AREA

DATE	February 23, 2017				
	WAA #		IL- / IL+	Tonnage/Soil Desc./Comments	Description

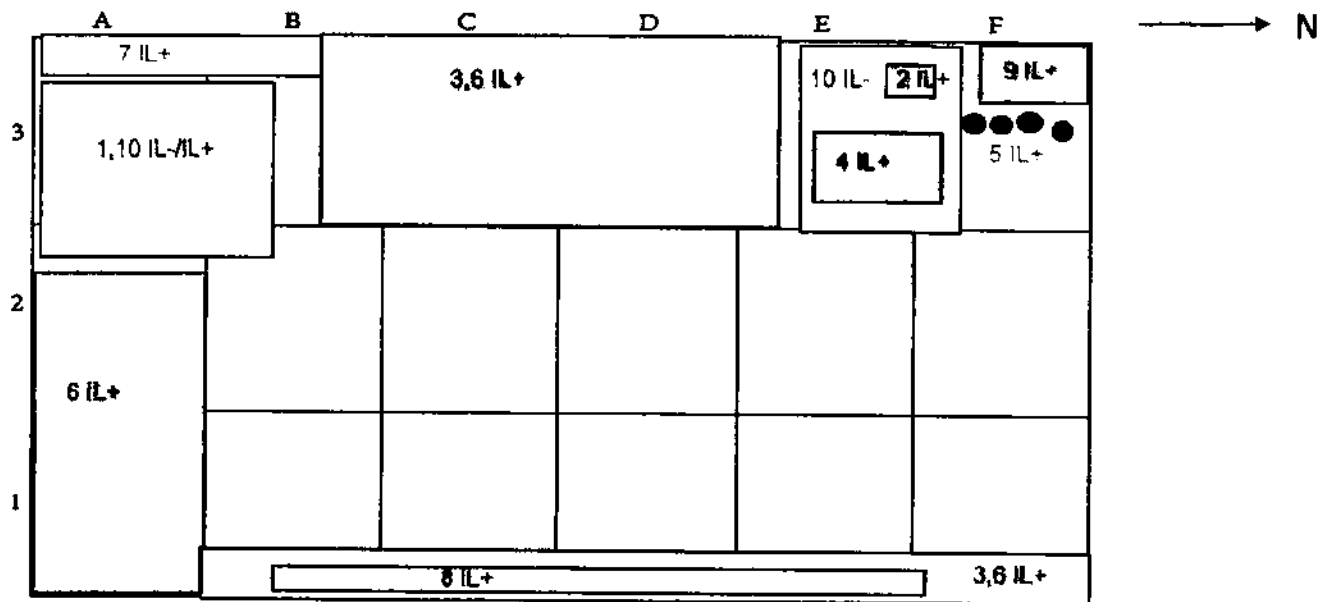
s.21			IL+	43.95	1
			IL+	5.28	2
			IL+	523.52	3
			IL+	112.06	4
			IL+	2.97	
			IL+	2202.51	6
			IL+	52.91	7
			IL+	5.56	8
			IL+	5.46	9
			IL-	406.29	10

ESTIMATED SOIL VOLUME:	1976.77 m <sup>3</sup>
ESTIMATED SOIL MASS:	3360.51 Tonnes

M = Metals  
 PAH = Polycyclic Aromatic Hydrocarbons  
 PHC = Petroleum Hydrocarbons  
 Other (Specify Above)

S = Salt (NaCl)

### DAILY SKETCH



Notes:



## Contact Pond

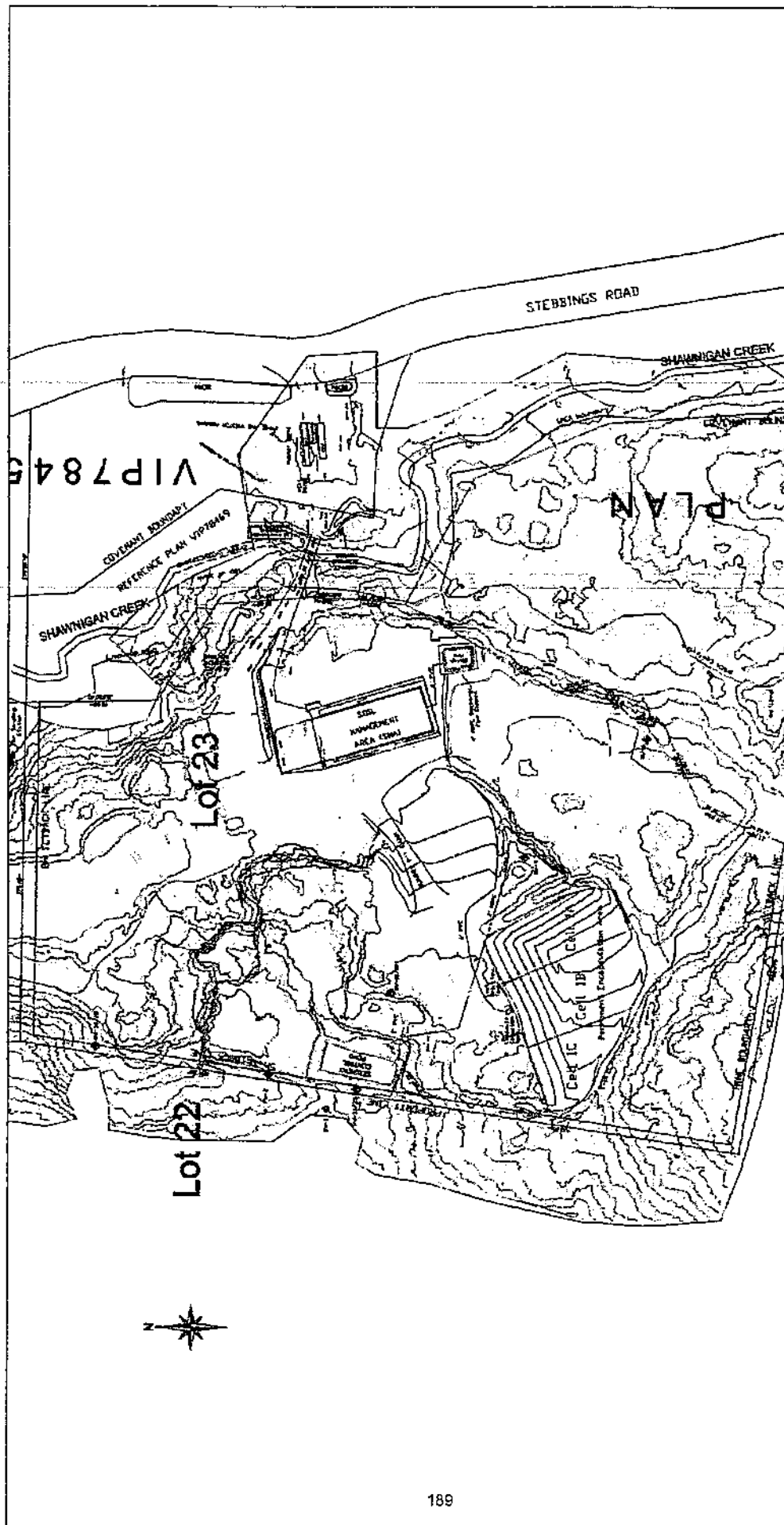
- Contact Pond location on Site Plan


- Active Earth Engineering Summary Water Management System
- Settlement Control Pond As-Built Drawing
- Stantec Review of Settlement Control Pond
- Cell 1 Leak Detection and Leachate Collection, Piping, Tanks

SOUTH ISLAND

RESOURCE MANAGEMENT





	
Allterra Construction Ltd 2155 Main Street Victoria, BC V8S 6H4	
Date: 17/02/17 Scale: 1:1000 Author: [blank] Checked: [blank] Drawn: [blank]	Project: 488 Stebbings Rd, Lot 23 Drawing Title: [blank] Content Title: [blank]
Based on: [blank] Date: [blank]	Based on: [blank] Date: [blank]





December 6, 2013

BC Ministry of Environment  
West Coast Region – Environmental Protection Division  
2080A Labieux Road  
Nanaimo, BC  
V9T 6J9

**ATTENTION:** Luc Lachance, P.Eng. – Senior Environmental Protection Officer

**REFERENCE:** **As-Built Summary – Water Management System**  
**Authorization to Discharge Waste Permit PR-105809**  
**640 Stebbings Road, Shawnigan Lake, BC**

---

### ***Introduction***

The Water Management Plan for the Site is described within the Technical Assessment Report (TAR) prepared by Active Earth Engineering Ltd. (Active Earth) in August 2012, and further detailed in the Environmental Procedures Manual (EPM) dated October 2013. Components of the system that have been completed and are described in this as-built report include:

1. Water diversion ditches;
2. Stormwater/sedimentation pond and associated outfall;
3. "Contact water" collection systems for the Soil Management Area; and,
4. The water treatment plant.

Upon completion of the works in progress, this as-built summary will be amended to include the leachate collection and leak detection systems, as well as the seepage blanket construction details associated with the soil containment cells within the Permanent Encapsulation Area (PEA). The works constructed to date, and detailed in this report, represent those works required for the initiation of soil acceptance to the Site.

### ***Water Diversion Ditches***

Surface water diversion works have been constructed along the upslope perimeter of the PEA for Cell 1 as shown on Figure 1. The works include two collection ditches that intercept all surface flows originating upslope of the PEA for Cell 1, and divert the flows to the west. The

---

Langley  
Vancouver  
Victoria

Mailing Address:  
105-4343 Tyndall Ave  
Victoria, BC V8N 3R9

Telephone: 250-686-9850  
Facsimile: 778-430-5475  
Website: [www.activeearth.ca](http://www.activeearth.ca)



ditch is a minimum of 1.0m wide at the base with side slopes of 2:1 (H:V) and a minimum depth of 0.6m. The ditch is designed to accommodate a 200 year storm event plus snowmelt.



The above photo shows a portion of the interception ditch upslope of the PEA Cell 1, including the confluence of the second diversion ditch as illustrated on Figure 1.

Surface flows originating from precipitation within the active quarry are collected in a topographic low area and then channelled to the Sedimentation Pond as shown on Figure 1.

The Soil Management Area (SMA) is constructed at the upper reaches of the Site in terms of elevation, upon the crest of the bedrock. The SMA was further built up by the placement of soil for construction of the underlying leak detection system and to create the base for the necessary grades to control surface water flows from precipitation incident to the SMA. Since the SMA is located at the height of land (and further elevated by fill placement), there are no surface water diversion works required. This was a consideration in determining the optimal location for the SMA on the Site.

Similarly, the water Containment Reservoir constructed adjacent to the SMA is also located at the height of land and does not require any surface water diversion.



The remainder of the Site will maintain the status quo for surface water management, and the surface water diversion works will be augmented as the permitted Site activities associated with reclamation activities progresses.

***Soil Management Area and Containment Reservoir***

As described above, the SMA does require any diversion works. All waters that are derived from precipitation incident to the SMA are managed as "contact water", meaning the water has the potential to contact contaminated soils. The construction details for the SMA and are described in the October 29, 2013 As-Built Summary report.

With respect to water management, all water from the SMA paved surface is directed into a single catch-basin/manhole that gravity feeds to the adjacent Containment Reservoir. The Containment Reservoir is 25m by 25m for a surface area of 625m<sup>2</sup>. The pond is lined with a 30 mil LLDPE synthetic liner and is 4m deep with side slopes of 2:1 (H:V), which gives it a capacity of approximately 1,100m<sup>3</sup>. This reservoir serves primarily as a storage pond for peak flows and will become redundant once a roof structure is constructed over the SMA. Water from the Containment Reservoir reports to the Water Treatment Plant (WTP).



The above photo shows the Containment Reservoir prior to the liner being installed.



### ***Water Treatment Plant***

The WTP is located on the west Site boundary adjacent to the Sedimentation Pond. Water from the WTP is discharged to the Sedimentation Pond following treatment and confirmation of acceptable water quality.

The WTP has been designed, supplied and assembled on Site by Stormtec Innovative Water Management Solutions (Stormtec). The WTP includes 4 holding tanks, a sand filter, carbon filters and associated controls. Details of the WTP are schematically illustrated on the attached Stormtec Drawing No. 13-4184.1.



The above photo shows the WTP with the Sedimentation Pond being constructed in the background.

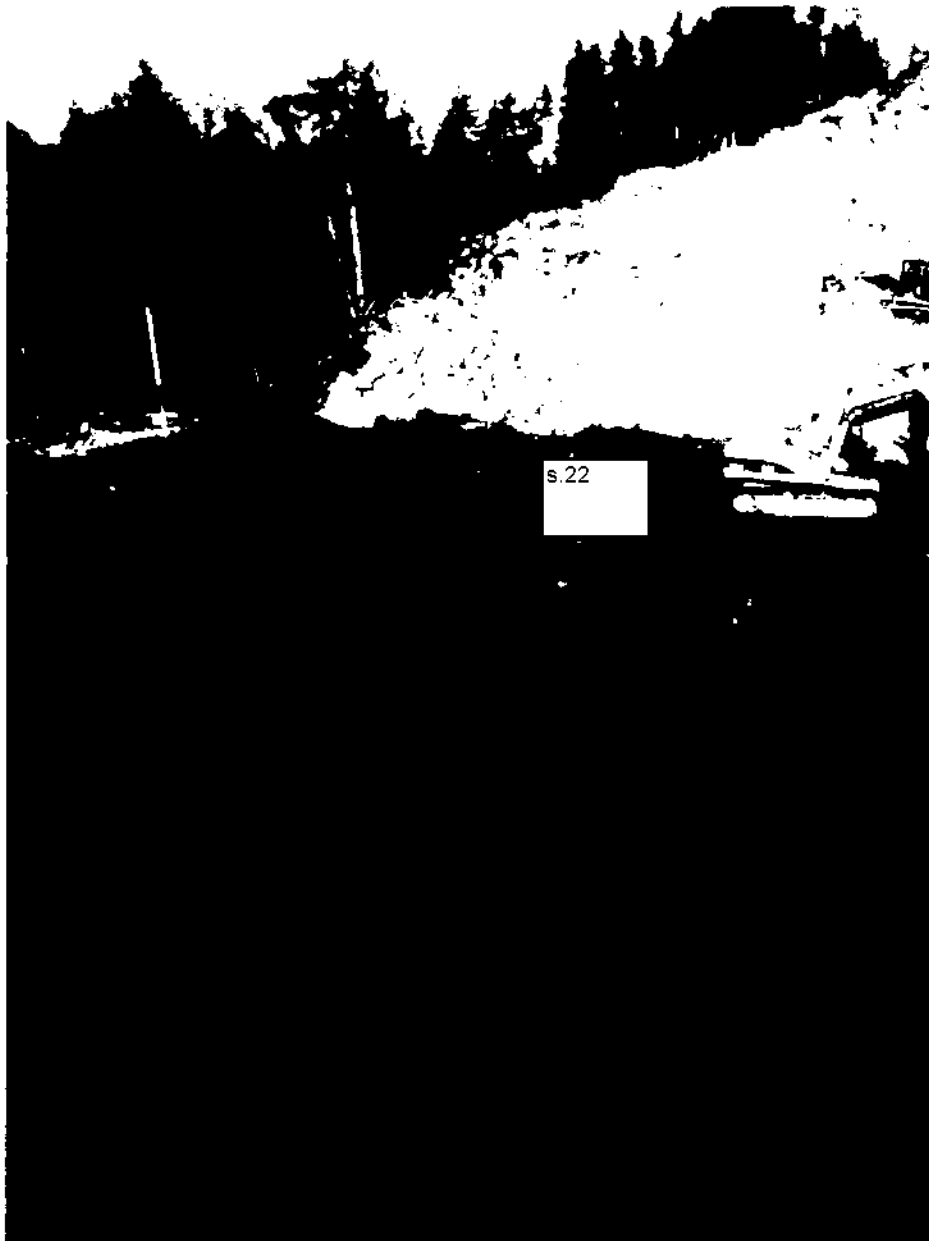
### ***Sedimentation Pond and Outfall***

The Sedimentation Pond is located on the western Site boundary immediately adjacent to the ephemeral stream (Figure 1), and the outfall from the pond discharges to this stream.

The Sedimentation Pond is 25m wide and 50m long with baffles to maximize the water residence time and associated settling out of suspended particles. The internal baffles and flow



pathway are presented on Figure 2. Diverted surface waters report directly to the pond, and post-treatment "contact water" also reports to the Sedimentation Pond from the WTP.



The above photo shows the Sedimentation Pond being constructed with the clay liner and berms in progress. The outfall is located to the right of the monitoring well (MW-3).





The above photo shows the completed Sedimentation Pond with 7 chambers as detailed on Figure 2.

The outfall from the Sedimentation Pond is also detailed on Figure 2, and includes a low-level piped discharge and a high-level spillway designed for peak flow events. The discharge location to the ephemeral stream is protected from erosion with rip rap.





The above photo shows the low-level piped outfall and the spillway for the Sedimentation Pond.



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***Pending Works***

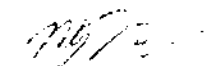
As mentioned above, the PEA is currently under construction and the as-built information will be presented under separate cover. It is not necessary for the PEA to be complete prior to the initial acceptance of soil to the Site, as the soil will be temporarily managed at the SMA until the PEA is complete. The leak detection and leachate collection systems in the PEA will be piped to the WTP in the same manner as the contact water from the SMA.

***Closure***

Please contact the undersigned if further information and/or clarification is required.

Yours truly,

**ACTIVE EARTH ENGINEERING LTD.**



Matt Pye, P.Eng.  
Principal, Senior Hydrogeologist

**Attachments**

Figure 1 – Water Management System

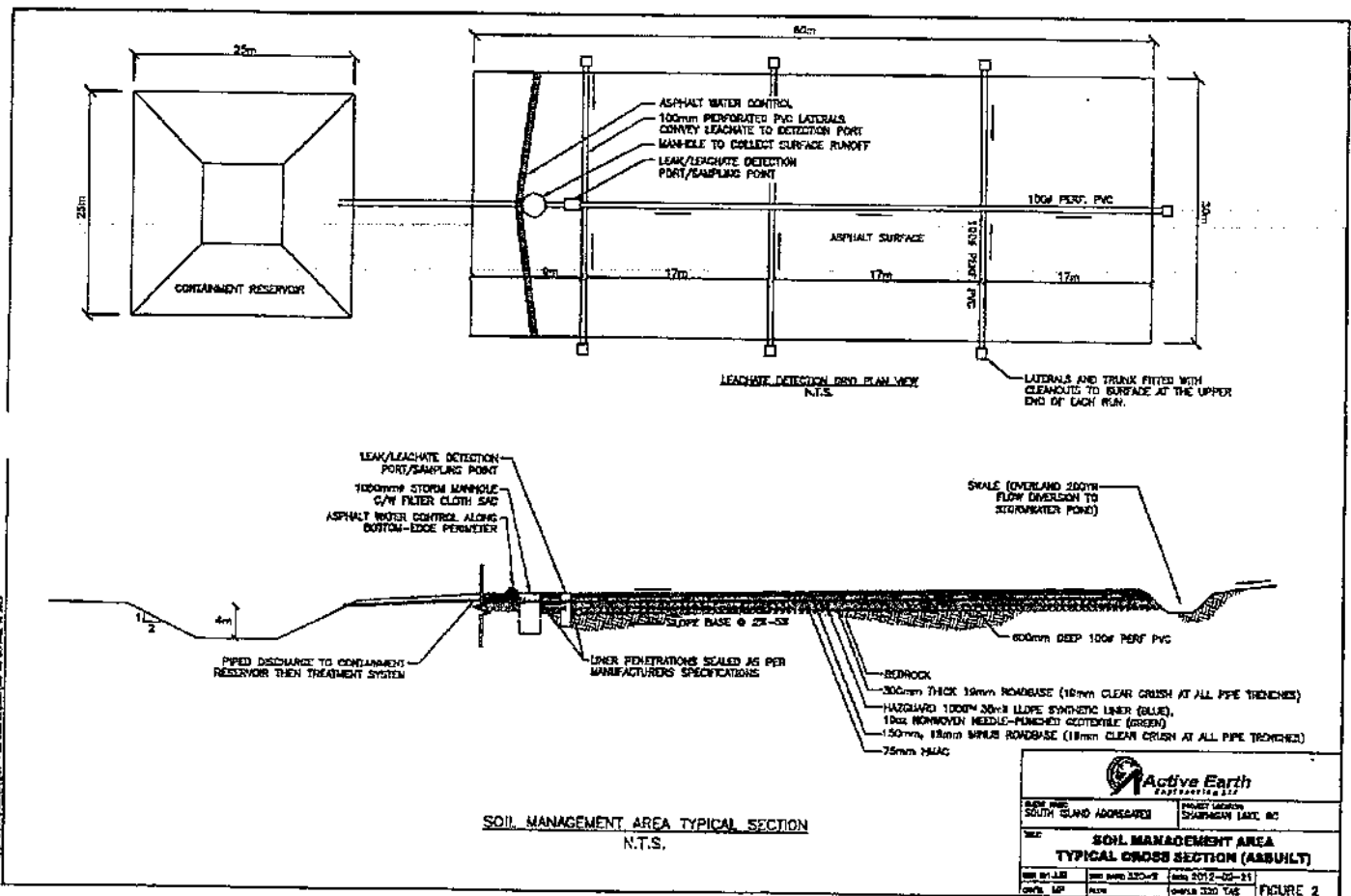
Figure 2 – Sedimentation Pond

Stormtec Drawing 13-4184.1 – Water Treatment Plant

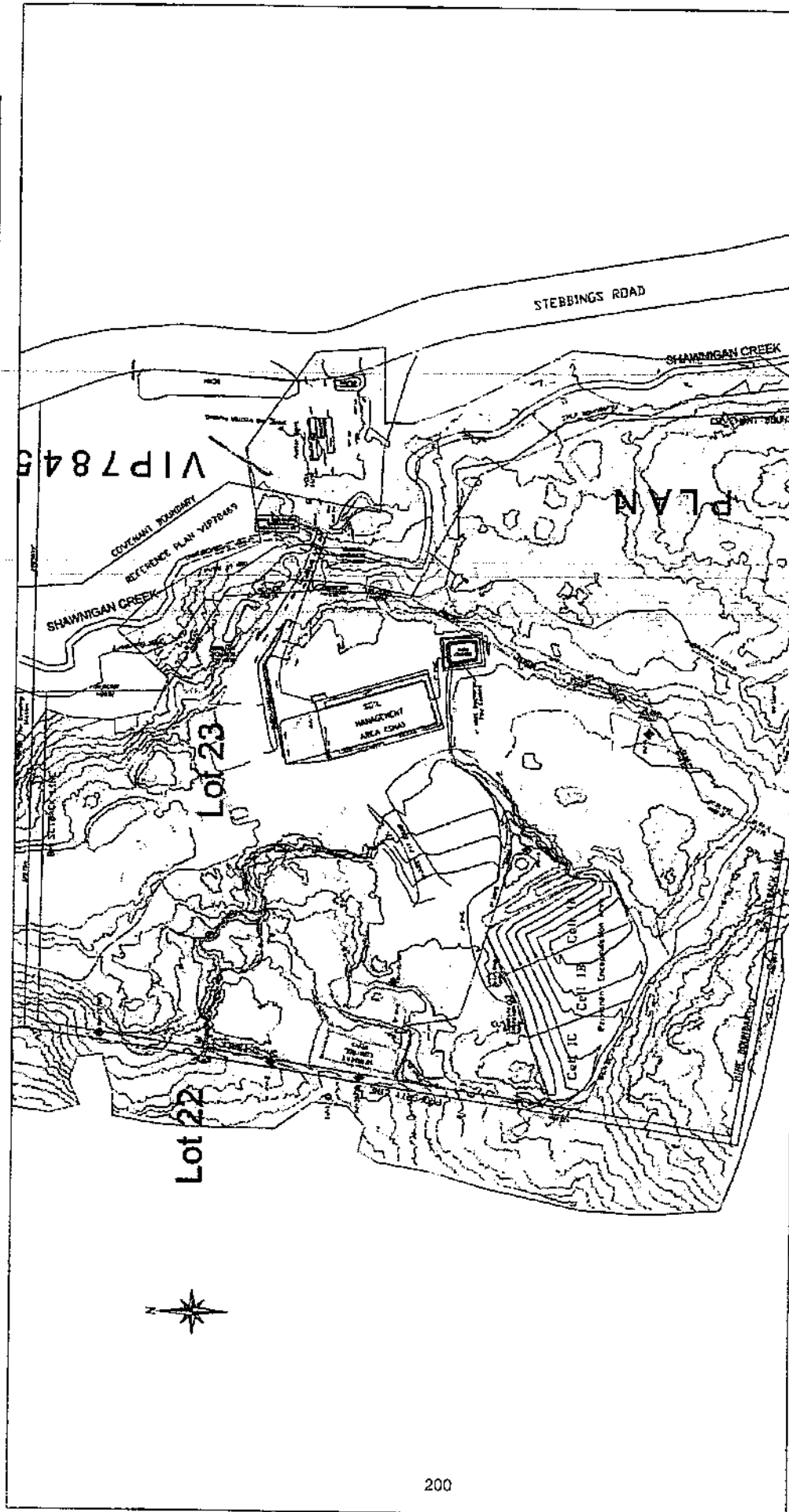












Altterra Construction Ltd.  
2180 Midway Road  
Victoria, BC  
V8B 6H4

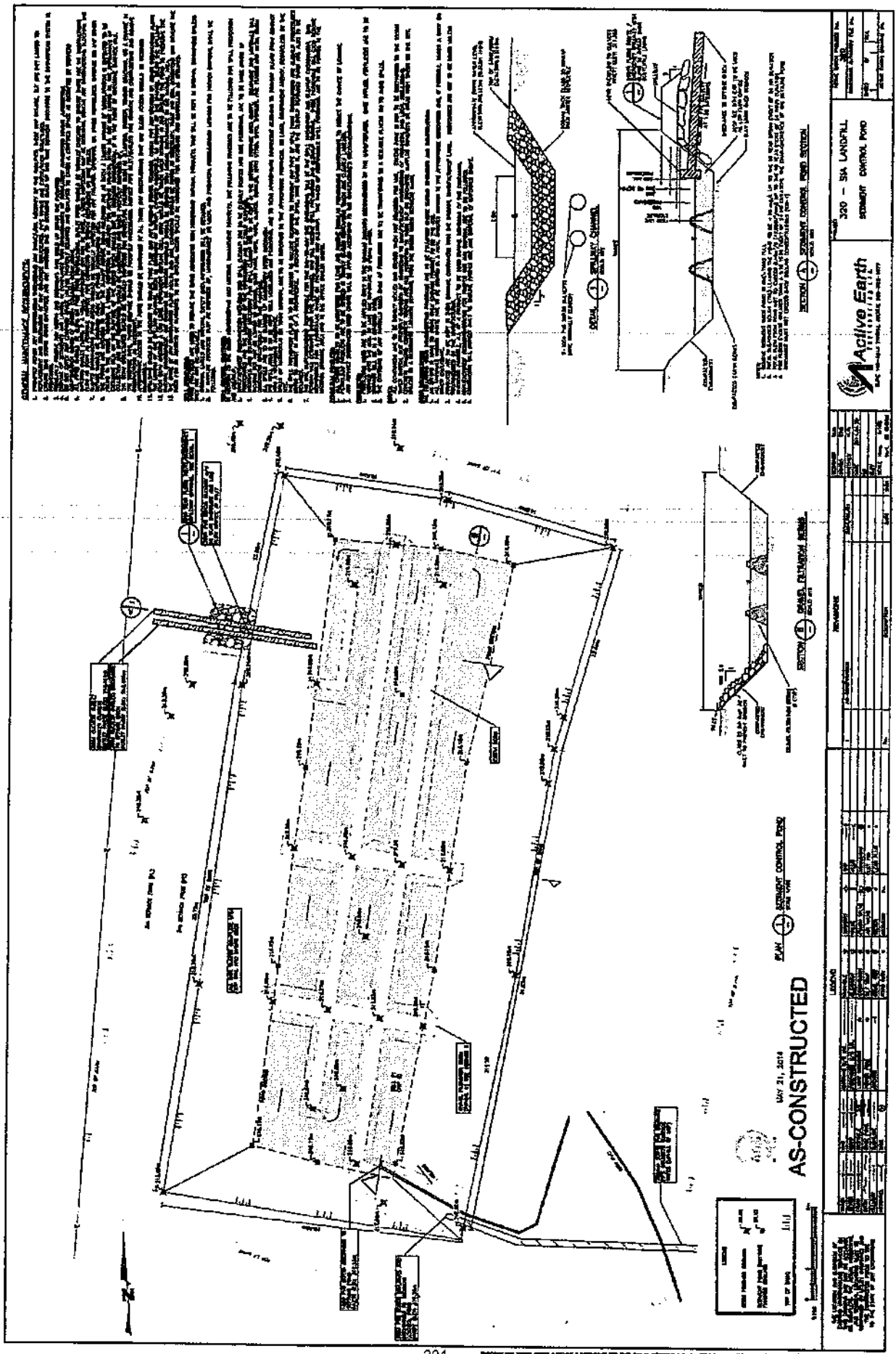
Sheet	Y07847
Scale	1:1000
Author	Altterra

Project	450 Stebbings Rd, Lot 23
Drawing Title	Sediment Control Pond

Drawn by	MEV
Checked	SPM

Revised by	None
Rev	None
Date	None
Notes	<ul style="list-style-type: none"> <li>- Based on MacEwan Drawing 13779-20-1</li> <li>- Surveyed by QPS, on August 22, 2018 and April 11, 2017</li> <li>- QPS Survey based on Reference Station 05-Equinox (OCM 60411), and confirmed on QCM 700895</li> </ul>









460 Stebbings Road  
Shawnigan Lake, BC V0R 2W3  
250.743.0811  
info@SIRM.ca  
www.sirm.ca

December 23, 2015

Cobble Hill Holdings Ltd. (BC0754588)  
c/o Herald Street Law  
101 - 536 Herald Street  
Victoria BC V8W 1S6

VIA EMAIL ([marty.sla@shaw.ca](mailto:marty.sla@shaw.ca); [AJ.Downie@gov.bc.ca](mailto:AJ.Downie@gov.bc.ca); [cassandra.caunce@gov.bc.ca](mailto:cassandra.caunce@gov.bc.ca))

**ATTENTION:** Marty Block, Director

**REFERENCE:** Stantec Assessment of Review of Settling Pond

Dear Sir:

Attached please find the Stantec Engineering Ltd. (Stantec) report "460 Stebbings Road – High Level Review of West Side Settling Pond Sizing" dated December 23, 2015 (Stantec Project File 111720018). This covering letter and the accompanying report are being copied to AJ Downie, Regional Director for the BC Ministry of Environment (MOE) and his alternate on this file, Cassandra Caunce, Director, Compliance Section.

The report reviews the design of the Settling Pond for active site non-contact storm water at the 460 Stebbings Road site governed by BC Ministry of the Environment (MOE) Permit PR-105809, Section 1.5 ("Ancillary Discharge – Settling Pond").

Due to an accelerated schedule for assessment, Stantec did not obtain or review design calculations by Active Earth Engineering Ltd. (AEEL). Instead, Stantec conducted a completely independent assessment based on the certified as-built drawings for the pond in relation to current Department of Fisheries and Oceans (DFO) "Land Development Guidelines" (LDG) along with the current MOE "Guidelines for assessing the Design, Size and Operation of Sedimentation Ponds Used in Mining".

Stantec's assessment confirms that retention time and spillway construction complies with guidance. Stantec states that the pond is believed to be adequately sized for the current requirements, with the caveat that ongoing reviews of the on-site storm water management should be conducted as the mining operations continue and the site conditions subsequently change.

Because of relatively high pond infiltration rates, a detected instance of excessive Total Suspended Solids concentration in pond effluent (25.7 mg/L vs. a standard of 25 mg/L), and good engineering practice, Stantec also made the following recommendations, which SIRM will proceed with, should CHH concur:

- The site will be modeled using storm water modeling software early next year to review water management practices on-site with the intention of preparing a more holistic storm water management plan, which will include, for example, the use of silt fences and other structures to re-



SIRM Response to untitled Ministry of Environment Letter dated December 3, 2015

duce the sediment load to the Settling Pond, as well as the aggressive re-vegetation of disturbed areas.

- The Settling Pond will be re-surveyed.
- Flow from the newly constructed west ditch will be redirected within the Settling Pond to increase its available retention (settling) time for this specific input.
- Berms within the Settling Pond will be built up to above the elevation of a 1 in 10 year storm event.
- The permeability of the pond floor will be confirmed via a percolation test (when weather conditions allow).
- The construction of Settling Pond walls will be reviewed to confirm that they do not/will not allow excessive exfiltration.
- A water sampling program will be implemented for incoming water into the pond to assess levels of TSS and the particle size distribution.
- Based on revised exfiltration estimates, exfiltration paths and rates will be assessed to ensure environmental protection.

We are working with Stantec to develop a reasonable and practical schedule for these recommendations, especially with respect to winter weather. We will update you as soon as practicable.

Please contact the undersigned if further information and/or clarification is required.

Yours truly,

SIRM



Todd Mizuik, Director

SIRM





December 23, 2015  
File: 111720018

**Attention: Todd Mizuik, Director**  
South Island Resource Management Ltd.  
460 Stebbings Road  
Shawnigan Lake, BC  
V0R 2W3

Dear Mr. Mizuik,

**Reference: 460 Stebbings Road – High Level Review of West Side Settling Pond Sizing**

## **1. BACKGROUND**

This letter report provides a review of the western Settling Pond (hereby referred to simply as "settling pond") Performance to meet Ministry of Environment (MOE) Permit requirements. This is the second letter report submitted to South Island Resource Management (SIRM), following the submission of the report entitled "460 Stebbings Road – Review of West Pit Floor Cut Off Ditch", dated December 18<sup>th</sup> 2015.

This assessment has been carried out to a very tight timeline, and as such Stantec were unable to obtain the previous design calculations performed by Active Earth relating to the pond sizing. For the purposes of this high level review, the current Department of Fisheries and Oceans (DFO) "Land Development Guidelines" (LDG) along with the current MOE "Guidelines for assessing the Design, Size and Operation of Sedimentation Ponds Used in Mining" were used as reference documents. The site will be modeled using Storm Water modeling software early next year to review all water management practices on-site with the intention of preparing a more holistic storm water management plan.

## **2. PERMIT REQUIREMENTS FOR WATER QUALITY**

The site is located at 460 Stebbings Road in the Cowichan Valley Regional District. Runoff from the site drains to Shawnigan Creek which subsequently drains into Shawnigan Lake, located approximately 5km from the site.

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The requirements for discharge of water are covered in section 1.5 in Permit PR-105809, issued by the Ministry of Environment on August 21, 2013. These requirements are listed below, and are taken from Permit PR-105809, Section 1.5 "Ancillary Discharge – Settling Pond".

1. The rate of settling pond discharge is 42,500 m<sup>3</sup>/day for up to 1 in 10 year return period flood event of 24 hour duration.
2. The authorized discharge period is continuous.
3. The characteristics of the settling pond discharge effluent (SW-1) must be equivalent to or better than the most stringent of those British Columbia Approved Water Quality Guidelines (BCAWQG) and A Compendium of Working Water Quality Guidelines for British Columbia (BCWWQG) for Freshwater Aquatic Life uses and Total Suspended Solids (TSS) must not exceed 25 mg/L for up to 1 in 10 year return period flood event of 24 hour duration.

For flood events greater than 1 in 10 year return period flood event of 24 hour duration, the characteristics of the settling pond discharge must not exceed background concentrations (SW-4).

The source of the discharge must be limited to non-contact site stormwater runoff and treated effluent released from the WTS described in Subsection 1.4.

The Director may specify different standards and other substances in writing for the protection of human health or the environment.

4. The authorized works are surface runoff collection and diversion ditches, leachate, surface runoff and leak detection control reservoirs, one surface settling pond, flow measurement device, monitoring and sampling equipment, emergency overflow and related appurtenances.
5. The authorized works must be complete and in operation while discharging.
6. Settled solids which have accumulated in the settling pond must be removed as required to maintain a minimum water depth below the pond decant of 0.5m. The removed solids must be disposed of in a manner approved by the director.
7. The location of the facilities from which the discharge originates and the point of discharge is Lot 23, Plan VIP78459, Blocks 156, 201, and 323, Malahat Land District.

A discussion of site operations and different classifications of site water/runoff were discussed in the December 18<sup>th</sup> 2015 West Ditch review memo, and will not be revisited at this time.

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### 3. SETTLING POND SIZING

#### 3.1: BACKGROUND INFORMATION

The following section outlines the rationale, design criteria and calculations used to assess the size of the Settling Pond. To complete this initial review of the Settling Pond's capacity, Stantec used the Rational Method to determine the contributing stormwater runoff into the pond for the sustained 24 hour storm events, looking at the pond's ability to treat and discharge up to the 1:10yr event and the capacity to direct the 1:200yr event into the ephemeral stream at the pond's spillway.

Figure 1 shows the catchment area for the settlement pond. The area encompasses the entirety of the mine boundary for the purposes of the high level review and calculations, but only the area shaded in blue currently drains towards the settling pond.

Surface runoff, as well as shallow sub-surface runoff flowing close to the surface may be deposited in the settling pond; however, water that infiltrates into the ground may also infiltrate to a depth whereby it will flow sub-surface offsite, bypassing the pond. The amount of water that will infiltrate, and the subsequent sub-surface drainage path of that water, is dependent on the sub-surface ground conditions. Although detailed discussions and investigations on deeper groundwater movement have previously taken place during the permitting process with MOE, there is limited information on the shallow subsurface conditions as a result of the mining process (constitution of the blast rock) and the seepage blanket, and so Stantec are unable to provide comment on sub-surface drainage at this time. It is proposed to conduct a detailed geotechnical and hydrogeological assessment of the site in 2016 in order to better define the nature of the shallow sub-surface drainage on-site.

In the absence of such infiltration data, certain assumptions were made in order to assess the size of the settling pond. To ensure the settling pond is adequately sized, a conservative runoff coefficient of 1.05 for 10 year storm event, and 1.1 for the 200 year storm event, was used. This was taken from the "BC Ministry of Transportation (MoT) Supplement to the TAC Geometric Design Guide", which is used to size ditches and culverts for highways. This runoff coefficient accounts for largely impermeable steep ground and also factors in snowmelt.

Following a detailed geotechnical investigation, and during the development of a more detailed Storm Water Management Plan (SWMP) in 2016, the calculations for runoff into the settling pond and pond sizing should be reviewed.

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Allterra Construction Ltd.  
2100 Lakeshore Road  
Victoria, BC  
V8B 6K4

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Author

Reviewer

Approved

Date

Project

400 Hobbins Rd, Lot 23

Project Name

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Project Number

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Project Number

170417

Date





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### 3.2: GENERAL OPERATION OF SETTLING PONDS

Settling ponds promote treatment of turbid water by 2 primary methods:

1. Slowing the velocity of the water by providing a long flow path through the pond with a flat grade, allowing solid particles suspended in the water to settle out to the bottom of the pond.
2. Filtering the water through various gradations of gravel berms, so solids suspended in the water get caught in the berms allowing cleaner water through the interstitial spaces between the gravel.

A "design storm" which the settling ponds must provide treatment to, is typically mandated by the governing authority, in this case being the Ministry of Environment and Permit PR-105809; the design storm in this case is the 10 year – 24 hour event. The flow leaving the pond should be controlled, whether by a weir or an orifice control, to not exceed the design storm peak flow. In events that are greater than the design storm flow/volume, the water flows over an overflow and discharges offsite.

### 3.3: DESIGN CRITERIA

The following is a list of design criteria and assumptions used during the sizing of the settlement pond:

- The calculations assume that there is no infiltration from the bottom or sides of the pond.
- The design storm which the pond is intended to treat to is the 10 year return period, 24 hour storm event. Over the 10 year – 24 hour event, water will overflow into the two 300mm diameter pipes and discharge offsite. The berms around the pond, and the emergency spillway, are intended to provide storage and attenuation for the 200 year flood, in order to allow a controlled discharge of the 200 year event from the pond.
- The runoff coefficient used for the entire contributing area is 1.05 for the 10 year event and 1.1 for the 200 year return storm event, as per "BC MoT Supplement to TAC Geometric Design Guide", Table 1020.A. The runoff coefficient assumes a moderate slope of 10-20% with snow melt.
- The time of concentration used is 24 hours, in order to represent the 24 hour storm event for the catchment. The corresponding rainfall intensity values "i" for the 10 and 200 year return periods are 3.3 mm/hr and 5.0 mm/hr respectively.
- The contributing catchment area is 10.51 ha and was estimated based on the worst case scenario, assuming all areas within mine boundary are disturbed and flow is directed

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towards the settling pond. There are other areas on the east side of the site which drain to smaller settling ponds prior to discharging to Shawnigan Creek; these ponds were not reviewed as part of this report.

- The IDF curve from North Cowichan was used, as the weather station experiences similar average precipitation to Shawnigan Lake (referenced from the Weather Network). North Cowichan generates approximately 10% more precipitation per year than Shawnigan Lake.

### 3.2: DESIGN CALCULATIONS

#### 3.2.1: Flow Calculation

Using the assumptions listed above the Rational Method was utilized to determine the volume and flow rates of runoff contributing to the Settling Pond.

##### Rational Method:

Stormwater runoff (Q) is calculated by a runoff coefficient (C, representing a % of water that flows overland during a storm event), rainfall intensity (I) and the contributing area (A). Below is the flow calculation for the 1:10 year 24 hour storm event:

$$Q = \frac{CIA}{360}$$
$$Q = \frac{1.05 * 3.3 \text{ mm/hr} * 10.51 \text{ ha}}{360} = 0.101 \text{ m}^3/\text{s}$$

#### 3.2.2: Orifice Sizing

The as-built drawings of the settling pond provided to Stantec do not show the orifice size at the discharge pipe; therefore Stantec cannot assess the suitability of the orifice sizing currently installed on-site. The calculations below detail the recommended orifice size required to convey the 10 year – 24 hour storm flow calculated in Section 3.2.1.

- $C_d$  = orifice coefficient = 0.6
- $A_o$  = orifice opening area
- $Q_o$  = 10 yr return flow =  $0.101 \text{ m}^3/\text{s}$
- $g$  = gravitational acceleration =  $9.81 \text{ m/s}^2$
- $h_o$  = 10 year overflow height above orifice invert = 1.23

$$Q_{\text{orifice}} = Q_o = C_d * A_o * \sqrt{2 * g * h_o}$$

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$$A_o = \frac{0.101}{0.6 * \sqrt{2 * 9.81 * 1.23}} = 0.0343 m^2$$

$$A_o = \pi r_o^2$$

$$r_o = 0.104 m$$

The diameter of the opening is twice the radius, therefore the required orifice opening diameter should be 200mm. This opening will maintain controlled flow through the orifice up to the predicted 10 year 24hr flow conditions.

### 3.2.3: Settling Pond Retention Time

The DFO "Land Development Guidelines" detail the required hydraulic retention time to be a "minimum of 40 minutes." The retention time is the time water would take to travel from the entrance point of runoff into the pond to the discharge point during the peak flow of a design storm. The longer the retention time, the more opportunity there is for settlement of suspended solids from the water.

The following is a review of the as-built drawings in regard to determining the retention time for a 10 year storm event. The LDG design parameters design the treatment area based on a 1:5 year storm, and while this is an acceptable guideline the MOE Permit requires the on-site run-off be treated to the 10 year return period, so the flow rate used in these calculations is the 10 year flow rate:

- $Q_{10} = 0.101 m^3/s$
- $A$  = typical cross section area of the flow path was averaged between the areas between the three berms =  $2.1 m^2$
- $L$  = flow path length from inlet to outlet orifice = 132m
- $V$  = average flow velocity
- $t$  = retention time

$$V = \frac{Q_{10}}{A} = \frac{0.101}{2.1} = 0.0481 m/s$$

$$t = \frac{L}{V} = \frac{132}{0.0481} = 2,744.3 sec = 45.7 min$$

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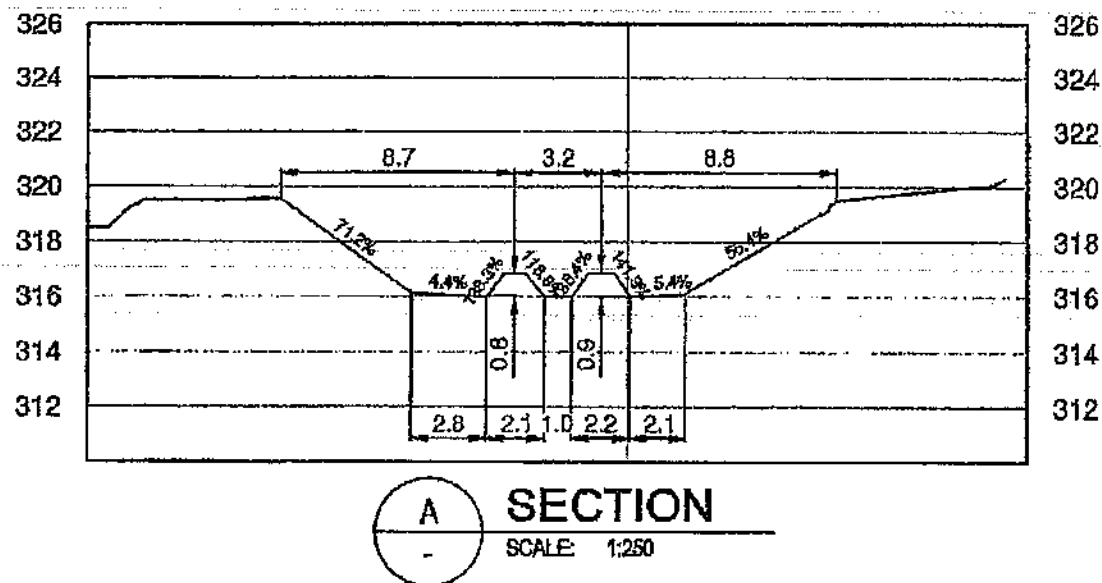


FIGURE 2: SETTLING POND CROSS SECTION FROM AS-BUILTS

The retention time does appear to meet the LDG required 40 minute minimum based on the 10 year, 24 hour flow estimate.

### 3.2.3: Spillway review

The spillway is required to handle and direct a 1 in 200 year 24 hour storm event into the ephemeral creek without topping over in any other areas. The spillway, as shown below, is capable of discharging a 200 year storm event (as predicted with the Rational Method) with low velocities over the embankment into the ephemeral creek. The as-built drawings detail that the spillway is lined with geotextile material and topped with Class 25 rip rap; this class of rip rap is deemed suitable for this application.

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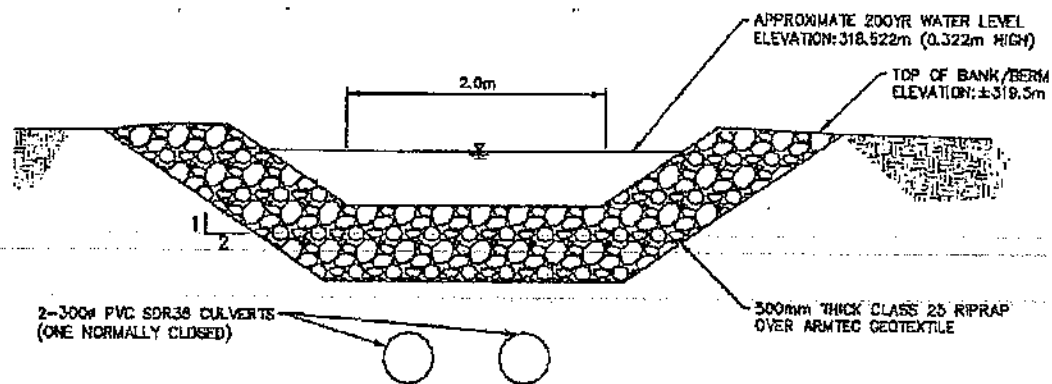


FIGURE 3: SPILLWAY SECTION FROM AS-BUILTS

$$200 \text{ year flow } Q_{200} = \frac{C \cdot i \cdot A}{360} = \frac{1.1 \cdot 5.0 \cdot 10.51}{360} = 0.161 \text{ m}^3/\text{s}$$

From a review of the as-built drawings, the spillway is believed to be adequate in its current configuration to accommodate the 200 year event.

Backup calculations are appended at the end of this letter.

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#### 4. RECOMMENDATIONS

##### 4.1: SETTLING POND DIMENSIONS AND CONSTRUCTION

No current survey is available for the existing settling pond, so all measurements regarding pond surface area, retention time etc. are based on the as-built drawings provided to Stantec. However, certain ambiguities between what has been observed on-site, and what is shown on the as-built drawings, require aspects of the pond construction to be confirmed by SIRM to validate calculations and recommendations made in this report. It is highly recommended that SIRM carry out, and provide to Stantec, a survey of the pond so the assumptions and calculations contained in this report can be confirmed.

Based on our initial assessment of the Settling Pond design, we recommend the following:

- From the site visit, it was noted that the west ditch run off enters the pond at the south west corner. The settling pond is designed with the intention that all runoff enter the pond at the south east corner, where the water treatment system currently outlets to. In order to get the maximum retention time through the pond. By entering at the south west corner, the runoff in the west ditch is essentially "short-circuiting" the pond, and further reducing the retention time for runoff from the west ditch. This negatively impacts the treatment of water from the west ditch. The flow from the west ditch should be redirected so that the maximum retention time is achieved. This could be done by constructing an impermeable berm (either clay cored, or with an impermeable liner/geotextile at the centre of a gravel berm) at the south end of the pond to intercept the west ditch flow and redirect to the south east corner.
- The clay and gravel berms within the pond should extend to the height of the 10 year overflow to ensure that all water within the design storm is receiving treatment. Currently, the as-built drawings show that the berm heights are below the 10 year overflow elevation, hence runoff could potentially "short-circuit" the pond berms and not receive adequate treatment during a 10 year event.
- The as-built drawings indicate the pond bottom and sides are lined with clay, which suggests the pond was designed to be primarily impermeable, as clay has a permeability of around  $1 \times 10^{-9}$  m/s. From visual observations of the pond following rain events, the water appears to infiltrate from the pond much quicker than this. The permeability of the actual material at the pond bottom should be confirmed by SIRM via a percolation test.
- Confirm that a clay core is present in all side berms of the pond so that excessive, uncontrolled exfiltration does not take place.

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- The vast majority of the settlement from site water is currently being done in the settling pond. By employing silt fences/hay bales intermittently within site swales, intermittent treatment of the site runoff can be carried out before the pond is reached, improving incoming water quality and reducing the load on the settling pond.
- Hydro seed and/or revegetate all disturbed areas on-site wherever possible.

Regular maintenance as outlined in the as-built drawings and within the SIRM Environmental Management Plan should be strictly adhered to, in particular with respect to the removal of sediment from the pond.

#### **4.2 FUTURE WORK TO REFINE POND DESIGN**

##### **4.2.1 Influent Water Sampling**

The above recommendations and report are based on generally accepted guidelines detailed in the "Land Development Guidelines" document, generated by the Department of Fisheries and Oceans. However, these are not site specific and are used in the absence of site-specific data. It is highly recommended that a water sampling program be employed for all incoming water into the pond, to assess the levels of TSS and the particle size distribution within the untreated site water. With this data, the pond design can be more accurately tailored to the site specific conditions, which may result in improvements to the pond design. Only with this influent sampling data can a more site specific design for the settling pond be completed.

In situations with very fine particles, settling via gravity alone may not be sufficient to meet the quality requirements at the discharge point. If this is the case, the use of flocculants will promote the settling out of smaller particles. The potential requirement for flocculants on-site can be assessed following a sampling program of both untreated influent flow and treated discharge.

##### **4.2.2 Percolation Test**

The calculations in this report assume an impermeable clay barrier lining the pond bottom and sides. While SIRM have confirmed verbally that a clay barrier was installed, the visual observations of the rate of water draining from the pond following a rain event suggest that the permeability of the liner is not representative of a typical clay material.

It is suggested that a percolation test be carried out in the presence of a registered geotechnical engineer to assess the actual permeability of the pond liner. Following this undertaking, the assessment of the pond will need to be reviewed.

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#### **4.2.3 Geotechnical/Hydrogeological Review**

Following on from the previous point, the flow path of water that exfiltrates out of the pond should be confirmed, in order to confirm that no damage is being done to the environment outside of the site. This will involve a geotechnical/hydrogeological review be completed in early 2016.

#### **4.2.4 Sub-Surface Water Sampling**

It is suggested that monitoring wells be constructed on the western property line in a number of locations and at varying depths, so that water sampling of the shallow sub-surface water can be tested to assess the quality.

#### **4.2.5 Detailed Storm Water Management Plan**

A more detailed storm water management review, undertaken using digital modeling and more sophisticated methods than the rational method, would provide a better representation of the storm water flow on-site, and would allow for optimizing the design of the settling pond. This review is proposed to be undertaken in 2016.

The pond is believed to be adequately sized for the current requirements. Ongoing reviews of the on-site storm water management should be conducted as the mining operations continue and the site conditions subsequently change.

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## 5. LIMITATIONS OF REPORT, OTHER CONSIDERATIONS AND NEXT STEPS

### 5.1: LIMITATION

Given the urgent nature of this review, required in order to quickly assess the Settling Pond's capability to meet MOE requirements, Stantec have utilized calculation methods which typically produce conservative (higher than likely) estimates for flow. The rational method is a simplified method for calculating storm water flows, but is generally accepted by most municipalities and agencies as a calculation for smaller catchment areas. A more detailed review using Storm Water modeling software would provide a more realistic representation of water flow on-site, and it is proposed to conduct this investigation in 2016.

Stantec can not provide comment at this time on the extent of storm water infiltration to ground anywhere on the site, nor on the shallow sub-surface drainage path or water quality within the broken blast rock and seepage blanket.

### 5.2: NEXT STEPS

It is recommended that a percolation test and a geotechnical/hydrogeological investigation be carried out in early 2016 to assess the flow and quality of the water exfiltrating from the pond.

Regards,

Stantec Consulting Ltd.

Alan Ghanam, P.Eng  
Managing Principal  
Phone: (250) 389-2347  
Fax: (250) 382-0514  
Al.ghanam@stantec.com

Attachment: Attachment

C.

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Stantec

Settling Pond 1:10yr (A.E. return)

Include Table

INCOMING FLOW  $Q = \frac{CIA}{360}$

to not know C value used

MOTI - Mountainous Terrain 10-25% Precip + 0.05 snowfall + 0.1 = 1.05

Design storm: 10 year, 24 hour  
C 'realistic' = 1.05  
A 'realistic' = 10.51 ha (Mine Boundary)  
i 3.3mm/hr North Cow IDF

North Cowichan IDF used as its Monty precip data is very similar to Shavangan Lake / yearly is higher (11% higher)

There is no existing IDF for Shavangan Lake from Env. Canada.

$$Q = \frac{1.05 \cdot 3.3 \text{ mm/hr} \cdot 10.51 \text{ ha}}{360} = 0.101 \text{ m}^3/\text{s}$$

$$\text{Volume of water over entire storm event} = 3.3 \text{ mm/hr} \cdot 24 \text{ hr} \cdot 10.51 \text{ ha} = 8324.0 \text{ m}^3$$

x 1.05 for snowmelt  
≈ 8,730 m<sup>3</sup>

$$\text{Actual storage (Volumes taken from As-built in CAD)} = 806 \text{ m}^3$$

$$\text{Flow path length} = 132 \text{ m}$$

$$\text{Outlet invert is } 1.23 \text{ m}$$

Headwater (H<sub>0</sub>) is 1.23m  
Difference between 10yr overflow

$$\text{Orifice sizing for } Q = 0.101 \text{ m}^3/\text{s} :$$

Q - Flow rate in

C<sub>d</sub> - loss coeff for orifice (0.6 for straight edge)

g - gravitational Acceleration

h<sub>0</sub> - Depth of water above orifice

A<sub>0</sub> - Area of orifice opening

$$Q = C_d A_0 \sqrt{2gh_0}$$

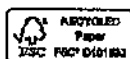
$$A_0 = \pi r_0^2 = \frac{Q}{C_d \sqrt{2gh_0}}$$

$$r_0 = \sqrt{\frac{Q}{\pi C_d \sqrt{2gh_0}}} = \sqrt{\frac{0.101 \text{ m}^3/\text{s}}{\pi \cdot 0.6 \cdot \sqrt{2 \cdot 9.81 \text{ m/s}^2 \cdot 1.23 \text{ m}}}} = 0.1044 \text{ m}$$

$$\phi \text{ orifice} = 2r_0 = 0.209 \text{ m}$$

Designed by: David Pottle

Checked by:



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Stantec

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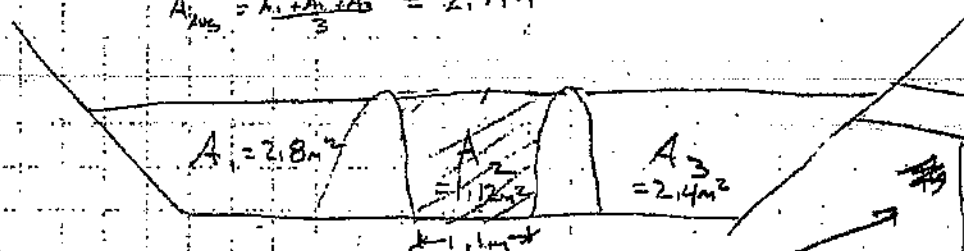
if currently only 100mm  $\phi$  orifice

$$Q = 0.023 \frac{\text{m}^3}{\text{s}} \times \left(\frac{60}{\text{s}}\right)^2 \times 24 \text{ hr} = 2000 \text{ m}^3 \text{ of discharge over 24 hrs}$$

Flow through  
a 100  $\phi$  orifice  
w/ 1.23m headwater

assuming water level const at 10yr outflow

$$A_{\text{avg}} = \frac{A_1 + A_2 + A_3}{3} = 2.1 \text{ m}^2$$



to not over flow berms orifice  
should be  $r = 0.153 \text{ mm}$   
 $d > 300 \text{ mm}$

If we assume  
the headwater  
is only 0.27m,  
as per Section A

retention time:

flow path Length = 132m

$$Q = 0.101 \frac{\text{m}^3}{\text{s}}$$

X-section Area for flow path = 2.1 m<sup>2</sup> (taken from X section of pond)

$$t = \frac{L}{V}$$

Avg. Trans. Areas

$$\text{Current} = \frac{132}{\left(\frac{0.101 \text{ m}^3}{2.1 \text{ m}^2}\right)} \times \frac{1 \text{ hr}}{60 \text{ s}} = 45.8 \text{ min}$$

Worst Case

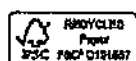
$$t = \frac{132 \text{ m}}{\left(\frac{0.101 \text{ m}^3}{1.12 \text{ m}^2}\right)} \times \frac{1 \text{ hr}}{60 \text{ s}} = 24.4 \text{ min}$$

$$\frac{132}{3} = 44 \text{ m}$$

$$t = \frac{44}{\left(\frac{0.101}{2.8}\right)} + \frac{44}{\left(\frac{0.101}{1.12}\right)} + \frac{44}{\left(\frac{0.101}{2.4}\right)} = 45.8 \text{ min}$$

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Drawing: V:\1117\active\111720018\4\_drawings\quantities\1117\active\111720018  
4\_drawings\quantities\111720018\_volume\_surface.dwg

Volume Summary							
Name	Type	Cut Factor	Fill Factor	2d Area (sq.m)	Cut (Cu. M.)	Fill (Cu. M.)	Net (Cu. M.)
318.73 volume	full	1.000	1.000	945.32	40.97	1486.71	1445.74<Fill>
318.23 volume	full	1.000	1.000	945.32	125.08	1098.16	973.08<Fill>
317.91 volume	full	1.000	1.000	945.32	202.22	872.80	670.58<Fill>
317.81 volume	full	1.000	1.000	945.32	229.94	805.99	576.05<Fill>
316.58 volume	full	1.000	1.000	945.32	733.35	146.65	586.70<Cut>

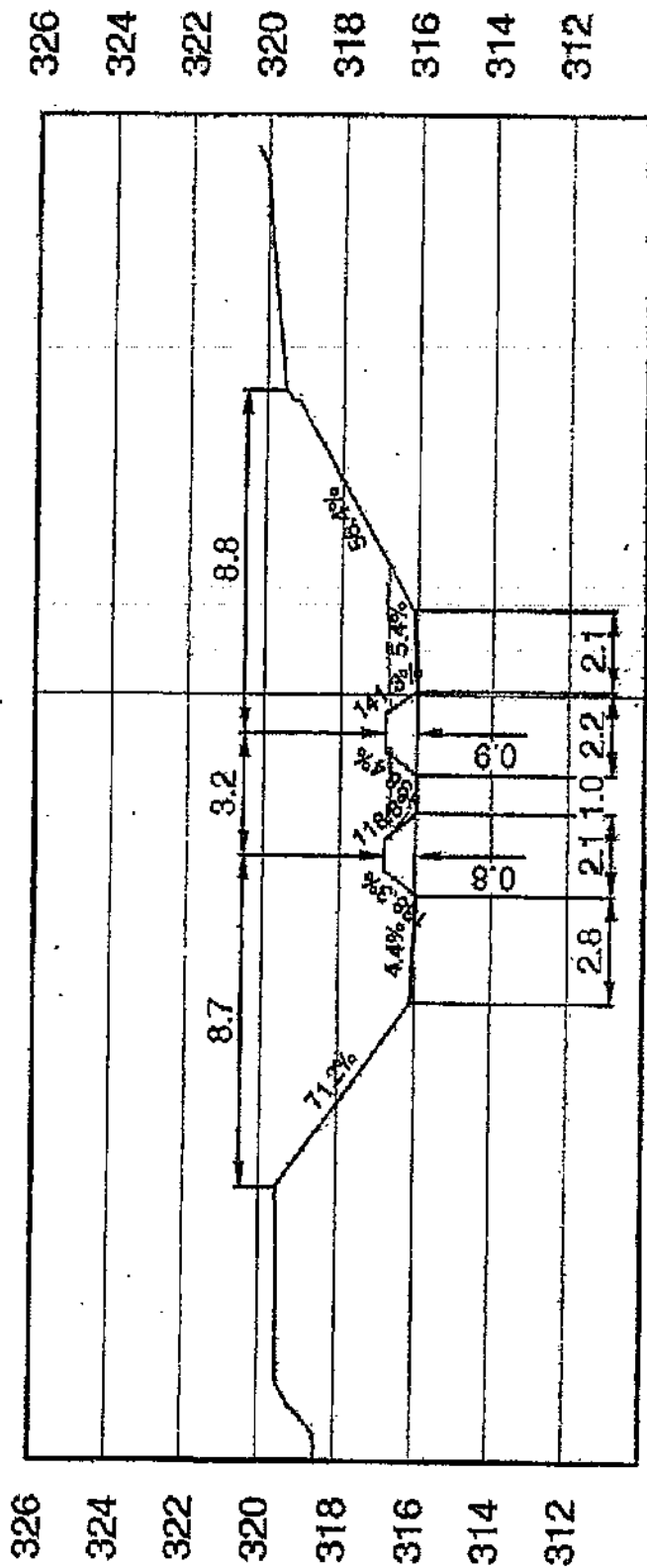
Totals				
	2d Area (sq.m)	Cut (Cu. M.)	Fill (Cu. M.)	Net (Cu. M.)
Total	4726.60	1331.56	4410.31	3078.75<Fill>

\* Value adjusted by cut or fill factor other than 1.0



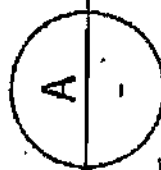






# SECTION

SCALE: 1:250



$$A_2 = \frac{1}{2} \times (1.5 + 0.8) \times 1.5 = 0.8$$

$$A_3 = 2.4 \text{ m}^2$$

$$\tan \theta = \frac{0.8}{1.5}$$

$$A_1 = 2.8 \text{ m}^2$$

$$A_2 = 1.12 \text{ m}^2$$

$$A_3 = 2.4 \text{ m}^2$$

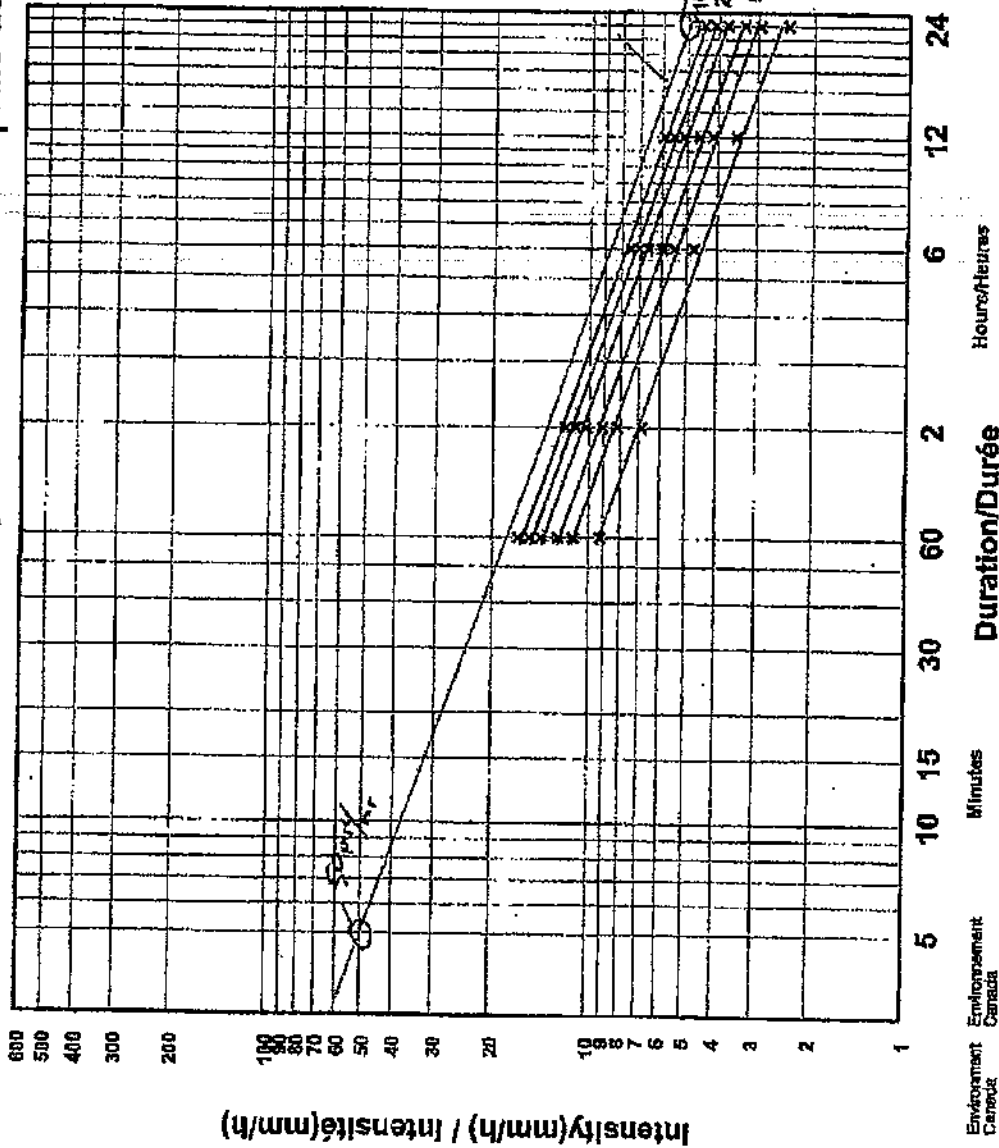
$$\text{Avg Area} = 2.11 \text{ m}^2$$



# Short Duration Rainfall Intensity-Duration-Frequency Data Données sur l'intensité, la durée et la fréquence des chutes de pluie de courte durée

2014/12/24

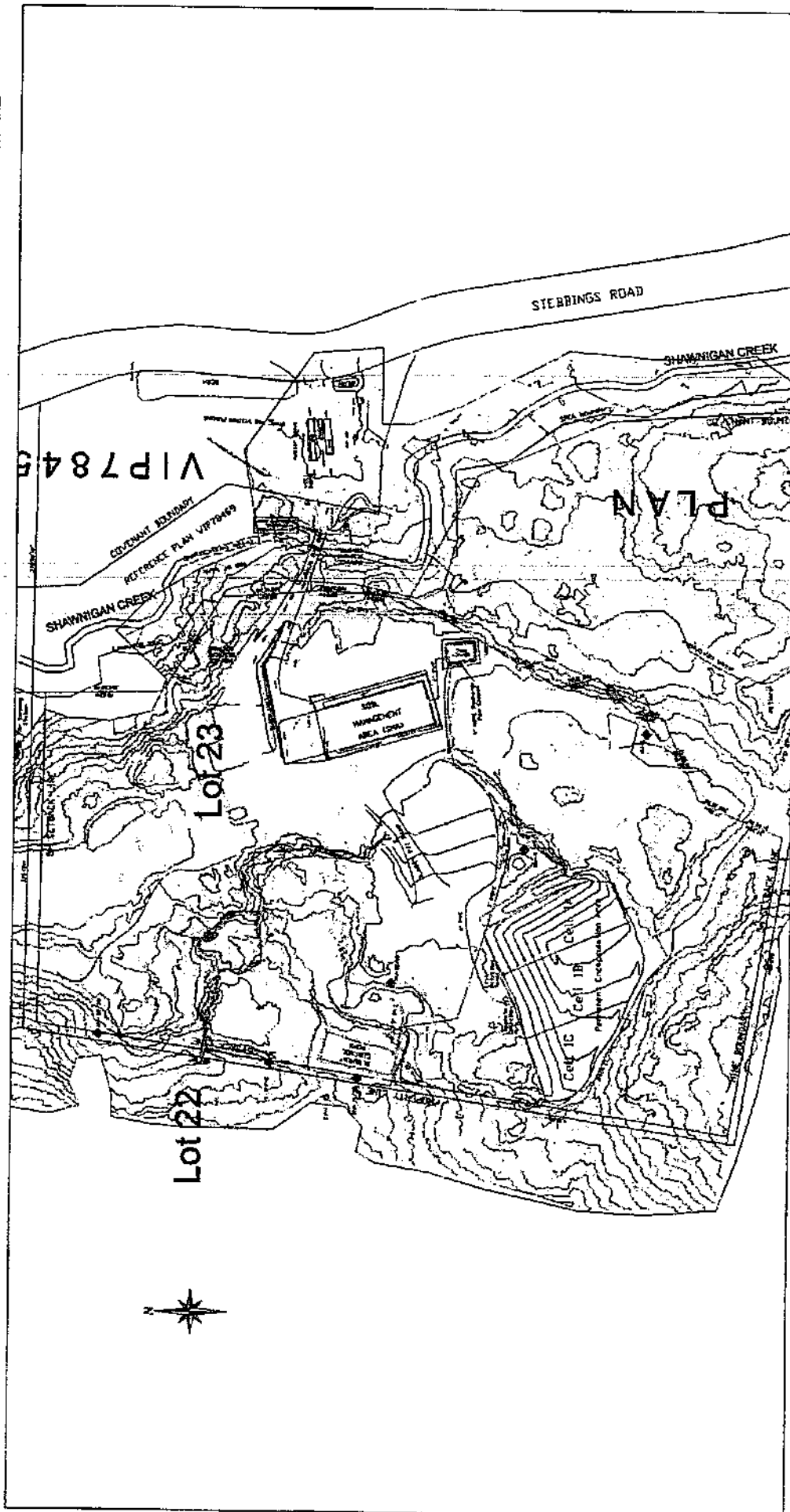
NORTH COWICHAN  
BC  
1015628  
1982 - 2005  
22 years / ans  
Latitude  
48° 49'N  
Longitude  
123° 43'W  
Elevation / Altitude  
45 m



Canada

Environnement  
Canada





Based on J&E/Thermy Drawing 02749-SK-1 - Additional survey measured by GPR, on August 23, 2016 and April 11, 2017 - GPR survey based on Reference Station 30-Englehart (GCR 600411), and confirmed on GCM 704695		Date: 12/04/17 Scale: 1:1000 Elevation: 1000m		
Project: 488 Stebbings Rd, Lot 23 Client: J&E/Thermy Water Management System		Allterra Construction Ltd. 2181 Mainway Road Victoria, BC V8S 4H4		
Drawn by: M.W. Check: G.W.		Date: 12/04/17 Scale: 1:1000 Elevation: 1000m		
Project: 488 Stebbings Rd, Lot 23 Client: J&E/Thermy Water Management System		Allterra Construction Ltd. 2181 Mainway Road Victoria, BC V8S 4H4		



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Ship to <sup>s.21</sup>

Tag:

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Product Type: **Water Tank**

Sold To: <sup>s.21</sup>

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Ship to <sup>s.21</sup>

Tag:

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Product Type: **Water Tank**

Sold To: <sup>s.21</sup>

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Premier WO: **19233**

Ship via:

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