Cobble Hill Landfill
Closure Plan
REPORT

REPARED FOR: Cobble Hill Holdings Ltd.
PREPARED BY: SPERLING HANSEN ASSOCIATES

December 2016
PRJ 16035

SPERLING HANSEN ASSOCIATES

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

SPERLING
HANSEN
ASSOCIATES

• Landfill Engineering
• Solid Waste Planning
• Environmental Monitoring
• Landfill Fire Risk Control

December 20th, 2016 SHA PRJ 16035

Cobble Hill Holdings Ltd.
460 Stebbings Road
Shawnigan Lake BC V0R 2W3
Attn: Mr. Martin Block

Re: **Cobble Hill Landfill Closure Plan**

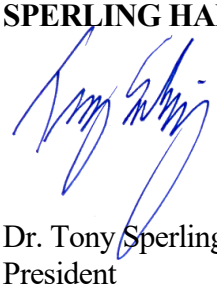
Sperling Hansen Associates (SHA) is pleased to submit a FINAL copy of the *Cobble Hill Landfill Closure Plan* for your review. The plan presents a comprehensive closure solution for Cobble Hill Landfill and Quarry site.

The closure design has been developed to enable both quarrying and landfilling operations concurently. The design includes vehicle and equipment access throughout the lifespan of the site for both operations while minimizing surface water contact and run off from active portions of the site.

The report includes an analysis and reporting on the site characterization, conceptual quarray development, final cover system design and stability, landfill phasing, permanent soil encapsulation, leachate management, surface water management, erosion control, post closure monitoring and costing.

We look forward to working on the next stage of this project with you. Please do not hesitate to call with any questions or concerns.

Yours truly,
SPERLING HANSEN ASSOCIATES



Dr. Tony Sperling, P.Eng.
President

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1. INTRODUCTION

1.1 Background

Sperling Hansen Associates (SHA) was retained by Cobble Hill Holdings Ltd. (CHH) to complete an update to the Closure Plan for submission to the BC Ministry of Environment (MOE).

The Cobble Hill Holdings Landfill (CHL) is located at 460 Stebbings Road, in South Shawnigan Lake Area (Electoral Area B) within the Cowichan Valley Regional District as outlined in Figure 1-1.

The site is currently operated as a rock quarry under the jurisdiction of the BC Ministry of Mines permit number Q-8-094. In conjunction with mining operations, the site is also permitted for Authorization to Discharge Waste under permit number 105809, allowing for contaminated soil to be treated and permanently encapsulated onsite as part of the mine reclamation plan.

Previously in 2013, a Closure Plan and Financial Security Posting was completed by Active Earth Engineering (AEE). The update will build off that report incorporating updates to the closure system design, surface water and contact water management, phasing concepts, monitoring and costing.

Additionally, SHA and CHH understand that operating a quarry and landfill together onsite requires a degree of flexibility in planning and operations. Therefore, as quarrying operations advance, the landfill phasing and cell layout may vary slightly from the closure plan due to extraction scheduling and aggregate production.

1.2 Purpose and Scope

SHA have been involved with CHH dating back to the early part of 2016 when SHA's President and Chief Engineer Dr. Tony Sperling P.Eng. was asked to complete third party review of the permanent cell closure that was underway at the landfill. In November, 2016 SHA agreed to continue working with CHH to complete an updated Closure Plan for submission to MOE before the end of 2016. The recommended work plan consists of three major tasks, each with numerous sub-tasks, as listed in the following sections.

1.2.1 Project Startup and Field Work

SHA staff have completed three site visits in total since the Spring of 2016. Based on the site visits and review of numerous documents including Technical Assessment Reports (AEE), Environmental Procedures Manual / Operations, Maintenance and Surveillance Manual (SIRM), Permits and others, SHA has a good understanding of site operations, environmental controls and future planning.

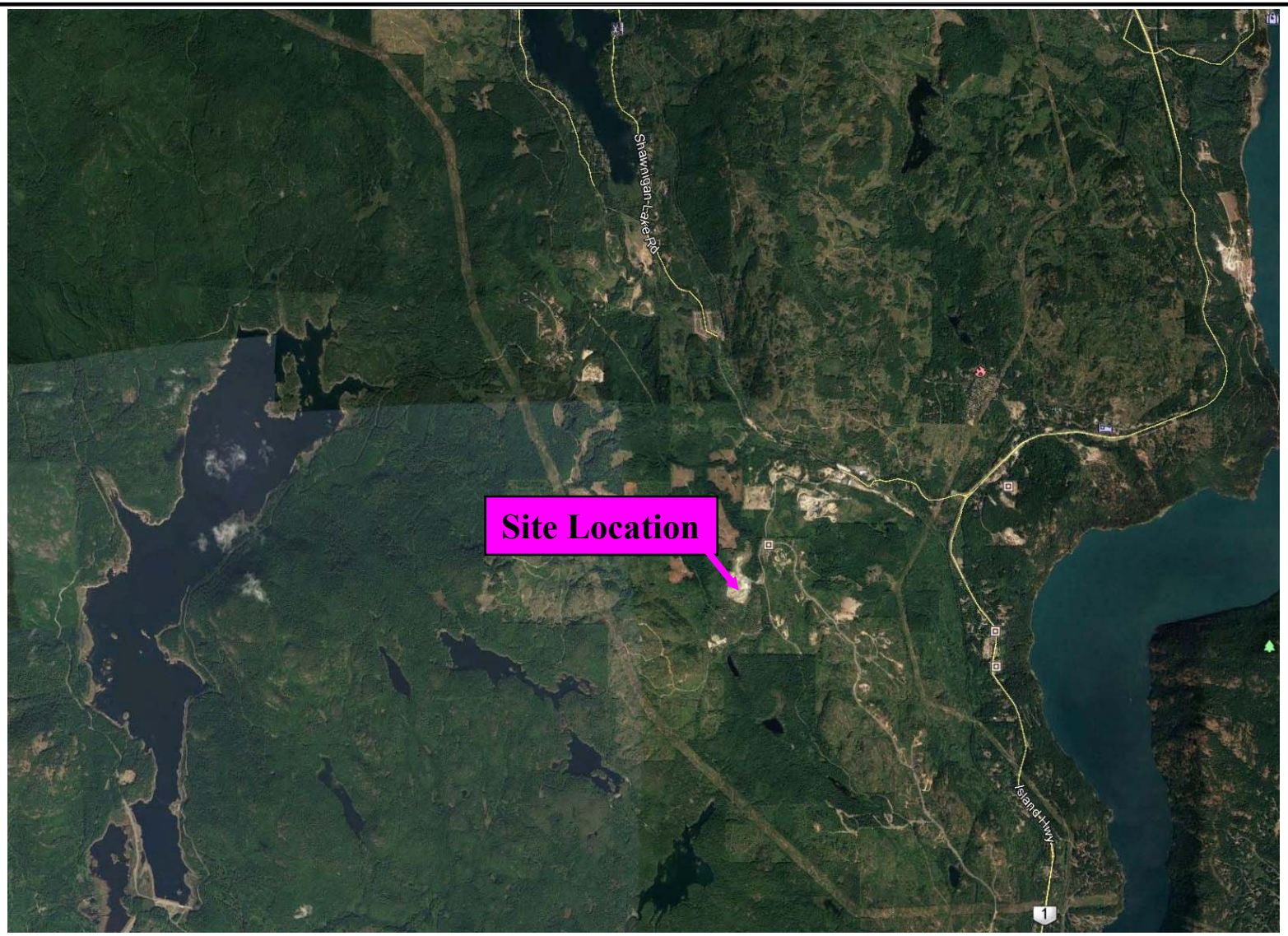
SHA understands the importance and intricacies of operating a quarry and landfill simultaneously onsite and will continue to work with CHH into the future to ensure environmental controls are at the forefront of operations.

1.2.2 Closure Plan

Included the following sub-tasks: Site Description, Summary of Quarry Phasing, Conceptual Reclamation Filling Plan, Permanent Cell Encapsulation Construction, Leachate Collection and Management, Contact Water Management, Storm Water Management, Final Closure Design, Geotechnical Considerations, Erosion Control, Monitoring and Costing.

1.2.3 Reporting

Included the following sub-tasks: Prepare and submit draft closure plan and to finalize report upon receiving comments from CHH.



SPERLING HANSEN ASSOCIATES	COBBLE HILL HOLDINGS LTD.	PROJECT: COBBLE HILL LANDFILL CLOSURE PLAN	TITLE: Site Location	SCALE: N/A	DATE: 2016/12/12 yyyy/mm/dd
					PROJECT NO: 16035
				DESIGNED: SG	DRAWING NO: FIGURE 1-1
				DRAWN: SG	
				CHECKED: TS	

2. SITE DESCRIPTION AND HISTORY

2.1 Physical Setting

The Cobble Hill Quarry is located at 460 Stebbings Road, in the South Shawnigan Lake Area, approximately 5 km south of Shawnigan Lake, BC.

The existing site property boundary encloses a 21 Ha area of land, of which approximately 8.4 Ha is planned for the quarry and landfill operations. An additional 2 Ha is currently being occupied by front end operations such as weigh scale and scale house as well as machinery parking areas and wheel wash facilities. The existing topography and infrastructure onsite is presented in Figure 2-1.

The Shawnigan Creek corridor crosses Lot 23 on the western 1/3 of the site, draining south to north. The lands to the south and west, Lot 22, is crown land. Cobble Hill Holdings Ltd. (CHH) own the parcel of land directly to the north, Lot 21 and the site is bound on the east by Stebbings Road.

2.2 Site History

In August 2006, a notice of intention to commence work on a quarry, including a plan of the proposed work system and a program for the protection and reclamation of the surface of the land and watercourses affected by the work was filed. A quarry permit (No. Q-8-094) was issued in October 2006, amended in April 2009 and again in July 2015.

In 2013, a permit (No. 105809) authorizing discharge of treated soil from a contaminated soil treatment facility at 460 Stebbings Road, was granted to CHH. The site was originally operated by South Island Aggregates (a subsidiary of CHH). As of June 2015, the quarry has been operated by South Island Resource Management Ltd. (SIRM).

Currently SIRM has completed permanent encapsulation of one cell in the western portion of the site. The encapsulation includes both basal and cap lining system composed of 40mil Geomembrane with drainage layers and above and below contaminated soil layers.

Minimal soil import is currently occurring on site with storage in the site's Soil Management Area, however, CHH does not plan to landfill further contaminated soil until further quarrying operations are undertaken to open up a part of the quarry to final grades. This will allow future soil cells to be permanently situated in portions of the quarry that will not be subject to further rock extraction, thereby avoiding the need for double handling of the soils. Completion of the quarrying operations could be 8-10 months away.

2.2.1 Site Location

CHL is located approximately 5km south of Shawnigan Lake in the Cowichan Valley Regional District (CVRD). The site was operated as a rock quarry prior to receiving Authorization to Discharge Waste. The site now operates as both a quarry and landfill.

Based on information outlined in the Technical Assessment for Authorization to Discharge Waste prepared Active Earth Engineering Ltd. (2012), the land surrounding the site is used primarily for forestry as well as mineral extraction. Five quarries exist within 1 kilometer of the site (Active Earth Engineering Ltd., 2012). Land use zoning for parcels surrounding the site includes Primary Forestry, Secondary Forestry and Community Land Stewardship.

According to the CVRD's zoning by-law, land zoned for Primary Forestry (F-1) may be used for the following purposes:

- management and harvesting of primary forest products excluding sawmills and manufacturing
- extraction, crushing and milling of aggregate material
- single family residential
- agriculture, horticulture, silviculture
- home based business
- bed and breakfasts
- secondary suite on parcels less than 10.0 hectares
- secondary suite or secondary dwelling on parcels greater than 10.0 hectares

The Primary Forestry lands adjacent to the site are owned with the CVRD and include the Stebbings Road Community Forest (Active Earth Engineering Ltd., 2012). Two residences exist on land located approximately 320 meters southeast of the site.

Land zoned for Secondary Forestry includes similar land uses as Primary Forestry; however, aggregate mining is not permitted. There are five one hectare parcels zoned for Secondary Forestry northeast of the site.

Land zoned for Community Land Stewardship exists 200 meters south of the site extending to 2.5 kilometers south. This zone includes a variety of land uses ranging from ecological conservation, single family dwellings, bed and breakfasts, home based business, equestrian centers, daycare, convenience store, schools and more.

An Industrial Park also exists in the vicinity of the site, located off Shawnigan Lake Road.

2.2.2 Legal

The legal description of the land parcel for the Shawnigan Lake Quarry is as follows:

Parcel I.D.: 026-226-502
Legal: Lot 23, Plan VIP78459, Blocks 156,201,323, Malahat Land District.

2.2.3 Permit

As of August 21, 2013, the Shawinigan Lake Landfill, received Permit 105809 to discharge waste. The permit authorizes discharge of contaminated soil. The permit allows for soil treatment onsite,

however, CVRD municipal bylaws, according to BC supreme court, indicate that soil treatment is not within the respective land use. Soil treatment is not conducted onsite.

A covered soil management area accepts soils contaminated with hydrocarbons, styrene, methyl tertiary butyl ether, volatile petroleum hydrocarbons, light and heavy extractable petroleum hydrocarbons, polycyclic aromatic hydrocarbons, chlorinated hydrocarbons, phones, chloride, sodium, and glycols.

The permit allows for discharge of contaminated soils and ash into a lined Landfill cell. Contaminate levels better than Hazardous Waste, as regulated by the Hazardous Waste Regulation, are permitted for landfilling. Contaminants permitted include those listed above as well as soils impacted by metals, dioxins, and furans.

Effluent from the site is permitted at a maximum discharge rate of 274 cubic meters per day, and must meet British Columbia Approved Water Quality Guidelines for Drinking Water and Freshwater Aquatic Life. The above-mentioned rate is currently being reviewed by the Ministry of Environment to allow for additional discharge during high storm events.

2.2.4 Geology and Hydrogeology

The site is underlain by Wark Gneiss bedrock – a formation composed of massive and gneissic metadiorite, metagabbro, and amphibolites (Active Earth Engineering Ltd., 2012). The site also includes a hard, granitic bedrock exposure.

There are no faults located under the site; two faults occur three kilometers to the southwest and six kilometers to the northwest.

The local flow regime is that of fractured flow through bedrock aquifers (Active Earth Engineering Ltd. 2012). There is no bedrock aquifer mapped directly underneath the site, however there are two bedrock aquifers located near the site: Spectacle Lake/Malahat Bedrock Aquifer and Shawnigan Lake/Cobble Hill Bedrock Aquifer. The site is serviced by an on-site groundwater well.

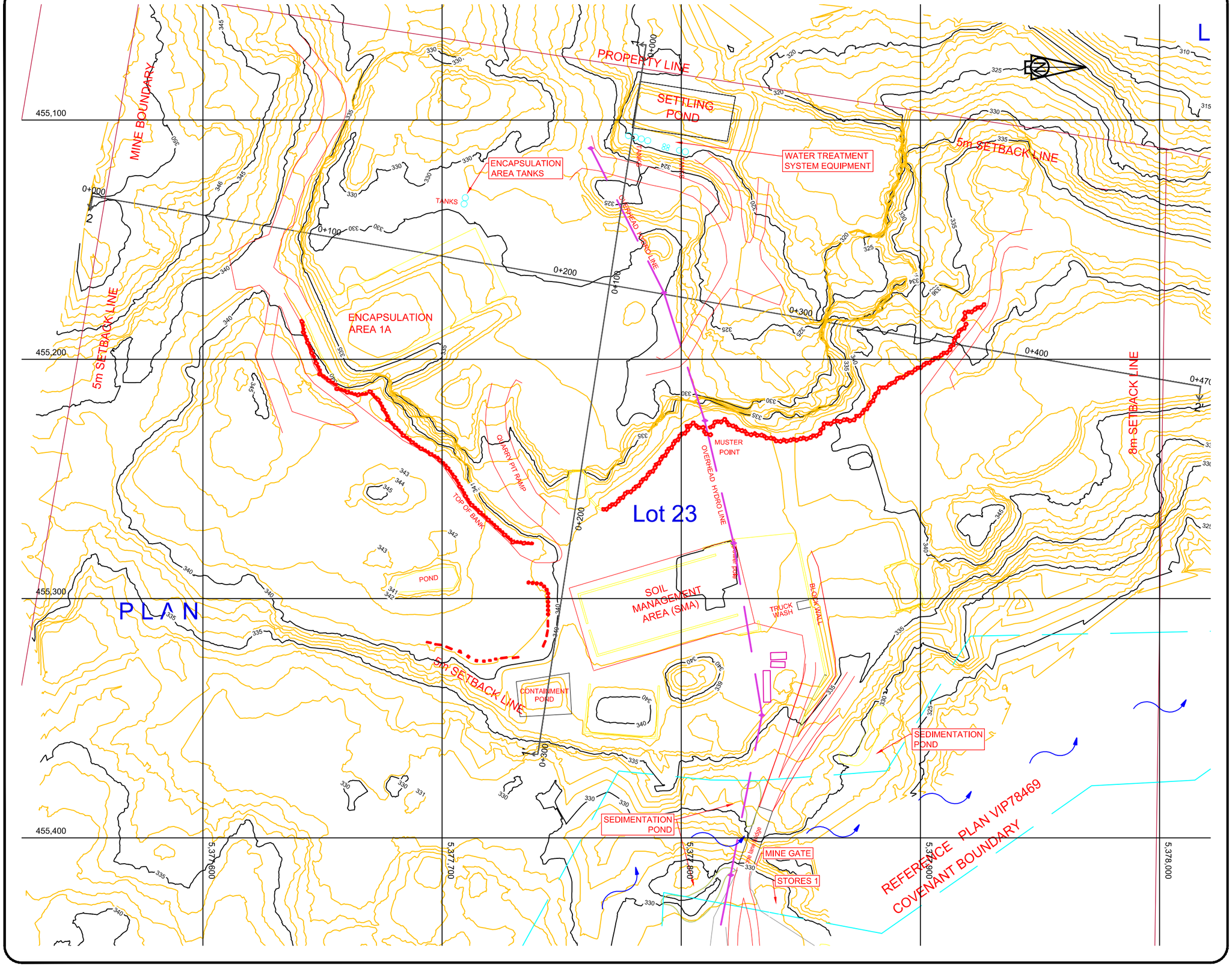
Due to previous quarrying at the site, there are no native soils in the immediate area. However, soils surrounding the site originate from glacial till.

2.2.5 Climate

The temperature and precipitation data for 1981 to 2010 were sourced from the Environment Canada website using the nearest weather station, located at Shawnigan Lake, B.C. about 15 km to the North. The climate data is summarized in Table 2-1 below. The average annual precipitation is approximately 1250 mm with approximately 1182 mm falling as rain and 67.9 cm falling as snow. The average annual temperature is approximately 9.9^{o}C with an average peak of 17.9^{o}C occurring in August and the minimum average temperature of 3.1^{o}C occurring in December. The maximum average snowfall of 20.3 cm occurs in January. Table 2-1 presents the average monthly precipitation and temperature for the Shawnigan Lake weather station that represents the CHL site.

Table 2-1 Climate Data for Shawnigan Lake station, 1981 to 2010 (Environment Canada, 2016)

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rainfall (mm)	195.1	120.7	112.5	70.9	50.6	40.0	23.2	27.9	33.3	114.1	214.2	179.7	1182.0
Snowfall (cm)	20.3	14.1	6.8	0.1	0.0	0.0	0.0	0.0	0.0	0.7	11.2	14.9	67.9
Precipitation (mm)	215.3	134.7	119.2	71.0	50.6	40.0	23.2	27.9	33.3	114.7	225.4	194.6	1250.0
Daily Average (°C)	3.4	4.1	6.1	8.7	12.1	15.1	17.7	17.9	14.9	10.0	5.6	3.1	9.9



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LEGEND:

- 5m EXISTING CONTOUR
- 1m EXISTING CONTOUR
- 5m DESIGN CONTOUR
- 1m DESIGN CONTOUR
- ROAD
- SURFACE WATER DITCH
- PROPERTY LINES
- CREEK
- CREEK OFFSET

CLIENT:

COBBLE HILL HOLDINGS LTD.

PROJECT:

COBBLE HILL LANDFILL CLOSURE PLAN

TITLE:

EXISTING TOPOGRAPHY

SCALE:	DATE:	PROJECT NO:
1:1,500	2016/12/10 yyyy/mm/dd	PRJ 16035
DESIGNED	SG	DRAWING NO:
DRAWN	SG	**FIGURE 2-1**
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3. CONCEPTUAL QUARRY DESIGN & PHASING PLAN

3.1 Background

In 2012, AEE completed a Quarry Phasing Plan for the site as part of the Technical Assessment for Authorization to Discharge Waste report which included the site being mined out in two lifts and approximately twenty phases. The quarry phasing plan was updated in 2015 by McElhanney Consulting Services Ltd. (McElhanney).

Although CHH has the above-mentioned quarry phasing plan in place, they are not constrained by the plan and want to remain flexible sequencing of the quarry development to ensure remediation soil filling is completed efficiently. This includes altering quarry plans to minimize double handling of materials onsite and ensuring that soil filling does not sterilize future bedrock resources.

SHA recommends that contaminated soil filling be managed in a way that enables rapid permanent encapsulation to ensure minimal contact with clean water and leachate generation.

3.2 Quarry Design

In general, quarrying at the site will commence on the western portion of the site and progress to the north and east before moving south. The base of the quarry will carry a 2% grade, draining to the west towards the existing settling pond. The base of the quarry will be blasted and excavated to a smooth surface, as much as possible, to ensure minimal ponding of water.

SHA has designed a seepage / drainage blanket layer over top of the completed bedrock surface to promote drainage and ensure any groundwater seepage is allowed to drain to collection infrastructure on the western boundary of the site. The seepage blanket will be composed of two clear crush gravel layers; a 300mm layer of 25-75mm gravel will be installed followed by a 200mm layer of finer filter 5-25mm gravel layer overtop.

With the seepage blanket installed, the basal layers for contaminated soil fill will follow. SHA engineered basal liner system includes a double lined system composed of a geosynthetic clay liner (GCL) overlain by a 40mil HPDE geomembrane liner.

Clean groundwater collected within the seepage blanket layer will be kept separate from the other surface water collection systems to enable testing of the groundwater for contamination from soil fill cells prior to discharge to the settling pond where the water will be mixed with clean storm water run-off. The clean water settling pond will be located at the western property boundary. All drainage and ponds have been designed to achieve gravity flow for ease of long term maintenance during operations and post closure.

3.3 Quarry Phasing

To enable soil landfilling and quarrying operations to be co-managed onsite, SHA has outlined a quarry phasing plan which provides sufficient operational room for drilling, blasting and material

management of aggregate mining onsite as well as landfilling of contaminated soil and the construction of permanent lined / encapsulated soil cells and final cover system.

SHA recommends the quarry be developed in three phases as presented below. The quarry phasing concept is outlined in Figure 3-1.

3.3.1 Phase 1 Quarry

To ensure sufficient space on the landfill floor for environmental control and basal containment layers SHA has outlined the extents of the Phase 1 Quarry on Figure 3-1. As shown, SHA foresees the Phase 1 Quarry being developed from north to south in 50-70m offsets to accommodate filling of the permanent encapsulation cells. The main road to the landfill base, paralleling the north quarry wall will provide access to all filling cells as well as quarrying operations.

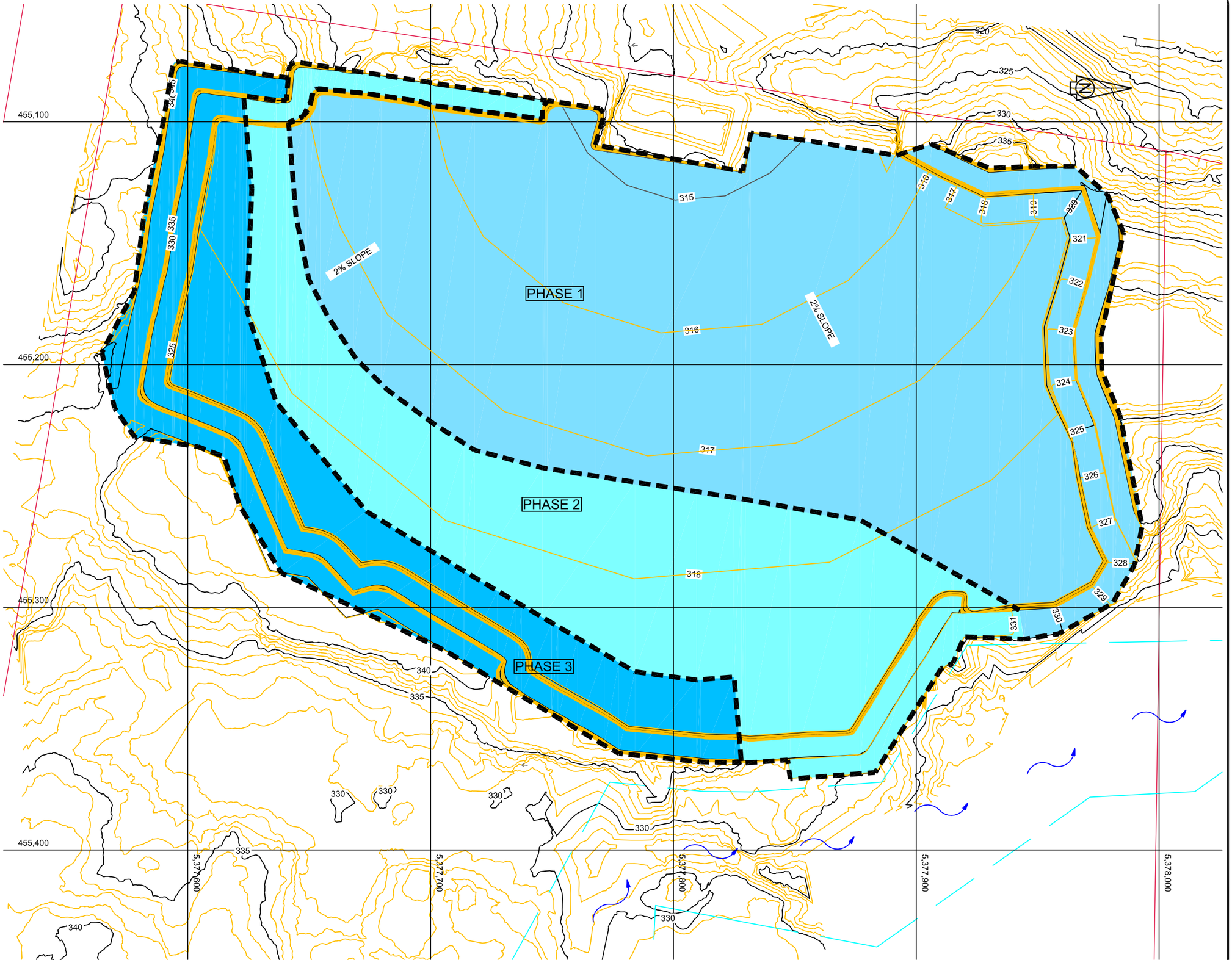
The base of Phase 1 will begin at 315m ASL at the western boundary and grade at 2% upward to approximately 317.5m ASL at the east, west and north extents. The limits of the Phase 1 Quarry will extend 20-30m past the eastern edge of the Phase 1 Fill to accommodate concurrent quarrying operations.

3.3.2 Phase 2 Quarry

Phase 2 Quarry will extend the landfill base further east and south. The base will continue to be mined at a 2% grade, draining to the west as outlined in Figure 3-1. Phase 2 of the quarry plan will include benches along the southwest and east extents.

3.3.3 Phase 3 Quarry

The remainder of the quarry will be developed in Phase 3, further extending the landfill base to the east and south. Benches have been included to ensure road access throughout mining operations for removal of aggregate products.



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- PROPERTY LINES
- CREEK
- CREEK OFFSET
- PHASE 1 QUARRY
- PHASE 2 QUARRY
- PHASE 3 QUARRY

CLIENT:

COBBLE HILL HOLDINGS LTD.

PROJECT:

COBBLE HILL LANDFILL CLOSURE PLAN

TITLE:

QUARRY PLAN PHASING

SCALE:	DATE:	PROJECT NO:
1:1,500	2016/12/16 yyyy/mm/dd	PRJ 16035

DESIGNED	SG	DRAWING NO:
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4. LANDFILL CLOSURE DESIGN

4.1 Introduction

In this chapter, the final contour design will be outlined as well as the overall airspace available for contaminated soil filling and environmental control layers.

Additionally, a key goal of a site specific Final Closure Design is to identify the most effective type of final cover system for the landfill under consideration. In British Columbia, four basic types of cover systems are used:

1) clay cover,
2) geosynthetic cover,
3) composite cover and
4) evaporative cover.

This chapter explores the potential effectiveness of each of these cover systems, identifies the best barrier layer option and then fine tunes the design in terms of identifying the optimum barrier layer thickness, drainage layer media and top soil thickness. In short, the objective of this chapter is to provide a detailed guide for construction of an effective closure system at the Cobble Hill Landfill (CHL).

4.2 Landfill Design

The final contours of the landfill were designed with the following objectives:

- Maximum final grades of 3H: 1V
- Minimum final grades of 25H: 1V (4%)
- Surface water ditch or bench every 15m (vertically)
- Promote surface water run off
- Facilitate efficient operations for concurrent quarrying and mine reclamation

As presented on Figure 4-1, the final contours for CHL range from 315m at the landfill toe or western portion of the site to 350m at the landfill crest along the southern boundary of the site. A midslope bench road and surface water collection ditch runs east to west across the slope at approximately 335m elevation.

A perimeter access road has been included along the eastern and northern perimeter of the quarry providing access for quarrying and reclamation through the lifespan of the site. Main access roads were designed at 10m wide while internal roads are narrower at 6m.

A clean water settling pond will be established along the western boundary of the site which will manage onsite run-off from closed areas, as well as non-contact run-off from the active rock quarry operations throughout the operational stages of the quarry and landfill as well as post closure.

In determining the amount of airspace available for ultimate disposal of contaminated soil SHA first determined the gross available air space provided by the final contour design and then subtracted the air space that will be consumed by the clean fill grading wedge, the basal liner system and the final cover system. The gross air space was determined with AutoCad by computing the volume available between the ultimate quarry excavation plan, previously presented in Figure 3-1 and the final contour design surface outlined in Figure 4-1. This analysis resulted in approximately 1,230,000 m^3 of airspace, as presented in Figure 4-2.

SHA understands that changes may occur to the ultimate design of the quarry in the coming years which may alter the overall available airspace at the site.

4.3 Final Cover Objectives

The purpose of final closure of any landfill is to put in place the necessary environmental control systems to effectively manage leachate, surface water and landfill gas (if present). A well-designed closure system should provide the following benefits:

- Isolation of refuse preventing direct contact with humans and vectors.
- Minimization of infiltration and leachate production through diversion and run-off.
- Prevention of leachate breakouts at the landfill toe and on side slopes.
- Protection of the cover from erosion through maintenance of a sustainable vegetative community.
- Enhancement of landfill gas collection (if applicable) by preventing upward venting of landfill gas and downward intrusion of oxygen from the atmosphere.

In developing the final cover design for CHL to meet the above objectives, the local site conditions and end-use had to be considered. The types and thickness of soils and other materials selected for the cover were based both on regulatory guidelines as well as site-specific objectives. Key elements considered in the final cover design were:

- Leachate minimization objectives could be achieved with a low permeability soil barrier layer with K (hydraulic conductivity) less than $1x10^{-6}$ cm/s or a geomembrane barrier.
- A drainage layer must be provided in the cover system above the barrier layer to prevent head build up and saturation of the top soil.
- An erosion control layer comprised of topsoil at least 150 mm thick, perhaps thicker, should be adopted to protect the underlying barrier layer and to provide a medium that will support vibrant vegetation growth for the areas where a vegetated end use is planned. Where an industrial end use is planned, the erosion control layer can be substituted by a pavement or gravel layer.

4.4 Regulatory Requirements

Regulatory requirements for landfill closure have been stipulated in the new MOE Landfill Criteria. The key requirements that dictate design of the final cover system are summarized below:

* The final cover barrier layer shall consist of a minimum of 1,000 mm of low permeability ($<1x10^{-5}$ cm/s) compacted soil (or equivalent) cap.
* The barrier layer shall be protected with a minimum 150 mm thick topsoil layer with approved vegetation established.
* Final cover shall be sloped at a minimum of 4%, to promote surface water runoff, to a maximum slope of 33%.
* Surface water runoff shall be directed outside of the leachate collection system.

4.5 Elements of the Final Cover Design

To achieve the objectives outlined previously, a minimum cover system consisting of a topsoil horizon and a barrier layer is required by the MOE. Additional layers that are usually introduced by SHA in our cover designs include a drainage layer on top of the barrier system. Depending on the particle size gradation of the various layers, it may also be necessary to introduce geotextile separation / cushion layers at key interfaces to prevent migration of topsoil or clay into the various drainage layers. Healthy vegetation is also a key element of final closure. In the discussion below, layers are presented in a bottom to top order.

Figure 4-3 provides a detailed illustration of the recommended final cover veneer presented for the CHL. Below is a description of each design layer.

- **Secondary Barrier Layer**

A 1,000 mm thick compacted soil barrier with a hydraulic conductivity of $1x10^{-6}$ cm/s or lower. To achieve this low level of permeability, soils must contain a significant percentage of clay-sized particles.

- **Primary Barrier Layer**

A 40mil double textured LLDPE geomembrane liner is recommended to minimize infiltration and to efficiently shed surface water from the above layers to ensure stability of the overall cover system. To protect the primary geomembrane liner, non-woven geotextile layers are recommended to serve as protective cushions both above and below the primary geomembrane liner.

- **Drainage / Cushion Layer**

The purpose of a drainage layer on top of the barrier is to quickly convey water that infiltrates into the top soil, passing it through the topsoil horizon down slope to the landfill toe or mid-slope groundwater interceptor ditch. Without an effective drainage layer, the topsoil could become saturated during heavy rainfall events. This condition could lead to excessive head build-up on the

barrier layer and would likely result in erosion and slumping problems on side slopes and increased infiltration over the landfill crest.

Detailed HELP flow modelling will be completed as part of the detailed design process, however based on previous experience we anticipate that a 300 mm thick layer of gravel placed beneath the topsoil layer should provide the necessary drainage for the cover system.

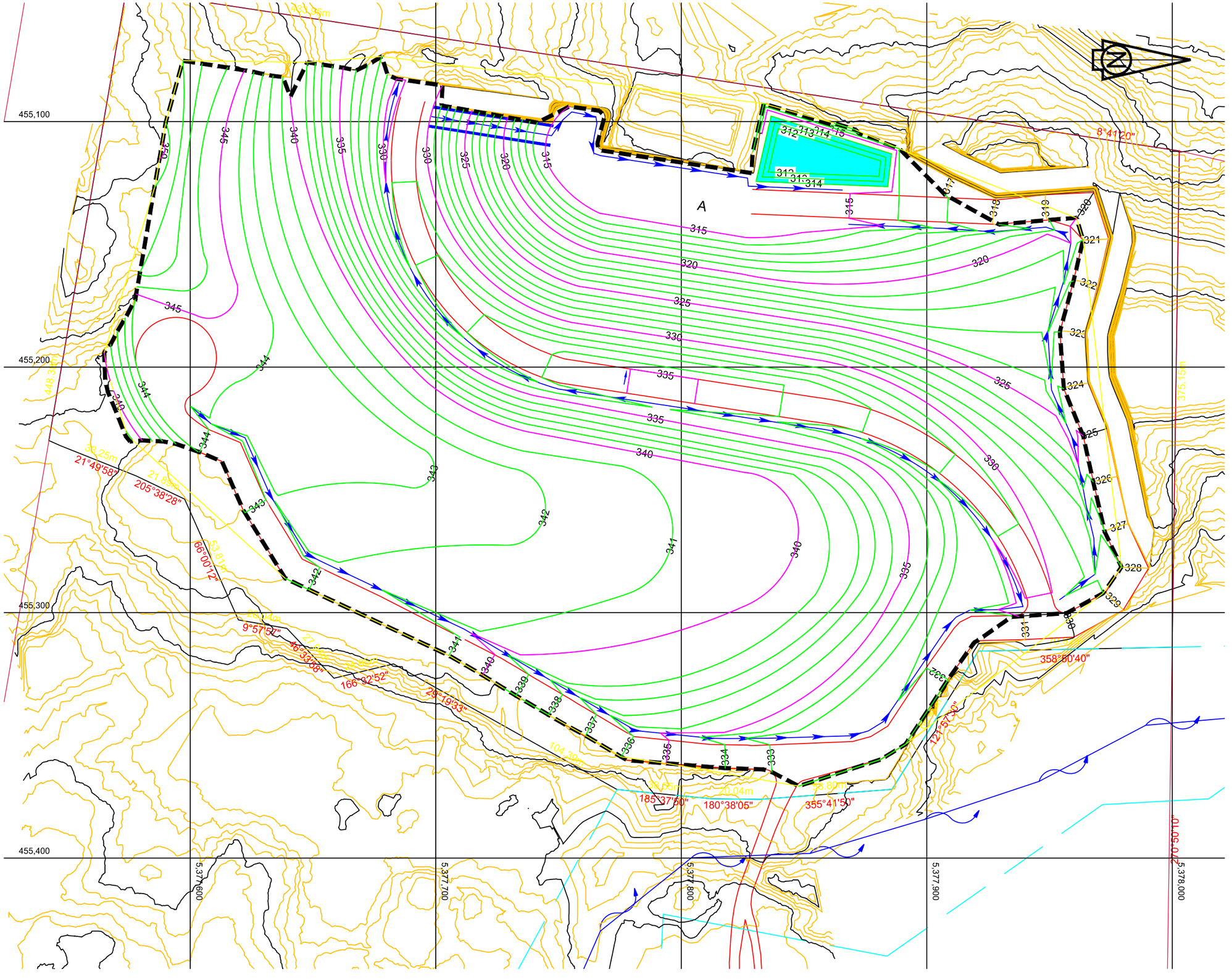
- **Top Soil Layer**

A layer of organic topsoil is essential to ensure a healthy and sustainable vegetative community on top of the final cover system. The minimum requirement is for a 150 mm thick layer of topsoil. In most final cover designs SHA recommends a thicker layer of topsoil, in this case a 1,000 mm thick layer is planned to provide maximum flexibility in the type of vegetation implemented long term, including shrubs and trees. The thick top soil will provide sufficient moisture retention in the soil during periods of drought, thereby preventing plant mortality, and will reduce the risk of root penetration into the underlying barrier layer.

4.6 Progressive Closure

Progressive closure of the reclamation cells will be necessary to keep generation of contact water to a minimum. Essentially, progressive closure involves filling upwards to final grades quickly, rather than spreading waste out horizontally, and then constructing final closure over completed sections of the landfill progressively. This approach has advantages as closure costs can be spread out over the life of the landfill, closed "green" areas can provide screening for operations and most importantly, leachate production will be reduced by capping waste sooner rather than later.

Figure 4-4 provides a progressive closure plan for the site for the CHL. Included in the plan are the sequential closure phases. Closure of the areas shown should occur within 1 year of the completion of each phase.



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- PROPERTY LINES

CLIENT:

COBBLE HILL HOLDINGS LTD.

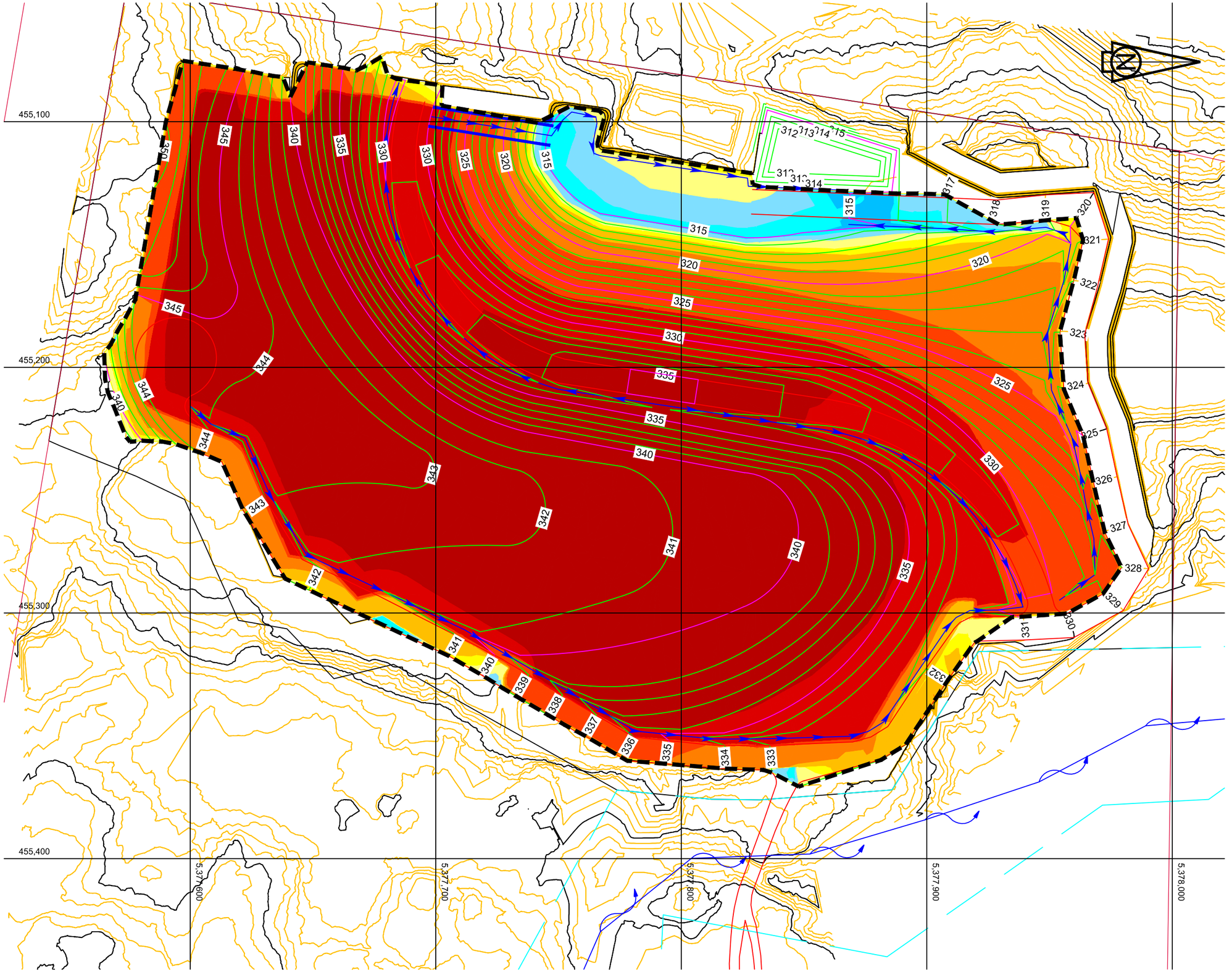
PROJECT:

COBBLE HILL QUARRY CLOSURE PLAN

TITLE:

FINAL DESIGN CONTOURS

SCALE:	DATE:	PROJECT NO:
1:1,500	2016/12/12 yyyy/mm/dd	PRJ 16035
DESIGNED	TS	DRAWING NO:
DRAWN	SG	**FIGURE 4-1**
CHECKED	IB	



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LEGEND:

Elevations Table			
No.	Min. Elev.	Max. Elev.	Color
1	-13.508	-10.000	
2	-10.000	-5.000	
3	-5.000	-2.500	
4	-2.500	-1.000	
5	-1.000	-0.500	
6	-0.500	0.000	
7	0.000	0.500	
8	0.500	1.000	
9	1.000	2.500	
10	2.500	5.000	
11	5.000	10.000	
12	10.000	15.000	
13	15.000	25.465	

VOLUME SUMMARY:

NET: 1,230,000 cu.m (FILL)

CLIENT:

COBBLE HILL HOLDINGS LTD.

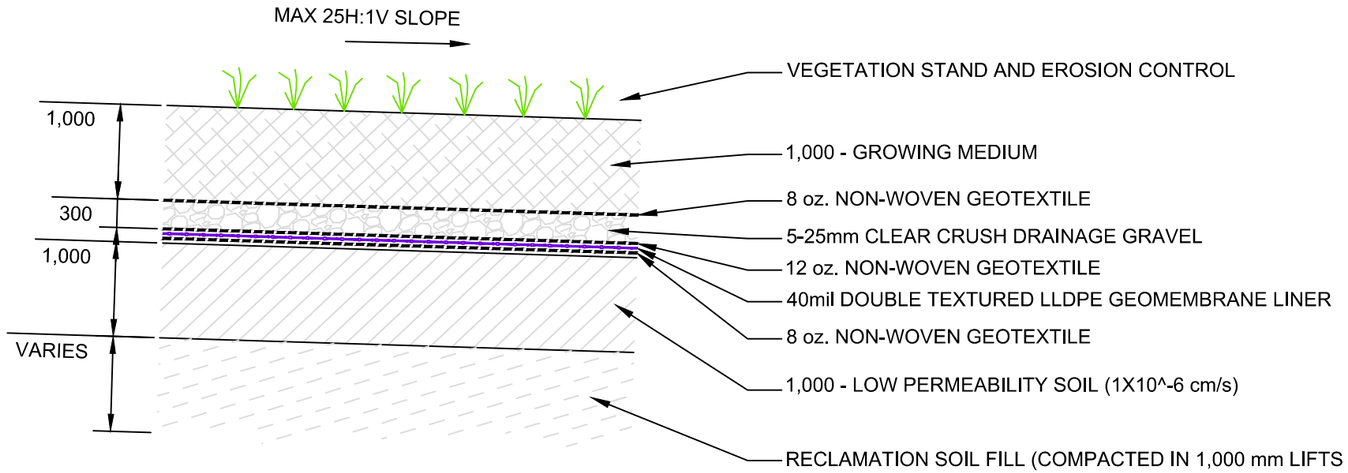
PROJECT:

COBBLE HILL QUARRY
CLOSURE PLAN

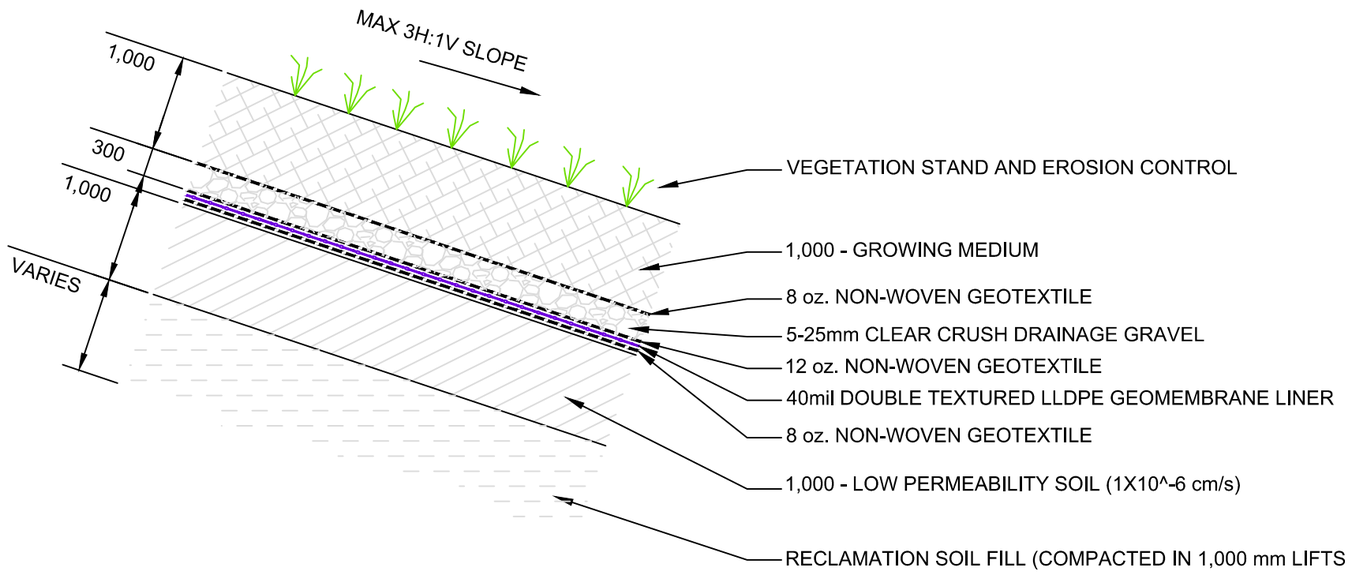
TITLE:

CUT & FILL
FINAL DESIGN CONTOUR
vs.
ULTIMATE QUARRY BASE

SCALE:	DATE:	PROJECT NO:
1:1,500	2016/12/12 yyyy/mm/dd	PRJ 16035
DESIGNED	SG	DRAWING NO:
DRAWN	SG	**FIGURE 4-2**
CHECKED	TS	



FINAL COVER SYSTEM DETAIL - CREST AREA



FINAL COVER SYSTEM DETAIL - SLOPED AREA

SPERLING HANSEN ASSOCIATES

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- Landfill Closure
- Environmental Monitoring

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Fax: (604) 986-7734

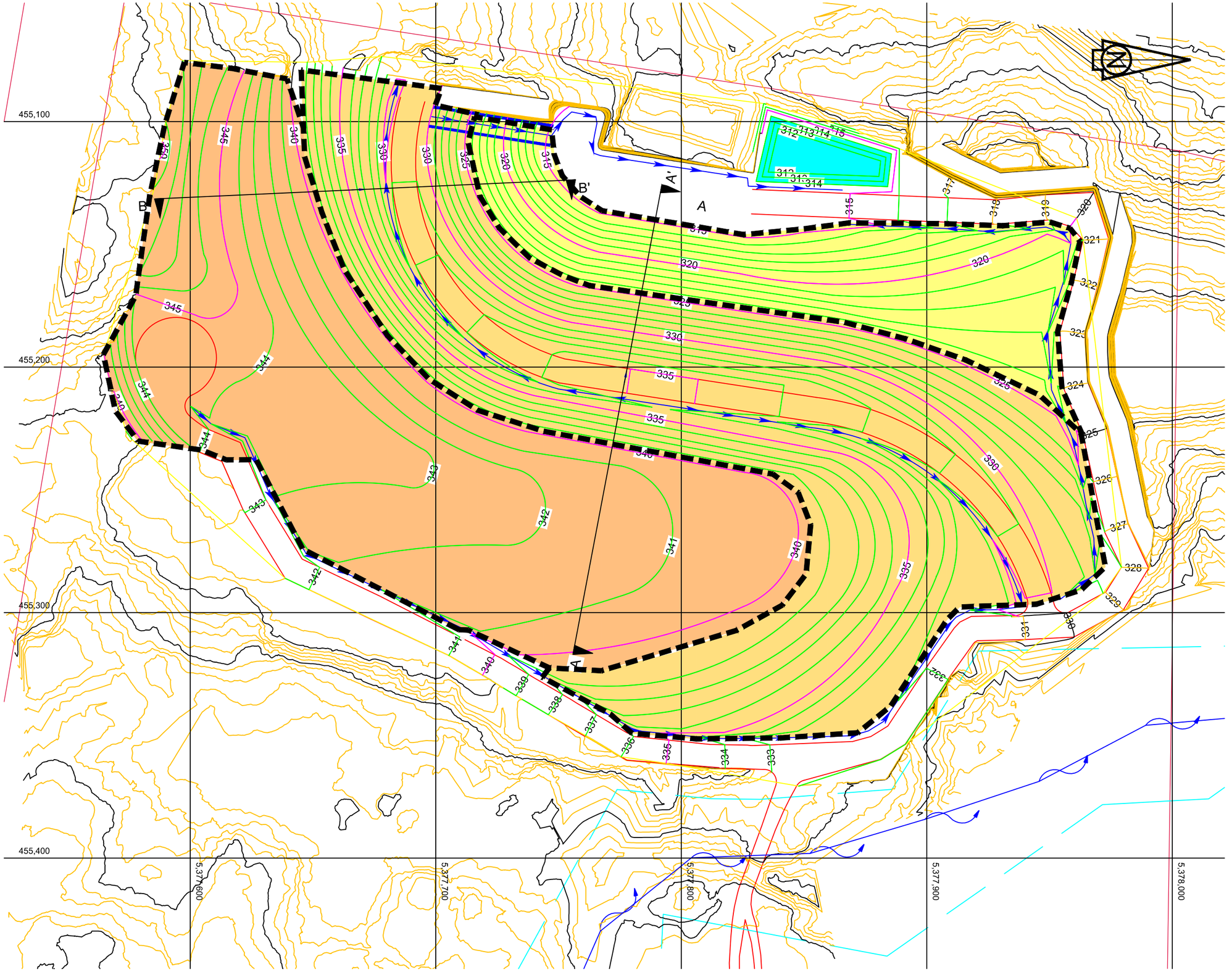
LEGEND:

CLIENT:
COBBLE HILL HOLDINGS LTD.

PROJECT:
COBBLE HILL QUARRY CLOSURE PLAN

TITLE:
FINAL COVER SYSTEM DESIGN DETAILS

SCALE:	DATE:	PROJECT NO:
N.T.S.	2016/12/08 yyyy/mm/dd	PRJ 16035
DESIGNED	TS	DRAWING NO:
DRAWN	SG	**FIGURE 4-3**
CHECKED	IB	



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LEGEND:

- 5m EXISTING CONTOUR
- 1m EXISTING CONTOUR
- 5m DESIGN CONTOUR
- 1m DESIGN CONTOUR
- ROAD
- SURFACE WATER DITCH
- PROPERTY LINES
- PROGRESSIVE CLOSURE 1
- PROGRESSIVE CLOSURE 2
- PROGRESSIVE CLOSURE 3

CLIENT:

COBBLE HILL HOLDINGS LTD.

PROJECT:

COBBLE HILL QUARRY CLOSURE PLAN

TITLE:

PROGRESSIVE CLOSURE PLAN

SCALE:	DATE:	PROJECT NO:
1:1,500	2016/12/12 yyyy/mm/dd	PRJ 16035

DESIGNED	TS	DRAWING NO:
DRAWN	SG	**FIGURE 4-4**
CHECKED	IB	

5. LANDFILL PHASING PLAN

5.1 Introduction

The filling sequence proposed to achieve final contours begins with the filling of Phase 1 and progresses through Phase 2, 3, 4, 5 and 6. This filling succession has been designed to enable the development of each quarry phase to ensure concurrent mining operations are maintained and quarry aggregate is not sterilized during the quarry reclamation process. Additionally, conceptual planning has been presented to ensure clean surface water and leachate / contact water can be managed separately, and that all water can be conveyed using simple gravity flow.

5.2 Phasing Plan

5.2.1 Phase 1

Phase 1 is presented in Figure 5-1 and will be constructed from north to south in sub-phases 1A through 1E. The western outer slopes will be completed at 3H:1V slope and will climb from 315m at the western toe to 326m at the 'flat top' crest. The internal eastern slopes will be built at 2.5:1 slope and will include access ramps on each sub-phase to ensure equipment access during filling.

Clean run-off from completed cells will be collected from in ditches at the toe of slopes and directed west to the clean water settlement pond. Contact water will be collected separately in leachate collectors on top of the basal liner and also conveyed by gravity to the west toe where the water will report to a holding tank for treatment. Three conduit pipes are proposed to convey water from the east side of the Phase 1 reclamation fill to the treatment ponds: one pipe for contact water, a second for clean run-off from closed cells and a third for groundwater captured in the leak detection system. A fourth large diameter pipe may be added to manage storm water from within the active quarry area, if there is a need to keep this water separate from clean run-off.

Once filling has been completed on the western slopes of Phase 1, progressive final closure of the slopes is recommended.

5.2.2 Phase 2

Phase 2 is outlined in Figure 5-2 and shows soil filling progress east off the internal slopes of Phase 1. The construction of Phase 2 provides a large flat working area on the crest of Phase 1 and 2 at elevation 326m. Internal access roads have been designed on the eastern internal slopes to access each soil filling cell as well as quarrying operations. Access to the flat crest area off the main northern access road is provided at elevation 327m.

The three storm water, contact water and leak detection conduits will get extended under the base of Phase 2 and daylight on the central eastern slopes of the phase.

5.2.3 Phase 3

The development of Phase 3 is similar to previous phases where the base of the phase is built out towards the east by approximately 30m, as shown in Figure 5-3. The eastern crest of Phase 3 is

designed at an elevation of 329m to provide sufficient grade to the west to discourage water ponding on the crest. Internal access roads are completed on the eastern slopes to provide vehicular and equipment access during filling and for mining and quarrying operations. Similar to the previous Phase 2, storm water run-off, contact water and leak detection conduits will be extended easterly and daylight near the quarry wall.

Prior to filling the next phase, the conduit pipes will need to be extended upslope to the eastern quarry boundary and fitted with clean out infrastructure to ensure the pipes are accessible for maintenance post filling.

5.2.4 Phase 4

Phase 4 of the landfilling plan shows the eastern base of the quarry completely filled in up to 331m. The extent of the phase is outlined in the dark black dashed line on Figure 5-4. The access roads constructed in Phase 3 will enable filling of the eastern base of the quarry in a 'retreat' filling method. Once Phase 4 is complete, the entire quarry base footprint will have been consumed with soil fill and the remaining phases will be built over the top in piggy-back fashion.

As mentioned previously, the storm water and leachate conduits will need to be extended to the eastern extents of the developed site to provide clean out access.

5.2.5 Phase 5

Phase 5 filling area is outlined by the thick black dashed line on Figure 5-5. Filling of soil cells will commence on the western edge and will be constructed with 3:1 outer slopes up to the 340m bench. As soon as the outer slopes have been completed, progressive final closure of the outer slopes should be constructed, as outlined by the yellow hatch.

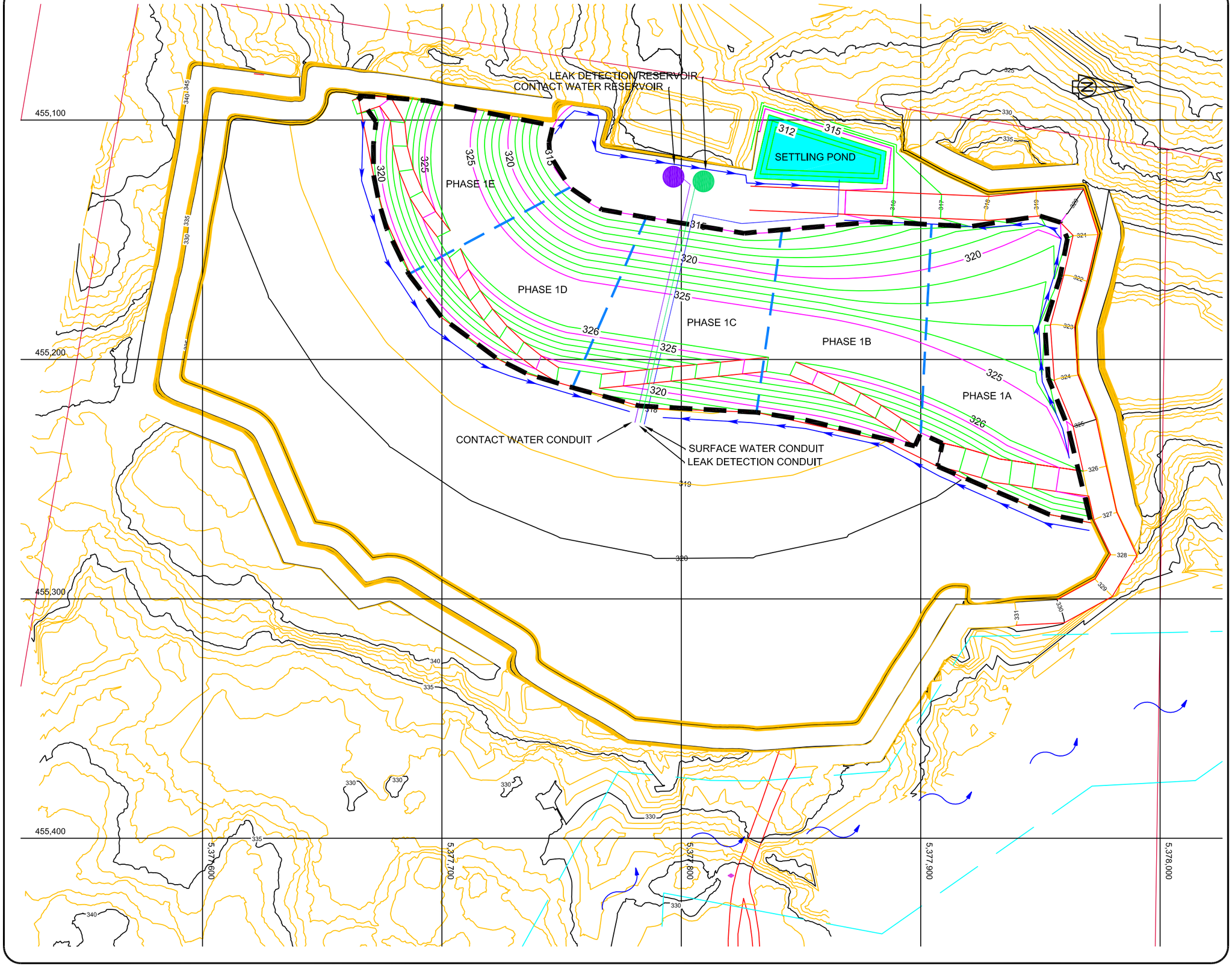
The midslope road and ditch will be constructed during this phase providing access during filling and will aid in collecting and shedding storm water from the crest and outer slopes.

5.2.6 Phase 6

The final phase of filling is shown on Figure 5-6 as Phase 6. This phase will continue filling vertically and toward the south with crest grades becoming more shallow to a minimum of 4% from south to north. The landfill crest will be completed at approximately 350m along the southern boundary of the site.

A perimeter road along the eastern boundary of the site will allow equipment and vehicles to access final phases of the landfill for filling and final cover construction. Surface water ditches will parallel the perimeter access roads, conveying all clean run-off to the western settlement pond.

While SHA has provided a detailed filling sequence of the reclamation fill, revisions to the phasing concept may need to made over time as the mine development plan evolves.



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LEGEND:

- PHASE BOUDNARY
- SUB-PHASE BOUDNARY
- ROAD
- SURFACE WATER CONDUIT
- LEAK DETECTION CONDUIT
- CONTACT WATER CONDUIT
- SURFACE WATER DITCH
- 1m DESIGN CONTOUR
- 5m DESIGN CONTOUR
- 5m EXISTING CONTOUR
- 1m EXISTING CONTOUR

CLIENT:

COBBLE HILL HOLDINGS LTD.

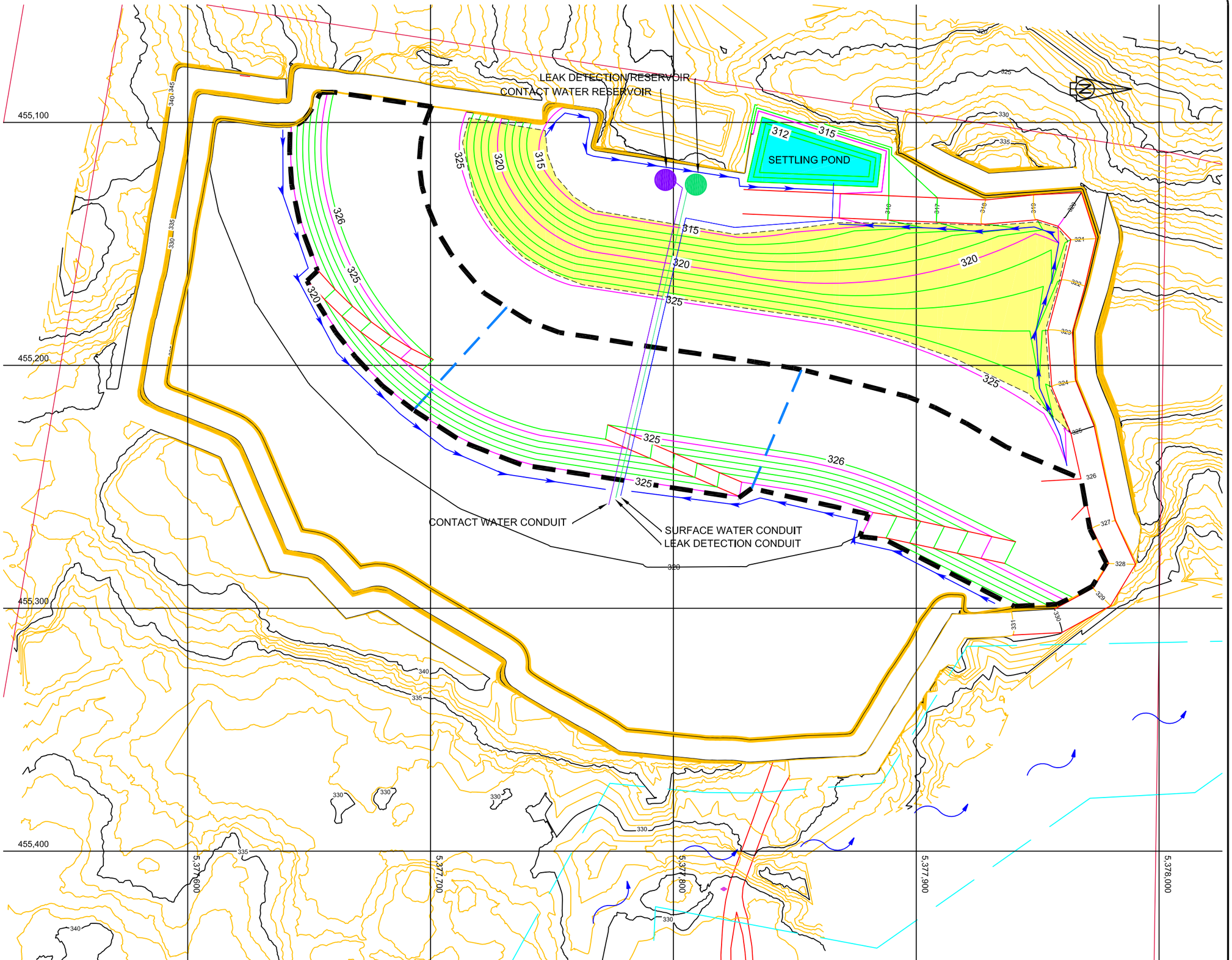
PROJECT:

COBBLE HILL LANDFILL
CLOSURE PLAN

TITLE:

PHASE 1
FILL PLAN LAYOUT

SCALE:	DATE:	PROJECT NO:
1:1,500	2016/12/12 yyyy/mm/dd	PRJ 16035
DESIGNED	SG	DRAWING NO:
DRAWN	SG	**FIGURE 5-1**
CHECKED	TS	



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LEGEND:

- PHASE BOUNDARY
- SUB-PHASE BOUNDARY
- ROAD
- SURFACE WATER CONDUIT
- LEAK DETECTION CONDUIT
- CONTACT WATER CONDUIT
- SURFACE WATER DITCH
- 1m DESIGN CONTOUR
- 5m DESIGN CONTOUR
- 5m EXISTING CONTOUR
- 1m EXISTING CONTOUR
- PROGRESSIVE CLOSURE

CLIENT:

COBBLE HILL HOLDINGS LTD.

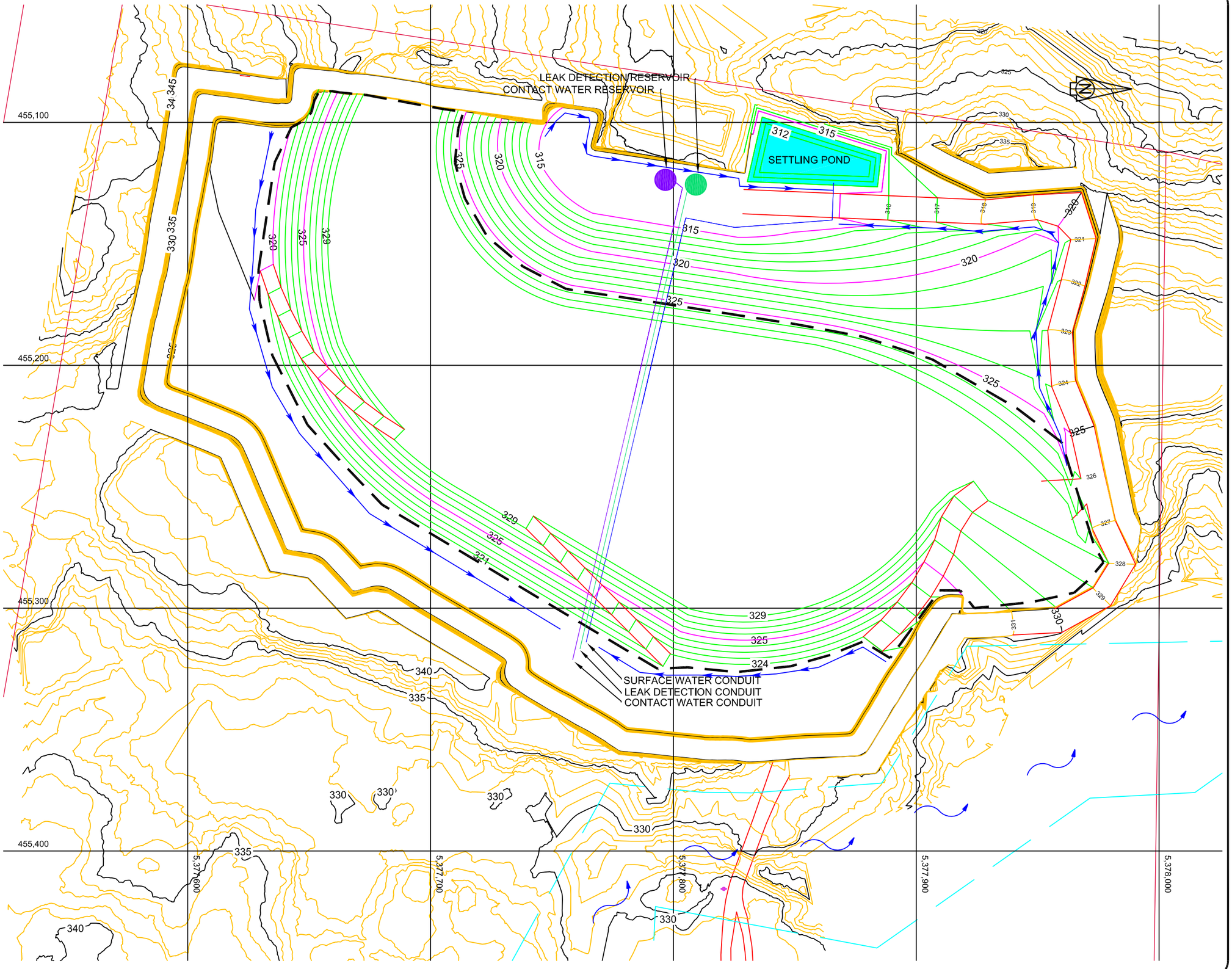
PROJECT:

COBBLE HILL LANDFILL
CLOSURE PLAN

TITLE:

PHASE 2
FILL PLAN AND LAYOUT

SCALE:	DATE:	PROJECT NO:
1:1,500	2016/12/12 yyyy/mm/dd	PRJ 16035
DESIGNED	SG	DRAWING NO:
DRAWN	SG	**FIGURE 5-2**
CHECKED	TS	



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LEGEND:

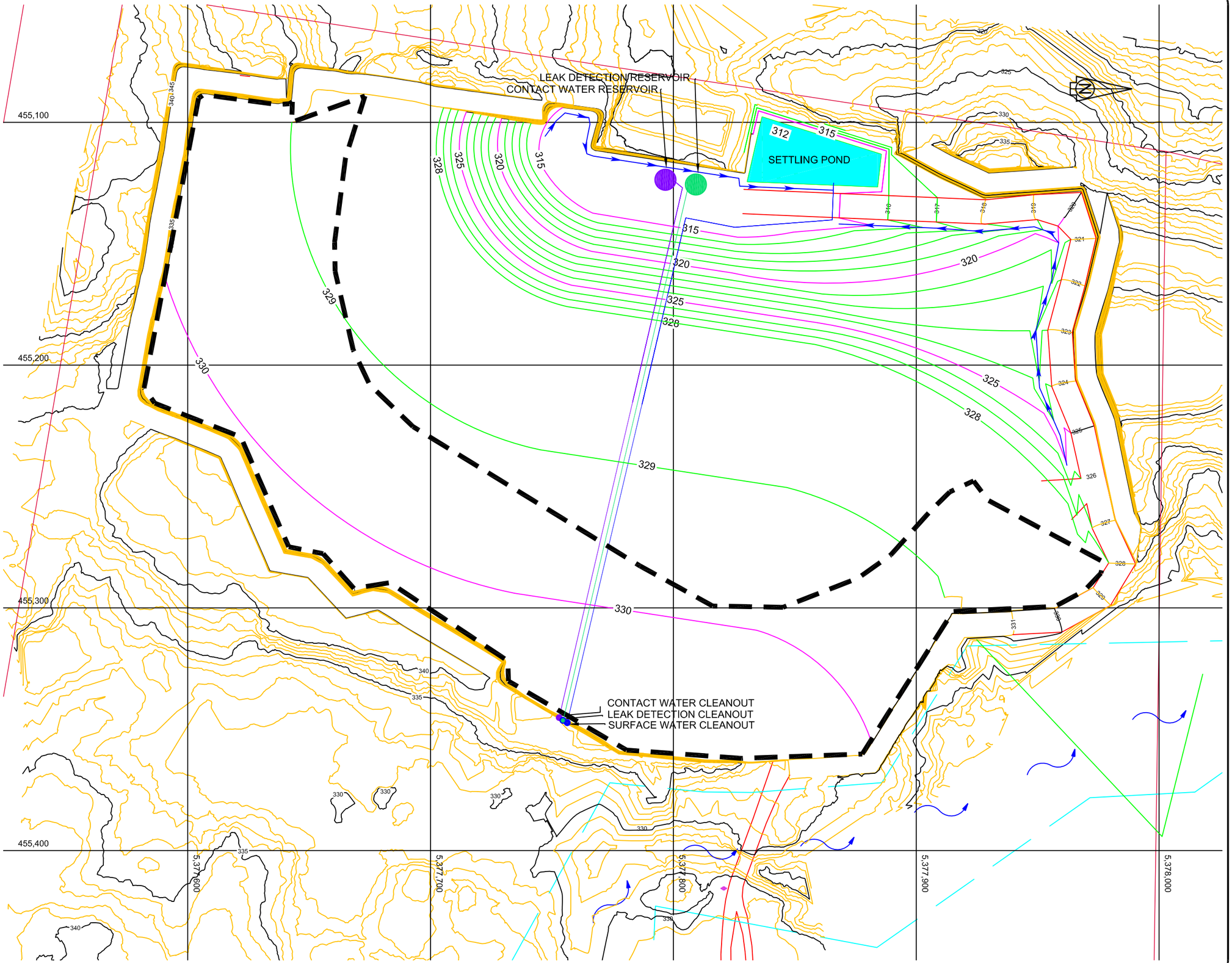
- PHASE BOUDNARY
- SUB-PHASE BOUDNARY
- ROAD
- SURFACE WATER CONDUIT
- LEEK DETECTION CONDUIT
- CONTACT WATER CONDUIT
- SURFACE WATER DITCH
- 1m DESIGN CONTOUR
- 5m DESIGN CONTOUR
- 5m EXISTING CONTOUR
- 1m EXISTING CONTOUR
- PROGRESSIVE CLOSURE

CLIENT:
COBBLE HILL HOLDINGS LTD.

PROJECT:
COBBLE HILL LANDFILL CLOSURE PLAN

TITLE:
PHASE 3 FILL PLAN AND LAYOUT

SCALE:	DATE:	PROJECT NO:
1:1,500	2016/12/12 yyyy/mm/dd	PRJ 16035
DESIGNED	SG	DRAWING NO:
DRAWN	SG	**FIGURE 5-3**
CHECKED	TS	



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LEGEND:

- PHASE BOUDNARY
- SUB-PHASE BOUDNARY
- RAOD
- SURFACE WATER CONDUIT
- LEAK DETECTION CONDUIT
- CONTACT WATER CONDUIT
- SURFACE WATER DITCH
- 1m DESIGN CONTOUR
- 5m DESIGN CONTOUR
- 5m EXISTING CONTOUR
- 1m EXISTING CONTOUR
- PROGRESSIVE CLOSURE

CLIENT:

COBBLE HILL HOLDINGS LTD.

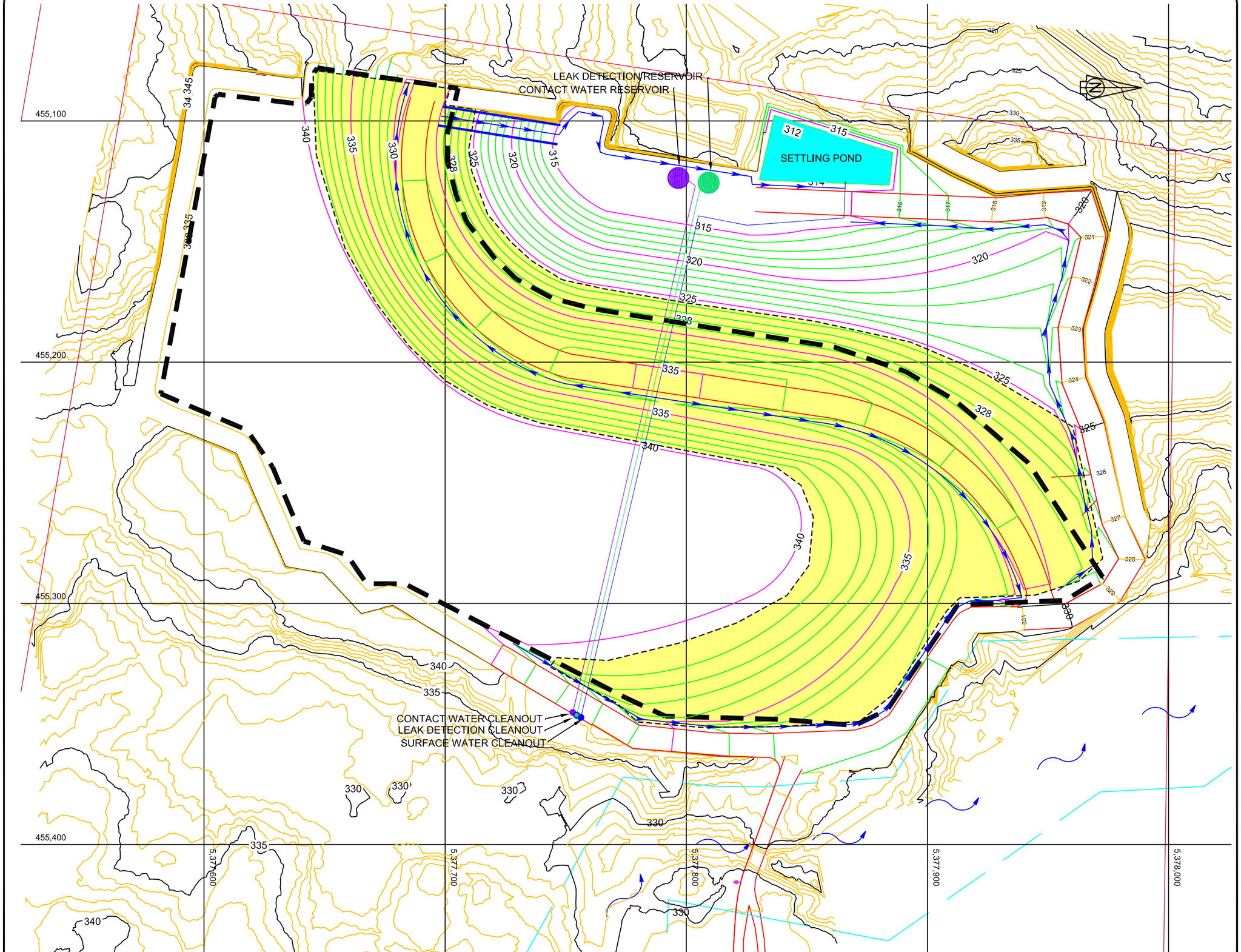
PROJECT:

COBBLE HILL LANDFILL CLOSURE PLAN

TITLE:

PHASE 4 FILLING PLAN AND LAYOUT

SCALE:	DATE:	PROJECT NO:
1:1,500	2016/12/12 yyyy/mm/dd	PRJ 16035
DESIGNED	SG	DRAWING NO:
DRAWN	SG	**FIGURE 5-4**
CHECKED	TS	



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LEGEND:

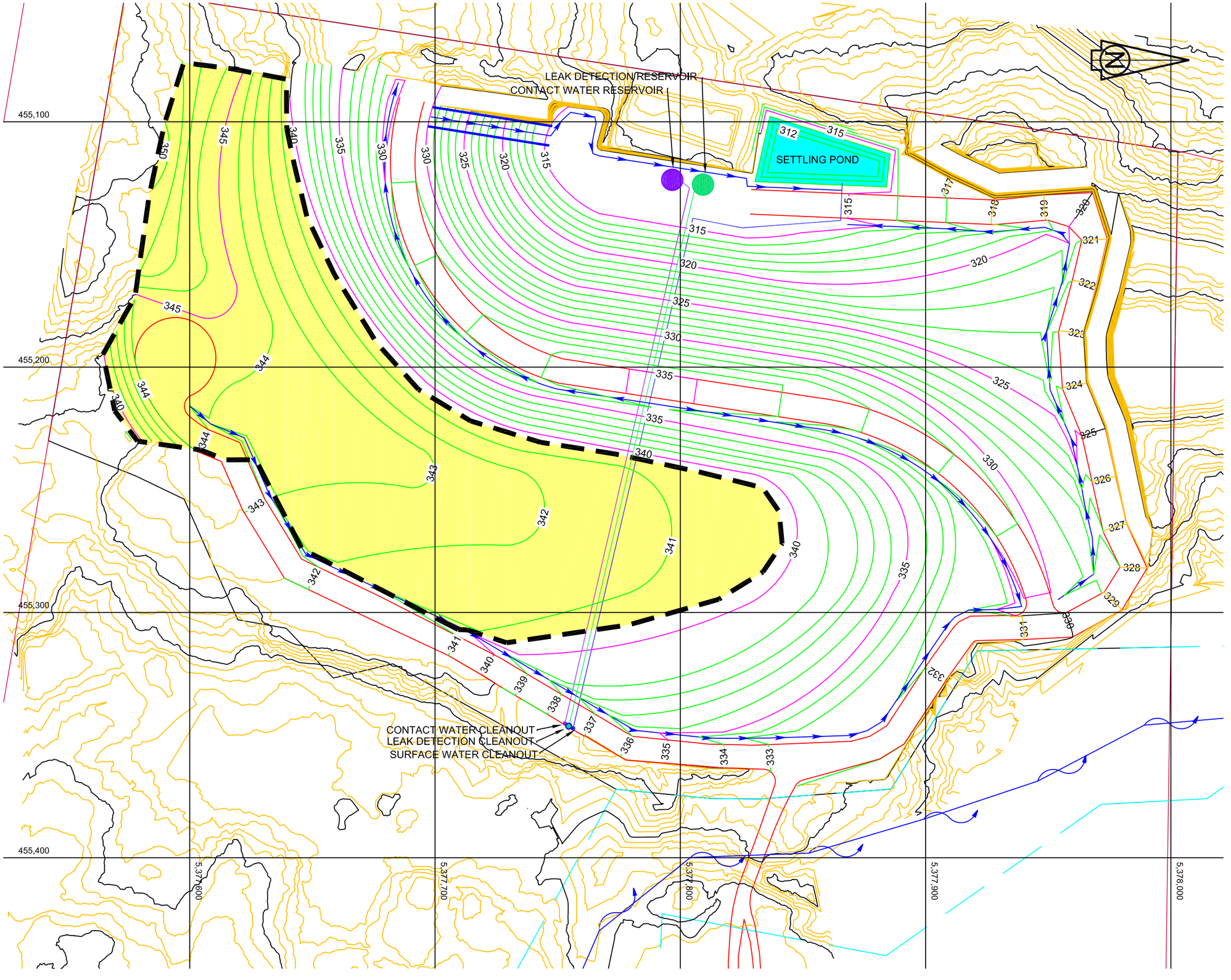
- PHASE BOUDNARY
- SUB-PHASE BOUDNARY
- ROAD
- SURFACE WATER CONDUIT
- LEAK DETECTION CONDUIT
- CONTACT WATER CONDUIT
- SURFACE WATER DITCH
- 1m DESIGN CONTOUR
- 5m DESIGN CONTOUR
- 5m EXISTING CONTOUR
- 1m EXISTING CONTOUR
- PROGRESSIVE CLOSURE

CLIENT:
COBBLE HILL HOLDINGS LTD.

PROJECT:
COBBLE HILL LANDFILL CLOSURE PLAN

TITLE:
PHASE 5 FILLING PLAN AND LAYOUT

SCALE:	DATE:	PROJECT NO:
1:1,500	2016/12/12 yyyy/mm/dd	PRJ 16035
DESIGNED	SG	DRAWING NO:
DRAWN	SG	**FIGURE 5-5**
CHECKED	TS	



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LEGEND:

- PHASE BOUDNARY
- SUB-PHASE BOUDNARY
- ROAD
- SURFACE WATER CONDUIT
- LEAK DETECTION CONDUIT
- CONTACT WATER CONDUIT
- SURFACE WATER DITCH
- 1m DESIGN CONTOUR
- 5m DESIGN CONTOUR
- 5m EXISTING CONTOUR
- 1m EXISTING CONTOUR
- PROGRESSIVE CLOSURE

CLIENT:
COBBLE HILL HOLDINGS LTD.

PROJECT:
COBBLE HILL LANDFILL
CLOSURE PLAN

TITLE:
PHASE 6
FILL PLAN AND LAYOUT

SCALE:	DATE:	PROJECT NO:
1:1,500	2016/12/12 yyyy/mm/dd	PRJ 16035
DESIGNED	SG	DRAWING NO:
DRAWN	SG	**FIGURE 5-6**
CHECKED	TS	

6. CELL CONSTRUCTION – SOIL ENCAPSULATION

As outlined in the attached Permit No. 105809 providing Authorization to Discharge, the Cobble Hill Landfill (CHL) plans to continue to receive contaminated soil, to remediate and landfill the received soil in lined permanent encapsulation cells.

Currently, one completed and capped cell exists onsite at CHL. Cobble Hill Holdings Ltd. (CHH) does not plan to accept and manage any further soil until further quarrying is completed to ensure base elevations on the landfill floor have been achieved. Based on discussions between SHA and CHH, importation of reclamation soils will be on hold for 6-8 months as the rock quarry footprint is advanced.

Described below are SHA's recommendations on how to prepare the quarry floor for reclamation, how to landfill the contaminated soil and how to complete the lined permanent cell encapsulation.

6.1 Cell Preparation

Prior to the start of soil placement in a reclamation cell at the CHL, the landfill base or quarry floor must first be prepared for soil receiving. As presented in Figure 6-1, SHA recommends constructing a composite Cell Base Liner overtop of the seepage / drainage blanket composed of two layers of clear crush aggregate.

With the seepage blanket installed, the basal layers for contaminated soil fill will follow. The engineered basal liner system recommended by SHA includes a double lined system composed of a geosynthetic clay liner (GCL) overlain by a 40mil HPDE geomembrane liner. The GCL material has become the secondary liner of choice in landfill applications as the bentonite clay has a hydraulic conductivity that is typically 3 to 5 orders of magnitude less permeable than low permeability silts and clays available on Vancouver Island, consistent engineering properties and much simpler installation. The recommended GCL liner will provide superior performance relative to the 1 m thick compacted clay liner previously specified. It has been SHA's experience working with numerous clay liners that they are prone to desiccation cracking and dust generation during the summer months and stockpiles are prone to erosion, absorption of water and tracking of mud during the winter months, increasing the potential for contamination of the gravel drainage layers during construction of the basal liner system.

To protect the primary liner system from damage, SHA recommends that a 12 oz non woven geotextile cushion layer be deployed directly on top of the textured HDPE geomembrane.

The final engineered liner layer is a 300 mm thick contact water collection layer comprised of 5-25 mm clear crush that can be produced on site. To keep this layer clean and functional, an 8 oz non woven geotextile filter layer should be deployed on top of the gravel to protect it from clogging. Once these layers are in place, soil filling can proceed.

6.1.1 Cell Landfilling

Given the discharge constraint of 274 cubic meter per day of effluent from the site, it is SHA's opinion that soil cells must not be built excessively large so that large areas of contaminated soil will not be exposed to the environement for extended periods of time throughout the year. Cells should be filled and capped efficiently to ensure that precipitation is diverted away from contact with contaminated soils to minimize the amount of effluent that needs to be managed.

Given the tight discharge constraints, SHA recommends that each cell be constructed with a base footprint of approximately 5,000 m^2 with maximum 2.5H:1V side slopes and a max height of approximately 10m. These dimensions should provide sufficient airspace for approximately 25,000 – 35,000 m^3 of contaminated soil to be placed in each encapsulated cell. Contaminated soil fill should be placed and compacted in 500 to 1,000mm lifts and graded smooth to ensure stability.

6.1.2 Cell Layout

A detailed layout of sub-phase 1A and 1B is presented in Figure 6-2. As shown, the internal south and east slopes are designed at maximum 2.5H:1V slopes. The western outer slopes match the final contour design grades at 3H:1V. Access roads on the internal eastern slopes provide equipment access through the filling elevations and will also provide access to the adjacent cells during the filling of Phase 2. The crest must not be constructed to elevations which would preclude a flat operational area for vehicles to turn around and cell closure materials to be deployed. In SHA's experience, a minimum width of 20 m is required to safely operate and turn around dump trucks.

Leachate collection pipes are to be laid out along the downslope edge of cells to collect any contact water discharging from the cell during construction and post encapsulation. The contact water must be directed to tanks or ponds via a solid pipe network.

6.1.3 Cell Closure

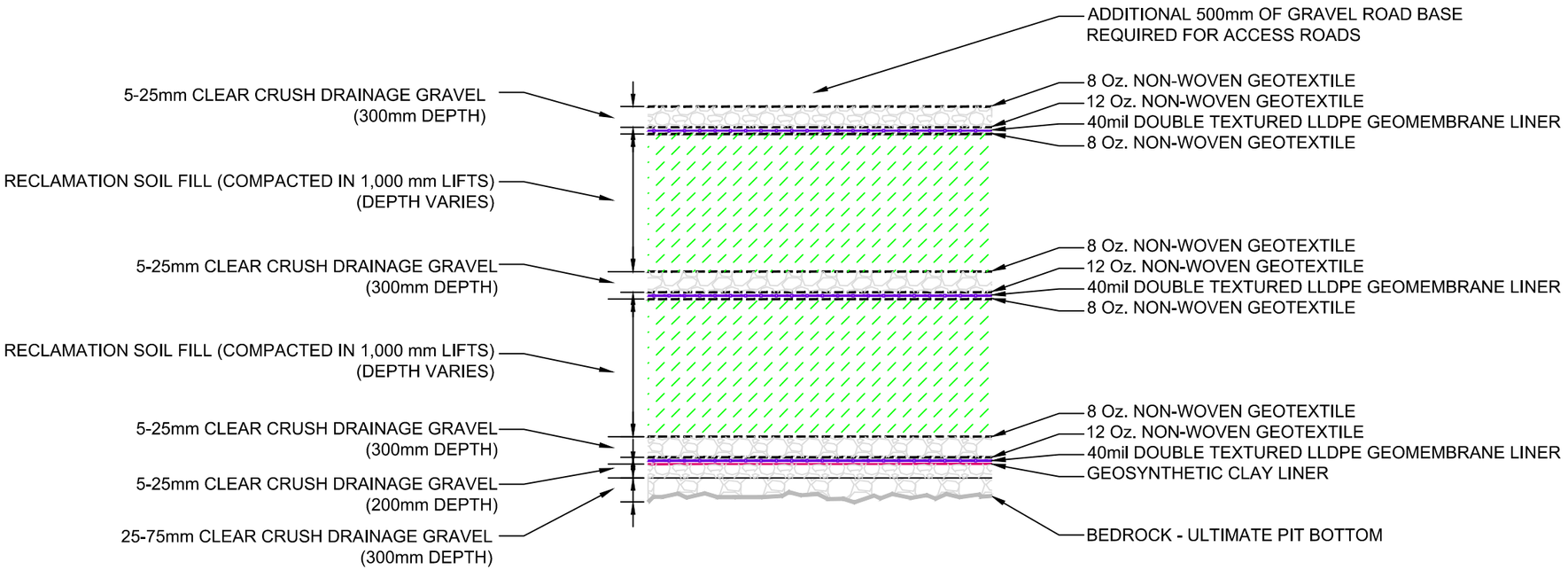
Figure 6-1 provides details for the fully lined permenant encapsulation of soil fill cells. This design allows for cells to be piggy-backed against each other and stacked ontop of one another as the landfill develops. Each cell is fully encapsulated with a 40mil LLDPE geomembrane with geotextile cushion layers for support. Additionally, a 300mm 5-25mm clear crush gravel drainage layer is designed on the base of each cell for efficient drainage of contact water to the downslope side.

SHA recommends that once each cell is completed, the gravel drainage layer be deployed immediately above the capped cell. This will provide added protection to the liner containment system from wind uplift and mechanical damage and will prepare the area for the next cell. As outlined in Chapter 5 Phasing Plan, access roads and operational areas will be developed over top of previously completed cells. In order to drive equipment over a completed cell an additional 500mm of road base should be deployed on top of the 5-25 mm crush drainage layer to avoid damage to the liner.

Run-off from closed areas will be collected in membrane lined open ditches at the toe of each cell. These ditches will collect surface water run off and convey it to the settlement pond. Contact water will be collected in the the perforated leachate collectors on top of the liner system and conveyed to thecontainment tanks for potential treatment in solid pipes.

SHA recommends that detailed design drawings and specifications be prepared for each cell prior to construction. It is important that the detailed design address the following:

- Contact water collection
- Collection of water from leak detection system
- Collection of clean run-off post closure
- Slope stability of cell for deep seated circular and/or block failure
- Slope stability of cover system veneer
- Access to cell for construction
- Access to cell for landfilling
- Erosion Control
- Clean out and maintenance of contact water and leak detection piping
- Protection of liner system during and post construction
- Diversion of run-on water



REMEDIATION SOIL FILLING CELL - CONSTRUCTION DETAILS

SPERLING HANSEN ASSOCIATES

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- Design & Operations Plans
- Landfill Closure
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LEGEND:

CLIENT:

COBBLE HILL HOLDINGS LTD.

PROJECT:

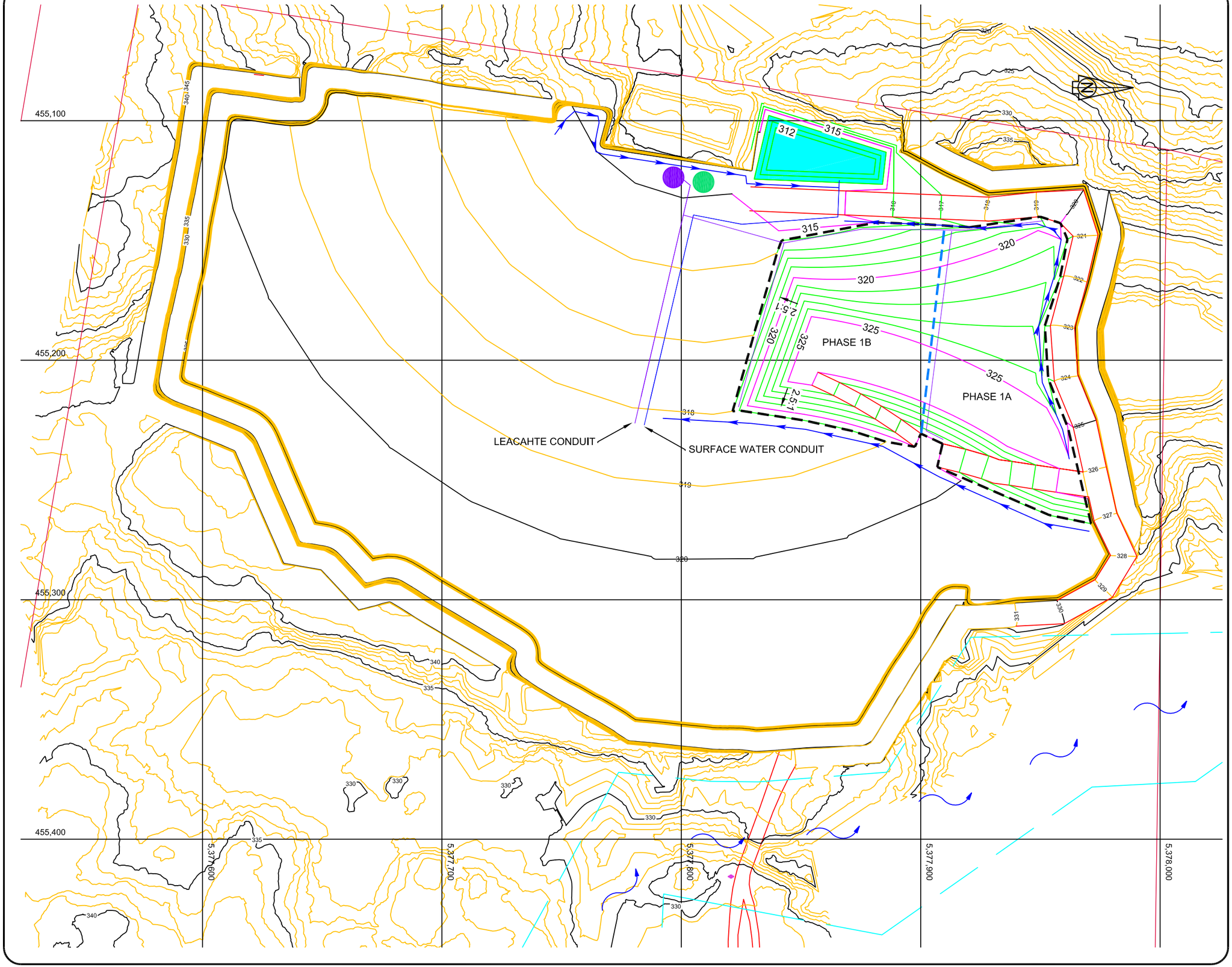
COBBLE HILL QUARRY
CLOSURE PLAN

TITLE:

REMEDIATED SOIL FILL CELL
CLOSURE DESIGN DETAILS

SCALE:	DATE:	PROJECT NO:
N.T.S.	2016/12/08 yyyy/mm/dd	PRJ 16035

DESIGNED	SG	DRAWING NO:
DRAWN	SG	**FIGURE 6-1**
CHECKED	TS	



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LEGEND:

- PHASE BOUDNARY
- SUB-PHASE BOUDNARY
- ROAD
- SURFACE WATER CONDUIT
- CONTACT WATER CONDUIT
- LEACHATE CONDUIT
- SURFACE WATER DITCH
- 1m DESIGN CONTOUR
- 5m DESIGN CONTOUR
- 5m EXISTING CONTOUR
- 1m EXISTING CONTOUR

CLIENT:

COBBLE HILL HOLDINGS LTD.

PROJECT:

COBBLE HILL LANDFILL CLOSURE PLAN

TITLE:

PHASE 1A & 1B DETAILED LAYOUT

SCALE:	DATE:	PROJECT NO:
1:1,500	2016/12/16 yyyy/mm/dd	PRJ 16035
DESIGNED	SG	DRAWING NO:
DRAWN	SG	**FIGURE 6-2**
CHECKED	TS	

7. LEACHATE MANAGEMENT

7.1 Leachate Management Strategy

The primary strategy for minimizing generation of contact water at the site is to cover the site with a geomembrane cover system. This will prevent leachate generation as a result of rainwater infiltration. In addition, SHA recommends the following strategy for managing leachate.

During landfilling operations, the use of poly tarps and temporary covers will aid in minimizing clean water contact with contaminated soil.

Additionally, run-on ditches should always be in place to divert clean run-on away from active cells and to collect surface water prior to contact with landfilled soils. Clean run-on should be conveyed to the settlement pond.

7.2 Leachate Generation

The leachate generation estimation was performed using the Hydrologic Evaluation of Landfill Performance (HELP) model. HELP is a quasi-two-dimensional hydrologic model of water movement across, into, through and out of landfills. The model accepts weather, soil and design data and uses solution techniques that account for the effect of surface storage, snowmelt, runoff, infiltration, evapotranspiration, vegetation growth, soil moisture storage, lateral subsurface drainage, leachate recirculation, unsaturated vertical drainage, and leakage through liners. HELP modelling of leachate production with the recommended cover system, documented in Chapter 4, forecasts an average annual leachate production rate of 2.2 mm/year or 176 m^3/year for the 8 Ha site after closure. The leachate generation estimate should be reviewed during detailed design of each new cell to ensure that total contact water production will not exceed 274 m^3/day.

7.3 Leachate Collection Strategy

During landfill operations, encapsulated soil cells will be constructed with gravel drainage layers and perforated collection piping along the downgradient toe of the cell. Cells built overtop of one another will have continuous / connected drainage layers providing an outlet for any contact water generated post closure. Collected contact water will report to water treatment area, on the western portion of the site.

There should also be a system in place to collect any minor amounts of shallow groundwater seepage that may occur from fractures in the bedrock side slopes and from the base of the landfill. These seepages would be collected in the seepage blanket drains and associated perforated piping system along the western toe of the site. There should be a monitoring program put in place to test any groundwater seepage draining from under the landfill to ensure no leakage of the basal liner system is occurring.

7.4 Contact Water and Clean Run-off Treatment Strategy

Contact water will be collected in a large tank at the western toe of the landfill and will then be conveyed into a treatment flow equalization lagoon. From there, water will be directed into a package treatment plant that has been engineered by others. Discharge from the treatment plant will be directed to mix with clean run-off discharge from the clean water settlement pond upslope of the property boundary.

Clean run-off from closed cells as well as run-off from the rock quarry will be directed to the clean water settlement pond. There, turbidity will be reduced through retention and possible addition of flocculant chemicals.

Groundwater seepage from beneath the liner will be allowed to flow naturally beneath the base of the quarry. Any shallow groundwater seepage that may be intercepted by the landfill collection system will be negligible in comparison to the surface water flows requiring management on the site.

The water treatment system has been designed to treat contact water generated in the landfill area. All collected water collected will be monitored and treated (if necessary) prior to discharge to the Settling Pond, and ultimately the ephemeral stream on the west property boundary.

The treatment system manages contact water derived from 1) leak detection system / seepage blanket at the base of the landfill floor, 2) leachate collection system from the soil cells in the landfill.

These pathways report to separate water containment reservoirs adjacent to the water treatment plant. These reservoirs may be sampled prior to treatment and discharge to the settling pond. It is envisioned that typical operation will include treatment of all waters reporting to the impacted water holding tanks.

The purpose of individually collecting the flows into separate containment reservoirs from the the two contact water pathways is to monitor the performance of the facility and enable identification of leachate generation volumes and concentrations related to specific pathways. This will allow for any targeted remedial measures to be effectively implemented if necessary.

The leachate treatment facility will include a package treatment plant contained in a treatment trailer, similar to the facility currently in operation at the site. The facility will treat leachate prior to discharge to the settling pond. If for some reasons, leachate generation volumes increase beyond the design discharge volume allowed of 274 m^3/ day, treated leachate will need to be contained in tanks and transported offsite to a liquid disposal site if onsite retention capacity is exhausted.

8. SURFACE WATER MANAGEMENT

The primary objectives of the surface water management plan for the Cobble Hill Landfill (CHL) are to:

- Keep clean water clean,
- Prevent erosion of the final cover system,
- Minimize percolation through the top surface of the landfill cover system;
- Prevent ponding of surface water on the cover system,
- Manage suspended sediments,
- Minimize leachate production,
- Control surface water in a manner compatible with the proposed end-uses.

This chapter reviews the background information on existing conditions and provides recommendations on run-on diversion, ditch sizing, storm water control and runoff controls during landfill development.

8.1 Drainage Plan for the Cobble Hill Holdings Landfill

The key goal of the surface water management plan for the CHL is to keep clean water clean and minimize leachate production by diverting onsite clean surface water away from potential contact with contaminated soil treatment and filling operations. The goal is to direct that water to the Western Settlement Pond prior to discharging offsite to an ephemeral tributary of Shawnigan Creek.

8.1.1 Run-On Diversion

Based on the topography surrounding the site, all surface water which accumulates due to precipitation that does not fall on the active landfilling and quarrying portions of the site will be directed to Shawnigan Creek to the east and south and to the ephemeral tributary of Shawinigan Creek to the north.

8.1.2 Storm Water Routing

Upon final closure of the CHL, diversion of clean run-off from the geomembrane cap will be required. Figure 8-1 shows the location and orientation of the ditches and downchutes for the closure of the CHH Landfill. It is proposed that the crest of the landfill be graded at 4% for drainage purposes as per the B.C. Landfill Criteria.

Surface water run-off from the crest will drain at a minimum grade of 4% into a series of ditches running along the south and eastern boundaries of the site. Run-off draining to the north and west will be collected in the mid slope road ditch which grades both to the east and west.

Surface water collected on the western potion of the mid slope roadside ditch will drain to a downchute at the western boundary which will convey clean water to the western toe settling pond. Similarly, surface water collected on the eastern portion of the mid slope roadside ditch will flow towards the east into the northeast perimeter ditch and eventually to the western toe of the landfill.

Surface water run-off from the lower portion of the western slope will be collected at the toe of the landfill and conveyed to the onsite settling pond at the western perimeter.

8.1.3 Toe/ Road Ditches

In order to determine the sizing of the toe/road swales/ditches, peak flows were determined using the Rational Method, which is commonly used to determine the peak flow runoff rates in small watersheds. The rationale for the method is that steady uniform rainfall intensity will cause runoff to reach its maximum rate when all parts of a watershed are contributing to the point of outflow. This is dependent on the time of concentration, which is taken as the time for water to flow to the outflow from the most remote point of the watershed. Along with the rainfall intensity and drainage area, which are relatively straightforward to determine, the peak flow is dependent on the runoff coefficient. The runoff coefficient is dependent on the final cover design. It is primarily influenced by topography, vegetation, the seasons and the subsurface material type. The method and coefficients for the analysis were obtained from the BC Agricultural Drainage Manual (1997). This method allows for variations of the material types, the vegetation types and the topography (slope) conditions.

SHA recommends ditches with a triangular cross section, 0.75m depth and 2.5H:1V side slopes lined with an erosion control blanket. Analysis of ditches can be revisited during detailed design. Figure 9-3 shows a conceptual surface water ditch for the CHL.

8.1.4 Crest Ditch

The crest drainage ditch will be constructed along the perimeter of the south and eastern boundary of the site. The crest ditch will collect runoff falling on the closed crest area, and direct it along roadside ditches to the toe of the western landfill slope. Based on the run-off analysis using the Rational Method, the ditches will need to be triangular in shape and have a total depth of 0.75 m, with side slopes at 2.5H:1V. A geomembrane flap will be welded to the main geomembrane panel along the full length of the ditch. The intent of this flap is to capture 100% of run-off collected from the landfill crest area and convey that run-off towards the western toe.

Control of erosion in the ditch is a key consideration. The top layer of the ditch will consist of 300 mm thick layer of rip rap or an erosion control blanket. Underlying the rip rap material will be a 200mm thick layer of 5-25 mm crush cushion layer and a heavy weight geotextile overlying the geomembrane as shown in Figure 8-2. It may be possible to replace the rip rap with a less expensive erosion control mat, as shown in Photo 8-1, when ditch grades are less than 5% grade. This should be assessed during detailed design.

Photo 8-1: Erosion control mating in use at Nanaimo Landfill

8.1.5 Down Chute

An armoured down chute will be constructed to convey run-off collected from the western upper slopes in the mid slope roadside ditch and conveyed to the toe of the landfill. Similarly, a downchute is also envisioned at the inlet of the settlement pond at the western boundary of the site. Photo 8-2 shows a downchute at the recently completed Delta Shake and Shingle Landfill implemented by SHA. Based on the run-off analysis and Rational Method calculations, the downchutes will be trapezoidal in shape and have a total depth of 0.75 m, bottom width of 2.0 m and side slopes at 3H:1V. The downchutes will be lined with medium weight geotextile, with a 500mm thick 300 to 600 mm Rip Rap Layer on top for the full depth of the downchutes as outlined in Figure 8-2.

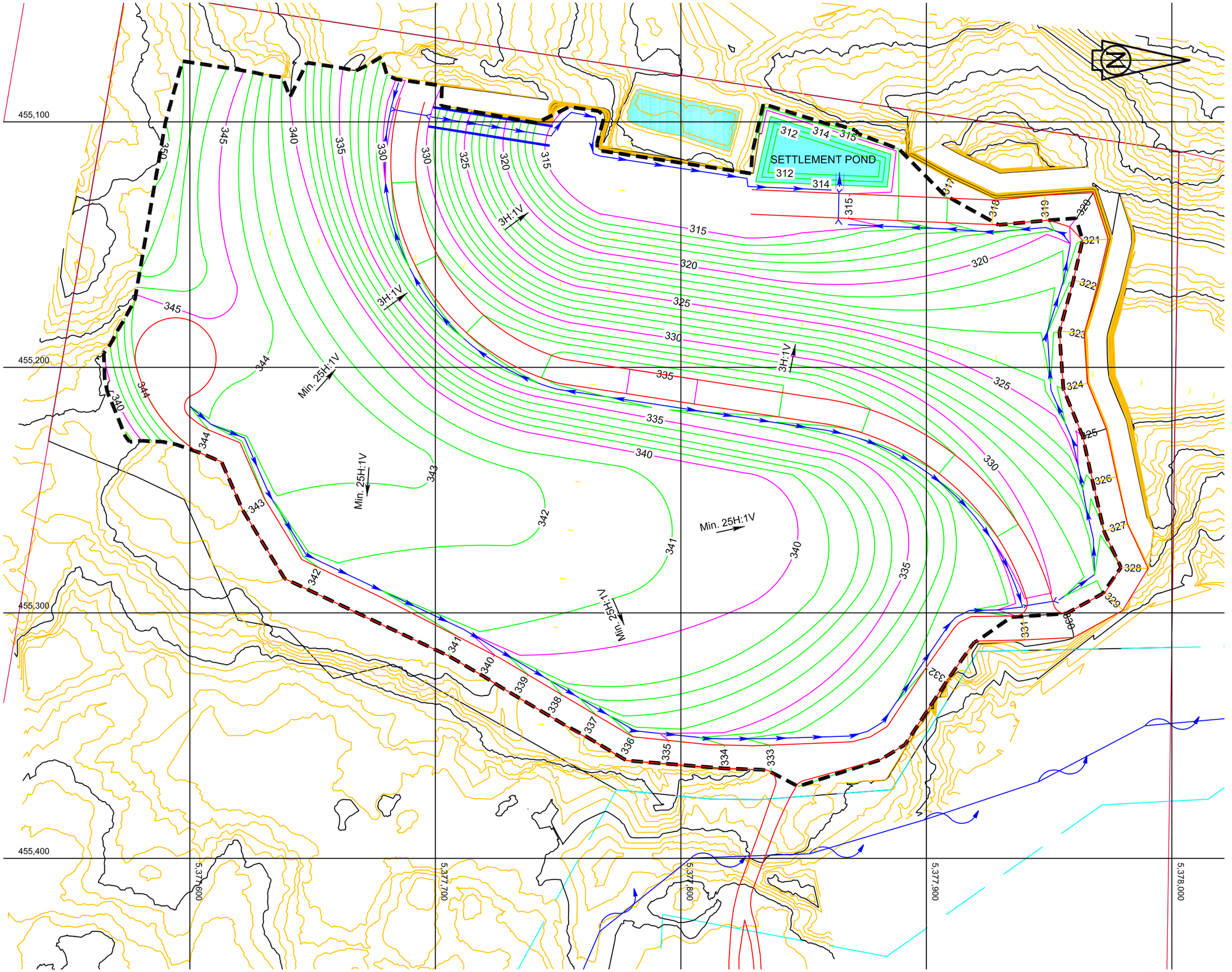
The Rip Rap layer will ensure that there is no erosion due to the high velocities that will be experienced within the downchutes. More detailed specification for the Rip Rap armouring will be developed during detailed design. Also, it will be important to provide some form of energy dissipation at the bottom of each chute to protect the lower ditch works from scour.

Photo 8-2: Delta Shake and Shingle Landfill Downchute

8.1.6 Culverts

Surface water culverts are envisioned at three locations on top of the final closure area of the landfill. Road crossing culverts have been designed at the most western and eastern edges of the mid slope road and ditch feature as well as at the bottom of the main access road to the western toe of the landfill directing flows into the settlement pond.

SHA recommends all culverts to be minimum 600 mm in diameter and can be either HDPE or CSP depending on whether or not they are on top of the designed 40mil LLDPE Geomembrane Liner Closure System. SHA recommends HDPE culverts be uses when on top of the liner system to ensure proper booting procedures are completed during geomembrane deployment.



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LEGEND:

- 5m EXISTING CONTOUR
- 1m EXISTING CONTOUR
- 5m DESIGN CONTOUR
- 1m DESIGN CONTOUR
- ROAD
- SURFACE WATER DITCH
- DOWNCHUTE
- CULVERT
- POND FEATURE
- PROPERTY LINES
- CREEK

CLIENT:

COBBLE HILL HOLDINGS LTD.

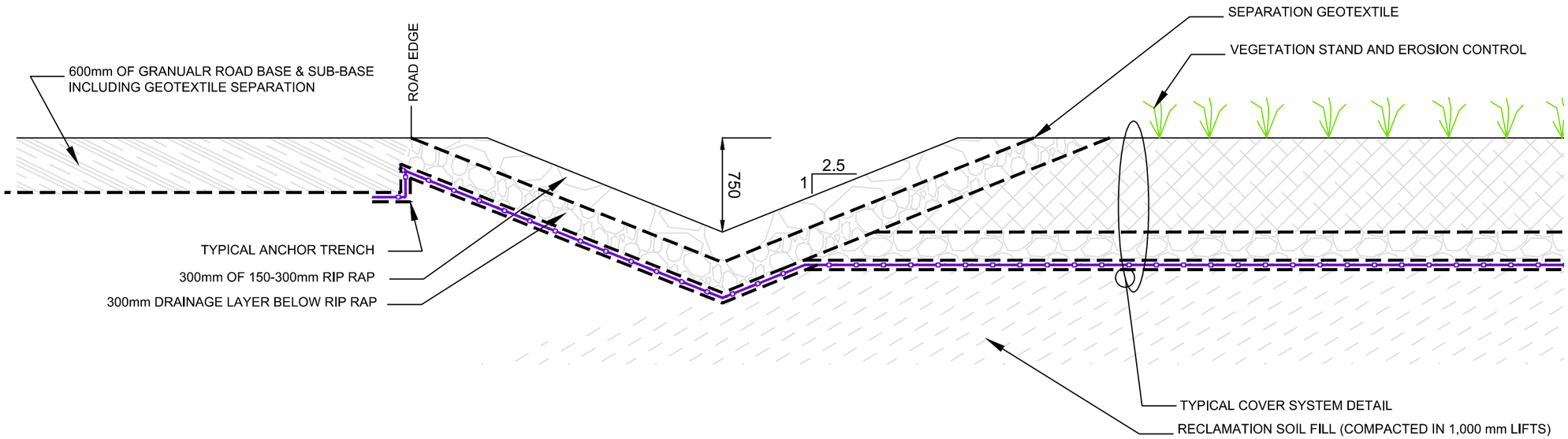
PROJECT:

COBBLE HILL HOLDINGS CLOSURE PLAN

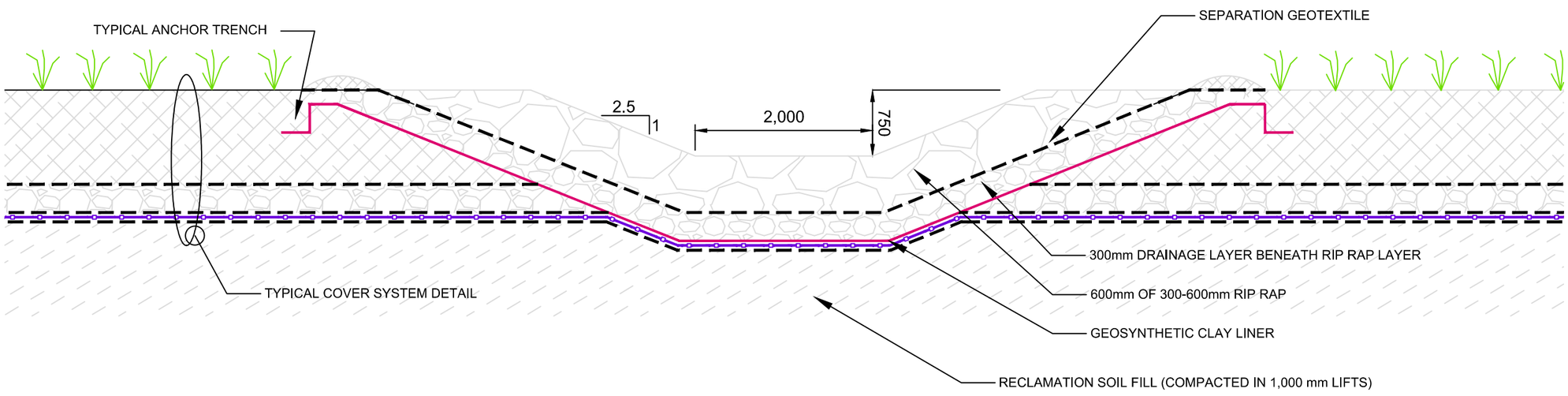
TITLE:

SURFACE WATER MANAGEMENT PLAN

SCALE:	DATE:	PROJECT NO:
1:1,500	2016/12/12 (yyyy/mm/dd)	PRJ 16035
DESIGNED	SG	DRAWING NO:
DRAWN	SG	**FIGURE 8-1**
CHECKED	TS	



SURFACE WATER DITCH DETAIL - Typical



SURFACE WATER DOWNCHUTE DETAIL - Typical

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LEGEND:

CLIENT:
COBBLE HILL HOLDINGS LTD.

PROJECT:
COBBLE HILL QUARRY CLOSURE PLAN

TITLE:
SURFACE WATER DESIGN DITCH & DOWNCHUTE DETAILS

SCALE:	DATE:	PROJECT NO:
1:50	2016/12/08 yyyy/mm/dd	PRJ 16035
DESIGNED	SG	DRAWING NO:
DRAWN	SG	**FIGURE 8-2**
CHECKED	TS	

9. GEOTECHNICAL CONSIDERATIONS

9.1 Underlying Stratigraphy

The ground surface at the site is an expression of an igneous intrusion of very hard granite bedrock through underlying bedrock known as Wark Gneiss. This hard granite rock, as well as the Wark Gneiss, are the source of materials for the quarry. The groundwater flow regime in the vicinity of the site is predominantly via fractured flow within a deep bedrock aquifer. Overburden soils are not thick enough in the region to develop an overburden aquifer.

9.2 Slope Stability Analysis

The purpose of this section is to prove that the proposed final design for the site will maintain acceptable factors of safety against failure. Stability of the site was modeled using the program SLIDE 4.0 designed for 2D slope stability analysis for soil and rock slopes.

9.2.1 Slope Stability Model

To verify stability of the proposed regrading, SHA conducted a detailed analysis using computer program SLIDE. The slope stability models discussed below have been developed largely from strength parameters that we have used for similar conditions.

Two cross-sections were selected through representative sloped areas of the site. The cross sections were developed from the proposed design contours shown in Figure 9-1. The cross-section locations analyzed are identified in plan view in the Figure. The cross sections used in the stability analysis are located in Appendix B Figures B-1 to B-2 in Appendix A and show the underlying geology of the landfill, the proposed profile and the material parameters used in the analysis. The analysis was performed using limit equilibrium technique and Bishop Simplified method of analysis. Materials are modeled using a Mohr-Coulomb strength envelope.

Failure scenarios were modeled for both static and seismic (earthquake) conditions for the proposed and existing profiles. The following factors of safety (FOS) for slope failure have been adopted as minimum standards:

- Static Conditions adjacent to Developed Land and Infrastructure 1.5
- Static Conditions adjacent to Undeveloped Land 1.3
- Seismic (Earthquake) Loading 1.0

A pseudo-static analysis was performed to determine if the slopes would be stable during an earthquake when subjected to peak ground acceleration expected for the area. The National Building Code of Canada 2012, Volume 2 provides seismic values for a number of locations across Canada. The peak horizontal ground acceleration (PGA) of 0.61 g for the Victoria area was found. This PGA has a probability of exceedance of 2% in 50 years.

The PGA acts momentarily in one direction and its use with static material properties may yield very low and incorrect factors of safety. The United States Environmental Protection Agency document "RCRA Subtitle D (258) Seismic Design Guidance for Municipal Waste Landfill Facilities (1995)" recommends using a seismic coefficient k_s of 50% of the PGA, in combination with the dynamic shear strength properties of the materials. Therefore, a design PGA of 0.305 g was used in the analysis. A vertical acceleration was also applied to the model and is typically between 60% and 75% of the horizontal acceleration. Therefore, 0.183 g for the vertical acceleration was chosen.

A number of assumptions were made in the process of simplifying complex situations in the field to a computer model:

- Strength characteristics of the ground materials were generalized;
- Stabilizing effects of vegetative cover on the side slopes were not included;
- Ground water levels were assumed to be below the line along the gravel drainage layer.

9.2.2 Soil Strength Parameters

Table 9-1 outlines the geotechnical parameters used for the modeled materials. Five types of materials were chosen to represent the site conditions: waste material, imported soil, gravel and bedrock.

All parameters of the underlying foundation material used in this analysis were taken from AE (1985) and Alta Tech (2015) reports as stated in Section 4.1.

Table 9-1 Geotechnical Parameters for SLIDE

Material	Unit Weight, γ (kN/m^3)	Cohesion, c' (kN/m^2)	Internal Friction Angle, φ' (degrees)
Waste	17	5	30
Imported Soil	16	2	30
Gravel	18	0	35
Bedrock	25	2	50

9.2.3 Ground Water Conditions

A total of five monitoring wells were installed to determine the groundwater conditions beneath the site. A stratification of fracture density/permeability beneath the site was observed that can be represented into two distinct layers as follows:

- 0 to 75 m- Upper Bedrock: Negligible groundwater flow
- Below 75 m- Deep Bedrock: Minor groundwater flow

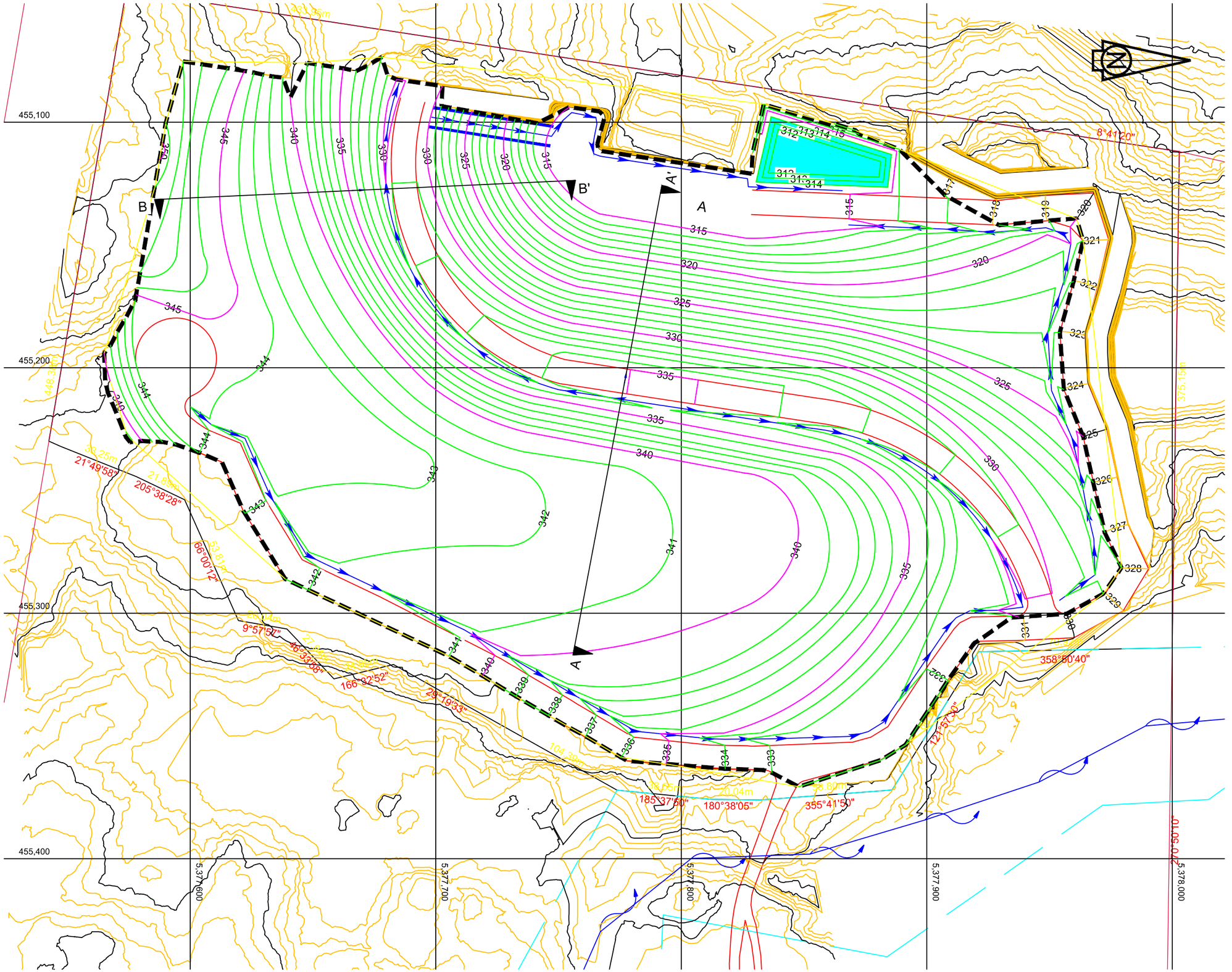
9.2.4 Global Slope Stability Results

Results of the SLIDE analysis for the proposed grading design and existing conditions can be found in Appendix C, Figures C-1 to C-2. Each figure shows the soil profile, the resultant failure circle, the minimum FOS and the deep-seated FOS. The following table summarizes the lowest FOS obtained for each cross section, the FOS of the deep-seated failure, the FOS under seismic conditions.

Table 9-2 Results from Slope Stability Analysis

Slope Cross Section	Condition	Maximum Slope Height (m)	Slope Angle (H:V)	FOS Static Minimum	FOS Static Deep-seated	FOS Seismic Minimum	FOS Seismic Deep-seated
A-A'	**Proposed**	**20**	**3:1**	**2.08**	**2.50**	**1.07**	**1.15**
B-B'	**Proposed**	**15**	**3:1**	**2.16**	**2.96**	**1.11**	**1.36**

The proposed design is stable for all static loading conditions with FOS values exceeding 1.50, the standard mentioned before. For the seismic loading conditions, FOS greater than 1.0 are obtained at all the cross sections. The seismic results are presented in Appendix C from C3 to C4.



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- 1m DESIGN CONTOUR
- ROAD
- SURFACE WATER DITCH
- PROPERTY LINES

CLIENT:

COBBLE HILL HOLDINGS LTD.

PROJECT:

COBBLE HILL QUARRY
CLOSURE PLAN

TITLE:

GEOTECHNICAL ANALYSIS CROSS SECTION LOCATIONS

SCALE:	DATE:	PROJECT NO:
1:1,500	2016/12/12 yyyy/mm/dd	PRJ 16035
DESIGNED	TS	DRAWING NO:
DRAWN	SG	**FIGURE 9-1**
CHECKED	IB	

10. EROSION CONTROL

This Chapter discusses the Erosion Control Plan for the Cobble Hill Quarry. The erosion control measures that are proposed are hydroseeding immediately after placing the final cover layer, straw wattles, straw on the slope, and rip rap. The main feature of the storm water management system will be the storm water retention pond. By attenuating peak flows from the reclaimed slopes of the rock quarry, downstream environments will be protected from scouring. Furthermore, retention of storm water in the settlement pond will allow for suspended solids to settle out. The main objective with the erosion control plan is to prevent soil migration in the first place.

10.1 Hydroseeding Plan

In order to protect the cover system from erosion during the first winter after construction, a strict monitoring and maintenance program to control erosion should be implemented. The most important element when safeguarding against erosion is to establish vegetation as early in the year as possible, giving the design seed mixture time to develop and establish itself. Hydraulic seeding can be applied to closure areas excluding armored ditches and roadways directly after the topsoil layer has been installed. A system comprised of both permanent and temporary measures such as erosion control blankets, straw wattles and straw bales is envisioned, with some elements being removed after the first winter and others remaining in place.

Photo 10-1: Vancouver Landfill Phase 1 Hydraulic Seeding Application

10.2 Straw Wattle Ditch Protection

Straw wattles are an effective and economical alternative to silt fence for sediment control and storm water runoff. Compared to the silt fence the straw wattles allow the water to slowly percolate through the wattles, slowing down the velocity and trapping sediment. They work by slowing down the velocity of rain runoff and help to prevent rill and gully slope erosion by holding bare soil in place and trapping sediment. Comprised of cylinders of recycled, compressed, 100% agricultural straw, straw wattles are wrapped in tubular, UV-stabilized black synthetic netting and can last up to two years allowing the design seed mixture time to develop and establish itself. Straw wattles are installed by staking in place, and can be used individually or tied together to achieve any desired length. Photo 10-2 below, illustrates the usage of straw wattles and erosion control matting at the Vancouver Landfill. SHA has also begun using straw bales, temporarily, on the inlet and outlet structures of culverts and downchutes which does a very effective job of collecting the fine particles suspended in the collected surface water. The use of hay bales and straw wattles are examples of temporary erosion control measures which can be removed once the vegetation layer is well established.

Photo 6-2 Erosion Control Measures on Phase 2 at Vancouver Landfill

10.3 Straw Slope Protection

Loose straw application on slopes is an effective temporary solution to prevent rilling and other erosion while vegetation is being established. An example of loose straw applied on a slope is shown in Photo 10-3 at the DSS Landfill in Delta. The slopes are now well vegetated during the second winter post-construction and the straw has degraded. It is not recommended to use composted yard waste for this application as is too dense and would prevent germination of the grass seeds.

Photo 10-3: Loose Straw Application on DSS Landfill in Delta.

10.4 Erosion Control in Ditches

A well-established grass cover will be effective in preventing uncontrolled erosion. In order to keep the ditch clean and free of sediments during construction and before grass is established, straw wattles should be installed on the upslope side of all ditches.

For the surface water conveyance system there is a need to allow the drainage layer to efficiently drain into the ditch without pore pressure build up, therefore a free-draining rip rap armour is recommended. For this reason the bottom and side slopes of the ditches and downchutes should be armoured with a 300 mm thick layer of rip rap or similar material. Photo 10-4 presents our vision of how the site ditches should appear once integrated into the final cover system.

Photo 10-4 Erosion control on slope and ditches at the Vancouver Landfill

In some ditches, an erosion control blanket can be used instead of the rip rap where the velocity of the surface water flow will be minimal. An example of erosion control matting in place of rip rap is shown in Photo 10-5.

Photo 10-5 Erosion Control Blanket in a ditch at the DSS Landfill in Delta.

11. POST CLOSURE MONITOIRNG

A detailed Environmental Monitoring Plan (EMP) for leachate, groundwater, surface water, and landfill gas is outlined in the following section and will be implemented during landfill operation, closure and post closure.

The EMP's objectives are to:

- Demonstrate compliance with the performance criteria.
- Demonstrate that monitoring results are consistent with the applicable plans and reports, including the groundwater and surface water impact assessment.
- Address the need for monitoring within 1 km of the landfill footprint.

The EMP has been developed in accordance with the "Guidelines for Environmental Monitoring at Municipal Solid Waste Landfills" for groundwater, surface water, leachate, and soils and vegetation. Best management practices should be followed as outlined in the British Columbia Field Sampling Manual complete with QA/QC sampling.

Active Earth Engineering Ltd. (AEE) In October 2013 proposed the following closure monitoring program:

Closure Monitoring Program

Monitoring Location	Parameters	Frequency
Groundwater Monitoring Wells	Dissolved Metals	1 / Year
	Hydrocarbons	
	Physical Parameters	
	Nutrients	
Surface Water	Total Metals	2 / Year
	Hydrocarbons	
	Physical Parameters	
	Nutrients	
Water at the Point of Discharge	Total and Dissolved Metals	2 / Year
	Hydrocarbons	
	Physical Parameters	
	Nutrients	
Soil Vapour Wells	Volatile Organics	1 / Year

Active Earth Engineering Ltd 2013

This proposed program by AEE included sampling of nearby surface water bodies, groundwater monitoring wells and soil vapour.

In March 2016 South Island Resource Management developed the Enviornmental Procedures Manual/ Operation, Maintenance and Surveillance Manual for the site. This manual describes in detail the current monitoring procedures. SHA proposes to extend this monitoring for the first few years after final closure to ensure that the closure is effective. Once a qualified professional determines that the landfill closure is effective the sampling intensity and frequency could be reduced.

11.1 Leachate Monitoring

Leachate Chemistry is required to assist with determining the contaminating lifespan of the landfill. As described in Chapter 7, it is expected that the leachate generation rate will diminish significantly as the site is capped with a geomembrane and overlaying soil layers. Leachate monitoring will be conducted until a Qualified Professional and the Chief Inspector deems otherwise.

It is anticipated that the existing Water Treatment System (WTS) will remain in operation until leachate generation is no longer a significant concern.

The proposed monitoring consists of effluent water monitoring from the catch basins, water treatment system, WTS outlet and Settling Pond Outlet. The following table states the proposed monitoring frequencies.

Monitoring Location	**Parameters**	**Frequency**
Catch Basins and Leak Detection Inspection Ports (SMA and encapsulation areas)	Total Metals Hydrocarbons Physical Parameters Nutrients	Annually
Water Treatment System Holding Tanks (When Applicable) and/or Containment Pond	Total Metals Hydrocarbons Physical Parameters Nutrients	Monthly (As Generated)
WTS Outlet	Total Metals Hydrocarbons Physical Parameters Nutrients	Monthly and Every 2,000 m^3 of Treated Effluent
Settling Pond Outlet (SW-1)	Total Metals Hydrocarbons Physical Parameters Nutrients	Monthly and Every 2,000 m^3 of Treated Effluent

11.2 Surface Water Monitoring

Currently surface water monitoring is completed two times per year and consists of taking five samples within a 30-day period. Some of the surrounding creeks are intermittent and only flow during saturated conditions. As a result, the quarterly monitoring should be conducted when the ground has been saturated and the creeks are flowing.

Monitoring Location	Parameters	Frequency
SW-2 – Ephemeral Creek (Up-Stream) SW-3 – Ephemeral Creek (Down-Stream) SW-4 – Shawnigan Creek (Up-Stream) SW-5 – Shawnigan Creek (Down-Stream)	Total Metals Hydrocarbons Physical Parameters Nutrients	Quarterly (When flowing)

11.3 Groundwater Monitoring

Further groundwater investigation is required to fully understand the groundwater chemistry. SHA did not receive any groundwater data and is thus adopted a conservative sampling frequency when proposing the following groundwater monitoring schedule. SHA proposes that additional wells be established during closure implementation further down gradient.

Previous groundwater investigations indicate the bedrock is fractured. Due to this, it may be possible that surface water infiltrating into the ground from the site may be missed in the monitoring wells unless the well is intercepting a fracture.

The original waste permit by MOE stated that a minimum of seven groundwater sampling facilities would be installed and maintained. SHA proposes to establish two more monitoring wells at least 1 km away from the site to safely account for any groundwater mixing between the rock fractures. Wells located 1 km from the landfill toe would give an early indication if any groundwater is impacted before it is discovered at a receptor further down gradient. The below table shows the proposed groundwater monitoring schedule.

Monitoring Location	Parameters	Frequency
MW-1 (S/D) (On-Site) MW-2 (Property Boundary) MW-3 (S/D) (Property Boundary) MW-5 (On-Site) MW-6 (On-Site, Up-Gradient) MW-7 (1km Down-Gradient) Proposed MW-8 (1km Down-Gradient) Proposed	Dissolved Metals Hydrocarbons Physical Parameters Nutrients	Quarterly

Locations for monitoring wells, water wells, surface water stations and air sampling stations are presented on Figure 11-1.

11.4 Landfill Gas Monitoring

As the landfill is not a Municipal Waste Landfill and the gas generation rate for the types of waste being landfilled is very slow, Landfill gas is not deemed to be of great concern at the site. That being said the contaminated soil may have volatile organic compounds (VOC's) which may escape through the barrier layer. In order to determine the quantity of VOC's being emitted from the landfill annual monitoring will be conducted. A VOC instrument will be used to sample from a minimum of 10 locations (1 sample per 200 m^2) or as directed by the Chief Inspector. Should the annual testing confirm that the landfill cap is preventing the release of any VOC's then the number of sampling locations could be reduced.

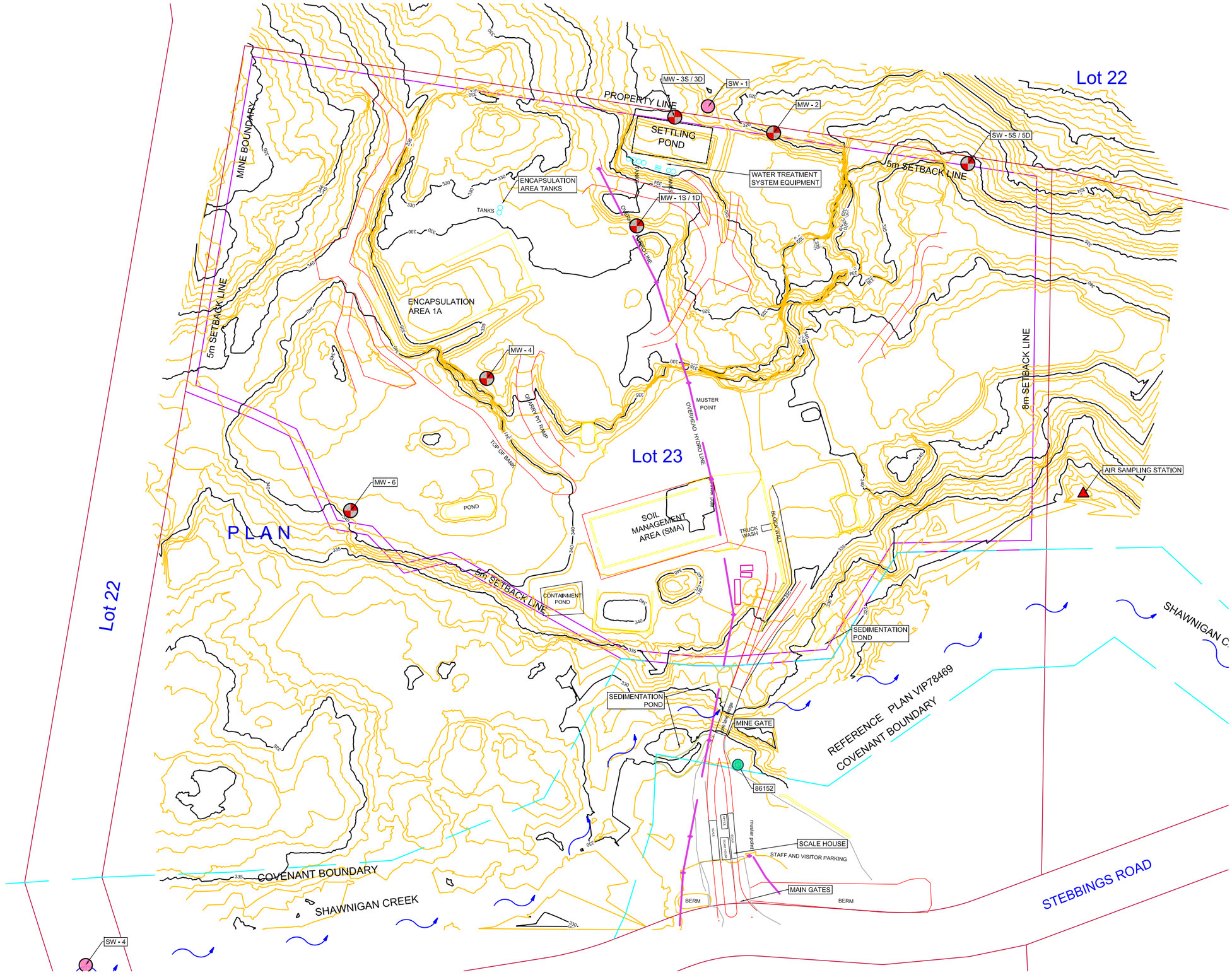
Even though the risk is deemed to be low, no permanent structures should be built on top of the landfill unless they are constructed with properly ventilated foundations. Also, standard confined space entry procedures must be followed when entering any manholes or other structures on or near the landfill site as landfill gas can accumulate in such structures over time.

11.5 Geotechnical Inspection

A geotechnical inspection should be initiated on an annual basis to inspect active and inactive areas within the landfill footprint. This inspection should also include checking the cover for potential problems arising from slumping, cracking or erosion, and determining the state of other infrastructure that does not receive regular inspection. If significant issues with infrastructure are identified, a Qualified Professional should be retained to resolve them.

11.6 Annual Report

Each year a Qualified Professional will collect the required monitoring data and compile an Annual Report outlining the closure performance of the landfill. Each year the Qualified Professional will assess the groundwater and surface water quality for potential impacts and evaluate the leachate generation rate and quality. In each report the Qualified Professional will make recommendations on the existing monitoring program and identify any changes that would improve the post closure monitoring.



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LEGEND:

- 5m EXISTING CONTOUR
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- 5m DESIGN CONTOUR
- 1m DESIGN CONTOUR
- ROAD
- SURFACE WATER DITCH
- PROPERTY LINES
- MONITORING WELLS
- WATER WELL
- SURFACE WATER STATION
- AIR SAMPLING STATION

CLIENT:

COBBLE HILL HOLDINGS LTD.

PROJECT:

COBBLE HILL LANDFILL CLOSURE PLAN

TITLE:

MONITORING LOCATIONS

SCALE:	DATE:	PROJECT NO:
1:2,000	2016/12/16 yyyy/mm/dd	PRJ 16035

DESIGNED	SG	DRAWING NO:
DRAWN	SG	**FIGURE 11-1**
CHECKED	TS	

12. SECURITY POSTING

The closure plan and security posting will be reviewed every five years as specified in Section 4.1 of the permit, see attached in Appendix A.

Given the current conditions at the site, where one fully encapsulated contaminated soil cell exists and has been completely lined and closed off, as well as the fact that Cobble Hill Landfill (CHL) does not plan to manage contaminated soil onsite until further quarrying takes place to make room for further landfilling, SHA believes that the current bonding is adequate to address current liabilities; however, additional bonding should be posted prior to commencing the development of a new contaminated soil cell.

12.1 Current Site Conditions

Currently, there is one fully lined and covered contaminated soil cell onsite. A small amount of contact water effluent is being managed by South Island Resource Management (SIRM). Additionally, CHL will not be accepting, remediating and landfilling any further soil onsite until additional landfill airspace becomes available through quarrying operations. Through discussions with Cobble Hill Holdings Ltd.'s (CHH) Manager, SHA understands that sufficient airspace will not become available till later in 2017, approximately eight to ten months away.

The level of financial security required for the proposed facility was envisioned based on a scenario where the facility is essentially abandoned during mid-operation within the first five years.

Given the existing conditions onsite, as outlined above, it is SHA's opinion that the security bonding currently in place is adequate until further acceptance, remediation and landfilling of soil continues, in late 2017. At that time, CHL will need to revisit their security requirements.

Below is description of both the security posting currently in place as well as the security required when soil management and landfilling continue.

12.1.1 Security Posting Details - Existing

The works required to complete closure of the facility and the associated costs have been estimated based on the following assumptions:

- 4,000 tonnes of soil are typically present and being actively managed/treated within the Soil Management and Treatment Area;
- The operational cell within the Permanent Encapsulation Area is 2,000m^2 and will be
- closed with a 30 mil LLDPE cover and required drainage works;
- The Soil Management Area does not require decommissioning, as there is no environmental risk posed by this infrastructure;
- The final cap requires construction over the operational portion of the Permanent Encapsulation Area:

    - An operational area of 2,000m^2 was assumed as the final cover will be constructed progressively during operation of the facility;
    - Final cover includes a 30 mil LLDPE liner plus 1m of low permeability soil plus 1m of growing medium with seeding;
- Long term monitoring of the water collection, treatment and discharge system is
- required; and,
- Long term monitoring of surface water, groundwater and ambient air is required for up to 25 years.

Table 12-1 presents the estimated costs based on the above assumptions. The total cost of the current security posting totals approximately $220,000.

12.1.2 Security Posting Details – for Future

The works required to complete closure of the facility and the associated costs have been estimated based on the following assumptions:

- 4,000 tonnes of soil are typically present and being actively managed/treated within the Soil Management and Treatment Area;
- The operational cell within the Permanent Encapsulation Area is 2,000m^2 and will be
- closed with a 40 mil LLDPE cover and required drainage works;
- The Soil Management Area does not require decommissioning, as there is no environmental risk posed by this infrastructure;
- The final cap requires construction over the operational portion of the Permanent Encapsulation Area:
    - An operational area of 2,000m^2 was assumed as the final cover will be constructed progressively during operation of the facility;
    - Final cover includes a 40 mil LLDPE double textured geomembrane liner plus 1m of low permeability soil plus 1m of growing medium with seeding;
- Long term monitoring of the water collection, treatment and discharge system is
- required; and,
- Long term monitoring of surface water, groundwater and ambient air is required for up to 25 years.

Table 12-2 presents the estimated costs based on the above assumptions. The total cost of the updated security posting totals approximately $331,000.

Table 12-1 Security Posting (Existing)

Contaminated Soil Facility Closure Cost Estimate	Units	Estimated Quantity	Unit Price	Total
Closure of Open Encapsulation Cell				
Relocation, Placement, Compaction and Grading of Remaining Contaminated Soil On-Site	tonnes	4,000	$ 4.00	$ 16,000.00
Engineering & Supervision	$/day	5	$ 1,000.00	$ 5,000.00
Sub-Total				**$ 21,000.00**
Construction of Final Cover System				
Supply & Install of 30mil LLDPE Cover System (inc. Geotextiles and Drainage Works)	m^2	2,000	$ 15	$ 30,000
Placement and Compaction of 1 m low permeability soil blanket	m^2	2,000	$ 14	$ 28,000
Placement and Compaction of 1m of growing medium, plus seeding	m^2	2,000	$ 14	$ 28,000
Engineering & Supervision	$/day	5	$ 1,000	$ 5,000
Mark-Up on Third party Disb.	10%	1	$ 20,000	$ 3,000
Sub-Total				**$ 94,000**
Post Closure Monitoring - 25 YR Term				
Laboratory Analysis (Ground Water, Surface Water, Ambient Air)	LS	1	$ 2,000.00	$ 2,000.00
Engineering, Sampling and Reporting	$/day	2	$ 1,000.00	$ 2,000.00
Mark-Up on Third party Disb.	10%			$ 200.00
Sub-Total				**$ 105,000.00**
			Total	**$ 220,000.00**

Notes:
-Assumes 4,000 tonnes of soil to be relocated onsite and complete encapsulation
-Assumes remaining soil places at approximately 1m thickness within cell
-Assume are of 2,000 m2 that requires final cover (final cover installed progressively during operations)
-Assumes 5 surface water locations, 7 monitoring wells and ambient air sampling during active operations - with reduced locations and frequency over time.
Collection of samples, monitoring of water treatment and collection / discharge system, reporting.

As outlined in the report and on the Permit, the security posting will be reviewed every 5 years to ensure an adequate and reasonable amount is allocated based on the actual operations of the Facility

Table 12-2 Security Posting (Updated Version)

Contaminated Soil Facility Closure Cost Estimate	Units	Estimated Quantity	Unit Price	Total
Closure of Open Encapsulation Cell				
Relocation, Placement, Compaction and Grading of Remaining Contaminated Soil On-Site	tonnes	4,000	$ 4.00	$ 16,000.00
Engineering & Supervision	$/day	4	$ 1,000.00	$ 4,000.00
Sub-Total				**$ 20,000.00**
Construction of Final Cover System				
Supply & Install of Secondary Liner System - 1,000mm of Compacted Low Permeability Soil	m^2	2,000	$ 15	$ 30,000
Supply & Install of Primary Liner System - 40mil Double Textured LLDPE Geomembrane with Geotextiles	m^2	2,000	$ 16	$ 32,000
Supply & Install of Drainage Layer - 300mm of Clear Crush Gravel	m^2	2,000	$ 3	$ 6,000
Supply and Install of Separation Layer Geotextile	m^2	2,000	$ 4	$ 8,000
Supply and Install of Growing Medium - 1,000mm of Topsoil & Seeding	m^2	2,000	$ 15	$ 30,000
Supply and Install of Seeding and Erosion Control Works	m^2	5,000	$ 2	$ 10,000
Engineering & Supervision	LS	1	$ 20,000	$ 20,000
Sub-Total				**$ 136,000**
Post Closure Monitoring - 25 YR Term				
Laboratory Analysis (Ground Water, Surface Water, Ambient Air)	LS	2	$ 2,500.00	$ 5,000.00
Engineering, Sampling and Reporting	LS	1	$ 2,000.00	$ 2,000.00
Sub-Total				**$ 175,000.00**
			Total	**$ 331,000.00**

Notes:
-Assumes 4,000 tonnes of soil to be relocated onsite and complete encapsulation
-Assumes remaining soil places at approximately 1m thickness within cell
-Assume are of 2,000 m2 that requires final cover (final cover installed progressively during operations)
-Assumes 5 surface water locations, 7 monitoring wells and ambient air sampling during active operations - with reduced locations and frequency over time.
Collection of samples, monitoring of water treatment and collection / discharge system, reporting.

As outlined in the report and on the Permit, the security posting will be reviewed every 5 years to ensure an adequate and reasonable amount is allocated based on the actual operations of the Facility

APPENDICES

APPENDIX A
Permits

BRITISH COLUMBIA

August 21, 2013

Tracking Number: 225272
Authorization Number: 105809

REGISTERED MAIL

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

Dear Permittee:

Enclosed is Permit 105809 issued under the provisions of the *Environmental Management Act*. Your attention is respectfully directed to the terms and conditions outlined in the permit. An annual fee will be determined according to the Permit Fees Regulation.

This permit does not authorize entry upon, crossing over, or use for any purpose of private or Crown lands or works, unless and except as authorized by the owner of such lands or works. The responsibility for obtaining such authority rests with the Permittee. This permit is issued pursuant to the provisions of the *Environmental Management Act* to ensure compliance with Section 120(3) of that statute, which makes it an offence to discharge waste, from a prescribed industry or activity, without proper authorization. It is also the responsibility of the Permittee to ensure that all activities conducted under this authorization are carried out with regard to the rights of third parties, and comply with other applicable legislation that may be in force.

This decision may be appealed to the Environmental Appeal Board in accordance with Part 8 of the *Environmental Management Act*. An appeal must be delivered within 30 days from the date that notice of this decision is given. For further information, please contact the Environmental Appeal Board at (250) 387-3464.

Ministry of Environment
Environmental Protection Division
2080A Labieux Road
Nanaimo, BC V9T 6J9
West Coast Region
Telephone: (250) 751-3100
Facsimile: (250) 751-3103

Administration of this permit will be carried out by staff from the West Coast Region. Plans, data and reports pertinent to the permit are to be submitted to the Regional Manager, Environmental Protection, at Ministry of Environment, Regional Operations, West Coast Region, 2080A Labieux Road, Nanaimo, BC V9T 6J9.

Yours truly,

Hubert Bunce
for Director, *Environmental Management Act*
West Coast Region

Enclosure

cc: Environment Canada

BRITISH COLUMBIA

MINISTRY OF ENVIRONMENT

PERMIT

PR-105809

Under the Provisions of the Environmental Management Act

Cobble Hill Holdings Ltd. (BC0754588)

Herald Street Law
101-536 Herald Street
Victoria BC V8W 1S6

is authorized to discharge refuse to ground and effluent to an ephemeral stream from a contaminated soil treatment facility and a landfill facility located at 640 Stebbings Road, Shawnigan Lake, British Columbia, subject to the terms and conditions listed below. Contravention of any of these conditions is a violation of the *Environmental Management Act* and may lead to prosecution.

1. AUTHORIZED DISCHARGES

1.1 Authorized Discharges – General Conditions

This section applies to the discharge of refuse from a contaminated soil treatment and to the landfill facility.

1.1.1 The combined maximum rate of discharge from the treatment and to the landfill facility is 100000 tonnes per year. The estimated density of soil accepted at the site ranges from 1.5 to 1.8 t/m^3 for the purpose of sampling incoming soil or treated soil for characterization. The above density estimate may be modified at any time with a scientific sampling method approved by the Director.

1.1.2 The authorized discharge period is between 7am and 5pm Monday to Friday.

1.1.3 The characteristics of the discharges must be as described under Subsections 1.2 and 1.3.

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Soil relocation requirements of the Contaminated Sites Regulation (CSR) apply to all other parameters than those specified in this permit and in the Soil Acceptance Plan referred to under Section 2.2.

Soils meeting facility location background quality in accordance with CSR Protocol 4 may also be discharged.

If land use or site specific factors specified in Column I of Schedule 5 of the CSR change at the permitted site, the Permittee must promptly notify the Director and immediately apply them for the purpose of Subsections 1.2 and 1.3.

1.1.4 The authorized works as defined under Subsections 1.2.1, 1.3.1, 1.4.5 and 1.5.4 must be complete and in operation while discharging.

1.1.5 The location of the facilities and the points of discharge is Lot 23, Plan VIP78459, Blocks 156, 201 and 323, Malahat Land District.

1.2 Authorized Discharge –Treatment Facility

This section applies to the discharge of refuse from a soil treatment facility. The site reference number for this discharge is E292169.

1.2.1 The authorized works are a lined asphalt paved soil management and bio-remediation treatment area of approximately 1800 m^2, temporary soil holding area (as described under Subsection 2.3), biocell, berm, primary and secondary containment detection and inspection sumps and associated cleanout ports, catch basins, groundwater monitoring wells (as described under Subsection 3.3), management works and related appurtenances approximately located as shown on Figure A.

1.2.2 The characteristics of the discharge must be equivalent to or better than:

soil suitable for industrial land use, as described by the Generic and Matrix Numerical Soil Standards in Schedule 4, 5, 7 and 10 (Column IV "Commercial, Industrial Soil Standard") of the CSR, including the most stringent applicable site specific factors as defined in the Environmental Procedures Manual (EPM) referred to in Subsection 2.13, considering intake of contaminated soil, toxicity to soil invertebrates and plants and

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groundwater flow to surface water used by freshwater aquatic life for the authorized soil treatment and discharge parameters as specified in Subsection 1.2.3.

1.2.3 The types of soil that can be bio-remediated at the treatment facility are soils contaminated with hydrocarbons, specifically soils contaminated with Benzene, Toluene, Ethylbenzene, Xylene (BTEX), Styrene, Methyl Tertiary Butyl Ether (MTBE), Volatile Petroleum Hydrocarbons (VPHs), Light and Heavy Extractable Petroleum Hydrocarbons (LEPHs/HEPHs), Polycyclic Aromatic Hydrocarbons (PAHs), Chlorinated Hydrocarbons, Phenolic Substances, Chloride, Sodium and Glycols as defined in Schedules 4 and 5 of the CSR.

Soils co-contaminated with hydrocarbons as described in this section and metals or other contaminants not suitable for bioremediation meeting industrial land use standards as defined in Schedules 4 and 5 of the CSR may also be accepted for treatment at the biocell.

1.3 Authorized Discharge – Landfill Facility

This section applies to the discharge of refuse from a soil treatment facility and from relocated contaminated soil and associated ash. The site reference number for this discharge is E292889.

1.3.1 The authorized works are a landfill, engineered lined landfill cells, perimeter ditches, erosion and sedimentation control infrastructure, primary and secondary containment detection and inspection sumps and associated cleanout ports, catch basins, groundwater monitoring wells, management works and related appurtenances approximately located as shown on Figure A.

1.3.2 The characteristics of the discharge must be better than:

Hazardous waste, as described in the Schedule 1, 1.1, 3 and 4 (Part 3, table 1 – Leachate Quality Standards) of the Hazardous Waste Regulation (HWR) and must be limited to contaminated soils and associated ash. Hazardous waste (as defined in the *Environmental Management Act* and the HWR), liquids, putrescible and other wastes must not be discharged.

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The Director may specify different standards and other substances in writing for the protection of human health or the environment.

1.3.3 The types of soil that can be discharged at the landfill facility are soils and associated ash contaminated with metals, Dioxins, Furans, BTEX, MTBE, VPHs, LEPHs/HEPHs, PAHs, Styrene, Chlorinated Hydrocarbons, Phenolic Substances, Chloride, Sodium and Glycols as defined in Schedules 4 and 5 of the CSR.

1.4 Ancillary Discharge – Water Treatment System

This section applies to the discharge of effluent from the water treatment system (WTS). The site reference number for the WTS discharge is E292170.

1.4.1 The annual average rate of the WTS discharge is 12.1 cubic metres per day.

1.4.2 The maximum rate of the WTS discharge is 274 cubic metres per day.

1.4.3 The authorized discharge period is continuous.

1.4.4 The characteristics of the discharged treated effluent 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 (AL) protection and Drinking Water (DW) uses for the parameters of concern: Inorganic Substances including metals, VPHw, LEPHw, VHw_{6-10}, $EPHw_{10-19}$, PAHs, BTEX, Styrene, Chlorinated Hydrocarbons, Phenolic Substances, Chloride, Sodium, Glycols, pH and Oil & Grease.

Dioxins and Furans analysis must be conducted at a laboratory and using an analytical method agreed to by the Director and results must be below detection limit at all times.

The source of the discharge must be limited to site stormwater runoff and water from the primary and secondary containment systems authorized under Subsections 1.2.1, 1.3.1 and 1.4.5.

The Director may specify different standards and other substances in

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writing for the protection of human health or the environment.

1.4.5 The authorized works are surface runoff collection and diversion ditches associated with the WTS, WTS (including pH control and flocculent injection system, settling tank, bag and activated carbon filters), leachate and leak detection reservoirs, flow measurement device, monitoring and sampling equipment, reservoirs and related appurtenances approximately located as shown on Figure A.

1.4.6 The authorized works must be complete and in operation while discharging.

1.4.7 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.

1.5 Ancillary Discharge – Settling Pond

This section applies to the discharge of stormwater from the settling pond. The site reference number for the settling pond outlet is E292898.

1.5.1 The rate of the settling pond discharge is 42,500 cubic metres per day for up to 1 in 10 year return period flood event of 24 hour duration.

1.5.2 The authorized discharge period is continuous.

1.5.3 The characteristics of the settling pond discharge effluent (SW-1) must be equivalent to or better than the most stringent of those BCAWQG and 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.

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The Director may specify different standards and other substances in writing for the protection of human health or the environment.

1.5.4 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 approximately located as shown on Figure A.

1.5.5 The authorized works must be complete and in operation while discharging.

1.5.6 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 0.5 metre. The removed solids must be disposed of in a manner approved by the Director.

1.5.7 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.

2. GENERAL REQUIREMENTS

2.1 Soils and Associated Ash Unacceptable for Treatment

The following types of waste must not be accepted for treatment at the site:

1) Hazardous waste as defined in the HWR;
2) Soils contaminated with any substances not included in Subsection 1.2 above with concentrations exceeding relevant standards specified in Schedule 4 and 5 of the CSR;
3) Soils and associated ash that cannot be treated or landfilled successfully in the opinion of the Director; and
4) Liquid waste or soil and associated ash with a water content exceeding those described in the Soil Acceptance Plan.
5) Restricted wastes listed in the Soil Acceptance Plan described in Subsection 2.2 of this permit.

2.2 Screening and Acceptance of Soil

The Permittee must submit a Soil Acceptance Plan prepared by a Qualified

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Professional to the satisfaction of the Director for screening soil and associated ash for all potential contaminants of concern prior to receiving any material at the facility. No changes must be made to the plan without prior approval by the Director. The Director may amend the plan for the protection of human health or the environment.

Those soils suspected to be unacceptable must be either rejected immediately or placed in a holding area (as defined in Subsection 2.3) within the soil management area waiting further re-characterization by a Qualified Professional in accordance with Technical Guidance Document #1 (Site Characterization and Confirmation Testing). If further characterization confirms soils as unacceptable for treatment or landfilling (as defined in Subsections 1.2 and 1.3) the soil must not be mixed with any other soil and must be removed from the facility in accordance with the requirements of the *Environmental Management Act* and of the CSR.

2.3 Holding Area for Soil and Associated Ash Suspected/Determined to be Unacceptable

The Permittee must designate a holding area within the soil management area for short term storage of soil waiting for re-characterization or shipment to an appropriate management site as determined by a Qualified Professional. Short term storage must not exceed 30 days from the day of the delivery or as agreed by the Director. The soil must be kept separate from the soil treatment area and be protected from the weather at all times.

2.4 Bedrock Integrity Inspection and Risk Assessment

A bedrock integrity inspection and risk assessment report must be submitted to the Director prior to the construction of any landfill cells. For any abnormalities (open fractures, presence of water, percolation, etc) identified during the inspection, the Permittee must notify the Director immediately and issue a structural report within 30 days following the inspection. The report must be submitted to the satisfaction of the Director and prepared by a suitably Qualified Professional and must include, but is not limited to:

a) all relevant information collected during the inspection and detailing the abnormality;
b) an explanation and/or interpretation of the abnormality;
c) a risk assessment in regards to the risk to human health and the receiving

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environment; and

d) remedial action planned and/or taken to control the risks.

2.5 Soil Aeration

a) Where the thickness of contaminated soil within the soil treatment facility is greater than 30 cm, the Permittee must periodically conduct mechanical soil aeration. Soil aeration must only be done under the following conditions to prevent nuisance to potential receptors:

   i. Ventilation index for Southern Vancouver Island for the day of soil turning is forecast as "good";
   ii. No sooner than three hours after sunrise and no later than two hours before sunset but within the authorized discharge period defined under Subsection 1.1.2;
   iii. Favorable weather conditions (considering temperature and wind direction, etc.)

b) Prior to every soil aeration event the Permittee must record the ventilation index forecast, time of sunrise and sunset, time and duration of aeration, and ambient temperature. Records must be tabulated along with soil volumes aerated and chemical characteristics in the biocell at the time of aeration.

2.6 Soil Amendment and Prohibition of Blending

Bioremediation must be undertaken without blending/mixing of contaminated soil with cleaner soils for the purpose of dilution to meet the required standards.

Soil amendments which will enhance remediation potential, including bulking materials such as sawdust or straw, may be added prior to or during treatment. Should water be required to enhance soil treatment, contact water generated at the facility must be used in priority.

2.7 Weather Protection

The Permittee must cover the soil treatment piles, soil holding area and active landfill areas completely from November to April when not actively worked on and provide sufficient weather protection and containment for nutrients stored at the site for the protection of human health and the environment.

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The Permittee must cover any soil stored within the holding area at all times.

2.8 Erosion and Sedimentation Control

The Permittee must ensure erosion and sedimentation control measures are implemented with the soil management and treatment area and the landfill area, to limit sediment releases to the settling pond, the water treatment system and to the receiving waters. Storm water runoff must be diverted away from the soil management and treatment area and all active landfill areas at all times. Erosion and sedimentation controls must be developed and implemented according to industry best management practices and consider the Aggregate Operators Best Management Practices Handbook prepared by the Ministry of Energy and Mines.

2.9 Odour Control

There must be no objectionable hydrocarbon odour evident outside the property boundaries. The Permitee must, at a minimum, implement contingency measures if the ambient air quality sampling results exceed the air quality standards defined under Subsection 3.5. The contingency measures must be defined in the EPM as documented in Subsection 2.13 and include, but are not limited to, reduced soil aeration times and the covering of soil piles.

The Director may amend the permit to require the implementation of additional control measures to limit odour generation.

2.10 Dust Control

Fugitive dust created within the operation area must be suppressed. Measured dustfall must not exceed the B.C. Ambient Air Quality Residential Objective of 1.7 mg/(dm^2-day) over a two week averaging period at the property boundary. The contingency measures must be documented in the EPM as defined in Subsection 2.13 and include, but not limited to, reduced activities, covering or application of dust suppressant on soil piles and exposed areas.

The Director may amend the permit to require the implementation of additional control measures on fugitive dust sources.

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2.11 Spill Reporting

All spills to the environment (as defined in the Spill Reporting Regulation) must be reported immediately in accordance with the Spill Reporting Regulation. Notification must be via the Provincial Emergency Program at 1-800-663-3456.

2.12 Maintenance of Works and Emergency Procedures

The Permittee must inspect the authorized works regularly and maintain them in good working order. In the event of an emergency or condition beyond the control of the Permittee which prevents effective operation of the authorized works or leads to unauthorized discharge, the Permittee must comply with all applicable statutory requirements, immediately notify the Director, and take appropriate remedial action for the prevention or mitigation of pollution. The Director may reduce or suspend operations to protect human health or the environment until the authorized works have been restored and/or corrective steps have been taken to prevent unauthorized discharges.

The Permittee must prepare and maintain an Emergency Response Plan (ERP) to the satisfaction of the Director that describes the procedures to be taken to prevent or mitigate any discharge in contravention of the EPM. The ERP must be immediately implemented if there is a discharge, or any risk of a discharge in contravention of the EPM. In addition, an up-dated ERP, including a report on any emergency responses, taken in the previous year, must be kept available, on site for inspection, as defined under Subsection 5.1.

The Permittee must review the ERP at least on an annual basis to determine if any changes are required and submit any revisions to the Director for acceptance.

2.13 Environmental Procedures Manual

An Environmental Procedures Manual (EPM) must be prepared and submitted by the Permittee to the Director. No soil may be received prior to acceptance of the EPM by the Director. The EPM must be kept current and available for use as a guide at all times at the facility. The manual must cover all typical aspects of an Environmental Management Systems (EMS) relevant to the management of the soil treatment, water treatment and landfill facilities including but not limited to, the following items:

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a) Risk identification and prioritization;
b) Administrative and engineering controls;
c) Roles and responsibilities;
d) Training requirements;
e) A Soil Acceptance Plan;
f) A Water Management Plan;
g) An Environmental Monitoring Plan, including on and off site monitoring locations and the sampling procedures for soil, water, groundwater and air quality, as required;
h) An Emergency Response Plan, including contingency measures.
i) Details on the site preparation and the construction of landfill cells;
j) Operation, inspection and maintenance of the soil management and treatment facility, the landfill facility, the water treatment system, erosion and sediment controls measures, the settling pond and associated appurtenances;
k) Internal and external EMS audits, and;
l) Notification, reporting, investigation and corrective and preventive measures.

The Permittee must review the EPM at least on an annual basis to determine if any changes are required and submit any revisions to the Director for acceptance. Annual reviews and submission of revisions are due on March 31 of each year.

2.14 Advisory Committee

The Permittee must establish an Advisory Committee and develop terms of references to the satisfaction of the Director. The Committee must be composed of one representative of each relevant regulatory agency and one representative from the local government. The Committee must meet annually within 3 months of the submission of the annual report as required under Subsection 5.3 and provide advice to the Director within 30 days of the meeting. Based on advice of the Committee, the Director may revise the monitoring, sampling and reporting requirements in Sections 3 and 5.

2.15 Qualified Professionals

All facilities and information, including works, plans, bedrock integrity and risk assessment, assessments, sampling, monitoring, investigations, surveys, programs and reports, must be conducted and certified by Qualified

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Professionals.

"Qualified Professional" means a person who

a) is registered to practice in British Columbia with his or her appropriate professional association, acts under that professional association's code of ethics, and is subject to disciplinary action by that professional association, and;

b) through suitable education, experience, accreditation and knowledge may be reasonably relied on to provide advice within his or her area of expertise as it relates to this permit.

2.16 Bypasses

The discharge of contaminants which have bypassed the authorized treatment works is prohibited unless the prior approval of the Director is obtained and confirmed in writing, except those authorized under Subsection 1.2 of this permit.

Temporary storage or accidental deposit of contaminated soil at areas other than the soil management area is considered a bypass.

2.17 Process Modifications

The Director must be notified in writing prior to implementing changes to any process that may adversely affect the quality and/or quantity of the discharge.

2.18 Plans - New Works

Plans and specifications of the works must be certified by a Qualified Professional registered to practice in the Province of British Columbia, and submitted to the Director. A Qualified Professional must certify that the works have been constructed in accordance with the plans before discharge commences.

2.19 Notification

The Director must be notified of a change in ownership of the works a minimum of 10 days prior to an ownership change.

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2.20 **Amended or Additional Requirements**

Based on the results of the monitoring programs, the Director may:

a) Amend the monitoring and reporting requirements;
b) Amend the requirements of any of the information required by this permit; including plans, program and studies;
c) Require additional investigations, tests, surveys or studies; or
d) Require additional treatment facilities.

3. MONITORING AND SAMPLING REQUIREMENTS

3.1 Incoming Soil and Associated Ash Sampling and Analysis

The Permittee must follow sampling procedures and frequency specified in the approved Soil Acceptance Plan described under Subsection 2.2 to verify soil and associated ash quality. The contaminants must include, but not be limited to, the parameters of concern listed in Subsection 1.3.3, as determined by a Qualified Professional. The Director may require testing of soil and associated ash for additional parameters.

3.2 Treated Soil Sampling and Analysis

The Permittee must sample and characterize each batch of treated soil in accordance with Technical Guidance #1 Site Characterization and Confirmation Testing or an equivalent sampling protocol approved by the Director. Each batch must be considered to be of suspect waste soil quality. Soil must be analysed prior to disposal as authorised in Subsection 1.2 and 1.3 of this permit. The samples must be analysed for the parameters relevant to the type of contamination for which the soil is undergoing treatment as determined by a Qualified Professional. The appropriate parameters must include, but must not be limited to, the parameters of concern listed in Subsection 1.3.3 as determined by a Qualified Professional.

Confirmation of completion of soil treatment must be obtained in writing from a Qualified Professional prior to discharge, for each stockpile of treated soil.

3.3 Groundwater Sampling and Analysis

The Permittee must install and maintain a minimum of seven groundwater

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for Director, *Environmental Management Act*
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sampling facilities (MW-1(S/D), MW-2, MW-3(S/D), MW-4 and MW-5) as shown on Figure B and obtain groundwater samples once each quarter in a manner satisfactory to the Director. MW-4 and MW-5 must be drilled using a non-destructive method and cores must be logged by a Qualified Professional. The design and location of the wells must be to the satisfaction of the Director. Proper care must be taken in sampling, storing and transporting the samples to adequately control temperature and avoid contamination, breakage, etc.

Groundwater samples must be analysed for all potential contaminants of concern. The contaminants may include, but not be limited to, the parameters of concern listed in Subsection 1.3.3, as determined by a Qualified Professional. The groundwater quality must be compared to the standards described in Schedules 6 and 10 of the CSR or any additional standards specified by the Director in writing.

The Permittee may be required to install additional groundwater sampling facilities upon request. The location and structural details of these sampling facilities are subject to the approval of the Director.

3.4 Surface Water Sampling and Analysis

The Permittee must sample the water treatment system effluent (WTS) and the settling pond discharge point (SW-1) monthly and every 2000 m^3 for the water treatment system discharge effluent in a manner suitable to the Director. Proper care must be taken in sampling, storing and transporting the samples to adequately control temperature and avoid contamination, breakage, etc.

Turbidity of the settling pond discharge effluent (SW-1) must be monitored bi-weekly between November to April and after every event greater than 1 in 10 year return period flood event of 24 hour duration.

Surface water samples must be analysed for all potential contaminants of concern. The contaminants may include, but not be limited to, the parameters of concern listed in Subsection 1.3.3, as determined by a Qualified Professional. The surface water quality results must be compared to the standards set out in Subsection 1.4.4 and 1.4.5.

3.5 Air Quality Monitoring

The Permittee must collect monthly ambient air samples during the active

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season (i.e. between April and November, inclusive) at the down-wind property line using a Summa® Canister. Ambient air samples must also be collected using a Summa® Canister if and when soils with measurable volatile contaminant concentrations exceeding the established thresholds are being managed or treated at the soil treatment facility at the location and as documented in the EPM.

The ambient air sample must be analysed for the all potential contaminants of concern, as determined by a Qualified Professional, and results must be compared to the CSR Schedule 11 RL standards. In the event that results exceed the standards, the Permittee must follow the requirements stated under Subsection 2.9.

3.6 Receiving Environment Sampling

The Permittee must implement a receiving environment monitoring program for the receiving groundwater and surface water summarized in the table below and as defined under the EPM:

Receiving Waters	Monitoring Locations		Frequency
Groundwater	Up Gradient	(MW-4) Southeast corner of the site	Quarterly
	Down Gradient	(MW-1(S/D)) On site	
		(MW-2) Property boundary	
		(MW-3(S/D)) Property boundary	
		(MW-5) North of the site	
Surface Water	Up Gradient	(SW-4) Shawnigan Creek	5 in 30** (2 times/year, conducted during fall first flush event and in the spring freshet)
		(SW-2) Ephemeral Creek 1	
	Down Gradient	(SW-5) Shawnigan Creek	
		(SW-3) Ephemeral Creek 2	

* 5 in 30 refers to at least 5 weekly samples taken in a period of 30 days. Due to the ephemeral nature of some of the creeks, the first 5 in 30 sample should be collected when the ground has first been saturated.

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Flow measurements must be collected from all surface water monitoring locations at the time of sampling.
Based on the results from the receiving environment monitoring program, the monitoring requirements may be extended or altered by the Director.

3.7 Sampling Procedures

Sampling is to be carried out in accordance with the procedures described in the "British Columbia Field Sampling Manual for Continuous Monitoring and the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment, and Biological Samples, 2003 Edition (Permittee)", or most recent edition, or by suitable alternative procedures as authorized by the Director.

A copy of the above manual is available on the Ministry web page at www.env.gov.bc.ca/epd/wamr/labsys/lab_meth_manual.html

3.8 Analytical Procedures

Analyses are to be carried out in accordance with procedures described in the "British Columbia Laboratory Manual (2009 Permittee Edition)", or the most recent edition, or by suitable alternative procedures as authorized by the Director.

A copy of the above manual is available on the Ministry web page at www.env.gov.bc.ca/epd/wamr/labsys/lab_meth_manual.html

3.9 Quality Assurance

a) The Permittee must obtain from the analytical laboratory (ies) their precision, accuracy and blank data for each sample set submitted as well as an evaluation of the data acceptability, based on the criteria set by the laboratory.

b) A duplicate sample must be prepared and submitted for analysis for each parameter sampled for each monitoring period.

c) The analytical laboratory (ies) must be registered in accordance with the Canadian Association of Laboratory Accreditation (CALA) unless otherwise instructed by the Director.

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4. SECURITY REQUIREMENTS

4.1 Closure Plan

The Permittee must submit a closure plan to the satisfaction of the Director in 6 months after the issuance of this permit. Based on monitoring results or changes in the operation, the Director may require amendment of the plan for environmental protection.

The closure plan must include, but may not be limited to investigations of soil, sediments, surface water and groundwater quality and treatment, identification and assessment of any residual contamination. If any residual contamination is identified, the Permittee will be required to remediate the site to meet the applicable soil, surface water and groundwater standards and objectives, as determined by the Director.

The closure plan must be reviewed at least every five (5) years to inform the security adjustment defined in Subsection 4.2.

4.2 Posting of Security and Costs

The Permittee must submit a cost estimate for maintenance, monitoring, remediation and closure of the landfill for the active life of the site and a minimum twenty-five year post-closure period based on the current updated Closure Plan referred to in Subsection 4.1. The cost estimate must be prepared or reviewed by a suitably qualified, independent third party. The cost estimate is subject to the Director's approval.

An updated cost estimate must be reassessed and submitted to the Director for approval at least once every five (5) years and the security adjusted accordingly. The Director has the discretion to require reassessment on a more frequent basis.

The Permittee must provide and maintain security in a form and amount specified by the Director. At the discretion of the Director security may be applied, to any of the following:

- To correct any inadequacy of the works relating to their construction,

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operation and maintenance;

- To correct any non-compliance with this permit or the *Environmental Management Act*; and remediation.

Any money spent from the posted security must be replenished within sixty (60) days or as otherwise specified by the Director.

The operation of the facility without valid security is not authorized.

The Permittee may request the return of security where the title of the works has been transferred to a municipal authority or where the posted amount exceeds the estimated closure and post-closure costs, including remediation. Granting the request is at the discretion of the Director.

5. REPORTING REQUIREMENTS

5.1 Records

Maintain for inspection by Environmental Protection Division staff, a record of the following logs, suitably tabulated:

1) Landfill cells construction QA/QC results;
2) Maintenance records of pollution control equipments listed as authorized works;
3) Facility inspection log with a record of observations of the soil management and treatment and landfill areas (including but not limited to bedrock integrity, liner, cover, stormwater and effluent collection and treatment works inspections), and preventative and corrective actions identified and implemented;
4) Current soil and associated ash inventory, including volumes and characteristics of soils and associated ash in the soil management and treatment area and landfill area;
5) Tracking ID number linked to soil and associated ash analysis results and the signature of a Qualified Professional who certifies completion of remediation in accordance with the requirements of the CSR and compliance with this permit;
6) Location of each batch of soil and associated ash in the soil management and treatment and landfill area on a map;
7) Analyses of screening of incoming soils and associated ash, and

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associated QA/QC results, as described in Subsection 2.1 and 2.2 of this permit;
8) Soil treatment activities including turning records and quantities of nutrients, bacteria seed or amendments added by date;
9) Weather conditions during turning events as described in Subsection 2.5 of this permit;
10) Results of the vapour and dust monitoring activities as required;
11) Analyses of treated soil, and associated QA/QC results, as described in Subsection 1.2 of this permit;
12) Quarterly volumes of soil stored in the holding area, awaiting final disposal as described in Subsection 2.3 of this permit;
13) A summary of Emergency Response Plan exercises, and incidents, including effluent/soil spills, requiring the Emergency Response Plan implementation.

The above records of analyses for the re-characterization or characterization of incoming soil or treated soil, respectively, must include batch sizes, number of samples collected and analysed per volume.

Records must be kept on site or at another location acceptable to the Director for at least three years and made available upon request.

5.2 **Environmental Quarterly Reports**

The Permittee must submit environmental quarterly reports prepared by a Qualified Professional with all monitoring data and associated QA/QC results, interpretations, conclusions and recommendations in a format acceptable to the Director and post the results online and provide a hard copy to the Director no later than 30 days after the end of each quarter.

5.3 **Environmental Annual Reports**

The Permittee must submit an environmental annual report prepared by a Qualified Professional with monitoring data and associated QA/QC results, interpretations, conclusions and recommendations in a format acceptable to the Director no later than March 31 of each year.

The environmental annual report must include, but is not limited to, the following:

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1) An executive summary;
2) Quality and quantity (in tonnes and m^3) of soil and associated ash received for treatment, direct landfilling and as direct landfill cover;
3) Quality and quantity (in tonnes and m^3) of soil and associated ash that could not be treated in the soil treatment facility and soil and associated ash rejected and diverted to other facilities for treatment and/or disposal;
4) Updated maps showing the active landfill area, the areas reclaimed and the location of each landfill cells (completed and in progress);
5) Landfill operational plan and remaining landfill life and capacity;
6) Review of the preceding year of operation, plans for the next year and a summary of any new information or changes to the facilities and plans, assessments, programs and reports;
7) Review of any non-compliances with the conditions of this permit, including an action plan and schedule to achieve compliance (as per Subsection 6.1); and
8) Results from the Environmental Monitoring Plan with interpretations, conclusions and recommendations.

The Permittee must post the environmental annual report online and provide a hard copy to the local library by March 31 of each year. The Permittee may omit proprietary information from the publically available environmental annual report in accordance with the Freedom of Information and Protection of Privacy Act, as agreed to by the Director.

6. NON-COMPLIANCE REPORTING

6.1 Non-compliance Reporting

For any non-compliance with the requirements of this permit, the Permittee must submit to the Director, Environmental Protection, a written report within 30 days of the non-compliance occurrence. The report must include, but is not necessarily limited to, the following:

a) all relevant test results related to the non-compliance;
b) an explanation of the most probable cause(s) of the non-compliance; and
c) remedial action planned and/or taken to prevent similar non-compliance(s) in the future.

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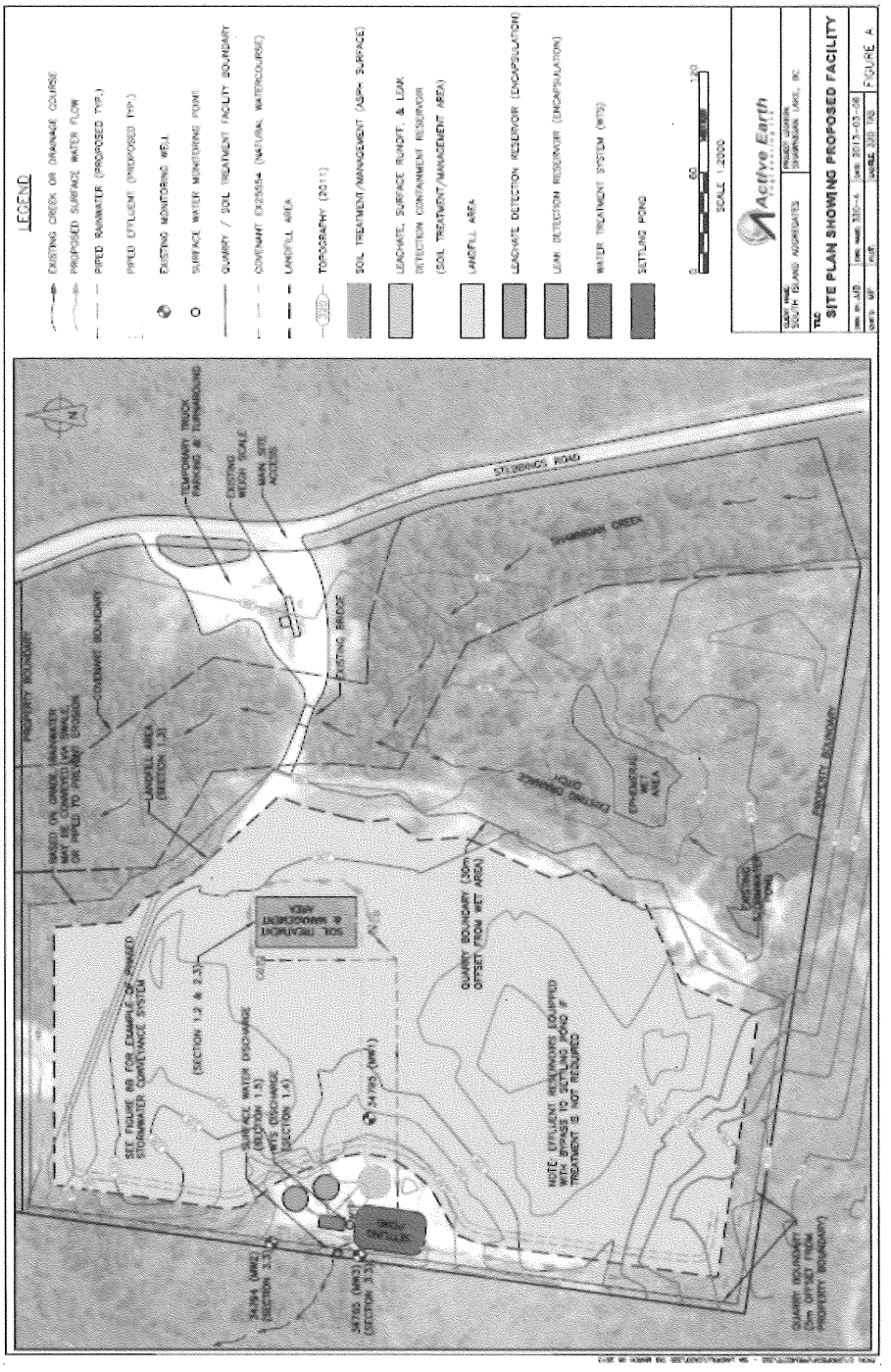
Figure A – Site Plan



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for Director, *Environmental Management Act*
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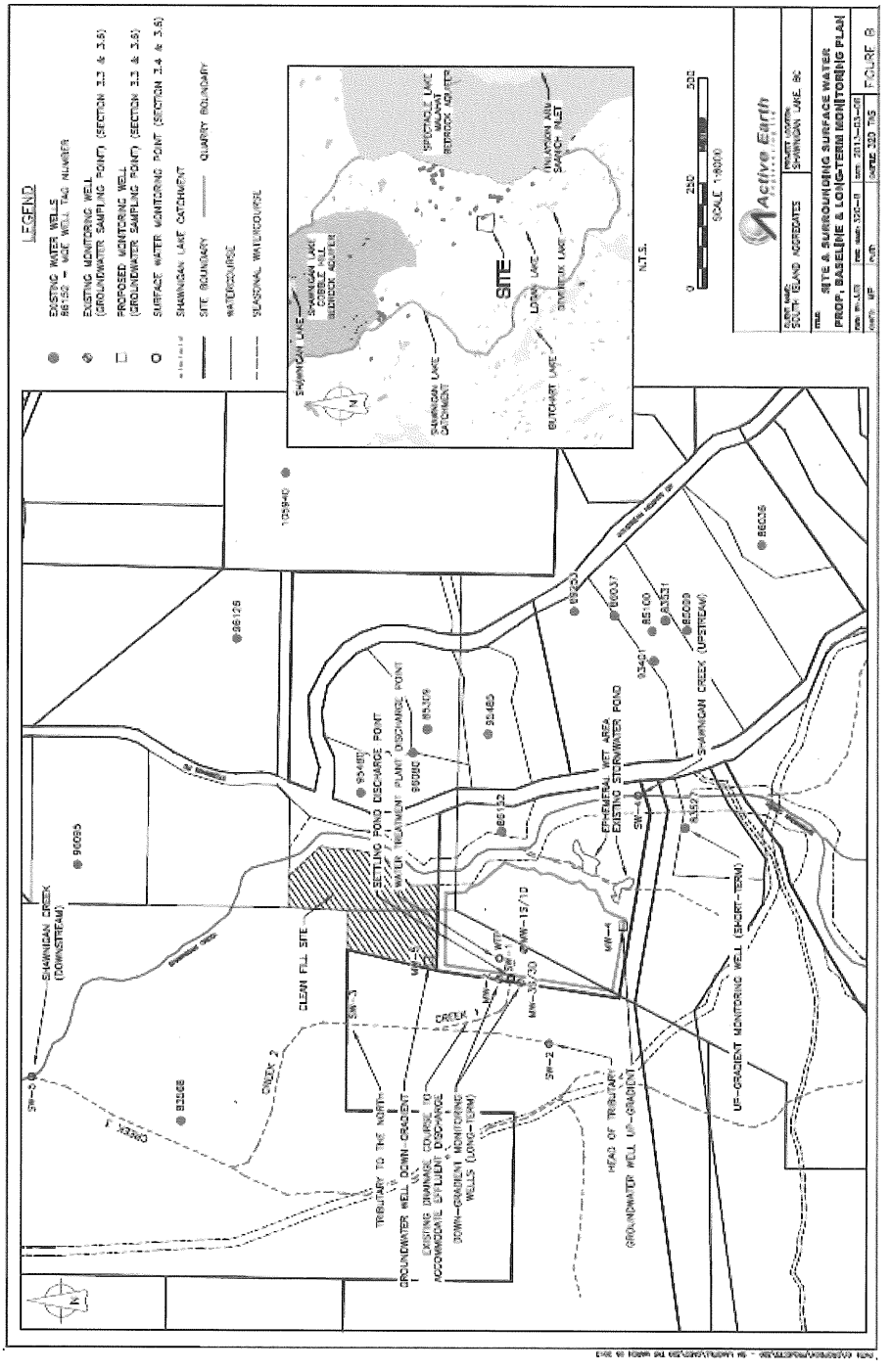
Permit Number: 105809

Figure B – Monitoring Sites



Date issued: August 21, 2013

Hubert Bunce
for Director, *Environmental Management Act*
West Coast Region

Permit Number: 105809

June 4, 2015

Tracking Number: 338485
Authorization Number: 105809

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

Dear Cobble Hill Holdings Ltd. (BC0754588),

Re: Environmental Appeal Board Directions - Amendments to the Permit under the *Environmental Management Act*

On March 20, 2015, the Environmental Appeal Board confirmed the permit subject to directions. A copy of the decision, including directions, is available at the Environmental Appeal Board's website http://www.eab.gov.bc.ca/index.htm.

Pursuant to the *Environmental Management Act*, Permit 105809 is hereby amended:

1. To amend the subject sentence of section **2.14 Advisory Committee** from:

> The Committee must be composed of one representative of each relevant regulatory agency and one representative from the local government.

to:

> The Committee must be composed of one representative of each relevant regulatory agency, one representative from the local government, one representative from the Shawnigan Residents Association and/or other interested community members as chosen by the Director.

2. To add section:

2.4.1 Reuse of Landfill Cell Liners Prohibited

> Reuse of geomembrane landfill cell liners is prohibited. This prohibition must be included in the Environmental Procedures Manual.

Environmental Protection Division Ministry of Environment
2080A Labieux Rd
Nanaimo BC V9T 6J9
Authorizations - South
Telephone: (250) 751 3100
Facsimile: (250) 751 3103

3. **Effective March 20, 2016,** to amend section **2.7 Weather Protection** from:

2.7 Weather Protection

The Permittee must cover the soil treatment piles, soil holding area and active landfill areas completely from November to April when not actively worked on and provide sufficient weather protection and containment for nutrients stored at the site for the protection of human health and the environment. The Permittee must cover any soil stored within the holding area at all times.

to:

2.7 Weather Protection

A permanent roof must be placed over, cover, and prevent precipitation from entering the soil management and bio-remediation treatment area including the temporary soil holding area (as described under subsection 2.3), referred to in subsection 1.2.1.

The Permittee must cover the active landfill areas completely from November to April when not actively worked on and provide sufficient weather protection and containment for nutrients stored at the site for the protection of human health and the environment.

4. To add section:

2.7.1 Wheel Rinsing

Before soil transport vehicles leave the site, their wheels must be rinsed to remove all soil and waste. Soil and waste must be managed in accordance with the permit. Rinse water must be directed to the leachate and leak detection reservoir(s). These requirements must be included in the Environmental Procedures Manual.

5. To add to section **3.6 Receiving Environment Sampling**, Table, Row 3 Surface Water, Column 3 Frequency:

Immediately after a 1-in-200 year, 24-hour storm event, at Monitoring Locations (SW-2) Ephemeral Creek 1 and (SW-3) Ephemeral Creek 2.

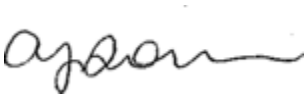
Please note that although a revised permit has not been produced at this time, a copy of this letter is being placed on the permit file, as an addendum to the permit. Your attention is respectfully directed to the conditions of the permit. An annual fee for the permit will be determined in accordance with the Permit Fees Regulation.

This permit does not authorize entry upon, crossing over, or use for any purpose of private or Crown lands or works, unless and except as authorized by the owner of such lands or works. The responsibility for obtaining such authority rests with the permittee. This permit is issued pursuant to the provisions of the *Environmental Management Act* to ensure compliance with Section 120(3) of that statute, which makes it an offence to discharge waste, from a prescribed industry or activity, without proper authorization. It is also the responsibility of the permittee to ensure that all activities conducted under this authorization are carried out with regard to the rights of third parties, and comply with other applicable legislation that may be in force.

This decision may be appealed to the Environmental Appeal Board in accordance with Part 8 of the *Environmental Management Act*. An appeal must be delivered within 30 days from the date that notice of this decision is given. For further information, please contact the Environmental Appeal Board at (250) 387-3464.

Administration of this permit will be carried out by staff from the regional office. Plans, data and reports pertinent to the permit are to be submitted to the Regional Director, at Ministry of Environment, Environmental Protection Division, Authorizations - South, 2080A Labieux Rd, Nanaimo BC V9T 6J9.

Yours truly,



A.J. Downie, M.Sc., P.Ag.
for Director, Environmental Management Act

CC: Environment Canada
Ministry of Energy and Mines

ENCL: None

PROVINCE OF BRITISH COLUMBIA
MINISTRY OF ENERGY, MINES AND PETROLEUM RESOURCES

QUARRY PERMIT
Amendment: April 20 2009

APPROVING WORK SYSTEM AND RECLAMATION PROGRAM
(Issued pursuant to Section 10 of the **Mines Act** R.S.B.C. 1996, C.293)

Permit: **Q-8-094** Mine No.: **1610355**

Issued to: **South Island Aggregates Ltd**
497 A Garbally Road
Victoria BC V8T 2J9

For work located at the following property: **South Island Aggregates Quarry**

Lot 23, Blocks 156, 201 and 323, Malahat District, Plan VIP78459

This approval and permit is subject to the appended conditions.

Issued this 4th day October in the year 2006
Amended this 20th day of April, in the year 2009
Amended this 17th day of July in the year 2015

Al. Hoffman. P. Eng
Chief Inspector

INTRODUCTION

This amendment issued July 17, 2015, replaces all previous permits and subsequent amendments. It incorporates conditions established through previous amendments and, as a result of the meeting with the Chief Inspector of Mines following discussions related to hours of work. In addition, it includes conditions established by the Senior Inspector of Mines to address concerns associated with the operation of this quarry.

This amendment issued July 17, 2015 includes the change of end land use and includes the conditions necessary to construct and operated the Waste Cells in accordance with, and in addition to, the Ministry of Environment Permit "PR-105809". This amendment includes conditions as required by the ruling of the Environmental Appeal Board Decision Nos. 2013-EMA-15(b) and 2013-EMA-019(c)

PREAMBLE

Notice of intention to commence work on a quarry, including a plan of the proposed work system and a program for the protection and reclamation of the surface of the land and watercourses affected by the work dated August 23, 2006, was filed with the Inspector on August 23, 2006. Notice of such filing was published in The Pictorial on September 3, 2006, and in the BC Gazette on September 7, 2006.

This permit contains the requirements of the Ministry of Energy and Mines for reclamation. It is also compatible, to the extent possible, with the requirements of other provincial ministries for reclamation issues. The amount of security required by this permit, and the manner in which this security may be applied, will also reflect the requirements of those ministries. Nothing in this permit, however, limits the authority of other provincial ministries to set other conditions, or to act independently, under their respective permits and legislation.

This amendment references and includes terms of the following Reports:

1. Active Earth Engineering (AEEL) "Technical Assessment for Authorization to Discharge Waste", August 2012.
2. Active Earth Engineering, "Geotechnical Assessment", October 24, 2013.
3. Levelton Consultants Ltd "South Island Aggregates Stebbings Road Quarry", October 2012.
4. BC Geological Survey "Bedrock Geology of the South Island Aggregates Stebbings Road Quarry" October 28, 2013.
5. Active Earth Engineering, "Summary of Core Drilling and Testing Results", October 2013.

6. Active Earth Engineering “Environmental Procedures Manual for Waste Discharge Permit PR-105809", October 28, 2013.
7. Leveloton Consultants Ltd follow-up memo “South Island Aggregates Containment Area-640 Stebbings Road, Shawnigan Lake, BC”, November 13, 2013.

Unless modified by Permit Q-8-094, or the Ministry of Environment Permit PR-105809, all terms of the referenced report form a part of this permit. Should there be a conflict between this permit and the Ministry of Environment (MOE) permit related to requirements under the terms of the MOE permit related to environmental protection, the terms of the MOE permit shall take precedence.

Decisions made by staff of the Ministry of Energy and Mines will be made in consultation with other ministries.

CONDITIONS

The Chief Inspector of Mines (Chief Inspector) hereby approves the work plan and the program for protection and reclamation of the land surface and watercourses subject to compliance with the following conditions: Unless modified by this amended permit all conditions within the original Notice of Work, dated August 23, 2006, and the subsequent amendment form an integral part of this permit.

1. Reclamation Security

(a) The owner, agent or manager (herein called the Permittee) shall maintain with the Minister of Finance securities in the amount of five thousand dollars ($55,000). The security will be held by the Minister of Finance for the proper performance of the approved program and all the conditions of this permit in a manner satisfactory to the Chief Inspector.

(b) The Permittee shall conform to all forest tenure requirements of the Ministry of Forests. Should the Permittee not conform to these requirements then all or part of the security may be used to cover the costs of these requirements.

(c) The Permittee shall conform to all Ministry of Environment approval, licence and permit conditions, as well as requirements under the **Wildlife Act**. Should the Permittee not conform to these conditions, then all or part of the security may be used to fulfill these requirements.

2. Land Use

The surface of the land and watercourses shall be reclaimed to the following land use: **Industrial Encapsulated Contaminated Soil containment cells**

3. Productivity

The level of land productivity to be achieved on reclaimed areas shall not be less than existed prior to mining on an average property basis unless the Permittee can provide evidence which demonstrates, to the satisfaction of the Chief Inspector, the impracticality of doing so.

4. Revegetation

Land shall be re-vegetated to a self-sustaining state using appropriate plant species.

5. Use of Suitable Growth Medium

(a) On all lands to be revegetated, the growth medium shall satisfy land use, productivity, and water quality objectives. Topsoil and overburden (to rooting depth) shall be removed from operational areas prior to any disturbance of the land and stockpiled separately on the property for use in reclamation programs, unless the Permittee can provide evidence which demonstrates, to the satisfaction of the Chief Inspector, that reclamation objectives can otherwise be achieved.

(b) No topsoil shall be removed from the property without the specific written permission of the Inspector.

6. Buffer Zones and Berms

Buffer zones and/or berms shall be established between the mine and the property boundary unless exempted in writing by the Inspector.

7. Treatment of Structures and Equipment

Prior to abandonment, and unless the Chief Inspector has made a ruling otherwise, such as heritage project consideration or industrial use:

(a) all machinery, equipment and building superstructures shall be removed;

(b) concrete foundations shall be covered and revegetated unless, because of demonstrated impracticality, they have been exempted by the Inspector; and,

(c) all scrap material shall be disposed of in a manner acceptable to the Inspector.

8. Watercourses

(a) Watercourses shall be reclaimed to a condition that ensures:

(1) long-term water quality is maintained to a standard acceptable to the Chief Inspector;

(2) drainage is restored either to original watercourses or to new watercourses which will sustain themselves without maintenance: and,

(3) use and productivity objectives are achieved and the level of productivity shall not be less than existed prior to mining unless the Permittee can provide evidence which demonstrates to the satisfaction of the Chief Inspector the impracticality of doing so.

(b) Water which flows from disturbed areas shall be collected and diverted into settling ponds.

9. Roads

(a) All roads shall be reclaimed in accordance with land use objectives unless permanent access is required to be maintained.

(b) Individual roads will be exempted from the requirement for total reclamation under condition 9(a) if either:

(1) the Permittee can demonstrate that an agency of the Crown has explicitly accepted responsibility for the operation, maintenance and ultimate deactivation and abandonment of the road, or

(2) the Permittee can demonstrate that another private party has explicitly agreed to accept responsibility for the operation, maintenance and ultimate deactivation and abandonment of the road and has, in this regard, agreed to comply with all the terms and conditions, including bonding provisions, of this reclamation permit, and to comply with all other relevant provincial government (and federal government) regulatory requirements.

10. Disposal of Fuels and Toxic Chemicals

Fuels, chemicals or reagents which cannot be returned to the manufacturer/supplier are to be disposed of as directed by the Chief Inspector in compliance with municipal, regional, provincial and federal statutes.

11. Temporary Shutdown

If this quarry ceases operation for a period longer than one year the Permittee shall either continue to carry out the conditions of the permit or apply for an amendment setting out a revised program for approval by the Chief Inspector.

12. Safety Provisions

All safety and other provisions of the ***Mines Act*** shall be complied with to the satisfaction of the Chief Inspector.

13. Monitoring

The Permittee shall undertake monitoring programs, as required by the Inspector, to demonstrate that reclamation objectives are being achieved.

14. Alterations to the Program

Substantial changes to the program must be submitted to the Inspector for approval.

15. Notice of Closure

Pursuant to Part 10.6.1 of the Health, Safety and Reclamation Code for Mines in British Columbia, a Notice of Completion of Work shall be filed with the Inspector not less than seven days prior to cessation of work.

16. Annual Report

Annual reports shall be submitted in a form and containing the information as and if required by the Inspector.

17. Site Stability

a) The inspector shall be advised in writing at the earliest opportunity of any unforeseen conditions that could adversely affect the extraction of materials, site stability, erosion control or the reclamation of the site.

b) The stability of the slopes shall be maintained at all times and erosion shall be controlled at all times.

c) The discovery of any significant subsurface flows of water, seeps, substantial amounts of fine textured, soils, silts and clays, as well as significant adverse geological conditions shall be reported to the inspector as soon as possible and work shall cease until the inspector advises otherwise.

SITE SPECIFIC CONDITIONS:

1. The importation of soil is permitted subject to the following conditions:

a) Soil imported must meet Ministry of Environment Soil Guidelines for the intended end land use, as identified in the Ministry of Environment Permit PR-105809.

b) Importation of material other than defined in 18(a) is prohibited unless approved by the Inspector.

c) The approval as required in 18(b) shall be processed as an amendment to this permit.

d) Documentation identifying the soil condition and suitability for the intended end land use must be maintained at the mine site office and made available to the Inspector on demand.

2. Property boundaries shall be permanently marked and maintained, and pit boundaries (mine footprint) shall be permanently marked and maintained. All

persons working on the property will be instructed as to the meaning of the markings; and,

a) The Permittee shall install a substantial fence along the property boundary.

b) This fence can be installed in stages with completion by September 1, 2016.

c) The portion of the property abutting the lands owned by the Cowichan Valley Regional District (CVRD) shall be fenced by September 2015. This includes lands abutting the restrictive covenant along Shawinigan Creek.

3. An 8-metre wide vegetation buffer shall be maintained on the northeast property boundary. The exiting trees shall not be removed.

4. All blasts shall be electronically monitored.

5. Blast limits are established at 50 millimeters per second peak particle velocity and 120 decibels on the L scale, at the property boundary, and:

a) The electronic monitor unit shall be located such that the air pressure (microphone) sensor has a clear unobstructed line of sight to the centre of the blast. The Inspector may allow or require monitoring at specific locations on a case by case basis as may be required.

b) The Manager shall maintain at the Mine Site Office, a signed copy of the Blast Log for each blast and a copy of the Electronic Monitor Record. Such records shall be made available to the Inspector on request.

c) Residents within 1km of the centre of the Quarry, and the Inspector, shall be given 24 hours notice of each scheduled blast. This 24 hours notice will establish a window of 1.5 hours within which the blast can be fired.

i. If, due to circumstances beyond the control of the Manager, a blast has been loaded and cannot be detonated within the time frame as described above, the Manager shall secure the site, post a watchman, and fire the blast the next day following the issuing of the required 24 hours notice. The Inspector may, at his discretion, allow the blast to be fired outside of the 24 hour notice window or, outside

of normal hours of work. In such cases the Inspector shall establish the conditions necessary for firing the blast.

6. For purposes of establishing the 1 km radius, the centre of the quarry is defined as: **W 48* 33.103, N 123* 36.390**

Standard Quarry Blasting Conditions:

7. To the extent practical, all blasts initiated on the quarry shall be videoed, and:

   a) A copy of the video shall be kept at the mine office, and made available to the Inspector on request.

   b) The video file shall include the following identification information as a word document;

      1. the pit name, and mine number
      2. the bench/location identification, including a map showing the location on the mine footprint.
      3. the name of the blaster
      4. the date of the blast
      5. the time of the blast

   c) Other information and records as may be required as conditions of the permit, or directives of the Inspector.

   d) The video shall clearly show the conduct of the blast in sequence of events including.

   e) The free faces prior to the blast, with emphasis placed on the face profile and the rock structure.

   f) The layout of the blast pattern including the tie ins.

   g) The overall site layout of the area within the “danger zone.”

8. Within 1 month of the date of this amendment to Permit Q-8-094, the Manager shall file with the Inspector an approved plan for ensuring compliance with Part 8, sections 8.7.1 to 8.7.4 of the Health Safety and Reclamation Code for Mines in British Columbia.

9. Hours of work shall be between 7am and 5pm Monday to Friday. No work, except as defined below, shall occur on weekends or Statutory Holidays:

   a) Light maintenance is permitted on Saturdays between 9am and 4pm. *Light Maintenance is defined as:* work requiring the only the use of hand

tools. It does not include air impact tools, air arcing, or any heavy equipment to perform a task.

b) Drilling operations shall be limited to the hours of 8am to 4pm Monday to Friday.

c) Notwithstanding the above, nothing in this condition prevents the Manger from working outside the permitted hours of work should:

i) a safety concern on site is such that a failure to complete necessary work can result in harm or risk to workers, members of the public, or the environment or,

ii) an agency having jurisdiction declares an emergency and product from this operation is required to mitigate or assist in the mitigation of the emergency.

d) Should the provisions of condition 23(c) be implemented the Manager shall advise the Inspector without delay.

e) A sign shall be posted at the entrance to the Quarry clearly indicating the permitted hours of work.

10. The Manager shall forward to the Inspector a copy of the updated mine plan required by the code. This code section refers to updates every three months.

11. The Manager shall schedule truck traffic entering or leaving the Quarry such that the trucks do not conflict with elementary school bus pick-up or drop off times.

12. **Occupational Health and Safety Committee:**

a) The Manager shall establish and maintain an Occupation Health and Safety Committee (HSRC) in accordance with the Health, Safety, and Reclamation Code for Mines in British Columbia 1.6.1(b).

b) HSRC 1.6.8 which requires Occupational Health and Safety Committee members to receive training shall apply to this site.

13. Within six months of the date of issue of this amendment, the Manager shall ensure one supervisor, as defined in the HSRC, is the holder of an Open Pit Shiftboss Certificate.

Permit Conditions related to the Construction, operation, and Maintenance of the Waste Cells as referenced in this Permit.

14. Blasting:

    a) No blasts shall be initiated during the installation of the liner, (geo- tech liner) including the upper liner as required by the approved plan.

    b) Installation includes the completion of any soil cover to a compactness of 0.66 meters thick.

15. Blasting of final walls in the quarry and for the waste cells:

    a) All final walls within the quarry shall be blasted using controlled blasting techniques, commonly referred to as “smooth blasting”.

    b) Following the blast all walls shall be scaled as may be required.

    c) Any row of holes to be blasted within 10 meters of the common boundary between the Quarry and property owned by the CVRD shall be surveyed in by a Licensed Land Surveyor. A copy of the survey shall be forwarded to the Inspector within one week of the blast.

16. Clay placed above the bedrock shall be placed in 250mm lifts, and compacted to 90% standard proctor until the Clay is 1meter compacted thickness.

17. At the completion of each 1 meter (compacted) lift the Manager shall provide the Inspector an as built of the lift signed by a suitable registered professional, registered in the Province of British Columbia.

    a) For soil imported into the cell, not including clay or sand, the Engineer of record shall identify soils where 95 Proctor could not be obtained, and shall identify the type of soil, the maximum compactness the soil can sustain, and the maximum moisture content to attain the compaction.

    b) For purposed of clarity, the engineer of record is not required to provide the above information on soil for every square foot of surface area but can provide the report in accordance with good engineering practice and standards.

18. All surface water shall be drained and controlled such that surface water does not have free access to the waste cell.

    a) Following rainfall, snow melt, or inadvertent flow of water into the waste cell, the Permittee shall take such measures as may be necessary to drain any accumulations of surface water from the cell.

    b) This may require suitable time frames to allow the drying of the soil to the point that the engineer of record is satisfied the moisture content does not compromise the achievement and maintenance of the required compaction as defined in this permit.

19. **Geotechnical**

    1. Design and Construction

        a) The construction of the waste storage facility, as described in the application, is approved.

        b) The sediment control pond shall be designed with a minimum 1 metre freeboard during the 200-year flood event.

        c) The Permittee shall ensure the facility is constructed under the supervision of a qualified professional engineer.

        d) Rock cuts and slope design shall be reviewed by a professional geotechnical engineer following blasting and excavation. The requirement for scaling and/or stabilization measures shall be evaluated to ensure the safety of workers working below these slopes.

        e) The facility shall be constructed in accordance with the design and construction specifications outlined in the application and approved by the Engineer of Record. The Engineer of Record shall review the construction drawings and specifications to verify that recommendations are properly incorporated as per design. Any changes to the proposed method of development will require previous approval of the Inspector.

        f) During construction, appropriate Quality Assurance/Quality Control (QAQC) shall be carried out. Within 30 days of completing construction, a construction QAQC report shall be submitted to the Inspector. This report shall include a summary of the liner installation, materials testing and

compaction information and the QAQC measures employed during construction.

g) The Permittee shall submit an as-built report with drawings to the Inspector prior to operation of the facility. As-built reports shall be sealed by a professional engineer and shall include a statement indicating that the facility was constructed in "general conformance with the design and specifications." A complete set of As-built drawings shall be kept at the mine site at all times and be provided to any Mines Inspector upon request.

2. Operation and Monitoring

a) Prior to operation of the facility, the Permittee shall submit an updated Operation, Maintenance, and Surveillance (OMS) manual and a Mine Emergency Response Plan (MERP) to the Inspector that outlines procedures for the successful operation, maintenance, and surveillance of the facility and emergency preparedness and response procedures. These documents shall be kept current and updated over time as procedures are modified.

b) All waste materials entering the facility shall meet the specifications as specified by the geotechnical engineer in the stability analyses and design of the facility. No waste materials that are subject to liquefaction (regardless of triggering mechanism) shall be disposed in the facility. Materials not meeting design specifications or operational requirements must be spoiled off-site at an alternate approved location.

c) Instrumentation shall be installed as recommended by the professional geotechnical engineer to monitor conditions related to the stability of the facility. Monitoring frequency, thresholds, and response procedures shall be determined by the geotechnical engineer and be clearly described in the OMS manual.

d) During operations, appropriate Quality Assurance/Quality Control (QA/QC) shall be carried out on the waste materials to ensure material properties meet geotechnical design and compaction requirements. Results of this testing shall be provided to the Inspector upon request. An up-to-date copy of QA/QC procedures, testing results, and inspection logs shall be maintained at site and made available for any Inspector upon request.

3. Reporting

a) Annual inspections of the waste storage facility shall be undertaken by a qualified Professional Geotechnical Engineer with a report submitted to the Inspector by March 31 of the year following the inspection. The report shall include a summary of observations, review of monitoring data including instrumentation, QA/QC procedures, testing results, and recommendations with respect to any necessary changes to operating procedures. Any recommendations relating to health and safety or geotechnical stability shall be followed unless a suitable alternative course of action is approved in writing by the professional undertaking the review, or by a third party qualified Professional Engineer, as may be determined by the Inspector.

20. **Completion of the cell:**

a) The final cover of each cell shall consist of two meters of till or residential classification soil, compacted to the degree necessary to prevent/limit erosion and sustain growth of appropriate vegetation.

b) The permitted shall prior to applying any vegetation cover to the completed cell provide the inspector a plan designed by an appropriate Qualified Person which demonstrates the vegetation cover is suitable for the area, and as cover for the waste cell.

c) Filling of the cells shall be conducted on a one cell at a time basis. Filling of the next cell can only commence upon completion of the cell the previous cell.

d) The previous condition does not prevent the Permittee form doing cell preparation, up to the point of being ready to receive fill material.

e) Prior to receiving fill in any cell the Permittee must provide a signed as built of the construction of the cell to date. This as built, signed by the engineer of record shall state that this construction meets the standards required by this permit and Ministry of Environment Permit PR-105809.

f) Each completed cell shall remain in and be subject ongoing monitoring under the terms of this permit for the life of the mine.

g) Once completed a cell shall not be disturbed unless work is necessary for maintenance or repair, and then only with the written approval of the Inspector.

h) The Manager shall, by March 31 of each year, provide the Inspector a report identifying the volume of water treated through the treatment plant, and shall include all operating costs associated with the operation and maintenance of the treatment plant.

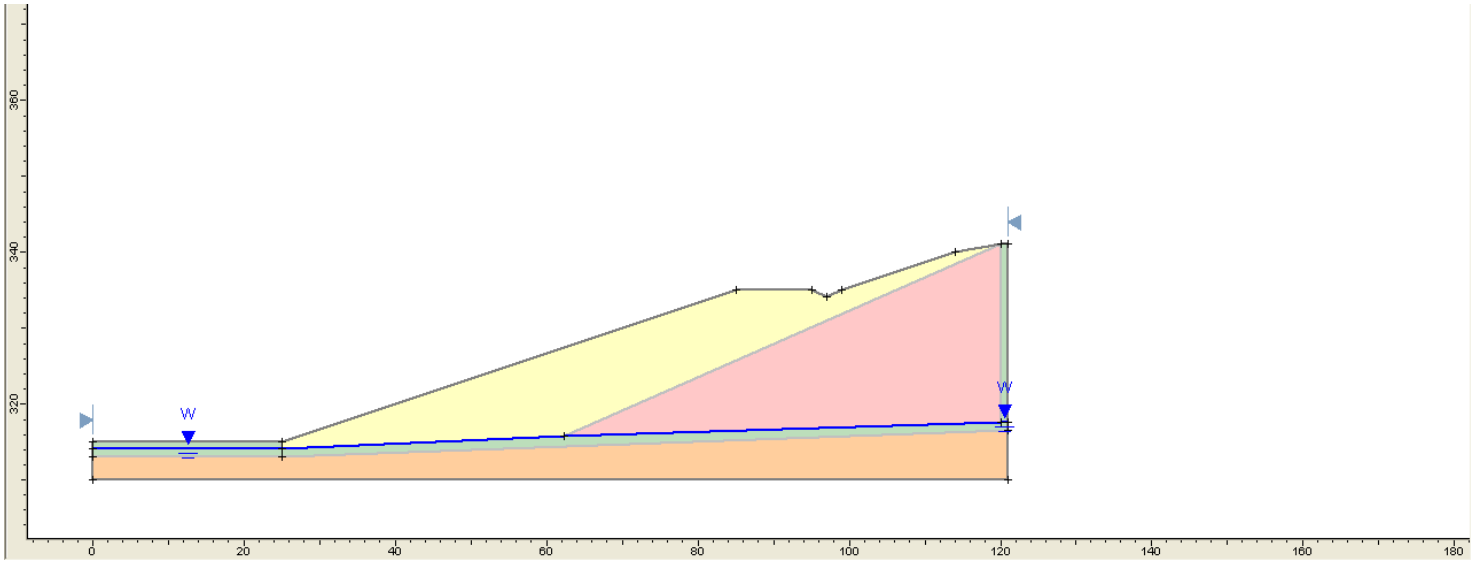
21. The Manager shall forward to the Inspector a copy of the report submitted to the Minister of Finance in relation to the annual Health and Safety Assessment. This report provides a report stating the annual production.

22. Surface water not subject to treatment in the water treatment plant shall be monitored at the discharge point to the receiving environment and suspended solids shall not exceed 25mg/litre. In addition this monitoring shall include analysis for nitrates, and nitrate content shall not exceed the limits specified for drinking water.

23. Production from this quarry is limited to 240,000 tonnes annually.

APPENDIX B
Slope Stability Analysis Sections

Layers	Unit Weight (KN/m³)	Cohession (KN/m²)	Friction angle (degree)
Waste	17	5	30
Imported Soil	16	2	30
Gravel	18	0	35
Bedrock	25	2	50



SPERLING HANSEN ASSOCIATES

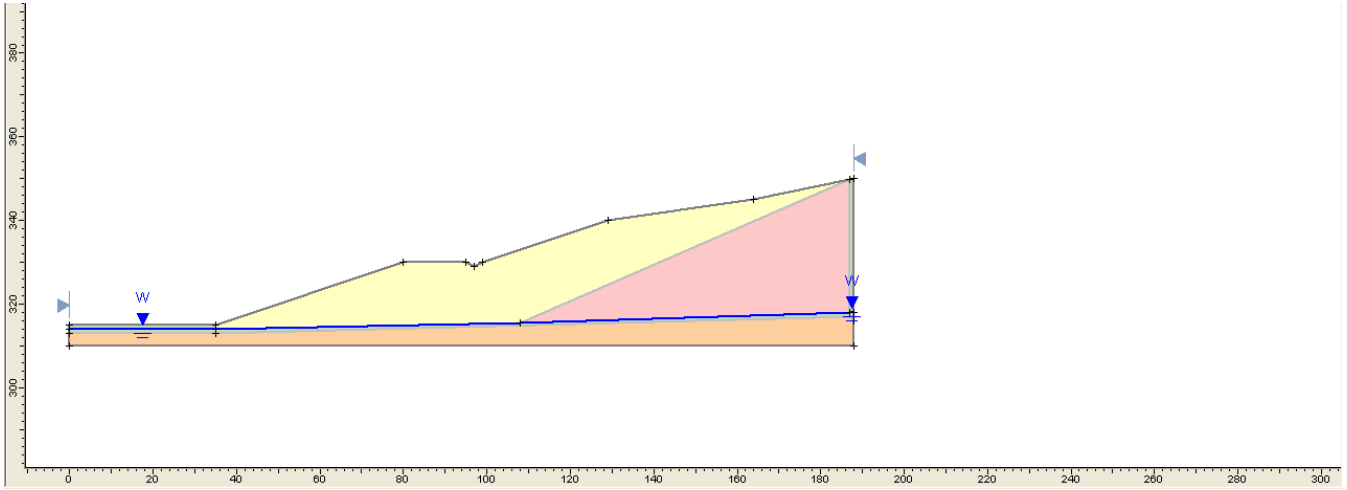
Cobble Hill Holding Ltd.

PROJECT:
Permit No. 105809
Cell Closure Plan

TITLE:
SECTION A-A' Proposed

SCALE:	DATE:	PROJECT NO:
N/A	2016/12/22 (yyyy/mm/dd)	16035
DESIGNED	IB	DRAWING NO:
DRAWN	IB	FIGURE B-1
CHECKED	TS	

Layers	Unit Weight (KN/m^3)	Cohession (KN/m^2)	Friction angle (degree)
Waste	17	5	30
Imported Soil	16	2	30
Gravel	18	0	35
Bedrock	25	2	50



SPERLING HANSEN ASSOCIATES

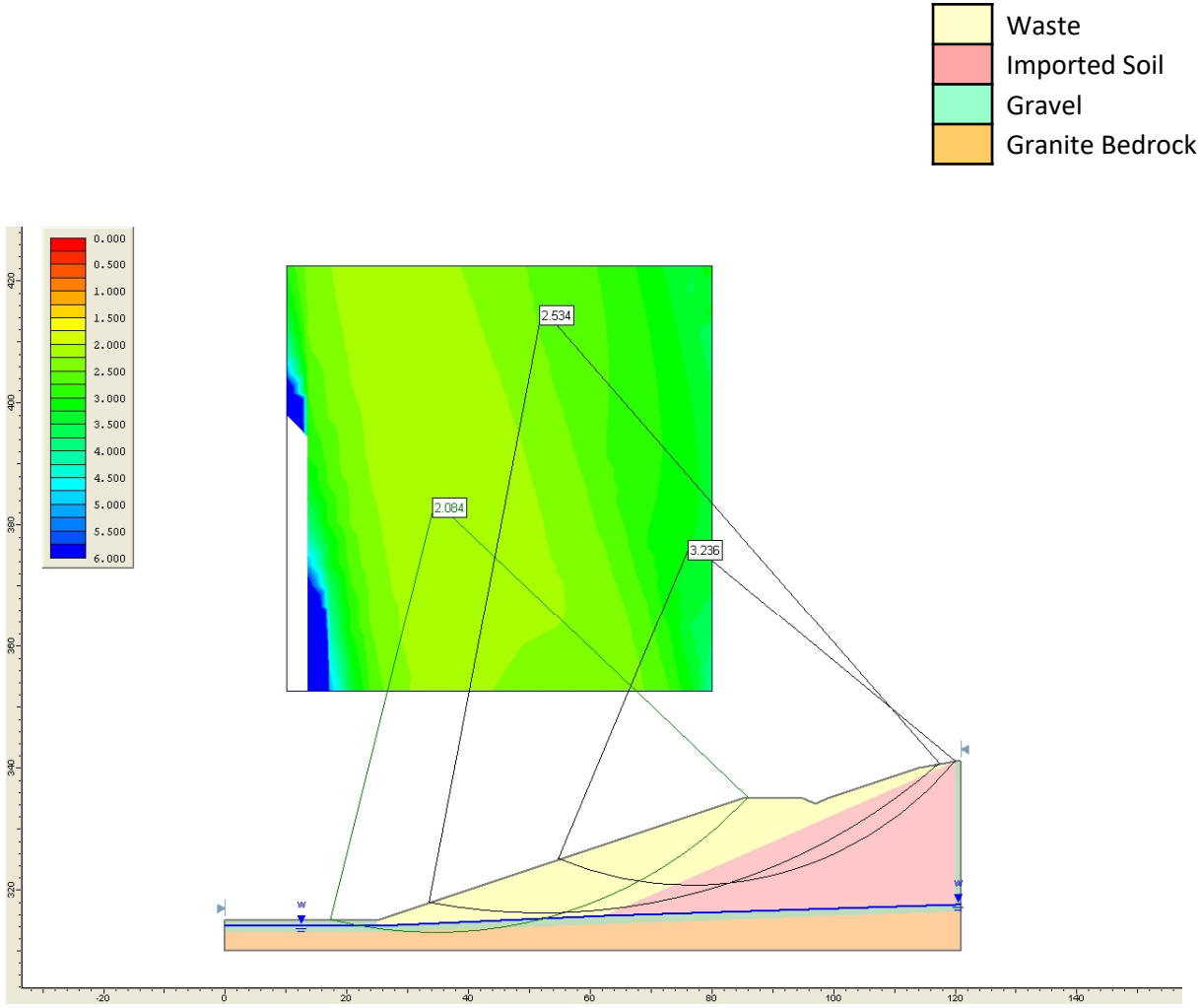
Cobble Hill Holding Ltd.

PROJECT:
Permit No. 105809
Cell Closure Plan

TITLE:
SECTION B-B' Proposed

SCALE:	DATE:	PROJECT NO:
N/A	2016/12/22 (yyyy/mm/dd)	16035
DESIGNED	IB	DRAWING NO:
DRAWN	IB	**FIGURE B-2**
CHECKED	TS	

APPENDIX C
SLIDE Results



Sperling Hansen Associates	Cobble Hill Holding Ltd.	PROJECT: Permit No. 105809 Cell Closure Plan	TITLE: **SECTION A-A' Static**	SCALE: N/A	DATE: 2016/12/22 yyyy/mm/dd
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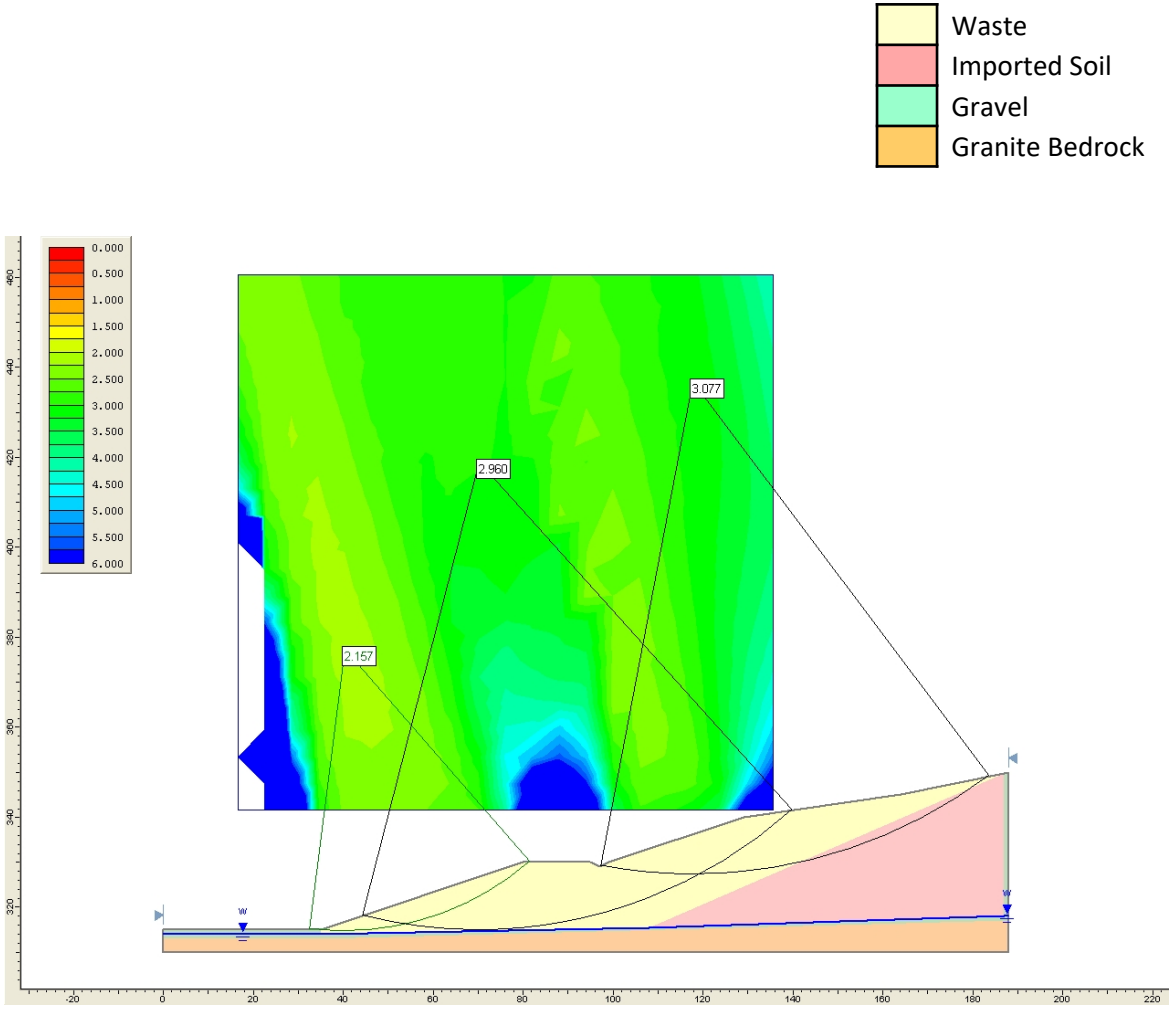
				DESIGNED: IB	DRAWING NO: **FIGURE C-1**
				DRAWN: IB	
				CHECKED: TS	



SPERLING HANSEN ASSOCIATES	Cobble Hill Holding Ltd.	PROJECT: Permit No. 105809 Cell Closure Plan	TITLE: **SECTION B-B' Static**	SCALE: N/A	DATE: 2016/12/22 yyyy/mm/dd
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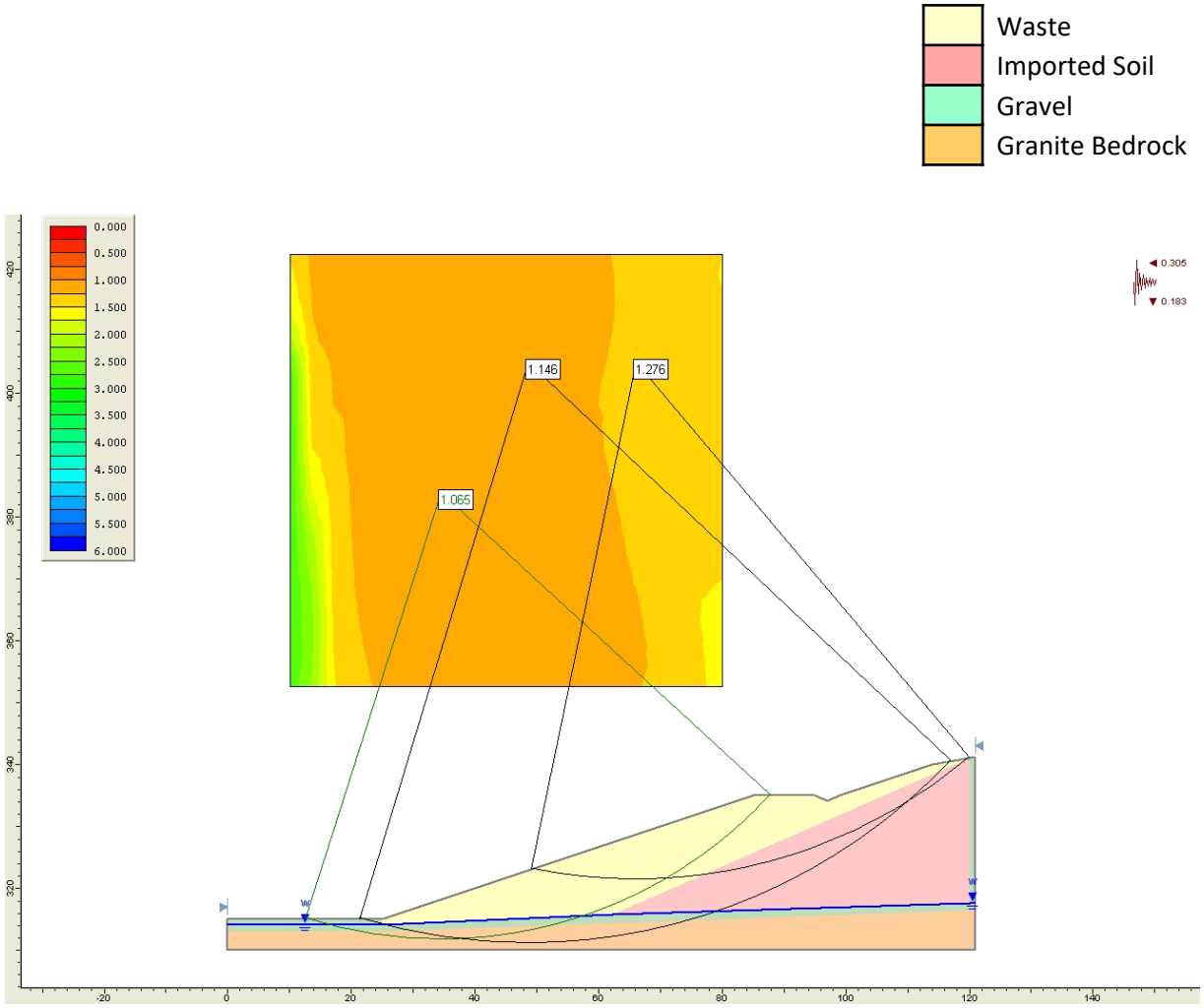
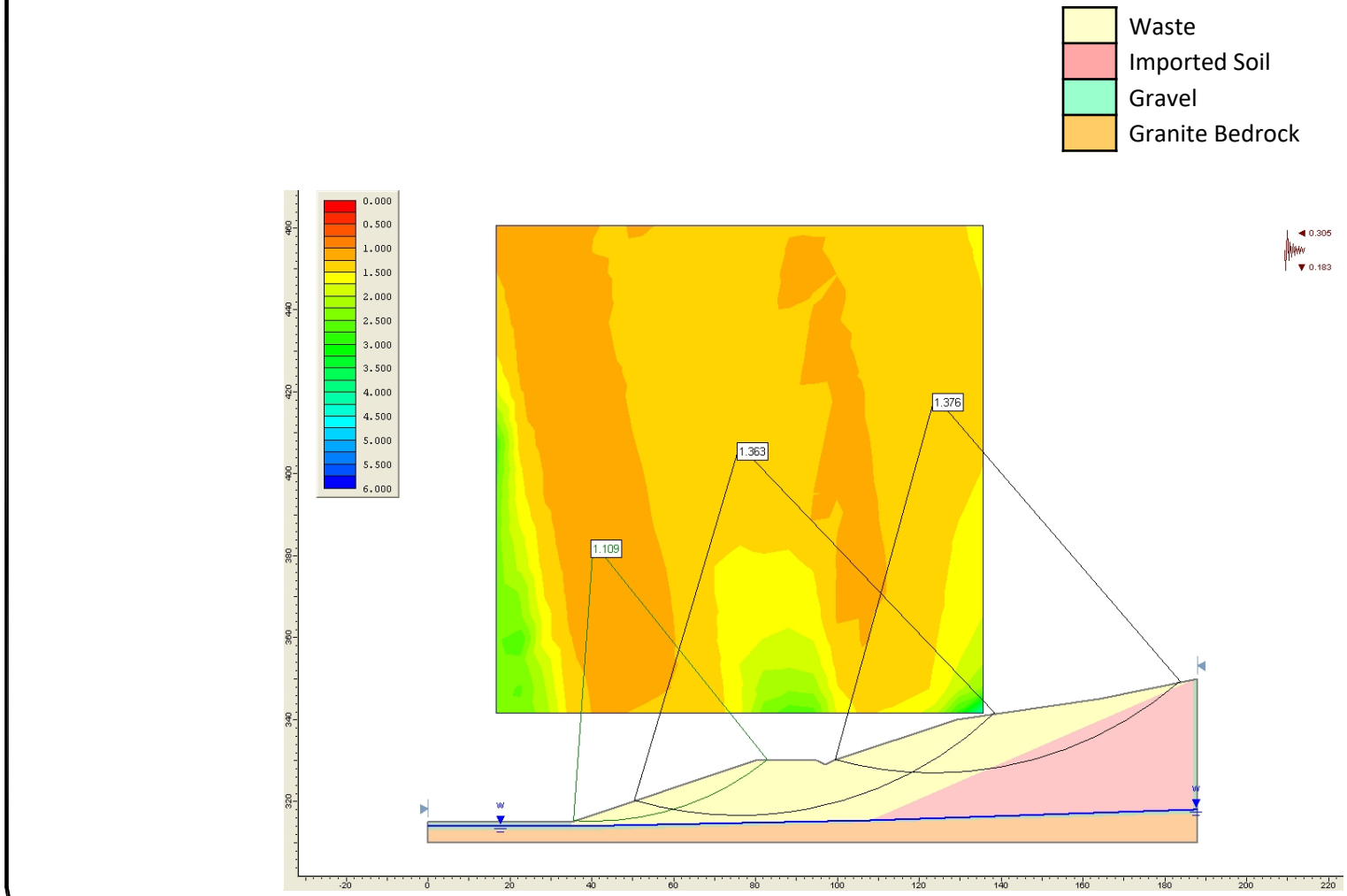


Sperling Hansen Associates	Cobble Hill Holding Ltd.	PROJECT: Permit No. 105809 Cell Closure Plan	TITLE: **SECTION A-A' Seismic**	SCALE: N/A	DATE: 2016/12/22 yyyy/mm/dd
				PROJECT NO: **16035**	
				DESIGNED: IB	DRAWING NO: **FIGURE C-3**
				DRAWN: IB	
				CHECKED: TS	



SPERLING HANSEN ASSOCIATES

Cobble Hill Holding Ltd.

PROJECT:
Permit No. 105809
Cell Closure Plan

TITLE:
SECTION B-B' Seismic

SCALE:	DATE:	PROJECT NO:
N/A	2016/12/22 (yyyy/mm/dd)	**16035**
DESIGNED	IB	DRAWING NO:
DRAWN	IB	**FIGURE C-4**
CHECKED	TS	