City of Richmond

Report to Committee

To:	General Purposes Committee	**Date:**	November 3, 2022
From:	Mark Corrado Director, Community Bylaws & Licencing	**File:**	12-8350-05-AMANDA #/Vol 01
Re:	**Soil Use for the Placement of Fill Application for the Property at 22040 River Road (Thandi)**		

Staff Recommendation

That the 'Soil Use for the Placement of Fill' application, submitted by Avtar Thandi (the "Applicant"), proposing to deposit soil for the purpose of improving the agricultural capability of the property located at 22040 River Road, be authorized for referral to the Agricultural Land Commission (ALC) for the ALC to review and determine the merits of the proposal from an agricultural perspective as the Applicant has satisfied all of the City's current reporting requirements.

Mark Corrado
Director, Community Bylaws and Licencing
(604-204-8673)

Att. 6

REPORT CONCURRENCE		
ROUTED TO:	**CONCURRENCE**	**CONCURRENCE OF GENERAL MANAGER**
Engineering	☑	
Finance	☑	
Policy Planning	☑	
Sustainability & District Energy	☑	
Transportation	☑	
SENIOR STAFF REPORT REVIEW	**INITIALS:**	**APPROVED BY CAO**

Staff Report

Origin

The City of Richmond has received a 'Soil Use for the Placement of Fill' application for the property located at 22040 River Road (Property). The Applicant is proposing to import and deposit 7,630 cubic metres of soil to improve the agricultural capability of the Property to grow blueberries.

The Property is situated within the Agricultural Land Reserve (ALR) and is subject to provisions of the *Agricultural Land Commission Act* (*ALC Act*) and its regulations, and the City's Soil Deposit and Removal Bylaw No. 10200 (Soil Bylaw).

Pursuant to applicable Provincial regulations, a 'Soil Use for the Placement of Fill' application requires authorization from local government in order to be referred to the Agricultural Land Commission (ALC) for their review and approval. As such, this application must be submitted to the City for review and a decision from Council. Should the application be referred to the ALC and should it subsequently be approved by the ALC, the Applicant is required to satisfy the City's requirements outlined in the Soil Bylaw before a soil deposit permit would be issued by the City.

The Applicant has satisfied all of the City's referral requirements for submission to the ALC.

This report supports Council's Strategic Plan 2018-2022 Strategy #2 A Sustainable and Environmentally Conscious City:

> *Environmentally conscious decision-making that demonstrates leadership in implementing innovative, sustainable practices and supports the City's unique biodiversity and island ecology.*
>
> *2.1 Continued leadership in addressing climate change and promoting circular economic principles.*
>
> *2.3 Increase emphasis on local food systems, urban agriculture and organic farming.*

Analysis

The Property is zoned AG1 (Agriculture). The current zoning permits a wide range of farming and compatible uses consistent with the provisions of the *ALC Act* and Regulations and the City's Official Community Plan and Zoning Bylaw. The Applicant is proposing to deposit 7,630 cubic metres of soil over 0.76 hectares (ha) of the Property at an average depth of 1.0m. The primary objective is to improve the agricultural capability of the Property by eliminating excess water issues by raising the elevation of the property.

Uses on Adjacent Lots

- To the North: ALR – Fraser River
- To the East: ALR – Land is not in agricultural production
- To the South: ALR – Land is not in agricultural production

- To the West: ALR – Land is not in agricultural production

Table 1: Existing Information and Proposed Changes for the Property

Item	**Existing**
Owner	Thandi Enterprises Ltd.
Applicant (the "Applicant")	Avtar Thandi
Qualified Agrologist (the "Agrologist")	Daniel Lamhonwah, PhD, MES, P. Ag. (Madrone Environmental Services Ltd.)
Qualified Professional (the "Engineer")	Dr. Stephen Ramsey, P. Eng.
Lot Size	1.23 hectares (3.03 acres)
Current Land Uses	The Property is currently being farmed
Proposed Land Uses	The Applicant intends to continue farming the Property following completion of the proposed project
Zoning	AG1
Official Community Plan Designation	Agriculture
ALR Designation	The Property is within the ALR
Riparian Management Area (RMA)	Yes; soil placement is permitted within west property boundary 15m RMA
Environmental Sensitive Area (ESA)	Yes; no disturbance proposed

Project Overview

The Applicant is proposing to deposit 7,630 cubic metres of soil over 0.76 ha of the Property at an average depth of 1.0m above current grade within the proposed soil deposit area. The primary objective is to improve the agricultural capability of the Property by eliminating excess water issues by raising the elevation of the Property.

Due to current poor drainage conditions on the Property that result in excess wetness and poorly drained organic soils as per the Agrologist, the aforesaid conditions negatively impacts the Applicant's ability to maintain a viable crop on the Property. As per the Agrologist, should the proposal be approved and carried out as recommended, the Property shall improve from a Class O4W (with excess water limitations) to a 2W classification (only short periods of excess water).

The estimated duration of the project is one year.

The timeline for completion is heavily dependent on ensuring the appropriate soil, as recommended by the Agrologist, is sourced to complete the project. Soil sourcing has not commenced at this time due to the considerable period of time involved with respect to the soil deposit application process and seeking approval from the City and ALC.

Following completion of the project, the Owner is proposing to grow blueberries; however, the soil to be imported will provide flexibility for the Applicant to grow the widest range of crops should the Applicant wish to do so in the future.

Staff Comments

The proposal aligns with a number of Council endorsed strategies and directions including concerns about the use of Richmond soil. Other objectives satisfied by the project are described as follows:

- The Applicant's desire to utilize Richmond soil where possible provides for a reduction in carbon emissions as there will be a considerable decrease in mileage as trucks will not be traveling back and forth from City approved development projects to the Fraser Valley as is the common practice; and
- The proposal to raise the Property to improve the agricultural viability is consistent with the City's current Flood Protection Management Strategy, which identifies raising land levels within all areas of the City as a key overall long-term objective.

Richmond Food Security and Agricultural Advisory Committee (FSAAC) Consultation

The Applicant presented the proposal to the FSAAC on May 26, 2022. The FSAAC unanimously supported the proposal passing the following motion with a condition:

> *The Food Security and Agricultural Advisory Committee (FSAAC) support the ALR Soil Use for Placement of Fill Application at 22040 River Road subject to the City requiring a bond to ensure the farm plan is implemented and the FSAAC also encourage the applicant to consider alternative soil management practices (including placing the fill on top of the existing peat), should this be acceptable to the ALC.*
>
> *Carried Unanimously*

Agricultural Considerations

The Applicant retained Madrone Environmental Services Ltd.to review and assess the Property and prepare recommendations to improve the growing conditions on the Property which included recommending the type of soil that would be acceptable to improve the property. The Agrologist has provided a Soil Placement Plan (Attachment 1).

The Soil Placement Plan addresses the current soil conditions on the Property. The Agrologist has concluded that the Property has a Class O4W (with excess water limitations). As per the Land Capability Classification for Agriculture in British Columbia Ministry of Environment (1983), a Class O4W property (where the 'O' indicates organic soils) has "frequent or continuous occurrence of excess water during the growing period causing moderate crop damage and occasional crop loss. Water level is near the soil surface during most of the winter and/or until late spring preventing seeding in some years, or the soil is very poorly drained." See attachment 2 for photos from Applicant.

In addition, the Agrologist confirms a secondary limitation and a classification of 5I due to frequent flooding (seven days or more per year), which negatively impacts the current blueberry crop. The current lease holder (Mr. Gurpal Singh) who has farmed the Property, confirms that there is "heavy flooding", which has impacted blueberry production (Attachment 3).

As noted in the Soil Placement Plan, the Applicant intends to retain the native topsoil and will strip/excavate and stockpile prior to importation and post-removal of the blueberry bushes. The Agrologist will be responsible for monitoring/ensuring the stripping of the native soil is completed as recommended. Following completion of importation, the native topsoil will be placed on top of the imported soil.

It is the opinion of the Agrologist that:

> *Adding soil will elevate the topography over the whole area and will improve drainage in the subsurface. If soil placement proceeds according to the proposal, [the Agrologist] estimate[s] that the post-soil Land Capability for Agriculture ratings will improve from Class O4W with excess water limitations to a Class 2W with only short periods of excess water. The inundation limitation posed by the annual flooding from the watercourse should also be improved to Class 2W due to [the] increased grade of the land above the watercourse.*

The proposal to import soil to raise a portion of the property to improve the property's agricultural viability is consistent with the City's current Flood Protection Management Strategy.

Bruce McTavish (MSc, MBA, PAg, RPBio) has reviewed the proposal (Attachments 4 & 5) from an agricultural perspective on behalf of the City. Mr. McTavish has stated that the Soil Placement Plan has addressed all issues he identified in his initial review dated September 26, 2019.

Mr. McTavish has confirmed (November 15, 2021) that the proposal satisfies requirements as per ALC Policy P-10 "Criteria for Agricultural Capability Assessments."

City staff have reviewed the reports provided by the Agrologist and have concluded that the reports satisfy the City's requirements.

Drainage & Geotechnical Considerations

The Applicant has provided the City a Geotechnical Assessment (Attachment 6) and a Drainage Plan.

The Geotechnical Assessment, provided by Dr. Stephen Ramsay, P.Eng. (Grey Owl Engineering), has determined the proposal "will not lead to any settlement or stability issues." As per the Assessment, "the proposed soil deposit will have no adverse consequences to adjacent areas of the subject property or to adjacent properties."

Staff have reviewed the Geotechnical Assessment and have no concerns relative to the conclusions of the Applicant's qualified professional.

Staff have reviewed the Drainage Plan and have no concerns relative to the conclusions of the Applicant's qualified professional.

Environmental Considerations

The Property has a small portion designated as an Environmentally Sensitive Area (ESA). The Agrologist and Owner have indicated that the ESA will not be disturbed.

There are no trees within the proposed soil deposit area.

No soil will be placed within the designated 15m Riparian Management Area (RMA) that extends along River Road to the north of the property. Soil will be placed within the designated 15m RMA that extends along the western property line. The proposed farming activity is not subject to the Riparian Areas Protection Regulation and is therefore permitted within the 15m RMA.

Should the City and ALC provide approval, the City's soil deposit permit (Permit) conditions will require that all work undertaken in or around a watercourse, must be completed in compliance with the *Water Sustainability Act*, under the guidance of a Qualified Environmental Professional (QEP). The City will require that erosion and sediment control measures be installed and inspected by a QEP should it be deemed necessary by City staff.

Financial Costs and Considerations for the Applicant

Due to ongoing and approved development within the City of Richmond and the Lower Mainland, developers and contractors must find a location (End Site) that will accept soil excavated and removed off-site to facilitate development. Due to such demand, a market has been created in which End Site owners can generate income via tipping fees such as the fees collected by the City for accepting agriculturally viable soil for the Garden City Lands. Such fees are variable depending on the location, type and volume of soil, and season. Contractors are willing to pay a premium based on location of the soil (Source Site) to the End Site in order to reduce costs.

Although End Site owners derive income due to tipping fees, said owners do incur significant costs to undertake such projects. It is anticipated that the project may generate tipping fees in excess of $100,000 for the Applicant. However, the income derived through tipping fees shall be offset by costs due to upfront reporting expenditures, site preparation, project management, daily personnel and machine expenditures, ongoing inspection and reporting by the project's agrologist-of-record, drainage upgrades, implementation of the farm plan and final reporting expenses.

As per the Consolidated Fees Bylaw No. 8636, the City will require payment from the Applicant of a non-refundable volume fee in the range of $7,630 and $15,260.

Road and Traffic Considerations

Transportation staff have reviewed the proposal and will require a Transportation Management Plan should the application receive approval.

Soil Deposit Permit Requirements and City Inspection and Project Oversight Protocols

Should the proposal receive ALC and City approval, City staff will prepare a comprehensive Permit that sets out a number of conditions, including but not limited to:

- Project oversight and reporting requirements by a qualified agrologist;
- Source site inspection requirements;
- Monitoring requirements;
- Requirements for protection of the Riparian Management Area near the proposed truck entrance point on River Road;
- Permitted hours/days of operation;
- Traffic Management Plan requirements; and
- Security deposits (explanation below).

Qualified Professional reporting requirements are intended to be similar to the requirements for the Sixwest Holdings project (Westminster Hwy). This will include that the agrologist-of-record inspect and approve all source sites. An on-site monitor will be required to inspect each load of soil prior to deposition on the Property and maintain an accurate daily log of trucks depositing soil on the site. At the sole discretion of the City, alternate measures may be required (i.e. survey) to determine the final volume of soil deposited on the Property.

In addition to the expected reporting requirements of the agrologist-of-record or other qualified professionals, City staff will maintain proactive inspection and enforcement on the Property that will include the following:

- Multiple site inspections per week of the Property at the onset of the project to ensure conditions of the Permit are being maintained;
- Weekly site assessments to continue to be undertaken when soil importation is underway to ensure the Permit conditions are respected;
- Maintain communication with the agrologist-of-record on a regular basis;
- Review reports to ensure conditions of the Permit are being satisfied; and
- Advise the ALC of concerns relative to the project and request that ALC staff undertake inspections to ensure compliance with ALC approval conditions.

No soil will be permitted to be imported/deposited until such time as all City and ALC requirements have been satisfied and the Permit has been issued by the City.

Security Bonds

Should the project receive approval, the City will require that the Applicant provide as per the Soil Bylaw, a security deposit in the amount of $38,150 ($5 per cubic metre). The security

deposit will not be returned until all conditions as stated in the Permit and the ALC approval are satisfied in their entirety, to the satisfaction of the City.

In addition, the Applicant has in response to the motion from FSAAC, advised staff that he will provide an additional security deposit in the amount of $8,000. The additional bond will be held by the City until implementation of the Farm Plan has been completed and said completion has been confirmed by the agrologist-of-record.

In addition to the security bonds that are to be provided to the City, the ALC has the authority to require a performance bond to ensure that the project is satisfactorily completed. The bond required by the ALC is also intended to ensure the rehabilitation of the Property in the event the project is not completed. ALC performance bonds and the approved volumes from previous approvals for projects within the City are as follows:

- $25,000 – 12,000m^3 (Sahota - approved August 2022)
- $60,000 – 23,673m^3 (Gosal - approved October 2020)
- $70,000 – 17,500m^3 (Athwal - approved May 2020)
- $160,000 – 48,000m^3 (City of Richmond - approved June 2017)
- $290,000 – 140,000m^3 (Sixwest Holdings - approved January 2017)
- $500,000 – 102,080m^3 (Sunshine Cranberry Farms - approved January 2014)

Alternatives to Council Approval

Should Council not authorize staff to refer the proposal to the ALC for their review and decision; the application will be considered to be rejected. Council may add additional recommendations for ALC consideration within a referral to the ALC.

Financial Impact

Should the proposal receive approval, the project will generate revenue for the City of between $7,630 and $15,260.

Conclusion

Staff recommends that the soil deposit application for the Property at 22040 River Road be authorized for referral to the ALC for the ALC to review and determine the merits of the proposal from an agricultural perspective as the Applicant has satisfied all of the City's current reporting requirements.

Mark Corrado
Director, Community Bylaws and Licencing
(604-204-8673)

MC: mm

Att. 1: Soil Placement Plan (rev. 13 Jan 2022)
2: Property photos re. 22040 River Rd (taken 16 Nov 2021)
3: Letter from Gurpal Singh (Farmer & Property Leasee) (26 Apr 2019)
4: McTavish Memo re. Madrone report review (26 Sept 2019)
5: McTavish Memo re. Madrone report review (15 Nov 2021)
6: Geotechnical Assessment (15 May 2021)

Attachment 1

MADRONE
environmental services ltd.

SOIL PLACEMENT PLAN

22040 River Road
Richmond, BC

FOR:

Mr. Avtar Thandi
127 Balmoral Rd. West
North Vancouver, V7N 2T6

BY:

Jessica Stewart, P.Ag.
Madrone Environmental Services Ltd.

Original: June 5, 2019
3rd Revision for CoR: January 13, 2022

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF PHOTOS

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SOIL PLACEMENT PLAN

22040 River Road
Richmond, BC

1 Introduction

Madrone Environmental Services Ltd. (Madrone) was retained by Mr. Avtar Thandi to prepare a soil placement plan for his property located at 22040 River Road, Richmond (PID: 000-651-672).

The soil placement plan and soil deposit application will be submitted to the City of Richmond (COR) and the Agricultural Land Commission (ALC) for non-farm use of agricultural land. The property is 1.2 hectares total; however, the soil will only be placed on a 0.76 ha portion of the land, which is zoned Agricultural (AG-1), and lies within the Agricultural Land Reserve (ALR).

The primary limitation of the land for soil-based agriculture is very poor drainage (uniform class OW4 for organic soils. The property experiences excess water during the winter months late into spring, and after prolonged precipitation events during the growing season. There is a second limitation of inundation by the watercourse situated along the entire western perimeter of the property, within 15 m of the blueberry plants. I rated this to be Class 5I, which translates to frequent overflow of 7 days or more causing crop damage. Finally, there is a potential third limitation of extreme acidity resulting in poor soil fertility (5F) of Terric Mesisols. This was not lab tested for this assessment but is inferred from soil survey descriptions.

Mr. Thandi currently farms blueberries on the property but intends to cultivate nursery trees and vegetables in soil bottomed greenhouses following soil placement.

He wishes to overcome the existing agricultural limitations and raise the surface level by an average of 1 m by placing good-quality soil on the property. The total volume for this proposed project is 7,630 m^3, covering approximately 0.76 ha. Mr. Thandi has approached the City of Richmond the past several years for assistance in resolving the frequent flooding on his property from a ditch along the west side; the flooding has damaged his blueberry crop. Initially, he considered applying to the ALC to have the property excluded from the ALR but would rather improve the land for farming instead of pursuing exclusion.

2 Physical Setting and Proposed Development

2.1 Location

Mr. Thandi's property at 22040 River Road, Richmond, BC, is approximately 22.7 km east of downtown Richmond (Figure 1). The property is situated on the south side of the Fraser River on River Road. The legal description of the property is: Lot 10 Block 5N Plan NWP8644 Section 35 Range 4W Land District 36 (PID: 000-651-672).

The property is rectangular and oriented lengthwise north-south, with a residence situated in the northeast corner and accessed via one crossing at River Road. The BC Assessment[1] reported lot size is 1.2 ha (3.0 acres). The entire property is zoned AG1 according to Richmond Zoning Bylaw 8672 and the property is within the ALR.

2.2 Historical Land Use

The Thandi family purchased the property in 1988 and planted blueberry bushes in the rear of the lot shortly after. I reviewed aerial photographs (airphotos) of the property taken in 1982, 1986, 2009, 2013, and 2016. The 2013 and 2016 airphotos are from the City of Richmond Interactive Map[2]. The older three airphotos are available via a GeoBC Airphoto Viewer for Google™Earth Pro.

[1] https://www.bcassessment.ca/ BC Assessment. Accessed April 15, 2019

[2] https://maps.richmond.ca/rim/ City of Richmond Interactive Map. Accessed April 15, 2019

Table 1. Historical Airphoto Review

Year	Photo Number	Observations & Interpretations of Property and Surrounding Area
1982	30BCC324 No. 093	Approximately ¾ of the property was completely cleared and appears to be cultivated for pasture grass/hay. The remaining northern ¼ of the property is still vegetated with shrubs and trees. These surround a house (1950's) that was demolished prior to construction of the existing residence in 2014. There appears to be two wet swales – one in the centre of the property, and a smaller swale in the southern limit of the property. The large cranberry farms that still exist to the southwest of the site were under cultivation by this time. The farmhouse on this property was constructed in 1955. Cranberry cultivation began in BC in 1946 in the Fraser Valley. This may be one of the earliest cranberry farms. The subdivision that currently exists due south was at this time a wetland/peat bog with partly cleared forest and shrubs. West neighbouring property – cleared but no visible agriculture. East neighbouring property – cleared, appears to be farmed for pasture/hay. Farmhouse constructed in 1955.
1986	30BCC535 No. 187	Large portion of the cleared area (where the current blueberry farm is) is visibly wet. This shows up as a darker colour. Appears to be two connected, wet swales. Gilley Road right of way appears to have been recently cleared, The wetland/peat bog has re-vegetated. The subdivision was completed in 1993 – development works likely started sometime in the late 1980's to early 1990's. West neighbouring property – cultivated field, possibly a pasture/hay crop.
2009	30BCC09001-287	Access roads, preparations for new residence on eastern neighbouring property (reduced crop production) West neighbouring – former crop cleared, possibly filled with soil (rear 2/3 of property). Large residence and tennis court constructed. Mr. Thandi's blueberry farm occupies majority of property and is of similar size and extent as modern day. Large subdivision built to south and southeast – small strip of forest still exists directly south of Mr. Thandi's property, on the east side of the cranberry farm. This strip of forest exists today. It may be city land or crown land (no property identification on BC Assessment).
2013	City of Richmond Interactive Map airphoto	Flooding present in the blueberry field on the property, specifically through the centre, the south, and along the eastern property line with the neighbor (Dave). It appears to be spring in this photo. It appears that the water came from the ditch along the western side as there is a line of water from the ditch to the flooding along the eastern property line.
2016	City of Richmond Interactive Map airphoto	Similar conditions as 2013 airphoto; the flood extent is very similar. The water levels in the ditches appear to be quite high in this photo – the water is visible all the way to the top of the bank. The surrounding properties do not have visible flooding in this airphoto. It is confined mainly to the Thandi property, with some shared flooding along the neighbouring property on the east side (but the flooding does not extend far into their land – it is confined to the property line with Mr. Thandi's blueberry field).

PHOTO 1: 1986 AIRPHOTO (BEFORE MR. THANDI PLANTED BLUEBERRIES) SHOWING VISIBLE WET SWALES/DEPRESSIONS IN THE MAJORITY OF THE LOT SOUTH OF THE RESIDENCE.
These are indicated by the blue arrow.

2.3 Current Land Use – Property and Surrounding Area

The blueberry farm on the property is currently leased to farmers (Star Labour Supply – Mr. Gurpal Singh). The hired farmers manage and sell the blueberry crop. Mr. Thandi does not reside on the property but his family members do. The residence in the northeast corner was constructed between 2013 and 2014 to replace the original old farmhouse. The surrounding farmhouses (original) are from 1955.

The surrounding area has a mix of land uses, including dense residential, industrial (railways, timber transport and storage, trucking), and agricultural. This area is the eastern limit of the ALR on Lulu Island; the ALR boundary terminates 1 km east of Mr. Thandi's property. It also terminates at the southern end of the property at the Gilley Road right of way (an old, non-status road), which is the limit of the large subdivision

constructed by 1993. The large cranberry farm to the southwest (21551 Westminster Highway) is the southeast terminus of the ALR on Lulu Island.

The nearest agricultural operations are predominantly cranberry farms. This includes the cranberry Farm at 21551 Westminster Highway (100 m southwest of the Thandi property). There was a nursery/greenhouse operation situated on the property at 22280 River Road (two properties to the east), but this was removed by 2009 airphotos and there does not appear to be any agricultural operations occurring on the property following an airphoto review for subsequent years.

PHOTO 2. LOOKING DUE SOUTH ACROSS THE BLUEBERRY FIELD ON THE SUBJECT PROPERTY.

PHOTO 3. LOOKING EAST WHERE THE BLUEBERRY FIELD (NATURAL GRADE OF THE LAND) MEETS THE BERM (COMPACTED BOULDERS) CONSTRUCTED TO RAISE THE RESIDENCE TO THE FLOOD CONSTRUCTION LEVEL (3.5 M GSC).
The residence is on the top left of the photo.

2.4 Climate

Mr. Thandi's property is situated approximately 9.6 km to the east of Richmond Nature Park[3], which is the nearest Environment Canada climate station with a long term record. Richmond Nature Park is situated at an elevation of 3 m above mean sea level (a.s.l.).

The thirty-year span of records from 1981 to 2010 show a mean annual precipitation of 1262 mm, a daily average temperature of 11°C, and 2244 effective growing (> 5°C) degree days.

According to the Climatic Capability for Agriculture in British Columbia map and report by Coligado, 1980, the majority of Lulu Island surrounding the property has a class 3A aridity limitation (specifically, class 3A(1)). Class 3 aridity limitations indicate drought or aridity between May 1 and September 30 resulting in moisture deficits, which are limiting to plant growth and could require moderately intensive management. This will dictate that certain crops will require irrigation for dry periods in mid-summer to early fall.

[3] http://climate.weather.gc.ca/climate_normals/index_e.html Richmond Nature Park climate station. Accessed April 15, 2019

2.5 Landscape and Topography

The property is situated on the south side of the Fraser River; the natural boundary of the river is approximately 25 m north of the property line. The surrounding topography is low-lying and level with no discernible slopes.

In absence of a topographic land survey and readily available topographic contours or spot elevations for this property, the exact elevations of the property are uncertain. There are Geodetic Control Markers (GCM) located throughout this area. The nearest survey monument record to this location is situated at Westminster Highway and Fraserside Gate, approximately 775 m due east of Mr. Thandi's property. The elevation of this Geodetic Control Marker (now destroyed, as of 2015) is 1.15 m a.s.l.[4] I have used this information for my preliminary soil cross-section and volume diagrams. A more detailed topographic survey would be required to determine the exact elevation on site (i.e. to the nearest centimeter).

The new residence constructed between 2013 and 2014 was required to be elevated to a minimum Flood Construction Level (FCL). The current FCL for this area is 3.5 m GSC[5]. A geotechnical investigation report prepared for the property in 2012 by GeoPacific Consultants Ltd. reported that the grade of the house site, which was elevated by imported fills (to bring it to the FCL at that time) is between 3.0 and 3.2 m to the west and rises to about 3.7 m to 4.0 m to the east. The house was constructed on the eastern side of the filled area. The fills form a berm that slopes downwards to the natural elevation (unfilled) of the property at the blueberry farm.

The surficial geology of this area was mapped by Armstrong (1980) as post-glacial Salish Sediments, specifically, lowland peat up to 1 m thick overlying overbank sandy to silt loam up to 2 m thick (Fraser River sediments). Lowland peat is mapped as reaching up to 14 m thick to the south of the property towards Westminster Highway.

According to the City of Richmond Interactive Map program, a small portion of the property along the north, west, south, and southeast perimeter are designated Environmentally-Sensitive Areas (ESA), specifically, Intertidal and Old Fields and

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[4] http://a100.gov.bc.ca/pub/mascotw/protected/final_long.html?Q_GCM_NO=515411 Geodetic Control Marker No. 515411. April 15, 2019

[5] http://maps.richmond.ca/rim/ City of Richmond Interactive Map Program – Flood Construction Levels. Accessed April 15, 2019

Shrublands[6]. The ditch that runs along the entire western edge of the property is a designated Riparian Management Area (RMA). There is a 15 m Riparian Management Area setback for this ditch – **agricultural use (farming) is exempt from this setback**. The RMA is partly vegetated by native trees and shrubs; this extends for approximately 3 m from the edge of the ditch (top of bank).

PHOTO 4. RMA/WATERCOURSE SITUATED ALONG THE WESTERN PROPERTY LINE. THIS IS NEAR SOIL PIT 2.
Note high ditch water levels – I measured the distance between the current water levels and the natural grade of the land at the bank on the left (Mr. Thandi's property) and found this to be 25 – 30 cm.

[6] http://rim.richmond.ca/rim/docs/ESAdefinitions.pdf City of Richmond ESA Definitions. Accessed April 15, 2019

PHOTO 5. PIPELINE (UNDER THE GRASS IN THE CENTRE) INSTALLED FOR THE CRANBERRY FARM SITUATED TO THE SOUTHWEST.
This was installed on the west side of the ditch/watercourse. It pumps water from the Fraser River as an irrigation source for the cranberry farm. Mr. Thandi's property is on the right side of the photo. note the pipeline has raised the west side of the bank of the ditch – water therefore overflows eastwards (Mr. Thandi's property) during periods of high water levels in the ditch.

PHOTO 6. GILLEY ROAD RIGHT-OF-WAY (NON-STATUS ROAD).
The left side of the photo is the southern portion of Mr. Thandi's property, which is an ESA. The ESA is overgrown with blackberry.

2.6 Published Soils and Land Capability Data

Prior to my field assessment, I reviewed soil survey information for this area, in addition to the Land Capability for Agriculture (LCA) ratings for the property. The soils in this area were mapped by Luttmerding[7] in the 1980's. The surveys were printed at a scale of 1:50,000 and are based on airphoto interpretation and field surveys. I provide a site-specific assessment of the soils and agricultural capability of the property in Section 3, below.

LCA ratings describe the general suitability of the land for agriculture as seven classes for mineral soil and seven classes for organic soil. The capability classes are modified into subclasses when limitations to agriculture exist. There are twelve subclasses for mineral soils and nine subclasses for organic soils. A detailed description of LCA rating classes and subclasses is provided in Appendix IV.

Soil surveys show that approximately two-thirds of the property is mapped as the Embree (60%) and Blundell (40%) soil series. The remaining southern one-third of the property is mapped as the Lulu (60%) and Richmond (40%) soil series. All but the Embree soil series are fen peat soils. Soil properties are summarized in Table 2.

[7] http://www.env.gov.bc.ca/esd/distdata/ecosystems/Soils_Reports/bc15_report.pdf
Soils of the Langley-Vancouver Map Area. B.C. Ministry of Environment. 1981. April 15, 2019

Table 2. Summary of Mapped[8] Soil Properties

Soil Series	Parent Material	Texture	Drainage	Classification	Land Capability for Agriculture (LCA) Class[9]
Embree	Mixed marine and fresh water deltaic deposits. 20 cm silty material containing organics over silt (no organics), followed by another horizon of organics only (20 cm). Underlying this is a 40 cm thick silt layer.	Silt loam to silty clay loam. Organics: mesic to humic.	Poorly to very poorly drained	Rego Humic Gleysol	4N- Salinity 4W- Excess Wetness
Blundell	10 – 40 cm organic material over medium-textured deltaic deposits	Poorly decomposed organic surface with medium grained sandy silt loam under layering. Saline and peaty conditions present.	Poor to very poor; high groundwater table	Rego Gleysol	4N- Salinity 4W- Excess Wetness
Lulu	Partially decomposed organic deposits (40 cm – 1.6 m), overlying deltaic sediments	Organics: mesic Deltaic sediments: moderately fine to fine silty clay to silty clay loam.	Very poorly drained	Terric Mesisol	5F- Extreme acidity affecting fertility. 04W- Excess Wetness
Richmond	Well-decomposed organic deposits (40 cm – 1.6 m) overlying deltaic sediments	Organics: humic Deltaic sediments: fine to medium-textured silt loam to silty clay loam.	Very poorly drained	Terric Humisol	4F- Very acid affecting fertility. 04W- Excess Wetness

According to the Canadian Soil Information Service (CanSIS)[10], both the Blundell and the Embree soils have a conductivity > 4 dS/m in the upper organic and mineral horizons (< 50 cm from surface), which correlates to a salinity limitation at the 4N level.

[8] Based on mapping by Luttmerding (1980) and the Soil Information Finder Tool; actual soils on site are described in Section 4.0 of this report.

[9] Derived from the General Land Use Comments in the Soils of the Langley-Vancouver Map Area survey, for each soil.

[10] http://sis.agr.gc.ca/cansis/index.html Canadian Soil Information Service. Accessed April 15, 2019

Furthermore, excess water is evident in the soil for a large part of the year that the soil is not frozen, which is an excess water limitation of 4W.

The Lulu and Richmond soils are described as being very poorly drained and "water is removed from the soil so slowly that the water table remains at or on the surface for the greater part of the time the soil is not frozen. Excess water is present in the soil for the greater part of the time."[11] This correlates to an estimated LCA of O4W.

The Soils of the Langley-Vancouver Area describes the Lulu soils as having 'extreme' acidity. Controlling water tables and liming can allow for production of most annual crops that are not affected by "wet feet" conditions. The Richmond soils are described as having very acid conditions that can be improved through liming. Both soils required artificial drainage to control high watertables.

3 Soils and Land Capability for Agriculture Assessment

I (Jessica Stewart, P.Ag.) visited the property on April 3, 2019 to carry out an assessment of the site soils during a period of moderate to heavy rainfall. I was met on site by Mr. Thandi and was assisted by Mr. Thandi's longtime neighbour (Dave) who brought an excavator on site for our soil investigation.

We excavated three soil pits on the property – the sites were chosen randomly in the blueberry field. I marked the location of these pits with a GPS in the field; these are shown on Figure 2 in Appendix I. During my soil assessment, I recorded soil properties such as soil texture, drainage, consistency, structure, colour, horizon classification and thickness, root restricting horizons, and evidence of gleying or mottling were noted during my assessment. Soil Pit Descriptions and pit photos are in Appendix II.

I also traversed the property and recorded my observations of slopes, vegetation, and the water levels of the ditch situated along the western perimeter of the property.

3.1 Soils – Determined from Assessment

Based on my soil profile descriptions, I correlated site soils to soils described in the Soils of the Langley-Vancouver Map Area, MoE Technical Report 15 (Luttmerding, 1981). From

[11] http://sis.agr.gc.ca/cansis/soils/bc/LUL/d~~~~/A/description.html CanSIS Lulu soil series description (similar for Richmond soils). Accessed April 15, 2019

my soil assessment, I identified one main soil type on the property that I classified as a Terric Mesisol, which correlates well with the Lulu soil series.
Soil pits on the property showed that there is consistently 40 cm of humic peat, overlying, by a variable depth, reddish brown, fibric to mesic peat. The thickness of this horizon ranged from 40 cm to 130 cm. Below the peat horizons, there is a silty clay loam that contains partly decomposed plant material (Cg horizon). These are overbank silt and clay deposits from the Fraser River.

PHOTO 7. CG HORIZON IN SOIL PIT 3, WHICH WAS EXCAVATED IN THE SOUTHERN END OF THE PROPERTY.
Note partly decomposed plant remains.

Based on my soil survey, I found the soil limitations to be excess water (O4W) due to very poorly drained soils. Class 4W limitations result in moderate crop damage and occasional crop loss.

A review of airphotos (Photo 8) from 2013 and 2016 and photos supplied by the client show that flooding from the ditch in the west side of the property occurs frequently; according to Mr. Thandi, this occurs more than 7 days annually[12]. This is evident in photos

[12] Flooding peaks during the winter months but persists through to late spring/early summer. It does not appear to be influenced by the annual Fraser River freshet, which historically occurs between mid-May and mid-June.

supplied by the client – these photos are in Appendix II. Flooding from the ditch more than 7 days a year correlates to an inundation limitation at the Class 5I level. During my field assessment, I measured water levels in the ditch relative to the top of the east bank, which is Mr. Thandi's land at the natural grade (just over 1 m above sea level). The water levels were between 20 and 30 cm of the top of the bank. The bank is lowest near PM 4 on Figure 2.

Flooding may be exacerbated over the property due to the higher bank on the west side of the ditch (see also, Photo 5 above which clearly shows this). The bank is higher due to the irrigation pipeline installed here – it runs parallel to the ditch and under the Gilley Road right of way to the south. This was constructed in the 1980's by B.K. Ranch Limited Partnership, the owner (at the time) of the cranberry farm situated to the southwest of Mr. Thandi's property (21551 Westminster Highway). The pipeline and associated pump were negotiated as an easement agreement with the Corporation of the Township of Richmond and Cranberry Management Consultants Ltd. (representing B.K. Ranch LP) in 1982[13]. Essentially when water levels in the ditch are high, water overflows eastwards onto Mr. Thandi's property which is situated at a lower elevation.

[13] FOI Request between City of Richmond and Mr. Thandi regarding easement and irrigation pipeline. This was made in 2016.

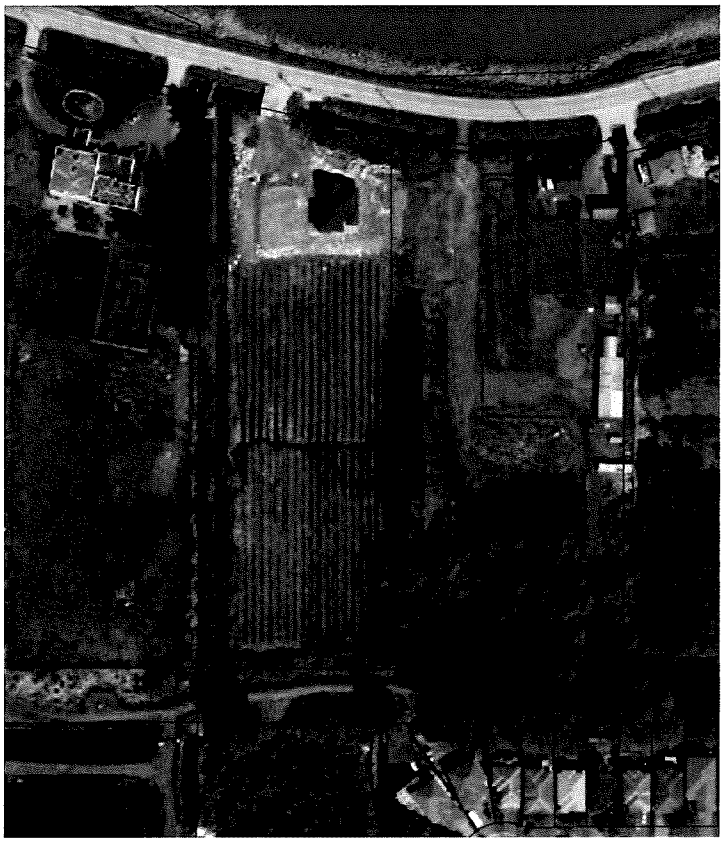

PHOTO 8. A 2013 AIRPHOTO FROM THE CITY OF RICHMOND INTERACTIVE MAP PROGRAM SHOWING FLOODING FROM THE DITCH EXTENDING EAST ACROSS THE PROPERTY AND POOLING AT A TOPOGRAPHIC LOW AT THE EAST PROPERTY LINE.
The floodwaters departed the ditch where there is a low bank.

There is a third soil limitation that is inferred from the presence of partly decomposed organics. The Terric Mesisols of the Lulu soil series are described by Luttmerding (1981) as having extreme acidity, which affects soil fertility. According to the Land Capability Classification for Agriculture in B.C., extreme soil acidity correlates to a fertility limitation at the class 5F level. No laboratory testing was performed for this assessment. We focused on the primary observed limitations that are excess water due to poorly drained soils and inundation by the ditch along the western property line. These limitations are currently causing the most damage to the blueberry plants.

PHOTO 9. SOIL PIT EXCAVATED NEAR PIT 3 IN THE PREVIOUS WEEK THAT FILLED WITH WATER AND HAD TO BE ABANDONED.
We waited for precipitation to diminish before conducting our soil assessment.

4 Soil Placement Proposal

4.1 Rationale

The site contains very poorly drained organic soils. There is excess free water from early fall to late spring; high watertables persist until the summer months. Furthermore, there is proven inundation from a nearby watercourse (ditch) along the entire western perimeter of the property. Using the BC Ministry of Forests and Range & Ministry of Environment Field Manual for Describing Terrestrial Ecosystems[14], saturated peat soils covered by surface water are considered to be flooded. The flooding regime for this property would be classified as: annual extended (exposed < 1 month during the last part of the growing season, which for blueberries is typically October) to moderate flooding (flooded for 1-3 months).

Mr. Thandi has invited the mayor of Richmond and municipal staff to view the flooding on his property. In 2016, he requested information regarding the installation of the irrigation pipeline along the western bank of the ditch in the early 1980's.

[14] https://www.for.gov.bc.ca/hfd/pubs/docs/lmh/lmh25-2.htm Field Manual for Describing Terrestrial Ecosystems - 2nd edition. BC Ministry of Forests and Range and BC Ministry of Environment. Accessed April 16, 2019

According to Mr. Thandi, the blueberry bushes situated along the western perimeter and in the northeast corner of his field are stunted and several are dying. I understand that Mr. Thandi has leased his farm to a third-party farmer for several years. The farmer has stated that the flooding has resulted in difficulties farming the property and would like to work with Mr. Thandi on resolving the flooding issues. A copy of this letter is supplied in Appendix V.

PHOTO 10. STUNTED BLUEBERRY PLANTS IN THE NORTHWEST CORNER OF THE FIELD.
These are affected by overflow from the ditch (watercourse) situated along the western perimeter of the property, in addition to the poorly drained soils of this entire area.

The B.C. Ministry of Agriculture Berry Production Guide provides recommendations on berry varieties, soil management, crop management, and pest management for blueberry farmers. According to the blueberry soil management guide[15]:

[15] https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/agriculture-and-seafood/agriservicebc/production-guides/berries/soilmanagement.pdf B.C. Ministry of Agriculture Berry Production Guide – Soil Management. Accessed April 16, 2019

> *"Berry crops require moderately to well drained soils with at least 0.5 m unrestricted rooting depth for successful cropping. Many lowland soils in BC have poor natural drainage with a high water table during the fall, winter and spring. These soils often need a subsurface and regional drainage system to remove excess water from the rooting zone for berry production."*

According to the University of Wisconsin, *Vaccinuim corymbosum* (highbush blueberry) can tolerate only periodic flooding (less than one week) in native, acidic soils[16]. If flooding is prolonged, oxygen is reduced in the soil which impedes respiration of roots. Roots begin to die and toxic compounds can build up in soils that are saturated. Furthermore, flooded soils favour the growth organisms such as *Fuasrium, Phytopthora, Pythium,* and *Rhizoctonia solani* which can cause root and crown rot and lead to plant death.

In general, periodically inundated areas can be improved by planting in raised beds[17] or berms and installing swales, ditches, and drain tiles to divert water away from the blueberry plants. This still does not improve the poorly drained organic soils (which have an underlying, dense silty clay loam) underlying the site. **To reiterate, resolving the Class 5I limitation does not improve the Class O4W limitation.**

The importation of good-quality and well-draining (loam, sandy loam, loamy sand) soil is thus considered a viable option to resolve poor draining and flooding issues on site (low-relief, flooding from the ditch to the west) as well as the agricultural limitations of the poorly drained native peat soils, which are excess wetness at Class O4W and fertility limitations due to the extreme acidity of Terric Mesisols (Class 5F – inferred but not lab tested at this time[18]).

In determining the ideal volume of soil for this project, I considered the following:

- The natural topography and drainage on the property;
- The crop type following soil deposition (which is soil-bottomed greenhouses containing vegetables and nursery trees, rather than re-planting blueberries); and

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[16] http://learningstore.uwex.edu/assets/pdfs/A3871.pdf UW Extension - Effects of Flooding on Woody Landscape Plants. Accessed April 16, 2019

[17] Mr. Thandi has planted in raised beds and has a ditch on the west side of this property – this has not improved the flooding.

[18] Given the relatively severe flooding from the ditch, a third limitation of extreme acidity was not lab tested. Resolving acidity through liming will only improve the soil fertility limitation to the next most serious limitation, which is inundation.

- The size of the area to be cultivated, taking into account setbacks for ESA's and the required 3 m property line setbacks.

With these considerations in mind, I have determined that approximately 7,630 m^3 of good-quality soil is anticipated to cover an area of approximately 0.76 ha, as shown on Figure 3 – Soil Placement Plan. Soil will be placed with varying thickness to achieve the desired final grade (higher on the east and sloping westwards). The maximum depth will not exceed 1.0 m as shown on Figure 4 – Scaled Cross-Section. Based on surrounding topographic elevations of 1.15 m, the final elevation[19] of the land following soil placement will not exceed 2.2 m. Furthermore, the fill will have a maximum slope of 1:3 (33%) along the east, west, and south sides. The north side of the fill will abut the berm constructed to over 3 m above sea level therefore no slope is required.

The actual rise in elevation after stripping, filling with an average of 1 m of soil, and then re-spreading of stockpiled topsoil will be affected by subsidence and accelerated decomposition of the organic soil (both in the subsoil and the topsoil). The net elevation increase will therefore be less than 1 m. The exact amount of subsidence that can be expected from the peat soils is difficult to estimate at this time as there are numerous factors that determine the rate of subsidence (in the short term, the amount of subsidence is related to the speed with which the water in the peat can be squeezed out to adjacent areas).

According to Zanelloa *et al* (2011),

> *"In drained peatlands the subsidence rate strongly depends on a number of factors, including type of peat, density of the organic material, drainage depth, climate, and cultivation practices. The overall settlement of the peatland surface is the sum of several components [Wösten et al., 1997; Deverel and Leighton, 2010]: (i) consolidation of the saturated porous medium due to the effective stress increase following the lowering of the water table; (ii) volume reduction of peat due to organic matter oxidation; (iii) swelling/shrinking of the shallow unsaturated peat layer due to seasonal wetting/ drying cycles; (iv) wind erosion; and (v) burning."* [20].

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[19] The exact elevation change (to the nearest cm) is subject to a topographic survey. This can be undertaken by Mr. Thandi if requested by the City of Richmond following an initial review of this proposal.

[20] https://agupubs.onlinelibrary.wiley.com/doi/pdf/10.1029/2011JF002010 Long term peatland subsidence: Experimental study and modeling scenarios in the Venice coastland. JOURNAL OF GEOPHYSICAL RESEARCH, VOL. 116.

4.2 Peat Stripping & Topsoil Management

In the interests of preserving the good-quality topsoil, stripping should be done before soil deposition over the area. From my soil investigation (detailed in the Land Capability Assessment) the first soil horizon (Oh1) is a black humic peat layer that is consistently 40 cm thick across all soil pits we excavated. There is a second organic horizon (Om2) of fibric to mesic peat that is highly variable in thickness, from 40 cm in the southeast edge of the property to 130 cm thick on the west side of the property near the ditch (watercourse).

It is recommended that, in the interest of reducing potential impacts from drying and settling should these two horizons be 'sandwiched' between an imported mineral fill, that the entirety of the peat horizons be stripped to the obvious Cg horizon and stockpiled. The peat would therefore be stripped to a depth of 90 cm near the centre, 80 cm to the south, and up to 130 cm along the west, with variable depths between these areas to be expected. The mineral fill horizon would thus be placed over the Cg horizon, and the stripped native peat replaced over top. Ideally, the humic peat and the fibric to mesic Om2 horizon will be replaced as per their previous orientation, with the humic peat at the top. This will require stripping in two steps and stockpiling these horizons separately.

It is likely that this operation will be done sequentially, with a portion stripped then filled, then another area stripped and filled. With continuous monitoring, Madrone will confirm that sufficient peat has been stripped from each portion prior to soil deposition. Alternatively, stripping can be done all at once.

Stripped topsoil and organics will be stockpiled in a safe location away from the west ditch, which is an RMA. The stockpiles should be no more than 5 m high, with 3:1 (horizontal to vertical) side slopes. They should be constructed such that water cannot accumulate on the surface (pyramid). The surface of the stockpile will be seeded with a suitable mixture of grass and/or grass/legumes (if left for six months or more) OR an erosion blanket or tarp will be placed over the stored topsoil for the duration of the deposit activities.

4.3 Soil Deposition

Soil placement activities will follow Part Five - Regulations in the Soil Removal and Soil Deposit Regulation Bylaw No. 8094 (City of Richmond, 2007)[21]. The fourteen regulations in this document should be reviewed with a retained agrologist prior to undertaking this project.

The following activities should be completed prior to soil placement:

- The blueberry bushes on site will be cleared and potentially chipped using a wood chipper – this is left to the discretion of the farmer. No (non-blueberry) vegetation will be removed from the edge of the ditch (within the 3 m property line setback).
- Erosion and sediment control structures have been installed;
- The topsoil has been stripped to the prescribed depth and properly stockpiled (for the portion being worked on, if work is sequential). The topsoil stripping will likely include roots of the blueberry bushes not collected initially by land clearing.

Soil will ideally be spread from the south end of the property first (**ending at the small strip of blackberry comprising the ESA such that the ESA will not be disturbed, as shown on Photo 6**), progressing northwards towards the berm situated at the base of the residential farm home plate. Once the soil has been spread and graded, the stockpiled topsoil (which is native peat from the property) will be spread over the surface to construct a consistent soil profile across the filled area.

After soil placement, Mr. Thandi wishes to grow a variety of crops such as vegetables and nursery trees in soil-bottomed greenhouses. Mr. Thandi may want to consider using simple Quonset greenhouse structures. The design and installation of the greenhouse farm will be at the discretion of the farmer who leases the land and Mr. Thandi. To reiterate, no foundations are planned for the greenhouses.

[21] http://www.richmond.ca/__shared/assets/bylaw_809418755.pdf Accessed March 2, 2016

4.4 Imported Soils

All imported soil must be suitable for agricultural land. The Agricultural Land Reserve Use Regulation (updated in 2019) states that the following must **not** be used as fill on agricultural land[22]:

1. construction or demolition waste, including masonry rubble, concrete, cement, rebar, drywall and wood waste;
2. asphalt;
3. glass;
4. synthetic polymers;
5. treated wood;
6. unchipped lumber.

Furthermore, any soil brought to the property should meet the Soil Standards for Agricultural Land (AL, Schedule 5 of Contaminated Sites Regulation of the Environmental Management Act)[23]. Contaminated soil, or soil that is suspected to be contaminated, must not be used.

The soil material should be inspected to ensure that it is acceptable for agricultural use. Reviewing existing environmental reports concerning potential contamination at the source site can aid in selecting the best soil material. Soil sourced in areas that have a history, or suspected history, of industrial or commercial use must be tested prior to transportation.

The supplier of the soil material should warrant that the source soil is free from contaminants. I recommend that Mr. Thandi signs a soil acceptance agreement with the parties responsible for supplying and transporting soils (see Appendix III). If contaminated soil material is brought onto the site, Mr. Thandi will assume liability for remediating the site and/or removing the contaminated material.

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[22] http://www.bclaws.ca/civix/document/id/complete/statreg/30_2019#part5 Agricultural Land Commission Act - AGRICULTURAL LAND RESERVE USE REGULATION. Accessed April 15, 2019

[23] http://www.bclaws.ca/civix/document/id/loo64/loo64/375_96sch5 Contaminated Sites Regulation - B.C. Reg. 375/96. Schedule 5. Accessed April 15, 2019

4.4.1 Physical Properties of Acceptable Soil Material

For this project, the sourced soil should be medium to coarse-textured, preferably sandy loam or loamy sand, to promote subsurface drainage. The coarse fragment content (2.5 cm or larger) should not exceed 10%; stones and cobbles (7.5 cm and larger) should not occupy more than 1%. These numbers correlate to a stoniness limitation of 2P, or by definition, offer only a slight hindrance to cultivation. The soil material should contain less than 15% organic matter to avoid decomposition and subsidence. Organic soils and clay-rich soils (silty clay loams, clay loams) should not be brought to the property. [unless they can be mixed with other soils to obtain a satisfactory texture?]

An agrologist can assist with reviewing source sites to confirm that the soil is suitable for agricultural land and is of the ideal texture for this specific project. Soil sampling will be required to test for contaminants (a soil cannot be verified as being contaminant-free without laboratory testing).

4.5 Constructed Soil Profile

The constructed soil profile will have approximately 40 cm of stockpiled native topsoil/peat mix at the surface, underlain by an average of 1.0 m of relatively stone-free, moderately medium to coarse textured (ideally sandy loam, loamy sand but loam is also acceptable as subsoil here) soil material that promotes good drainage. Soils with high amounts of clay should be avoided.

4.6 Erosion and Sediment Control

The following basic ESC measures are recommended for the property – a more detailed ESC plan may be prepared if the soil deposit application is approved for the property:

- Silt fencing will be required along the entire western perimeter of the proposed soil fill boundary to protect the watercourse from mobilized sediment. I recommend that a professional inspects all implemented ESC prior to any importation beginning on the property.
- Following topsoil stripping, silt fencing should be placed at the base of topsoil and peat stockpiles to prevent soil loss from the side slopes OR they should be covered with plastic or seeded with grass and/or legumes. Silt fencing, if installed, should encircle the perimeter of the stockpile entirely. Stockpiles should be sited well away from the western perimeter of the property near the watercourse; if left over winter their surfaces should be seeded or covered with a suitable erosional tarp.

- Currently, the driveway is wide with a sufficiently large parking area that is graveled. If necessary, a wheel wash may be installed as a sediment control measure at the entrance/exit of the driveway at River Road;
- To further minimize soil tracking on adjacent roads, I recommend that soil deposit activities (including prior site preparation) be shut down during periods of high rainfall, defined here as 25 mm or more in 24 hours.

5 Hydrology

Based on my observations and review of imagery and maps for the area, there are no watercourses located on the subject property. The ditch situated just outside the western property line is however treated as a watercourse and riparian management area by the City of Richmond. The property is level – I did not record slopes of more than 2% in the field. The property drains west into the watercourse along the enter perimeter of the property. After the soil is spread, it should be graded such that it slopes approximately 1% westwards towards the watercourse/ditch. This conforms to the natural topography.

In consultation with Mr. Thandi's neighbor (Dave), it is possible that a ditch could be constructed along the east side of the property to drain any water that accumulates here. If the soil is sloped west, is should not impact the property on the east (22160 River Road).

A more detailed drainage study would require retention of a qualified professional engineer, potentially with training in peat soil engineering.

6 Post-Soil Improvement to Land Capability for Agriculture

Adding soil will elevate the topography over the whole area and will improve drainage in the subsurface. If soil placement proceeds according to the proposal, I estimate that the post-soil Land Capability for Agriculture ratings will improve from Class O4W with excess water limitations to a Class 2W with only short periods of excess water. The inundation limitation posed by annual flooding from the watercourse should also be improved to Class 2W due to increased grade of the land above the watercourse.

7 Monitoring and Reporting

The terms of the soil permits may indicate that Madrone is expected to conduct inspections of the site and materials and to provide monitoring reports to the City of Richmond and the ALC.

Soil placement should be monitored at regular intervals. This project can be reasonably completed in one year (<8000 m^3 of soil) and should be scheduled between a dry period spanning ideally May to October. I anticipate that monitoring will be required during the following project milestones:

1. The start of the project, during which time the agrologist will assess the ESC and completeness of the topsoil stripping (two separated peat horizons);
2. After 2000 m^3 has been brought to the site or after three months, whichever comes first and thereafter, once the project reaches 5000 m^3; and
3. At the end of the project once 7630 m^3 is reached. A closure report will be required once the project is complete. The final report should include an assessment of the final land capability for agriculture ratings and a comparison between the initial and final land capability for agriculture (LCA) ratings. It should contain an estimate of the volume of soil placed and details about the soil source site(s).

In order to complete the closure report, I recommend that accurate and complete written or electronic records be kept of all soil brought to the site.

Records must contain, at a minimum, the location of the soil source site(s), the volume and number of loads with date and time of delivery, and the name of the trucking company.

Without this information, the closure report cannot be completed, and any security deposits with the ALC and the COR will be forfeited.

8 Conclusion

The agricultural use of the land is limited by excess free water and very poorly drained organic soils. Drainage is limited by high water tables, and limited freeboard due to high water levels to the west.

Furthermore, **irrespective of the poorly drained organic soils**, there is frequent annual inundation from the ditch situated along the western perimeter of the property. This has been documented by the property owner and has resulted in difficulties farming blueberry plants on the property. I emphasize again that improving inundation from the ditch does not solve the next most serious limitation, which is very poorly drained organic soils. Given these existing limitations, we did not conduct lab testing for acidity of the soils, which is inferred from the Soils of the Vancouver-Langley map area to be extreme. Acidity can be improved through careful liming and subsequent soil pH testing.

Placing an estimated 7,630 m^3 of good-quality soil on 0.76 ha of the property will allow Mr. Thandi and his contracted farmers to overcome the wetness and inundation limitations of the site and utilize the land for soil-bottomed greenhouse farming. According to the City of Richmond[24], blueberries are the second most grown crop in Richmond after cranberries, with 556 ha under cultivation in 2011. This accounts for 33.2% of census farms in Richmond, and 13.9% of the entire ALR. Thus Mr. Thandi's proposal to raise the land above the poorly-drained and inundated (by the west watercourse) peat soils and farm in soil-bottomed greenhouses would help him diversify both his farm and the variety of crops grown in the City of Richmond.

I recommend stripping both the upper 40 cm of black humic peat **AND** the underlying fibric to mesic peat horizon, the latter of which is variable in thickness from 40 – 130 cm. Following stripping, there will be placement of the good-quality sub-soil (loam, sandy loam ideally) over the Cg horizon, and then returning the salvaged peat (with the Om2 horizon placed before the black humic peat, which should be at the surface as per the original profile) on the new soil surface. It is important:

- To ensure no topsoil resources are lost to erosion and that topsoil quality is not degraded while it is stored.
- That imported soil does not contain any foreign material or contaminants, or excess stones. It should be continuously monitored.
- To maintain the existing vegetation (which is a natural riparian buffer) located along the bank of the watercourse situated along the entire western perimeter of the property (this is a designated RMA). The vegetation is contained within the 3 m required property line setback regardless; and

[24] https://www.richmond.ca/plandev/planning2/agriculture/about.htm About Agriculture in Richmond. Accessed April 16, 2019

- That no soil is placed in the ESA (strip of blackberry on Photo 6, to the north of the right-of-way) situated along the very southern edge of the property, which is currently overgrown with blackberry.

If my recommendations are followed, the capability of the land for agricultural use will be significantly improved, from O4W to Class 2W.

Sincerely yours,
MADRONE ENVIRONMENTAL SERVICES LTD.

Prepared by:

*This is a digitally signed duplicate of the official manually signed and sealed document.

Jessica Stewart, P.Ag., G.I.T.

Reviewed by:

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Gordon Butt, P.Geo.

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10 Limitations

The evaluations contained in this report are based on professional judgment, calculations, and experience. They are inherently imprecise. Soil, agricultural, hydrological, and drainage conditions other than those indicated above may exist on the site. If such conditions are observed, Madrone should be contacted so that this report may be reviewed and amended accordingly.

The recommendations contained in this report pertain only to the site conditions observed by Madrone at the time of the inspection. This report was prepared considering circumstances applying specifically to the client. It is intended only for internal use by the client for the purposes for which it was commissioned and for use by government agencies regulating the specific activities to which it pertains. It is not reasonable for other parties to rely on the observations or conclusions contained herein.

Madrone completed the field survey and prepared the report in a manner consistent with current provincial standards and on par or better than the level of care normally exercised by Professional Agrologist's currently practicing in the area under similar conditions and budgetary constraints. Madrone offers no other warranties, either express or implied.

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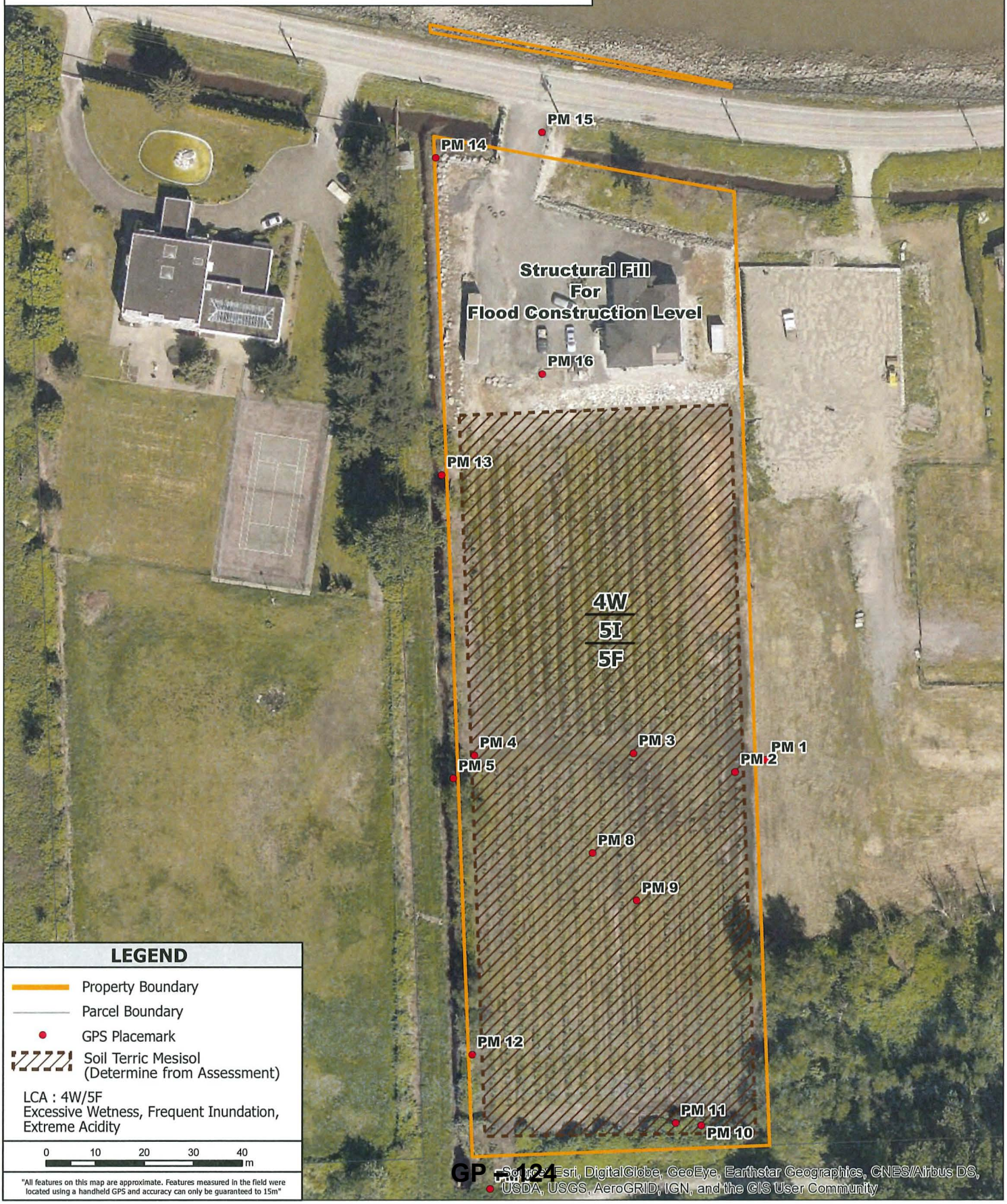
APPENDIX I

Figures and Cross-Section Drawings

FIGURE 1. OVERVIEW OF THE SUBJECT PROPERTY (OUTLINED IN ORANGE) FACING WEST. THE ORANGE OUTLINE AT THE FRASER RIVER IS INCLUDED IN THE PARCELMAP BC EXPORT BUT IS NOT BELIEVED TO BE PART OF THE PROPERTY.

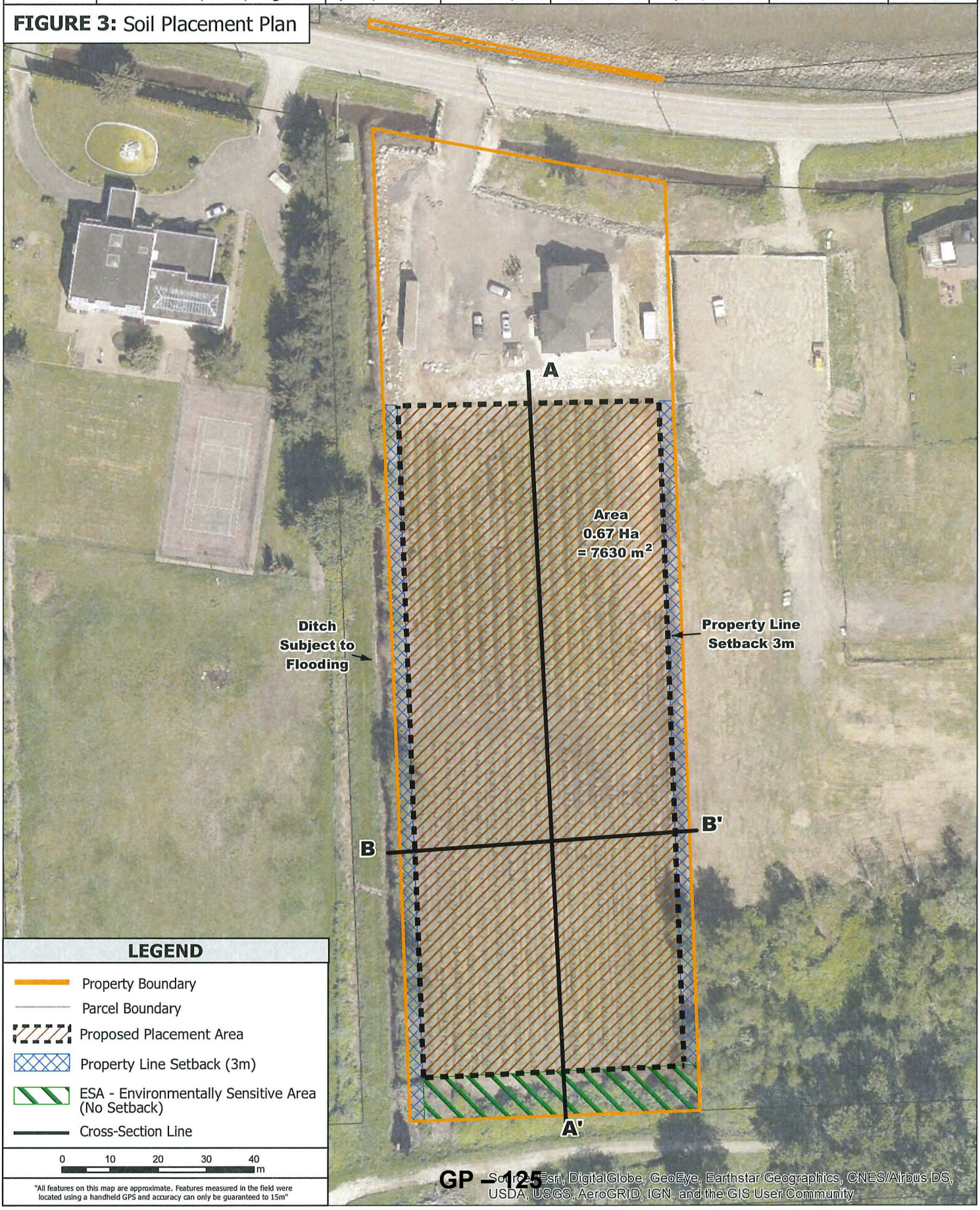
MADRONE environmental services ltd	**PROJECT:** Soil Placement Plan: 22040 River Road			**CLIENT:** Avtar Thandi		**DOSSIER:** 19.0087	N W E S
	ASSESSED BY: Jessica Stewart, G.I.T., P.Ag.	**FIELD VISIT:** April 3, 2019	**LOCATION:** Richmond, BC	**MAP SCALE:** 1:1,000	**MAPPING DATE:** May 15, 2019	**DRAWN BY:** Jessi Yellowlees	

FIGURE 2: Soils Mapping and Land Capability for Agriculture



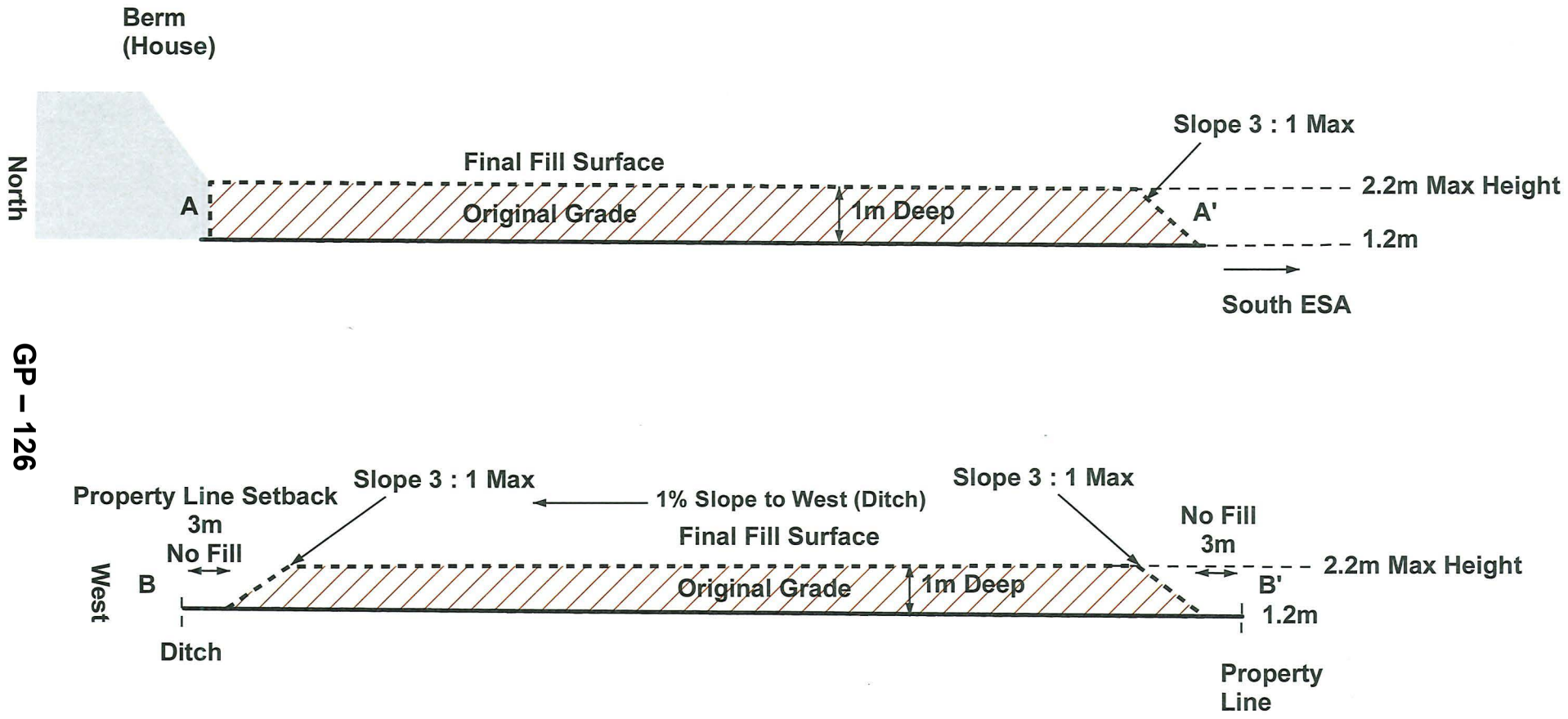
MADRONE environmental services ltd	**PROJECT:** Soil Placement Plan: 22040 River Road			**CLIENT:** Avtar Thandi		**DOSSIER:** 19.0087	N W E S
	ASSESSED BY: Jessica Stewart, G.I.T., P.Ag.	**FIELD VISIT:** April 3, 2019	**LOCATION:** Richmond, BC	**MAP SCALE:** 1:1,000	**MAPPING DATE:** July 16, 2019	**DRAWN BY:** Jessi Yellowlees	

FIGURE 3: Soil Placement Plan



MADRONE environmental services ltd	**PROJECT:** Soil Placement Plan: 22040 River Road			**CLIENT:** Avtar Thandi		**DOSSIER:** 19.0087
	ASSESSED BY: Jessica Stewart, G.I.T., P.Ag.	**FIELD VISIT:** April 3, 2019	**LOCATION:** Richmond, BC	**MAP SCALE:** 1:425	**MAPPING DATE:** July 16, 2019	**DRAWN BY:** Jessi Yellowlees

FIGURE 4: Scaled Cross-Section



LEGEND

- Berm/House
- Proposed Placement Area

0 5 10 15 20 m

"All features on this map are approximate. Features measured in the field were located using a handheld GPS and accuracy can only be guaranteed to 15m"

Cross-Section 3x Exaggeration

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APPENDIX II

Soil Pit Descriptions & Photos of Flooding

Pit 1 – Soil Profile Description (Placemark 3, Figure 2)

Horizon	Depth (cm)	Description
Oh1	0 - 40	Dark brown to black, humic (von Post class 7), plentiful fine roots, stratified.
Om2	40 - 90	Medium to light reddish brown, mesic (von Post class 5), friable to firm, plentiful fine to medium roots, weakly stratified
Cg	90 - 120+	Light blue-grey, silty clay loam, firm, no roots, no coarse fragments. Identifiable organics: sedge, woody plants remains.

Comments:

- Located in the approximate centre of the blueberry field.
- Water encountered at bottom and sides of pit (seeping in quickly) - 1.2 m deep.
- Soil classification: Terric Mesisol

Pit 2 – Soil Profile Description (Placemark 4, Figure 2)

Horizon	Depth (cm)	Description
Oh1	0 - 40	Dark brown to black, humic (von Post class 7), plentiful fine roots.
Om2	40 - 170	Medium reddish brown, fibric to mesic (von Post class 4-5), plentiful fine to medium roots, plentiful undecomposed plant material (reeds, sedges)
Cg	170 - 180+	Medium blue-grey, silty clay loam, firm, no roots, no coarse fragments. Woody plants remains.

Comments:

- Located along the centre-west property line (near the RMA/watercourse) where blueberry bushes are stunted.
- No water in this pit – there a buried drainage pipe from the blueberry field leading into the watercourse here.
- Deepest organics excavated on the property – over 1.7 m deep
- Soil classification: Terric Mesisol

Pit 3 – Soil Profile Description (Placemark 10, Figure 2)

Horizon	Depth (cm)	Description
Oh1	0 - 40	Dark brown to black, humic (von Post class 7), plentiful fine roots.
Om2	40 - 80	Medium reddish brown, fibric to mesic (von Post class 4), plentiful fine to medium roots, weakly stratified, wet.
Cg	80 - 100+	Light blue-grey to olive grey, silty clay loam, firm, no roots, no coarse fragments. Identifiable organics: sedge, woody plants remains.

Comments:

- Located in the southeast corner of the blueberry field near the ESA.
- Water encountered at bottom of pit – seeping in slowly. 1.0 m deep.
- Soil classification: Terric Mesisol

Client Photos of Flooding

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APPENDIX III

Inclusion in Soil Importation Assessment Reports

Inclusion in Soil Importation Assessment reports

For each source site, the owner/operator of the receiving site should secure a written Soil Acceptance Agreement with the parties responsible for supplying and transporting soils. The agreement should specify that:
The imported soil must not contain:

A. any contaminants in concentrations that exceed the standards in Schedule 7, Column III of the Contaminated Sites Regulation under BC's Environmental Management Act, or

B. any hazardous waste as defined in the Hazardous Waste Regulation of the Environmental Management Act,

The imported soil must not have been transported onto the donor site from another site,

The owner of the receiving site has the right to test and/or require the supplier to test for contaminants and soil texture, and to inspect the source site,

The supplier will provide *all* available site contamination reports pertaining to the imported soil and that at minimum a Preliminary Site investigation Phase 1 (or Stage 1) or Phase 2 (or Stage 2) report will be provided for any source site that is an industrial, government or large residential development,

The parties supplying/transporting soils are responsible for removing any soils and remediating any resulting contamination if the soils are found to be contaminated or if the supplier failed to supply all available site contamination reports pertaining to the imported soil, and

Any loads arriving at the site without proper documentation of the source of the soil and evidence of Soil Acceptance Agreement for the source site will be refused entry.

Entrance to the receiving site should be controlled and records should be maintained that identify the source of each load and the parties supplying/transporting the load. Consideration should be given to requiring security deposits from the suppliers/transporters.

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APPENDIX IV

Land Capability for Agriculture Overview

Land Capability for Agriculture (LCA) in BC is a classification system that groups agricultural land into classes that reflect potential and limitations to agriculture. The classes are differentiated based on soil properties, landscape, and climate conditions. The system considers the range of possible crops and the type and intensity of management practices required to maintain soil resources but it does not consider suitability of land for specific crops, crop productivity, specific management inputs or the feasibility of implementing improvements.

There are two land capability hierarchies, one for mineral soils and one for organic soils. Each hierarchy groups the land into seven classes that describe the range of suited crops and required management inputs. The range of suited crops decreases from Class 1 to Class 7 (Class O1 and O7 for Organic soils) and/or the management inputs increase from Class 1 to Class 7. For example, Class 1 lands can support the broadest range of crops with minimal management units.

Lands in Classes 1 to 4 are considered capable of sustained agricultural production of common crops. Class 5 lands are considered good for perennial forage or specially-adapted crops. Class 6 lands are good for grazing livestock and Class 7 lands are not considered capable of supporting agricultural production.

LCA Classes are subdivided into subclasses based on the degree and kind of limitation to agriculture. Subclasses indicate the type and intensity of management input required to maintain sustained agricultural production and specify the limitation. For example, lands rated Class 2W have an excess water limitation that can be improved by managing water on the site.
Most lands are rated for unimproved and improved conditions. Unimproved ratings are calculated based on site conditions at the time of the assessments, without irrigation. Past improvements are assessed as part of the unimproved rating. Forested lands are assessed assuming they are cleared. Improved ratings are assigned assuming that existing limitations have been alleviated. Generally, improvement practices taken into account are drainage, irrigation, diking, stone removal, salinity alleviation, subsoiling, intensive fertilization and adding soil amendments.

LCA Classes

Table A describes the characteristics of each mineral and organic soil class. Mineral soil classes are 1–7 and organic soil classes are O1–O7.

Table A. LCA Classes

Class	Description	Characteristics
1 01	No or very slight limitations that restrict agricultural use	Level or nearly level. Deep soils are well to imperfectly drained and hold moisture well. Managed and cropped easily. Productive.
2 02	Minor limitations that require ongoing management or slightly restrict the range of crops, or both	Require minor continuous management. Have lower crop yields or support a slightly smaller range of crops that class 1 lands. Deep soils that hold moisture well. Managed and cropped easily.
3 03	Limitations that require moderately intensive management practices or moderately restrict the range of crops, or both	More severe limitations than Class 2 land. Management practices more difficult to apply and maintain. Limitations may: Restrict choice of suitable crops. Affect timing and ease of tilling, planting or harvesting. Affect methods of soil conservation.
4 04	Limitations that require special management practices or severely restrict the range of crops, or both	May be suitable for only a few crops or may have low yield or a high risk of crop failure. Soil conditions are such that special development and management conditions are required. Limitations may: Affect timing and ease of tilling, planting or harvesting. Affect methods of soil conservation.
5 05	Limitations the restrict capability to producing perennial forage crops or other specially adapted crops (e.g. Cranberries)	Can be cultivated, provided intensive management is employed or crop is adapted to particular conditions of the land. Cultivated crops may be grown where adverse climate is the main limitation, crop failure can be expected under average conditions.
6 06	Not arable, but capable of producing native and/or uncultivated perennial forage crops	Provides sustained natural grazing for domestic livestock. Not arable in present condition. Limitations include severe climate, unsuitable terrain or poor soil. Difficult to improve, although draining, dyking and/or irrigation can remove some limitations.
7 07	No capability for arable culture or sustained natural grazing	All lands not in class 1 to 6. Includes rockland, non-soil areas, small water-bodies.

LCA Subclasses for Mineral Soil

LCA Classes, except Class 1 which has no limitations, can be divided into subclasses depending upon the type and degree of limitation to agricultural use. There are twelve LCA subclasses to describe mineral soils (Table B). Mineral soils contain less than 17% organic carbon; except for an organic surface layer (SCWG, 1998).

Table B. LCA Subclasses for Mineral Soil

LCA Subclass	Map Symbol	Description	Improvement
Soil moisture deficiency	A	Used where crops are adversely affected by droughtiness, either through insufficient precipitation or low water holding capacity of the soil.	Irrigation
Adverse climate	C	Used on a subregional or local basis, from climate maps, to indicate thermal limitations including freezing, insufficient heat units and/or extreme winter temperatures.	N/A
Undesirable soil structure and/or low perviousness	D	Used for soils that are difficult to till, requiring special management for seedbed preparation and soils with trafficability problems. Includes soils with insufficient aeration, slow perviousness or have a root restriction not caused by bedrock, permafrost or a high watertable.	Amelioration of soil texture, deep ploughing or blading to break up root restrictions. Cemented horizons cannot be improved.
Erosion	E	Includes soils on which past damage from erosion limits erosion (e.g. Gullies, lost productivity).	N/A
Fertility	F	Limited by lack of available nutrients, low cation exchange capacity or nutrient holding ability, high or low Ph, high amount of carbonates, presence of toxic elements or high fixation of plant nutrients.	Constant and careful use of fertilizers and/or other soil amendments.
Inundation	I	Includes soils where flooding damages crops or restricts agricultural use.	Diking
Salinity	N	Includes soils adversely affected by soluble salts that restrict crop growth or the range of crops.	Specific to site and soil conditions.
Stoniness	P	Applies to soils with sufficient coarse fragments, 2.5 cm diameter or larger, to significantly hinder tillage, planting and/or harvesting.	Remove cobbles and stones.
Depth to solid bedrock and/or rockiness	R	Used for soils in which bedrock near the surface restricts rooting depth and tillage and/or the presence of rock outcrops restricts agricultural use.	N/A
Topography	T	Applies to soils where topography limits agricultural use, by slope steepness and/or complexity.	N/A
Excess Water	W	Applies to soils for which excess free water limits agricultural use.	Ditching, tilling, draining.
Permafrost	Z	Applies to soils that have a cryic (permanently frozen) layer.	N/A

LCA Subclasses for Organic Soil

Organic soils are composed of organic materials such as peat and are generally saturated with water (SCWG, 1998). Subclasses for organic soils (Table C) are based on the type and degree of limitation for agricultural use an organic soil exhibits. There are three subclasses specific to organic soils. Climate (C), fertility (F), inundation (I), salinity (N), excess water (W) and permafrost (Z) limitations for organic soil are the same as defined for mineral soil.

Table C. LCA Subclasses for Organic Soil.

LCA Subclass	Map Symbol	Description	Improvement
Wood in the profile	B	Applies to organic soils that have wood within the profile	Removal
Depth of organic soil over bedrock and/or rockiness	H	Includes organic soils where the presence of bedrock near the surface restricts rooting depth or drainage and/or the presence of rock outcrops restricts agricultural use	N/A
Degree of decomposition or permeability	L	Applies to organic soils that are susceptible to organic matter decomposition through drainage	N/A

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APPENDIX V

Farmer's Letter Regarding Flooding

STAR LABOUR SUPPLY LTD.
426 E 59TH STREET , VANCOUVER, BC.
V5X-141

April 26th 2019

Thandi Enterprises 195 ltd.
127 West Balmoral Rd. North Vandcouver BC.
V7N 4M7.

Mr. A Thandi

As you are aware we are in contract in looking after the blueberry farm located at 22040 river rd Richmond BC. I must advise you that we are having a hard time maintaning the farm due the heavy flooding that has been accuring throughout our lease. We are losing berry production and the trees have been damaged and my workers and equipment gets stuck in the the farm grounds .This is not safe or financialy productive and we must find a solution to resove this problem.

your truly

Gurpal singh

220140 River Rd - Thandi

Site photos (taken 16 Nov 2021)

STAR LABOUR SUPPLY LTD.
426 E 59TH STREET , VANCOUVER, BC.
V5X-141

April 26th 2019

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your truly

Gurpal singh

McTAVISH
RESOURCE & MANAGEMENT
CONSULTANTS LTD.

#203 – 19292 60 Avenue
Surrey BC
V3S 3M2

Date: September 26, 2019

Attn: Mike Morin, City of Richmond

From: Bruce McTavish

Re: Review of Madrone report on 22040 River Road, Richmond BC

The report is complete and meets the ALC Policy 10 requirements for Agricultural Capability Assessments.

I do have the following technical concerns that should be addressed:

The report states that there will be on average 40 cm of organic soil (peat) stripped and stockpiled and then up to 1m of good quality and well draining soil deposited and 40 cm of peat replaced as topsoil. Given that the average depth of the peat is 113 cm, stripping only 40 cm will leave significant peat below the newly placed mineral soil (see diagram below). The result is a layered soil that is silty clay subsoil (Cg), Peat, Sand (or loam), topped by peat. The weight of the mineral soil will cause compression of the underlying peat and since the depths are different there will be differential settling.

The creation of the layered soil will cause a break in the soil capillarity which may result in increased soil drying in the organic (peat) topsoil.

With only 40 cm of peat as a topsoil and the increased drying due to the break in the capillarity there will be a significant increase in oxidation of the peat, resulting in subsidence (shrinkage of the topsoil). This topsoil layer could disappear very quickly leaving the fill layer to farm.

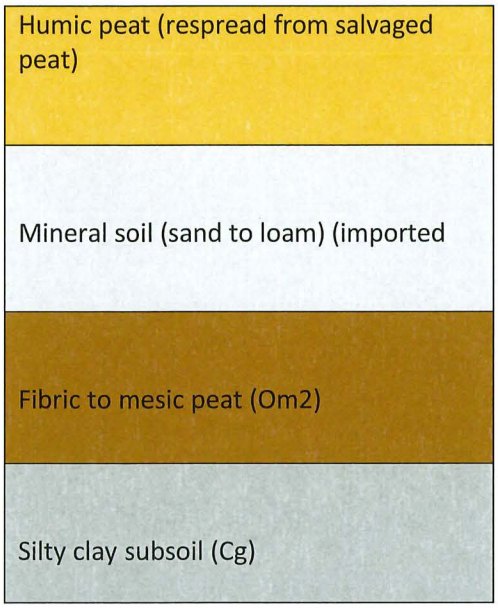

Figure 1: Proposed new soil profile

The report should address the above issues as they will have long term consequences to the ability to farm the property.

#203 – 19292 60 Avenue
Surrey BC
V3S 3M2

The following quote from page 13 does not make sense, I believe it is an editorial comment that needs to be removed.

> Based on my soil survey, I found the soil limitations to be excess water (O4W) due to very poorly drained soils. Class 4W limitations result in moderate crop damage and occasional crop loss. You may need to explain the difference between O4W and 4W

Sincerely,

Bruce McTavish, MSc MBA PAg RPBio
President | Principal Agrologist/Biologist
Mobile: 604.240.2481 **Email:** bruce@mctavishconsultants.ca

Attachment 5

McTAVISH
RESOURCE & MANAGEMENT
CONSULTANTS LTD.

#203 – 19292 60 Avenue
Surrey BC
V3S 3M2

Date: November 15, 2021

Attn: Mike Morin, City of Richmond

From: Bruce McTavish

Re: Review of Madrone report on 22040 River Road, Richmond BC 2nd Revision November 1, 2021.

I have reviewed the report dated November 1, 2021 2nd Revision. This report deals with the issues that I identified in my memo of September 26, 2019. Specifically, the proposal is now to strip all the organic soil add appropriate fill and then replace the organic soil. This will eliminate the compression of the organic soil and make it easier to manage organic soil subsidence.

The report is complete and meets the ALC Policy 10 requirements for Agricultural Capability Assessments.

Sincerely,

Bruce McTavish, MSc MBA PAg RPBio
President | Principal Agrologist/Biologist
Mobile: 604.240.2481 **Email:** bruce@mctavishconsultants.ca

GREY OWL ENGINEERING

May 15, 2021

127 Balmoral Road West
North Vancouver, BC
V7N 2T6

Attn: Avtar Thani

Re: 22040 River Road – Soil Deposit Application – Geotechnical Assessment

As requested, Grey Owl Engineering Ltd. (GOE) has carried out a geotechnical assessment for the above referenced project.

The geotechnical work included completion of this geotechnical report with comments and recommendations pertaining to settlement and stability related to the proposed soil deposit at the subject site for farming purposes.

The scope of services was limited to the evaluation of the geotechnical characteristics of the site and no consideration has been given to any environmental aspects. Should any changes be made to the proposed layout, elevations, or general nature of the project, GOE should be notified to review and modify the recommendations to reflect those changes, as appropriate.

Site Description

The proposed soil deposit site is located in the south 0.76 ha portion of the 1.2 ha property, which is situated at 22040 River Road in Richmond, BC, approximately 10 km northeast of Richmond centre on Lulu Island (Madrone See Attachment 1).

The following is understood based on the Madrone Soil Placement Plan dated July 19, 2019:

The owner of the property at 22040 River Road, proposes to import approximately 7,630 m3 of soil to depth of approximately 1 m over 0.76 ha.

The soil placement area (0.76 ha) will be used for blueberry farming.

The intent of topsoil placement is to elevate the growing area to provide adequate drainage and to introduce an organic matter amendment to the existing soils.

The owner intends to engage local companies to source and import the soil.

Site Investigation

A site investigation confirmed the description provided by Madrone in the Soil Deposit Plan.

Discussion and Recommendations

The proposed depth of soil is 1 m. The additional soil bearing pressure will not lead to any settlement or stability issues.

The placed soil described in the proposed soil deposit will have no adverse effects on the subject property or on adjacent properties. The 3m buffer proposed in the Madrone Soil Deposit Plan around the perimeter of the soil placement area is adequate to ensure no adverse consequences to adjacent areas of the subject property or to adjacent properties.

Closure

This report should be considered preliminary and is subject to review and revision as required. This report is prepared for the exclusive use of the owners of 22040 River Road, Richmind, BC and their designated representatives and may not be used by other parties without the written permission of Grey Owl Engineering Ltd. The City of Richmond may also rely on the fmdings of this report.

If during construction soil conditions are noted to be different from those described in this report, GOE Geotechnical must be notified immediately in order that the geotechnical recommendations can be confirmed or modified, if required. Further, this report assumes that field reviews will be completed by GOE Geotechnical during construction.

The site contractor should make their own assessment of subsurface conditions and select the· construction means and methods most appropriate to the site conditions. This report should not be included in the specifications without suitable qualifications approved by the geotechnical engineer.

The use of this report is subject to the Report Interpretation and Limitations, which is included with the report. The reader's attention is drawn specifically to those conditions, as it is considered essential that they be followed for proper use and interpretation of this report.

Should any questions arise, please do not hesitate to contact the undersigned.

Yours truly,
GREY OWL ENGINEERING LTD.

MAY 3 0 2021

Dr. Stephen Ramsay P.Eng.

REPORT INTERPRETATION AND LIMITATIONS

1. STANDARD OF CARE

Grey Owl Engineering Ltd. (GOE) has prepared this report in a manner consistent with generally accepted engineering consulting practices in this area, subject to the time and physical constraints applicable. No other warranty, expressed or implied, is made.

2. COMPLETENESS OF THIS REPORT

This Report represents a summary of paper, electronic and other documents, records, data and files and is not intended to stand alone without reference to the instructions given to GOE by the Client, communications between GOE and the Client, and/or to any other reports, writings, proposals or documents prepared by GOE for the Client relating to the specific site described herein.

This report is intended to be used and quoted in its entirety. Any references to this report must include the whole of the report and any appendices or supporting material. GOE cannot be responsible for use by any party of portions of this report without reference to the entire report.

3. BASIS OF THIS REPORT

This report has been prepared for the specific site, development, design objective, and purpose described to GOE by the Client or the Client's Representatives or Consultants. The applicability and reliability of any of the factual data, findings, recommendations or opinions expressed in this document pertain to a specific project at described in this report and are not applicable to any other project or site, and are valid only to the extent that there has been no material alteration to or variation from any of the descriptions provided to GOE. GOE cannot be responsible for use of this report, or portions thereof, unless we were specifically requested by the Client to review and revise the Report in light of any alterations or variations to the project description provided by the Client.

If the project does not commence within 18 months of the report date, the report may become invalid and further review may be required.

The recommendations of this report should only be used for design. The extent of exploration including number of test pits or test holes necessary to thoroughly investigate the site for conditions that may affect construction costs will generally be greater than that required for design purposes. Contractors should rely upon their own explorations and interpretation of the factual data provided for costing purposes, equipment requirements, construction techniques, or to establish project schedule.

The information provided in this report is based on limited exploration, for a specific project scope. GOE cannot accept responsibility for independent conclusions, interpretations, interpolations or decisions by

the Client or others based on information contained in this Report. This restriction of liability includes decisions made to purchase or sell land.

4. USE OF THIS REPORT

The contents of this report, including plans, data, drawings and all other documents including electronic and hard copies remain the copyright property of GOE. However, we will consider any reasonable request by the Client to approve the use of this report by other parties as "Approved Users." With regard to the duplication and distribution of this Report or its contents, we authorize only the Client and Approved Users to make copies of the Report only in such quantities as are reasonably necessary for the use of this Report by those parties. The Client and "Approved Users" may not give, lend, sell or otherwise make this Report or any portion thereof available to any other party without express written permission from GOE. Any use which a third party makes of this Report - in its entirety or portions thereof - is the sole responsibility of such third parties. GREY OWL ENGINEERING LTD. ACCEPTS NO RESPONSIBILITY FOR DAMAGES SUFFERED BY ANY PARTY RESULTING FROM THE UNAUTHORIZED USE OF THIS REPORT.

Electronic media is susceptible to unauthorized modification or unintended alteration, and the Client should not rely on electronic versions of reports or other documents. All documents should be obtained directly from GOE.

5. INTERPRETATION OF THIS REPORT

Classification and identification of soils and rock and other geological units, including groundwater conditions have been based on exploration(s) performed in accordance with the standards set out in Paragraph 1. These tasks are judgemental in nature; despite comprehensive sampling and testing programs properly performed by experienced personnel with the appropriate equipment, some conditions may elude detection. As such, all explorations involve an inherent risk that some conditions will not be detected.

Further, all documents or records summarizing such exploration will be based on assumptions of what exists between the actual points sampled at the time of the site exploration. Actual conditions may varysignificantly between the points investigated and all persons making use of such documents or records should be aware of and accept this risk.

The Client and "Approved Users" accept that subsurface conditions may change with time and this report only represents the soil conditions encountered at the time of exploration and/or review. Soil and ground water conditions may change due to construction activity on the site or on adjacent sites, and also from other causes, including climactic conditions.

The exploration and review provided in this report were for geotechnical purposes only. Environmental aspects of soil and groundwater have not been included in the exploration or review, or addressed in any other way.

The exploration and Report is based on information provided by the Client or the Client's Consultants, and conditions observed at the time of our site reconnaissance or exploration. GOE has relied in good faith upon all information provided. Accordingly, GOE cannot accept responsibility for inaccuracies, misstatements , omissions , or deficiencies in this Report resulting from misstatements, omissions , misrepresentations or fraudulent acts of persons or sources providing this information.

6. DESIGN AND CONSTRUCTION REVIEW

This report assumes that GOE will be retained to work and coordinate design and construction with other Design Professionals and the Contractor. Further, it is assumed that GOE will be retained to provide field reviews during construction to confirm adherence to building code guidelines and generally accepted engineering practices, and the recommendations provided in this report. Field services recommended for the project represent the minimum necessary to confirm that the work is being carried out in general conformance with GOE's recommendations and generally accepted engineering standards. It is the Client's or the Client's Contractor's responsibility to provide timely notice to GOE to carry out site reviews. The Client acknowledges that unsatisfactory or unsafe conditions may be missed by intermittent site reviews by GOE. Accordingly, it is the Client's or Client's Contractor's responsibility to inform GOE of any such conditions .

Work that is covered prior to review by GOE may have to be re-exposed at considerable cost to the Client. Review of all Geotechnical aspects of the project are required for submittal of unconditional Letters of Assurance to regulatory authorities. The site reviews are not carried out for the benefit of the Contractor(s) and therefore do not in any way effect the Contractor(s) obligations to perform under the terms of his/her Contract.

7. SAMPLE DISPOSAL

GOE will dispose of all samples 3 months after issuance of this report, or after a longer period of time at the Client's expense if requested by the Client. All contaminated samples remain the property of the Client and it will be the Client's responsibility to dispose of them properly.

8. SUBCONSULTANTS AND CONTRACTORS

Engineering studies frequently requires hiring the services of individuals and companies with special expertise and/or services which GOE Geotechnical Ltd. does not provide. These services are arranged as a convenience to our Clients, for the Client's benefit. Accordingly, the Client agrees to hold the Company harmless and to indemnify and defend GOE Geotechnical Ltd. from and against all claims arising through

such Subconsultants or Contractors as though the Client had retained those services directly. This includes responsibility for payment of services rendered and the pursuit of damages for errors, omissions or negligence by those parties in carrying out their work. These conditions apply to specialized subconsultants and the use of drilling, excavation and laboratory testing services, and any other Subconsultant or Contractor.

9. SITE SAFETY

GOE assumes responsibility for site safety solely for the activities of our employees on the jobsite. The Client or any Contractors on the site will be responsible for their own personnel. The Client or his representatives, Contractors or others retain control of the site. It is the Client's or the Client's Contractors responsibility to inform GOE of conditions pertaining to the safety and security of the site - hazardous or otherwise- of which the Client or Contractor is aware.

Exploration or construction activities could uncover previously unknown hazardous conditions, materials, or substances that may result in the necessity to undertake emergency procedures to protect workers, the public or the environment. Additional work may be required that is outside of any previously established budget(s). The Client agrees to reimburse GOE for fees and expenses resulting from such discoveries. The Client acknowledges that some discoveries require that certain regulatory bodies be informed. The Client agrees that notification to such bodies by GOE Geotechnical Ltd. will not be a cause for either action or dispute.