City of Richmond

Report to Committee

To:	General Purposes Committee	**Date:**	October 5, 2021
From:	Mark Corrado Manager, Community Safety Policy and Programs	**File:**	12-8080-12-01/Vol 01
Re:	**Soil Use for the Placement of Fill Application for the Property PID: 005-480-663 (17260 Block of River Road - Sahota)**		

Staff Recommendation

That the 'Soil Use for the Placement of Fill' application, submitted by Harinder (Harry) Sahota (the "Applicant"), proposing to deposit soil for the purpose of developing a garlic farm on the property identified as PID: 005-480-663, located south of 17260 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.

Cecilia Achiam
General Manager, Community Safety
(604-276-4122)

Att. 6

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

6758919

Staff Report

Origin

The City of Richmond has received a 'Soil Use for the Placement of Fill' application for the property identified as PID: 005-480-663 (the "Property") which is located south of 17260 River Road. The Property and 17260 River Road, which are both owned by the Owner, are bisected by a City-owned "right-of-way" i.e. unimproved road allowance (the "Allowance"). The Applicant is proposing to import and deposit 12,000 cubic metres of soil to improve the agricultural capability of the Property to produce garlic.

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

Should the applicant's 'Soil Use for the Placement of Fill' application be approved by Council and the ALC, the Applicant would be required to obtain a licensing agreement with the City to utilize the Allowance.

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 *ALCA* and Regulations and the City's Official Community Plan and Zoning Bylaw. The Applicant is proposing to deposit 12,000 cubic metres of soil over the majority of the 1.22 ha 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 to create a garlic farm.

Uses on Adjacent Lots

- To the North: ALR – Land is not in agricultural production
- To the East: ALR – Land is not in agricultural production
- To the South: ALR – Canadian National Railway
- To the West: ALR – Land is not in agricultural production

Table 1: Existing Information and Proposed Changes for the Property

Item	**Existing**
Owner	Sahota Holdings Ltd.
Applicant	Harinder (Harry) Sahota (the "Applicant")
Qualified Agrologists (the "Agrologists")	Daniel Lamhonwah, PhD, MES, P. Ag. (Madrone Environmental Services Ltd.) Jessica Stewart, P.Ag., P.Geo (Madrone Environmental Services Ltd.)
Lot Size	1.22 hectares (3.02 acres)
Current Land Uses	The Property is not currently being farmed
Proposed Land Uses	The Applicant intends to farm 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; no disturbance proposed
Environmental Sensitive Area (ESA)	Yes

Project Overview

The Applicant, who has owned the Property since 2008, is applying to deposit 12,000 cubic metres of soil over the entirety of the Property minus setback requirements at an average depth of 1.0m. The objective is to improve the agricultural capability of the Property from its current Class 4W (with excess water limitations) to a 2W classification to allow for the development of a garlic farm. The Agrologists have stated the proposed soil type to be imported (sandy loam, loamy sand) will ensure the Applicant can grow garlic post-project completion. In addition, 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.

The Applicant has advised that the project will take two years to complete. The timeline for completion is heavily dependent on ensuring the appropriate soil as, recommended by the Agrologists, 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.

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;
- Following completion of the project and implementation of the Farm Plan under the guidance of a qualified agrologist, the Applicant will start farming lands not currently under production thus supporting initiatives as described within the City's Food Charter; and
- The proposal to raise the Property to improve the agricultural viability is consistent with the City's current Flood Protection Management Strategy (FPMS) 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 September 28, 2021. The FSAAC unanimously supported the proposal passing a motion with the following condition:

> *That the Food Security and Agricultural Advisory Committee (FSAAC) support the Agricultural Land Reserve Soil Use for the Placement of Fill Application at PID 005-480-663 (CD 93639) subject to the City retaining a portion ($40,000) of the security deposit associated with the application to ensure the farm plan is implemented within a year of the project completion.*

Agricultural Considerations

The Applicant retained Jessica Stewart, P.Ag., P.Geo to review and assess the Property and prepare recommendations to improve the growing conditions on the Property in addition to preparing a farm plan that addresses the Applicant's desire to grow garlic post-project completion. The Agrologists have provided a Soil Placement Plan (Attachment 1) and a Summary Report (Attachment 2) which includes a farm plan.

The Soil Placement Plan (the "Placement Plan") has addressed the current soil conditions on the Property. The Agrologists have concluded that the Property has a class 4W limitation. As per the Land Capability Classification for Agriculture in British Columbia manual, a Class 4W property 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."

The Agrologists have stated "that the placement of soil will raise the growing medium above the water tables and would be a **permanent solution** to improve the agricultural limitations of the [Property]." Furthermore, it is the opinion of the Agrologists that pumping may not be an appropriate solution given the surrounding area and would be "costly and may not be reliable" for the Applicant to implement.

As noted in the Placement Plan, the Applicant intends to strip/excavate the native topsoil/peat and stockpile on the Property prior to soil importation. Following completion of importation, the peat/topsoil will be placed on top of the imported soil. The primary motivator in conserving the native topsoil/peat is to ensure conservation of the "good-quality topsoil."

The Summary Report provided by the Agrologists both encapsulates the overall soil deposit proposal and provides a framework of the Applicant's intensions to grow garlic following completion of the project. The Summary Report is in line with the City's Farm Plan requirements.

In addition to the aforesaid reports, the Agrologists have provided a memorandum (Attachment 3) identifying areas within the Lower Mainland in which the agriculturally-suitable soil may be sourced. As per the memorandum, the Agrologists have identified that agriculturally-suitable soil required to complete the proposal may be sourced from Richmond (first priority of the Applicant), Delta, South Vancouver, South Burnaby, and the UBC Endowment Lands. Analysis to determine suitable source locations was undertaken by the Agrologists utilizing the BC Soil Information Tool which provides access to soil survey data, reports and maps and is hosted by the provincial government.

Bruce McTavish (MSc, MBA, PAg, RPBio), an independent qualified agrologist representing the City, has reviewed the proposal (Attachment 4) from an agricultural perspective on behalf of the City and has not provided any concerns regarding the proposal or current land capability assessment by the Agrologists.

Mr. McTavish's review substantiates the conclusions of the Agrologists that the Property has a land capability of 4W. In addition, Mr. McTavish "supports [their] conclusion that the wetness is likely exacerbated by land raising on adjacent properties." Lastly, Mr. McTavish has confirmed 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 Agrologists and have concluded that the reports satisfy the City's requirements.

Drainage & Geotechnical Considerations

The Applicant has provided the City a Drainage Plan (Attachment 5) and a Geotechnical Investigation report (Attachment 6).

The Geotechnical Report, provided by Geopacific Consultants Ltd., has concluded that implementation of the Placement Plan, which includes excavation of the native peat and replacement with structural fill (i.e. soil) with a grade reinstatement of 1.0m will not negatively impact neighbouring lands or City infrastructure. As noted above, soil placement will follow the stripping and stockpiling of the excavated native topsoil/peat which will then be placed over top of the imported soil.

As noted in the Placement Plan, the Applicant owns two properties that are separated by an Allowance. The Applicant will be required to obtain a licencing agreement with the City to utilize the Allowance to access the Property and direct runoff to the City drainage system on River Road. Completion of a licencing agreement will be required prior to issuance of a soil deposit permit should the proposal receive approval. Additional drainage and geotechnical information may be required by staff to facilitate a potential licensing agreement.

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

Environmental Considerations

The Property is designated as an Environmentally Sensitive Area; however, the Property is within the ALR. As per City requirements, the Applicant will be required to obtain an ESA DP exemption.

The Applicant is exempt from obtaining a tree removal permit for the Property.

Should the City and ALC provide approval, the City's soil deposit permit (the "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). Should it be deemed necessary, City staff will require that erosion and sediment control measures be installed and inspected by a QEP.

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 (the "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 (the "Source Site") to the End Site in order to reduce significant costs. Although End Site owners derive income due to tipping fees, soil deposit projects are not without significant costs to the Permit holder.

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, and final reporting expenses. It is estimated by the Applicant that site preparation costs will be "approximately $30,000 to $40,000."

In addition, should Consolidated Fees Bylaw No. 8636, Amendment 10283 be adopted by Council, the City will require payment from the Applicant of a non-refundable volume fee in the range of $12,000 to $24,000.

Please refer to Attachment 2 for an outline of potential costs to the Applicant to complete the project, conduct farming operations and projected income through the sale of garlic.

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 an qualified agrologist;
- Source site inspection requirements;
- On-site 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 (further explained below).

Qualified Professional reporting requirements are intended to be similar to the requirements for the Sixwest Holdings soil deposit project located on Westminster Highway. 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;
- Regular monthly on-site meetings with the site supervisor;
- 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 soil deposit project receive approval, the City will require that the Applicant provide as per the Soil Bylaw, a security deposit in the amount of $60,000 ($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.

The Applicant has been advised that a portion of the security deposit in the amount of $40,000 will be withheld until implementation of the Farm Plan has been confirmed by the agrologist-of-record as completed.

In addition to the security bond 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:

- $60,000 – 23,673$m^3$ (Gosal - approved Oct 2020)
- $70,000 – 17,500$m^3$ (Athwal - approved May 2020)
- $160,000 – 48,000$m^3$ (City of Richmond - approved June 2017)
- $290,000 – 140,000$m^3$ (Sixwest Holdings - approved Jan 2017)
- $500,000 – 102,080$m^3$ (Sunshine Cranberry Farms - approved Jan 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 and the revised Consolidated Fees Bylaw No. 8636, Amendment 10283 be adopted, the project will generate revenue for the City of between $12,000 and $24,000.

Conclusion

Staff recommends that the soil deposit application for the Property identified as PID: 005-480-663, located south of 17260 River Road, be authorized for referral to the ALC and 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.

Mike Morin
Soil Bylaw Officer, Community Bylaws
(604-204-8625)

Mark Corrado
Manager, Community Safety Policy and Programs
(604-204-8673)

MC: mm

Att. 1: Soil Placement Plan - Madrone (22 July 2020)
2: Summary Report - Madrone (17 July 2020)
3: Memorandum re. Locations of Suitable Soils - Madrone (01 Nov 2021)
4: McTavish Memo (21 Apr 2020)
5: Drainage Plan - GeoPacific (rev. 29 June 2021)
6: Preliminary Geotechnical Investigation Report - GeoPacific (12 Feb 2021)

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SOIL PLACEMENT PLAN

PID: 005-480-663
River Road
Richmond, BC

FOR:

Mr. Harinder Sahota
5547 S.E. Marine Drive
Burnaby, B.C., V5J 3G7

BY:

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

July 22, 2021

MADRONE ENVIRONMENTAL SERVICES LTD.
202-2790 GLADWIN ROAD • ABBOTSFORD • BC • V2T 4S7
TEL 604.504.1972 • FAX 604.504.1912 • WWW.MADRONE.CA

DOSSIER: 19.0469

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SOIL PLACEMENT PLAN

PID: 005-480-663
River Road
Richmond, BC

1 Introduction

Madrone Environmental Services Ltd. (Madrone) was retained by Mr. Harinder Sahota to prepare a soil placement plan for his property located just south of River Road in the City of Richmond. Mr. Sahota owns two properties – one small 0.34 ha parcel is accessed via River Road and has a civic address of 17260 River Road (PID: 004-905-88). It is referred to in this report by its 'civic address'. This property has a single residence in the northwest corner at River Road.

The proposed soil placement project pertains **only**[1] to the second property that Mr. Sahota owns to the immediate south 17260 River Road, which has a separate property identification number but no civic address (PID: 005-480-663). It is referred to in this report as "the Property" and "the Site" . The properties are bisected by a "city road dedication"; according to Mr. Sahota, this was a planned road that was ultimately not built.

This soil placement plan and soil deposit application ('Schedule B') will be submitted to the City of Richmond (COR) and the Agricultural Land Commission (ALC) for consideration. According to B.C. Assessment data[2], the Property is 1.39 hectares (3.44 acres). It is zoned

[1] There are no plans to improve the gravel driveway access that crosses the City road dedication and provides access to the no-frontage property from 17260 River Road.

[2] https://www.bcassessment.ca/Property/Info/QTAwMDA1VzdDRQ== B.C. Assessment property data. Accessed January 13, 2020

Agricultural (AG-1), and lies within the Agricultural Land Reserve (ALR). Mr. Sahota's other property at 17260 River Road is also in the ALR.

The primary limitation of the land for soil-based agriculture is poor drainage. There is a uniform class 4W limitation. The property, which was formerly part of a large bog containing forest and standing water, experiences excess water during the winter months late into spring, and after prolonged precipitation events during the growing season. The peat soils are shallow and limit water movement. There is a firm, slowly pervious mineral horizon situated below the peat. Mottling in that mineral horizon indicates fluctuating water tables.

Furthermore, the property is located on the Fraser River floodplain. Due to the River Road dyke (which is part of the North Dyke), it is however, not subject to annual inundation by the Fraser River freshet. The significance of the floodplain designation is that the Property is low-lying with little elevation differences between surrounding drainage ditches.

The placement of underdrains or drain tiles may result in a limited improvement. There is only one ditch bordering the property that is situated to the south of the site at similar elevation, therefore, the Site lacks freeboard.

Subsurface drainage[3] does not function when the water level in the receiving drainage ditch (which in this case, is to the south) is higher than the drainage tile. Pumping water out of the property would require assurance that the ditch to the south can accommodate the volume of new water without impact to the railway or surrounding property owners. It would also entail running discharge pumps – these are costly and may not be reliable, which may result in losses to the farmer should they fail during a period of crop production.

I have proposed that the placement of soil will raise the growing medium above the water tables and would be a **permanent solution** to improve the agricultural limitations of the site.

Mr. Sahota has not farmed the property but intends to cultivate vegetables in an open field following soil placement (he originally planned greenhouses but these are not allowed by CoR engineering on a 'backland' property lacking frontage and dedicated road access). The land will be leased to a farmer to undertake this agricultural operation. **Essentially, Mr.**

[3] A formerly used term for this is 'drainage tile'. The ALC uses the term drainage tile frequently. These are perforated pipes or 'PVC' placed under the surface – the exact spacing is subject to the soil texture and local drainage.

Sahota wishes for his land to be used for some form of agricultural production rather than lying vacant and unused.

He wishes to overcome the existing agricultural limitations and raise the surface level by an average[4] of 1.0 m by placing well-draining, sandy soil (screened by a P.Ag. for textural suitability and agricultural suitability[5] prior to importation) on the property. The total volume for this proposed project is 12,000 m^3, covering approximately 1.39 ha (the entirety of the property). Again, this pertains only to the PID: 005-480-663 property and not the 17260 property or right-of-way.

2 Physical Setting and Proposed Development

2.1 Location, Municipal Zoning & Development

The Property subject to this proposed development is situated approximately 8.1 km northeast of downtown Richmond (**Figure 1**). The property is bound to the east and west by residential lots (agricultural) and to the south by the Canadian National railway line.

It is bound to the north by a right-of-way that I understand was to be a built road. It is not identified as a utility right-of-way or as an "undeveloped street" on the City of Richmond Interactive Map program[6]. This right-of-way separates the Property from 17260 River Road (not physically but as a legal boundary). There are no field markings (i.e. fence, stakes) that indicate this right-of-way exists. The driveway built from River Road runs through this feature to access the Property that is intended to be developed under this proposal.

[4] The average elevation of the property is approximately 0.9 m, however site elevations range from 0.77 m to 1.29 m. The elevations are from a topographic survey recently completed for the Site.

[5] Contains no prohibited materials or excess coarse fragments, and is not overly sandy or clay rich.

[6] https://maps.richmond.ca/rim/ Richmond Interactive Map. Accessed January 13, 2020

FIGURE 1: OVERVIEW OF THE PROPERTY (ORANGE OUTLINE) AND 17260 RIVER ROAD (PINK OUTLINE). THE RIGHT-OF-WAY FEATURE SEPARATING THE LOTS IS INDICATED (NOT PART OF EITHER PROPERTY). THE PARCEL BOUNDARIES ARE FROM IMAPBC, WHICH IS A PROVINCIAL GEODATABASE.

The 17260 River Road property is situated on the south side of the Fraser River on River Road, which is also a dyke constructed by the City of Richmond to protect from Fraser River flooding.

The legal description, zoning, and size of both properties owned by Mr. Sahota are summarized in Table 1 below.

Air photo analysis allows us to observe changes in the landscape over time, as well as find features that may not be clearly visible during field assessments. However, short-term events such as flooding are not always captured in air photos; we can only see them when the damage is extensive and long-lasting.

TABLE 2: HISTORICAL AIRPHOTO REVIEW

Year	Photo Number	Observations & Interpretations of Property and Surrounding Area
1938	A5872-90	Single, old, black and white airphoto. Very grainy image, difficult to see subject property detail but CP railway has been constructed. River Road established. To the south of the railway, the wet peat bog is nearly completely undeveloped. There are standing pools of water throughout the bog. There is no house on the property. Property and adjoining lots appear to be cultivated fields at River Road but are undeveloped on the north side of the CP railway (bog) – this at present day, is the approximate southern half of these lots. Mayland Farms Ltd. at No. 7 exists by this time – appears to be planted rows and a long barn (possibly dairy cows).
1949	BC786-75, -76	Extensive post-war development of bog. There are visible field rows throughout the area, particularly along No. 7 and No. 8 roads. The bog hasn't been developed between the farms that front these roads (south of the CP railway). There appears to be a house on the 17260 Road property near the present-day location. Nearly the entire property area subject to soil placement is wet, with visible standing water, particularly in the southwest corner (topographic low based on the information in the supplied topographic survey). There is what appears to be either a road or a drainage canal between the CP Railway and a farm at No. 7 Road. Difficult to tell but appears to be drainage-related.
1951	S70-RI-24, -25	There is a house in the present-day location of 17260 River Road, as well as two structures at the southwest corner of the 17260 property. The land appears to be joined with what is now a separate property to the east. There is field grain or forage crop on the property where it meets River Road. The Property (subject to soil placement proposal) is visibly wet, with standing water along the southern half. A body of water appears to connect to the adjacent property to the west (see also, Photo 1, below). There are scattered trees in the wet area. It is not used for farming. The bog is undeveloped south of the railway and between farms along No. 7 and No. 8 roads. There is standing water throughout.

Year	Photo Number	Observations & Interpretations of Property and Surrounding Area
1955	BC1870-15	Single, black and white photo. Farming development has moved into the bog from both No. 7 and No. 8 roads. Trees have been cleared in the southern limit of the property (there are still some remaining) – the adjacent property to the west is wet but the property itself appears quite dry. This photo may have been taken during the summer months. Discrete standing water throughout the bog to the south of the railway visible. 17260 used for field crop (perhaps hay).
1963	BC5063-16, -17	Trees completely removed from the property. There is standing water in the southern portion of the property visible. The 17260 property and the subject property form one field – appears to be cultivated for hay. Substantial development of the bog to the south of the railway. Development of cranberry farms. Field rows present.
1969	BC5321-073, -74	Photo taken March 12, 1969. No change from 1963 photo. Property is completely cleared. There is standing water throughout the proposed soil placement area. This water connects to the water to the west – the southern half of these properties towards the railway are completely undeveloped.
1973	BC5525-131, -132	Photo taken April 30, 1973. Approximately 2/3rds of the property is visibly wet with standing water and shrubs in the photo – the northern 1/3rd is drier. The 17260 River Road property has a wet swale through the centre and towards the northwest corner where the house is. The neighboring properties to the west are forested towards their southern extent at the railway.
1982	BCC324-208, -209	First colour airphoto available. There are numerous cranberry and blueberry farms in the surrounding area. Approximately 2/3rds of the property is now covered in small trees and shrubs. The 17260 property and right of way are covered in grass (completely deforested) but do not appear to be cultivated. There are no farm rows. There may be hay/forage. This photo is taken during the fall as the cranberry wet harvest is clearly visible. No apparent wetness on the property. The ditch along River Road is full of water. There may be water in the vegetated area on the property but it is not visible. This is upland bog forest.
1986	30BC86039-021, -22	Photo taken July 6, 1986. The 17260 property appears to have a plowed field. There is no agriculture in the right of way or on the subject Property. Similar to 1982, the property is forested and has shrubs. It appears quite dry – this photo is taken during the summer. The ditch between the property and the railway does have visible water.
1991	FF9131-106	Colour photograph taken September 18, 1991. The quality is good but the scale is quite small (1:24,000). There are no significant changes to the site since 1986. The property is still covered in upland forest and shrubs. Only the northern part of the property near the right of way is clear of vegetation. No apparent agricultural activity at 17260 Road. There may be hay grown in the field as it is kept continuously clear of vegetation but detail is difficult to see.
1997	FFCVCR9700L-5-145, -146	Colour photograph taken September 22, 1997. As for 1991 – increasing density of upland forest on the property. The bog to the south of the railway is now completely developed into farmland. Of significant note – the property to the west of the Site is cleared and there appears to be soil deposition and earthworks underway. All trees have been removed.

Year	Photo Number	Observations & Interpretations of Property and Surrounding Area
2004	SRS6929-5	Photo taken April 2, 2004. Neighbour to the west – vegetation has grown over placed soil. There is no apparent agriculture underway (field rows, trees, crops, greenhouses ect). There are no structures on this particular site. The subject property is forested – only the northern 1/3rd and the right of way are cleared. It appears that the 17260 field has been under hay or other forage production. The field is gold/brown as for a pasture – there are no shrubs or trees.
2016	BCD16408-378, -379	Black and white photo. Relatively large scale (small area) – good detail of the property. The forest/shrubs have expanded northwards into the right-of-way. The field at 17260 is also overgrown. There are larger trees growing at River Road along the ditch. There is no agricultural use apparent. The surrounding properties fronting River also do not have apparent agriculture such as fields/crops. There may be small hobby uses that are not visible such as chickens (eggs) ect.

PHOTO 1: AIRPHOTO FROM 1951 OF THE SUBJECT PROPERTY (INCLUDING 17260 RIVER ROAD).
There is a body of standing water along the southern property line of the proposed placement area. This merges with water to the west. This is a peat bog that formerly merged with the peat bog to the south. The peat bog to the south of the railway is undeveloped (there are farms on the perimeter of No. 7 (west) and No. 8 (east) Roads. The 17260 river road property and the right-of-way appears to be a pasture (forage, hay crop).

2.3 Current Land Use – Property and Surrounding Area

The property was cleared of the majority of its trees in 2019. As mentioned above, there is a single residence on the 17260 property that was re-built following a fire. Otherwise, there are no other land uses. Neither property is farmed.

Mr. Sahota recently (also in 2019) replaced the driveway crossing (that spans the large ditch on the south side of River Road) that was in the northwest corner of 17260 River Road with a new crossing that is approximately 40 m east-southeast. The old crossing was removed. There is a new gravel driveway that runs from the new crossing, through 17260 river Road, through the right-of-way, and terminates at the southwest corner of the Property subject to development. There are **no** plans to improve this driveway (e.g. pave, add more gravel, widen).

PHOTO 2: THE RESIDENCE ON THE WEST END OF 17260 RIVER ROAD, ORIGINALLY CONSTRUCTED IN 1950 BUT RECONSTRUCTED FOLLOWING A FIRE. NOTE FLOODED CONDITIONS. THIS PHOTOGRAPH WAS TAKEN IN EARLY JANUARY.

PHOTO 3: NEW GRAVEL DRIVEWAY (AND CROSSING IN BACKGROUND TO THE CENTRE) THAT CONNECTS THE PROPERTY TO RIVER ROAD. THE DRIVEWAY HAS BEEN BUILT ABOVE THE NATURAL GRADE BY UP TO 0.5 M ACCORDING TO THE LAND SURVEY.

The surrounding area has a mix of land uses, including dense residential, industrial (railways, shipyards, sawmills, timber transport and storage, trucking), and agricultural. The nearest agricultural operations are predominantly cranberry farms. There are also poultry farmers (chickens, eggs), vegetable farms (and retail), dairy, and forage and grain crops. The CN Railway runs along the southern perimeter of the property. To the east and west, there are small residential lots that are in the ALR but do not appear to be used for agriculture.

According to the property report available on the Richmond Interactive Map, the "City of Richmond has applied on behalf of the property owners for the block exclusion of 16360 to 17360 River Road from the Agricultural Land Reserve". This is indicated as approved on the property report. The exact wording is: "Development Applications, 2000 084994 000 00 AG (Approved)." I noted that the property report still states it is in the ALR; however, this may have been done in advance of constructing the road through the right-of-way (the road was ultimately not built).

2.4 Climate

Mr. Sahota's property is situated approximately 5.3 km northeast of Richmond Nature Park[8], 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[9], 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.

2.5 Landscape and Topography

The property is situated on the Fraser River floodplain. I reviewed the City of Richmond "Flood plain designation and protection Bylaw No. 8204[10]" maps and found that the Property is designated as floodplain by the CoR. The Flood Construction Level (FCL) is defined by Engineers and Geoscientist British Columbia (EGBC) in the Professional Practice Guidelines[11] as:

> *"...the Design Flood level plus an allowance for Freeboard. In BC, the standard Design Flood for flood protection purposes is the flood with a 0.5% chance of being exceeded in any given year (the 200-year flood). Some local jurisdictions may specify a different (typically more conservative) Design Flood condition. Examples of this include the Fraser River, where the Design Flood is the 1894 flood of record, and other areas where geohazards (debris flows or*

[8] http://climate.weather.gc.ca/climate_normals/index_e.html Richmond Nature Park climate station. Accessed January 13, 2020

[9] This is the highest daily average temperature in Canada.

[10] https://www.richmond.ca/__shared/assets/Bylaw_8204_0410201225280.pdf City of Richmond "Flood plain designation and protection Bylaw No. 8204. Accessed January 13, 2020

[11] https://www.egbc.ca/getmedia/f5c2d7e9-26ad-4cb3-b528-940b3aaa9069/Legislated-Flood-Assessments-in-BC.pdf Legislated Flood Assessments In A Changing Climate In Bc. August 2018. Engineers and Geoscientists British Columbia. Accessed January 13, 2020

debris floods) coexist with clear-water Flood Hazards. The minimum allowance for Freeboard is typically 0.3 m above the instantaneous Design Flood level or 0.6 m above the daily average Design Flood level, whichever results in the higher FCL. However, for many BC rivers, Freeboard has been set higher than these minimum values to account for sediment deposition, debris jams, and other factors. Where the Design Flood level cannot be determined or cannot be reasonably used to set flood protection standards, an assessed height above the natural boundary of the water body or above the natural ground elevation may be used."

The FCL (for structures) for both properties is 3.1m Geodetic Survey of Canada (GSC) [12]. River Road is a standard dyke constructed by the CoR – it is part of the North Dyke. The elevation of the dyke in the property area is unknown but is presumed to be over 3 m according to the City of Richmond River and Freeboard Levels Map.[13] The Dyke elevation is 3.23 m at Bath Slough (which is approximately 3.4 km downstream to the west) and 3.77 m at Queensborough (which is approximately 7.4 km downstream to the east) [14].

A preliminary geotechnical investigation was undertaken by Geopacific consulting engineers (Geopacific) in August of 2019. The report has been supplied to Madrone. The investigation included five test holes dug by auger. All five holes were advanced to a depth of 9.1 m below ground surface (bgs). The test hole logs show that there is approximately 0.6 m of "topsoil", followed by peat to a depth of between 1.5 m and 2.1 m bgs. Below the peat, there is a silt that extends to 7 to 7.6 m bgs. This is underlain by compact sand. The water table (in late August, the driest time of the year typically for Richmond) was recorded at 1.0 to 1.2 m.

Mr. Sahota had a topographic survey commissioned by Target Land Surveying for the Property (excluding 17260 River Road) in December of 2019 (**Figure 2**). The land survey shows that elevations on the Property range from a low of 0.77 m Geodetic at the centre-west property line) to 1.29 m at the centre-south property line. The total elevation difference over the Property is therefore 0.52 m.

According to the topographic survey, the gravel driveway sits higher than the surrounding land – elevations of the driveway approach 1.52 m at the northeast property line. As

[12] http://maps.richmond.ca/rim/ City of Richmond Interactive Map Program – Flood Construction Levels. Accessed January 13, 2020

[13] https://www.richmond.ca/scadamaps/riverlevelmap.jpg River Level Map. City of Richmond. Accessed January 13, 2020

[14] https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/integrated-flood-hazard-mgmt/as-built-dike-drawings-and-reports/dike-inventory/richmond_3.pdf Richmond Dyke Drawings. Accessed January 13, 2020

mentioned, the gravel driveway runs from the entrance at 17260 River Road through the right-of-way and into the Property. It is less than one year old and may be subject to settlement due to the compression of the underlying peat.

The surficial geology of this area was mapped by Armstrong (1980) as post-glacial Salish Sediments, specifically, lowland peat up to 8 m thick overlying Fraser River deposits (overbank sandy to silt loam up to 2 m thick overlying 15 m or more of channel fill or tidal flat deposits).

According to the City of Richmond Interactive Map program, the entirety of the Property is designated as an Environmentally-Sensitive Area (ESA), specifically, Upland Forest[15]. The property has been cleared of forest in 2019; there is a small group of trees clustered at the centre of the south property line and along the east and western property lines (south and east property lines are fenced). The felled trees and branches (wood waste) have been stockpiled on the property but have not been removed or burned at this time.

2.6 Hydrology

Based on my observations and review of imagery and maps for the area, there are no watercourses located on the subject property. A review of GeoBC data also does not return any watercourses for the subject property.

In the 1951 airphotos, I observed what observed to be a connected waterbody (ponded water) between the Property and the neighbouring property to the west. This connectivity no longer exists – the west property was filled with soil sometime after 1991 and by 1997. Essentially, the property was cut off from the larger bog to the south by the construction of the CN railway.
Currently, there is only one ditch bordering the Property to the south, between the property line (fenced) and the CN railway. As the ditch is on what appears to be the CN railway property (right of way), I did not bypass the fence to inspect this ditch (as this is private CN railway property) but recorded observations from a distance. The ditch appears to be at least 1 to 1.5 m wide and contained water however, I could not verify the depth from a distance.

[15] http://rim.richmond.ca/rim/docs/ESAdefinitions.pdf City of Richmond ESA Definitions. Accessed January 13, 2020

2.7 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[16] in the 1980's for the Ministry of Environment. 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 III.

Soil surveys show that approximately two-thirds of the property is mapped as the Blundell (60%) and Delta (40%) soil series. The remaining southern one-third of the property is mapped as the Lulu, Richmond, and Lumbum soil series. The properties of the mapped soils are summarized in Table 3, below.

[16] 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.
January 13, 2020

TABLE 3: SUMMARY OF MAPPED (PRE-ASSESSMENT) SOIL PROPERTIES

Soil Series	Parent Material	Texture	Drainage	Classification
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
Delta	Medium to moderately fine-textured deltaic deposits	Silt loam or silty clay loam grading to silty clay loam or silty clay. Saline conditions present.	Poor; high groundwater table	Orthic Humic Gleysol
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
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
Lumbum	Deep, partially-decomposed, organi c deposits at least 160 cm thick .	Organics: fibric to humic Deltaic sediments: either clayey deltaic, silty floodplain or clayey glaciomarine deposits	Very poorly drained	Typic Mesisol

According to the Province of B.C. Soil Information Finder Tool (SIFT)[17] which is based on data collected from Provincial Soil Surveys (including the Soils of the Langley-Vancouver map area), the assessed capability of land for agriculture for the Delta and Blundell soil complex is Class 4W.

The subcategory, W, indicates excess free water present during the growing season that potentially inhibit plant growth or damage crops (Coligado, 1980). Soils with a Class 4W limitation are amenable to improvement through drainage or well-draining fill. This however, assumes that there is sufficient freeboard to accomplish the necessary drainage. There is not sufficient freeboard in this area based on my field observations and little elevation differences over the Site. The topographic survey shows that the total elevation change over the property is on the order of 0.52 m. Improvement of the Class 4W limitation on this specific Site is therefore limited.

[17] https://www2.gov.bc.ca/gov/content/environment/air-land-water/land/soil/soil-information-finder Soil Information Finder Tool. Accessed January 14, 2020

Other SIFT-reported limitations for the Blundell and Delta soils include:

- salinity (N, due to tidal environment of the deeper horizons) and;
- undesirable soil structure (D, due to firm and clay-enriched subsoils with low perviousness) .

In the Soil Management Handbook for the Lower Fraser Valley[18], the Blundell soil management group dominant soil limitations are described as follows:

- *The shallowness of the organic layer, over mineral subsoil, limits the rooting zone and water movement.*
- *Variable depth to underlying mineral soil results in some uneven crop growth and makes these soils difficult to drain.*
- *If left in a bare and pulverized condition, soils are subject to water erosion during periods of heavy precipitation and to wind erosion when the surface dries.*

Furthermore, the Canadian Soil Information Service (CanSIS)[19] describes the Blundell soil series (the predominantly-mapped unit here) as poorly drained:

"Water is removed so slowly in relation to supply that the soil remains wet for a comparatively large part of the time the soil is not frozen. Excess water is evident in the soil for a large part of the time. Subsurface flow or groundwater flow, or both, in addition to precipitation are the main water sources; there may also be a perched water table, with precipitation exceeding evapotranspiration. Soils have a wide range in available water storage capacity, texture, and depth, and are gleyed subgroups, Gleysols, and Organic soils."

[18] https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/agriculture-and-seafood/agricultural-land-and-environment/soil-nutrients/610000-1_soil_mgmt_handbook_fraservalley.pdf Soil Management Handbook for the Lower Fraser Valley. Page 10. Accessed January 14, 2020

[19] http://sis.agr.gc.ca/cansis/soils/bc/BNL/psad~/A/description.html CanSIS. Blundell Soil Series description. Accessed January 14, 2020

3 Soils and Land Capability for Agriculture Assessment

I (Jessica Stewart, P.Ag.) visited the property on January 7, 2020 to carry out an assessment of the site soils during a period of moderate to heavy rainfall. I was met on site by Mr. Sahota, who brought an excavator on site for our soil investigation.

On the day of our assessment, there was standing water located throughout the Site, in particular near the residence of the 17260 property (Photo 2, above) and in the southwest corner of the proposed placement area. According to the land survey, the southwest side of the property is a topographic low. The lowest site elevations are recorded here, at 0.77 m GSC.

PHOTO 4: STANDING WATER IN THE SOUTHWEST CORNER OF THE PROPERTY.

PHOTO 5: FACING DUE WEST ON THE PROPERTY. THIS STANDING WATER IS OVER 0.3 M DEEP.

We excavated four soil pits on the property – the sites were chosen randomly in the cleared field, which still contains stockpiled branches and tree stumps.

I marked the location of these pits with a GPS in the field; these are shown on **Figure 3** (Soil Mapping and Land Capability) in Appendix I. These are indicated as Pit 1, Pit 2 ect. 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. **No soil testing (i.e. nutrients, pH, salinity) was performed for this project.**

I also traversed the property and recorded my observations of slopes, vegetation, and the presence of ditches in the southern end of the Property and at River Road (the 17260 River Road property).

The property was a former upland bog forest. The airphotos show that the property was essentially severed from the larger former bog to the south by the CN railway construction. There are still paper birch trees clustered along the southern, west, and east property lines however, the majority of the trees have been removed as of mid-2019. There are still native shrubs, grasses, and invasive Himalayan blackberry. The neighbouring property to the west (no civic address – it is confined between the railway and River Road lots to the north) has dense blackberry growth that is several metres tall. It is in fact, spreading onto the property, as seen in Photo 4, above.

PHOTO 6: LOOKING ACROSS THE SOUTHERN END OF THE PROPERTY, FACING WEST. THE TREES ON THE LEFT SIDE OF THE PHOTO REMAIN ON SITE (PAPER BIRCH). THE TRAINS ON THE LEFT ARE ON THE CN RAILWAY.

3.1 Soils – Determined from Assessment

My excavated soil pits on the property yielded a black to reddish brown, predominantly humic peat that overlies a grey to blue (gleyed) grey silt loam horizon called the Cg (less common: silty clay loam). These are fluvial deposits from the Fraser River. In two of the

four pits, the Cg horizon contains partly decomposed plant material. It is also firm to very firm in consistency.

The thickness of the peat horizon (in my soil pits) ranged from 35 cm to 80 cm however, the geotechnical test pits excavated by Geopacific during drier summer 2019 conditions (which enabled deeper excavations into wet areas of peat that I could not excavate during my assessment in January) yielded peat depths between 0.6 m and 1.8 m (maximum). A review of Geopacific's test pit locations in their report shows that none of our pits overlap exactly therefore, peat depths are highly variable over very short distances on the property.

PHOTO 7: SILT LOAM (LESS COMMONLY, SILTY CLAY LOAM) FOUND IN THE CG HORIZON. NOTE DECOMPOSED PLANT MATERIAL PRESENT IN THIS SAMPLE.

PHOTO 8: MESIC PEAT FROM SOIL PIT 3. THIS IS THE ONLY PIT WITH A MESIC PEAT BELOW A HUMIC PEAT.

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 my soil assessment, I identified one main soil type on the property that I classified as a Rego Gleysol, which corresponds well with the Blundell soil series.

Based on my soil survey, I found the soil limitations to be excess water (4W) due to poorly drained soils. There is excess free water from early fall to late spring; high watertables

persist until the summer months. Class 4W limitations result in moderate crop damage and occasional crop loss. Wetness subclass information can be found in Appendix C.

All soil pits feature gleying in the Cg horizon; gleying (and mottling) are indicative of water saturation and periodic anaerobic conditions due to fluctuating water tables in the subsoil. Coupled with strongly acidic soil conditions that are characteristic of peat soils, this would result in some reduced nutrient availability – with potassium and phosphorous being limited macronutrients alongside limited mobilization of high valence micronutrients (e.g. Cu, Ca, etc.) from the organic matter under anaerobic and acidic conditions. Mottling starts as shallow as 30 cm in Pit 1 and as deep as 80 cm in Pit 3 – mottling would not be present in the organic horizon (peat, Op or Oh).

PHOTO 9: AIRPHOTO FROM 1997 SHOWING ACTIVE SOIL FILLING TO THE WEST (RED ARROW). THIS MATERIAL WAS PLACED SEVERAL METRES HIGH AND IS NOW OVERGROWN WITH BLACKBERRY. MR. SAHOTA'S PROPERTIES (BOTH THE SITE AND 17260 RIVER ROAD) ARE OUTLINED IN ORANGE.

There is a less serious limitation presented by dense subsoils that result in a root restricting layer and low perviousness within 50 cm from the surface. This is a Class 3D limitation and it is introduced by the firm Cg horizon.

To summarize, the native soil on the property is agriculturally limited by both 1) excess free water and 2) dense subsoils/undesirable soil structure in the Cg horizon.

There is a third soil limitation reported for the Blundell soils – the Canadian Soil Information Service (CanSIS) describes the Blundell as having high to very high salt content[20]. The conductivity is reported to be greater than 4 dS/m however, it does not state if this is in the upper 50 cm (which would correlate to a Class 4N limitation due to salinity), or below 50 cm, which would correlate to a Class 3N salinity limitation.

No laboratory testing was performed for this assessment as we focused on the primary observed limitations that are excess water due to poorly drained soils and high water tables. The salinity limitations may be improved through irrigation to flush out the excess salt but it is difficult to determine the level of improvement that may be reached through this method. Improving the salinity through pumping also again, depends on whether the nearby ditches can accommodate such increases in water volume. For this site, there is only one ditch bordering the south of the Property.

4 Soil Placement Proposal

4.1 Rationale for Proposal

4.1.1 Site Characteristics and Local Land Changes

My site assessment shows that the Property has poorly drained soils, specifically, Rego Gleysols that have humic (with one pit exhibiting a mesic horizon between silt loam and humic peat) peat soils overlying fine-textured fluvial (floodplain) deposits from the Fraser River. The excess water limitation to agriculture (4W) results from high local groundwater conditions and poor regional conveyance of water within drainage infrastructure due to the low-lying nature of the floodplain. As demonstrated by the topographic survey, the property is as low as 0.77 m above sea level. The total elevation difference over the property is 0.52 m.

The historical aerial photo review demonstrates that the southern half of the Property and the surrounding area to the south of the railway was a forested peat bog. Standing water was present throughout the bog and on the property in the airphotos ranging from 1938 to 1973. After 1973, vegetation on the southern portion of the property increases and it becomes difficult to see standing water in this area. The bog to the south of the railway was intensely developed with farms and drainage infrastructure apparent by 1982. Most farms appear to

[20] http://sis.agr.gc.ca/cansis/soils/bc/BNL/psad~/A/description.html CanSIS Blundell Soils. Accessed February 2, 2020.

be cranberries and blueberries, however there are dairy farms and forage crops apparent, particularly along No. 7 and No. 8 Road.

From my review of historic aerial imagery, it is apparent that the Property has been subject to excess water conditions, even having a surface water connectivity with the adjacent and now filled property to the west (refer to Photo 1, the 1951 airphoto). Photos do show that the 17260 property appears to have been cultivated as a hay/forage crop but no such agriculture extended into the subject Property.

It is my opinion that the excess wetness experienced on the property may be now artificially exacerbated due its confinement between purposely raised land to the north (River Road dyke), south (CN Railway grade), and to the west (soil placement, up to several metres in elevation by visual inspection from Mr. Sahota's Site – this property has no civic address). There does not appear to be soil placement on the lands to the east (17360 and 17340 River Road). The River Road dyke and the CN railway were in place by the earliest airphoto data I reviewed (1938) however, filling of the property to the west began sometime between 1991 and 1997. Vegetation was re-established by 2004.

4.1.2 Drainage Options

According to the Soil Management Handbook[21], the shallowness of the organic layer over mineral subsoil in the Blundell soils limits water movement and the depth of rooting. Furthermore, the variable depth to the mineral horizon (the Cg, or silt loam) can result in uneven crop growth and difficulty in draining these soils. When left bare (following crop harvest and tilling, for example), erosion of these soils can result from both precipitation and wind. Erosion can be mitigated by planting cover crops in the fall. This can also improve water management. The management handbook states that even with drainage installed, soils will have excess water than can result in unsuccessful crop growth, particularly of nursery trees, tree fruits, and strawberries.

Improvement of the 4W limitation via installing drainage (such as drain tiles) may have limited effectiveness. Installation of subsurface drainage entails placing perforated pipes, often within a fabric filter 'sock' to prevent mobilization of fine-grain silt/clay particles at depth to collect and convey subsurface water to ditching along a 1 – 2% gradient.

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21 https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/agriculture-and-seafood/agricultural-land-and-environment/soil-nutrients/610000-1_soil_mgmt_handbook_fraservalley.pdf Soil Management Handbook for the Lower Fraser Valley. Page 10. Accessed January 14, 2020

Drainage tile functions entirely through subsurface conveyance of water to the perforated pipe, and subsequent gravity-driven drainage to ditching. The spacing of drainage tile is adjusted based on the soil texture, while the depth is varied depending on local water table elevation and intended crop type. Drainage tile does not function when the water level in the receiving drainage ditch is higher than the drainage pipe.

The issue here is 'freeboard', which is the elevational difference between water in the ditches (in this instance, the ditch to the south) and the water table of the property. Underground drainage pipes must at least 30 cm (some references suggest up to 50 cm) and preferably 60 cm deep, meaning that the freeboard must be 50 cm at a minimum. In Richmond, the freeboard in the winter is often less than this. If this is too small, then subsurface drainage will not work without pumping.

As described in Section 2.6, there is a ditch situated at the south property line and on the north side of the railway grade. Water levels were below the crest of the ditch at the edge of the property near the fence but the ditch was not completely full. The elevations of this ditch relative to the property is unknown as the land survey does not extend into private railway property. The ditch collects drainage from the property as well as the railway right of way. My initial observation is that water levels in the ditch are not significantly lower than that of the property, perhaps on the order of less than 0.5 m. Confirming ditch elevations would require taking topographic points (land surveyor), however, it is noted that this ditch appears to be on CN railway property, as it is situated outside the property fence.

PHOTO 10: DITCH SITUATED BETWEEN THE CN RAILWAY AND THE PROPERTY, WHICH IS THE FENCE IN THE FOREGROUND. THE WATER LEVELS ARE INDICATED BY A BLUE ARROW.

There is a ditch along the northern property line of 17260 River Road. The water levels in this ditch were observed to be quite high. Connecting perforated pipes to this ditch from the Property would require piping the water between 40 (from northeast corner to River Road ditch) and 180 m (southeast corner to River Road ditch).

There is no topographic data for the 17260 property (the survey did not extend this far), however, there is no discernible elevation difference between the lands to facilitate drainage in this direction. Even if the land was built up on the Property to facilitate a 1-2% pipe gradient[22] northwards, the pipe would need elevation difference between the ditch at River Road and the Property (freeboard), as well as ditch water elevations below that of the Property. As shown in Photo 11, water levels in the River Road ditch are fairly high – they were approximately 0.3 m from the top of the bank on the south side, which is the level land surface of 17260 (this is approximately the length of a standard school ruler).

[22] Lower gradients (i.e. 0.6%) can work for drainage systems however, below this, there is a tendency for the pipe to clog with sediment.

PHOTO 11: DITCH LOCATED AT 17260 RIVER ROAD - NOTE WATER LEVELS ARE QUITE HIGH. THIS PHOTO WAS TAKEN JANUARY 7, 2020

4.1.3 Anticipated Challenges without improvements

The property, in its current state with peat soils (which are generally highly acidic – the pH was not tested on Site), is not suitable for growing forage crops, legumes, or cool-season vegetables as they would require more alkaline soil conditions for optimal plant growth. This can only be achieved through judicious and continuous lime amendments to increase the pH to 6.0-7.5. Additionally, vegetables would require raised beds if no drainage improvements are conducted. Raised beds are a necessary condition for vegetable production on floodplains, but then would require substantial labour inputs (cultivation, weed control, pesticide application, sprinkler installation etc.) throughout the growing season. Forage crops, alternatively, only require machinery twice a year – at seeding (annual crops such as corn) and harvesting.

Furthermore, without drainage improvements, the current drainage class restricts the time during which farm machinery (used to till, plow, seed, or harvest crops if not done by hand farm labour) can operate on soils. Machine access will likely be limited between October and April and in some years with higher than average precipitation, until June. Year to year variability in accessibility can pose planning difficulties to farmers. There is also a very short time window to work the soil and plant or harvest crops.

It is thus a legitimate concern that the timely and costly establishment of a farm on the Site without prior soil placement or drainage system will lead to poor-yielding crops. In addition, establishing crops in waterlogged soils poses a risk of root disease.

4.1.4 Suggested Improvement Method – Soil Placement

The importation of good-quality and well-draining (loam, sandy loam, loamy sand) soil is thus considered a viable option to resolve the agricultural limitations of the poorly drained native peat soils, which are excess wetness at Class 4W. Raising the land will also improve the undesirable soil structure encountered in the Cg horizon, as this will now be located much deeper from plant roots (greater than 1 m – undesirable soil structure does not take into account depths below 1 m). This dense, impervious layer has a Class 3D limitation for agriculture.

4.2 Methodology to Calculate Soil Depth and Volume

In determining the ideal depth and ultimately, the volume of soil required to raise the land to improve wetness limitations, I considered:

1. The natural topography of the Site (as determined from the topographic survey, **Figure 2**).
2. The drainage (ditches, natural slopes), as well as areas of ponded water.
3. The area to be cultivated (in ha).
4. Any features, including city infrastructure or private infrastructure that may require setbacks.
5. The proposed farm use following soil deposition, which according to Mr. Sahota is open field farming with an access road (unpaved) along the western perimeter of the property.

The average elevation of the property, as taken from the land survey, is approximately 0.9 m. As described above in Section 2.5, the elevations on the property range from 0.77 m to a topographic high of 1.29 m. Raising the land by 0.5 m, for example, may be insufficient, as there will be settling of placed soils and decomposition of the peat once it is disturbed.

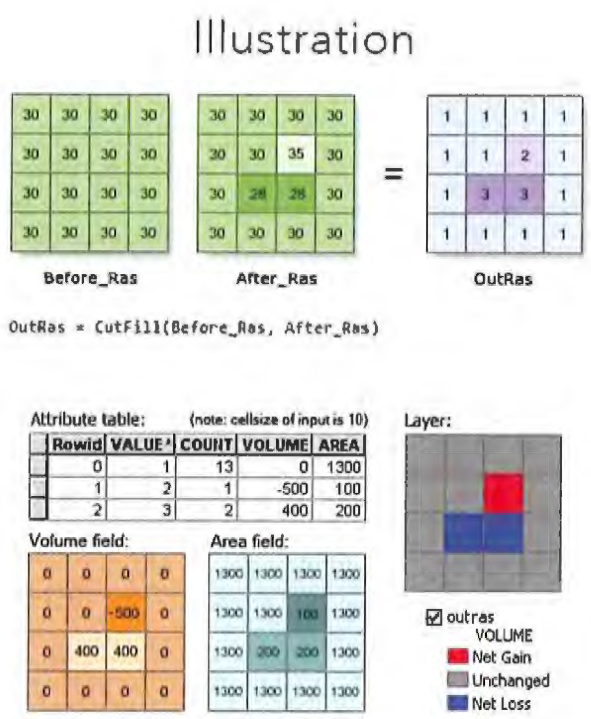
Therefore, I considered that raising the average elevation of the property (which is approximately 0.9 m) by 1 .0 m yields 1.9 m. Therefore, the depth of soil required to bring the property uniformly to 1.9 m, which will still be below the grade of the River Road dyke,

the CN railway, and the property to the west (no civic address, shown in Photo 9 for reference), will range from 0.61 m (adding 0.61 m to the 1.29 m topographic high) to 1.13 m (adding 1.13 m to the 0.77 m topographic low) deep.

As shown on **Figure 4**, the microtopography of the property is in fact, quite undulating. These figures were prepared by generating cross-sections from the supplied topographic data points contained in the survey. Calculating the soil volume from cross-sections with highly undulating topography is difficult and subject to significant error than if the land was near uniformly level.

As such, I have engaged Madrone's GIS team to use a tool called Spatial Analysist in ArcGIS (ArcMap 10.3). This tool calculates the volume change between two surfaces. It is typically used for cut and fill operations[23].

[23] https://desktop.arcgis.com/en/arcmap/10.3/tools/spatial-analyst-toolbox/cut-fill.htm ArcGIS Cut Fill tool. Accessed February 5, 2020



DRAWING 1: THIS IS AN ILLUSTRATION OF WHAT THE CUT FILL TOOL LOOKS LIKE IN ARCGIS. IN THIS METHOD, ALL AREAS IMPORTED AS THE SURFACE AREA GAINING SOIL TO REACH A FINAL ELEVATION. THE FINAL VOLUME CAN BE CALCULATED FROM THE ATTRIBUTE TABLE FROM:
HTTPS://DESKTOP.ARCGIS.COM/EN/ARCMAP/10.3/TOOLS/SPATIAL-ANALYST-TOOLBOX/CUT-FILL.HTM

Essentially, the method requires two surfaces, and then it could calculate the volume between the two. The first surface is the actual elevations of the land taken from the topographic survey. These elevations were imported into ArcGIS. The second surface is the final elevation chosen for the Site, which is a relatively flat 1.9 m. The area of the surface(s) is the entire property boundary, which is known from the imported legal survey.

Using this methodology, all areas are gaining soil but at different depths. We have determined that approximately 11,650 m^3 of soil is required to create a level surface with a final elevation of 1.9 m, or approximately 1.0 m above the current average grade of 0.9 m. The maximum depth is 1.13 m in the southwest corner where the topographic low occurs. For simplicity, I have rounded this up to 12,000 m^3. The final surface, at 1.9 m, is shown on **Figure 5.** Please note that there is no output figure produced by running this tool – it returns the volume only.

Although not accounted for in the volume calculation (as the tool cannot accommodate a change in elevation within a single raster cell, or elevation point), the final soil deposit will

have maximum slopes of 1:3 (33%) on all sides. This is to reduce the effect of rill and gully erosion, as well as the potential for instability (slumping) if the slopes of the soil placement area are graded too steeply.

4.3 Peat Stripping & Topsoil Management

The imported soil will not be placed over the peat topsoil. Rather, the peat topsoil will be stripped to the surface of the mineral horizon (which is the distinctly grey silt loam horizon), stockpiled, and the imported mineral soil will be placed at the top of the silt loam (Cg). The peat will then be spread on top in an even layer. The volume calculation still stands, as we are simply 'swapping' another soil layer between the existing peat (Oh) and silt loam (Cg) horizons. The volume of soil does not change whether it is placed on top or 'in the middle'. The net elevation increase is the same.

There are several reasons why peat stripping should be done for this project.

1. Covering the peat with a mineral soil will constitute a loss of a valuable topsoil resource. 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 (Oh) is a black to reddish brown, humic peat layer that is between 35 cm and 80 cm thick. The geotechnical test pits were done at different locations on the property and recorded peat between 0.6 m and 1.8 m thick. The geotechnical test pits were done in the summer when site conditions were drier and enabled augering into portions of the property where peat is deeper. During my assessment, I could only excavate in sparse dry areas. Despite this, my soil pits all filled with water however at different rates.
2. The peat is subject to settlement if loaded by placed soils.

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." [24].

4.4 Soil Deposition - Methods

During soil placement, all regulations contained in the CoR Soil Removal and Soil Deposit Regulation Bylaw No. 8094[25] must be adhered to. The CoR may require review of this regulation prior to permit issuance to ensure compliance. If you have questions regarding the regulations, these should be brought to the Soil Bylaw Officer at the city prior to commencing activities.

The exact method of placement is at the direction of the earthworks operator and Mr. Sahota, so long as the methodology does not result in a breach of city bylaws. I do however recommend that stripping is done in 'cells' such that areas of the peat topsoil are stripped and stockpiled adjacent to the stripped area, then filled with the sourced mineral soil in a sequential fashion.

Cells that experience high water tables (water ponding) may need to be left to drain and placement done during drier conditions. This will greatly depend how quickly soil can be procured, when the project is started, and the weather conditions experienced at the Site during placement activities. A particularly wet summer, for example, may greatly delay placement efforts. Soil placement can be attempted during the winter however, stoppage may become frequent if high water tables impede work. Machines cannot work on overly wet soils as these will not be load bearing. This is also a poor reclamation practice.

As described in Section 4.2, the slopes of the soil will have a maximum gradient of 1:3 (33%) along all sides along the edges of the placed soil. This will ensure that slumping and erosion are minimized. Soil that slopes too steeply (i.e. over 50%) will likely slump and could present a nuisance to the east and south neighbouring properties, which are level with the Property. Note that the City of Richmond Soil Removal and Fill Deposit Regulation Bylaw No. 8094 states that no removal or deposit shall be undertaken on a statutory right-of-way or easement without obtaining the permission writing of the City or other authority having jurisdiction over such statutory right-of-way[26]. The right-of-way appears to be under the

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[24] 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.

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

[26] https://www.richmond.ca/__shared/assets/BL809447443.pdf City of Richmond Soil Removal and Fill Deposit Regulation Bylaw No. 8094 Accessed February 2, 2020

jurisdiction of the CoR. That stated, the applicant, Mr. Sahota, does not wish to place soil on the easement.

Following replacement of the peat topsoil, the best option would be to slope the final deposit to the south where the existing ditch is located. There are no other ditches located around the Property. A drainage plan, including run-off and storm run-off calculations, may be required as part of a complete soil placement plan. This must be prepared by a professional engineer with training in civil engineering and/or water resources engineering.

After soil placement, Mr. Sahota wishes to grow a variety of crops such as garlic and potentially nursery trees in an open field.

The replaced peat topsoil is often recommended to be planted with a rotational nitrogen-fixing cover-crop under no-till conditions for a period of 1 to 3 years in order to re-establish soil structure and function. After which, assessment of drainage conditions and soil structure will guide any further requirement for water management infrastructure, such as installation of drainage tile.

4.5 Imported Soil Requirements

For this project, the sourced soil should be medium to coarse-textured, preferably sandy loam or loamy sand, to promote subsurface drainage. Loams and fine sandy loam are acceptable secondary textures (i.e. not the most commonly imported texture). This will exclude most Richmond soils, which tend to be organics overlying silt loams to silty clay loams and in some cases, clay loams, as in areas along Blundell Road and No. 6 Road.

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.

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[27]:

1 construction or demolition waste, including masonry rubble, concrete, cement, rebar, drywall and wood waste;

[27] http://www.bclaws.ca/civix/document/id/complete/statreg/30_2019#part5 Agricultural Land Commission Act - AGRICULTURAL LAND RESERVE USE REGULATION. Accessed January 13, 2020

2 asphalt;

3 glass;

4 synthetic polymers;

5 treated wood; and

6 unchipped lumber.

All imported soils will meet the BC Contaminated Site Regulations (BCCSR) – Schedule 3.1, Column 4 applicable agricultural land standards for the site[28]. Contaminated soil, or soil that is suspected to be contaminated, must not be used. Soil sampling will be required to test for contaminants (a soil cannot be verified as being contaminant-free without laboratory testing). This would be part of a Phase 2 Environmental Site Assessment (ESA). Large sites such as condo construction projects, typically have available ESA reports and are therefore ideal sites to source soil from. **Small source sites (i.e. <10,000 m³) typically do not have this information. Soil sampling in these instances would therefore be at the expense of the soil supplier/earthworks contractor.**

The soil material should be inspected to ensure that it is acceptable for agricultural use. This forms part of the screening process required by the City of Richmond as part of the conditions of a soil permit. The screening process must be conducted by a qualified environmental professional (called a QEP, a recognized term by the CoR and the ALC) such as a Professional Agrologist (P.Ag.)

In addition to being free of contaminants (as confirmed by a Phase 1 ESA, or Phase 2 ESA if Potential Contaminants of Concern are suspected by the professional assessing the Source Site) and prohibited materials (as confirmed by a P.Ag. during Source Site screening), source soils with the following attributes should be **rejected**:

1 High clay content (generally glaciomarine, glaciolacustrine in origin), i.e. greater than 30% clay, including silty clay loams, clay loams (clay soil has never been observed by Madrone in the field in Richmond);

2 High organic content (peat soils such as Humisols, Mesisols, or Fibrisols, which are found in abundance in Richmond, are at or near 100% organic matter);

[28] http://www.bclaws.ca/civix/document/id/complete/statreg/375_96_07#Schedule3.1 Environmental Management Act - CONTAMINATED SITES REGULATION. Schedule 3.1 Accessed January 13, 2020

3 Excessive (i.e. >20% by total volume) quantities of coarse fragments (sized 2.5 cm or greater) – coarse gravels should comprise less than 10% by volume if placed in the upper 0.5 m of the deposit[29]. Cobbles (7.5 – 25 cm) and stones (>25 cm) should comprise less than 1% to meet a Class 2P limitation for stoniness. If stony soils are unintentionally brought onto the site, the soils should be raked or sorted to remove the stones; and

4 Excessively sandy material that is more than 80% sand is also not ideal. This pure sand material is sourced from sites that are pre-loading (alternatively, this can be referred to as pre-load – it is sand sourced from the Fraser River).

The QEP overseeing the project should be knowledgeable in the fields of contaminated sites and invasive species management. Additionally, each shipment origin, truckload, volume and end location should be tracked and available upon request.

According to the CoR[30]:

> *"A soil permit is a Site Profile triggering permit. The process is shown on the contaminated sites Richmond Website. The applicant [Mr. Sahota] will need to provide either:*
>
> *o A City of Richmond Site Profile Exemption Declaration Form confirming that there is no history of Schedule 2 activities on the site that a valid BC ENV exemption applies or*
>
> *o A completed BC ENV Site Profile"*[31]

Madrone can assist with these requirements if requested by Mr. Sahota. This step would be required prior to issuance of the city permit.

The supplier of the soil material should warrant that the source soil is free from contaminants. I recommend that Mr. Sahota signs a soil acceptance agreement (legal document) with the parties responsible for supplying and transporting soils. If contaminated

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[29] The Land Capability Classification for Agriculture in B.C. MOE Manual defines stoniness as the sieved portion of coarse fragments in the upper 25 cm. We have expanded this to the upper 50 cm of the horizon, which is beyond the current criteria by 25 cm. https://www.alc.gov.bc.ca/assets/alc/assets/library/agricultural-capability/land_capability_classification_for_agriculture_in_bc_1983.pdf

[30] Pers. Comm. with the City of Richmond Soil Bylaw Officer.

[31] https://www2.gov.bc.ca/gov/content/environment/air-land-water/site-remediation/site-profiles Site Profiles. Accessed January 14, 2020

soil material is brought onto the site, Mr. Sahota will assume liability for remediating the site and/or removing the contaminated material. Soil sourced in areas that have a history, or suspected history, of industrial or commercial use must be tested prior to transportation.

4.6 Erosion and Sediment Control

The Soil Management Handbook for the Lower Fraser Valley[32] describes the Blundell soils as being "subject to water erosion during periods of heavy precipitation and to wind erosion when the surface dries", if left in a 'bare and pulverized condition'. Furthermore, earthworks to strip peat will certainly result in widespread disturbance to the soils and the requirement for erosion and sediment control measures during the entirety of earthworks, until the soil has been property seeded with a cover crop.

Furthermore, the City of Richmond Soil Deposit and Fill Deposit Regulation Bylaw No. 8094[33] requires that every application for a soil permit must contain:

> *"documents, plans, and information relating to the proposed removal and deposit operation [including]...*
>
> - *The methods proposed to control the erosion of the banks of a removal or deposit;*
> - *During and upon completion of every removal and deposit operation, the boundaries of all adjacent parcels, highways, rights-of-way and easements shall be protected from erosion or collapse and from run-off of water or mud"*
> - *All stockpiles of soil or fill shall be confined to the locations prescribed in the permit and shall be maintained so that they do not adversely affect or damage adjacent parcels or cause a nuisance to any person"*

A detailed Erosion and Sediment Control (ESC) plan it outside of the scope of this report. Any ESC plan should be reviewed by the CoR prior to permit issuance to ensure that all city requirements have been met. I can provide some basic recommendations for ESC that should be considered, based on the observations I made of the Site in January of 2020.

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[32] https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/agriculture-and-seafood/agricultural-land-and-environment/soil-nutrients/610000-1_soil_mgmt_handbook_fraservalley.pdf Soil Management Handbook for the Lower Fraser Valley. Page 10. Accessed January 14, 2020

[33] https://www.richmond.ca/__shared/assets/BL809447443.pdf City of Richmond Soil Deposit and Fill Deposit Regulation Bylaw No. 8094. Accessed January 14, 2020

1. I recommend that silt fencing is placed around the perimeter of the soil placement area. This will ensure that sediment-laden water does not transported to adjacent properties to the west, south, or east. The easement, which is situated between the Property at 17260 River Road, does not contain any infrastructure of any kind but it is considered outside of the boundaries of both of Mr. Sahota's access. As such, silt fencing should also be installed to keep sediment off of the easement.
2. Prior to stripping peat, all ESC measures should be implemented and inspected by an ESC monitor or qualified individual with experience in ESC implementation.
3. Following stripping of peat, any stockpiles should be covered by erosional tarps or seeded to protect from erosion. Stockpiles should not be left to linger for long periods of time (i.e. more than 1 year), as there will be degradation of the topsoil due to organic matter degradation.
4. Consider implementing a wheel wash if the gravel driveway that is currently installed is not sufficient in cleaning truck tires. The wheel wash may require regular cleaning by a vacuum truck. Currently, the driveway is 85 m long. Additional gravel, if required, should be at least 75 mm.
5. A rainfall shutdown should be implemented prior to commencing any earthworks. This is at the direction of the earthworks contractor. I recommend implementing a shutdown of 50 mm of precipitation in 24 hours. The contractor may want to lower the shutdown if there is significant snow on the ground (rain-on-snow event) as higher volumes of water can be expected due to snow melt.

There is a ditch situated on the south side of River Road (therefore, along the northern property line of the 17260 River Road property). This ditch is treated as a watercourse and riparian management area (RMA) by the City of Richmond. There is a 15 m riparian area regulation (RAR) setback established by the CoR. **As the 17260 River Road lot will not be developed, the setback will not be infringed by the proposed soil placement.** The crossing over this ditch has been upgraded by Mr. Sahota, as seen in the photo below.

PHOTO 12: LOOKING DUE SOUTH ACROSS THE ENTRANCE OF 17260 RIVER ROAD. THE SOIL PLACEMENT AREA IS LOCATED IN THE TOP LEFT CORNER OF THE PHOTO. THIS CROSSING WAS UPGRADED IN 2019 – THE OLD CROSSING WAS SITUATED TO THE RIGHT OF THIS PHOTO.

5 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. Following construction of the final soil profile, the Land Capability for Agriculture for the property will improve from Class 4W with excess water limitations to a Class 2W with only short periods of excess water, primarily during late fall to late winter when precipitation is heaviest.

Placement of a well-draining mineral horizon (the imported soil, which will be sandy loam or loamy sand) will improve growing conditions and enable the planting of more diverse crops over the property. Currently, there are no **well-suited** crops for Blundell Soils[34] – suited crops for the property in its current state include blueberries, cereals, corn, perennial forage crops, and shallow rooted annual vegetables.

The existing Class 3D limitation due to undesirable soil structure in the Cg horizon will be completely improved to no limitation (Class 1) by raising the growing medium (the replaced organic topsoil) above the Cg horizon by 1 m.

6 Monitoring and Reporting

The ALC requires that soil permit holders retain a professional agrologist (the QEP) to conduct inspections of the site and materials and to provide monitoring reports to ensure that the project is completed as per the submitted application. The ALC may have site-specific conditions – these are outlined in the soil permit decision, should the project be approved. The CoR will have similar requirements to conduct inspections of the Site and provide status updates. The CoR will also require screening of all sourced soil by a professional agrologist.

The ALC requires that soil importation projects are completed with 2 years from the date of the decision. Extensions may be granted upon receipt of a written request however, the reasons for extension must be detailed by the agrologist and the status of the project must be reported.

[34] https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/agriculture-and-seafood/agricultural-land-and-environment/soil-nutrients/610000-1_soil_mgmt_handbook_fraservalley.pdf Soil Management Handbook for the Lower Fraser Valley. Page 10. Accessed January 14, 2020

The total volume of soil proposed for the project is 12,000 m^3. This equates to approximately 500 m^3 per month, if soil is brought at relatively equal rates. There may be periods when soil cannot be sourced (which would result in delays) or site work is delayed due to adverse weather conditions resulting in overly wet soils.

The ALC may devise its own monitoring schedule (i.e. every month or every 3000 m^3, whichever comes first) and therefore, I will defer recommending implementing an exact schedule at this time. However, I strongly recommend that the project QEP should conduct site inspections during the following important project milestones:

1. Prior to any excavations, to ensure proper placement of the planned ESC measures, as required by the CoR and the retained earthworks contractor.
2. After stripping of the peat topsoil, whether this is done completely in one phase, or at different phases. This is to ensure that the entirety of the peat is stripped to the silt loam horizon, and that the peat topsoil is being managed appropriately such that degradation or erosion and sediment transport is minimized. This may also be supervised by a geotechnical engineer.
3. After heavy rainfall or rain-on-snow events, to ensure that ESC measure are effective and that adverse erosion (including rill and gully erosion) of stockpiled topsoil or placed mineral soils (edge of placement area) is not occurring.
4. Prior to topsoil placement to ensure that the placed soil has been raked and decompacted – this is ensure that large coarse fragments (cobbles, stones) have been removed and that the placed soil is not compacted, which would impede infiltration of rainwater and reduce soil tilth. Again, this may be done in phases, depending on whether you wish to place all soil at once, or place it in sequence, filling individual cells at different time periods and completing the cell by topsoil replacement.
5. At the end of the project once 12,000 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)[35], 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.

7 Conclusions

The agricultural use of the land is limited by excess free water and poorly drained soils (Rego Gleysols). Drainage is limited by high water tables, and limited freeboard in ditches located to the south and in the adjacent land (17260 River Road) at the River Road dyke. Airphotos show that the Property, until 2019, has been a forested wetland (typical trees in this area include paper birch, red alder, and black cottonwood with understorey vegetation comprised of native shrubs, ferns, forbs, and mosses)[36].

The removal of topsoil, placement of soil with suitable physical attributes for agricultural purposes (as described in Section 4.5 – Imported Soil Requirements), and replacement of salvaged topsoil (the 'growing medium', now elevated) generally increases the land level above the regional water table. It is critical to recognize that placement of quality soil is a solution to excess water conditions resulting from a high local water table that permanently addresses the agricultural limitation. Further, Soil Placement – when Climate Change is accounted for by the QP Agrologist making recommendations on depth of placed soil – is a method of Climate Adaptation that does not require continual input beyond initial establishment.

Placing an estimated 12,000 m^3 of pre-screened soil on 1.39 ha of the property will allow Mr. Sahota to utilize the improved land for open field garlic farming. If my recommendations are followed, the capability of the land for agricultural use will be significantly improved, from 4W to Class 2W.

[35] These will have been pre-screened by the project QEP prior to importation.

[36] https://www.richmond.ca/__shared/assets/OCP_9000_guidelines34178.pdf City of Richmond OCP Section 14.7.4 Upland Forest ESA Description. Accessed February 2, 2020

Lastly, Mr. Sahota has expressed his intent to obtain the soil for his project from with the City of Richmond municipal boundaries.

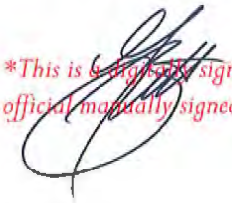
Sincerely yours,
MADRONE ENVIRONMENTAL SERVICES LTD.

Prepared by:

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

Jessica Stewart, P.Ag., P.Geo.

Peer-reviewed by:



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

Gordon Butt

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9 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.

MADRONE
environmental services ltd.

APPENDIX I

Figures

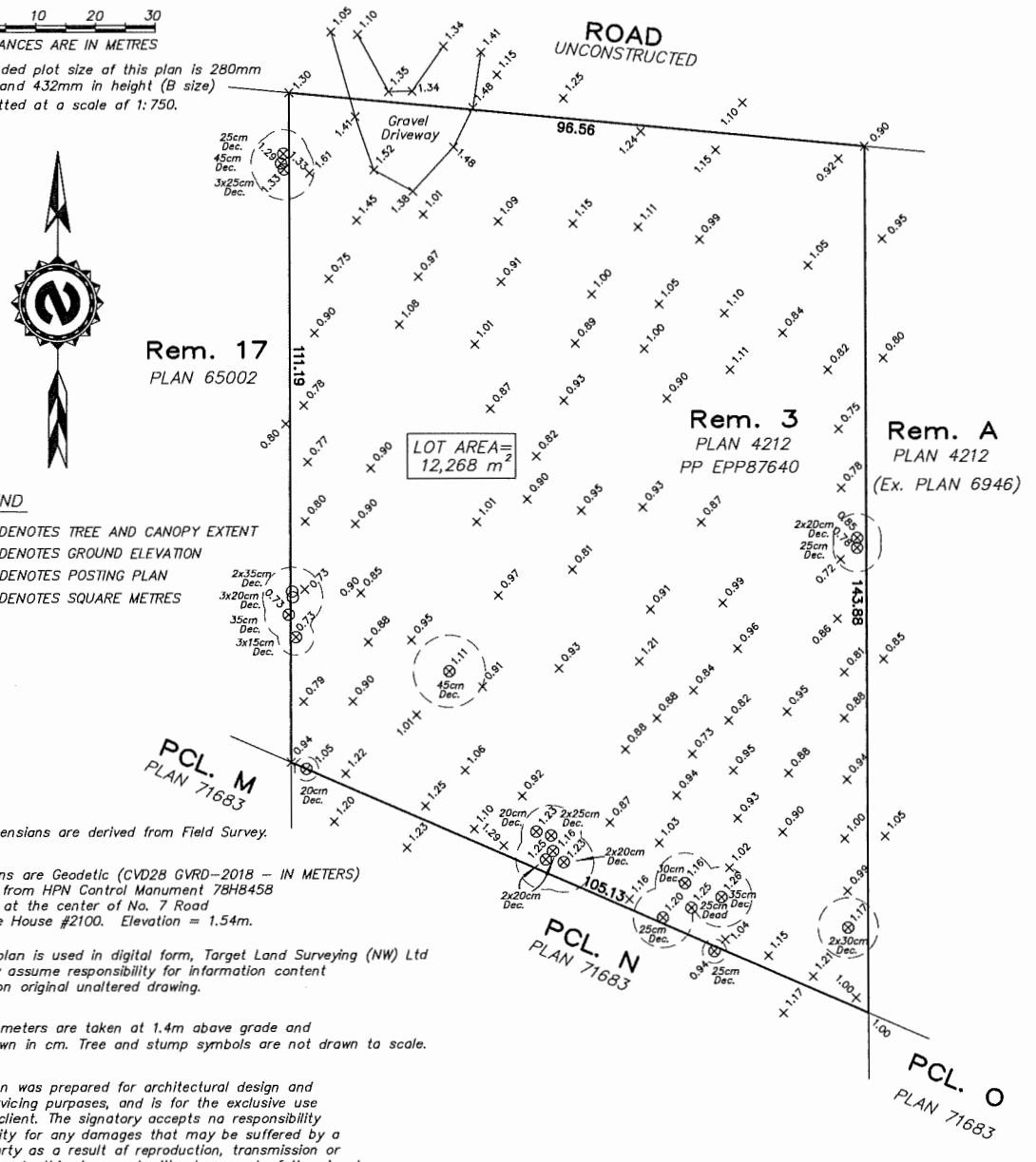
TOPOGRAPHIC SITE PLAN OVER LOT 3 EXCEPT FIRSTLY: PART ON PLAN 4720; SECONDLY: PART LYING SOUTH OF CANADIAN NATIONAL RAILWAY ON PLAN 4720; THIRDLY: PART ON SRW PLAN 71683; SECTION 24 BLOCK 5 NORTH RANGE 5 WEST NEW WESTMINSTER DISTRICT PLAN 4212

CIVIC ADDRESS:
*No Access Property (17260 River Road), Richmond
PID: 005-480-663

SCALE 1 : 750

5 0 10 20 30
ALL DISTANCES ARE IN METRES

The intended plot size of this plan is 280mm in width and 432mm in height (B size) when plotted at a scale of 1:750.



LEGEND

(O)	DENOTES TREE AND CANOPY EXTENT
×##.##	DENOTES GROUND ELEVATION
PP	DENOTES POSTING PLAN
m²	DENOTES SQUARE METRES

NOTES:
Lot dimensions are derived from Field Survey.

Elevations are Geodetic (CVD28 GVRD-2018 - IN METERS) Derived from HPN Control Monument 78H8458 located at the center of No. 7 Road opposite House #2100. Elevation = 1.54m.

If this plan is used in digital form, Target Land Surveying (NW) Ltd will only assume responsibility for information content shown on original unaltered drawing.

Tree diameters are taken at 1.4m abave grade and are shown in cm. Tree and stump symbols are not drawn to scale.

The Parcel described above contains the following legal notations on Title:
Certificate of Title may be affected by th Land Commission Act see Agricultural Land Reserve Plan No.1 deposited July 30, 1974.

Zoning: AG1

CERTIFIED CORRECT
OATED THIS 13TH DAY OF DECEMBER, 2019

_____ B.C.L.S.
Michael Rinsma, BCLS 975

TARGET LAND SURVEYING
www.targetlandsurveying.ca

FILE: N3727-REM3-TOPO

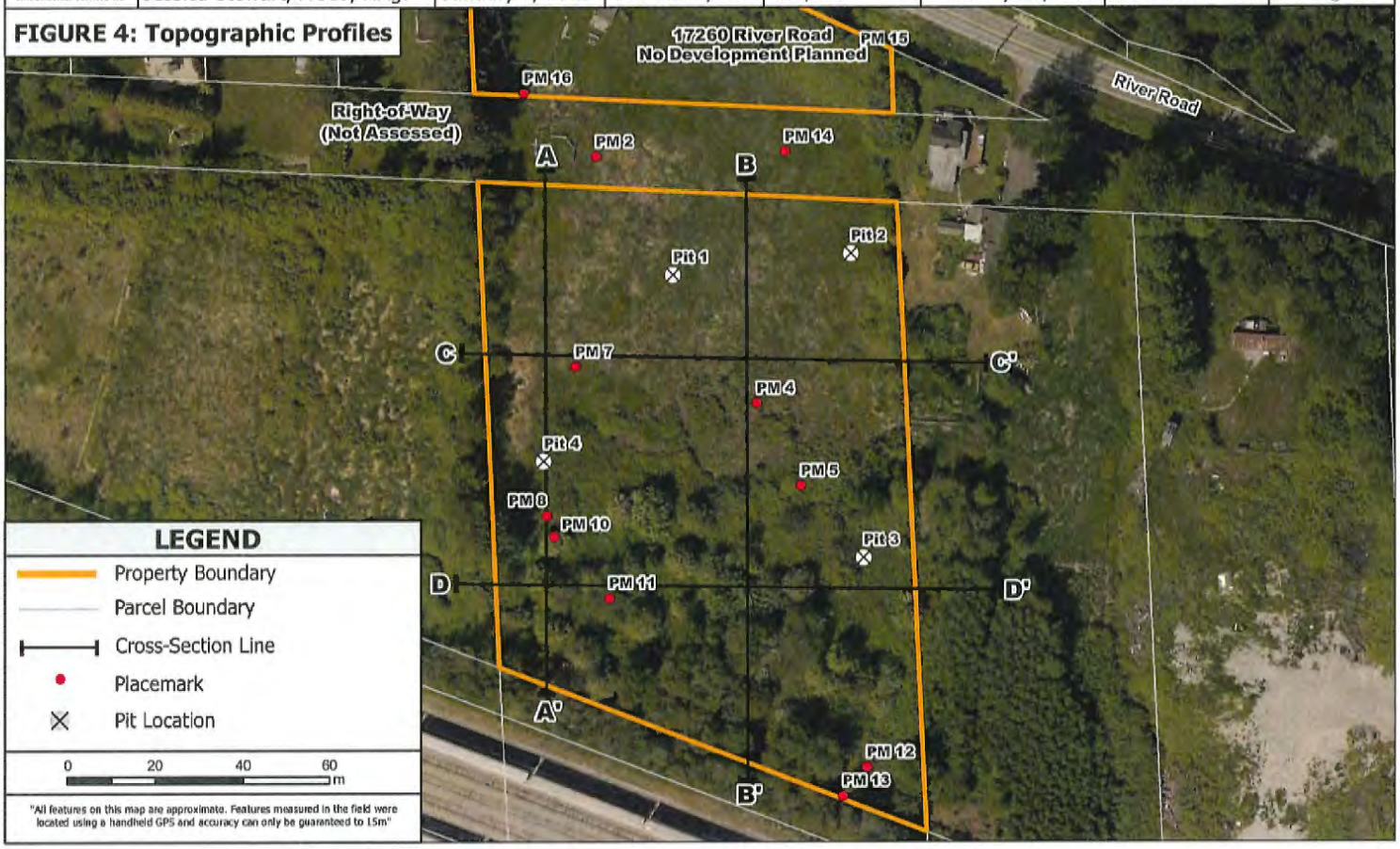
THIS DOCUMENT IS NOT VALID UNLESS ORIGINALLY SIGNED AND SEALED
BUILDING OFFSETS SHOWN ON THIS PLAN ARE NOT TO BE USED TO RE-ESTABLISH PROPERTY LINES OR CORNERS

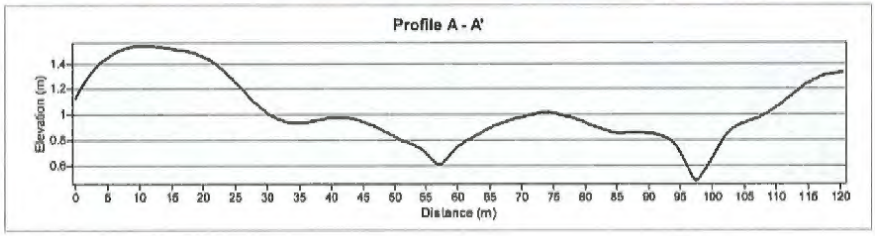
MADRONE environmental services ltd	**PROJECT:** Soil Deposit Assessment : PID 005 - 480 - 663		**CLIENT:** Harinder Sahota		**DOSSIER:** 19.0469	N W E S
	ASSESSED BY: Jessica Stewart, P.Geo, P.Ag.	**FIELD VISIT:** January 7, 2020	**LOCATION:** Richmond, BC	**MAP SCALE:** 1:1,000	**MAPPING DATE:** January 30, 2020	**DRAWN BY:** Jessi Yellowlees

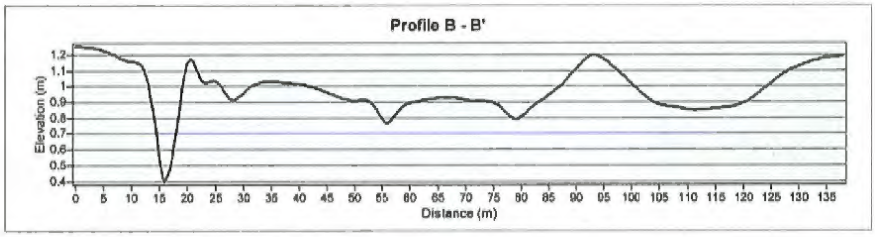
FIGURE 3: Soil & Land Capability for Agriculture

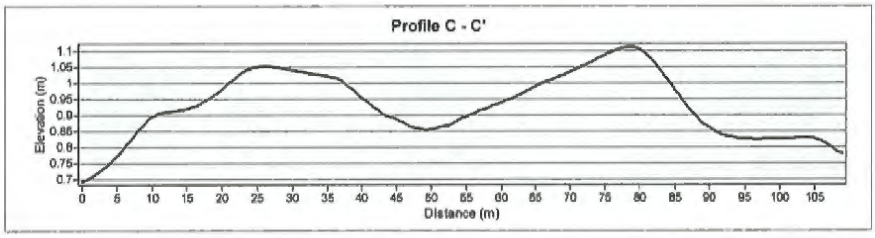
MADRONE environmental services ltd.	**PROJECT:** Soil Deposit Assessment : PID 005 - 480 - 663		**CLIENT:** Harinder Sahota		**DOSSIER:** 19.0469	N W E S
	ASSESSED BY: Jessica Stewart, P.Geo, P.Ag.	**FIELD VISIT:** January 7, 2020	**LOCATION:** Richmond, BC	**MAP SCALE:** 1:1,561	**MAPPING DATE:** February 10, 2020	**DRAWN BY:** Jessi Yellowlees

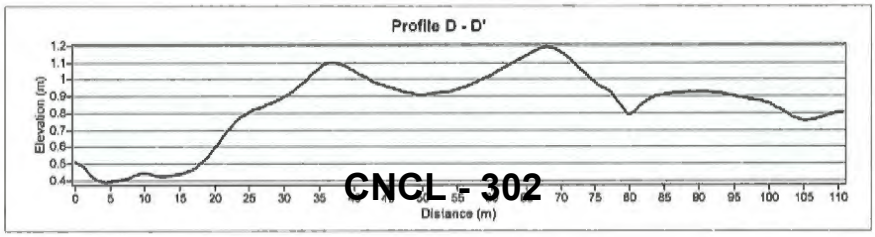
FIGURE 4: Topographic Profiles





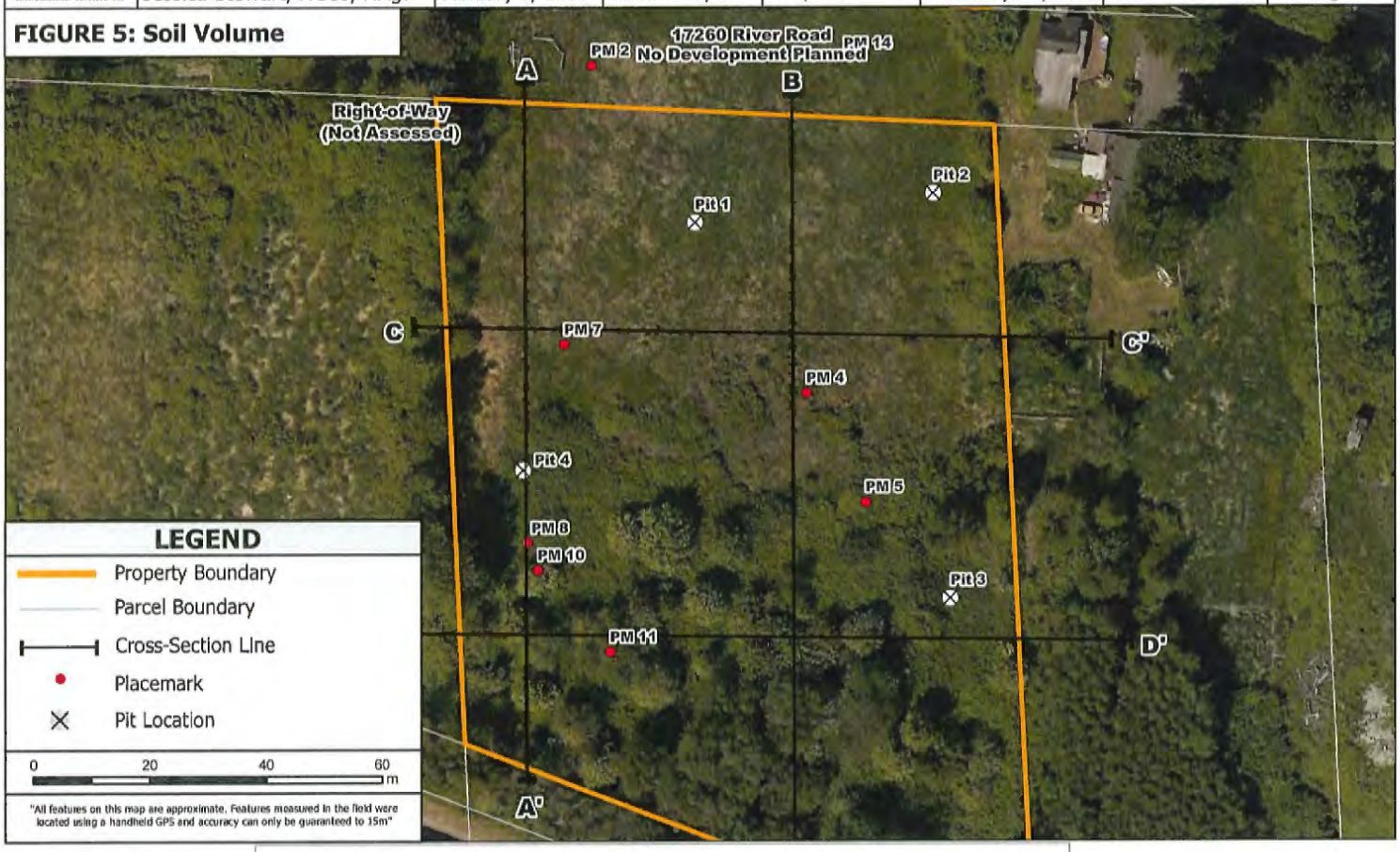


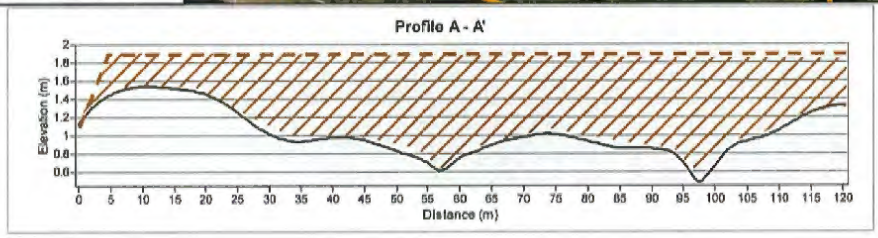


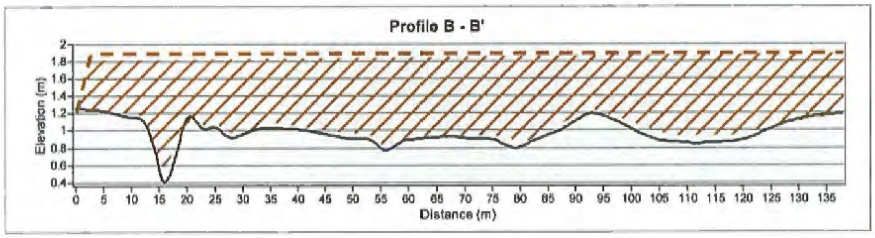


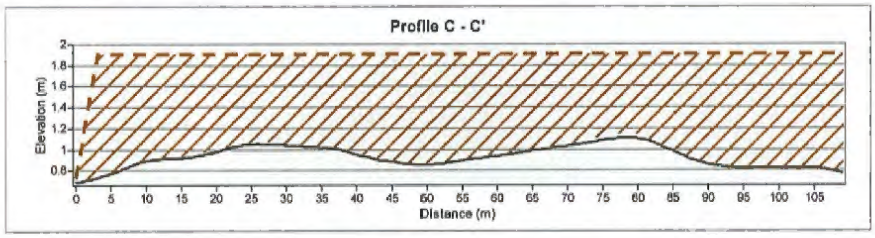
PROJECT:			CLIENT:		DOSSIER:
Soil Deposit Assessment : PID 005 - 480 - 663			Harinder Sahota		19.0469
ASSESSED BY:	**FIELD VISIT:**	**LOCATION:**	**MAP SCALE:**	**MAPPING DATE:**	**DRAWN BY:**
Jessica Stewart, P.Geo, P.Ag.	January 7, 2020	Richmond, BC	1:1,174	February 10, 2020	Jessi Yellowlees

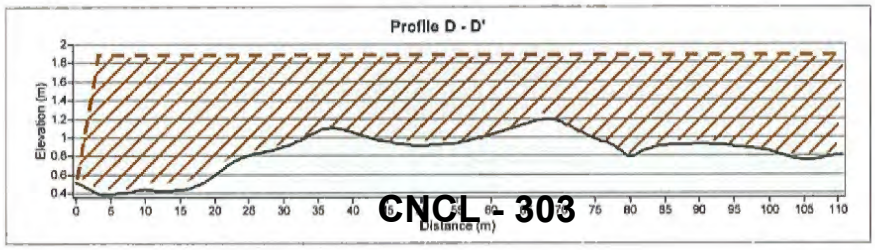
FIGURE 5: Soil Volume











LEGEND

Fill

Existing Topography

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APPENDIX II

Soil Pit Descriptions & Photos

PIT 1 - SOIL PROFILE DESCRIPTION

Horizon	Depth (cm)	Description
Op	0 - 35	Dark, reddish brown to black, humic (von Post class 7), plentiful fine roots. Cultivated (p) in the past. Wavy, uneven contact with Cg1 horizon (as seen in photo)
Cg1	35 - 70	Light blue-grey, silt loam, firm, moist, no roots, no coarse fragments. Common, medium prominent orange mottles.
Cg2	70 - 130+	Light blue-grey, silty clay loam, firm, no roots, no coarse fragments. Many, prominent, medium orange mottles. Increased mottling with depth.

Comments:

- Located in the centre-north property boundary.
- Water encountered at bottom and sides of pit (seeping in quickly) - 1.3 m deep.
- Soil classification: Rego Gleysol

PIT 2 – SOIL PROFILE DESCRIPTION

Horizon	Depth (cm)	Description
Op	0 - 50	Dark brown to black, humic (von Post class 7), plentiful fine roots. Cultivated (p) in the past. Uneven boundary with Cg 1 horizon.
Cg	50 - 110+	Grey to blue grey, silt loam to silty clay loam (variable), very firm, moist, no roots, no coarse fragments. Common to many, medium prominent orange to yellow mottles. Increased mottling with depth. Did not encounter Cg2 horizon due to water table/seepage.

Comments:

- Located in the northeast corner of the Property.
- Pit excavated to 1.1 m before hitting water table. Water seeped from bottom and sides quickly (see photo above). Groundwater piping evident from sides of pit. Completely filled in less than 5 minutes.
- Soil classification: Rego Gleysol

PIT 3 – SOIL PROFILE DESCRIPTION

Horizon	Depth (cm)	Description
Oh1	0 - 50	Black to reddish black, humic (von Post class 7-8), plentiful fine to large roots. Very wet. Uncultivated area that has recently been cleared.
Oh2	50 - 80	Dark brown to reddish brown (lower), mesic, (von Post class 5-6), plentiful fine to large roots. Very wet. This is distinctly lighter than the upper organic horizon and less decomposed.
Cg	80 - 120+	Light grey, silty clay loam, firm, no roots, no coarse fragments. Many, prominent, medium orange mottles, contains decomposed plant remains.

Comments:

- Located in southeast corner of the property near the fence line. Originally upland forest bog – has been recently cleared. This area does not appear in historical imagery to have ever been cultivated for agriculture. Organic horizons are deeper than in Pits 1 and 2 here.
- Pit excavated to 1.2 m before encountering water table. Pit filled with water in less than 10 minutes.
- Soil classification: Rego Gleysol

PIT 4 – SOIL PROFILE DESCRIPTION

Horizon	Depth (cm)	Description
Oh	0 - 40	Dark brown to black, humic (von Post class 7 to 8), plentiful fine roots. Does not appear to have been cultivated – formerly an upland forest bog area. Very wet.
Cg	40 - 110+	Grey, silt loam, firm, no roots, no coarse fragments. Many, prominent, medium orange mottles. Decomposed plant material (woody plant, sedges etc). Wet.

Comments:

- Located in the southwest corner of the property – this area was forested until 2019. Surrounding land is wet – ponded water over 0.3 m deep throughout.
- Excavated an area without ponded water but encountered water table at 1.1 m deep. Filled with water during assessment but did not completely fill.
- Soil classification: Rego Gleysol

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APPENDIX III

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

MADRONE
environmental services ltd.

1081 Canada Ave
Duncan, BC V9L 1V2
p. 250.746.5545
f. 250.746.5850

#202 – 2790 Gladwin Road
Abbotsford, BC V2T 4S7
p. 604.504.1972
f. 604.504.1912

info@madrone.ca
www.madrone.ca

July 17, 2020

Mr. Mike Morin
City of Richmond

RE: Summary of Soil Placement Plan and Garlic Farm Plan Proposal for PID: 005-480-663, River Road, Richmond (No Civic Address) – Intended for Policy Planning and Food Security and Agricultural Advisory Committee (FSAAC) Review

Introduction

The City of Richmond (the 'CoR') Policy Planning has requested a summary of the Soil Placement Plan previously submitted to the City of Richmond and the Agricultural Land Commission (the 'ALC') as part of a soil deposit application for the property identified as PID: 005-480-663, located adjacent to (south of) 17260 River Road, Richmond. The CoR further requested that the summary include an itemized Proposed Agricultural Plan.

We (the applicant and agrologist) understand that the summary will be submitted to the CoR Food Security and Agricultural Advisory Committee (FSAAC) for their review when considering the proposed project, which entails raising the low-lying peat lands by an average[1] of 1.0 m by placing well-draining, sandy soil (screened by a P.Ag. for textural suitability and agricultural suitability[2] prior to importation) on the property.

The total volume for this proposed project is 12,000 m^3, covering approximately 1.39 ha (the entirety of the property). To clarify, this proposal pertains only to the property identified as PID: 005-480-663; it does not include the 17260 River Road property or right-of-way that runs between the two properties. This right-of-way was a formerly proposed city road that ultimately was not constructed.

[1] A topographic survey completed for the site shows undulating microtopography and an elevation range of 0.52 m over the property. Elevations range from 0.77 to 1.29 m according to the topographic land survey commissioned by the applicant. The 1m elevation increase is therefore an average.

[2] Contains no prohibited materials or excess coarse fragments, and is not overly sandy or clay rich.

This summary has been prepared by Jessica Stewart, P.Geo, P.Ag., who prepared the Soil Placement Plan that accompanies the ALC and city application on behalf of Mr. Harinder (Harry) Sahota, the landowner and applicant. Mr. Sahota also owns the adjacent property 17260 River Road, from which access is facilitated.

This letter summarizes the following information for the Property, as requested by the CoR:

a. A Site Plan
b. A Site Description
c. Legal Description
d. Zoning and Current Land Use
e. Soils Description and Unimproved Agricultural Capability
f. Soil Management Rationale/Improved Agricultural Capability
g. Recommended Agricultural Uses and Suitable Crops
h. Proposed Agricultural Plan including
    1. Drainage Requirements/Rationale
    2. Irrigation Requirements/Rationale and Water Sources
    3. Proposed Agricultural Operator
    4. Proposed Planting Plan with a site plan
    5. Agricultural Improvement Cost Estimate (including material costs, drainage costs, irrigation costs and installation costs)
    6. Projected Income Statement (5-10 years)

Item a – Site Plan

Please see **Figure 1** in Appendix A.

Item b – Site Description

According to B.C. Assessment data[3], the Property is 1.39 hectares (3.44 acres). The Property subject to this proposed development is situated approximately 8.1 km northeast of downtown Richmond.

It is bound to the east and west by residential lots (agricultural) and to the south by the Canadian National (CN) railway line. It is bound to the north by a right-of-way that I understand was to be a built road (not constructed). It is not identified as a utility right-of-way or as an "undeveloped street" on the City of Richmond Interactive Map program . This right-of-way separates the Property from 17260 River Road (not physically but as a legal boundary). There are no field markings (i.e. fence, stakes) that indicate this

[3] https://www.bcassessment.ca/Property/Info/QTAwMDA1VzdDRQ== B.C. Assessment property data. Accessed June 26, 2020

right-of-way in the field. The raised gravel driveway built from River Road runs through the right-of-way to access the Property that is intended to be developed under this proposal.

The property is situated on the Fraser River floodplain. Mr. Sahota had a topographic survey (**Attachment 1**) commissioned by Target Land Surveying for the Property (excluding 17260 River Road) in December of 2019. The land survey shows that elevations on the Property range from a low of 0.77 m Geodetic at the centre-west property line to 1.29 m at the centre-south property line.

Item c - Legal Description

The legal description of the property is:

Lot 3 Block 5N Plan NWP4212 Section 24 Range 5W Land District 36 Except Plan 4720 & PT LYING SOUTH OF CNR 4720, SRW 71683

The property ID is 005-480-663. There is no civic address as the property has no frontage (with River Road). It is unofficially but commonly referred to by the CoR as a 'backland' property within the Agricultural Land Reserve (ALR).

Item d - Zoning and Current Land Use

The property is zoned AG1 (Agricultural) according to the Richmond Zoning Bylaw 2011 and the property is within the Agricultural Land Reserve (ALR).

The property was cleared of the majority of its trees in 2019. As mentioned above, there is a single residence on the 17260 property that was re-built following a fire. Otherwise, there are no other land uses. The subject property is not farmed.

Mr. Sahota recently (also in 2019) replaced the driveway crossing (that spans the large ditch on the south side of River Road) that was in the northwest corner of 17260 River Road with a new crossing that is approximately 40 m east-southeast. The old crossing was removed.

The surrounding area is actively farmed for cranberries, blueberries, eggs, and forage crops. There are also several dairy farms in the area. River Road is a heavy industrial area with trucking and manufacturing businesses, shipyards, and railways.

Item e - Soils Description and Unimproved Agricultural Capability

From the Soil Placement Plan prepared by Madrone and dated February 27, 2020 (**Attachment 2**):

My excavated soil pits on the property yielded a black to reddish brown, predominantly humic peat that overlies a grey to blue-grey silt loam horizon called the Cg (less common: silty clay loam). These are fluvial deposits from the Fraser River. In two of the four pits, the Cg horizon contains partly decomposed plant material. It is also firm to very firm in consistency.

The soil type on the property is classified as a Rego Gleysol, which corresponds well with the Blundell soil series described in the Soils of the Langley-Vancouver Map Area, MoE Technical Report 15 (Luttmerding, 1981).

Based on my soil survey, I found the primary **unimproved** agricultural limitation to be excess water (4W) due to poorly drained soils. There is excess free water from early fall to late spring; high watertables persist until the summer months. Class 4W limitations result in moderate crop damage and occasional crop loss.

There is a less serious limitation presented by dense subsoils that result in a root restricting layer and low perviousness within 50 cm from the surface. This is a Class 3D limitation and it is introduced by the firm Cg horizon.

To summarize, the native soil on the property is agriculturally limited by both 1) excess free water and 2) dense subsoils/undesirable soil structure in the Cg horizon.

Item f - Soil Management Rationale/Improved Agricultural Capability

Rationale for soil placement – 1) low-lying topography with poorly drained soils, airphoto history showing wet site conditions through time 2) exacerbated drainage conditions due to surrounding land-use and changes and 3) lack of improvement anticipated with attempting to install drains or pumps.

1. My site assessment shows that the Property has poorly drained soils, specifically, Rego Gleysols that have humic soils overlying fine-textured fluvial (floodplain) deposits from the Fraser River.

   The excess water limitation to agriculture (4W) results from high local groundwater conditions and poor regional conveyance of water within drainage infrastructure due to the low-lying nature of the floodplain. As demonstrated by the topographic survey, the property is as low as 0.77 m above sea level. The total elevation difference over the property is 0.52 m.

The historical aerial photo review shows that the southern half of the Property and the surrounding area to the south of the railway was originally a forested peat bog. Standing water was present throughout the bog and on the property in the airphotos ranging from 1938 to 1973. After 1973, vegetation on the southern portion of the property increases and it becomes difficult to see standing water in this area. The bog to the south of the railway was intensely developed with farms and drainage infrastructure (large canals and ditches) is apparent by 1982.

From my review of historic aerial imagery, it is apparent that the Property has been subject to excess water conditions, even having a surface water connectivity with the adjacent and now filled property to the west (refer to Photo 1, the 1951 airphoto in **Attachment 2**).

2. It is my opinion that the excess wetness experienced on the property may be now artificially exacerbated due its confinement between purposely raised land to the north (River Road dyke), south (CN Railway grade), and to the west (soil placement, up to several metres in elevation by visual inspection from Mr. Sahota's Site – this property has no civic address. The purpose of this soil placement is not known as the property has not been evidently used for agriculture since it was placed).

3. The placement of underdrains or drain tiles may result in a limited improvement. There is only one ditch bordering the property that is situated to the south of the site at similar elevation, therefore, the Site lacks freeboard. Subsurface drainage[4] does not function when the water level in the receiving drainage ditch (which in this case, is to the south) is higher than the drainage tile. Pumping water out of the property would require assurance that the ditch to the south can accommodate the volume of new water without impact to the railway or surrounding property owners. It would also entail running discharge pumps – these are costly and may not be reliable, which may result in losses to the farmer should they fail during a period of crop production.

I have proposed that the placement of soil will raise the growing medium above the water tables and would be a permanent solution to improve the agricultural limitations (excess water, dense subsoils) of the site.

[4] A formerly used term for this is 'drainage tile'. The ALC uses the term drainage tile frequently. These are perforated pipes or 'PVC' placed under the surface – the exact spacing is subject to the soil texture and local drainage.

Adding soil will elevate the topography over the whole area and will improve drainage in the subsurface. Following construction of the final soil profile, **the Land Capability for Agriculture for the property will improve from Class 4W with excess water limitations to a Class 2W with only short periods of excess water, primarily during late fall to late winter when precipitation is heaviest.**

Placement of a well-draining mineral horizon (the imported soil, which will be sandy loam or loamy sand) will improve growing conditions and enable the planting of more diverse crops over the property. Currently, there are no **well-suited** crops for Blundell Soils[5].

The existing Class 3D limitation due to undesirable soil structure in the Cg horizon will be completely improved to no limitation (Class 1) by raising the growing medium (the replaced organic topsoil) above the Cg horizon by 1 m.

Item g - Recommended Agricultural Uses and Suitable Crops

According to the Soil Management Handbook[6], the shallowness of the organic layer over mineral subsoil in the Blundell soils limits water movement and the depth of rooting. Furthermore, the variable depth to the mineral horizon (the Cg, or silt loam) can result in uneven crop growth and difficulty in draining these soils.

When left bare (following crop harvest and tilling, for example), erosion of these soils can result from both precipitation and wind. Erosion can be mitigated by planting cover crops in the fall. This can also improve water management. The management handbook states that even with drainage installed, soils will have excess water than can result in unsuccessful crop growth, particularly of nursery trees, tree fruits, and strawberries (unsuitable crops).

For the native soils assessed on the property, suited crops are: annual legumes, blueberries, cereals, cole crops, corn, perennial forage crops, root crops (except carrots) and shallow rooted annual vegetables.

There are no **well-suited** crops for these soils.

The definitions in the Soil Management Handbook for the Lower Fraser Valley are as follows:

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[5] https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/agriculture-and-seafood/agricultural-land-and-environment/soil-nutrients/610000-1_soil_mgmt_handbook_fraservalley.pdf Soil Management Handbook for the Lower Fraser Valley. Page 10. Accessed June 26, 2020

[6] https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/agriculture-and-seafood/agricultural-land-and-environment/soil-nutrients/610000-1_soil_mgmt_handbook_fraservalley.pdf Soil Management Handbook for the Lower Fraser Valley. Page 10. Accessed June 26, 2020

Well suited crops: a low to moderate level of management inputs are required to achieve an acceptable level of production.

Suited crops: a moderate to high level of management inputs are required to achieve an acceptable level of production.

Item h - Proposed Agricultural Plan

Mr. Sahota has proposed farming garlic on the property following soil placement. This must be done in an open field environment as the CoR engineering department will not permit greenhouses on a backland property without dedicated road access (confirmed in June 2020).

1. Drainage Requirements/Rationale

The placed soil will be subtly graded (1-2% max) to drain into either the existing ditch to the south or drain into the existing north ditch (at River Road) via culvert through the City road allowance (also referred to as "the right of way" in this letter and the Soil Placement Plan) and through the 17260 River Road property (which the applicant owns). Draining south into the existing ditch at the property line is preferred and may require permission from CN, who shares the ditch.

A drainage study is pending from Geopacific Engineering.

2. Irrigation Requirements/Rationale and Water Sources

The property area is designated as 3A (1) in the Climatic Capability for Agriculture scheme of Coligado, 1980[7]. 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.

Summer moisture deficits will initially have to be offset by irrigation; a new drip irrigation system can be employed (short intervals every day). For a farm of this size, hand watering by a pump is not practical. Basic research shows that drip irrigation costs approximately $1 per metre[8]. Thus initial irrigation installation costs will be considerable. Mr. Sahota owns a contracting company and is experienced in land

[7] https://www.alc.gov.bc.ca/assets/alc/assets/library/agricultural-capability/climatic_capability_for_agriculture_in_bc_1981.pdf Climatic Capability for Agriculture in BC. Coligado, 1981.

[8] http://www.irrigationdirect.ca/Drip-Irrigation-Kits-For-Row-Crops-Using-Drip-Tape/ Canadian drip irrigation sales - $275 for 300 m installation kit.

preparation and installation of such infrastructure. Therefore, the cost of installing this is considered either under land preparation costs or under farm employee costs (detailed in the Project Income Statement section, below).

Garlic bulbs are shallow rooted and as a result are susceptible to moisture stress. A garlic bulb will require between 2.5 and 5.0 cm of water per week, with sandy soils requiring the upper limit of this estimate (the native soils on site would require the lower limit)[9]. The bulbs will not be irrigated in the last two weeks before harvesting.

Irrigation needs will need to be supplied via the municipal water supply. The property does not have an active well according to the landowner. The water supply connection may be facilitated through an existing municipal connection at 17260 River Road.

3. Proposed Agricultural Operator

The property owner and applicant, Mr. Harinder Sahota, will be the primary agricultural operator. He will hire an individual to farm the property on a day-to-day basis. The cost of this is accounted for in the project income statements, below.

4. Proposed Planting Plan with a site plan

Please see **Figure 2** in Appendix A.

Mr. Sahota proposes planting the majority of the property, which is 1.39 ha, with garlic. Two areas exempt from the planting plan are:

1. A farm access road (dirt road, no pavement or asphalt millings) that is up to 6 m wide to accommodate farm vehicles and access to planted fields.
2. A row break between planted fields that will allow access to the east side of the property and fields (no farm road).

Therefore, just over 1.0 ha of the 1.39 ha will be planted with garlic.

[9] https://www2.gov.bc.ca/gov/content/industry/agriservice-bc/production-guides/vegetables/garlic BC Ministry of Agriculture Garlic Production Guide. Accessed July 2, 2020

Basic garlic planting plan:

1. Garlic is a perennial plant that requires a cold period to initiate growth. For cool climates such as that in coastal British Columbia, garlic is generally planted during the fall and harvested the following summer.
2. Garlic bulbs can be purchased by reputable garlic sellers throughout North America (i.e. Russian Red, Italian Purple, Spanish Roja, and Music varieties). The bulbs are separated (or cracked) by hand or by machine to obtain individual cloves that can then be propagated.
3. A single clove will produce an entire garlic bulb, but cloves must be planted every season in the interests of preserving genetic stock. The clove should be planted with the pointed end facing up at a depth of 3 to 5 cm – cloves placed in an incorrect orientation may develop but with misshapen bulbs and shoots.
4. Depending on weed control methods (such as tilling), rows can be planted as close as 20 cm, with garlic clove plant spacing of 7 to 12 cm within the row[10]. Garlic can be planted in single rows or in multi-row beds and the beds themselves may be raised or flat.
5. If two fields are planted (Field 1 – 85 m wide east-west and approximately 75 m long north-south, Field 2 – 85 m wide and approximately 50 m long. Irregularly-sized polygons due to lot shape), using the above plant-spacing parameters, this equates to approximately 375 rows of 700 plants in Field 1 and 250 rows of 700 plants in Field 2. This equates to 262,000 garlic cloves planted for Field 1 and 175,000 garlic cloves planted for Field 2.
6. Mr. Sahota may elect to plant one field in the first season and plant the second field in the next season if the first crop is successful (no issues with disease or pests, for example). Alternatively, he can plant the entire field in the first season (fall planting) for an early summer harvest in the second year.

5. Agricultural Improvement Cost Estimate (including material costs, drainage costs, irrigation costs and installation costs)

Mr. Sahota owns his own contracting company and has nearly 40 years of experience in land preparation and earthworks. His company is called Sahota Contractors and is based in Burnaby, B.C. He has a team of employees who can assist with land preparations.

According to Mr. Sahota, it is approximately $10,000 per acre to prepare a site, install ditches, place soil ect. Therefore, for this site, approximately $30,000 to $40,000 is anticipated for site preparation (the property is 3.44 acres).

[10] https://www2.gov.bc.ca/gov/content/industry/agriservice-bc/production-guides/vegetables/garlic BC Ministry of Agriculture Garlic Production Guide. Accessed July 2, 2020

6. Projected Income Statement (5-10 years)

The proposed farm operation is garlic farming, which Mr. Sahota has begun doing as a hobby at his Burnaby residence.

PHOTO 1. GARLIC PLANTED BY MR. SAHOTA AT HIS RESIDENCE HOBBY FARM IN BURNABY.

Estimating the projected income from garlic farming is largely speculative. It is estimated using current (2020) costs of garlic seed (cloves), machinery, farm wages, and fuel for example. Due to events beyond the applicants control, costs may significantly vary in 5 to 10 years. For instance, fuel costs may increase significantly due to geopolitical events. Garlic seed costs have remained relatively stable since 2016 from my preliminary research however, seed can be difficult to source due to increased popularity of this crop in Canada.

Costs of first planting:

Garlic is sold by the bulb (although this is called a "seed" by some suppliers). I have researched Canadian garlic "seed" sellers and found that garlic bulb prices vary between varieties and bulb sizes. The variation can be between $1.85 per bulb for small bulb of common varieties such as Russian Red, to approximately $4.85 for jumbo bulbs[11]. I will use an average price of $2.00 per bulb to account for a variety of garlic

[11] https://garlicseed.ca/collections/all-varieties John Boy Farms online garlic seed prices for 2018/2019. Manitoba, Canada.

types that may be grown on the property. The cost decreases if purchased as a large bulk order (i.e. 10 bulbs or more)[12].

The number of clove 'seeds' in each bulb differs greatly between garlic varieties – between 4 and 20 seeds in cases. A good average estimate is 10 cloves per bulb.

If Mr. Sahota plants one field (Field 1) in the first season (**therefore, Year 1 is defined as the first harvest year if planting is done the previous fall – the planting year is essentially Year 0**) with approximately 260,000 cloves, this would require approximately 26,000 bulbs. Field 2 would require approximately 17,500 bulbs, for a total of 43,500 bulbs for both fields.

Thus the initial bulb investment may be on the order of $80,000 (if both fields are planted at $2 per bulb). **It is important to note that garlic bulbils from the first harvest can be retained to propagate more garlic – this would negate the need to purchase new bulbs for the second season.**

Projected Income

According to 2019 annual market data from Agriculture and Agri-Food Canada[13], organic garlic in Canada fetched $78 to $88 per 22 lb container (standard unit). This corresponds to $3.5 to $3.90 per lb. According to a 2017 article on Canadian garlic farming in the Western Producer[14], prices for locally produced garlic in Ontario fetch $5 per pound for wholesale and up to $8 per lb sold 'on the farm'.

An initial crop of 260,000 plants (bulbs) would yield approximately 28,000 lbs of garlic (an average bulb is approximately 50 grams). If only half of this crop is sold, this corresponds to 16,000 lbs with a wholesale price (using the lowest quoted price of $3.50 per lb in 2019 market data) of approximately $56,000. **If the entire crop is sold wholesale, it would yield a sales income of $112,000.**

If both fields are planted, approximately 48,000 lbs of garlic could be produced, yielding $168,000 if sold wholesale (using $3.50 per lb). It is unrealistic that all bulbs will be sold – some bulbs may not sold due to poor growth characteristics or disease and some bulbs must be retained for re-planting and

[12] http://www.rasacreekfarm.com/garlic-store/current-inventory-levels Rasa Creek Farms in Lumby, B.C. will be charging $2 per bulb in summer 2020 for non-organic garlic.

[13] https://infohort.agr.gc.ca/IH5_Reports/cognosSubmitter.xhtml Annual Summary of Daily Wholesale to Retail Market Prices – Garlic. Prices for Toronto, Ontario.

[14] https://www.producer.com/2017/04/garlic-growers-smell-future-expansion/ Western Producer news article - 2017.

propagation. If 75% of the crop produced by the farm (36,000 lbs) is sold at 2019 wholesale prices of $3.50 per lb, this may yield approximately $126,000.

This is not the projected net annual income of the farm. There will be costs associated with regular farm maintenance, wages, planting (including cracking bulbs to harvest cloves for further propagation of seed), fertilization/soil amendments, harvesting, and treatment of pests and disease. Mr. Sahota will hire an individual to conduct all farm maintenance – if he pays this individual $50,000 per year (which is higher than current reported farm wages of approximately $12-$14.00 per hour), and spends approximately $5000 to $10,000 per year on farm supplies including tools, implements, fertilizer, costs to run the farm can be expected to be up to approximately $60,000 per year.

There is also a one-time significant cost of purchasing the initial bulbs. This may be upwards of $80,000 for the first year (if both fields are planted, or 435,000 plants). Bulbs can be retained annually and propagated from the original purchased stock.

The basic, projected five year net income is:

Approximately $60,000 per year to run the farm (farm wages and supplies, maintenance, soil testing, amendments, tools, machinery upgrades ect.) = $300,000 for five years.

$80,000 initial bulb investment (difficult to source garlic locally due to popularity and limited suppliers, this translates to high costs for the bulbs)

Sales income from 75% of the crop: $126,000 per year (if garlic prices remain stable) x 5 years = $630,000

630,000 - $300,000 - $80,000 = $250,000 after five years (if there is continuous harvest)

10 year net income using above parameters - $500,000.

This does not include property taxes paid by Mr. Sahota, purchase of new bulbs in the event of pest or disease affecting the initial bulbs, consulting fees for pest management/control, soil testing, or the purchase of a tractor. A tractor may be on the order of $50,000 plus annual maintenance and fuel costs. Mr. Sahtoa currently owns backhoes and a variety of earthworks equipment therefore; a tractor may not be necessary for the initial farm operation.

Other potential costs include hiring additional labour (to assist a permanent farm employee) during harvest season to ensure quick harvest. Attracting farm labour may be difficult in the Lower Mainland therefore, higher wages may be necessary.

Yours Truly,
MADRONE ENVIRONMENTAL SERVICES LTD.

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

Jessica Stewart, P.Geo., P.Ag.

On behalf of: Mr. Harinder Sahota (applicant)

Attachments – Supplementary Information

1. Topographic Survey
2. Soil Placement Plan (Madrone)

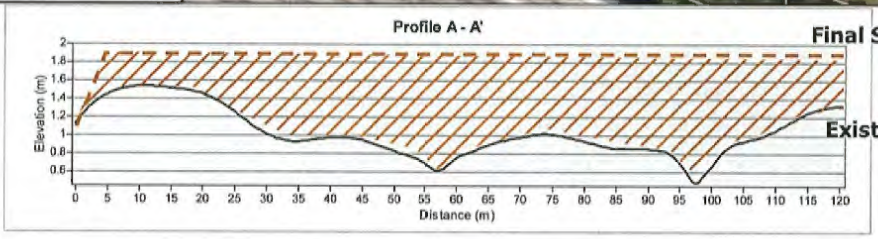
MADRONE
environmental services ltd.

APPENDIX A

Figures

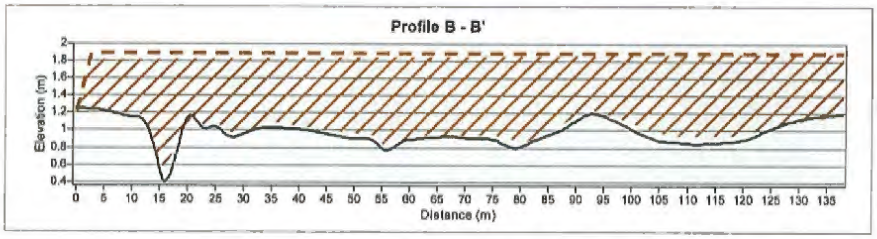
PROJECT: Soil Deposit Assessment : PID 005 - 480 - 663			CLIENT: Harinder Sahota		DOSSIER: 19.0469
ASSESSED BY: Jessica Stewart, P.Geo, P.Ag.	FIELD VISIT: January 7, 2020	LOCATION: Richmond, BC	MAP SCALE: 1:1,400	MAPPING DATE: July 7, 2020	DRAWN BY: Jessi Yellowlees

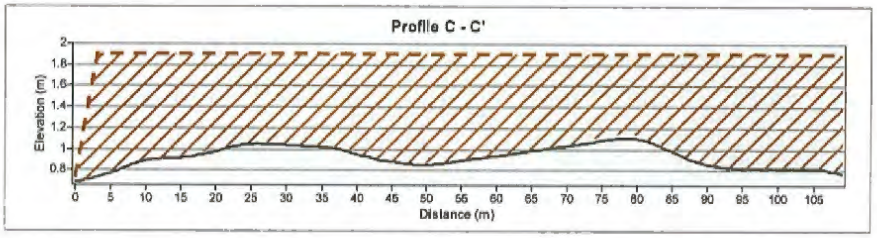
FIGURE 1: Site Plan

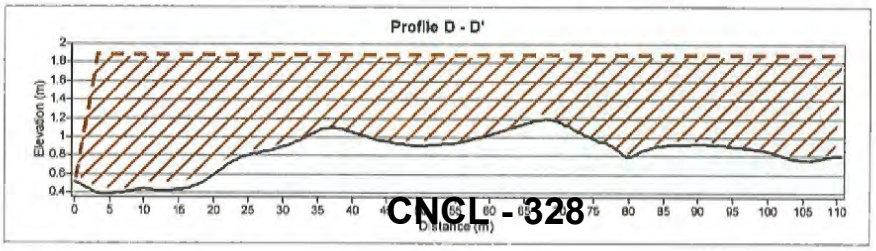


Final Surface Elevation

Existing Topography (from survey)







LEGEND

Imported Soil

Existing Topography

MADRONE environmental services ltd.	**PROJECT:** Soil Deposit Assessment : PID 005 - 480 - 663			**CLIENT:** Harinder Sahota		**DOSSIER:** 19.0469
	ASSESSED BY: Jessica Stewart, P.Geo, P.Ag.	**FIELD VISIT:** January 7, 2020	**LOCATION:** Richmond, BC	**MAP SCALE:** 1:950	**MAPPING DATE:** July 7, 2020	**DRAWN BY:** Jessi Yellowlees

FIGURE 2: Planting Plan - Garlic Farm

MADRONE
environmental services ltd.

1081 Canada Ave
Duncan, BC V9L 1V2
p. 250.746.5545
f. 250.746.5850

#1 – 30435 Progressive Way
Abbotsford, BC V2T 6Z1
p. 604.504.1972
f. 604.504.1912

info@madrone.ca
www.madrone.ca

November 1, 2021

Mr. Harinder Sahota
5547 SE Marine Drive
Burnaby BC V5J 3G7
hsahota56@gmail.com

Dear Mr. Sahota,

Memorandum RE: Locations of agriculturally-suitable soil for importation to PID 005-480-663, River Road, Richmond, BC [CD 93639]

Madrone Environmental Services Ltd. ('Madrone'), acting as the qualified professionals (QP's) retained by you, Mr. Harinder (Harry) Sahota ('the Client'), has prepared this memorandum to identify suitable locations to source soil for completion of the soil importation project proposed for PID 005-480-663, River Road, Richmond, BC ('the Site'). This memorandum is intended to be submitted to the City of Richmond ('the City') for review and consideration by the Mayor and City Councilors prior to the meeting between the Client, Madrone and the General Purpose Committee Meeting scheduled for November 9, 2021.

The approximate volume of imported soil required for completion of the project has been estimated 12,000 m^3, calculated based on the proposed import area (1.39 ha, the entirety of the property minus property line setbacks) and the depth of soil needed (ranging from 0.61 m to 1.13 m[1]) to elevate the lands on the Site for the purpose of improving agricultural capability. It is Madrone's professional opinion that the textural (i.e., physical properties) and origin (i.e., geographical source) criteria for agriculturally-suitable soil required for project completion include the following:

1. A loam textured mineral soil (ideally a silt loam to sandy loam texture);
2. Minimal coarse fragment content (i.e., minimal gravel, cobble and stone content); and
3. Sourced from an area currently and historically zoned residential. Soils should not be sourced from commercial or industrial lands (current or historic) due to potential contamination. Lands currently zoned and used for agriculture are unsuitable soil source locations because of the regulatory restrictions concerning removing soils from agricultural lands.

[1] A topographic land survey was used to prepare this estimate; the survey results are included in the soil deposit assessment/plan prepared for the Site.

As such, Madrone has performed a desktop assessment to identify suitable areas within Richmond and Delta, and also in surrounding municipalities, where agriculturally-suitable soils may be sourced from for the Site. The Client and Madrone would prefer to import soil exclusively from within the municipality of Richmond; it is our opinion that the Client should the prioritize accepting soil originating from Richmond where and when possible. However, we recognize that soil series and their surficial parent materials are not confined by municipal boundaries and as such, there are soils within the City of Richmond municipal limits that are found in neighbouring municipalities and should therefore be considered.

Madrone emphasizes that the topsoil on the Site will be stripped and preserved for later replacement on top of the placed subsoil; we do not anticipate importing topsoil.

Based on Madrone's desktop assessment, agriculturally-suitable soil for important to the Site can be found at the following locations:

- City of Richmond northwest of the Greenacres Golf Course in the residential nieghbourhood west of Jacombs Road and north of Highway 91 (**Placemark 1, Figure 1**);
- City Richmond in the Southarm neighbourhood between No.4 Road and No. 5 Road, north and south of Steveston Highway (**Placemark 2, Figure 1**);
- Municipality of Delta north of Ladner Trunk Road between Highway 17A and 64 St, (**Placemark 3, Figure 1**); and
- South Vancouver west of the Point Grey Golf and Country Club (**Placemark 4, Figure 1**) and east of the Marine Drive Golf Club (**Placemark 5, Figure 1**)

All of these locations are mapped as containing Blundell, Ladner and Benson soils, an ideal agricultural soil because of their stone-free, silt loam texture. Moreover, these locations do not appear to be within commercial area or industrial area, thus reducing the potential for chemical contamination of the sourced soil.

Due to the volume of agriculturally-suitable soil required for project completion (12,000 m^3), the sourcing of soil for importation to the Site will likely need to come from several of the aforementioned locations for completion of the proposed importation project within a 2 year timeframe.

Note that these recommendations are based on provincial mapping[2] which was developed at a small scale covering large areas (1:20,000) and were likely not field verified (via assessment of soil pits) for specific residential neighbourhoods A field assessment should be conducted by a qualified professional to confirm the location-specific textural characteristics of any soils prior to importation. Moreover, prior to

[2] Province of British Columbia (2018). Soil Information Finder Tool. https://www2.gov.bc.ca/gov/content/environment/air-land-water/land/soil/soil-information-finder. Accessed September 23, 2021.

importation to the Site, source soils should be sampled and submitted for laboratory analyses to ensure they are not chemically contaminated (heavy metals, polyaromatic hydrocarbons etc.).

Please contact the undersigned authors should there be any questions regarding the contents of this memo.

Sincerely,

MADRONE ENVIRONMENTAL SERVICES LTD.

Prepared by:

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

Daniel Lamhonwah, PhD, MES, P.Ag
Environmental Scientist, Professional Agrologist

Senior Reviewed by:

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

Jessica Stewart, P.Ag, P.Geo
Professional Agrologist, Professional Geoscientist

FIGURE 1. RECOMMENDED LOCATIONS TO SOURCE SOIL FOR IMPORTATION TO PID 005-480-663, RICHMOND, BC. SHADED POLYGONS SHOWS THE LOCATIONS OF THE PROVINCIAL AGRICULTURAL LAND RESERVE (ALR). IMAGERY PROVIDED BY GOOGLE EARTH; DATED 2021.

McTAVISH
RESOURCE & MANAGEMENT CONSULTANTS LTD.

#203 – 19292 60 Avenue
Surrey, BC
V3S 3M2

April 21, 2020

Bruce McTavish RPBio PAg, has reviewed the documents presented for the proposed fill project located on PID 005-480-663. These documents include the Madrone Environmental Services Ltd. Soil Placement plan, topographic profile, and the preliminary Geotechnical Investigation by Geopacific.

The methodology for soil and agricultural capability assessment meets the criteria of the ALC P-10 policy "Criteria for Agricultural Capability Assessments".

The assessment concluded that the soils on the site are in the Blundell soil series and that the agricultural capability is 4W. The soils are agriculturally limited by excess free water and dense subsoils with undesirable soil structure in the Cg horizon. My review of the soil pit data provided in the Madrone report (including pictures of each pit) support the conclusions that the agricultural capability is 4W.

The Madrone report indicates that the soils are Rego Gleysols in the Blundell soil series. The information provided in the Madrone report supports their conclusion that the soils found on site are in the Blundell soil series.

The Madrone report quotes the Canadian Soil Information Service (CanSIS) as stating the soils have high salinity, however there was no soil testing carried out to confirm this.

The Madrone report states:

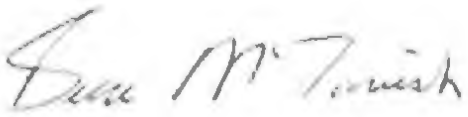
> It is my opinion that the excess wetness experienced on the property may be now artificially exacerbated due its confinement between purposely raised land to the north (River Road dyke), south (CN Railway grade), and to the west (soil placement, up to several metres in elevation by visual inspection from Mr. Sahota's Site – this property has no civic address). There does not appear to be soil placement on the lands to the east (17360 and 17340 River Road). The River Road dyke and the CN railway were in place by the earliest airphoto data I reviewed (1938) however, filling of the property to the west began sometime between 1991 and 1997. Vegetation was re-established by 2004.

My review of the historical aerial photography provided in the Madrone report supports their conclusion that the wetness is likely exacerbated by land raising on adjacent properties.

The Madrone report recommends stripping the existing peat soil and than replacing this as farmable topsoil after the mineral fill is placed on the site. This is the best method of dealing with peat soil as the peat soil especially if mixed with medium textured mineral soil provides a good agricultural growing medium.

The Madrone report has covered all the critical areas of soil and land capability assessment and meets the ALC requirements in their P-10 policy "Criteria for Agricultural Capability Assessments".

The Madrone conclusion on soil depth including peat depth are supported by the geotechnical report.

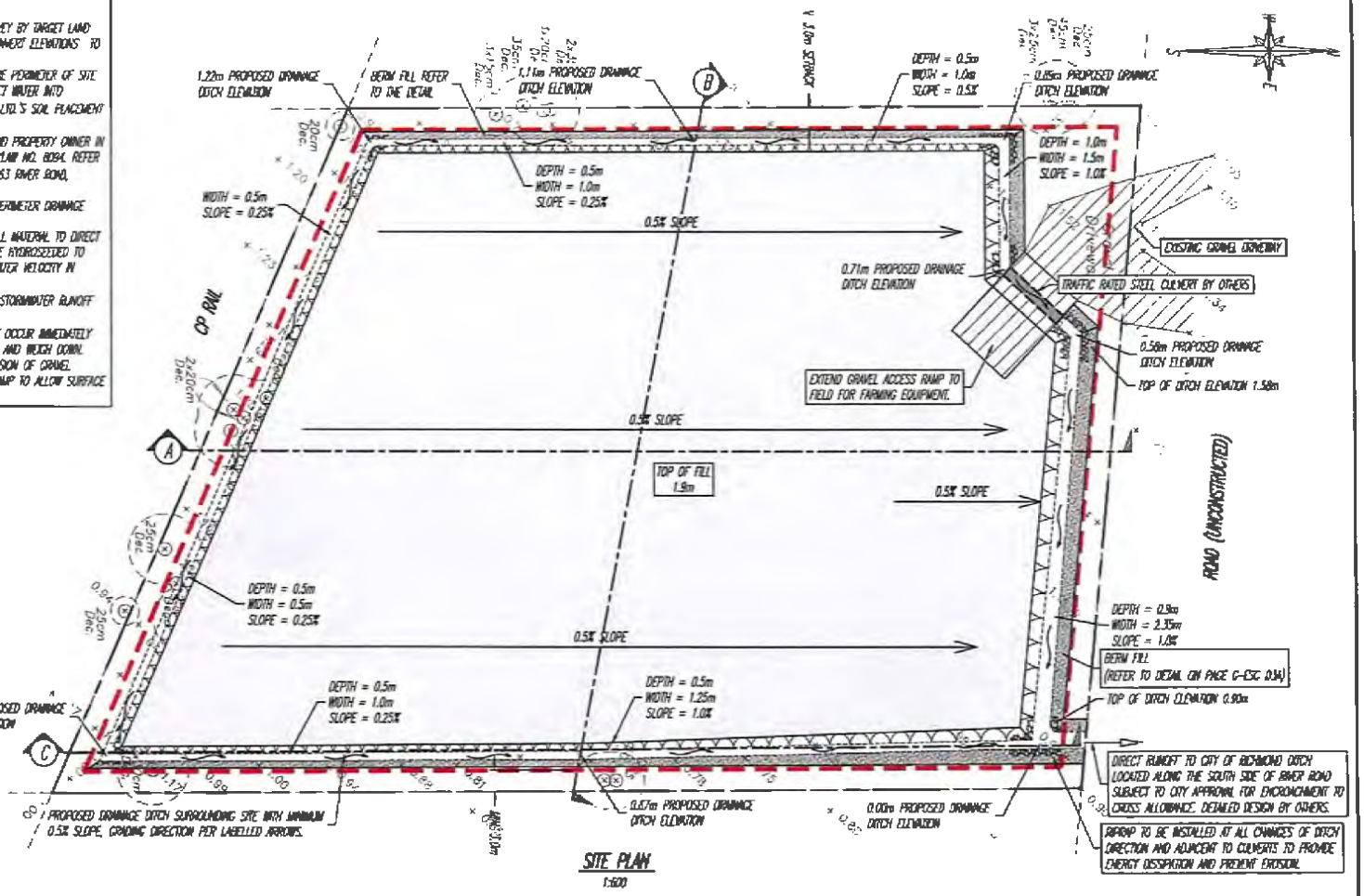


Bruce McTavish, MSc MBA PAg RPBio Red Seal Landscape Horticulture
President

NOTES:

1. INVERT ELEVATIONS AND DRAINAGE DITCH GRADING ARE BASED ON THE PREPARED SURVEY BY TARGET LAND SURVEYING AND PUBLICLY AVAILABLE INFORMATION FROM THE CITY OF RICHMOND GIS. INVERT ELEVATIONS TO BE CONFIRMED PRIOR TO CONSTRUCTION.
2. MINIMUM 3.0 M SETBACK FROM TOE OF FILL SLOPES TO BE ESTABLISHED ALONG ENTIRE PERIMETER OF SITE TO SEPARATE FILL FROM SURROUNDING PROPERTIES. SETBACK TO BE GRADED TO DIRECT WATER INTO PERIMETER DRAINAGE DITCHES ONSITE. (REFER TO MADRONE ENVIRONMENTAL SERVICES LTD.'S SOIL PLACEMENT PLAN PID: 005-480-663 RIVER ROAD, RICHMOND, BC DATED JULY 15, 2020.)
3. THE METHOD OF FILL DEPOSITION IS TO BE CONDUCTED BY EARTHWORKS OPERATOR AND PROPERTY OWNER IN COMPLIANCE WITH CITY OF RICHMOND SOIL REMOVAL AND SOIL DEPOSIT REGULATION BYLAW NO. 8094. REFER TO MADRONE ENVIRONMENTAL SERVICES LTD.'S SOIL PLACEMENT PLAN PID: 005-480-663 RIVER ROAD, RICHMOND, BC DATED JULY 15, 2020 FOR ADDITIONAL RECOMMENDATIONS.
4. TOP OF FILL MATERIAL TO BE GRADED TO DIRECT SURFACE STORMWATER RUNOFF TO PERIMETER DRAINAGE DITCHES.
5. SURFACE STORMWATER RUNOFF DRAINAGE DITCHES TO BE CONSTRUCTED AT TOE OF FILL MATERIAL TO DIRECT WATER TO DISCHARGE POINT AT NORTHEAST CORNER OF SITE. DRAINAGE DITCHES TO BE HYDROSEEDED TO STABILIZE SLOPES. ROCK OR FILTER SOCK CHECK DAMS TO BE INSTALLED TO SLOW WATER VELOCITY IN DITCHES.
6. PIPE/CULVERT TO BE INSTALLED AT NORTHEAST CORNER OF SITE TO DIRECT SURFACE STORMWATER RUNOFF TO CITY DRAINAGE DITCH NORTH OF SITE (BY OTHERS).
7. STABILIZE ALL SLOPES OF FILL MATERIAL BY HYDROSEEDING. IF HYDROSEEDING CANNOT OCCUR IMMEDIATELY DUE TO WEATHER CONDITIONS, COVER EXPOSED SLOPES WITH POLYETHYLENE SHEETING AND WEIGH DOWN.
8. ACCESS TO THE TOP OF FILL FOR FUTURE FARM EQUIPMENT TO BE GAINED VIA EXTENSION OF GRAVEL DRIVEWAY. TRAFFIC RATED STEEL CULVERT TO BE INSTALLED UNDER GRAVEL ACCESS RAMP TO ALLOW SURFACE STORMWATER RUNOFF TO BE DIRECTED TO NORTHEAST CORNER FOR DISCHARGE.

DESIGN ASSUMPTION:
AS PER TABLE 8.1 IN THE BC AGRICULTURAL DRAINAGE MANUAL, THE ANTICIPATED PEAK FLOW FROM A SITE IN THE LOWER FRASER VALLEY OF AN AREA OF 12267.7m² IS 7.36 L/s



SITE PLAN
1:600

LEGEND:
- PROPERTY LINE
- SETBACK
- DRAINAGE DITCHES
- WATER FLOW DIRECTION
- BERM FILL
- EXISTING ELEVATION
- TOP OF FILL SLOPE DIRECTION

NO.	DATE	BY	REVISION
04	JUNE 29, 2021	M.K.	GRADING & DITCH REQUIREMENT REVISIONS
03	MAY 28, 2021	M.K.	GRADING & DITCH REQUIREMENT REVISIONS
02	MAY 11, 2021	M.K.	DITCH SPECIFICATIONS & PAGE RENUMBERING
01	APRIL 22, 2021	M.K.	DITCH ELEVATIONS

GEOPACIFIC

DESIGNED BY:	A.Ge.
DRAWN BY:	M.K.
APPROVED BY:	F.B.
REVIEWED BY:	M.T.I.
SCALE:	AS SHOWN

PROPOSED AGRICULTURAL DEVELOPMENT

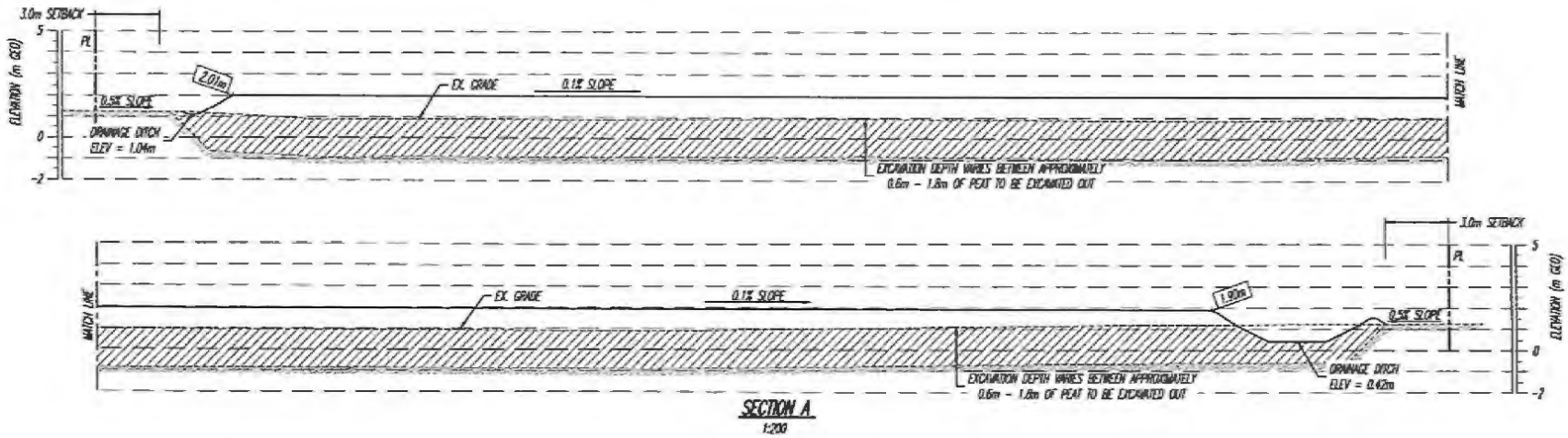
PID: 005-480-663

DRAINAGE PLAN

FILE NO:	12308
DRAWING NO:	G-01
DATE:	OCTOBER 20, 2020

SEAL: PROFESSIONAL ENGINEER, PROVINCE OF BRITISH COLUMBIA, F. BATENI # 45495

ORIGINAL PAPER SIZE 11"x17"



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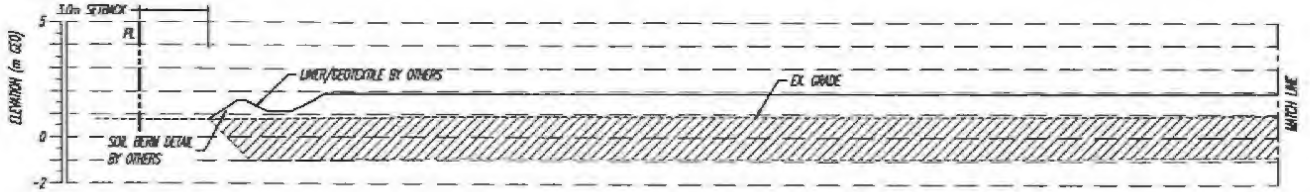

SECTION B
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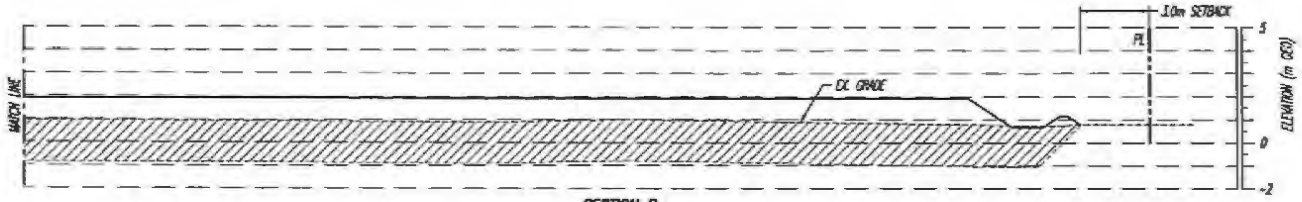


NOTES:

1. INVERT ELEVATIONS AND DRAINAGE DITCH GRADING ARE BASED ON THE PREPARED SURVEY BY TARGET LAND SURVEYING AND PUBLICLY AVAILABLE INFORMATION FROM THE CITY OF RICHMOND GIS. INVERT ELEVATIONS TO BE CONFIRMED PRIOR TO CONSTRUCTION.

LEGEND:

- ------ - EXISTING ELEVATION
- /// - EXISTING PEAT FILL
- [ ] - PROPOSED FILL MATERIAL
- 2.00m - PROPOSED ELEVATION

NO.	DATE	BY	REVISION
04	JUNE 29, 2021	N.K.	MINOR REVISIONS
03	MAY 28, 2021	N.K.	GRADING & DITCH REQUIREMENT REVISIONS
02	MAY 11, 2021	N.K.	DITCH SPECIFICATIONS & PAGE RENUMBERING
01	APRIL 22, 2021	N.K.	DITCH ELEVATIONS

GEOPACIFIC
VANCOUVER KAMLOOPS CALGARY

DESIGNED BY: A.Gz.
DRAWN BY: N.K.
APPROVED BY: F.B.
REVIEWED BY: M.T.L.
SCALE: AS SHOWN

PROPOSED AGRICULTURAL DEVELOPMENT

PID: 005-480-663

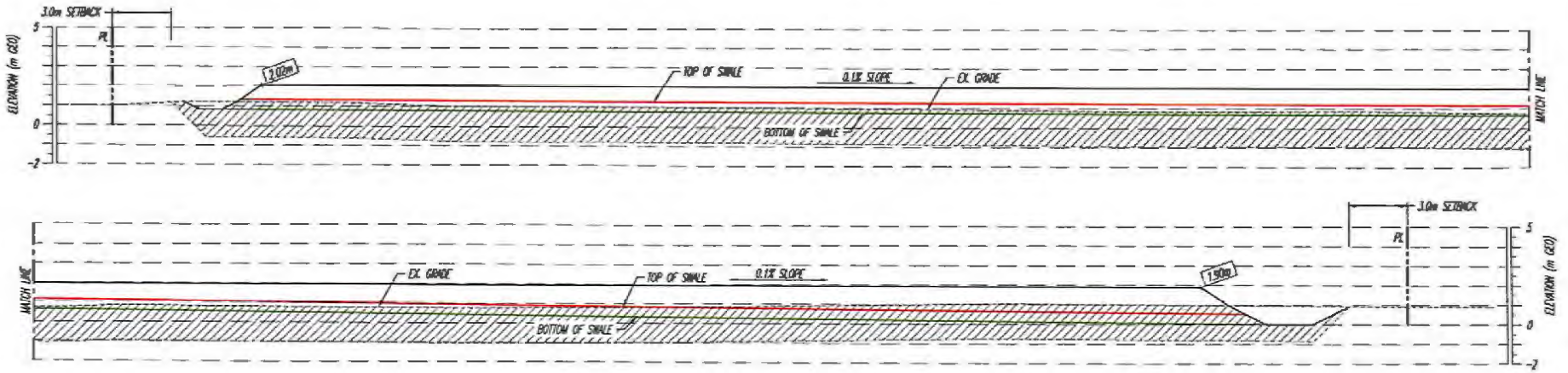
SECTION A & B

FILE NO: 12308
DRAWING NO: G-02A
DATE: OCTOBER 20, 2020

SEAL:
NOV 0 5 2021
PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
F. BATENI
45495

ORIGINAL PAPER SIZE 11"x17"

CNCL - 337



SECTION C
1:200

NOTES:

1. INVERT ELEVATIONS AND DRAINAGE DITCH GRADING ARE BASED ON THE PREPARED SURVEY BY TARGET LAND SURVEYING AND PUBLICLY AVAILABLE INFORMATION FROM THE CITY OF RICHMOND GIS. INVERT ELEVATIONS TO BE CONFIRMED PRIOR TO CONSTRUCTION.

JUL 0 5 2021

LEGEND:
- ------ - EXISTING ELEVATION
- —— - TOP OF SWALE
- —— - BOTTOM OF SWALE
- /// - EXISTING PEAT FILL
- [ ] - PROPOSED FILL MATERIAL
- 2.00m - PROPOSED ELEVATION

NO.	DATE	BY	REVISION
04	JUNE 29, 2021	N.K.	MINOR REVISIONS
03	MAY 28, 2021	N.K.	GRADING & DITCH REQUIREMENT REVISIONS
02	MAY 11, 2021	N.K.	DITCH SPECIFICATIONS & PAGE RENUMBERING
01	APRIL 22, 2021	N.K.	DITCH ELEVATIONS

GEOPACIFIC
VANCOUVER KAMLOOPS CALGARY
1779 W. 75th Avenue Vancouver, B.C. V6P 6P2
P 604.439.9422 F 604.439.9189

DESIGNED BY: A.Gz.
DRAWN BY: N.K.
APPROVED BY: F.B.
REVIEWED BY: M.T.L.
SCALE: AS SHOWN

PROPOSED AGRICULTURAL DEVELOPMENT
PID: 005-480-663
SECTION C

FILE NO: 12308
DRAWING NO: G-D2B
DATE: OCTOBER 20, 2020

SEAL: PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA F. BATENI # 45495

ORIGINAL PAPER SIZE 11"x17"

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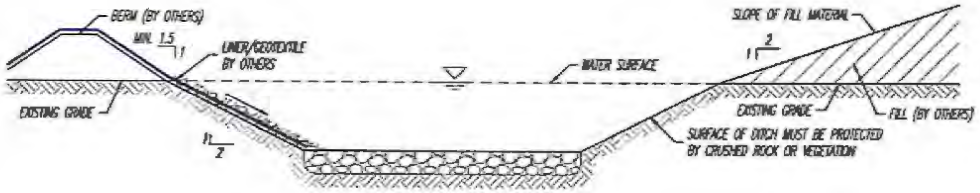


DRAINAGE DITCH DETAIL

1:20

NOTES:

1. SURFACE OF DRAINAGE DITCH TO BE HYDROSEEDED.
2. DRAINAGE DITCH TO HAVE MINIMUM 0.25% SLOPE.
3. WIDTH AND SLOPE OF DITCH AS SPECIFIED ON G-ESC1.
4. PROVIDE REGULAR DITCH MAINTENANCE TO PREVENT GROWTH OF DENSE VEGETATION.
5. BERM TO BE SEEDED FOR GRASS COVER.

JUL 05 2021

LEGEND:

NO.	DATE	BY	REVISION
05	JUNE 29, 2021	N.K.	MINOR REVISIONS
04	JUNE 21, 2021	N.K.	REVISED SWALE DETAIL & PAGE RENUMBERING
03	MAY 28, 2021	N.K.	REMOVED PLASTIC SHEETING DETAIL
02	MAY 11, 2021	N.K.	REVISED SWALE DETAIL & PAGE RENUMBERING
01	APRIL 22, 2021	N.K.	REVISED DITCH DETAIL

GEOPACIFIC
VANCOUVER KAMLOOPS CALGARY

DESIGNED BY:	A.Qz.
DRAWN BY:	N.K.
APPROVED BY:	F.B.
REVIEWED BY:	M.T.L.
SCALE:	AS SHOWN

PROPOSED AGRICULTURAL DEVELOPMENT

PID: 005-480-663

DETAIL DRAWINGS (1 OF 2)

FILE NO:	12308
DRAWING NO:	G-03
DATE:	OCTOBER 20, 2020

SEAL:

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
F. BATENI
45495

ORIGINAL PAPER SIZE: 11"x17"

GEOPACIFIC
VANCOUVER KAMLOOPS CALGARY

P 604.439.0922
F 604.439.9189
geopacific.ca
1779 W 75th Ave,
Vancouver, B.C. Canada V6P 6P2

Sahota Holdings Ltd.
5547 Marine Drive
Burnaby, BC
V5J 3G7

February 12, 2021
File: 12308

Attention: Harry Sahota

Re: Preliminary Geotechnical Investigation Report- Proposed Agricultural Development
17260 River Road, Richmond, BC

1.0 INTRODUCTION

We understand that you wish to redevelop the above referenced site with an agricultural development. No detailed design information has been provided at this time, however, we expect the redevelopment would consist of removing peat soils at the site, stockpiling peat soils, filling the site with structural fill, and capping the fill with agricultural soil for farming purposes. We further expect that a gravel access road will be provided in the area. The remainder of the site would be utilized as a storage yard.

This report has been prepared exclusively for Sahota Holdings Ltd., for their use and the use of others on their design and construction team for this project. This report presents the results of an investigation of the soil and groundwater conditions at the site and makes preliminary recommendations for the design and construction of the proposed buildings and asphalt paved parking areas.

2.0 SITE DESCRIPTION

The site is located east of the intersection of River Road and No. 8 Road in East Richmond, BC. The site is bounded by River Road to the north, private property to the east and west, and a CN Railway yard to the south. The site is presently improved with a single family home at the north west corner of the site, and is covered in low lying vegetation and some trees. The site is essentially flat. The location of the site in relation to adjacent lands as well as existing improvements is shown on the attached plan, Drawing No. 12308-01, following the text of this report.

3.0 FIELD INVESTIGATION

GeoPacific Consultants Ltd. conducted a site investigation on June 27, 2019, using the subcontracted services of Uniwide Drilling of Prince George, BC. The site investigation was comprised of five augered test holes, two cone penetration test (CPT) soundings, and one seismic cone penetration test (SCPT). All five augered test holes were advanced to a depth of 9.1 metres below current site grades. The soils were logged in the field and samples were collected for laboratory moisture content analysis.

Prior to our investigation, a BC one call was placed and a member of our utility locate staff was on site to clear the test locations of buried services. All test holes were backfilled and sealed in accordance with provincial abandonment requirements following classification, sampling and logging.

The CPT is an in-situ testing device which is pushed into the ground employing a hydraulic ram on the drill rig. The cone penetrometer records measurements of tip resistance, sleeve resistance, dynamic pore water pressure, temperature, and inclination in 50 mm increments. Shear wave velocities can also be collected in 1 m intervals when required. The data obtained may be correlated to estimate engineering parameters such as shear strength, relative density, soil behaviour type, and consolidation coefficients. The stratigraphic interpretation was verified with the auger test holes as described above.

The test hole logs are presented on Figure A.01 to A.05 in Appendix A. The CPT sounding data is presented in Figures B.01 to B.03 of Appendix B. Interpreted Soil Parameters are presented in Appendix C, Liquefaction Assessment in Appendix D and Shear Wave Velocity data in Appendix E. The approximate locations of the test hole and CPT soundings are shown on our Drawing 12308-01, following the text of this report.

4.0 SUBSURFACE CONDITIONS

4.1 Soil Conditions

The soil conditions at our test hole locations were considered to consist of topsoil, underlain by peat, underlain by organic silt, underlain by overbank silt deposits, underlain by Fraser River channel sands, underlain by marine silt to the maximum depth explored. A detailed description of the soils encountered is as follows:

TOPSOIL

The ground surface at our test hole locations is covered with between 150 and 600 mm of topsoil. The topsoil was noted as black-brown, moist, with some organics.

PEAT/ORGANIC SILT

The topsoil is underlain by a layer of soft peat in TH 19-01, TH19-02 and TH19-05. The peat was described as soft, semi-fibrous, moist to wet and dark brown. The peat extends to depths between 0.6 to 1.8 m below grade at the site. The moisture content of the peat was found to be between 76.9 and 289.4 percent based on laboratory analysis. The peat and/or topsoil is underlain by a sequence of wet, soft, fibrous organic silt. The organic silt was found in all of our test holes, extending to depths of between 1.5 to 4.0 m below grade at the site. The moisture content of the organic silt was found to be between 53.1 and 166.4 percent based on laboratory analysis. This peat and organic silt shows high compressibility under the anticipated loading.

SILT (Overbank Sediments)

The peat and/or organic silt is underlain by a sequence of overbank sediments comprised of soft to firm silt to sandy silt. The overbank silt sequence extends to depths of between 7.0 to 7.6 m below grade at the site, The undrained shear strength of the silt is between 20 and 25 kPa based on CPT interpretations, shown in Appendix C. The moisture content of the silt was found to be between 38.8 and 86.1 percent based on laboratory analysis. The overbank sediments show moderate compressibility under the anticipated loading.

Fine Sandy SILT to Silty SAND (Transitional Sequence)

The overbank silt is underlain by 0.3 to 1.2 metre of a transitional sequence comprised of compact silty sand to firm to stiff sandy silt. Laboratory testing shows the moisture content of the transitional sequence is around 46.7 percent. The undrained shear strength was determined to be between 60 to 110 kPa. The sequence is non-plastic and therefore not compressible under the anticipated loading.

SAND (Channel Fill Sediments)

The overbank sequence is underlain by a sequence of channel deposited sands. The slight variations in insitu density, compressibility and mineralogy and grain size are reflected in the shape of the tip resistance curve shown on Figures B.01 to B.03. In general, the Fraser River channel sands at this site are well graded, medium grained, predominately quartz, highly stratified and compact.

SANDY SILT TO CLAYEY SILT (Marine deposits)

The channel deposited sands are underlain by marine deposited sandy silt to clayey silt at depths of between 25.5 and 30 meters below current site grades. These deposits are expected to continue to a significant depth at the site.

For a more detailed description of the subsurface conditions refer tot he test hole logs in Appendix A, the CPT sounding logs in Appendix B and interpreted soil parameters in Appendix C, following the text of this report.

4.2 Groundwater Conditions

The water table at the site was determined by pore pressure dissipation tests carried out in the clean sand layers present at depth, during the CPT soundings. The CPT soundings indicate a static water level of about 1.2 metres below present site grades. Groundwater levels are expected to vary seasonally and tidally with generally lower groundwater levels during drier summer and fall months and periods of low tides. Note that perched groundwater should be expected to occur above the relatively impermeable upper silt layer, and can especially be expected during the wetter winter and spring months.

5.0 DISCUSSION

5.1 General Comments

We understand that the new development will consist of re-purposing the low lying, poorly drained site to accommodate future farming. This would involve removing peat soils at the site, stockpiling peat soils, filling the site with structural fill, and capping the fill with peat for farming purposes. We are in receipt of the soil placement plan, prepared by Madrone. Based on the soil placement plan, we expect grades at the site would be raised by approximately 1.0 m. We have produced a drainage plan for the site based on the soil placement plan prepared by others.

We confirm that the proposed over excavation of peat, replacement with structural fill and grade reinstatement of 1.0 m or less is acceptable form a geotechnical standpoint, and there will be no adverse impacts on surrounding properties and City infrastructure during and post project completion.

We confirm that we have reviewed the soil placement plan, and confirm that the proposed agricultural development feasible from a geotechnical standpoint provided that our recommendations are adhered to.

6.0 RECOMMENDATIONS

6.1 Site Preparation

Prior to any filling on site, all existing foundations, pipes and/or construction debris and any peat, topsoil, loose or otherwise disturbed soil must be removed from the construction area to expose a subgrade of soft to firm silt. Excavation of peat should extend laterally beyond the footprint of fill based on a 1H:1V offset. In general, stripping depths are expected to be around 0.6 to 1.8m, depending on the depth of peat.

We emphasize that the stripping depths are the minimum stripping depths at the test hole locations. It should be recognized that the thickness of unacceptable soil can vary throughout the site.

The native silt will be sensitive to moisture and disturbance; therefore, we recommend that the site be graded to direct water to the perimeter of the excavation to sumps with pumps. The subgrade should also be blinded with 100 mm of 19 mm clear crushed gravel.

GeoPacific must be contacted to confirm the soil conditions during initial excavations for the proposed renovations and confirm the stripping depths and compaction of engineered fill during construction.

6.2 Permanent Fill Placement

As discussed in Section 5.1 above, the peat will be removed from the site, which will be filled with permanent fill followed by a layer of peat topsoil to heights of up to 1.0 m above existing site grades. We expect permanent fill will consist of silty sand to sandy silt. Permanent fill should be placed in 300 mm loose lifts and compacted to a minimum of 90% Modified Proctor Dry Density with a moisture content that is within 2% of optimum for compaction. Fill placement should be completed during dry periods of the year to ensure compaction can be achieved.

GeoPacific should be contacted to review permanent fill placement and compaction.

6.3 Stockpiles

We understand that the stockpiling of both permanent fill material and peat may be required on site during the above noted site preparation work. Due to the sensitivity of underlying soils to excess loading, we recommend peat stockpiles are limited in height to 2.5 m, and permanent fill stockpiles are limited to a height of 1.5 m. Stockpiles should be maintained at a minimum distance equal to the total height of the stockpile from adjacent properties and city infrastructure.

6.4 Temporary Excavations

We expect that temporary excavations of up to 1.8 m may be required to remove the peat from the site. Temporary excavations should be maintained at a maximum slope of 1.5H:1V. All slopes, where not immediately backfilled by structural fill, should be covered in poly sheeting for erosion protection. All cuts in excess of 1.2 m requiring manned entry should be reviewed by GeoPacific in accordance with WorkSafe BC requirements.

6.4 On Site Road Structure

Following the recommended site preparation outlined in Section 6.1, it is our opinion that the minimum road structure identified in Table 1 is adequate to support conventional automobile and truck traffic.

Table 1: Recommended Minimum On Site Road Structure

MATERIAL	THICKNESS (mm)	CBR
Crushed Gravel Base Course - 19 mm minus	150	80
Crushed Gravel and Sand Sub-Base - 75 mm minus	200	8

All base and subbase fills should be compacted to a minimum of 95% Modified Proctor dry density with a moisture content within 2% of optimum for compaction.

6.5 Utility Design and Installation

We anticipate up to 2.0 metres of permanent fill willbe placed over the natural silt which is soft to firm. The silt is sensitive to disturbance and should be protected once exposed. Backfilling of any trenches excavated in the silt should be done with free draining granular material such as sand or clear crushed gravel. Where sand is used, it must be compacted immediately after placement since it will quickly saturate below the water table. Thus, use of clear crush gravel is often more practical below the water table.

All excavations and trenches must conform to the latest Occupational Health and Safety Regulation supplied by the Worker Compensation Board of British Columbia. Any excavation in excess of 1.2 m in depth requiring worker entry must be reviewed by a professional geotechnical engineer.

7.0 DESIGN REVIEWS AND CONSTRUCTION INSPECTIONS

The preceding section make recommendations for the design and construction of the proposed development. We have recommended the review of certain aspects of the design and construction. It is important that these reviews are carried out to ensure that our intentions have been adequately communicated. It is also important that any contractors working on the site review this document prior to commencing their work.

It is the responsibility of the contractors working on-site to inform GeoPacific a minimum of 48 hours in advance that a field review is required. In summary, reviews are required by geotechnical engineer for the following portions of the work.

1. Stripping	Review of stripping depth and peat replacement.
2. Excavation	Review of temporary slopes in excess of 1.2 metres depth.
3. Engineered Fill	Review of materials and compaction degree.
4. Drainage	Review of drainage installation and placement of fills.

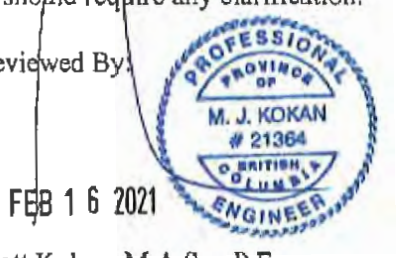
8.0 CLOSURE

This report is prepared solely for used by our client and their design team for this project as described to the general standards of similar work for similar projects in this area. GeoPacific Consultants Ltd. accepts no responsibility for any other use of this report.

We are pleased to assist you with this project and we trust this information is helpful and sufficient for your purposes at this time. However, please do not hesitate to call if you should require any clarification.

For:
GeoPacific Consultants Ltd.

Reviewed By:



FEB 1 6 2021

Daniel Kokan, B.A.Sc., EIT
Geotechnical Engineer in Training

Matt Kokan, M.A.Sc., P.Eng.
Principal