City of Richmond

Report to Committee

To:	Community Safety Committee	**Date:**	June 19, 2020
From:	Cecilia Achiam General Manager, Community Safety	**File:**	12-8080-12-01/Vol 01
Re:	**Soil Use for the Placement of Fill Application for the Property Located at 19740 River Road (Sidhu)**		

Staff Recommendation

That the 'Soil Use for the Placement of Fill' application submitted by Sukminder (Minder) Sidhu (the "Applicant") for the Property located at 19740 River Road proposing to deposit peat to develop and expand the current cranberry farming operation 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	☒
Policy Planning	☒
Sustainability	☒
Transportation	☒
SENIOR STAFF REPORT REVIEW	**INITIALS:** CJ
APPROVED BY CAO	

Staff Report

Origin

The City of Richmond is in receipt of a 'Soil Use for the Placement of Fill' application for the property located at 19740 River Road (the "Property"). The intent of the application is to deposit peat (the "Soil") for the purpose of developing an unfarmed section of the property (northwest portion) and creating a new cranberry cell.

The Property is situated within the Agricultural Land Reserve (ALR) and is subject to provisions of the *Agricultural Land Commission Act (ALC Act)* and its regulations (the "Regulations"), and the City's Soil Removal and Fill Deposit Regulation Bylaw No. 8094 (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 would be required to satisfy the City's requirements outlined in the Soil Bylaw before a soil deposit permit would be issued by the City.

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

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

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

Analysis

The Property is zoned AG1 (Agriculture). The current zoning permits a wide range of farming and compatible uses consistent with the provisions of the *ALC Act* and *Regulations* and the City's Official Community Plan and Zoning Bylaw 8500. The Applicant is applying to deposit 32,000 cubic metres of peat over approximately 5.3 ha of the 35.73 ha Property at an average depth of 0.6m to expand the existing cranberry operations. The proposed peat deposit area does not contain an Environmentally Sensitive Area or a Riparian Management Area.

Uses on Adjacent Lots

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

Table 1: Existing Information and Proposed Changes for the Property

Item	**Existing**
Owner(s)	Jagbar Farms Ltd. (Directors: Sukhminder & Nasib Kaur Sidhu)
Lot Size	35.73 hectares (88.29 acres)
Applicant	Sukminder (Minder) Sidhu (the "Applicant")
Consultant	Jessica Stewart, P. Ag., GIT (Madrone Environmental Services Ltd.)
Consultant	Dr. Stephen Ramsay, P.Eng.
Current Land Uses	A significant portion of the Property is a cranberry farm; proposed peat deposit area is not currently farmed
Proposed Land Uses	Transition unfarmed area into an additional cranberry cell
Official Community Plan Designation	Agriculture
ALR Designation	Property is within the ALR
Zoning	Agriculture (AG1)
Riparian Management Area	None
Environmental Sensitive Area	None

Project Overview

The Applicant, whose family has owned the Property since the 1960's, is proposing to deposit 32,000 cubic metres of peat within the undeveloped northwest portion of the Property to further develop and expand the current cranberry farming operation. The proposed peat deposit area is approximately 5.3 ha at an average depth of 0.6m.

The Applicant has provided a Soil Placement Plan (Attachment 1) developed by a qualified agrologist, Jessica Stewart, P. Ag., GIT, (the "Agrologist") of Madrone Environmental Services Ltd. In addition, a Farm Plan Summary (Attachment 2) provides information related the creation/implementation of the expanded cranberry operation. Figure 5 (Attachment 3) identifies the proposed peat deposit area and proposed planting plan.

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

Agrologist – is sourced to complete the project. Peat 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. The Applicant has stated that potential sources include sites in the Queensborough area.

Following completion of the project, expansion of the current cranberry growing operations will, as per the Agrologist, increase to a "total cranberry production [of] approximately 30 ha" over the entire property.

Richmond Food Security and Agricultural Advisory Committee (FSAAC) Consultation

The Applicant presented the proposal to the FSAAC on June 18, 2020. The FSAAC unanimously supported the proposal and passed the following motion:

> *That the Food Security and Agricultural Advisory Committee support the ALR Soil Use for Placement of Fill Application at 19740 River Road, with the understanding that the imported material will be exclusively peat.*

Agricultural Considerations

The Agrologist has submitted a Soil Placement Plan (the "Placement Plan") and a Farm Plan. The Placement Plan summarizes the following:

- Site description;
- Land capability assessment (ie. current soil conditions);
- Soil importation plan;
- Proposed site monitoring;
- Agricultural plan post-soil deposition/placement;
- Current hydrology; and
- Summary of the Agrologist's recommendations.

The Placement Plan indicates current soil conditions within the proposed soil deposit area are considered to be low in nutrient value and have a poor fertility rating. It is proposed that the imported peat be deposited over the existing soil which had been imported as per a previous ALC approval in 2000. It must also be noted that sand had been imported by a previous land owner for a proposed sawmill that did not come to fruition.

The Agrologist states that the "soil sourced and brought to site should be a rich dark colour and humic to mesic in organic decomposition. Peat soils with a high quantity of roots, particularly large roots and tree branches should be screened before placement." As per the Agrologist, the addition of an organic matter (ie. peat), will amend the current soil conditions and provide an appropriate growing medium for the future cranberry crop. With the addition of the peat: "the post-fill Land Capability for Agricultural ratings will improve from Class 3F minor to moderate fertility limitations to Class 2W, or mild limitations due to high water table (excess wetness)." As per the Agrologist, Class 2 lands have minor limitations that require good ongoing management practices or slightly restrict the range of crops, or both.

The Farm Plan summarizes the following:

- Proposed agricultural plan;
- Project rationale;
- Current land use;
- Soil management; and
- Farm implementation costs.

The Placement Plan and Farm Plan satisfy City reporting requirements.

Bruce McTavish (MSc, MBA, PAg, RPBio) has reviewed the proposal from an agricultural perspective on behalf of the City and has no concerns regarding the land capability assessment provided by the Agrologist as it relates to the current conditions of the Property. In addition, Mr. McTavish has confirmed that the proposal meets all requirements of *ALC Policy P-10 - Criteria for Agricultural Capability Assessments.*

Should the proposal be approved, the City will require that a qualified agrologist be retained to monitor the peat deposit project and provide regular reporting. Should an agrologist not be retained or cease providing regular oversight and reporting, the City would reserve the right, as per the Permit conditions, to suspend and/or void the Permit until such time as a new qualified agrologist, agreeable to the City and ALC, is retained to monitor the project and provide regular reporting.

Drainage & Geotechnical Considerations

As per the Placement Plan, the completed peat deposit area "will [in future years] be intentionally flooded to 'wet pick' the berries every fall". As such, a Water Management Assessment (Attachment 4) has been provided and been reviewed by staff. The Water Management Assessment provides an explanation of the on-site drainage and diking system used throughout the three existing cranberry fields currently farmed by the owner. The engineer-of-record (Dr. Stephen Ramsey, P. Eng.) states that "the proposed drainage system will not have any adverse impacts on adjacent properties".

The Applicant has also provided a Geotechnical Assessment (the "Assessment") and topographic survey. The Assessment (Attachment 5) provides an evaluation of previous authorized soil deposition undertaken in 2000. As per the Assessment: "No adverse geotechnical impacts have been noted occurred during the previous 20 years". In addition, the Assessment states "[t]he proposed soil placement will not have any geotechnical impacts on any of the adjacent properties".

Soil deposit permit conditions will provide staff the latitude to request a geotechnical report at any time and in addition to requiring a closure report from the geotechnical engineer following completion of the project.

Engineering staff are satisfied with the conclusions of both assessments.

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. At the January 27, 2020 Regular Council Meeting, Council made a referral for staff to review the FPMS and provide comments with regard to the raising of land, specifically as it relates to agricultural land and agricultural viability. Staff are preparing a response to this referral.

Environmental Considerations

There is no Environmentally Sensitive Area designated within the proposed peat placement area or a Riparian Management Area within close proximity of the peat placement area. There will be no impacts to trees due to peat deposit operations.

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

Financial Costs and Considerations for the Applicant

Unlike typical soil deposit projects, the Applicant intends to only import peat to complete the project. The Applicant has stated that peat importation will not result in him receiving any tipping fees as is typically collected with other types of soil.

The Applicant has provided a table outlining the upfront and estimated future project costs to expand the current cranberry farming operation (Attachment 6).

Road and Traffic Considerations

Transportation staff have reviewed the proposal. A Traffic Management Plan will be required to be submitted and reviewed by City staff prior to the Permit being issued to ensure site traffic is properly managed and public safety is addressed. River Road does have a 9T load limit; however, trucks will be permitted to use this roadway if there is no alternative route to the destination.

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:

- Oversight by a professional agrologist;
- Source site inspection requirements;
- On-site monitoring and reporting requirements;
- Measures needed to eliminate impacts, including drainage, to neighbouring properties and City infrastructure;
- Permitted hours/days of operation;
- An approved Traffic Management Plan; and

- Security deposits (further explained below).

Site monitoring, source site inspection and 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 an on-site monitor to inspect each load of peat prior to deposition and maintain an accurate daily log of trucks depositing peat on the Property. The Agrologist will be required to inspect and approve all source sites. At the sole discretion of the City, alternate measures may be required (i.e. survey) in order to determine the volume of peat deposited on the Property.

In addition, due to the location of the jet fuel pipeline to the north of the proposed peat placement area, the Applicant will need to ensure that the pipeline owner or any other government body having authority over the pipeline has provided approval to undertake work before the City will provide a Permit. Such activities would warrant that the Applicant notify BC 1 Call prior to commencing with the project.

No peat 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.

In addition to the expected reporting requirements of the Agrologist or other qualified professionals to the City and ALC, City staff will maintain proactive inspections and enforcement on the Property that will include the following:

- multiple site inspections of the Property per week at the onset of the project to ensure conditions of the Permit are being maintained;
- weekly site assessments to continue to be undertaken when peat importation is underway to ensure the Permit conditions are respected;
- meet on-site with the site supervisor a minimum of two times per month;
- maintain communications with the Agrologist and the project coordinator on a monthly basis;
- review the Agrologist's reports to ensure conditions of the Permit are being satisfied;
- advise the ALC of any concerns relative to the project and request that ALC staff undertake inspections to ensure compliance with the ALC approval conditions; and
- advise pipeline owner representatives or responsible government authority of any concerns relative to the project and request that said representatives undertake inspections to ensure compliance with any provincial and/or federal standards when conducting work within the defined buffer zone.

Security Bonds

Should the peat deposit project receive approval, the City will require that the Applicant provide the following security bonds:

- $5,000 pursuant to s. 8(d) of the current *Boulevard and Roadway Protection Regulation Bylaw No. 6366* to ensure that roadways and drainage systems are kept free and clear of materials, debris, dirt, or mud resulting from the soil deposit activity; and

- $10,000 pursuant to s. 4.2.1 of the current *Soil Removal and Fill Deposit Regulation Bylaw No. 8094* to ensure full and proper compliance with the provisions of this Bylaw and all other terms and conditions of the Permit.

In addition to the security bonds provided to the City, the ALC has the authority to require a performance bond to ensure that all required mitigation and monitoring measures are 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 four previous approvals for projects within the City are as follows:

- $70,000 – 17,500$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 January 2017)
- $500,000 – 102,080$m^3$ (Sunshine Cranberry Farms Ltd. - approved January 2014)

As per the Permit conditions, security deposits 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. City staff is to conduct a final inspection and receive confirmation from the ALC that the project has been completed as per ALC approval prior to closing the file.

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 and/or conditions within a referral to the ALC, similar to conditions already provided within this report.

Financial Impact

None.

Conclusion

Staff is recommending that the 'Soil Use for the Placement of Fill' application for the Property located at 19740 River Road be authorized for referral to the ALC to 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
(8625)

Carli Williams, P.Eng.
Manager, Business Licence and Bylaws
(4136)

Att. 1: Soil Placement Plan (rev. 03 July 2019)
2: Farm Plan Summary (rec. 09 Jun 2020)
3: Agricultural Planting Plan – Fig. 5 (28 Jun 2019)
4: Water Management Assessment (30 Mar 2020)
5: Geotechnical Assessment (30 Mar 2020)
6: Project Cost Table (rec. 09 Jun 2020)

Attachment 1

MADRONE
environmental services ltd.

SOIL PLACEMENT PLAN

Jagbar Farms
19740 River Road, Richmond

FOR:

Mr. Sukhminder Sidhu
Jagbar Farms Ltd.
19740 River Road, Richmond

BY:

Jessica Stewart, P.Ag., G.I.T.
Madrone Environmental Services Ltd.

May 2, 2019
Revised: July 3, 2019

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SOIL PLACEMENT PLAN

19740 River Road, Richmond

1 Synopsis

Mr. Sukhminder Sidhu, the owner of the property at 19740 River Road, proposes to import approximately 32,000 m³ of exclusively peat soil to depth of approximately 0.6 m over 5.3 ha of land located in the un-farmed northwest corner of the property. The property is an active cranberry farm with a total area of 36.8 ha (90.9 acres); the purpose of importing peat is to improve the agricultural limitations of the northwest area, which will allow Mr. Sidhu to expand his cranberry farm to this portion of the site.

The soil placement area (5.3 ha) will be diked on all sides (the west side is currently diked), as is normal for cranberry farming. The fields are flooded with water during harvest time (October) to facilitate a "wet pick". The material for the dikes (sand, gravel) is already located on site.

The proposed 5.3 ha soil placement area is limited primarily by low nutrient holding capacity and low fertility at the Class 3F level, and dense subsoils (3D) due to compaction of the underlying soils during previous soil placement/importation. There are additional mild limitations due to stoniness (2P) and excess wetness (2W).

The intent of topsoil placement is to introduce an organic matter amendment to the predominantly sandy soils placed in the northwest of the property and planting cranberry plants in this area. Jagbar Farms intends to engage local companies to source and import the soil. I have proposed the following basic plan for the site:

1 Prior to any importation, remove all identified construction waste, including large boulders, concrete, rebar, gyproc, and garbage as shown at Placemarks 7, 9, and 14

on **Figure 1**of this report. There may be other pieces scattered around the site. A large rake attachment (to a tractor) can be used to remove large (i.e. >0.2 m) fragments but hand removal may be required for smaller pieces not removed by the rake.

2 I recommend construction of the dikes **before** placement of the organic peat soil to avoid potential run-off issues to adjacent lands on the north, northeast/east (River Road) and west sides (reservoir, then the CN Railway).

3 Since Jagbar Farms is experienced in dike construction and maintenance and has the required materials available on site, I will defer the exact installation of the dikes to them.

4 The proposed access point to the site is from the second entrance at 20000 River Road. Trucks will travel across the farm access road (dike) to the placement site, which should clean the truck tires of tracked sediment. A wheel wash can be installed at 20000 River Road if the gravel access roads are insufficient at sediment removal.

5 Place locally sourced (if possible), mesic to humic peat on the surface of the 5.3 ha fill area and spread it to a uniform depth of 0.6 m. A surveyor can assist with staking the final elevation throughout this area.

6 The sourced peat soil should consist of clean soil from an uncontaminated source; it should have less than 20% coarse fragments (i.e. gravel, cobbles, boulders > 2.5 cm), should not be clay-rich, and should not contain any foreign material. Madrone can assist with screening soil sites for potential contaminants (preliminary studies) and assessing coarse fragment content of incoming soil loads. Sites should also be checked for potential invasive plant species.

7 Since the cranberry bog will be intentionally flooded to “wet pick” the berries every fall, there are no constructed slopes required to drain the site (the land is level).

8 The soil placement operation should be monitored at regular intervals through the process. I recommend monitoring reports every 3000 m^3 in the first year of the project.

9 Once complete a final report should be issued on the condition and final, improved land capability of the filled area. This will be required by the ALC for the return of security bonds posted for the duration of the project.

2 Introduction

Mr. Sukhminder ("Minder") Sidhu of Jagbar Farms Ltd. (Jagbar Farms) retained Madrone Environmental Services Ltd. (Madrone) to prepare a Soil Placement Plan for a portion of the property located at 19740 River Road, Richmond B.C. (**Figure 1**). In addition to preparing a placement plan that adheres to local bylaws[1] and the Agricultural Land Reserve (ALR) General Regulation[2] and ALR Use Regulation[3], a Soil Placement Plan comprises a soil survey of the existing property, soil and climatic restrictions to agriculture, as well as a determination of the land capability for agriculture based on our field assessment.

Jagbar Farms is an active cranberry farm that is part of the Ocean Spray cranberry co-operative. Mr. Sidhu has owned and farmed this property with his family since 1982 (the first cranberry harvest was fall of 1983)[4]. Prior to 1982, Jagbar Farms owned a blueberry acreage less than 1 km from the property. Mr. Sidhu is a long-standing farmer in the City of Richmond and currently has farm status on this property. Jagbar Farms owns additional farmland in the area.

[1] https://www.richmond.ca/__shared/assets/BL809447443.pdf Soil Removal and Fill Deposit Regulation Bylaw No. 8094. City of Richmond. Accessed March 5, 2019

[2] http://www.bclaws.ca/civix/document/id/complete/statreg/171_2002 Agricultural Land Commission Act

Agricultural Land Reserve General Regulation. Accessed March 5, 2019

[3] http://www.bclaws.ca/civix/document/id/complete/statreg/30_2019 Agricultural Land Commission Act

Agricultural Land Reserve Use Regulation. Accessed March 5, 2019

[4] https://digital.lib.sfu.ca/cfu-859/cra0039-005 Bell Farms Ltd, May Brothers Farms Ltd, Columbia Cranberry Company Ltd, and Jagbar Farms Ltd and Canadian Farmworkers Union, Local 1 - Labour Relations Board of British Columbia Decision - CRA0039-005. Accessed March 5, 2019

PHOTO 1. GREAT BLUE HERON
Flying over a Richmond cranberry bog during fall harvest. Photo credit: Anton Bielousov.
http://sakvoiazh.ru/

Mr. Sidhu wishes to expand his cranberry farm by importing exclusively peat to a depth of approximately 0.6 m in the northwest corner of his property, which will improve the fertility of the soil for cranberry farming. This plan pertains to approximately 5.3 ha of land located in the northwest corner of the property (the "soil placement area").

This part of the property has been previously elevated by prior permitted soil placement (ALC permits in 1991 and 2000); the placement intended to elevate the area from flooding posed by the Fraser River and to elevate new cranberry plants above the high water tables. As such, this area of the property is not underlain by native soils but rather imported soils. It is not currently farmed or used for any other purpose.

3 Site Description

The proposed soil deposit site is located in the northwest corner of the property, which is situated at 19740 River Road in Richmond, BC, approximately 9.7 km northeast of Richmond centre on Lulu Island (**Figure 1**). The property is bound to the north by residential properties (no farming indicated), to the east by River Road (and the Fraser River), to the south by a vacant and forested property, and to the west by the Canadian Pacific (CP) Railway.

The legal description of the property is: Block 5N Plan NWP5172 Section 28 Range 4W Land District 36 Except Plan 2 ALL PTNS OF; LYING TO THE NE OF THE NE LIMIT OF THE SRW AS SHOWN ON 5172 S&E BYLAW 50800 & PCL A (RD199324E) S&E S&E BYLAW 50800 Manufactured Home Reg.# B03764.

The property ID is 002-525-836. According to BC Assessment, the property is 36.8 ha (90.93 acres) in extent. The property is zoned AG1 (Agricultural) according to the Richmond Zoning Bylaw 2011 and the property is within the Agricultural Land Reserve (ALR).

3.1 Historical Land Use

I reviewed aerial photography images from 1982, 1986 (the earliest images available via Google™Earth Pro), 2009, and conducted research regarding past use of the property. The farm used to be owned by Jack Bell, who was the first commercial cranberry grower in the province (starting with three acres planted at an unidentified property in 1946)[5]. Jagbar Farms purchased the farm in fall of 1982 and performed their first cranberry harvest on the property in the fall of 1983[6].

The 1982 airphoto shows a large clearing near the current farm storage situated at the River Road driveway entrance. Approximately half of the property is still forested in this photo. By 1986, the site is completely cleared of forest and blueberry established in the northwest corner of the property (where the proposed peat placement is situated). The remainder of the property is a cranberry farm in the 1986 airphoto. There is an irrigation canal established along the southeast side of the property at River Road; this is still in place today. Some access roads were also constructed but these have been upgraded by importing fill (to elevate them above the cranberry bog).

The 2009 airphoto appears to have been taken during the fall when all the surrounding cranberry and blueberry plant leaves have turned red. The farm appears very similar to current day; there are cranberry plants on the majority of the property, as well as a well-developed network of dikes, irrigation canals and reservoirs, and access roads/farm roads. The northwest corner of the property has been filled by soil brought to the site between 1991 and approximately 2005. The remainder of the property has not been filled by imported soil.

[5] https://orderofbc.gov.bc.ca/members/obc-1991/1991-jack-bell/ 1991 Order of British Columbia recipient, Jack Bell. Accessed March 5, 2019

[6] https://digital.lib.sfu.ca/cfu-859/cra0039-005 SFU Digitized Collections: Bell Farms Ltd, May Brothers Farms Ltd, Columbia Cranberry Company Ltd, and Jagbar Farms Ltd and Canadian Farmworkers Union, Local 1 - Labour Relations Board of British Columbia Decision - CRA0039-001. Accessed March 5, 2019

According to a readily available City of Richmond Report[7], Jagbar Farms received approval from the ALC and the City of Richmond in August of 2000 (the date of the staff report) to deposit 52,000 m^3 of fill in the northwest corner of the property. This area is 2.0 ha in extent on the supplied map for the August 2000 report and abuts the reservoir built adjacent to the railway on the west side of the property. The Soil Conservation Permit was issued for five years. Prior to this permit, another soil permit was issued by the ALC on July 17, 1991 for a two year period to deposit 10,000 m^3 of fill on site to grow cranberries and blueberries that were growing on flood-prone land.

3.2 Current Land Use – Property and Surrounding Area

Jagbar Farms has a farm storage facility (constructed 2014 to 2015) located on site, in addition to a manufactured home near the River Road entrance. The majority of the property or approximately 24.7 ha is occupied by cranberry plants or farm infrastructure such as dikes, farm roads, and irrigation canals and reservoirs. Approximately 2600 m^2 of the property situated on the southwest side of property is outdoor storage for farm machinery, including tractors, excavators, harvesting machinery, and implements.

The surrounding area is actively farmed for cranberries, blueberries, and forage crops[8]. There are also several dairy farms in the area. River Road is a heavy industrial area with trucking and manufacturing businesses, shipyards, and railways.

3.3 Climate

The nearest Environment Canada weather station is at Richmond Nature Park[9], located approximately 6.2 km to the southwest at an elevation of 3 m above mean sea level. The records from 1981 to 2010 show a mean annual precipitation of 1262 mm, a daily average temperature of 11°C (among the highest in Canada), and 2244 effective growing (> 5°C) degree days (Environment Canada, 2011).

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[7] https://www.richmond.ca/__shared/assets/0828_item131305.pdf Application for Soil Conservation Permit (Soil Placement). August 22, 2000. Accessed March 5, 2019

[8] Farm Activity information in the surrounding area gathered by data from City of Richmond Interactive Map Program, BC Assessment, and Google Earth Pro imagery for 2018.

[9] http://climate.weather.gc.ca/climate_normals/index_e.html Richmond Nature Park climate station. Accessed March 5, 2019

For comparison, the UBC ClimateWNA_Map[10] program normals data for the period spanning 1981 to 2010 shows that the property area receives approximately 1255 mm of precipitation annually and 2279 effective growing degree days > 5°C. This correlates well with the Richmond Nature Park data.

Due to the distribution of when precipitation falls, the property is designated a 3A(1) in the Climatic Capability for Agriculture scheme of Coligado, 1980. Class 3 aridity limitations indicate drought or aridity between May 1 and September 30 resulting in moisture deficits, which are limiting to plant growth and could require moderately intensive management. This will dictate that certain crops will require irrigation for dry periods in mid-summer to early fall

3.4 Landscape and Topography

The property is situated on a delta formed by the Fraser River, which is located approximately 25 m northeast of the property boundary at River Road. The local topography is level with no bedrock outcrops or discernible streams.

Lulu Island was below sea level and covered by the marine waters of the Salish Sea at the end of the Fraser Glaciation approximately 11,000 years ago. After isostatic rebound (and recession of marine waters) and growth of the delta by deposition of clay and silt by the Fraser River (and later sandy deposits), the land naturally vegetated with forested wetlands Before the property was cleared for farming, it was a forested wetland situated adjacent to the Fraser River intertidal zone.

The landscape has been altered by soil importation in the northwest corner; this has raised the land by an estimated 2.5 m (and up to 3 m) above the natural elevation (see **Photo 2**, below). The remainder of the site has not been elevated by fill; a geodetic control marker located in the southern part of the property (in the cranberry field, **Photo 3**) is situated at approximately 1.8 m above sea level[11]. This is the main topographic information I have found for this area; there is no topographic land survey data (available through Jagbar Farms) or contours available from iMapBC or the Richmond Interactive Map.

[10] http://www.climatewna.com/ ClimateWNA_Map program. Accessed March 5, 2019

[11] http://a100.gov.bc.ca/pub/mascotw/protected/final_long.html?Q_GCM_NO=473793 Geodetic Control Marker, GCM No: 473793. Accessed March 5, 2019

According to the Richmond Interactive Map program[12] the Flood Construction Level (FCL) for developments in this area is 3.5 m GSC; this is the minimum elevation of the base of the foundation required for any new building (including the farm storage facility) in this part of the Fraser River floodplain. River Road is a dike that forms the eastern limit of the North Dike of Lulu Island[13].

The surficial geology of this area was mapped by Armstrong (1980) as post-glacial Salish Sediments. These sediments are composed of bog, swamp and shallow lake deposits. There is lowland peat up to 14 m thick overlying Fraser River overbank deposits comprised of sand, silt, and clay.

[12] https://maps.richmond.ca/rim/ Richmond Interactive Map Program. V. 1.12. Accessed March 5, 2019

[13] http://www.env.gov.bc.ca/wsd/public_safety/flood/maps/richmond_3.pdf Ministry of Environment: Richmond Dike Map. Accessed March 5, 2019

PHOTO 2. APPROXIMATELY 2.5 M OF FILL HAS BEEN PREVIOUSLY PLACED
Over the northwest corner of the property, including where the farm storage facility is situated at the River Road entrance.

PHOTO 3. LOOKING NORTHEAST
Across the cranberry farm. This photo was taken from an access road that also acts as a dike. The field is partly flooded by melting snow and ice.

The majority of cranberry farm is situated in a flooded peat bog that has been diked for over 30 years. Mr. Sidhu and I did not excavate the peat soils due to flooded conditions; furthermore, we did not want to damage the producing cranberry plants. The mapped and assessed soils are described in detail in the next sections of this report.

3.5 Published Soils and Land Capability Data

This section of the report summarizes the characteristics of the surveyed and mapped soils and Land Capability for Agriculture (LCA) ratings for the property. 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 C.

The soils in this area were mapped by Luttmerding in the 1980's as part of the soil survey titled "Soils of the Langley-Vancouver Map Area". The soil maps were printed at a scale of 1:50,000 and are based on a reconnaissance level soil survey and air photo interpretation and represent a broad interpretation of soils and agricultural capability. I provide a site-specific assessment of the agricultural capability of the property in Section 4, below.

Soil survey maps show that the majority of the property is mapped as the Lulu and Richmond soils (south and west sides), which are organic soils. A small portion of the northern part of the property, including the proposed soil placement site, is mapped as a mix of the Delta and Blundell soils, which are mineral soils with an organic capping. The remaining east portion of the property at River Road is mapped as the Tsawwassen soils, which are anthropogenic (human-modified) sands and gravelly sands dredged and diked along the Fraser River. A summary of the mapped soil properties is summarized in Table 1 and are shown on **Figure 2** in Appendix A. I emphasize that the soils surveyed by Luttmerding are not necessarily accurate but in absence of test pits in the cranberry field, provide a snapshot of the potential soils that may be found in this area.

Table 1. Summary of Mapped[14] Soil Properties

Soil Series	Parent Material	Texture	Drainage	Classification
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
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
Tsawwassen	Anthropogenic (placed for dike, road construction, modified by people)	Coarse, gravelly sand	Moderately Well Drained	Orthic Regosol

The Soil Capability for Agriculture Map (Canada Land Inventory, 1998)[15] shows the property area is dominated by organic soils and is therefore not assigned a capability class. However, according to the Province of B.C. Soil Information Finder Tool (SIFT), which is based on data collected from Provincial Soil Surveys, the assessed capability of land for agriculture for the Delta and Blundell soil complex is Class 4W, 3N, 2D. For the Lulu and Richmond Soils, it is O4WL, and for the Tsawwassen Soils, it is 5FA. A description of each of these capability classes is described in Table 2, below.

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

[15]http://sis.agr.gc.ca/cansis/publications/maps/cli/250k/agr/cli_250k_agr_92g_sw.jpg Soil Capability for Agriculture. Map 92g-SW. Vancouver.

Table 2. Summary of Mapped[16] Land Capability for Agriculture

Soil Series	LCA Rating	Description of Land Capability Rating
Lulu & Richmond Soils	O4WL	Organic Soils with Class 4W limitation and Class 4L limitation. Class 4W is defined as "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". Class 4L -
Blundell & Delta Soils	4W, 3N, 2D	Class 4W – frequent or continuous occurrence of excess water during the growing period or very poorly drained, as above for the Lulu, Richmond soils. Class 3N (salinity) – soils have moderate salt content from 0 to 50 cm and/or have high salt content from 50 to 100 cm [depth]. Most crops are adversely affected. Class 2D (undesirable soil structure and/or low perviousness) – soils have a root restricting layer within 50 to 75 cm of the mineral soil surface, or the upper 25 cm has a slightly sticky wet consistent and usually has a texture of silty clay loam, clay loam, or sandy clay, or the slowest permeability is usually 0.5 to 1.0 cm/hr in the upper 100 cm.
Tsawwassen	5FA	Class 5F (fertility) – soils with very severe nutrient imbalances, extreme acidity or alkalinity and/or extremely high levels of carbonates. Fertility status restricts the range of crops. Class 5A (soil moisture deficiency) – soil moisture deficit is from 266 to 340 mm.

4 Field Assessment

I visited the property on February 21, 2019 to assess the soils in the proposed soil placement site and discuss the importation plan with Mr. Sidhu. Conditions were sunny with excellent visibility; recent snowfall had begun to melt, but was partly frozen with ice throughout the area. I was met on site by Mr. Sidhu, who excavated the soil pits with a machine in the proposed placement site.

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

As part of my assessment, I have described soil profiles in three excavated soil pits that ranged in depth from 0.7 m to 1.3 m. The first soil pit was dug to refusal by the machine due to dense subsoils. Soil pit locations were selected randomly around the northwest part of the property (the proposed placement area) and were marked by GPS in the field (**Figure 1** in Appendix A). Detailed observations of soil properties, including soil texture, drainage, consistency, structure, colour, horizon classification and thickness, and evidence of gleying or mottling were noted during my assessment. Soil Pit Descriptions and photos are located in Appendix B. Note that no soil nutrient or pH testing was performed in this assessment.

Following my soil survey, I traversed the site and made additional surface observations in the areas around the test pits, such as the location of ditches, vegetation, and other features such as dikes and irrigation canals. These are described by Placemark Number (PM #) and shown on **Figure 1**.

4.1 General Observations

The northwest portion of the property has been filled and is situated approximately 2.5 to 3 m (estimated – the property has not been surveyed at this time however a survey will be prepared if requested as part of a soil permit application with the City of Richmond) above the grade of River Road and the remainder of the property, which is a cranberry farm.

Slopes over the northwest area are less than 2% (near level). At Placemarks 7, 9, and 14, I observed three stockpiles between 10 m^3 and 20 m^3 containing boulders, concrete, rebar, and gyproc. As outlined in the Soil Placement Plan (Section 5.0), these should be removed prior to peat placement.

Along the northern property line, I observed that the majority (but not all) of the neighbouring properties have been elevated by soil placement. I have surmised that this has been done to bring the residences to the required Flood Construction Level for the area (3.5 m GSC currently), which is approximately 1.7 m above the natural grade recorded by local geodetic markers. There are no obvious agricultural activities being conducted on these smaller properties. Between the properties, there is extensive growth of blackberry, surrounded by large alder and cottonwood trees.

PHOTO 4. BOULDER, CONCRETE STOCKPILE SITUATED AT PM 7 IN THE PROPOSED PLACEMENT AREA.

On the west side of the proposed soil placement area, I observed that an approximately 0.5 m high berm has been installed. Beyond this, there is a water reservoir constructed for irrigation. Adjacent to this reservoir, there is an access road and dike that is owned by CN Rail. The railway is situated to the west of the access road. Beyond the railway there are the neighbouring cranberry and blueberry farms.

The proposed soil placement area does not have any vegetation nor has it been prepared for farming (i.e. decompacted, raked, diked, or planted). There was some snowmelt and ice accumulation on the surface. During our excavation, the pits filled somewhat quickly with water from both the surface and from high water tables.

PHOTO 5. LOOKING NORTHWEST
Along the western property line at the reservoir, access road/dike, and the CN Railway. The property boundary is indicated by the black dashed line.

PHOTO 6. STOCKPILE OF COARSE SAND AND GRAVEL
Situated at PM 18 on the property – this will be used to construct dikes around the imported peat, which will allow cranberry farming.

PHOTO 7. LOOKING NORTHWARDS
Across the proposed soil placement area, which has been filled as of 2005 and does not feature any vegetation.

4.2 Soil Observations

The soil brought to the site between 1991 and 2005 is a mix of many soil types that have been placed to construct a soil profile. Since this is not native soil, it cannot be correlated to the mapped soil series of Luttmerding (1980).

The soil has been in place for between 14 and 28 years, which has allowed some development of the profile through natural pedogenic processes. There is still great variation in texture, colouring, and horizon thickness between the three profiles.

In Pit 1, soil textures range from a sandy loam to a sandy clay loam with approximately 5% cobbles and 1% boulders at 50 cm. The lowest horizon is very firm due to compaction during soil placement activities in the past. There is light gleying in the middle Bgj horizon due to fluctuating water tables.

Soil Pit 2 features approximately 1 m of sandy loam containing coarse sand and 10% coarse gravel. Below this, the texture is loamy sand with between 5 and 10% coarse gravel. The pit was very wet when excavated and quickly collapsed. The lower horizon extended to 1.3 m deep and was found to be firm due to compaction (similar to Pit 1).

The last pit, Pit 3, was found to contain exclusively loamy sand to a depth of 1 m. The upper B horizon, which extends to approximately 55 cm, has dark grey to dark brown colouring that is highly variable, and contains approximately 5% coarse gravel. The lower horizon has 10% coarse gravel and is an olive brown to olive grey colour.

All soil pits were wet due to both surface flooding (melting snow and ice) and high groundwater tables (saturated soil conditions). There is light gleying observed in Pits 1 and 2 whereas Pit 3 has dominantly brown and olive colours.

As these are anthropogenic soils that have not changed significantly since they were placed between 1991 and 2005, I have not attempted to classify them using the Canadian System for Soil Classification.

4.3 Land Capability for Agriculture

In this section I will indicate my LCA ratings for the surveyed soil in the northwest portion of the site using the specific criteria presented in Land Capability Classification for Agriculture in British Columbia (Kenk and Cotic, 1983). The agricultural capability of the proposed placement area is dependent upon the existing soil and site conditions.

Based on my soil pit observations, I have found that the dominant limitation for agriculture is low fertility[17] at a Class 3F due to low quantities of organic matter in the soil (inferred by soil texture and colouring, but not soil testing at this time) and low nutrient holding capacity due to sandy loam and loamy sand soil textures. This was found in ¨Pits 2 and 3.

In Pit 2, there is a stoniness limitation of Class 2P due to the 10% coarse gravels present in the upper 25 cm of the soil. This is improvable through stone removal via rake, or by placement of 0.6 m of peat soil without coarse fragments.

There is also a Class 3D limitation found in both Pits 1 and 3 due to very firm subsoils. In Pit 1, this starts at 0.5 m (very firm sandy clay loam) and in Pit 3 this starts at 0.55 m due to very firm loamy sand. This is due to compaction of the soil during placement activities. This can be improved somewhat through sufficient deep ploughing or ripping to break up the dense subsoil. Deep ripping must be done when the soil is not saturated, (generally

[17] Generally, fertility can be assigned following analysis by labs but we have found that actual test samples can return a wide range of nutrient and pH values, particularly if the soil is imported from several sites. At this time, we have not performed soil testing due to the anticipated large differences between samples tested at this site.

Mid to late summer). It is possible that there has been some cementation of the horizons over time. Ripping may be required more than once, since soils can regain high bulk densities over time. Alternatively, the placement of 0.6 m of uncompacted peat at the surface will negate the 2D limitation, as this horizon will be over 1 m deep.

For all soil pits, this is a mild Class 2W wetness limitation due to locally high water tables, low perviousness (compacted subsoils in pits 1 and 3), and surface ponding throughout the proposed peat placement area.

The 2W, 2P and 3D limitations can only be improved to the next most serious limitation, which is the fertility limitation. Mr. Sidhu is seeking to improve the 3F limitation by importing exclusively peat topsoils leveled to 0.6 m deep and planting cranberry plants.

5 Topsoil Placement Plan

5.1 Rationale for Topsoil Placement

Between 1991 and 2005, Mr. Sidhu imported subsoils with two permits issued by the ALC and the City of Richmond. The soil was placed for the following purposes:

- To elevate the land above the natural grade (which is approximately 1.8 m above sea level, as indicated by the geodetic control marker located in the cranberry field to the south of the proposed soil placement area) to improve the agricultural limitations of excess wetness and high water tables in the naturally-occurring peat soils, and re-plant cranberries here following placement;
- To bring sand to the site, which is required in cranberry bog construction to ensure rapid water movement;
- To elevate the land to the Flood Construction Level required to construct the farm storage facility situated at River Road (the FCL is 3.5 m GSC); and
- To maintaining the farm access roads and dikes on the site. Formerly, many access roads were built using sawdust and wood materials but since many sawmills have closed around the province, it is harder to obtain these products (according to Mr. Sidhu). There is a stockpile of sand and minor gravel that is approximately 1400 m^3 situated at Placemark 18 on Figure 1.

According to the New Brunswick Department of Agriculture, Fisheries and Aquaculture[18]:

> *"Sand is used in cranberry bog construction to ensure rapid water movement through the upper soil layer and prevent water ponding on the bed surface.* ***Cranberries will not flourish under constantly wet soil conditions.*** *Ponded water in the beds may cause problems with root rot and eventual death of the vines. A moist, well oxygenated root zone approximately six inches deep is preferred by the plants. Ideal sand texture is classified as 80% coarse sands (particle size from 0.2 &2 mm) and 18% fine sand (particle size between 0.02 and 0.2 mm). This size distribution allows enough coarse material for good drainage …"*

The northwest portion of the site has been prepared through importation of sandy loams, loamy sand, and minor sandy clay loams but requires both surrounding dikes and a "peat capping" to provide organic matter to the cranberry plants. This is preferred over importing sawdust, which is difficult to source due to the closure of sawmills throughout the province.

The BC Cranberry Grower's Association recommends up to 30 cm of sawdust when using this as an organic matter amendment[19]. Mr. Sidhu would like to import 0.6 m of peat as the peat will decompose and settle over time and as such will not be permanently situated at 0.6 m above grade. Sand-based cranberry plantings depend on fertilizers for their nutrients for optimal yields[20].

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[18] https://www2.gnb.ca/content/gnb/en/departments/10/agriculture/content/land_development/cranberry.html New Brunswick Department of Agriculture, Fisheries and Aquaculture: Cranberry Site Selection. Accessed March 6, 2019

[19] https://delta.civicweb.net/document/39534 Ministry of Agriculture and Lands, Guidelines for Farm Practices Involving Fill. 2006. Accessed March 6, 2019

[20] http://www.umass.edu/cranberry/downloads/chartbooks/2015%20chartbook/2015%20Chart%20book%20FINAL%20Nutrition.pdf?_ga=1.76704021.1821567400.1483116588 University of Massachusetts: Nutrition Management For Producing Bogs 2015. Accessed March 6, 2019

5.2 Basic Topsoil Importation Plan

I recommend that topsoil placement proceed through a series of well-defined steps:

Step 1. Removal of construction waste (i.e. concrete, gyproc) and boulders from the surface of the proposed placement area.

This should be done prior to soil placement so that this material is not inadvertently mixed with the peat soils brought to the site. The boulders may be used in road or berm construction but I will defer this to Mr. Sidhu. The remaining waste should be removed from the property as it is not suitable for agricultural land.

Step 2. Construction of the dikes surrounding the placement area.

Prior to topsoil importation, I recommend construction the dikes required around the north, east, and south sides of the placement area. There is a dike built along the west side of the placement area that is approximately 0.5 m high – this may require improvements.

If the dikes are constructed prior to placement, this will reduce the potential for nuisance transport of sediment-laden water off-site, and reduce compaction of the peat soils if done after placement (due to machines operating around the perimeter. I will defer the exact order of operations to Mr. Sidhu but have made this recommendation on the basis of both erosion and sediment control and good topsoil management practices.

Step 3. Importation and monitoring of peat topsoil

Next, good quality well-draining, black to dark brown and mesic to humic[21] peat soil ideally sourced from local sites (Richmond, Delta, and potentially Burnaby) is spread over the deposit area. I estimate that approximately 32,000 m^3 of fill will be spread over the northwest site area of 5.3 ha. The peat will be spread to a uniform thickness of 0.6 m, with no slopes or varying thickness required. The soil placement area, depth of peat, and volume of soil is shown on **Figure 3** in Appendix A. The proposed dike locations are also shown on this figure.

[21] If unsure of the decomposition of the sourced peat soils, Madrone or a retained agrologist can assess these soils on site or at their source site.

There will be decomposition and settling of the peat soils over time. As such, the 0.6 m grade elevation is not expected to be maintained.

Peat soils should not be handled during excessively wet conditions as this may result in compaction of the soils. Operations should cease during periods of high precipitation, i.e. 25 mm in a 24 hour period. If peat soils are stockpiled, the piles should not exceed 5 m in height and should slope less than 30%. This will reduce erosion of the stockpiles.

According to Mr. Sidhu, the preferred access is via the separate entrance with the civic address of 20000 River Road. This is shown on **Figure 3**. Trucks will travel along graveled access roads to the placement site, which should clean the truck tires. If excessively wet conditions occur or soil is tracking onto River Road, a wheel wash can be installed at the 20000 River Road entrance. This access point is well clear of obstructions (i.e. no trees or shrubs surrounding the entrance). As well, there is a gate installed here to control access to the site. River Road is an approved truck route close to Westminster Highway and Highway 91.

5.3 Sourced Peat Soil

5.3.1 Physical Properties of Acceptable Source Soil

Soil sourced and brought to site should be a rich dark colour and humic to mesic in organic decomposition. Peat soils with a high quantity of roots, particularly large roots and tree branches should be screened before placement. Products of wood-processing such as wood shavings, sawdust or wood chips are not appropriate. Soils with high clay content (which can happen if machines "grab" too much of the underlying silty clay and clay loam subsoils common in the Richmond, Lulu, and Triggs soils of the Richmond area) or coarse fragments larger than fine gravels (2.5 cm or greater) are not desirable and should be avoided.

Soils should be checked for these parameters ideally before arriving on site. If stony soils are unintentionally brought onto the site, the soils should be raked or sorted to remove the stones. A standard operating procedure (SOP) can be followed – an example SOP has been included in Appendix E.

Soils should be free of foreign or non-soil material and uncontaminated. Foreign material includes but is not limited to concrete, asphalt, waste, garbage, and lumber. As a large quantity of soil is sourced from properties featuring recently-demolished residences, I advise Mr. Sidhu and any contracted earthworks operators to check that demolished house

waste (including potential underground storage tanks, or UST's) has been removed from the source site prior to any excavations and transfers of soil to the property.

Weedy or invasive species control should be practiced, under the direction of the monitoring Agrologist. After the topsoil has been placed, the site should be inspected to determine if further treatments are necessary before establishing the cranberry crop. Since Mr. Sidhu is a highly experienced cranberry farmer, I will defer the exact treatments and preparations of the topsoil for cranberry planting to him.

To reiterate, any soil imported would have to be monitored to ensure it does not contain:

- Excessive coarse gravel, cobbles or stones;
- Contaminants;
- Foreign material;
- Excessive clay;
- Invasive plant species such as Japanese Knotweed and Himalayan Blackberry; or
- Other undesirable substances.

5.3.2 Chemical Properties of Acceptable Fill Material

Contaminated soils must not be used as fill. The supplier should warrant that the source soil is free from contamination. Fill should not come from areas that have histories of industrial or commercial land use. If contaminated fill material is brought onto the site, Jagbar Farms will assume liability for remediating the site or removing the contaminated material. **I encourage Jagbar Farms to include an agreement with their earthworks contractors and soil truckers that assigns liability for contaminated soils. An example inclusion agreement is included in Appendix D of this report.**

Currently, Madrone conducts a desktop environmental assessment as well as a site visit to assess for any visible non-soil material and invasive species in each fill site. I also recommend obtaining Phase 1 reports for large sites (i.e. >3000 m^3 of soil) that are less than 2 years old from contractors. If a Phase 1 report is not available, I encourage Mr. Sidhu or his earthworks contractor to contact Madrone for a pre-importation site assessment and desktop study.

6 Hydrology

There are no mapped or observed natural watercourses on site. The entire farm has a contained reservoir and dike system such that no drainage leaves the site. I understand that dikes will be constructed around the proposed placement area, which will contain any surface water accumulated in this area.

Jagbar Farms has maintained a contained reservoir and drainage system on this property for nearly 40 years and as such, I will defer the exact design of their drainage and irrigation systems to them. The City of Richmond may require detailed drainage plans as part of a soil placement permit.

7 Post-Fill Land Capability for Agriculture

Following proper topsoil placement as per my recommendations, I estimate that the post-fill Land Capability for Agriculture ratings will improve from Class 3F minor to moderate fertility limitations to Class 2W, or mild limitations due to high water tables (excess wetness). The undesirable soil structure/root restricting layer limitation (3D) and the stoniness limitation (2P), will be eliminated as the existing subsurface will then be too deep to affect the growth of cranberries (>1.0 m) through placement of 0.6 m of peat soils.

Jagbar Farms has over 35 years of cranberry farming experience and will amend the peat soils to ensure the proper pH range is reached prior to planting of the cranberry plants following topsoil placement.

8 Agricultural Plan – City of Richmond

The City of Richmond has required a proposed Agricultural Plan including:

1. Drainage Requirements/Rationale
2. Irrigation Requirements/Rationale and Water Sources
3. Proposed Agricultural Operator
4. Proposed Planting Plan on a Site Plan
5. Agricultural Improvement Cost Estimate (including material costs, drainage costs, irrigation costs and installation costs)

8.1 Drainage and Irrigation

The property dykes, water reservoirs, pumps, and most of the irrigation system were designed and implemented prior to the first harvest in the early 1980's. The entire cranberry farm (existing, **not** the proposed northwest corner) is dyked, with access roads established on these dykes. All water is therefore kept within the dykes.

Irrigation water is pumped from the Fraser River; a City of Richmond drainage lift station runs through the approximate centre of the property (**Figure 4**). The drainage ditch connects to a pump house situated in the large (8-9 m wide) water reservoirs that run across the entire western perimeter of the property. In the southeast corner of the property (at River Road), there is an approximately 400 m long ditch that drains southeast; this is the only drainage on the property that I could locate that connects to city infrastructure.

According to the City of Richmond Interactive Map, there are ditches situated on either side of the CN railway; these drain northwest towards No. 8 Road. The farm's water reservoirs are situated on the east side of the railway and they do not appear to connect as they are separated by a road (CN railway property).

The entire northern property line does not have any installed drainage between neighbouring properties. Dykes are planned along this perimeter to retain water in the cranberry farm proposed for this area.

The proposed extension of the cranberry farm will utilize the same water systems as current. The reservoirs to the west of the site will be used to irrigate the field, and flood the field during the wet pick in October.

8.2 Agricultural Operator

The proposed agricultural operator is Jagbar Farms. The farm hires labourers to maintain the field year-long. Jagbar Farms has been an established farm business since the 1970's.

8.3 Agricultural Plan – Planting & Costs

The peat will settle for one year (this is a standard practice). The soil will be tested and adjusted for nutrients (i.e. nitrate, phosphorus, potassium, sulphur) and pH prior to planting.

According to Mr. Sidhu, cranberry vines are planted in March. The vines are acquired from an American cranberry plant seller. The required amount of vines is approximately 2000 lbs per acre. This equates to approximately 26,000 lbs of vines to plant the 5.3 ha area (13. 09 acres). The planting plan is shown on **Figure 5**.

From many years of experience in farming cranberries, Mr. Sidhu is well informed of the costs of planting per acre. This includes irrigation, soil management, and farm labour. The current cost to plant the 5.3 ha proposed cranberry farm extension area is $25,000 to $30,000 per acre.

This equates to $330,000 to $393,000. This includes labour to construct the berms and irrigation systems for the area.

9 Summary of Recommendations

Jagbar Farms wishes to import approximately 32,000 m^3 of exclusively peat topsoils to improve primarily the fertility limitations for cranberry bog agriculture in the northwest portion of the existing farm. Following soil placement, a cranberry bog will be established here. Based on the existing site conditions, I have proposed the following basic plan for importing soil to the site at 19740 River Road:

1. Prior to any importation, remove all identified construction waste, including large boulders, concrete, rebar, gyproc, and garbage as shown at Placemarks 7, 9, and 14 on **Figure 1** of this report. Due to the layer of snow on the site, there may be additional boulders and construction debris scattered over the surface that also require removal. A large rake attachment can be used to remove large (i.e. >0.2 m) fragments but hand removal may be required for smaller pieces not removed by the rake.
2. I recommend construction the dikes **before** placement of the peat soil to avoid potential run-off issues to adjacent lands on the north, northeast /east (River Road) and west sides (reservoir, then the railway).

3 Since Jagbar Farms is experienced in dike construction and maintenance and has the required materials available on site, I will defer the exact installation of the dikes to them.

4 Placing locally sourced (if possible), good-quality peat on the surface of the 5.3 ha fill area and spreading to a uniform depth of 0.6 m. A surveyor can assist with staking the final elevation throughout this area to ensure that the thickness does not exceed 0.6 m.

5 The sourced peat soil should consist of clean soil from an uncontaminated source; it should have less than 20% coarse fragments (i.e. sediment > 2.5 cm), should not be clay-rich, and should not contain any foreign material. Large roots and woody debris should also be avoided as this may pose a hindrance to cultivation.

6 Madrone can assist with screening soil sites for potential contaminants (preliminary studies) and assessing coarse fragment content of incoming soil loads. Sites should also be checked for potential invasive plant species.

7 Since the cranberry bog will be intentionally flooded to "wet pick" the berries every fall, there are no constructed slopes required to drain the site.

8 The soil placement operation should be monitored at regular intervals through the process. I suggest a monitoring schedule in Section 8, below.

9 Once complete a final report should be issued on the condition and final, improved land capability of the filled area. It is expected that this project will require approximately 2 years to complete however this depends on how quickly peat soils can be sourced and brought to the site. A large subdivision excavation, for example, may yield a large portion of peat soils in a very short time.

9.1 Monitoring

Should Mr. Sidhu's soil placement application be jointly approved by the ALC and the City of Richmond, the terms of the soil deposit permit will indicate that Madrone is expected to conduct inspections of the site and materials and to provide inspection reports.

Mr. Sidhu or his contractor (if he selects one as an agent in this process) should contact Madrone before beginning any site preparation work or topsoil placement to develop a monitoring schedule that meets the conditions of its permit and conforms to my recommendations for the site.

Monitoring visits should be scheduled to coincide with important project milestones and randomly when the site is active. The important milestones are:

- The removal of all construction debris and boulders from the soil placement area;
- The construction of the dikes around the soil placement area prior to peat importation, to ensure that no off-site transport of sediment or excess water (which can be introduced by imported soils if transported in a wet state) off the site onto neighbouring lands, which can pose a nuisance. At this stage an inspection by the City of Richmond may be required as well.
- The beginning and end of peat importation, to ensure that the peat has sufficient organic matter (mesic to humic in decomposition), is free of undesirable materials and textures (i.e. excess clay), and to ensure that it has been placed at the intended thickness of 0.6 m uniformly throughout the placement area.
- When the peat has been completely spread and is prepared for cranberry planting at which point a closure report can be prepared for the project and issued to the ALC and the City of Richmond.

Furthermore, Madrone or your Agrologist monitor will inspect the site for the spread of any invasive plant species or soil erosion and transport issues (i.e. peat stockpiles sloping too steeply, resulting in rill erosion).

9.2 Reporting

I recommend preparing periodic monitoring reports every 3000 m^3 of imported soil during the first year and reports every 5000 m^3 after the first year if there are no significant project issues (such as excessive soil stoniness, invasive species spread). In addition, a closure report should be prepared once the project is complete. The report should include an assessment of the final land capability for agriculture ratings and a comparison between the initial and final LCA ratings.

It should contain an estimate of the volume of topsoil placed and details about fill source site. I recommend that accurate and complete records of all fill brought to the site, including truck counts, be kept. A Traffic Management Plan can be prepared outlining the proposed truck routes to the site upon request by the City of Richmond following submission of this report.

10 Conclusions

Experienced cranberry farmer Minder Sidhu of Jagbar Farms proposes to place approximately 32, 000 m³ of peat topsoils to 5.3 ha of the northwest portion of the property to improve moderate soil infertility (3F due to sandy subsoils and low nutrient holding capacity) and dense subsoil (3D) limitations, in addition to minor stoniness (2P). The final land capability is predicted to be a Class 2W due to excess water (2W) in the winter months.

The placement of a peat capping in the northwest placement area of the property will introduce organic matter required for new cranberry plants that will be grown here. This will bring Jagbar's total cranberry production to approximately 30 ha.

PHOTO 8. CRANBERRY THRESHING MACHINE DURING WET PICK IN OCTOBER.
Photo Credit: Anton Bielousov. http://sakvoiazh.ru/

Prepared by:

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

BRITISH COLUMBIA INSTITUTE OF AGROLOGISTS 3050 Jessica Stewart P.Ag.

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

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12 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 Agrologists currently practicing in the area under similar conditions and budgetary constraints. Madrone offers no other warranties, either expressed or implied.

APPENDIX A

Maps & Figures

MADRONE environmental services ltd	**PROJECT:** Fill Assessment: 19740 River Road		**LOCATION:** Richmond, BC	**CLIENT:** Jagbar Farms	**DOSSIER:** 19.0063
	ASSESSED BY: Jessica Stewart, G.I.T., P.Ag.	**FIELD VISIT:** February 14, 2019	**MAP SCALE:** 1:5,500	**MAPPING DATE:** March 06, 2019	**DRAWN BY:** Jessi Yellowlees

FIGURE 1: Overview Of Property

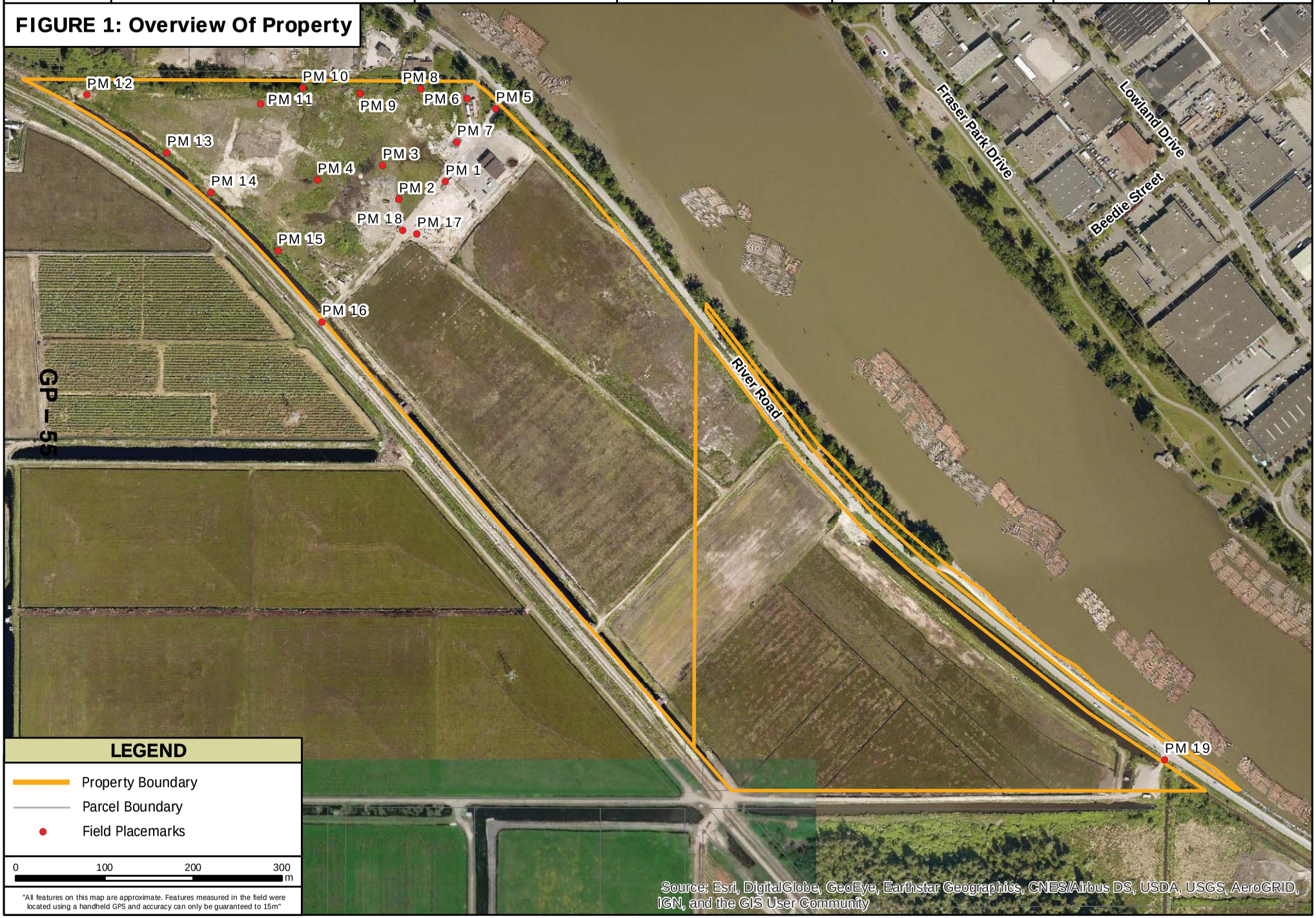


Figure 2. Soil Information Finder Tool - Surveyed Soils by Luttmerding (1980)

BC Soil Survey Polygons

1:9,028

0 0.05 0.1 0.2 mi

0 0.07 0.15 0.3 km

Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user

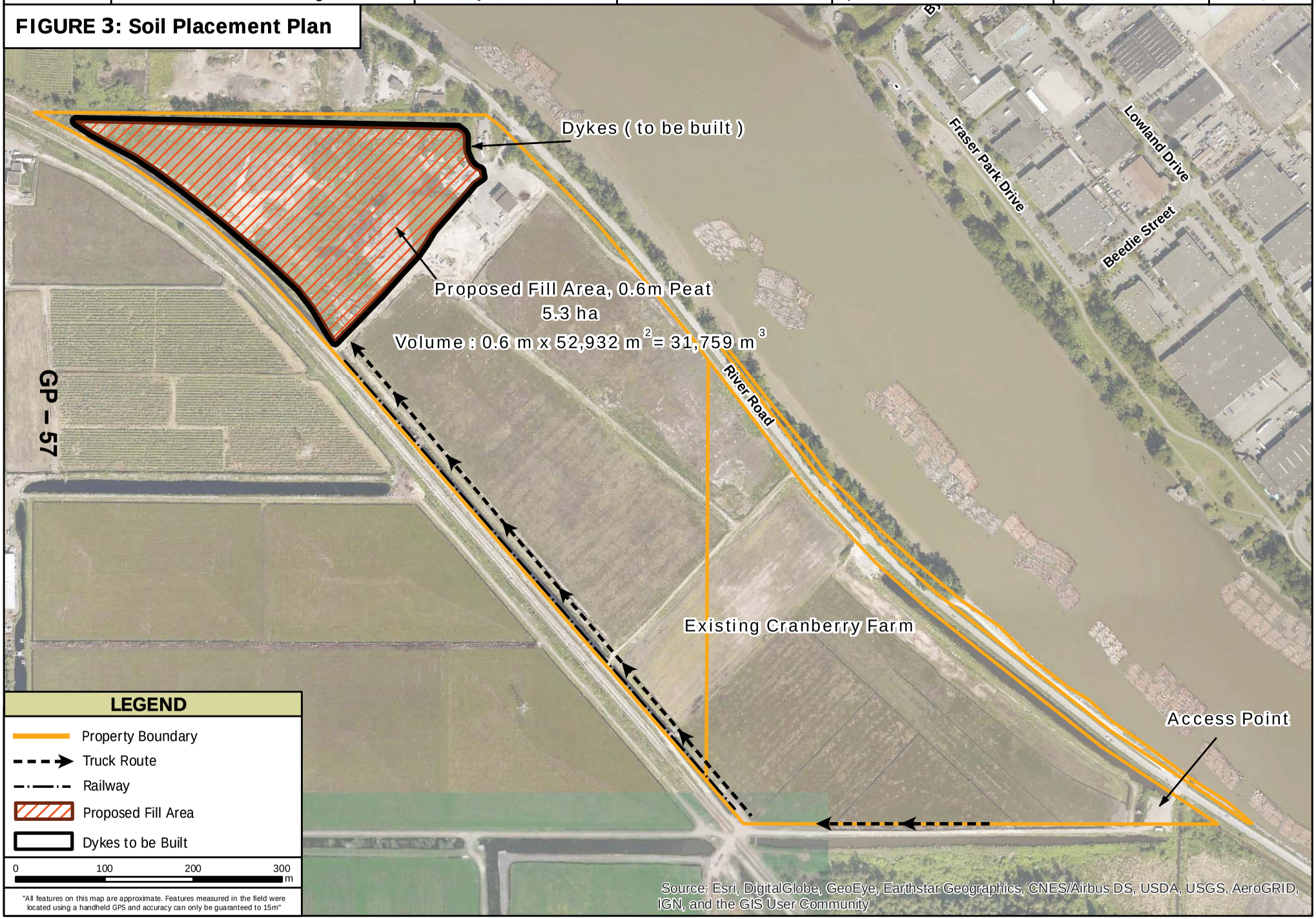
https://governmentofbc.maps.arcgis.com/apps/MapSeries/index.html?appid=cc25e43525c5471ca7b13d639bbcd7aa

Web AppBuilder for ArcGIS

Burnaby, USDA FSA, DigitalGlobe, GeoEye, CNES/Airbus DS | Esri, HERE, Garmin, iPC, NRCan |

MADRONE environmental services ltd	**PROJECT:** Fill Assessment: 19740 River Road		**LOCATION:** Richmond, BC	**CLIENT:** Jagbar Farms	**DOSSIER:** 19.0063
	ASSESSED BY: Jessica Stewart, G.I.T., P.Ag.	**FIELD VISIT:** February 14, 2019	**MAP SCALE:** 1:5,500	**MAPPING DATE:** April 11, 2019	**DRAWN BY:** Jessi Yellowlees

FIGURE 3: Soil Placement Plan



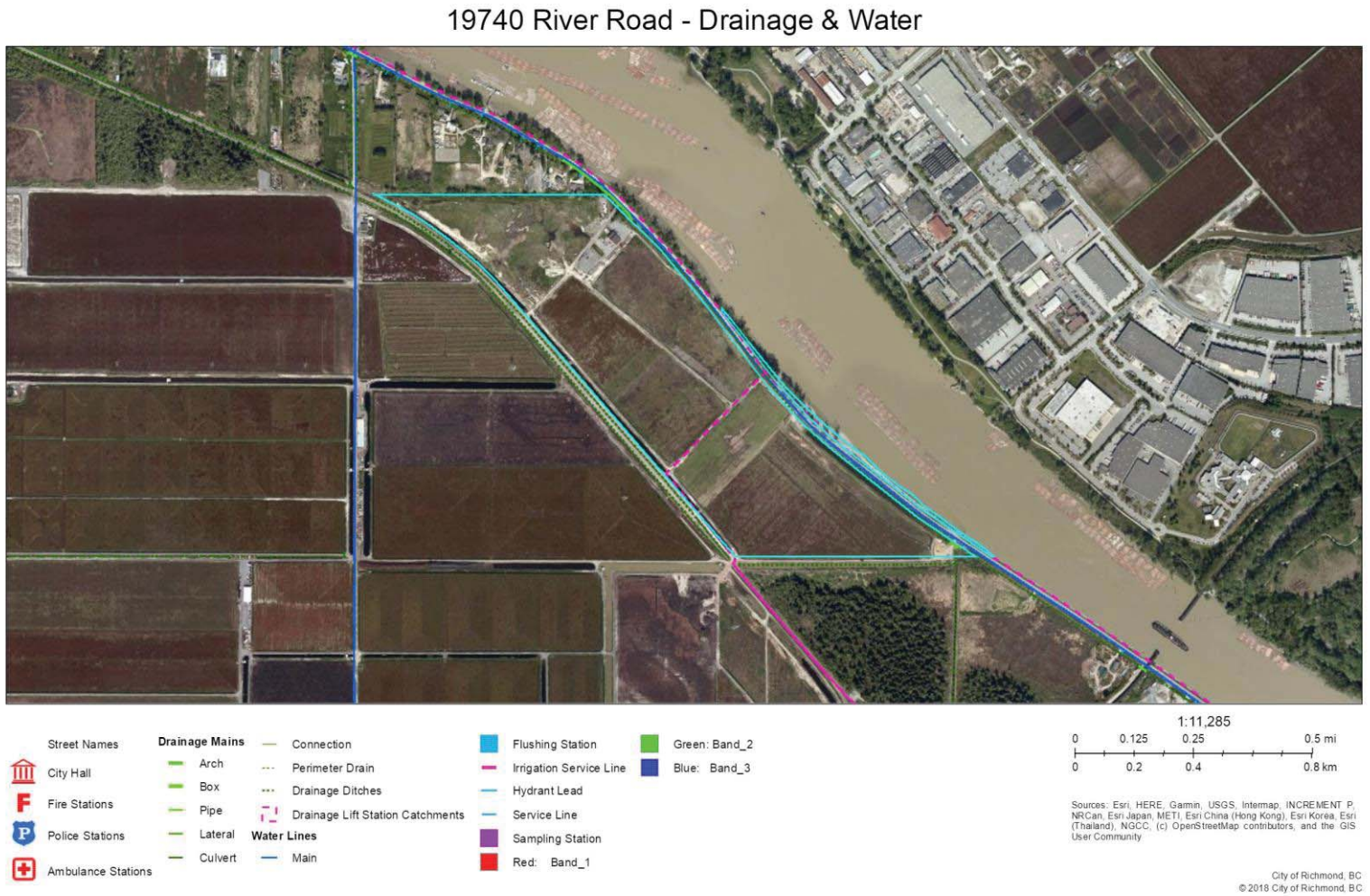


FIGURE 4. DRAINAGE AND WATER INFRASTRUCTURE RELATIVE TO THE SUBJECT PROPERTY. DATA FROM THE CITY OF RICHMOND INTERACTIVE MAP PROGRAM.

MADRONE environmental services ltd	**PROJECT:** Fill Assessment: 19740 River Road		**LOCATION:** Richmond, BC	**CLIENT:** Jagbar Farms	**DOSSIER:** 19.0063
	ASSESSED BY: Jessica Stewart, G.I.T., P.Ag.	**FIELD VISIT:** February 14, 2019	**MAP SCALE:** 1:5,500	**MAPPING DATE:** June 28, 2019	**DRAWN BY:** Jessi Yellowlees

FIGURE 5: Agricultural Plan [Planting]

Plan	
1	Import peat
2	Let peat settle for 1 year & test for suitability (soil nutrient management)
3	Plant 2000 lbs. of vines per acre in March

Dykes (to be built)

Proposed Fill Area, 0.6m Peat
5.3 ha
Volume : 0.6 m x 52,932 m^2 = 31,759 m^3

River Road

Existing Cranberry Farm

Access Point

LEGEND

- Property Boundary
- Truck Route
- Railway
- Cranberry Vines - 2000 lbs/acre
- Proposed Fill Area
- Dykes to be Built

0 100 200 300 m

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

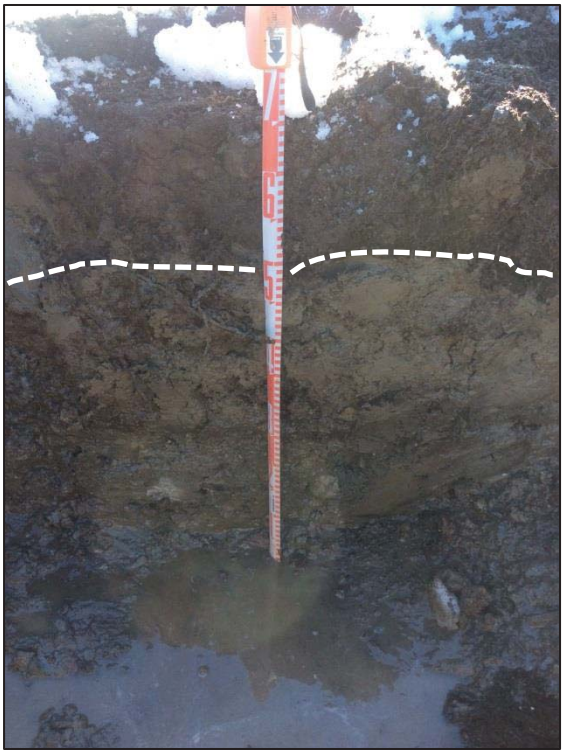
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

APPENDIX B

Soil Pit Descriptions & Photographs

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

Property	Value
Pit Depth	0.7 m (to refusal)
# of soil horizons	3
Horizon	Depth (m)
Ap	0-0.2
Bgj	0.2-0.5
IIBg	0.5-0.7+
Land Capability (unimproved)	3D, 2W



Comments: Approximately 20 cm of dark, grey brown sandy loam overlying a grey to olive grey sandy clay loam. The last horizon is a very firm, compacted, blue grey sandy clay loam. The very firm horizon at 50 cm correlates to a 3D limitation due to dense subsoils.

Soil Textures, Pit 1:

Horizon	Soil Texture
Ap	Sandy loam, <5% fine gravel, 1% cobbles
Bg	Sandy clay loam, <5% fine gravel.
IIBg	Sandy clay loam, contains coarse sand, 5% cobbles and 1% boulders, very firm.

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

Property	Value
Pit Depth	1.3 m
# of soil horizons	2
Horizon	Depth (m)
0-1.0	Bgj
1.0-1.3+	IIBg
Land Capability (unimproved)	2P, 3F, 2W

Comments: Approximately 1 m of olive grey sandy loam with fine gravel (approximately 10%) overlying grey brown, firm loamy sand (compacted). The sandy textures of this soil correlate to a reduced nutrient holding capacity (3F estimated). The 10% fine to coarse gravel in the upper 25 cm of the first horizon correlates to a 2P stoniness limitation.

Soil Textures, Pit 2:

Horizon	Soil Texture
Bgj	Sandy loam (coarse sand), 10% coarse gravel
IIBg	Loamy sand, <5% cobbles, 5-10% coarse gravel, firm

Pit 3 – Soil Profile Description (Placemark 4, Figure 1)

Property	Value
Pit Depth	1.0
# of soil horizons	2
Horizon	Depth (m)
Bm	0-0.55
IIBg	0.55-1.0+
Land Capability (unimproved)	3F, 3D, 2W

Comments: Dark brown to dark grey (variable as seen in photo) loamy sand overlying very firm (compacted) olive grey brown loamy sand. The loamy sand textures in this soil correlate to a reduced nutrient holding capacity (3F estimated in absence of soil testing for this project).

Soil Textures, Pit 3:

Horizon	Soil Texture
Bm	Loamy sand, <5% coarse gravel
IIBg	Loamy sand, 10% coarse gravel, very firm

APPENDIX C

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 water table.	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

APPENDIX D

Inclusion in Fill Importation Assessment Reports

For each source site, the owner/operator of the receiving site should secure a written Soil Acceptance Agreement with the parties responsible for supplying and transporting soils. The agreement should specify that

1. The imported soil must not contain:
    a. any contaminants in concentrations that exceed the standards in Schedule 7, Column III of the Contaminated Sites Regulation under BC's Environmental Management Act, or
    b. any hazardous waste as defined in the Hazardous Waste Regulation of the Environmental Management Act,
2. The imported soil must not have been transported onto the donor site from another site,
3. The owner of the receiving site has the right to test and/or require the supplier to test for contaminants and soil texture, and to inspect the source site,
4. The supplier will provide *all* available site contamination reports pertaining to the imported soil and that at minimum a Preliminary Site investigation Phase 1 (or Stage 1) or Phase 2 (or Stage 2) report will be provided for any source site that is an industrial, government or large residential development,
5. The parties supplying/transporting soils are responsible for removing any soils and remediating any resulting contamination if the soils are found to be contaminated or if the supplier failed to supply all available site contamination reports pertaining to the imported soil, and
6. Any loads arriving at the site without proper documentation of the source of the soil and evidence of Soil Acceptance Agreement for the source site will be refused entry.

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

APPENDIX E

Standard Operating Procedure: Stony Soils in Imported Fills

Objective

The objective of the SOP is to ensure soils in the upper 50 cm of the fill meet stoniness standards for Class 2P limitations; that is:

A. Total coarse fragment content (>2.5 cm or 1 inch): **less than 10%;**
B. Cobbles and stones (>7.5 cm or 3 inches): **less than 1%.**

Madrone recognizes that the identification of stoniness may be difficult; therefore, this SOP identifies measures at different stages in the importation of fill. Following all measures in this SOP will reduce the chance that stony soils will be incorporated in the fill.

Measures to be Implemented

Control of stoniness will be accomplished by measures implemented at

a) the source site,

b) upon entry to the receiving site;

c) at the dump site on the property.

The measures are:

1 inspect soils before dumping and keep them in separate stockpiles for either processing (stone removal) or later removal from site;

2 treat soils that have more than 1% cobbles and stones using a rake;

3 ensure that soils that have more than 10% gravel (2.5 to 7.5 cm) are buried at least 50 cm from the final grade of the fill.

Procedures

1 At **source site**. Fill with excessive coarse fragments will be identified at the source site and separated from non-stony soils. **Only non-stony soils will be delivered** to the fill site.

2 At **receiving site entrance**. All fill that contains excessive coarse fragments (based on visual inspection) will be identified upon entry and dumped separately from the fill, for removal or processing later. If stony soils are suspected in a load, this must be communicated to the project supervisor.

3 At **receiving site, at dumping site**. As fill is being dumped it must be inspected for stoniness, relative to the above standards. If the soil does not meet the standards, it must be removed from the fill and stockpiled separately for removal or processing later.

4 All separated stockpiles of stony material must be inspected, and the decision to remove or process should be made by the site supervisor.

5 All cobbles and stones greater than 7.5 cm or 3 inch diameter should be removed using the specially designed rake. After processing, the cobbles and stones should occupy less than 1% of the volume of soil. (fragments less than 7.5 cm cannot be removed by the rake).

6 If coarse fragments between 2.5 cm and 7.5 cm (1 and 3 inches) occupy more than 10% of the soil volume, after removal of cobbles and stones, the soil should only be used as a subsoil and should not be placed within 50 cm of the final grade of the fill.

The stoniness content of all fill will be assessed during routine site inspections by Madrone after every increment of 3000 m^3 fill volume (recommended volume – may be adjusted according to the project).

Summary of Soil Placement Plan and Farm Plan Proposals for Jagbar Farms, 19740 River Road – Intended for Policy Planning and Food Security and Agricultural Advisory Committee (FSAAC) Review

The City of Richmond (CoR) Policy Planning has requested a summary of the Soil Placement and Water Management Plans submitted to the City of Richmond and the Agricultural Land Commission (ALC) as part of a soil deposit application for Jagbar Farms, located at 19740 River Road, Richmond, BC. They further requested that the summary include a Farm Plan (or summarized Proposed Agricultural Plan).

We understand that the summary will be submitted to the CoR Food Security and Agricultural Advisory Committee (FSAAC) for their review when considering the project, which entails the placement of a maximum of 31,800 m^3 (rounded to 32,000 m^3) of solely local peat soils on 5.3 ha of the 36.8 ha property. The proposed depth of peat is 0.6 m, or approximately 2 feet.

This summary has been prepared by Madrone (Jessica Stewart, P.Geo, P.Ag., who prepared the Soil Placement Plan that accompanies the application) and Dr. Stephen Ramsay, P.Eng. (who prepared the Water Management Plan, Site Plan, and Addendum) on behalf of Mr. Sukhminder Sidhu, the landowner and applicant.

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)

Item a – Site Plan

The Site Plan was prepared by Dr. Stephen Ramsay P.Eng., utilizing the completed topographic land survey for the property. The proposed soil placement area is approximately 15% of the property. This area is 53,000 m^2 in extent, or rounded to 5.3 ha for the proposal.

Please see Attachment 1.

Item b – Site Description

The proposed soil deposit site is located in the northwest corner of the property, which is situated at 19740 River Road in Richmond, BC, approximately 9.7 km northeast of Richmond centre on Lulu Island (**Figure 1**). The property is bound to the north by residential properties (no farming indicated), to the east by River Road (and the Fraser River), to the south by a vacant and forested property, and to the west by the Canadian Pacific (CP) Railway.

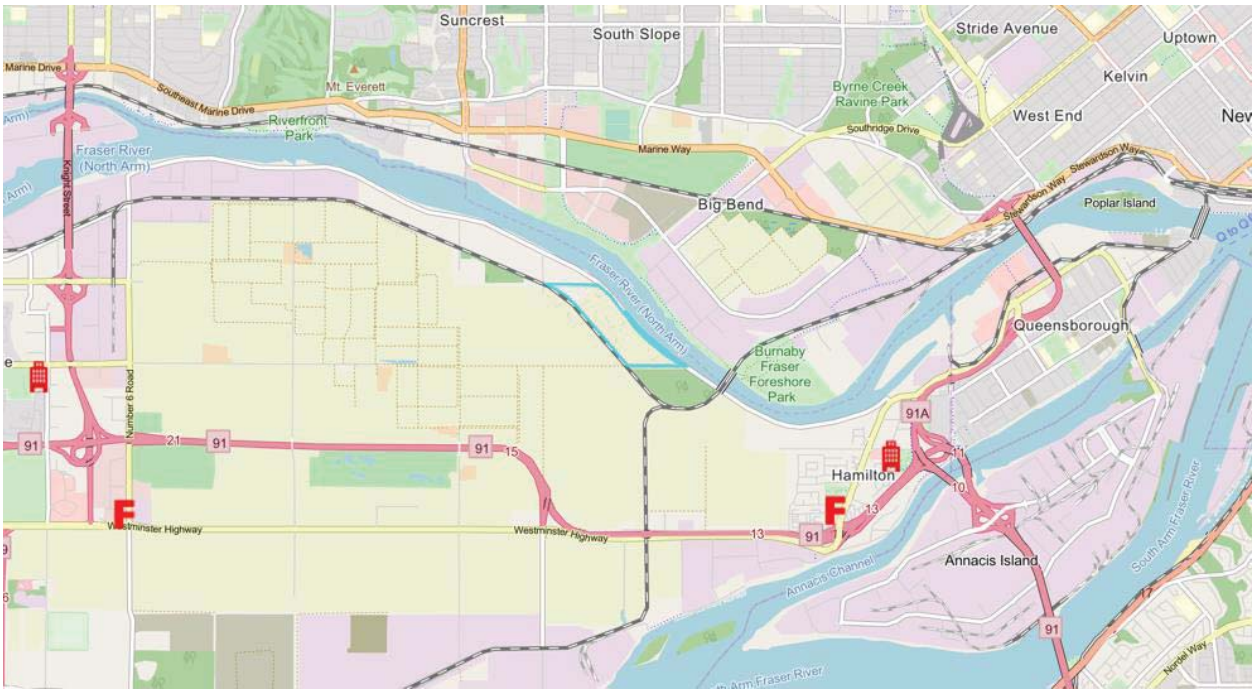


FIGURE 1 SITE LOCATION OUTLINED IN BLUE.

The property is situated on the defined (by CoR) Fraser River floodplain[1]. A topographic land survey completed in 2016 for the property shows that the current topographic range of the site is 2 to 6 m above sea

[1] https://www.richmond.ca/__shared/assets/Bylaw_8204_0410201225280.pdf Floodplain Designation and Protection Bylaw No. 8204. City of Richmond.

level (a.s.l.). The land has been artificially raised in places, as detailed in the Soil Placement Plan and the supplied Topographic Survey. The majority of the site has not been raised and is an existing, long-term cranberry farm.

Item c - Legal Description

The legal description of the property is:

Block 5N Plan NWP5172 Section 28 Range 4W Land District 36 Except Plan 2 ALL PTNS OF; LYING TO THE NE OF THE NE LIMIT OF THE SRW AS SHOWN ON 5172 S&E BYLAW 50800 & PCL A (RD199324E) S&E BYLAW 50800 Manufactured Home Reg.# B03764.

The property ID is 002-525-836.

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).

Jagbar Farms has a farm storage facility (constructed 2014 to 2015) located on site, in addition to a manufactured home near the River Road entrance. The majority of the property or approximately 24.7 ha is occupied by cranberry plants or farm infrastructure such as dikes (alternatively referred to as a berms), farm roads, and irrigation canals and reservoirs. Approximately 2600 m^2 of the property situated on the southwest side of property is outdoor storage for farm machinery, including tractors, excavators, harvesting machinery, and implements.

The surrounding area is actively farmed for cranberries, blueberries, 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 pared by Madrone and dated July 3,2019 (Attachment 2):

The soil brought to the site between 1991 and 2005 is a mix of many soil types that have been placed to construct a soil profile and required elevation in the soil deposit area. Since this is not native soil, it cannot be correlated to the mapped soil series of the Langley-Vancouver Map Area survey[2].

[2] http://www.env.gov.bc.ca/esd/distdata/ecosystems/Soils_Reports/BC15/bc15-v3_report.pdf Soils of the Langley-Vancouver Map area. Report No. 15. British Columbia Soil Survey. H.A. Luttmerding (1981).

The imported soil has been in place for between 14 and 28 years (oldest deposits), which has allowed some juvenile development of the profile through natural pedogenic processes. There is still great variation in texture, colouring, and horizon thickness between the three test pits dug at the soil placement site.

In Pit 1, soil textures range from a sandy loam to a sandy clay loam with approximately 5% cobbles and 1% boulders at 50 cm. The lowest horizon is very firm due to compaction during soil placement activities in the past. There is light gleying in the middle Bgj horizon due to fluctuating water tables.

Soil Pit 2 features approximately 1 m of sandy loam containing coarse sand and 10% coarse gravel. Below this, the texture is loamy sand with between 5 and 10% coarse gravel. The pit was very wet when excavated and quickly collapsed. The lower horizon extended to 1.3 m deep and was found to be firm due to compaction (similar to Pit 1).

The last pit, Pit 3, was found to contain exclusively loamy sand to a depth of 1 m. The upper B horizon, which extends to approximately 55 cm, has dark grey to dark brown colouring that is highly variable, and contains approximately 5% coarse gravel. The lower horizon has 10% coarse gravel and is an olive brown to olive grey colour.

All soil pits were wet due to both surface flooding (melting snow and ice) and high groundwater tables (saturated soil conditions). There is light gleying observed in Pits 1 and 2 whereas Pit 3 has dominantly brown and olive colours.

As these are anthropogenic soils that have not changed significantly since they were placed between 1991 and 2005, Madrone have not attempted to classify them using the Canadian System for Soil Classification.

Using the specific criteria presented in Land Capability Classification for Agriculture in British Columbia, Madrone rated the agricultural capability of the proposed soil deposit area, which is dependent upon the existing soil and site conditions. Based on the Madrone soil placement plan, the current agricultural limitations are Class 2W, 2P, 3F, and 3D.

From the Soil Placement Plan dated July 3,2019:

Madrone have found that the dominant limitation for agriculture is low fertility at a Class 3F due to low quantities of organic matter in the soil (inferred by soil texture and colouring, but not soil testing at this time) and low nutrient holding capacity due to sandy loam and loamy sand soil textures. This was found in Pits 2 and 3.

In Pit 2, there is a stoniness limitation of Class 2P due to the 10% coarse gravels present in the upper 25 cm of the soil. This is improvable through stone removal via rake, or by placement of 0.6 m of peat soil without coarse fragments.

There is also a Class 3D limitation found in both Pits 1 and 3 due to very firm subsoils. In Pit 1, this starts at 0.5 m (very firm sandy clay loam) and in Pit 3 this starts at 0.55 m due to very firm loamy sand. This is due to compaction of the soil during placement activities. This can be improved somewhat through sufficient deep ploughing or ripping to break up the dense subsoil. Deep ripping must be done when the soil is not saturated, (generally Mid to late summer). It is possible that there has been some cementation of the horizons over time. Ripping may be required more than once, since soils can regain high bulk densities over time. Alternatively, the placement of 0.6 m of uncompacted peat at the surface will negate the 2D limitation, as this horizon will be over 1 m deep.

For all soil pits, this is a mild Class 2W wetness limitation due to locally high water tables, low perviousness (compacted subsoils in pits 1 and 3), and surface ponding throughout the proposed peat placement area.

Item f - Soil Management Rationale/Improved Agricultural Capability

The 2W, 2P and 3D limitations can only be improved to the next most serious limitation, which is the fertility limitation. Mr. Sidhu is seeking to improve the 3F limitation by importing exclusively peat topsoils leveled to 0.6 m deep and planting cranberry plants.

Following proper topsoil placement, Madrone estimated that the post-fill Land Capability for Agriculture ratings will improve from Class 3F minor to moderate fertility limitations to Class 2W, or mild limitations due to high water tables (excess wetness). The undesirable soil structure/root restricting layer limitation (3D) and the stoniness limitation (2P), will also be eliminated as the existing subsurface will then be too deep to affect the growth of cranberries (>1.0 m) through placement of 0.6 m of peat soils.

Jagbar Farms has over 35 years of cranberry farming experience and will amend the peat soils to ensure the proper pH range is reached prior to planting of the cranberry plants following topsoil placement.

Item g - Recommended Agricultural Uses and Suitable Crops

Soil survey maps[3] from 1981 show that the majority of the property soils, including the south and west sides, are mapped as the Lulu (Terric Mesisol) and Richmond soils (Terric Humisol), which are organic soils with very poor drainage. A small portion of the northern part of the property, including the proposed soil placement site, is mapped as a mix of the Delta and Blundell soils, which are mineral soils with an organic capping. The remaining east portion of the property at River Road is mapped as the Tsawwassen soils, which are anthropogenic (human-modified) sands and gravelly sands dredged and diked along the Fraser River.

[3] http://www.env.gov.bc.ca/esd/distdata/ecosystems/Soils_Reports/BC15/bc15-v3_report.pdf Soils of the Langley-Vancouver Map area. Report No. 15. British Columbia Soil Survey. H.A. Luttmerding (1981).

The Blundell soils have poor to very poor drainage and high groundwater tables. They are Rego Gleysols. The Delta soils also have poor drainage and high groundwater tables. The classification is Orthic Humic Gleysols.

Madrone emphasizes that the soils surveyed by Luttmerding are not necessarily accurate but in absence of test pits in the cranberry field, provide a snapshot of the potential soils that may be found in this area.

An airphoto and map review shows that the property area was a former peat bog that is naturally suitable for cranberry and blueberries due to acidic soils. This assumes that the excess wetness limitations can be managed by subsoiling and ditching as part of agricultural development.

In its current state, the proposed soil placement area is suitable for cranberry farming if an organic capping is sourced and placed (to improve the 3F limitation) on the imported soils originally placed to raise the site above the naturally poor to very poorly drained soils with high watertables (Delta, Blundell, Richmond and Lulu soil series).

Item h - Proposed Agricultural Plan

1. Drainage Requirements/Rationale

See Water Management Plan report, dated February 3,2020 (Attachment 3) and Addendum Letter (Attachment 4), dated March 30,2020

Drainage is provided within the field area by 100 mm perforated pipe installed at approximately 6 m spacing to conduct excess water to the perimeter ditch of the field.

The Water Management Report emphasizes that the proposed drainage is identical to the existing drainage system used successfully by Jagbar. The soil placement area contributes approximately 15% to the drainage area and is smaller than existing drainage areas on the farm.

2. Irrigation Requirements/Rationale and Water Sources

See Water Management Plan (Attachment 3) or Addendum (Attachment 4).

3. Proposed Agricultural Operator

The proposed agricultural operator is Jagbar Farms. Jagbar have extensive experience cranberry farming at the site since 1982.

4. Proposed Planting Plan with a site plan

Information from Mr. Sidhu:

- Approximately 3,000 lb/acre[4] of vines are required to plant the field (5.3 ha is 13.1 acres, therefore approximately 39,000 lbs of vines are required).

- The vines are obtained from pruning of existing field and are bundled (approximately 90%, the remaining 10% are to come from a neighbouring farm at no cost).

- The planting consists of distributing the vines in the field and disking (see photo of planting machine below)

PHOTO 1. CRANBERRY VINE PLANTING MACHINE OWNED BY JAGBAR FARMS

See Attachment 5, Agricultural Planting Plan for 5.3 ha area planted with cranberry vines.

[4] Note that the original planting plan in the Soil Placement plan report shows a minimum of 2000 lbs per acre – this has been increased to a preferred 3000 lbs per acre by Mr. Sidhu. The planting plan supplied with this summary has been updated to reflect this increase.

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

Information from Mr. Sidhu:

- Vines for planting are obtained from the existing cultivated areas of the farm. This ensures consistency and uniformity of the crop. No vines will be purchased from outside sources. Currently, new farmers without existing plants/vines are required to purchase stock from the USA and prices are approximately $25,000 per acre[5].

- The first commercial crop is expected in approximately 3 years.

- The cost to maintain and cultivate is approximately $5,000/acre/yr ($5000 x 13.1 acres = $66,000/year)

- The cost of harvesting is approximately $1,000/acre ($1000 x 13.1 acres = $13,000)

Attachments

1. Site Plan (Topographic Survey)
2. Soil Placement Plan (Madrone)
3. Water Management Plan
4. Addendum Letter
5. Planting Plan for 5.3 ha (Madrone)

Prepared by:

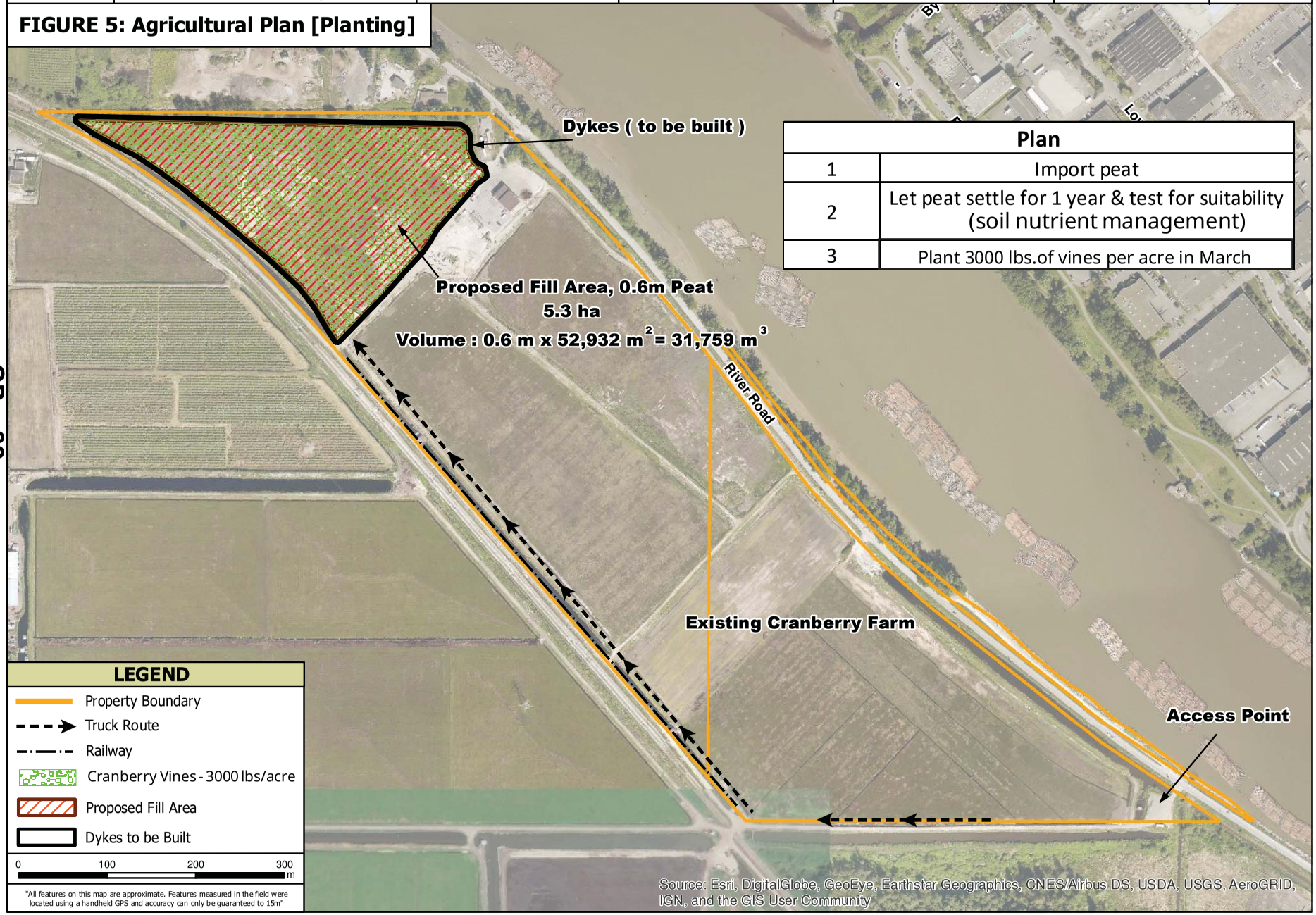
Dr. Stephen Ramsay, P.Eng.

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

[5] Pers. Comm. between Jessica Stewart and an anonymous former cranberry farmer in this area, who supplied this cost estimate to Madrone.

MADRONE environmental services ltd	**PROJECT:** Fill Assessment: 19740 River Road		**LOCATION:** Richmond, BC	**CLIENT:** Jagbar Farms	**DOSSIER:** 19.0063
	ASSESSED BY: Jessica Stewart, G.I.T., P.Ag.	**FIELD VISIT:** February 14, 2019	**MAP SCALE:** 1:5,500	**MAPPING DATE:** June 28, 2019	**DRAWN BY:** Jessi Yellowlees

FIGURE 5: Agricultural Plan [Planting]



Plan	
1	Import peat
2	Let peat settle for 1 year & test for suitability (soil nutrient management)
3	Plant 3000 lbs.of vines per acre in March

GREY OWL ENGINEERING

March 30, 2020

Jagbar Farms Ltd.
19740 River Road
Richmond, BC. V6Y 2C1

Attn: Sukhminder Sidhu

Re: Water Management Assessment – Jagbar Farms. Ltd. – 19740 River Road, No. 4 Road, Richmond, BC – ADDENDUM

Dear Sukhminder,

This addendum expands on the previous Water Management Assessment dated February 3, 2020 (see Soil Placement Application - Attachment 4)

The purpose of this addendum is to explain the drainage system used by Jagbar Farms and confirm that there will be no adverse impacts on surrounding properties.

Attachment 1 shows the subject property. Attachment 2 shows a schematic of the cranberry cultivation fields.

There are four (4) cranberry farming areas on the property. Three (3) are currently active cranberry farming (2, 3, and 4). The triangular area (1) is a proposal for a further cranberry farming area.

The Soil Placement Application relates to the triangular area (1) at the northwest end of the property. The three active farming areas have been cultivated for approximately thirty (30) years using the current and proposed water management and drainage arrangements. No adverse effects have been related during this operational period.

The three currently operational farming areas are completely surrounded by dikes located on the subject property.The proposed farming area will also be completely surrounded by similar dikes located

on the subject property. All four cranberry farming areas are also surrounded by a drainage ditch in each area internal to the dikes in each area.

There are three water management and drainage issues to be considered:

1) Drainage related to irrigation

   This has been dealt with in the previous Water Management Assessment. Irrigation is small compared to natural precipitation. Moreover, irrigation is limited to the growing seasons (April to September) when there is a net water budget deficit. In any event the irrigation is contained by the dyke system which is described more fully below. Therefore, there are no adverse affects to adjacent properties due to irrigation.

2) Drainage related to normal precipitation

   Natural precipitation has been dealt with in the previous Water Management Assessment. Again, the precipitation is entirely contained within the dyked system which will be described more fully below.

3) Drainage related to cranberry harvesting

   Harvesting is the limiting case due to the larger volume of water involved. The three current cranberry cultivation areas are operational in a cascade system to conserve water. See Attachment 2 for existing water flow between cranberry cultivation areas.

Water for cranberry harvesting proceeds from the highest elevation field (currently field 2) to lower elevation fields in sequence (2 to 3 to 4).Water is conserved by reusing in the cascade during harvesting.

Water is sourced from and ultimately discharged to the ditch system that connects to the Fraser River at the southeast corner of the property. (See Attachment 3). Water levels in the ditch systemare regulated by the control structures connecting to the Fraser River at the southeast corner of the property.

The ditch system extends along the south and west boundaries of the properties. There are pump stations along the west boundrary of the property to provide water for irrigation and harvesting. The water is distributed by fixed and mobile pipes.

Water is collected by a perimeter ditch system in each of the cranberry cultivation areas (see Attachment 4) and ultimately discharged to the ditch system at the southeast corner of the Fraser River connection.

This arrangement has been used continuously by Jagbar Farms for approximately 20 years.

We reiterate that the entire cultivation area, and each field is completely contained by dykes and perimeter drainage ditches.

Moreover, the south boundary and the west boundary of the property are adjacent to the ditch systems which separates and isolates the property from adjacent properties.

The Geotechnical Assessment confirms that no adverse impacts have been noted on any boundaries of the property or on the adjacent property using this water management system during the previous 20 year operational period of Jagbar Farms.

The east boundary property is bounded by the Fraser River dike and River Road. The eastern part of the boundary is separated and isolated from River Road the the Fraser River dike by a drainage ditch connected to the Fraser River.

The northeast boundary is bounded by the Kinder Morgan Pipeline right of way (ROW). The northern dyke is located approximately 15 m from the edge of the ROW.

The proposed fourth cranberry cultivation area will be constructed and operated in an identical manner to the three currently operating areas.

Harvesting water will be sourced from the ditch system on the southweat boundary of the property using the existing pump stations. Additional water will be sourced as required during the progression of the harvesting operation.

The harvesting water cascade will start with the proposed area and proceed sequentially through areas 1, 2, 3, and 4. The drainage will ultimately discharge to the ditch system at the southeast corner of the property area near the Fraser River connection.

Note that the four (4) cranberry cultivation fields (including the proposed new field) have areas of 24%, 23%, 32% and 49% of the total property area, respectively. Area 4 is the largest therefore the Areas 1, 2, and 3 are accomodated within the existing and demonstrated drainage capacity of Area 4.

Field (4) is the lowest and requires the largest quantity of water for harvesting (and incidentally, also contributes the largest quantity for irrigation and natural precipitation). Therefore, the proposed Field 1 contribution which is significantly smaller than existing operations and fits within the existing arrangements.

The proposed drainage system will not have any adverse impacts on adjacent properties.

Yours truly,

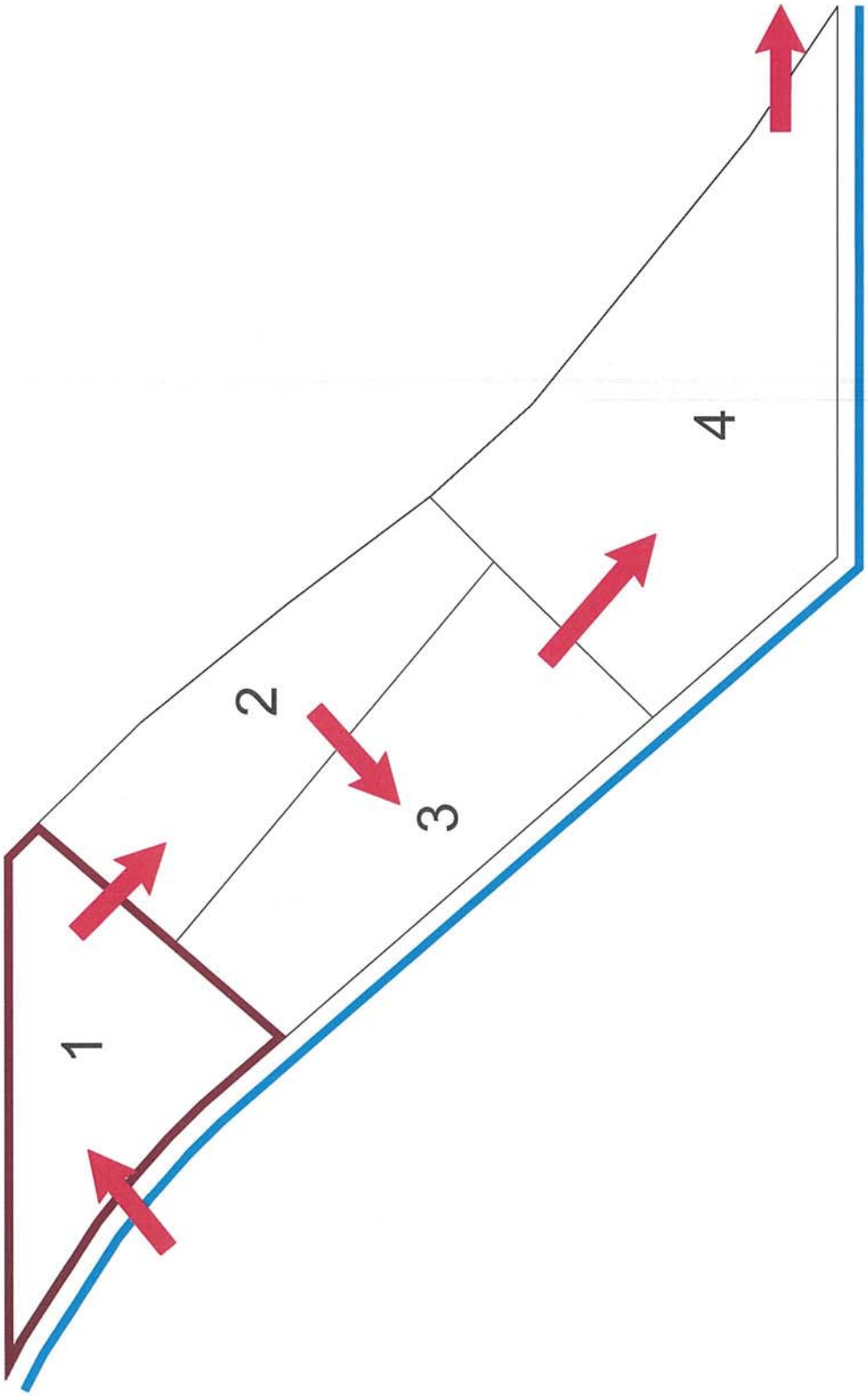
GREY OWL ENGINEERING LTD.

Dr. Stephen Ramsay P.Eng

MAR 3 0 2020

Attachment 1

Attachment 2


1
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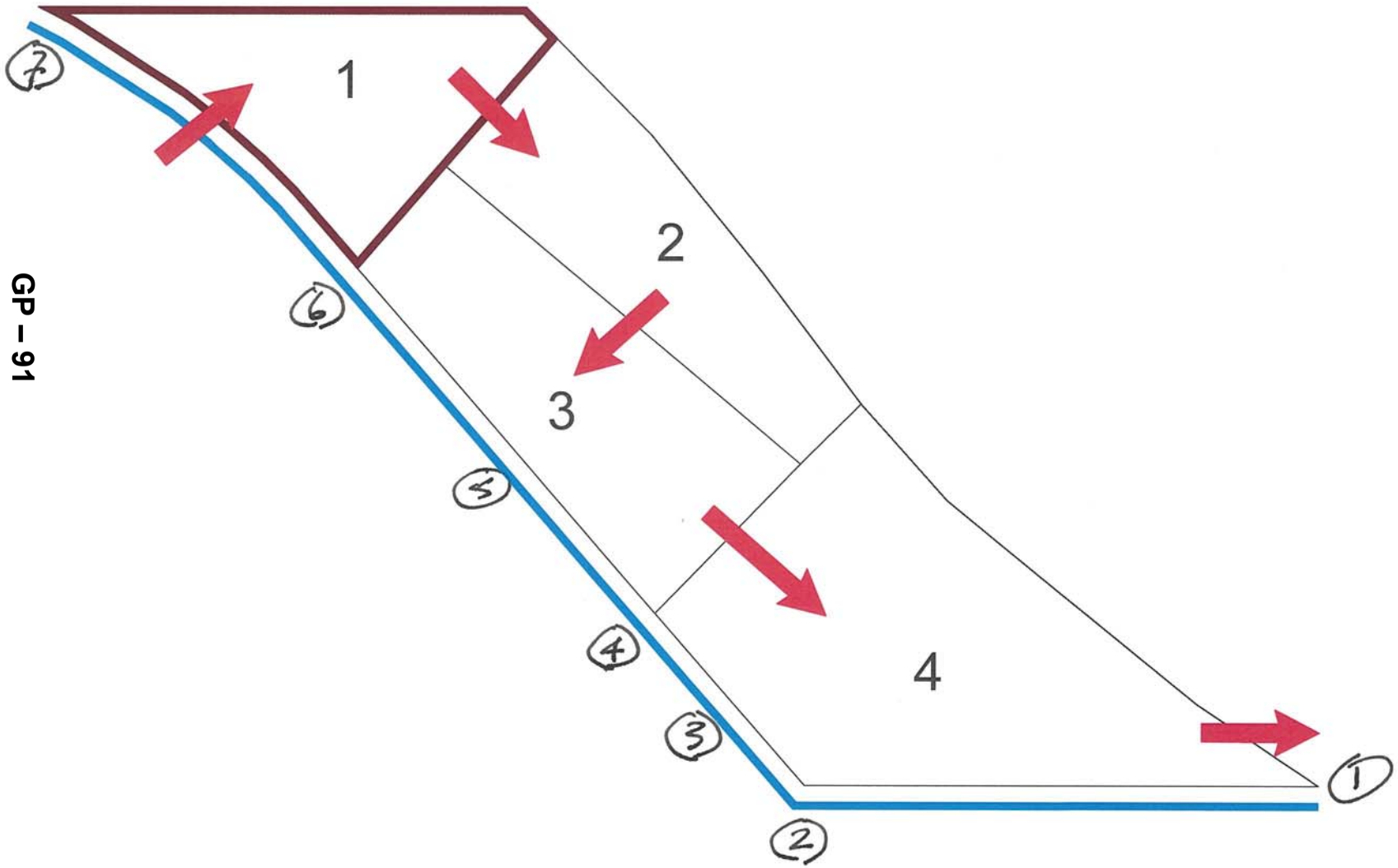
3
4

Attachment 3

Ditch system photo locations.



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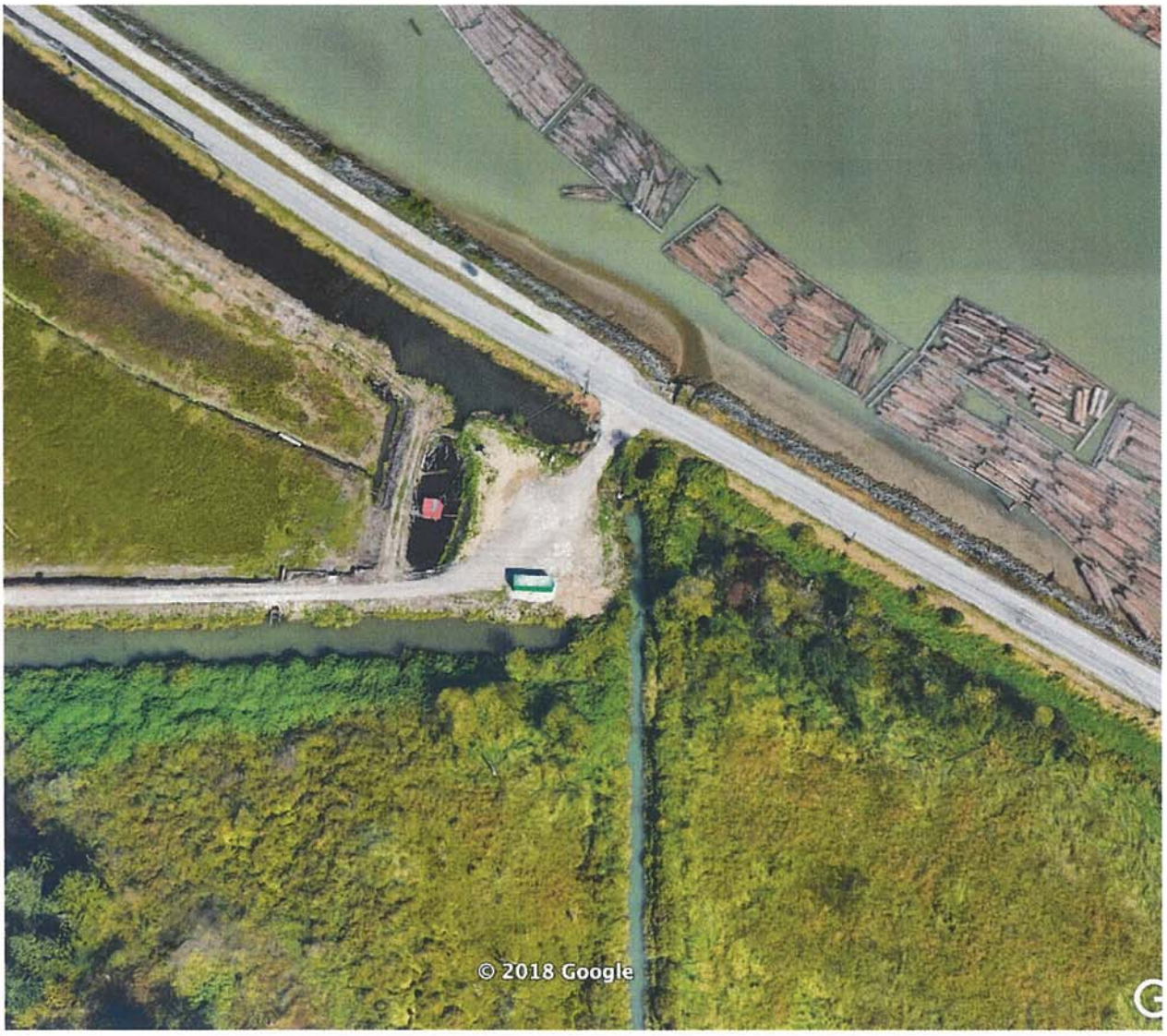

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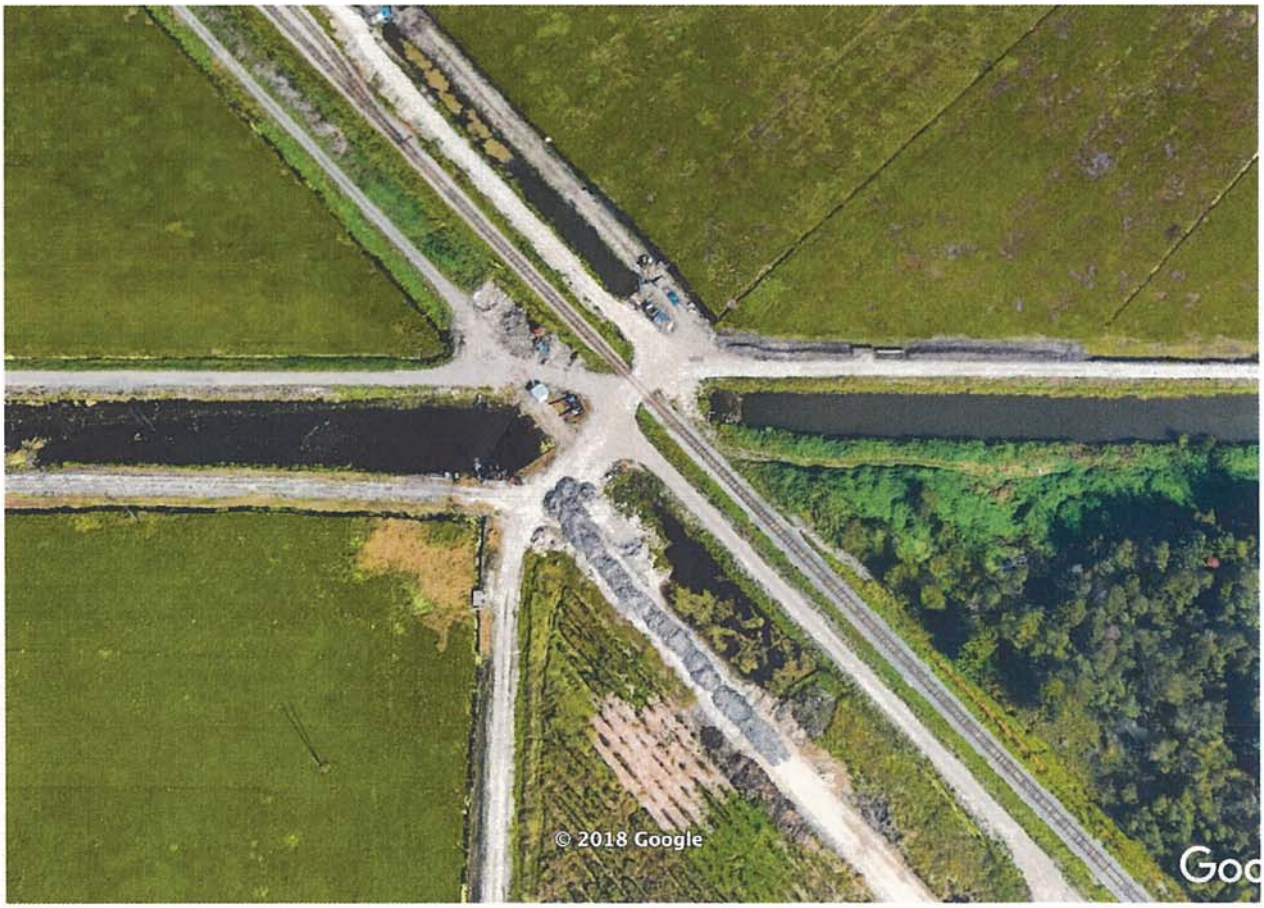
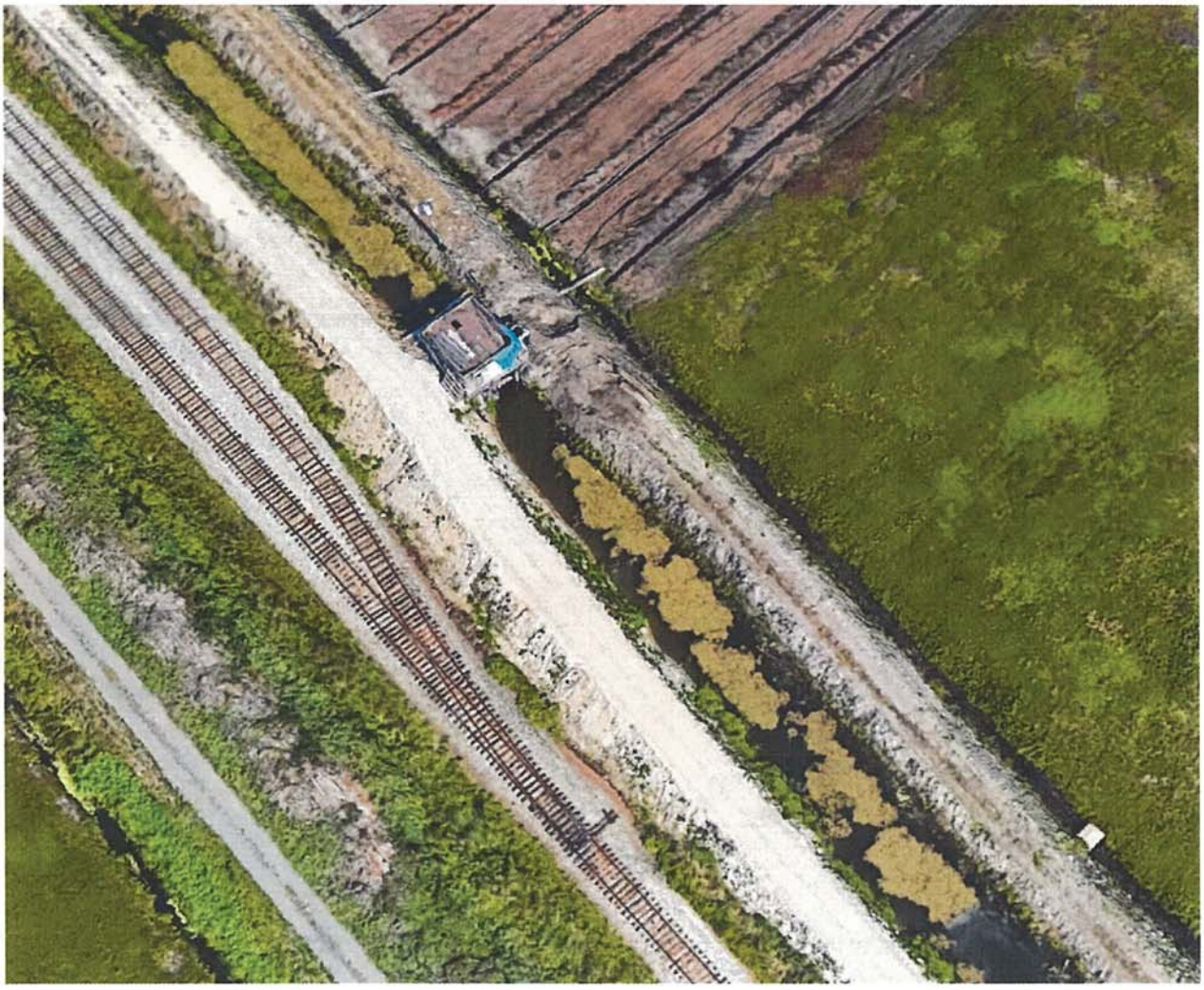
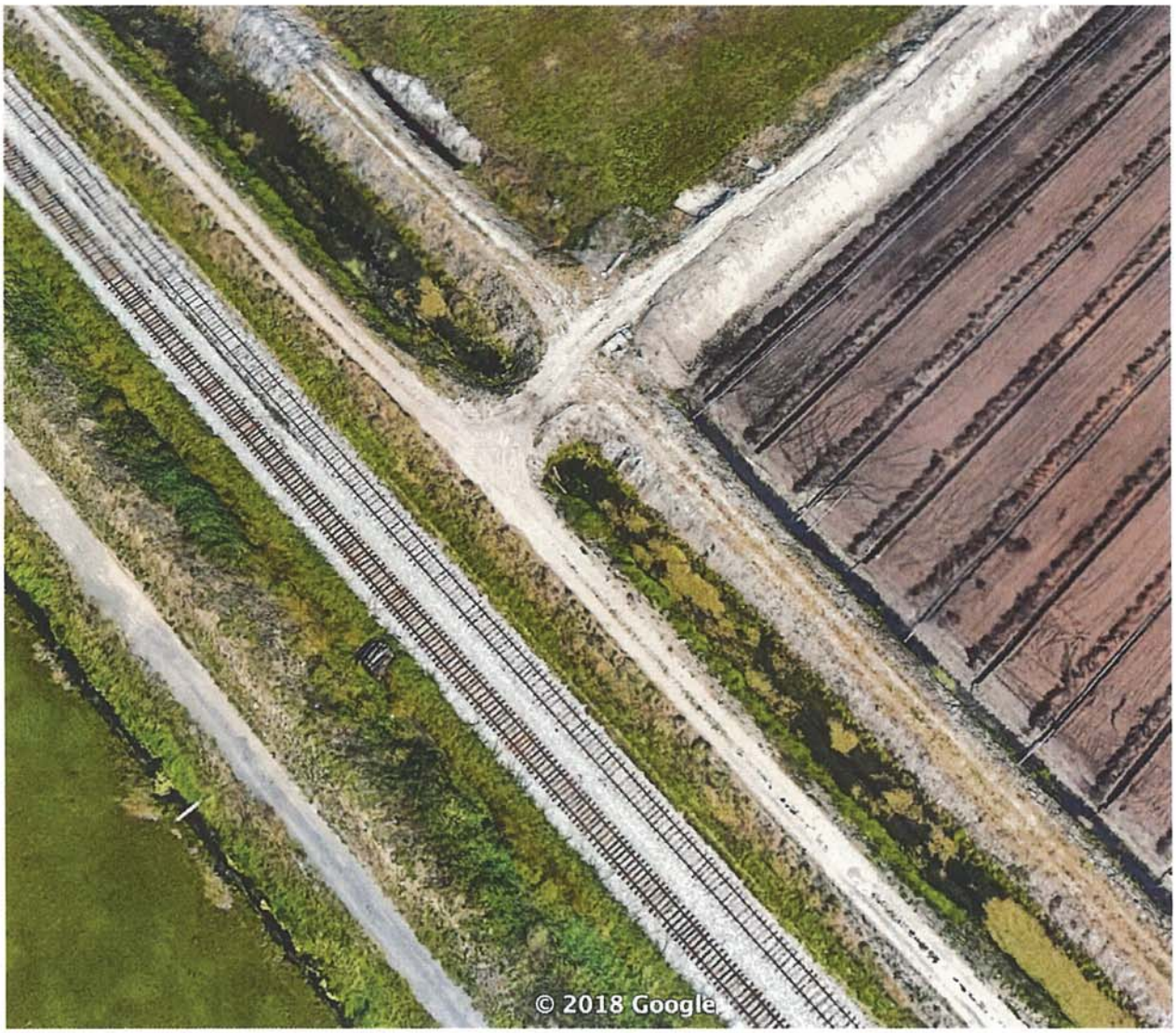
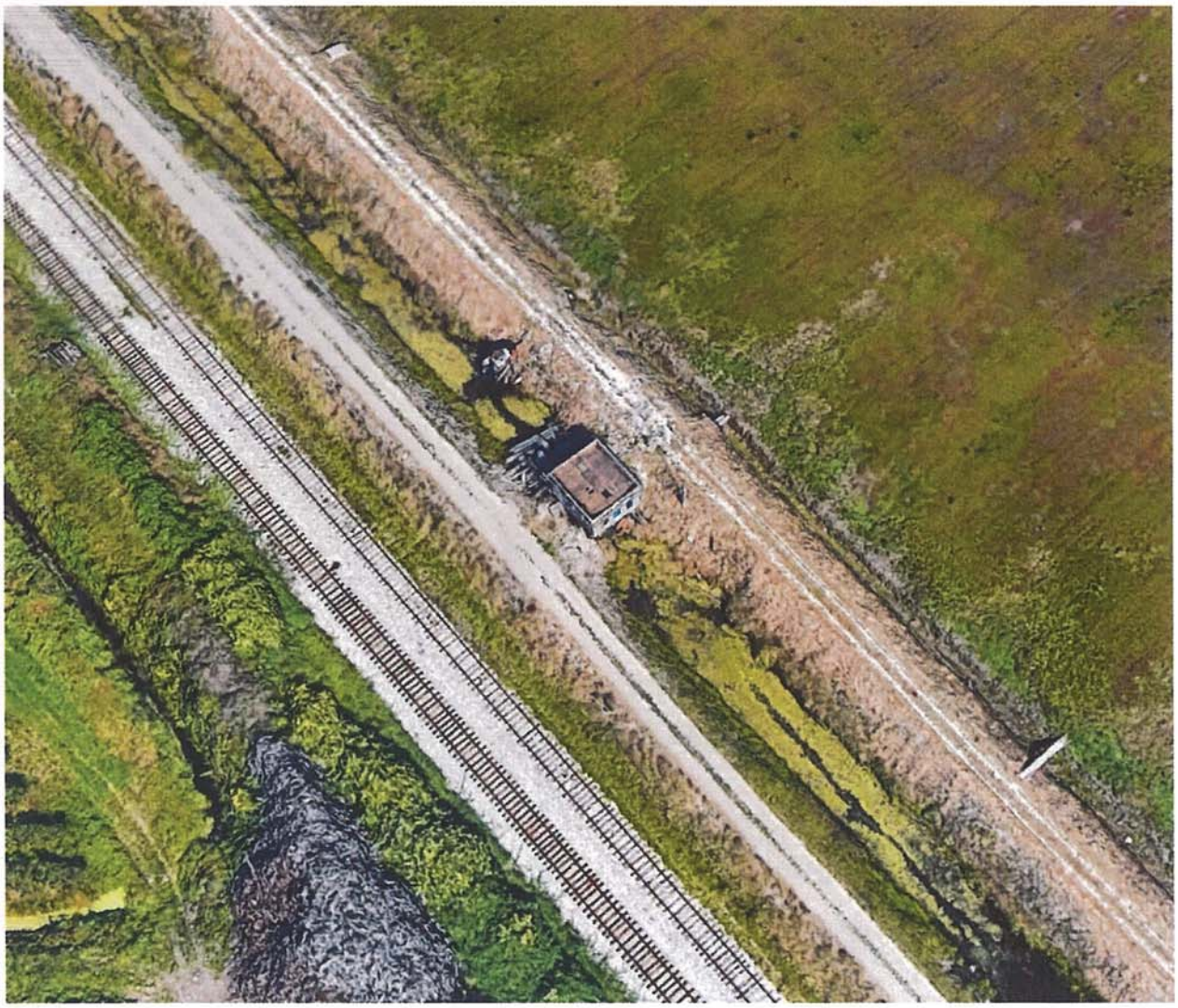





© 2018 Google

5



7

Attachment 4

ArcGIS Web Map

2019-08-30, 9:23:39 AM

Street Names
Community Centres
Richmond Oval
Skating Arenas
Swimming Pools
Libraries
City Hall
Fire Stations
Police Stations
Ambulance Stations

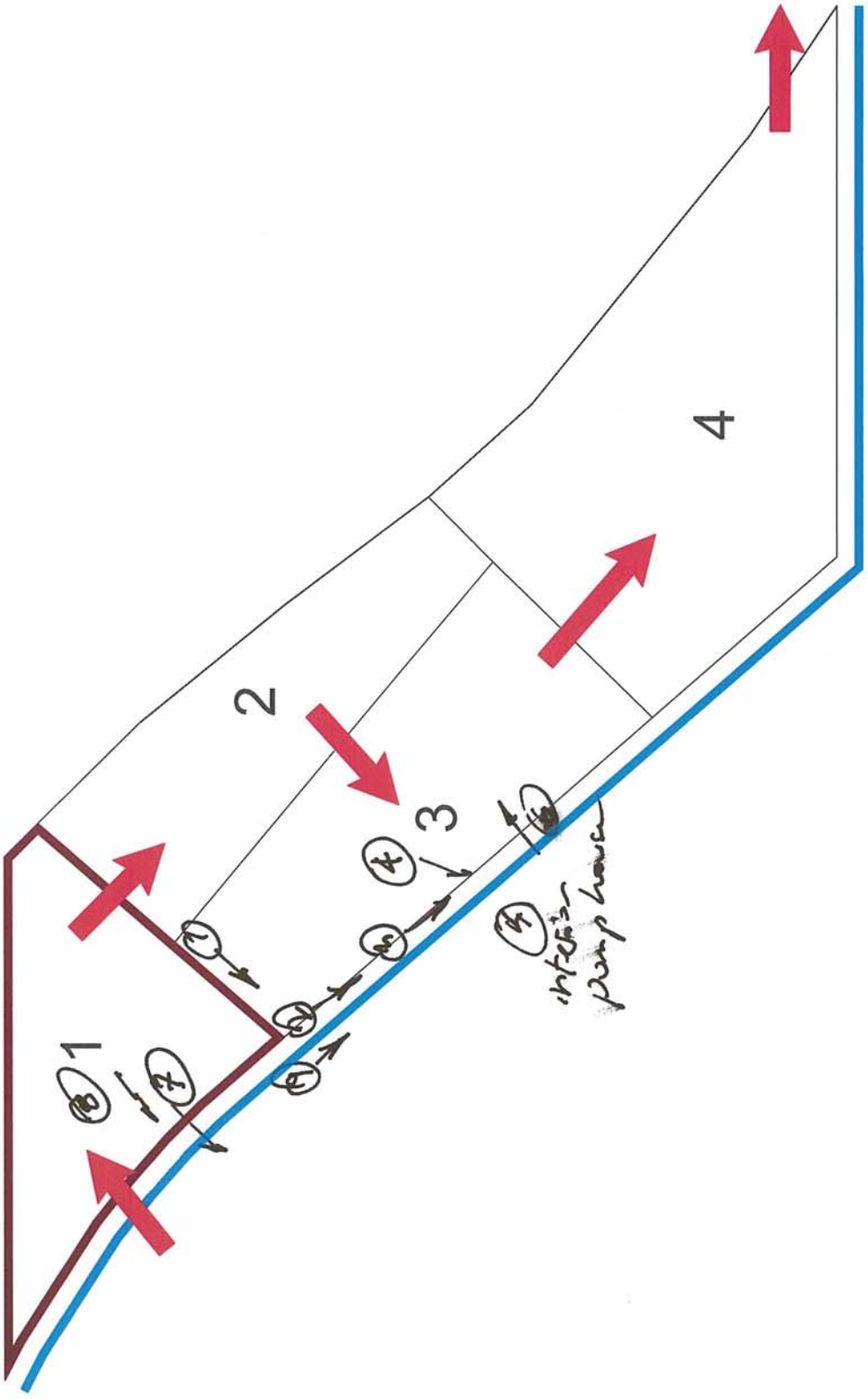
Red: Band_1
Green: Band_2
Blue: Band_3

1:7,523

0 0.075 0.15 0.3 mi
0 0.125 0.25 0.5 km

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

City of Richmond, BC
© 2018 City of Richmond, BC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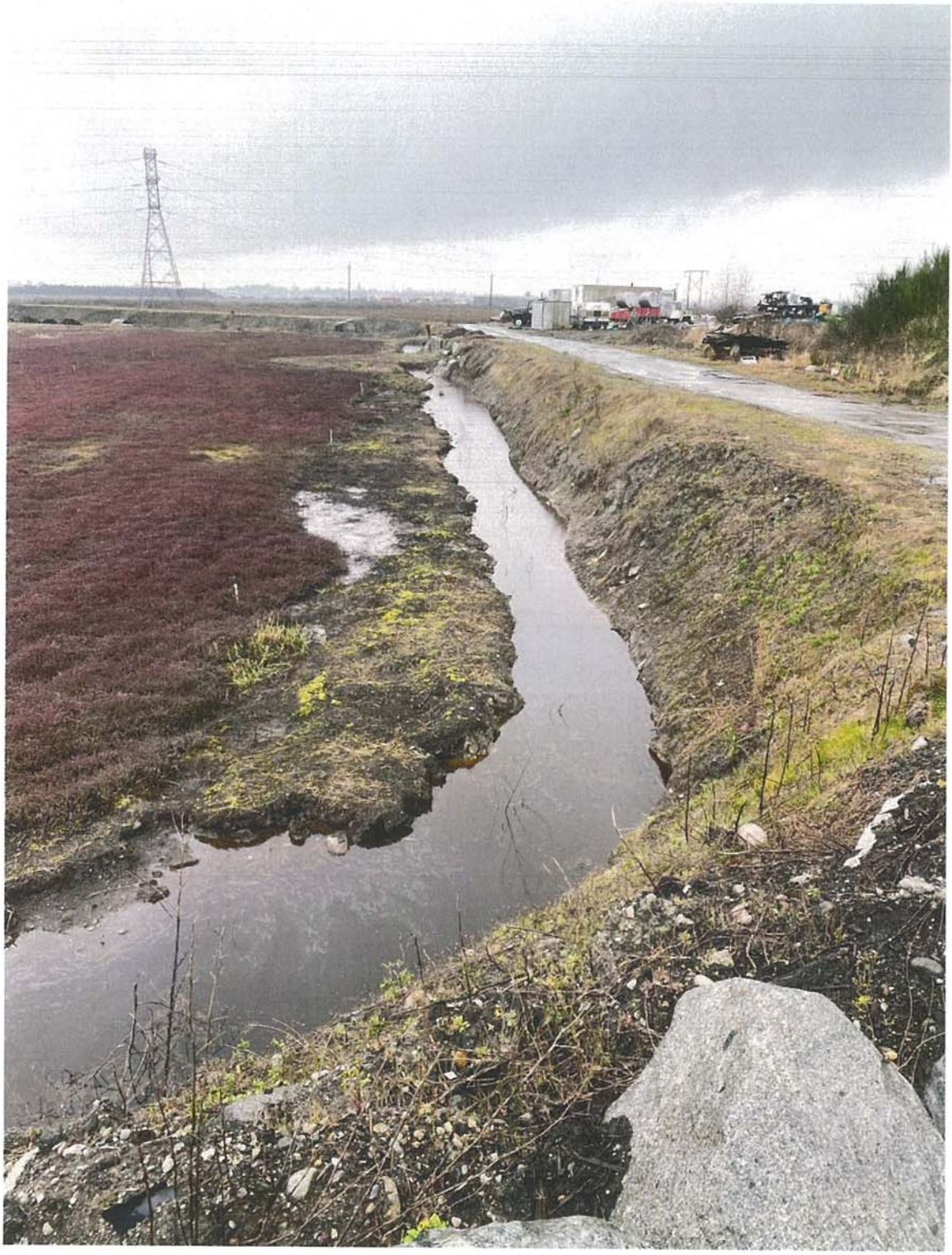
(1)



(2)

(3)

(4)

(5)

(7)

Attachment 5

March 30 , 2020

Jagbar Farms Ltd.
19740 River Road,
Richmond, BC
V6V 1M3

Attn: Sukhminder Sidhu

Re: 19740 River Road – Soil Deposit Application – Geotechnical Assessment – ADDENDUM

This Addendum expands on the previous Geotechnical Assessment dated February 3, 2020 (see Soil Placement Application – Attachment 4).

The purpose of this addendum is to confirm that there will be no adverse impacts on surrounding properties.

The commentary relates specifically to the soil placement area at the northwest end of the property.

The area has been filled previously to a depth of approximately 2.5m to establish the current elevation. The most recent fill was placed in approximately 2000 pursuant to the previous authorizations. No adverse geotechnical impacts have been noted occurred during the previous 20 years.

The south boundary is adjacent to the existing irrigation and drainage ditch system connecting to the Fraser River.

The southwest boundary is adjacent to the Richmond ditch system. The CP Rail right of way (ROW) is on the southwest side of the ditch. The CP Rail ROW shows no evidence of geotechnical issues and no adverse effects have been noted during the previous 20 years of cranberry cultivation.

The ditch on the south and southwest boundaries system shows no evidence of geotechnical issues and no adverse effects have been noted during the previous 20 years of cranberry cultivation.

The north boundary is adjacent to the Kinder Morgen pipeline ROW. The ROW shows no evidence of geotechnical issues and no adverse effects have been noted in the previous 20 years of cranberry cultivation.

The northeast boundary is adjacent to the Fraser River dike and River Road. The Fraser River dike and River Road show no evidence of geotechnical issues and no adverse effects have been noted in the previous 20 years of cranberry cultivation.

The proposed soil placement is separated from the Kinder Morgan ROW by a buffer of approximately 15m including the existing embarkment and proposed dike at the north boundary of the soil placement area.

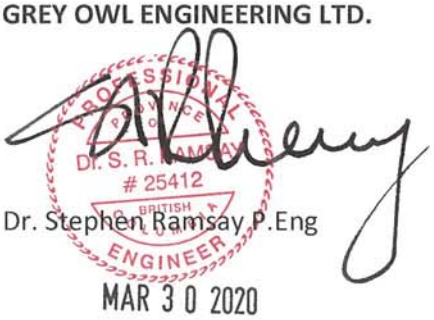
Attcahment 1 shows the Kinder Morgan ROW adjacent to the noth boundary of the subject property.

See figure 1 to 3 attached which demonstrates the separation of the Kinder Morgan ROW from the Jagbar Farms property and from the proposed soil placement areas. The separation exceeds the Kinder Morgan guidelines for concern with the ROW.

The proposed soil placement will not have any geotechnical impacts on any of the adjacent properties.

In summary, there are no indications of pre-existing geotechnical issues related to cranberry cultivation which has occurred continuously at Jagbar Farms for over 30 years. The proposed soil placement area has sufficient buffer and physical separation from adjacent properties to avoid any geotechnical impacts.

Yours truly,
GREY OWL ENGINEERING LTD.



Dr. Stephen Ramsay P.Eng

MAR 3 0 2020

ArcGIS Web Map

Attachment 1.

GP – 113

2020-04-13, 9:39:21 AM

- Air Parcels
- Strata
- Parcels (black line)
- Community Centres
- Richmond Oval
- Skating Arenas
- Swimming Pools
- Libraries
- Theatre
- City Hall
- Fire Stations
- Police Stations
- Ambulance Stations
- Hospitals

1:4,223

0 0.05 0.1 0.2 mi

0 0.075 0.15 0.3 km

City of Richmond, BC
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ArcGIS Web Map

GP – 114

2020-04-13, 9:40:24 AM

- Air Parcels
- Strata
- Parcels (black line)
- Community Centres
- Richmond Oval
- Skating Arenas
- Swimming Pools
- Libraries
- Theatre
- City Hall
- Fire Stations
- Police Stations
- Ambulance Stations
- Hospitals
- Red: Band_1
- Green: Band_2
- Blue: Band_3

1:4,223

0 0.05 0.1 0.2 mi

0 0.075 0.15 0.3 km

City of Richmond, BC
© 2018 City of Richmond, BC

ArcGIS Web Map

GP – 115

2020-03-27, 5:00:52 PM

1:528

0 0.005 0.01 0.02 mi

0 0.01 0.02 0.04 km

Property Address

- Air Parcels
- Strata
- Parcels (black line)
- Community Centres
- Richmond Oval
- Skating Arenas
- Swimming Pools
- Libraries
- Theatre
- City Hall
- Fire Stations
- Police Stations
- Ambulance Stations
- Hospitals
- Red: Band_1
- Green: Band_2
- Blue: Band_3

City of Richmond, BC
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Attachment 2
Existing and Proposed Pipeline Route

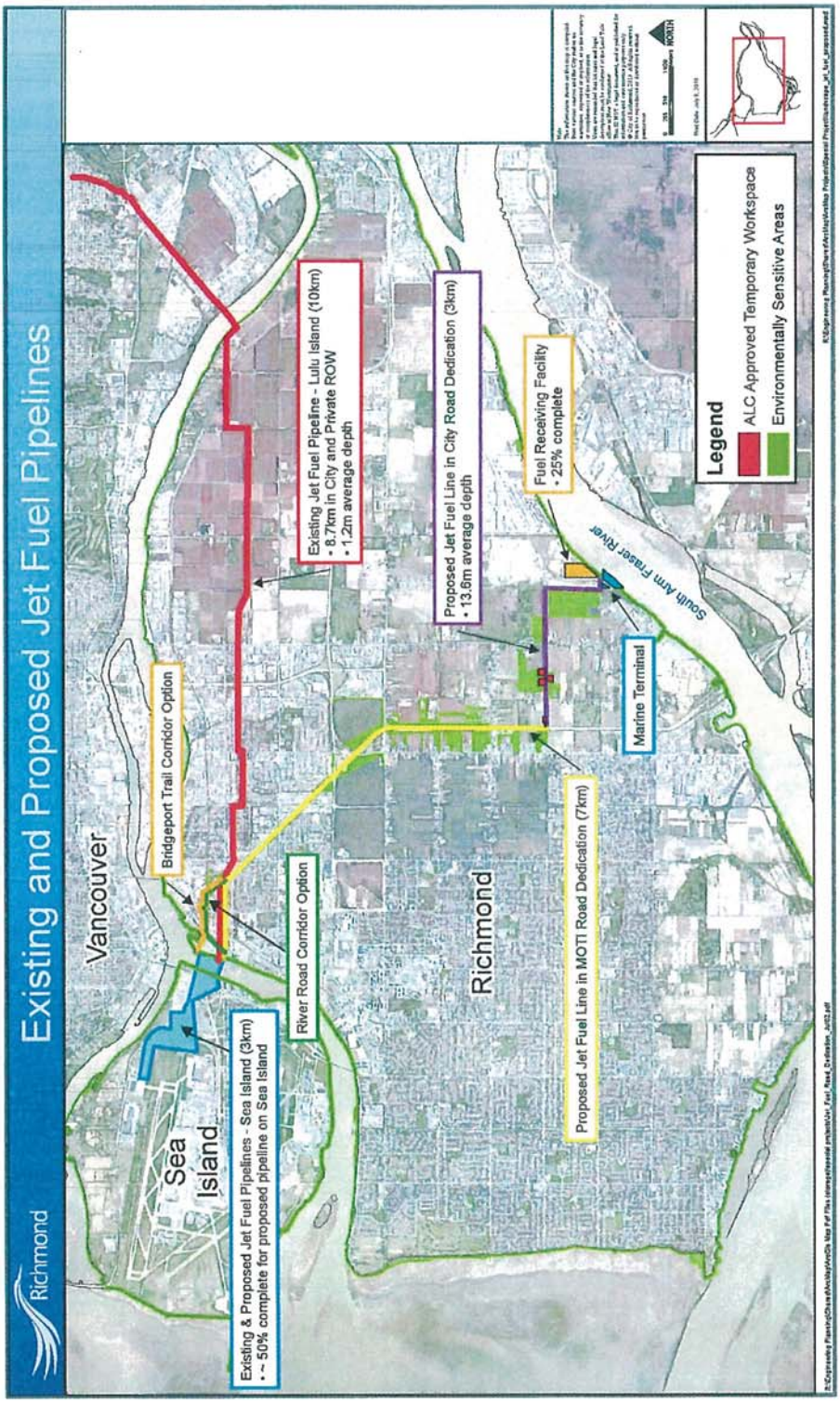

Figure 1
Kinder Morgan Pipeline ROW

Figure 2
Kinder Morgan pipeline ROW adjacent to northwest boundary of Jagbar Farms. ROW is separated from soil deposit by buffer including ROW, ditch, and embarkment at right.

Figure 3
Kinder Morgan ROW at left. Jagbar Farms at right.

Non-Farm Use Fill Application for 19740 River Road, Jagbar Farms (Peat only, development area of 5.3 ha or 13.1 acres)

Project Cost Estimates	
During peat importation - ongoing monitoring and reporting by Professional Agrologist as required by the ALC and the City of Richmond (generally per 3,000 m^3) – 10-12 visits for 32,000 m^3 of peat	**$6,000 (approx. $500 per monitoring visit and report, estimate from invoices for similar projects in area)**
Earthworks costs – 2 year maximum duration (Project management, load inspector, machine/labour costs, fuel, traffic management)	**The total cost of development of the soil deposit area is estimated at $23,000-$27,000/acre ($50,000-$60,000/ha) inclusive of earthworks, drainage (underground drainage within field and perimeter ditch drainage, irrigation, peat soil placement and grading and planting.** **These costs are typical based on previous experience at Jagbar Farms.**
Cranberry Farm implementation cost estimate in new 5.3 ha area (irrigation, installation of berms, labour, new cranberry plants, any other installations)	**See above.** **Total implementation cost approximately $292,000 (calculated via: $55,000 average x 5.3 ha)** **Cost to maintain and cultivate cranberry crop once established (see FSAAC Summary document): $5,000/acre/year = $66,000 per year for 13.1 acres** **No profit from crop for approximately 3 years (crop needs to grow, develop) from establishment**
ALC application fee (if proposal is forwarded to the ALC by the CoR)	**$1,500**
Final topographic survey	**$2,000-$4,000**[1]
Final Agrologist Report (Closure Report for ALC)	**$3,000-$4,000**[2]
Final Geotechnical Report (if required)	**$2,000-$4,000**
Project Cost Estimate (does not include upfront costs, detailed below)	**Approximately $309,000 *plus* $66,000 per year to maintain crop for initial three years of establishment until first commercial harvest** **Where cost is estimated as a range above, the average has been used in this calculation.**

[1] Cost of survey varies by company and complexity of terrain – area to be surveyed is 5.3 ha (13.1 acres).

[2] Includes potential fertility testing as part of ALC closure requirements (topsoil).

Upfront Costs (To Date, paid by Jagbar Farms)	
Soil Placement Plan	**$2,500**
Topographic Survey (Existing)	**$1,500**
Drainage Plan	**$1,500**
Geotechnical Report	**$1,500**
Application Fee (CoR)	**$600**
Total Upfront Costs Paid to Date	**$7,600**
Additional upfront costs, if required	**$5,000-$10,000 for ESC implementation such as gravel road rehabilitation, possible wheel wash installation[3]**
Peat Tipping Fees	**All structural fill required establish the existing grade of the soil placement area has been placed under previous authorizations (see Soil Placement Plan & Geotechnical Assessment). Sufficient material exists at the site for all anticipates earthworks related to the dikes and drainage system (no material necessary).** **The peat soil will be sourced from specified areas in Queensborough where previous peat soil has been sourced. This is to ensure consistency and uniformity of the soil through the Jagbar Farm operations and similar growing conditions throughout.** **The peat soil will be sourced from areas of Queensborough that are being developed requiring removal of the existing peat soil at**

[3] Large sites with 3+ year projects have ESC costs of over $35,000 (costs seen by Madrone in related projects). This is a cranberry farm with existing gravelled farm roads. The peat will be confined between berms therefore, run-off is not anticipated to be a management issue. The main ESC anticipated will be road improvements (bringing in fresh gravel, spreading) and potential wheel wash installation at entrance to ensure trucks do not track sediment onto River Road. If gravel is sufficient at cleaning tires, no wheel wash will be installed.

	those sites. The rate at which peat soil is sourced is dependent, in part, on the development in Queensborough and is expected to have a duration of about two (2) years. **Note that the peat soil will be extracted and trucked at the expense of the developer(s) of the Queensborough site(s) and is supplied at no cost to Jagbar Farms.** **This is not a commercial fill site and no fees are paid to Jagbar Farms for the peat soil.**