Appendix A

TETRA TECH

District of Central Saanich
Waste Collection System Assessment – Revision 1

PRESENTED TO
District of Central Saanich

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EXECUTIVE SUMMARY

Tetra Tech Canada Inc. (Tetra Tech) was retained by the District of Central Saanich (the District) to conduct a solid waste collection assessment by reviewing, assessing, and conceptualizing the solid waste collection services in the District. Based on concerns expressed by residents, the current solid waste collection system is an open market service which has multiple waste collection firms travelling through the District collecting garbage and organics at curbside. Residents have expressed concerns regarding this method of collection as it contributes to excess greenhouse gas emissions (GHG).

The District is located on southern Vancouver Island in the Greater Victoria Area and is a member municipality of the Capital Regional District (CRD). With a population of 16,814, the District continues to grow at a rate of 0.9% annually. Within the next few years, the District is forecasted to have 4,000 single family households.

A regulatory review was conducted to identify the guidelines for solid waste provincially and regionally. The CRD Solid Waste Management Plan (SWMP) identifies four goals and the strategies to achieve these goals. Two goals that are relevant to District's solid waste collection program are:

1. Have informed citizens who participate effectively in proper waste management practices; and
2. Surpass the provincial per capita waste disposal target (goal of 125 kg/capita/year).

The District adopted the District Climate Leadership Plan (Plan) that sets two goals including an overarching goal for "*100% less GHG emissions by 2050, relative to 2007"*. The Plan indicates that there are three primary sources of community GHG emissions, and two of these sources are (1) solid waste management and (2) transportation.

Currently, residents are responsible to subscribe to curbside collection services with private haulers for garbage and organics (i.e., kitchen scraps and some yard waste) as the District does not coordinate or oversee a solid waste collection service. Blue box recyclable materials are curbside collected by the CRD on a biweekly basis, and this program is funded through subsidies provided by RecycleBC. Waste disposal data and environmental impact assessments from solid waste management is not reported to the District.

Four communities, Town of View Royal (View Royal), Town of Sidney (Sidney), District of Oak Bay (Oak Bay), and Township of Esquimalt (Esquimalt) were reviewed to identify current curbside collection practices on southern Vancouver Island. Most municipalities within the CRD are serviced for garbage collection and kitchen scraps collection. The majority of waste generated in the CRD is disposed at Hartland Landfill. CRD provides recycling curbside collection to most households within the CRD and this program is funded by RecycleBC. Municipalities have weekly or biweekly garbage and kitchen scraps collection.

Municipalities that manage solid waste collection services have control over their data (i.e., municipal collection or one centralized hauler) and are able to report on their disposal rates and GHG reduction efforts. For example, a municipality can require their centralized hauler to report their data to the municipality as part of contract negotiations. This would allow for more effective monitoring and reporting of the Plan's goals.

Tetra Tech developed a potential curbside waste collection model that the District could consider. Two scenarios were developed that included an in-house collection service (District owns and operates collection vehicles) or contracted model (District contracts curbside collection to a hauler). The service level was determined based on the jurisdiction scan conducted. The table below describes the proposed service level.

Waste Stream	Responsibility	Collection Frequency	Comments
Garbage	District or Contractor	Every-Other-Week (EOW)	▪ EOW garbage collection may reduce the amount of garbage collection and promote additional organic waste collection.

Waste Stream	Responsibility	Collection Frequency	Comments
Organics	District or Contractor	Weekly	▪ A combination of food waste and grass clippings. ▪ It is assumed that the curbside organics program would not be inclusive of yard waste collection.
Recycling	Capital Regional District	Every-Other-Week (EOW)	▪ Recycling collection service provided by the CRD. ▪ Most municipalities in the CRD do not provide curbside collection for recycling. ▪ No tangible benefits to the District by changing the current recycling practice.

Based on the service level requirements and the number of households, it was calculated that the forecasted curbside waste collection model would require the following (details of the model requirements are discussed in Section 6 of the report):

- Three collection trucks (includes one spare);
- One full-time driver per truck;
- One part-time driver should be available for six months of the year to cover for peak periods, sick time, and vacations;
- One full-time staff member should be fully dedicated to maintaining the fleet;
- One full-time administrative staff/manager should be fully dedicated to the program; and
- One supervisor will manage the fleet and assets for the solid waste operations.

A conservative financial analysis was conducted. Summary of the results is in the table below.

Summary	Capital Cost	Operations	Annual Amortized Capital	Total Annual Cost	Cost per Household per Month
Option 1 (in-house)	$2,303,979	$955,761	$326,085	$1,281,846	$26.75
Option 2 (contracted)	$2,303,979	$874,179	$340,103	$1,296,567	$27.06

Fuel consumption is a major GHG contributor to waste collection services. The electric vehicle (EV) waste collection trucks were assessed to determine its costs and benefits. The table below summarizes the financial implications if there was one EV waste collection truck in the fleet.

Total Capital Cost	Annual Operating Cost	Annual Amortized Capital Cost	Total Annual Cost	Cost per Household (Annual)	Cost per Household (Monthly)
$2,961,979	$923,318	$423,129	$1,346,447	**$337.20**	**$28.10**

An EV waste collection truck is estimated to have 0 GHG emissions; thus, incorporating a fully electric waste collection truck represents a decrease of 44.5 tonnes of CO_2 per year, which is the estimated amount of GHG emissions from one diesel truck per year.

As part of this study, establishing a yard waste drop-off facility at the existing Central Saanich Public Services Yard was considered. Residents currently drop off yard waste at Hartland Landfill or private sector facilities. Two facility designs were considered: Option 1 (Existing Roll-Off Bins) and Option 2 (Drop-off Bunkers). The financial implications of a yard waste drop-off facility were analyzed and compared, and summarized below.

Option	Estimated Annual Cost	Estimated Annual Cost per Household	Estimated Monthly Cost per Household
Option 1	$299,192	$74.80	$6.23
Option 2	$351,198	$87.80	$7.32

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ACRONYMS & ABBREVIATIONS

Acronyms/Abbreviations	Definition
C&D	Construction and Demolition
Charter	Community Charter
CNG	Compressed Natural Gas
CRD	Capital Regional District
CVP	Commercial Vehicle Pilots Program
District	District of Central Saanich
EOW	Every Other Week
Esquimalt	Township of Esquimalt
EV	Electric Vehicle
GHG	Greenhouse Gas
MSRP	Manufacturer's Suggested Retail Price
MSW	Municipal Solid Waste
Oak Bay	District of Oak Bay
Plan	Climate Leadership Plan
View Royal	Town of View Royal
Sidney	Town of Sidney
SUVI	Specialty Use Vehicle Incentive
SWMP	Solid Waste Management Plan
Tetra Tech	Tetra Tech Canada Inc.
ZEV	Zero-Emission Vehicles

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of District of Central Saanich and their agents. Tetra Tech Canada Inc. (Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than District of Central Saanich, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this document is subject to the Limitations on the Use of this Document attached in the Appendix or Contractual Terms and Conditions executed by both parties.

1.0 INTRODUCTION

Tetra Tech Canada Inc. (Tetra Tech) was retained by the District of Central Saanich (the District) to conduct a solid waste collection assessment by reviewing, assessing, and conceptualizing the solid waste collection services in the District. Based on concerns expressed by residents, the current solid waste collection system is an open market service which has multiple waste collection firms travelling through the District collecting garbage and organic waste at curbside. Residents have expressed concerns regarding this method of collection as it contributes to excess greenhouse gas emissions (GHG).

2.0 REGIONAL OVERVIEW

The District is located on Vancouver Island in the Greater Victoria Area and is a member municipality of the Capital Regional District (CRD).

2.1 Population and Housing

The District's population is 16,814 with a population density of 406.8 people per square km (Statistics Canada, 2019), the greatest density of which are within the "urban settlement areas" defined by the yellow ovals on Figure 2-1 below. There are 7,121 private dwellings of which 3,750 are single-detached homes (over 50%) with an average household size of 2.4. The District estimates that the population has been growing at an estimated 0.9% annually.

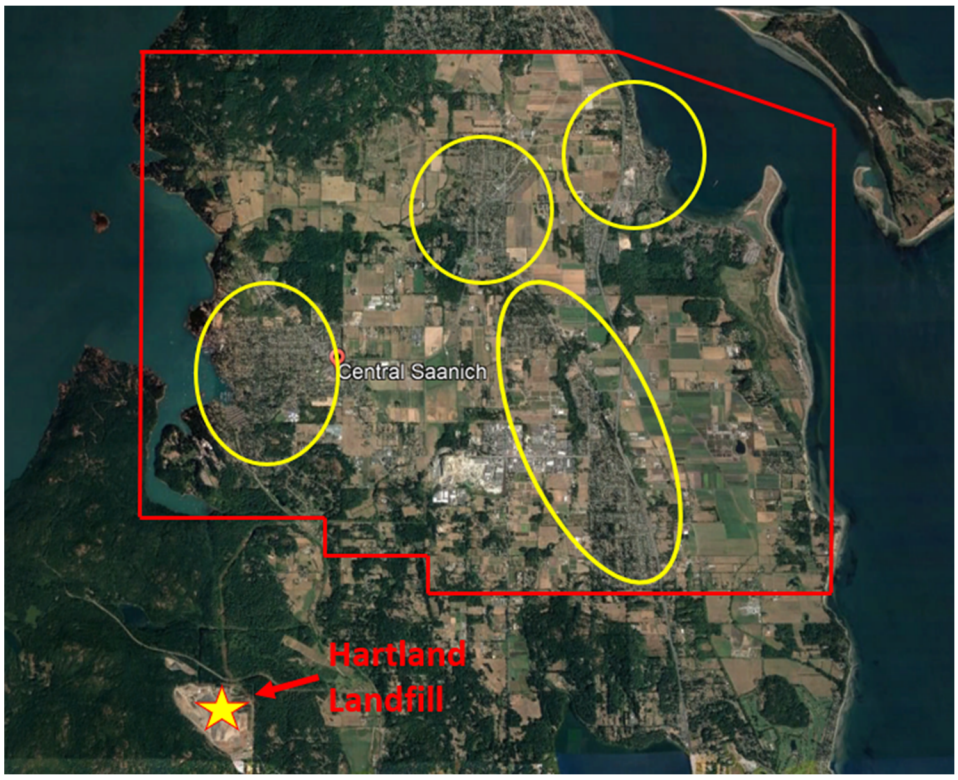

Figure 2-1: District of Central Saanich Map

3.0 REGULATORY REVIEW

There are several regulatory documents that provide guidelines on what the District should consider if implementing a solid waste management system. Tetra Tech reviewed the following regulatory documents:

- The Environmental Management Act.
- The Community Charter.
- CRD Solid Waste Management Plan (SWMP).
- CRD's solid waste management bylaws.
- District's Climate Leadership Plan.

3.1 Provincial Regulations

3.1.1 Environmental Management Act

The Environmental Management Act (Act), under the British Columbia Provincial Government, regulates industrial and municipal waste discharge, pollution hazardous waste and contaminated site remediation. It provides the authority for introducing wastes into the environment with the consideration of protecting human health and the environment.

Under the Act, a municipality, alone or with other municipalities, may submit for a waste management plan for approval by the minister that complies the regulations respecting the management of municipal liquid waste (Part 3, 24(1)). This waste management plan is optional for municipalities.

The Act also provides authority to regional districts to develop bylaws to prohibit, regulate, or otherwise control the introduction of municipal solid waste (MSW), or garbage, into the environment within the area covered by the regional district's approved SWMP. A person must manage the MSW, or garbage, and recyclable material at a site in accordance to any applicable bylaws in their respective area. Regional districts also have the authority to make bylaws to regulate the management of MSW or recyclable material including the transportation of waste material within the area or through the area covered by the SWMP.

3.1.2 Community Charter

The Community Charter (Charter) provides municipalities and their councils the following authority:

- A legal framework for their powers, duties and functions that are necessary to fulfill their function;
- Authority and discretion to address existing and future community needs; and
- Flexibility to determine the public interest of the communities and to respond to the different needs and changing circumstances of their communities.

The fundamental powers provided to the municipality and council include:

- Provide any service that the council considers necessary or desirable, and may do this directly or through another public authority; and
- By bylaw, regulate prohibit and impose requirements in relation to municipal services.

The areas of authority the District have, according to the Charter, are procedures (e.g., adopting bylaws), property taxation and bylaw enforcement.

3.2 Regional and Municipal Regulations

3.2.1 Capital Regional District Solid Waste Management Plan

The CRD is responsible for regional solid waste management planning for 13 member municipalities (including the District), and 3 electoral areas on southern Vancouver Island and the Gulf Islands. CRD develops partnerships to facilitate and deliver projects and services to ensure a sustainable, livable, and vibrant regional district.

The regional SWMP identifies goals and strategies of how the regional district will manage its solid waste. The updated SWMP was endorsed by the CRD Board on March 31, 2021 and has been submitted to the British Columbia Ministry of Environment and Climate Change for approval.

The SWMP identifies four goals and the strategies to achieve these goals. Two goals that are relevant to District's solid waste collection program are:

1. Have informed citizens who participate effectively in proper waste management practices; and
2. Surpass the provincial per capita waste disposal target (goal of 125 kg/capita/year).

Specifically, the strategies that may impact the District's solid waste collection system include:

- **Strategy #5: Support local governments in working towards zero waste and a circular economy.**
  - Provide model language for local governments to use when developing bylaws, best practices, official community plans, and economic development strategies. The model language will be created in collaboration and research in partnership with municipalities and potentially other regional districts.
  - In partnership with member municipalities, the CRD will work with local governments to identify the need for solid waste facilities and zoning for waste management activities.
- **Strategy #6: Continue and enhance policy development.**
  - In partnership with member municipalities and other interested organizations, develop model procurement policies for use.
  - Investigate licensing waste management facilities which will encourage transparency, and consistency. This will require facilities to protect public health and the environment.
  - Investigate regulatory mechanisms to manage municipal solid waste and recyclable material in the regional district.

As a member municipality of the CRD, the District can participate in the solid waste management system by:

- Providing various curbside collection or drop-off services to residents;
- Providing education and outreach associated with local solid waste service;
- Municipal waste management planning, which may include zero waste planning;
- Liaising with the CRD with regards to solid waste services and issues;
- Participating in the development and implementation of the SWMP;
- Undertaking local zero waste initiatives; and

- Providing land use zoning approval for a variety of solid waste and recycling facilities in their municipality.

3.2.2 Solid Waste Management Bylaws

The following bylaws are in place in the CRD for the purpose of solid waste management. Each bylaw is summarized to reflect the needs of the District.

Bylaw 1903, Solid Waste Disposal Local Service Establishment Bylaw No. 1, 1991

Bylaw 1903 establishes solid waste disposal function as a local service for the Electoral Areas of Langford, Sooke, Saltspring Island, and Outer Gulf Islands and the municipalities of North Saanich, Sidney, Central Saanich, Saanich, Victoria, Oak Bay, Esquimalt, View Royal, Colwood, and Metchosin. Municipalities are permitted to establish their own collection service should they choose to. The CRD does not regulate the collection service for each municipality. The CRD can, however, establish, acquire, maintain, operate, and regulate facilities for collecting of recyclable waste and facilities for composting waste.

Bylaw 3881, The Hartland Landfill Tipping Fee and Regulation Bylaw

Bylaw 3881 provides a list of banned items for disposal at the Hartland Landfill and establishes tipping fees for garbage and recycling. On January 1, 2015, CRD implemented a kitchen scraps disposal ban and updated the bylaw with an amendment stating that “no person shall deposit Kitchen Scraps at the Disposal Site [Hartland Landfill] except at the Kitchen Scraps Transfer Station and provided that they are source separated”. This implies that kitchen scraps, or food waste, is banned from disposal at the landfill and needs to be disposed at a designated area if they are separated from garbage.

Relevant fees for residents of the District are listed in Table 3-1.

Table 3-1: Tipping Fees

Waste Type	Disposal Site Designated Location	Tipping Fee ($/tonne)	Other Fees	Minimum Tipping Fee
Refuse (garbage)	Active Face	$110	-	-
Refuse (garbage)	Public Drop Off Area	$110	$10 bin fee	-
Yard & Garden Materials	As directed by CRD staff	$59	-	$10
Weeds (source separated)	Active Face	$59	-	$10
Kitchen Scraps, effective January 1, 2017	Kitchen Scraps Transfer Station	$120	-	-

3.2.3 District Climate Leadership Plan

The District adopted the Climate Leadership Plan (Plan) in July 2020. The Plan identifies actions within the District’s realm of authority and influence in areas such as solid waste management and transportation. Two goals were set by the Plan including an overarching goal for “*100% less GHG emissions by 2050, relative to 2007*”. The Plan indicates that there are three primary sources of community GHG emissions, and two of the of those sources are solid waste management and transportation.

The solid waste GHG emissions accounts for approximately 12% of the total community emissions. It is assumed that this is mostly attributed to the organic waste (food waste and yard waste) that decomposes at the landfill and

generate methane gas, a GHG that is more than 20 times more potent that carbon dioxide (CO_2). The District supports diverting food and yard waste from landfill disposal in principle.

Transportation accounts for approximately 66% of the total community GHG emissions. The District is taking action by keeping the majority of the new growth within the Urban Settlement Area. Waste collection trucks driving in and around the District are emitting carbon dioxide. Limiting the number of collection truck should reduce GHG emissions.

4.0 CURRENT WASTE COLLECTION SYSTEM

This section describes the current waste collection system at the District.

4.1 Levels of Service

Residents are responsible to subscribe to curbside collection service with private haulers for garbage and food waste as the District does not coordinate or oversee the collection service. Blue box recyclable materials are curbside collected by the CRD on a biweekly basis, and this program is funded through subsidies provided by RecycleBC. Table 4-1 below summarizes the types of waste collected at curbside, who provides the service and the collection frequency.

Table 4-1: District of Central Saanich Curbside Collection Services

Waste Stream	Service Provider	Collection Frequency
Garbage	Capital City Recycling Ltd. Waste Management Pan-insula Disposal	Weekly to Monthly, On-Demand
Recycling	Capital Regional District (CRD)	Biweekly
Food Waste (Organics)	Capital City Recycling Ltd. Waste Management Pan-insula Disposal	Weekly to Monthly, On-Demand

It should be noted that there are other haulers in the area that provide one-time hauling of materials such as construction and demolition (C&D) materials, yard waste, estate cleanouts, but do not provide residential garbage collection.

Garbage is disposed at the CRD's Hartland Landfill. For yard waste, District residents are encouraged to contact a private hauler or to self-haul their loads directly to the Hartland Landfill.

4.2 Service Providers

The District provides residents with a list of available private sector waste haulers in the region on the District's website. Residents would contact and subscribe for garbage and/or organics collection if they choose to. CRD provides recycling collection service for all residents in the region, including the District.

Due to commercial confidentiality, private haulers are unlikely to provide confidential operational information such as fuel usage, GHG emissions, collection routes and internal costs. Table 4-2 presents publicly available information of the District's primary haulers.

Food scraps collection is included in the garbage collection costs for two private haulers. Initial research could not determine whether food scraps collection is an additional cost for the other private hauler. Additionally, one private hauler offers a green bin lease program at $3.50/month on top of costs provided below.

Table 4-2: Service Provider Information

	Private Hauler #1	Private Hauler #2	Private Hauler #3	Capital Regional District
Scale of Operations	Local	Local	International	Local
Collected Waste Streams	Garbage, Food Scraps	Garbage, Food Scraps	Garbage, Food Scraps	Recycling
Level of Service	Weekly, Biweekly, Monthly	Weekly, Biweekly, Monthly	Weekly, Biweekly, Monthly	Biweekly
Cost[1]	$9.50/month (monthly) $14.17/month (biweekly) $20.84/month (weekly)	From $10.19/month From $13.50/pickup (yard waste)	$38.19/month[2] *based on waste hauler's cost calculator	$0 *Collection costs are covered under BC's extended producer responsibility program

[1]Private Haulers #1 and #2 costs are inclusive of kitchen scraps collection and garbage collection.
[2]Calculated using a waste hauler's online calculator for the District of Central Saanich Municipal Hall (1903 Mt Newton Cross Rd, Saanichton, BC)

4.3 Environmental Impact

The typical primary sources of GHG emissions associated with solid waste are from the fuel consumption of collection trucks and the degradation of organic waste in landfills.

The BC Climate Action Charter is a voluntary agreement between the BC government, Union of BC municipalities, and each local government signatory that wants to take action on climate change. The District has committed to this charter by adopting the Climate Leadership Plan. In 2018, it is reported that the transportation sector accounts for approximately 37% (Provincial Greenhouse Gas Emissions Inventory) of GHG emissions in British Columbia, thus being a target to reduce GHGs. Waste collection is a focus area that aligns with the BC Climate Action Plan and the District's Climate Leadership Plan.

Fuel consumption is a major GHG contributor to collection services. Thus, more collection trucks on the road will result in more fuel consumption and GHG emissions. By having multiple haulers providing curbside collection service to residents, the GHGs associated with collection is likely higher per capita than if the District had one centralized hauler. However, the specific GHG emissions cannot be estimated, as private haulers will not share their collection routes (which often extend over multiple municipalities) and their fuel usage due to commercial confidentiality.

4.4 Disposal Rate

The District does not collect waste disposal data from residents or haulers. The disposal rate is estimated based on available data and certain assumptions.

Assumptions

It is assumed that the available private haulers collect waste from other surrounding municipalities so calculating the District's disposal rate from hauler's disposal quantities is challenging. Also, it is assumed that all waste collected from the District is disposed at the Hartland Landfill, approximately 3 km south of the District's border.

Disposal Rate Estimations

The CRD reports that approximately 149,538 tonnes of MSW was disposed at the Hartland Landfill in 2020[1]. With a regional population of 425,503, the average disposal rate is 351 kg/capita/year at the Hartland Landfill (Capital Regional District, 2020). The average disposal rate takes into consideration municipalities with formal diversion programs such as City of Victoria and District of Saanich. It is assumed that the single-detached residences account for 25% of the total disposal rate. Hence, it is estimated that the garbage disposal rate is 87.8 kg/capita/year.

The CRD collects about 16,000 tonnes of recyclables annually, resulting in an estimated recycling rate of 39 kg/capita/year. Approximately 23,800 tonnes of organic waste were diverted across the CRD in 2019. This included 4,000 tonnes of kitchen scraps,10,800 tonnes of yard and garden waste and 9,000 tonnes of mixed organic waste (50/50 kitchen scraps and yard waste). The estimated organic diversion rate of 56 kg/capita/year across the CRD.

The District does not collect waste disposal data from residents or haulers. The disposal rates below are estimated based on available data and certain assumptions.

Table 4-3 below summarizes the estimated tonnages of each type of material disposed in the District based on CRD data. The 2020 population was calculated based on an estimated population increase of 0.9% annually.

Table 4-3: District of Central Saanich Tonnage Estimations

Waste Stream	2020 CRD Disposal Rate (tonnes/capita)	Population (2020 Estimate)	District Estimated Tonnage (tonnes/year)
Garbage	0.351	17,584	6,117
Kitchen Scraps	0.020		351
Yard Waste	0.036		650
Recycling	0.039		686

5.0 JURISDICTION SCAN

This section presents a comparison of key solid waste management parameters for four municipalities within the CRD. The District selected the municipalities based on similar population and collection provider. The four municipalities are as follows:

- Town of View Royal (View Royal);
- Town of Sidney (Sidney);
- District of Oak Bay (Oak Bay); and
- Township of Esquimalt (Esquimalt).

[1] Highwest Landfill tonnages were not included in the disposal rate as that landfill accepts only C&D waste. The scope of this work includes only residential waste.

All details discussed within the subsections below are presented in Appendix B. Most single-detached households in the CRD have recycling collection provided at no direct costs to taxpayers. Of the jurisdictions included in this memo, only Oak Bay conducts their own curbside recycling. For the other three municipalities, recycling is collected by the CRD and is funded entirely by Recycle BC. It shall be noted that Oak Bay's recycling collection is also subsidized by Recycle BC.

Town of View Royal

View Royal has an estimated 10,408 people living in 4,299 private dwellings. Garbage and kitchen scraps are collected on a weekly basis by one centralized third-party hauler (Waste Management). Both streams are collected in wheeled totes (maximum 40 kg per week) via semi-automated collection vehicles. Each household within the town is charged $189 per year for curbside garbage and kitchen scraps collection, funded through property taxes.

Town of Sidney

Sidney has an estimated 11,672 residents living in 5,960 private dwellings. Garbage and kitchen scraps are collected on a weekly basis by one centralized third-party hauler (Emterra Environmental). Residents use their own supplied vessels (bins, bags or wheeled totes) for garbage (maximum volume of 80 L or 20 kg). Kitchen scraps are collected in a provided green container (no weight limit). Households within the town are charged $156 per year, funded through the utility bill.

District of Oak Bay

Oak Bay has an estimated 18,094 residents living in 8,122 private dwellings. Garbage collection is conducted by municipal vehicles via municipality-supplied wheeled totes (140 L) on a biweekly basis. Kitchen scraps are collected by a third-party hauler (GFL Environmental) in 132 L wheeled totes at the same frequency. As the collection program is blended (municipal and private collection), the cost per household is the highest of the reviewed jurisdictions at $286 per year, funded through the utility bill.

Township of Esquimalt

Esquimalt is home to an estimated 17,655 people in 8,742 private dwellings. The Township is responsible for the collection of garbage and kitchen scraps on a biweekly basis. Esquimalt uses semi-automated trucks that collect from 121 L wheeled totes for garbage and kitchen scraps. Esquimalt was unable to provide an estimated collection cost per household as that information is not readily available to the municipality. The collection costs are built into the municipality's property taxes.

5.1 Summary of Scan

The jurisdiction scan of four comparable municipalities allows for an "apples to apples" comparison of key solid waste system metrics that the District can use for comparison with their current system. Most municipalities within the CRD are serviced for garbage collection and kitchen scraps collection. The majority of waste generated in the CRD is disposed at Hartland Landfill. CRD provides recycling curbside collection to most households within the CRD and this program is funded by RecycleBC.

All municipalities receive collection with semi-automated trucks designed for the collection of wheeled totes. However, Sidney offers a semi-automated/manual hybrid for their garbage stream allowing residents the choice of garbage bin type. The bins are supplied by either the resident or the municipality. Municipalities have weekly or biweekly garbage and kitchen scraps collection.

Municipalities with one hauler (View Royal and Sidney) have the lowest cost for garbage and kitchen scraps collection. Oak Bay has the highest collection cost per household in which collection is provided by both the municipality and a contractor.

In general, municipalities that have control over their data (i.e., municipal collection or one centralized hauler) are able to have more control over their disposal rates. For example, a municipality can require their centralized hauler to report their data to the municipality as part of contract negotiations. This would allow for more effective enforcement.

Comparatively, residents in the District would pay approximately $252 per year for weekly collection. Having one centralized hauler retained by the District would allow for one consolidated negotiation which may result in lower annual collection costs per household.

6.0 IN-HOUSE COLLECTION SYSTEM

This section describes a centralized collection system for the District to consider.

6.1 Collection Considerations

6.1.1 Level of Service

After discussions with the District, it was agreed that the curbside collection system would have the following level of service, presented in Table 6-1.

Table 6-1: Level of Service

Waste Stream	Responsibility	Collection Frequency	Comments
Garbage	District or Contractor	Every-Other-Week (EOW)	▪ EOW garbage collection may reduce the amount of garbage collection and promote additional organic waste collection.
Organics	District or Contractor	Weekly	▪ A combination of food waste and grass clippings. ▪ It is assumed that the curbside organics program would not be inclusive of yard waste collection.
Recycling	Capital Regional District	Every-Other-Week (EOW)	▪ Recycling collection service provided by the CRD. ▪ Most municipalities in the CRD do not provide curbside collection for recycling. ▪ No tangible benefits to the District by changing the current recycling practice.

6.1.2 Vehicle Type

This section outlines two waste collection strategies, manual and automated collection, that is available.

Manual Collection

Manual collection involves waste being picked up and loaded into the collection truck by an individual. Manual collection is more labour intensive and typically requires at least two operating staff (a driver and a swamper). The receptacles of waste for manual collection are usually bags or garbage cans (less than 100 L), though this results in an increased risk of workplace injury for collection staff because of the repetitive motions, consistent stress, strain of lifting heavy items and jumping on and off the trucks for each collection stop. Table 6-2 presents some benefits and considerations of manual collection.

Table 6-2: Manual Collection Program Benefits and Considerations

Benefits	Considerations
▪ Less expensive bins and trucks required for operation compared to semi-automated/automated collection systems. ▪ More jobs created to operate the manual collection system.	▪ Higher labour costs. ▪ Increased probability for workplace injury. ▪ Less efficient than an automated system.

Automated Collection

Automated collection requires less staff as a robotic arm will pick up and load the waste into the truck. Automated collection can service more households per hour per staff member, hiring can occur from a broader pool of the workforce, and lower workplace injury rates. Table 6-3 presents some benefits and considerations for automated collection.

Table 6-3: Automatic Collection Benefits and Considerations

Benefits	Considerations
▪ Decreased risk of workplace injury. ▪ Reduced staffing costs/requirements.	▪ Automated collection trucks are more costly to purchase and require additional servicing expertise to maintain the automated arm. ▪ Requires specialized collection bins that are compatible with the trucks.

6.1.3 Fuel Types

Haulers typically use diesel fueled collection trucks. However, diesel trucks produce high GHG emissions and are expensive to operate, dependent on the fluctuating price of diesel.

Other fuel alternatives include compressed natural gas (CNG). When compared to diesel, customers have saved up to 40% in fuel costs for CNG (Fuel Cost Savings for Commercial Fleet, n.d.), being mindful that fuel cost will vary depending on the supply and demand in the market. CNG can reduce the GHG emissions from trucks by up to 30% compared to diesel (Environmental Benefits of LNG or CNG-Fuelled Truck Fleets, n.d.).

6.2 Collection System Requirements

For the purpose of developing collection system models for the District, it is assumed that a new collection system would be launched in 2023. Using the population growth rate of 0.9% per year, it is estimated that the population of the District would rise to 17,902 people and number of single-detached homes would be 3,993. Furthermore, with an average household size of 2.4 people per household, the population in single-detached homes is estimated to be 9,583.

6.2.1 Vehicles

For the purposes of this study, waste streams would be collected using single-bodied automated side-loading trucks. The automated truck method is preferred as there will likely be fewer worker injuries as there is less material handling. Single-bodied trucks have approximately 20% more capacity than split-bodied trucks, thus resulting in less frequent trips to the Hartland Landfill, which reduces collection times, mileage, and fuel consumption. The assumptions that were used to calculate the number of required trucks is found in Appendix C.

Table 6-4 below outlines the estimated number of trucks required based on the assumptions described in Appendix C. As the Hartland Landfill is in close proximity to the District, it is assumed that trucks will have sufficient time to complete more than one trip per day. For weekly collection of organics, it is estimated that 1.27 trucks are required to meet the demand. However, only 0.63 trucks are required for EOW garbage collection. The truck designated for garbage collection will have sufficient time to return to the District to assist with organics collection once the garbage has been tipped at the Hartland Landfill.

Table 6-4: Required Number of Trucks

	Garbage	Organics
Number of pickups per week	1,997	3,993
Seconds to pick up per house	30	30
Weekly Time to pick up (seconds)	59,895	119,790
Weekly Time to pick up (hours)	16.64	33.28
Daily Collection Time (hours)	5.25	5.25
Number of Working Days per Week	5	5
Number of trucks required to service each stream per day	0.63	1.27
Total Number of Trucks Required[1]	**2**	
Total Number of Trucks Required plus 10% spare ratio[2]	**3**	

[1]The model has rounded up the required number of trucks from the calculated 1.9 trucks to 2 full trucks

[2]The model has rounded up the required number of trucks (inclusive of the spare ratio) from 2.1 trucks to 3 full trucks.

6.2.2 Labour

Municipality-run curbside collection will require the following labour:

- One full-time driver per truck;
- One part-time driver should be available for six months of the year to cover for peak periods, sick time, and vacations;
- One full-time staff member should be fully dedicated to maintaining the fleet;
- One full-time administrative staff/manager should be fully dedicated to the program;
- One supervisor will manage the fleet and assets for the solid waste operations;
- Each full-time employee is allotted 30% of their salary in benefits; and
- Each full-time employee is allotted 2% of their salary in overhead costs.

6.2.3 Infrastructure

It is assumed that collection vehicles will be stored outside at the District Public Works Yard. Indoor vehicle storage is not required for the climate in the District. For three collection vehicles, the District would require at least 115 m^2 of parking space.

6.2.4 Bin Management

It is assumed that every single family household in the District would be provided a new garbage bin and a new organic waste bin at the outset of the collection program. The garbage and organic waste bins are assumed to be 240 litres (L). It is also assumed that the frequency of bin replacement will be 10% annually.

7.0 CONTRACTED COLLECTION SYSTEM

A contracted service model was assessed in the event the District were to consider contracting out waste collection to a private contractor. It is assumed that the assumptions presented in Section 6.2 apply to contracted collection system as well, with the exception of the following changes:

- Single-body collection trucks are new and require financing and borrowing rate of 4%, 1% higher than District;
- New bins will be purchased by the contractor, same interest rate (4%) as above;
- The District would need one in-house contract manager;
- Labour rates are lower than municipal rates, assumed 10% less than District's rates; and
- Profit margins of 7% are included in overall cost for District.

These assumptions will be taken into consideration in the financial analysis below.

8.0 FINANCIAL ANALYSIS

The following subsections present the estimated costs of Option 1 (municipality-run) and Option 2 (private contractor-run) collection systems in the District. A detailed list of assumptions can be located in Appendix C.

8.1 Option 1 – Municipal Collection System

Table 8-1 below presents the estimated costs of a municipality-run collection system. The costs shown below are inclusive of a 15% collection vehicle contingency and a 10% collection bin contingency. A detailed cost breakdown can be observed in Appendix D.

Table 8-1: Option 1 – Municipal Collection System

Total Capital Cost	Annual Operating Cost	Annual Amortized Capital Cost	Total Annual Cost	Cost per Household (Annual)	Cost per Household (Monthly)
$2,303,979	$785,444	$326,085	$1,281,846	**$321.02**	**$26.75**

8.2 Option 2 – Contracted Collection System

Table 8-2 below presents the estimated costs of a contracted-run collection system. The costs shown below are inclusive of a 15% collection vehicle contingency and a 10% collection bin contingency. As indicated below, the total annual cost is inclusive of a 7% profit margin. A detailed cost breakdown can be observed in Appendix E.

Table 8-2: Option 2 – Contracted Collection System

Total Capital Cost	Annual Operating Cost	Annual Amortized Capital Cost	Total Annual Cost	Cost per Household (Annual)	Cost per Household (Monthly)
$2,303,979	$703,862	$340,103	$1,296,567	**$324.71**	**$27.06**

8.3 Financial Comparison

Table 8-3 summarizes the costs for the two options analyzed. Both collection system estimates are conservative. If the District is able to reduce the collection time per household or if the bin set out rate is closer to 90% of all homes instead of the assumed 100%, efficiencies can be achieved. For the purchase of collection vehicles, we have assumed new vehicles, but spare vehicles are often purchased used, which may reduce the cost by as much as half the price of a new truck. It shall be noted that the private sector could also operate their trucks from customers outside of the District's contract which could reduce the cost for the District.

Table 8-3: Financial Summary for Municipal and Contracted Curbside Collection Systems

Summary	Capital Cost	Operations	Annual Amortized Capital	Total Annual Cost	Cost per Household per Month
Option 1	$2,303,979	$955,761	$326,085	$1,281,846	$26.75
Option 2	$2,303,979	$874,179	$340,103	$1,296,567	$27.06

9.0 ENVIRONMENTAL CONSIDERATIONS

The BC Climate Action Charter is a voluntary agreement between the BC government, Union of BC municipalities, and each local government signatory that wants to take action on climate change. The District has committed to this charter reflecting its priorities to lowering its carbon footprint by implementing the corporate strategic plans such as the Climate Leadership Plan.

Fuel consumption is a major GHG contributor to collection services. Thus, if there are more trucks on the road, there will be more fuel consumption hence more GHG emissions. It is important to consider that using a single-body truck will result in more trucks due to additional stops at the transfer station. Should the District use single-body trucks, as assumed in the analysis above, truck routes will need to be reviewed to optimize the operations for collection.

According to the British Columbia Ministry of Environment and Climate Change Strategy, diesel garbage trucks are classified as “heavy duty diesel trucks”, which carry an estimated GHG emission factor of 2.630 kg of CO_2-equivalents for every litre of fuel combusted (British Columbia Ministry of Environment and Climate Change Strategy, 2020)[2]. It is estimated that a potential municipal-run collection vehicle fleet of two heavy duty diesel trucks would require 33,870 L of diesel annually. This translates to just over 89 tonnes of CO_2 equivalent emissions annually, or 44.5 tonnes CO_2 equivalent per vehicle, thus the new service would add to the annual corporate emissions for the District. Compared to the current situation where each household contracts service providers privately and heavy duty trucks from different haulers are following similar travel patterns, a collection service run by the District would reduce the duplication of travel patterns taken by collection trucks and associated emissions. The amount of waste collection system greenhouse gases released could amount to half of what is emitted currently, however this value is unknown.

For the District managed collection system, another consideration for GHG emissions is the introduction of organics collection to the system. Currently, households can choose whether to divert organics for collection separately or not. A District-managed collection system would enforce organics diversion across the entire District, reducing the amount of organics ending up in garbage bins and going to landfill, which in turn would reduce waste-associated GHG emissions. As noted in Section 4, it is assumed that 351 tonnes of kitchen scraps (see Table 4-3) is currently being disposed into garbage loads by residents and ending up in the landfill. Using the BC Biogas and Composting Facility GHG Calculation Tool, a reduction of 351 tonnes of kitchen scraps going to the Hartland landfill would result in a reduction of 300 tonnes CO_2 equivalent being generated[3].

9.1 Electric Vehicle Considerations

The following section provides an overview on electric vehicle (EV) waste collection trucks. A fully electric truck is powered by the electrical grid, which charges the vehicle battery, as well as by regenerative braking (Office of Energy Efficiency and Renewable Energy, n.d.).

9.1.1 Current Market

EV waste collection trucks are being piloted and/or used in various North American jurisdictions. The following are examples of EV trucks being used for residential waste collection:

- A Municipality in British Columbia: ordered two class 6 electric refuse trucks from BYD to pilot.

[2] https://www2.gov.bc.ca/assets/gov/environment/climate-change/cng/methodology/2020-pso-methodology.pdf
[3] https://www2.gov.bc.ca/assets/gov/environment/climate-change/lg/oip_ghg-calculator.xlsx

- City of Los Angeles: completed a pilot test with electric refuse trucks and found that electric truck, developed by BYD and Wayne Engineering, averaged 3.6 tonnes per day of refuse collected and had a range of approximately 160 km a day (Carlton, 2017).
- City of Chicago: used the first fully electric truck in 2013 but has since sued Motiv Power System Inc. (Motiv) in 2019 alleging the costly vehicle had been faulty and frequently out of commission. Motiv has since pulled out of the market (Crunden, 2020).
- Cities of Vancouver, Washington and Miami, Florida: piloting the first sale of the new Lion8 zero-emission refuse truck jointly developed by Quebec-based Lion Electric Co. and Boivin Evolution (Bouchard, 2020). The sale, made to Waste Connections Inc., represents the first application of a fully electric waste collection truck and automated arms in North America.
- New York City: piloted the Mack LR Electric, a fully electric truck in September 2020. The pilot tested the trucks in 12-hour shifts, which included a 6- to 8-hour garbage collection route as well as acting as a snowplow in the winter. Following the pilot, the New York Department of Sanitation announced plans to purchase seven Mack LR Electric refuse trucks (Verger, 2021).

The BC government has committed a total of $11 million in funding to be made available through the CleanBC Go Electric Commercial Vehicle Pilots Program (CVP) to help encourage the adoption of zero-emission vehicles (ZEVs). Successful applicants are eligible to receive up to one-third of total costs of the ZEV deployments and/or infrastructure projects. Applications will run until all funds are exhausted (CleanBC, 2020). The CleanBC Go Electric Specialty Use Vehicle Incentive (SUVI) Program, a sub-program of CVP, is available to help support the deployment of zero-emission commercial vehicles that are not supported in CVP. The SUVI program listed vehicle eligibility criteria that must be met to qualify for a rebate. Currently, Peterbilt and Lion Electric ZEVs, which range in manufacturer's suggested retail price (MSRP) from $555,000 to $850,000, qualify for an estimated $100,000 rebate (CleanBC, n.d.).

9.1.2 Requirements for EV Collection System

Similar to electric passenger vehicles, the EV truck’s battery is charged during the act of stopping using a regenerative brake system which generates electricity and harvests the otherwise-wasted energy to keep the battery charged. This extends the range of the battery. However, battery capacities are dependent on multiple factors including: truck body and/or other parts, the type of charging station (e.g., Level II, Level III), city road versus highway driving, topography, and climate (temperature) among other considerations.

There are Level II EV stations and DC Fast Charging in the District where trucks can potentially charge; however, these stations are intended for public use. A dedicated charging station will most likely need to be installed where the EV truck will be parked to allow for overnight charging. Overnight charging allows maximum efficiency of fully charging the truck and reducing overall peak demand of electricity and resulting in lower energy costs.

District staff suggested a preference for a Level III EV charging station to charge the truck. Tetra Tech understands that the District received a recent quote that includes the cost of a Level III charger and the installation to be approximately $180,000. The industry standard for EV charger life expectancy is 10 years (Powertech Labs Inc., 2020).

In addition, collection routes may need to be reconsidered to optimize efficiency for collection to account for EV stations, battery capacities, and time to charge.

9.1.3 Pros/Cons of EV Collection Truck

Should the District choose to include EV waste collection trucks in its fleet the following items should be considered:

- The range of an EV waste collection truck on a single charge can vary substantially, from 90 to 274 km. These estimates are generally for optimal conditions; therefore, the District should also consider the type of driving (e.g., city versus highway), number of households, and topography, which can affect the overall travel distance. Depending on the type of EV waste collection truck selected, the District may need to consider shorter collection routes, installing several EV charging stations for recharging and scheduling recharging time during the day, or determining the feasibility of installing charging stations at the transfer station or landfill. Overnight charging and parking locations with access to charging stations will also need to be considered.
- The District may need to consider the provider and distribution of energy for fuel. Utility companies should be engaged early in the process to ensure an adequate amount of power.
- Use of EV trucks require different maintenance compared to diesel trucks due to its components, and therefore requires training. The District should consider if maintenance of the EV truck will be solely provided by the dealer and/or distributor (contract), or if District staff will be trained to maintain the trucks.
- Trucks have different capacities (e.g., storage, torque) depending on the class, build, battery packs, etc. Finding the right balance between performance and specifications (i.e., capability) is important to consider for EV trucks. For example, battery packs of EV trucks are heavy and can affect the overall payload capacity and storage.

The following table summarizes the advantages and disadvantages of EV garbage trucks

Table 9-1: Advantages and Disadvantages of EV Collection Trucks

Parameter	Advantages	Disadvantages
Vehicle Costs	▪ Overall life cycle operation costs are lower than standard gas vehicles. (e.g., less engine parts to maintain).	▪ Higher capital cost upfront compared to a diesel truck (up to 2-3x).
Maintenance Costs	▪ Overall maintenance operation costs are lower than standard combustion vehicles. (e.g., less engine parts to maintain).	▪ True maintenance costs still being tested and not fully known.
Operations	▪ Lower cost of electricity compared to diesel. ▪ EV trucks do not have a transmission therefore does not require shifting gears. Results in quieter operations and quicker acceleration. ▪ Less maintenance of truck parts. For example, an EV truck engine has a significantly smaller amount of parts compared to a diesel engine.	▪ Parts require special maintenance and handling (e.g., battery). May require staff training, specialized warranties, or handling by vendors/other specialists. ▪ Weight of batteries are heavy, reducing the trucks' payload capacity. ▪ Technology is not fully commercialized for commercial vehicles
Travel Distance	▪ Average of 100 km to 250 km on one charge.	▪ Travel distance on one battery charge may decrease as a result of various factors (e.g., city vs. highway driving, topography, cold weather).
Fuel Consumption/GHG Emissions	▪ Zero exhaust emissions.	▪ Requires access to readily available energy (electricity). ▪ Recharging battery may take hours compared to refueling a diesel truck at a gas station.

Parameter	Advantages	Disadvantages
Infrastructure	▪ May be able to use existing charging stations.	▪ May require the construction of more charging stations/plugs in buildings for power source. ▪ Increased cost for charging stations that charge the trucks faster (Level 3). ▪ May require coordination with utility companies to ensure an adequate source of power.

9.1.4 Financial and Environmental Implications

Battery Capacity

Depending upon the model and specifications, EV trucks have different battery capacities and charging times. For example, the Lion8 zero-emission class 8 refuse truck developed by Lion Electric Co. and Boivin Evolution is expected to be able to travel 274 km in one charge (Lion Electric, n.d.). In contrast, BYD developed a class 8 truck that is limited to 90 km for a single charge with a maximum speed of 104 km/hr. BYD's battery is reported to be capable of completely recharging within 2.5 hours, depending on whether the DC fast charging station (i.e., Level 3 charging station) operates at 120 kW or 240 kW (Gitlin, 2019).

GHG and Other Impacts

A fully electric truck will have zero exhaust emissions. For provincial GHG accounting purposes, the electricity GHG emissions will be accounted for. Assuming that electricity use contributes 0 tonnes of CO_2, a fully electric truck represents a decrease of 44.5 tonnes of CO_2 per year, which is the amount of GHGs emitted per diesel truck per year. A fully electric truck is also quieter and accelerates faster than a diesel truck, producing less noise pollution for residents and drivers and potentially more pickups per day.

Truck Options

The following table lists a few examples of EV collection trucks that are currently available on the market and their specifications and approximate price.

Table 9-2: Examples of EV Collection Trucks that are Currently Available on the Market

Company	Headquarters Location	Model (if applicable)	Price (CAD)	Features
Peterbilt Pacific Inc.	British Columbia, Canada	520EV (chassis)	MSRP $844,487[1]	▪ 400 kWh battery ▪ 145 km range (approx. 1,100 homes) ▪ Full battery charge takes 3 to 4 hours (Level 3 charger)
BYD North America	California, USA	BYD 8R (Class 8)	~$375,000[2]	▪ 281 kWh iron phosphate battery ▪ 90 km range ▪ Full battery charge takes 2.5 to 3.5 hours (Level 3 charger)
Boivin Evolution	Quebec, Canada	BEV series (automated arm and collection body)	~$850,000[3] (includes chassis)	Joint sale of a new Lion8 zero-emission refuse truck with Lion Electric Co.: ▪ Handles up to 1000 carts/day

Company	Headquarters Location	Model (if applicable)	Price (CAD)	Features
				▪ 20 or 27 cu.yd capacity ▪ Electric motors and actuator, with no hydraulic equipment ▪ Runs with own 46 kWh battery pack ▪ Charging time: 4-8 hours (Level 2)
Lion Electric Co.	Quebec, Canada	Lion8, All-Electric (Class 8, chassis)	~$850,000[3] (includes automated arm and collection body)	▪ Up to 480 kWh battery ▪ Up to 270 km range ▪ Charging time: 5-16 hours (Level 2 charger), 1.5-5 hours (Level 3 charger) ▪ Up to 80% savings on total energy costs ▪ 60% lower service costs
Mack	North Carolina, USA	LR Electric	~$625,000[4]	▪ 376 kWh battery (4 NMC lithium-ion batteries) ▪ 161 km range ▪ Full charge in 2 hours at 150 kW (Level 3 charger)

1 (CleanBC, n.d.)
2 (Taub, 2018)
3 Information provided by John McBean, National Sales Manager, Lion Electric.
4 (Berks Transfer, 2021)

Costs

The cost of EV waste collection trucks can cost up to two to three times more than a diesel truck. Prices are known to range from $375,000 to $850,000. Although there is no direct fuel cost, fuel cost is indirectly accounted through electricity costs. This potentially increases the demand charge and electricity costs if the truck is charged at District facilities. Additionally, maintenance costs are reduced but maintenance requires specialized training. It is estimated that there is a cost savings of up to 80% for operating an electric truck over a diesel truck (Lovely, 2020).

The table below represents the estimated costs of replacing one diesel truck with one EV truck in a municipality-run collection system. The costs shown below are inclusive of a 15% collection vehicle contingency and a 10% waste infrastructure contingency. The waste infrastructure includes the cost of the collection bins and the unit cost and installation cost for one Level III EV charging station. A detailed cost breakdown can be found in Appendix F.

Table 9-3: EV Truck Option with Municipal Collection System

Total Capital Cost	Annual Operating Cost	Annual Amortized Capital Cost	Total Annual Cost	Cost per Household (Annual)	Cost per Household (Monthly)
$2,961,979	$923,318	$423,129	$1,346,447	**$337.20**	**$28.10**

Table 9-4 compares the estimated costs for Options 1 and 2 with diesel trucks and the EV truck option.

Table 9-4: Financial Summary for Municipal and Contracted Curbside Collection Systems and EV Truck Option

Summary	Capital Cost	Operations	Annual Amortized Capital	Total Annual Cost	Cost per Household (Monthly)
Option 1 (Municipal Collection)	$2,303,979	$955,761	$326,085	$1,281,846	$26.75
Option 2 (Contracted Service)	$2,303,979	$874,179	$340,103	$1,296,567	$27.06
EV truck option (Option 1 w/ 1 EV truck)	$2,961,979	$923,318	$423,129	$1,346,447	$28.10

10.0 EVALUATION OF COLLECTION MODELS

The following table is a SWOT (strengths, weaknesses, opportunities, and threats) analysis of an in-house service model.

Table 10-1: SWOT Analysis for In-House Service

Strengths	Weaknesses
▪ Control over quality of service. ▪ More responsive and relevant communications with the community. ▪ More trust from the community when collections is done by the municipality over a contractor. ▪ District can leverage lower borrowing rates. ▪ Control over collection routes and can adjust the system as needed. ▪ Creates local job opportunities. ▪ Flexibility in use and deployment of trucks and staff. For example, trucks can be adapted for snow removal if needed. Drivers and trucks can also assist with District operations in the event of emergencies. ▪ Ability to utilize existing staff/processes to take collection in-house. ▪ Developing strength in contract management.	▪ Public sector wages are generally higher than industry rates, potentially resulting in higher collection costs. ▪ More resources needed for management of personnel (e.g., HR issues, customer service). ▪ Limited direct experience managing solid waste collection. ▪ In-house service will increase the District's corporate fuel consumption and GHG emissions. It will also create the need for additional GHG accounting. ▪ The District will need to dedicate staffing resources towards education and outreach to reduce waste, increase green waste recycling, and meet environmental targets. ▪ There may be space limitations for the transfer of material if collection vehicles do not go directly to Hartland, which may lead to issues with vectors.
Opportunities	**Threats**
▪ Consolidation of services in the District could mean that some administrative staff could take on more responsibilities. ▪ May allow the opportunity to coordinate services with neighboring municipalities.	▪ Increased carbon pricing could increase fuel costs for the District. ▪ Rising overall capital and maintenance costs of mobile collection equipment. ▪ Size of collection in the District precludes economies of scale.

The following table is a SWOT analysis of a contracted service model.

Table 10-2: SWOT Analysis for Contracted Services

Strengths	Weaknesses
▪ Employee hourly rates are typically lower due to competitive industry wages. ▪ Trucks can be used for other customers which lowers collection costs per customer. ▪ Increased carbon pricing would be the responsibility of the contractor rather than the District.	▪ Collection service satisfaction rates can be lower than public sector rates. ▪ Profit margin (typically 5-15%) usually added to collection contract price. ▪ Service quality tied closely to contract requirements. ▪ Flexibility in collection program modifications is limited. ▪ Adjustments in the system typically require contract amendments. The contractor can have the ability to charge excessively.
Opportunities	**Threats**
▪ Fewer human resource management duties such as Workers Compensation Board reviews for the District.	▪ Staff retention can be challenging for contracted collection services.

10.1 Risk Considerations

This section provides risks to consider when comparing service delivery options. This discussion does not take into consideration tipping fees or tote servicing.

10.1.1 Safety

Safety is a priority in all aspects of the waste management industry. Contractors who are required to comply with safety requirements from other entities typically employ additional service charges to ensure the standards are equal or better. An important consideration for the owner of the solid waste operation is to document and maintain key performance indicators (KPIs) for safety related issues and incidents. This will help the owner assess compliance with safety standards and evaluate how well their community compares with other jurisdictions that track similar KPIs. Maintaining these metrics is a sign of the owner's commitment to safety.

Maintaining safety related statistics also helps identify areas where additional training is required to achieve certain safety standards.

10.1.2 Service Control

Staff and capital assets such as waste collection trucks are valuable elements to a community's waste management system. Because these elements are funded by the District, they are available to work on community clean up or environmental emergencies should such an event arise. This control of services and ability to pivot to the community's needs is one of the main drivers for large cities wanting to keep or maintain in-house services.

Maintaining in-house services also allows the community to change their services without jeopardizing contract agreements. Often contracts are written with specific details and changing any of these details could result in penalties that the contractor can exercise. This can be a challenging situation if changes in the solid waste management system are being contemplated.

10.1.3 Flexibility

As noted above, this is an important consideration especially for instances where changes in the waste management system are expected. Contracted services are typically stringent and offer little flexibility if changes

are required. Typically, changes to the contract are costly to the local government and these cost implications can sometimes inhibit improvements to a system.

Contracts can be written in a manner that provides more flexibility for service changes. These contracts tend to have more considerations and added costs.

10.1.4 Public Acceptability

In most communities, public acceptability is influenced by customer satisfaction, and customers tend to feel a higher level of satisfaction when they have an efficient, high-quality waste collection service. Measures that are indicative of high-quality service levels include, but are not limited to, the following:

- Minimal missed pickups;
- Fast response times to complaints and/or missed pickups (i.e., less than 24 or 48 hours);
- Minimal property damage incidents;
- Minimal safety related incidents;
- Minimal mechanical breakdown of vehicles; and
- No spillage of waste and/or vehicle fluids in the community.

Customer satisfaction is a metric that communities should measure. This can be determined through community surveys that could be conducted annually or biannually to gauge how well the community supports the existing services.

In addition to high quality services, there is sometimes a higher level of public acceptability when jobs are awarded to individuals who live in the community. Some residents feel that better service would likely come from those who are happy to be part of the community.

10.1.5 Staffing

Staffing is an important consideration for a resilient and highly capable waste collection team. Labour rates for public sector staff are typically paid 10% to 15% more than private sector organizations, when compared to a recent job posting (Class 3 Garbage Truck Driver in Saanichton, BC , 2020). When the public sector has a job posting, there is a tendency to hire more experienced candidates who can theoretically provide a higher quality of service. This is an important consideration when hiring waste collection drivers because it should result in an individual who has better driving skills, understands how to avoid property damage and demonstrate ability for route management.

10.1.6 Cost

Cost is often one of the most important considerations for waste collection services. Waste collection program costs are primarily made up of capital costs for the trucks (~29%), labour costs (~43%), and vehicle operating expenses (~13%). The following discusses some the strengths and weakness as it relates to an in-house and contracted service waste collection program.

10.1.6.1 Capital Cost – Collection Trucks

According to waste collection vehicle dealers, public and private sector entities pay approximately the same amount for waste collection trucks. Private sector entities could potentially save money by ordering fewer options on their collection fleet. Depending on the type of option, the price difference is typically small once the amortization of the vehicle cost is taken into consideration which is normally about seven years (typical service life for waste collection trucks).

Where the public sector usually has the advantage is the lending rate for purchasing the vehicle. Local governments normally have lower interest rates from financial institutions, and this can result in a noticeable cost saving for the annual capital cost payments for the truck.

10.1.6.2 Labour Costs

Labour is normally one of the largest cost components in a waste collection system. As noted above, the private sector pays between 10% to 15% less than the public sector. This typically results in newer drivers working for the private sector or experience drivers being hired by the public sector.

It is also important to note that the private sector usually has a high turnover rate. Often as private sector staff become more proficient in their capabilities, they start looking for better opportunities such as working as a waste collection driver for local governments.

10.1.6.3 Vehicle Operating Expenses

Vehicle operating expenses include vehicle maintenance, fuel cost, bin replacement and vehicle insurance. Vehicle maintenance costs can be more favorable for the private sector if their fleet maintenance shops are nearby.

Fuel, bin replacement and vehicle insurance are costs that are approximately the same whether it is performed by the public or private sectors.

10.1.7 Missed Pickups

Collecting waste is the primary function of a universal curbside collection system. Missed pickups must be considered a priority and targets should be established to ensure expected service levels are being met. Suitable targets or metrics for missed pickups include, but are not limited to, total number of missed pickups per year or number of missed pickups for every 1,000 scheduled pickups.

Advancements in Global Positioning System (GPS) tracking and routing software has helped in reducing the number of missed pick up in many communities. Similarly, with more experienced drivers, missed pickups tend to be less because their drivers tend to have more driving experience, have a better understanding of their route, their customer's tendencies, where the totes are located, and how to deal with challenges over the course of the week. Municipalities surveyed have indicated that they tend to hire driver from the private sector because of the experience they have gained and their training. It is likely that private sector haulers will have less experienced drivers and are potentially more susceptible to missed pickups.

11.0 YARD WASTE DROP-OFF FACILITY

The District expressed interest in understanding the feasibility of constructing and operating a yard waste drop-off facility for residents and businesses in the District. The drop-off facility would be in addition to the yard waste drop-off at Hartland Landfill, at the Central Saanich Public Services Yard.

11.1 Current Yard Waste Management

Residents currently drop off yard waste at Hartland Landfill or private sector facilities for the indicated fees.

Table 11-1: Yard Waste Drop-off Facility Rates

	Hartland Landfill	Private Facility 1	Private Facility 2
Yard and garden material	$59/tonne	$134/tonne $11 Minimum charge	Pickup Loads $10 One Ton Loads $20 $5 minimum charge
Branches and stumps	$110/tonne	$134/tonne 3” and under	-

Locating a yard waste drop-off facility at the Central Saanich Public Services Yard would allow for another option for residents to drop-off yard waste within the District, without having to drive to the Hartland Landfill.

The yard waste drop-off facility options are assumed to be located at the Central Saanich Public Works Yard, and this site is assumed to be available and geotechnically sound to have a yard waste drop off facility constructed.

11.1.1 Yard Waste Generation Rate

As discussed in previous sections, the District does not collect waste disposal data and as a result does not have yard waste tonnages. The amount of yard waste that could potentially be received at a District operated yard waste depot was calculated based on CRD’s waste management data. In 2019, the CRD estimated 23,000 tonnes of organic waste diverted in the CRD. This number included 4,000 tonnes of kitchen scraps,10,800 tonnes of yard and garden waste and 9,000 tonnes of mixed organic waste (4,500 tonnes being yard waste). The potential annual yard waste tonnage is 15,300 tonnes. Based on estimated CRD population in 2019 (402,938[4]), the estimated yard waste disposal rate is 38 kg/capita/year. Applying this metric to the District’s population, this results in approximately 660 tonnes per year of yard waste from the District, based on the District’s 2019 population (17,272[5]).

Tetra Tech also contacted the District of Saanich (Saanich) to compare the total annual yard waste quantities that they receive. Saanich estimates 8,000 tonnes of yard waste is collected annually in their jurisdiction with approximately 49,400 private dwellings in the community. The household yard waste generation rate is calculated to be 0.16 tonnes/household/year. Using this metric with the District’s household count, this would equate to approximately 646 tonnes per year.

Based on the two approaches for calculating yard waste generation, it is reasonable to estimate that the District would receive approximately 650 tonnes per year of yard waste at Central Saanich Public Works Yard.

11.1.2 Yard Waste Management Practices for Surrounding Communities

Table 11-2 summarizes the yard and garden waste collection services and facilities offered by several surrounding communities.

[4] 2019 population is extrapolated based on 2016 and 2021 Census population data (383,360 and 415,451, respectively)
[5] 2019 population is extrapolated based on 2016 Census population data (16,814) and applying a 1.1% growth rate

Table 11-2: Yard and Garden Waste Service Levels in the Capital Regional District

	Curbside Collection (Yard Waste)	Yard Waste Drop Off Facility	Drop Off Facility Fees
District of North Saanich[1,2,3]	Not Available	Available at the North Saanich Public Works Yard ▪ Residents only (proof required)	▪ Fees: $7 per car, $15 per pick up or trailer
Town of Sidney[1,2,5]	Monthly Collection ▪ Allowed 3 garbage cans or 3 Kraft bags that are no larger than 80 L and less than 20 kg each	No Yard Waste Drop Off	N/A
District of Oak Bay[1,2,6]	Collection Every Other Week ▪ Yard waste and kitchen scraps collected together in green bin (yard waste accepted since January 2021) ▪ Each household allowed one wheeled green cart 132 L bin ▪ Once per year in March: "Garden Refuse Day" ▪ Maximum of 3 m^3 per household	Available at the Oak Bay Public Works Yard ▪ Residents only (resident sticker on vehicle required)	Information not available
Township of Esquimalt[1,2,7]	▪ No Yard Waste Collection ▪ Weekly collection for food waste only	Available at the Esquimalt/ View Royal Yard & Garden Waste Transfer Station	▪ Free for residents (proof of residency required) ▪ Non-residents can access facility for a fee
Town of View Royal[1,2,8]	▪ Yard waste collected once a Year (typically in November) ▪ Weekly collection for food waste only	Available at the Esquimalt/ View Royal Yard & Garden Waste Transfer Station	▪ Free for residents (proof of residency required) ▪ Non-residents can access facility for a fee

1 (Capital Regional District, n.d.-a)
2 (Capital Regional District, n.d.-b)
3 (District of North Saanich, 2022)
4 (Tetra Tech Canada Inc., 2021)
5 (Town of Sidney, n.d.)
6 (District of Oak Bay, 2022)
7 (Township of Esquimalt, 2022)
8 (Town of View Royal, 2022)

11.2 Facility Design Considerations

Tetra Tech developed two conceptual designs/layouts for a yard waste facility:

1. Option 1: Existing Roll-Off Bins
2. Option 2: Drop-off Bunkers

11.2.1 Design Option 1

Figure 11-1: Example of Yard Waste in Roll-Off Bin

For the first design, the intent is to use the existing bin wall and 40 yd^3 roll-off bins for yard waste drop off. Appendix G shows the existing bin wall and access route for customers. The existing bin wall is currently used by District staff for various waste disposal practices, with three bins already dedicated for yard waste (includes grass trimmings, branches under 3 inches, and branches over 3 inches). This design minimizes initial capital cost, as the only additional engineered components would be to complete the road into the south end of the Public Works Yard, add guard rails to the entire wall lock block wall for customer safety, and some traffic signage for traffic flow. This option would increase operational cost to the facility as the roll-off bins would be filled at a faster rate, resulting in higher frequency collection of roll-off bins. There is an option to purchase additional 40 yd^3 roll-off bins along with a roll-off truck if the District requires, however, it is likely more cost effective to start with having the bins picked up more frequently to assess the demand of the site.

11.2.2 Design Option 2

Figure 11-2: Example of Bunker for Yard Waste

For the second design, the intent is to build drop-off bunkers with concrete interlocking blocks for yard waste drop off. This would keep customers from using the existing bin wall and allow Public Works operations to separate from the residential yard waste drop off area. Appendix H shows a potential location for the 10 m by 10 m bunkers. The associated capital cost for this option includes the lock blocks for the bunker walls, the roadway at the south end of the Public Works Yard, and some traffic signage for traffic flow. This option requires a loader (and operator) to remove yard waste from the bunkers and load the yard waste into a transfer trailer. The transfer trailers should be able to hold more yard waste than the roll-off bins, thereby reducing the number of trips to the yard waste processing facility.

11.2.3 Kiosk

For both designs, a small 3 metre by 3 metre kiosk could be established to provide shelter for the site attendant, along with a payment system if fees are to be collected. Any safety equipment could also be stored in the kiosk.

11.2.4 Access Road

For both designs, an access road will need to be developed from Keating Cross Road to the south portion of the Public Works Yard. For the pre-conceptual designs, the road is designed to be a two-lane 10 m wide road. As the road base is already in place for this road, Tetra Tech assumed an additional 50 mm of surfacing aggregate would be adequate to finish the road. It will be important to consider the number of vehicles that can be on the access road as they are queuing to drop off the yard waste. This will impact the traffic management system and may affect the staffing required at the facility.

11.2.5 User Fees

Hartland Landfill and other private yard waste disposal facilities charge a fee for discarded yard waste. The District will need to determine whether an entry/drop-off fee per customer would be applied, or if residential utility bills would cover the cost for operating the yard waste drop-off facility at the Public Works Yard.

11.2.6 Operations

One full-time employee will be required to ensure residents using the drop-off facility are from the District and are dropping off only yard waste. The attendant would direct residents to use the correct bins as well as ensure public safety. A second full-time employee may be required for collecting fees, being a spotter for vehicles during busy periods and traffic control. The District can evaluate the number of staff required based on the number of visitors to the site.

11.2.6.1 Option 1 Equipment

For use of the existing bin wall, additional equipment should be minimal as the existing waste service provider can collect the bins on an as-needed basis. Tetra Tech recommends continuing to use the existing waste service provider on an as-needed basis until a regular schedule can be determined. Once the rate of bin removal has become predictable, the bins can be removed on a set schedule.

11.2.6.2 Option 2 Equipment

This option requires new interlocking blocks to create bunkers that are used to hold discarded yard waste. A loader would also be required to maintain the pile and to load yard waste into a transfer trailer for off-site processing.

11.2.7 Organics Processing Costs

The yard waste will need to be hauled to an appropriate organics processing site. The District will have to consider the hauling cost and the organics tipping fees for the off-site processing facility.

11.3 Financial Implications

This section describes the financial implications for both option designs. Many of the unit prices are based on previous reports with other BC regional districts. Additionally, the District has provided estimated hauling rates and organics processing costs. It is assumed that the District will manage its capital costs through its existing reserve and contribute to the reserve based on a linear depreciation over 30 years.

Table 11-3 and 11-4 show the expected capital costs, operations costs, and the total annual costs for each option. Detailed cost breakdown can be found in Appendix I.

Table 11-3: Option 1 Capital and Annual Operations Costs

Total Capital Cost	Annual Operating Cost	Annual Amortized Capital Cost	Total Annual Cost
$173,583	$293,406	$5,786	$299,192

Table 11-4: Option 2 Capital and Annual Operations Costs

Total Capital Cost	Annual Operating Cost	Annual Amortized Capital Cost	Total Annual Cost
$315,483	$340,682	$10,516	$351,198

12.0 YARD WASTE FACILITY CONSIDERATIONS

This section describes some considerations of the yard waste drop off facility.

12.1 General Considerations

- The land at the Central Saanich Public Services Yard may have other purposes, such as locating other municipal services in a centralized area.

12.2 Option 1 Facility Considerations

The following considerations are for Option 1, using the existing roll-off bin wall:

- Existing bin wall uses existing infrastructure to accept yard waste from the public;
- The only additions to the bin wall are guardrails to prevent customers from falling into the bins;
- A drop-off wall makes it relatively easy to have public unload yard waste from their vehicles into 40 yd^3 bins;
- Traffic at the public works yard would increase;
- Would have to find a way to prevent the public from using other bins – such as cardboard, dimensional lumber, metal;
- Roadway into the facility would require capital improvements; and
- Potential for slope failure adjacent to access road – may need to consider slope stability assessment.

12.3 Option 2 Facility Considerations

The following considerations are for Option 2, building bunkers to store yard waste:

- It will take time to learn how to manage large quantities of yard waste sitting in bunkers as the material can decompose and reach high internal temperatures that can lead to yard waste fires;
- If the yard waste is piled in bunkers, it would require an additional handling step and equipment to remove it from site, which is additional time and cost;
- Traffic at the public works yard would increase;
- Road would need further development; and
- Potential for slope failure adjacent to access road – may need to consider slope stability assessment.

12.4 Environmental Impact

As mentioned above, there is no waste data available for the District. Tetra Tech estimated the yard waste diversion quantities from the CRD. It is important to consider that if yard waste is not collected at the curbside, residents would be required to haul their yard waste to the drop off facility. This may impact the total GHG emitted due to waste management. Additionally, there is potential for cars to remain idle should there be traffic resulting from the facility. This may also contribute to GHG emissions.

The public will have easier access to drop off the yard waste, thus potentially increasing organic waste diversion from the landfill. This will result in reduced GHGs related to organic material decomposing at the landfill.

12.5 Financial Impact

Assuming there are approximately 4,000 households in the District, the estimated annual cost per household ranges from $74.80-$87.80 depending on the design selected. The estimated monthly cost per single-detached household ranges from $6.23 to $7.32. The table summarizes the financial impact of the yard waste depot.

Option	Estimated Annual Cost	Estimated Annual Cost per Household	Estimated Monthly Cost per Household
Option 1	$299,192	$74.80	$6.23
Option 2	$351,198	$87.80	$7.32

The table describes one method of financing the yard waste facility such as a utility bill or property tax. There are other funding mechanisms to consider such as a pay-per-use system which is in effect at the District of North Saanich and at Hartland Landfill.

13.0 CLOSURE

We trust this document meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech Canada Inc.

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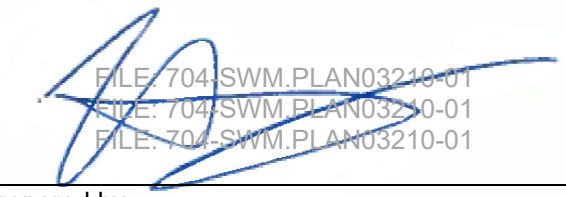

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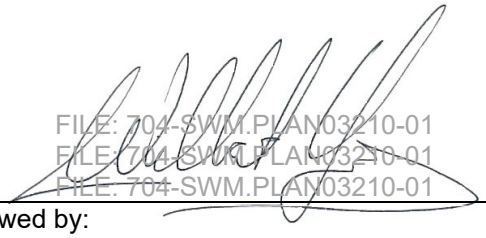

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APPENDIX A

LIMITATIONS ON THE USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOENVIRONMENTAL

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1.5 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

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The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

The Professional Document is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present, or variation in assumed conditions which might form the basis of design or recommendations as outlined in this report, at or on the development proposed as of the date of the Professional Document requires a supplementary investigation and assessment.

TETRA TECH is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

1.7 NOTIFICATION OF AUTHORITIES

In certain instances, the discovery of hazardous substances or conditions and materials may require that regulatory agencies and other persons be informed and the client agrees that notification to such bodies or persons as required may be done by TETRA TECH in its reasonably exercised discretion.

APPENDIX B

JURISDICTION SCAN

Jurisdiction	District of Central Saanich	Town of View Royal	Town of Sidney	District of Oak Bay	Township of Esquimalt
Population	16,814	10,408	11,672	18,094	17,655
Number of Private Dwellings	7,121	4,299	5,960	8,122	8,742
Collection Service Provider (Contracted vs. Municipal)	Contracted (multiple haulers)	Contracted (Waste Management)	Contracted (Emterra Environmental)	Municipal (garbage) Contracted (kitchen scraps)	Municipal
Level of Service (Garbage, Recycling, Organics)	Garbage Kitchen Scraps Recycling	Garbage Kitchen Scraps Recycling	Garbage Kitchen Scraps Recycling	Garbage Kitchen Scraps Recycling	Garbage Kitchen Scraps Recycling
Frequency (weekly, biweekly)	Varies (MSW and kitchen scraps) Biweekly (Recycling)	Weekly (garbage and kitchen scraps) Biweekly (Recycling)	Weekly (garbage and kitchen scraps) Biweekly (Recycling)	Biweekly (all streams)	Biweekly (all streams)
Collection Type (Automated, Semi-Automated, Manual)	Semi-Automated and Manual	Semi-Automated	Semi-Automated and Manual	Semi-Automated	Semi-Automated
Container Type	Bins, bags, or wheeled totes	Wheeled Totes	Bins, bags, or wheeled totes (garbage) Green tote (kitchen scraps)	Wheeled Totes	Wheeled Totes
Container Supplier	Residents	Residents	Residents (garbage) Municipality (kitchen scraps)	Municipality	Residents
Container Limits	Limits are set by each individual hauler	40kg per week	80 L or 20 kg (garbage) Kitchen scraps (no weight limit)	140 L tote (garbage) 132 L tote (kitchen scraps)	121 L tote/ 24 kg
Cost of Service per Household per Year	$252 (weekly collection)	$189	$156 (includes yard waste collection)	$286 (includes yard waste collection)	Not Readily Available
Funding Model	Individual Contracts with the Haulers	Property Tax	Utility Bill	Utility Bill	Property Tax

APPENDIX C

COLLECTION SYSTEM ASSUMPTIONS

Vehicle Assumptions

The number of trucks required were calculated using the following assumptions:

- The garbage generation rate is based on 2020 CRD per capita disposal rate.
- Organic waste generation rate was estimated for CRD based on the estimated amount of organics collected in 2019, inclusive of food waste and yard waste. As the CRD has not publicly posted the estimated 2020 organic waste tonnages, the 2019 organic waste disposal rate was used;
- Primary collection vehicles would be purchased new.
- Spare collection vehicles would be purchased used, assume 50% of the cost.
- Collection vehicles operate using diesel fuel.
- Customer base would be 3,993 single family detached houses.
- All curbside collected MSW and organics would be transported to Hartland Landfill.
- A minimum spare ratio of 10% would be used to account for truck maintenance and unscheduled breakdowns.
- Collection duration is estimated to take an average of 30 seconds per household. Automated trucks typically take an average of 20 to 25 seconds to pick up for urban settings. Since the District has less housing density compared to most urban settings, as well as gravel roads with varying grade, it was projected that the collection duration should be longer by about 20%.
- Collection would occur 5-day work week, 8 hours a day, totalling 40 hours per week. Each workday includes 1 hour for daily start-up meetings and end of day checks, half hour for lunch and two 15-minute breaks.

Financial Analysis Assumptions

The following financial parameters were used for modelling the curbside collection programs of Option 1 and Option 2:

- Debt financing for capital:
  - 3% for municipal collection system
  - 4% for contracted collection system
- Amortization periods:
  - Seven (7) years for vehicles
  - Ten (10) years for curbside carts
- Municipal Labour rates (contracted service assumed 10% less)
  - Full-time drivers: $30.80
  - Customer Service Manager: $37.30
  - Maintenance: $38.46

  - Foreman: $40.38

Note: benefits and overhead costs are assumed at 30% and 2% of annual salary, respectively.

- Bin Costs
  - Garbage waste bin (240 L): $115 each
  - Organic waste bin (240 L): $115 each
- New vehicle cost (diesel): $450,000
- Used vehicle cost (diesel): $225,000
- Annual vehicle expenses,
  - Average annual fuel cost: $50,800
  - Average annual maintenance and insurance costs (assumed 10% of collection vehicle capital): $112,500

The following financial parameters were used for modelling the curbside collection programs of replacing one diesel truck with one electric vehicle (EV) collection truck in Option 1 (EV truck option):

- Fleet consists of one (1) new EV truck, one (1) new diesel truck, and one (1) used diesel truck.
- Debt financing for capital:
  - 3% for municipal collection system
- Amortization periods:
  - Seven (7) years for vehicles
  - Ten (10) years for curbside carts and charging station
- Municipal Labour rates (remains unchanged from Option 1)
  - Full-time drivers: $30.80
  - Customer Service Manager: $37.30
  - Maintenance: $38.46
  - Foreman: $40.38

Note: benefits and overhead costs are assumed at 30% and 2% of annual salary, respectively.

- Bin Costs
  - Garbage waste bin (240 L): $115 each
  - Organic waste bin (240 L): $115 each
- Level III charging station

  - Unit and installation cost is $180,000[1]
  - Lifetime of 10 years
- New vehicle cost (EV): $850,000[2]
- New vehicle cost (diesel): $450,000
- Used vehicle cost (diesel): $225,000
- Annual vehicle expenses
  - Average annual diesel fuel cost for one vehicle: $25,400
  - Average annual electricity cost for one vehicle: $3,956
    - This assumes the average battery capacity is 400 kWh and consumes 250[3] kWh/day; thus, requiring 150 kWh/day.
  - Average annual maintenance and insurance costs for diesel trucks (assumed 10% of collection vehicle capital): $67,500
  - Average annual maintenance and insurance costs for EV truck (assumed 4% of collection vehicle capital): $34,000[4]
  - Maintenance on EV can be done in house by Maintenance staff

[1] Estimate provided by the District based on quote provided in 2022

[2] The cost estimate for a new EV collection truck is based on the highest price estimate of a Lion8 Class 8 refuse truck.

3 Ribberink, H., Wu, Y., Lombardi, K., & Yang, L. (2021, June 11). Electrification Opportunities in the Medium- and Heavy-Duty Vehicle Segment in Canada. World Electric Vehicle Journal, 12(2), 86. doi:https://doi.org/10.3390/wevj12020086

4 The Lion8 Class 8 refuse truck is estimated to achieve a 60% reduction in vehicle operational costs compared to a diesel truck.

APPENDIX D

MUNICIPAL COLLECTION SYSTEM COSTS

Option 1 - Municipal Collection System

Capital Costs	Unit	Quantity	Unit Cost	Cost
Waste Collection				
New Trucks	each	2	$450,000	$900,000
Used Truck	each	1	$225,000	$225,000
			Subtotal	$1,125,000
			Contingency (15%)	$168,750
			Waste Collection Total	**$1,293,750**
Waste Infrastructure				
Organics Totes	each	3,993	$115	$459,195
Garbage Totes	each	3,993	$115	$459,195
			Subtotal	$918,390
			Contingency (10%)	$91,839
			Waste Infrastructure Total	**$1,010,229**
Operations Costs				
Annual Operations - Staff				
1 FTE Driver Salary	each	2	$64,064	$128,128
Benefits	each	2	$19,219	$38,438
Overhead	each	2	$1,281	$2,563
1 Part time driver Salary	each	1	$32,032	$32,032
Benefits	each	1	$9,610	$9,610
Overhead	each	1	$641	$641
Customer Service Manager	each	1	$77,586	$77,586
Benefits	each	1	$23,276	$23,276
Overhead	each	1	$1,552	$1,552
1 FTE Supervisor	each	1	$84,000	$84,000
Benefits	each	1	$25,200	$25,200
Overhead	each	1	$1,680	$1,680
1 FTE Maintenance staff	each	1	$80,000	$80,000
Benefits	each	1	$24,000	$24,000
Overhead	each	1	$1,600	$1,600
			Labour Total	**$530,305**

Annual Rolling Stock				
Garbage Tote Replacement	each	399	$115	$45,920
Organics Tote Replacement	each	399	$115	$45,920
			Rolling Stock Total	**$91,839**
Annual Vehicle Expenses				
Fuel	each	2	$25,400	$50,800
Truck maintenance and Insurance	lump sum	1	$112,500	$112,500
			Vehicle Expenses Total	**$163,300**
Capital Cost Total				$2,303,979
Annual Amortized Capital Cost				$326,085
Annual Operations and Maintenance				$785,444
Garbage Tipping Fee				$92,501.84
Organics Tipping Fee				$77,815.58
			Total Annual Cost	$1,281,846
			Annual cost per household in 2021	**$321.02**
			Cost per household per month in 2021	**$26.75**

- Interest rate 3%
- Amortization period: 7 years for trucks, 10 years for carts

APPENDIX E

PRIVATE COLLECTION SYSTEM COSTS

Option 2 – Contracted Collection System

Capital Costs	Unit	Quantity	Unit Cost	Cost
Waste Collection				
New Trucks	each	2	$450,000	$900,000
Used Truck	each	1	225,000	$225,000
			Subtotal	$1,125,000
			Contingency (15%)	$168,750
			Waste Collection Total	**$1,293,750**
Waste Infrastructure				
Organics Totes	each	3,993	$115	$459,195
Garbage Totes	each	3,993	$115	$459,195
			Subtotal	$918,390
			Contingency (10%)	$91,839
			Waste Infrastructure Total	**$1,010,229**
Operations Costs				
Annual Operations - Staff				
1 FTE Driver Salary	each	2	$57,658	$115,315
Benefits	each	2	$17,297	$34,595
Overhead	each	2	$1,153	$2,306
1 Part time driver Salary	each	1	$28,829	$28,829
Benefits	each	1	$8,649	$8,649
Overhead	each	1	$577	$577
District Contract Manager	each	1	$77,586	$38,793
Benefits	each	1	$23,276	$23,276
Overhead	each	1	$1,552	$1,552
1 FTE Supervisor	each	1	$75,600	$75,600
Benefits	each	1	$22,680	$22,680
Overhead	each	1	$1,512	$1,512
1 FTE Maintenance staff	each	1	$72,000	$72,000
Benefits	each	1	$21,600	$21,600
Overhead	each	1	$1,440	$1,440
			Labour Total	**$448,723**

Annual Rolling Stock				
Garbage Tote Replacement	each	399	$115	$45,920
Organics Tote Replacement	each	399	$115	$45,920
			Rolling Stock Total	**$91,839**
Annual Vehicle Expenses				
Fuel	each	2	$25,400	$50,800
Truck maintenance and Insurance	lump sum	1	$112,500	$112,500
			Vehicle Expenses Total	**$163,300**
			Capital Cost Total	$2,303,979
			Annual Amortized Capital Cost	$340,103
			Annual Operations and Maintenance	$703,862
			Garbage Tipping Fee	$92,501.84
			Organics Tipping Fee	$77,815.58
			Total Annual Cost	**$1,214,282.36**
			Total Annual Cost with Profit Margin (7%)	**$1,296,566.61**
			Annual cost per household in 2021	**$324.71**
			Cost per household per month in 2021	**$27.06**

- Interest rate 4%
- Amortization period: 7 years for trucks, 10 years for carts

APPENDIX F

MUNICIPAL COLLECTION SYSTEM WITH EV TRUCK COSTS

EV Truck Option with Municipal Collection System

Capital Costs	Unit	Quantity	Unit Cost	Cost
Waste Collection				
Diesel truck	each	1	$450,000	$350,000
EV truck	each	1	$850,000	$750,000
Used Diesel Truck	each	1	$225,000	$175,000
			Subtotal	$1,525,000
			Contingency (15%)	$228,750
			Waste Collection Total	**$1,753,750**
Waste Infrastructure				
Organics Totes	each	3,993	$115	$459,195
Garbage Totes	each	3,993	$115	$459,195
Level II Charging Station	each	1	$12,700	$12,700
			Subtotal	$931,090
			Contingency (10%)	$93,109
			Waste Infrastructure Total	**$1,024,199**
Operations Costs				
Annual Operations - Staff				
1 FTE Driver Salary	each	2	$64,064	$128,128
Benefits	each	2	$19,219	$38,438
Overhead	each	2	$1,281	$2,563
1 Part time driver Salary	each	1	$32,032	$32,032
Benefits	each	1	$9,610	$9,610
Overhead	each	1	$641	$641
Customer service/IT staff	each	1	$77,586	$77,586
Benefits	each	1	$23,276	$23,276
Overhead	each	1	$1,552	$1,552
1 FTE Supervisor	each	1	$84,000	$84,000
Benefits	each	1	$25,200	$25,200
Overhead	each	1	$1,680	$1,680
1 FTE Maintenance staff	each	1	$80,000	$80,000
Benefits	each	1	$24,000	$24,000

Overhead	each	1	$1,600	$1,600
			Labour Total	**$530,305**
Annual Rolling Stock				
Garbage Tote Replacement	each	399	$115	$45,920
Organics Tote Replacement	each	399	$115	$45,920
			Rolling Stock Total	**$91,839**
Annual Vehicle Expenses				
Diesel Fuel	each	1	$25,400	$25,400
Electricity	each	1	$3,956	$3,956
Diesel truck maintenance and Insurance	each	1	$67,500	$67,500
EV truck maintenance and Insurance	each	1	$34,000	$34,000
			Vehicle Expenses Total	**$130,856**
			Capital Cost Total	$2,961,979
			Annual Amortized Capital Cost	$423,129
			Annual Operations and Maintenance	$753,000
			Garbage Tipping Fee	$92,501.84
			Organics Tipping Fee	$77,815.58
			Total Annual Cost	**$1,346,447**
			Annual cost per household in 2021	**$337.20**
			Cost per household per month in 2021	**$28.10**

- Interest rate 3%
- Amortization period: 7 years for trucks, 10 years for carts and charging station

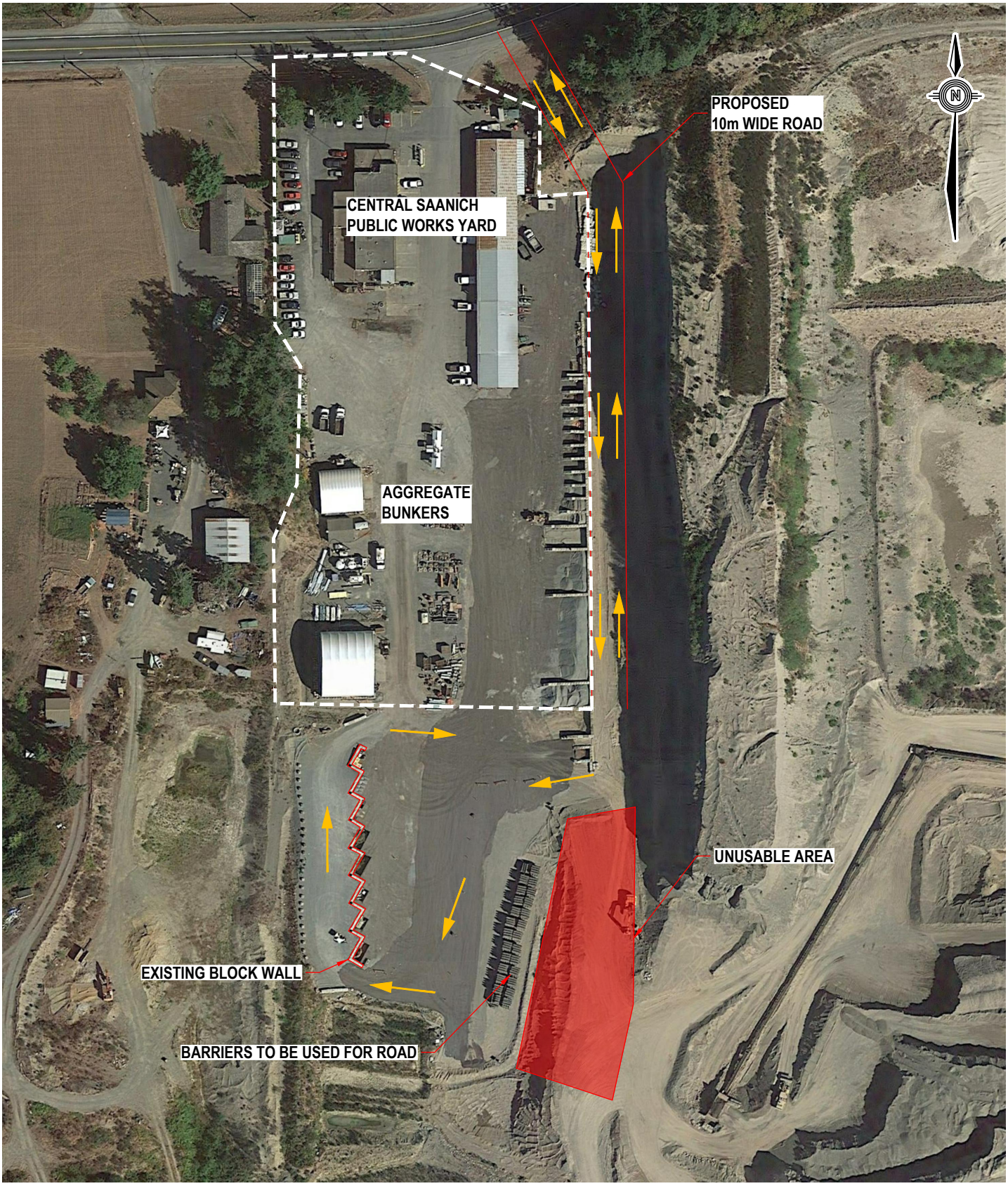
Electricity cost was estimated as follows:

- Assumptions:
  - Charging the EV truck battery draws 20 kW peak demand (20 kW is approximately the maximum power draw for a Level 2 charger)
  - Recharge battery with 250 kWh once per working day
  - 260 working days in a year
  - Use BC hydro rates for medium general service (defined as peak demand of 35-150 kW and energy use of less than 550,000 kWh per year)

Costs	Unit	Quantity	Unit Cost	Annual Cost
Basic charge	Per day	365 days per year	$0.2656	$96.94
Demand charge	Per kW	20 kW peak demand	$5.38	$107.60
Energy charge	Per kWh	260 days per year, 150 kWh per charge	$0.0962	$3,751.80
			Total Annual Electricity Cost Per EV Truck	**$3,956.34**

APPENDIX G

PRE-CONCEPTUAL OPTION 1



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Scale: 1: 1 500

CLIENT

Central Saanich

TETRA TECH

YARD WASTE DROP-OFF ASSESSMENT
DISTRICT OF CENTRAL SAANICH, BC

PRE-CONCEPTUAL DESIGN 1 - EXISTING LOCK BLOCK WALL

PROJECT NO.	DWN	CKD	REV
SWM.PLAN03210-01	MM	HW	0

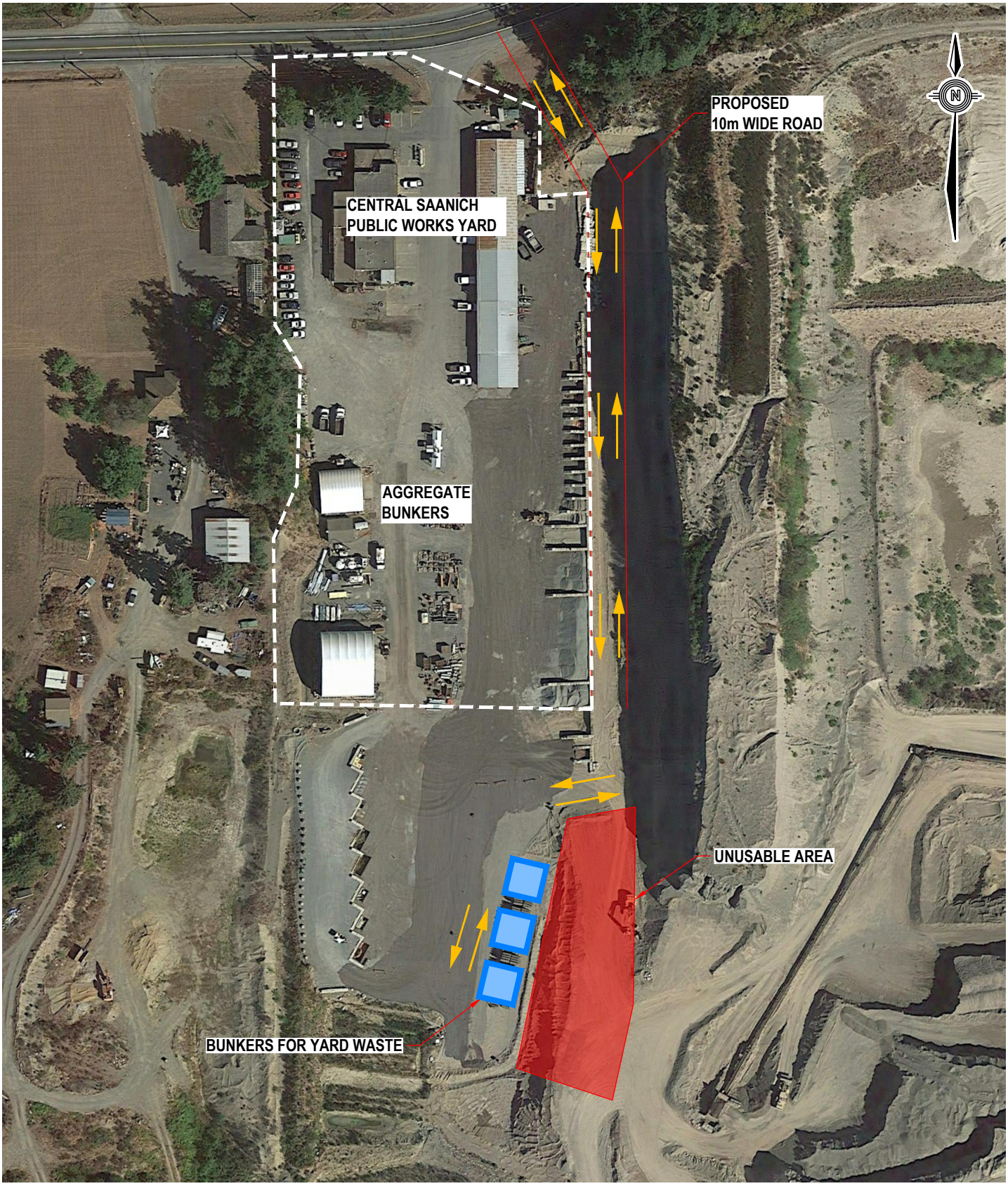
OFFICE	DATE
VAN	May 05, 2022

Figure 1

Q:\Riverbend\Drafting\SWM.PLAN\PLAN03210-01\PRE-CONCEPT FIGURES\Pre-conceptual Figure 1 and 2.dwg [FIGURE 1] May 05, 2022 - 10:58:07 am (BY: MURPHY, MIKE)

APPENDIX H

PRE-CONCEPTUAL OPTION 2



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Scale: 1: 1 500

CLIENT

Central Saanich

TETRA TECH

YARD WASTE DROP-OFF ASSESSMENT
DISTRICT OF CENTRAL SAANICH, BC

PRE-CONCEPTUAL DESIGN 2 - DROP-OFF BUNKERS

PROJECT NO.	DWN	CKD	REV
SWM.PLAN03210-01	MM	HW	0

OFFICE	DATE
VAN	May 05, 2022

Figure 2

Q:\Riverbend\Drafting\SWM.PLAN\PLAN03210-01\PRE-CONCEPT FIGURES\Pre-conceptual Figure 1 and 2.dwg [FIGURE 2] May 05, 2022 - 10:57:50 am (BY: MURPHY, MIKE)

APPENDIX I

YARD WASTE FACILITY COSTS

Option 1: Existing Roll-Off Bins

Item	Description	Unit	Quantity	Unit Price	Total Price
Admin, Execution, and Closeout	Bonds, Insurance, Mobilization, Demobilization, Temporary Controls, and Closeout (10% of Capital)	L.S.	1	$13,150	$13,150
	Slope Stability Assessment	L.S.	1	$25,000	$25,000
	Surveying	L.S.	1	$5,000	$5,000
Site Infrastructure	Road finishing (50 mm surface aggregate)	m²	1,917	$6.00	$11,502
	Signage	L.S.	1	$5,000.00	$5,000
	Fencing	L.S.	1	$10,000.00	$10,000
	Jersey Barrier Placement	L.S.	1	$5,000.00	$5,000
	3'x5' Pre-fab Kiosk	L.S.	1	$45,000.00	$45,000
	Additional 40 yard bins	ea	1	$25,000.00	$25,000
	Roll-off Truck	ea	0	$250,000.00	$0
				Capital Subtotal	$144,652
				Engineering (20% of Total Capital Costs)	*$28,930*
				Total Capital Costs	*$173,583*
				Total Annualized 30 Year Linear Depreciation Capital Costs	***$5,786***
Annual Operations					
Staff	FTE	ea	1	$75,000	$75,000
Roll off bin pickup by GFL	Round trips per year	ea	145	$205	$29,725
Tipping Fee	Cost per Tonne	tonnes	650	$200	$130,000
				Operations Subtotal	$234,725
				Contingency (25% of Operations Costs)	*$58,681*
				Total Annual Operating Costs	*$293,406*
				Total Annual Cost	**$299,192**

Option 2: Drop-off Bunkers

Item	Description	Unit	Quantity	Unit Price	Total Price
Admin, Execution, and Closeout	Bonds, Insurance, Mobilization, Demobilization, Temporary Controls, and Closeout (10% of Capital)	L.S.	1	$23,900	$23,900
	Slope Stability Assessment	L.S.	1	$25,000	$25,000
	Surveying	L.S.	1	$5,000	$5,000
Site Infrastructure	Road finishing (50 mm surface aggregate)	m²	1,917	$6.00	$11,502
	Signage	L.S.	1	$5,000.00	$5,000
	Fencing	L.S.	1	$10,000.00	$10,000
	Jersey Barrier Placement	L.S.	1	$5,000.00	$5,000
	3'x5' Pre-fab Kiosk	L.S.	1	$45,000.00	$45,000
	Lock Blocks	ea	30	$250.00	$7,500
	Small Loader	ea	1	$125,000.00	$125,000
				Capital Subtotal	$262,902
				Engineering (20% of All Costs)	*$52,580*
				Total Capital Costs	*$315,483*
				Total Annualized 30 Year Linear Depreciation Capital Costs	***$10,516***
Annual Operations					
Staff	FTE	ea	1	$75,000	$75,000
Roll off bin pickup by GFL	Round trips per year	ea	73	$205	$14,965
Tipping Fee	Cost per Tonne	tonnes	650	$200	$130,000
				Operations Subtotal	**$219,965**
				Contingency (25% of All Costs)	*$120,717*
				Total Annual Operating Costs	*$340,682*
				Total Annual Cost	**$351,198**