Energy and Emissions Fleet Assessment

District of Central Saanich

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EXECUTIVE SUMMARY

In Spring 2024, the District of Central Saanich issued a Request for Offer (RFO) to complete an Energy and Emissions Fleet Assessment. This initiative aims to provide guidance and recommendations to aid the District in assessing its fleet and providing direction to meet climate action goals. These climate goals include emission reduction targets of 45% by 2030 and 100% by 2050.

A comprehensive fleet assessment was conducted, identifying areas of strength and opportunities for improvement. The fleet size and utilization were rated as "good" or "excellent" with other areas of fleet composition, average vehicle age, useful life targets and data tracking recommended for improvement. Data tracking is likely to improve as an analyst has already been hired and tracking fleet data is part of the role, but it's too early to confirm improvements as part of this project.

To develop an emissions reduction and EV transition strategy, extensive research and analysis was conducted. This included the formulation of EV transition plans for the next 10 years, infrastructure assessments, reviews of alternative fuels, and review of industry best practices. Financial considerations, such as leveraging carbon credits and incentives, were also explored.

The resulting strategy balances technology readiness, financial impacts, operational risks, and emissions reductions. It focuses on three core components:

1. Optimized Transition Scenario for EV adoption
2. Renewable Diesel
3. Incentives and Carbon Credits

This approach positions the District to meet or exceed its emissions reduction targets of a 45% reduction by 2030, but longer range projections only predict a 95% reduction by 2050. A financial analysis for the 2025–2035 period revealed the potential for significant cost savings. The net present value of fleet replacements is projected at $28.9 million under current practices and technologies but drops to $25.7 million with the optimized scenario—yielding potential savings of $3.2 million.

To support implementation, a detailed list of 19 recommended actions has been developed, providing a clear roadmap for the District to work towards emission reduction goals.

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DEFINITIONS AND ACRONYMS

BEV – battery electric vehicles

CFR – Clean Fuel Regulation (Canada)

DCFC – DC Fast Charger

District – The Corporation of the District of Central Saanich

EV – Electric Vehicles

EVSE – Electric Vehicle Supply Equipment (Chargers)

FCEV – Fuel cell electric vehicles

FCM – Federation of Canadian Municipalities

FIMS – Fleet information management system

FUS – Fire Underwriters Survey

GVWR – Gross Vehicle Weight Rating

HEV – Hybrid electric vehicles

ICE – Internal combustion engine

kWh – Kilowatt hours

LCFS – Low Carbon Fuel Standard

MCS – Megawatt Charging Standard

NPV – Net present value

PHEV – Plug-in hybrid electric vehicles

RFO – Request for Offer

SOC – State of charge

TCO – Total Cost of Ownership

ZEV – Zero Emission Vehicle

ZEVR – Zero Emission Vehicle Regulations

1. INTRODUCTION

In Spring 2024, the District issued an RFO for Energy and Emissions Fleet Assessment. The primary aim of this RFO was to invite proposals from reputable consulting firms capable of offering guidance and recommendations to aid the District in assessing its fleet and providing direction to meet climate action goals. Additionally, the consulting firms were expected to develop a plan that meets the BC Hydro EV Ready Fleet Plan Incentive requirements. Through the evaluation process, Innotech Fleet Strategies Ltd. was chosen to complete this work and provide the District with guidance to meet emission reduction targets. The methodology and approach are intended to effectively balance risks and pave the way for a successful strategy and a list of detailed recommendations.

2. BACKGROUND

The District is located in the Capital Regional District on Southern Vancouver Island, British Columbia and consists of a population of approximately 17,000. It includes both coastal and rural areas spread over a small region of 41 square kilometers. The in scope fleet consists of 67 heavy-duty, medium-duty, and light-duty vehicles and operations include typical municipal services, fire and police and exclude PEMO services that are shared with Sidney and North Saanich. The District completed its Climate Leadership Plan in 2020, which includes objectives to transition its fleet to electric or to low emissions vehicles. A target has been set to reduce emissions by 45% by 2030 and 100% by 2050.

The intent of this project is to provide an energy and emissions assessment and recommend a future forecast for the fleet to help the District meet its emissions target. Specifically, there are five core items in scope for this project which include:

1. Develop an EV transition plan meeting the BC Hydro EV Fleet Ready Plan requirements;
2. Review alternative or low carbon fuels that may help to meet emission reduction targets;
3. Review of Fleet Management best practices such as behavioural and/or policy-based initiatives;
4. Review planned growth of the fleet as a result of new service offerings or improved service offerings, or other initiatives not considered “Business as Usual”;
5. Outline potential profits/revenue from Low Carbon Fuel Credits;

2.1 ALIGNMENT WITH FEDERAL AND PROVINCIAL GOVERNMENTS

Aligning with market sentiment and government policies, many fleets are setting aggressive carbon-reduction targets. The Government of Canada has set a mandatory target for all new light-duty cars and passenger trucks sold to be ZEV by 2035, with interim targets of 20% by 2026 and 60% by 2030. In addition, the Canadian government has set a target of 35% for all new medium and heavy-duty vehicles to be ZEV by 2030[1] and will develop ZEV regulations for 100% by 2040. However, some vehicles and operations, such as emergency services, are expected to be exempt.

The Province of British Columbia has developed a similar target, with some key differences, to advance ZEV adoption in the interim. These include a Zero Emission Vehicle Regulations (ZEVR) governing the implementation of light-duty ZEVs with targets of 26% by 2026, 90% by 2030 and 100% by 2035. They are currently working on developing similar regulations for medium and heavy commercial vehicles[2]. These targets have resulted in increased funding for numerous carbon-reduction initiatives across Canada.

[1] "2030 Emissions Reduction Plan – Transportation," Government of Canada, accessed at https://www.canada.ca/content/dam/eccc/documents/pdf/climate-change/erp/factsheet-06-transportation.pdf

[2] "Zero Emissions Vehicle Act," Province of British Columbia, accessed at https://www2.gov.bc.ca/gov/content/industry/electricity-alternative-energy/transportation-energies/clean-transportation-policies-programs/zero-emission-vehicles-act#:~:text=The%20ZEV%20Regulation%20is%20now,B.C.%20to%20meet%20consumer%20demand

2.2 PROJECT APPROACH

The project was divided into three distinct phases, which are shown below in Table 1.

Table 1: Project phases

	Phase 1 Baselining and Needs Identification:	**Phase 2** Emissions Reduction Plan Development	**Phase 3** Project Completion
Key Activities	• Meeting 1 – project kickoff • Collection of Fleet and Facility data • Meeting 2 - Fleet operations discovery • Meeting 3 - Facility operations discovery • Analyze fleet profile and performance	• Complete an electrical infrastructure assessment including site assessment • Develop an EV transition plan • Develop an infrastructure plan and charging plan • Identify opportunities for alternative fuel use to lower emissions. • Identify industry best practices for behavioural and policy initiatives • Meeting 4 – review of findings and draft recommendations	• Completion of final report, findings and recommendations. • Completion of BC Hydro EV Ready Fleet Plan Workbook
Deliverables	• Draft fleet replacement plan including EV transition and emissions profiles	• Draft emissions reduction plan including EV transition, infrastructure, low carbon fuels, industry best practices.	• Final Report and BC Hydro workbook.

This work program was carefully developed to meet the District's requirements and follows a multi-disciplinary approach consisting of three phases. Throughout the process, there is ample opportunity for input and review from District staff which ensures a strategy that is developed with consideration for any unique District needs. This approach is designed to improve alignment and communication and to ensure that the recommendations are realistic and reasonable.

3. OPERATIONAL ASSESSMENT

Numerous workshops were held with District staff to gain insights into the District's fleet and operations. Representatives from various departments, including Public Works, Parks, Finance, Fleet, Facilities, and Climate Action, participated in these workshops. During the sessions, District staff provided an overview of the current fleet, the usage of vehicles, maintenance practices, budgeting processes, fleet replacement practices, EV transition readiness, and current challenges.

In addition to the workshops, various documents and datasets were provided, and site visits were conducted. The fleet-specific documents and data included a list of vehicles with basic descriptions, high-level specifications and configurations, and annual utilization. Other documents included information on facilities and electrical infrastructure, such as BC Hydro consumption data. Site visits were conducted at multiple locations, including Public Works, Fire Hall, and the Municipal Hall, to review electrical infrastructure.

3.1 CURRENT FLEET AND OPERATIONS

The in-scope fleet consists of 67 vehicles largely used for Public Works, Parks, Police and Fire. The vehicles include cars, police cars, pickup trucks, medium-duty work trucks, dump trucks, fire trucks, tractors, mowers and other similar vehicles. A full fleet list can be found in Appendix A: Fleet Listing.

These vehicles are used to support services including underground utilities (water/sewer), roads, parks, police, fire, engineering and general municipal use, which are all common services provided by most municipalities. Embedded within these services are a mix of capital projects and maintenance services. The District focuses on maintenance services which would include tasks such as sewer flushing, road patching, mowing, snow clearing, etc. Most capital projects are contracted out, which is common for municipalities, and the District is in alignment with its peers with this approach.

3.2 COMPARISON TO INDUSTRY PEERS

The District’s fleet size and general fleet management practices were compared with several other municipalities in BC and across Canada. This comparison considered the District’s geographical size, population, unique topography, and weather-related requirements. Where required, it was normalized to ensure a consistent comparison. The scorecard for this comparison is shown in Table 2 with each category further detailed below.

Table 2: Fleet Assessment Scorecard

Category	Rating	Central Saanich	Industry Peers
Normalized Fleet Size	Good	36	39.5
Fleet Composition	Fair		
Average Age	Fair	11	9
Average Annual Mileage	Excellent	11,700 km	7,800 km
Useful Life Targets	Fair	4-25	5-15
Fleet Data Tracking	Fair		

Normalized fleet size – *This is a comparison to other municipalities with similar populations. The District's normalized fleet size is 36 which is less than the 67 vehicles in scope for this project. The lower normalized fleet size is attributed to the fact that it only considers the subset of vehicles used for comparable services to industry peers, excluding vehicles like Police vehicles, Fire vehicles (which are largely governed by the Fire Underwriter's Survey), and equipment such as backhoes and tractors, which exhibit high variability among peers.*

Fleet composition *– The composition considers the make, model, year, and type of vehicles. A fleet should strive to have as many similar vehicles as possible, while still balancing this with operational needs. For example, and not specific to the District, a fleet with a 2019 Ford F150, 2020 GMC 1500, and 2021 Dodge 1500 does not score well on fleet composition. These vehicles have distinct requirements for parts, repair methods, warranty service, and operator familiarity. The District has a relatively high variability in vehicle makes and models for the same vehicle classes and would benefit from a purchasing strategy that focuses on a single vehicle make/model for a given number of years within a specific vehicle class.*

Average age *– The average age of the fleet is slightly older than comparable municipalities. An older fleet generally results in decreased reliability, increased maintenance costs, higher emissions and outdated productivity and safety features.*

Average annual mileage – *The average annual mileage is excellent and an indicator of healthy and effective utilization. While it's significantly higher than municipal peers, it's not high enough to indicate that additional vehicles are needed or that the overall mileage on vehicles is too high.*

Vehicle useful life targets *– The District provided useful life targets are generally within a few years of industry standard targets, however, there was lack of consistency among vehicles of a* *similar class. Development of a consistent forward looking document such as a fleet policy or tangible capital asset replacement schedule is recommended. It's also noted that the age at which vehicles are actually replaced differs from the useful life target. As a result, the useful life target has a rating of "Good" whereas the average age has a rating of "Fair".*

The Fire fleet has a completely different benchmark to follow for useful life targets. The Fire Underwriters Survey (FUS) defines the life for apparatuses throughout Canada and the US and is linked to insurance rates, which provides a strong case for Fire departments to follow the recommended life[3].

***Fleet data tracking** – The fleet data category encompasses the centralization and thoroughness of information relating to the District's vehicles. Basic data typically includes vehicle specifications, mileage, age, capital and upfitting costs, maintenance expenses, fuel consumption, planned replacement dates, and other pertinent details specific to the fleet. This data is crucial for making well-informed decisions regarding vehicle replacement, comparing costs for transitioning to electric vehicles and identifying underperforming assets. Currently, the District has basic information but doesn't appear to be using it for decision-making on when to replace vehicles or to monitor overall fleet management. An Analyst has been hired and will be developing a fleet management dashboard where this info is centralized, compiled and reviewed. This is expected to improve fleet management capabilities and is in alignment with industry best practices.*

The findings from this scorecard and the underlying data analysis provide valuable insights. One of the challenges of conducting a fleet assessment is the limited knowledge of how the vehicles are used operationally and their specific specifications/configurations. Additionally, there were instances where crucial data regarding vehicle utilization was not available. As a result of these constraints, offering specific recommendations for each vehicle is not feasible at this point. It's essential for the District to conduct further thorough research to ensure that any recommendations made will not negatively impact operations or the services provided.

4. RESEARCH AND ANALYSIS

This section delves into the shift toward EVs, providing an overview of the vehicles themselves, the formulation of transition plans, and a roadmap for infrastructure development. Beyond just electrification, other strategies for reducing emissions, including alternative fuels, are also outlined. Finally, financial considerations, such as carbon credits and incentives, are also discussed. All this

[3] "Insurance Grading Recognition of Used or Rebuilt Fire Apparatus," Fire Underwriter's Survey, accessed at https://fireunderwriters.ca/assets/img/FUS-TechnicalBulletin-InsuranceGradingRecognitionofUsedorRebuilt.pdf

information is then synthesized to craft a comprehensive strategy in **Section 5: Strategy and Recommendations**.

4.1 OVERVIEW OF ELECTRIFICATION

As organizations shift towards broader adoption of EVs, the demand is driving more available options in both the plug-in hybrid and full electric market. In Canada, governments at all levels are providing significant incentives and programs to assist individuals and businesses in replacing their fossil fuel-powered vehicles with EVs. While the vehicle technology is not yet advanced enough for all duty cycles and market segments, return-to-base fleets, such as those operated by municipalities, provide the optimal operation and duty cycles for EVs. Light-duty vehicles, such as cars, SUVs and small pickup trucks, are the most advanced with numerous models available from all manufacturers. These vehicles have been demonstrating lower maintenance costs, good performance in mild climates, and longer battery life than expected. Light-duty vehicles have been successfully used in operational business for many years.

Heavy-duty vehicles represent vehicle classes 6-8 and typically consist of dump trucks, garbage trucks, sewer combination trucks, hydro excavators and other large vehicles. These vehicles are lagging behind light-duty vehicles in terms of technological readiness and number of years in the market. Many heavy-duty vehicle manufacturers offer limited vehicle options with limited real-world operating performance and reliability data. Most manufacturers only began commercial production of their heavy electric vehicles in 2021 or 2022. These vehicles are generally well-suited to predictable operational use, such as delivery services. Unpredictable uses, such as municipal operations where vehicles are used 24/7 for snow clearing and emergency infrastructure repairs, and the requirement for complex truck bodies present some real challenges and risks. While this technology is progressing rapidly, organizations need to consider the risks to their service levels before introducing these vehicles into their fleet. However, these risks should not prevent organizations from assessing the suitability of this technology and beginning to develop a plan for implementation and budgets to begin procurement. It’s also important to note that procurement of Heavy or Medium Duty vehicles with Municipal specifications can take up to two years from the time a Purchase Order is issued until delivery.

Medium-duty vehicles include Classes 3-5 and typically consist of service trucks and construction vehicles, such as Ford F350-550, Isuzu cabovers, etc. This market segment is lagging behind both light and heavy-duty vehicles in terms of electric options. Limited options are available from manufacturers, however, this is a growing segment with a number of options that have just been released or expected to be available within the next year. Similar to heavy-duty vehicles, this market segment is expected to progress quickly, and businesses should begin assessing the technology and begin planning for implementation.

Charging infrastructure is readily available with numerous level 2 and DCFC (formerly known as level 3) options from many manufacturers on the market. MCS is also an emerging charging technology with several demonstration projects in the United States. MCS is faster than DCFC and generally requires liquid cooling for charging cables. Utility providers are investing heavily in planning and implementing infrastructure upgrades to support charging networks and the transition of businesses to EVs. BC Hydro is offering incentives and encouraging businesses to develop EV fleet strategies so it can better understand future power needs and plan for infrastructure to support anticipated power requirements[4].

The carbon reduction potential for electrification is high, especially in British Columbia, where most electricity generated is clean hydroelectric. Many other provinces and states still use coal and natural gas for electricity generation, which means higher carbon emissions when used as a power source for EVs. Another environmental consideration for battery electric vehicles is battery recycling. Recycling has seen significant technological advancement over the past few years. Companies such as Li-Cycle have developed safe battery recycling technology that can recover up to 95% of the raw materials[5]. The

[4] "Electric Fleets", BC Hydro, accessed at: https://www.bchydro.com/powersmart/electric-vehicles/industry/fleets.html

[5] "Services", Li-Cycle, accessed at: https://li-cycle.com/services/

Province of British Columbia has also added EV batteries to its recycling regulations, which is expected to help increase investment in recycling technology and facilities within British Columbia.

4.2 EV TRANSITION MODELLING

Clean Ops Fleet Analyser is a modelling tool that has been used to analyze EV transition scenarios. This easy-to-understand fleet analysis tool is focused on providing fleets with key information for improved vehicle replacement planning, decision making and insights into emission reductions. This analysis accounts for capital costs, maintenance costs, fuel costs, carbon costs, salvage value, technological maturity and operational risk. Two scenarios are analyzed for the District:

1. **Baseline Scenario**

   This scenario models all fleet replacements using the same vehicle and fuel technology options as the incumbent fleet. This means if there is currently a gasoline vehicle, it will be replaced at the end of its life with another gasoline vehicle, regardless of technology progression or regulatory requirements. This is not a scenario that a fleet would actually follow, however, it provides important metrics when comparing it against the optimized scenario.

2. **Optimized Scenario**

   This scenario uses a combination of incumbent fuel technologies, zero-emission vehicle technologies and a smoothed replacement planning to optimize an organization's capital replacement plan. The vehicle fuel technology that is modelled is based on a total cost of ownership (TCO) analysis and switches to an EV when the TCO is projected to be beneficial for the EV. For each vehicle, it also accounts for the maturity of EV technology and the risk to critical services provided by that vehicle. For example, any vehicles that are identified as used for emergency purposes, such as Fire trucks, snow plows, etc, would be transitioned at a later date than a similar vehicle not used for emergency purposes. This allows for additional technological maturity and reduced risk for critical services. Finally, the optimized scenario also employs a smoothed replacement plan which minimizes annual variances in capital expenditures and the workload associated with developing specifications and purchasing new vehicles.

As more and more fleets focus on emissions reductions, Clean Ops Fleet Analyser includes an emissions analysis for all scenarios. The analysis is based on the latest Province of British Columbia Best Practices Methodology for Quantifying Greenhouse Gas Emissions as well as actual fuel use to determine specific emissions per vehicle. The emissions reductions in this section are just for fleet electrification and alone may not be enough to reach targets. Additional emission reduction strategies are also shown for the final strategy in **Section 5: Strategy and Recommendations**.

Actual data from the incumbent fleet was obtained and used for as accurate of an analysis as possible. Where data is incomplete or appears inaccurate, averages from similar peer fleets is used to create a realistic transition model. A summary of the transition results is provided below, with a more detailed and legible Excel document also provided to the District. Figure 1 below shows the potential number of vehicles electrified by year. Based on the optimized scenario, 51% of the fleet can be electrified by 2035, with a rough projection of 75% by 2050. In addition to Figure 1 below, the detailed Excel document provided to the District lists the specific year when each vehicle is electrified.

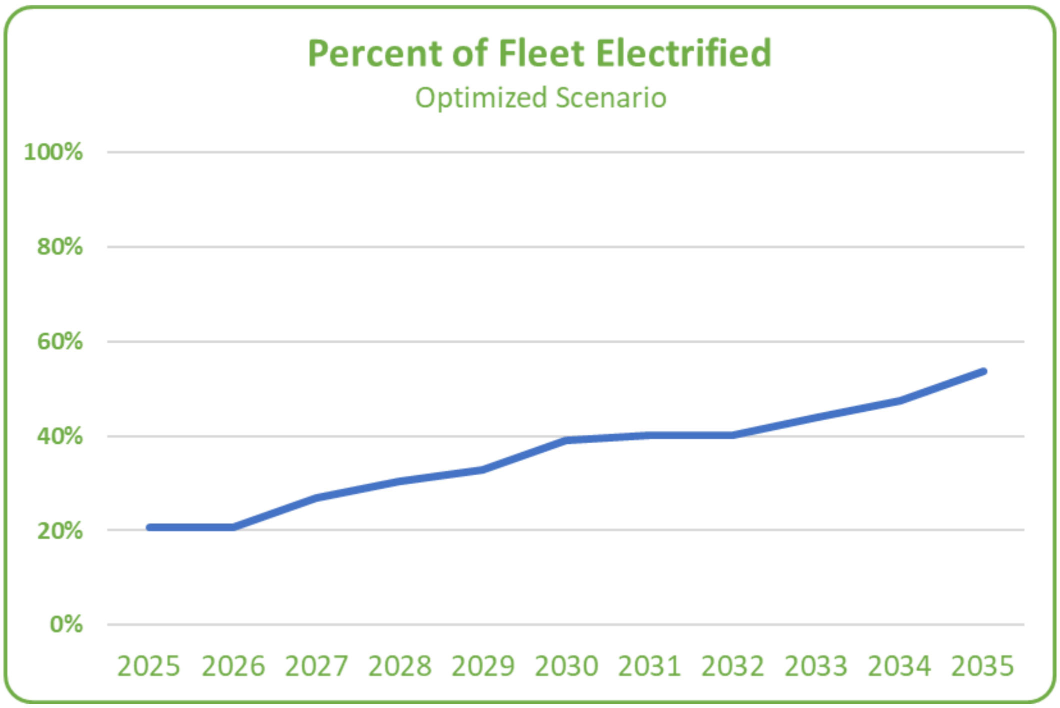


Figure 1: Percent of Fleet Electrified

Emissions reductions from the optimized scenario result in a 35% reduction by 2030 and a rough projection of 85% by 2050 (see Figure 2). Emissions are reduced from that baseline[6] of 265,000 kg in 2024 to 172,000kg in 2030 and 40,000 kg in 2050. Municipalities tend to use a baseline of 2007; however, as emissions and vehicle records related to the fleet are not available for that year, a baseline of 2024 has been used for this analysis. All emissions for this project include the Municipal, Fire (excluding shared PEMO vehicles) and Police fleet. This alone is not enough to meet the target for a 45% reduction by 2030 and 100% reduction by 2050, so other options have to also be considered, as presented in **Section 5: Strategy and Recommendations**.

[6] 2007 Fleet emissions (baseline year for Climate Leadership Plan) was 265,000/265 tonnes, not including Police services.

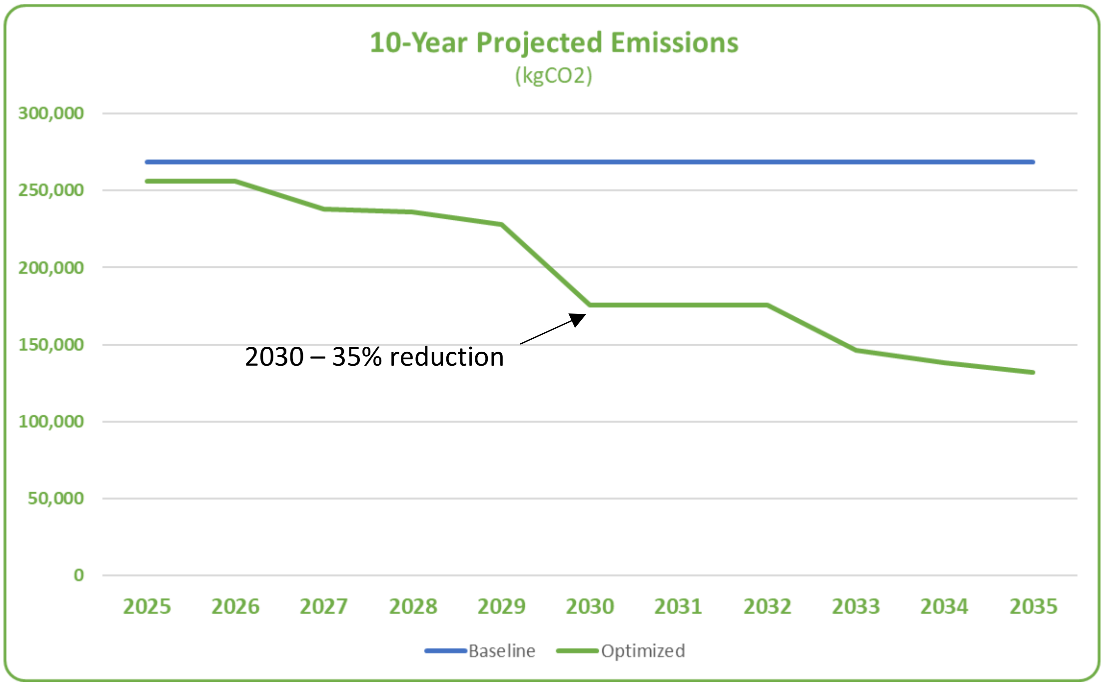
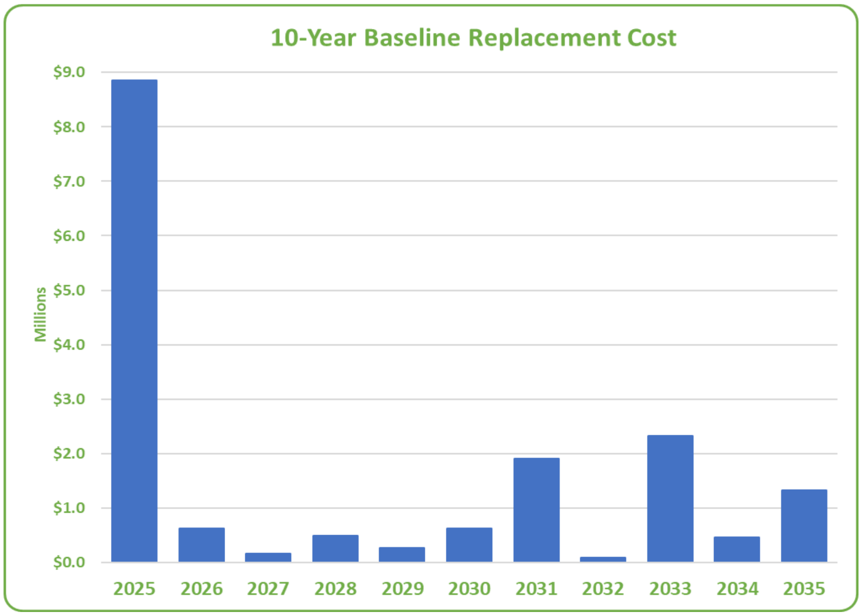


Figure 2: Emissions Profile from Fleet Electrification

A comparison of capital costs over a 10-year period is presented for both the baseline and optimized scenarios. The anticipated lifespan of each vehicle is determined according to industry standards for municipalities, as referenced in **Section 3.2: Comparison to Industry Peers**. The baseline scenario indicates a substantial capital expenditure in 2025, as a considerable portion of the fleet will have surpassed its useful life. It is acknowledged that this level of expense is unlikely to be feasible within the District's budget, particularly given the significant workload associated with vehicle replacements. As a result, the optimized scenario aims to alleviate this burden from both operational and financial perspectives.

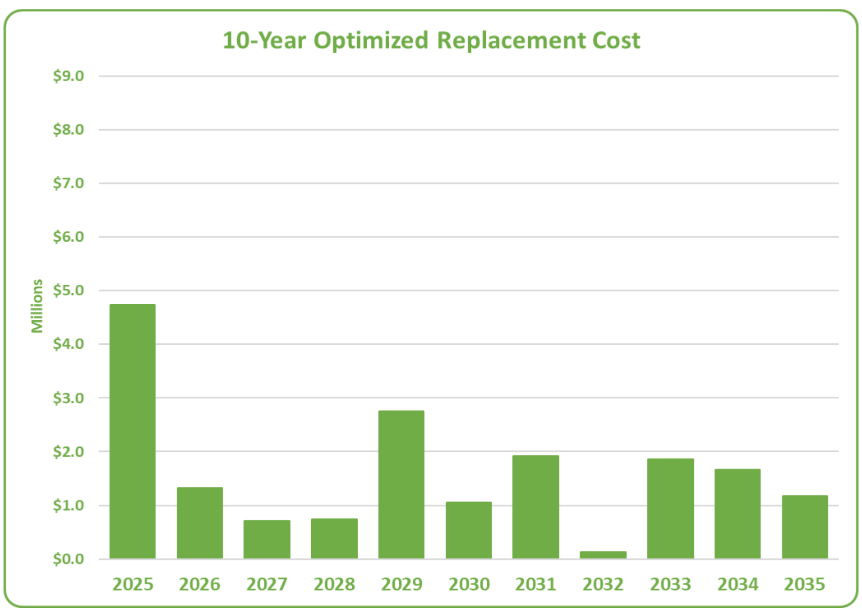
Replacements are then modelled with the optimized scenario reducing the initial expenditure and smoothing replacements. Two notable capital expenditure peaks still occur in 2025 and 2029, primarily due to the necessity of replacing Fire Apparatus, which are high-cost vehicles. The replacement schedule for these vehicles is regulated by the Fire Underwriters Survey (FUS), meaning that adjustments to the replacement year could adversely affect the District's insurance rating.

Under the baseline scenario, a capital expenditure of $8.9 million is required in 2025; however, the optimized scenario reflects a reduction to $4.7 million ($3.4 million of which is for two fire apparatus). It is essential to highlight that this capital comparison pertains exclusively to vehicle replacements and excludes the costs associated with electrical and charging infrastructure, which will be discussed in the subsequent section. Additionally, the net present value (NPV) over the 10-year period has been calculated for each scenario, with the optimized scenario demonstrating a significantly lower NPV of $25.7 million compared to the baseline's NPV of $28.9 million. This NPV calculation encompasses both capital and operating costs (maintenance and fuel), while still omitting considerations for chargers and electrical infrastructure.



10 Year NPV: $28.9M

Figure 3: 10 Year Capital Replacement Costs and NPV – Baseline Scenario



10 Year NPV: $25.7M

Figure 4: 10 Year Capital Replacement Costs and NPV – Optimized Scenario

The 10 year capital cost replacement figures above provide key information to help inform the strategy. The detailed analysis that was used for the capital costs and NPV includes a full TCO review, risk analysis and projected industry technology advancement. This additional information has been provided to the District separately so that it can be used for more detailed budgeting processes and for detailed evaluation at the time of vehicle replacements.

4.3 ELECTRICAL INFRASTRUCTURE ASSESSMENT

There are three locations that were considered for fleet electrification as part of this strategy. These locations are:

1. Public Works/Municipal Yard – 1703 Keating Cross Rd
2. Fire Hall – 1512 Keating Cross Rd
3. Municipal Hall – 1902 Mount Newton X-Road

The existing peak demand load and projected EV demand for the optimized scenario are presented in the table below. Prior to performing any required upgrades, a Demand Load Study performed by a licensed electrician is recommended to confirm results at each of the locations.

Table 3: Summary of Electrical Capacity Assessment at 2035

	Public Works	**Fire Hall**	**Municipal Hall**
Electrical Service Capacity[1]	173 kVA	231 kVA	231 kVA
Maximum Electrical Demand[1]	64 kVA	64 kVA	156 kVA
Remaining Capacity[1]	109 kVA	167 kVA	75 kVA
2035 - Projected EV Load; optimized scenario[2]	48 kW	2 kW	142 kW
Upgrades Required[2]	No	No	Yes

1. Data retrieved from BC Hydro provided 1-year historical load information. Data should be confirmed via demand load study. See **Appendix B: Electrical Capacity Assessment and Detailed Charging Plan** for additional details.
2. Assumes charging infrastructure is networked and load sharing enabled.

As part of this assessment, facility redevelopment and upgrades to the current electrical infrastructure were considered. The District has indicated that redeveloping the Public Works yard and Municipal Hall is under review, though no firm schedules or designs are in place.

To ensure a cost-effective and fiscally responsible approach, the recommended solutions emphasize careful load sharing and charger networking. This strategy minimizes the need for electrical infrastructure upgrades at these locations through 2035. By leveraging networking and load-sharing technologies, additional chargers can be installed without upgrading the main service until 2030, preventing unnecessary capital investments before redevelopment plans are finalized.

However, based on the modelling, infrastructure upgrades will be required at Municipal Hall in 2030 to support the transition of five front-line police vehicles to EVs. Due to their short charging windows, these vehicles will require DC fast charging (DCFC), as outlined in the charging plan. Further details on this plan can be found in the next section.

Further details for the preliminary electrical infrastructure assessment and facility location layouts are in **Appendix B: Electrical Capacity Assessment and Detailed Charging Plan.**

4.4 CHARGING PLAN

A charging plan was developed and calls for a 1:1 ratio of charging plug to vehicle. This allows for ease of operations as vehicles are not required to be swapped or have scheduled days when they can use a plug, which can result in vehicles not being charged when needed. All facilities were modelled with charging times as provided by the District, which range from 2 hours for frontline Police vehicles to 12 hour overnight charging for many Public Works vehicles. The installation of chargers and new circuits is aligned with the optimized EV transition scenario and these charge times. This results in the installation of circuits, chargers and civil construction in the year that EVs are expected to be purchased and delivered, therefore optimizing capital spending. Initial civil infrastructure occurs in 2025 for Public Works, 2025 for Municipal Hall and 2034 for the Fire Hall.

The charging plan considers level 2 chargers and DCFC. These are expected to provide sufficient output for vehicle needs, allow for data tracking, networking and power sharing. As the electrical infrastructure at each location has limited in capacity, it’s critical that a strict charge management practice be followed. This includes charging all vehicles overnight, ensuring chargers are networked and that power sharing is enabled to manage the total EVSE loads.

The tables below summarize the charging infrastructure installation by year and for each location. These tables assume the use of FLO EVSE as it aligns with what the District already uses. Additional details can be found in **Appendix B: Electrical Capacity Assessment and Detailed Charging Plan**.

Table 4: Public Works - Proposed EVSE at Each Year

Year	# of Level 2 (40A) Circuits	# of Level 2 Connectors	# of DCFC
2025	2	5	
2027	2	4	
2028		2	
2029	1	1	
2031		1	
2033	1	1	1
2034	1	1	
2035		3	

Table 5: Fire Hall - Proposed EVSE at Each Year

Year	# of Level 2 (40A) Circuits	# of Level 2 Connectors	# of DCFC
2034	1	1	

Table 6: Municipal Hall - Proposed EVSE at Each Year

Year	# of Level 2 (40A) Circuits	# of Level 2 Connectors	# of DCFC
2025	2	2	
2027		1	
2028		1	
2029		1	
2030			5

This charging plan is considered a baseline for today's charging technology and the District should monitor the evolution of charging technology. Megawatt Charging Standard (MCS), automated charging, inductive charging or battery swapping are some of the technologies that are emerging and may prove better suited to the District's operations as the technology matures.

4.5 OTHER EMISSIONS REDUCTION STRATEGIES

In addition to fleet electrification, there are other proven strategies for reducing emissions. A few options are noted below with two recommended, low-risk strategies including the use of renewable diesel as well as the adoption of Industry Best Practices.

1. **Biodiesel** is a biofuel that has been used for decades and is typically derived from vegetable oils, animal fats, rapeseed oil, sunflower oil, and palm oil[7] . It is available in various blends, such as B5 (5% biodiesel, 95% standard diesel) and B20 (20% biodiesel, 80% standard diesel), and is already commonly included in the diesel fuel supply throughout British Columbia. Under the BC Low Carbon Fuel Standard, diesel fuel must contain a minimum of 4% renewable content, increasing to 8% on April 1, 2025[8] While the specific renewable content is not defined, biodiesel is commonly used to meet this requirement.

   Despite its benefits, biodiesel has some key limitations. One challenge is fuel quality and engine compatibility. Biodiesel is not refined to the high-quality fuel standards required by engine manufacturers, and most manufacturers only allow up to a 20% blend (B20) before voiding engine warranties. Another concern is its performance in cold weather. Biodiesel has poor low-temperature properties, leading to the formation of solids at the cloud point—a phenomenon known as "gelling," where the fuel becomes too thick to flow properly.

   B20 can reduce emissions by up to 20% compared to standard diesel, though the actual reduction varies depending on the supplier's feedstock and refining process. Additionally, because BC's Low Carbon Fuel Standard already mandates some renewable content in diesel, the incremental emissions benefit from using biodiesel may be lower. It is important to

[7] "Biofuels explained", US Energy Information Administration, accessed at https://www.eia.gov/energyexplained/biofuels/biodiesel-rd-other-basics.php#:~:text=Vegetable%20oils%20(mainly%20soybean%20oil,and%20yellow%20grease%20from%20restaurants.

8 Low Carbon Fuel Standard", Province of British Columbia, accessed at https://www2.gov.bc.ca/gov/content/industry/electricity-alternative-energy/transportation-energies/renewable-low-carbon-fuels/requirements

recognize that biodiesel is still a combustion fuel, meaning tailpipe emissions—similar to those from standard diesel—are still produced, contributing to local air pollution and environmental concerns.

To ensure optimal performance and compliance, discussions with fuel suppliers are recommended to determine the cloud point for various blends, pricing, and emissions reduction potential. Since blends higher than B20 void engine warranties, using a higher concentration is not advised.

2. **Renewable diesel** is also known as Renewable Hydrogenated Diesel (RHD) or R100 in its pure form meets diesel fuel quality standards and is suitable as a direct drop-in replacement for both engines and existing fueling infrastructure. This fuel has been in commercial production since 2007, with the number of refining facilities across the world slowly increasing, and a number of refining facilities now located in North America, including one in the lower mainland of British Columbia. Because it's a drop in replacement, it can be supplied regularly as a diluted percentage, such as R20 (20 percent RHD), or at its full strength. Discussions with the District's existing fuel suppliers are recommended to help inform a suitable blend and supply frequency.

   R100 can provide up to an 85% emission reduction compared with standard diesel. This emissions reduction is calculated based on the BC Best Practices Methodology for Quantifying Greenhouse Gas Emissions and as each supplier has a different feedstock and refining process, there are some variances in the exact emissions reduction for their specific product, so the exact reduction will be dependent on the fuel supplier. It's also important to note that despite the emissions reduction, this fuel still undergoes a combustion process in an engine and tailpipe emissions are still a byproduct. These tailpipe emissions are similar to those of non-renewable diesel and still contribute to local pollution and air quality concerns. For this reason, renewable diesel is recommended as a way to supplement or accelerate carbon emission reduction, but it is not an optimal long-term solution on its own.

3. **Industry Best Practices** – In addition to electrification and alternative fuels, other industry best practices have been reviewed. A number of municipalities across Canada have been contacted, with many having similar practices, and only those relevant and with potential benefit to the District are presented below. Many of the best practices prove difficult to determine exact emission reduction as they cannot be measured independently. However, qualitative emission reduction potentials are provided and based on feedback from peer municipalities that have successfully implemented these.

a. Green Procurement Policy – City of Burlington

The City of Burlington has implemented a Green Procurement Policy as well as Green Procurement Guidelines. The Policy outlines the objectives to ensure the City acquires sustainable products and services and references several standards by which the sustainability of a product or service can be measured. The Guidelines provide information to employees to educate them on what Green Procurement means, why it's important and misleading or false information that respondents may provide as part of their bids.

Impact: *Low*

Cost/Resources: *Low*

Ease of Implementation: *Moderate*

b. Anti-Idle and Telematics – City of Saskatoon

The City of Saskatoon has revised their policy and invested in anti-idle technologies. This is a significant effort in change management, but considering some of the challenges and range reduction of electric vehicles in cold climates, they have deemed this a good investment. They have implemented GPS systems on their fleet and developed an idle report for Operational Managers. This allows Managers to develop awareness with staff, understand their department's idling behaviours and work one-on-one with staff who may not be following the policy.

Impact: *Low*

Cost/Resources: *High*

Ease of Implementation: *Moderate*

c. Fleet Procurement Committee – Metro Vancouver

Metro Vancouver has taken steps to implement a Fleet Procurement Committee. This is a widely popular approach by a number of other municipalities that generally include representatives from Fleet, Sustainability, Operations and Finance. This Committee makes recommendations on individual vehicles, fuel type, specifications, and others when a municipality is either replacing one of its vehicles or purchasing additional vehicles. Historically, Operations and Fleet defined the vehicles to be purchased, and the decisions had a very operational-centric focus. However, this Committee approach ensures that corporate priorities and good business cases are considered as part of the decisions.

Impact: *Moderate*

Cost/Resources: *Low*

Ease of Implementation: *Low*

4.6 FINANCIAL CONSIDERATIONS AND INCENTIVES

The incentives and considerations outlined in this section will be important factors the District should include in annual work plans and budgeting. All of these financial considerations and incentives change periodically and cannot be easily predicted as part of the final strategy. Therefore, they are not included in any financial analysis but are detailed below so the District has the information required to review and apply as applicable.

4.6.1 AVAILABLE INCENTIVES

The transition to EVs generally involves a significant initial investment in infrastructure upgrades and vehicle purchases. Although the expected lower operating costs (including lower fuel costs) can eventually balance out these expenses over a vehicle's lifespan, the heightened need for capital still poses a financial challenge for numerous organizations. Various incentives, grants, and loans are available to assist organizations in every stage of their transition. Below is a list of known financial support options along with brief descriptions. Many of these can be combined and have differing maximums and conditions. These support programs are based on the information available at the time of writing and typically necessitate thorough planning, including the submission and approval of an application, before receiving funding. It is crucial to note that these incentive programs can change with little notice, so organizations should verify their availability and suitability at the time of application.

Table 7: Financial Support and Incentives

	Applicable Financial Support
Passenger Vehicles	• Clean BC Go Electric - this program provides up to $3,000 per EV. https://goelectricbc.gov.bc.ca/rebates-and-programs/for-businesses-and-organizations/passenger-vehicle-rebates-for-fleets/ • Transport Canada iZEV - this program provides up to $5,000 per EV. https://tc.canada.ca/en/road-transportation/innovative-technologies/zero-emission-vehicles/incentives-zero-emission-vehicles-izev. *Note: the iZEV Program is on pause as of January 2025 and expected to resume on April 1, 2025 with a new fiscal budget.*

On-Road Medium & Heavy Duty Vehicles	• Clean BC Go Electric - this program provides up to $100,000 per EV for vehicles typically used by a Municipality. The amount of the rebate is typically based on the size of the vehicles with smaller vehicles only eligible for up to $10,000 while larger vehicles are eligible for up to $100,000. https://www.goelectricotherrebates.ca/rebate • Transport Canada iMHZEV - this program provides up to $100,000 per EV for typical vehicles used for Municipal services. Similar to the Clean BC program, the level amount of the incentive is linked to the size of the vehicle. https://tc.canada.ca/en/road-transportation/innovative-technologies/zero-emission-vehicles/incentives-medium-heavy-duty-zero-emission-vehicles
EV Transition Planning & Feasibility Studies	• BC Hydro EV Fleet Ready Plan - this program covers 50% of the cost up to a maximum of $15,000. https://www.bchydro.com/powersmart/electric-vehicles/industry/fleets/incentives.html#professional-planning • FCM Green Municipal Fleet Electrification - this program covers up to 80% of eligible expenses to a maximum of $200,000. The scope includes feasibility studies for transition to ZEVs including a municipal fleet and/or transit fleet. https://greenmunicipalfund.ca/municipal-fleet-electrification
Electrical Infrastructure Upgrades	• BC Hydro - this program provides up to 50% of the electrical infrastructure upgrade costs for any infrastructure upgrades identified as part of the EV Fleet Ready Plan. https://www.bchydro.com/powersmart/electric-vehicles/industry/fleets/incentives.html#electrical-infrastructure
Fleet Chargers	• Clean BC Go Electric Fleet Charging Program - this program provides up to $100,000 per EV charger. The incentive amount is based on the size of the charger, with smaller level 2 chargers eligible for up to $2,000, while faster chargers are eligible for up to $100,000. https://www2.gov.bc.ca/gov/content/industry/electricity-alternative-energy/transportation-energies/clean-transportation-policies-programs/clean-energy-vehicle-program/go-electric-fleet-support-program • Natural Resources Canada ZEVIP (Zero Emission Vehicle Infrastructure Program) - this program provides up to 50% of the funding for project costs. It has specific application intake timing and requirements, and for small projects, funding may be administered through approved charging station suppliers. https://natural-resources.canada.ca/energy-efficiency/transportation-alternative-fuels/zero-emission-vehicle-infrastructure-program/21876
Capital Cost & Loan Support	• FCM Green Municipal Fleet Electrification - in addition to the feasibility studies, this program also provides support for the capital costs for ZEVs, chargers and facility upgrades. This program includes a grant and loan portion covering up to 80% of project cots. The loan maximum is $10M, with a grant covering up to 20% of the loan amount. https://greenmunicipalfund.ca/municipal-fleet-electrification

4.6.2 CARBON CREDITS

Carbon credits are a commodity that can be monetized for organizations that convert their fleet to EVs. There are two programs applicable to organizations in British Columbia, the provincial Low Carbon Fuel Standard and the federal Clean Fuel Regulation[9]. Organizations that own and operate EVSE can collect credits under both of these programs. The credits can be saved, sold on the carbon trading market, or used to offset emissions. As these credits are commodities, the price fluctuates with market values. Average 2023 prices were approximately $475/tonne for credits under the LCFS and $127/tonne for the CFR. There are currently no restrictions on how the proceeds from credits can be used. Ideally, they would be used to offset EVSE costs, purchase additional electric vehicles, or for a similar carbon reduction initiative, but at this time, it is unregulated. Using carbon credits for EV energy at today's carbon credit pricing results in net revenue on the electricity consumed by the EV.

These credits are earned based on the differential emissions between an EV and a comparable ICE vehicle; calculated using the integrated grid carbon intensity of 9.2 tCO2e/GWh (2021)[10] vs the carbon intensity for a comparable ICE vehicle. These values change on an annual basis, and for 2024, diesel fuel is 79.28 gCO2e/MJ (2024)[11]. Vehicle efficiencies and fuel or electricity use are then required to calculate the difference. One tonne of carbon saved by an EV is considered one credit. Initial estimates indicate that up to $400,000 in carbon credits could be collected by 2035 by the District (see Table 9 in Section 5.2). Typically, an aggregator or energy specialist is used to track the required data and calculate credits. An aggregator can also be used to manage the carbon trading, but an organization can also choose to do this in-house.

The carbon credit industry in British Columbia is still relatively new and expected to evolve over the coming years. For the purposes of this project, carbon credits are not factored into the financial analysis or emissions reductions but are provided for insight and further exploration by the District.

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[9] Province of British Columbia, https://www2.gov.bc.ca/gov/content/industry/electricity-alternative-energy/transportation-energies/renewable-low-carbon-fuels

[10] "Electricity emission intensity factors for grid-connected entities", Province of British Columbia, accessed at: https://www2.gov.bc.ca/gov/content/environment/climate-change/industry/reporting/quantify/electricity

[11] "LCFS Requirements", Province of British Columbia, accessed at: https://www2.gov.bc.ca/gov/content/industry/electricity-alternative-energy/transportation-energies/renewable-low-carbon-fuels/requirements

5. STRATEGY AND RECOMMENDATIONS

Using the research and analysis from the previous section, a strategy can now be developed. This section combines all options that have been reviewed to develop a roadmap with a key focus on the strategy, emissions, and recommendations. The core components of the strategy and roadmap are outlined first, followed by additional detail on emissions reduction targets, financial impacts and a detailed list of recommendations.

5.1 CORE STRATEGY AND ROADMAP

Section 4: Research and Analysis outlines a range of best practices for emissions reduction, fleet electrification and fleet management. Together, these practices form the foundation of the recommended strategy, which balances technology readiness, financial impacts, operational risks, and emissions reductions.

The strategy focuses on three core components:

1. **Optimized Transition Scenario**

   This scenario uses a TCO analysis to determine when switching to EVs becomes beneficial. It also accounts for the market readiness of EV technology and assesses the potential risks to service during the transition. This scenario includes detailed plans for implementing EVs, electrical infrastructure, and charging station deployment.

2. **Renewable Diesel**

   This is a drop-in replacement fuel that offers up to an 85% reduction in emissions and provides an effective interim solution during the EV transition.

3. **Incentives and Carbon Credits**

   Leveraging carbon credits and incentives will be a key part of financing the transition to EVs and associated emission reduction.

The District delivers essential services during both routine operations and emergencies, making it essential to ensure vehicles meet operational requirements. The strategy prioritizes technology readiness, with the optimized scenario transitioning vehicles as technology matures and manufacturer development costs stabilize. Financial considerations are also a key factor. Although the analysis excludes incentives due to their dynamic nature, the strategy emphasizes the importance of regularly researching and reviewing available incentives, as these could accelerate electrification or offset costs, such as those associated with renewable diesel.

The strategy is designed to guide future decisions while allowing for flexibility to adapt to unforeseen changes, such as new operational demands, industry trends, grant opportunities, financial constraints, or technological advancements. By maintaining a balanced approach, the District can continue to work toward its emissions reduction targets while staying responsive to evolving circumstances. To sustain progress, the District should continue its best practices of conducting annual vehicle and operational reviews throughout the strategy's implementation. The fleet industry is undergoing rapid technological change, and by adopting this proactive strategy, the District has positioned itself for success in reducing harmful emissions.

Figure 5 outlines the major tasks and components of the strategy in a chronological format. A comprehensive list of detailed recommendations can be found in **Section 5.4: Recommended Actions**.

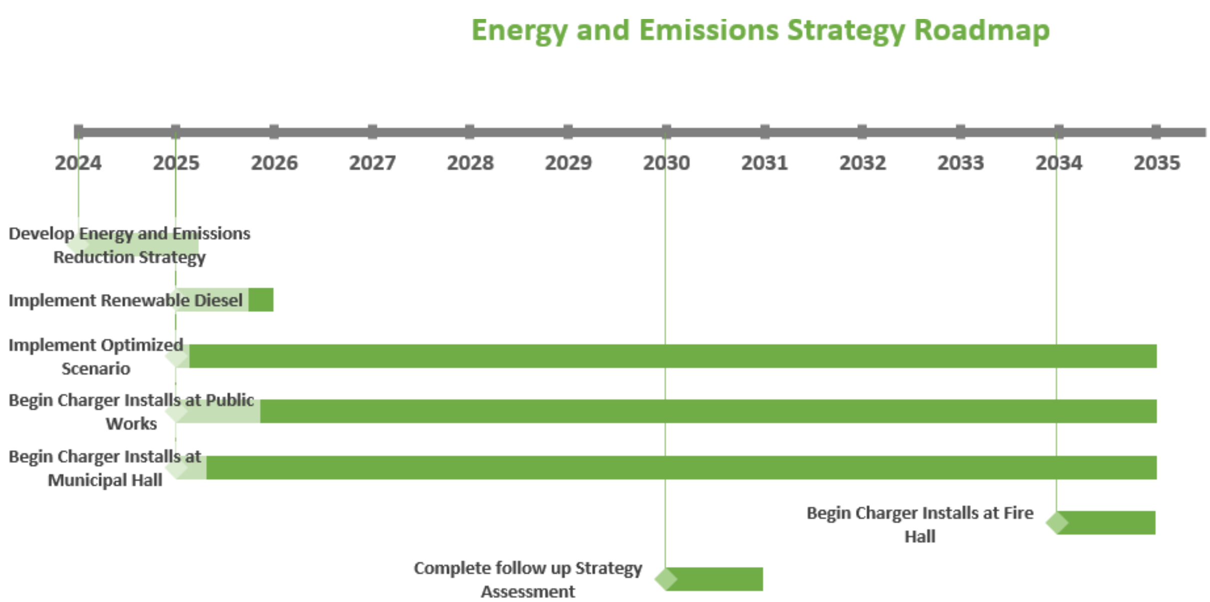

Figure 5: Strategy Roadmap

5.2 CARBON REDUCTION TARGETS

As part of this strategy, the District's ambitious emissions reduction targets are considered, a 45% reduction by 2030 and 100% by 2050. Achieving these goals through fleet electrification alone is not projected to be economically feasible. Electrification is estimated to reduce emissions by 35% by 2030 and 85% by 2050.

The Province of British Columbia's Low Carbon Fuel Standard (LCFS) incrementally reduces the carbon intensity of diesel and gasoline until 2030. This standard is expected to provide an additional 17% reduction in carbon intensity by 2030. When combined with electrification, these measures are forecasted to result in a 45% emissions reduction by 2030 and 88% by 2050. This meets the 2030 target, but is still expected to fall short of the 2050 target (Figure 6).

Should the District wish to exceed the 2030 target and get closer to the 2050 target, renewable diesel could also be introduced. Full-strength renewable diesel has the potential to reduce emissions by up to 85% today. However, this reduction potential is expected to decrease to approximately 70% by 2030 due to the impact of the LCFS.

The pathway to achieving the 2030 and 2050 emissions reduction targets involves a combination of the following:

- Electrification – Recommended as the primary approach for reducing emissions.
- LCFS – this provincial requirement will automatically reduce emissions for any fuel supplied to the District.
- Renewable Diesel – Necessary to supplement electrification and the LCFS to meet the 2030 emissions reduction target.
- Continued annual tracking – it's important to continue annual tracking of fuel consumption and emissions. This will ensure the District remains on track to meet targets.

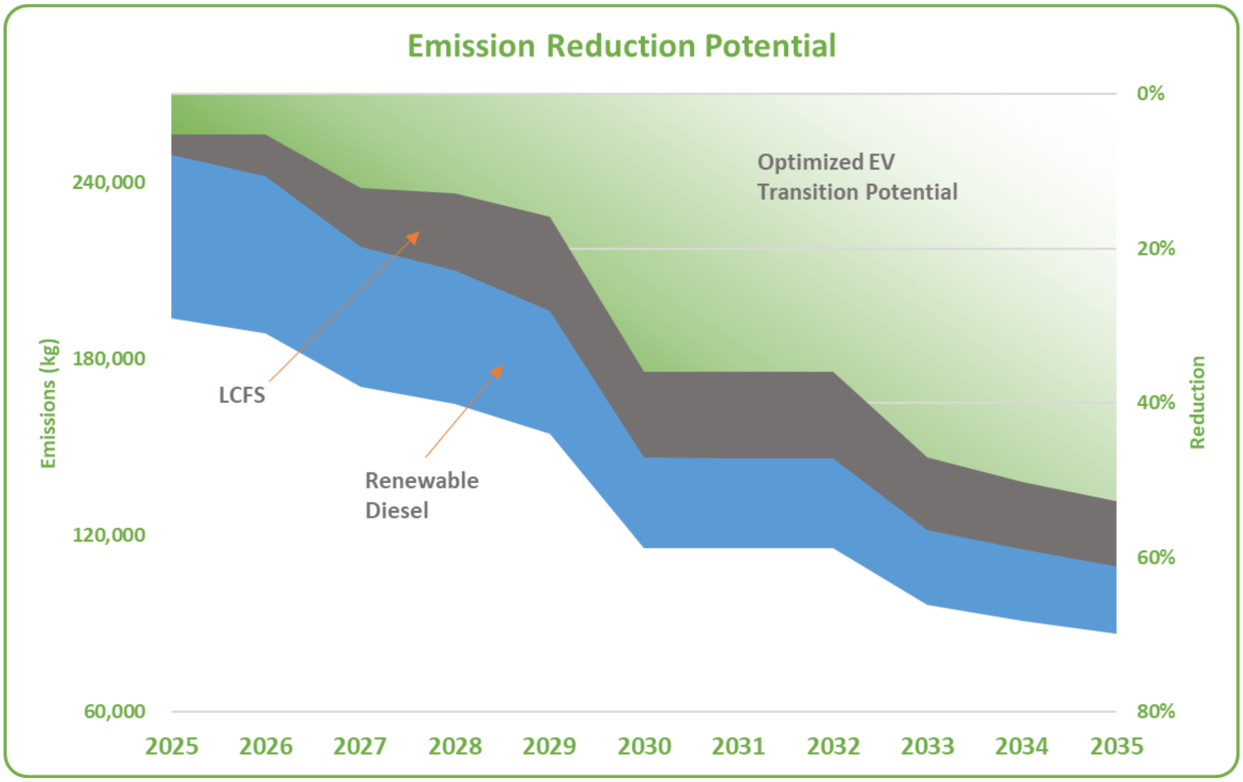

Figure 6: Emissions Reduction Potential

Figure 6 shows the stacked potential of each of these options. By combining all three, an emission reduction potential of up to 57% is possible by 2030 (113,000 kg), and up to 90% by 2050 (26,000 kg). By integrating these measures, the District aims to optimize its emissions reduction strategy while working towards its 2030 and 2050 goals.

5.3 FINANCIAL IMPACTS

The financial impacts of this strategy focus exclusively on electrification, encompassing vehicle purchases, operating costs, electrical infrastructure upgrades, and charging equipment. The analysis compares the baseline scenario with the optimized scenario, highlighting key differences.

In the optimized scenario, vehicles transition to electric only when the TCO is expected to be favorable. This selective approach naturally results in a lower NPV for the vehicles. Capital costs are slightly higher for the optimized scenario, but can also be offset slightly by carbon credits.

Table 8: Estimated Cumulative Costs to 2035

	Incremental Capital		NPV –	Carbon Credit
	Vehicles	Chargers[2]	Vehicles only	Potential[1]
Baseline	0	0	$28.9M	-
Recommended Strategy *-Optimized Scenario* *-Renewable Diesel* *-Carbon Credits*	$0.8M	$1.2M	$25.7M	$0.4M

1. Based on a carbon credit value of $600/tonne
2. This cost only includes infrastructure and chargers for public works and municipal hall.

Other elements of the strategy, such as the use of renewable diesel or fleet management best practices, are assumed to have a cost-neutral or negligible financial impact and are therefore excluded from the table. Current market pricing of renewable diesel is generally at par with standard diesel for an R50 blend, with some suppliers offering at par for an R100 blend depending on volumes, customer loyalty and other considerations. The District would need to discuss pricing directly with suppliers. Additionally, incentives have not been factored into the analysis, as they are not guaranteed. By excluding incentives, the analysis reflects a worst-case cash flow scenario, with any incentives received by the District expected to further reduce capital costs.

Detailed financial information for each vehicle, including replacement costs, maintenance, and fuel costs, has been provided separately to the District. This ensures the District has the necessary data for additional analysis or budgeting if required.

5.4 RECOMMENDED ACTIONS

Table 9 below is a more granular list of all recommendations that form this strategy.

Table 9: List of Recommendations

	Description	Rationale
1.	Improve fleet data collection	Fleet data collection allows for improved decision-making on vehicle maintenance needs and vehicle replacement and can reduce downtime and associated impact on other operational groups.

	Description	Rationale
2.	Improve fleet composition	Improved fleet composition results in familiarity of vehicles for operators and technicians, shared parts and streamlined support from external maintenance providers. These benefits typically result in improved efficiency for maintenance and operations. Purchasing strategies such as contracts to purchase a single vehicle make/model for a specific vehicle class and defined period of time should be considered.
3.	Define useful life targets	Develop a fleet policy, standard operating procedure, tangible capital asset replacement schedule or similar document the defines useful life targets by vehicle class. This is in alignment with industry standards and will aid in consistent amortization and replacement planning.
4.	Consider the development of a Green Procurement Policy	Many municipalities have begun implementing sustainability metrics and requirements into purchasing policies. Defining the fleet specific requirements for sustainability should be included in the development of any such policy.
5.	Consider the implementation of a telematics system	Telematics can provide numerous benefits including but not limited to data tracking, improvements for safety and security and even notifications for maintenance scheduling. Telematics systems can be costly, and if implemented, it's important to ensure there are sufficient benefits to justify the cost.
6.	Consider the implementation of a fleet procurement committee.	This committee would ensure that key stakeholders are consulted for the purchase of new and replacement vehicles. These stakeholders typically balance the operational need, costs, vehicle specs, safety, maintenance, alternative methods to provide the service, and sustainability.
7.	Adopt the Optimized Scenario for EV transition	This scenario was developed in conjunction with District staff and is expected to be achievable and realistic while balancing risk to District operations and critical services.
8.	Begin charger installs at Public Works in 2025.	This aligns with EVs being introduced at this site as per the optimized scenario. Beyond this initial install, additional chargers should be installed according to the charging plan.
9.	Begin charger installs at Municipal Hall in 2025.	This aligns with EVs being introduced at this site as per the optimized scenario. Beyond this initial install, additional chargers should be installed according to the charging plan.

	Description	Rationale
10.	Begin charger installs at the Fire Hall in 2034.	This aligns with EVs being introduced at this site as per the optimized scenario. Beyond this initial install, additional chargers should be installed according to the charging plan.
11.	Continue annual review of vehicle replacement plans, including fuel and emissions reporting.	This fleet strategy report does not replace the need to continue with annual updates to fleet replacement plans and the review of suitable replacement vehicles for operational use. Operational use, maintenance costs, fuel use, emissions and organizations needs change on a regular basis and should be reviewed annually and considered in any replacement plan.
12.	Review the ability and cost for the existing fuel provider to supply Renewable Deisel	This fuel is now widely available on Vancouver Island with many other organizations utilizing it with positive results. R50 is generally cost-neutral to regular diesel, with some suppliers potentially providing R100 as cost-neutral. R100 provides up to an 85% reduction in carbon emissions.
13.	Research and apply for incentives.	While incentives are listed as part of this project, they are constantly changing, and eligibility may be organization-specific. The District should review each of them in further detail and engage with the incentive provider.
14.	Regularly update and renew this strategy.	As the District moves forward on its electrification plans, regular review of this strategy should be completed approximately every 5 years to ensure new and emerging technologies are accurately reflected. Future fleet strategy assessments could be significantly smaller in scope than this initial project.
15.	Monitor the development of emerging technology for zero-emission vehicles.	ZEV technologies are advancing, hence it is important to monitor and update plans accordingly to best support operational requirements.
16.	Review the detailed requirements for the collection of carbon credits.	Eligibility for carbon credits requires specific data tracking and validation. Requirements should be reviewed in detail to determine the best approach and method for managing them.
17.	Train maintenance staff	Maintenance staff should be trained on EV maintenance, diagnostics and high-voltage safety.

	Description	Rationale
18.	Procure industry recommended PPE for high-voltage vehicle safety	This is required as part of a complete EV safety and maintenance program.
19.	Develop a safe work practice	A safe work practice should be developed for safely de-energizing an EV when required.

The development of this strategy has been completed in a manner that factors in the District's infrastructure, training, and current adoption of EVs. In order for this to be a successful strategy, the District should implement the recommendations in this report. Every effort was made to anticipate industry trends, available vehicles, technology progression, and estimated costs. However, there is still a need for the District to complete an annual review of vehicle replacements, follow industry progression, review changing operational needs, and assess the suitability of any EVs for their fleet.

5.5 LIMITATIONS

As with any review or assessment, certain limitations may impact the ability to provide precise and accurate information or recommendations. These limitations may stem from data availability, environmental conditions, human error, and other factors. While every effort was made to minimize these limitations, the District should carefully review all recommendations and conduct a more thorough internal assessment before proceeding with implementation. A detailed description of the identified limitations is outlined below:

1. **Available Data**
   The District's fleet data is limited, which is consistent with many similar-sized municipalities. These data gaps and inaccuracies may affect the precision of replacement plans or recommendations.

2. **Fleet Size and Composition**
   The District's fleet is dynamic and constantly changing with new vehicles being purchased and old ones disposed of. As a result, it's difficult to confirm the exact fleet size, composition, and needs due to conflicting fleet size and composition information. Efforts were made to consolidate all data and determine an accurate and reflective fleet composition. Where discrepancies are suspected, the Fleet List should be used as it defines the fleet size and composition that was used for the purposes of this analysis.

3. **Operational Information**
   Efforts were made to gain a detailed understanding of the District's operations, vehicle usage, and challenges through several stakeholder meetings. However, achieving a comprehensive understanding of the District's specific operations often requires years of observation and broader stakeholder engagement. As such, the insights gathered are at a high level, meant to identify key themes and challenges.

4. **Vehicle Specifications and Replacement Costs**
   Replacement costs for vehicles and equipment can vary significantly based on required features. The same make and model may have optional upgrades that add tens or even hundreds of thousands of dollars to the capital cost. Generic specifications for work and municipal vehicles were used to develop budget estimates, which may not fully reflect the District's specific needs for every vehicle. In addition, any tariffs or significant supply chain changes in the industry could have a significant impact on future costs.

5. **Changing Regulations and Industry Evolution**
   The fleet electrification industry is evolving rapidly. Information can become outdated shortly after release, with new EVs regularly entering the market. Financial incentives may change unexpectedly, commodity markets (e.g., carbon credits) can fluctuate, and other factors may shift over time. The information in this report is accurate as of the time of writing and cited where appropriate, but future developments may affect its validity.

6. **Financial Constraints**
   Budget limitations may restrict the District's ability to implement some recommendations. It will be essential to prioritize actions and adopt a phased approach to progress toward these goals over time.

APPENDIX A: FLEET LISTING AND DATA

This document was provided to the District as a separate Excel document.

APPENDIX B: ELECTRICAL CAPACITY ASSESSMENT AND DETAILED CHARGING PLAN

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Technical Memorandum No. 01 v1.0 - FINAL

PROJECT NAME:	**DISTRICT OF CENTRAL SAANICH FLEET ASSESSMENT**		
OWNER:	District of Central Saanich		
PRIME CONSULTANT:	Innotech Fleet Strategies	**DATE:**	March 18, 2025
CONTRACTOR:	N/A	**MEMO NO.:**	01 v1.0
ATTENTION:	**Steven Wiebe P.Eng, PMP**		
SUBJECT:	**Preliminary Assessment**		

1 Introduction

The District of Central Saanich is interested in increasing efficiency and reducing greenhouse gas (GHG) emissions of their fleet operations. The District of Central Saanich retained Innotech Fleet Strategies to provide recommendations that allow the District to understand the industry, set realistic emission reduction targets, balance risk, and provide a roadmap for a cost-effective and successful implementation. Innotech Fleet Strategies retained PBX Engineering Ltd to assist with the following scope of work:

- Gather and review all electrical as-built information for all sites.
- Perform a site survey to verify and confirm existing conditions for all sites.
- Review existing Utility data to perform an electrical capacity assessment for all sites.
- Attend review meeting to discuss findings.
- Assist in the preparation of the EVSE Charging Plan for all sites.
- Prepare the Electrical Infrastructure plan for one (1) site.
- Attend review meeting to discuss findings.
- Provide cost estimates for EVSE, subscriptions, and electrical infrastructure for one (1) site.
- Prepare EV Ready Plan for one (1) site.

The District of Central Saanich is considering electrifying their fleet at the following three (3) locations:

- Municipal Yard
- Fire Hall #1
- Municipal Hall

The purpose of this Technical Memorandum is to:

- Review proposed equipment and determine requirements,
- Summarize the findings from the electrical site assessments,
- Summarize the findings from the electrical capacity assessments, and
- Determine options for providing power to the EVSE infrastructure for one (1) site.

2 Codes and Standards

This Technical Memorandum has been prepared in accordance with all authoritative / legislated codes and standards adopted at the time of design by the Authorities Having Jurisdiction (AHJ), including the following:

- British Columbia Building Code, 2024
- BC Hydro EV Ready Plan Guidelines
- Canadian Electrical Code Part 1 Safety Standard for Electrical Installations: CSA C22.1 – 2021
- Canadian Electric Vehicle Infrastructure Deployment Guidelines – 2014

3 Record Information / Information Provided By Others

The following information has been used as reference information in the preparation of this technical memorandum:

- Municipal Hall, 1-Year Historical Load Consumption Data, 1-Hour Resolution, Jan-Dec 2023, BC Hydro
- Firehall, 1-Year Historical Load Consumption Data, 1-Hour Resolution, Jan-Dec 2023, BC Hydro
- Municipal Yard, 1-Year Historical Load Consumption Data, 1-Hour Resolution, Jan-Dec 2023, BC Hydro

4 Definitions

In this section, industry accepted electric vehicle standards, configurations, and types are defined and explained in detail.

4.1 Abbreviations

A	Amp
AC	Alternating Current
BMS	Battery Management System
BCH	British Columbia Hydro and Power Authority
DC	Direct Current
DCFC	Direct Current Fast Charging
EV	Electric Vehicle
EVSE	Electric Vehicle Supply Equipment
GHG	Greenhouse Gas
kW	Kilowatt
PMT	Padmount Transformer
PH	Phase
V	Volts

4.2 EVSE System Configurations

There are varying configurations for EVSE as developed by electric vehicle manufacturers. As a result, they offer a range of charging options. In general, they conform to the standard system configuration shown below.

The EV battery is located on-board the vehicle. Power is delivered to the vehicle battery through an inlet, which is considered a part of the vehicle. A connector with a cord connects the vehicle and makes an electrical connection for the purposes of charging and exchanging information. The connector makes an electrical connection between the vehicle and the utility (or the power source). The utility is known as the

Energy Portal. The connector, cord, and associated components that make the connection are collectively known as the Electric Vehicle Supply Equipment (EVSE). The interface between the EVSE and Energy Portal can be as simple as a plug and receptacle interface. The charging configurations vary based on type of connector and charging levels.

4.3 Charging Levels

Four (4) levels of charging comprise charging stations for commercial applications or for public use on private or public property. They are as follows:

- AC Level 1 Charging
- AC Level 2 Charging
- DC Fast Charging (DCFC) (formerly Level 3)
- Megawatt Charging System (MCS)

The amount of time needed to charge an EV battery is a function of charge level, battery size, battery age, the EV Battery Management System (BMS), and the on-board charger specifications. The BMS will communicate with the EVSE to identify the circuit rating and adjust the charge to the battery accordingly. On-board battery chargers are only used with AC Level 1 and 2 charging. With DCFC and above, the EVSE connection is direct to the battery.

The battery to be considered for charging times is a 65kWh battery, typical of most consumer electric cars currently on the road (e.g. Chevy Bolt). The on-board charger specifications will determine the amount of charge a battery can receive. For example, the Chevy Bolt can accept up to 7.7kW of charging on an AC Level 2 Charging station. For a level 2 station of greater power output, the Chevy Bolt will still only accept up to 7.7kW. Furthermore, charging speed slows via the BMS as the battery gets closer to full to prevent damage to the battery. It can take about as long to charge the last 10 percent of the battery as the first 90 percent.

4.3.1 AC Level 1 Charging

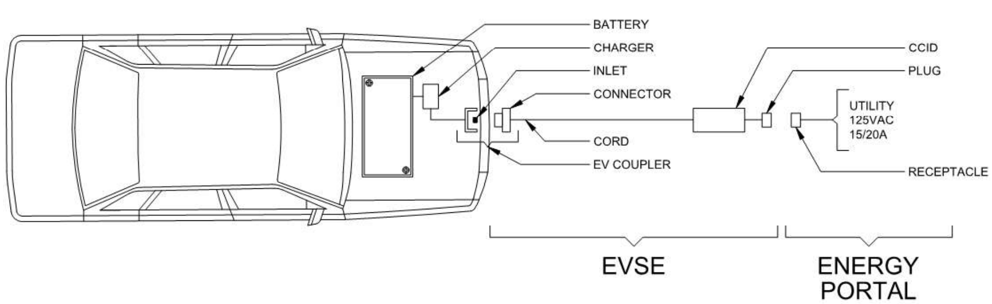

Figure 1 - Standard AC Level 1 Charging Station Configuration

AC Level 1 Charging provides the slowest charging times. Typical charging for this system is up to 1.9 kW, which translates to a current of 16 Amps (20 Amp rated circuit) at common Voltage levels (120VAC). Power is delivered to the on-board vehicle battery through an EVSE connected to facility power via plug-in from a standard 3-prong AC Cord Set (120VAC, 20 Amp). AC Level 1 Charging is more common in residential applications and typically provides charge times of 40 to 50 hours to completely charge a typical EV battery when fully depleted.

4.3.2 AC Level 2 Charging

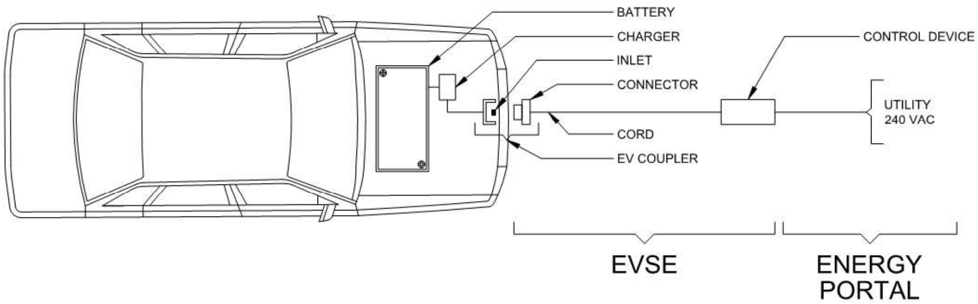

Figure 2 – Standard AC Level 2 Charging Station Configuration

AC Level 2 Charging provides faster charging times than Level 1. Typical charging for this system is between 6.7 kW and up to 19.2 kW, which translates to currents between 32 Amps (40 Amp rated circuit) and up to 80 Amps (100 Amp rated circuit). Charging currents are delivered at higher Voltages (208VAC or 240VAC, Single-Phase). Power is delivered to the on-board vehicle battery through an EVSE that is hard-wired to the facility electrical distribution system. AC Level 2 Charging is more common in commercial applications and typically provide charge times of 4 to 10 hours to completely charge an EV battery when fully depleted.

The order of magnitude total cost for a single-head AC Level 2 Charging Station is $30,000.00. The cost includes civil infrastructure, conduit and wiring, supporting electrical equipment, and the EVSE. Cost savings can be achieved by using multiple-head charging stations and power sharing technology for multiple charging stalls.

4.3.3 DC Fast Charging

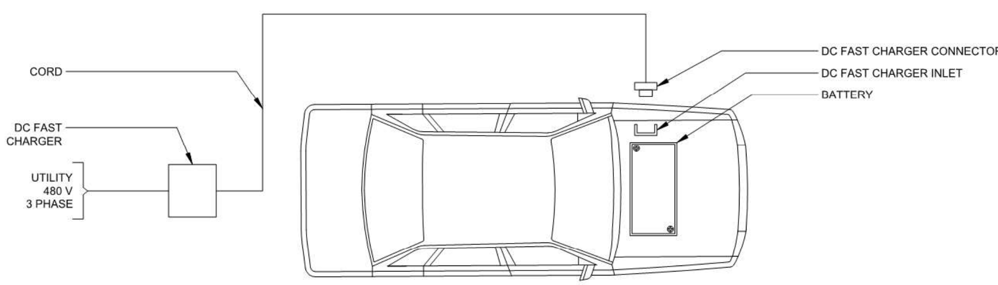

Figure 3 – Standard DC Fast Charging Station Configuration

DC Fast Charging provides the fastest charging times, and the installation required is typically the most expensive of the charging options. Typical charging for this system is between 50 kW and up to 350 kW, which translates to currents between 60 Amps (80 Amp rated circuit) and up to 420 Amps (600 Amp rated circuit) at higher Voltages (480VAC, Three-Phase) than Level 2. The on-board vehicle BMS will communicate with the EVSE to deliver DC power directly to the vehicle battery. The EVSE is hard-wired to the facility electrical distribution system. DC Fast Charging can provide a charge time as quick as 15 minutes for passenger vehicles with high power DC chargers to several hours for heavy-duty trucks with very large battery capacities.

The order of magnitude total cost for a single-head DC Fast Charging Station is $250,000.00. The cost includes civil infrastructure, conduit and wiring, supporting electrical equipment, and the EVSE. Cost savings can be achieved by using multiple charging stations and power sharing technology.

4.3.4 Megawatt Charging System

The Megawatt Charging System is the newest technology in development and is positioning itself to go beyond the current DCFC standard. Charging for this system is up 3,750 kW (3.75 Megawatt) or more. The intent of the design is to deliver the fastest charge times to the very large battery capacities that are found in heavy-duty trucks and buses. The technology is in the early adoption stage and is not expected to be feasible in the near term for the District of Central Saanich.

4.4 Intelligent Charging Stations

EVSE manufacturers provide intelligent charging solutions. Current technologies allow individual charger connectors to communicate with one another to share a common electrical load. This approach is known as Load or Power Sharing. Consider a single Level 2 charging circuit 6.7 kW (32 Amps @ 208VAC) that can be shared with up to 4 connectors. In this scenario, each connector can deliver up to the capacity of the circuit at 6.7 kW. When multiple connectors are used, the power is shared among all connectors up to a total of 6.7 kW. For example, with 4 connectors connected to EVs, each connector would deliver 1.7 kW (8 Amps @ 208VAC). With 2 connectors connected to EVs, each connector would deliver 3.4 kW (16 Amps @ 208VAC). With 4 EVs connected, the charging stations are intelligent in that they shift charge to connected EVs that require charge as other connected EVs become fully charged.

4.5 Networked Charging Stations

Networked EV Charging Stations are connected to the internet via cellular communications. EVSE providers charge an annual fee to manage the network. EVSE connected to the network allow facility owners to collect data such as time and location of charging events, energy provided, GHGs avoided, and any applicable billing and revenue. Facility owners can also track charge time, connection time, average and peak power, and total power per event. Networking provides the ability for EVSE to integrate with building management systems to move EV charging to off-peak times or to throttle down the charging output during times of peak power demand and energy costs. Strategies like these can be employed to increase EVSE installation beyond base electrical capacity and to save facilities from cost-prohibitive utility upgrades.

Networked chargers are typically required for Carbon Credit tracking and reporting as they provide a reliable method for collecting data on energy use per vehicle and, consequently, the associated emission reductions.

4.6 EVSE Product Options

The following section summarizes the EVSE product options. The EVSE manufacturer that is currently deployed by the District of Central Saanich and the only to be considered in this report is FLO. For the purposes of Fleet charging, only AC Level 2 and DC Fast Charging will be considered.

4.6.1 AC Level 2 Charging

FLO provides networked Level 2 charging solutions for property owners, businesses, and municipalities. The charging stations come in standard and power select models. Each model allows for power sharing models.

Technical specifications for the charging stations are summarized in the table below.

Specification	FLO CoRe+	FLO CoRe+ Max
Voltage	208/240VAC, Single-Phase	208/240VAC, Single-Phase
Current	32A (power shared between up to four ports)	80A (power shared between up to two ports)

Specification	FLO CoRe+	FLO CoRe+ Max
Power	Up to 6.66/7.68kW @ 208/240V	Up to 16.6/19.2kW @ 208/240V
Wiring	3-wire	3-wire
Enclosure Rating	Type 4X	Aluminum Type 3R per UL 50E
Connector	SAE J1772 (up to 4)	SAE J1772 (up to 2)
Cable Length	6.4m (optional 7.6m)	6.8m (optional 7.6m)
Networking	Cellular 4G LTE	Cellular 4G LTE
Certification	CSA and UL	CSA and UL
Operating Temperature	-40°C to 50°C	-40°C to 50°C
Installation	Pedestal on concrete or wall mounting	Pedestal on concrete or wall mounting

Table 1 - AC Level 2 Charging Station Specifications

Power Sharing strategies for the FLO CoRe+ are summarized in the following table:

Ports In Use	Amps Output Per Port	kWh Output Per Port (208V)
1	32 Amp	6.66 kWh
2	16 Amp	3.33 kWh
3	10.7 Amp	2.22 kWh
4	8 Amp	1.66 kWh

Table 2 - FLO CoRe+ Power Sharing

Refer to *Appendix A* for *FLO CoRe+ and CoRe+ Max Level 2 Fleet Charging Stations Specifications* for more details.

4.6.2 DC Fast Charging

FLO provides robust, reliable, and networked DC Fast Charging Stations. Technical specifications for the charging stations are summarized in the table below.

Specification	FLO SmartDC	FLO Ultra
Voltage	480VAC, Three-Phase	480VAC, Three-Phase

Specification	FLO SmartDC	FLO Ultra
Current	65A or 130A (100A or 200A Breakers)	Up to 385A (power shared between two ports). (500A Breaker)
Power	50kW or 100kW (54kVA or 108kVA @ 93% PF)	Up to 320kW
Wiring	4-wire	4-wire
Enclosure Rating	Type 3R	Type 3R
Connector	1: SAE Combo and CHAdeMO	2: CCS Type 1 and CHAdeMO
Cable Length	3.7m (optional 6.1m)	(2) 5.4m
Networking	Cellular 4G LTE	Cellular 4G LTE
Certification	CSA and UL	CSA and UL
Operating Temperature	-40°C to 50°C	-40°C to 55°C
Installation	Concrete pedestal	Concrete pedestal

Table 3 -DC Fast Charging Station Specifications

Refer to *Appendix A* for *FLO SmartDC and Ultra DCFC Stations Specifications* for more details.

5 Requirements

The following section summarizes the requirements of the proposed EVSE, industry standards, and the electrical code requirements.

5.1 Canadian Electrical Code Requirements

According to the Canadian Electrical Code (CEC) the following requirements must be met:

- Permanent warning sign installed at the connection of the EVSE to the branch circuit warning against operation of the equipment without sufficient ventilation.
- Separate branch circuit protected by appropriately sized breaker, disconnect, and conductors. Located on the supply side of the point of connection for the EVSE, within sight of and accessible to the EVSE, and capable of being locked in the open position.
- Outdoor charging sites shall be permitted to include curbsides, open parking structures, parking lots and similar locations.
- Requires certification from an accredited test agency such as CSA group (or accepted equivalent).

5.2 Canadian EV Infrastructure Deployment Guidelines

The Canadian EV Infrastructure Deployment Guidelines provide essential information and resources to implement EV charging infrastructure. This information includes location selection and lighting recommendations.

The location selected should be such to avoid tripping hazards and allow vehicles to park forwards or backwards in parking space. If EVSE is mounted in front of vehicle, wheel-stops or bollards may be recommended. See the following Figure 4 for a typical EVSE middle placement pedestal mounting in row parking.

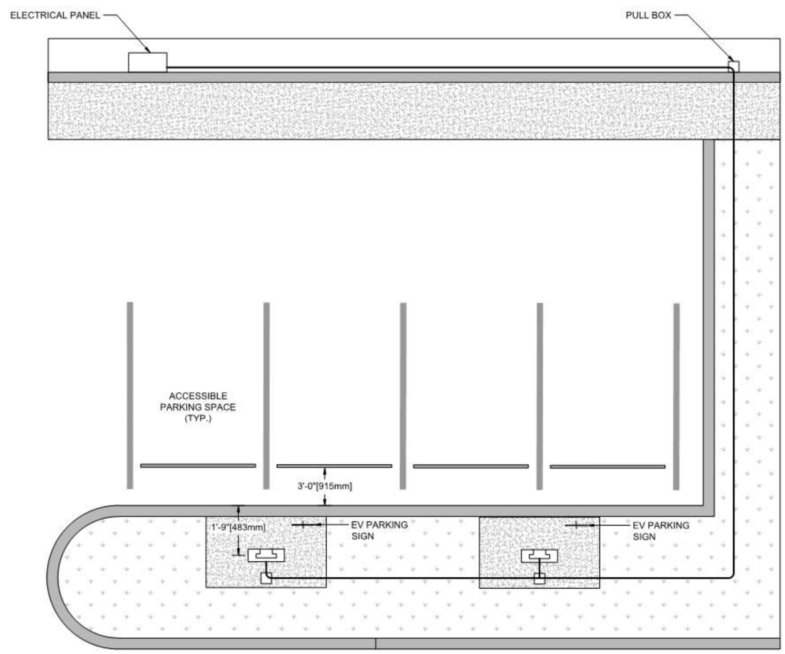

Figure 4 - Typical EVSE Middle Placement Pedestal Mounting in Row Parking

Lighting should be sufficient to read associated signs, instructions, or controls on EVSE and provide visibility around the vehicle for all possible EV inlet locations.

6 Assessment and Findings

The three (3) locations to be considered are the Municipal Yard, Fire Hall #1, and Municipal Hall. The following is a summary of the review of the electrical record information and an electrical capacity assessment of the existing services at the sites.

Refer to *Appendix B: Load Analysis Summary*

6.1 Methodology

6.1.1 Existing Electrical Capacity Analysis

The existing peak demand load was ascertained using 1-Year BC Hydro provided load consumption history. The existing peak demand was determined by taking the maximum value of all the demand load data that was provided. Load consumption history provided by BC Hydro was provided as metering data and captured in 1-day intervals. This is a risk that the peak demand may have occurred within either the 1-day interval and was not captured. A Demand Load Study performed by a licensed electrician is recommended to confirm results at each of the locations prior to performing any work.

Refer to *Appendix C: BC Hydro 1-Year Historical Consumption Summary*

6.1.2 Minimum Required Demand Load

With the total energy requirement information provided by the Innotech analysis, the minimum required demand load was calculated as follows:

$$Min.\ Required\ Demand\ Load\ [kW] = \frac{Annual\ Total\ Energy\ Requirement\ \left[\frac{kWh}{annum}\right]}{Annual\ EV\ Charging\ Time\ \left[\frac{h}{annum}\right]}$$

The annual EV charging time was determined in consultations with Innotech about individual facility daily operations. It was calculated as follows:

$$Annual\ EV\ Charging\ Time\ \left[\frac{h}{annum}\right] = \left(Daily\ EV\ Charging\ Time\ \left[\frac{h}{day}\right]\right) * \left(\#\ of\ Days\ Charging\ per\ Week\ \left[\frac{day}{week}\right]\right) * \left(\#\ of\ Weeks\ per\ Annum\left[\frac{week}{annum}\right]\right)$$

The daily EV charging time and number of days charging per week for each facility is tabulated below.

Location	Daily EV Charging Time [h/day]	# of Days Charging per Week [day/week]
Municipal Yard	12 h/day	7 day/week
Fire Hall	12 h/day	7 day/week
Municipal Hall – Emergency	2 h/day	7 day/week
Municipal Hall – Non-emergency	10 h/day	7 day/week

Table 4 - Summary of typical EV charging times per location.

Refer to *Appendix B: Load Analysis Summary.*

6.1.3 Proposed Equipment

The Innotech analysis provided to PBX the number of vehicles to be transitioned to electric annually through 2035. Based on the estimated daily energy use and daily charge time of the EVs, the recommended EVSE type was determined.

Refer to *Appendix A: EVSE Technical Specifications.*

Refer to *Appendix B: Load Analysis Summary.*

6.2 Municipal Yard

6.2.1 Location

The District of Central Saanich Municipal Yard is located at 1703 Keating Cross Rd, Saanichton, BC V8M 1W9 and comprises several buildings on site to serve Public Works operations, including a vehicle service shop, material storage sheds, and an administration building. The Public Works department operates, constructs, and maintains the engineering infrastructure in Central Saanich. There are preliminary discussions to replace the yard.

The site has six (6) existing Level 2 EVSE serving six (6) charging stalls. Refer to the Location Plan in Figure 5.

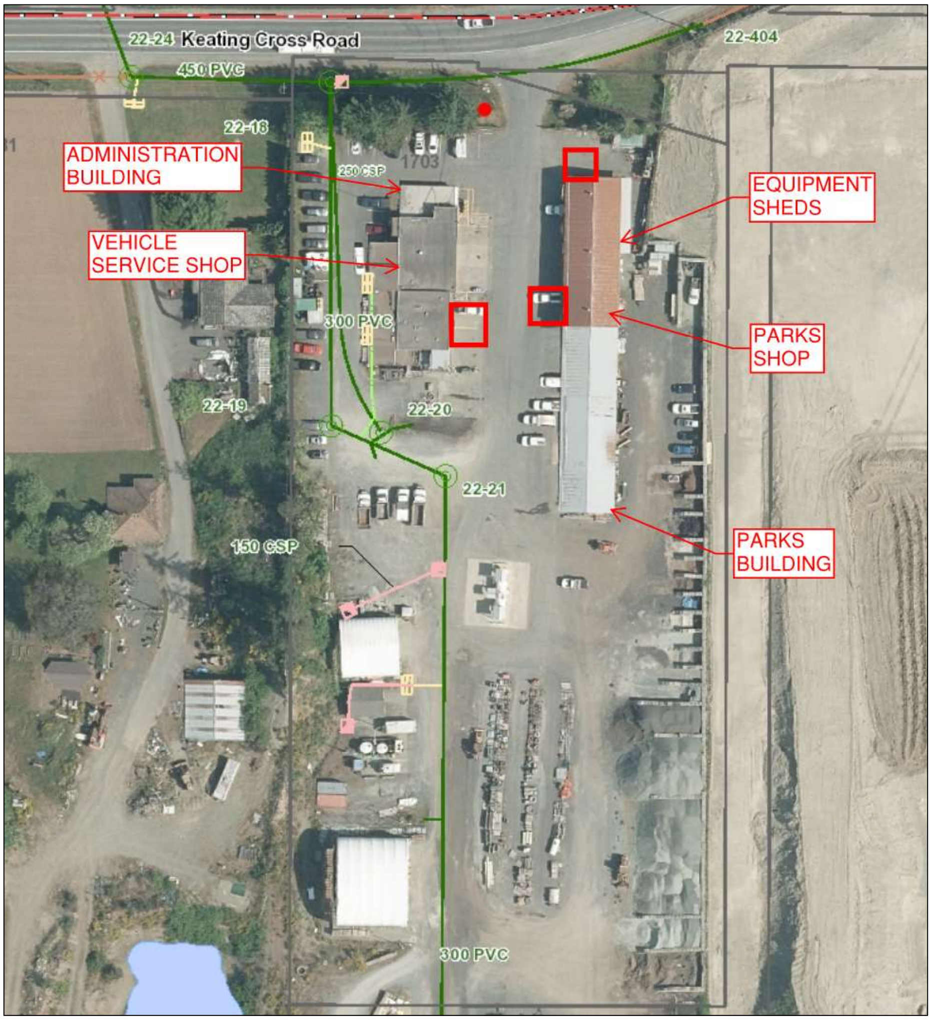

Figure 5 – Municipal Yard Location Plan

6.2.2 Existing Electrical Infrastructure

Refer to *Appendix D: Single Line Diagram*

The existing incoming electrical utility service to the Municipal Yard is 600A (80% Rated), 120/208V, 3-phase, and is supplied overhead from a BC Hydro pole-mounted transformer bank on Keating Cross Rd. The electrical room is located on the second floor of the Vehicle Service Shop. The service feeds a 600A, 120/208V, 3-phase, 4-wire, main switch and splitter. Connected to the splitter are disconnect switches for the panels throughout the site.

The existing Level 2 EVSE are served from Panels 'D', 'Parks Shop', and 'West Shop'.

6.2.3 Electrical Capacity Assessment

Refer to *Appendix B: Load Analysis Summary.*

The existing 600A, 120/208V, 3-phase service base electrical capacity was calculated at $208V * 480A\ (600A\ continuous\ rating\ @\ 80\%) * \sqrt{3}\ (three - phase)/1000 = 173kVA$. The maximum electrical demand load was determined to be 64kVA. The existing service is underloaded at 37% of the base service size and there is a remaining capacity of 109kVA for new loads. The existing service capacity is sufficient to support the potential EVSE loads and a service upgrade will not be required.

Capacity shall be confirmed via Demand Load Study by a qualified Electrical Contractor (CEC C22.1 Rule 8-106).

6.2.4 Proposed Equipment & Load Analysis

Based on the fleet assessment performed by Innotech, the facility will require a total number of EVSE at each year as tabulated below:

Year	# of Level 2 (40A) Circuits	# of Level 2 Connectors	# of DCFC
2025	2	5	
2027	2	4	
2028		2	
2029	1	1	
2031		1	
2033	1	1	1
2034	1	1	
2035		3	

Table 5 – Municipal Yard proposed EVSE at each year.

The existing service capacity is sufficient to support the potential EV loads. Charge management strategies will need to be employed to maintain a total EV load below the existing service capacity. The recommended strategy is circuit sharing with four (4) EV connectors per Level 2 circuit. Some vehicles may require charge above that which is available on a Level 2 circuit with all four (4) EV connected. Operations will need to be adjusted accordingly.

The proposed plan is to provide a 200A, 120/208V, 3-phase, 4-wire panel dedicated to the Level 2 EVSE circuits. The panel would be connected via disconnect on the main service splitter in the electrical room. EVSE circuits will require breakers, conductors, and surface-mount raceways. EVSE will require mechanical protection.

It is also recommended that a new dedicated service to an electrical kiosk be installed to serve the electrical requirements of the DCFC EVSE. The separate service will allow for the EVSE expansion to proceed without impacting building operations. The service entrance, meter base, and EVSE distribution would be contained in the electrical kiosk. The kiosk allows flexibility as it is possible to relocate the structure as needed by future needs.

6.2.5 Opinion of Construction Cost

The total estimated order of magnitude opinion of electrical construction cost for 2025 is **$194,000.00**. The construction will cover the requirements of the EV fleet deployment through 2028. The breakdown of costs is as follows:

Description	Cost
Civil Infrastructure	$ 4,000.00
Conduit & Wiring	$ 39,000.00

Description	Cost
Electrical Equipment	$ 11,000.00
Project Wide	$ 9,000.00
Contingency (25% Const.)	$ 16,000.00
Construction Subtotal	**$ 79,000.00**
EVSE Cost	$ 97,836.97
Engineering	$ 12,000.00
Demand Load Study	$ 5,000.00
Total	**$ 193,202.93**

The estimated order of magnitude opinion of electrical construction cost for subsequent Level 2 connectors is **$10,900.00**.

The estimated order of magnitude opinion of electrical construction cost for subsequent Level 2 circuits is **$8,100.00**.

The estimated order of magnitude opinion of electrical construction cost for an electrical kiosk and single-connector DCFC is **$250,000.00**.

The estimated costs are based on general assumptions and typical conditions. Actual costs may vary significantly due to factors including, but not limited to: site conditions, locations of charge stalls, distance to power supply, permitting, code compliance, and scope of work. This estimate is provided as an order-of-magnitude assessment and is subject to refinement based on detailed design, site assessments, and market conditions at the time of installation.

6.3 Fire Hall #1

6.3.1 Location

The District of Central Saanich Fire Hall #1 is located at 1512 Keating Cross Rd, Saanichton, BC V8M 1W9. It comprises offices, meeting rooms, and an apparatus bay. The electrical service entrance is located in the electrical room on the Southeast corner of the apparatus bay.

The site has two (2) existing Level 2 EVSE serving two (2) charging stalls. Refer to the Location Plan in Figure 6.

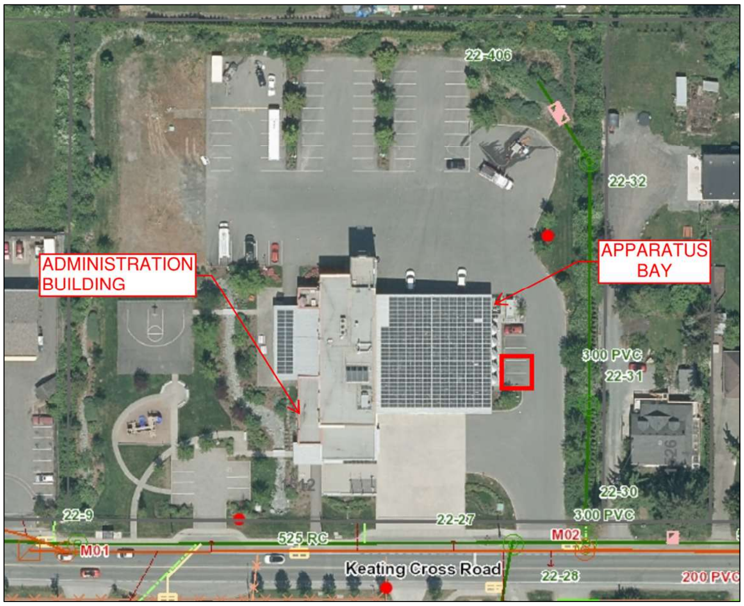

Figure 6 – Fire Hall #1 Location Plan.

6.3.2 Existing Electrical Infrastructure

The existing incoming electrical utility service to the facility is 800A (80% Rated), 120/208V, 3-phase, and is supplied from a BC Hydro PMT on Keating Cross Rd. The service feeds a 800A service entrance rated main breaker in the 1000A, 120/208V, 3-phase, 4-wire, main distribution centre MDC. Refer to the Partial Single Line Diagram in Figure 7.

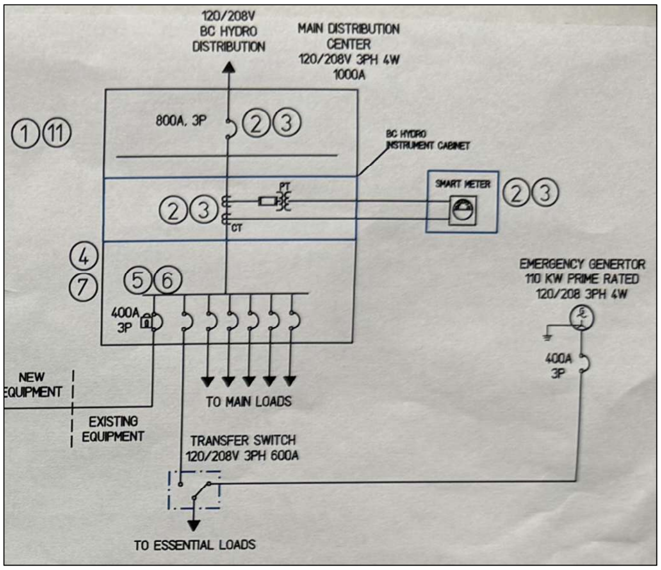

Figure 7 – Fire Hall #1 Service Entrance Partial Single Line Diagram

6.3.3 Electrical Capacity Assessment

Refer to *Appendix B: Load Analysis Summary.*

The existing 800A, 120/208V, 3-phase service base electrical capacity was calculated at $208V * 640A$ $(800 A\ continuous\ rating\ @\ 80\%) * \sqrt{3}\ (three - phase)/1000 = 231kVA$. The maximum electrical demand load was estimated to be 64kVA. The existing service is loaded at 28% of the base service size and there is a remaining capacity of 167kVA for new loads. The existing service capacity is sufficient to support the potential EVSE loads and a service upgrade will not be required. Capacity shall be confirmed via Demand Load Study by a qualified Electrical Contractor (CEC C22.1 Rule 8-106).

6.3.4 Proposed Equipment & Load Analysis

Based on the fleet assessment performed by Innotech, the facility will require a total number of EVSE at each year as tabulated below:

Year	# of Level 2 (40A) Circuits	# of Level 2 Connectors	# of DCFC
2034	1	1	

Table 6 – Fire Hall #1 proposed EVSE.

The existing service capacity is sufficient to support the potential EV loads. Charge management strategies should be employed to maintain the total EV load. The recommended strategy is circuit sharing with two (2) EV connectors per Level 2 circuit.

The proposed plan is to provide a 200A, 120/208V, 3-phase, 4-wire panel dedicated to the Level 2 EVSE circuits. The panel would be connected via breaker on the main distribution centre in the electrical room.

6.4 Municipal Hall

6.4.1 Location

The District of Central Saanich Municipal Hall is located at 1903 Mount Newton X-Road, Central Saanich, BC, V8M 2A9 and serves as the administrative headquarters of Central Saanich. The building is shared with Public Safety services (Police and Fire Departments). There are preliminary discussions to replace the Hall.

The site has six (6) existing Level 2 EVSE serving six (6) charging stalls. In addition, there are two (2) public Level 2 EVSE charging stalls. Refer to Location Plan in Figure 8.

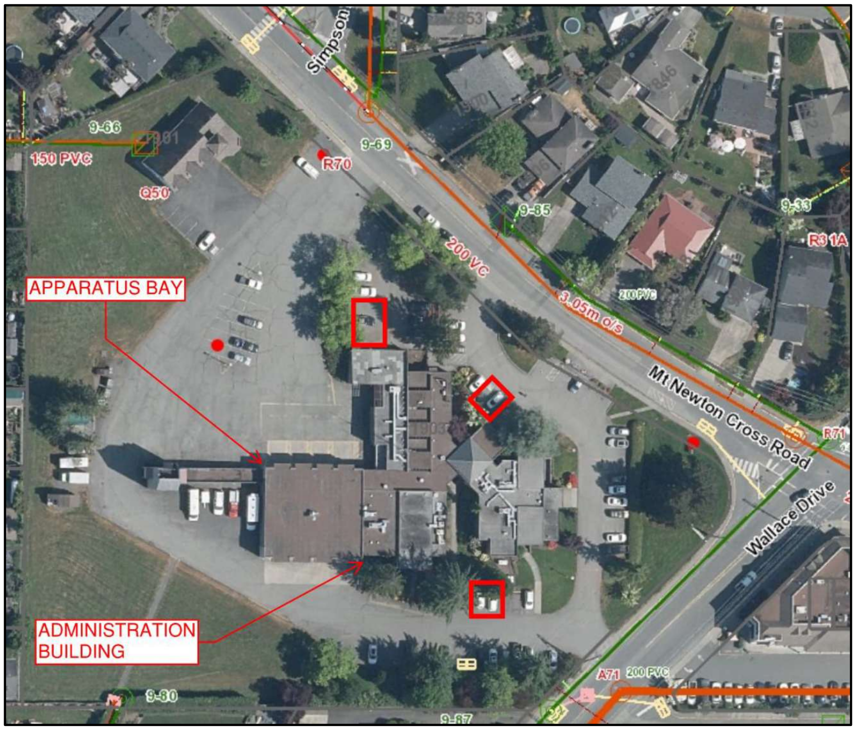

Figure 8 – Municipal Hall Location Plan

6.4.2 Existing Electrical Infrastructure

Refer to *Appendix D: Single Line Diagram*

The existing incoming electrical utility service to the facility is 800A (80% Rated), 120/208V, 3-phase, underground service and is supplied from a BC Hydro pole-mounted transformer bank on Mt Newton Cross Road. The service feeds an 800A, 120/208V, 3-phase, 4-wire main switch and switchgear assembly located in the Main Electrical Room. There also exists a 225A, 120/208V, 3-phase, 4-wire Panel 'EV' dedicated to EVSE.

6.4.3 Electrical Capacity Assessment

Refer to *Appendix B: Load Analysis Summary.*

The existing 800A, 120/208V, 3-phase service base electrical capacity was calculated at $208V * 640A\ (800A\ continuous\ rating\ @\ 80\%) * \sqrt{3}\ (three - phase)/1000 = 231kVA.$ The maximum electrical demand load was estimated to be 156kVA. The existing service is loaded at 68% of the base service size and there is a remaining capacity of 75kVA for new loads. The existing service capacity is not sufficient to support the potential Level 2 and DCFC EVSE loads, and a service upgrade will be required. However, the existing service capacity is sufficient to support the Level 2 EVSE load. Capacity shall be confirmed via Demand Load Study by a qualified Electrical Contractor (CEC C22.1 Rule 8-106).

6.4.4 Proposed Equipment & Load Analysis

Based on the fleet assessment performed by Innotech, the facility will require a total number of EVSE at each year as tabulated below.

Year	# of Level 2 (40A) Circuits	# of Level 2 Connectors	# of DCFC
2025	2	2	
2027		1	
2028		1	
2029		1	
2030			5
2035	1	2	

Table 7 – Municipal Hall proposed EVSE.

The existing electrical capacity is sufficient to support the potential Level 2 EVSE loads. Charge management strategies should be employed to maintain the total EV load. The recommended strategy is circuit sharing with up to four (4) EV connectors per Level 2 circuit. Furthermore, DC Fast Charging connectors will need to be added to meet emergency operation needs.

The proposed plan is to use existing electrical Panel 'EV' to serve the Level 2 EVSE circuits. The panel has physical capacity for additional breakers. The EVSE circuits will require breakers, conductors, and raceways. EVSE will require mechanical protection.

It is also recommended that a new dedicated service to an electrical kiosk be installed to serve the electrical requirements of the DCFC EVSE. The separate service will allow for the EVSE expansion to proceed without impacting building operations.

6.4.5 Opinion of Construction Cost

The total estimated order of magnitude opinion of electrical construction cost for 2025 is **$88,000.00**. The construction will cover the requirements of the EV fleet deployment through 2028. The breakdown of costs is as follows:

Description	Cost
Civil Infrastructure	$ 7,000.00
Conduit & Wiring	$ 11,000.00
Electrical Equipment	$ 1,000.00
Project Wide	$ 9,000.00
Contingency (25% Const.)	$ 7,000.00
Construction Subtotal	**$ 35,000.00**
EVSE Cost	$ 36,000.00
Engineering	$ 12,000.00
Demand Load Study	$ 5,000.00
Total	**$ 88,000.00**

The estimated order of magnitude opinion of electrical construction cost for the subsequent Level 2 connector in 2029 is **$10,870.55**.

The estimated order of magnitude opinion of electrical construction cost for an electrical kiosk and single-connector DCFC is **$250,000.00**. Each additional connector is estimated at **$75,000.00**.

The estimated order of magnitude opinion of electrical construction cost for the subsequent Level 2 circuit and connectors for the Fire Department fleet deployment in 2035 is **$30,100.00**.

The estimated costs are based on general assumptions and typical conditions. Actual costs may vary significantly due to factors including, but not limited to: site conditions, locations of charge stalls, distance to power supply, permitting, code compliance, and scope of work. This estimate is provided as an order-of-magnitude assessment and is subject to refinement based on detailed design, site assessments, and market conditions at the time of installation.

7 Conclusion and Recommendation

We request this document and attachments be reviewed in their entirety.

It is recommended the EVSE infrastructure be provided as noted herein.

It is recommended that the District of Central Saanich review their fleet EV and EVSE infrastructure deployment in 5-years' time as the approach noted herein may need to be adjusted as technologies mature.

8 Closure

This document has been prepared based upon the information referenced herein. It has been prepared in a manner consistent with good engineering judgement. Should new information come to light, PBX Engineering Ltd. requests the opportunity to review this information and our conclusions contained in this report. This document has been prepared for the exclusive use of the District of Central Saanich, and there are no representations made by PBX Engineering Ltd. to any other party. Any use that a third party makes of this document, or any reliance on or decisions made based on it, are the responsibility of such third parties.

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Attachments:

- Appendix A: EVSE Technical Specifications
- Appendix B: Load Analysis Summary
- Appendix C: BC Hydro 1-year Load History Summary
- Appendix D: Single Line Diagram

Appendix A: EVSE Technical Specifications

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CoRe+™

Shown with optional cable management system

ENERGY STAR

C US

CoRe+

Smart level 2 charging station for private, public and commercial applications

The CoRe+ charging station is specifically designed for private applications such as workplaces, multi-unit residential buildings, fleets, and is also suitable for public spaces

Choose between the Standard and PowerSharing™ versions of the CoRe+ at acquisition time.

Benefits

- **PowerSharing technology (optional) (U.S. Pat. No. 9,927,778)**
  Greatly reduce installation cost by sharing the remaining incremental capacity of an existing electrical infrastructure
- **PowerLimiting™ technology (U.S. Pat. No. 10,197,976)**
  Add multiple charging stations to an existing installation while minimizing the building's peak power demand through:
  - Fixed limit
  - Scheduled limitations
- Rugged and reliable design able to withstand harsh weather

Smart Charging Solution

- **Enhanced charging station owner experience** - Complete remote management capabilities including software and firmware updates
- **Enhanced user experience** - Deliver real-time updates and notifications to drivers
- **Revenue generation** – Implement payment services to generate revenue
- **Access control** – Configure stations to authorize access using the FLO mobile app or RFID card authentication, or allow unrestricted access to the station

Key features

- Type 4X enclosure in cast aluminum casing
- Certified to operate in temperatures ranging from -40 °C to 50 °C / -40 °F to 122 °F
- Equipped with a charging cable that remains flexible at low temperature
- Wall-mounted and pedestal configuration options. Pedestal configuration helps meet ADA requirements
- Pedestal configuration that helps meet ADA requirements
- Modular design to facilitate servicing and maintenance
- Access provided free of charge or according to a usage fee
- LED status indicator
- Optional cable management system
- Optional cascading kit enables serial daisy-chain connection of multiple charging stations on pedestals and on the same branch circuit

Overview

The CoRe+ charging station is designed for applications where multiple charging stations may be necessary now or in the future, such as public sites, workplaces, multi-unit residential buildings (condos and apartments), or commercial fleets. The CoRe+ can be equipped with a cable management system keeping the cables safe and suspended.

Future-proof energy management features

PowerSharing

- Allows the addition of charging ports (keeping up with the fast-paced increase demand for EVSE) for limited electrical infrastructure.
- Requires minimal modification to an existing electrical installation. Our technology can power up to 4 times more vehicles than standard installations would allow.

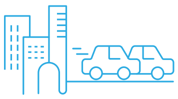
PowerLimiting

- Minimize the incremental power demand on the building's infrastructure (which can significantly increase with uncontrolled EVSEs).
- Limits the power drawn from the grid for an entire site based on a schedule or by communicating directly with a BMS.

Physical features

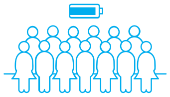
- Rugged charging station able to withstand extreme weather and corrosion
- Thick and sturdy cast aluminum casing
- Universal SAE J1772 connector
- Flexible 6.4 m / 21' (optional 7.62 m / 25') cable that remains malleable even during winter's coldest temperatures
- Mounting pedestal helping to meet ADA requirements

Applications



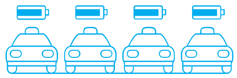
Public sites

For business owners and organizations wanting to provide their customers with first-class charging experience and become a destination of choice, while demonstrating their sustainable development leadership.



Workplace

For companies looking to offer an EV charging service to their employees, and looking for a solution that can evolve at the same rate as the demand for the service while maintaining reasonable installation and operation costs.



Fleet

For fleet managers who wish to grow their EV fleets without expanding their electrical infrastructure while maintaining the operational costs at an affordable level.

Available configurations

CoRe+

Wall-mounted

Single pedestal

Back-to-back pedestal

CoRe+ with cable management system

Wall-mounted

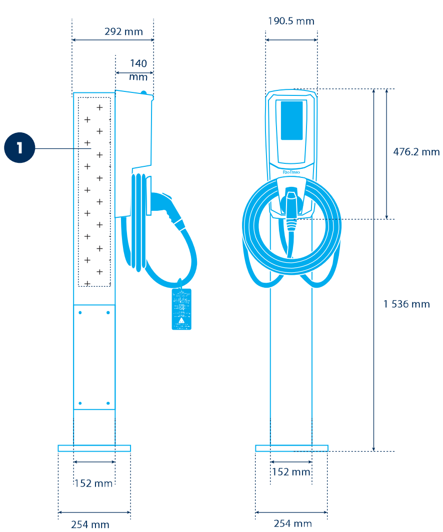
Dual side-to-side

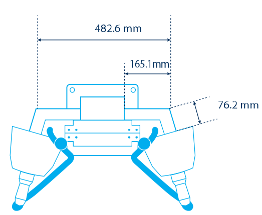
Back-to-back or single pedestal

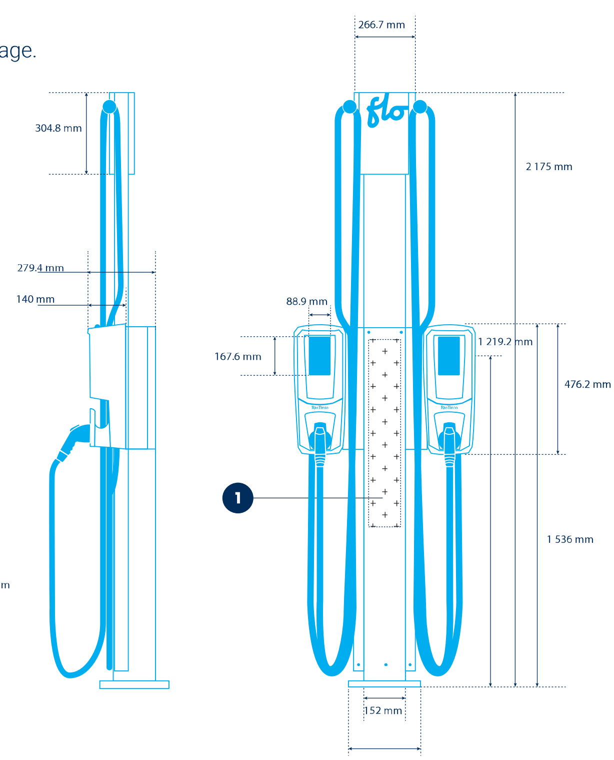
Dimensions and customization

1 Every charging station includes easily customizable branding areas.
The CoRe+ comes in its original colour, which can be modified with your custom signage.

Customizable partner panel area
Dimensions (H x W): 760 mm (30") x 120 mm (4.72")







CoRe+™

Technical specifications

	Standard option	PowerSharing option
Aluminum casing	Type 4X enclosure	
Charging connector	SAE J1772	
Cable	6.4 m (optional 7.62 m) / 21’ (optional 25’ m)	
Input Power	Standard: 30 A @ 208 VAC or 240 VAC for each charging station	PowerSharing : 32 A @ 208 VAC or 240 VAC per set of 4 charging stations
Charging power	1.2 kW to 7.2 kW (maximum configurable by software)	
Output current	6 A to 30 A (maximum configurable by software)	
Integrated GFCI	20 mA, auto reset (3 attempts at 15-minute intervals)	
Frequency	60 Hz	
Operating and storage temperature	-40°C to +50°C / -40 °F to 122 °F	
Weight	Charging station: 21 lbs / 9.53 kg Pedestal: 32 lbs / 14.5 kg	
Humidity	Up to 95% (non-condensing)	
Card reader	ISO 14443 A/B, ISO 15693, NFC	
Communication interface	ZigBee - IEEE 802.15.4 meshed network	
Networking	Cellular – LTE (gateway is installed separately for optimal performances)	
Certifications	CSA- C22.2 No. 280 / UL 2594, CSA C22.2 No 281.1 and 281.2 / UL 2231-1 and 2231-2 Energy Star	
EMC compliance	USA -FCC 47 CFR part 15 class A CAN - ICES-3 (A)	
Metering Accuracy	Certified according to California Type Evaluation Program (CTEP)	
Model Number	C+V2-EVSE-30-25-LC1-RR1-NSL-FL-NRRV-ST (COCH0001-FL-P07)	C+V2-EVSE-30-25-LC1-RR1-NSL-FL-NRRV-PS (COPS0001-FL-P07)

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Designed and manufactured by AddÉnergie

CoRe+ MAX™

The fastest[1] Level 2 charging station

Designed to evolve as more drivers make the switch to electric vehicles, the CoRe+ MAX is destined to become an integral part of your fleet, commercial, or workplace application.

Easy to use and reliable

- Cable management system (CMS) with unique counterweight system for smooth retraction.
- Built to last with rugged Type 3R aluminum water resistant enclosure and integrated cable holster for neat, safe cable storage.

Versatile and efficient

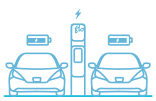
- Save on electricity costs with patented PowerSharing™ and PowerLimiting™ technologies.
- Customizable installation choices suit a variety of parking configurations.

Smart Station, Smarter Investment

- Monitor station health and gain key insights with the cloud-based management dashboard.
- Maximize uptime with proactive station monitoring and remote intervention services.

For Workplace

Offer EV charging services to your employees, with a solution that will evolve with you as more drivers make the switch to electric vehicles.



For Fleets

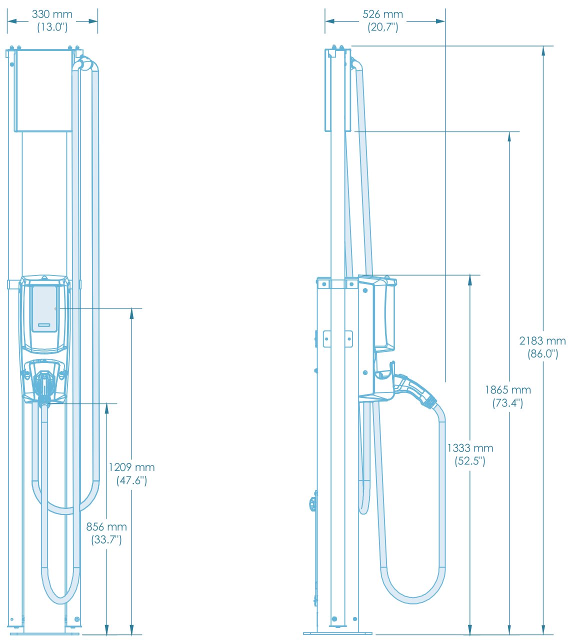
Ideal for fleet managers who wish to grow their light and medium duty EV fleets while maintaining affordable operational costs.

[1] As permitted under the SAE J1772 standard.

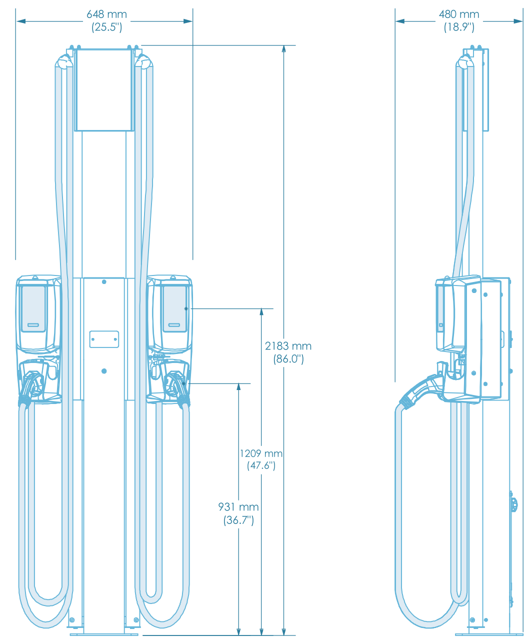
C US

Available Configurations

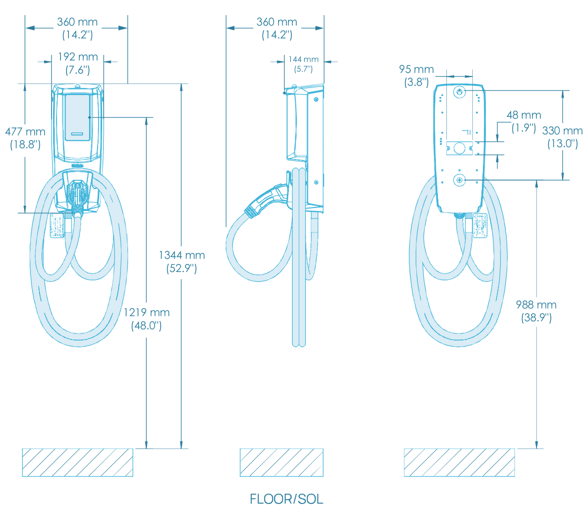
DIMENSIONS



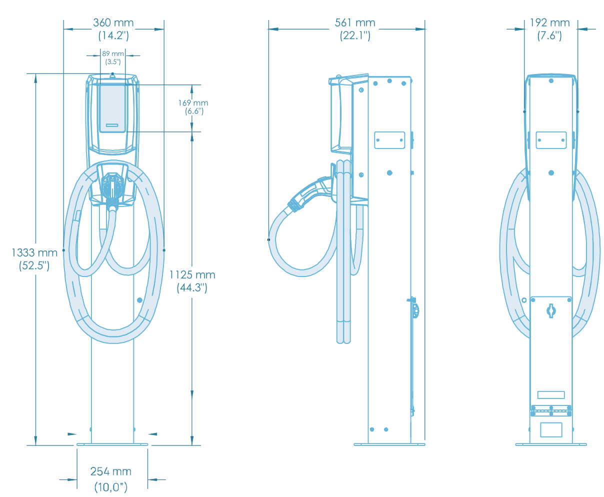
Single CoRe+ MAX on pedestal with CMS



Dual side-by-side CoRe+ MAX on pedestal with CMS



Wall Mount CoRe+ MAX (without CMS)



Single CoRe+ MAX on pedestal (without CMS)

Technical Specifications

HARDWARE

Enclosure	Aluminium Type 3R
Charging connector	SAE J1772
Cable length	7.62 m / 25 ft (without CMS)
Cable Management System (optional)	6.79 m / 19 ft cable - Calibrated suspended weight
Operating and storage temperature	40 °C to 50 °C / -40 °F to 122 °F
Weight	Charging station: 12.1 kg / 27 lbs; Pedestal: 14.5 kg / 32 lbs; CMS (CoRe+ MAX): 10.9 kg / 24 lbs
Humidity	Up to 95% (non-condensing)

ELECTRICAL

Electrical load	208 VAC or 240 VAC for each charging station
Charging power	1.2 kW to 19.2 kW (maximum configurable by software)
Output current	6 A to 80 A (maximum configurable by software and adjustable via a rotary switch)
Integrated GFCI	20 mA, auto reset (3 attempts at 15-minute intervals)
Frequency	60 Hz

INTERFACE

Card reader	ISO 14443 A/B, ISO 15693

CONNECTIVITY

Communication interface	ZigBee - IEEE 802.15.4 meshed network
Networking	Cellular – 4G/LTE (gateway is installed separately)

CERTIFICATION AND COMPLIANCE

Certifications	CSA- C22.2 No. 280 UL 2594, CSA C22.2 No 281.1 and 281.2 UL 2231-1 and 2231-2 UL Listed
EMI Compliance	USA - FCC 47 CFR part 15 class A CAN - ICES-003 (A)
Americans with Disabilities	ADA Compliant

Learn more
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1 (855) 543-8356
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Made in North America

Designed and manufactured by AddÉnergie Technologies Inc. d/b/a FLO.

SmartDC™

SmartDC™

Multi-Standard DC Fast Charging Station

The SmartDC™ is a robust, reliable, 50 kW or 100 kW multi-standard charging station for commercial and industrial applications designed for indoor and outdoor use. Its sturdy construction ensures longer service life and greater operational reliability, even in harsh environmental conditions.

Equipped with both CHAdeMO and SAE Combo (CCS1) connectors, the SmartDC charging station is designed to offer a fast, reliable charging experience for every electric vehicle capable of DC fast-charging.

The SmartDC comes with a remote management tool that connects with FLO's cloud-based servers, allowing for remote updates and monitoring. With this powerful capability, the SmartDC can be integrated into any modern Electric Vehicle (EV) Charging Network. It is also ready to support ISO-15118 standard (Plug & Charge).

*The 50 kW SmartDC charger is shown here with optional cable management system and optional credit card reader.

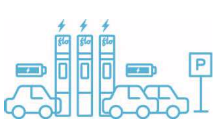
Key features

- Robust type 3R casing, reliable and designed to withstand harsh weather and corrosion
- Modular design to facilitate servicing and maintenance
- Available in two versions: 50 kW and 100 kW maximum output
- Compatible with the CHAdeMO and SAE Combo (CCS1) protocols (Tesla compatible, with adapter)
- RFID card and/or mobile app authentication and payment
- Optional cable management system in the 50 kW version
- Optional credit card reader (US only)
- Flexible billing based on time and/or kWh delivered, when permitted by the local jurisdiction

Benefits

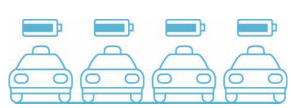
- Reduced Mean Time To Repair (MTTR) and enhanced customer experience with the remote management tool
- Interoperability with networks supporting OCPP1.6J
- Enhanced charging station owner experience with complete remote management capabilities including software and firmware update
- Enhanced user experience with real-time updates and notifications to drivers
- Revenue generation through payments via RFID member cards, credit cards, NFC, and mobile app
- Configurable Access Control
- Reduced lead time thanks to its North American manufacturing

Applications



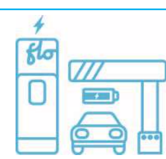
Commercial

For parking lot owners interested in offering their customers a first-class experience by providing EV DC fast-charging services.



Fleet

For EV fleet managers who want to minimize charging time and maximize the usage rate of their fleet.



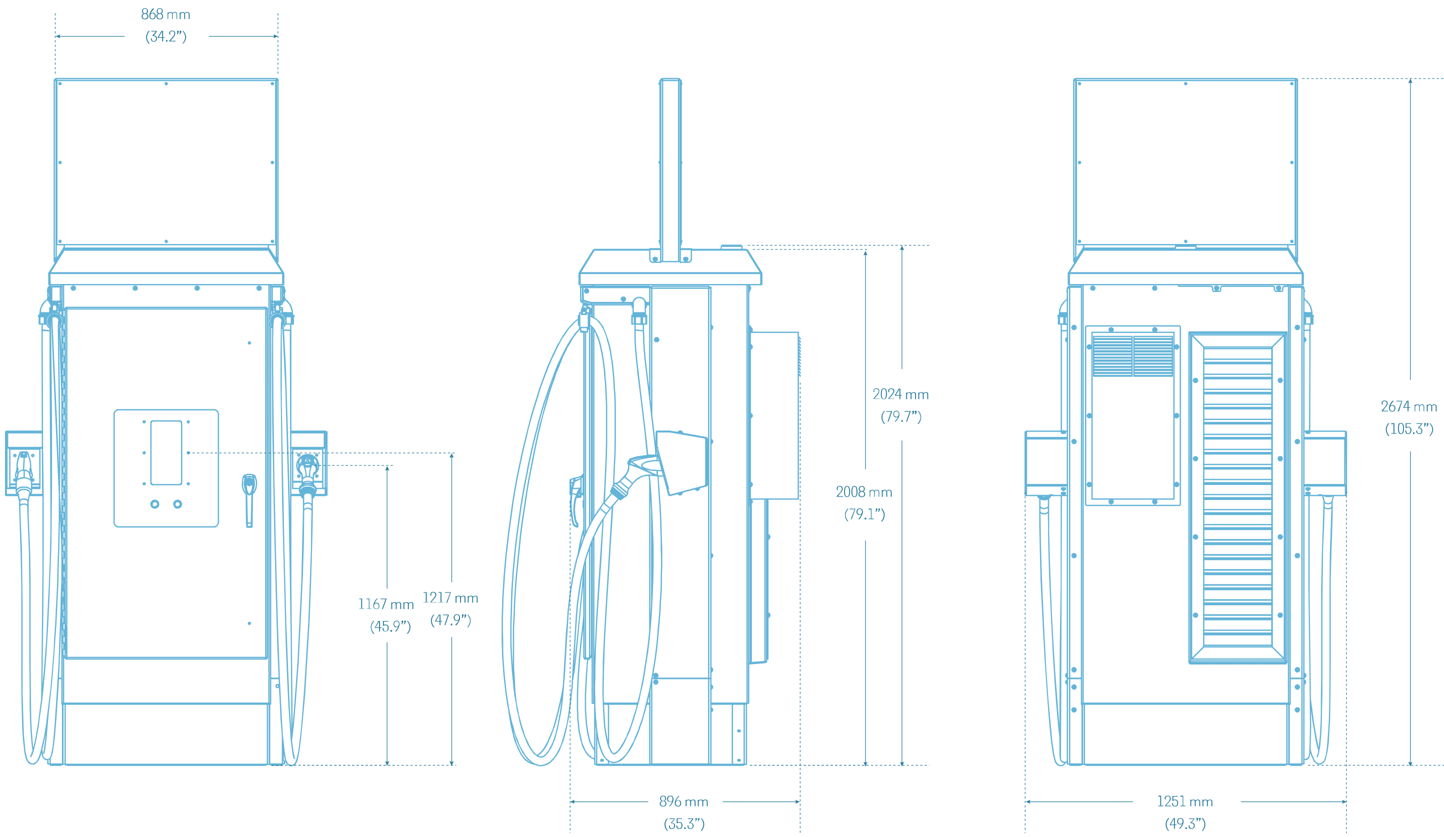
Gas stations

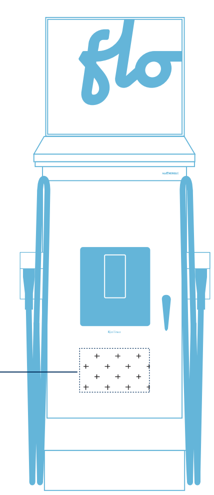
For gas station owners who wish to offer a complementary service that will help retain customers migrating to EVs.

Rest areas

For public administrators responsible for highways that wish to encourage electromobility between cities.

Dimensions and customization





Every charging station includes a customizable branding area. This area allows the display of partner logos or other publicity.

Customizable partner panel area
Dimensions (H x W): 10.31" x 16.14" (25.5 cm x 40.64 cm)

Contact FLO™ for artwork templates and material specifications.

Technical specifications

	50 kW	100 kW
Casing	Aluminum Type 3R enclosure – Resistant to harsh weather and vandalism	
Charging connectors	SAE Combo (CCS1) and CHAdeMO	
Cable length	20' (6.1 m) CMS included as an option	12' (3.7 m)
Supply voltage	Nominal three-phase 480 Y/277 VAC (neutral required), 60 Hz nominal (408 to 528 VAC, 55 to 65 Hz)	
Maximum input current	65 A @ 480 VAC	130 A @ 480 VAC
Maximum input power	54 kVA	108 kVA
Power factor	98% or better	
Efficiency (at max. output power)	93% or better	
Output power measurement tolerance	+/-1%	
Output voltage range	50 to 500 VDC	
Output current range	0.5 to 125 ADC	0.5 to 200 ADC
Dimensions (H x W x D)	79.7" x 49.25" x 32.8" (2,024 mm x 1,251 mm x 833 mm) **Height with top sign installed** 105.28" (2,674 mm)	
Weight	560 lbs (255 kg) **With cable management system** 675 lbs (300 kg)	675 lbs (300 kg)
Operating temperature	-40 °F to 122 °F (-40 °C to 50 °C)	
Storage temperature	-40°F to 158°F (-40°C to +70°C)	
Humidity	Up to 95% (non-condensing)	
Credit card reader	Optional. Payment by credit card (tap, insert, swipe) and NFC (Google Pay, Apple Pay)	
RFID card reader	Fitted standard. Supports ISO 14443 A/B, ISO 15693	
Certifications	cULus: UL 2202, UL 2231-1, UL 2231-2, CSA C22.2 No. 107.1 CSA C22.2 No. 281.1, CSA C22.2 No. 281.2 FCC part 15 Class A ICES-3 (A) Energy Star certified (*50 kW certified, 100 kW in progress)	
Networking	Cellular – 4G (LTE), HSPA+	
Model #	DCCH502AN1-FL-P03	DCCH502AO1-FL-P03

Designed and manufactured by
AddÉnergie Technologies Inc.

For more information
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Document ID: FLO__SmartDC_SpecSheet_V.2.0.4_2022-08-22_US_EN

FLO Ultra™

FLO Ultra™ Series

The ultimate fast charging experience.

Smart Design

- Maximize real estate with dual DC fast charger outlets in a single station
- With up to 320 kW, charge up to 80% in as little as 15 minutes*
- Dedicated intuitive user interface for each charging outlet
- With dynamic powersharing, delivers up to 500 kW for one car in a modular configuration*

Brillantly Simple

- Patent-pending, motorized cable management for effortless charging
- Easy to find with highly visible lighting canopy and intuitive state of charge indicators
- Flexible, secure payment options

Built-to-Last

- Rugged, aluminum enclosure to withstand the elements
- Modular design for maximum uptime, easy serviceability, and expandability
- Expand as needs grow with DC input for connecting multiple chargers together

*Results may vary. Dependent on car make and model and number of cars charging simultaneously.

FLO Ultra™

Technical specifications

ELECTRICAL

Output power	Up to 320 kW
AC Input voltage	480 VAC + 10% / - 15 % (60 Hz)
AC Input connection	3-phase: L1, L2, L3, GND
DC output voltage	150 - 1000 VDC
CHAdeMO DC output current	0.5-200 A
CCS DC output current	0.5-500 A

ENVIRONMENT

Operating temperature	-40 °F to 131 °F / -40 °C to 55 °C
Operating Humidity	5% to 95%, non-condensing
Operating Altitude	2000M
Enclosure	Aluminum Type 3R
Impact rating	IK10

INTERFACE and CONTROL

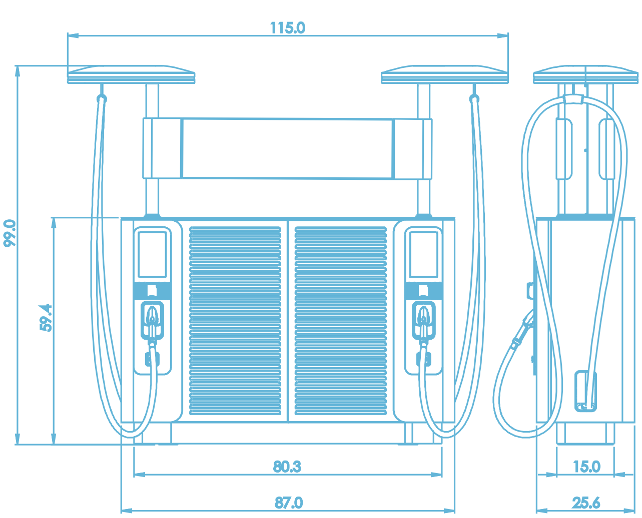
User interface	• (2) 12.1" color LCD touchscreen • English, French, Spanish • Charging station status LED indicators • Vehicle state of charge LED indicators
Authentication / Payment methods	• AutoCharge, Remote Start • Card member RFID ISO14443A/B, IEC15693, HID, MiFare) • Credit & debit card (contactless tap, chip, & swipe) • Mobile and NFC payments
Protocol communication car	• CCS Type 1 (DIN-SPEC 70121, ISO15118-2, ISO15118-20) • CHAdeMO 0.9
CPO Networking (OCPP)	4G LTE / Ethernet

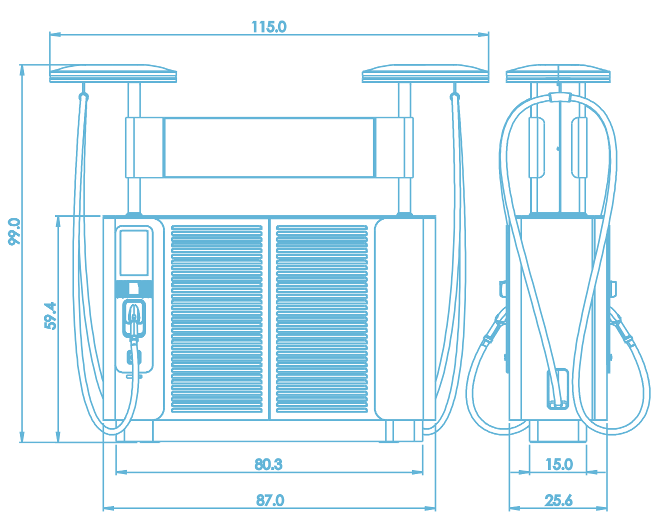
Monitoring	• Incoming AC voltage monitoring • DC energy meter
Certification (Pending)	• UL2202/UL2231-1/UL2231-2 • CSA C22.2 No 107.1/CSA C22.2 No 281.1/CSA C22.2 No 281.2 • NRTL listed ENERGY STAR 1.1 • NIST Handbook 44 S3.40 - Type Evaluation Program
Compliance	• Canadian Electric Code • National Electric Code (NFPA 70) • Americans with disabilities ACT (ADA) • FCC Part 15 Class A • NMB-003 (A) • CSA-IEC 61000-6-2 • Payment Card Industry Data Security Standard • California Prop 65(toxicity)

PHYSICAL

Dimensions (H x W x D)	98-3/4" x 115" x 28-3/4 " – 2508mm x 2920mm x 730mm
Weight (320 kW station)	1500 lbs/680 kg
Cable length	(2) 18ft/5.4m cables

Dimensions and customization





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Appendix B: Load Analysis Summary

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ELECTRICAL LOAD ANALYSIS SUMMARY

Equipment Schedule

Description	Connected Load [VA]	Demand Factor [%]	Demand Load [kVA]
DCFC EVSE - FLO SmartDC 50kW (65A, 480V, 3Ø)	54,040	100%	54.04
Level 2 EVSE - FLO Dual CoRe+ (32A, 208V, 1Ø)	6,656	100%	6.66

EV Load Summary

Description	Total Annual Energy [kWh]	Min. Req. Charging Load[1] [kW]	+50% Charging Load Safety Factor [kW]
Total proposed EV load	99,815	31.99	47.99

Existing Electrical Service Capacity Analysis

Electrical service (208V, 3Ø)	600 A
Electrical service 80% rated (208V, 3Ø)	480 A
Electrical service capacity	173 kVA
Maximum electrical demand load[2]	64 kVA
Electrical service load percentage	37%
Remaining Capacity for new loads	109 kVA
Total proposed EV load	48 kW

Therefore, the electrical service has capacity for the total proposed EV load.

# of required Level 2 EVSE	7
Total proposed Level 2 EVSE load	47 kVA
Total # of required Level 2 EVSE connectors	18
# of required DCFC EVSE	1
Total proposed DCFC EVSE load[3]	54 kVA

Notes:

1. The minimum required demand load is determined based on the estimated daily energy usage and time available for charging.
2. Data retrieved from BC Hydro provided 1-year historical load information. Metering data provided at 1-hour intervals. This is a risk that the maximum demand load was not captured (within 1-hour). A safety factor of 25% has been applied. All metering data shall be confirmed via demand load study.
3. Note there are 6x existing Electrical Chargers, these have been removed from the total annual kwH & required charging load.

ELECTRICAL LOAD ANALYSIS SUMMARY

Equipment Schedule

Description	Connected Load [VA]	Demand Factor [%]	Demand Load [kVA]
DCFC EVSE - FLO SmartDC 50kW (65A, 480V, 3Ø)	54,040	100%	54.04
Level 2 EVSE - FLO Dual CoRe+ (32A, 208V, 1Ø)	6,656	100%	6.66

EV Load Summary

Description	Total Annual Energy [kWh]	Min. Req. Charging Load[1] [kW]	+50% Charging Load Safety Factor [kW]
Total proposed EV load	4,618	1.06	1.59

Existing Electrical Service Capacity Analysis

Electrical service (208V, 3Ø)	800 A
Electrical service 80% rated (208V, 3Ø)	640 A
Electrical service capacity	231 kVA
Maximum electrical demand load[2]	64 kVA
Electrical service load percentage	28%
Remaining Capacity for new loads	167 kVA
Total proposed EV load	2 kW

Therefore, the electrical service has capacity for the total proposed EV load.

# of required Level 2 EVSE	1
Total proposed Level 2 EVSE load	7 kVA
Total # of required Level 2 EVSE connectors	1

Notes:

1. The minimum required demand load is determined based on the estimated daily energy usage and time available for charging.
2. Data retrieved from BC Hydro provided 1-year historical load information. Metering data provided at 1-hour intervals. This is a risk that the maximum demand load was not captured (within 1-hour). A safety factor of 25% has been applied. All metering data shall be confirmed via demand load study.

ELECTRICAL LOAD ANALYSIS SUMMARY

Equipment Schedule

Description	Connected Load [VA]	Demand Factor [%]	Demand Load [kVA]
DCFC EVSE - FLO SmartDC 50kW (65A, 480V, 3Ø)	54,040	100%	54.04
Level 2 EVSE - FLO Dual CoRe+ (32A, 208V, 1Ø)	6,656	100%	6.66

EV Load Summary

Description	Total Annual Energy [kWh]	Min. Req. Charging Load[1] [kW]	+50% Charging Load Safety Factor [kW]
Total proposed EV load	76,002	94.83	142.24

Existing Electrical Service Capacity Analysis

Electrical service (208V, 3Ø)	800 A
Electrical service 80% rated (208V, 3Ø)	640 A
Electrical service capacity	231 kVA
Maximum electrical demand load[2]	156 kVA
Electrical service load percentage	68%
Remaining Capacity for new loads	75 kVA
Total proposed EV load	142 kW

Therefore, the electrical service does not have capacity for the total proposed EV load.

# of required Level 2 EVSE	3
Total proposed Level 2 EVSE load	20.0 kVA
Total # of required Level 2 EVSE connectors	7
# of required DCFC EVSE	5
Total proposed DCFC EVSE load[3]	270 kVA

Notes:

1. The minimum required demand load is determined based on the estimated daily energy usage and time available for charging.
2. Data retrieved from BC Hydro provided 1-year historical load information. Metering data provided at 1-hour intervals. This is a risk that the maximum demand load was not captured (within 1-hour). A safety factor of 25% has been applied. All metering data shall be confirmed via demand load study.
3. Note there are 6x existing Electrical Chargers, these have been removed from the total annual kwH & required charging load.

Appendix C: BC Hydro 1-year Load History Summary

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BC Hydro 1-Year Historical Consumption Summary

Location	1-Year Net Consumption (kWh)	Max of Demand (kW)	Average of Power Factor (%)	Max of Demand (kVA)	+25% Safety Factor
Municipal Hall	410151	123.8	99.82	124.7	155.8
Fire Hall	104911	51.2	Unknown[1]	Unknown[1]	64.0
Municipal Yard	135900	51.2	100.00	51.2	64.0

Notes:

1. Data was not made avaialble by BC Hydro.

Appendix D: Single Line Diagram

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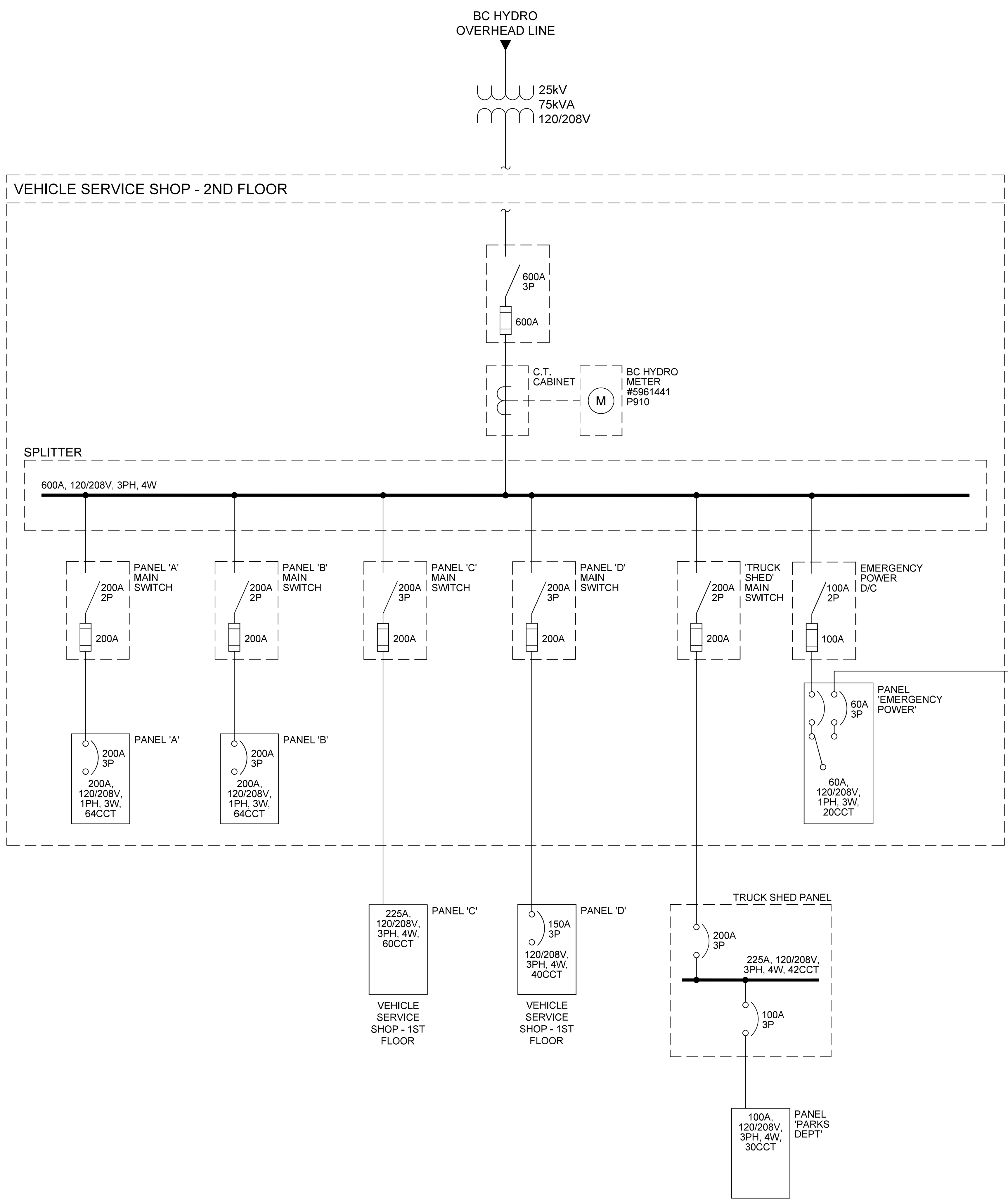
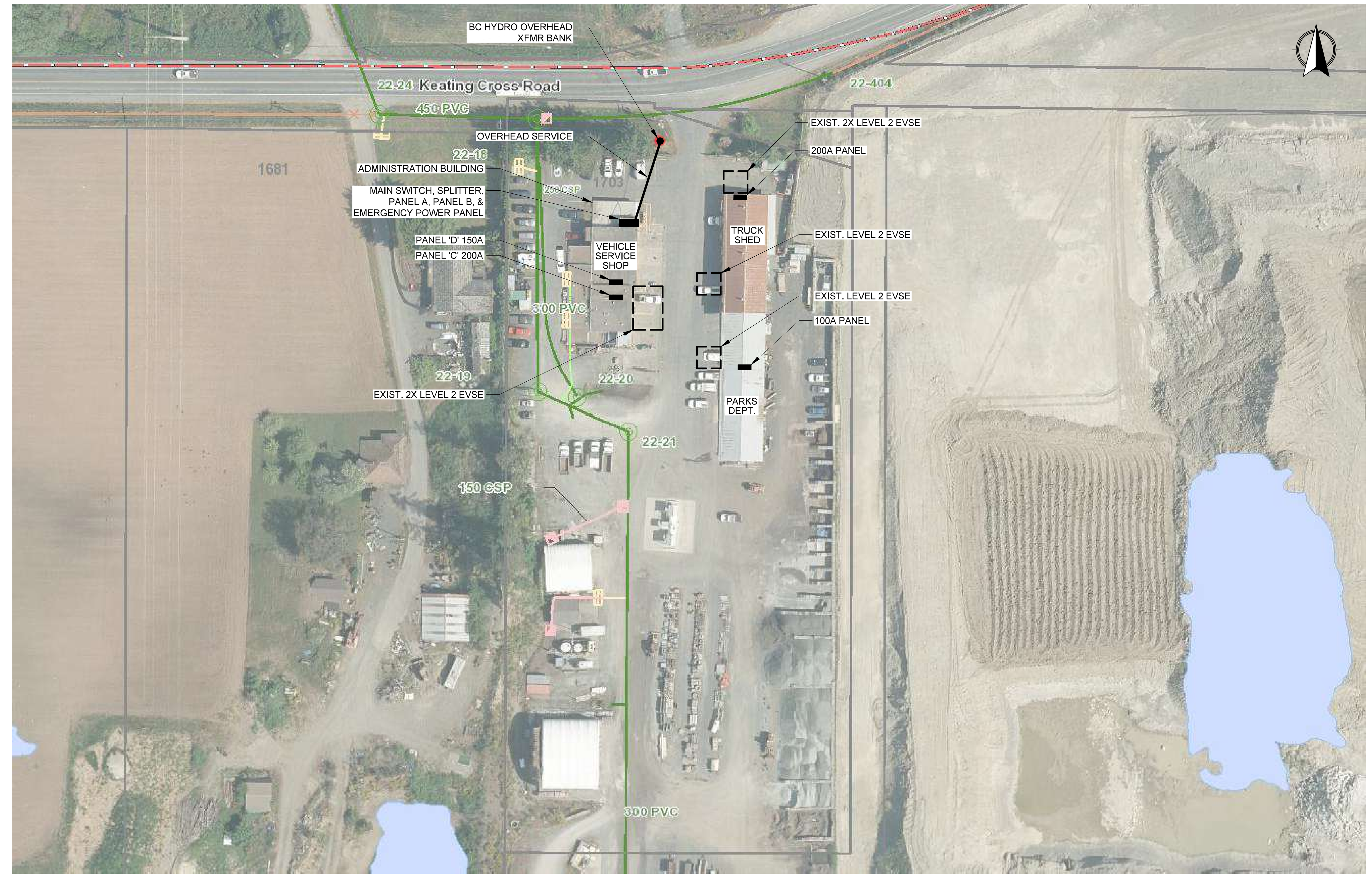


DETAIL 1 SINGLE LINE DIAGRAM - EXISTING
NTS - MUNICIPAL YARD



DETAIL 2 SITE PLAN
NTS - MUNICIPAL YARD

LINE TYPE LEGEND	
———	ABOVE GROUND CONDUIT/CABLE
– – –	BELOW GROUND CONDUIT/CABLE

SINGLE LINE DIAGRAM	
M	ELECTRICAL METER
SPD	SURGE PROTECTION DEVICE
	FUSE
	DISCONNECT SWITCH
DMS	DIGITAL METERING SYSTEM
	CURRENT TRANSFORMER
	BREAKER
	DELTA-WYE TRANSFORMER
	GROUNDING

ISSUED FOR CLIENT REVIEW
NOT FOR CONSTRUCTION

PBX ENGINEERING
PBX ENGINEERING Ltd.
Suite 201 - 1221 Broad St.
Victoria BC, V8W 2A4
Tel 250.388.7222

PBX ENGINEERING LTD.
PERMIT TO PRACTICE NUMBER:
1000208

CLIENT
Central Saanich

REV	DATE	ISSUE / REVISION
PA	25/03/18	PRELIMINARY ASSESSMENT

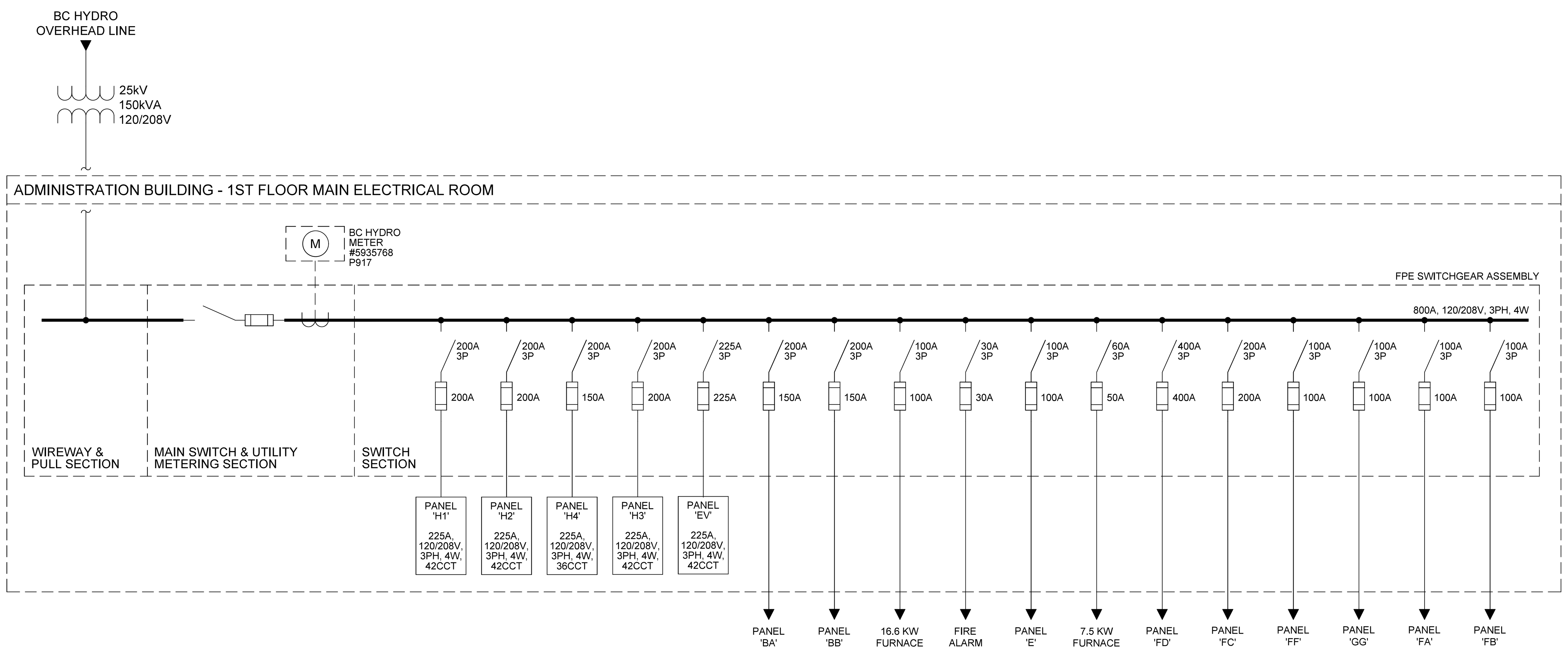
DRAWN BY	DESIGNED BY	APPROVED BY
MA	DGH	RA

PBX PROJ. No.	SCALE
240499	AS SHOWN

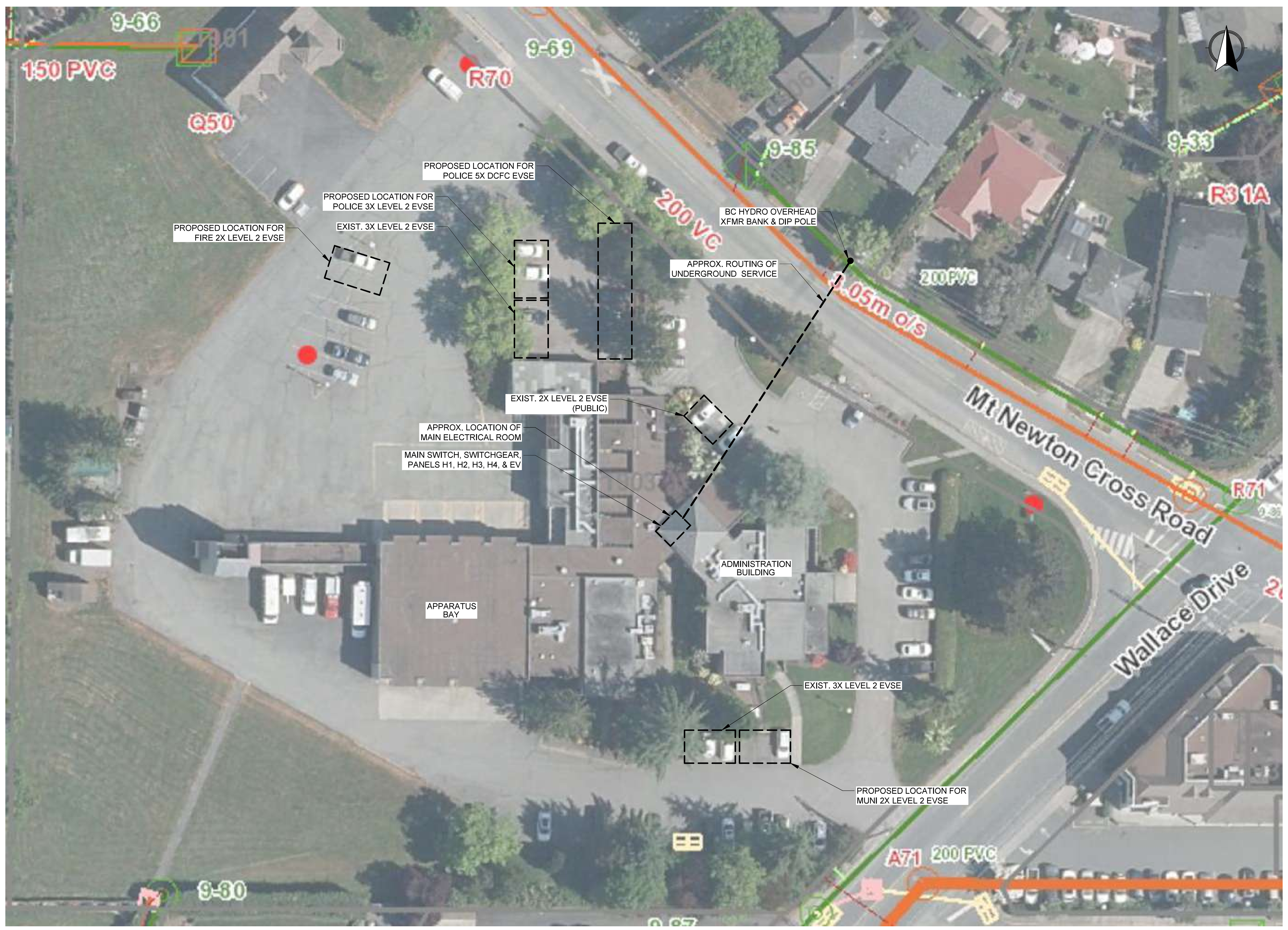
PROJECT
DISTRICT OF CENTRAL SAANICH
FLEET ASSESSMENT

TITLE
MUNICIPAL YARD
SINGLE LINE DIAGRAM
& SITE PLAN

DRAWING NUMBER	REV.
E010	PA



DETAIL 1 / - SINGLE LINE DIAGRAM - EXISTING
NTS MUNICIPAL HALL



DETAIL 2 / - SITE PLAN
NTS MUNICIPAL HALL

LINE TYPE LEGEND	
(solid line)	ABOVE GROUND CONDUIT/CABLE
(dashed line)	BELOW GROUND CONDUIT/CABLE
SINGLE LINE DIAGRAM	
M	ELECTRICAL METER
SPD	SURGE PROTECTION DEVICE
	FUSE
	DISCONNECT SWITCH
DMS	DIGITAL METERING SYSTEM
	CURRENT TRANSFORMER
	BREAKER
	DELTA-WYE TRANSFORMER
	GROUNDING

**ISSUED FOR CLIENT REVIEW
NOT FOR CONSTRUCTION**

PBX ENGINEERING
PBX ENGINEERING Ltd.
Suite 201 - 1221 Broad St.
Victoria BC, V8W 2A4
Tel 250.388.7222

PBX ENGINEERING LTD.
PERMIT TO PRACTICE NUMBER:
1000208

CLIENT
Central Saanich

REV	DATE	ISSUE / REVISION
PA	25/03/18	PRELIMINARY ASSESSMENT

DRAWN BY	DESIGNED BY	APPROVED BY
MA	DGH	RA

PBX PROJ. No.	SCALE
240499	AS SHOWN

PROJECT
DISTRICT OF CENTRAL SAANICH
FLEET ASSESSMENT

TITLE
MUNICIPAL HALL
SINGLE LINE DIAGRAM
& SITE PLAN

DRAWING NUMBER	REV.
E020	PA