Summer Gardens
Electric Vehicle Charging Stations
EV Ready Plan

Halifax County Condominium Corporation #130
1470 Summer Street, Halifax, Nova Scotia, B3H 3A3
Halifax, Nova Scotia

M&R Project No. 23-009

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Executive Summary

M&R Engineering has been retained by the Halifax County Condominium Corporation No.130 ("Summer Gardens") to provide an EV Ready Plan for the implementation of electric vehicle charging station (EVCS) infrastructure at the Summer Gardens condominium complex on Summer Street in Halifax, NS. The EV Ready Plan will provide an overview on EV charging in a multi-unit residential application, outline the existing electrical infrastructure, the required changes to this infrastructure to implement wide scale EV charging, invoicing of residents and an order of magnitude cost estimate. The following Program has been prepared exclusively for HCCC 130 and M&R Engineering bears no liability for any use by third parties.

The property at 1470 Summer Street consists of a twenty-one storey condominium tower with common ground area and a single below grade parking garage, pool, refuse disposal and service spaces. The site is located on Summer Street across from the Sacred Heart School of Halifax and was constructed in 1986. The building is governed by the Halifax County Condominium Corporation No.130.

We trust that this report meets with the Corporations requirements for consideration and are prepared to review the objectives in further detail with the Condo Corporation. Should there be any further questions or concerns regarding the report or its recommendations, please do not hesitate to contact the undersigned.

Sincerely,

Digitally signed by Tom Hopkin
DN: cn=Tom Hopkin, o=MR Engineering, ou, email=thopkin@mreng.ca, c=CA
Date: 2023.07.28 11:46:18 -03'00'

Tom Hopkin, P.Eng.
Electrical Engineer
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Introduction

The purpose of this report is to provide an EV Ready Plan ("The Plan") for the implementation of electric vehicle (EV) charging station infrastructure at the Summer Gardens condominium complex in Halifax, NS. The Plan will provide an overview on EV charging in a multi-unit residential application, outline the existing electrical infrastructure and the required changes to this infrastructure to implement wide scale EV charging. The Plan will review the different types of electric vehicle charging stations, where they are typically deployed, and which station would be used as a standard of reference for this project.

In the final sections of this report, we will review the means of load control for the EV stations and how the billing and invoicing for this proposed solution would be implemented. The report will also touch on the rebates and incentives currently available for the work outlined in this Program.

The Project Program will include an order of magnitude estimate of the cost associated with the program being proposed.

The following codes and standards are referenced within this report:

1. NBC 2015, National Building Code of Canada 2015.
2. CSA C22.1-18, Canadian Electrical Code, Part 1 2018.

M&R Engineering Report Summary 2020

In early 2020, M&R Engineering was approached by the Summer Gardens with a request to provide a report on several electrical and mechanical issues. This included a feasibility review for replacing the hot water tanks with instantaneous hot water heaters, installing heat pumps in the individual units, and installing EV charging stations for the building's residents. At the time of the report, M&R Engineering determined that based on the facility's historical electrical demand, and by implementing Class II electric vehicle charging stations (EVCS), up to twenty-one (21) EVCS's could potentially be installed and simultaneously charging electric vehicles. This could be achieved with minimal intervention into the building's current electrical infrastructure.

In January 2023, the Condo Corporation reached out to M&R Engineering with an interest in further developing a Project Program which would explore in greater detail the required infrastructure for wide scale EV implementation for this building.

Goal for Project

There are 124 parking spots at 1470 Summer Street for the building's residents and visitors. The mandate of this project is to provide electrical infrastructure to all 124 parking spaces. As the number of parking spaces exceeds the available electrical capacity for simultaneous EV charging, the Plan will outline the power management strategy to permit all stations to be connected to the buildings electrical infrastructure without overloading the service. In addition, as the common elements electrical service has a single meter from the utility, the solution will address a means to provide invoicing the building occupants who are charging their vehicle(s).

Electric Vehicle Charging

Electric vehicle charging is the process of providing electricity to a storage battery in an electric vehicle. This could include personal vehicles owned by the general public, fleet vehicles owned by businesses, or transport trucks and construction vehicles. The EV industry continues to advance with automotive companies bringing new vehicles onto the market each year. Battery technology and overall vehicle efficiency continues to improve year over year and the range of electric vehicles is increasing.

The charging time for electric vehicles can vary greatly as different vehicles have a variety of battery sizes and different charging protocols or limits. The charge time also depends on the type of EVCS that is installed. In general, the industry recognizes that there are three different levels of charging related to electric vehicles.

- Level I charging station: Typically residential charging station, the vehicle plugs into a 120 volt / 15 amp receptacle. These stations typically deliver approximately 8km of charge per hour.
- Level II charging station: These stations can be installed in either residential or commercial applications. Commercial charging stations are typically level II. These charging stations are typically 208 volt / 40 amp connections but can range as high as 80 amp connections, depending on the manufacturer. These units include an industry standard, unique charging cable that plugs directly into the vehicle and can deliver approximately 95km of charge per hour. Refer to photo 1 below for an example of a standard level II charging station.
- Level III charging station: These stations are often referred to as "DC fast charging stations" and are typically deployed along highways at service stations for quickly recharging a vehicles battery when it is nearly depleted and requires a lot of charge in a short window. These units will often require 300 amps of power and can deliver as much as 400km of charge per hour.


Photo 1: Typical level II EV charging station.

Electric vehicle charging station manufacturers will typically offer two different types of EV charging stations: networked and stand-alone charging systems. Networked stations receive an internet connection and utilize software to manage the operation of the EVCS. When an authorized user presents their credentials, either by key-fob or some form of payment system, the EVCS will enable the flow of power to the vehicle. These types of stations are typically deployed in commercial applications or at public locations such as shopping malls or businesses and will allow for EV drivers to charge their vehicle under a stipulated rate.

Where the stations are all supplied from a common vendor, the units can also be networked to permit load sharing on common electrical circuits. The software parameters can be adjusted to provide full charge when only one vehicle is connected and then throttle the delivered power to all vehicles when additional EVs plug in to the same circuit.

Stand-alone charging stations do not require an internet connection. Quite simply put, when the electric vehicle is plugged in, power is delivered at 100% output until the battery is full. These charging stations are typically installed at private residences or at secured locations where only authorized people will use the charging station. Photo 1 above depicts a standard non-networked EVCS.

The Plan for Summer Gardens anticipates the deployment of level II charging stations for all parking locations. For additional information on level II charging stations, please refer to Appendix A.

The performance criteria for the recommended electric vehicle charging station in this Plan are as follows:

- Level II charging station, non-networked
- Power requirements: 40 Amp, 208 Volt, 1 Phase
- Casing: NEMA 4X or equivalent, 100% aluminum, designed for indoor or outdoor installations
- Wall mounted with integral commercial grade cable and SAE J1772 connector

Overview of Electrical Infrastructure

The Summer Gardens condominium tower was constructed in 1986 and most of the base building electrical infrastructure appears to be original to the building construction. The building is served by six high-voltage utility transformers installed in an NSPI vault located on the P1 parking level. These six transformers provide two separate services to the building, a metered 600amp, 347/600volt, 3phase, 4wire service to feed the base building electrical requirements, and a 4000amp, 120/208volt, 3phase, 4wire service that feeds a 3000amp, plug-in style vertical bus duct assembly amongst other loads.

The buildings 600volt service terminates at a at two cell 600amp, 347/600V, 3phase, 4wire switchgear assembly manufactured by Federal Pioneer, model S-4. The distribution section of this switchgear assembly sub-feeds lobby heaters, panelboard P1, mechanical splitter P5 in the mechanical penthouse, the generator transfer switch and emergency distribution, along with several zones of ramp heating that were previously electric and converted to hydronic. Refer to photo 2 below.

Photo 2: 600Volt main distribution switchboard.

The buildings 208volt service terminates at a 4000amp, 120/208volt, 3phase, 4wire switchgear assembly manufactured by Federal Pioneer, model S-4. The distribution section of this switchgear assembly sub-feeds a 3000amp vertical bus duct assembly which sub-feeds to tenant meter centers located on every second level which feed the panelboards within each unit. The distribution section also feeds Panel P, a distribution panelboard which sub-feeds various house panels.

The core areas of the building, such as common areas and elevator lobbies, are fed from panelboards located in either the P1 main electrical room or the mechanical penthouse at the top of the building. The electrical distribution for mechanical heating and ventilation equipment are also located primarily in these two main service areas.

The proposed electrical infrastructure for EV charging for this site would connect to the “common elements” electrical meter, which is to say the 600volt building service. This service is metered by a utility meter in the main electrical room.

Proposed Electrical Infrastructure

To provide the electrical infrastructure for Summer Gardens for EV charging, the following changes would be required for the 600volt electrical service. A graphical representation of these proposed changes can be reviewed in Appendix B.

- Reconfigure the fusible switches and associated wiring within the main switchboard to provide a space sufficiently sized to accommodate a 200amp / 600volt / 3pole breaker within this board. This would require an interruption of power to the building to make these changes.
- A new 150kVA, 600volt to 120/208 volt step-down transformer would be installed in the main electrical room and would be wired to the new breaker in the main switchboard.
- This transformer would feed an 800amp, 120/208volt, 3phase, 4wire distribution panel that would be located in the parking garage, immediately outside the electrical room. The panel would be include five 400amp, 208volt, 3pole breakers to feed metered EV distribution panels.
- The first 400amp, 208volt, 3phase metered EV distribution panel would be installed adjacent to the distribution panel noted above. An example of this type of system is the EVCMC from Intellimeter. Refer to Appendix C for additional information on this unit.
- 40amp/208volt/1phase electrical circuits would be installed from the EV distribution panel out to all 124 parking stations within the building.

On implementation, the initial electrical infrastructure would include all items in the list above. Each EV distribution panel contains 30 relays and therefore can handle 30 EVCS’s. This first panel would be installed in year one, permitting up to 30 occupants to purchase an EVCS. Over time, if the number of owners with EVs grows to exceed the 30 vehicle capacity, they would install a second EV distribution panel and the networked backbone between the two panels.

As the majority of the electrical infrastructure or common elements of the distribution is to be paid for by the condominium corporation, the cost to the building residents is reduced to:

- Cost to purchase and install an EVCS
- Cost to connect the EVCS to the circuit at their parking stall
- Integration of electrical circuit at the main EV distribution panel

Load Management Platform

In order to provide EVCS for all 124 parking stalls on site, a load management platform is required to regulate the electrical load on this branch of distribution. The required infrastructure list above included notes on a load management platform. This system is a relay-based platform with integral metering components. The system monitors the active connected load and closes or opens electrical relays to permit or restrict power from flowing to EVCS based on the system demand. The maximum demand parameters would be programmed into the software at time of commissioning.

The load management system would operate on a first-come-first-served basis. The first twenty vehicles to connect for charging would be energized and begin charging their battery. The next vehicle connected would remain offline until the one of the connected stations completes its charging cycle and is disconnected. The process would repeat as additional vehicles began their charging cycle. By this method, whenever a vehicle is charging, it is charging at 100% circuit load, the user is receiving full power throughout their charge cycle and is never throttled down. This ensures a smoother billing process as the condo corporation is only permitted to charge owners for the time they were charging and not for the actual power into their vehicles. If the stations were to throttle down (multiple stations on a common electrical circuit), owners could end up being charged for a 4 hour charge at 50% where they could have charged to capacity in 2 hours are 100% charge rate. The owner ends up paying more for the same amount of electrical charge.

An example of this type of system is the EVCMC Energy Management System from Intellimeter, which is the basis of design for this Program. This system includes all necessary metering and software to monitor the loads to each of the 30 internal relays and includes permissive settings to close and open relays as required to keep the load under the stipulated threshold. Additional information on this system can be found in Appendix C.

Billing / Invoicing

The power for the EVCS distribution system is to be connected to the current house or "common elements" meter in the main electrical room. The invoices for this are paid for by the condominium corporation. As a result, any additional power consumed on this service for the purposes of charging an EV would need to be monitored and a means of recovering this cost must be included.

The metering that is included in the load management platform is employed to not only turn relays on and off but will also monitor and record the total power and charge time for each EVCS. This total charge time can then be downloaded by the condominium corporation in order to draw up invoices for occupants charging their vehicles to bill them for their usage. The condo corporation could set a rate to charge occupants for the power usage based on the utility rate at the time, and possibly to recover the initial capital investment.

The condominium corporation can decide to out-source this invoicing to the metering agency, but this would involve additional costs. The initial start up cost is $1,000 from Intellimeter and there is a monthly fee of $3.50 per meter for every account for which they generate an invoice.

The networked charging station solution would regulate the power flow to electric vehicles by throttling back the power output of the EVCS based on the total system demand. The disadvantage to this solution is that the condo corporation is not permitted to charge tenants a rate based on the actual power provided to the EV, i.e. rates based on kilowatt-hour consumption. The corporation can only charge based on the total time connected. Tenants could therefore potentially be billed for a 4-hour charge but only receive 50% output from their EVCS. This could lead to complaints of over-billing. For this reason, the program recommends proceeding with non-networked or standard electric vehicle charging stations.

Order of Magnitude Costing

The following estimate is considered a Class D estimate, which is to say the actual cost of construction is anticipated to be within +/- 20% of the noted value. A higher degree of accuracy can be achieved when a consultant has been engaged to provide a detailed design for this project.

Electrical Distribution Costs:	$ 345,000
Each additional EV Charging Management Controller (Installed & commissioned)	$ 50,000 - $65,000

Notes:
1. Taxes extra.
2. This estimate is completed in 2023 dollars and does not allow for escalation.
3. Professional engineering services are not included in this estimate.

This allows for conduit and wire to be installed to all 124 parking stalls in the building. If the condominium corporation decided to reduce this down to only providing conduit and wire to the first 30 spots around the building, the estimate above could be reduced by as much as $160,000.

Rebates and Incentives

The rebate program for the installation of electrical infrastructure for EV charging stations in Nova Scotia is managed by Efficiency Nova Scotia (ENS). The newly created rebate program was launched in 2023 and is just getting started. The rebate program includes two different rebate incentives for building owners and constructors, the EV Ready Charger Rebate Program and the EV Ready Plan. This Program has been created for the Summer Gardens condominium to meet the client's requirements but also to comply with the EV Ready Plan outlined by ENS in order to receive a rebate for this work.

The current rebate structure from ENS for the EV Ready Plan will provide a rebate for 75% of the cost to develop the plan up to $4,000 for an existing multi-unit residential building (MURB). The condominium corporation will be eligible for this rebate. The associated paperwork for this rebate are included in Appendix D below.

The second part of the incentive program is the EV Ready Charger rebate which will provide financial assistance in the form of a rebate for 50% of the costs to install an eligible charging station. For existing MURB's, this goes to a maximum of $3,000 per charging station to a maximum of $15,000 per building. Unfortunately, the current rebate program requires that the charging stations be a smart or networked product. These units cost more than standard charging stations and require a network fee be paid on a yearly basis. After reviewing this with representatives of the condominium corporation, it was decided that due to the restrictions this would place on the type of charging station, the increased per-unit cost and system network fees, the Program defined here will not target this rebate from ENS.

Conclusions and Recommendations

In conclusion, this report has found that it is feasible to install the electrical infrastructure to ensure that all building residents at Summer Gardens could opt to install an electric vehicle charging station in the future. Building residents would install level 2 charging stations which would provide a much faster charge rate over the basic residential level 1 charging station. With the recommended infrastructure in place, future tenant EV charging station installations will be made quickly and easily and can be completed in an orderly fashion.

While installing networked EV charging stations would result in some degree of rebates for the buildings occupants, it would only benefit the first handful of stations and would lock those and all future tenants into contracts with an external third party. As noted in the sections above, a networked solution could potentially result in complaints from tenants for over-billing for the actual power delivered to their vehicle.

The proposed solution in this report would permit the end users to purchase a level 2 EVCS from any vendor of their choice and the stations do not need to be networked, resulting in less up front capital cost to the EVCS owner. The means of power control also will result in 100% power output being delivered for the duration of the time the tenant has their EVCS running.

APPENDIX A:
Typical Level II Electric Vehicle Charging Station

APPENDIX B:

Basic Single Line Diagram of System Modifications

APPENDIX C:

Load Management Platform from Intellimeter

APPENDIX D:

Completed Consultants Handbook for
Efficiency Nova Scotia Rebate