

City of Vernon: Electric Vehicle Infrastructure Gap Analysis

Community Energy Association

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About CEA

The Community Energy Association (CEA) accelerates bold action by local governments and Indigenous communities related to climate and energy.

CEA grew from a committee established by the Government of BC and the Union of BC Municipalities in the 1990s, was incorporated as a non-profit in 2003, and registered as a charity the following year. CEA functions as a nonprofit consultant with members and a Board of Directors; more than half of CEA's member-organizations are local governments and Indigenous communities.

Today, CEA's members and staff live in communities large and small and share in the benefits of being a community of practitioners. We bring our collective expertise, experiences, commitment to Truth and Reconciliation, and passion to reduce local greenhouse gas emissions while maximizing co-benefits, so that communities are healthy and resilient.

This requires building local and regional capacity, leveraging funds, and fostering collaboration among all levels of government, Indigenous communities, energy providers, educational institutions, and other organizations to plan and implement local solutions.

Our work includes creating community projects and plans, implementing infrastructure projects, facilitating opportunities to share information and build collaboration among communities and sectors, and developing public engagement campaigns. These activities are funded by public and private organizations that share a commitment to local climate leadership. Staff teams are organized in service areas that cultivate expertise in the areas most relevant to communities: the built environment, capacity and leadership development, communications and engagement, planning and research, relationships and reconciliation, and transportation.

Our teams are committed to meeting client goals and objectives and, as a non-profit, we ensure that everything we learn is accessible and creates opportunities for communities to replicate successes.

Reconciliation Statement

The Community Energy Association (CEA) commits to the principles of Truth and Reconciliation. As an organization, we support the *Calls to Action* released by the *Truth and Reconciliation Commission of Canada* and recognize the importance of the self-determination of Indigenous Peoples as articulated in the *United Nations Declaration on the Rights of Indigenous Peoples*.
Through all the work we do to help communities reduce greenhouse gas emissions, conserve energy and support community energy resilience, CEA will:

- **Acknowledge** that Indigenous Peoples have suffered under colonialization and that the intergenerational trauma of unjust colonial policies and practices continues to impact Indigenous Peoples and communities.
- **Commit** to learn and understand the history of Indigenous and settler relationships in this place we call Canada and ensure that those learnings inform CEA's actions so that we can build new, stronger relationships with our Indigenous partners.
- **Commit** to seeking meaningful and sustained relationships with Indigenous communities and organizations based on good faith, shared goals, mutual respect, and equitable processes, plans, actions and partnerships.
- I**nvite** Indigenous Communities to become members of CEA and **commit** to recruiting staff who identify as Indigenous.
- **Commit** to ensuring our work in Indigenous territories is respectful of those territories and its' peoples. We will respectfully acknowledge the traditions and knowledge that has been passed down since time immemorial.
- **Invite** CEA's members and CEA's project partners in government, industry, education, the non-profit sector, and in the communities where we work, to join us in working to end the systemic inequities faced by Indigenous communities.

SECTION ONE Executive Summary

Public electric vehicle (EV) charging infrastructure is key to accelerating EV adoption. The City of Vernon is committed to reducing GHG emissions from the transportation sector by enabling residents and businesses to transition to electric mobility. Low carbon transportation is important to the City's Climate Action Plan, published in April 2021. In particular, Goal 3 seeks to ensure "The community's transition to low greenhouse gas vehicles, such as electric, is supported".[1] The City has already installed five EV chargers (13 plugs) on municipal property and is electrifying the municipal fleet.

Enabling a network of publicly available EV chargers is crucial in supporting Vernon's residents to make the switch from internal combustion engine (ICE) to electric vehicles. A holistic charging network also benefits the many visitors travelling to Vernon and the Okanagan Region each year. Strategically located along Highway 97 between the Okanagan, Kalamalka, and Swan lakes, Vernon is a key recreation destination with year-round recreation opportunities.

In response to the transition to low-carbon transportation, the City of Vernon has worked with the Community Energy Association to perform an Electric Vehicle Charging Infrastructure Gap Analysis. This project will help to strategically plan Vernon's future charging needs and optimal Electric Vehicle Supply Equipment (EVSE) network configuration, and support Vernon's residents' and businesses' transition to EVs.

The City of Vernon has commissioned this report to strategically advance the goals of the City's Climate Action Plan. The report assesses the baseline condition of EV adoption in Vernon, identifying current literature, data, and City staff input. We then use a GIS model to perform a gap analysis of the existing conditions charging network, identifying areas of special interest for future EVSE or which require special attention and policy. A set of recommendations is made based on these assessments. The general methodology is laid out below:

[1] City of Vernon Climate Action Plan, 2021, page 28. https://www.vernon.ca/sites/default/files/docs/Sustainability/Climate-Action/210408_cap_full_final.pdf

Understanding of Context: Quantitative Baseline Assessment

CEA undertook data analysis from public sources such as PlugShare and the City of Vernon to inform the baseline assessment. The City of Vernon currently has 30 public charging ports available for use. When considering areas outside the City of Vernon planning boundary, there are 40 total public charging ports stationed across 15 different sites. There are also 12 Tesla charging ports which at this time are not universal and only Tesla drivers can use them. CEA then used growth projections provided by the City of Vernon, current and expected EV adoption rates, and best practice ratios for the number of EVs to Charging Ports to determine the expected number charging ports needed in Vernon by 2030: 362.

Site Selection and Evaluation: Geospatial Mapping

ArcGIS mapping software was used to perform EV charger gap analysis for 2 scenarios, residential and commercial. Demographic data, including but not limited to population, income, and housing density data was used in conjunction with existing EV infrastructure data to calculate the weighted analysis, resulting in approximately 35 locations identified as suitable for future EV chargers. Each location was ranked from 1-3 from most to least desirable, considering desirable siting criteria such as land ownership, traffic, accessibility, safety, and existing utility infrastructure. The mapping analysis showed 31% of locations were residential, 54% were commercial, and 15% fit both criteria.

Reporting of Results: Final Recommendations

Given the assessment of baseline conditions, and geospatial mapping exercise, several recommendations are presented for the City of Vernon to consider. Key recommendations include:

- Undertake early efforts to identify and partner with government and/or private landowners to serve as potential future EVSE site hosts. Public-private partnerships will be key to ensuring a robust network is achieved, given the limited dispersity of City-owned land.
- Work to secure capital funding to deploy EVSE on selected City-owned sites over the coming 2 years. Sites owned by the City of Vernon present the clearest opportunity for short-term gap closure as external engagement and partnerships are not required. The City of Vernon is encouraged to view the site selection process through an equity lens, ensuring all EVSE is accessible for a wide range of users. Providing

interoperability will provide a seamless user experience for EV users and accelerate the widespread adoption of EV technologies.

- Incorporate EV Ready requirements for both residential and commercial land uses, to support the wider uptake of EVSE across the City. Future proofing new buildings in the City of Vernon will reduce costs compared to retrofitting existing parking stalls, based upon best practices exhibited by municipalities with such bylaws.

SECTION TWO Introduction

In response to community support for climate action, the City of Vernon adopted its Climate Action Plan (CAP) in April 2021 and endorsed a target of achieving a 50% reduction of net-zero greenhouse gas (GHG) emissions by 2030. The Climate Action Plan identified eight Focus Areas where the City will direct its efforts to reduce GHG emissions from the largest local sources in Vernon, with Land Use & Transportation accounting for more than 63 percent of Vernon's community GHG emissions.

One of the tools available to the City of Vernon to decrease emissions from the transportation sector is facilitating EV adoption by residents and visitors through support for public EV charging. To accomplish this, the City of Vernon must first assess the current gaps in public electric vehicle charging infrastructure, as outlined in this report. Understanding the current gap in EV charging infrastructure will enable the City of Vernon to promote EV adoption by:

- Providing municipal land for public EV charging infrastructure, either owned and operated by a third party or the municipality itself.
- Encouraging the development of public EV charging infrastructure on privately owned land within the municipality through a range of policy tools and programs.
- Enabling policies for residential and commercial building infrastructure.

It is important to remember that the objectives of a public charging network are:

- Reducing Range Anxiety: To alleviate range anxiety by providing drivers with the opportunity to charge a vehicle when its battery is almost depleted.
- Increasing the EV Profile: To raise public awareness and understanding of electric vehicles and increase exposure and knowledge of EV technology.
- Accommodating Garage Orphans: To offer viable charging opportunities for households without access to off-street parking, colloquially known as "garage orphans."
- Equity: To promote equitable access to EV charging infrastructure regardless of income or housing type

Public EV Charging

Public EV charging (Level 2 and Level 3 – Direct current fast charging or DCFC) infrastructure facilitates travel to and within a region. As has been well documented in recent local, regional, provincial and national surveys, the ability to travel to desirable destinations reliably is a major factor in consumers' decision to purchase an EV. Thus, it is important to locate EV charging stations so drivers can easily integrate charging into their existing daily routines. This means siting stations with access to local amenities like places of work, residences (i.e., multi-unit buildings, homes without garages or off-street parking), shopping, restaurants, and cafes, as well as parks, museums, and other local attractions. It also means ensuring residents have the opportunity to conveniently charge overnight at home, as 70% of EV charging occurs during the evening while the driver is at home [2].

[2] Canadian Automobile Association, Driving and Charging, 2024. https://evbuyersguide.caa.ca/content/charging#:~:text=Electric%20vehicle%20driving%20range&text=Depending%20on%20the%20vehicle%2C%20and,and%20growing%20all%20the%20time.

SECTION THREE Quantitative Baseline Assessment and Forecast-Findings

The following subsections describe the general methodology used to establish the quantitative baseline (e.g., current number of EV chargers available in Vernon, current EV adoption in Vernon, benchmarking against comparable communities), forecast modelling results, and CEAs findings from this analysis.

Baseline Assessment and Forecast Methodology

Baseline Assessment

For the baseline assessment, CEA used publicly available data sets provided by Natural Resources Canada, City of Vernon, PlugShare, Open Charge Map, Charge Hub, and Energy Hub. The existing electric vehicle charging station characteristics (e.g., charger type, fee structures, location, etc.) are recorded as well. All data points included in the baseline assessment are summarized in an Excel table and the file accompanies this final report, attached as Appendix 1. Information was collected from the various sources and confirmed for accuracy with City of Vernon staff.

In addition to the information CEA obtained from the various sources listed, City of Vernon staff informed CEA of new EV charging stations which are currently under construction in the City, located at The Community Services Building, which CEA included in the baseline assessment.

Forecast Model

For the forecast model, CEA used both population and EV adoption statistics to estimate the number of EVs expected in Vernon in 2030.

CEA calculated a 2021 baseline of EV registration in Vernon based upon Insurance Corporation of BC (ICBC) data. Using ICBC Data for the Province of British Columbia, CEA also calculated a 'worst case' scenario of EV adoption where

Vernon's total EV share is a proxy of Provincial ICBC Data. This was done as Vernon's current total EV registration forms a greater share of total Provincial EV registration than Vernon's share of the Provincial population. That is to say, EV adoption in Vernon is greater than would be expected based upon the Provincial average. CEA used this to inform a "high adoption" and "low adoption" scenario. This was calculated as follows:

> *Vernon's population in 2021 represented 0.82% of BC's population. In 2021 there were 163,852 EVs in BC. Applying 0.82% to this figure gives 1,341 EVs in Vernon based upon the proportion of the city within BC.*
>
> *As a result, the actual number of EVs in Vernon in 2021, 2.419 EVs, is approx. 80% higher than the figure calculated using provincial data, 1,341 EVs.*

These assumptions have been used to calculate the number of necessary EV charger ports by 2030 to meet the recommended ratios as defined by best practices. For all project recommendations, CEA has used the recommended ratio of 24 EVs to 1 charging port as suggested by Dunsky[3].

CEA used Vernon's Official Community Plan (OCP) prediction of a population of 69,359 by 2036. This population projection results in an expected population of 58,087 for Vernon in 2030.

CEA then applied both the Provincial and City of Vernon rates of EV adoption to this population projection.

[3] Dunsky, Canada's Public Charging Infrastructure Needs, 2022. https://natural-resources.canada.ca/sites/nrcan/files/energy/cpcin/2022-ev-charging-assesment-report-eng.pdf

Baseline Assessment Findings

Current EV Adoption

Currently in the City of Vernon, there are 2,419 EVs registered, which make up 8% of all vehicles registered in the City of Vernon[4]. Total registration is broken down into:

- 237 Battery Electric Vehicles (BEV) – 10% of all EV's registered; *and*
- 2,182 Plug-in Hybrid Electric Vehicles (PHEV) – 90% of all EV's registered.

> BEV = Battery Electric Vehicle. Onboard batteries power one or more electric motors. Plug batteries into the electricity grid to recharge.
>
> PHEV= Plug-in Hybrid Electric Vehicle. Powered by an internal combustion engine (ICE) and an electric motor. Plug the on-board battery into the grid to charge.

Vernon's Existing EV Chargers

There are three types of EV chargers available to EV drivers, from Level One to Level Three. Each level provides differing rates of charge based on electrical output, with Levels Two and Three most conducive to filling the public EV charging gap. Each level of EV charger is detailed below.[5]

[4] ICBC Vehicle Registration Data, 2021. https://public.tableau.com/app/profile/icbc/viz/VehiclePopulation-PassengerVehicles-2022/2022PassengerVehicles?publish=yes

[5] BC Hydro, Types of EV Chargers, 2024. https://electricvehicles.bchydro.com/charge/choosing-a-home-EV-charger

Level One

- Uses a connection to a 120V outlet
- Charges 4-8 km per hour
- Commonly used for overnight “trickle charging”.

Level Two

- Uses a connection to a 240V outlet, like those used by ovens and clothes dryers in homes
- Charges 30 – 40 km per hour
- Used in homes, businesses, common areas and public charging sites

Level Three

- Uses a direct current connection to an electrical system
- Charging power varies from 50 kilowatts (kW) to 350 kW depending on hardware
- Used mostly in businesses and public charging sites

There are currently 21 Level 2 charging ports and 9 Level 3 charging ports among the publicly available EV charging stations installed in the City of Vernon’s planning boundary. When looking at areas surrounding Vernon (10 km radius), this number increases to 26 Level 2 and 14 Level 3 publicly available charging ports, with several additional stations just outside of this radius.

Table 1 Existing EVSE Infrastructure in Vernon

	Level 2 Ports	Level 3 Ports
	Current	*Current*
City of Vernon	21	9
Surrounding area (10km radius)	5	5

Forecast Model Findings

CEA determined that currently Vernon accounts for 0.82% of the provincial population, although unproportionally 1.48% of the provinces EVs are registered in the City. By 2030 it is expected that Vernon will account for roughly 1.00% of the provincial population.

There are expected to be 635,000 EVs registered in BC in 2030. Therefore, if Vernon continues to account for 1.48% of the provincial EV share, 392 ports are needed in the City to fulfil the EV to charging port ratio. However, if Vernon's share of EVs matches its population (assuming an equal distribution of EV adoption across all municipalities, which is unlikely) Vernon will need 265 ports. Given there are 30 ports already existing in Vernon, this puts the deficit needing to be addressed in the range of 235-362 ports.

The findings of the forecast model are provided in more detail in Appendix 2.

SECTION FOUR Geospatial Mapping

Using the results of the Baseline Assessment and Forecast Model, CEA used ArcGIS software to complete an analysis which depicts areas not currently being served by existing EVSE which are most in need of public EV charging going forward.

CEA facilitated several meetings with staff from the City of Vernon to understand and confirm the criteria for qualifying areas in need of public charging. Generally, these can be conceived of in two main categories: residential areas, and commercial areas.

Residential areas in need of public charging are areas where there is a high instance of existing multi-unit residential buildings (MURBs), areas with single family homes without driveways, garages, or other off-street parking, and areas where equity-seeking populations may be living. These areas often do not allow for easy access to charging while at home, and therefore residents need public charging opportunities nearby where they can leave their vehicles for long periods of time.

Commercial areas in need of public charging are areas which are popular or busy with activity from either residents or visitors, and which are not served by existing public charging stations.

With this understanding, CEA then used various GIS layers, data points, and modelling functions to systematically map these gap areas. The following section describes our methodology:

Approach and Methodology

Data sources for this analysis came from City of Vernon, Natural Resources Canada, Statistics Canada, and ICBC. A complete list of the data utilized, and their respective sources is included in Appendix 1.

An EV charging station gap analysis was completed using GIS with a weighted overlay analysis. A weighted overlay analysis allows multiple criteria to be considered when modelling geographic suitability and can be an effective way of identifying potential locations. Two weighted overlay analyses were performed for the placement of potential EV

charging station locations in City of Vernon, considering two different scenarios of charging station siting criteria and placement parameters.

Scenario 1- **Residential** was used to identify potential Level 2 EV charging station locations to fulfil residential charging needs in areas of high population density containing a greater number of multi-unit residential buildings and minimal dedicated charging spaces. Low-Income status of households, as defined by Statistics Canada, was also used to further identify areas in the city with a higher percentage of households in low-income status for deployment of EVSE was also applied to all areas of the City of Vernon.

Scenario 2 - Commercial was used to identify potential Level 2 and Level 3 DC fast charger station locations in commercially densified and destination zones containing multiple desirable amenities or attractions (e.g., large shopping complexes or accommodation providers) for residents and/or visitors. These areas have higher traffic volumes where residents and tourists gather in greater numbers and visit for shorter periods, requiring shorter yet efficient charging times ideally suited to Level 3 DC fast chargers.

The analysis process from raw data to final weighted overlay using GIS for both scenarios followed the below steps:

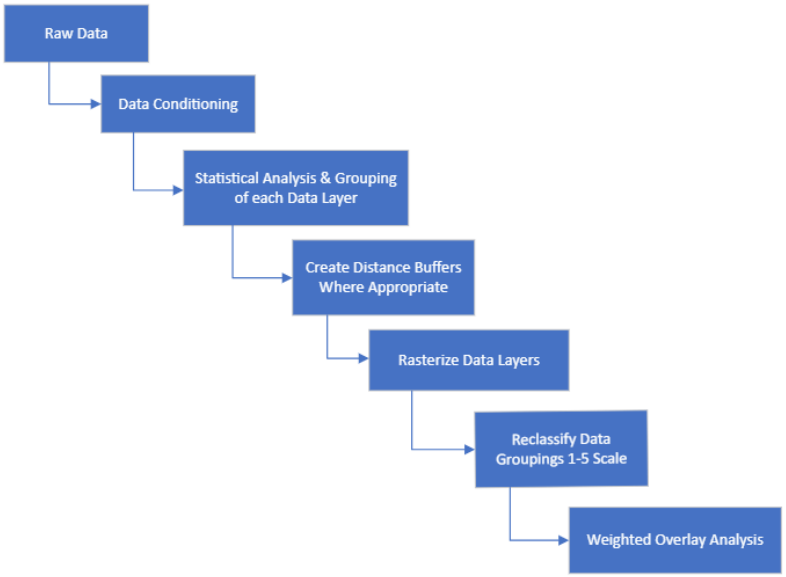


Figure 1 EVSE Gap Analysis Methodology

Census of Canada population and housing data was collected from the 2021 Census at the Census Dissemination Tract level for City of Vernon. A review of the population density (Appendix 3, Figure 1) was conducted to identify priority areas for future EVSE deployment.

Existing EV station infrastructure (Appendix 3, Figures 2 & 3) was collected and cross-checked from a variety of sources as discussed earlier in this report. Additional city infrastructure data was gathered from the City of Vernon's Open Data portal including land use and zoning based on the most recent OCP, City owned land (with emphasis on parks and parking lots), other land ownership (Provincial, Federal, private), public buildings (schools, hospital, recreation centers), and local places of interest (theatres, historical sites, the waterfront etc.) based on their commercial, recreation or tourism value. Data layers were then evaluated for suitability and used for the two EV infrastructure gap scenario analyses.

The raw data in each layer for both residential and commercial analysis was analyzed, combined, and counted for each neighbourhood in Vernon where needed (**spatially joined**), transformed into data layers that could be used in statistical calculations (**rasterized**) and then statistically grouped into 5 categories (**classes**) to show data variability across the city. Those statistical groups were then **reclassified** on a scale of 1-5 for data comparability, with 1 representing the least desirable values (i.e., areas already served by EVSE) and 5 representing the most desirable values (i.e., areas suitable for new EVSE) for that data. Finally, the layers were combined in an overlay analysis where each data category was given a weighting decided upon in an iterative process with input from City of Vernon staff to create the final maps (Figures 5 & 6, Appendix 6).

To capture the areas in the City of Vernon where people live and where long-term and overnight Level 2 charging stations would be best suited, the residential weighted analysis combined multiple layers using weighted modifiers to dictate their relative impact on results. The weights were chosen in consultation with staff from the City of Vernon. For this analysis CEA used population density (50% weighting), prevalence of multi-unit residential buildings (25% weighting), and distance from existing EVSE infrastructure (25% weighting) (Appendix 3, Figure 4).

Scenario 1: Residential EVSE Gaps – *Where People Live*

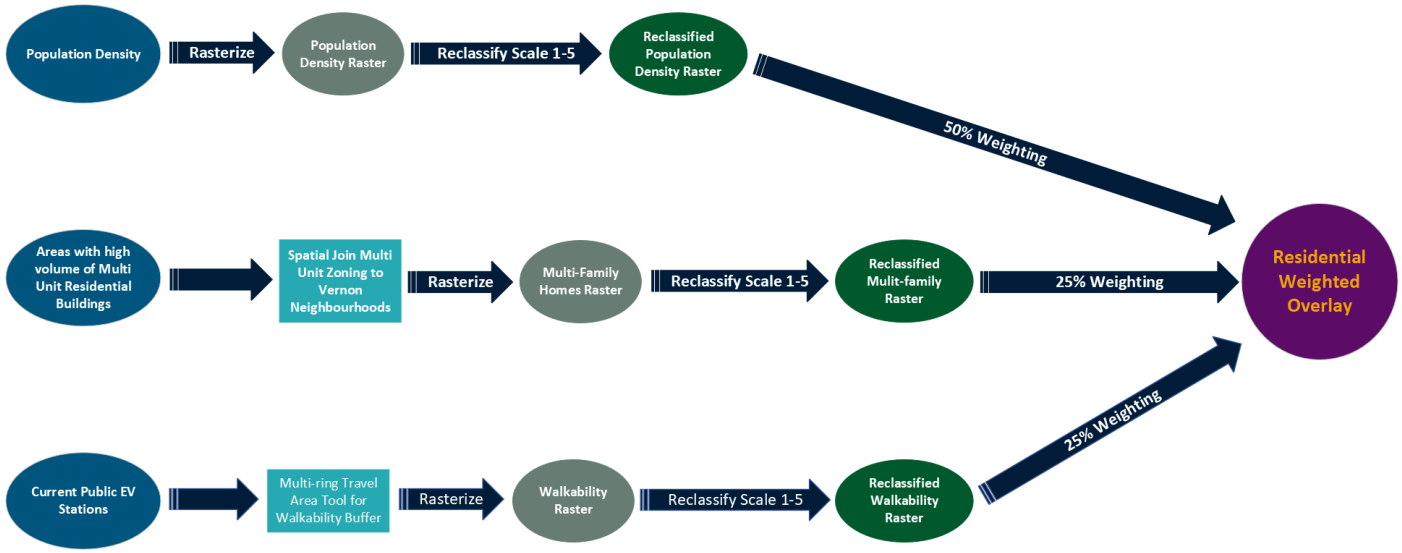


Figure 2 Simplified process flow of data type and analysis for Residential EVSE weighted overlay mapping.

In contrast, the commercial weighted analysis identified places in the City of Vernon where people travel to for work, shopping, recreation, and tourism where DC Fast charging would be more appropriate. This analysis focused on land use zoning where people would be going to work (commercial/industrial/public land 20% weighting), land use identified by City of Vernon staff as being desirable parcels for EVSE locations (20% weighting) and local places of interest (30% weighting) while also considering areas already covered by current EVSE infrastructure (30% weighting) (Appendix 3, Figure 5).

Scenario 2: Commercial EVSE Gaps – *Where People Work & Visit*

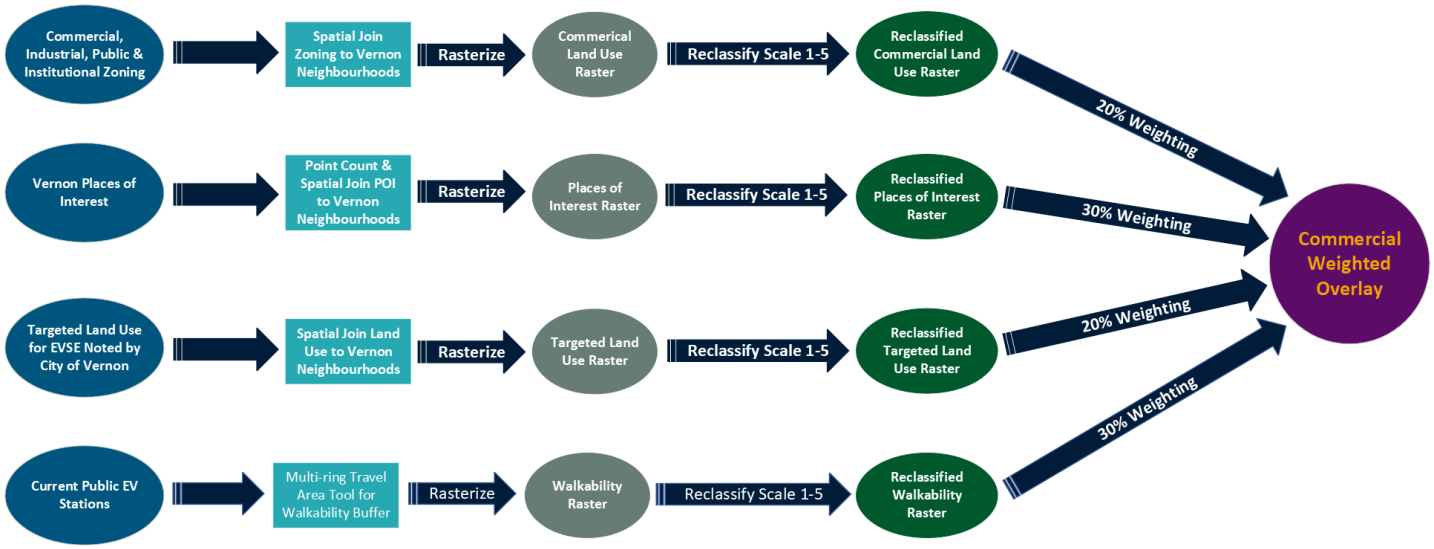


Figure 3 Process flow of data type and analysis for Commercial EVSE weighted overlay mapping.

Walkability was considered and applied prior to the weighted overlay analysis in both scenarios, where the average walkable distance is defined as one that can be covered in 5 minutes of walking, or approximately 400m at an average pace[6]. A walkability analysis was applied to all existing EVSE in the City of Vernon, capturing all walkable routes (**multi-ring travel area**) from those locations in 4 stages taking into account 300m, 500m, 700m and 900m of distance (**walkability buffer**) that one could cover from each location (Appendix 3, Figure 6). These routes considered sidewalk/pathway availability and represent real walking routes in all neighbourhoods. In doing this, a distance or

[6] Millward, Hugh and Scott, "*Active-Transport Walking Behavior: Destinations, Durations, Distances*", Journal of Transport Geography, 28 (2013), 101-110

walkability buffer was created for the current EV charging station locations to consider spacing between locations for maximum coverage when sighting new infrastructure.

Along with walkability, all layers used in the commercial analysis (as described above) went through the same process as the residential portion of the analysis. All data layers used in the commercial analysis were transformed for use in statistical analysis **(rasterized),** grouped into categories **(classified)**, and then **reclassified** on a desirability scale of 1-5.

After the layers were assigned the weighted modifiers and overlaid, the resulting map layers identified hot spots within City of Vernon that combined the highest values, representing the most desirable criteria, from each data set and highlighted the areas to focus on when expanding the publicly available EV network (Appendix 3, Figures 4-5). After the weighted overlay analysis was completed, additional geographic data and human analysis were applied to the maps to narrow down the locations further. The proposed locations are discussed in more detail in Section 5, and the maps that give the visual overview of those are found in Appendix 3, Figures 7-9. Figure 7 highlights the residential locations that would be primarily Level 2 charging stations, Figure 8 highlights those locations best suited to DCFC in commercial zones and close to places of interest. Finally Figure 9 provides an overview of all locations together. Note that several locations could serve as either residential Level 2 or commercial DCFC stations, and these are shown in both map scenarios. Combining multiple charging options in zones that have high need both residentially and commercially is an effective way to maximize EVSE coverage at key locations in the City.

An additional lens of analysis was provided through the siting criteria applied to each potential EVSE location. The criteria applied were nearby amenities, accessibility, and safety. This method echoes EVSE implementation best practices that ensure future infrastructure will be accessible to everyone, whilst fostering EV adoption.

Finally, when considering active transportation corridors in the City of Vernon, it is also valuable to examine the location of the main bike routes in relation to the suitability analyses. Appendix 3, Figure 10 shows the bike routes within the City limits with an added 300m walkability buffer as used in the EV station location analysis. Local area parks are also noted on this map for context as bike routes are often tied to recreational points of interest. The City's bike routes cover the majority of the dense urban areas of Vernon when taking into account their walkability. In determining the ranking of potential new EV station locations, the City should consider bike routes and note locations that might also serve as E-bike charging stations alongside EV charging to give both options for community members. In particular, recreation centres, shopping centers as well as other commercial locations along popular bike routes could serve as E-bike charging

locations. When looking at the bike route coverage on top of the proposed locations, there are many options for dual purpose charging.

EVSE Distribution across Census Dissemination Areas

By 2030, Vernon will need an estimated additional 362 public EV charger ports to address anticipated EV adoption by residents and visitors. This is based upon the baseline assessment of existing public infrastructure, and future scenario forecasting using the recommended ratio for Canada (24 EVs to 1 charger port)[7].

Determining the recommended number of EVSE charging stations and ports was accomplished with an analysis and projection of the amount of charger ports that would be needed by 2030 in the City of Vernon. Needs were based on projected population growth and desired EV adoption targets for the province of British Columbia to 2030. The market share of EV's registered in the community of Vernon with respect to the overall projections for the province was considered based on the last 5 years of EV registrations recorded for the City of Vernon by Statistics Canada. Finally, these projections for both population growth and number of EV's on the road in Vernon were reviewed considering Canada's recommended electric vehicle to available charging port ratio in a community [8]. The methodology and findings of this forecast are discussed in more detail in section three.

To provide the City of Vernon with a brief guide to the number of EVSE required per census dissemination area, of which there are over 60, the target of 362 EVSE was distributed based on:

- Only included the census dissemination areas which fell within the 3 highest rated classes of the combined weighted overlay.
- based on the estimated number of vehicles owned per household (assuming a Canadian average of 1.5 vehicles per household) as a percentage of Vernon's total car ownership, *and*
- based upon each census area's population as a percentage of Vernon's total population (44,139).

[7] Dunsky, Canada's Public Charging Infrastructure Needs, 2022. https://natural-resources.canada.ca/sites/nrcan/files/energy/cpcin/2022-ev-charging-assesment-report-eng.pdf
[8] Dunsky, Canada's Public Charging Infrastructure Needs, 2022. https://natural-resources.canada.ca/sites/nrcan/files/energy/cpcin/2022-ev-charging-assesment-report-eng.pdf

Using estimated vehicles or population as a metric for distributing total charging ports does not lead to significant discrepancies - this confirms that the weighted analysis model based on residential units achieves alignment with the population distribution of Vernon.

Each census area has a target number of EV charger ports to be provided by 2030. There are some nuances, for example area **59370205** (Okanagan Hills) which has a high population density, due to the prevalence of single-family homes in the area. Based on the methodology above, this census area has been allocated 22 charger ports, the highest of any area. However, providing so much infrastructure in this area would not address the key gaps required by the City. As such, no locations have been distributed within this area as this gap can be closed by individual homeowners installing chargers as they purchase an EV. For a detailed breakdown of the EVSE distribution per census dissemination area, please refer to Appendix 4.

In this case, the City may use the geographical data to inform future targeted education and outreach campaigns on grants for home charging or EV retrofits, amongst other initiatives.

A more detailed review of all proposed locations using Google Maps and Google Street View was conducted to ground truth the placement of the final recommended locations and apply a non-geographical analysis, considering items such as site accessibility, safety concerns, and suitability for DCFC charging.

SECTION FIVE Recommendations

The following section details key actions and associated implementation steps the City of Vernon can undertake to increase EV charging infrastructure. The ultimate deliverable for this project is a GIS-based analysis of gaps in Vernon's EV charging network, based on a 2030 projection; as well as a list of recommended sites for consideration to help close these gaps. These deliverables have been provided, in their full form, as appendices and/or attachments to this report. That is, CEA has provided the City of Vernon with all GIS layers created and model outputs (Appendix 3), as well as an excel spreadsheet which contains detailed information on each site being suggested (Appendix 5). It should be noted that CEA has refrained from suggesting the number of charging ports which should be located at each individual suggested site. This is, in part, due to the more detailed level of technical evaluation required during the capital design phase. Each site should be reviewed to confirm electrical capacity, sub-surface infrastructure, and other technical considerations prior to site confirmation. These items were considered out of scope for this project.

As general best practice, in Canada it is recommended that 10% of all charging ports should be Level 3 DCFC charging to meet national demand[9]. The City of Vernon is encouraged to consider this, along with the baseline assessment findings, when considering which sites should be pursued for Level 3 charging, and the share of Level 2 and Level 3 ports at any given site. Given this best practice and the determined gap for Vernon to be an estimated 362 ports, the City should consider ensuring that at least 36 ports are Level 3. Generally, a mix of Level 2 and Level 3 charging should still be maintained, to suite the variety of user needs, charging demands, affordability considerations, and/or electrical capacity available on a case-by-case basis.

It is important to consider that implementing EVSE to achieve gap closure is only a single step towards electrifying passenger vehicle trips made in Vernon. To maximize the impact of future implementation on emissions reduction it is recommended that the City undertake public awareness and education, policy tools, incentives, and other site-specific initiatives. These recommendations are described in detail below.

[9] Dunsky, Canada's Public Charging Infrastructure Needs, 2022. https://natural-resources.canada.ca/sites/nrcan/files/energy/cpcin/2022-ev-charging-assesment-report-eng.pdf

Opportunities for Future Expansion

35 potential locations have been identified for expansion of the community's EVSE Network (Appendix 3, Figures 7-9, Appendix 5). Of these, approximately 31% are residential locations and 54% are commercial locations, with the remaining 15% fulfilling both location type criteria. All proposed locations for both Level 2 and Level 3 chargers were ranked 1-3, with 1 being most desirable and 3 less desirable.

Residential Level 2 EVSE rankings were based on the type of land available, with City of Vernon land (parks, parking lots, street parking) and city facility buildings ranking higher since City of Vernon has greater ability to influence development on city property.

Commercial Level 2 and Level 3 EVSE rankings were based on areas with high traffic volume, density of amenities and ease of accessibility to large parking spaces for high volume use. Additionally, transit hubs, tourist destinations and recreation areas were also ranked higher. Furthermore, locations that have current EVSE that are exclusively Tesla compatible, were also considered higher priority to provide equity for drivers of all EV models.

Higher ranks in both scenarios were also given to locations that could fulfil criteria in both residential and commercial zones, such that a multi-use charging station could be built with both Level 2 and Level 3 charging ports.

In both scenarios, land and/or facility use agreements with other governments (provincial or federal), or private landowners are necessary to effectively expand the EVSE network in the City of Vernon. Locations sited on land not owned by City of Vernon were ranked lower due to the potential for extra expenses and complex agreements when building at these locations. However, all sites listed are seen as prime locations to fill the charging gap in Vernon. The exercise of ranking the sites is more reflective of the ease of which EVSE might be installed, not of overall site suitability.

Based on these projections, the City of Vernon will need between 235-362 extra charging ports to serve its growing population's electric vehicle charging needs by 2030. The initial 35 EVSE proposed locations serve to start fulfilling these needs and can be built in a phased approach as the population and built environment landscape changes through 2030. To accomplish these expansion goals, the City of Vernon should also look to existing EVSE locations for easy ways to upgrade stations with additional chargers and ports.

Considerations when reviewing potential locations:

- Locations are proposed based on the methodology and analysis described in this report, without additional knowledge of utility infrastructure or business relationships within the City of Vernon.
- As building progresses and land use zoning changes up to 2030, potential locations might be moved, added, or removed by the City of Vernon to accommodate changes in the built environment.
- Locations do not have a recommended number of charging ports at each site. This will need to be considered and customized when each final location is confirmed and may be dependent on the phase in which a location is built, and the physical or technical parameters present at each location.
- The suitability of the potential locations may change at any time as the city landscape and business priorities and relationships with outside stakeholders evolve.

Next Steps in Evaluating Locations

Further review of potential locations needs to be carried out to evaluate utility infrastructure and electrical capacity more deeply at each location. Additionally, traffic flow should be assessed in areas where a location could be better suited on one side of an intersection or another where the potential exists to move across the street. Review of the locations should be prioritized based on their ranking, and those locations that serve residential areas with low levels of existing EVSE infrastructure. Additional priority should be placed on commercial sites, and sites owned by the municipality including parks. These are areas of high use and traffic flow, and adding EVSE to transportation hubs will enhance the electric mobility network in the Vernon area.

Adopting an EV Ready Bylaw as a requirement for all future dwellings would help fill the EVSE infrastructure gap. EV Ready Bylaws are becoming a popular and effective tool used by municipalities to ensure residents gain access to at-home charging. They are a critical step to increasing EV adoption in the future, in line with international best practices. City of Vernon can demonstrate strong climate action by adopting EV Ready Bylaws and encouraging other municipalities in the area to follow suit.

For areas with a high density of MURBs, encouraging EV Ready retrofits on a case-by-case basis can help address residential charging gaps. This would be a last resort scenario, with other suitable residential sites to be prioritized first.

Ensuring access to public charging infrastructure

Parking demand and availability of chargers for EV drivers in need of energy is a growing concern for EV charging hosts. In some locations, the demand for parking may exceed availability. In addition, some charging stalls may be used as personal parking and charging spaces in lieu of at-home charging, reducing their access for visitors and other users. This is an emerging challenge as EV adoption grows, especially in areas around urban centers. As urban EV drivers embark on road trips to their favorite destinations, they rely on public charging to 'energize' their travel. If public charging spaces are occupied for extended amounts of time by EV drivers for whom the charging instance is merely convenient, not necessary, that location isn't available for someone who needs it to travel to the next destination. The amount of time an EV driver spends at a charging station is commonly referred to as 'dwell time'. Notably, Level 3 (DC Fast Charger) EV stations aren't often challenged by prolonged dwell times as EV drivers are in transit and typically looking to charge then move on. Dwell time is longest at free public Level 2 stations where someone may simply be plugging in for convenience while they shop, eat, etc.

There have been app and non-app-based solutions implemented in other jurisdictions across Canada to overcome dwell time challenges to varying degrees of success. CEA has compiled and evaluated some potential solutions relevant to the local context, as noted below:

Emerging Best Practices in Pricing (Dynamic Pricing)

At the time of publication, CEA generally advises that Level 2 charging rates should be in the range of $1.00 - $2.00 per hour. This range of rates should allow for electricity and operational costs to be recovered, as well as allow the municipality to earmark revenue for future maintenance and replacement.

Dynamic Pricing refers to a scenario where the rate a driver pays to charge their vehicle increases depending on the time spent at the charger, or amount of energy consumed. Dynamic pricing is an effective tool to maintain the flow of drivers at a particular charging station as it discourages unnecessary dwell times. For instance, the charging provider or site host might decide that the rate for using the charger should be increased from $1.50 per hour to $2.25 per hour after the first 45 minutes of charging. Dynamic pricing must be considered carefully based on the characteristics of the charging station at hand, such as: rate of charger delivered, demand for that site, availability of other parking spaces, or proximity to other nearby charging stations.

"Proper pricing can increase overall productivity by motivating drivers to only consume the resources they require when they need them. Resources include not only the energy required to recharge a vehicle, but also the time needed, and physical space occupied during the charging session. These space and time elements must be considered when determining a site's pricing policy to curb excessive usage, which can impose a physical constraint on the number of vehicles serviceable per day." [10]

The City of Penticton recently updated its fee structure for that its Level 2 stations are free for the first two hours and then $2/hour thereafter. This approach is in line with best practices for ensuring low dwell time; however, this should be monitored over time to ensure that adequate cost recovery is taking place through a combination of user fees and Low Carbon Fuel Standard credits.

Etiquette Signage and Education

Accessible and informative signage when paired with other dwell time solutions such as permitting and dynamic pricing can help to incentivize desired EV charging behaviours. Installing signage at the charging station can remind or inform EV drivers of charging etiquette. Messages such as the following:

- Only Park in an EV charging space when you're actually charging
- Remember to always move your vehicle as soon as charging is complete
- Use the charging station app (Flo, ChargePoint) to monitor your charge should you decide to leave your vehicle
- If your travel distance does not require a complete charge, consider leaving the station available for a fellow EV driver once your charge is partially complete to meet your trip needs.
- Consider finishing your charge at 80% because the last 20% of your battery chargers slower. If you have time, consider moving to a Level 2 charger.
- Use the PlugShare App to check in and leave notes for other drivers

[10] Ryan Winn, author of Electric Vehicle Charging at Work

A bonus opportunity is to add EV charging etiquette messaging to interpretive signage about local amenities, services and attractions.

EVSE Accessibility

A publication by BC Hydro in 2021 'EV Fast Charging: Design and Operational Guidelines for Public DCFC Stations in British Columbia'[11] includes accessibility guidelines. The 'Focus on Barrier-free and accessible station design elements' includes the following recommendations. Note that these recommendations pertain to parking stalls servicing EVSE only and are not meant to impact the number or availability of accessible parking stalls.

- **Bollards** A distance of about 1.2 metres (4 feet) to 1.7 metres (5.5. feet) between bollards should protect the charger from damage and allow for access to station. Also ensure there is enough space around the charger to be able to manoeuvre a wheelchair, for example.
- **Surface** The parking stall surface and the area around the charger should have a firm, slip-resistant and level surface using concrete or asphalt. Do not use gravel.
- **Grade** Ensure the entire area, including the charger, is on grade. Some drivers might experience difficulty transporting the charging cable even if there is a minor slope.
- **Concrete pad** When using a precast concrete pad for a fast charger, the pad should be elevated flush with grade so as to not make it difficult to reach the screen or charging cables. If the concrete pad cannot be flush with the grade, consider an access ramp.
- **Signage** All signage and instructions for using the charger should use a clear and easy-to-read font.
- **Accessible stall dimensions** If you have the space, ensure the stall is at least 3.7 metres (12 feet) wide which includes at least 1.5 metres (5 feet) for entering and leaving a vehicle. This will provide adequate space for parking and an access aisle for reaching the charger.

[11] https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/power-smart/electric-vehicles/BCHydro-EV-Fast-Charging-Guidelines.pdf

- **Charger** Purchase a charger that meets US ADA requirements of placing the screen, holster and cables at a more accessible height.
- **Cable management** Charging cables can be damaged by drivers who do not put them away properly. And when left on the ground, they can pose a tripping hazard. Cables also need to be long enough to reach an electric vehicle's charge port which adds weight to the cable. Cables will also get heavier with higher-powered charging stations. This creates challenges for drivers who struggle with the weight of the cables or those who use mobility aids. Prolonging the life of cables and improving user experience can be addressed by installing a cable management system, like the ones at certain gas stations where the cable retracts when not in use.

Other considerations on accessible charging include:

- All EV charging stations should meet minimum accessibility standards, thereby eliminating the need for designated accessible EV charging stations.
- An access aisle of 1.5m is necessary. Two spaces can share this access aisle. Access aisles should clearly be marked to discourage parking in them.
- The access aisle should join an accessible route.
- The slope of accessible parking spaces and access aisles should be a maximum of 1 degree in all directions, with a compact or firm surface.
- The ability to plug in power mobility devices would be of huge benefit, particularly at inner-community charging stations.
- All accessible/universal design should include surface painting as well as sign at head of charging station location, with signage explaining that the accessible charging station is available to everyone if all other chargers are in use.
- Accessible EV charging stations should include a curb cut/ramp if required to change grades between parking surface and surface where EV charger located.
- Accessible EV charging stations should be provided at a ratio of 1:25. A minimum of one accessible EV charge station should be required in any parking facility that is required to have one electric vehicle parking space.

- Consider canopies on at least a portion of accessible EV charge stations as per Electric Vehicle Charging Station Guidebook
- Consider retractable cables for accessible EV stations.
- Avoid cables blocking pedestrian paths.
- Investigate the potential use of wireless charging via inductive technology in winter environments. This would remove the requirement to interact with heavy cables or poorly designed EV charge stations.

Beyond the City of Vernon's existing best practices and mandate to comply with 'EV Fast Charging: Design and Operational Guidelines for Public DCFC Stations in British Columbia', the following elements are noted for consideration to make EV charging in Vernon accessible for all. City of Vernon will want to review and consider these during EVSE purchase and installation.

- Increasing the size of the vehicle parking stall to a maximum of 5m. A typical accessible stall is 4m in width.
- Widening access aisles between stalls to 2m. A typical access aisle is 1.5m.
- Installing and positioning chargers on a levelled parking surface rather than a raised curb
- Ensuring the charger cable is positioned so it can be reached by all, and a cable management system is in place so that all users can easily access and lift the cables to and from their vehicle.

"EV chargers also often have other communication features such as display screens, apps, card readers and more in order to function and receive payment. These components must be compatible with the needs of all EV owners including those who are deaf or hard of hearing, visually impaired, have dexterity limitations, or have other disabilities. Some features which increase accessibility include user interfaces or display screens (including apps) which are compatible with screen readers, the use of tactile and braille controls, and audio descriptions or speech output."

Source: https://www.dunsky.com/making-ev-charging-accessible-for-all-canadians/#:~:text=Some%20considerations%20to%20alleviate%20these,than%20on%20a%20raised%20curb.

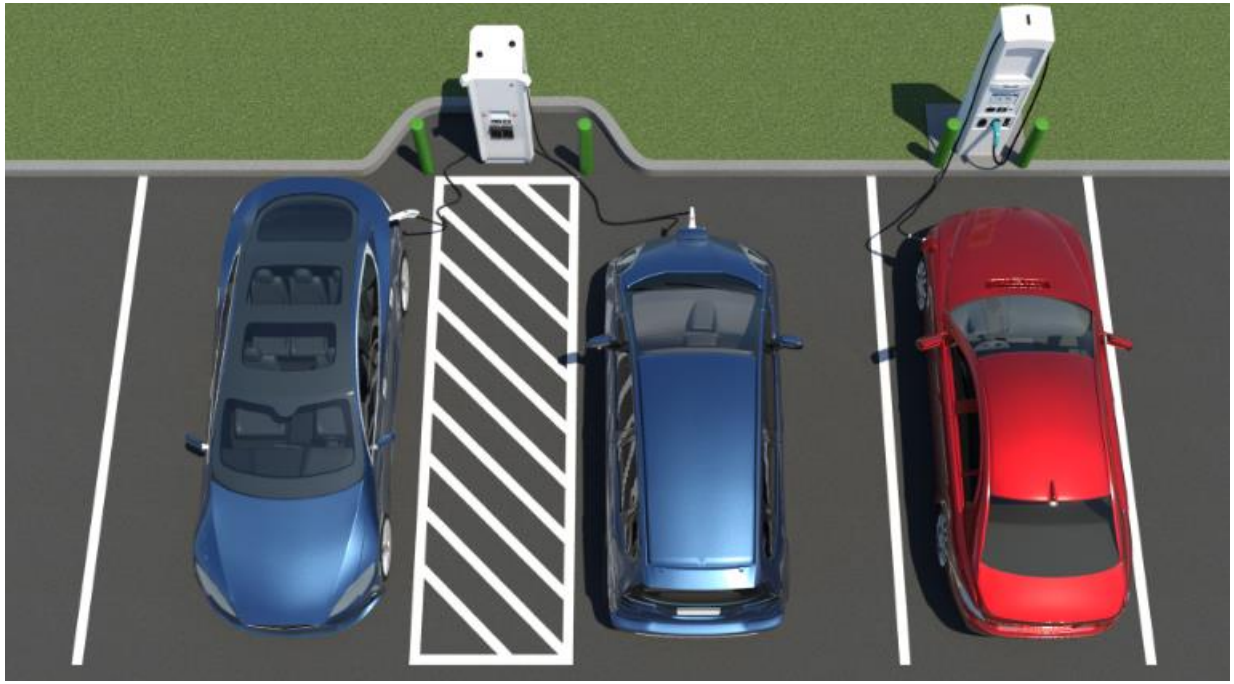


Figure 4. Accessible charging station graphic. Source: https://www.access-board.gov/ta/tad/ev/

Encourage private sector development

Beyond adoption of municipal bylaws to require EV charging infrastructure in new buildings and traditional fuelling facilities, the City of Vernon can consider:

- Incentivise landowners to make land available for charging. Acquiring land is among the biggest costs for private charger operators. Cities can help to address this by providing tax incentives and other revenues to landowners who enable EV charging on their sites. This has been an important policy behind China's EV market growth.
- Streamline the permitting process. Many cities have expedited lengthy and bureaucratic permitting processes which can discourage investment in charging infrastructure. Stockholm's Charging Master Plan, for example, makes it as easy as possible for companies to install charging stations.

Appendices

Appendix 1: Baseline Assessment Data

Included as separate file attachment.

Appendix 2: Public EVSE Forecast Results

Included as separate file attachment.

Appendix 3: GIS maps

Included as separate file attachment.

Appendix 4: EVSE distribution per Census Dissemination Area

Included as separate file attachment.

Appendix 5: Final Site Selection

Included as separate file attachment.

Appendix 1: Baseline Assessment Data Sources

Dataset	Year published	Author	Title	Link
635,000 EVs in British Columbia by 2030	2023	BC Hydro	*Expert says Canada doesn't have enough EV charging stations to meet growing demand*	https://bc.ctvnews.ca/mobile/expert-says-canada-doesn-t-have-enough-ev-charging-stations-to-meet-growing-demand-1.6503286?cache=oswkadlgqjzv?clipId=89530
British Columbia Population 2021	2021	Statistics Canada	*Census Profile, 2021 Census of Population*	https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/details/page.cfm?Lang=E&SearchText=British%20Columbia&DGUIDlist=2021A000259&GENDERlist=1,2,3&STATISTIClist=1&HEADERlist=0
British Columbia Population 2030	2020	British Columbia Statistics	*People 2020: BC Sub-Provincial Population Projections, page 1*	https://www2.gov.bc.ca/assets/gov/data/statistics/people-population-community/population/people_population_projections_highlights.pdf
Estimate Total Public Charging Infrastructure Needs as a Percentage for Canada	2022	Natural Resources Canada	*Canada's Public EV Charging Infrastructure Needs, pages 1-37.*	https://natural-resources.canada.ca/sites/nrcan/files/energy/cpcin/2022-ev-charging-assesment-report-eng.pdf
Existing EVSE in Vernon	2023	Plugshare	*Vernon Public EVSE Map*	https://www.plugshare.com/location/95070
Light Duty and EV Registration Data, British Columbia & Vernon	2022	Insurance Corporation of British Columbia	*Vehicle Population, 2022 Passenger Vehicles*	https://public.tableau.com/app/profile/icbc/viz/VehiclePopulation-PassengerVehicles-2022/2022PassengerVehicles?publish=yes
Recommended EV to Public Charger Port Ratio in Canada	2022	Natural Resources Canada	*Canada's Public EV Charging Infrastructure Needs, pages 1-37.*	https://natural-resources.canada.ca/sites/nrcan/files/energy/cpcin/2022-ev-charging-assesment-report-eng.pdf
Vernon Population 2021	2022	City of Vernon	*New Census Data Shows Significant Growth for Vernon*	https://www.vernon.ca/activities-events/news-events/news-archive/new-census-data-shows-significant-growth-vernon
Vernon Population 2036	2023	City of Vernon	*City of Vernon Official Community Plan, page 30*	https://www.vernon.ca/sites/default/files/docs/bylaws/OCP/4populationhousing.pdf

Appendix 2: Public EVSE Forecast Results

Population Data			
Vernon population 2021	44,519	Vernon Population 2030	58,087
BC population 2021	5,437,722	BC Population 2030	5,820,000
% of BC population	**0.82**	% of BC population	**1.00**

Current EV charger Ports in Vernon	
Number of Level 2 Chargers in Vernon	21
Number of Level 3 Chargers in Vernon	9
Total	**30**

EV Data, Province and City			
ICBC Vehicle Reg Data 2021- https://public.tableau.com/app/profile/icbc/viz/VehiclePopulation-PassengerVehicles-2022/2022PassengerVehicles?publish=yes			
No. Light Duty Vehicle in BC 2021	2,696,242	No. Light Duty Vehicle in Vernon 2021	30,328
Hybrid	104,008	Hybrid	2,182
Battery	59,844	Battery	237
Total EV	**163,852**	Total EV	**2,419**
% EV	**6.1**	% EV	**8.0**
		Vernon Actual % Market Share of Evs	**1.48%**
		People to EV ratio in Vernon, 2021	**18.4**

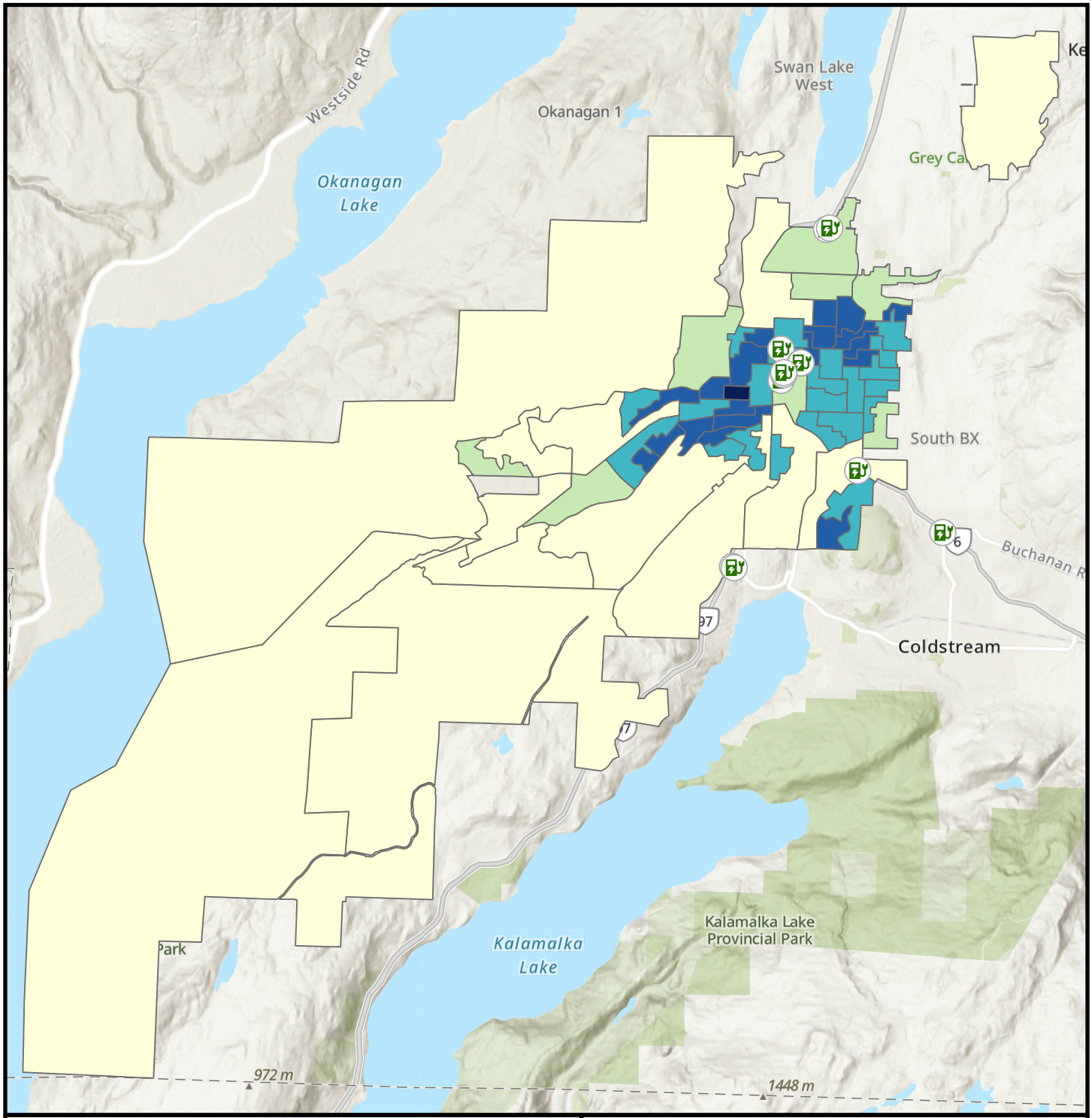
EV: Charger Port Calculations, Province and City Data			
Vernon as a Proxy of Provincial Data (ICBC Provincial Stats)		*Vernon Actual Baseline (ICBC Municiaplity Stats)*	
Number of EVs in Vernon	**1635**	Number of EVs in Vernon	**2419**
Number of people to EVs in Vernon	**27**	Number of people to EVs in Vernon	**18**
Number of EVs to Charger Ports in Vernon	**55**	Number of EVs to Charger Ports in Vernon	**81**
CURRENT ESTIMATE EV:CHARGER RATIO IN VERNON= 45:1		*CURRENT ESTIMATE EV:CHARGER PORT RATIO IN*	

BC 2030 EV Growth Calculations			Predicted # EVs in BC by 2030
	Vernon as a Proxy of Province	*City of Vernon 2030 Projection*	
Estimate Number of EVs in Vernon	**6350**	**9398**	**635,000**
Number of people to EVs in Vernon	**9**	**6**	
Number of EVs to Charger Ports in Vernon	**212**	**313**	

EV to Charger Port Ratios by 2030						
	California 7:1 Ratio		*EU 10:1 Ratio*		*Canada Ratio 24:1*	
	No. of Ports Needed	Deficit	No. of Ports Needed	Deficit	No. of Ports Needed	Deficit
2021 ICBC Provincial Data	234	**204**	164	**134**	68	**38**
2030 Projection Based Upon Provincial Vehicle Registration Data	907	**877**	635	**605**	265	**235**
2021 ICBC City of Vernon Vehicle Registration Data	346	**316**	242	**212**	101	**71**
2030 Projection Based Upon City of Vernon Vehicle Registration Data	1343	**1313**	940	**910**	392	**362**

Vernon 2030 EV Growth Calculations							
No. Light Duty Vehicle in Vernon 2030- based on population growth data	84995	Vernon Hybrid EV ownership projected to 2030, based on 1.12% market share		Vernon Battery EV ownership projected to 2030, based on 1.12% market share		Vernon Light Duty ownership projected to 2030, based on 1.12% market share	
Hybrid	6115	**2023**	2444	**2023**	265	**2023**	33967
Battery	664	**2024**	2786	**2024**	303	**2024**	38723
Total EV	6779	**2025**	3176	**2025**	345	**2025**	44144
% EV	8	**2026**	3621	**2026**	393	**2026**	50324
		2027	4128	**2027**	448	**2027**	57370
		2028	4705	**2028**	511	**2028**	65401
		2029	5364	**2029**	583	**2029**	74557
		2030	**6115**	**2030**	**664**	**2030**	**84995**

Estimate total public charging infrastructure needs as a percentage for Canada (split between Level 3 v Level 2)					
Year	**2030**	**2035**	**2040**	**2045**	**2050**
Public Level 3	13,800	32,000	50,200	62,700	69,000
Public Level 2	181,000	410,000	593,000	673,000	658,000
Total	194,800	442,000	643,200	735,700	727,000
% Level 3	7%	7%	8%	9%	9%
% Level 2	93%	93%	92%	91%	91%



City of Vernon Current Public EV Stations

Population Density per Square Kilometre:

- **35 - 646**
- **647 - 1,511**
- **1,512 - 2,724**
- **2,725 - 4,496**
- **4,497 - 6,190**

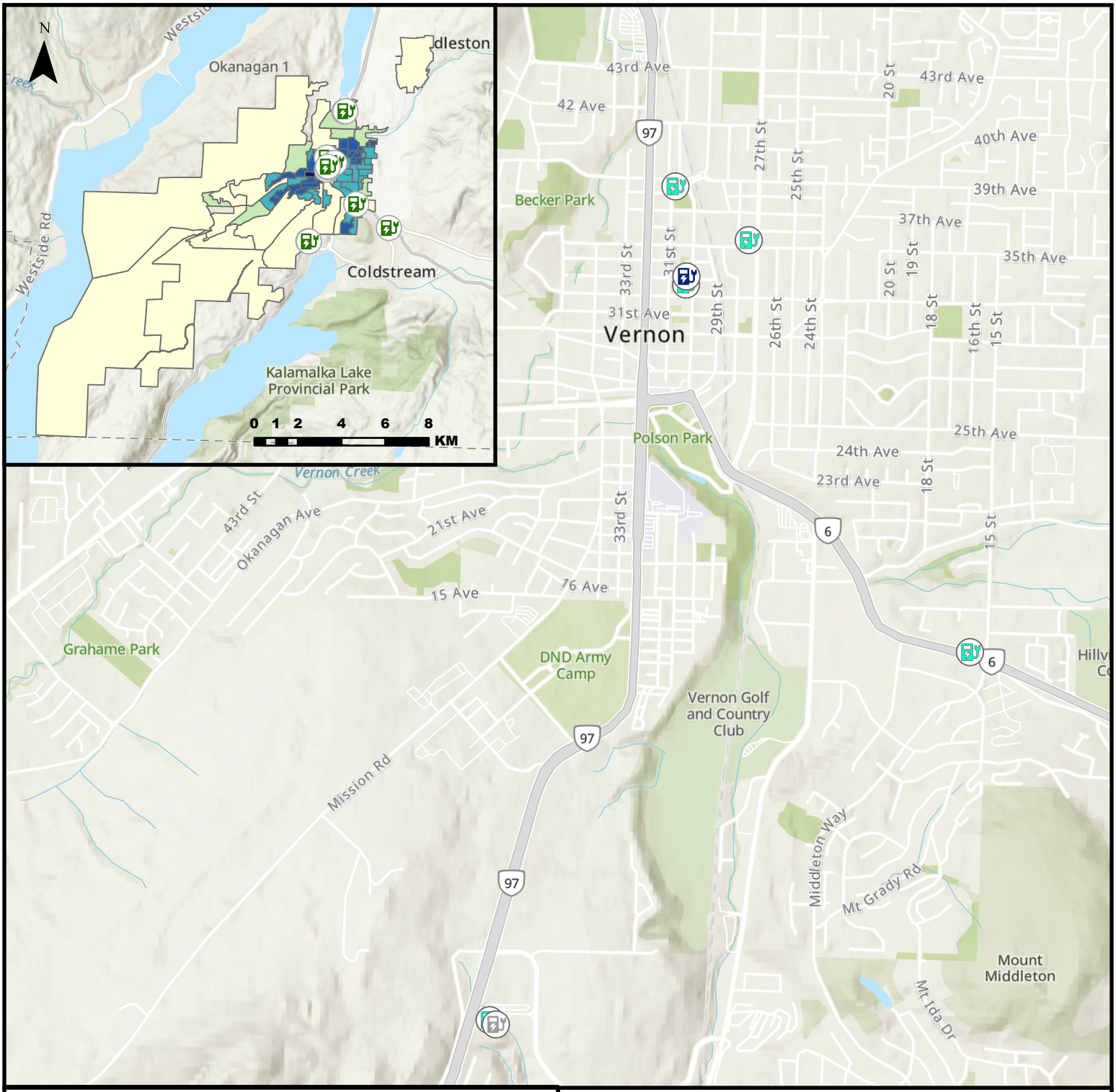
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Figure 1

City of Vernon Population Density by Census Dissemination Tract

Spatial Reference
Name: NAD 1983 UTM Zone 11N
Datum: North American 1983



City of Vernon Current L2 EVSE

Number of EV Level 2 Charging Ports at Each Station

- 1
- 2
- 3 - 4
- 5 - 6

Vernon City Boundary

Inset Map:

City of Vernon All Public EV Stations

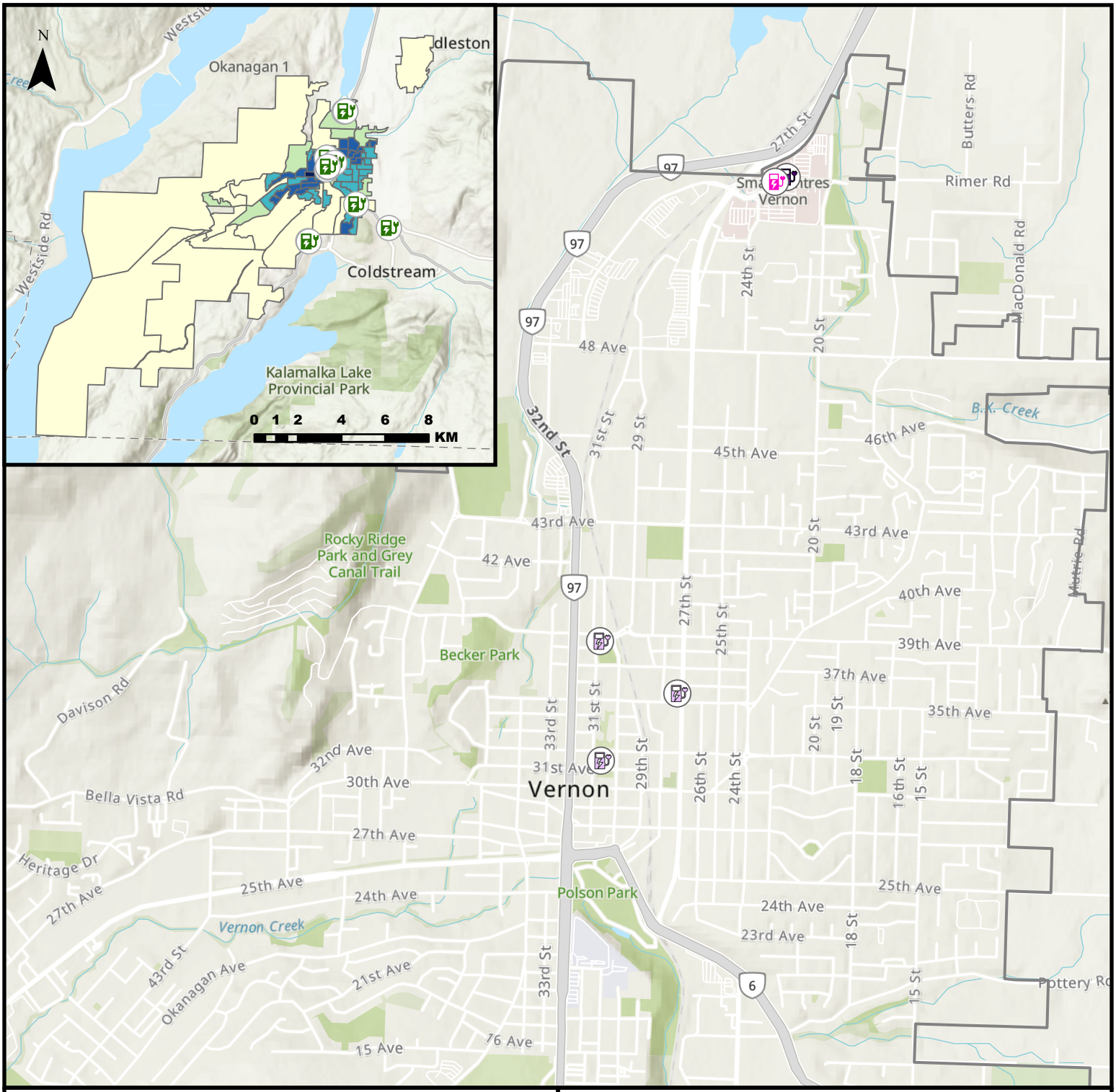
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Figure 2

City of Vernon Locations & Number of Charging Ports of Level 2 EVSE Current to Spring 2024

Spatial Reference
Name: NAD 1983 UTM Zone 11N
Datum: North American 1983



City of Vernon Current L3 DC Fast EVSE

Number of EV Level 3 Charging Ports at Each Station

- 1 - 2
- 3 - 4
- 5 - 12

Vernon City Boundary

Inset Map:

City of Vernon All Public EV Stations

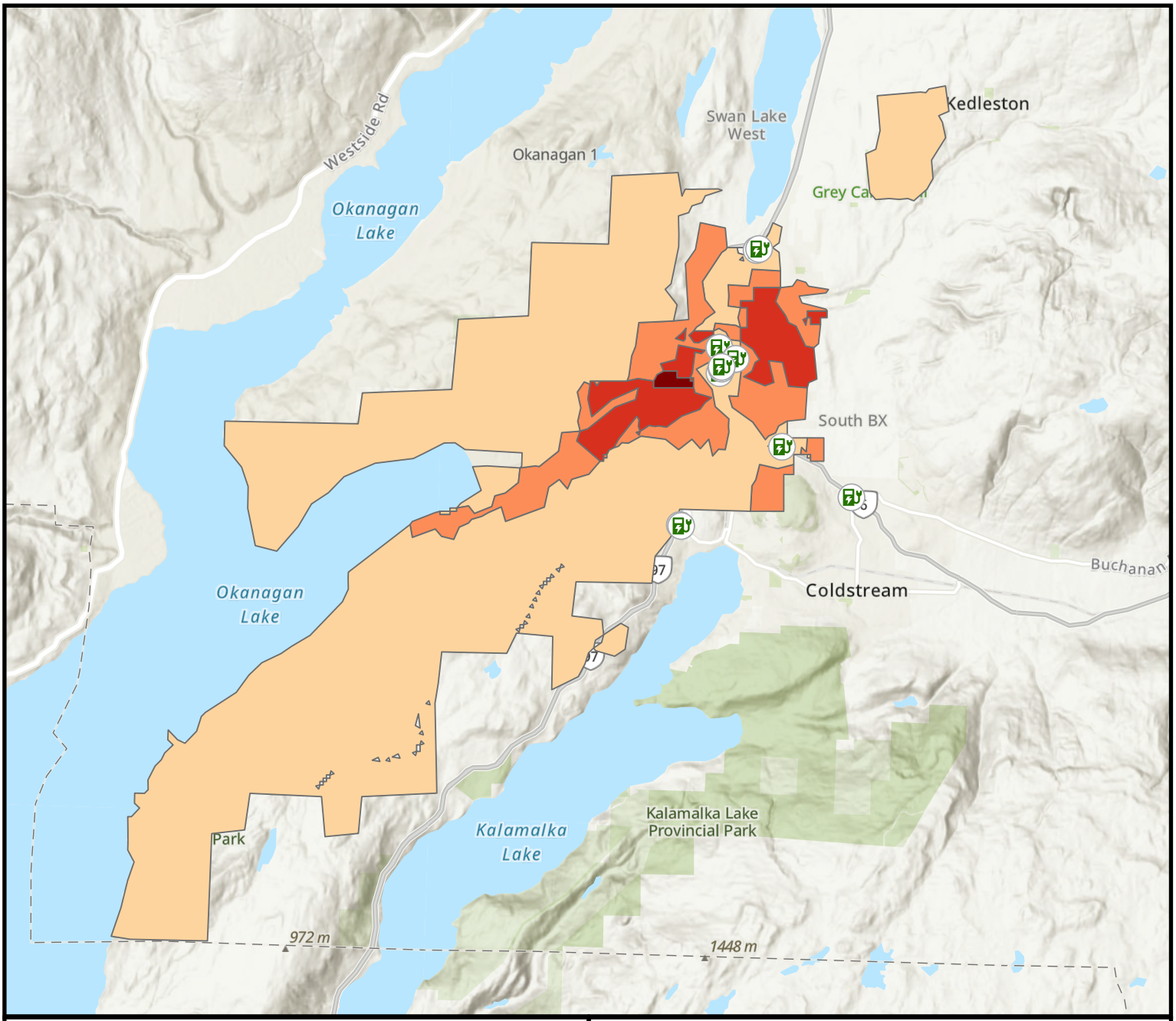
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Figure 3

City of Vernon Locations & Number of Charging Ports of Level 3 DC Fast EVSE Current to Spring 2024

Spatial Reference
Name: NAD 1983 UTM Zone 11N
Datum: North American 1983



City of Vernon Current Public EV Stations

Weighted Analysis - Suitability of Areas
Residential EV Locations

Rank:

- 1 - Least Suitable
- 2
- 3
- 4
- 5 - Most Suitable

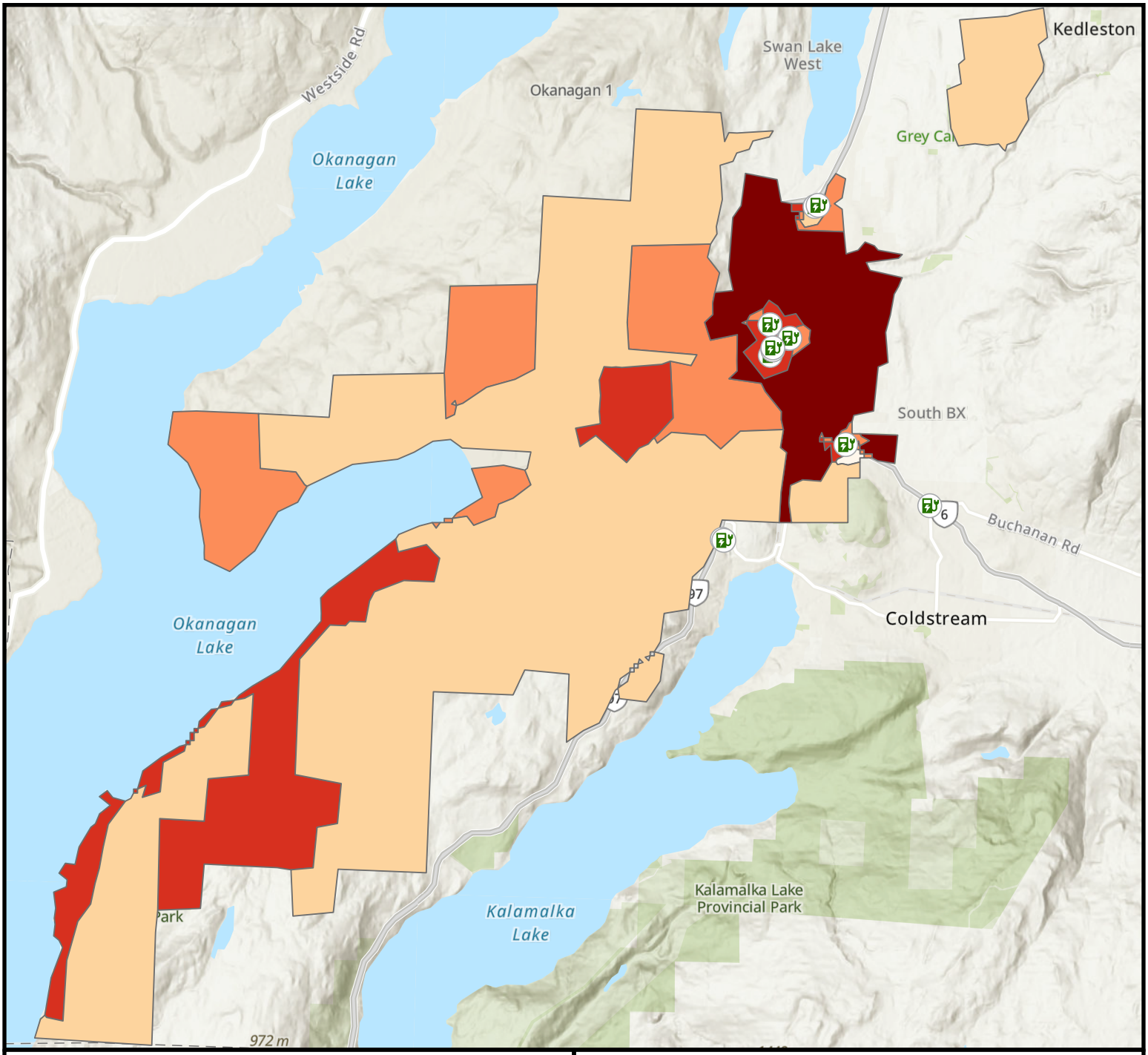
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Figure 4

Weighted Analysis Residential Lens
25% Walkability, 25% MURB Zoning, 50% Population Density

Spatial Reference
Name: NAD 1983 UTM Zone 11N
Datum: North American 1983



City of Vernon Current Public EV Stations

Weighted Analysis - Suitability of Areas
Commercial EV Locations

Rank:

- 1 - Least Suitable
- 2
- 3
- 4
- 5 - Most Suitable

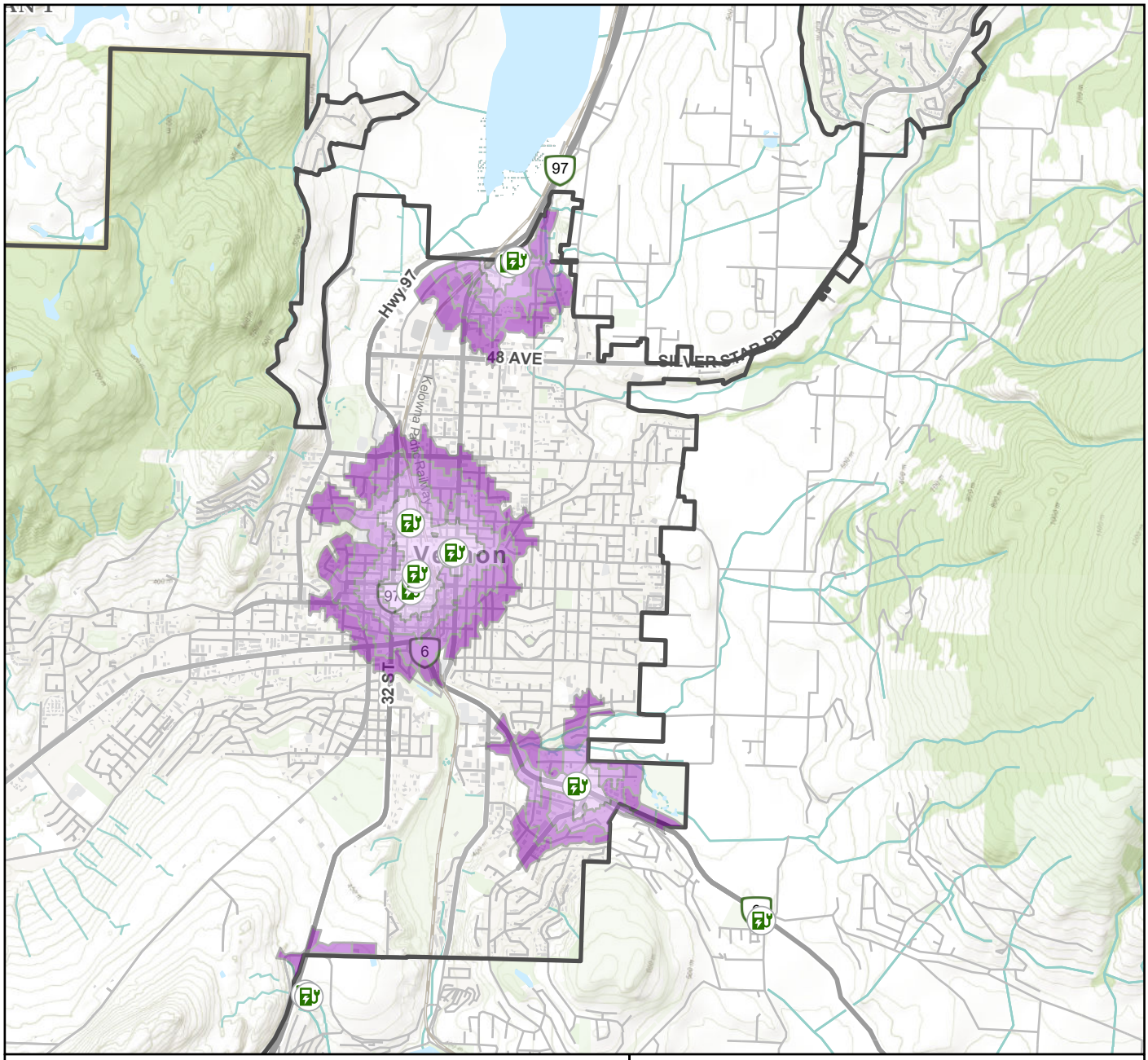
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Figure 5

Weighted Analysis Commercial Lens 30% Walkability, 20% Target Zoning, 30% Places of Interest, 20% Commercial/ Industrial/Public/Institution Zoning

Spatial Reference
Name: NAD 1983 UTM Zone 11N
Datum: North American 1983



City of Vernon Current Public EV Stations

Walkability Travel Areas (Metres)

- 300
- 500
- 700
- 900

Vernon City Boundary

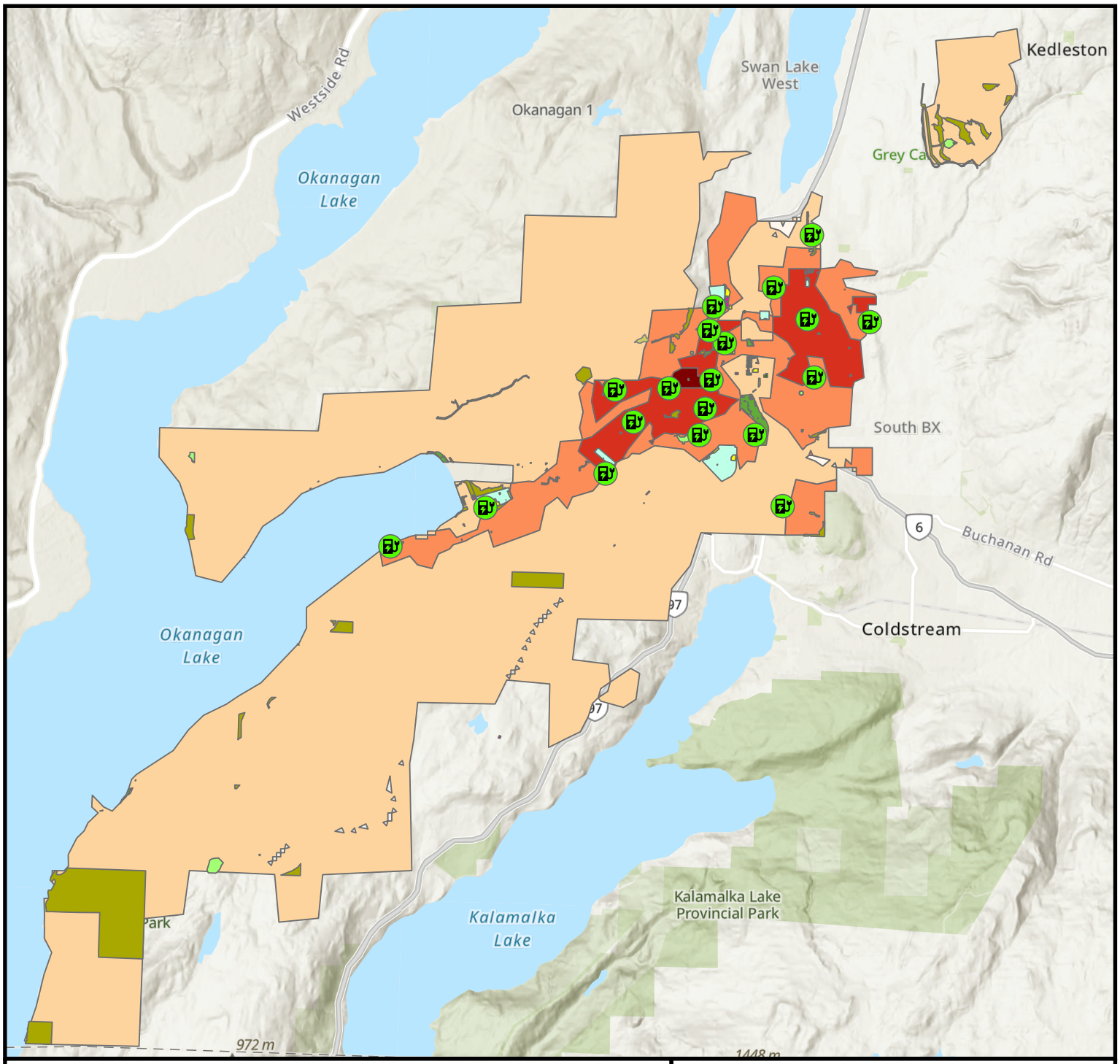
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Figure 6

Walkability Travel Distance from City of Vernon Current EV Charging Stations

Spatial Reference
Name: NAD 1983 UTM Zone 11N
Datum: North American 1983



Potential Residential EVSE Locations

Weighted Analysis - Suitability of Areas
Residential EV Locations

Rank:

- 1 - Least Suitable
- 2
- 3
- 4
- 5 - Most Suitable
- City Owned Facilities
- City Owned Parking Lots

City of Vernon Parks by Category

- Athletic Park
- Community Park
- Neighbourhood Park
- Urban Parks and Plazas
- Natural Area
- Unclassified

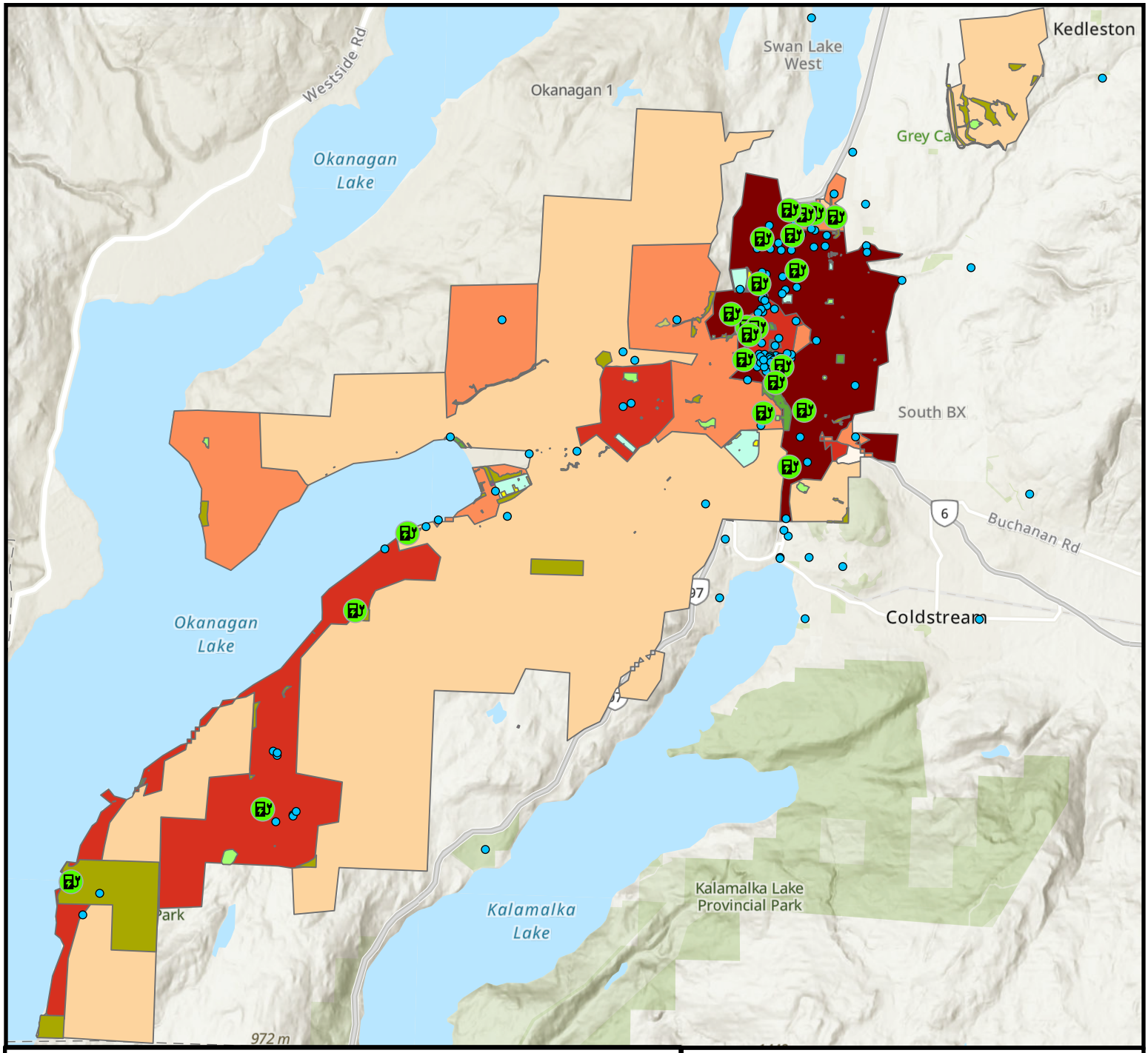
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Figure 7

Potential Level 2 EVSE in Residential Zones

Spatial Reference
Name: NAD 1983 UTM Zone 11N
Datum: North American 1983



Potential Commercial EVSE Locations

Weighted Analysis - Suitability of Areas
Residential EV Locations

Rank:

- 1 - Least Suitable
- 2
- 3
- 4
- 5 - Most Suitable
- City Owned Facilities
- City Owned Parking Lots

City of Vernon Parks by Category

- Athletic Park
- Community Park
- Neighbourhood Park
- Urban Parks and Plazas
- Natural Area
- Unclassified
- Vernon Places of Interest

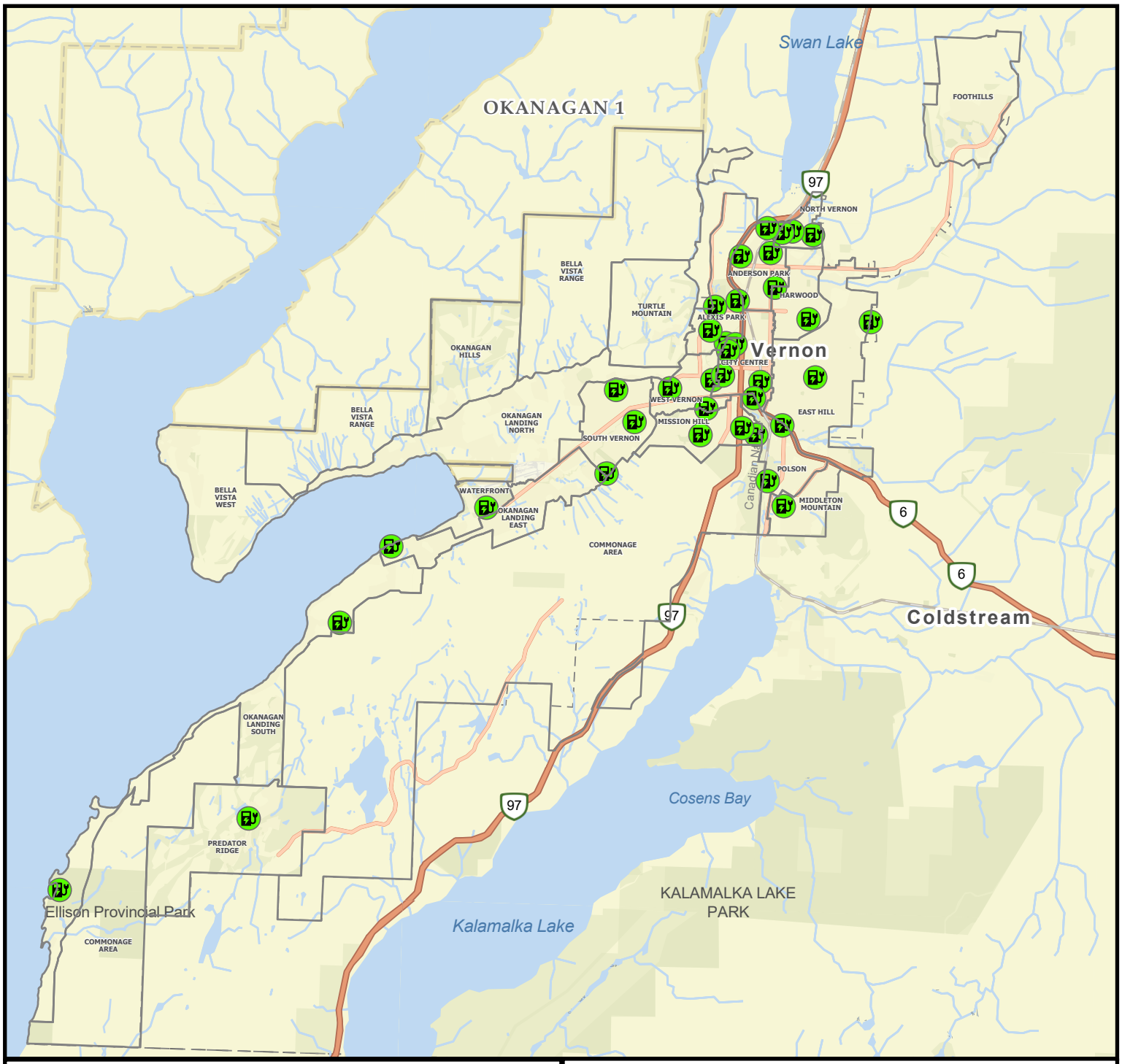
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Figure 8

Potential Level 3 EVSE in Commercial Zones

Spatial Reference
Name: NAD 1983 UTM Zone 11N
Datum: North American 1983



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City of Vernon All Potential EVSE Locations

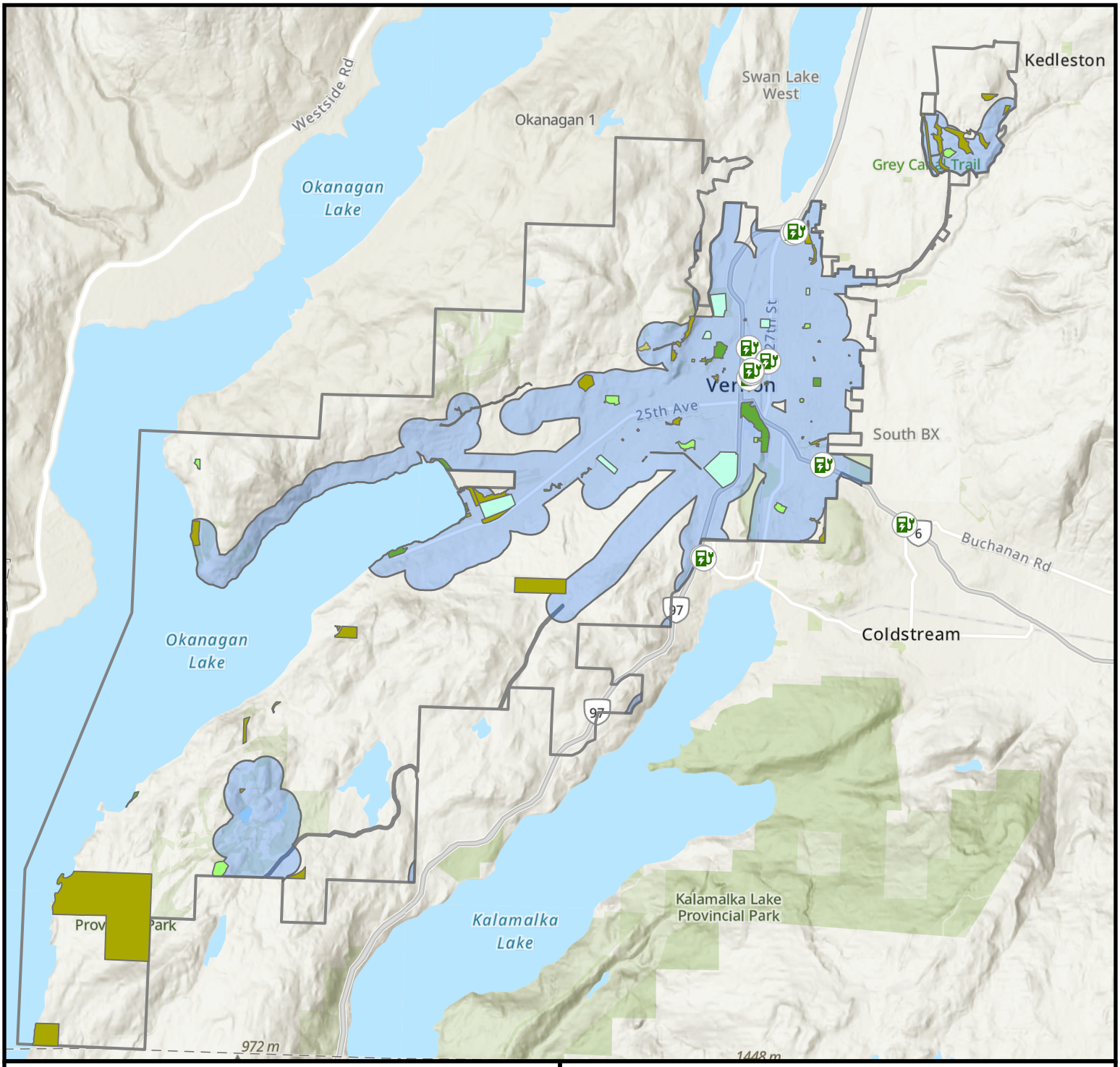
BELLA VISTA WEST

City of Vernon Neighbourhoods

Figure 9

City of Vernon Potential EVSE Infill Locations

Spatial Reference
Name: NAD 1983 UTM Zone 11N
Datum: North American 1983



City of Vernon Current Public EV Stations

City of Vernon Parks by Category

- **Athletic Park**
- **Community Park**
- **Neighbourhood Park**
- **Urban Parks and Plazas**
- **Natural Area**
- **Unclassified**

City of Vernon Bike Routes - 300m Walkability buffer zone applied

City of Vernon Boundary

0 1 2 3 4 5 KM

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Figure 10

City of Vernon Bike Routes with Walkability Buffer & Parks Network

Spatial Reference
Name: NAD 1983 UTM Zone 11N
Datum: North American 1983

Appendix 4: EVSE Distribution per Census Dissemination Area

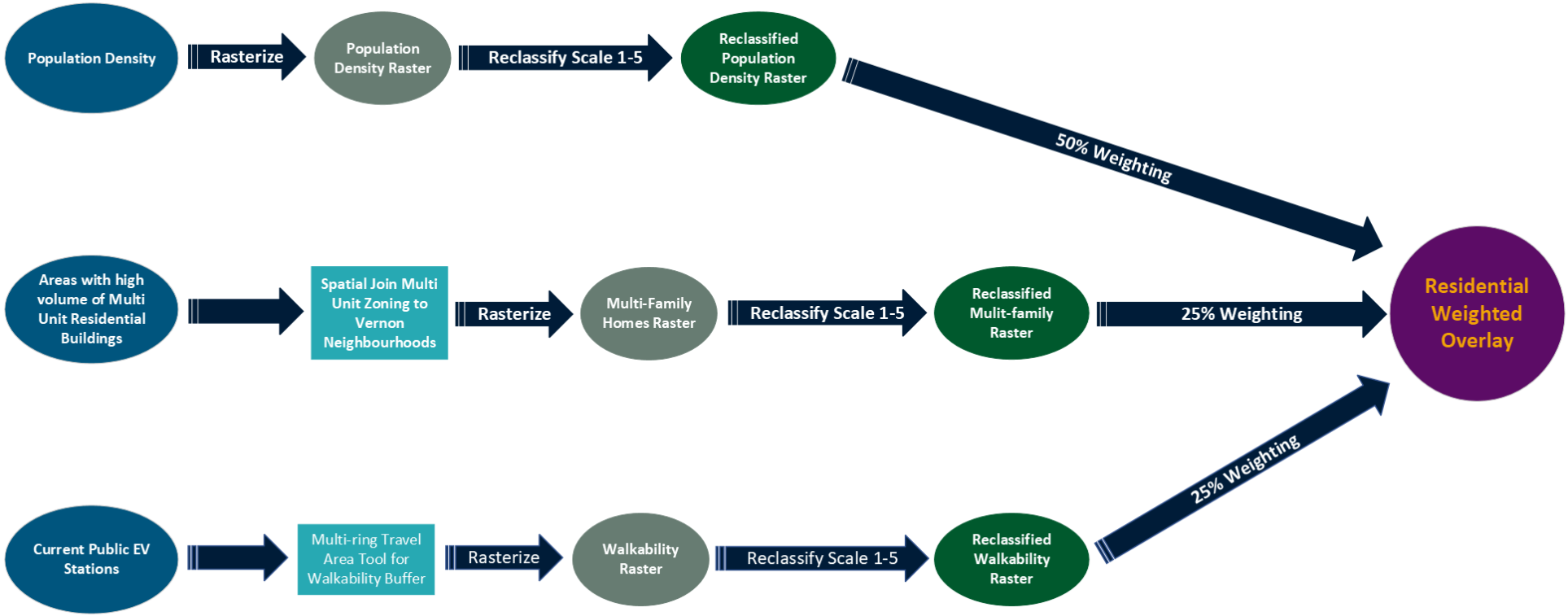
Census Dissemination Area ID	Population	# Private Dwellings	Car Ownership (1.5 per house)	Car Ownership Per Census Area as % of Total Ownership	Target # Ports per Area (car ownership)	Density (sq km)	Population % of area	Target # Ports per Area (population)
59370164	613	274	411	1	5	925	1.4	5
59370167	399	149	224	1	3	2,500	0.9	3
53970168	456	162	243	1	3	3,431	1.0	4
59370169	414	198	297	1	3	3,315	0.9	3
59370170	380	177	266	1	3	2,570	0.9	3
59370171	405	191	287	1	3	2,502	0.9	3
59370172	484	204	306	1	3	2,004	1.1	4
59370173	334	125	188	1	2	2,467	0.8	3
59370179	589	236	354	1	4	2,724	1.3	5
59370181	518	244	366	1	4	2,932	1.2	4
59370182	663	256	384	1	4	3,464	1.5	5
59370183	753	352	528	2	6	2,865	1.7	6
59370184	538	203	305	1	3	3,528	1.2	4
59370185	619	276	414	1	5	1,291	1.4	5
59370193	689	506	759	2	8	6,190	1.6	6
59370196	516	236	354	1	4	2,066	1.2	4
59370197	387	150	225	1	3	2,180	0.9	3
59370198	516	213	320	1	4	3,660	1.2	4
59370199	746	345	518	2	6	3,470	1.7	6
59370200	577	345	518	2	6	2,457	1.3	5
59370201	931	441	662	2	7	3,665	2.1	8
59370202	613	343	515	2	6	3,853	1.4	5
59370203	1,578	840	1,260	4	14	1,311	3.6	13
59370205	2,627	1,266	1,899	6	21	116	6.0	22
59370206	589	229	344	1	4	2,145	1.3	5
59370207	1,022	473	710	2	8	637	2.3	8
59370208	966	497	746	2	8	1,874	2.2	8
59370209	408	169	254	1	3	3,472	0.9	3
59370210	515	205	308	1	3	3,169	1.2	4
59370211	1,040	411	617	2	7	280	2.4	9
59370212	419	243	365	1	4	104	0.9	3
59370213	493	272	408	1	5	2,242	1.1	4
59370214	569	282	423	1	5	309	1.3	5
59370216	596	275	413	1	5	455	1.4	5
59370217	1,364	655	983	3	11	2,448	3.1	11
59370218	864	344	516	2	6	3,092	2.0	7
59370256	679	475	713	2	8	35	1.5	6
59370257	802	358	537	2	6	414	1.8	7
59370258	538	257	386	1	4	479	1.2	4
59370259	1,041	405	608	2	7	1,201	2.4	9
59370261	472	196	294	1	3	1,058	1.1	4
59370262	538	219	329	1	4	607	1.2	4
59370263	1,548	1,095	1,643	5	18	86	3.5	13
59370272	304	134	201	1	2	2,512	0.7	2
59370273	616	254	381	1	4	4,496	1.4	5
59370276	1,156	747	1,121	3	13	3,442	2.6	9
59370277	474	242	363	1	4	2,584	1.1	4
59370279	612	481	722	2	8	2,102	1.4	5
59370280	407	191	287	1	3	837	0.9	3
59370282	498	323	485	1	5	3,562	1.1	4
59370283	782	393	590	2	7	3,476	1.8	6
59370286	526	239	359	1	4	300	1.2	4
59370287	547	246	369	1	4	1,985	1.2	4
59370289	375	178	267	1	3	2,995	0.8	3
59370290	563	236	354	1	4	2,721	1.3	5
59370291	533	224	336	1	4	2,058	1.2	4
59370292	484	197	296	1	3	1,850	1.1	4
59370293	566	215	323	1	4	1,858	1.3	5
59370304	167	432	648	2	7	1,952	0.4	1
59370308	505	216	324	1	4	1,511	1.1	4
59370316	2,195	854	1,281	4	14	646	5.0	18
59370321	365	128	192	1	2	3,339	0.8	3
59370325	1,656	834	1,251	4	14	1,182	3.8	14
	44,139	**21,556**	**32,334**	**100**	**362**	**135,001**	**100.0**	**362**

Appendix 5: Final Site Selection

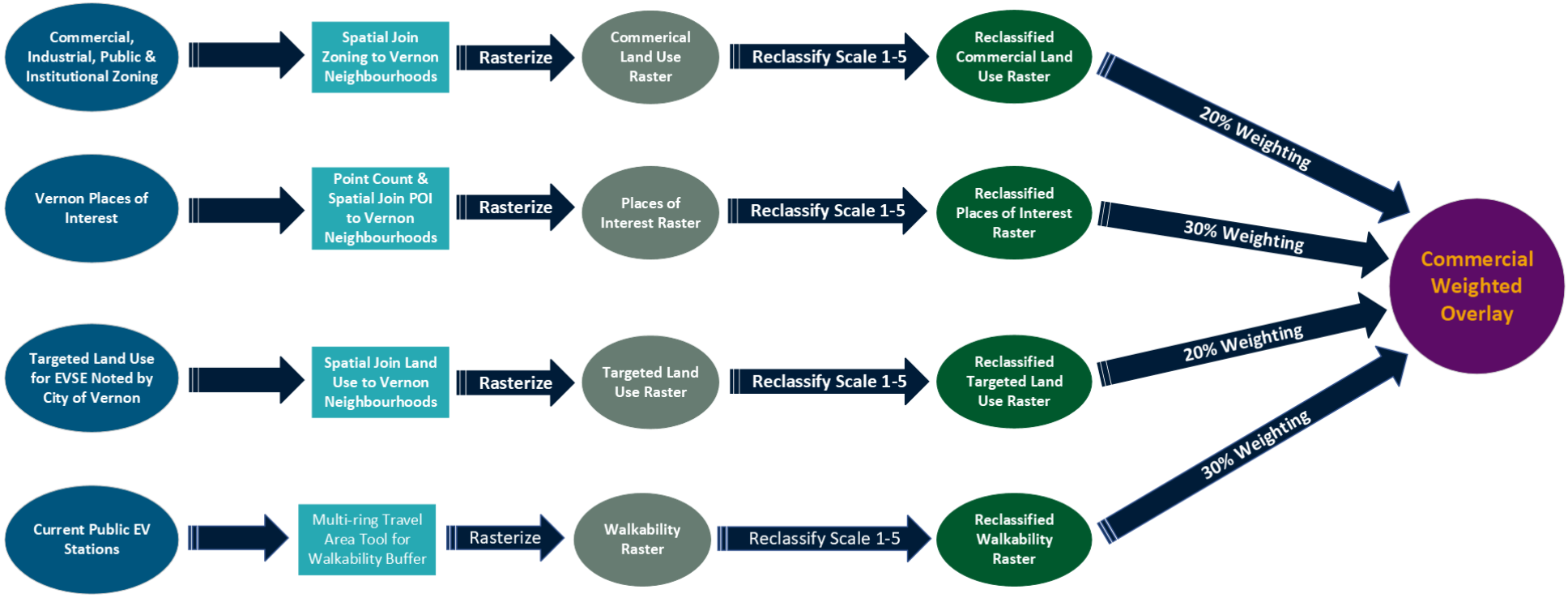
Rank	Name	Street Address	Target # of EVSE Ports per Area	Latitude	Longitude	EVSE Preference	Residential/Commercial	Facility Type	Land Ownership	Nearby Amenities	Accessibility Considerations	Safety Considerations	Notes
1	Active Living Centre	<Null>	4	50.275133	-119.280881	Highly suitable for L3 charging	Residential/Commercial	Recreation Facility	Municipal	Vernon Prestige Hotel Grocery/Food Service/Café/Multiple restaurants. Mall located at 33rd St and 43rd Ave.	The ALC is being developed on an unused site, and therefor charger accessibility can be integrated into the site design for the overall project. CEA will provide documents which provide extensive recommendations on accessible charging stall design.	No major safety concerns	BC Hydro prime location - already approved for construction
1	Lakeview Park	<Null>	4	50.264118	-119.254892	Highly suitable for L3 charging	Residential	Park	Municipal	Lakeview Market, Silverstar Elementary. Largely residential area with few notable amenities.	As this site is set for renovations, CoV could design a parking lot with accessible EV charging stalls.	No major safety concerns	Possible BC Hydro location - renovation of facilities and in an up and coming dense residential zone
1	Harwood North/Girouad Park	4515 27 St, Vernon, BC V1T 4Y6	5	50.278929	-119.257431	Prefereable for L2 charging	Residential/Commercial	Shopping	Private	Plaza 27 (including multiple restaurants and convenience store), Gas+ Station	An abundance of large paved parking lots nearby should allow space for accessible stalls to be included in EVSE deployment. Vernon might consider adding enhanced predestrian infrastructure in this area such as signalized crosswalks and traffic calming, to increase overall safety for folks walking or	Vernon might consider adding enhanced predestrian infrastructure in this area such as signalized crosswalks and traffic calming, to increase overall safety for folks walking or rolling once they leave their vehicle.	High density residential and commercial hot spot - location requires private partnership, currently at strip mall and veteran's organization parking lot but could move to other commercial location in area
1	41st Street & 27th Ave Residential	3802 27 Ave, Vernon, BC V1T 1S6	8	50.260942	-119.29172	Prefereable for L2 charging	Residential	Mix of singlefamily homes and MURBs	Municipal/Private	Happy Days Conveience Store. Largely residential area with few amenities.	No accessibility concern are explicitly noted, as this site requires further investigation and/or partnership with local MURBs to provide a suitable site for charger placement.	This area features some homes without driveways; which pose challenging for charging as running cables across pedestrian walkways to charge vehicles parked along the street presents hazards	Residential location needed for high population density, hard to find an exact loaction here could be partnered with private land in nearby MURB parking lot east along 27th avenue or commercial location SW along 41st street
1	Clarence Fulton Secondary	<Null>	8	50.247425	-119.307157	Prefereable for L2 charging	Residential	School	Municipal	Located opposite garden centre. 1km away from multiple restaurants including McDonald's- liekly too far to walk.	No major accessibility concerns.	Placement at a school could cause safety concerns for children walking to or playing near the school, as the chargers could increase traffic to the area.	Dense residential zone, location has several public places near here and could be good place to infill
1	Armory Park	<Null>	5	50.254471	-119.269478	Highly suitable for L3 charging	Residential	Park	Municipal	Located far from appropriate amenities. Close to Vernon Hospital. Nearby hiking trails- could be used by hikers whilst exercising.	Street shoulders are gravel or grass which is not accessible for folks with a mobility aid.	Streetside chargers should be carefully installed along with traffic calmin measures to reduce safety risks for EV drivers as they exit onto the street and plug in their vehicle.	South end of Polson Park, renovation may provide opportunity in a dense pop zone
1	Science Centre	<Null>	5	50.260457	-119.270283	Strong L3 potential. It is a highly commercial area, adjacent to the skatepark, city centre, and 2 major thoroughfares.	Commercial	Attraction	Municipal/Private	Adjacent to Highway 6. Close to key amenities such as Polson Park (washrooms) , various restaurants, and Vernon Downtown core.	Some stalls in the parking lot run adjacent along a raised curb, which present accessibility concerns for folks with mobility aids trying to reach charging units which are placed behind the curb.	No major safety concerns	Noth Polson Park location, could be moved to another parking lot if no room here, but an ideal location for an attraction
1	Polson Mall	<Null>	5	50.25609	-119.265191	Prefereable for L2 charging	Commercial	Shopping	Private	Excellent location with lots of amenities including pharamacy, grocery store, and restaurants.	Some stalls in the parking lot run adjacent along a raised curb, which present accessibility concerns for folks with mobility aids trying to reach charging units which are placed behind the curb.	The site appears to be enclosed from major roadways, which can lead to poor public visibility during overnight hours. This could potentially lead to increased risk of vandalism, theft, or other crime.	Mall located adjacent to Highway 6 with multiple key amenities, including grocery stores, hairdressers, and a bank. High commercial and population density.
1	Marshall Field	<Null>	4	50.241257	-119.337406	Prefereable for L2 charging	Residential	Recreation Facility	Municipal	Washroom facilities, but not close to other amenities. Ideal for sepctators watching events on baseball field, dog walkers, etc.	Renovations of the area should allow for complete accessibility design	Renovations of the area should allow for complete safe design	Possible BC Hydro location - renovation of facilities and in an up and coming dense residential zone
1	36th Street Residential	2312 36 St, Vernon, BC V1T 6W2	2	50.258508	-119.282328	Prefereable for L2 charging	Residential	Mix of singlefamily homes and MURBs	Municipal/Private	Would serve MURBs; provide overnight charging for residents	Some stalls in the parking lot run adjacent along a raised curb, which present accessibility concerns for folks with mobility aids trying to reach charging units which are placed behind the curb.	No major safety concerns.	Residential location needed for high population density, hard to find an exact loaction here but many MURB's in area and could find a private partnership
1	Schubert Centre Parking	<Null>	9	50.263173	-119.280984	Prefereable for L2 charging	Residential	Parking Lot	Municipal/Private	Located just off 30th Ave in close proximity to various grocery stores and a pharmacy.	Some stalls in the parking lot run adjacent along a raised curb, which present accessibility concerns for folks with mobility aids trying to reach charging units which are placed behind the curb.	No major safety concerns.	In very dense MURB zone, might need to work with private landowner here - Impark lot is a possibility
1	Becker Park 1	<Null>	9	50.269257	-119.277863	Highly suitable for L3 charging	Residential/Commercial	Park	Municipal	In close proximity to amenities such as 7/11, a bank, and a Shell garage.	Large parking lot conducive to accessible EV chargers.	No major safety concerns.	Prime location filling both residential and commercial needs - possible BC Hydro location
1	Performing Arts Centre	<Null>	9	50.26914	-119.275419	Prefereable for L2 charging	Commercial	Arts & Culture	Municipal	In close proximity to amenities such as 7/11, a bank, and a Shell garage.	Some stalls in the parking lot run adjacent along a raised curb, which present accessibility concerns for folks with mobility aids trying to reach charging units which are placed behind the curb.	No major safety concerns.	Additional infill for commercial location, can be moved to another location in this area
1	Becker Park 2	<Null>	9	50.267985	-119.277209	Highly suitable for L3 charging	Commercial	Recreation Centre	Provincial	In close proximity to amenities such as Tim Hortons, a bank, and a Shell garage.	Large parking lot conducive to accessible EV chargers.	No major safety concerns.	Additional infill for commercial location, can be moved to another location in this area
1	Towne Theatre	<Null>	3	50.263096	-119.268772	Prefereable for L2 charging	Commercial	Arts & Culture	Municipal	Excellent location in downtown core. Close proximity to various amenities.	Streetside charging possible, but may be too narrow	Provide additonal pedestrian safety features and traffic calming measures.	Additional infill for commercial location, can be moved to another location in this area
1	30th Avenue and 34th Street	30th Avenue and 34th Street	3	50.263999	-119.276958	Prefereable for L2 charging	Commercial	Shopping	Private	Adjacent to Sun Valley mall, containing multiple restaurants and stores.	Some stalls in the parking lot run adjacent along a raised curb, which present accessibility concerns for folks with mobility aids trying to reach charging units which are placed behind the curb.	No major safety concerns.	Strip mall with high commercial and population density, located on a key route through Downtown Vernon to Highway Avenue. The larger parking lot at FreshCo is best target, but could be elsewhere depending on landowner interest
1	Vernon Square	<Null>	4	50.276232	-119.275168	Prefereable for L2 charging	Commercial	Shopping Centre	Municipal	Mid sized mall with high density of key amenities including grocery store, cafes, and restaurants.	Large open parking lot with various suitable areas to build accessible EV chargers.	No major safety concerns. Area wel l lit. Would likely only be acessible during store opening hours.	Additional infill for commercial location, can be moved to another location in this area
1	Village Green Mall	<Null>	14	50.284172	-119.267161	Prefereable for L2 charging	Commercial	Shopping	Municipal	Large mall in northern Vernon with several key amenities in close proximity.	Large paved car park conducive to accessible EV parking stalls. Provide clear signage in parking lot.	No major safety concerns. Area wel l lit. Would likely only be acessible during store opening hours.	Additional infill for commercial location, can be moved to another location in this area
1	Anderson Business Park South	<Null>	14	50.283468	-119.274731	Prefereable for L2 charging	Commercial	Shopping	Private	Large industrial site in northern Vernon with several key amenities in walking distance.	Large paved car park conducive to accessible EV parking stalls. Provide clear signage in parking lot.	No major safety concerns. Area wel l lit.	Additional infill for commercial location, can be moved to another location in this area
1	Anderson Business Park North	<Null>	14	50.288211	-119.268182	Prefereable for L2 charging	Commercial	Shopping Centre	Private	Large industrial site in northern Vernon with several key amenities in walking distance.	Large paved car park conducive to accessible EV parking stalls. Provide clear signage in parking lot.	No major safety concerns. Area wel l lit.	Additional infill for commercial location, can be moved to another location in this area

2	Harwood	<Null>	6	50.273559	-119.257041	Prefereable for L2 charging	Residential	Park	Municipal	Girouad Park. Otherwise, largely residential area. Walking distance to Dollar Tree and K Mart on 43rd Ave.	Harwood/Girouard park features a gravel parking lot with a raised curb dividing it from the roadway, presenting potential accessibility challenges. The parking lot is not very wide, and it could be difficult to accomodate accessible stall design. Thhere may be opportunities for nearby placements at a school or in City-	Placement at a school could cause safety concerns for children walking to or playing near the school, as the chargers could increase traffic to the area.	Dense residential zone, this location needs some help with placement, 2 city parking lots adjacent to park, are those good or can we find a good alternate location near here? Could be moved to Harwood Elementary as well - Review
2	Mutrie Road	900 block of 39th Avenue	3	50.273407	-119.241174	Prefereable for L2 charging	Residential	Park	<Null>	Largely residential and rural, with no close amenities.	As this site is set for renovations, CoV could design a parking lot with accessible EV charging stalls.	No major safety concerns	Current location at dog park, on edge of dense population zone, but in area of new development. Location could move depending on development - review
2	Ellison Provincial Park	<Null>	13	50.176755	-119.442568	Prefereable for L2 charging	Commercial	Park	Provincial	Remote location, not many amenities in walking distance. Likely be used by hikers using the trails at this location.	Upper trailhead car park made of gravel, with additional parking on the road. Not conducive to folks with mobility needs	remote, poorly lit.	Provincial park land that is useful to capture lakeshore south recreation
2	Walmart	<Null>	14	50.287794	-119.261819	Prefereable for L2 charging	Commercial	Shopping Centre	Private	Located in SMartCentres mall, offering washroom facilities, refreshments, and other amenities.	Large paved car park conducive to accessible EV parking stalls. Provide clear signage in parking lot.	No major safety concerns. Area well lit. Would likely only be acessible during store opening hours.	Additional infill for commercial location, can be moved to another location in this area
2	Mission Hill Park	3876 15 Ave, Vernon, BC V1T 8H4	3	50.254161	-119.283594	Prefereable for L2 charging	Residential	Park	<Null>	Mission Hill Elementary- convenient for school drop off and pick up?	Road width may inhibit the accessibility of streetside charging installed at the dog park. Alternatively, chargers could be placed nearby at the elementary school in the paved parking lot.	Streetside chargers should be carefully installed along with traffic calmin measures to reduce safety risks for EV drivers as they exit onto the street and plug in their vehicle. Secondly, placement at the nearby elementary school could cause safety concerns for children	Dense residential zone, infilll location, could be paced at Mission Hill Elementary or onstreet at the Mission Hill Dog Park entrance
2	Heritage Park	<Null>	5	50.261104	-119.305374	Prefereable for L2 charging	Residential	Park	Municipal	Strip mall south of site just off 27th Avenue. Multiple restaurants.	Road width may inhibit the accessibility of streetside charging.	Proximity to local traffic could pose a safety concern	Not a good spot to put EVSE as no parking lot obvious here, could be partnered with private land in nearby MURB parking lot
2	Jubilee	<Null>	5	50.255521	-119.273048	Prefereable for L2 charging	Commercial	Hospital	Provincial	Located far from appropriate amenities. Likely be used by staff on shift at hospital who cannot charge at home.	Some stalls in the parking lot run adjacent along a raised curb, which present accessibility concerns for folks with mobility aids trying to reach charging units which are placed behind the curb.	No major safety concerns	High ranking location for need, but would have to work with Province to implement
2	Paddlewheel Park	<Null>	6	50.234454	-119.361236	Prefereable for L2 charging	Residential/Commercial	Recreation	Municipal	Washrooms avaialble at park, also close to 1516 restaurant. Location isolated from other amenities.	Desktop analysis shows this to be a gravel parking lot, which could pose accessibility concerns for folks using mobility aids.	There does not appear to be lighting or designated pedestrian walkways in the parking lot	Fits both residential and commercial, also tourist. City parking lot along lakeshore so appealing for multiple reasons
2 or 3	Alexis Park Parking Lot		2	50.27136814	, -119.2834820002	Prefereable for L2 charging	Commercial	Park	Municipal	used by visitors to park, not in walking distance to many amenities.	Parking provided on street or dirt paths. Unsuitable for folks with mobility impairments. Too narrow for EV charging.	Poorly lit area. Pedestrians have no choice but to walk on road- no footpaths.	Municipal park located northwest of Downtown Vernon with mid population density and high commercial ranking more favourable locations nearby, so infill location with lower ranking
3	Predator Ridge	<Null>	13	50.189402	-119.395241	Prefereable for L2 charging	Commercial	Park	Private	The resort at this location has amenites including accomodation, restaurants, and washrooms. Otherwise not close to other amenities. Likely use case is visitors staying at the resort charging overnight.	Some stalls in the parking lot run adjacent along a raised curb, which present accessibility concerns for folks with mobility aids trying to reach charging units which are placed behind the curb.	Location poorly lit.	Find a commercial partner location here, lower priority as this is a single family residential zone
3	Vernon Golf and Country Club		5	50.247325	-119.264896	Prefereable for L2 charging	Commercial	Leisure	Private	Located opposite Jen Alio's restaurant. Golf club will have amenities such as washrooms.	Google Maps do not allow for a clear view of the parking lot to determine likely placements and accessibility remarks.	Undertermined.	Golf club and restaurant located south of Vernon's downtown core, accessible off Kalamalka Lake Road. Lower priority target due to the limited visitation. If parking is restricted after hours this could limit the total benefit provided by the chargers to the public. CoV should check into any restirctions on parking imposed by the golf course
3	Quality Inn and Suites		4	50.27428548488	-119.2744813	Prefereable for L2 charging	Commercial	Hotel	Private	Located just south of Vernon Square mall, close proximity to numerous key amenities.	Some stalls in the parking lot run adjacent along a raised curb, which present accessibility concerns for folks with mobility aids trying to reach charging units which are placed behind the curb.	No major safety concerns	Hotel located adjacent to Highway 97 in Downtown Vernon, with high population density. Close proximity to numerous amenities.
3	Okanagan Royal Park Inn		6	50.260763	-119.277331	Prefereable for L2 charging	Commercial	Mixed Use	Private	Adjacent to Highway 97, Polson Park, and Vernon downtown core.	Some stalls in the parking lot run adjacent along a raised curb, which present accessibility concerns for folks with mobility aids trying to reach charging units which are placed behind the curb.	No major safety concerns.	Mixed use commerical location with accomodation, doctors office, conveniecne store, and gas station.
3	Sawicki Park	<Null>	5	50.242991	-119.261896	Prefereable for L2 charging	Residential	Park	Municipal	Possible washrooms at park, but Google Maps image outdated (2014). Largely residential area.	Some stalls in the parking lot run adjacent along a raised curb, which present accessibility concerns for folks with mobility aids trying to reach charging units which are placed behind the curb. There does not appear to be an accessible sidewalk or pedestrian route leading out of the parking lot, for visitors who may wish to	No major safety concerns	Lower priority on edge of dense residential and commercial, but city owned existing parking lot here
3	Locheed Provincial Park	<Null>	13	50.221752	-119.373685	Prefereable for L2 charging	Commercial	Park	Provincial	Low access to amenities. Large location generally isolated from other facilities. Access via trailheads?	N/A - further investigation to fins a suitable site for EVSE is needed.	N/A - further investigation to fins a suitable site for EVSE is needed.	Provincial park land that is useful to capture recreation, could also find a commercial partner in this residential zone other than the park. Lower priority target due to single family residential zoning

Appendix 6: GIS Model Workflow



5. Simplified process flow of data type and analysis for Residential EVSE weighted overlay mapping.



6. Process flow of data type and analysis for Commercial EVSE weighted overlay mapping.