Report for

Coopers Pointe EV Infrastructure Assessment

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DESIGNING A BETTER TOMORROW

Table of Contents

1. Introduction

The following report provides a strategy for implementation of electric vehicle (EV) charging infrastructure based on the existing capacity of the electrical system at *Coopers Pointe*, located at 980 Cooperage Way, Vancouver.

EV sales in British Columbia have increased by almost 400% between Q3 2017 and Q3 2019, with EV sales accounting for more than 10% of all passenger vehicle sales in the province and a much higher percentage in Metro Vancouver. Inherent advantages of EVs include performance, efficiency, noise reduction, reduced maintenance, and zero tail-pipe emissions. With battery costs decreasing every year, increasing availability of different EV models, BC and national incentive programs, BC ZEV (Zero Emission Vehicle) mandate, combined with the underlying motivation of greenhouse emission reductions targets, EV adoption can be expected to continue to accelerate. This means more visitors and tenants of *Coopers Pointe* with EVs, and subsequently greater demand for charging facilities.

The intent of the report is to ensure *Tribe Management Inc.* is in an informed position to address the challenges of demand for charging. Major components of the report include:

- Basics;
- Capacity;
- Charging performance;
- Design;
- Costs;
- Recommendations.

Refer to the following section for a brief description of the basics of EV charging.

2. Basics

Electric vehicles may be either fully electric, known as battery electric vehicles (BEVs); or a combination of electric and gasoline powered, known as plug-in hybrid electric vehicles (PHEVs). Both require recharging of the battery via electric vehicle charging equipment.

Electric vehicle charging equipment, known as electric vehicle supply equipment (EVSE) is classified in the following major categories:

- Level 1: 15-amp, 120-volt power outlet;
- Level 2: Typically, 32-amp, 208 or 240-volt single phase EVSE;
- Level 3: Typically, 30-amp or higher, 480-volt three phase EVSE.

Development of the charging solution is based on Level 2 EVSE, for reasons detailed in the Charging Performance section. Configuration types are available in the following major categories:

- Dedicated: An EVSE supplied from a dedicated branch circuit. Dedicated circuits require significant electrical system infrastructure to accommodate the electrical load and dedicated wiring to each stall. Performance is typically higher than other configurations, as there is no impact from other EVSE.
- Load management: Multiple EVSE on an electrical circuit. 2-share (or 4-share) means there are two (or four) chargers on one electrical circuit. Power delivery is based on actual requirement at each EVSE. A system with load management is defined in the 2018 Canadian Electrical Code as an Electric Vehicle Energy Management System (EVEMS).

Refer to the following diagrams for depiction of dedicated and load management configurations.

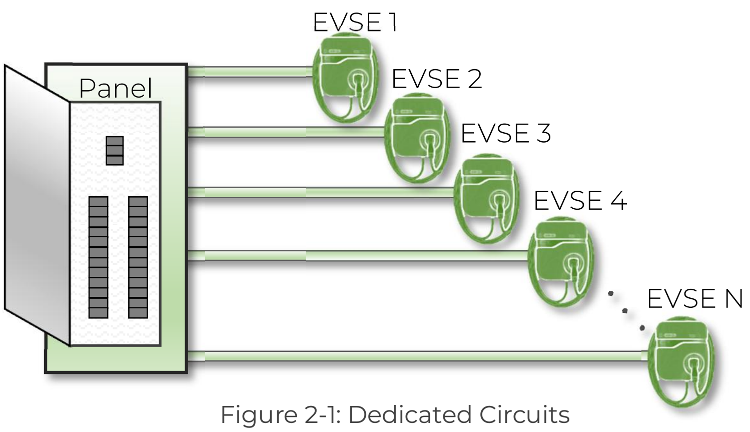

Figure 2-1: Dedicated Circuits

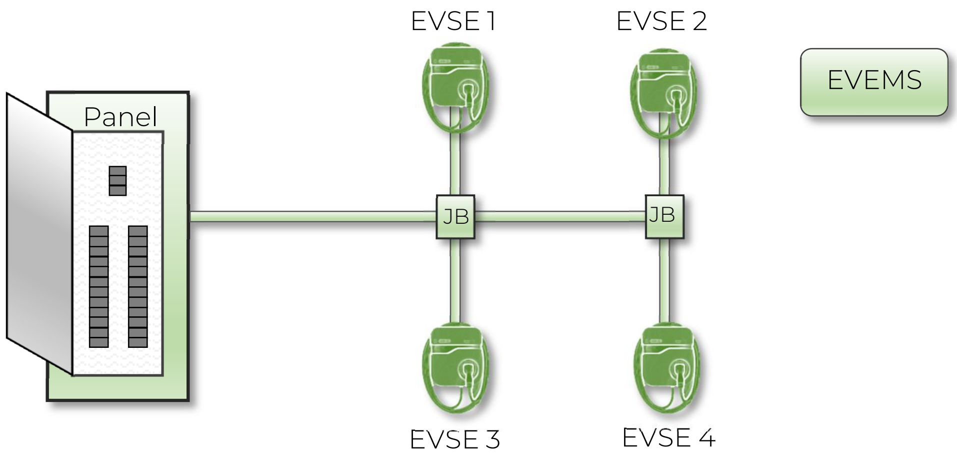

Figure 2-2: Load Management

Load management systems represent a compromise between electrical infrastructure costs and charging performance. Advantages of load management include:

- Reduced costs for supply and installation of electrical infrastructure (excludes EVSE);
- Greater utilization of electrical infrastructure;
- Reduced electrical demand and associated utility demand charges;
- Integral power and energy metering;
- Improved monitoring features and network capabilities (typically);
- Greater service support (typically).

Disadvantages of load management include:

- Reduced charging performance;
- Standardization on one EVSE make;
- Reduced options of available EVSE;
- Increased supply and installation costs of EVSE;
- Monthly service fees (typically).

Refer to the following section for details on charging performance.

3. Charging Performance

Residential

For residential stalls, a minimum charging performance of 12 kWh (kilowatt hours) over an eight (8) hour overnight period is recommended. This represents a driving range of 54 km (based on a conservative efficiency of 220 Wh/km[1]), which is considered appropriate, based on the average daily driving distance of 28 km for the City of Vancouver. The provision is also consistent with municipal bylaw requirements for new construction for multi-unit residential buildings (MURBs), as enacted by the City of Vancouver[2], and the City of Richmond[3].

The minimum charging performance requirement ensures that EVs are fully charged 90% of the time from overnight charging, and sufficiently charged for driving the subsequent day more than 99% of the time. With a 4-share configuration (four EVSE on a 40 A, 208 V circuit) satisfying the minimum recommended charging performance, this is typically the option chosen by residential stratas, given that this is the most economical solution. This does not prevent provision of higher charging performance; we recommended stakeholder engagement with residents to discuss charging performance expectations.

Visitor

Visitor parking has inherently shorter dwell times compared to residential parking, resulting in reduced time for charging. In order to provide a reasonable level of charging and user experience, 6.6 kW or 3.3 kW is typically provided, which represents around 30 km or 15 km of range per hour. 6.6 kW is achieved by dedicated circuits to each charger, and 3.3 kW is achieved by a 2-share configuration. Given the spare electrical capacity of the facility, 6.6 kW is achievable, but incurs additional infrastructure costs of up to 50% compared to a 2-share configuration.

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[1] https://batteryuniversity.com/learn/article/electric_vehicle_ev
[2] https://vancouver.ca/files/cov/electric-vehicle-charging-for-buildings-load-management.pdf
[3] https://www.richmond.ca/__shared/assets/_3_-_Bylaw_9520___975648978.pdf

The existing parking stall composition at Coopers Pointe is as follows:

Location	No.	Type/No.		
		Residential	Visitor	Car Wash
Level P1	31	25	5	1
Level P2	46	46	-	-
Level P3	47	47	-	-
Total	124	118	5	1

Table 3-1: Stall Composition

At the time of site review, several stalls allocated to residential parking had not been assigned to individual tenants. A stall designated for car washing, located adjacent to the visitor stalls, will not require EVSE.

Refer to the following section for a capacity assessment.

4. Capacity Assessment

The electrical system capacity of *Coopers Pointe* is $1{,}000\ kVA$ (kilovolt-amps). A 20% buffer, equivalent to $200\ kVA$, is reserved for potential building expansions/load additions. The historical maximum demand of the building during the most recent 12-month period was $246\ kVA$. An allowance of $125\ kVA$ is reserved for future A/C loads, based on PTAC systems implemented in the remaining residential units without air conditioning, and running at maximum capacity during summer hours. Refer to AME report for details. The remaining spare capacity for EV charging is $429\ kVA$. This is considerable spare capacity, providing flexibility for charging implementation. Refer to the following table for a load calculation summary.

Item		kVA
1.	Electrical System Capacity	1,000
2.	20% Reserved/Buffer Capacity	200
3.	Peak Demand (2018-2019)	246
4.	Proposed A/C Load	125
Total Remaining Capacity for EV Charging		429

Table 4-1: Load Calculation

Based on the 123 suitable parking stalls in the facility, the maximum electrical demand for various levels of EVSE adoption is as follows:

EVSE Adoption		No.	Maximum Demand (kVA)			
			Dedicated	2-Share	3-Share	4-Share
1.	10% of stalls	13	65	42	30	27
2.	20% of stalls	25	109	78	54	47
3.	50% of stalls	62	271	186	126	106
4.	100% of stalls	123	537	371	246	206

Table 4-2: Maximum demand

The existing electrical system has sufficient capacity to accommodate EVSE in all stalls in load sharing configurations, and the majority of stalls (98) in a dedicated configuration.

City of Vancouver municipal bylaws enacted for new construction for MURBs have designated 100% of residential parking stalls shall be equipped with electrical infrastructure for EVSE[4] that is capable of meeting the minimum charging performance. While there are no legal requirements to provide charging for existing buildings, installing infrastructure for EVSE in MURBs is typically favoured, as it allows by residents to have EVSE installed as necessary with minimal cost and complexity. To ensure all residents have equal access to charging, infrastructure needs to be installed in 100% of resident stalls. Due to the low number of visitor stalls (5) with respect to the total number of stalls (123), equipping 100% of visitor stalls with EVSE infrastructure would be reasonable.

Refer to the following section for design details.

5. Design

Four indicative design options are provided, for consideration. These options are based on installing infrastructure for all stalls, with varying circuit configurations based on details outlined in the Charging Performance section. While option 1, with exclusively dedicated circuits, is unlikely to be necessary for the building, it conveys the upper limit in terms of electrical infrastructure requirements and associated costs. Option 2 is based on a 2-share configuration, realizing cost savings compared to option 1, while maintaining an increased charging performance when compared to the third option. Option 3, a combination of 4-share for residential stalls and 2-share for visitor stalls, is the most economical and recommended option to deliver suitable charging performance for both residents and visitors. A fourth option, utilizing 6-share (48 A, 208 V) circuit for residential stalls and 2-share (32 A, 208 V) for visitor stalls, enables the use of EVSE

[4] https://vancouver.ca/files/cov/electric-vehicle-charging-for-buildings-load-management.pdf

designed for 48 A circuits. Installing 48 A, 208 V circuits would restrict the use of the majority of Level 2 EVSE, as typically only 32 A, 208 V circuits are supported; however, certain EVSE models designed for 48 A, 208 V circuits are very competitively priced and may reduce total project costs if this option is implemented.

The options detailed are as follows:

Configuration		Circuits	Type/No. of Stalls	
			Tenant	Visitor
1.	100% Residential, 100% Visitor, Dedicated (537 kVA)			
	Dedicated	123	118	5
	2-share	-	-	-
	4-share	-	-	-
	Total	123	118	5
2.	100% Residential, 100% Visitor, 2-share (371 kVA)			
	Dedicated	-	-	-
	2-share	63*	118	5
	4-share	-	-	-
	Total	63	118	5
3.	100% Residential 4-share, 100% Visitor 2-share (226 kVA)			
	Dedicated	-	-	-
	2-share	3	-	5
	4-share	31*	118	-
	Total	34	118	5
4.	100% Residential 6-share, 100% Visitor 2-share (230 kVA)			
	Dedicated	-	-	-
	2-share	3	-	3
	4-share	-	-	-
	6-share	21*	118	-
	Total	24	118	3

Table 5-1: Design Options

* additional circuits included due to physical stall configurations.

Design parameters can be refined by conducting a survey of the tenants at Coopers Pointe to determine factors such as current and planned EV adoption, EV type, and daily driving distances.

Refer to the parking layouts (Appendix A) and single line diagrams (Appendix B) for further details. The following section provides details on billing.

6. Billing

Coopers Pointe can recoup electricity costs for EV charging by billing the end-users (tenants and visitors) or by allocating costs to the appropriate budget (e.g. strata fees). A networked EVSE supplier (such as *Flo* and *ChargePoint*) can facilitate the payment and/or cost allocation process by providing a consolidated billing management interface. With such services, EV owners directly pay the charging network supplier for charging sessions, and the strata is typically reimbursed for electricity costs on a monthly basis. With non-networked systems, there is typically no ability to charge based on actual electricity consumption; this generally results in a fixed monthly or time-based fee that may or may not reflect actual consumption. The general preference of EV owners is to pay for energy consumed.

Refer to the following section for cost details.

7. Costs

Based on design options, infrastructure cost estimates are as follows:

Installation Options		Electrical Infrastructure	Cost per Stall
1.	100% Residential, 100% Visitor, Dedicated	$ 208,362	$ 1,694
2.	100% Residential, 100% Visitor, 2-share	$ 148,603	$ 1,208
3.	100% Residential 4-share, 100% Visitor 2-share	$ 94,200	$ 766
4.	100% Residential 6-share, 100% Visitor 2-share	$ 98,229	$ 799

Table 7-1: Cost Estimates

The above costs do not include charger procurement and installation. The purchase price of ChargePoint CPF50 (48 A circuits) and AddEnergie CoRe+PS (32 A circuits) chargers are $2,000 and $3,500 respectively. Allow an installation cost of $500 per stall for budgeting purposes.

Refer to Appendix D for a detailed cost analysis.

Load management typically represents the lowest electrical infrastructure and total cost solution, with the highest EVSE cost. Load management services are currently typically associated with annual or monthly fees. Load management reduces electricity demand charges[5], relative to dedicated circuits. Estimated costs are indicative, for the purpose of high-level consideration, and are subject to decisions during subsequent phases of the works.

To minimize initial cost while continuing to prepare for increased EV charging demand in the future, the infrastructure for all stalls should be installed in a single stage, while the quantity of EVSE installed can be sized to the current demand for EV charging. As EV adoption continues, additional EVSE can be added at the cost of hardware and installation, with no further design necessary.

Avenues for cost saving opportunities should be considered during the design phase, including:

- *CleanBC* (administered by *BC Hydro*) incentives[6], although minor in relation to overall costs, are worthwhile exploring, particularly for any initial works;
- *Zero Emission Vehicle Infrastructure Program*[7], designed to provide funding in part to equip MURB's with EVSE. This program provides up to 50% of project costs, and up to $5,000 per charger for Level 2 EVSE.

Suppliers are also open to negotiation of contracts where a large installation is expected to cover an entire building or portfolio of buildings owned and managed by the same company.

Refer to the following sections for conclusions.

8. Conclusions

Given the considerable spare electrical capacity of the facility, there is inherent ability to provide charging, and flexibility in terms of charging performance. While there is available capacity and flexibility, overprovision results in unnecessary increased costs.

The spare capacity of Coopers Pointe is $429\,kVA$. This is sufficient to equip all stalls with Level 2 EVSE infrastructure in load management configurations, and the majority of stalls in a dedicated configuration.

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[5] 2019 BC Hydro rate is $12.34 per kW. https://app.bchydro.com/accounts-billing/rates-energy-use/electricity-rates/business-rates.html
[6] https://app.bchydro.com/electric-vehicles/incentives/apartment-workplace-charger-rebate.html
[7] https://www.nrcan.gc.ca/energy-efficiency/energy-efficiency-transportation/zero-emission-vehicle-infrastructure-program/21876

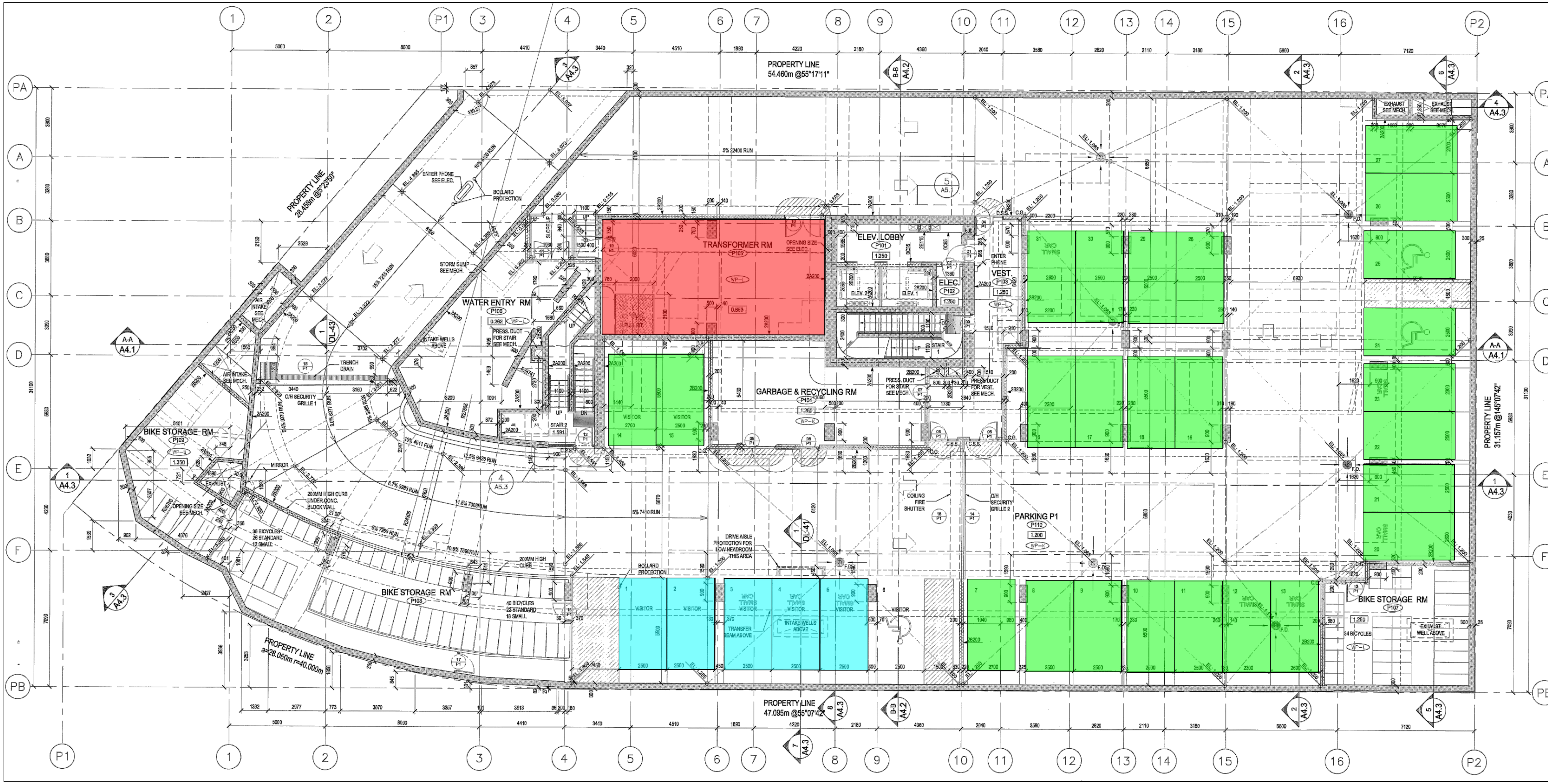
Installation of the EV infrastructure in phases is possible, but incurs increased overall costs and complexity, and disrupts building users for a longer duration of time. Provision of EV infrastructure in all stalls allows EVSE to be installed as necessary, decreasing overall costs and ensuring equal charging access to all residents.

We provide the following recommendations:

- Consider the work from a holistic perspective, in lieu of immediate or short-term demands. Considerable cost savings are achievable by implementing processes for the entirety of the work;
- Assess the current level of EV adoption to evaluate the present and future charging performance requirements;
- We recommend implementation of load management but highlight there are advantages and disadvantages with any solution. Stakeholder engagement is important, particularly by the tenants and visitors (those most impacted by decisions);
- Installation of a system capable of delivering a minimum charging performance of 12 kWh (kilowatt hours) over an overnight period;
- Approach the work in an appropriate, quality-minded, manner. The work represents a major investment, worthy of appropriate consideration, planning, and process structure.

It is also recommended to avoid underestimation of the acceleration in adoption of this disruptive technology. With many predictors identifying price parity between EVs and ICE (internal combustion engine) vehicles to occur within the next five years, acceleration in adoption can be reasonably expected.

Appendix A: Layouts



NOTES:

A. RESIDENTIAL STALLS WITH POTENTIAL TO BE EQUIPPED WITH EVSE SHOWN IN GREEN.
B. VISITOR STALLS WITH POTENTIAL TO BE EQUIPPED WITH EVSE SHOWN IN BLUE.
C. MAIN ELECTRICAL ROOM SHOWN IN RED.

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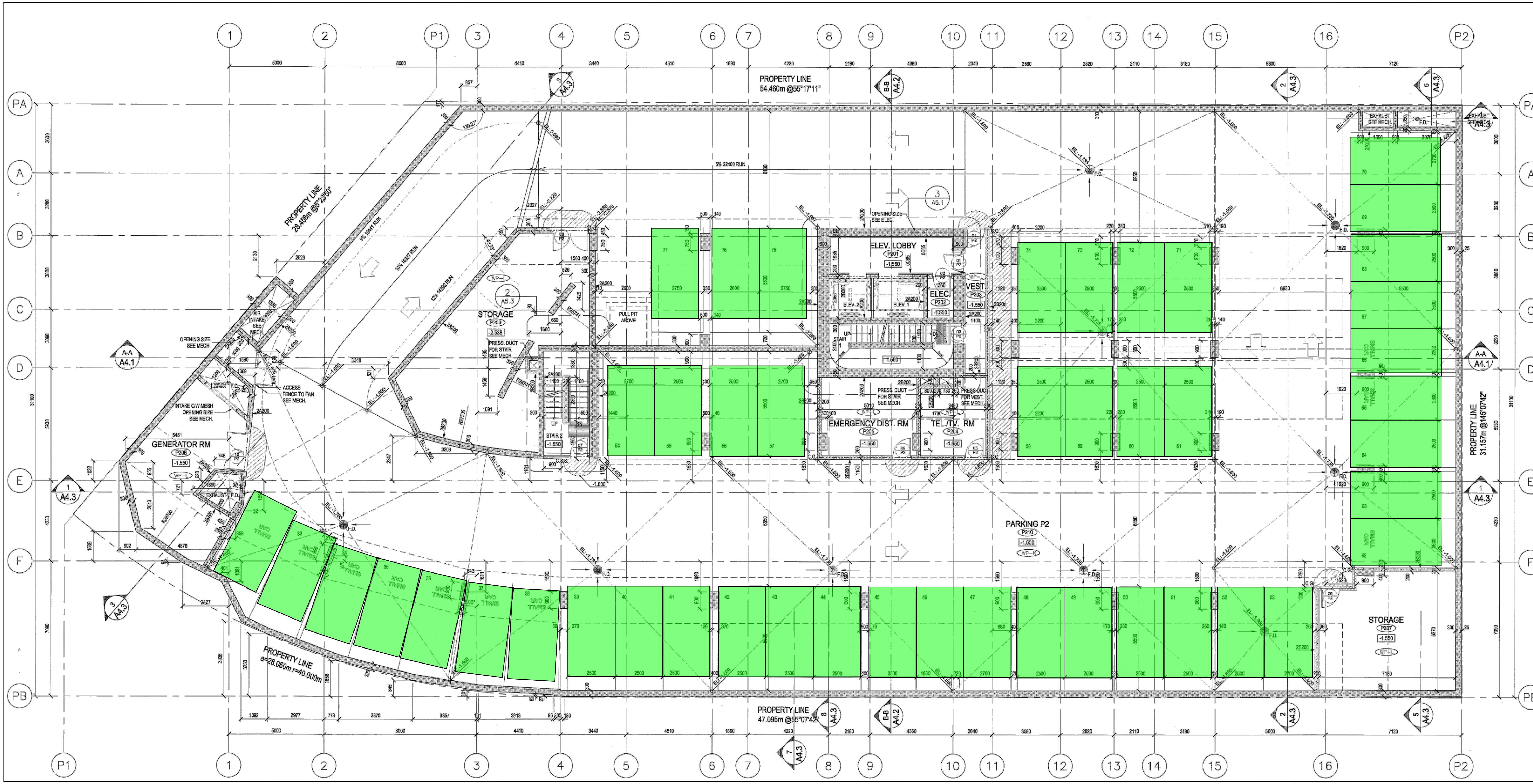
COOPERS POINTE
980 COOPERAGE WAY, VANCOUVER, BC

drawing title

P1 PARKING DIAGRAM (30 STALLS)

designed JC	scale NTS	date APR 2020	
drawn JC	project no. 2-20-168		
checked VL	drawing no. E01		rev.
approved VL			



NOTES:

A. RESIDENTIAL STALLS WITH POTENTIAL TO BE EQUIPPED WITH EVSE SHOWN IN GREEN.

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COOPERS POINTE
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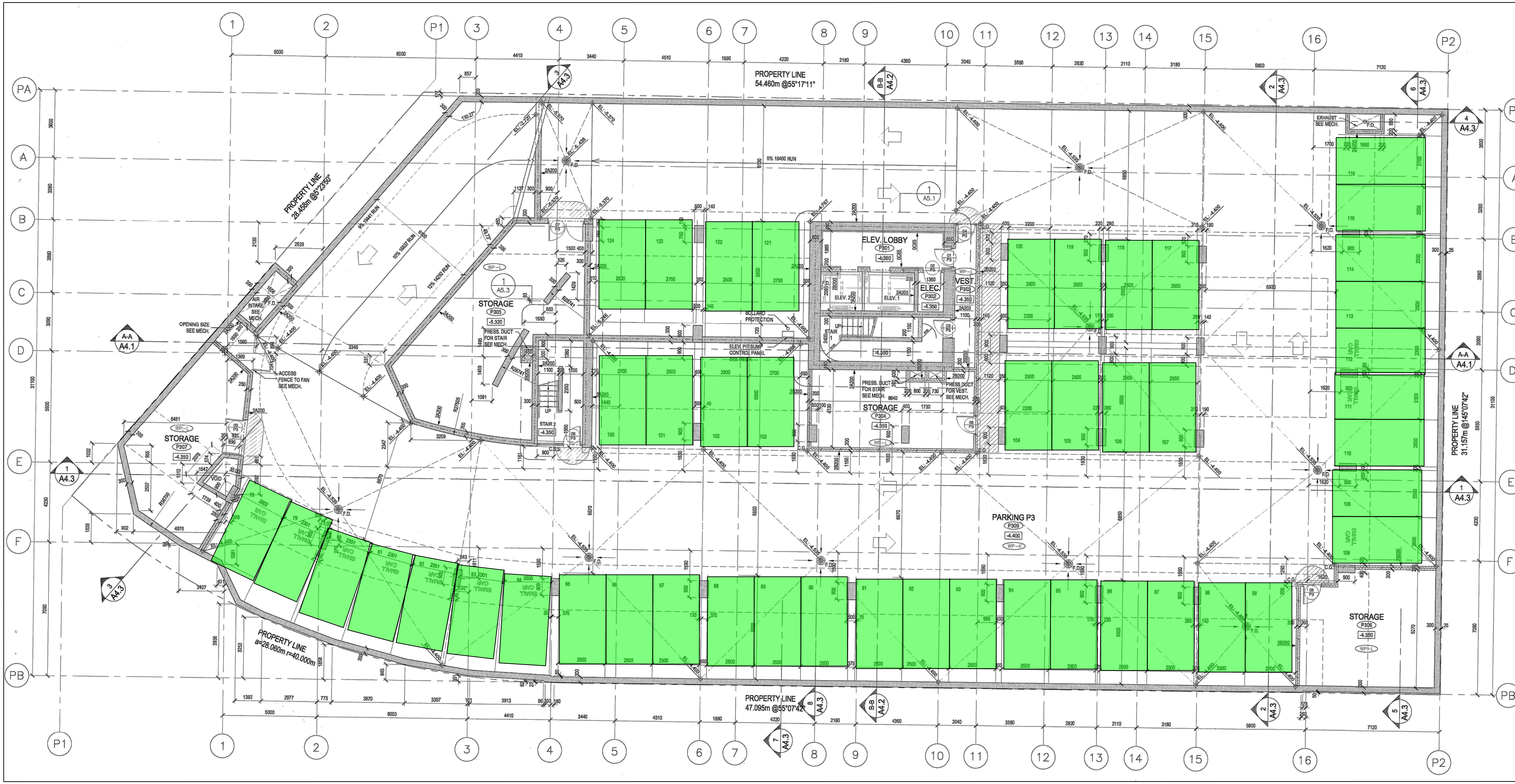
drawing title

P2 PARKING DIAGRAM (46 STALLS)

designed	JC	scale	NTS	date	APR 2020
drawn	JC	project no.	2-20-168		
checked	VL	drawing no.	E02	rev.	
approved	VL				



NOTES:

A. RESIDENTIAL STALLS WITH POTENTIAL TO BE EQUIPPED WITH EVSE SHOWN IN GREEN.

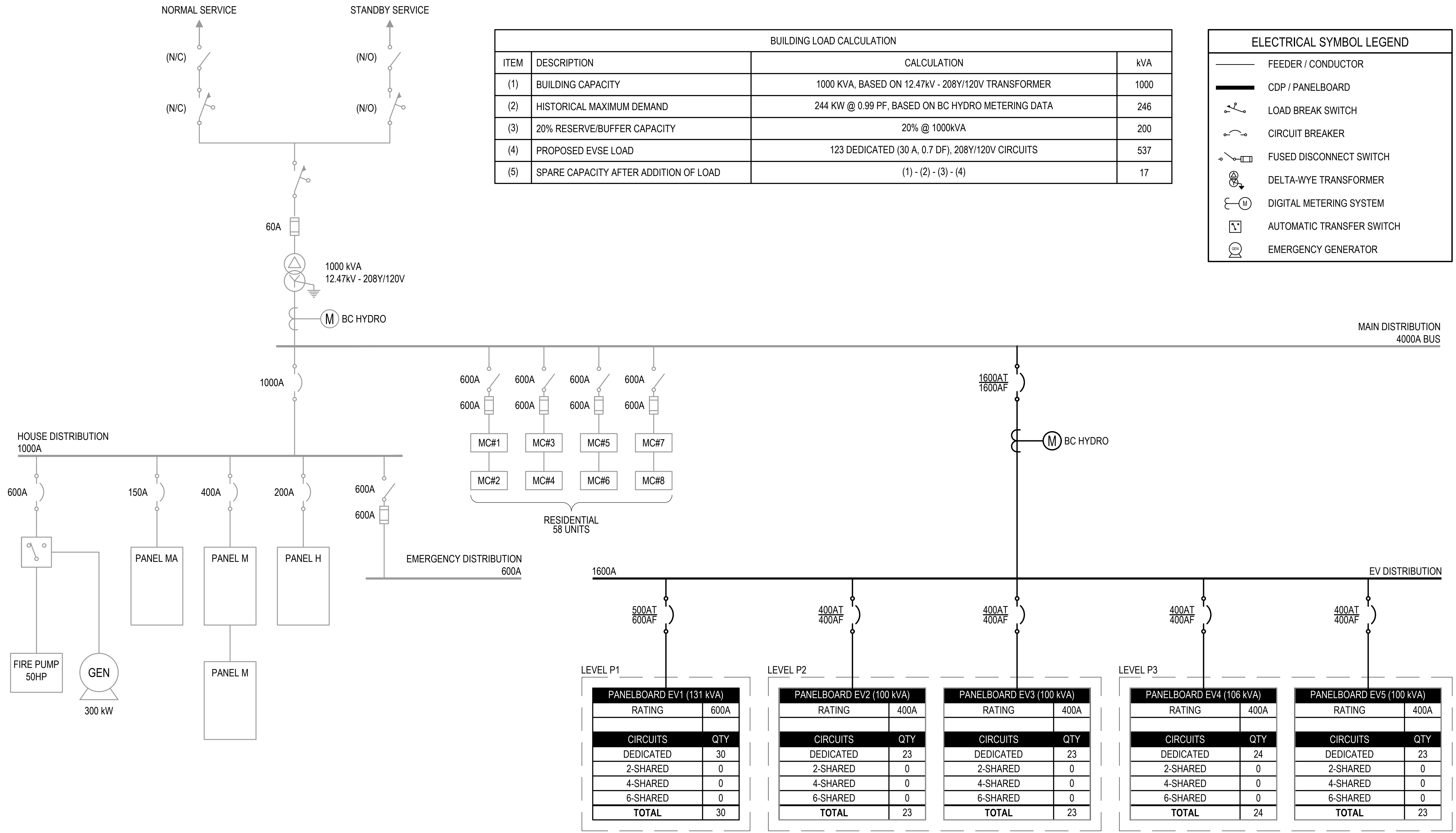
consultant	project	designed	scale	date
AES Designing A Better Tomorrow 505 Burrard Street, Suite 950, Vancouver, BC V7X 1M4 604.569.6500 | www.aesengr.com CALGARY | EDMONTON | VANCOUVER | VICTORIA	COOPERS POINTE 980 COOPERAGE WAY, VANCOUVER, BC	JC	NTS	APR 2020
		drawn	project no.	
		JC	2-20-168	
	drawing title	checked	drawing no.	rev.
	P3 PARKING DIAGRAM (47 STALLS)	VL	E03	
		approved		
		VL		

Appendix B: Single Line Diagrams

BUILDING LOAD CALCULATION			
ITEM	DESCRIPTION	CALCULATION	kVA
(1)	BUILDING CAPACITY	1000 KVA, BASED ON 12.47kV - 208Y/120V TRANSFORMER	1000
(2)	HISTORICAL MAXIMUM DEMAND	244 KW @ 0.99 PF, BASED ON BC HYDRO METERING DATA	246
(3)	20% RESERVE/BUFFER CAPACITY	20% @ 1000kVA	200
(4)	PROPOSED EVSE LOAD	123 DEDICATED (30 A, 0.7 DF), 208Y/120V CIRCUITS	537
(5)	SPARE CAPACITY AFTER ADDITION OF LOAD	(1) - (2) - (3) - (4)	17

ELECTRICAL SYMBOL LEGEND

- FEEDER / CONDUCTOR
- CDP / PANELBOARD
- LOAD BREAK SWITCH
- CIRCUIT BREAKER
- FUSED DISCONNECT SWITCH
- DELTA-WYE TRANSFORMER
- DIGITAL METERING SYSTEM
- AUTOMATIC TRANSFER SWITCH
- EMERGENCY GENERATOR



PANELBOARD EV1 (131 kVA)	
RATING	600A
CIRCUITS	QTY
DEDICATED	30
2-SHARED	0
4-SHARED	0
6-SHARED	0
TOTAL	30

PANELBOARD EV2 (100 kVA)	
RATING	400A
CIRCUITS	QTY
DEDICATED	23
2-SHARED	0
4-SHARED	0
6-SHARED	0
TOTAL	23

PANELBOARD EV3 (100 kVA)	
RATING	400A
CIRCUITS	QTY
DEDICATED	23
2-SHARED	0
4-SHARED	0
6-SHARED	0
TOTAL	23

PANELBOARD EV4 (106 kVA)	
RATING	400A
CIRCUITS	QTY
DEDICATED	24
2-SHARED	0
4-SHARED	0
6-SHARED	0
TOTAL	24

PANELBOARD EV5 (100 kVA)	
RATING	400A
CIRCUITS	QTY
DEDICATED	23
2-SHARED	0
4-SHARED	0
6-SHARED	0
TOTAL	23

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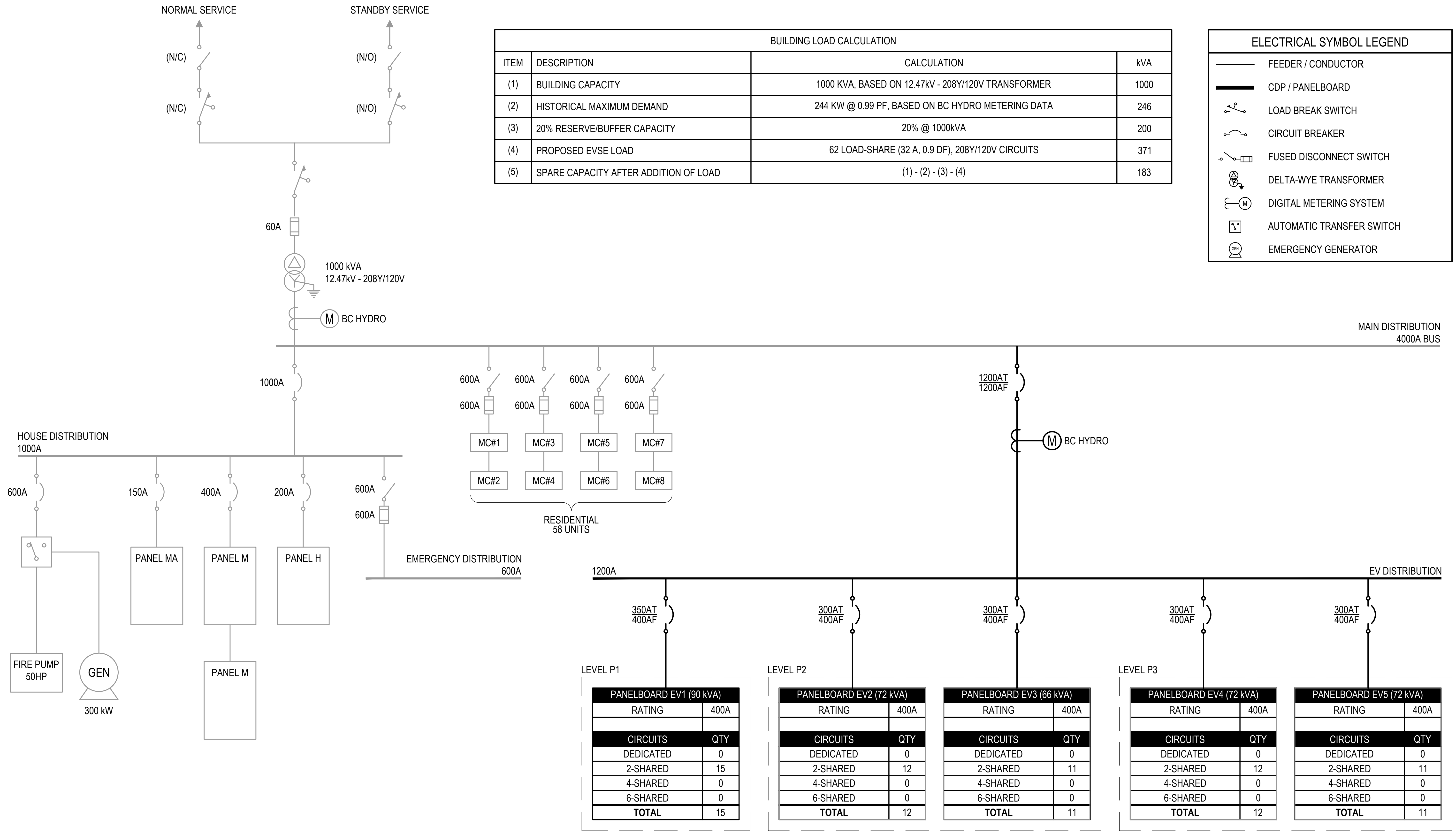
drawing title

PARTIAL SINGLE LINE DIAGRAM & LOAD CALCULATION
OPTION 1 - 100% DEDICATED

designed JC	scale NTS	date APR 2020	
drawn JC	project no. 2-20-168		
checked VL	drawing no. E04		rev.
approved VL			



BUILDING LOAD CALCULATION			
ITEM	DESCRIPTION	CALCULATION	kVA
(1)	BUILDING CAPACITY	1000 KVA, BASED ON 12.47kV - 208Y/120V TRANSFORMER	1000
(2)	HISTORICAL MAXIMUM DEMAND	244 KW @ 0.99 PF, BASED ON BC HYDRO METERING DATA	246
(3)	20% RESERVE/BUFFER CAPACITY	20% @ 1000kVA	200
(4)	PROPOSED EVSE LOAD	62 LOAD-SHARE (32 A, 0.9 DF), 208Y/120V CIRCUITS	371
(5)	SPARE CAPACITY AFTER ADDITION OF LOAD	(1) - (2) - (3) - (4)	183

ELECTRICAL SYMBOL LEGEND

- FEEDER / CONDUCTOR
- CDP / PANELBOARD
- LOAD BREAK SWITCH
- CIRCUIT BREAKER
- FUSED DISCONNECT SWITCH
- DELTA-WYE TRANSFORMER
- DIGITAL METERING SYSTEM
- AUTOMATIC TRANSFER SWITCH
- EMERGENCY GENERATOR

LEVEL P1

PANELBOARD EV1 (90 kVA)	
RATING	400A
CIRCUITS	QTY
DEDICATED	0
2-SHARED	15
4-SHARED	0
6-SHARED	0
TOTAL	15

LEVEL P2

PANELBOARD EV2 (72 kVA)	
RATING	400A
CIRCUITS	QTY
DEDICATED	0
2-SHARED	12
4-SHARED	0
6-SHARED	0
TOTAL	12

PANELBOARD EV3 (66 kVA)	
RATING	400A
CIRCUITS	QTY
DEDICATED	0
2-SHARED	11
4-SHARED	0
6-SHARED	0
TOTAL	11

LEVEL P3

PANELBOARD EV4 (72 kVA)	
RATING	400A
CIRCUITS	QTY
DEDICATED	0
2-SHARED	12
4-SHARED	0
6-SHARED	0
TOTAL	12

PANELBOARD EV5 (72 kVA)	
RATING	400A
CIRCUITS	QTY
DEDICATED	0
2-SHARED	11
4-SHARED	0
6-SHARED	0
TOTAL	11

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drawing title
PARTIAL SINGLE LINE DIAGRAM & LOAD CALCULATION
OPTION 2 - 100% 2-SHARE

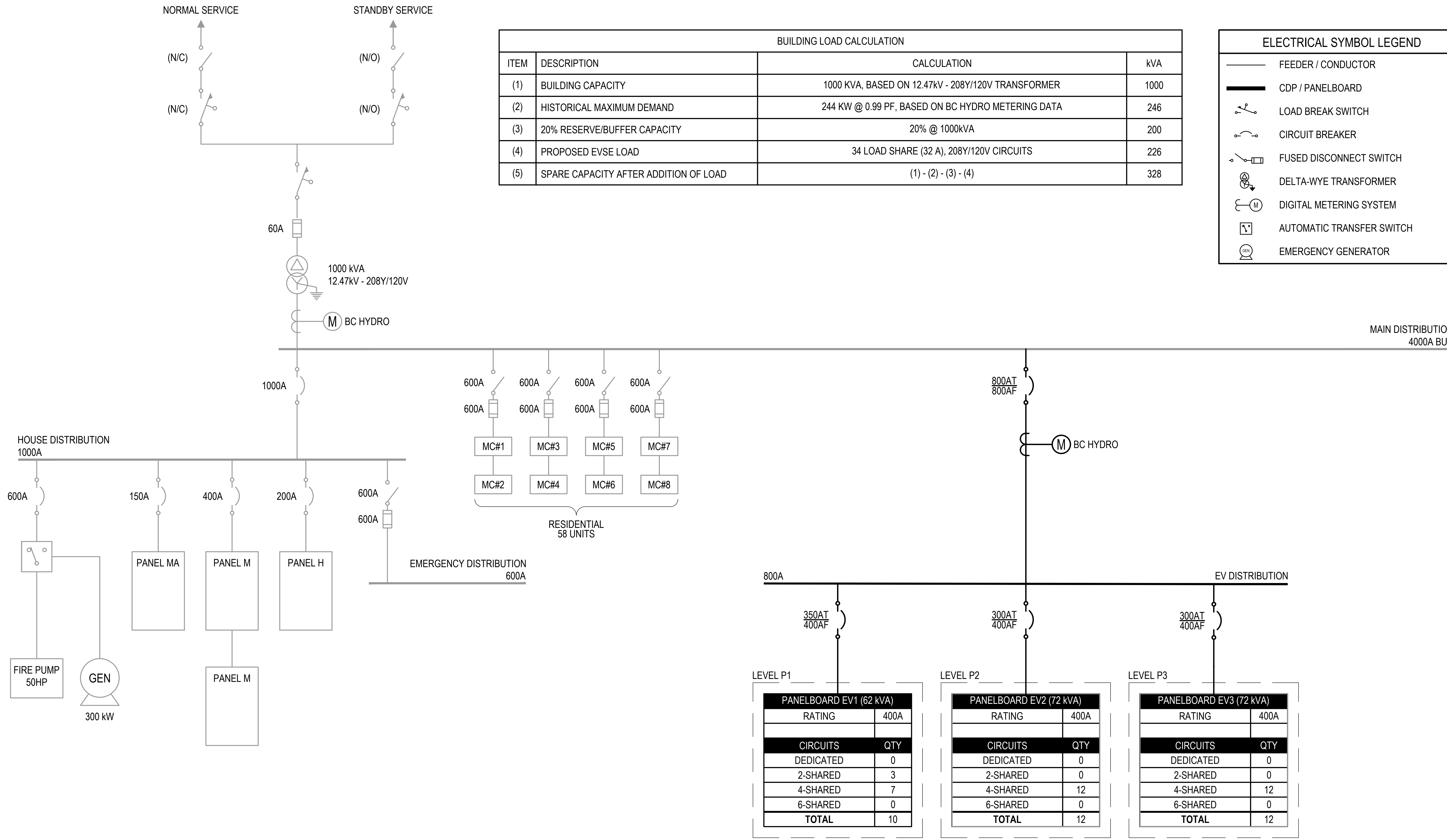
designed JC	scale NTS	date APR 2020	
drawn JC	project no. 2-20-168		
checked VL	drawing no. E05		rev.
approved VL			

BUILDING LOAD CALCULATION

ITEM	DESCRIPTION	CALCULATION	kVA
(1)	BUILDING CAPACITY	1000 KVA, BASED ON 12.47kV - 208Y/120V TRANSFORMER	1000
(2)	HISTORICAL MAXIMUM DEMAND	244 KW @ 0.99 PF, BASED ON BC HYDRO METERING DATA	246
(3)	20% RESERVE/BUFFER CAPACITY	20% @ 1000kVA	200
(4)	PROPOSED EVSE LOAD	34 LOAD SHARE (32 A), 208Y/120V CIRCUITS	226
(5)	SPARE CAPACITY AFTER ADDITION OF LOAD	(1) - (2) - (3) - (4)	328

ELECTRICAL SYMBOL LEGEND

- FEEDER / CONDUCTOR
- CDP / PANELBOARD
- LOAD BREAK SWITCH
- CIRCUIT BREAKER
- FUSED DISCONNECT SWITCH
- DELTA-WYE TRANSFORMER
- DIGITAL METERING SYSTEM
- AUTOMATIC TRANSFER SWITCH
- EMERGENCY GENERATOR



PANELBOARD EV1 (62 kVA)	
RATING	400A
CIRCUITS	QTY
DEDICATED	0
2-SHARED	3
4-SHARED	7
6-SHARED	0
TOTAL	10

PANELBOARD EV2 (72 kVA)	
RATING	400A
CIRCUITS	QTY
DEDICATED	0
2-SHARED	0
4-SHARED	12
6-SHARED	0
TOTAL	12

PANELBOARD EV3 (72 kVA)	
RATING	400A
CIRCUITS	QTY
DEDICATED	0
2-SHARED	0
4-SHARED	12
6-SHARED	0
TOTAL	12

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drawing title

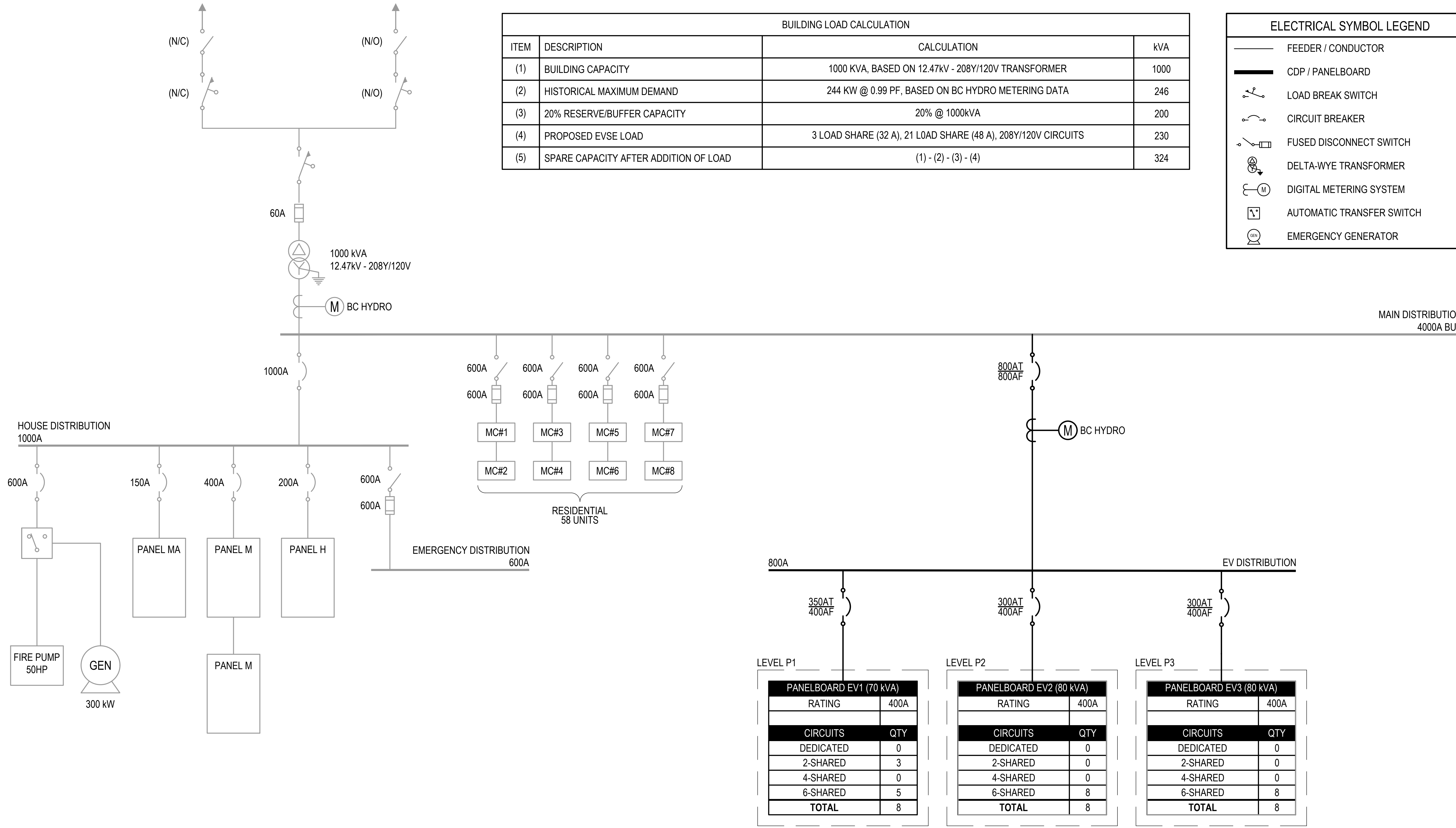
PARTIAL SINGLE LINE DIAGRAM & LOAD CALCULATION
OPTION 3 - RESIDENTIAL 4-SHARE, VISITOR 2-SHARE

designed JC	scale NTS	date APR 2020	
drawn JC	project no. 2-20-168		
checked VL	drawing no. E06		rev.
approved VL			

BUILDING LOAD CALCULATION			
ITEM	DESCRIPTION	CALCULATION	kVA
(1)	BUILDING CAPACITY	1000 KVA, BASED ON 12.47kV - 208Y/120V TRANSFORMER	1000
(2)	HISTORICAL MAXIMUM DEMAND	244 KW @ 0.99 PF, BASED ON BC HYDRO METERING DATA	246
(3)	20% RESERVE/BUFFER CAPACITY	20% @ 1000kVA	200
(4)	PROPOSED EVSE LOAD	3 LOAD SHARE (32 A), 21 LOAD SHARE (48 A), 208Y/120V CIRCUITS	230
(5)	SPARE CAPACITY AFTER ADDITION OF LOAD	(1) - (2) - (3) - (4)	324

ELECTRICAL SYMBOL LEGEND

- FEEDER / CONDUCTOR
- CDP / PANELBOARD
- LOAD BREAK SWITCH
- CIRCUIT BREAKER
- FUSED DISCONNECT SWITCH
- DELTA-WYE TRANSFORMER
- DIGITAL METERING SYSTEM
- AUTOMATIC TRANSFER SWITCH
- EMERGENCY GENERATOR



PANELBOARD EV1 (70 kVA)	
RATING	400A
CIRCUITS	QTY
DEDICATED	0
2-SHARED	3
4-SHARED	0
6-SHARED	5
TOTAL	8

PANELBOARD EV2 (80 kVA)	
RATING	400A
CIRCUITS	QTY
DEDICATED	0
2-SHARED	0
4-SHARED	0
6-SHARED	8
TOTAL	8

PANELBOARD EV3 (80 kVA)	
RATING	400A
CIRCUITS	QTY
DEDICATED	0
2-SHARED	0
4-SHARED	0
6-SHARED	8
TOTAL	8

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drawing title
PARTIAL SINGLE LINE DIAGRAM & LOAD CALCULATION
OPTION 4 - RESIDENTIAL 6-SHARE, VISITOR 2-SHARE

designed JC	scale NTS	date APR 2020	
drawn JC	project no. 2-20-168		
checked VL	drawing no.		rev.
approved VL	E07		

Appendix C: Photos

Photo 1: ChargePoint

Photo 2: AddÉnergie/FLO

Appendix D: Cost Analysis

100% DEDICATED

Stalls:	123
Circuits (40A 208V 2-pole):	123
Existing max. demand (kVA):	246
EVSE max. demand (kVA):	537
Final max. demand (kVA):	783

No.	DESCRIPTION	UNIT COST ($)	QTY	COST ($)
ELECTRICAL INFRASTRUCTURE				
1	BC Hydro meter and CT cabinet	2,500	1	2,500
2	1600A circuit breaker	23,578	1	23,578
3	Distribution board (1600A 208Y/120V)	12,000	1	12,000
4	600A circuit breaker	7,267	1	7,267
5	400A circuit breaker	5,092	4	20,368
6	Cabling (20m, 4#500 kcmil): distribution board to panelboard	2,498	5	12,488
7	Conduit (20m, 91mm (3-1/2")): distribution board to panelboard	1,929	5	9,643
8	400 A MLO, 208Y/120V, 42 cct panelboard (with 40 A breakers)	4,517	5	22,585
9	Cabling (30m, 2#8): panelboard to EVSE	191	123	23,543
10	Conduit (30m, 27mm (1")): panelboard to EVSE	605	123	74,390
	Cost ($)			208,362
	Cost ($ per stall)			1,694

100% 2-SHARE

Stalls:	123
Circuits (40A 208V 2-pole):	62
Existing max. demand (kVA):	246
EVSE max. demand (kVA):	371
Final max. demand (kVA):	617

No.	DESCRIPTION	UNIT COST ($)	QTY	COST ($)
ELECTRICAL INFRASTRUCTURE				
1	BC Hydro meter and CT cabinet	2,500	1	2,500
2	1200A circuit breaker	14,562	1	14,562
3	Distribution board (1200A 208Y/120V)	12,000	1	12,000
4	400A circuit breaker	5,092	5	25,460
5	Cabling (20m, 4#500 kcmil): distribution board to panelboard	2,498	5	12,488
6	Conduit (20m, 91mm (3-1/2")): distribution board to panelboard	1,929	5	9,643
7	400 A MLO, 208Y/120V, 42 cct panelboard (with 40 A breakers)	4,517	5	22,585
8	Cabling (30m, 2#8): panelboard to EVSE	191	62	11,867
9	Conduit (30m, 27mm (1")): panelboard to EVSE	605	62	37,498
	Cost ($)			148,603
	Cost ($ per stall)			1,208

RESIDENTIAL 4-SHARE, VISITOR 2-SHARE

Stalls:	123
Circuits (40A 208V 2-pole):	34
Existing max. demand (kVA):	246
EVSE max. demand (kVA):	226
Final max. demand (kVA):	472

No.	DESCRIPTION	UNIT COST ($)	QTY	COST ($)
ELECTRICAL INFRASTRUCTURE				
1	BC Hydro meter and CT cabinet	2,500	1	2,500
2	800A circuit breaker	9,426	1	9,426
3	Distribution board (800A 208Y/120V)	10,000	1	10,000
4	400A circuit breaker	5,092	3	15,276
5	Cabling (20m, 4#500 kcmil): distribution board to panelboard	2,498	3	7,493
6	Conduit (20m, 91mm (3-1/2")): distribution board to panelboard	1,929	3	5,786
7	400 A MLO, 208Y/120V, 42 cct panelboard (with 40 A breakers)	4,517	3	13,551
8	Cabling (50m, 2#6): panelboard to EVSE	408	5	2,038
9	Conduit (50m, 27mm (1"): panelboard to EVSE	1,008	5	5,040
10	Cabling (30m, 2#8): panelboard to EVSE	191	29	5,551
11	Conduit (30m, 27mm (1")): panelboard to EVSE	605	29	17,539
	Cost ($)			94,200
	Cost ($ per stall)			766

RESIDENTIAL 6-SHARE, VISITOR 2-SHARE

Stalls:	123
Circuits (40A 208V 2-pole):	24
Existing max. demand (kVA):	246
EVSE max. demand (kVA):	230
Final max. demand (kVA):	476

No.	DESCRIPTION	UNIT COST ($)	QTY	COST ($)
ELECTRICAL INFRASTRUCTURE				
1	BC Hydro meter and CT cabinet	2,500	1	2,500
2	800A circuit breaker	9,426	1	9,426
3	Distribution board (800A 208Y/120V)	10,000	1	10,000
4	400A circuit breaker	5,092	3	15,276
5	Cabling (20m, 4#500 kcmil): distribution board to panelboard	2,498	3	7,493
6	Conduit (20m, 91mm (3-1/2")): distribution board to panelboard	1,929	3	5,786
7	400 A MLO, 208Y/120V, 42 cct panelboard (with 60 A breakers)	4,517	3	13,551
8	Cabling (50m, 2#4): panelboard to EVSE	507	21	10,640
9	Conduit (50m, 27mm (1"): panelboard to EVSE	1,008	21	21,168
10	Cabling (30m, 2#8): panelboard to EVSE	191	3	574
11	Conduit (30m, 27mm (1")): panelboard to EVSE	605	3	1,814
	Cost ($)			98,229
	Cost ($ per stall)			799