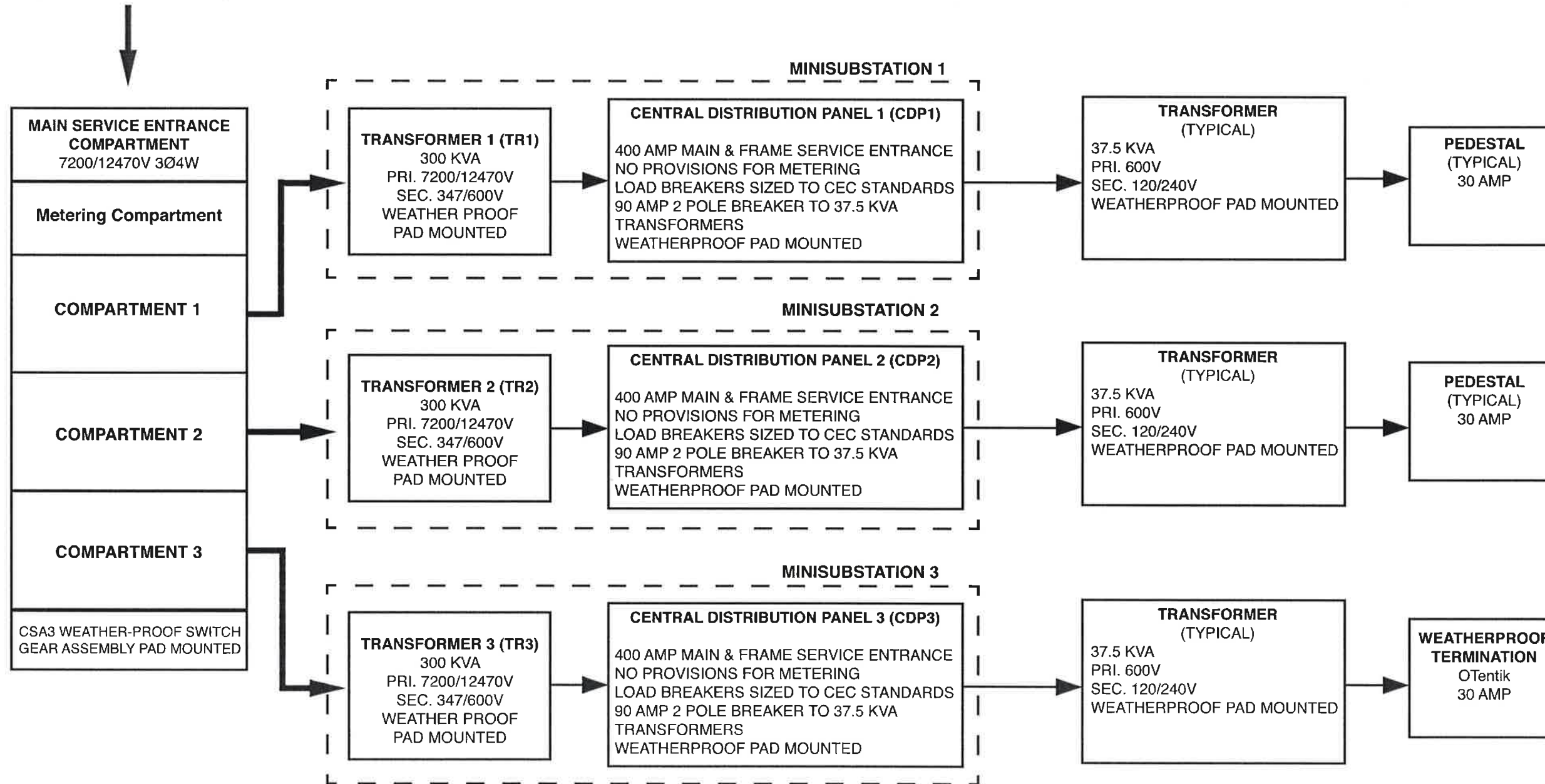


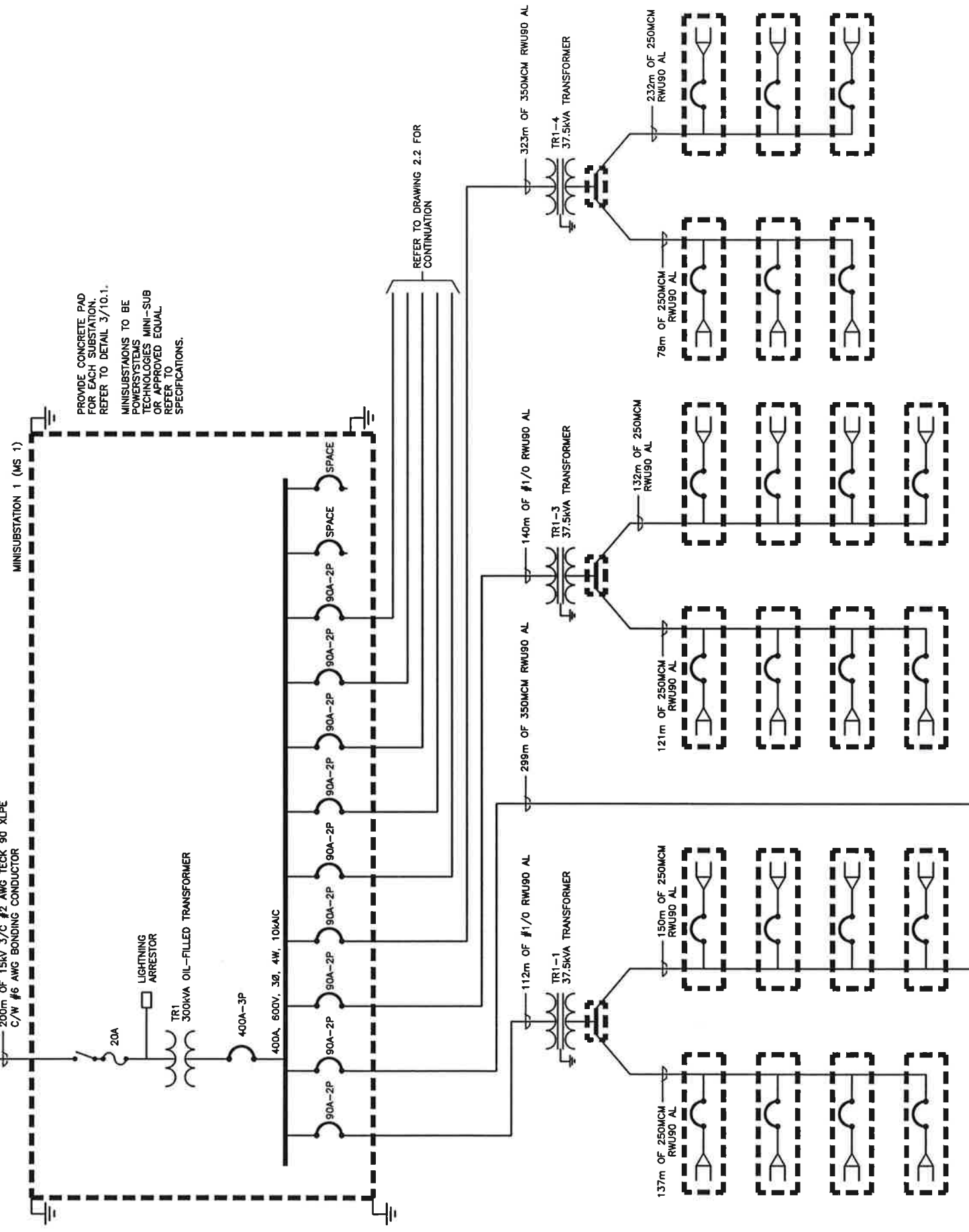
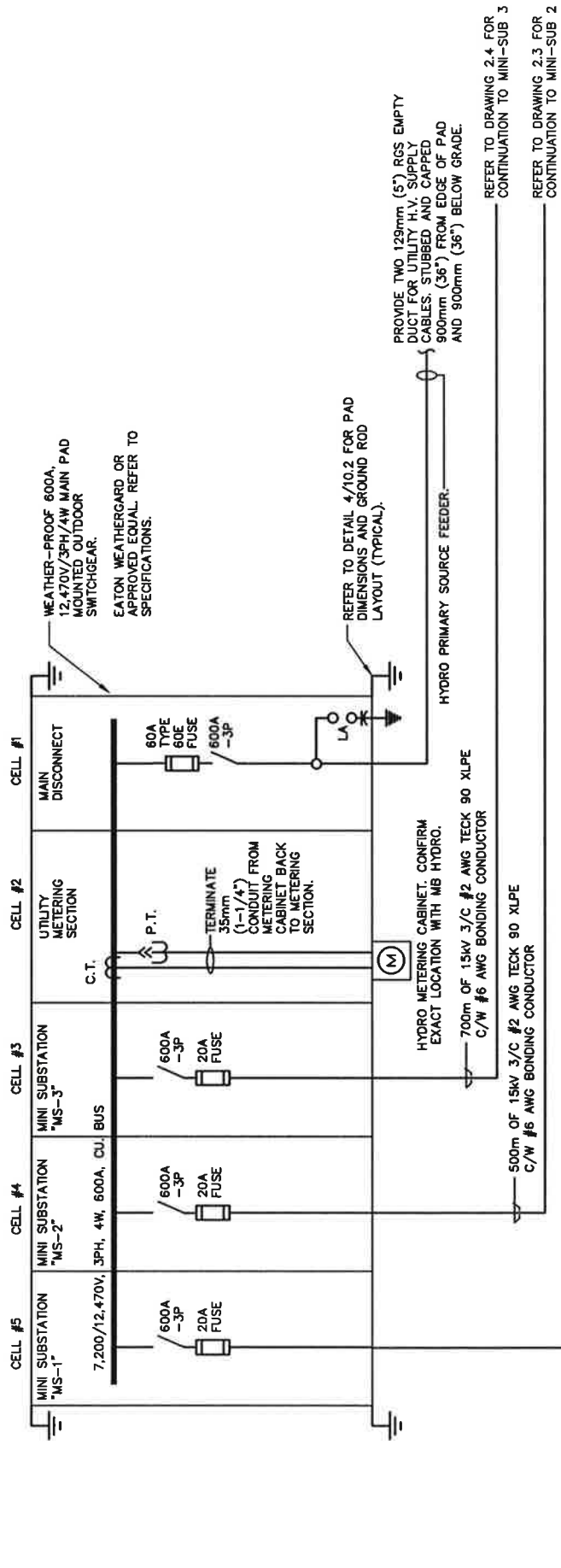
APPENDIX C

ELECTRICAL DRAWINGS

UNDERGROUND FEEDER(S)
BY OTHERS -
BY MANITOBA HYDRO - 4/G



Parks Canada / Parcs Canada	
Project title / Titre du projet	
Wasagaming Campground Redevelopment Project	
Riding Mountain National Park	
Drawing title / Titre du dessin	
Single Line Distribution & Details	
Drawing Number / Numéro de dessin	
1	
Date	
March 2015	
Drawn by / Conçu par	
S. Bennett, M. Rac	



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 Canada

Project title / Titre du projet
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Riding Mountain National Park

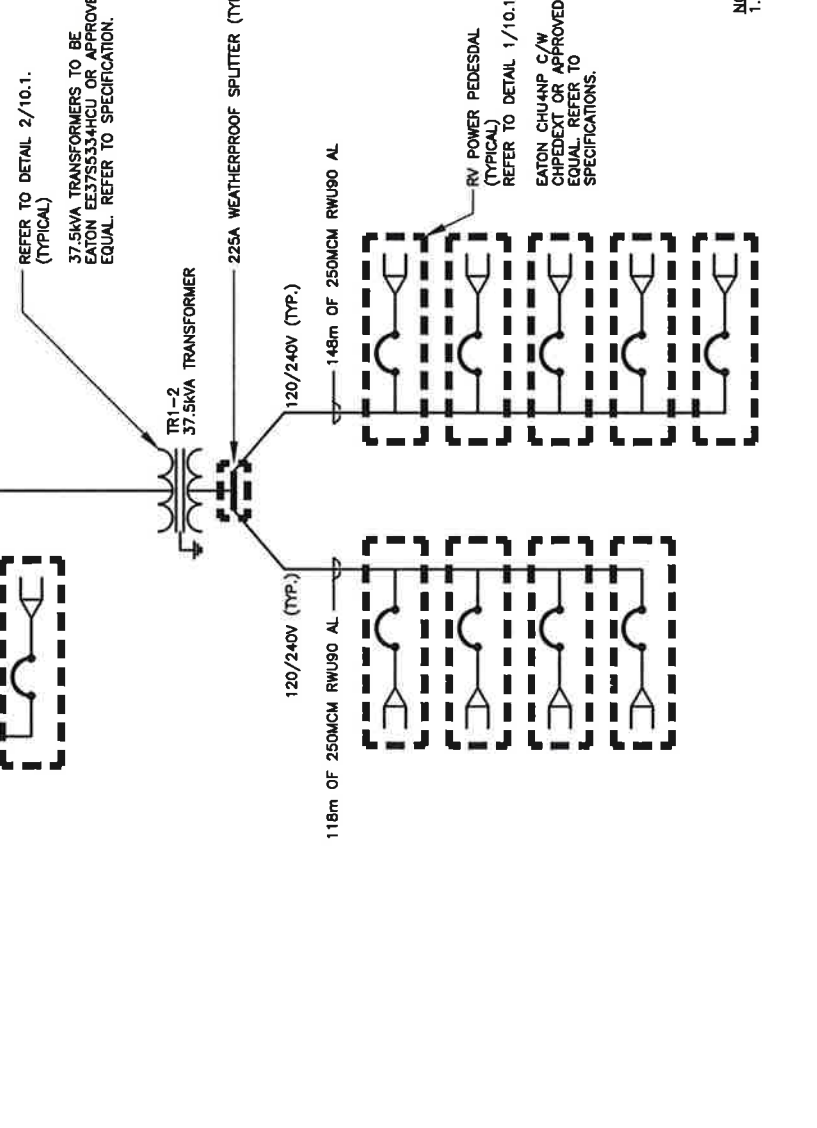
Drawing title / Titre du dessin
 Single Line Diagram (1 of 4)

Drawing Number
 2.1

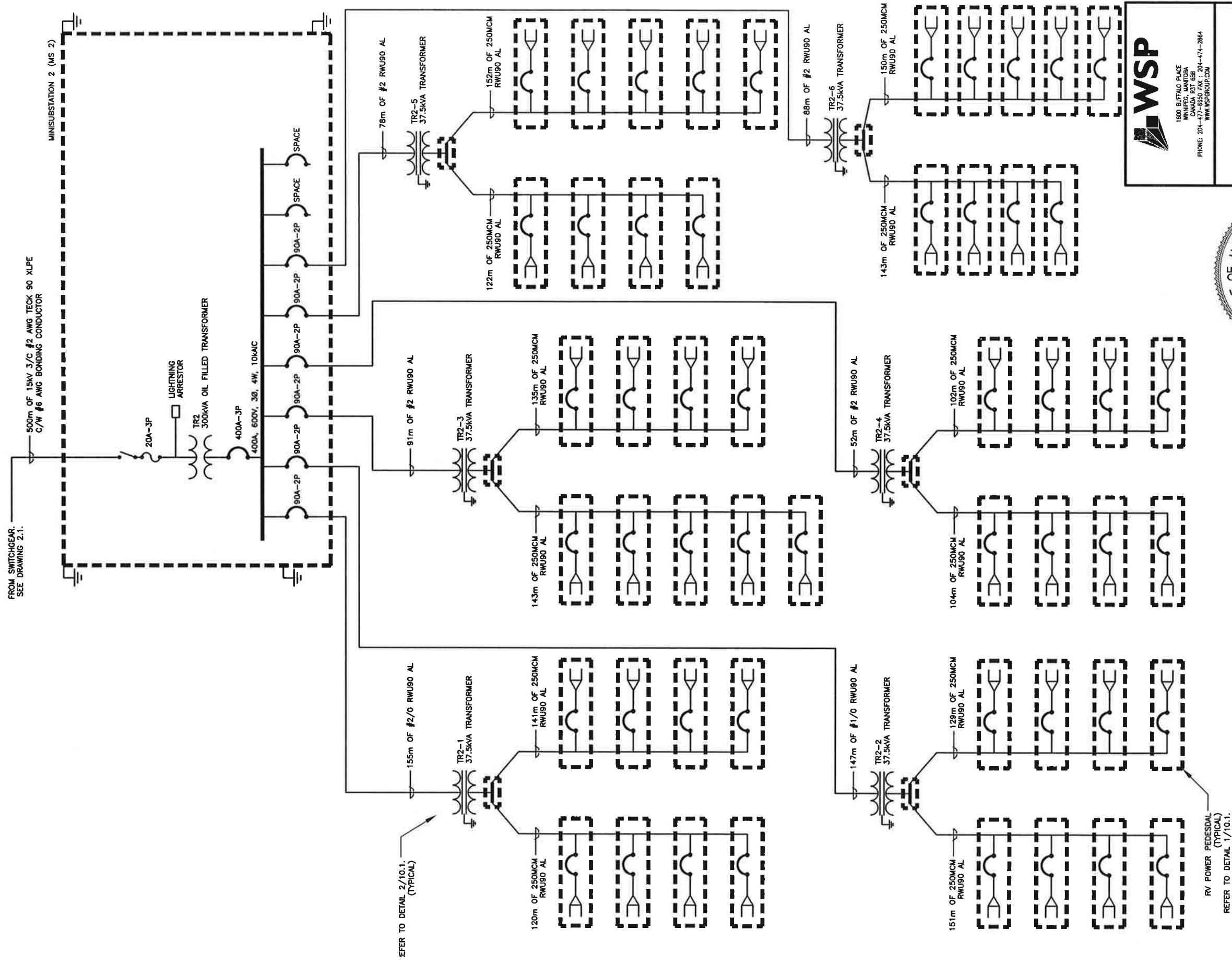
Date
 March 2015

Drawn By
 A. Johnson

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NOTES:
 1. LENGTHS OF CABLE SHOWN ARE APPROXIMATE. ACTUAL LENGTHS MAY VARY.



RV POWER PEDESTAL (TYPICAL) REFER TO DETAIL 1/10.1.

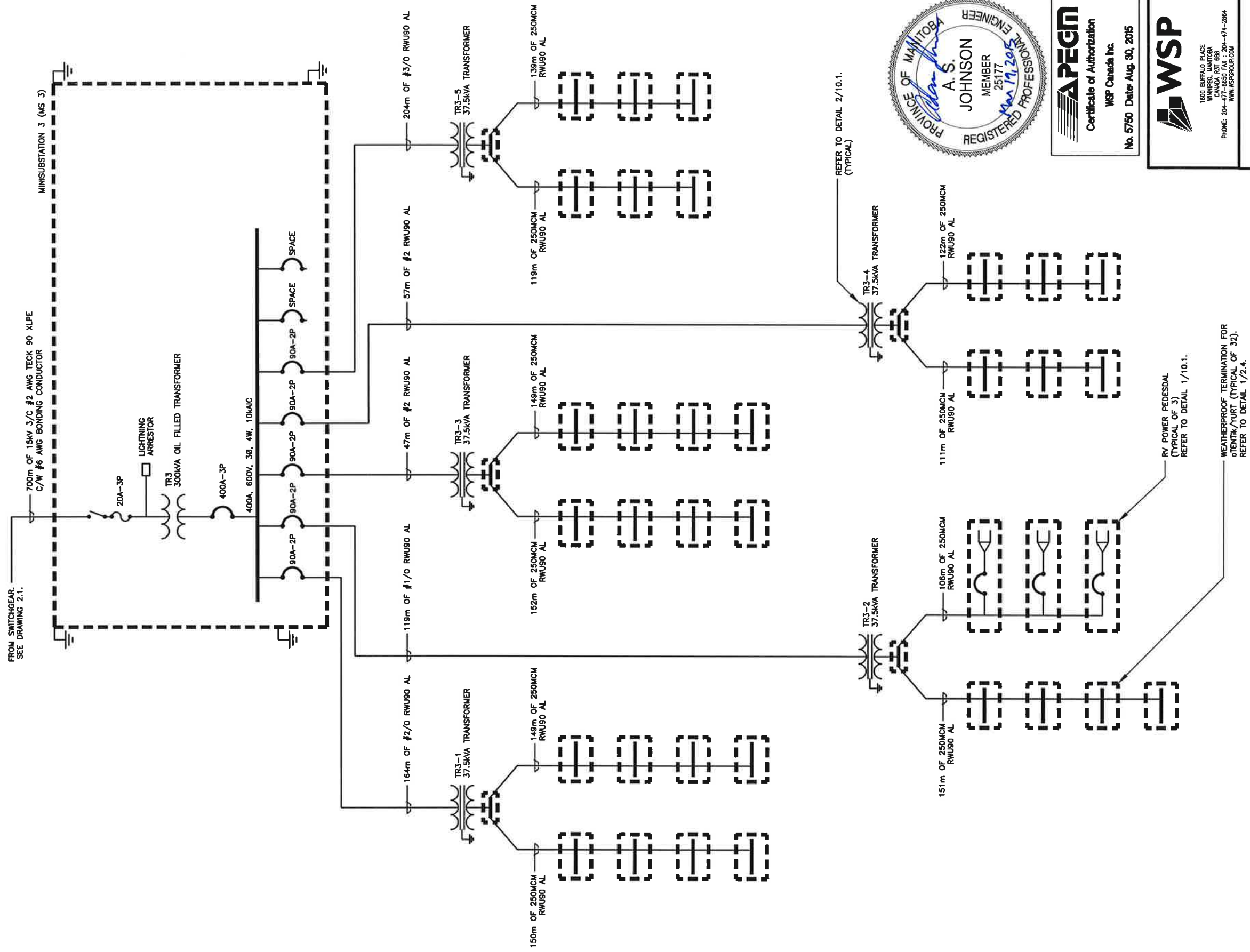
REFER TO DETAIL 2/10.1. (TYPICAL)

<p>1800 BUFFALO PLACE WILLOWDALE, ONTARIO, CANADA, R1T 1B8 PHONE: 204-477-8550 FAX: 204-474-2864 WWW.WSPGROUP.COM</p>	<p>Parcs Canada Parcs Canada</p>
	<p>Project title / Titre du projet Wasagaming Campground Redevelopment Project Riding Mountain National Park</p>
<p>Drawing title / Titre du dessin Single Line Diagram (3 of 4)</p>	
<p>Drawing Number 2.3</p>	
<p>Date March 2015</p>	
<p>Drawn By A. Johnson</p>	



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NOTES:
1. LENGTHS OF CABLE SHOWN ARE APPROXIMATE. ACTUAL LENGTHS MAY VARY.



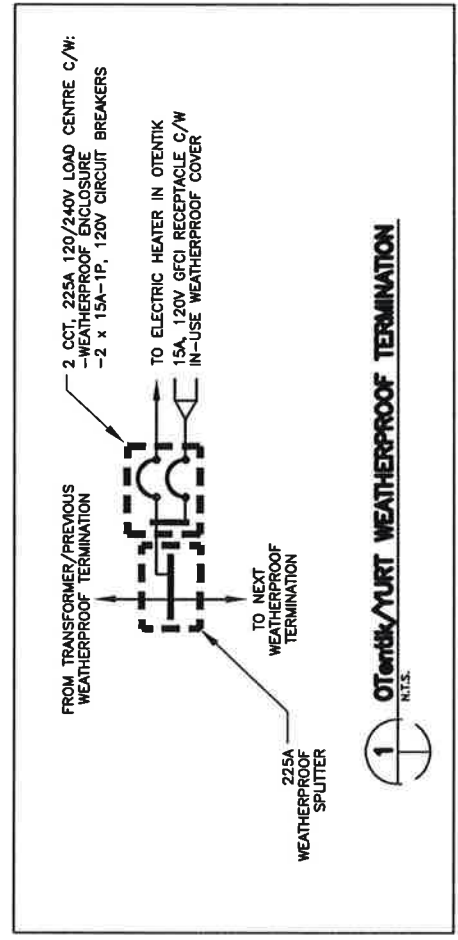
<p>1600 BUEFELS PLACE WINNIPEG, MANITOBA CANADA R3T 6R8 PHONE: 204-477-6650 FAX: 204-474-2864 WWW.WSPGROUP.COM</p>	<p>Parks Canada</p>
<p>Drawing title / Titre du dessin Single Line Diagram (4 of 4)</p>	
<p>Drawing Number 2.4</p>	
<p>Date March 2015</p>	
<p>Drawn By A. Johnson</p>	



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RY POWER PEDESTAL
(TYPICAL OF 3)
REFER TO DETAIL 1/10.1.

WEATHERPROOF TERMINATION FOR
OTENTIK/YURT (TYPICAL OF 32).
REFER TO DETAIL 1/2.4.



NOTES:
1. LENGTHS OF CABLE SHOWN
ARE APPROXIMATE. ACTUAL
LENGTHS MAY VARY.

Electrical Plan for the Wasagaming Campground - Riding Mountain National Park

	MiniSub ID	Trans ID	Wire ID	# of Pedestals on String	Length of Wire in m	Length of Wire in ft	Wire Type
High Voltage from MS to 600V Trans	1	MS 1	1	77	197.54	648.10	15KV 3/C #2 AWG TECK 90 XLPE CW #6 AWG
	2	MS 2	2	51	497.96	1633.73	15KV 3/C #2 AWG TECK 90 XLPE CW #6 AWG
	3	MS 3	3	35	208.12	682.81	15KV 3/C #2 AWG TECK 90 XLPE CW #6 AWG
	3	TR3-3	33	8	47.40	155.51	#2 GA Alum RWU-90
	2	TR2-4	24	8	51.89	170.24	#2 GA Alum RWU-90
	3	TR3-4	34	6	56.62	185.76	#2 GA Alum RWU-90
	2	TR2-5	25	9	78.05	256.07	#2 GA Alum RWU-90
	2	TR2-6	26	9	87.54	287.20	#2 GA Alum RWU-90
	2	TR2-3	23	9	91.01	298.59	#2 GA Alum RWU-90
	3	TR3-2	32	7	119.21	391.11	#1/O GA Alum RWU-90
	1	TR1-8	18	10	121.87	399.84	#1/O GA Alum RWU-90
	1	TR1-5	15	9	135.15	443.41	#1/O GA Alum RWU-90
1	TR1-6	16	8	136.61	448.20	#1/O GA Alum RWU-90	
1	TR1-1	11	9	136.71	448.52	#1/O GA Alum RWU-90	
1	TR1-3	13	8	139.79	458.63	#1/O GA Alum RWU-90	
1	TR1-7	17	9	145.18	476.31	#1/O GA Alum RWU-90	
2	TR2-2	22	8	146.95	482.12	#1/O GA Alum RWU-90	
2	TR2-1	21	8	154.72	507.61	#2/O GA Alum RWU-90	
3	TR3-1	31	8	164.13	538.48	#2/O GA Alum RWU-90	
3	TR3-5	35	6	203.81	668.67	#3/O GA Alum RWU-90	
1	TR1-9	19	9	212.74	697.97	#3/O GA Alum RWU-90	
1	TR1-4	14	6	231.56	759.71	#4/O GA Alum RWU-90	
1	TR1-2	12	9	299.01	981.00	350 MCM Alum RWU-90	
From Trans to Pedestals	1	TR1-4	114	3	78.05	256.07	250 MCM Alum RWU-90
	1	TR1-4	214	3	100.86	330.91	250 MCM Alum RWU-90
	2	TR2-4	224	4	101.54	333.14	250 MCM Alum RWU-90
	2	TR2-4	124	4	103.84	340.68	250 MCM Alum RWU-90
	3	TR3-2	232	3	106.30	348.75	250 MCM Alum RWU-90
	3	TR3-4	134	3	110.68	363.12	250 MCM Alum RWU-90
	1	TR1-1	111	4	111.54	365.94	250 MCM Alum RWU-90
	1	TR1-7	217	4	115.86	380.12	250 MCM Alum RWU-90
	1	TR1-2	112	4	118.04	387.27	250 MCM Alum RWU-90
	1	TR1-9	219	5	118.18	387.73	250 MCM Alum RWU-90
	1	TR1-9	119	4	118.56	388.98	250 MCM Alum RWU-90
	3	TR3-5	135	3	118.93	390.19	250 MCM Alum RWU-90
	2	TR2-1	121	4	119.68	392.65	250 MCM Alum RWU-90
	1	TR1-3	113	4	121.14	397.44	250 MCM Alum RWU-90
	3	TR3-4	234	3	121.84	399.74	250 MCM Alum RWU-90
	2	TR2-5	125	4	122.42	401.64	250 MCM Alum RWU-90
	2	TR2-2	222	4	129.15	423.72	250 MCM Alum RWU-90
	1	TR1-5	215	5	132.30	434.06	250 MCM Alum RWU-90
	1	TR1-3	213	4	132.34	434.19	250 MCM Alum RWU-90
	2	TR2-3	223	4	135.17	443.47	250 MCM Alum RWU-90
	1	TR1-6	216	4	136.94	449.28	250 MCM Alum RWU-90
	3	TR3-5	235	3	139.20	456.69	250 MCM Alum RWU-90
	1	TR1-6	116	4	141.01	462.63	250 MCM Alum RWU-90
	2	TR2-1	221	4	141.05	462.76	250 MCM Alum RWU-90
	1	TR1-5	115	4	142.01	465.91	250 MCM Alum RWU-90
	2	TR2-3	123	5	142.79	468.47	250 MCM Alum RWU-90
	2	TR2-6	126	4	143.15	469.65	250 MCM Alum RWU-90
	1	TR1-2	212	5	148.46	487.07	250 MCM Alum RWU-90
	3	TR3-1	231	4	148.59	487.50	250 MCM Alum RWU-90
	1	TR1-7	117	5	148.77	488.09	250 MCM Alum RWU-90
	3	TR3-3	233	4	148.89	488.48	250 MCM Alum RWU-90
	1	TR1-1	211	5	149.65	490.98	250 MCM Alum RWU-90
	3	TR3-1	131	4	149.97	492.03	250 MCM Alum RWU-90
2	TR2-6	226	5	150.46	493.64	250 MCM Alum RWU-90	
2	TR2-2	122	4	150.57	494.00	250 MCM Alum RWU-90	
3	TR3-2	132	4	151.13	495.83	250 MCM Alum RWU-90	
1	TR1-8	118	5	151.21	496.10	250 MCM Alum RWU-90	
2	TR2-5	225	5	151.81	498.06	250 MCM Alum RWU-90	
1	TR1-8	218	5	151.97	498.59	250 MCM Alum RWU-90	
3	TR3-3	133	4	152.19	499.31	250 MCM Alum RWU-90	

The Guidelines we used for wire sizing:

600 V - Wire Sizing Chart - all wires AWG

- 0-300 ft #2 GA Alum RWU-90
- 301-500 ft #1/O GA Alum RWU-90
- 501-600ft #2/O GA Alum RWU-90
- 601-700 ft #3/O GA Alum RWU-90
- 701-800 ft #4/O GA Alum RWU-90
- 801-1000 ft 350 MCM Alum RWU-90

* Ground wire shall be no smaller than #4 AWG Bare Copper

These wire lengths and sizes shall be used for all wire as measured from the main distribution to Transformer.

120/240 V - Wire Sizing Chart - all wires AWG

- 201-300 ft #4/O GA Alum RWU-90
- 301-500 ft 250 MCM Alum RWU-90

* Ground wire shall be no smaller than #6 AWG Bare Copper

These wire lengths and sizes shall be used for all wire as measured from the pad mounted Transformer to the light pedestal.



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	Parks Canada
Project title / Titre du projet Wasagaming Campground Redevelopment Project	
Riding Mountain National Park	
Drawing title / Titre du dessin Single Line Distribution & Lengths	
Drawing Number / Numéro de dessin	3
Date	October 2014
Drawn by / Conçu par	S. Bennett, J. Keeney

WASAGAMING CAMPGROUND
RIDING MOUNTAIN NATIONAL PARK



- Additional Electrical Equipment Installation:**
- Switch Gear Box
 - ◆ Minisubstations
 - 37.5 KVA Transformer
 - MB Hydro High Voltage Drop Off
 - High Voltage to 225 KVA Transformers
 - CDP to 37.5 KVA Transformers
 - To Pedestals



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Project title / Titre du projet
Wasagaming Campground
Redevelopment Project
Riding Mountain National Park

Drawing title / Titre du dessin
Wire Schematic Overview

Drawing Number / Numero de dessin
4

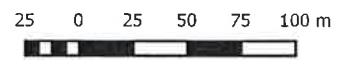
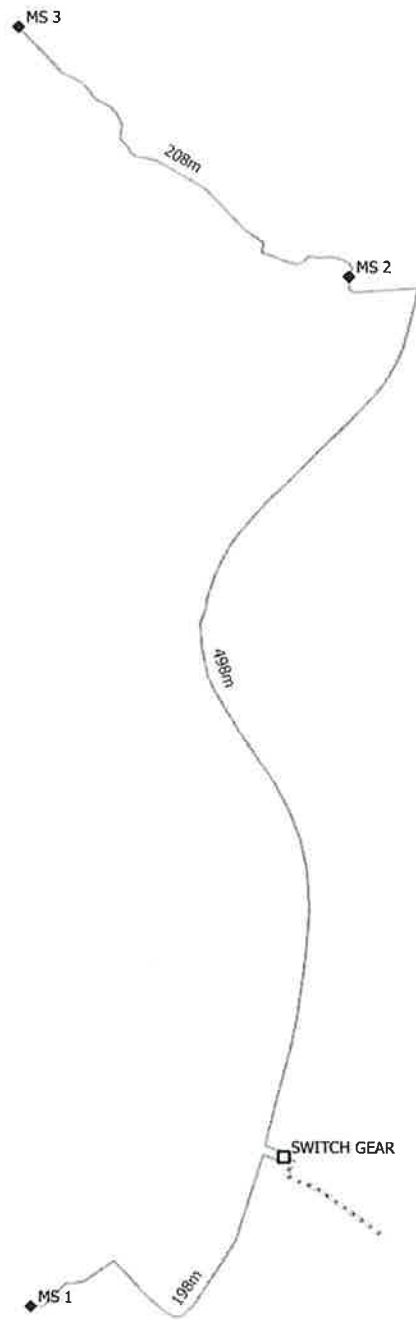
Date
October 2014

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S. Bennett, J. Keeney

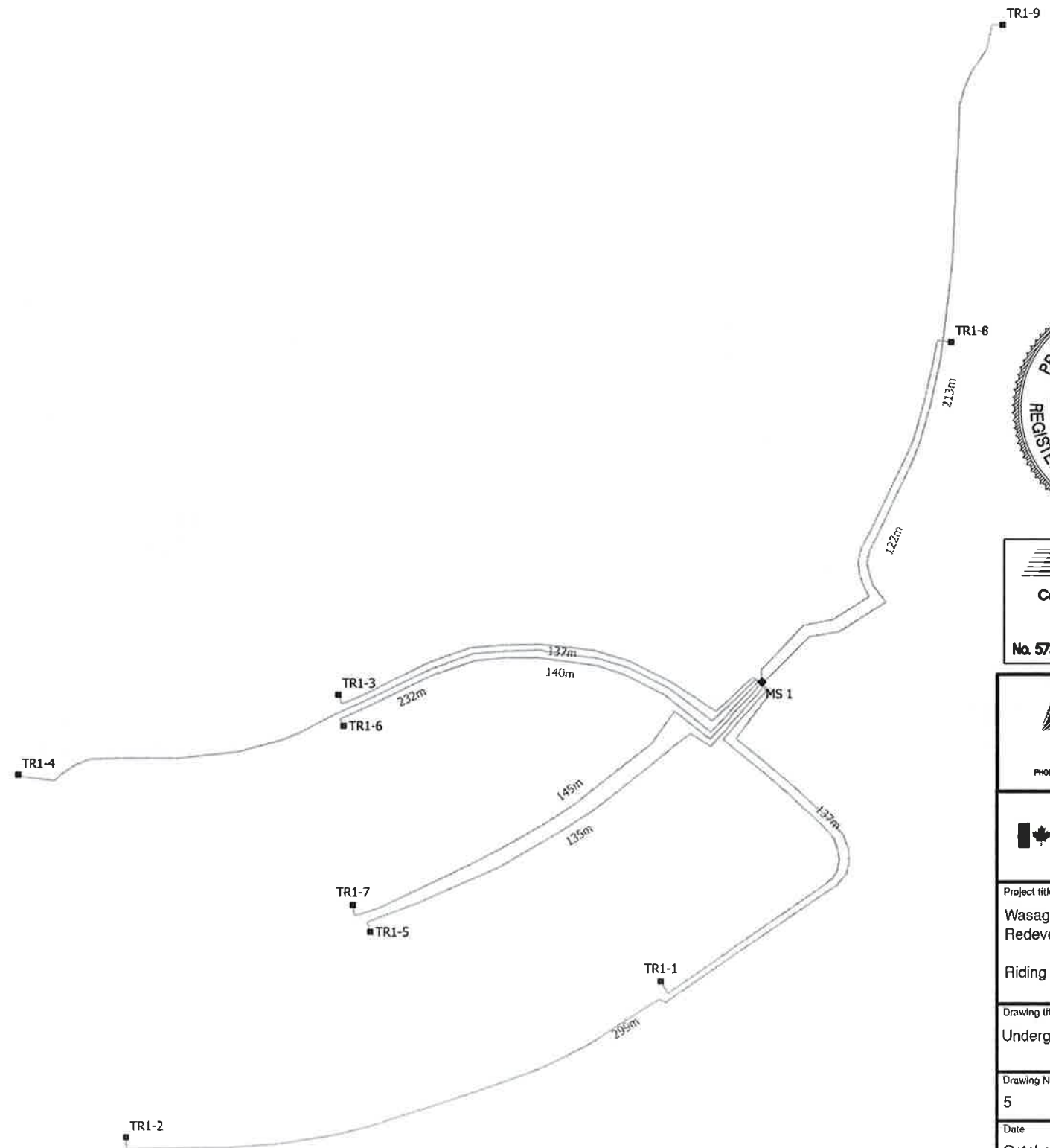
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HIGH VOLTAGE TRANSFORMERS



37.5 KVA TRANSFORMERS



Project title / Titre du projet
**Wasagaming Campground
 Redevelopment Project**

Riding Mountain National Park

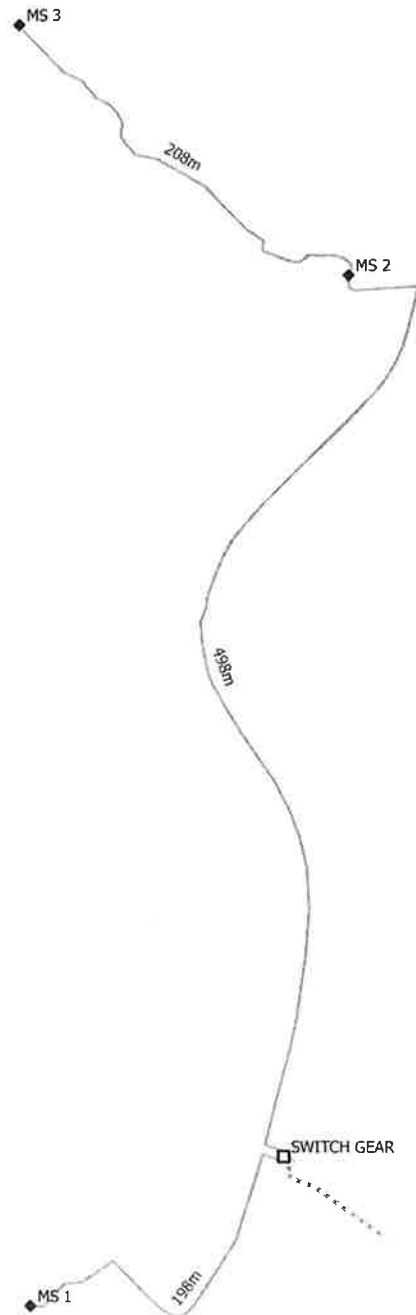
Drawing title / Titre du dessin
Underground Wire Schematic

Drawing Number / Numéro de dessin
5

Date
October 2014

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S. Bennett, J. Keeney

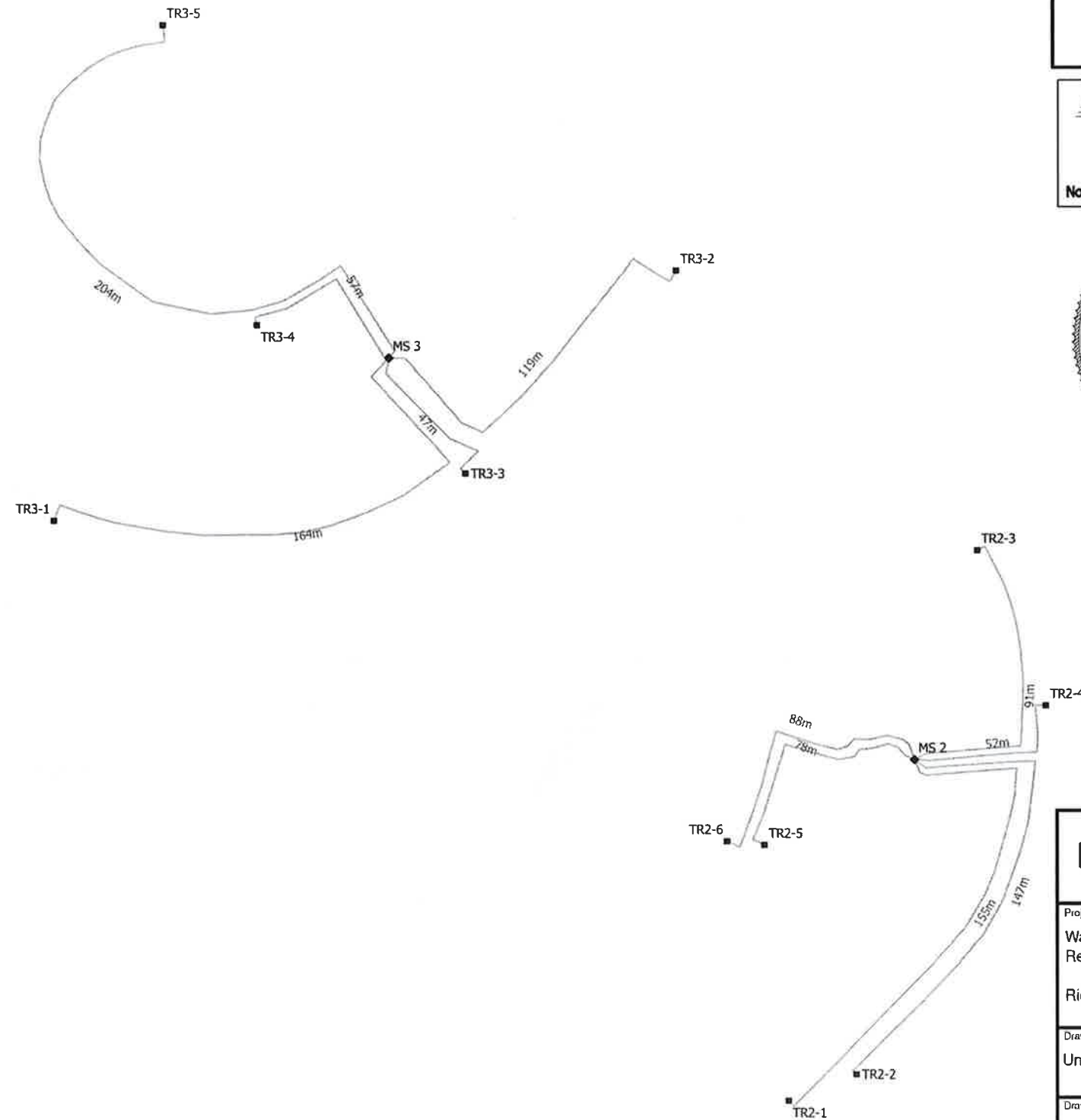
HIGH VOLTAGE TRANSFORMERS



25 0 25 50 75 100 m



37.5 KVA TRANSFORMERS





50 0 50 100 m



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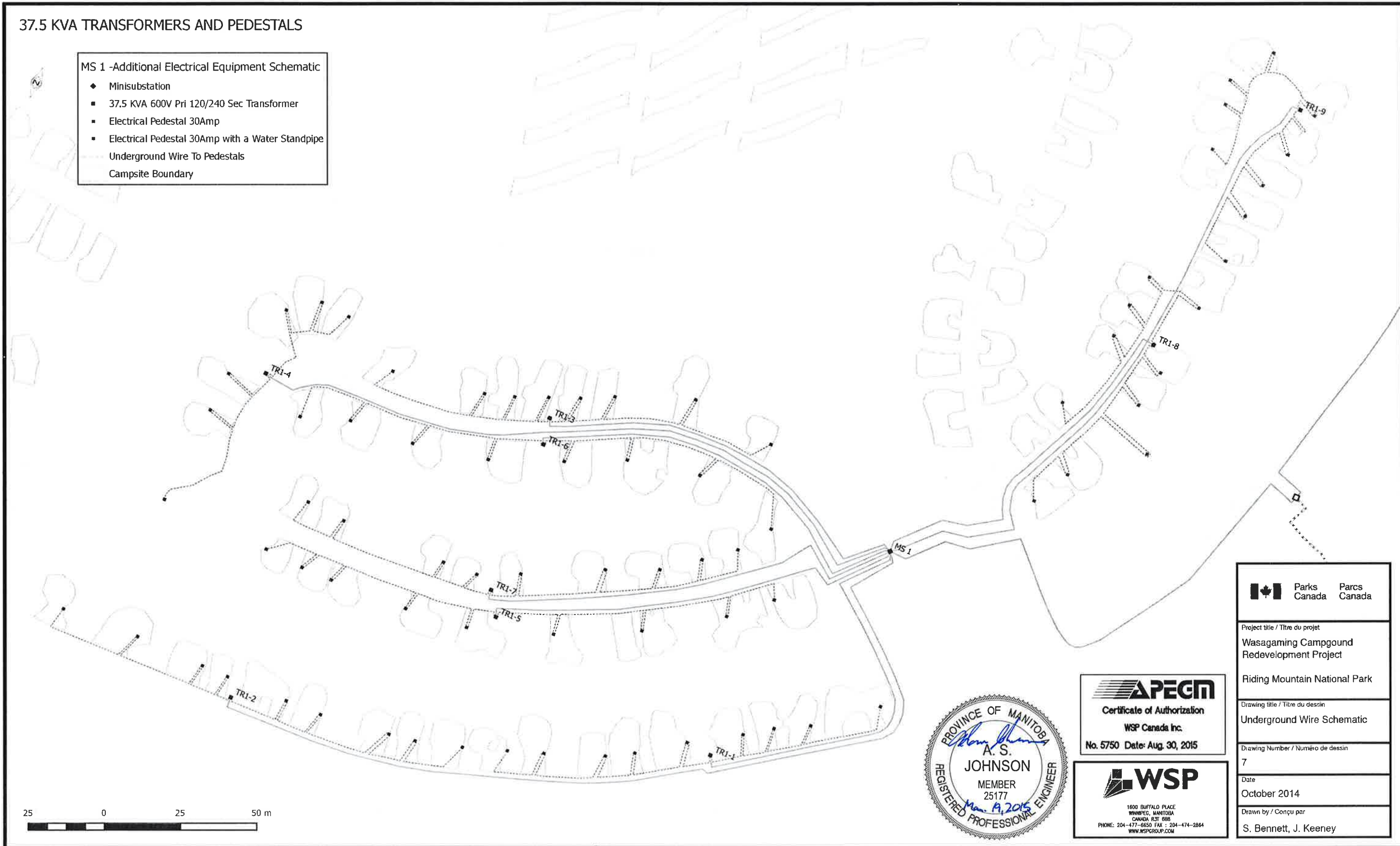


 Parks Canada	 Parcs Canada
Project title / Titre du projet Wasagaming Campground Redevelopment Project	
Riding Mountain National Park	
Drawing title / Titre du dessin Underground Wire Schematic	
Drawing Number / Numéro de dessin 6	
Date October 2014	
Drawn by / Conçu par S. Bennett, J. Keeney	

37.5 KVA TRANSFORMERS AND PEDESTALS

MS 1 - Additional Electrical Equipment Schematic

- ◆ Minisubstation
- 37.5 KVA 600V Pri 120/240 Sec Transformer
- Electrical Pedestal 30Amp
- Electrical Pedestal 30Amp with a Water Standpipe
- Underground Wire To Pedestals
- Campsite Boundary

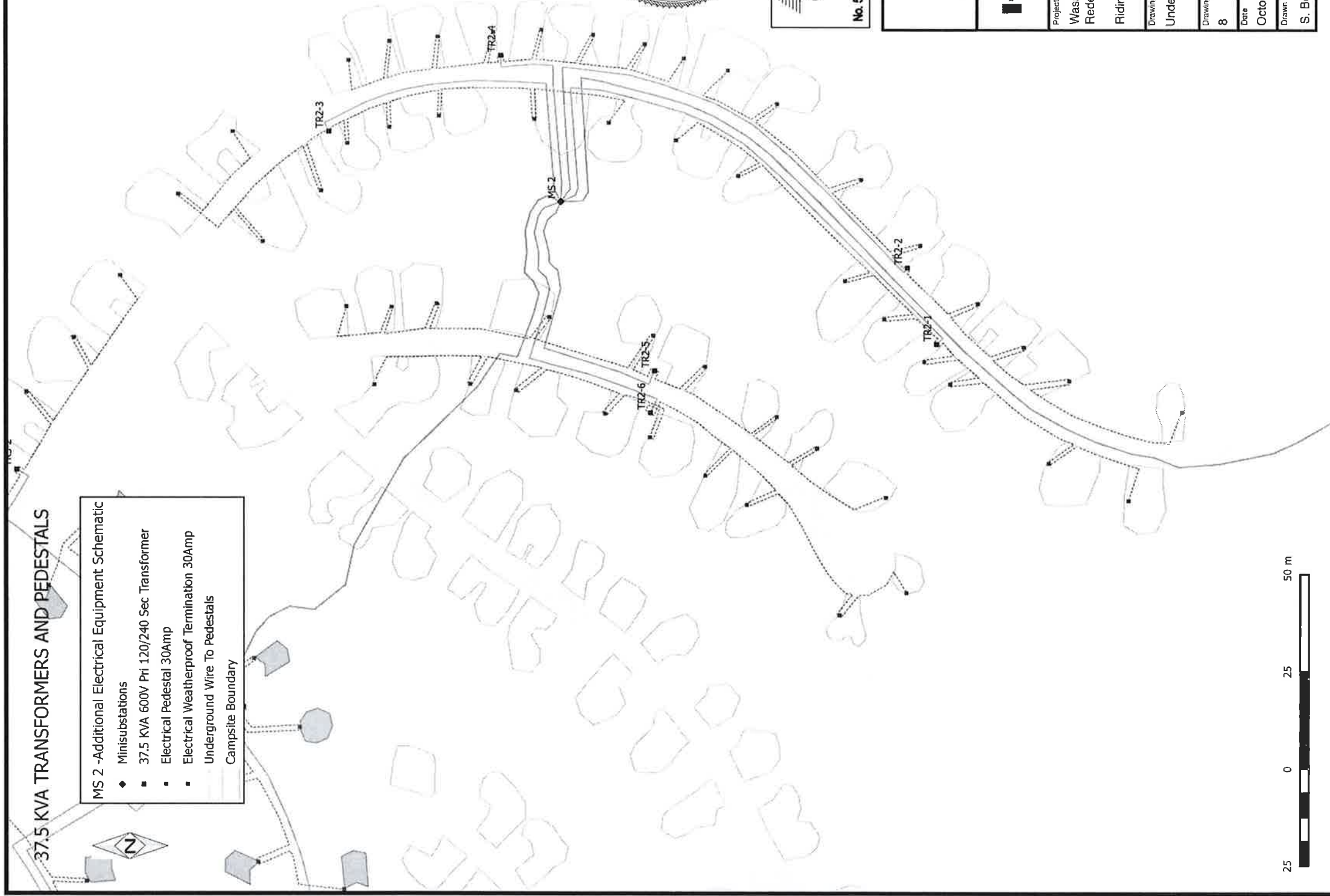


	Parks Canada Parcs Canada
Project title / Titre du projet Wasagaming Campground Redevelopment Project	
Riding Mountain National Park	
Drawing title / Titre du dessin Underground Wire Schematic	
Drawing Number / Numéro de dessin 7	
Date October 2014	
Drawn by / Conçu par S. Bennett, J. Keeney	



37.5 KVA TRANSFORMERS AND PEDESTALS

- MS 2 - Additional Electrical Equipment Schematic
- ◆ Minisubstations
 - 37.5 KVA 600V Pri 120/240 Sec Transformer
 - Electrical Pedestal 30Amp
 - Electrical Weatherproof Termination 30Amp
 - Underground Wire To Pedestals
 - Campsite Boundary



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Parcs Canada
Parks Canada

Project title / Titre du projet
Wasagamung Campground
Redevelopment Project
Riding Mountain National Park

Drawing title / Titre du dessin
Underground Wire Schematic

Drawing Number / Numéro de dessin
8

Date
October 2014

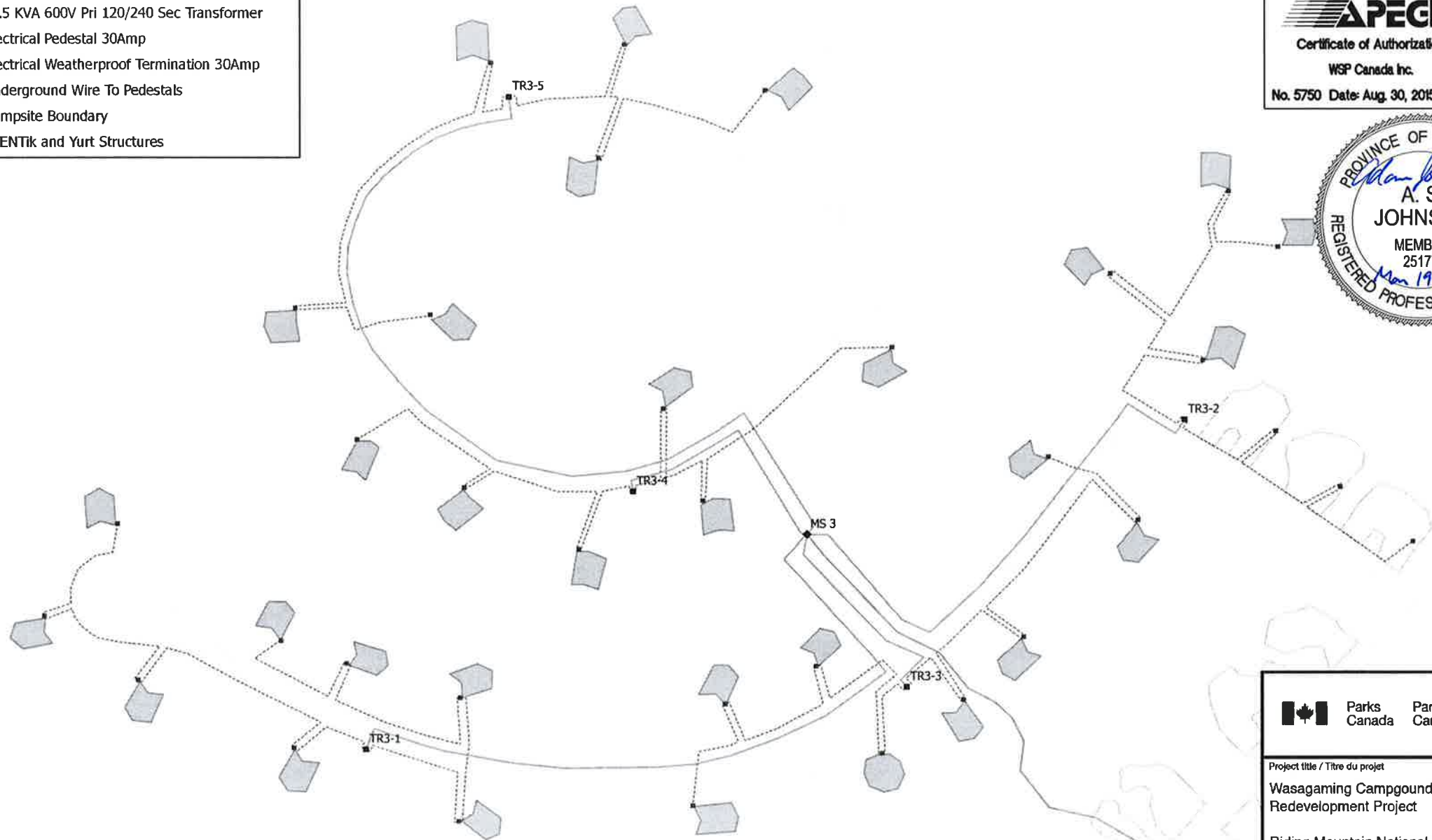
Drawn by / Conçu par
S. Bennett, J. Keeney

37.5 KVA TRANSFORMERS, PEDESTALS AND WEATHERPROOF TERMINATION



MS 3 -Additional Electrical Equipment Schematic

- ◆ Minisubstations
- 37.5 KVA 600V Pri 120/240 Sec Transformer
- Electrical Pedestal 30Amp
- Electrical Weatherproof Termination 30Amp
- Underground Wire To Pedestals
- Campsite Boundary
- oTENTik and Yurt Structures



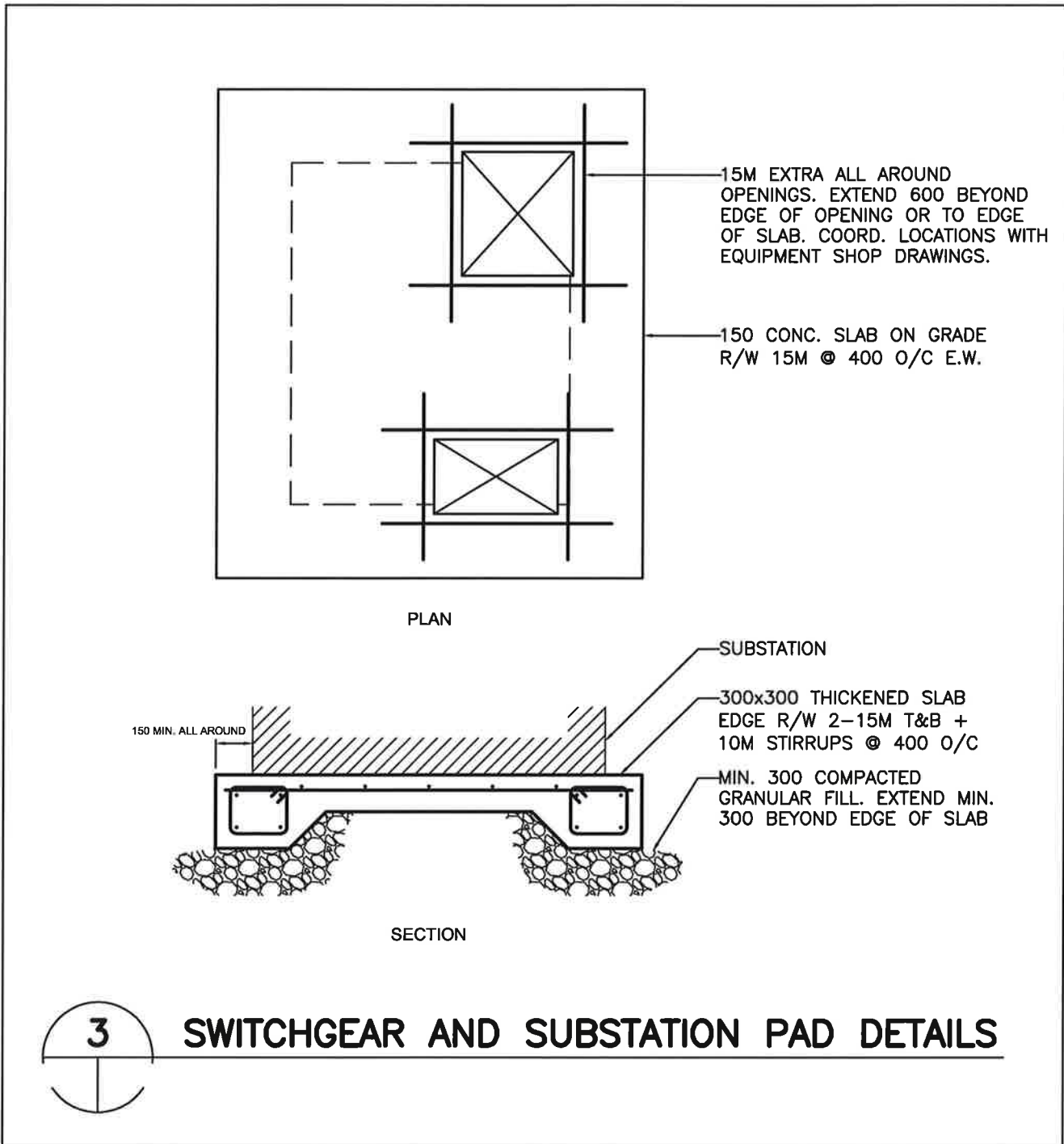
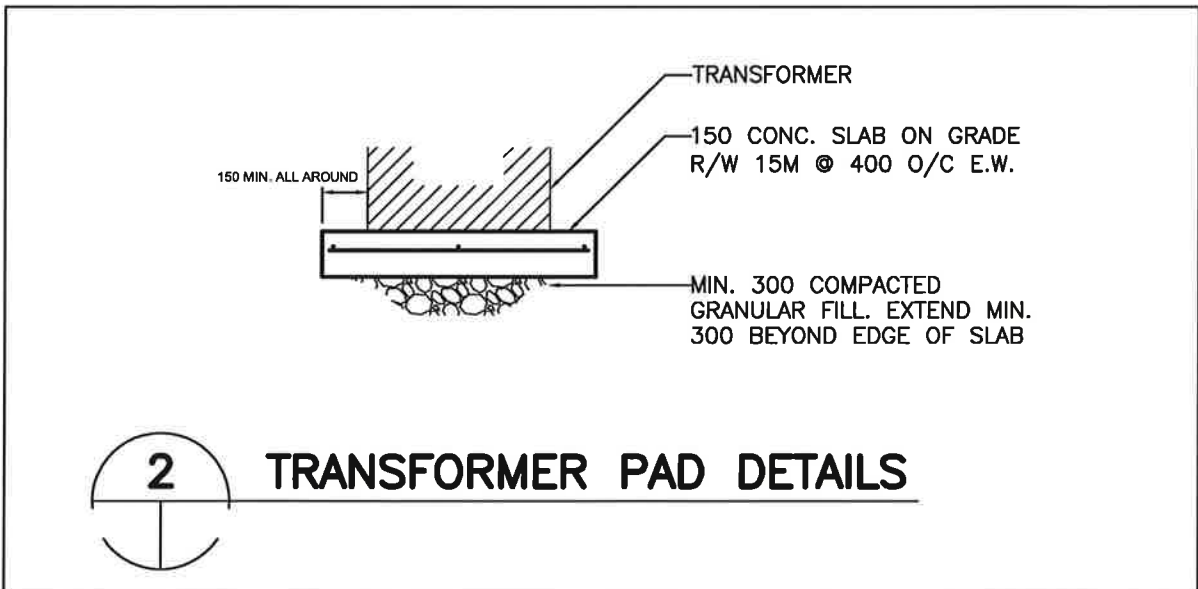
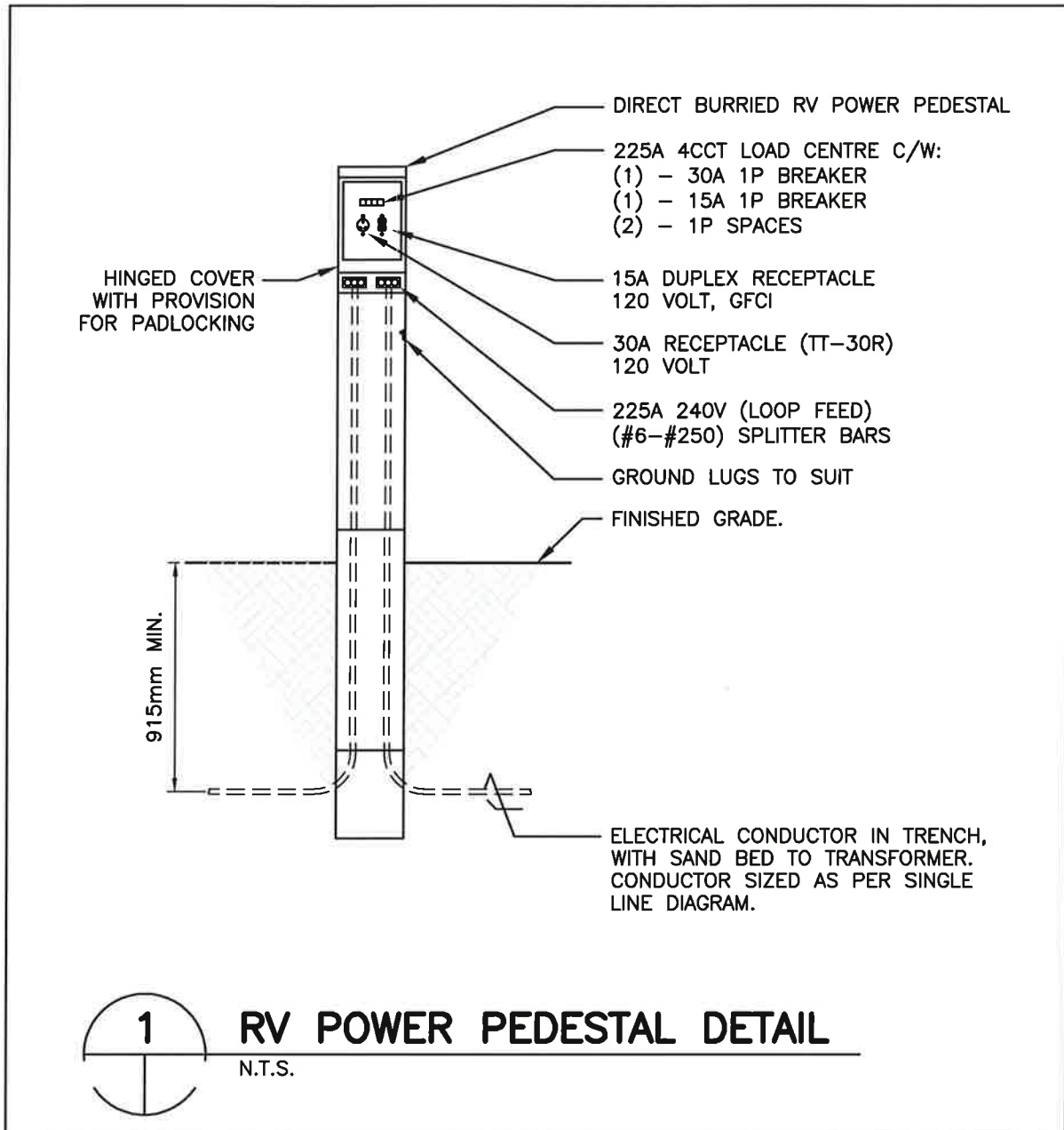
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Parks Canada / Parcs Canada
Project title / Titre du projet Wasagaming Campground Redevelopment Project
Riding Mountain National Park
Drawing title / Titre du dessin Underground Wire Schematic
Drawing Number / Numéro de dessin 9
Date October 2014
Drawn by / Conçu par S. Bennett, J. Keeney





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No. 5750 Date: Aug. 30, 2015

PROVINCE OF MANITOBA
A.S.
JOHNSON
MEMBER
25177
31.2015
REGISTERED PROFESSIONAL ENGINEER

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Parks Canada

Project title / Titre du projet
Wasagaming Campground
Redevelopment Project
Riding Mountain National Park

Drawing title / Titre du dessin
Electrical Details
(1 of 3)

Drawing Number
10.1

Date
March 2015

Drawn By
A. Johnson

CONFIRM EXACT ROUTING OF PRIMARY U/G FEEDERS. ON SITE. REFER TO 6/10.2 FOR DETAIL.

GROUND ELECTRODE INSPECTION BOX. REFER TO DETAIL 9/10.3.

#3/0 AWG STRANDED BARE COPPER WIRE GROUND CONDUCTOR TO MAIN EQUIPMENT GROUND BUS. (TYPICAL).

#3/0 Cu. GROUND RING. REFER TO DETAIL 7/10.2. (TYPICAL).

PROTECTION BOLLARD. (TYP.)

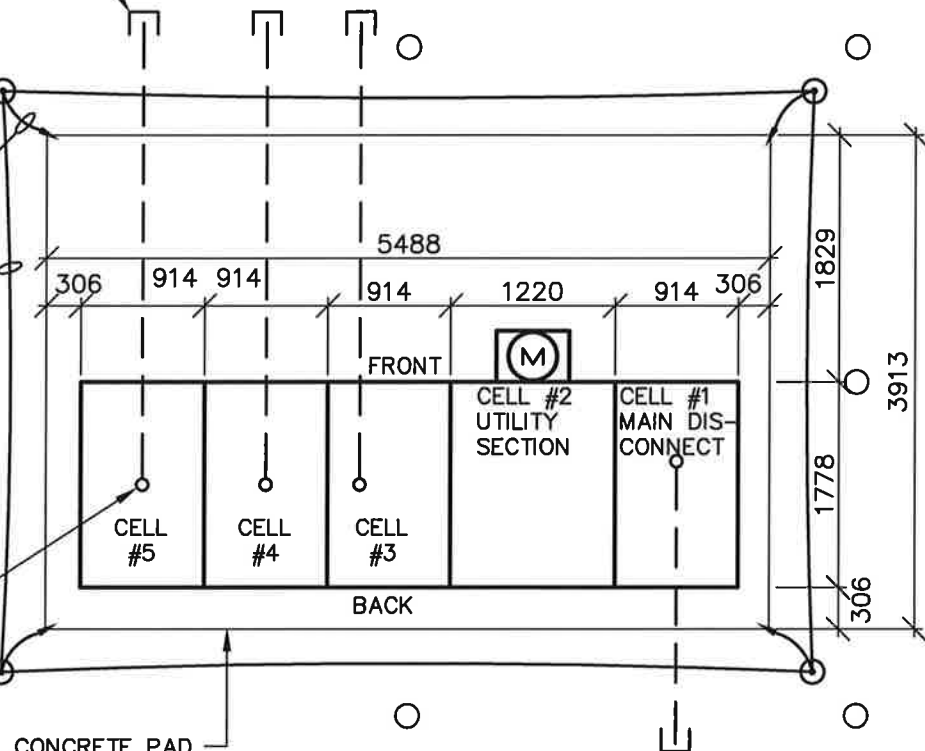
STUB CONDUIT 100mm (4") ABOVE CONCRETE PAD TO ACCOMMODATE THREADED CAP ENDS. GROUND CONDUIT TO SWITCHGEAR (TYP.)

STATION ELECTRODE 3/4" DIA. x 10'-0" LONG COPPER GROUND ROD TO BE INSTALLED IN GROUND INSPECTION BOX. (TYPICAL 1 OF 4)

CONCRETE PAD. REFER TO DETAIL 3/10.1.

NOTE:

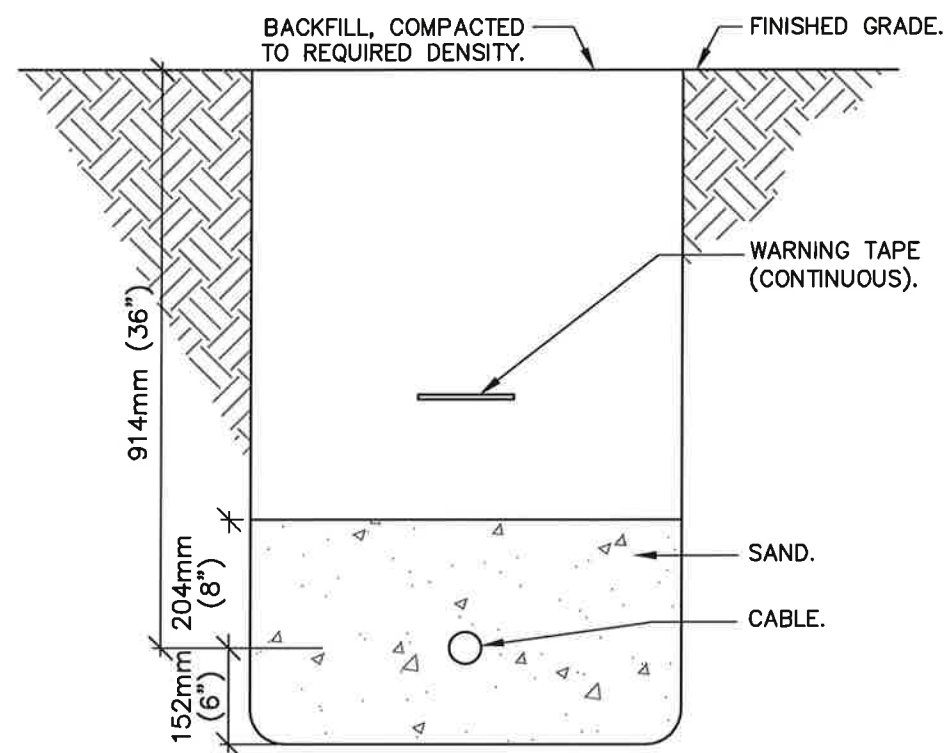
DETAIL IS BASED ON INFORMATION PROVIDED BY EATON CUTLER-HAMMER. OTHER MANUFACTURERS MAY REQUIRE ADDITIONAL CELLS FOR A TRANSITION OR CONTROL TRANSFORMER. CONFIRM FINAL LAYOUT AND DIMENSIONS WITH SHOP DRAWINGS.



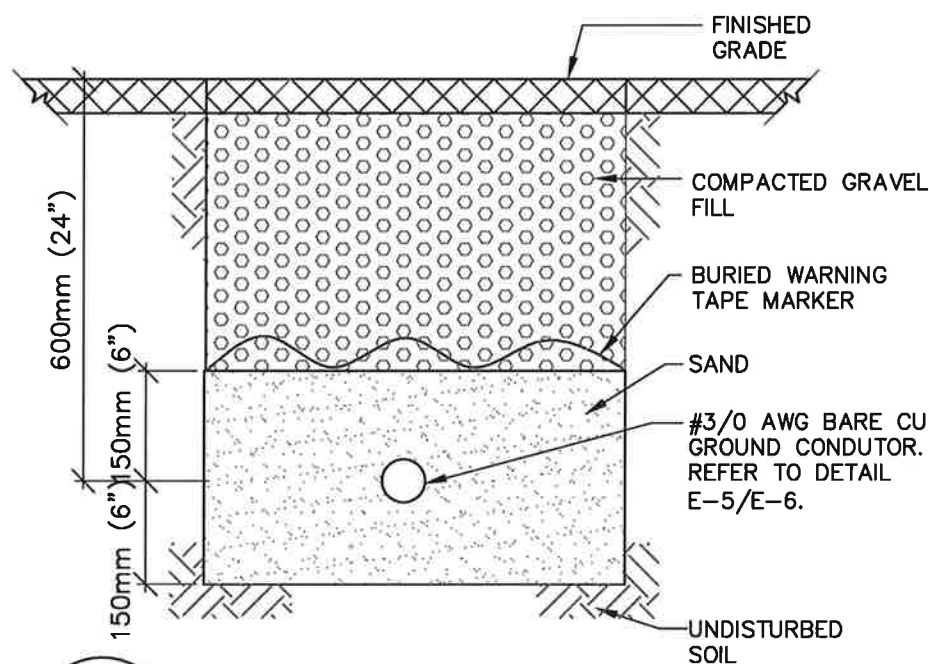
4 SWITCHGEAR EQUIPMENT AND GROUND DETAIL

NOTE:

1. REPAIR OR MAKE GOOD ALL ASPHALT, CONCRETE, GRAVEL OR GRASS SURFACES EXCAVATED BY TRENCH TO SATISFACTION OF OWNER.



6 PRIMARY FEEDER TRENCH DETAIL



7 GROUNDING TRENCH DETAIL

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Wasagaming Campground
Redevelopment Project
Riding Mountain National Park

Drawing title / Titre du dessin
Electrical Details
(2 of 3)

Drawing Number
10.2

Date
March 2015

Drawn By
A. Johnson

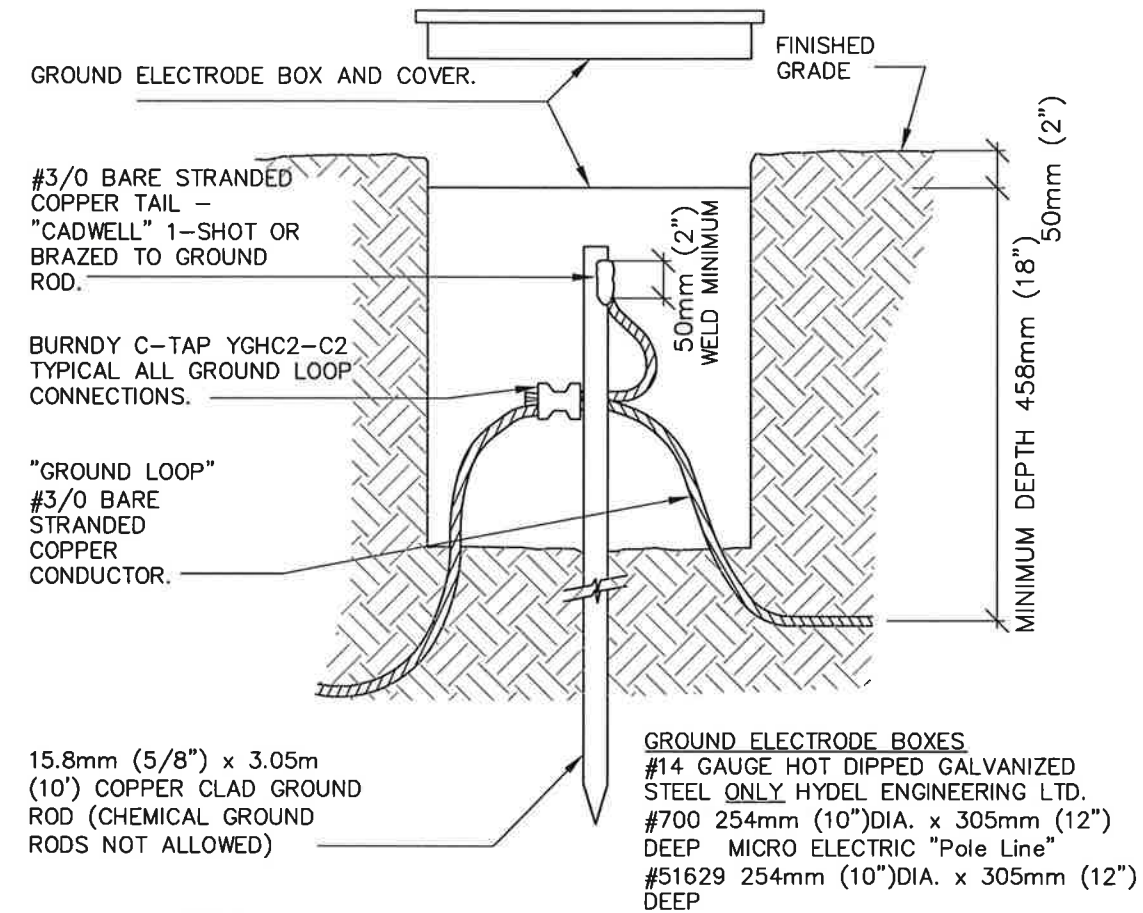
VOLTAGE DROP SUMMARY - FROM 37.5kVA TRANSFORMER TO PEDESTALS/OTENTIKS

(2) WORST CASE SCENARIOS

Voltage 240 V
 Acceptable Drop 3%
 Acceptable Drop 7.2 V
 Aluminum

TRANSFORMER	SEGMENT	DISTANCE (m)	CURRENT (A)	COND. SIZE (kcmil)	V. DROP (V)	V. DROP (%)	CUMULATIVE V. DROP (%)
TR1-8	TR1-8 TO 1ST PED	17	150	250	1.14	0.47%	0.47%
	1ST PED TO 2ND	41	120	250	2.19	0.91%	1.39%
	2ND PED TO 3RD	32	90	250	1.28	0.53%	1.92%
	3RD PED TO 4TH	32	60	250	0.86	0.36%	2.28%
	4TH PED TO 5TH	30	30	250	0.40	0.17%	2.45%
TOTAL:		152				2.45%	
TR3-3	TR1-8 TO 1ST OT	21	120	250	1.12	0.47%	0.47%
	1ST OT TO 2ND	39	90	250	1.56	0.65%	1.12%
	2ND OT TO 3RD	65	60	250	1.74	0.72%	1.84%
	3RD OT TO 4TH	28	30	250	0.37	0.16%	2.00%
TOTAL:		153				2.00%	

8 VOLTAGE DROP SUMMARY



NOTE:
 1. WHEN INSTALLING HYDEL COVERS, SET THE TOP OF THE CANISTER APPROXIMATELY 50mm (2") BELOW GRADE. REQUEST INSPECTION OF GROUNDING SYSTEM PRIOR TO COVERING TO GRADE LEVEL.

9 GROUND INSPECTION BOX AND ELECTRODE DETAIL



Project title / Titre du projet	Wasagaming Campground Redevelopment Project
	Riding Mountain National Park
Drawing title / Titre du dessin	Electrical Details (3 of 3)
Drawing Number	10.3
Date	March 2015
Drawn By	A. Johnson

GENERAL

1. THE ELECTRICAL SYSTEM SHALL COMPLY WITH THE REQUIREMENTS OF THE LATEST EDITION OF THE CANADIAN ELECTRICAL CODE AND WITH ALL PROVINCIAL AND MUNICIPAL LAWS, RULES AND ORDINANCES, AND TO THE AUTHORITY HAVING JURISDICTION AND OWNER.
2. WORK SHALL INCLUDE ALL LABOUR, MATERIAL AND EQUIPMENT REQUIRED FOR INSTALLING, TESTING AND REPLACING IN INITIAL OPERATION THE COMPLETE ELECTRICAL SYSTEM.
3. SUBMIT SHOP DRAWINGS TO ENGINEER FOR REVIEW VIA EMAIL WITHIN 2 DAYS OF AWARD OF CONTRACT FOR O&M MANUALS.
4. PREPARE AND SUBMIT TO THE PROPER AUTHORITIES ALL REQUIRED DRAWINGS AND OBTAIN ALL NECESSARY PERMITS AND PAY ALL FEES CONNECTED HEREWITH.
5. BE RESPONSIBLE FOR ARRANGING, AND PAY ALL REQUIRED FEES, FOR INSPECTIONS OF WORK BY AUTHORITIES HAVING JURISDICTION OVER SAME.
6. ALL WORK COMPLETED SHALL BE EXECUTED IN A FIRST CLASS AND WORKMANLIKE MANNER.
7. ALL WORK SHALL BE LAID OUT IN ITS MECHANICAL APPEARANCE. IT SHALL BE LOGICALLY ARRANGED FOR SIMPLICITY OF INSTALLATION, ACCESSIBILITY AND ELECTRICAL EFFICIENCY.
8. GUARANTEE SATISFACTORY OPERATION OF ALL WORK AND APPARATUS INSTALLED. REPLACE, AT NO EXPENSE TO THE OWNER, ALL ITEMS WHICH FAIL OR PROVE DEFECTIVE WITHIN A PERIOD OF ONE YEAR AFTER DATE OF SUBSTANTIAL PERFORMANCE, PROVIDING SUCH A FAILURE IS NOT DUE TO IMPROPER USAGE BY OWNER. MAKE GOOD ALL DAMAGE INCURRED AS A RESULT OF FAILURE OR REPAIR OF ELECTRICAL WORK. NO CERTIFICATE GIVEN, PAYMENT MADE, OR PARTIAL OR ENTIRE USE OF EQUIPMENT BY OWNER, SHALL BE CONSTRUED AS ACCEPTANCE OF DEFECTIVE WORK OR ACCEPTANCE OF IMPROPER MATERIALS.
9. LOCATIONS OF ALL EQUIPMENT ARE SUBJECT TO MODIFICATION BY OWNER, WHO RESERVES THE RIGHT TO MOVE THESE UP TO 1800 MM FROM THE POSITION SHOWN, WITHOUT CHANGE TO THE CONTRACT PRICE, PROVIDED NOTICE IS GIVEN BEFORE THE RELATED WORK HAS COMMENCED.
10. PROVIDE INDOOR/OUTDOOR GRADE TAPE ON ALL ELECTRICAL EQUIPMENT/DEVICES, CONTRACTOR TO PRODUCE LABELS WITH A 'BRADY HANDI PORTABLE LABEL MAKER':
 - 120/208V NORMAL POWER (BLACK/WHITE LETTERS)
 - 600V NORMAL POWER (GREEN/WHITE LETTERS)
 - HYDRO UTILITY POWER (ORANGE/BLACK LETTERS)
 - MOUNT ON ALL EQUIPMENT NAMEPLATES TO INDICATE DESIGNATION, FUNCTION, AND VOLTAGE CHARACTERISTICS OF PANEL.
12. PERFORM ALL CUTTING AND PATCHING AS REQUIRED.
13. CONTRACTOR SHALL MAINTAIN AT THE JOB ONE SET OF PLANS, WHICH HE SHALL CLEARLY NOTE ALL CHANGES OR DEVIATIONS FROM THE CONTRACT DOCUMENTS AS THE JOB PROGRESSES. SUBMIT TO THE CONSULTANT AT THE COMPLETION OF THE WORK.
14. OPERATION AND MAINTENANCE MANUALS TO BE IN ACCORDANCE WITH THE REQUIREMENTS OF TECHNICAL BULLITEN #15 ISSUED BY THE JOINT MAA/WCA COMMITTEE AND THE CONTRACT GENERAL CONDITIONS. SUBMIT ONE PRELIMINARY COPY TO THE CONSULTANT PRIOR TO COMPLETION OF WORK. REVISE AS DIRECTED AND SUBMIT 3 FINAL COPIES TO THE OWNER. ALSO INCLUDE A COPY OF THE PANEL DIRECTORIES AND ALL INSPECTION AND TESTING CERTIFICATES.
15. IT IS NOT THE INTENTION OF THIS SPECIFICATION TO REITERATE THE APPLICABLE CODES. IT IS EXPECTED THAT THE CONTRACTOR WILL BE RESPONSIBLE FOR PROVIDING ALL GROUNDING, WIRING METHODS, ETC.
16. THE CONTRACTOR IS TO EXAMINE THE CONDITIONS OF THE SITE AND BE RESPONSIBLE FOR RELOCATING OR REMOVING AND REPLACING ALL EQUIPMENT NECESSARY FOR THE ELECTRICAL WORK REQUIRED FOR THIS PROJECT.
17. NOTIFY THE ENGINEER OF ANY ERRORS OR OMISSIONS PRIOR TO SUBMISSION OF TENDER, OTHERWISE NO ADDITIONAL COMPENSATION WILL BE GIVEN.
18. SCHEDULE THE WORK WITH THE OWNER. ALLOW FOR SCHEDULING OF SHUTDOWNS TO AFTER OPERATING HOURS.

19. PRIOR TO SCHEDULING FINAL INSPECTION, THE CONTRACTOR IS TO ENSURE THAT ALL WORK IS COMPLETED, AND IN PARTICULAR, THAT AS-BUILT DRAWINGS ARE COMPLETED, ALL FACEPLATES INSTALLED, VERIFICATION TESTS HAVE BEEN DONE, AND CERTIFICATES THAT INDICATE WORK INSTALLED CONFORMS TO REQUIREMENTS OF THE AUTHORITY HAVING JURISDICTION.

CLEANING

1. MAINTAIN THE WORK IN TIDY CONDITION, FREE FROM THE ACCUMULATION OF WASTE PRODUCTS AND DEBRIS.
2. REMOVE WASTE MATERIAL AND DEBRIS FROM SITE AND DEPOSIT IN WASTE CONTAINERS AT END OF EACH WORKING DAY.

TESTING

1. VERIFY ALL RECEPTACLES HAVE BEEN WIRED CORRECTLY USING AN OUTLET CIRCUIT TESTER. PROVIDE WRITTEN RESULTS TO ENGINEER.
2. SUBMIT ALL TEST RESULTS IN DUPLICATE TO THE CONSULTANT FOR APPROVAL.

ENVIRONMENTAL PROTECTION

1. DO NOT BURY RUBBISH AND WASTE MATERIALS ON SITE.
2. DO NOT DISPOSE OF WASTE OR VOLATILE MATERIALS, SUCH AS MINERAL SPIRITS, OIL OR PAINT THINNER INTO WATERWAYS, STORM OR SANITARY SEWERS.
3. PROVIDE TEMPORARY DRAINAGE AND PUMPING AS NECESSARY TO KEEP EXCAVATIONS AND SITE FREE FROM WATER.

COORDINATION STUDY

1. A OVERCURRENT AND COORDINATION STUDY SHALL BE PREPARED AND INCLUDE ALL TIME CURRENT CHARACTERISTIC CURVES PLOTTED ON LOG PAPER.
2. THE OVERCURRENT AND COORDINATION STUDY AND ARC FLASH HAZARD STUDY SHALL INCLUDE A PROFESSIONAL ELECTRICAL ENGINEER'S STAMP AND STATEMENT WHICH CLEARLY CONFIRMS THE SELECTIVE AND FULLY COORDINATED SYSTEM PERMITS MAXIMUM SERVICE CONTINUITY.
3. THE STUDY SHALL:
 - 3.1. SELECT SETTINGS AND CHARACTERISTICS FOR THE ELECTRICAL DISTRIBUTION EQUIPMENT AND PROTECTIVE DEVICES IN ORDER TO ACHIEVE MAXIMUM SELECTIVITY BETWEEN DEVICES DURING FAULT CONDITIONS (IE. THE DEVICE NEAREST THE FAULT WILL OPERATE FIRST, THUS MINIMIZING THE INTERRUPTION) AND TO PROVIDE PROPER PROTECTION FOR ALL DISTRIBUTION EQUIPMENT, TRANSFORMERS, CABLE, ETC.
 - 3.2. DETERMINE THE FAULT CURRENTS AT CRITICAL POINTS IN THE POWER SYSTEM UNDER THE WORST CASE CONDITIONS IN ORDER TO ENSURE THE ADEQUACY OF THE ELECTRICAL EQUIPMENT AND PROTECTIVE DEVICES.
 - 3.3. INCLUDE ALL BREAKERS IN CDP TYPE PANELBOARDS. BREAKER SETTINGS SHALL BE LISTED IN THE STUDY FOR ALL BREAKERS WITH ADJUSTABLE TRIPS.

TRANSFORMERS

1. 37.5kVA TRANSFORMERS AS FOLLOWS:
2. USE TRANSFORMERS OF ONE MANUFACTURER THROUGHOUT PROJECT.
3. RATINGS:
 - 3.1. 600V : 120/240V, SINGLE PHASE, 3 WIRE
 - 3.2. OUTDOOR, WEATHERPROOF NEMA 3 ENCLOSURE
 - 3.3. DOUBLE OUTPUT LUGS.
4. TRANSFORMERS TO HAVE, BUT NOT BE LIMITED TO, THE FOLLOWING CHARACTERISTICS:
 - 4.1. TYPE: ANN, DRY TYPE.
 - 4.2. 60 HZ
 - 4.3. VOLTAGE TAPS: 4 AT 2 1/2%, 2 FCAN, 2 FCBN.
 - 4.4. INSULATION: CLASS 150° C. TEMPERATURE RISE.
 - 4.5. BASIC IMPULSE LEVEL (BIL): STANDARD.
 - 4.6. HIP-POT: STANDARD.
 - 4.7. SOUND LEVEL: 45-55 dB.
 - 4.8. IMPEDANCE AT 170° C.: TO CSA C9 AND CSA C22.2 NO. 47.
 - 4.9. ENCLOSURE: REMOVABLE METAL FRONT PANEL FOR INTERIOR,

- 4.10. FULLY WEATHERPROOF 3R.
- 4.11. MOUNTING: PAD MOUNTED
- 4.12. FINISH: STANDARD.
- 4.13. WINDINGS: COPPER.
- 4.14. SOUND ABSORBING, ISOLATION PADS.

5. INSTALL TRANSFORMERS IN LEVEL, UPRIGHT POSITION.
6. REMOVE SHIPPING SUPPORTS ONLY AFTER TRANSFORMER IS INSTALLED AND JUST BEFORE PUTTING INTO SERVICE.
7. LOOSEN ISOLATION PAD BOLTS UNTIL NO COMPRESSION IS VISIBLE.
8. MAKE PRIMARY AND SECONDARY CONNECTIONS IN ACCORDANCE WITH MANUFACTURER'S WIRING DIAGRAM.
9. ENERGIZE TRANSFORMER AFTER INSTALLATION IS COMPLETE.
10. TEST FOR VOLTAGE DROP AT FURTHEST RV PEDESTAL WHILE ALL RV PEDESTALS ARE FULLY LOADED. USED LOAD BANK OR SIMILAR. ADJUST TAPS ON TRANSFORMER TO MAINTAIN VOLTAGE DROP OF LESS THAN 3% AT FURTHEST RV PEDESTAL.
11. TRANSFORMERS WITH CONFIGURATIONS OPEN DELTA OR T CONNECTION ARE NOT ACCEPTED.
12. ELECTRICAL CONTRACTOR TO GROUND TRANSFORMER.
13. ELECTRICAL CONTRACTOR TO SUBMIT SHOP DRAWINGS.

RV PEDESTALS

1. APPROVED FOR USE IN CANADA
2. LOAD CENTRE COMPLETE WITH:
 - 2.1. (1) 30A-1P CIRCUIT BREAKER
 - 2.2. (1) 15A-1P CIRCUIT BREAKER
 - 2.3. (2) 1P SPACES
3. RECEPTACLES:
 - 3.1. LEFT POSITION RECEPTACLE COMMERCIAL/INDUSTRIAL GRADE TT-30R RECEPTACLE (120V, 30A).
 - 3.2. CENTRE POSITION RECEPTACLE COMMERCIAL/INDUSTRIAL GRADE 5-15R RECEPTACLE (120V, 15A).
4. IN-USE COVER
5. NEMA 3R
6. DIRECT BURRIED. REMOVABLE COVERS FOR EASE OF INSTALLATION.
7. BAKED ON POLYESTER POWDER COAT FINISH.
8. EATON CUTLER-HAMMER CHU4NP PEDESTAL C/W CHPEDEXT EXTENSION OR APPROVED EQUIVALENT.



Project title / Titre du projet	Wasagaming Campground Redevelopment Project
Riding Mountain National Park	
Drawing title / Titre du dessin	Specification (1 of 3)
Drawing Number	11.1
Date	February 2015
Drawn By	A. Johnson

SWITCHGEAR

1. ACCEPTABLE MANUFACTURERS:

- 1.1. EATON/CUTLER-HAMMER,
- 1.2. SCHEIDER - SQUARE D,
- 1.3. SIEMENS.

2. SWITCHGEAR RATINGS:

- 2.1. GEAR SHALL CONSIST OF OUTDOOR NON-WALK-IN ENCLOSURE CONTAINING LOAD INTERRUPTER SWITCHES AND THE NECESSARY ACCESSORY COMPONENTS ALL FACTORY ASSEMBLED (EXCEPT FOR NECESSARY SHIPPING SPLITS) AND OPERATIONALLY CHECKED. THE ASSEMBLY SHALL BE SELF-SUPPORTING AND FLOOR MOUNTED ON A LEVEL CONCRETE PAD. THE INTEGRATED SWITCHGEAR ASSEMBLY SHALL WITHSTAND THE EFFECTS OF INTERRUPTING CURRENTS UP TO THE ASSIGNED MAXIMUM SHORT CIRCUIT RATING.
- 2.2. SYSTEM VOLTAGE: 12.47KV NOMINAL, 3 PHASE, 4 WIRE SOLIDLY GROUNDED NEUTRAL, 60 HZ.
- 2.3. MAIN BUS AMPACITY: 600A

3. SWITCHGEAR CONSTRUCTION:

- 3.1. THE SWITCHGEAR SHALL CONSIST OF MULTIPLE SECTIONS INCLUDING MAIN INCOMING LOAD INTERRUPTER SWITCH SECTION, UTILITY METERING COMPARTMENT, FUSIBLE LOAD INTERRUPTER SWITCH COMPARTMENTS.
- 3.2. COMPRESSION TYPE LUGS SHALL BE FURNISHED. THE GROUND BUS SHALL EXTEND THROUGH THE FULL LENGTH OF THE SWITCHGEAR.
- 3.3. A VIEWING WINDOW SHALL BE INSTALLED IN THE SWITCH ENCLOSURE AND LOCATED SO AS TO ENABLE VISIBLE INSPECTION OF THE SWITCH BLADES AND BLOWN FUSE INDICATORS FROM OUTSIDE THE ENCLOSURE.
- 3.4. THE MAIN BUS IS TO BE RATED 600 AMPS AND BE FULLY INSULATED FOR ITS ENTIRE LENGTH WITH AN EPOXY COATING BY THE FLUIDIZED BED PROCESS. THE CONDUCTORS ARE TO BE SILVER-PLATED COPPER AND BE OF A BOLTED DESIGN. ACCESS TO THIS COMPARTMENT IS GAINED FROM THE FRONT OR REAR OF THE STRUCTURE BY REMOVING A STEEL BARRIER. PROVIDE STANDARD PROVISIONS FOR FUTURE EXTENSION, AS APPLICABLE.
- 3.5. INSTRUMENT TRANSFORMERS:
 - 3.5.1. CURRENT TRANSFORMERS: EACH LOAD INTERRUPTER SWITCH COMPARTMENT SHALL HAVE PROVISION FOR FRONT-ACCESSIBLE MOUNTING OF UP TO FOUR CURRENT TRANSFORMERS PER PHASE (ANSI STANDARD RELAY ACCURACY), TWO ON BUS SIDE AND TWO ON CABLE SIDE OF LOAD INTERRUPTER SWITCH. THE CURRENT TRANSFORMER ASSEMBLY SHALL BE INSULATED FOR THE FULL VOLTAGE RATING OF THE SWITCHGEAR. THE CURRENT TRANSFORMERS WIRING SHALL BE TYPE SIS #12 AWG. RELAYING AND METERING ACCURACY SHALL CONFORM TO ANSI STANDARDS.
 - 3.5.2. VOLTAGE TRANSFORMERS ARE DRAW-OUT MOUNTED WITH PRIMARY CURRENT-LIMITING FUSES AND SHALL HAVE RATIO AS INDICATED. THE TRANSFORMERS SHALL HAVE MECHANICAL RATING EQUAL TO THE MOMENTARY RATING OF THE CIRCUIT BREAKERS AND SHALL HAVE METERING ACCURACY PER ANSI STANDARDS.

4. UTILITY METERING:

- 4.1. EACH UTILITY METERING VERTICAL SECTION SHALL

CONTAIN PROVISIONS FOR CURRENT TRANSFORMERS AND VOLTAGE TRANSFORMERS AS REQUIRED BY THE UTILITY. THE CONSTRUCTION SHALL CONFORM TO THE UTILITY COMPANY'S METERING STANDARDS. IT SHALL ALSO CONFORM TO THE GENERAL ELECTRICAL AND CONSTRUCTION DESIGN OF THE SWITCHGEAR SPECIFIED ABOVE.

5. FUSES:

- 5.1. THE SWITCHGEAR SHALL BE EQUIPPED WITH A FUSELOGIC SYSTEM TO PROVIDE SINGLE-PHASE PROTECTION WITH THE FOLLOWING FEATURES:
 - 5.1.1. DIRECT ACTING, 15 KV, "E" RATED FUSES TO AUTOMATICALLY OPEN THE MANUALLY OPERATED LOAD INTERRUPTER SWITCH IN THE EVENT OF A BLOWN FUSE. FOR FUSES RATED HIGHER THAN THOSE SHOWN, SYSTEM SHALL BE SHUNT TRIP OPERATED DIRECTLY FROM BLOWN FUSE CONTACTS (CONTROL POWER REQUIRED). BLOCKING THE CLOSING OF THE SWITCH SHALL FURTHER PREVENT POTENTIAL SINGLE-PHASE CONDITIONS WHEN A FUSE IS BLOWN OR IF A FUSE IS NOT INSTALLED.
 - 5.1.2. PREVENTION OF POTENTIAL SINGLE-PHASE CONDITIONS BY BLOCKING THE CLOSING OF THE MANUALLY OPERATED LOAD INTERRUPTER SWITCH WHEN A FUSE IS BLOWN OR IF A FUSE IS NOT INSTALLED.
 - 5.1.3. THREE FORM C AUXILIARY SWITCHES (1 PER PHASE) FOR PHASE BLOWN/MISSING FUSE INDICATION. ONE FORM C AUXILIARY SWITCH (1 FOR ALL 3 PHASES) FOR BLOWN/MISSING FUSE INDICATION.
 - 5.1.4. FUSES SHALL BE FIXED IN POSITION IN A NON-DISCONNECT FUSE MOUNTING WITH PROVISIONS FOR REMOVAL AND REPLACEMENT FROM THE FRONT OF THE GEAR.
 - 5.1.5. FUSES SHALL BE UL LISTED.
 - 5.1.6. THE BLOWN FUSE INDICATOR SHALL BE AN "EXTENDED TRAVEL" TYPE WITH A MINIMUM OF 1 INCH OF TRAVEL.

6. COMPONENTS:

- 6.1. OVER-CENTER MECHANISM:
 - 6.1.1. THE LOAD INTERRUPTER SWITCH SHALL BE RATED AT 600 AMPERES CONTINUOUS AND INTERRUPTING; FIXED MOUNTED ON NEMA CLASS A-20 PORCELAIN STANDOFF INSULATORS; MANUALLY OPERATED; QUICK-MAKE, QUICK-BREAK WITH THE SPEED OF OPERATION INDEPENDENT OF THE OPERATOR. TO PROVIDE FOR DEPENDABLE OPERATION, THE DEVICE SHALL NOT RELY ON CHAINS OR CABLES TO DRIVE THE BLADE ASSEMBLIES OPEN AND CLOSED. THE SPRING OPERATOR ASSEMBLY SHALL BE ISOLATED FROM HIGH VOLTAGE AND COUPLED THROUGH A DIRECT DRIVE SHAFT.
- 6.2. SWITCHES SHALL SEPARATE CURRENT CARRYING PATHS AND ARCING INTERRUPTION PATHS.
- 6.3. SWITCH BLADES SHALL BE MOUNTED ON INSULATORS THAT ARE ATTACHED TO GROUNDED METAL BARRIERS. SWITCHES THAT UTILIZE BLADES MOUNTED ON A COMMON SHAFT WITH INSULATION FROM BLADE TO BLADE RATHER THAN BLADE TO GROUND ARE UNACCEPTABLE.
- 6.4. THE SWITCH OPERATING HANDLE SHALL BE COVERED BY A FULL-HEIGHT SOLID DOOR. REMOVABLE HANDLES ARE NOT ACCEPTABLE. THE HANDLE MUST OPERATE IN THE CONVENTIONAL FASHION WITH THE SWITCH CLOSED WITH THE HANDLE IN THE UP POSITION AND THE SWITCH OPEN WITH THE HANDLE IN THE DOWN POSITION. PROVISIONS SHALL BE AVAILABLE FOR PADLOCKING THE SWITCH IN EITHER THE OPEN OR CLOSED POSITION.

7. LIGHTNING ARRESTORS:

- 7.1. PROVIDE LIGHTNING SURGE ARRESTORS WITH RATINGS IN ACCORDANCE WITH MANUFACTURE'S RECOMMENDATIONS. ARRESTORS SHALL BE INTERMEDIATE CLASS, ONE PER PHASE RATED TO PROTECT EQUIPMENT FROM POTENTIAL SURGES WITH THE FOLLOWING CHARACTERISTICS:
 - 7.1.1. METAL OXIDE SURGE ARRESTOR TO ANSI/IEEE C62.11 FOR BETTER PERFORMANCE AND HIGH RELIABILITY OF SURGE PROTECTION SCHEMES. INCLUDE INFORMATION IN SHOP DRAWINGS.
 - 7.1.2. ARRESTOR HOUSING SEPARABLE TYPE TO MEET ANSI/IEEE 386.
 - 7.1.3. MOV IN SERIES WITH NON-LINEAR RESISTANCE GRADED GAP STRUCTURE.
 - 7.1.4. VOLTAGE RATING - 15KV.
 - 7.1.5. MEET ANSI/IEEE STANDARD 142.

8. CONTROL POWER TRANSFORMER:

- 8.1. PROVIDE 12.47KV : 120V CONTROL POWER TRANSFORMER FOR SWITCHGEAR CONTROL VOLTAGE FOR HEATERS, LIGHTS, ETC.
- 8.2. CPT SIZE TO BE DETERMINED BY THE MANUFACTURER.
- 8.3. PROVIDE 15A, 120V DUPLEX RECEPTACLE FOR MAINTENANCE USE.

9. ENCLOSURES:

- 9.1. ENCLOSURES SHALL BE CONSTRUCTED PER IEEE/ANSI C37.20.3 OUTDOOR SPECIFICATIONS. (EXCEEDS NEMA 3R.)
- 9.2. EACH VERTICAL SECTION SHALL HAVE A FLAT WEATHERPROOF ROOF WITH LABYRINTH SHAPED JOINTS. USE OF GASKET OR CAULKING TO MAKE ROOF JOINTS WEATHERPROOF SHALL NOT BE PERMITTED. ALL EXTERIOR OPENINGS SHALL BE SCREENED TO PREVENT THE ENTRANCE OF SMALL ANIMALS AND BARRIERS TO INHIBIT THE ENTRANCE OF SNOW, SAND, ETC. A MINIMUM OF ONE (1) 250-WATT, 120-VOLT SPACE HEATER C/W THERMOSTAT AND LIGHT SHALL BE PROVIDED IN EACH VERTICAL SECTION. POWER FOR THE SPACE HEATER(S) AND LIGHT(S) SHALL BE FURNISHED BY A CONTROL POWER TRANSFORMER MOUNTED IN THE SWITCHGEAR.
- 9.3. EACH VERTICAL SECTION SHALL BE VENTILATED AT THE TOP, BOTTOM AND FRONT TO ALLOW AIRFLOW TO PROVIDE COOLING AND HELP PREVENT BUILDUP OF MOISTURE WITHIN THE STRUCTURE. THE VENTILATED COVERS SHALL BE EXTERNALLY REMOVABLE TO ALLOW SAFE MAINTENANCE OF THE FILTER MEDIA WITHOUT PROVIDING ACCESS TO LIVE PARTS.
- 9.4. ENCLOSURE SHALL BE DUST RESISTANT. ALL VENTILATED OPENINGS SHALL BE FILTERED TO INHIBIT THE INGRESS OF DUST. THE VENTILATED COVERS SHALL BE EXTERNALLY REMOVABLE TO ALLOW SAFE MAINTENANCE OF THE FILTER MEDIA WITHOUT PROVIDING ACCESS TO LIVE PARTS. ALL EXTERNAL DOORS AND COVERS SHALL BE GASKETED.

10. FINISH:

- 10.1. PRIOR TO ASSEMBLY, ALL ENCLOSING STEEL SHALL BE THOROUGHLY CLEANED AND PHOSPHATIZED. A POWDER COATING SHALL BE APPLIED ELECTROSTATICALLY, THEN FUSED-ON BY BAKING IN AN OVEN. THE COATING IS TO HAVE A THICKNESS OF NOT LESS THAN 1.5 MILS. THE FINISH SHALL HAVE THE FOLLOWING PROPERTIES:
 - 10.1.1. IMPACT RESISTANCE (ASTM D-2794): 60 DIRECT/60 INDIRECT
 - 10.1.2. PENCIL HARDNESS (ASTM D-3363): H
 - 10.1.3. FLEXIBILITY (ASTM D-522): PASS 1/8-INCH MANDREL
 - 10.1.4. SALT SPRAY (ASTM B117-85 [20]): 600 HOURS
 - 10.1.5. COLOR: ANSI 61 GRAY



Project title / Titre du projet	Wasagaming Campground Redevelopment Project
	Riding Mountain National Park
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Drawing Number	11.2
Date	February 2015
Drawn By	A. Johnson

MINISUBSTATIONS

1. ACCEPTABLE MANUFACTURER:

- 1.1. POWERSYSTEMS TECHNOLOGY

2. RELATED WORK:

- 2.1. CAST-IN-PLACE CONCRETE, FROST-FREE PAD
- 2.2. INSTALLATION OF ANCHOR DEVICES, SETTING TEMPLATES.

3. DESCRIPTION OF SYSTEM:

- 3.1. OUTDOOR UNIT SUBSTATION WITH:
 - 3.1.1. PRIMARY SWITCHGEAR
 - 3.1.2. TRANSFORMERS
 - 3.1.3. SECONDARY BREAKERS

4. SOURCE QUALITY CONTROL:

- 4.1. SUBMIT PRODUCTION TEST RESULTS TO ENGINEER.
- 4.2. SUBSTATIONS MANUFACTURED AND/OR FACTORY ASSEMBLED BY ONE SUPPLIER.
- 4.3. SUBSTATION TO BE ASSEMBLED, TESTED AND SHIPPED IN ONE SECTION AND AS ONE UNIT.

5. SHOP DRAWINGS:

- 5.1. SUBMIT SHOP DRAWINGS THAT INCLUDE:
 - 5.1.1. FLOW AND WIRING METHOD
 - 5.1.2. DIMENSIONED FOUNDATION TEMPLATE
 - 5.1.3. DIMENSIONED CABLE ENTRANCE AND EXIT LOCATIONS
 - 5.1.4. DIMENSIONED CABLE TERMINATION AND HEIGHTS

6. MATERIAL:

- 6.1. THE SUBSTATION TO BE A ONE PIECE DESIGNED, ASSEMBLED UNIT, USING SF6 SWITCHING AND LIQUID FILLED PADMOUNT TRANSFORMER, TO FORM A COMPLETE UNIT SUBSTATION. UNIT TO BE CAPABLE OF HAVING BREAKERS ADDED WITHOUT INCREASING THE SIZE.
- 6.2. THE SUBSTATION CONFIGURATIONS TO FOLLOW SINGLE LINE DIAGRAM.

7. PRIMARY SWITCHGEAR:

- 7.1. OUTDOOR, 15kV, 600A, 3 PHASE, 3 WIRE, INTERRUPTING CAPACITY 40KA ASYM BIL 95 kV, CSA CERTIFIED AS PER CSA C22.2 NO.31, CSA 22.2 NO.193 AND CSA 22.2 NO.58

8. GENERAL CONSTRUCTION:

- 8.1. TO MEET CSA C22.2 NO.31 AND EEMAC G8. TOTAL ASSEMBLY TO BE SOLID WELDED, NOT BOLTED. ALL COMPONENTS TO BE BARRIERED, SEGREGATED AND FULLY INTERLOCKED FOR SAFETY.
- 8.2. PRIMARY AND SECONDARY COMPARTMENT ARRANGEMENT: PRIMARY COMPARTMENT TO BE ON THE LEFT SIDE AND SECONDARY COMPARTMENT TO BE ON THE RIGHT SIDE AS PER CSA STANDARD.

9. PRIMARY ENCLOSURE

- 9.1. PRIMARY ENCLOSURE: METAL ENCLOSED FREE STANDING, PAD MOUNTED, DEAD FRONT, OUTDOOR TAMPERPROOF NON WALK-IN EEMAC 3 ENCLOSURE 1 CUBICLE UNIT. MAXIMUM DIMENSIONS: 2010 MM HIGH X 2600 MM WIDE X 1800 MM DEEP. CONSTRUCTED FROM ROLLED FLAT STEEL SHEETS 11 GAUGE THICK.
- 9.2. USE NON-CORRODIBLE BOLTS AND HARDWARE.
- 9.3. FULL HEIGHT OUTER DOORS REINFORCED, HEAVY DUTY RUBBER GASKET, THREE POINT LATCH, STOPS, TO OPEN AT LEAST 135°. REMOVABLE SILL TO ALLOW PLACING UNIT OVER CABLES WITHOUT LIFTING. PROVIDE TWO PENTA-HEAD BOLTS TO SECURE DOOR.
- 9.4. BASE CHANNELS TO BE ADEQUATE TO SUPPORT WEIGHT OF UNIT SUBSTATION DURING OFF LOADING. LIFTING LUGS TO BE PROVIDED TO OFF LOAD THE SUBSTATION.
- 9.5. STORAGE CONTAINER ON INSIDE SURFACE OF DOOR COMPARTMENT.

10. PRIMARY SWITCHING

- 10.1. THE OUTLINED REQUIREMENTS ARE FOR SF6 FILLED LOAD BREAK NON FUSED TYPE SWITCHES. THE SWITCH SHALL BE SUPPLIED IN ACCORDANCE WITH THIS SPECIFICATION AND THE ACCOMPANYING CIRCUIT DIAGRAM, INCLUDING THE REQUIRED NUMBER OF INCOMING AND OUTGOING CIRCUITS, NUMBER OF SWITCHED WAYS, CLOSED OPEN, SWITCH TANK GROUND WIRED TO THE SUBSTATION MAIN GROUND BAR. FUSE INTERLOCKING SYSTEM, TYPE AND QUANTITY OF CABLE CONNECTIONS (200A)
- 10.2. SERVICE RATINGS: THE SWITCH ASSEMBLY SHALL BE DESIGNED AND TESTED AND RATED PER CSA 22.2 NO.193 AND CSA 22.2 NO.58

- 10.2.1. DESIGN VOLTAGE 15.5 kV
- 10.2.2. IMPULSE WITHSTAND VOLTAGE 95 kV
- 10.2.3. AC WITHSTAND VOLTAGE 35kV
- 10.2.4. DC WITHSTAND VOLTAGE 53kV
- 10.2.5. LOAD BREAK CONTINUOUS 600AMPS
- 10.2.6. MOMENTARY FAULT CLOSING 40KA ASYMMETRICAL
- 10.2.7. TWO SECOND RATING 25KA SYMMETRICAL
- 10.2.8. OPEN GAP IMPULSE WITHSTAND 200 kV BIL
- 10.2.9. CURRENT LIMITING FUSE RATING 50KA
- 10.2.10. TEMPERATURE RATING -40 TO +120 °F

- 10.3. THE SEALED TANK DESIGN SHALL BE FULLY SUBMERSIBLE DEAD FRONT, AND CORROSION RESISTANT. THE TANK SHALL BE ¼" MILD STEEL. SEAM WELDED TO PROVIDE A HERMETICALLY SEALED UNIT. CONSTRUCTION IS DESIGNED TO WITHSTAND 15 PSIG WITHOUT CAUSING OPERATIONAL PROBLEMS. TANK FLANGES SHALL BE WELDED TO PREVENT LEAKAGE AND SHALL BE TURNED TO ELIMINATE SHARP CORNERS. EXTERNAL FASTENERS AND FITTINGS SHALL BE CORROSION RESISTANT STAINLESS STEEL OR BRONZE. MOUNTING BRACKETS AND COVERS SHALL BE HOT DIP GALVANIZED ALL BUSHINGS SHALL BE WELDED FLANGE TYPE. SWITCH TANKS TO BE LEAKAGE CHECKED USING A HELIUM MASS SPECTROMETER. THE HELIUM MASS SPECTROMETER IS CALIBRATED TO DETECT A LEAK AS SMALL AS 1X 10-7 CUBIC CENTIMETERS PER SECOND.
- 10.4. THE BASE FRAME TO BE CONSTRUCTED OF TUBULAR STEEL WELDED TO TRANSFORMER. SIDE ACCESS TO CABLE BUSHINGS IS PROVIDED BY A FULL HEIGHT BOLT ON COVER MINIMUM 12 GAUGE.
- 10.5. SWITCH SHALL BE EQUIPPED WITH AN EXTERNAL OPERATING HANDLE FOR MANUAL OPERATION, AND SHALL INCLUDE QUICK MAKE QUICK BRAKE SPRING OPERATION. THE SHAFT SHALL HAVE TRIPLE O-RING OPERATING DESIGN, WHICH CAN WITHSTAND PRESSURE OF UP TO 50 PSI WITHOUT LEAKING. POSITIVE POSITION INDICATORS, VIEWING WINDOW TO CONFIRM CONTACT POSITION FOR ALL PHASES IN ALL POSITIONS. VIEWING WINDOW TO SHOW INDICATORS OF SWITCH POSITION. PADLOCK PROVISIONS FOR ALL POSITIONS. PROVISION FOR MOUNTING OF KEY INTERLOCKS ON ALL SWITCHES, REMOVABLE HANDLE.
- 10.6. THE SWITCH SHALL INCLUDE THE FOLLOWING MINIMUM CONSTRUCTION REQUIREMENTS. CURRENT CARRYING PARTS SHALL BE HIGH CONDUCTIVITY COPPER WITH PLATING AND ASSEMBLY FOR LOW RESISTANCE CONNECTORS. CONTACTS SHALL BE SELF ALIGNING, SELF CLEANING, AND DESIGNED TO INCREASE CONTACT PRESSURE WITH INCREASING CURRENT. MOVING CONTACTS SHALL BE EQUIPPED WITH ½ CYCLE INTERRUPTER ASSISTANCE TO MINIMIZING ARCING DURING SWITCHING AND TO ELIMINATE ARCING TO THE MAIN CONTACT SURFACES. CONTACT SUPPORTS SHALL BE HIGH STRENGTH MOLDED POLYESTER WITH SKIRTS AND BARRIERS TO PREVENT TRACKING AND FLASH OVER. FLEX CONNECTORS SHALL PREVENT CONTACT MISALIGNMENT DUE TO HIGH CURRENT OR OTHER MECHANICAL FORCES.
- 10.7. SWITCH OPERATION SHALL BE CONTROLLED BY QUICK MAKE QUICK BREAK SPRING OPERATORS WITH LATCHES TO PREVENT CONTACT BLOWOFF OR MOVEMENT AFTER OPERATION. SPRING OPERATORS SHALL BE MOUNTED INSIDE THE TANK TO ELIMINATE DAMAGE TO CRITICAL PARTS. ALL SWITCHES TO HAVE PROVISION FOR A GROUND POSITION WHICH IS NOT SEPARATE FROM THE SWITCH. UNITS THAT HAVE A SEPARATE OR INTERLOCKED GROUND POSITION ARE NOT ACCEPTABLE.
- 10.8. THE SWITCH SHALL BE FACTORY FILLED WITH SF6 PER ASTM D-2472 AND SHALL INCLUDE A SELF-SEALING VALVE AND A MECHANICALLY PROTECTED COLOR CODED PRESSURE GAUGE TO MONITOR THE SF6 GAS AS NEEDED. A SPECIAL INTERNAL ABSORBENT SHALL NEUTRALIZE ARC BY PRODUCTS.
- 10.9. CABLE TERMINATORS SHALL BE ELBOW CONNECTOR, RATED FOR CABLE SIZE AS REQUIRED.
- 10.10. NAME PLATES SHALL INCLUDE THE FOLLOWING PROPERLY SECURED TO THE TANK:
 - 10.10.1. PHASE MARKINGS
 - 10.10.2. FACTORY RATING AND SERIAL NUMBER
 - 10.10.3. LINE DIAGRAM OF INTERNAL SWITCHING
 - 10.10.4. SWITCH TO BE ARCWHIPPER TYPE

11. GROUNDING:

- 11.1. COPPER GROUND BUS NOT SMALLER THAN 50 X 6 MM EXTENDING FULL WIDTH OF CUBICLE BOTTOM.
- 11.2. BOND NON-CURRENT CARRYING METAL PARTS, INCLUDING SWITCHGEAR FRAMEWORK, CONNECTORS, ENCLOSURE AND BASES TO GROUND BUS.

12. INTERLOCKS:

- 12.1. KEY INTERLOCK BETWEEN THE SWITCH OPERATING AND FUSE COVER TO BE PROVIDED TO PREVENT ACCESS TO FUSES WHILE THEY ARE LIVE.

13. PRIMARY FUSES:

- 13.1. FUSES TO BE BAY 0 NET INTERLOCKED WITH THE SWITCH.
- 13.2. BACK UP CURRENT LIMITING FUSES TO BE IN SERIES WITH BAY 0 NET FUSE FOR HIGH CURRENT FAULTS.
- 13.3. AUTOMATIC PRESSURE RELIEF IS REQUIRED TO PREVENT HOT OIL ESCAPING DURING FUSE CHANGING.
- 13.4. FUSE COMPARTMENT TO HAVE DRIP TRAY WITH ADSORBING MATERIALS.

14. TRANSFORMER CHARACTERISTICS:

- 14.1. CSA C2-M1982, THREE PHASE DISTRIBUTION TRANSFORMERS, TYPES ONAN.
- 14.2. TRANSFORMER TO MEET CSA C802-94 MINIMUM LOSSES FOR POWER TRANSFORMERS
- 14.3. TRANSFORMER TO MEET CSA 227.4
- 14.4. LIQUID COOLED, PRIMARY COPPER WINDING, OUTDOOR, DISTRIBUTION TRANSFORMER
- 14.5. PRIMARY: 12.47 kV, 60 HZ, DELTA CONNECTED, 3 PHASE, 3 WIRE
- 14.6. SECONDARY: 347/600 V, WYE CONNECTED, 3 PHASE, 4 WIRE, GROUNDED NEUTRAL
- 14.7. CAPACITY: 300 KVA.
- 14.8. BASIC IMPULSE LEVEL: 95 KV
- 14.9. POLARITY: ADDITIVE.
- 14.10. IMPEDANCE: 4% OR ABOVE
- 14.11. VOLTAGE TAPS:
 - 14.11.1. FOUR - 2.5% TAPS, 2-FCAN, 2-FCBN.

15. TAP CHARGER:

- 15.1. EXTERNALLY OPERATED OFF-LOAD TAP CHARGER, WITH PROVISION FOR PADLOCKING ON 3 PHASE UNIT.

16. HIGH VOLTAGE BUSHINGS:

- 16.1. BUSHINGS: TO ANSI/ IEEE 386
- 16.2. BUSHINGS BETWEEN THE TRANSFORMER AND SWITCH TO BE MADE TO PLUG DIRECTLY TOGETHER AND FORM A SUBMERSIBLE SEALED CONNECTION

17. SECONDARY COMPARTMENT:

- 17.1. SPADE BUSHING
- 17.2. 400V MAIN BREAKER
- 17.3. 400V BRANCH BREAKERS

18. ACCESSORIES:

- 18.1. LIQUID CELSIUS TEMPERATURE THERMOMETER, MAXIMUM INDICATING TYPE, DIAL SIZE 150 MM WITH CONTACTS
- 18.2. LIQUID LEVEL GAUGE WITH CONTACTS
- 18.3. TOP NON-FLAMMABLE INSULATING LIQUID SAMPLING DEVICE
- 18.4. SET OF (QTY-3) LIGHTNING ARRESTERS

19. SHOP FABRICATION:

- 19.1. SHOP ASSEMBLE AND TEST COMPONENTS OF SUBSTATION.
- 19.2. AFTER COMPLETION OF FACTORY ASSEMBLY AND HIGH POTENTIAL TEST, PREPARE FOR SHIPMENT TO SITE IN 1 SECTION.

20. FINISHES:

- 20.1. APPLY FINISHES
- 20.2. CUBICLE EXTERIORS: GREEN.
- 20.3. CUBICLE INTERIORS: GREEN.
- 20.4. PROVIDE ANTI GRAFFITI COATING TO ALLOW PRESSURE WASHING OF UNWANTED MATERIALS.

21. EQUIPMENT IDENTIFICATION:

- 21.1. PROVIDE EQUIPMENT IDENTIFICATION:
 - 21.1.1. TRANSFORMER NAME PLATE WITH RATINGS
 - 21.1.2. SWITCH NAME PLATE WITH RATINGS
 - 21.1.3. SF6 TEMPERATURE/PRESSURE NAME PLATE
 - 21.1.4. HV WARNING SIGNS
 - 21.1.5. SINGLE LINE DIAGRAM



Project title / Titre du projet	Wasagaming Campground Redevelopment Project
Riding Mountain National Park	
Drawing title / Titre du dessin	Specification (3 of 3)
Drawing Number	11.3
Date	February 2015
Drawn By	A. Johnson