



**Final TSR Facility Study Report
Manitoba Hydro TSR Study Group
F090**

**ATC Work Order No. 57639 – East Krok-Kewaunee
ATC Work Order No. 57640 – Stone Lake**

**Green Bay, Wisconsin
MISO # R164-08**

Prepared for the Midwest ISO

**Rev. 1
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Original Report Issued 1/15/2010

Revision 1 Issued 6/10/2010

Revision 1 (6/10/2010): Updated document title page. No material changes to body of report or appendices.

1. Overview of the Project

Long term firm transmission service requests have been made under the Midwest Independent System Operator's (MISO's) Open Access Transmission and Energy Markets Tariff. This Transmission Service Request (TSR) Facility Study Report is prepared in response to a request originated in Manitoba Hydro-Electric Board (MHEB) Group TSR System Impact Study (SIS) Report R164-08. The SIS Report requires Transmission upgrade Options 1 and 3 both to be carried forward into the Facilities Studies as the Minnesota Public Utility Commission and the Public Service Commission of Wisconsin will require study information for more than one option before granting a Certificate of Need.

MISO started the discussion beyond the original scope of the SIS that would impact considerations such as physical build-outs, reserve margins, and operating situations. After explaining assumptions that had been made in the original SIS, MISO requested feedback from the Transmission Operators (TOs) on reactive support requirements.

ATC received Facility Study RFPs from MISO for the following 3 upgrades.

1. Stone Lake 75 MVar Capacitor Bank Project
2. East Krok-Kewaunee Project
3. Saratoga Petenwell Project

This TSR Facility Study Report addresses the first two upgrades, Stone Lake Cap Bank and East Krok-Kewaunee Project.

2. Stone Lake Substation

***i.* Background**

The MISO MH TSR study, performed by consultant Siemens/PTI, found a transient voltage violation at the Minong Substation near Stone Lake substation following faults at the King Substation just east of the twin cities. MISO proposed a mitigation of the addition of a 75 MVar cap bank to the ring bus at Stone Lake Substation.

***ii.* Summary**

ATC commented that the AS King bus had been modeled with a longer clearing time than was actually present. MISO followed up on ATC's comment and Siemens PTI reevaluated three types of faults with the new clearing time and verified that there were no longer violations present at Minong with this new, shorter clearing time. As such, improvements including addition of cap bank at Stone Lake would no longer be required to mitigate this constraint.

3. East Krok-Kewaunee Substation

***i.* Background**

The MISO MHEB TSR study, performed by consultant Siemens/PTI, found a thermal violation in the Kewaunee-East Krok line. This violation was due to the MISO decision to sink the requested power at WPS peakers near Green Bay. MISO proposed a mitigation of upgrading East Krok substation terminal equipments, CTs and meters to get an improved summer emergency rating from 287 MVA to 291.2 MVA.

***ii.* Summary**

To obtain the TSR desired rating of 291.2 MVA for East Krok-Kewaunee 138 kV line F-84, it was determined that there are no substation upgrades required. Substation Equipment & Line Data (SELD) indicated that a meter at East Krok on the East Krok-Kewaunee line was rated below required 291.2 MVA level. The inclusion of this meter in the SELD database was an error, as it had been removed from the system. SELD has been updated and the meter has been eliminated from the database. The CT rating factors (RF) in the 1200 A oil circuit breaker were listed at 1.0 at East Krok in the SELD database. Per letter dated 11/4/74 from GE the actual rating factor of these CTs is 2.0. SELD database has been modified to reflect this higher RF. This eliminates the CT constraint in the SIS report, as the line summer emergency rating is now 321 MVA.

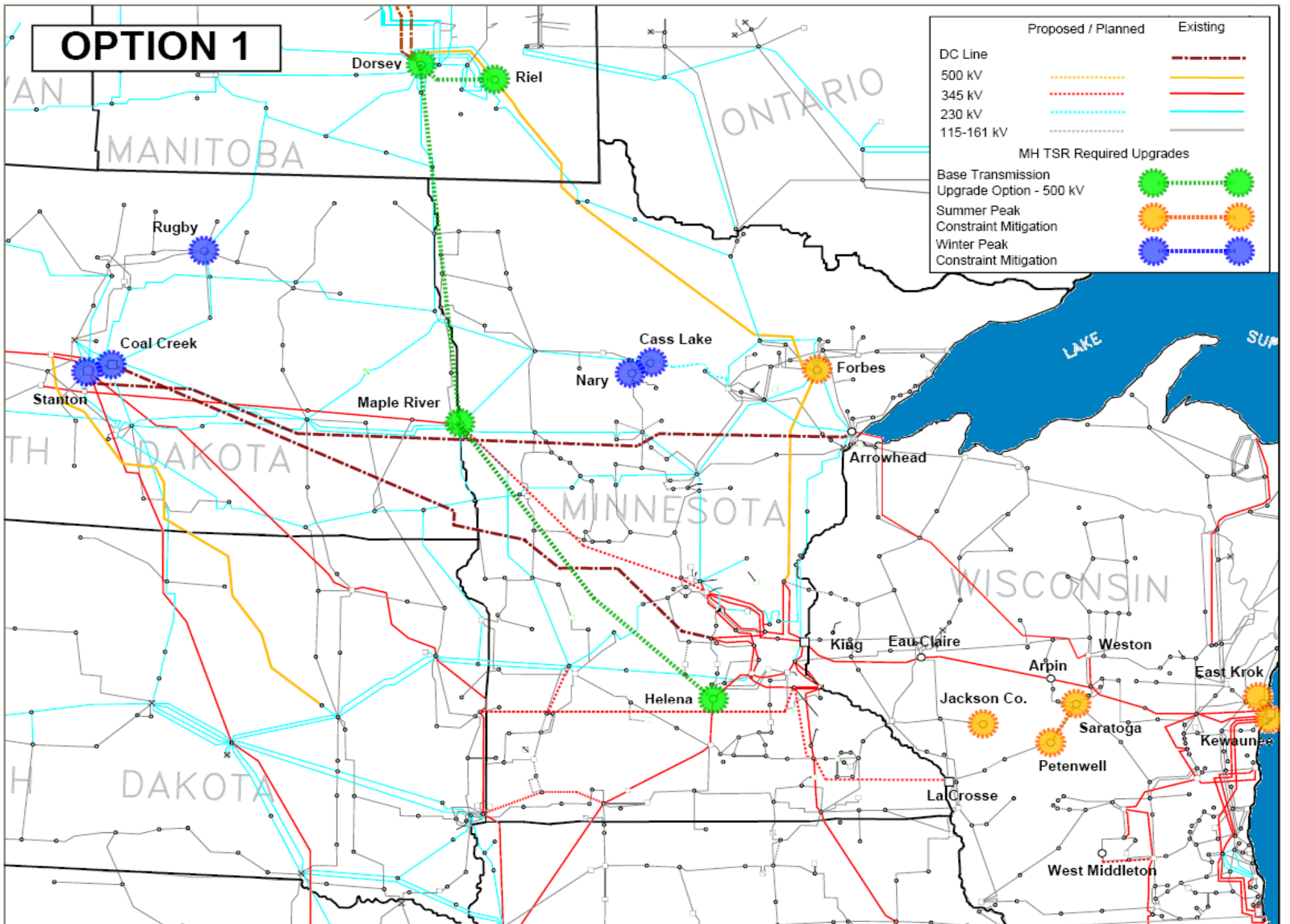
4. Summary of the Project

Based on the summaries of the initial facility study work performed and noted above, a detailed facility study and corresponding facility upgrades are not required.

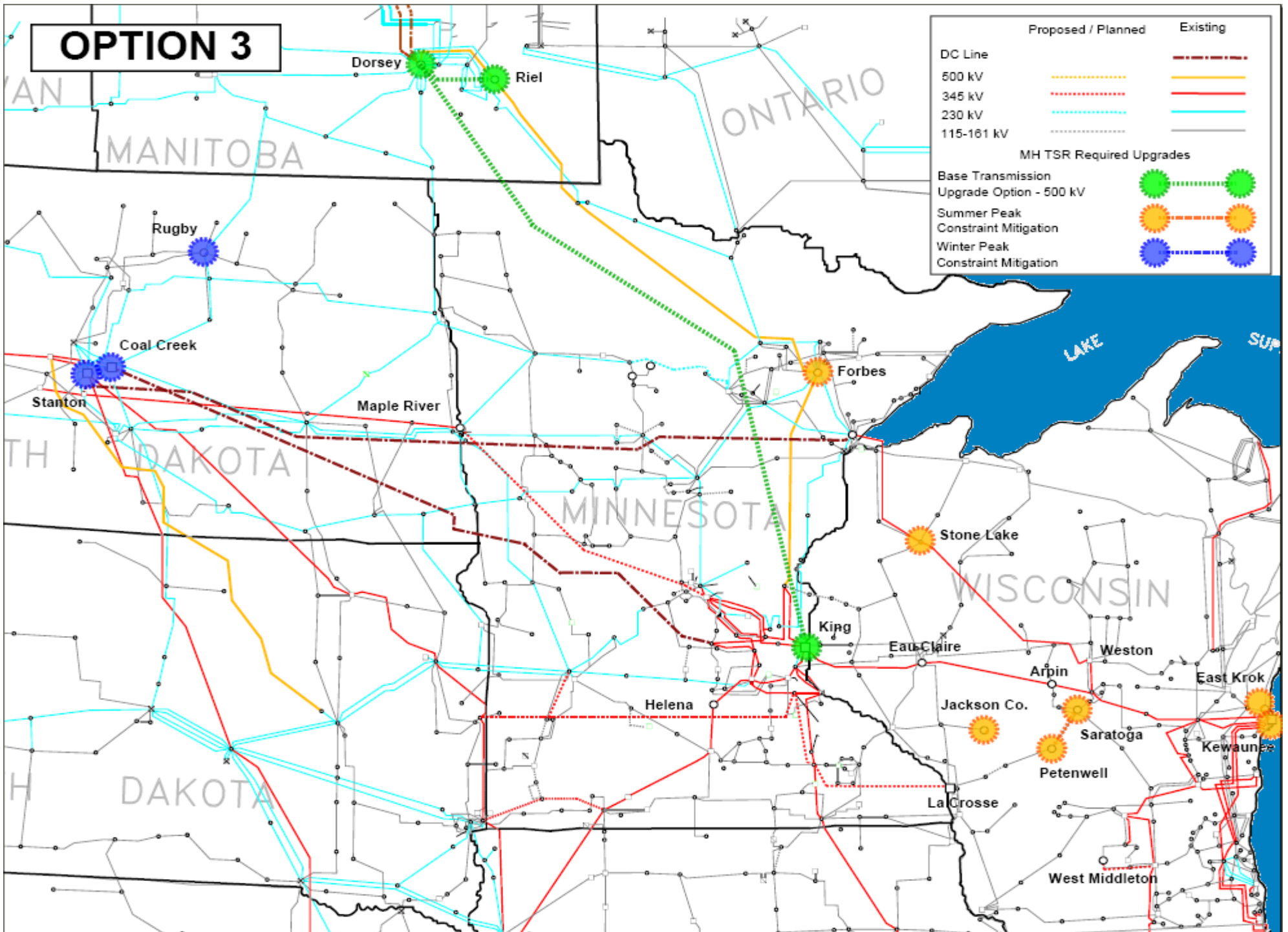
5. Exhibits

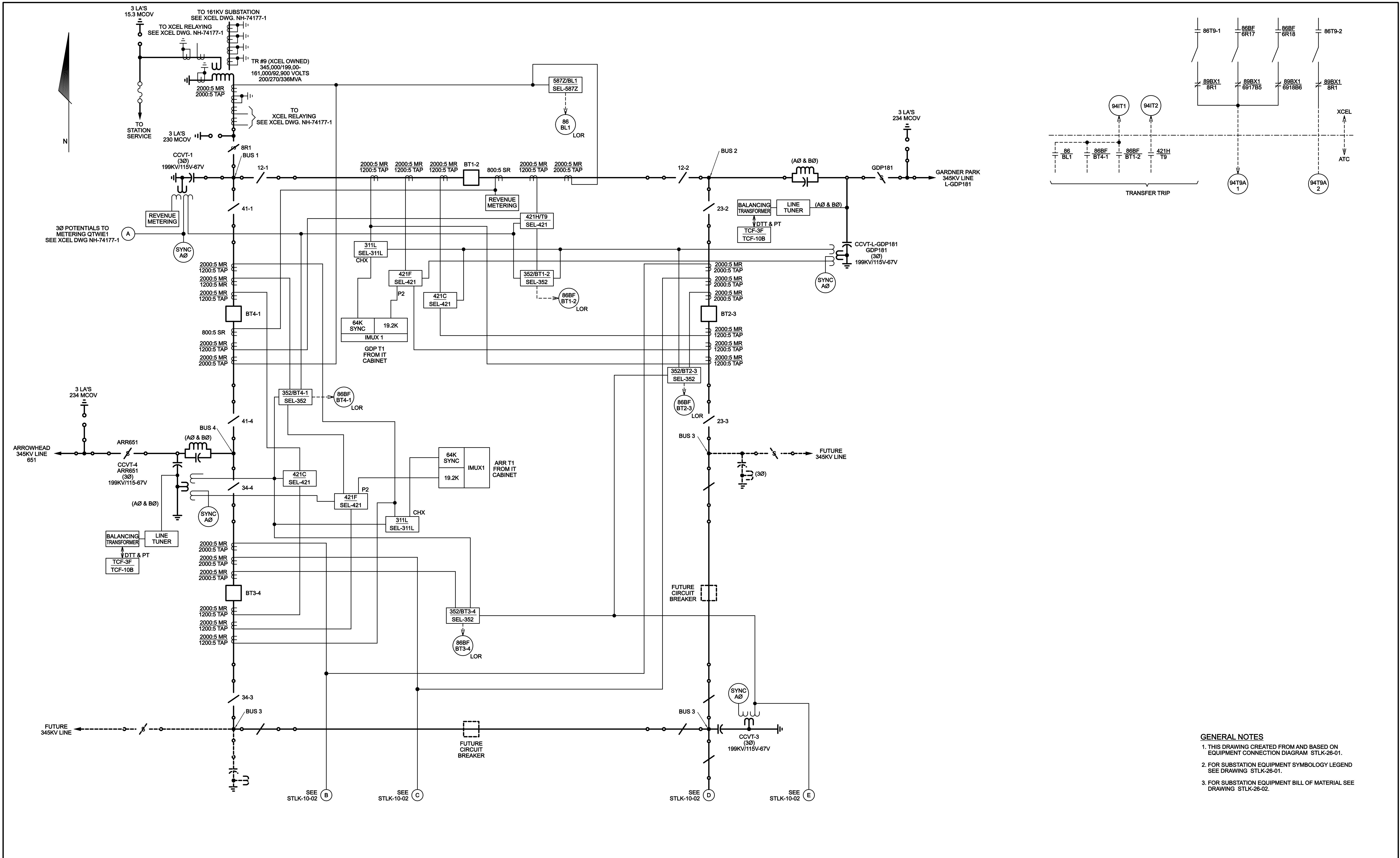
- A1 - MH TSR Solution Option 1 System Diagram
- A2 - MH TSR Solution Option 3 System Diagram
- A3 - Stone Lake Substation One-Line
 - A3-1 STLK-10-01
 - A3-2 STLK-10-02
- A4 - East Krok Substation One-Line
- A5 - Kewaunee Substation One-Line

OPTION 1



OPTION 3





- GENERAL NOTES**
1. THIS DRAWING CREATED FROM AND BASED ON EQUIPMENT CONNECTION DIAGRAM STLK-26-01.
 2. FOR SUBSTATION EQUIPMENT SYMBOLOGY LEGEND SEE DRAWING STLK-26-01.
 3. FOR SUBSTATION EQUIPMENT BILL OF MATERIAL SEE DRAWING STLK-26-02.

REV	DATE	W.O. #	DESCRIPTION	DRAWN	CHKD	APP'D	CMPLY
3	4/11/08	63897	AS-BUILT REV. #2, W.O. #63897	RG	JA		PEI
2	9/4/07	63897	ISSUED FOR CONSTRUCTION	MW	RL		PEI
1	1/15/07	62580	AS-BUILT REV. #0, W.O. #62580	JL	JT		PEI
0	6/20/06	62580	ISSUED FOR CONSTRUCTION	BM	BM		PEI

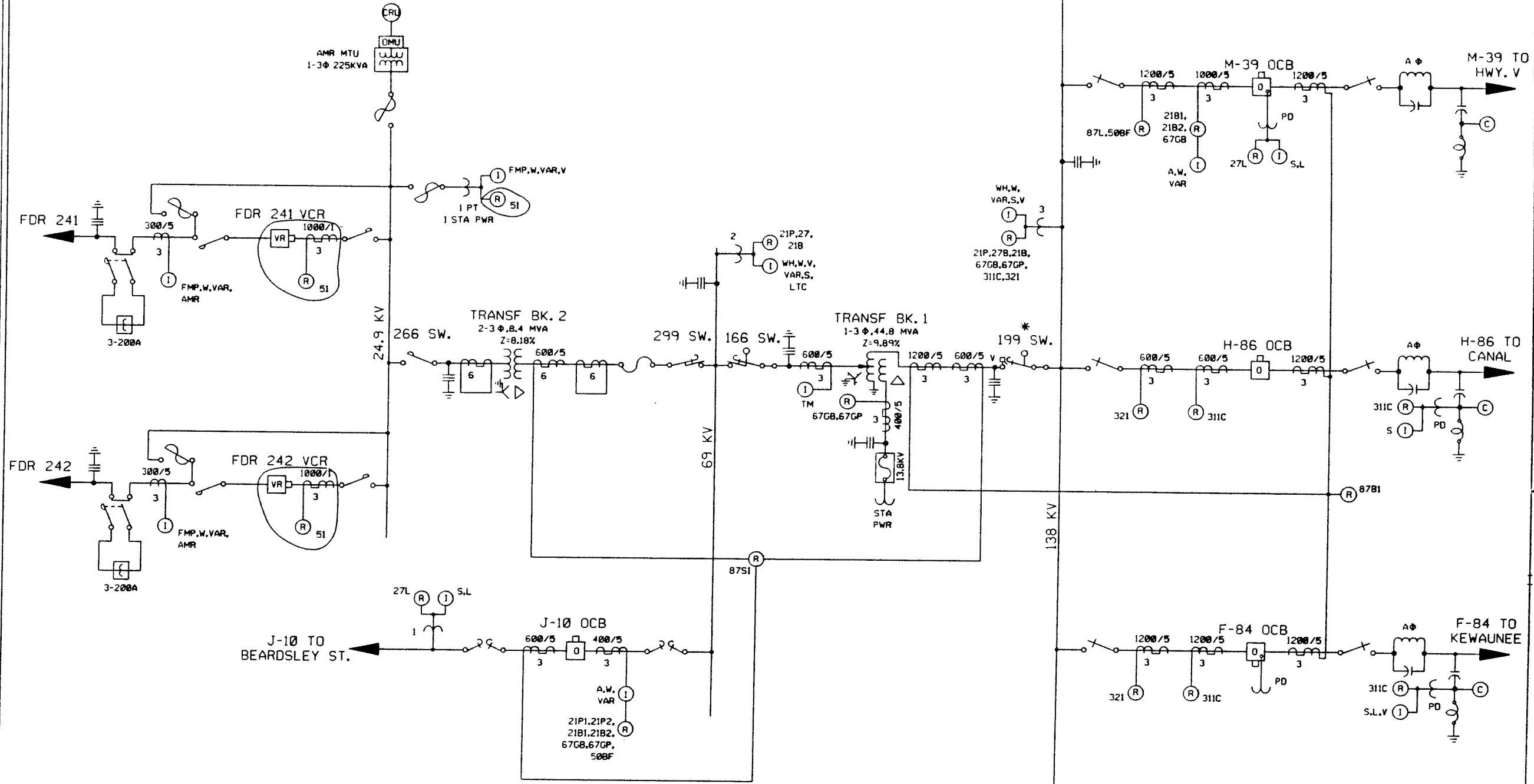


PROTECTION ONE LINE DIAGRAM
345/161KV
STONE LAKE SUBSTATION

DRAWING No. **STLK - 10 - 01**

SCALE NONE

S:\projects\stlk-10-01.dgn 6/6/2008 12:40:09 PM



* FOR LOAD SHIFTING ONLY.

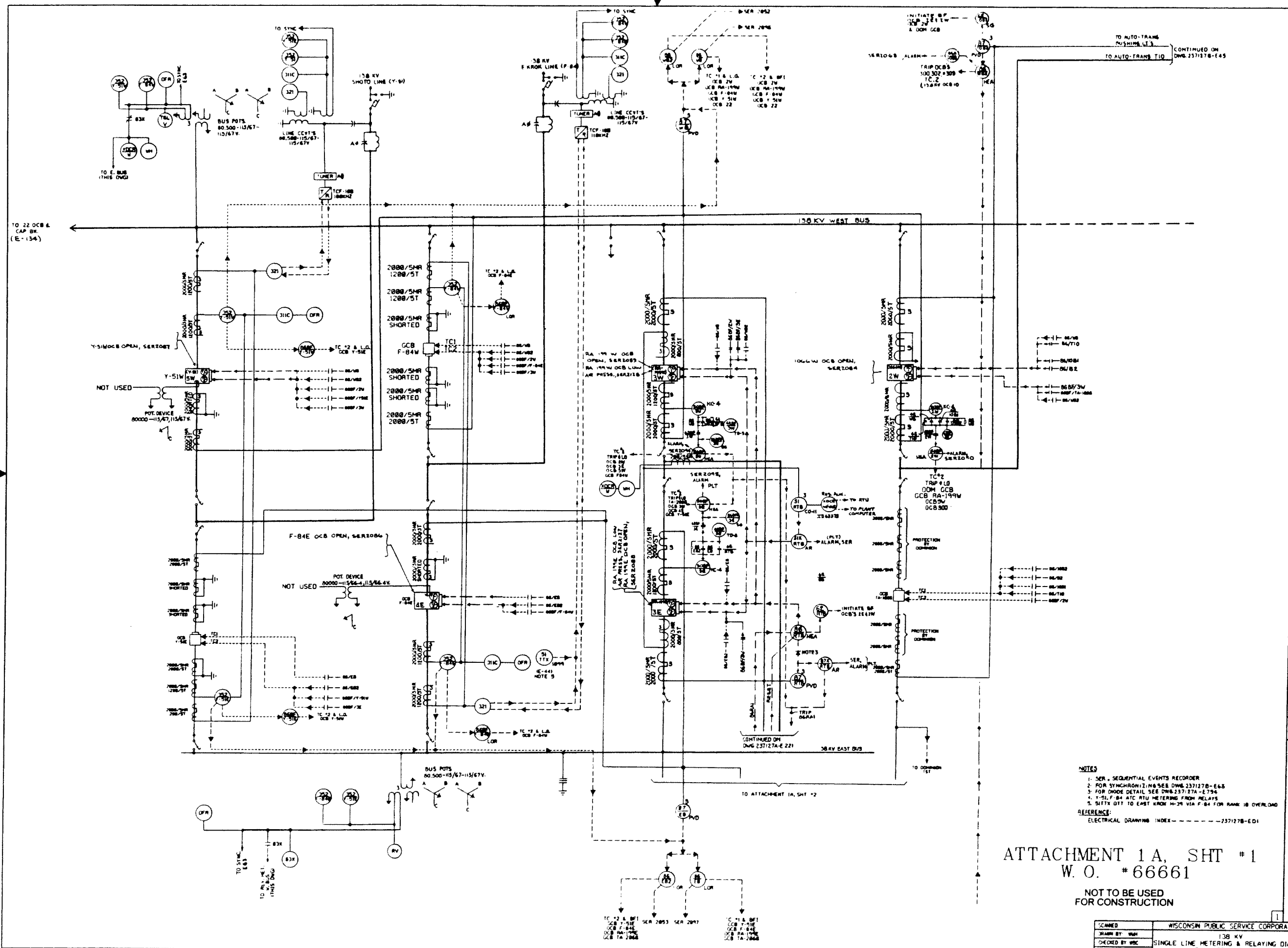
A
C
K

DRAWN BY: AMA
DATE: 7-22-87
CHECKED BY: EPM
APPD BY: JLR

WISCONSIN PUBLIC SERVICE CORPORATION
RELAY DIAGRAM
EAST KROK SUB

REV'D: 2-10-06
APPD BY: **amk**
C-20600

E



REVISIONS	
A	Rev. Pub. Acq. of 138 KV Bus for Construction by LHM 1-21-70. CWD: JCC (Nuclear) APP'D: JCC
B	Filed per LHM 2-25-70. CWD: JCC (Nuclear) APP'D: JCC
C	Filed per LHM 3-22-70. CWD: JCC (Nuclear) APP'D: JCC
D	Filed per LHM 5-12-70. CWD: JCC (Nuclear) APP'D: JCC
E	Filed per LHM 7-24-70. CWD: JCC (Nuclear) APP'D: JCC
F	REPLACED EAST 138KV BUS
G	DATE: 08-08-03 MS. CWD: JCC. APP'D: JCC
H	AS BUILT PER ATC - 61758
I	BY: RUE-CJW 04-13-04. CWD: RUE-MDB. APP'D: RUE-JC 04-13-04
J	138/345KV RELAY UPGRADE. ATC W/O - 81111
K	BY: RUE-CJW 08-28-04. CWD: RUE-MDB. APP'D: RUE-JC 08-28-04
L	ADDED REVERSE METERING. BY: RUE-LAA 10-06-04. CWD: RUE-MDB. APP'D: RUE-JC 10-15-04
M	AS BUILT PER ATC W/O - 81111
N	BY: DFG. CWD: LHM. APP'D: DEMECI. 02-18-05
O	BY: DFG. CWD: LHM. APP'D: DEMECI. 02-23-05
P	BY: LHM. CWD: DEM. APP'D: DEMECI. 11-27-05
Q	ADDED TCO SW. SER NO. C PLANT. AL. MOVED TELV FROM 138V TO 47V PER FLD. SARGED PRINT. DRAWN: JCC 3/16/07. CWD: JCC. APP'D: JCC. FILMED: 4-7-07
R	138KV SHOTO & E. FROM LINE RELAY. ADDED AUX CTRL. DWG: PL 8-24-73. CWD: JCC. APP'D: JCC. FILMED: 8-1-73
S	ADDED PT OCB & CAP. BA TO 138KV BUS. BY: ANA 12-14-08. CWD: JCC. APP'D: JCC
T	138KV BUS. MODIFICATIONS, FOR CONSTRUCTION. BY: LHM 1-24-09. CWD: JCC. APP'D: JCC
U	FILED 2-9-09
V	REVISED PER FIELD MARKED PRINTS. BY: JCC 4-4-09. CWD: JCC. APP'D: JCC. FILMED: 4-11-09

NOTES
 1. SER. SEQUENTIAL EVENTS RECORDER
 2. FOR SYNCHRONIZING SEE DWG 237127B-E48
 3. FOR DIODE DETAIL SEE DWG 237127A-E794
 4. T-51, F-84 ATC RTU METERING FROM RELAYS
 5. SIXTY DTY TO EAST BAY M-34 VIA F-84 FOR RANK 18 OVERLOAD

REFERENCE:
 ELECTRICAL DRAWING INDEX - 237127B-ED1

ATTACHMENT 1A, SHT #1
 W. O. # 66661

NOT TO BE USED FOR CONSTRUCTION

DESIGNED BY	WISCONSIN PUBLIC SERVICE CORPORATION	DATE	7/30/69
DRAWN BY		SCALE	NONE
CHECKED BY		TITLE	138 KV SINGLE LINE METERING & RELAYING DIAGRAM
APP'D BY	JCC	PROJECT	KEWAUNEE SUBSTATION

E-46 -AA