Capacity Validation Study

Appendices

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Capacity Validation Study Report Appendices

Appendix A - Definition of Terms:

Bus: A physical electrical interface where many transmission devices share the same electric connection. For example, a bus is a point in the transmission grid where transmission lines, transformers and other transmission devices connect at a common location.

Capacity: The load-carrying ability, expressed in megawatts (MW), of generation, transmission or other electrical equipment.

CapX2020: CapX2020 is a joint initiative of 11 transmission-owning utilities in Minnesota and the surrounding region to expand the electric transmission grid to ensure continued reliable and affordable service. The new transmission lines will be built in phases designed to meet this increasing demand as well as to support renewable energy expansion.

Conservation: Practice of decreasing the quantity of energy used while achieving a similar outcome. Generally, conservation reduces the energy consumption and energy demand per capita, and thus offsets the growth in energy supply needed to keep up with population growth.

Contingency: An outage of a transmission line, generator or other piece of equipment, which affects the flow of power on the transmission network and impacts other network elements.

Current: The movement or flow of electricity. It can be considered a type of "pressure" that drives electrical charges through a circuit. Current is measured in amperes.

Demand: The amount of electric energy being delivered to or by a system or part of a system at a given instant or averaged over any designated interval of time. Demand is generally expressed in kilowatts (kW) or megawatts (MW).

Direct current (DC): The constant flow of electric charge.

Distribution factor (DF): The percentage or proportion of a transfer that flows across a particular transmission facility. If the distribution factor is associated with a system intact condition, it is typically referred to as a Power Transfer Distribution Factor (PTDF). If the distribution factor is associated with an outage (contingency) condition, it is typically referred to as an Outage Transfer Distribution Factor (OTDF). DFs can be positive, negative or zero.

Double circuit: Two sets of independent circuits with the same beginning and ending points.

Eligible energy technology: (as defined in Minnesota legislation) "Unless otherwise specified in law, 'eligible energy technology' means an energy technology that generates electricity from the following renewable energy sources: (1) solar; (2) wind; (3) hydroelectric with a capacity of less than 100 megawatts; (4) hydrogen, provided that after January 1, 2010, the hydrogen must be generated from the resources listed in this clause; or (5) biomass, which includes, without limitation, landfill gas, an anaerobic digester system, and an energy recovery facility used to capture the heat value of mixed municipal solid waste or refuse-derived fuel from mixed municipal solid waste as a primary fuel."

Energy source: Raw materials that are converted to electricity through chemical, mechanical or other means. Energy sources can include coal, gas, water, wind, biomass and solar.

FERC: Federal Energy Regulatory Commission; an independent agency that regulates the interstate transmission of natural gas, oil and electricity.

Generation: The act of converting various forms of energy input (thermal, mechanical, chemical and/or nuclear energy) into electric power. The amount of electric energy produced is usually expressed in kilowatt hours (kWh) or megawatt hours (MWh).

Generation sink: The chosen destination for generation added during a power system study. In order for a power system model to function, the generation in the model must equal the sum of the load and losses in the system. When new generation is studied, generation elsewhere must be turned down to enable the model to handle the new energy.

Grid: The interconnected transmission and distribution networks operated by electrical utilities that deliver electricity to end users.

Heavy loads: High volume of electricity flowing on a line, transformer or other equipment to meet a high demand for electricity, usually during hot weather in this region.

Import/export: Ability of the transmission system to bring power into or out of an area in order to serve load.

Kilovolt (kV): A kilovolt is equal to one thousand volts (V).

Kilowatt (kW): A unit of electrical power equal to one thousand watts.

Kilowatt hour (kWh): One kWh represents the use of one thousands watts of electricity for one hour. Put another way, one kWh equals 10 100-watt light bulbs burning simultaneously for one hour.

Load: All the devices that consume electricity and make up the total demand for power at any given moment or the total power drawn from the system.

Market dispatch: The use of generators in a power system model according to least-cost principles. The most expensive units are those that are turned off first.

Megawatt (MW): A megawatt is equal to one million watts and is enough power to serve the residential demand of approximately 800 to 1000 homes.

Megawatt-hour (MWh): One MWh equals 1 million watt hours.

MHEX: The Manitoba Hydro Exporting (MHEX) is the sum of the flows on the three 230 kV and the 500 kV tie lines that cross the Manitoba and the Minnesota and North Dakota borders.

MRO: The Midwest Reliability Organization is a not-for-profit organization dedicated to ensuring the reliability of the bulk power system in the Midwest part of North America. The MRO is one of eight regional reliability organizations that are part of NERC. The primary focus of MRO is developing and ensuring compliance with regional and international standards and performing assessments of the grid's ability to meet the demands for electricity. The MRO membership is comprised of municipal utilities, cooperatives, investor-owned utilities, a federal power marketing agency, Canadian Crown Corporations, and independent power producers.

Midwest ISO: Midwest Independent Transmission System Operator; a not-for-profit member-based organization of electric transmission owners, covering a 15 state region from the Dakotas to Pennsylvania. Midwest ISO administers and manages the transmission of electricity within its region.

Midwest ISO Queue: The Midwest ISO generation interconnection queue is the list of generators interested in obtaining permission to interconnect to the region's electric transmission system and are within the Midwest ISO transmission tariff footprint.

MWEX: Minnesota-Wisconsin Export (MWEX) is the sum of the flows on the Arrowhead-Stone Lake and the King Eau Claire 345 kV lines.

NDEX: The North Dakota Export (NDEX) is the sum of the flows on 18 lines that make up the "North Dakota Export" Boundary.

NERC: North American Electric Reliability Council is a not-for-profit corporation formed by the electric utility industry following the New York blackout in 1968 to ensure the reliability of the electricity supply in North America. NERC consists of eight Regional Reliability Organizations whose members account for virtually all the electricity supplied in the United States, Canada and the northern portion of

Mexico. NERC's planning standards apply primarily to the bulk electric system, meaning the electric generation resources, transmission lines and interconnections generally operated above 100-kV.

Network: A system of interconnected lines and electrical equipment.

OTDF: The Outage Transfer Distribution Factor (OTDF) is the proportion of the incremental (power) transfer that is observed on the particular facility of interest during an outage of another facility. For example, if a 100 MW source to sink power transfer is simulated during an outage of a facility and the flow on a particular line or transformer increases by 3 MW, the OTDF is reported as 0.03 or 3 percent.

Outage: The unavailability of electrical equipment, possibly as a result of planned for maintenance or unplanned (forced) problems caused by weather or equipment failures.

Phase: One of three elements of a transmission circuit that has a distinct voltage and current. Each phase has maximum and minimum voltage peaks at different times than the other phases.

Power flows: Electricity moving through lines or other equipment.

PTDF: The Power Transfer Distribution Factor (PTDF) is the proportion of the incremental transfer that is observed on the facility of interest. For example, if a 100 MW source to sink power transfer is simulated, and the flow on a transmission facility increases by 2 MW, the PTDF is reported as 0.02 or 2 percent. PTDFs are usually used in reference to system intact conditions.

Rebuild: Removing an existing line and replacing it with a new, higher capacity line.

Reliability: The degree of performance of the elements of the bulk electric system that results in electricity being delivered to customers within accepted standards and in the amount desired. It is the ability to deliver uninterrupted electricity to customers on demand and to withstand sudden disturbances such as short circuits or loss of system components.

Renewable resource: A power source that is renewed by nature, such as solar, wind, hydroelectric, geothermal, biomass or similar sources of energy.

SAF: Significantly Affected Facilities (SAF) are those facilities which are overloaded in the base case OR that become overloaded as a result of the new generation AND the new generation causes increased overloading with a Power Transfer Distribution Factor (PTDF) > 5% or an Outage Transfer Distribution Factor (OTDF) > 3%. 3% [DPK: is 3% correct for OTDF?].

Serve load: The ability to reliably deliver the amounts of electricity necessary to match customer needs at any given time.

Single circuit: A circuit with three sets of conductors.

Stability: The ability of an electric system to maintain a state of equilibrium during normal and abnormal system conditions or disturbances.

Structures: Towers or poles that support transmission lines.

Substation: A facility that monitors and controls electrical power flows, uses high voltage circuit breakers to protect power lines, and transforms voltage levels to meet the needs of end users.

System planning: The process by which the performance of the electric system is evaluated and future changes and additions to the bulk electric system are determined.

Thermal rating: The maximum amount of electrical current that a transmission line or electrical facility can conduct over a specified time period before it sustains permanent damage from overheating or before it violates public safety requirements.

Thermal overloads: Power flows on lines or equipment that exceed their capacity limits.

Transfer capability: The measure of the ability of the interconnected electric systems to move or transfer power in a reliable manner from one area to another over all transmission lines between those areas under specified system conditions.

Transformers: Devices that change voltage levels.

Transmission: An interconnected group of lines and equipment for transporting electric energy in bulk on a high voltage power lines between power sources (e.g. power plants) and major substations where the voltage is 'stepped down' for distribution to customers. Transmission is considered to end where the line connects to a distribution station.

Upsized: During the CapX 2020 Group I Certificate of Need process, the Applicants responded to pressure to increase the capacity of the lines by proposing to "upsize" the projects. This meant they were proposing to build single-circuit 345 kV lines capable of having a second circuit strung on them. In general, "upsized" CapX Group I lines means lines with the second circuit constructed.

Voltage: The difference in electrical charge between two points in a circuit. In power systems, voltage is generally an indication of the potential capacity of a line. Higher voltage lines generally carry power longer distances.

Voltage stability: The system is able to maintain the proper voltages needed to serve load during system faults and other outage conditions.

Watt (W): Unit of power equal to volts x amps.

Watt-hour (Wh): The total amount of energy used in one hour by a device that requires one watt of power for continuous operation.

Wind net annual capacity: This is found by dividing the expected annual energy production of the wind generator by the theoretical maximum energy production if the generator were running at its rated power all year. Net annual capacity factor is commonly expressed as a percentage.

Appendix B - Wind Projects included in the Base Model:

Bus Number	Bus Name	Basecse MW	Type	Project	Purchaser	State	Status
905	G301 69.000	4	WIND	Zachary Ridge/LJ Wind Farm	ALTW	IA	Online
907	G330 69.000	19	WIND	McNeilus		MN	Online
33521	WSL WTG 0.6000	50	WIND	Monfort	WE/ALT	WI	Online
33523	TWCK WTG 0.6900	98	WIND	Two Creeks	WPS	WI	Under Construction
33579	GRNFLD G 0.6900	80	WIND	Green Field	WE	WI	Online
33582	BLUSKY G 0.6900	80	WIND	Blue Sky	WE	WI	Online
33660	MGEWIND 138.00	12.3	WIND	Rosiere/Kewaunee Co.	MGE	WI	Online
34000	NIW 5 161.00	80	WIND	Worth County (Top of IA)	ALTW	IA	Online
34218	WORTHMN8 69.000	6	WIND	Worthington, MN	MRES	MN	Online
34414	CGORDO1G 24.900	42	WIND	Clear Lake (Cerro Gordo)	ALTW	IA	Online
34546	HANCWIND 25.000	100	WIND	Handcock County	ALTW	IA	Online
34547	BROOKE 8 69.000	80	WIND	Storm Lake II	ALTW	IA	Online
34906	FLYCLD 8 69.000	43.5	WIND	Flying Cloud (Spirit Lake)	ALTW	IA	Online
38780	B-RIDG1 0.6000	54.45	WIND	Butler Ridge	WIPPI	WI	Under Construction
39870	FWDEC G1 0.5750	200	WIND	Forward Wind	WE	WI	Online
60065	WEST PIP 34.500	8	WIND	West Pipestone		MN	Online
60066	GMW 34.500	14.4	WIND	McNeilus	Xcel	MN	Online
60066	GMW 34.500	19.9	WIND	McNeilus	Xcel	MN	Online
60066	GMW 34.500	15	WIND	McNeilus	Xcel	MN	Online
60067	DAN JUHL 34.500	12	WIND	Minn Wind III-IX (Luverne)	Xcel	MN	Online
60392	WRIDGE 8 69.000	10	WIND	West Ridge		MN	Online
60393	FENTON 9 34.500	200	WIND	Fenton Wind Power Project	Xcel	MN	Online
60394	YANKEE 9 34.500	100	WIND	MN-Dak	Xcel	MN	Online
60394	YANKEE 9 34.500	100	WIND			MN	Under Construction
60395	ERIDGE 8 69.000	10	WIND	East Ridge Wind Farm	Xcel	MN	Online
60396	WOLFWI 8 69.000	6.3	WIND	Wolf Wind Farm	Xcel	MN	Online
60708	BUFFRIDG 34.500	25	WIND	Buffalo Ridge	Xcel	MN	Online
60708	BUFFRIDG 34.500	107.2	WIND	Lake Benton I	Xcel	MN	Online
60708	BUFFRIDG 34.500	51.7	WIND		Xcel	MN	Online
60708	BUFFRIDG 34.500	23	WIND	Farmers Co-op	Xcel	MN	Online
60708	BUFFRIDG 34.500	16.8	WIND		Xcel	MN	Online
60708	BUFFRIDG 34.500	1.5	WIND		Xcel	MN	Online
60715	CHANRMB9 34.500	51.8	WIND	Morane	Xcel	MN	Online
60715	CHANRMB9 34.500	81	WIND	Chanarambie (Murray Co)	Xcel	MN	Online
60715	CHANRMB9 34.500	100.5	WIND	Lake Benton II	Xcel	MN	Online
60715	CHANRMB9 34.500	12	WIND	Viking	Xcel	MN	Online
61190	WOODSTK8 69.000	10.4	WIND	Woodstock	Xcel	MN	Online
61603	OLVRCNTY 0.6900	50.6	WIND	Oliver County I	MP	ND	Online
61606	OLVRCNT2 0.6900	4.5	WIND	Oliver County II	MP	ND	Online
61606	OLVRCNT2 0.6900	10.5	WIND	Oliver County II	MP	ND	Online
61606	OLVRCNT2 0.6900	15	WIND	Oliver County II	MP	ND	Online
61606	OLVRCNT2 0.6900	19.5	WIND	Oliver County II	MP	ND	Online
62710	CHANDLR8 69.000	6	WIND	Chandler	GRE	MN	Online
63070	PL VLLY5 161.00	200	WIND	Wapsi I & II	XCEL/SMMPA	MN	Under Construction
63090	TWF 9G 34.500	100	WIND	Trimont Wind Farm	GRE	MN	Online
63161	EDGE GEN 34.500	21	WIND	ND II (Edgely)	OTP	ND	Online
63714	OSGOOD 8 69.000	2.1	WIND	Iowa Dist Wind		IA	Online
63906	BVISTA 5 161.00	112	WIND	Storm Lake I	MEC	IA	Online
63912	CLIPR G1 0.5700	160	WIND	Intrepid (Buena Vista, Sac Co)	MEC	IA	Online
63980	VICTRYG1 0.5750	99	WIND	Victory Wind Farm	MEC	IA	Online
64217	POCHNTG1 0.5750	250	WIND	Pomeroy I, II, III	MEC	IA	Online
64276	CCITYSG1 0.5750	75	WIND	Charles City	MEC	IA	Online
64287	CCITY S8 69.000	16	WIND	Charles City	MEC	IA	Online
64287	CCITY S8 69.000	16	WIND	Charles City	MEC	IA	Online
64315	ENXCO G1 0.5700	150	WIND	Century Wind	MEC	IA	Online
65060	AINSWN1G 34.500	50	WIND	Ainsworth	NPPD	NE	Online
66881	LANGDONG 0.5750	16.5	WIND	Langdon	MPC/OTP	ND	Online
66881	LANGDONG 0.5750	31.5	WIND	Langdon	MPC/OTP	ND	Online
66881	LANGDONG 0.5750	48	WIND	Langdon	MPC/OTP	ND	Online
66881	LANGDONG 0.5750	63	WIND	Langdon	MPC/OTP	ND	Online
67292	EDGCLR_1 0.6900	40.5	WIND	ND Wind Energy Center	BEPC	ND	Online
67293	FTTMCLR1 0.6900	40.5	WIND	Highmore	BEPC	SD	Online

67295	WILTCLR1	0.6900	49.5	WIND	Wilton Wind (Ecklund)	BEPC	ND	Online
67467	MPSBROOK	115.00	1.5	WIND	Moorhead	MRES	MN	Online
67816	STLEONWG	0.6000	99	WIND	St Leon	MHEB	MB	Online
60045	HI PRWNG	34.500	201	WIND	High Prairie I & II (Mower & Prairie Star)	Xcel	MN	Online
60046	VELVAW G	115.00	12	WIND	Velva Wind Farm	Xcel	ND	Online
67473	MMU SW 7	115.00	18.7	WIND	Marshall Wind	MRES	MN	Online
62793	ODIN TP8	69.000	20	WIND	Odin Wind	MRES	MN	Online
34226	STORDEN8	69.000	50.4	WIND	Jeffers 2 (1.8 x 28 Vestas)	Xcel	MN	Online
63090	TWF 9G	34.500	100	WIND	Elm Creek (100 MW)	GRE	MN	Under Construction
67326	ELLENDL4	230.00	180	WIND	Tatanka (1.5 X 120 Acciona)	Market	ND	Online
61623	MINNTAC4	230.00	25	WIND	Taconite Ridge (2.5 x 10 Clipper)	MP	MN	Online
66881	LANGDONG	0.5750	40.5	WIND	Langdon II (1.5 X 27 GE)	MPC	ND	Under Construction
67123	STORLA 7	115.00	51	WIND	Wessington Springs (1.5 x 34 GE)	HCPD	SD	Under Construction
66754	MAPLE R4	230.00	358	WIND	Luverne/Pillsbury/Ashtibula	MPC/OTP	ND	Under Construction
63481	G426_WFG	0.6900	125	WIND	Endeavor	ALTW	IA	Online
66756	SQBUTTE4	230.00	400.5	WIND	Square Butte Wind	MP	ND	Proposed

Table 2 - Summary of wind in the base model by state and status (MW).

Status	IA	MB	MN	ND	NE	SD	WI	Grand Total
Online	1354.6	99	1374.1	562.1	50	40.5	422.3	3902.6
Proposed				400.5				400.5
Under Construction			400	398.5		51	152.45	851.95
Grand Total	1354.6	99	1774.1	1361.1	50	91.5	574.75	5155.05

Appendix C - Limiter Upgrade Costs:

Limiting Constraint	Rating (MVA)	Limiter	Cost ($1,000)	Miles	Fix
34000 NIW 5 161 34010 HAYWARD5 161 1	202	Conductor	9,653	16.5	Rebuild
34000 NIW 5 161 34015 LIME CK5 161 1	202	Conductor	9,653	16.5	Rebuild
34005 HRN LK 5 161 34007 LAKEFLD5 161 1	112	Equipment/Conductor	9,945	17	Rebuild
34005 HRN LK 5 161 62801 SSTORDN8 161 1	155	Conductor	-		Wrong rating
34006 LAKEFLD3 345 60331 LKFLDXL3 345 1	918	Sag limited	1,000		Raise Structures
34007 LAKEFLD5 161 34008 FOX LK 5 161 1	160	Conductor	-	22	Cross Trip
34007 LAKEFLD5 161 34137 TRIBOJI5 161 1	223	Conductor	14,040	24	Rebuild
34007 LAKEFLD5 161 63483 G426TAP5 161 1	223	Conductor	12,870	22	Rebuild
34008 FOX LK 5 161 61932 RUTLAND5 161 1	165	Equipment/Conductor	10,530	18	Rebuild
34009 WINBAGO5 161 34013 WNBAGOS5 161 1	167	Equipment	130	0	Replace Equipment
34009 WINBAGO5 161 61932 RUTLAND5 161 P1	165	Equipment/Conductor	7,605	13	Rebuild
34010 HAYWARD5 161 34013 WNBAGOS5 161 1	167	Equipment/Conductor	29,250	50	Rebuild
34010 HAYWARD5 161 61984 AUSTIN 5 161 1	279	Conductor	10,530	18	Rebuild
34010 HAYWD#25 161 61984 AUSTIN 5 161 1	279	Conductor	10,530	18	Rebuild
34010 HAYWD#25 161 601019 HAYWARD3 345 1	336	Transformer	-		New, Install Larger
34013 WNBAGOS5 161 34965 HAYWD#15 161 1	167	Equipment	130	50	Replace Disconnect
34014 ADAMS 5 161 34570 ADAMS_N5 161 1	335	Equipment	130	0	Replace Equipment
34014 ADAMS 5 161 34572 ADAMS_S5 161 1	330	Equipment	130	0	Replace Equipment
34014 ADAMS 5 161 60102 ADAMS 3 345 1	300	Transformer	4,940		Add 2nd tx
34014 ADAMS 5 161 60102 ADAMS 3 345 2	335	Transformer	4,940		Install larger tx
34015 LIME CK5 161 34016 EMERY 5 161 1	200	Conductor	8,775	15	Rebuild
34015 LIME CK5 161 34572 ADAMS_S5 161 1	194	Conductor	23,985	41	Rebuild
34016 EMERY 5 161 63774 SHEFFLD5 161 1	307	Conductor	9,945	17	Rebuild
34016 EMERY 5 161 64252 FLOYD 5 161 1	238	Conductor	21,060	36	Rebuild
34018 HAZLTON3 345 60102 ADAMS 3 345 1	956	Equipment	130	75	Replace Equipment
34020 HAZL S 5 161 34135 DUNDEE 5 161 1	167	Equipment/Conductor	10,530	18	Rebuild
34021 LANSINGW 161 34022 LANSING5 161 1	330	Equipment	130	0	Busbar
34021 LANSINGW 161 69523 GENOA 5 161 1	223	Equipment/Conductor	15,795	27	Rebuild
34022 LANSING5 161 69531 POSTVIL5 161 1	218	Equipment	130	37	Replace Equipment
34061 BNE JCT5 161 64205 FT.DODG5 161 1	147	Equipment/Conductor	130	23	Replace Equipment
34077 IA FALS7 115 34527 IAFINDT7 115 1	60	Conductor	77	0.16	Rebuild
34137 TRIBOJI5 161 63483 G426TAP5 161 1	223	Conductor	1,170	2	Rebuild
34137 TRIBOJI5 161 63701 WISDOM 5 161 1	209	Conductor	9,945	17	Rebuild
34137 TRIBOJI5 161 66563 SPENCER5 161 1	195	Equipment/Conductor	9,945	17	Rebuild
34570 ADAMS_N5 161 61984 AUSTIN 5 161 1	279	Conductor	12,285	21	Rebuild
34570 ADAMS_N5 161 69547 ROCHSTR5 161 1	200	Conductor	21,645	37	Rebuild
34572 ADAMS_S5 161 69526 BVR CRK5 161 1	223	Equipment/Conductor	9,360	16	Rebuild
34920 STORDEN 161 62801 SSTORDN8 161 1	155	Unknown	-		Wrong rating
60101 FORBES 2 500 60174 ROSEAUS2 500 1	2343	Conductor	2,000,000	192	Build 2nd 500
60101 FORBES 2 500 60198 CHIS-N 2 500 1	1733	Equipment	-		Series Caps
60102 ADAMS 3 345 63032 PL VLLY3 345 1	1195	Conductor	32,300	17	Rebuild
60105 PR ISLD3 345 60106 PR ISLD5 161 10	224	Transformer	4,940		Replace tx
60105 PR ISLD3 345 63431 NROC 345 345 1	1195	Conductor	53,960	28.4	Rebuild
60106 PR ISLD5 161 62224 RAVENNA5 161 1	236.5	Conductor	81	0.52	Reconductor
60107 W FARIB7 115 62865 AIRTECH7 115 1	239	Equipment	130	4.6	Replace Equipment

Limiting Constraint	Rating (MVA)	Limiter	Cost ($1,000)	Miles	Fix
60108 WILMART3 345 60365 FIELD_S3 345 1	1165	Conductor	-	27.1	Reconductor
60110 WILMART7 115 60111 SWAN LK7 115 1	139	Conductor	7,648	15.9	Rebuild
60110 WILMART7 115 60830 EASTWD18 115 1	194	None	2,116	4.4	Rebuild
60111 SWAN LK7 115 60112 FTRIDLY7 115 1	140	Conductor	6,349	13.2	Rebuild
60112 FTRIDLY7 115 60145 FRANKLN7 115 1	139	Conductor	12,362	25.7	Rebuild
60114 ELM CRK3 345 60115 ELMCRK 7 115 9	448	Transformer	6,032		Add 2nd tx
60114 ELM CRK3 345 60151 MNTCELO3 345 1	1195	Equipment	130	43	Replace Wavetraps
60119 LKYNKTN7 115 60171 LYON CO7 115 1	274	Conductor	9,620	20	Rebuild
60119 LKYNKTN7 115 60279 BUFFRID7 115 1	292	Conductor	9,620	20	Rebuild
60123 PIPESTN7 115 60125 PATHFDR7 115 1	225	Conductor	20,202	42	Rebuild
60123 PIPESTN7 115 60279 BUFFRID7 115 1	292	Conductor	9,139	19	Rebuild
60123 PIPESTN7 115 60362 CHANRMB7 115 1	384	Conductor	7,215	15	Rebuild
60125 PATHFDR7 115 60129 SPLT RK7 115 1	341	Conductor	481	1	Rebuild
60126 SPLT RK3 345 60130 SPLTRTA3 345 1	717	Equipment	130	4.9	Replace Equipment
60126 SPLT RK3 345 60131 SPLTRTB3 345 1	717	Equipment	130	4.9	Replace Equipment
60127 SPLT RK4 230 60129 SPLT RK7 115 7	336	Transformer	4,160		Install larger tx
60127 SPLT RK4 230 66523 SIOUXFL4 230 1	386	Equipment	130	1	Replace Equipment
60130 SPLTRTA3 345 66537 WHITE 3 345 1	720	Equipment	130	59	Replace Equipment
60131 SPLTRTB3 345 66564 SIOUXCY3 345 1	720	Equipment	130	84	Replace Equipment
60133 SHEYNNE4 230 63336 AUDUBON4 230 1	318	Equipment	31,460	44	Rebuild
60133 SHEYNNE4 230 66435 FARGO 4 230 1	391	Conductor	5,005	7	Rebuild
60133 SHEYNNE4 230 66754 MAPLE R4 230 1	426	Conductor	5,005	7	Rebuild
60144 DGLASCO7 115 62817 LSAUKTP7 115 1	112	Conductor	4,762	9.9	Rebuild
60146 GRANCTY7 115 60164 XRDS 7 115 1	214	Conductor	-	3.7	
60148 MINVALY7 115 60149 MINVALT4 230 6	187	Transformer	-		Already Replaced
60148 MINVALY7 115 60357 MAYNARD7 115 1	78	Conductor	5,435	11.3	Rebuild
60148 MINVALY7 115 61954 REDFLST7 115 1	120	Equipment	12,987	27	Rebuild
60148 MINVALY7 115 66551 GRANITF7 115 1	209	Equipment	2,549	5.3	Rebuild
60149 MINVALT4 230 60150 MNVLTAP4 230 1	319	Equipment	130	1	Replace Equipment
60150 MNVLTAP4 230 63054 PANTHER4 230 1	388	Conductor	57,000	30	Rebuild HV
60150 MNVLTAP4 230 66550 GRANITF4 230 1	388	Conductor	390	2.5	Reconductor
60151 MNTCELO3 345 60152 MNTCELO4 230 6	336	Transformer	-		Install larger tx
60151 MNTCELO3 345 60160 SHERCO 3 345 1	1195	Equipment	130	6	Replace CT, Wavetrap, Disc, Breakers
60153 MNTCELO7 115 62955 OAKWOOD7 115 1	140	Conductor	5,387	11.2	Rebuild
60154 SAUK RV7 115 60163 WST CLD7 115 1	153	Conductor	-	10	Reconductor
60154 SAUK RV7 115 60397 QUARRY7 115 115 1	153	Conductor	-		Reconductor
60157 STCLOUD7 115 60397 QUARRY7 115 115 1	153	Conductor	-		Reconductor
60159 STCTPW 7 115 60162 WAKEFLD7 115 1	124	Conductor	-	18	Reconductor
60163 WST CLD7 115 62812 SRTLLTP7 115 1	98	Conductor	78	0.5	Reconductor
60163 WST CLD7 115 62814 WESTWD 7 115 1	214	Conductor	-	0.6	
60164 XRDS 7 115 60165 MEI INT7 115 1	210	Conductor	-	1.1	
60165 MEI INT7 115 62814 WESTWD 7 115 1	210	Conductor	-	2.2	
60170 MARSHAL7 115 60171 LYON CO7 115 1	194	Conductor	1,924	4	Rebuild
60170 MARSHAL7 115 67472 MMU_N7ST 115 1	127.9	Conductor	265	1.7	Reconductor
60171 LYON CO7 115 60500 LYON CO3 345 C1	448	Transformer	-		New, Install Larger
60173 ROSEAUN2 500 60174 ROSEAUS2 500 1	1732	Equipment	11,000		Replace Series Cap, wavetrap
60173 ROSEAUN2 500 67564 DORSEY 2 500 1	1732.1	Equipment	-		Use Emergency Rating

Limiting Constraint	Rating (MVA)	Limiter	Cost ($1,000)	Miles	Fix
60175 ROSEAU 4 230 67576 RICHER 4 230 1	280.1	Conductor	54,340	76	Rebuild
60181 ALDRICH7 115 60210 FIFTHST7 115 1	209	Conductor	156	1	Reconductor
60186 AS KING3 345 60187 AS KING7 115 1	448	Transformer	-		Use Emergency Rating
60186 AS KING3 345 60199 CHIS CO3 345 1	1195	Conductor	72,200	38	Rebuild
60186 AS KING3 345 60221 KOLMNLK3 345 1	1195	Conductor	22,800	12	Rebuild
60186 AS KING3 345 60304 EAU CL 3 345 1	1195	Conductor	19,422	83	Stability interface
60187 AS KING7 115 60325 WILOWRV7 115 1	350	Conductor	3,432	22	Reconductor
60191 BLUE LK4 230 60193 BLUE LK7 115 1	336	Transformer	6,032		Install larger tx
60191 BLUE LK4 230 62980 MCLEOD 4 230 1	319	Conductor	87,400	46	Rebuild HV
60192 BLUE LK3 345 60262 EDEN PR3 345 1	1195	Conductor	11,400	6	Rebuild
60192 BLUE LK3 345 60502 HELNASS3 345 1	1165	Conductor	37,240	19.6	Rebuild
60196 CHISAGO7 115 60199 CHIS CO3 345 6	515	Transformer	6,032		Add 3rd Tx
60196 CHISAGO7 115 60920 LINDSTM7 115 1	350	Conductor	1,092	7	Reconductor
60197 CHIS CO2 500 60198 CHIS-N 2 500 1	1733	Series Caps	11,000		Replace Series Cap, wavetrap
60197 CHIS CO2 500 61493 CHIS D1Y 110 10	1203	Transformer	-		Use Emergency Rating
60197 CHIS CO2 500 61494 CHIS D2Y 110 9	1203	Transformer	-		Use Emergency Rating
60199 CHIS CO3 345 60221 KOLMNLK3 345 1	1195	Conductor	72,200	38	Rebuild
60199 CHIS CO3 345 61493 CHIS D1Y 110 10	1203	Transformer	-		Use Emergency Rating
60199 CHIS CO3 345 61494 CHIS D2Y 110 9	1203	Transformer	-		Use Emergency Rating
60202 COON CK3 345 60251 TERMINL3 345 1	1195	Conductor	26,600	14	Rebuild
60202 COON CK3 345 60272 MPLEGV23 345 1	1064.8	Equipment	130	8.3	Replace Equipment
60204 COTTAGE7 115 60238 REDROCK7 115 1	191	Conductor	3,367	7	Rebuild
60208 EDINA 7 115 60249 STLSPRK7 115 1	239	Equipment	2,116	4.4	Rebuild
60208 EDINA 7 115 60280 NINE MI7 115 1	239	Equipment/Conductor	130	2	Replace Equipment
60209 ELLOTPK7 115 60246 SO TOWN7 115 1	257	Conductor	468	3	Reconductor
60212 GOOSELK7 115 62091 VADNSTP7 115 1	189	Conductor	-	1.6	Reconductor
60214 HIBRDGE7 115 60239 ROGRSLK7 115 1	200	Conductor	-	4	Rating Increased
60217 INVRHLS3 345 60218 INVRHLS7 115 9	550	Transformer	6,032		Add 2nd tx
60218 INVRHLS7 115 60220 INVRGRV7 115 1	372	Equipment	130	2	Replace Equipment
60225 LXNGTON7 115 62091 VADNSTP7 115 1	189	Conductor	-	4	Reconductor
60234 PARKERS7 115 60346 CEDARLK7 115 1	239	Equipment	-	6	Replace Equipment
60236 REDROCK3 345 60238 REDROCK7 115 10	448	Transformer	-		Add 3rd tx
60236 REDROCK3 345 60238 REDROCK7 115 9	448	Transformer	-		Already covered
60239 ROGRSLK7 115 60334 LONE OA7 115 1	194	Conductor	328	2.1	Reconductor
60251 TERMINL3 345 61491 TERMID2Y 110 9	672	Transformer	-		Use Emergency Rating
60251 TERMINL3 345 61492 TERMID1Y 110 10	672	Transformer	-		Use Emergency Rating
60252 TERMINL7 115 61491 TERMID2Y 110 9	672	Transformer	-		Already covered
60252 TERMINL7 115 61492 TERMID1Y 110 10	672	Transformer	-		Already covered
60262 EDEN PR3 345 60263 EDEN PR7 115 10	448	Transformer	-		Use Emergency Rating
60262 EDEN PR3 345 60263 EDEN PR7 115 9	448	Transformer	-		Use Emergency Rating
60269 HASSAN 7 115 62955 OAKWOOD7 115 1	140	Conductor	2,964	19	Re-Conductor
60276 AIRLAKE7 115 62234 LKMARN 7 115 1	239	Equipment	130	6	Replace Disc, CT
60279 BUFFRID7 115 60381 YANKEE 7 115 1	620	Conductor	4,810	10	Add 2nd Circuit
60286 NOBLES 3 345 60287 NOBLES 7 115 1	672	Transformer	-		Use Emergency Rating
60286 NOBLES 3 345 60287 NOBLES 7 115 2	672	Transformer	-		Use Emergency Rating
60290 ST LAKE5 161 69561 WASHCO 5 161 1	264	Conductor	14,625	25	Rebuild
60304 EAU CL 3 345 60305 EAU CLA5 161 9	300	Transformer	4,940		Use Emergency Rating

Limiting Constraint	Rating (MVA)	Limiter	Cost ($1,000)	Miles	Fix
60308 LACROSS5 161 60311 MAYFAIR5 161 1	215	Conductor	1,170	2	Rebuild
60309 MRSHLND5 161 69566 NLAX 5 161 1	400	Conductor	5,460	35	Reconductor
60311 MAYFAIR5 161 69566 NLAX 5 161 1	216	Conductor	1,170	2	Rebuild
60316 TREMVAL5 161 60323 SEVN ML5 161 1	197		22,464	38.4	Rebuild
60316 TREMVAL5 161 69543 ALMA 5 161 1	245.3	Conductor	19,890	34	Rebuild
60320 HYDROLN5 161 60321 HYDROLN7 115 1	187	Transformer	2,700		Add 2nd tx
60331 LKFLDXL3 345 60364 FIELD_N3 345 1	1165	Conductor	-	27.1	Assume Fixed
60357 MAYNARD7 115 62005 KERKHOT7 115 1	78	Conductor	7,071	14.7	Rebuild
60364 FIELD_N3 345 60365 FIELD_S3 345 1	1195	Equipment	-	0	Use Emergency Rating
60371 ERIE RD7 115 66508 S3 7 115 1	140	Conductor	624	4	Reconductor
60371 ERIE RD7 115 67472 MMU_N7ST 115 1	127.9	Conductor	156	1	Reconductor
60382 BRKNGCO7 115 60383 BRKNGCO3 345 1	448	Transformer	6,032		Install larger tx
60382 BRKNGCO7 115 60383 BRKNGCO3 345 2	448	Transformer	6,032		Install larger tx
60389 QUARRY3 345 60397 QUARRY7 115 115 1	448	Transformer	-		New, Install Larger
60505 LKMARN 3 345 62234 LKMARN 7 115 C1	448	Transformer	-		Use Emergency Rating
60507 HAZEL 3 345 60508 HAZEL 4 230 C1	336	Transformer	-		New, Install Larger
60507 HAZEL 3 345 60508 HAZEL 4 230 C2	336	Transformer	-		New, Install Larger
60508 HAZEL 4 230 66550 GRANITF4 230 C1	519.9	Conductor	-		New, Install Larger
60920 LINDSTM7 115 62276 SHAFER 7 115 1	350	Conductor	312	2	Reconductor
61051 STCRX 5G 161 69065 POPLK5 161 1	332	Conductor	1,148	7.36	Reconductor
61128 LAW CRK7 115 62276 SHAFER 7 115 1	341	Conductor	936	6	Reconductor
61612 RIVERTN4 230 61617 MUDLAKE4 230 1	383.2	Conductor	15,200	8	Rebuild HV
61615 ARROWHD4 230 63055 BEARCK 4 230 1	359.7	Conductor	104,500	55	Rebuild HV
61617 MUDLAKE4 230 63045 BENTON 4 230 1	383.2	Conductor	102,600	54	Rebuild HV
61625 BLCKBRY4 230 61626 BOSWELL4 230 2	399	Conductor	-	19	Use Emergency Rating
61627 SHANNON4 230 66753 RUNNING4 230 1	407	Conductor	58,630	82	Rebuild
61636 SWANVIL7 115 61647 LONG PR7 115 1	98	Sag limited	250		Raise Structures
61636 SWANVIL7 115 61649 BLNCHRD7 115 1	98	Sag limited	250		Raise Structures
61639 MNP-STP7 115 62895 THMSTWN7 115 1	98	Sag limited	250		Raise Structures
61639 MNP-STP7 115 62896 ALDRICH7 115 1	98	Sag limited	250		Raise Structures
61642 VERNDLE7 115 62893 WINGRIV7 115 1	120	Conductor	519	1.08	Rebuild
61642 VERNDLE7 115 62896 ALDRICH7 115 1	98	Sag limited	250		Raise Structures
61646 DOGLKTP7 115 62213 STHDLTP7 115 1	98	Sag limited	250		Raise Structures
61646 DOGLKTP7 115 62895 THMSTWN7 115 1	98	Sag limited	250		Raise Structures
61647 LONG PR7 115 62817 LSAUKTP7 115 1	98	Sag limited	250		Raise Structures
61649 BLNCHRD7 115 61650 LITTLEF7 115 1	90	Sag limited	4,040	8.4	Rebuild
61650 LITTLEF7 115 62268 LANGLTP7 115 1	98	Sag limited	250		Raise Structures
61651 MUDLAKE7 115 61652 BRAINRD7 115 1	98	Sag limited	250	4	Raise Structures
61676 HIBBARD7 115 61680 WNTR ST7 115 1	182	Operations issue	-		Adjust phase shft
61680 WNTR ST7 115 61683 STIN-MN7 115 1	182	Operations issue	-		Adjust phase shft
61906 MAPLE LF 161 61948 BYRON 5 161 1	302	Conductor	2,925	5	Rebuild
61906 MAPLE LF 161 61948 BYRON 5 161 2	332	Conductor	2,925	5	Rebuild
61906 MAPLE LF 161 63430 CASCADE 161 1	302	Conductor	3,510	6	Rebuild
61906 MAPLE LF 161 63430 CASCADE 161 2	332	Conductor	3,510	6	Rebuild
61948 BYRON 5 161 61950 BYRON 3 345 1	448	Transformer	4,940		Add 2nd tx
61950 BYRON 3 345 63032 PL VLLY3 345 1	1165	Conductor	30,400	16	Rebuild
61950 BYRON 3 345 63431 NROC 345 345 1	1195	Conductor	27,740	14.6	Rebuild

Limiting Constraint	Rating (MVA)	Limiter	Cost ($1,000)	Miles	Fix
61980 RICE 5 161 69526 BVR CRK5 161 1	75	Equipment	130	14	Replace Equipment
61984 AUSTIN 5 161 63070 PL VLLY5 161 1	448.7	Conductor	12,285	21	Rebuild
62000 MARSHLK7 115 63288 ODESSA 7 115 1	96.6	Conductor	4,122	8.57	Rebuild
62000 MARSHLK7 115 63289 CORRELL7 115 1	96.6	Conductor	1,433	2.98	Rebuild
62001 BENSON 7 115 62002 WALDEN 7 115 1	79.7	Equipment	130	19	Replace Equipment
62001 BENSON 7 115 62006 KERKHO 7 115 1	79.7	Equipment/Conductor	12,506	26	Rebuild
62002 WALDEN 7 115 63218 MOROTP 7 115 1	141.6	Conductor	3,704	7.7	Rebuild
62003 JOHNJCT7 115 63216 ORTONVL7 115 1	96.6	Conductor	11,852	24.64	Rebuild
62003 JOHNJCT7 115 66555 MORRIS 7 115 1	106	Rebuild	7,407	15.4	Rebuild
62005 KERKHOT7 115 62006 KERKHO 7 115 1	89.6	Conductor	4,858	10.1	Rebuild
62224 RAVENNA5 161 63071 SPRNGCK5 161 1	236.5	Conductor	2,761	4.72	Rebuild
62225 BURNVIL7 115 62232 DKTAHGT7 115 1	139	Conductor	3,511	7.3	Rebuild
62232 DKTAHGT7 115 62237 KENRICK7 115 1	144	Conductor	2,261	4.7	Rebuild
62234 LKMARN 7 115 62237 KENRICK7 115 1	144	Conductor	1,732	3.6	Rebuild
62234 LKMARN 7 115 B$0118 115/69 1.00 1	70	Transformer	3,250		Replace tx
62268 LANGLTP7 115 62819 FSCHRHL7 115 1	98	Conductor	2,694	5.6	Rebuild
62425 WILLMAR7 115 B$0112 115/69 1.00 1	112	Transformer	3,250		Replace tx
62526 RUSH LK7 115 63286 QUADRNT7 115 1	127.5	Conductor	5,002	10.4	Rebuild
62527 ELMO 7 115 62531 INMAN 7 115 1	203.3	Conductor	3,078	6.4	Rebuild
62527 ELMO 7 115 62752 MLTN TP7 115 1	203.3	Conductor	10,293	21.4	Rebuild
62528 TAMARAC7 115 62533 CORMRNT7 115 1	98	Conductor	3,511	7.3	Rebuild
62528 TAMARAC7 115 63234 PEL RPD7 115 1	98	Conductor	3,511	7.3	Rebuild
62529 CMRTJCT7 115 62530 FRAZEE 7 115 1	98	Conductor	7,215	15	Rebuild
62529 CMRTJCT7 115 62533 CORMRNT7 115 1	98	Conductor	722	1.5	Rebuild
62529 CMRTJCT7 115 63236 AUDUBON7 115 1	96	Conductor	4,473	9.3	Rebuild
62530 FRAZEE 7 115 63235 PERHAM 7 115 1	127.4	Conductor	5,772	12	Rebuild
62531 INMAN 7 115 63052 INMAN 4 230 1	175	Transformer	4,160		Install larger tx
62616 BIGSWAN7 115 62982 HUTCHMN7 115 1	113.5	Equipment	130	17.8	Replace Equipment
62666 GLNDALE7 115 B$0098 115/69 1.00 1	46.7	Transformer	3,250		Replace tx
62752 MLTN TP7 115 67471 ALEXTAP7 115 1	202.2	Conductor	1,560	10	Reconductor
62812 SRTLLTP7 115 62819 FSCHRHL7 115 1	98	Conductor	241	0.5	Rebuild
62980 MCLEOD 4 230 63054 PANTHER4 230 1	319	Equipment/Conductor	53,580	28.2	Rebuild HV
62980 MCLEOD 4 230 B$0125 230/115 1.00 1	187	Transformer	3,380		Add 2nd tx
62981 MCLEOD 7 115 62983 HUTCH3M7 115 1	195.6	Conductor	2,501	5.2	Rebuild
62981 MCLEOD 7 115 B$0125 230/115 1.00 1	187	Transformer	-		Already covered
62982 HUTCHMN7 115 62983 HUTCH3M7 115 1	168.9	Conductor	337	0.7	Rebuild
63032 PL VLLY3 345 B$0148 345/161 1.00 1	500	Transformer	-		Use Emergency Rating
63032 PL VLLY3 345 B$0149 345/161 1.00 1	625	Transformer	-		Already Covered
63032 PL VLLY3 345 B$0150 345/161 1.00 2	625	Transformer	-		Already Covered
63049 STANTON4 230 67106 LELANDO4 230 1	430.2	Conductor	715	1	Rebuild
63051 HENNING4 230 63052 INMAN 4 230 1	383.2	Conductor	2,674	3.74	Rebuild
63051 HENNING4 230 63366 SILVRLK4 230 1	320	Conductor	11,941	16.7	Rebuild
63052 INMAN 4 230 63058 WINGRIV4 230 1	318.7	Conductor	13,857	19.38	Rebuild
63053 HUBBARD4 230 63336 AUDUBON4 230 1	359.7	Conductor	35,750	50	Rebuild
63054 PANTHER4 230 B$0132 230/69 1.00 1	70	Transformer	3,380		Add 2nd tx
63056 BALTA 4 230 63379 RUGBY 4 230 1	429.4	Conductor	34,200	18	Rebuild HV
63058 WINGRIV4 230 B$0127 230/115 1.00 1	187	Transformer	4,160		Replace tx

Limiting Constraint	Rating (MVA)	Limiter	Cost ($1,000)	Miles	Fix
63070 PL VLLY5 161 B$0148 345/161 1.00 1	500	Transformer	-		Already covered
63070 PL VLLY5 161 B$0149 345/161 1.00 1	557.7	Transformer	4,940		Replace a Transformer
63070 PL VLLY5 161 B$0150 345/161 1.00 2	557.7	Transformer	-		Already Covered
63173 DAWS TP7 115 63206 LOUSBRG7 115 P1	96	Conductor	1,841	11.8	Reconductor
63173 DAWS TP7 115 63211 CANBY 7 115 P1	96	Conductor	3,307	21.2	Reconductor
63189 MAPLER1Y 345 66754 MAPLE R4 230 1	336	Transformer	-		Use Emergency Rating
63189 MAPLER1Y 345 66792 MAPLE R3 345 1	336	Transformer	-		Already covered
63190 MAPLER2Y 345 66754 MAPLE R4 230 1	336	Transformer	-		Use Emergency Rating
63190 MAPLER2Y 345 66792 MAPLE R3 345 1	336	Transformer	-		Already covered
63193 FORMAN Y 230 63263 FORMN 7 115 1	112	Transformer	4,160		Replace tx
63193 FORMAN Y 230 63363 FORMAN 4 230 1	140	Transformer	-		Already covered
63194 FERGSFLY 230 63231 FERGSFL7 115 1	112	Transformer	4,160		Replace tx
63194 FERGSFLY 230 63331 FERGSFL4 230 1	112	Transformer	-		Already covered
63195 BIGSTONY 230 63214 BIGSTON7 115 1	233	Transformer	4,160		Replace tx
63195 BIGSTONY 230 63314 BIGSTON4 230 1	233	Transformer	-		Already covered
63206 LOUSBRG7 115 63217 APPLETN7 115 P1	96	Conductor	1,076	6.9	Reconductor
63210 TORONTO7 115 63212 BURR 7 115 1	96	Conductor	11,881	24.7	Rebuild
63211 CANBY 7 115 63212 BURR 7 115 1	96.6	Conductor	510	1.06	Rebuild
63211 CANBY 7 115 63311 CANBY 3 345 9	336	Transformer	500		New - Build bigger
63211 CANBY 7 115 63400 CANBY 3 345 9	336	Transformer	-		New, Install Larger
63211 CANBY 7 115 66551 GRANITF7 115 1	96	Reconductor	18,855	39.2	Rebuild
63212 BURR 7 115 63213 MARIETT7 115 1	96	Conductor	10,342	21.5	Rebuild
63213 MARIETT7 115 63214 BIGSTON7 115 1	96	Conductor	11,578	24.07	Rebuild
63214 BIGSTON7 115 63215 HIWY12 7 115 1	310	Conductor	962	2	Rebuild
63215 HIWY12 7 115 63216 ORTONVL7 115 1	216	Equipment/Conductor	2,165	4.5	Rebuild
63216 ORTONVL7 115 63287 ORTQUAR7 115 1	96.6	Conductor	1,664	3.46	Rebuild
63217 APPLETN7 115 63289 CORRELL7 115 1	96.6	Conductor	2,929	6.09	Rebuild
63218 MOROTP 7 115 66555 MORRIS 7 115 1	80	Equipment	-	6	Reconductor
63219 GRANTCO7 115 63220 ELBOWLK7 115 1	160	Sag limited	250		Raise Structures
63219 GRANTCO7 115 63223 HOOT LK7 115 1	96.6	Conductor	11,544	24	Rebuild
63219 GRANTCO7 115 66555 MORRIS 7 115 1	96	Conductor	12,747	26.5	Rebuild
63220 ELBOWLK7 115 63221 BRANDN 7 115 1	160	Sag limited	250		Raise Structures
63221 BRANDN 7 115 67452 ALEXSS 115 1	160	Sag limited	250		Raise Structures
63221 BRANDN 7 115 67452 ALEXSS 7 115 1	160	Equipment	250		Raise structures
63222 ALEXAND7 115 67452 ALEXSS 115 1	160	Sag limited	250		Raise Structures
63223 HOOT LK7 115 63231 FERGSFL7 115 1	96	Conductor	962	2	Rebuild
63223 HOOT LK7 115 63233 EDGETAP7 115 1	96	Conductor	544	1.13	Rebuild
63233 EDGETAP7 115 63234 PEL RPD7 115 1	96	Conductor	10,115	21.03	Rebuild
63235 PERHAM 7 115 63286 QUADRNT7 115 1	153.4	Conductor	106	0.22	Rebuild
63263 FORMN 7 115 66438 FORMAN 7 115 1	120	Conductor	48	0.1	Rebuild
63281 WILT TAP 115 63285 SOLWAY 7 115 1	96.6	Conductor	5,291	11	Rebuild
63287 ORTQUAR7 115 63288 ODESSA 7 115 1	96.6	Conductor	2,434	5.06	Rebuild
63314 BIGSTON4 230 63322 BSSOUTH4 230 P1	519.9	PLANNED	100	2	New - Build bigger
63314 BIGSTON4 230 63325 BROWNSV4 230 1	291	Sag limited	2,000	36.71	Raise Structures
63314 BIGSTON4 230 66503 BLAIR 4 230 1	480	Conductor	-	33.2	Reconductor
63318 BSSTH Y1 230 63322 BSSOUTH4 230 1	400	Transformer	1,000		New - Build bigger
63318 BSSTH Y1 230 63417 BSSOUTH3 345 1	400	Transformer	-		Already covered

Limiting Constraint	Rating (MVA)	Limiter	Cost ($1,000)	Miles	Fix
63319 BSSTH Y2 230 63322 BSSOUTH4 230 1	400	Transformer	1,000		New - Build bigger
63319 BSSTH Y2 230 63417 BSSOUTH3 345 1	400	Transformer	-		Already covered
63325 BROWNSV4 230 63327 HANKSON4 230 1	291	Sag limited	2,000	33.46	Raise Structures
63327 HANKSON4 230 63329 WAHPETN4 230 1	320	Equipment/Conductor	18,233	25.5	Rebuild
63327 HANKSON4 230 601063 HANKNSN3 345 1	336	Transformer	-		New, Install Larger
63329 WAHPETN4 230 63331 FERGSFL4 230 1	320	Equipment/Conductor	20,735	29	Rebuild
63329 WAHPETN4 230 66754 MAPLE R4 230 1	292	Conductor	102,600	54	Rebuild HV
63331 FERGSFL4 230 63366 SILVRLK4 230 1	320	Equipment/Conductor	9,724	13.6	Rebuild
63358 BUFFALO3 345 63369 JAMESTN3 345 1	792	Equipment	130	56	Replace Equipment
63358 BUFFALO3 345 66792 MAPLE R3 345 1	792	Equipment	130	34	Replace Equipment
63379 RUGBY 4 230 67523 GLENBOR4 230 1	429.4	Conductor	201,400	106	Rebuild HV
63405 CROSSTWN 161 63430 CASCADE 161 1	425	Conductor	585	1	Rebuild
63405 CROSSTWN 161 63440 SILVER L 161 1	425	Conductor	585	1	Rebuild
63410 WILLOW C 161 63445 CHESTER 161 1	221	Conductor	4,095	7	Rebuild
63415 N HILLS 161 63420 IBM 161 1	305	Conductor	1,755	3	Rebuild
63415 N HILLS 161 63432 NROC 161 161 1	278	Conductor	-		New, Install Larger
63420 IBM 161 63430 CASCADE 161 1	221	Conductor	1,170	2	Rebuild
63431 NROC 345 345 63432 NROC 161 161 1	448	Transformer	-		New, Install Larger
63440 SILVER L 161 63445 CHESTER 161 1	335	Conductor	2,925	5	Rebuild
63445 CHESTER 161 69547 ROCHSTR5 161 15	302	Conductor	-	0	
63445 CHESTER 161 69547 ROCHSTR5 161 16	332.2	Conductor	585	1	Rebuild
66236 WATERT1T 345 66529 WATERTN3 345 1	400	Transformer	4,680		Add 2nd tx
66236 WATERT1T 345 66530 WATERTN4 230 1	400	Transformer	-		Already covered
66296 GRANITFT 230 66550 GRANITF4 230 1	250	Transformer	4,160		Install larger tx
66296 GRANITFT 230 66551 GRANITF7 115 1	250	Transformer	-		Already Fixed
66426 BISMARK4 230 67338 GLENHAM4 230 1	264	Equipment	130	95	Replace Equipment
66438 FORMAN 7 115 66522 SUMMIT-7 115 1	80	Equipment	130	68.4	Replace Equipment
66452 RUGBY 7 115 67264 RUGBCPC7 115 1	144	Equipment	130	0	Replace Equipment
66466 GRANTF2T 230 66550 GRANITF4 230 1	200	Transformer	4,160		Install 3rd Tx
66466 GRANTF2T 230 66551 GRANITF7 115 1	200	Transformer	-		
66474 AURORA 7 115 66504 BROOKNG7 115 1	120	Equipment/Conductor	10,582	22	Rebuild
66474 AURORA 7 115 66505 FLANDRU7 115 1	120	Equipment	130	17.05	Replace Equipment
66500 ARLNGTN7 115 66504 BROOKNG7 115 1	120	Equipment	130	23	Replace Equipment
66500 ARLNGTN7 115 66531 WATERTN7 115 1	120	Equipment	130	27.5	Replace Equipment
66503 BLAIR 4 230 66530 WATERTN4 230 1	398	Equipment/Conductor	4,368	28	Reconductor
66503 BLAIR 4 230 66550 GRANITF4 230 1	398	Equipment/Conductor	7,176	46	Reconductor
66504 BROOKNG7 115 66531 WATERTN7 115 1	120	Equipment	130	44	Replace Equipment
66504 BROOKNG7 115 66538 WHITE 7 115 1	160	Equipment	130	13	Replace Equipment
66508 S3 7 115 66551 GRANITF7 115 1	120	Equipment/Conductor	15,392	32	Rebuild
66515 HURON 7 115 67404 HURONWP7 115 1	120	Equipment/Conductor	4,810	10	Rebuild
66523 SIOUXFL4 230 66578 PAHOJA 4 230 1	450	Conductor	3,120	20	Reconductor
66550 GRANITF4 230 66554 MORRIS 4 230 1	239	Equipment	130	60	Replace Equipment
66554 MORRIS 4 230 66555 MORRIS 7 115 1	100	Transformer	3,380		Replace tx
66562 EAGLE 4 230 66578 PAHOJA 4 230 1	320	Conductor	3,432	22	Reconductor
66752 DRAYTON4 230 66755 PRAIRIE4 230 1	428	Conductor	37,895	53	Rebuild
66752 DRAYTON4 230 67557 LETELER4 230 1	460.5	Conductor	27,528	38.5	Rebuild
66753 RUNNING4 230 66760 LUND 4 230 1	317	Conductor	43,615	61	Rebuild

Limiting Constraint	Rating (MVA)	Limiter	Cost ($1,000)	Miles	Fix
66756 SQBUTTE4 230 66791 CENTER 3 345 1	428	Transformer	4,160		Add 2nd tx
66757 MORANVI4 230 66760 LUND 4 230 1	317	Conductor	27,885	39	Rebuild
66791 CENTER 3 345 67316 COYOTE 3 345 1	597.6	Equipment	130	35	Replace Equipment
67326 ELLENDL4 230 67327 ELLENDL7 115 1	100	Transformer	-		Use Emergency Rating
67327 ELLENDL7 115 67401 ABDNJCT7 115 1	80	Equipment/Conductor	21,645	45	Rebuild
67401 ABDNJCT7 115 67402 ABDNSBT7 115 1	88	Equipment	130	7.5	Replace Equipment
67404 HURONWP7 115 67410 MITCLNW7 115 1	120	Equipment/Conductor	25,493	53	Rebuild
67404 HURONWP7 115 67411 BTAP WP7 115 1	120	Equipment/Conductor	4,377	9.1	Rebuild
67461 ALEXNOKO 115 67471 ALEXTAP7 115 1	202.2	Conductor	172	1.1	Reconductor
67503 DORSEY 4 230 67526 ST.LEON4 230 1	309.1	Conductor	57,200	80	Rebuild
67503 DORSEY 4 230 67566 DORSEYM4 230 52	1200	Transformer	26,000		Add 3rd tx
67503 DORSEY 4 230 67598 DORSY2M4 230 51	1200	Transformer	26,000		Add 3rd tx
67523 GLENBOR4 230 67524 CORNWLS4 230 1	279.9	Conductor	28,600	40	Rebuild
67557 LETELER4 230 67559 LAVEREN4 230 1	419.5	Conductor	35,035	49	Rebuild
67560 RIDGEWY4 230 67576 RICHER 4 230 1	335	Conductor	27,885	39	Rebuild
67564 DORSEY 2 500 67566 DORSEYM4 230 52	1200	Transformer	-		Add 3rd tx (repeat of above)
67564 DORSEY 2 500 67598 DORSY2M4 230 51	1200	Transformer	-		Add 3rd tx (repeat of above)
69073 BVD5 161 69079 BVD3 345 1	448	Transformer	4,680		New, Install Larger
69073 BVD5 161 69549 WABACO 5 161 1	400	Conductor	3,120	20	Reconductor
69507 SENECA 5 161 69508 GRANGRAE 161 1	201	Conductor	10,121	17.3	Rebuild
69507 SENECA 5 161 69511 BELLCTR5 161 1	189	Equipment	130	9	Replace Equipment
69507 SENECA 5 161 69523 GENOA 5 161 1	304	Conductor	12,870	22	Rebuild
69523 GENOA 5 161 69527 HARMONY5 161 1	223	Equipment/Conductor	22,230	38	Rebuild
69523 GENOA 5 161 69535 LAC TAP5 161 1	279	Conductor	12,285	21	Rebuild
69523 GENOA 5 161 669523 GENOA3 345 1	336	Transformer	-		New, Install Larger
69526 BVR CRK5 161 69527 HARMONY5 161 1	223	Equipment/Conductor	12,285	21	Rebuild
69543 ALMA 5 161 69549 WABACO 5 161 1	245.3	Conductor	11,700	20	Rebuild
69543 ALMA___5 161 69549 WABACO 5 161 1	223	Conductor	2,106	3.6	Rebuild
69543 ALMA___5 161 69551 ELK MND5 161 1	194	Conductor	26,325	45	Rebuild
69547 ROCHSTR5 161 69549 WABACO 5 161 1	201	Conductor	7,605	13	Rebuild
69557 BARRON 5 161 69561 WASHCO 5 161 1	264	Conductor	15,795	27	Rebuild
69557 BARRON 5 161 69565 APL RVR5 161 1	229.9	Equipment	130	24	Replace CT
69566 NLAX 5 161 69567 NLAX 3 345 1	448	Transformer	-		New, Install Larger
B$0112 115/69 1.00 62425 WILLMAR7 115 1	112	Transformer	-		Already covered
B$0125 230/115 1.00 62980 MCLEOD 4 230 1	187	Transformer	-		Already covered
B$0125 230/115 1.00 62981 MCLEOD 7 115 1	187	Transformer	-		Already covered
B$0127 230/115 1.00 62893 WINGRIV7 115 1	187	Transformer	-		Already covered
B$0132 230/69 1.00 63054 PANTHER4 230 1	70	Transformer	-		
B$0148 345/161 1.00 63032 PL VLLY3 345 1	500	Transformer	-		
B$0148 345/161 1.00 63070 PL VLLY5 161 1	500	Transformer	-		
34009 WINBAGO5 161 60120 BLUEETA5 161 1	200	Conductor	6,435	11	Rebuild
63058 WINGRIV4 230 B$0128 230/115 115 1	187	Transformer	4,160		Replace tx
62893 WINGRIV7 115 B$0128 230/115 230 1	187	Transformer	-		Already Covered
63327 HANKSON4 230 63363 FORMAN 4 230	320	Conductor	55,100	29	Rebuild HV
60109 WILMART5 161 60110 WILMART7 115	168	Transformer	2,700		Replace tx
62526 RUSH LK7 115 62531 INMAN 7 115	191.6	Conductor	4,810	10	Rebuild

Data Tables:

A copy of the full data tables is available upon request.

Figure 1 – Description of how to read the Data Tables on the proceeding pages.

	A	B	C	E	F	K
1	Limiter that cannot be reached			Attainable MW	2ac	
2	Prices In Millions of Dollars			Attainable Cost		
3				% cutoff	$	2,047.00
4	Max Interface	All Sources	Twin Cities Sink	Limiter	MUDLAKE4_230 (61617) -- BENTON 4_230 (63045)	
5	Max Interface	All Sources	Twin Cities Sink	MW Transfer	3992.9	
6	Max Interface	All Sources	Twin Cities Sink	Upgrade Cost	$	160.15
7	Max Interface	All Sources	Twin Cities Sink	% of Total Cost		7.82%
8	Max Interface	All Sources	Twin Cities Sink	Cost Jump	$	102.60
9	Max Interface	All Sources	Twin Cities Sink	% Cost Jump		5.01%

Annotations:

- Case name representing the transmisson projects that were added to the base case in order to achieve the results shown below.
- Cost of the planned transmission projects that were added to the base case.
- This is limiter that is considered unreasonable to fix due to either cost or constructability issues.
- This is the transfer cabability of the sysetm if all of the limiters up to but not including the limiter listed above are upgraded.
- This is the price of the upgrades to the system if all of the limiters up to but not including the limiter listed above are fixed.
- This is the percentange of the planned transmission project cost that needs to be spent in order to achieve the transfer capability shown above.
- This is the cost of fixing the system component that is considered unreasonable to fix.
- The percentage of the planned transmission project cost that would need to be spent in order to upgrade the component that is considered unreasonable to fix.

	2abe	2abf	2abg	2acd	2ace	2acf	2acg	2abcf	2abcg	2abfg	2abcfg	2acdefg	2abcdefg
$	2,905.00	2,386.00	2,563.00	2,890.00	2,739.00	2,220.00	2,397.00	2,701.00	2,878.00	2,736.00	3,051.00	4,105.00	4,586.00
	MUDLAKE4 230 -- BENTON 4 230	BLUE LK3 345 -- HELNASS3 345	MUDLAKE4 230 -- BENTON 4 230	CHIS CO3 345 -- KOLMNLK3 345	CHIS CO3 345 -- KOLMNLK3 345	MUDLAKE4 230 -- BENTON 4 230	CANBY 7 115 -- GRANITF7 115	CHIS CO3 345 -- KOLMNLK3 345	CHIS CO3 345 -- KOLMNLK3 345	BLUE LK4 230 -- MCLEOD 4 230	CHIS CO3 345 -- KOLMNLK3 345	BLUE LK3 345 -- HELNASS3 345	None
	3842.2	3977	3714.1	4872.5	4356.3	4529.2	3981.6	5773.5	5105.8	3867	5953.2	5736.3	6000
$	239.96	262.50	251.03	281.87	276.22	181.46	265.43	235.61	264.69	259.29	310.86	414.85	214.28
	8.26%	11.00%	9.79%	9.75%	10.08%	8.17%	11.07%	8.72%	9.20%	9.48%	10.19%	10.11%	4.67%
$	102.60	37.24	102.60	72.20	72.20	102.60	18.86	72.20	72.20	87.40	72.20	37.24	Max Value
	3.53%	1.56%	4.00%	2.50%	2.64%	4.62%	0.79%	2.67%	2.51%	3.19%	2.37%	0.91%	Max Value
	AS KING3_345 -- EAU CL 3_345	AS KING3_345 -- EAU CL 3_345	MCLEOD 4_230 -- PANTHER4_230	AS KING3_345 -- EAU CL3_345	AS KING3_345 -- EAU CL 3_345	AS KING3_345 -- EAU CL 3_345	None	AS KING3_345 -- EAU CL 3_345	COON CK3_345 -- TERMINL3_345	LIME CK5_161 -- ADAMS_S5_161	None	None	None
	2198.3	2099.4	3666.7	1811.3	2060.4	1698.5	3397.7	1979.1	4247.9	3616.9	4780.9	4933.3	5458.3
$	155	154	272	124	128	120	200	141	307	276	318	225	246
	5.4%	6.5%	10.6%	4.3%	4.7%	5.4%	8.4%	5.2%	10.7%	10.1%	10.4%	5.5%	5.4%
$	19	19	54	19	19	19	Max Value	19	27	24	Max Value	Max Value	Max Value
	0.7%	0.8%	2.1%	0.7%	0.7%	0.9%	Max Value	0.7%	0.9%	0.9%	Max Value	Max Value	Max Value
	None	None	MNVLTAP4_230 -- PANTHER4_230	None	None	None	None	None	None	None	None	None	None
	6000	6000	5603.2	6000	6000	6000	6000	5591.9	6000	6000	6000	6000	6000
$	278	207	265	132	106	99	109	64	226	211	67	67	65
	9.58%	8.66%	10.36%	4.56%	3.85%	4.46%	4.54%	2.36%	7.86%	7.70%	2.19%	1.63%	1.41%
	Max Value	Max Value	57	Max Value	Max Value	Max Value	Max Value	Max Value	Max Value	Max Value	Max Value	Max Value	Max Value
			2.22%										
	None		None	None					None				None
	2037.5		2262.7	2705.6					2361.5				2894.3
$	257		270	235					245				175
	8.9%		10.5%	8.1%					8.5%				3.8%
	Max Value		Max Value	Max Value					Max Value				Max Value
	Max Value		Max Value	Max Value					Max Value				Max Value
	None		BLUE LK4_230 -- MCLEOD 4 230	None					None				None
	3000		2785.5	3000					3000				2985.8
$	185		243	103					91				47
	6.4%		9.5%	3.6%					3.2%				1.0%
	Max Value		87	Max Value					Max Value				Max Value
	Max Value		3.4%	Max Value					Max Value				Max Value
	None		None	None					None				None
	3000		3000	3000					3000				2984
$	126		114	126					114				104
	4.3%		4.5%	4.4%					3.9%				2.3%
	Max Value		Max Value	Max Value					Max Value				Max Value
	None		PR ISLD3_345 -- NROC 345_345	AS KING3_345 -- EAU CL 3_345					None				None
	1439.7		1566.8	1597.6					1534.2				2535.1
$	277		289	163					305				225
	9.5%		11.3%	5.7%					10.6%				4.9%
	Max Value		268,179	19					Max Value				Max Value
	Max Value		10463.5%	0.7%					Max Value				Max Value
	AS KING3_345 -- EAU CL 3_345		None	AS KING3_345 -- EAU CL 3_345					None				None
	2380.3		3000	1790.5					3000				3000
$	132		274	94					206				146
	4.5%		10.7%	3.3%					7.2%				3.2%
$	19		Max Value	Max Value					Max Value				Max Value
	0.7%		Max Value	Max Value					Max Value				Max Value
	AS KING3_345 -- EAU CL 3_345		None	None					None				None
	2590.8		3000	3000					3000				3000
$	198		214	237					187				174
	6.8%		8.4%	8.2%					6.5%				3.8%
	Max Value		Max Value	Max Value					Max Value				Max Value
	Max Value		Max Value	Max Value					Max Value				Max Value

	BLUE LK4_230 -- MCLEOD 4_230	BLUE LK4_230 -- MCLEOD 4_230	BLUE LK4_230 -- MCLEOD 4_230	None	None	None	None	None	None	BLUE LK4_230 -- MCLEOD 4_230	None	None	None
	5528.7	5101.8	5085.7	6000	6000	6000	6000	6000	6000	4899.2	6000	6000	6000
$	307	267	275	147	234	167	248	111	235	252	111	109	95
	10.6%	11.2%	10.7%	5.1%	8.6%	7.5%	10.3%	4.1%	8.2%	9.2%	3.6%	2.7%	2.1%
$	87	87	87	Max Value	Max Value	Max Value	Max Value	Max Value	87	87	Max Value	Max Value	Max Value
	3.0%	3.7%	3.4%	Max Value	Max Value	Max Value	Max Value	Max Value	Max Value	3.2%	Max Value	Max Value	Max Value
	AS KING3_345 -- EAU CL 3_345	AS KING3_345 -- EAU CL 3_345	CANBY 7_115 -- GRANITF7_115	AS KING3_345 -- EAU CL3_345	AS KING3_345 -- EAU CL3_345	AS KING3_345 -- EAU CL3_345	PR ISLD3_345 -- NROC 345_345	AS KING3_345 -- EAU CL3_345	None	MCLEOD 4_230 -- PANTHER4_230	None	None	None
	2859.2	2710.1	4601.4	2490.4	2583.2	2326.5	3916.7	2668.5	4914.6	4724.3	5318.7	5371.7	5743.2
$	160	155	280	148	151	148	216	146	288	270	323	225	255
	5.5%	6.5%	10.9%	5.1%	5.5%	6.7%	9.0%	5.4%	10.0%	9.9%	10.6%	5.5%	5.6%
$	19	19	19	19	19	19	54	19	Max Value	54	Max Value	Max Value	Max Value
	0.7%	0.8%	0.7%	0.7%	0.7%	0.9%	2.3%	0.7%	Max Value	2.0%	Max Value	Max Value	Max Value
	WAHPETN4_230 -- MAPLE R4_230	None	HANKSON4_230 -- FORMAN 4_230	None	None	None	None	None	None	None	None	None	None
	5827.2	6000	6000	6000	6000	6000	5896.8	5775.8	6000	5859.1	6000	6000	6000
$	206	134	261	93	144	83	93	81	260	135	82	67	62
	7.1%	5.6%	10.2%	3.2%	5.2%	3.8%	3.9%	3.0%	9.0%	4.9%	2.7%	1.6%	116090.7%
$	103	Max Value	55	Max Value	Max Value	Max Value	Max Value	Max Value	Max Value	Max Value	Max Value	Max Value	Max Value
	3.5%	Max Value	2.1%	Max Value	Max Value	Max Value	Max Value	Max Value	Max Value	Max Value	Max Value	Max Value	Max Value
	None		None	None					None				None
	2369.7		2461	3000					2287.3				3000
$	220		220	178					213				112
	7.6%		8.6%	6.2%					7.4%				2.4%
	Max Value		Max Value	Max Value					Max Value				Max Value
	Max Value		Max Value	Max Value					Max Value				Max Value
	None		None	None					None				None
	3000		3000	3000					3000				3000
$	115		211	63					83				44
	4.0%		8.2%	2.2%					2.9%				1.0%
	Max Value		Max Value	Max Value					Max Value				Max Value
	None		Max Value	Max Value					Max Value				Max Value
	None		None	None					None				None
	2847.7		3000	3000					3000				3000
$	230		114	126					114				104
	7.9%		4.4%	4.4%					3.9%				2.3%
	Max Value		Max Value	Max Value					Max Value				Max Value
	Max Value		Max Value	Max Value					Max Value				Max Value
	None		None	AS KING3_345 -- EAU CL 3_345					None				None
	1849.9		2028.6	2125.1					2041.2				3000
$	233		288	171					290				199
	8.0%		11.2%	5.9%					10.1%				4.3%
	Max Value		Max Value	Max Value					Max Value				Max Value
	Max Value		Max Value	Max Value					Max Value				Max Value
	None		None	AS KING3_345 -- EAU CL 3_345					None				None
	3000		3000	2402.2					3000				3000
$	158		245	114					145				96
	5.4%		9.6%	3.9%					5.0%				2.1%
	Max Value		Max Value	Max Value					Max Value				Max Value
	Max Value		Max Value	Max Value					Max Value				Max Value
	None		None	None					None				None
	3000		3000	2772.2					3000				3000
$	102		184	217					184				143
	3.5%		7.2%	7.5%					6.4%				3.1%
	Max Value		Max Value	Max Value					Max Value				Max Value
	Max Value		Max Value	Max Value					Max Value				Max Value

	2abe	2abf	2abg	2acd	2ace	2acf	2acg	2abcf	2abcg	2abfg	2abcfg	2acdefg	2abcdefg
ROSEAUN2_500 -- DORSEY 2_500	DORSEY 2_500 -- DORSEYM4_230	DORSEY 2_500 -- DORSY2M4_230	DORSEY 2_500 -- DORSY2M4_230	ROSEAUN2_500 -- DORSEY 2_500	ROSEAUN2_500 -- DORSEY 2_500	DORSEY 2_500 -- DORSY2M4_230	FORBES 2_500 -- CHIS-N 2_500	ROSEAUN2_500 -- DORSEY 2_500	DORSEY 2_500 -- DORSY2M4_230	FORBES 2_500 -- CHIS-N 2_500	DORSEY 2_500 -- DORSY2M4_230	ROSEAUN2_500 -- DORSEY 2_500	None
,056	2,905	2,386	2,563	2,890	2,739	2,220	2,397	2,701	2,878	2,736	3,051	4,105	4,586
133.3	2921.5	2615.3	1963.9	2546.8	2147.6	2423.1	1369.3	3148.5	2997.5	2203.2	3217.9	2492.3	4077.8
30.32	106.53	70.56	31.22	3.99	18.23	No Transfer	0.47	35.47	66.57	0.34		26.21
3.28%	3.67%	2.96%	1.22%	0.14%	0.67%	0.00%	#VALUE!	0.02%	1.23%	2.43%	0.01%	0.00%	0.57%
266.8	AS KING3_345 -- EAU CL 3_345	AS KING3_345 -- EAU CL 3_345	FORBES 2_500 -- CHIS-N 2_500	AS KING3_345 -- EAU CL 3_345	AS KING3_345 -- EAU CL 3_345	AS KING3_345 -- EAU CL 3_345	FORBES 2_500 -- CHIS-N 2_500	AS KING3_345 -- EAU CL 3_345	FORBES 2_500 -- CHIS-N 2_500	FORBES 2_500 -- CHIS-N 2_500	FORBES 2_500 -- CHIS-N 2_500	None	
2265.5	2108.5	2843.4	1880.7	2066.5	1703.8	2819	2038.2	3153.8	3357	3943	4933.3	5458.3
16.20	155.45	154.25	222.54	123.84	128.19	120.38	166.39	141.13	209.03	200.92	234.09	224.65	246.14
4.78%	5.35%	6.46%	8.68%	4.29%	4.68%	5.42%	6.94%	5.23%	7.26%	7.34%	7.67%	5.47%	5.37%
6000	None	None	MNVLTAP4_230 -- PANTHER4_230	None	None	None	None	None	None	None	None	None	None
6000	6000	6000	6000	6000	6000	6000	5591.9	6000	6000	6000	6000
51.55	278.31	206.67	265.48	131.70	105.55	99.01	108.80	63.87	226.14	210.76	66.79	66.79	64.58
5.29%	9.58%	8.66%	10.36%	3.85%	4.46%	4.54%	2.36%	7.86%	7.70%	2.19%	1.63%	1.41%
1669	CHIS CO2_500 -- CHIS-N 2_500	FORBES 2_500 -- CHIS-N 2_500	DORSEY 2_500 -- DORSY2M4_230					FORBES 2_500 -- CHIS-N 2_500				DORSEY 2_500 -- DORSY2M4_230	
1256.4	1372.4	1425.9	1480.9	1828.1
92.66	137.96	154.97	65.76	175.13	77.47
3.03%	4.75%	6.05%	2.28%	6.09%	1.69%
155.2	None	BLUE LK4_230 -- MCLEOD 4_230	ROSEAUN2_500 -- ROSEAUS2_500					None				None	
3000	2790.7	2739.8	3000	3000
94.64	184.94	242.65	63.02	90.80	47.32
8.10%	6.37%	9.47%	2.18%	3.16%	1.03%
3000	None	None	None					None				None	
3000	3000	3000	3000	3000
25.79	125.79	114.09	125.79	113.50	103.56
4.12%	4.33%	4.45%	4.35%	3.94%	2.26%
502.1	ROSEAUN2_500 -- DORSEY 2_500	ROSEAUN2_500 -- DORSEY 2_500	ROSEAUN2_500 -- DORSEY 2_500					ROSEAUN2_500 -- DORSEY 2_500				ROSEAUN2_500 -- DORSEY 2_500	
1060.3	885.2	1127.1	972.6	1974.2
50.79	171.73	114.59	70.19	114.98	105.67
5.26%	5.91%	4.47%	2.43%	3.99%	2.30%
289.1	AS KING3_345 -- EAU CL 3_345	None	AS KING3_345 -- EAU CL 3_345					None				None	
2395.8	3000	1805.5	3000	3000
17.54	131.50	274.33	94.39	206.16	145.85
4.17%	4.53%	10.70%	3.27%	7.16%	3.18%
508.6	AS KING3_345 -- EAU CL 3_345	None	None					None				None	
2627.5	3000	2572.2	3000	3000
11.03	197.68	214.37	236.94	186.63	174.47
7.89%	6.80%	8.36%	8.20%	6.48%	3.80%

		BLUE LK4_230 -- MCLEOD 4_230	BLUE LK4_230 -- MCLEOD 4_230	BLUE LK4_230 -- MCLEOD 4_230	None	None	None	FORBES 2_500 -- CHIS-N 2_500	None	None	BLUE LK4_230 -- MCLEOD 4_230	None	None	None
881.2	5548.1	5110.3	5119.4	6000	6000	6000	5849.8	6000	4910.2	6000	6000	6000
95.07	306.60	267.02	275.40	146.69	234.24	167.15	239.58	110.88	235.20	251.82	110.88	108.85	94.62
9.66%	10.55%	11.19%	10.75%	5.08%	8.55%	7.53%	9.99%	4.10%	8.17%	9.20%	3.63%	2.65%	2.06%
872.7	AS KING3_345 -- EAU CL 3_345	AS KING3_345 -- EAU CL 3_345	CANBY 7_115 -- GRANITF7_115	AS KING3_345 -- EAU CL 3_345	AS KING3_345 -- EAU CL 3_345	AS KING3_345 -- EAU CL 3_345	PR ISLD3_345 -- NROC 345_345	AS KING3_345 -- EAU CL 3_345	None	MCLEOD 4_230 -- PANTHER4_230	None	None	None
2881.9	2728.5	4613.9	2502.5	2689.1	2346.4	3926.2	2673.2	4914.6	4766.2	5318.7	5371.7	5743.2
16.20	159.74	154.51	279.64	147.95	150.72	147.82	215.96	146.33	287.98	270.27	322.91	224.52	254.64
4.78%	5.50%	6.48%	10.91%	5.12%	5.50%	6.66%	9.01%	5.42%	10.01%	9.88%	10.58%	5.47%	5.55%
849.7	WAHPETN4_230 -- MAPLE R4_230	None	HANKSON4_230 -- FORMAN 4_230	None	None	None	None	None	None	None	None	None	None
5851.3	6026.4	6000	6000	6000	5896.8	5775.8	6000	5859.1	6000	6000	6000
37.92	206.18	134.12	261.12	92.70	143.58	83.47	92.57	80.54	260.09	135.29	81.71	67.31	62.31
2.88%	7.10%	5.62%	10.19%	3.21%	5.24%	3.76%	3.86%	2.98%	9.04%	4.94%	2.68%	1.64%	1.36%
931.9	None	None	None	None				None			None			None
2369.7	2461	2943.4	2287.3	3000
09.64	219.57	219.82	177.79	212.53	111.95
6.86%	7.56%	8.58%	6.15%	7.38%	2.44%
3000	None	None	None					None				None	
3000	3000	3000	3000	3000
18.65	115.30	210.99	63.02	83.17	44.22
4.54%	3.97%	8.23%	2.18%	2.89%	0.96%
684.9	None	None	None					None				None	
2847.7	3000	3000	3000	3000
16.33	229.98	113.50	125.79	113.50	103.56
7.08%	7.92%	4.43%	4.35%	3.94%	2.26%
198.3	None	None	AS KING3_345 -- EAU CL 3_345					None				None	
1849.9	2028.6	2128.2	2041.2	3000
52.01	232.52	287.61	170.89	290.39	198.85
7.92%	8.00%	11.22%	5.91%	10.09%	4.34%
3000	None	None	AS KING3_345 -- EAU CL 3_345					None				None	
3000	3000	2402.7	3000	3000
16.26	157.87	244.87	114.13	144.91	95.88
3.80%	5.43%	9.55%	3.95%	5.04%	2.09%
3000	None	None	None					None				None	
3000	3000	2772.2	3000	3000
25.79	101.80	183.95	216.92	183.95	143.47
4.12%	3.50%	7.18%	7.51%	6.39%	3.13%

Graphs:

Graph 1 – Summary of transfer capability for nine transmission scenarios for the Twin Cities Sink with the pocket sources under the Max Interface scenario.

Each bar represents the estimated transfer capability for each transmission option for the given assumptions.
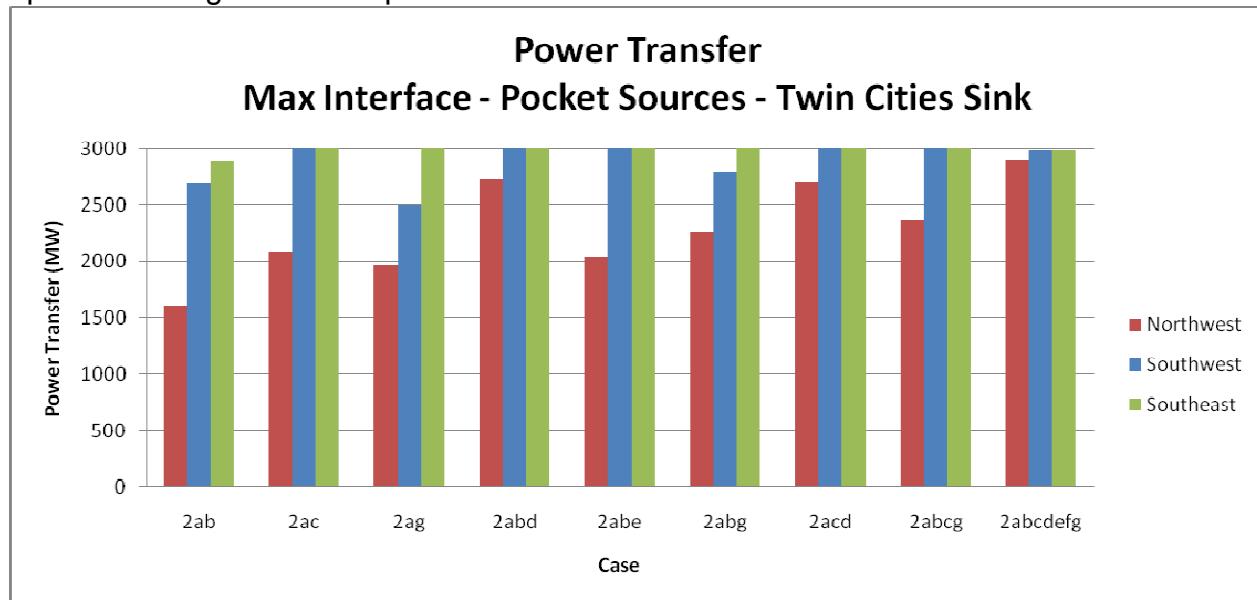
Graph 2 – Summary of transfer capability for nine transmission scenarios for the Midwest ISO Sink with the pocket sources under the Max Interface scenario.

Each bar represents the estimated transfer capability for each transmission option for the given assumptions.
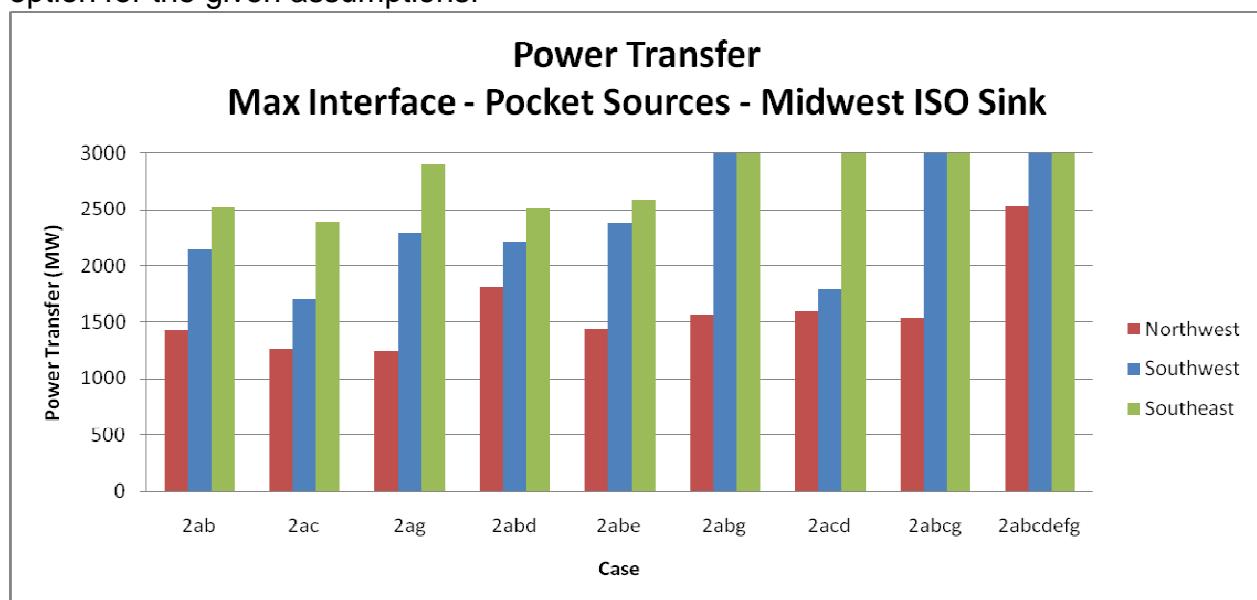
Graph 3 – Summary of transfer capability for nine transmission scenarios for the Twin Cities Sink with the pocket sources under the Historical Interface scenario.

Each bar represents the estimated transfer capability for each transmission option for the given assumptions.
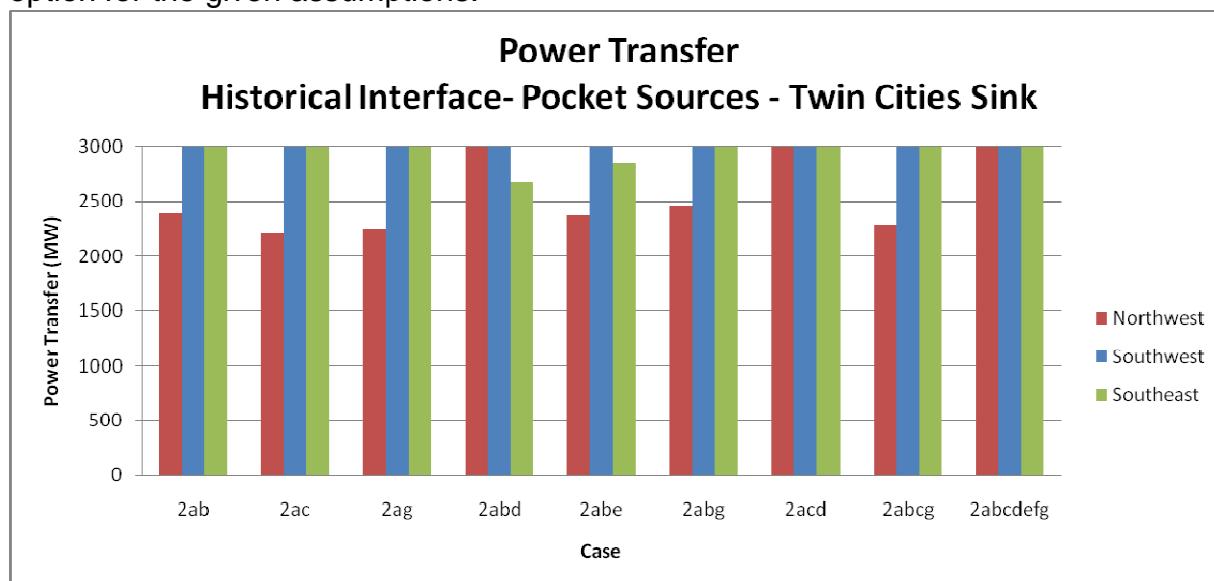
Graph 4 – Summary of transfer capability for nine transmission scenarios for the Midwest ISO Sink with the pocket sources under the Historical Interface scenario.

Each bar represents the estimated transfer capability for each transmission option for the given assumptions.
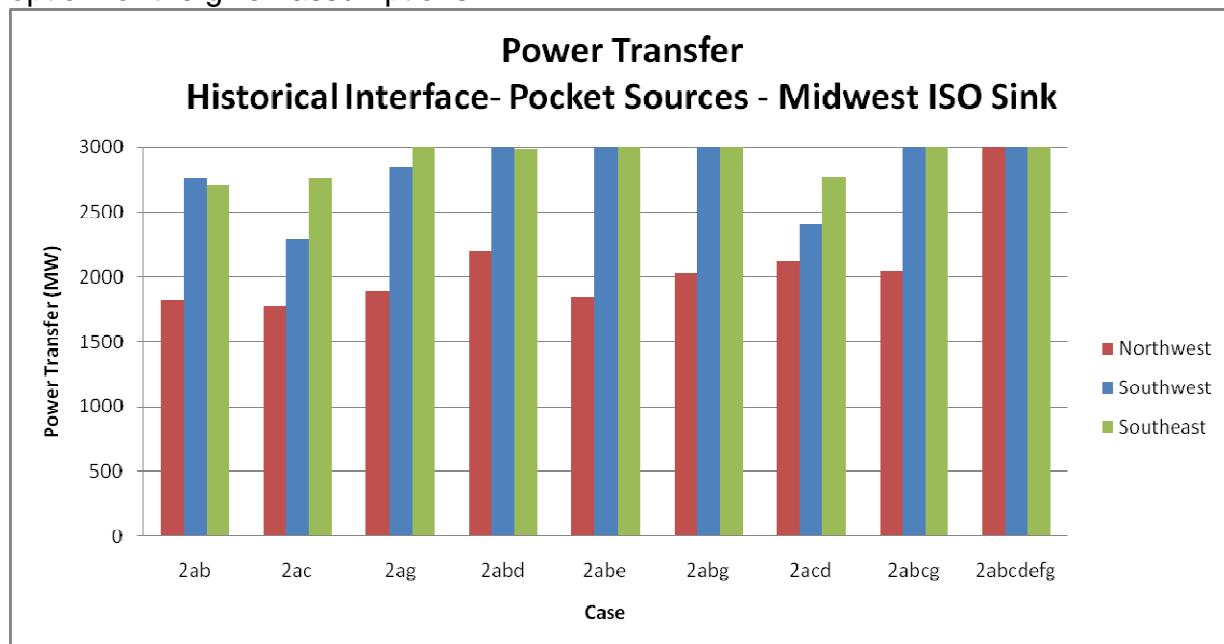
Graph 5 – Summary of transfer capability for each transmission scenario given the sink for all sources combined under the Max Interface scenario.
A component was chosen as a limiter in this graph if it caused an overload on the 500 kV line. Each bar represents the estimated transfer capability for each transmission option for the given assumptions.
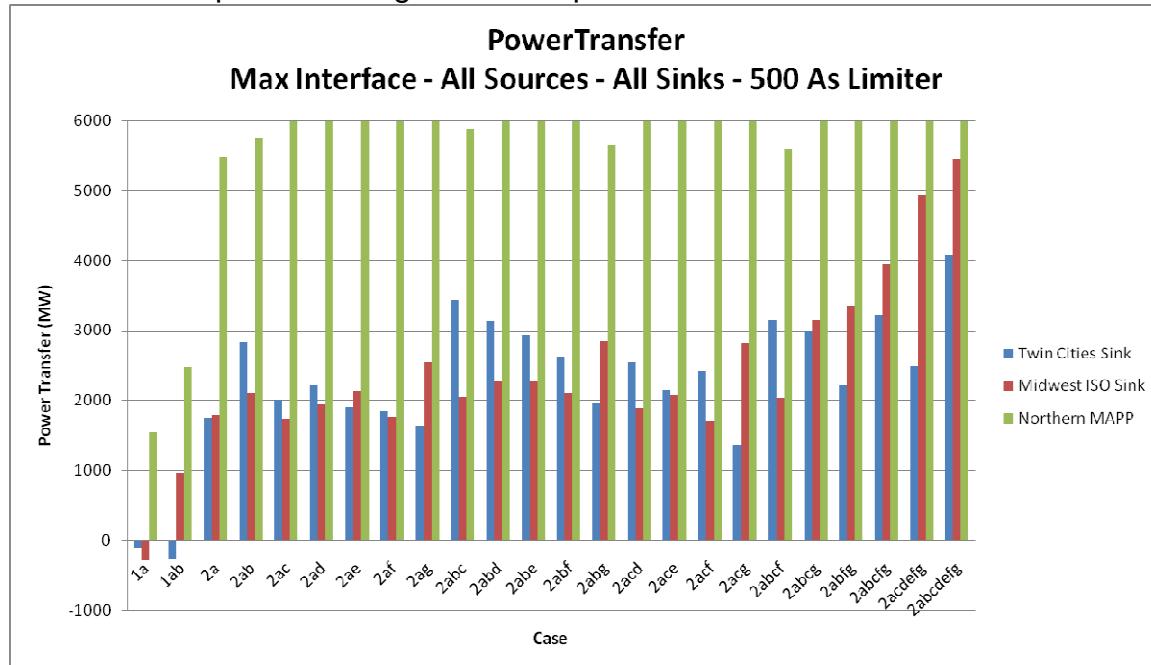
Graph 6 – Summary of transfer capability for each transmission scenario given the sink for all sources combined under the Historical Interface scenario.

A component was chosen as a limiter in this graph if it caused an overload on the 500 kV line. Each bar represents the estimated transfer capability for each transmission option for the given assumptions.
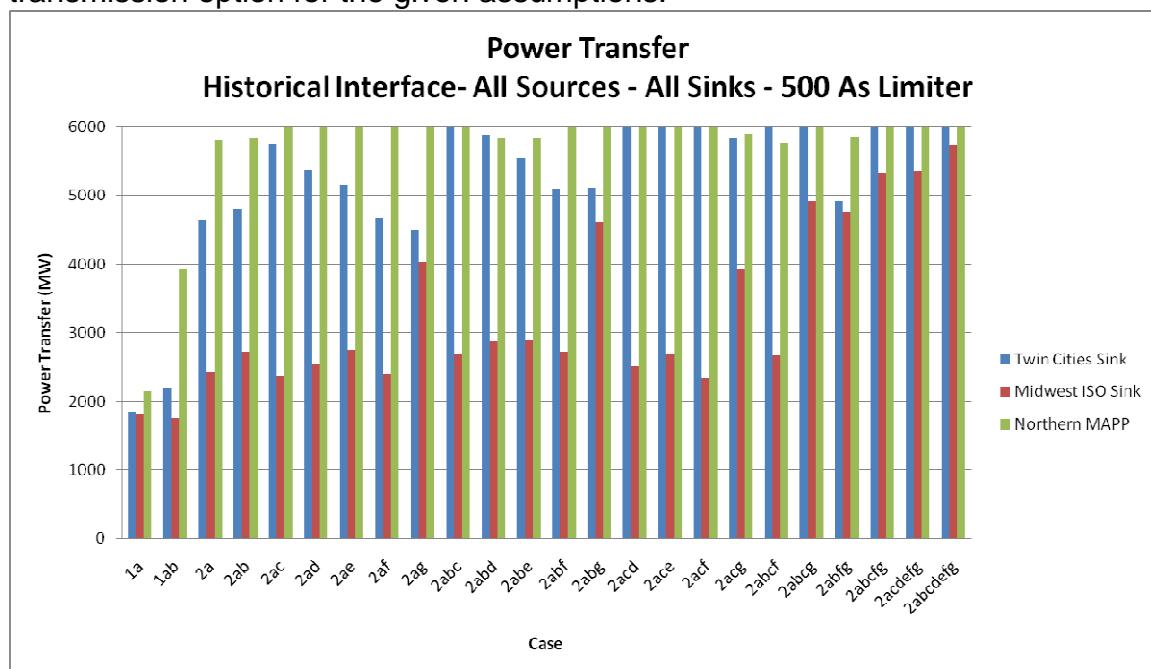
Graph 7 – Summary of transfer capability for nine transmission scenarios for the Twin Cities Sink with the pocket sources under the Max Interface scenario.

A component was chosen as a limiter in this graph if it caused an overload on the 500 kV line. Each bar represents the estimated transfer capability for each transmission option for the given assumptions.
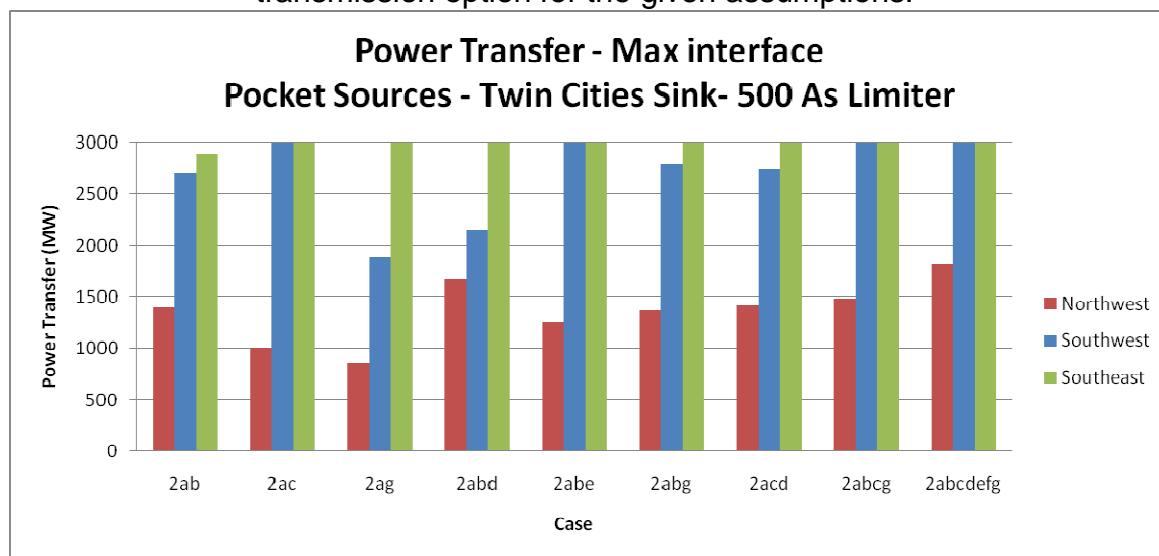
Graph 8 – Summary of transfer capability for nine transmission scenarios for the Midwest ISO Sink with the pocket sources under the Max Interface scenario.

A component was chosen as a limiter in this graph if it caused an overload on the 500 kV line. Each bar represents the estimated transfer capability for each transmission option for the given assumptions.
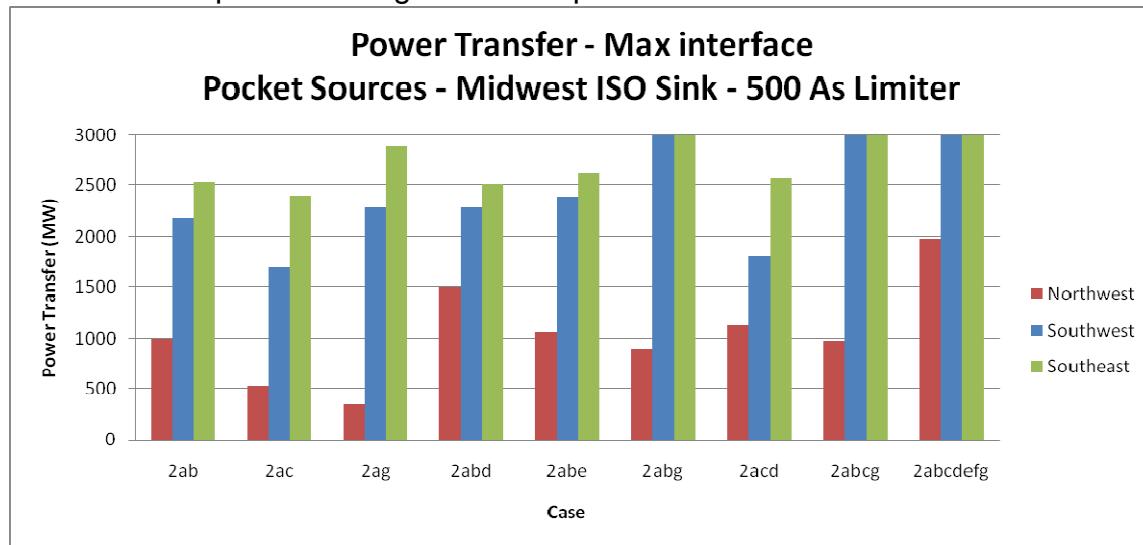
Graph 9 – Summary of transfer capability for nine transmission scenarios for the Twin Cities Sink with the pocket sources under the Historical Interface scenario.

A component was chosen as a limiter in this graph if it caused an overload on the 500 kV line. Each bar represents the estimated transfer capability for each transmission option for the given assumptions.
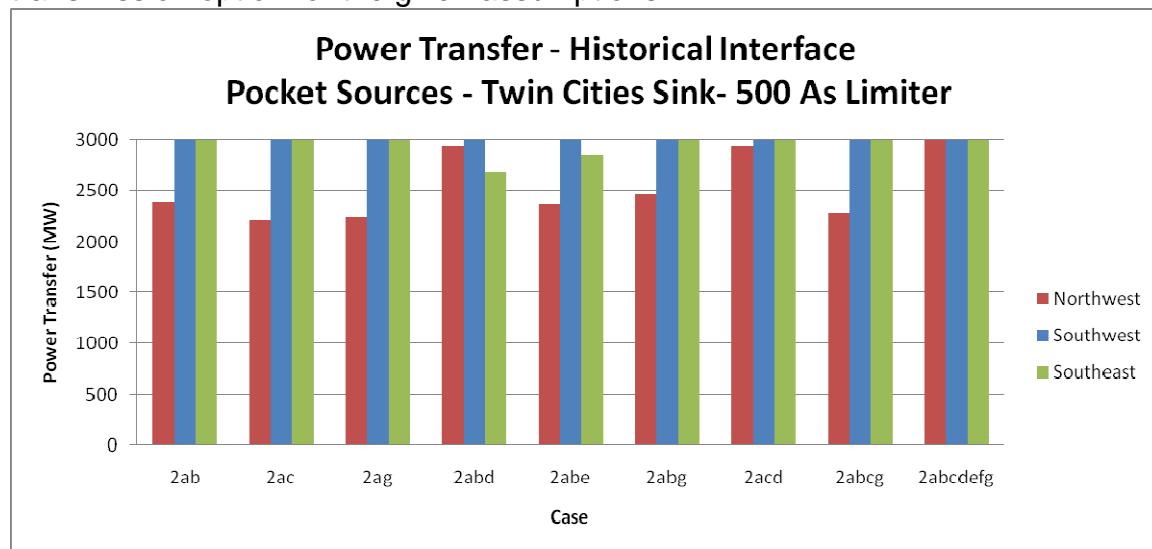
Graph 10 – Summary of transfer capability for nine transmission scenarios for the Midwest ISO Sink with the pocket sources under the Historical Interface scenario.

A component was chosen as a limiter in this graph if it caused an overload on the 500 kV line. Each bar represents the estimated transfer capability for each transmission option for the given assumptions.
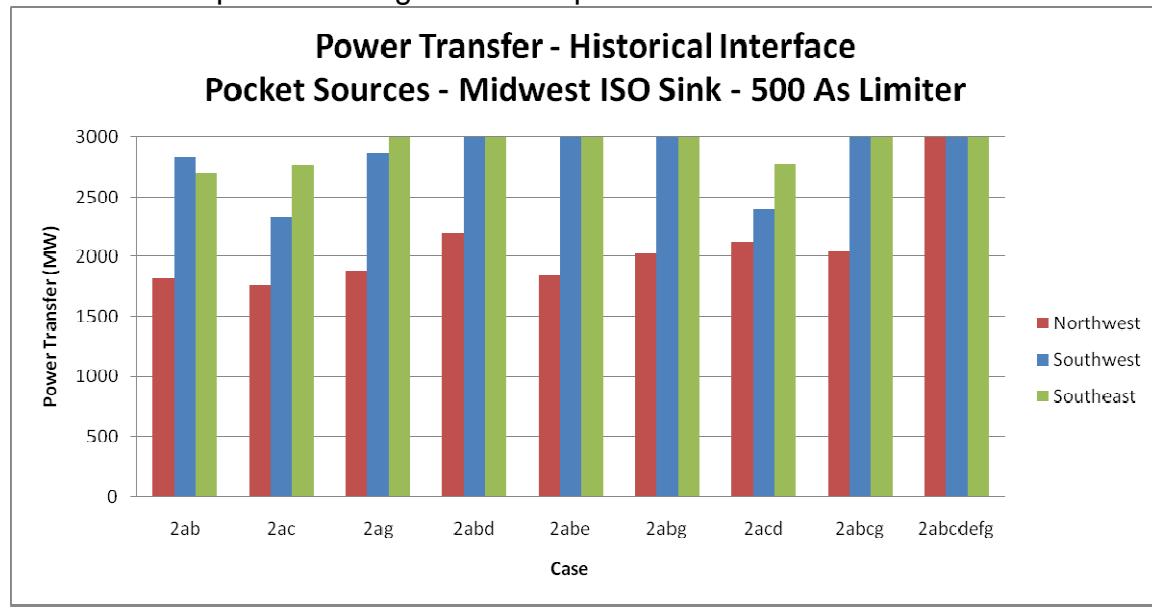
Appendix E - Monitor, Contingency and Subsystem files for PSS™E MUST

com MTO Monitored Element Description File – 2016 CVS Study
com +++++++++++++++++++++
com Thermal
com +++++++++++++++++++++
COM Redefine PTDF (0.05 = 5%) and OTDF (0.03 = 3%) Cutoff
COM values to skip reporting monitored elements impacted
COM by the transfer study below these values
COM
COM
COM DEFINING BRANCHES TO BE MONITORED
COM
MONITOR BRANCHES IN SUBSYSTEM 'MTO-MON' KVRANGE 100 999
END
COM
COM DEFINING TIES TO BE MONITORED
COM
MONITOR TIES FROM AREA 680 IN KVRANGE 100 999
MONITOR TIES FROM AREA 667 IN KVRANGE 100 999
MONITOR TIES FROM AREA 652 IN KVRANGE 100 999
MONITOR TIES FROM AREA 626 IN KVRANGE 100 999
MONITOR TIES FROM AREA 618 IN KVRANGE 100 999
MONITOR TIES FROM AREA 613 IN KVRANGE 100 999
MONITOR TIES FROM AREA 608 IN KVRANGE 100 999
MONITOR TIES FROM AREA 600 IN KVRANGE 100 999
MONITOR TIES FROM AREA 331 IN KVRANGE 100 999
END
COM
COM DEFINING A VOLTAGE BAND FOR MONITORING VOLTAGE VIOLATION
COM
MONITOR VOLTAGE RANGE SUBSYSTEM 'MTO-MON' kvrange 100 999 0.9 1.05
END
COM
COM The following defines voltage drop and voltage rise
COM deviation threshold to check voltage changes of
COM monitored buses in contingency case from their
COM base case values. For this study we do not need it!
COM MONITOR VOLTAGE DEVIATION SUBSYSTEM 'MTO-MON' r [r]
COM
COM
COM REDEFINING RATING MULTIPLIERS
COM The example below shows the redefinition of the default
COM ratings A and B as set in the MUST Options, i.e., base case
COM and contingent ratings. In general, it defines a default
COM of 100% (A) for base case and 100% (B) for contingent ratings.
COM Then, for area 151 it defines rating A with the 120%
COM multiplier as the contingent rating. Further, for
COM areas 300-400 it reduces the base case ratings to
COM 98% of A and the contingent ratings to 95% of B.
COM
COM RATING MULTIPLIERS
COM Areas 1 999 A 100 B 100
COM Area 151 A 100 A 120 / the second definition will overwrite
COM / the previous definition for that area
COM Areas 300 400 A 98 B 95
COM End
COM
END
END

COM Subsystem File For MTO 2016 CVS

SUBSYSTEM 'MTO-SOURCE'
  BUS 60394 /* Yankee
  BUS 60393 /* Fenton
  BUS 60171 /* Lyon Co,
  BUS 60287 /* Nobles,

```
BUS 60382   /* Brookings
BUS 66551   /* Granite Falls
BUS 66555   /* Morris
BUS 63214   /* Big Stone
BUS 34014   /* Adams
BUS 63070   /* Pleasant Valley
BUS 61948   /* Byron
BUS 66754   /* Maple River
BUS 63327   /* Hankinson
BUS 62531   /* Inman
BUS 60384   /* West Faribault
BUS 67470   /* Jackson
BUS 66708   /* Karlstad
BUS 60126   /* Split Rock
   PARTICIPATE
        BUS 60394 3.0  /* Yankee
        BUS 60393 3.0  /* Fenton
        BUS 60171 6.5  /* Lyon Co
        BUS 60287 4.5  /* Nobles
        BUS 60382 9.0  /* Brookings
        BUS 66551 6.5  /* Granite Falls
        BUS 66555 4.5  /* Morris
        BUS 63214 6.5  /* Big Stone
        BUS 34014 6.5  /* Adams
        BUS 63070 6.5  /* Pleasant Valley
        BUS 61948 9.0  /* Byron
        BUS 66754 4.5  /* Maple River
        BUS 63327 7.5  /* Hankinson
        BUS 62531 6.5  /* Inman
        BUS 60384 4.5  /* West Faribault
        BUS 67470 4.5  /* Jackson
        BUS 66708 2.0  /* Karlstad
        BUS 60126 5.0  /* Split Rock
    END
END

Subsystem 'MTO-SE'
  BUS 34014   /* Adams
  BUS 63070   /* Pleasant Valley
  BUS 61948   /* Byron
  BUS 60384   /* West Faribault

    PARTICIPATE
        BUS 34014 24.5  /* Adams
        BUS 63070 24.5  /* Pleasant Valley
        BUS 61948 34  /* Byron
        BUS 60384 17  /* West Faribault
    END
END

Subsystem 'MTO-SW'
  BUS 60394   /* Yankee
  BUS 60393   /* Fenton
  BUS 60171   /* Lyon Co,
  BUS 60287   /* Nobles,
  BUS 60382   /* Brookings
  BUS 66551   /* Granite Falls
  BUS 67470   /* Jackson
  BUS 60126   /* Split Rock
   PARTICIPATE
        BUS 60394 7.1  /* Yankee
        BUS 60393 7.1  /* Fenton
        BUS 60171 15.5  /* Lyon Co
        BUS 60287 10.7  /* Nobles
        BUS 60382 21.4  /* Brookings
        BUS 66551 15.5  /* Granite Falls
        BUS 67470 10.7  /* Jackson
        BUS 60126 12  /* Split Rock
    END
END
```

Subsystem 'MTO-NW'
  BUS 66555 /* Morris
  BUS 63214 /* Big Stone
  BUS 66754 /* Maple River
  BUS 63327 /* Hankinson
  BUS 62531 /* Inman
  BUS 66708 /* Karlstad
    PARTICIPATE
        BUS 66555 14.3 /* Morris
        BUS 63214 20.6 /* Big Stone
        BUS 66754 14.3 /* Maple River
        BUS 63327 23.8 /* Hankinson
        BUS 62531 20.6 /* Inman
        BUS 66708 6.4 /* Karlstad
    END
END

SUBSYSTEM 'MTO-SINK1'
  BUS 60012 /* Black Dog
  BUS 60013 /* Black Dog
  BUS 60006 /* King
  BUS 60000 /* Sherco 1
  BUS 60001 /* Sherco 2
  BUS 60002 /* Sherco 3?
  BUS 60003 /* Prairie Island
    PARTICIPATE
        BUS 60012 5.0   /* Black Dog
        BUS 60013 5.0   /* Black Dog
        BUS 60006 15.0   /* King
        BUS 60000 19.0   /* Sherco 1
        BUS 60001 19.0   /* Sherco 1
        BUS 60002 23.0   /* Sherco 1
        BUS 60003 14.0   /* Prairie Island
    END
END

SUBSYSTEM ALTE
        AREA 364 / ALTE
END

SUBSYSTEM AMEREN
        AREA 356 / AMEREN
END

SUBSYSTEM FE
        AREA 202 / FE
END

SUBSYSTEM METC
        AREA 218 / METC
END

SUBSYSTEM WE
        AREA 365 / WE
END

SUBSYSTEM 'MTO-SINK2'
        AREA 364
        AREA 356
        AREA 202
        AREA 218
        AREA 365
                PARTICIPATE
                SUBSYSTEM AMEREN 20.0
                SUBSYSTEM FE 10.0
                SUBSYSTEM METC 20.0
                SUBSYSTEM WE 25.0
                SUBSYSTEM ALTE 25.0

```
        END
END
SUBSYSTEM 'MTO-SINK3'
   BUS 60012  /* Black Dog
   BUS 60013  /* Black Dog
   BUS 60006  /* King
   BUS 60000  /* Sherco 1
   BUS 60001  /* Sherco 2
   BUS 60002  /* Sherco 3?
   BUS 60003  /* Prairie Island
   BUS 67103  /* Antelope Valley
   BUS 67110  /* Leland Olds
   BUS 67315   /* Coyote
   BUS 61775   /* Boswell
     PARTICIPATE
           BUS 60012 5.0   /* Black Dog
           BUS 60013 5.0   /* Black Dog
           BUS 60006 7.0   /* King
           BUS 60000 9.0   /* Sherco
           BUS 60001 9.0   /* Sherco
           BUS 60002 9.0   /* Sherco
           BUS 60003 6.0   /* Prairie Island
           BUS 67103 15.0  /* Antelope Valley
           BUS 67110 15.0  /* Leland Olds
           BUS 67315 15.0  /* Coyote
           BUS 61775 5.0   /* Boswell
     END
END
SUBSYSTEM 'MTO-MON'
   JOIN 'GROUP 1'
   AREA 680  /* dairyland
   AREA 667  /* Manitoba hydro
   AREA 652  /* wapa
   AREA 626  /* otter tail
   AREA 618  /* GRE
   AREA 613  /* SMMPA
   AREA 608  /* Minnesota Power
   AREA 600  /* Xcel
   AREA 331  /* Alliant West
KVRANGE 100 999
   END
END
END




COM Main Contingency File for MTO CVS Study
COM 10-30-2008

DEFAULT DISPATCH
   SUBSYSTEM 'MTO-MON'
END

COM ------------------------------------------------------------------------
COM The WI,MI and NE areas were removed from the original
COM - jrn 10-30-08
COM ------------------------------------------------------------------------
SINGLE BRANCH IN AREA 680 IN KVRANGE 150 999
SINGLE TIES FROM AREA 680 IN KVRANGE 150 999
SINGLE UNIT IN AREA 680
SINGLE BRANCH IN AREA 667 IN KVRANGE 150 999
SINGLE TIES FROM AREA 667 IN KVRANGE 150 999
SINGLE UNIT IN AREA 667
SINGLE BRANCH IN AREA 652 IN KVRANGE 150 999
SINGLE TIES FROM AREA 652 IN KVRANGE 150 999
SINGLE UNIT IN AREA 652
SINGLE BRANCH IN AREA 626 IN KVRANGE 150 999
SINGLE TIES FROM AREA 626 IN KVRANGE 150 999
SINGLE UNIT IN AREA 626
```

```
SINGLE BRANCH IN AREA 618 IN KVRANGE 150 999
SINGLE TIES FROM AREA 618 IN KVRANGE 150 999
SINGLE UNIT IN AREA 618
SINGLE BRANCH IN AREA 613 IN KVRANGE 150 999
SINGLE TIES FROM AREA 613 IN KVRANGE 150 999
SINGLE UNIT IN AREA 613
SINGLE BRANCH IN AREA 608 IN KVRANGE 150 999
SINGLE TIES FROM AREA 608 IN KVRANGE 150 999
SINGLE UNIT IN AREA 608
SINGLE BRANCH IN AREA 600 IN KVRANGE 150 999
SINGLE TIES FROM AREA 600 IN KVRANGE 150 999
SINGLE UNIT IN AREA 600
SINGLE BRANCH IN AREA 331 IN KVRANGE 150 999
SINGLE TIES FROM AREA 331 IN KVRANGE 150 999
SINGLE UNIT IN AREA 331


INCLUDE  '\Canada\can-catergory-B_081105.con'
INCLUDE  '\Dakotas\daks-category-B_081105.con'

COM ------------------------------------------------------------------------
COM MN.con, MN-category-B_2008.con from the
COM DRG 42 sites directory - jrn 10-30-08
COM psse.con not applicable - jrn 11-17-08
COM ------------------------------------------------------------------------
COM INCLUDE  '\Minnesota\psse.con'
INCLUDE  '\Minnesota\MN.con'
INCLUDE  '\Minnesota\MN-category-B_2008.con'

INCLUDE  '\additional\capx-JasonS-bf.con'
INCLUDE  '\additional\CAPX-Riel-1765_2011_W-Hess.con'
INCLUDE  '\additional\RRV-xfmr.con'
COM ------------------------------------------------------------------------
COM commented out all class c contingencies from se-miso.con
INCLUDE  '\additional\se-miso.con'
COM ------------------------------------------------------------------------
COM CapX-double-outage.con contains all 345 double ciruit
COM outages for CAPX lines - jrn 10-30-08
COM ------------------------------------------------------------------------
INCLUDE  '\additional\CapX-double-outage.con'


COM ------------------------------------------------------------------------
COM commented out all class c contingencies from CorridorCreated.con
INCLUDE  '\additional\CorridorCreated.con'

END
```

```
COM '  D. Diakiw    August 11, 2005' – Canadian Contingency B file
COM ' '
COM '  >>>      '
COM ' '
COM ' MH Lines and transformers (HV) 115 kV and above including'
COM '   selected gen transformers '
COM ' '
COM '   See mh-excluded.con for missing lines, banks, and generators'
COM ' '
COM ' from original 2003 MAPP Series Year 2009 topology'
COM ' 'updated for MTEP-06 2011 case
COM ' '
COM ' '
COM '   TIES INCLUDED - DC REDUCTION TRIGGERS FOR EXPORT'
COM ' '
COM ---------------------------------------------------
COM Total Number of Category B Contingencies --- 210
COM ---------------------------------------------------
COM ---------------------------------------------------
COM Removed all transmission contingengies < 161kV
COM Removed all breaker contingengies that only trip one line < 161kV
COM - jrn  10-30-2008
COM ---------------------------------------------------
```

CONTINGENCY ' D602F '
/////////////////////////////////
/This contingency outages the Dorsey to Roseau 500 kV line
/According to the OP Guides, the power on the DC line should be
/reduced by 100% (1698 MW) in this event.
/MAG 11-21-08
/////////////////////////////////
COM 'TRIP 500 KV LINE D602F '
COM 67621 DOES NOT EXIST, THE LINE GOES STRAIGHT FROM
COM (MAG 11_18_08)
  TRIP LINE FROM BUS 67564 TO BUS 60173 CKT 1
COM   TRIP LINE FROM BUS 67564 TO BUS 67621 CKT 1
COM   TRIP LINE FROM BUS 67621 TO BUS 60173 CKT 1
  CHANGE BUS 67503 LOAD BY 1698 MW
END
CONTINGENCY ' A3R '
COM 'TRIP 230 KV LINE A3R '
  TRIP LINE FROM BUS 67511 TO BUS 67584 CKT 1
  TRIP LINE FROM BUS 67530 TO BUS 67584 CKT 1
  TRIP LINE FROM BUS 67579 TO BUS 67584 CKT 1
END
CONTINGENCY ' C28R '
COM 'TRIP 230 KV LINE C28R '
  TRIP LINE FROM BUS 67524 TO BUS 67704 CKT 1
  TRIP LINE FROM BUS 67525 TO BUS 67704 CKT 1
  TRIP LINE FROM BUS 67609 TO BUS 67704 CKT 1
END
CONTINGENCY ' D12C '
COM 'TRIP 230 KV LINE D12C '
  TRIP LINE FROM BUS 67503 TO BUS 67574 CKT 1
  TRIP LINE FROM BUS 67524 TO BUS 67574 CKT 1
END
CONTINGENCY ' D54C '
COM 'TRIP 230 KV LINE D54 '
  TRIP LINE FROM BUS 67503 TO BUS 67590 CKT 1
  TRIP LINE FROM BUS 67524 TO BUS 67590 CKT 1
END
CONTINGENCY ' G8P '
COM 'TRIP 230 KV LINE G8P '
  TRIP LINE FROM BUS 67508 TO BUS 67702 CKT 1
  TRIP LINE FROM BUS 67510 TO BUS 67702 CKT 1
END
CONTINGENCY ' P19W '
COM 'TRIP 230 KV LINE P19W '
  TRIP LINE FROM BUS 67506 TO BUS 67607 CKT 1
  TRIP LINE FROM BUS 67508 TO BUS 67607 CKT 1
END
CONTINGENCY ' P58C '
COM 'TRIP 230 KV LINE P58C '
  TRIP LINE FROM BUS 67515 TO BUS 67752 CKT 1
  TRIP LINE FROM BUS 67585 TO BUS 67728 CKT 1
  TRIP LINE FROM BUS 67585 TO BUS 67754 CKT 1
  TRIP LINE FROM BUS 67752 TO BUS 67754 CKT 1
COM 67753 IS NO LONGER IN THE SYSTEM (MAG 11_18_08)
COM   TRIP LINE FROM BUS 67753 TO BUS 67754 CKT 1
END
CONTINGENCY ' R32V '
COM 'TRIP 230 KV LINE R32V '
COM BUS 67623 IS ACTUALLY BUSES 67664 AND 67666 (MAG 11_18_08)
  TRIP LINE FROM BUS 67558 TO BUS 67664 CKT 1
  TRIP LINE FROM BUS 67664 TO BUS 67560 CKT 1

END
CONTINGENCY ' R33V '
COM 'TRIP 230 KV LINE R33V '
COM OUTAGING SECOND CIRCUIT OF REMOVED BUS (MAG 11_18_08)
COM   TRIP LINE FROM BUS 67558 TO BUS 67623 CKT 2
COM   TRIP LINE FROM BUS 67623 TO BUS 67560 CKT 2
  TRIP LINE FROM BUS 67558 TO BUS 67666 CKT 1

```
    TRIP LINE FROM BUS 67666 TO BUS 67560 CKT 1

END
CONTINGENCY ' S60L '
COM 'TRIP 230 KV LINE S60L '
   TRIP LINE FROM BUS 67526 TO BUS 67575 CKT 1
   TRIP LINE FROM BUS 67557 TO BUS 67575 CKT 1
END

/////////////////////////////////////////////
COM The continencies 'DSY BK51' and 'DSY BK52'
COM Have the same effect as 'DORSEY-500-230-51'
COM And 'DORSEY-500-230-52' in MN.con
COM MAG 11-21-08
/////////////////////////////////////////////
COM CONTINGENCY ' DSY BK51'
COM 'TRIP   DSY BK51 '
COM ACTUALLY CKT 52, NOT CKT 1 (MAG 11_18_08)
COM   TRIP LINE FROM BUS 67503 TO BUS 67566 CKT 52
COM   TRIP LINE FROM BUS 67564 TO BUS 67566 CKT 52
COM   TRIP LINE FROM BUS 67565 TO BUS 67566 CKT 52
COM END
COM CONTINGENCY ' DSY BK52'
COM 'TRIP   DSY BK52 '
COM ACTUALLY CKT 51, NOT CKT 1 (MAG 11_18_08)
COM    TRIP LINE FROM BUS 67503 TO BUS 67598 CKT 51
COM   TRIP LINE FROM BUS 67564 TO BUS 67598 CKT 51
COM   TRIP LINE FROM BUS 67597 TO BUS 67598 CKT 51
COM END
COM 'MH Generation trip'
COM
COM ' Future facilities'
COM
CONTINGENCY '300 RxxS '
COM 'TRIP 230 KV LINE Ros-Slv'
COM ACTUALLY CKT 1, NOT CKT c1 (MAG 11_18_08)
   TRIP LINE FROM BUS 67530 TO BUS 67579 CKT 1
END
CONTINGENCY '301 Wind '
COM 'TRIP 230 KV LINE B78S'
COM ACTUALLY CKT 1, NOT CKT c1 (MAG 11_18_08)
   TRIP LINE FROM BUS 67814 TO BUS 67526 CKT 1
END
COM
COM 'END MH SINGLE CONTINGENCIES'
COM ' '
COM
CONTINGENCY 'END OF FILE'
TRIP LINE FROM BUS 99999 TO BUS 99998 CKT 99
END

END
```

```
COM ' Contingency file for Dakotas – MTO 2016 CVS
COM ' TRAWG 2002 STUDY WORK '
COM ' dakotas SINGLE CONTINGENCIES ONLY'
COM ' '
COM ' NO TRIPPING OF LINES OUTSIDE OF MAPP'
COM ' '
COM ' '
COM ' ALL BRANCHES AS SINGLE OUTAGES'
COM ' AND ALL INT/CONTROL AREA TIES '
COM ' '
COM ' MONT CONTAINS DAKOTAS AREA ONLY'
COM '     110KV AND HIGHER'
COM ' '
COM ----------------------------------------------------
COM Total Number of Category B Contingencies --- 1 (MDU)
COM ----------------------------------------------------
```

```
COM ----------------------------------------------------
COM removed all contingencies for transmission < 161kV
COM - jrn 10-30-2008
COM ----------------------------------------------------


COM '3 Pole Trip of Coyote - Center 345 kV Line'
COM 'also trips Coyote Station unless the plant'
COM 'is operating near minimum, which is rare.
CONTINGENCY 'MDU-1 '
        TRIP LINE FROM BUS 66791 TO BUS 67316 CKT 1
        DISCONNECT BUS 67315
END
CONTINGENCY 'END OF FILE'
TRIP LINE FROM BUS 99999 TO BUS 99998 CKT 99
END

END
```

```
COM '1st Contingency file for Minnesota – MTO 2016 CVS
CONTINGENCY CC2GSU
COM 'Flows on the Coal Creek DC lines are'
COM '527 MW on each line in our case'
COM 'just increase the power at 63030'
COM 'jrn 11-24-08'
  TRIP BRANCH FROM BUS 63001 TO BUS 63041 CKT 1
COM  CHANGE BUS 63041 LOAD BY -575 MW
  CHANGE BUS 63030 LOAD BY  575 MW
END

////////////////////////////////
COM THE LOAD AT BUS 67503 SHOULD BE CHANGED
COM BY 50% (849 MW) NOT 50 MW
COM MAG 11-21-08
COM The load at 67569 should not be changed
COM in this case because MH is exporting power
COM jrn 11-24-08
////////////////////////////////
CONTINGENCY DORSEY-500-230-51
  DISCONNECT BUS 67598
COM  CHANGE BUS 67569 LOAD BY -50 MW
COM  CHANGE BUS 67503 LOAD BY  50 MW
COM  CHANGE BUS 67569 LOAD BY -849 MW
  CHANGE BUS 67503 LOAD BY 849 MW

END
CONTINGENCY DORSEY-500-230-52
  DISCONNECT BUS 67566
COM  CHANGE BUS 67569 LOAD BY -50 MW
COM  CHANGE BUS 67503 LOAD BY  50 MW
COM  CHANGE BUS 67569 LOAD BY -849 MW
COM  CHANGE BUS 67569 LOAD BY -849 MW
  CHANGE BUS 67503 LOAD BY 849 MW

END
CONTINGENCY DORSEY-FORBES-500
COM The load at 67569 should not be changed
COM in this case because MH is exporting power
COM jrn 11-24-08
  TRIP BRANCH FROM BUS 67564 TO BUS 60173 CKT 1
  TRIP BRANCH FROM BUS 60173 TO BUS 60174 CKT 1
  TRIP BRANCH FROM BUS 60174 TO BUS 60101 CKT 1
COM  CHANGE BUS 67569 LOAD BY -1246 MW
COM  CHANGE BUS 67503 LOAD BY  1246 MW
COM  CHANGE BUS 67569 LOAD BY -1698 MW
  CHANGE BUS 67503 LOAD BY  1698 MW
END
CONTINGENCY FORBES-CHISAGO-500
////////////////////////////////
```

```
/This contingency outages the Dorsey to Chisago 500 kV line
/According to the OP Guides, the power on the DC line should be
/reduced by 100% (1698 MW) in this event.
/MAG 11-21-08
/////////////////////////////////
  TRIP BRANCH FROM BUS 60101 TO BUS 60198 CKT 1
  TRIP BRANCH FROM BUS 60198 TO BUS 60197 CKT 1
COM The load at 67569 should not be changed
COM in this case because MH is exporting power
COM jrn 11-24-08
COM  CHANGE BUS 67569 LOAD BY -752 MW
  CHANGE BUS 67503 LOAD BY 1698 MW
END
CONTINGENCY HAYWARD-161-69
  TRIP  BRANCH FROM BUS 34010 TO BUS 34294 CKT 1
  CLOSE BRANCH FROM BUS 34293 TO BUS 34294 CKT 1
END
CONTINGENCY BIGSTONE-230-115
  TRIP BRANCH FROM BUS 63195 TO BUS 63214 CKT 1
  TRIP BRANCH FROM BUS 63195 TO BUS 63314 CKT 1
  TRIP BRANCH FROM BUS 63195 TO BUS 63316 CKT 1
END
/* CONTINGENCY BLAK-BOS-OPGD
/*   TRIP BRANCH FROM BUS 61625 TO BUS 61626 CKT 1
/*   DISCONNECT BUS 61774
/* END

END
```

```
COM 2nd Contingency file for Minnesota – MTO 2016 CVS
COM Updated on 9/05/2007
COM per TAS update by David Kempf-GRE and Pete Schommer-MP based on MP, OTP, XCEL, DPC and GRE
responses

COM ' Minnesota SINGLE CONTINGENCIES ONLY'

COM -----------------------------------------------------------------------
COM                   Category B
COM -----------------------------------------------------------------------
COM
COM -----------------------------------------------------------------------
COM                   with DC reduction (B: )
COM -----------------------------------------------------------------------
COM ' 001 Defined as multi-terminal, with DC reduction'
COM 'A 66757-60175 MORANVI4-ROSEAU 4 CKT 1   OPENS  B'
COM 'B 60175-67576 ROSEAU 4-RICHER 4 CKT 1   OPENS  A'
COM '--------------------------------------------------------'
CONTINGENCY '001     '
COM 'Reduce 100% measured at 67576'
COM 'TRIP LINE FROM BUS 66757 TO BUS 60175 CKT 1 DCRED'
TRIP LINE FROM BUS 66757 TO BUS 60175 CKT 1
TRIP LINE FROM BUS 60175 TO BUS 67576 CKT 1
DISCONNECT BUS 60168
DISCONNECT BUS 60175
COM 'FLow at 67576 Richer is 183 MW
COM 'CHANGE BUS 67503 SHUNT BY  151.0 MW
CHANGE BUS 67503 SHUNT BY  183.0 MW
COM 'in the MTO 2016 study the SHERCO units
COM 'are fully dispatched, thus cannot be increased
COM 'CHANGE BUS 60002 GENERATION BY  151.0 MW
COM 'CHANGE BUS 60001 GENERATION BY  0.0 MW'
COM 'CHANGE BUS 60002 GENERATION BY  0.0 MW'
COM 'CHANGE BUS 60008 GENERATION BY  0.0 MW'
END

COM ' 003 Defined as multi-terminal, with DC reduction'
COM 'A 66757-66793 MORANVI4-MORANV2T CKT 1   OPENS  B C D E F'
COM 'B 66719-66793 MORANVI7-MORANV2T CKT 1   OPENS  A C D E F'
COM 'C 66769-66793 MORANV29-MORANV2T CKT 1   OPENS  A B D E F'
```

COM 'RUNNING4-MORANVI4 is Running-Lund (66760) -Moran - jrn 11-17-08'
COM 'D 66753-66757 RUNNING4-MORANVI4 CKT 1   VLD SGL DCRED'
COM 'E 66757-60175 MORANVI4-ROSEAU 4 CKT 1   Will not open Moranville Tr.'
COM 'F 60175-67576 ROSEAU 4-RICHER 4 CKT 1   Will not open Moranville Tr.'
COM '--'
CONTINGENCY '003   '
COM 'Reduce 100% measured at 67576'
COM 'TRIP LINE FROM BUS 66757 TO BUS 66793 CKT 1 DCRED'
TRIP LINE FROM BUS 66757 TO BUS 66793 CKT 1
TRIP LINE FROM BUS 66719 TO BUS 66793 CKT 1
TRIP LINE FROM BUS 66769 TO BUS 66793 CKT 1
COM TRIP LINE FROM BUS 66753 TO BUS 66757 CKT 1
TRIP LINE FROM BUS 66753 TO BUS 66760 CKT 1
TRIP LINE FROM BUS 66760 TO BUS 66757 CKT 1
TRIP LINE FROM BUS 66757 TO BUS 60175 CKT 1
TRIP LINE FROM BUS 60175 TO BUS 67576 CKT 1
DISCONNECT BUS 60168
DISCONNECT BUS 60175
COM 'FLow at 67576 Richer is 183 MW
COM 'CHANGE BUS 67503 SHUNT BY 151.0 MW
CHANGE BUS 67503 SHUNT BY 183.0 MW
COM 'in the MTO 2016 study the SHERCO units
COM 'are fully dispatched, thus cannot be increased
COM 'CHANGE BUS 60002 GENERATION BY 151.0 MW
COM 'CHANGE BUS 60001 GENERATION BY 0.0 MW'
COM 'CHANGE BUS 60002 GENERATION BY 0.0 MW'
COM 'CHANGE BUS 60008 GENERATION BY 0.0 MW'
END

COM ' 005 Defined as multi-terminal, south transformer outage'
COM 'A 66753-66779 RUNNING4-RUNNINST CKT 1   OPENS B C'
COM 'B 66780-66779 RUNNINU8-RUNNINST CKT 1   OPENS A C'
COM 'C 66764-66779 RUNNINS9-RUNNINST CKT 1   OPENS A B'
COM '--'
CONTINGENCY ' 005'
TRIP LINE FROM BUS 66753 TO BUS 66779 CKT 1
TRIP LINE FROM BUS 66780 TO BUS 66779 CKT 1
TRIP LINE FROM BUS 66764 TO BUS 66779 CKT 1
END

COM ' 009 Defined as multi-circuit, tower'
COM ' Both 63030-60270-60233 and 63030-60202 must trip for the Coal'
COM ' Creek to Dickinson DC line to trip. The DC will'
COM ' carry 1000 MW if only one of these lines trip'
COM ' SET BUS 63000 AND 63001 = PGEN + PLOAD = xxx.0 and xxx.0'
COM ' SET BUS 63041 AND 63030 ALWAYS ZERO FOR DC TRIP'
COM 'A 63030-60270 DICKNSN3-MPLEGV13 CKT 1   OPENS C tower, MTL B, A C trip DC line'
COM 'B 60270-60233 MPLEGV13-PARKERS3 CKT 1   OPENS with A'
COM 'C 63030-60202 DICKNSN3-COON CK3 CKT 1   OPENS A tower, A C trip DC line'
COM 'D 63030-62925 DICKNSN3-DICKNSN7 CKT 1   Transfr to better simulate DC'
COM 'E 60114-60233 ELM CRK3-PARKERS3 CKT 1   OPENS A or F, R of W, tower, MTL D'
COM 'F 63030-60270 DICKNSN3-MPLEGV13 CKT 1   OPENS E or G tower, F G trip DC line'
COM ' 60270-60233 MPLEGV13-PARKERS3 CKT 1   OPENS with F'
COM 'G 63030-60202 DICKNSN3-COON CK3 CKT 1   OPENS B or F tower, F G trip DC line'
COM ' 63030-62925 DICKNSN3-DICKNSN7 CKT 1   Transfr to better simulate DC'
COM ' Muti-circuit outage of transformer with Dummy Bus and dummy ownership bus'
COM 'A 60160-60272 SHERCO 3-MPLEGV23 CKT 1   OPENS B,H,I,J MTL'
COM 'H 60202-61488 COON CK3-CNCMID1Y CKT 1   OPENS A,B,I,J MTL'
COM 'I 60203-61488 COON CK7-CNCMID1Y CKT 1   OPENS A,B,H,J MTL'
COM 'J 60656-61488 CNCTER19-CNCMID1Y CKT 1   OPENS A,B,H,I MTL'
COM 'B 60272-60202 MPLEGV23-COON CK3 CKT 1   OPENS A,H,I,J MTL'
COM '--'

CONTINGENCY '009   6'
COM 'Transformer multi-terminal outage, A,B,H,I,J'
TRIP LINE FROM BUS 60160 TO BUS 60272 CKT 1
TRIP LINE FROM BUS 60272 TO BUS 60202 CKT 1
TRIP LINE FROM BUS 60202 TO BUS 61488 CKT 9
TRIP LINE FROM BUS 61488 TO BUS 60203 CKT 9
TRIP LINE FROM BUS 61488 TO BUS 60656 CKT 9

END

COM ' '
COM ' '
COM ' SINGLES AND SINGLE PRIORS THAT REQUIRE D.C. RED'
COM ' '
CONTINGENCY 'SINGLE-030'
COM 'HVDC reduction scheme (identical'
COM 'to all other MH-USA tie lines). The DC red'
COM 'for this line is equal to the loading as'
COM 'measured at Glenboro (67523) and this load should
COM 'be modeled at Dorsey.
COM '--'
TRIP LINE FROM BUS 63379 TO BUS 67523 CKT 1
COM 'line flow at Glenboro (67523) is 35.9 MW
CHANGE BUS 67503 SHUNT BY 16.3 MW /* value needs to be adjusted for each case
CHANGE BUS 67503 SHUNT BY 35.9 MW /* value needs to be adjusted for each case
END

CONTINGENCY 'SINGLE-031'
COM Drayton-Prairie 230 kV
COM 'Reduce flow from 67557 100%'
COM 'TRIP LINE FROM BUS 66752 TO BUS 66755 CKT 1 DCRED'
TRIP LINE FROM BUS 66752 TO BUS 66755 CKT 1
COM 'Flow from bus 67557 is 184.9 MW
COM CHANGE BUS 67503 SHUNT BY 291.8 MW
CHANGE BUS 67503 SHUNT BY 184.9 MW
COM 'in the MTO 2016 study the SHERCO units
COM 'are fully dispatched, thus cannot be increased
COM CHANGE BUS 60002 GENERATION BY 111.6 MW
COM CHANGE BUS 60001 GENERATION BY   63.6 MW
COM CHANGE BUS 60028 GENERATION BY 116.6 MW
END

CONTINGENCY 'SINGLE-034'
COM Drayton-Letellier 230 kV
COM 'Reduce 100% measured at 67557'
COM 'TRIP LINE FROM BUS 66752 TO BUS 67557 CKT 1 DCRED'
TRIP LINE FROM BUS 66752 TO BUS 67557 CKT 1
COM 'Flow from bus 67557 is 184.9 MW
COM CHANGE BUS 67503 SHUNT BY 291.8 MW
CHANGE BUS 67503 SHUNT BY 184.9 MW
COM 'in the MTO 2016 study the SHERCO units
COM 'are fully dispatched, thus cannot be increased
COM CHANGE BUS 60002 GENERATION BY 111.6 MW
COM CHANGE BUS 60001 GENERATION BY   63.6 MW
COM CHANGE BUS 60028 GENERATION BY 116.6 MW
END

CONTINGENCY 'SINGLE-040'
COM Running-Lund-Moranville 230 kV
COM 'Reduce 100% measured at 67576'
COM 'TRIP LINE FROM BUS 66753 TO BUS 66760 CKT 1 DCRED'
COM 'TRIP LINE FROM BUS 66760 TO BUS 66757 CKT 1 DCRED'
TRIP LINE FROM BUS 66753 TO BUS 66760 CKT 1
TRIP LINE FROM BUS 66760 TO BUS 66757 CKT 1
COM 'Line flow at 67576 is 183 MW
COM CHANGE BUS 67503 SHUNT BY 151.0 MW
CHANGE BUS 67503 SHUNT BY 183 MW
COM 'SHERCO is fully dispatched in the MTO 2016 study
COM CHANGE BUS 60002 GENERATION BY 151.0 MW
COM 'CHANGE BUS 60001 GENERATION BY 0.0 MW'
COM 'CHANGE BUS 60002 GENERATION BY 0.0 MW'
COM 'CHANGE BUS 60008 GENERATION BY 0.0 MW'
END

CONTINGENCY 'SINGLE-042'
COM Running-Shannon 230 kV
COM 'Reduce 100% measured at 67576'
COM 'TRIP LINE FROM BUS 66753 TO BUS 61627 CKT 1 DCRED'

TRIP LINE FROM BUS 66753 TO BUS 61627 CKT 1
COM 'Line flow at 67576 is 183 MW
COM CHANGE BUS 67503 SHUNT BY 151.0 MW
CHANGE BUS 67503 SHUNT BY 183 MW
COM 'SHERCO is fully dispatched in the MTO 2016 study
COM CHANGE BUS 60002 GENERATION BY 151.0 MW
COM 'CHANGE BUS 60001 GENERATION BY 0.0 MW'
COM 'CHANGE BUS 60002 GENERATION BY 0.0 MW'
COM 'CHANGE BUS 60008 GENERATION BY 0.0 MW'
END

CONTINGENCY 'SINGLE-044'
COM Richer-Roseau 230 kV
COM 'Reduce 100% measured at 67576'
COM '* NOT A SINGLE, SEE MTL ABOVE'
COM 'TRIP LINE FROM BUS 67576 TO BUS 60175 CKT 1 DCRED'
TRIP LINE FROM BUS 67576 TO BUS 60175 CKT 1
COM 'Line flow at 67576 is 183 MW
COM CHANGE BUS 67503 SHUNT BY 151.0 MW
CHANGE BUS 67503 SHUNT BY 183 MW
COM 'SHERCO is fully dispatched in the MTO 2016 study
COM CHANGE BUS 60002 GENERATION BY 151.0 MW
COM 'CHANGE BUS 60001 GENERATION BY 0.0 MW'
COM 'CHANGE BUS 60002 GENERATION BY 0.0 MW'
COM 'CHANGE BUS 60008 GENERATION BY 0.0 MW'
END

CONTINGENCY 'SINGLE-046'
COM Center-Coyote 345 kV,
COM * IF MORE THAN 225 MW NET ON UNIT
COM * TRIP LINE AND UNIT
COM * CASE SHOWS 397.8 MW NET ON UNIT
COM 'TRIP LINE FROM BUS 66791 TO BUS 67316 CKT 1 GNRED'
COM 'TRIP UNIT   BUS 67316 TO BUS 67315 CKT 1'
TRIP LINE FROM BUS 66791 TO BUS 67316 CKT 1
TRIP LINE FROM BUS 67316 TO BUS 67315 CKT 1
END
COM ' '
COM ' End Of Outages That Cause DC or Unit runback'
COM ' '
COM ' '
COM --
COM   Multi-Terminal (B:)
COM --

COM 'NSP Defined as multi-circuit, multi-terminal'
COM 'A 60221-60199 KOLMNLK3-CHIS CO3   OPENS B TOWER, C MTL'
COM 'B 60221-60186 KOLMNLK3-AS KING3   OPENS A tower'
COM 'C 60221-60222 KOLMNLK3-KOLMNLK7 ckt 2   VLD SNG'
COM '--'
CONTINGENCY 'NSP--   2'
TRIP LINE FROM BUS 60221 TO BUS 60199 CKT 1
TRIP LINE FROM BUS 60221 TO BUS 60222 CKT 10
END

COM ' 502 The Drayton bus was updated with a ring bus. The 2'
COM ' transformer trip/outage no longer open ends the 230kV line.'
COM ' 502 Defined as multi-terminal, Drayton Transformer 2 TRIP'
COM 'A 66752-66788 DRAYTON4-DARYTO2T CKT 1   OPENS B C'
COM 'B 66705-66788 DRAYTON7-DRAYTO2T CKT 1   OPENS A C'
COM 'C 66762-66788 DRAYTO29-DRAYTO2T CKT 1   OPENS A B'
COM '--'
CONTINGENCY '502   2'
COM 'Trip Transformer 2'
TRIP LINE FROM BUS 66752 TO BUS 66788 CKT 1
TRIP LINE FROM BUS 66705 TO BUS 66788 CKT 1
TRIP LINE FROM BUS 66762 TO BUS 66788 CKT 1
END

COM '500   GRE Defined as multi-terminal line'
COM 'A 66550-63050 GRANITF4-WILLMAR4   OPENS B'
COM 'B 63050-62427 WILLMAR4-WILLMAR8 OPENS A'
COM '--'
CONTINGENCY '500'
TRIP LINE FROM BUS 66550 TO BUS 63050 CKT 1
DISCONNECT BRANCH FROM BUS 63050 TO BUS 62427 TO BUS 62443 CKT 1
END

COM '510 Defined as multi-terminal'
COM 'A 66550-66554 GRANITF4-MORRIS 4 CKT 1   OPENS B C'
COM 'B 66554-66555 MORRIS 4-MORRIS 7 CKT 1   OPENS A C'
COM 'C 66553-66554 MOORHED4-MORRIS 4 CKT 1   VLD SGL'
COM '--'
CONTINGENCY '510   '
TRIP LINE FROM BUS 66550 TO BUS 66554 CKT 1
TRIP LINE FROM BUS 66554 TO BUS 66555 CKT 1
TRIP LINE FROM BUS 66553 TO BUS 66554 CKT 1
END

COM '540 Defined as multi-terminal'
COM 'CONTINGENCY 'HUBBARD MTL, GRE'
COM 'A 63336-63053 AUDUBON4-HUBBARD4 CKT 1   OPENS B'
COM 'B 63053-61641 HUBBARD4-HUBBARD7 CKT 1   OPENS A'
COM 'HUBBARD7 NOW A 3 WIND XFMR. ADDED THAT'
COM 'AND TOOK OUT THE HUBBARD TAP'
COM '- Jerrod Nelson - 11-13-08'
COM '--'
CONTINGENCY '540   '
TRIP LINE FROM BUS 63336 TO BUS 63053 CKT 1
COM TRIP LINE FROM BUS 63053 TO BUS 61641 CKT 1
TRIP BRANCH FROM BUS 63053 TO BUS 62897 TO BUS 63078 CKT 1
DISCONNECT BUS 63078
END

COM '545 Defined as multi-terminal'
COM 'A 63325-63327   BROWNSV4-HANKSON4 CKT 1   OPENS B C'
COM 'B 63314-63325   BIGSTON4-BROWNSV4 CKT 1   OPENS A C'
COM 'C 63325-63125   BROWNSV4-BROWNSV9 CKT 1   OPENS A B'
COM '--'
CONTINGENCY '545   '
TRIP LINE FROM BUS 63325 TO BUS 63327 CKT 1
TRIP LINE FROM BUS 63314 TO BUS 63325 CKT 1
TRIP LINE FROM BUS 63325 TO BUS 63125 CKT 1
END

COM 'CONTINGENCY 610 HAS NEW BREAKERS BEING ADDED AT WAHPETON'
COM '610 Defined as multi-terminal'
COM 'A 63331-63329 FERGSFL4-WAHPETN4 CKT 1   VLD SGL'
COM 'B 63327-63329 HANKSON4-WAHPETN4 CKT 1   VLD SGL'
COM 'C 66754-63329 MAPLE R4-WAHPETN4 CKT 1   VLD SGL'
COM 'D 63329-63191 WAHPETN4-WAHPET1Y CKT 1   OPENS A B C E F G H I'
COM 'E 63191-63229 WAHPET1Y-WAHPETN7 CKT 1   OPENS A B C D F G H I'
COM 'F 63191-63129 WAHPET1Y-WAHPETN9 CKT 1   OPENS A B C D E G H I'
COM 'G 63329-63201 WAHPETN4-WHAPET2Y CKT 1   OPENS A B C D E F H I'
COM 'H 63201-63229 WAHPET2Y-WAHPETN7 CKT 1   OPENS A B C D E F G I'
COM 'I 63201-63129 WAHPET2Y-WAHPETN9 CKT 1   OPENS A B C D E F G H'
COM '--'
CONTINGENCY '610   1'
TRIP LINE FROM BUS 63331 TO BUS 63329 CKT 1
TRIP LINE FROM BUS 66754 TO BUS 63329 CKT 1
TRIP LINE FROM BUS 63329 TO BUS 63191 CKT 1
TRIP LINE FROM BUS 63191 TO BUS 63229 CKT 1
TRIP LINE FROM BUS 63191 TO BUS 63129 CKT 1
END
CONTINGENCY '610   2'
TRIP LINE FROM BUS 63327 TO BUS 63303 CKT 1
TRIP LINE FROM BUS 63327 TO BUS 63329 CKT 1
TRIP LINE FROM BUS 63329 TO BUS 63201 CKT 1

TRIP LINE FROM BUS 63201 TO BUS 63229 CKT 1
TRIP LINE FROM BUS 63201 TO BUS 63129 CKT 1
END

COM '615 Defined as multi-terminal'
COM 'A 61610-63053 BADOURA4-HUBBARD4 CKT 1   OPENS B C D E'
COM 'B 61610-61612 BADOURA4-RIVERTN2 CKT 1   OPENS A C D E'
COM 'C 61610-61794 BADOURA4-BADOUJCT CKT 1   OPENS A B D E'
COM 'D 61794-61640 BADOUJCT-BADOURA7 CKT 1   OPENS A B C E'
COM 'E 61794-61795 BADOUJCT-BADOUTRT CKT 1   OPENS A B C D'
COM '--'
CONTINGENCY '615   '
TRIP LINE FROM BUS 61610 TO BUS 63053 CKT 1
TRIP LINE FROM BUS 61610 TO BUS 61612 CKT 1
TRIP LINE FROM BUS 61610 TO BUS 61794 CKT 1
TRIP LINE FROM BUS 61794 TO BUS 61640 CKT 1
TRIP LINE FROM BUS 61794 TO BUS 61795 CKT 1
END

COM ' 620 Defined as a multi-terminal'
COM 'A 61615-61614 ARROWHD4-98LTAP 4 CKT 1   OPENS B C D E F'
COM 'B 61625-61614 BLCKBRY4-98LTAP 4 CKT 1   OPENS A C D E F'
COM 'C 61616-61614 HILLTOP4-98LTAP 4 CKT 1   OPENS A B D E F'
COM 'D 61616-61576 HILLTOP4-HILLPJCT CKT 1   OPENS A B C E F'
COM 'E 61576-61672 HILLPJCT-HILLTOP7 CKT 1   OPENS A B C D F'
COM 'F 61576-61577 HILLPJCT-HILLPTR9 CKT 1   OPENS A B C D E'
COM '--'
CONTINGENCY '620   '
TRIP LINE FROM BUS 61615 TO BUS 61614 CKT 1
TRIP LINE FROM BUS 61625 TO BUS 61614 CKT 1
TRIP LINE FROM BUS 61616 TO BUS 61614 CKT 1
TRIP LINE FROM BUS 61616 TO BUS 61576 CKT 1
TRIP LINE FROM BUS 61576 TO BUS 61672 CKT 1
TRIP LINE FROM BUS 61576 TO BUS 61577 CKT 1
END

COM '625 Defined as multi-terminal'
COM 'A 61623-61624 MINNTAC4-FORBES 4 CKT 1   OPENS B C D'
COM 'B 61623-61558 MINNTAC4-MINT1JCT CKT 1   OPENS A C D'
COM 'C 61558-61710 MINT1JCT-MINNTAC7 CKT 1   OPENS A B D'
COM 'D 61558-61559 MINT1JCT-MINT1TR9 CKT 1   OPENS A B C'
COM '--'
CONTINGENCY '625   '
TRIP LINE FROM BUS 61623 TO BUS 61624 CKT 1
TRIP LINE FROM BUS 61623 TO BUS 61558 CKT 1
TRIP LINE FROM BUS 61558 TO BUS 61710 CKT 1
TRIP LINE FROM BUS 61558 TO BUS 61559 CKT 1
END

COM '660 GRE Defined as multi-terminal line'
COM 'A 63043-63046 ELK RIV4-BUNKER 4 CKT 1   OPENS B'
COM 'B 63043-62134 ELK RIV4-ELKR14S8 CKT 2   OPENS A'
COM '--'
CONTINGENCY '660   '
TRIP LINE FROM BUS 63043 TO BUS 63046 CKT 1
DISCONNECT BRANCH FROM BUS 63043 TO BUS 62134 TO BUS 62157 CKT 2
END

COM '665 GRE Defined as multi-terminal line'
COM 'A 63043-60152 ELK RIV4-MNTCELO4 CKT 1   OPENS B'
COM 'B 63043-62134 ELK RIV4-ELKRI4S8 CKT 1   OPENS A'
COM '--'
CONTINGENCY '665   '
TRIP LINE FROM BUS 63043 TO BUS 60152 CKT 1

DISCONNECT BRANCH FROM BUS 63043 TO BUS 62134 TO BUS 62156 CKT 1
END

COM '670 CAT B **GRE Defined as multi-terminal'
COM 'D 60160-60202 SHERCO 3-COON CK3 CKT 1   OPENS E,F,G'
COM 'E 61487-60655 CNCMID2Y-CNCTER29 CKT 1   OPENS D,E,G'
COM 'F 61487-60203 CNCMID2Y-COON CK7 CKT 1   OPENS D,E,F'
COM 'G 61487-60202 CNCMID2Y-COON CK3 CKT 1   OPENS D,E,F'
COM '**GRE Defined as multi-terminal '
COM 'F 63031-60160 BUNKER 3-SHERCO 3 CKT 1   OPENS G, H'
COM 'G 63031-60202 BUNKER 3-COON CK3 CKT 1   OPENS F, H'
COM 'H 63046-63031-63076 BUNKER 4-BUNKER 3 CKT 1   OPENS F, G'
COM '---'
CONTINGENCY '670   2'
COM 'Valid multi-terminal only'
TRIP LINE FROM BUS 63031 TO BUS 60160 CKT 1
TRIP LINE FROM BUS 63031 TO BUS 60202 CKT 1
DISCONNECT BRANCH FROM BUS 63046 TO BUS 63031 TO BUS 63076 CKT 1
END
CONTINGENCY '670   3'
COM 'Valid multi-terminal only'
TRIP LINE FROM BUS 60160 TO BUS 60202 CKT 1
TRIP LINE FROM BUS 60202 TO BUS 61487 CKT 10
TRIP LINE FROM BUS 61487 TO BUS 60203 CKT 10
TRIP LINE FROM BUS 61487 TO BUS 60655 CKT 10
END

COM ' 675 Defined as multi-terminal'
COM 'A 63045-60142 BENTON 4-BENTON 3 CKT 1   OPENS B C '
COM 'B 63045-60142 BENTON 4-BENTON 3 CKT 2   OPENS A C '
COM 'C 60142-60160 BENTON 3-SHERCO 3 CKT 1   OPENS A B '
COM '---'
CONTINGENCY '675   '
DISCONNECT BRANCH FROM BUS 63045 TO BUS 60142 TO BUS 63075 CKT 1
DISCONNECT BRANCH FROM BUS 63045 TO BUS 60142 TO BUS 63079 CKT 2
TRIP LINE FROM BUS 60142 TO BUS 60160 CKT 1
END

COM '700 Defined as multi-terminal'
COM 'B 60192-60217 BLUE LK3-INVRHLS3   OPENS A   tower'
COM 'C 60217-60236 INVRHLS3-REDROCK3   OPENS B   mtl'
COM '---'
CONTINGENCY '700   2'
COM ' Multi-terminal portion only'
TRIP LINE FROM BUS 60192 TO BUS 60217 CKT 1
TRIP LINE FROM BUS 60217 TO BUS 60236 CKT 1
END

COM '705 Defined as mtl'
COM 'A 60192-60233 BLUE LK3-PARKERS3   OPENS B or C tower'
COM 'B 60192-60262 BLUE LK3-EDEN PR3   OPENS A   tower MTL'
COM 'C 60233-60262 PARKERS3-EDEN PR3   OPENS A   tower MTL'
COM '**   Defined as multi-terminal'
COM 'B 60192-60262 BLUE LK3-EDEN PR3   OPENS B'
COM 'D 60262-60263 EDEN PR3-EDEN PR7   OPENS B'
COM '**   Defined as multi-terminal'
COM 'C 60233-60262 PARKERS3-EDEN PR3   OPENS E'
COM 'E 60262-60263 EDEN PR3-EDEN PR7   OPENS C'
COM '---'
CONTINGENCY '705   3'
COM 'Valid Multi-terminal only'
TRIP LINE FROM BUS 60192 TO BUS 60262 CKT 1
TRIP LINE FROM BUS 60262 TO BUS 60263 CKT 9
END
CONTINGENCY '705   4'
COM 'Valid Multi-terminal only'
TRIP LINE FROM BUS 60233 TO BUS 60262 CKT 1
TRIP LINE FROM BUS 60262 TO BUS 60263 CKT 10

END

COM '725-1 GRE Defined as multi-terminal line'
COM 'A 63040-63057 BLAINE 4-LINWOOD4 CKT 1   OPENS B C'
COM 'B 63040-62128 BLAINE 4-BLAINE 8 CKT 1   OPENS A C'
COM 'C 63040-63046 BLAINE 4-BUNKER 4 CKT 1   OPEND A B'
COM '--'
CONTINGENCY '725-1   '
TRIP LINE FROM BUS 63040 TO BUS 63057 CKT 1
DISCONNECT BRANCH FROM BUS 63040 TO BUS 62128 TO BUS 62130 CKT 1
TRIP LINE FROM BUS 63040 TO BUS 63046 CKT 1
END

COM '765 Defined as multi-terminal'
COM 'A 63048-60237 RUSH CY4-REDROCK4   OPENS B C'
COM 'B 60236-60237 REDROCK3-REDROCK4   OPENS A C'
COM 'C 60361-63048 ROCKCR 4-RUSH CY4   OPENS A B'
COM '--'
CONTINGENCY '765   '
TRIP LINE FROM BUS 63048 TO BUS 60237 CKT 1
TRIP LINE FROM BUS 60236 TO BUS 60237 CKT 5
TRIP LINE FROM BUS 60361 TO BUS 63048 CKT 1
END

COM '770 Defined as multi-terminal'
COM 'A 60109-60110 WILMART5-WILMART7   OPENS B C'
COM 'B 60109-60120 WILMART5-BLUEART5   OPENS A C'
COM 'C 60120-34009 BLUEETA5-WINBAGO5   OPENS A B'
COM '--'
CONTINGENCY '770   '
TRIP LINE FROM BUS 60109 TO BUS 60110 CKT 5
TRIP LINE FROM BUS 60109 TO BUS 60120 CKT 1
TRIP LINE FROM BUS 60120 TO BUS 34009 CKT 1
END

COM '785-1 Defined as multi-terminal'
COM 'A 60129-60128 SPLIT R7-SPLIT R5   OPENS B C'
COM 'SPLIT R5-MAGNLIA5 is really Split R-Dan Juhl (60370) - Magnalia'
COM 'There is a tap off Dan Juhl 60067 also disconnected'
COM 'jrn 11-17-08'
COM 'B 60128-34003 SPLIT R5-MAGNLIA5   OPENS A C'
COM 'C 34003-34004 MAGNLIA5-ELK   5   OPENS A B'
COM '--'
CONTINGENCY '785-1 '
TRIP LINE FROM BUS 60129 TO BUS 60128 CKT 6
COM TRIP LINE FROM BUS 60128 TO BUS 34003 CKT 1
TRIP LINE FROM BUS 60128 TO BUS 60370 CKT 1
TRIP LINE FROM BUS 60370 TO BUS 34003 CKT 1
TRIP LINE FROM BUS 34003 TO BUS 34004 CKT 1
DISCONNECT BUS 60067
END

COM '785-2 Defined as multi-terminal'
COM 'C 34003-62709 ELK   5-BREWSTR5   '
COM 'D 62709-34005 BREWSTR5-HRN LK 5   '
COM 'E 34005-34225 HRN LK 5-HERONLK8 CKT 1'
COM TRIP ELK 161/69 KV TX 1
COM TRIP ELK 161/69 KV TX 2
COM '--'
CONTINGENCY '785-2 '
TRIP LINE FROM BUS 34004 TO BUS 62709 CKT 1
TRIP LINE FROM BUS 34005 TO BUS 62709 CKT 1
TRIP LINE FROM BUS 34005 TO BUS 34225 CKT 1
TRIP LINE FROM BUS 34004 TO BUS 34223 CKT 1
TRIP LINE FROM BUS 34004 TO BUS 34223 CKT 2
END

```
COM '790  Defined as multi-terminal'
COM 'A 66550-60147  GRANITF4-MINVALY4    OPENS  B'
COM 'B 60147-60148  MINVALY4-MINVALY7 1  OPENS  A'
COM '------------------------------------------------------'
CONTINGENCY '790    '
TRIP LINE FROM BUS 66550 TO BUS 60147 CKT 1
TRIP LINE FROM BUS 60147 TO BUS 60148 CKT 5
END


COM '795  Defined as multi-terminal'
COM 'A 66550-60150  GRANITF4-MNVLTAP4   OPENS  B C D E'
COM 'B 60148-60149  MINVALY7-MINVALT4   OPENS  A C D E'
COM 'C 60150-63054  MNVLTAP4-PANTHER4   OPENS  A B D E'
COM 'D 60149-60150  MINVALT4-MNVLTAP4   OPENS  A B C E'
COM 'E 63054-60742  PANTHER4-PANTHER8   OPENS  A B C D'
COM '------------------------------------------------------'
CONTINGENCY '795    '
TRIP LINE FROM BUS 66550 TO BUS 60150 CKT 1
TRIP LINE FROM BUS 60148 TO BUS 60149 CKT 6
TRIP LINE FROM BUS 60150 TO BUS 63054 CKT 1
TRIP LINE FROM BUS 60149 TO BUS 60150 CKT 1
DISCONNECT BRANCH FROM BUS 63054 TO BUS 60742 TO BUS 62585 CKT 1
END

COM '800  Defined as multi-terminal'
COM  Wilton 230/115 kV #2 transformer
COM 'DISCONNECT  66798 WILTON2T'
COM 'DISCONNECT  66797 WILTON29'
COM '------------------------------------------------------'
CONTINGENCY '800     1'
DISCONNECT BUS 66798
DISCONNECT BUS 66797
END

COM '825  Defined as multi-terminal'
COM 'A 63032-60102  PL VLLY3-ADAMS  3   OPENS  B C'
COM 'B 60102-34014  ADAMS  3-ADAMS  5   OPENS  A C'
COM 'C 60102-34018  ADAMS  3-HAZLTON3   VLD SGL'
COM '------------------------------------------------------'
CONTINGENCY '825     '
TRIP LINE FROM BUS 63032 TO BUS 60102 CKT 1
TRIP LINE FROM BUS 60102 TO BUS 34014 CKT 1
TRIP LINE FROM BUS 60102 TO BUS 34018 CKT 1
END

COM '865   Defined as multi-terminal, otp'
COM 'FERGSFL4-HENNING4 is actually Fergus-Silver Lake (63366) -Henning'
COM 'There is also a tap off silver lake 63166 jrn 11-17-08'
COM 'A 63331-63051  FERGSFL4-HENNING4 CKT 1   OPENS  B C'
COM 'B 63051-63052  HENNING4-INMAN  4 CKT 1   OPENS  A C'
COM 'HENNING9 is bus 63309 - jrn 11-13-08'
COM 'was C 63051-62573  HENNING4-HENNING9 CKT 1   OPENS  A B'
COM 'now C 63051-63309  HENNING4-HENNING9 CKT 1   OPENS  A B'
COM '------------------------------------------------------'
CONTINGENCY '865    '
COM TRIP LINE FROM BUS 63331 TO BUS 63051 CKT 1
TRIP LINE FROM BUS 63331 TO BUS 63366 CKT 1
TRIP LINE FROM BUS 63366 TO BUS 63051 CKT 1
TRIP LINE FROM BUS 63051 TO BUS 63052 CKT 1
COM TRIP LINE FROM BUS 63051 TO BUS 62573 CKT 1
TRIP LINE FROM BUS 63051 TO BUS 63309 CKT 1
DISCONNECT BUS 63166
END


COM '866   Defined as multi-terminal, otp'
COM 'A 63052-63058  INMAN  4-WINGRIV4 CKT 1   OPENS  B'
COM 'B 63052-63051  INMAN  4-HENNING4 CKT 1   OPENS  A'
```

COM '--'
CONTINGENCY '866   '
TRIP LINE FROM BUS 63052 TO BUS 63058 CKT 1
TRIP LINE FROM BUS 63052 TO BUS 63051 CKT 1
END

COM 'Wing River   Defined as multi-terminal'
COM '63052-63058 INMAN 4-WINGRIV4 CKT 1 '
COM '63058-62893-62894 WING RIVER 230 - WING RIVER 230'
COM '63058-61612 WING RIVER 230 - RIVERTON 230'
COM '--'
CONTINGENCY 'WING RIVER XF'
TRIP LINE FROM BUS 63052 TO BUS 63058 CKT 1
DISCONNECT BRANCH FROM BUS 63058 TO BUS 62893 TO BUS 62894 CKT 1
TRIP LINE FROM BUS 63058 TO BUS 61612 CKT 1
COM '--'
END

COM '907 Defined as multi-circuit, multi-terminal'
COM 'A 60202-60221 COON CK3-KOLMNLK3   OPENS B TOWER, C MTL'
COM 'B 60202-60251 COON CK3-TERMINL3   OPENS A TOWER, D E F MTL'
COM 'C 60221-60222 KOLMNLK3-KOLMNLK7   VLD SNG'
COM 'D 61491-60251 TERMID2Y-TERMINL3   D E F VLD SNG'
COM 'E 61491-60252 TERMID2Y-TERMINL7   D E F VLD SNG'
COM 'F 61491-61188 TERMID2Y-TERTER29   D E F VLD SNG'
COM '--'
CONTINGENCY '907   3'
TRIP LINE FROM BUS 60202 TO BUS 60251 CKT 1
TRIP LINE FROM BUS 61491 TO BUS 60251 CKT 9
TRIP LINE FROM BUS 61491 TO BUS 60252 CKT 9
TRIP LINE FROM BUS 61491 TO BUS 61188 CKT 9
END
CONTINGENCY '907   4'
TRIP LINE FROM BUS 61491 TO BUS 60251 CKT 9
TRIP LINE FROM BUS 61491 TO BUS 60252 CKT 9
TRIP LINE FROM BUS 61491 TO BUS 61188 CKT 9
END

COM '910_1 Defined as multi-terminal'
COM 'A 60107-60265 W FARIB7-LOONLKTP   OPENS B C D E F G'
COM 'B 60107-60792 W FARIB7-WFARBLT8   OPENS A C D E F G'
COM 'C 60107-61952 W FARIB7-S FARIB5   OPENS VLD SNG'
COM 'D 60265-60264 LOONLKTP-LOON LK7   OPENS A B C E F G'
COM 'E 60264-61976 LOON LK7-LOON LK8   OPENS A B C D F G'
COM 'LOONLKTP-DOME goest through East Wind (60830) - jrn 11-18-08'
COM 'DOME-WILMART goest through East Wind (60830) - jrn 11-18-08'
COM 'F 60265-60113 LOONLKTP-DOME   7   OPENS A B C D E G'
COM 'G 60113-60110 DOME   7-WILMART7   OPENS A B C D E F'
COM '--'
CONTINGENCY '910_1   '
TRIP LINE FROM BUS 60107 TO BUS 60265 CKT 1
TRIP LINE FROM BUS 60107 TO BUS 60792 CKT 1
TRIP LINE FROM BUS 60107 TO BUS 61952 CKT 1
COM TRIP LINE FROM BUS 60265 TO BUS 60283 CKT 1
TRIP LINE FROM BUS 60265 TO BUS 60264 CKT 1
TRIP LINE FROM BUS 60830 TO BUS 60265 CKT 1
TRIP LINE FROM BUS 60264 TO BUS 61976 CKT 1
COM TRIP LINE FROM BUS 60265 TO BUS 60113 CKT 1
TRIP LINE FROM BUS 60265 TO BUS 60830 CKT 1
TRIP LINE FROM BUS 60113 TO BUS 60830 CKT 1
COM TRIP LINE FROM BUS 60113 TO BUS 60110 CKT 1
TRIP LINE FROM BUS 60830 TO BUS 60110 CKT 1
END

COM '917 Defined as multi-circuit, multi-terminal'

```
COM 'A 60251-60221  TERMINL3-KOLMNLK3   OPENS  B TOWER, C D E MTL'
COM 'B 60202-60251  COON CK3-TERMINL3   OPENS  A TOWER, F G H MTL'
COM 'C 61492-60251  TERMID1Y-TERMINL3   C D E VLD SNG'
COM 'D 61492-60252  TERMID1Y-TERMINL7   C D E VLD SNG'
COM 'E 61492-61187  TERMID1Y-TERTER19   C D E VLD SNG'
COM 'F 61491-60251  TERMID2Y-TERMINL3   F G H VLD SNG'
COM 'G 61491-60252  TERMID2Y-TERMINL7   F G H VLD SNG'
COM 'H 61491-61188  TERMID2Y-TERTER29   F G H VLD SNG'
COM '------------------------------------------------------'
CONTINGENCY '917   2'
TRIP LINE FROM BUS 60251 TO BUS 60221 CKT 1
TRIP LINE FROM BUS 61492 TO BUS 60251 CKT 10
TRIP LINE FROM BUS 61492 TO BUS 60252 CKT 10
TRIP LINE FROM BUS 61492 TO BUS 61187 CKT 10
END
CONTINGENCY '917   3'
TRIP LINE FROM BUS 61492 TO BUS 60251 CKT 10
TRIP LINE FROM BUS 61492 TO BUS 60252 CKT 10
TRIP LINE FROM BUS 61492 TO BUS 61187 CKT 10
END


COM '930  Defined as multi-circuit, multi-terminal'
COM 'A 60233-60114  PARKERS3-ELM CRK3   OPENS  B TOWER'
COM 'B 60233-60270  PARKERS3-MPLEGV13   OPENS  A TOWER, C MTL'
COM 'C 60270-63030  MPLEGV13-DICKNSN3   OPENS  B MTL'
COM 'D 61489-60233  PKLMID2Y-PARKERS3   OPENS ONLY FOR A&B, D E F MTL'
COM 'E 61489-60234  PKLMID2Y-PARKERS7   OPENS ONLY FOR A&B, D E F MTL'
COM 'F 61489-60656  PKLMID2Y-PKLTER29   OPENS ONLY FOR A&B, D E F MTL'
COM '------------------------------------------------------'
CONTINGENCY '930   2'
TRIP LINE FROM BUS 60233 TO BUS 60270 CKT 1
TRIP LINE FROM BUS 60270 TO BUS 63030 CKT 1
END
CONTINGENCY '930   3'
TRIP LINE FROM BUS 61489 TO BUS 60233 CKT 10
TRIP LINE FROM BUS 61489 TO BUS 60234 CKT 10
TRIP LINE FROM BUS 61489 TO BUS 60659 CKT 10
END



COM 'RUSH CITY multi-terminal line'
COM 'A 63057-63048 LINWOOD4-RUSH CY4 CKT 1'
COM 'B 63048-62293 RUSH CY4-RUSH CY8 CKT 1'
COM '--------------------------------------------------------'
CONTINGENCY '725-2     '
TRIP LINE FROM BUS 63057 TO BUS 63048 CKT 1
DISCONNECT BRANCH FROM BUS 63048 TO BUS 62293 TO BUS 62317 CKT 1
END


COM 'PANTHER 3 TERMINAL
COM '62980-63054 MCLEOD-PANTHER 230'
COM '60150-63054 MNVLTAP4-PANTHER'
COM '60742-63054 PANTHER XF'
COM '--------------------------------------------------------'
CONTINGENCY 'PANTHER MTL'
TRIP LINE FROM BUS 62980 TO BUS 63054 CKT 1
TRIP LINE FROM BUS 60150 TO BUS 63054 CKT 1
DISCONNECT BRANCH FROM BUS 60742 TO BUS 63054 TO BUS 62585 CKT 1
END


COM 'MCLEOD 3 TERMINAL
COM '63054-62980 MCLEOD-PANTHER 230'
COM 'MCLEOD-BLACK DOG 230 is actually MCLEOD-BLUE LAKE 60191 -jrn 11-18-08'
COM '60189-62980 MCLEOD-BLACK DOG 230'
COM '62981-62980 MCLEOD 230-115 XF'
COM '63074 is a three winding tap off MCLEOD 230-115 XFMR - jrn 11-18-08'
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COM '--------------------------------------------------------'
CONTINGENCY 'MCLEOD MTL'
TRIP LINE FROM BUS 63054 TO BUS 62980 CKT 1
COM TRIP LINE FROM BUS 60189 TO BUS 62980 CKT 1
TRIP LINE FROM BUS 60191 TO BUS 62980 CKT 1
DISCONNECT BRANCH FROM BUS 62981 TO BUS 62980 TO BUS 63074 CKT 1
DISCONNECT BUS 63074
END


COM 'ADM-RCE-HAR  Defined as multi-circuit'
COM 'C 61980-69526 RICE    -BEAVERCK CKT 1   OPENS D E'
COM 'D 34572-69526 ADAMS   -BEAVERCK CKT 1   OPENS C E'
COM 'E 69527-69526 HARMONY -BEAVERCK CKT 1   OPENS C D'
COM '--------------------------------------------------------'
CONTINGENCY 'ADM-RCE-HAR'
COM 'Multi-terminal portion'
TRIP LINE FROM BUS 61980 TO BUS 69526 CKT 1
TRIP LINE FROM BUS 61980 TO BUS 34371 CKT 1
TRIP LINE FROM BUS 34572 TO BUS 69526 CKT 1
TRIP LINE FROM BUS 69527 TO BUS 69526 CKT 1
END


COM 'ALM-WBC-ROC  Defined as multi-circuit'
COM 'C 69543-69549 ALMA    -WABACO   CKT 1   OPENS D E'
COM 'D 69198-69549 WABACOTX-WABACO   CKT 1   OPENS C E'
COM 'E 69547-69549 ROCHESTR-WABACO   CKT 1   OPENS C D'
COM '--------------------------------------------------------'
CONTINGENCY 'ALM-WBC-ROC'
COM 'Multi-terminal portion'
TRIP LINE FROM BUS 69543 TO BUS 69549 CKT 1
TRIP LINE FROM BUS 69198 TO BUS 69549 CKT 1
TRIP LINE FROM BUS 69547 TO BUS 69549 CKT 1
END

COM ' '
COM ' '
COM '  END MINNESOTA AREA CONTINGENCIES'
COM ' '
COM '  START WISCONSIN AREA CONTINGENCIES'
COM ' '
COM ' '
COM ' '

COM '050  Defined as multi-circuit,  Interregional'
COM 'A 60186-60304  AS KING3-EAU CL 3   OPENS  B C'
COM 'B 60304-39244  EAU CL 3-ARP 345    vld sgl'
COM 'C 60304-60305  EAU CL 3-EAU CLA5 ckt9 OPENS A B'
COM ' These lines are west of Council Creek'
COM ' They could trip for loss of E.C.-Arpin 345 kV'
COM ' 39901 [COC DPC     ] to 38342 [COC 69  69.0]'
COM ' 38333 [HLT 69  69.0] to 68821 [MAUSTON 69.0]'
COM '--------------------------------------------------------'
CONTINGENCY '050    1'
COM 'king-eau claire-arpin with 69 tripping'
TRIP LINE FROM BUS 60186 TO BUS 60304 CKT 1
TRIP LINE FROM BUS 60304 TO BUS 39244 CKT 1
TRIP LINE FROM BUS 60304 TO BUS 60305 CKT 9
TRIP LINE FROM BUS 39901 TO BUS 38342 CKT 1
TRIP LINE FROM BUS 38333 TO BUS 68821 CKT 1
END
CONTINGENCY '050    2'
COM 'king-eau claire-arpin w/o 69 tripping'
TRIP LINE FROM BUS 60186 TO BUS 60304 CKT 1
TRIP LINE FROM BUS 60304 TO BUS 39244 CKT 1
TRIP LINE FROM BUS 60304 TO BUS 60305 CKT 9
END
CONTINGENCY '050    3'
COM 'eau claire-arpin with 69 tripping'
```

TRIP LINE FROM BUS 60304 TO BUS 39244 CKT 1
TRIP LINE FROM BUS 39901 TO BUS 38342 CKT 1
TRIP LINE FROM BUS 38333 TO BUS 68821 CKT 1
END

COM 'NSP Defined as multi-terminal'
COM 'A 60313-60285 PINE LK7-EAGLEPT7   OPENS B tower'
COM 'B 60313-60312 PINE LK7-PINE LK5   OPENS CDEF'
COM 'C 60329-60314 CRYSTAL5-PINELKT5   OPENS BDEF'
COM 'D 69565-60314 APL RVR5-PINELKT5   OPENS BCEF'
COM 'E 60312-60314 PINE LK5-PINELKT5   OPENS BCDF'
COM 'F 69565-69007 APL RVR5-APLRVR 8   OPENS BCDE'
COM '---'
CONTINGENCY 'NSP12   '
TRIP LINE FROM BUS 60313 TO BUS 60285 CKT 1
TRIP LINE FROM BUS 60313 TO BUS 60312 CKT 3
TRIP LINE FROM BUS 60329 TO BUS 60314 CKT 1
TRIP LINE FROM BUS 69565 TO BUS 60314 CKT 1
TRIP LINE FROM BUS 60312 TO BUS 60314 CKT 1
TRIP LINE FROM BUS 69565 TO BUS 69007 CKT 1
END

CONTINGENCY '835-1   '
COM 'Fault between Wheaton Tap and Red Cedar/Hydro Lane'
TRIP LINE FROM BUS 60282 TO BUS 60319 CKT 1
TRIP LINE FROM BUS 60319 TO BUS 60318 CKT 1
TRIP LINE FROM BUS 60319 TO BUS 60320 CKT 1
END

COM '840 Defined as multi-terminal'
COM 'A 60318-60368 WHEATON5-JEFRSRD5 CKT 1   OPENS B'
COM 'B 60319-60318 WHEATTP5-WHEATON5 CKT 1   OPENS A'
COM '---'
CONTINGENCY '840   '
COM ' Fault on line from Wheaton looking towards Jef and
COM ' then to Eau Claire 161 kV'
TRIP LINE FROM BUS 60318 TO BUS 60368 CKT 1
TRIP LINE FROM BUS 60319 TO BUS 60318 CKT 1
END

COM '850 Defined as multi-terminal'
COM 'A 60313-60312 PINE LK7-PINE LK5   OPENS B C D E'
COM 'B 60329-60314 CRYSTAL5-PINELKT5   OPENS A C D E'
COM 'C 69565-60314 APL RVR5-PINELKT5   OPENS A B D E'
COM 'D 60312-60314 PINE LK5-PINELKT5   OPENS A B C E'
COM 'E 69565-69007 APL RVR5-APLRVR 8   OPENS A B C D
COM '---'
CONTINGENCY '850   '
TRIP LINE FROM BUS 60313 TO BUS 60312 CKT 3
TRIP LINE FROM BUS 60329 TO BUS 60314 CKT 1
TRIP LINE FROM BUS 69565 TO BUS 60314 CKT 1
TRIP LINE FROM BUS 60312 TO BUS 60314 CKT 1
TRIP LINE FROM BUS 69565 TO BUS 69007 CKT 1
END

COM '875 Defined as multi-circuit'
COM 'C 60308-69535 LACROSS5-LAC TAP5 CKT 1   OPENS D E'
COM 'MRSHLND5-LAC TAP5 is actually MRSHLND-NLAX 5 (69566) - LAC T jrn -11-18-08'
COM 'D 60309-69535 MRSHLND5-LAC TAP5 CKT 1   OPENS C E'
COM 'E 69523-69535 GENOA 5-LAC TAP5 CKT 1   OPENS C D'
COM '---'
CONTINGENCY '875   2'
COM 'Multi-terminal portion'
TRIP LINE FROM BUS 60308 TO BUS 69535 CKT 1
COM TRIP LINE FROM BUS 60309 TO BUS 69535 CKT 1
TRIP LINE FROM BUS 60309 TO BUS 69566 CKT 1
TRIP LINE FROM BUS 69566 TO BUS 69535 CKT 1

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TRIP LINE FROM BUS 69523 TO BUS 69535 CKT 1
END
COM ' '
COM ' '
COM '  END WISCONSIN AREA CONTINGENCIES'
COM ' '
COM

CONTINGENCY 'END OF FILE'
TRIP LINE FROM BUS 99999 TO BUS 99998 CKT 99
END
END
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COM 'CapX contingencies – MTO 2016 CVS
COM 'NSP  Defined as multi-circuit 345kV'
COM 'A 60503-60504  FRNKLN 3-HELNASS3   OPENS B tower'
COM 'B 60503-60502  FRNKLN 3-LYON CO3   OPENS A tower'
COM '-----------------------------------------------------'
CONTINGENCY 'CAPX1    '
TRIP LINE FROM BUS 60501 TO BUS 60502 CKT C1
TRIP LINE FROM BUS 60501 TO BUS 60500 CKT C1
END

COM 'NSP  Defined as multi-circuit 345 and 115kV'
COM 'A 60503-60504  FRNKLN 3-HELNASS3   OPENS B tower'
COM 'B 60503-60145  FRNKLN 3-FRANKLN7   OPENS A tower'
COM '-----------------------------------------------------'
CONTINGENCY 'CAPX2    '
TRIP LINE FROM BUS 60501 TO BUS 60502 CKT C2
TRIP LINE FROM BUS 60501 TO BUS 60145 CKT C1
END

COM 'NSP  Defined as multi-circuit - 345kV'
COM 'A 60504-60503  HELNASS3-FRNKLN 3   OPENS B tower'
COM 'B 60504-60192  HELNASS3-BLUE LK3   OPENS A tower'
COM '-----------------------------------------------------'
CONTINGENCY 'CAPX5    '
TRIP LINE FROM BUS 60502 TO BUS 60501 CKT C1
TRIP LINE FROM BUS 60502 TO BUS 60192 CKT 1
END


COM 'NSP  Defined as multi-circuit - 345kV'
COM 'A 60504-60503  HELNASS3-FRNKLN 3   OPENS B tower'
COM 'B 60504-60108  HELNASS3-WILMART3   OPENS A tower'
COM '-----------------------------------------------------'
CONTINGENCY 'CAPX6    '
TRIP LINE FROM BUS 60502 TO BUS 60501 CKT C2
TRIP LINE FROM BUS 60502 TO BUS 60108 CKT 1
END


COM 'NSP  Defined as multi-circuit - 345/115'
COM 'A 60504-60505  HELNASS3-LKMARN 3   OPENS B C mtl'
COM 'B 60504-62234  LKMARN 3-LKMARN 7   OPENS A C mtl'
COM 'C 60505-60506  LKMARN 3-HMPTNCR3   OPENS A B mtl'
COM '-----------------------------------------------------'
CONTINGENCY 'CAPX7    '
TRIP LINE FROM BUS 60502 TO BUS 60505 CKT C1
TRIP LINE FROM BUS 60505 TO BUS 62234 CKT C1
TRIP LINE FROM BUS 60505 TO BUS 60503 CKT C1
END

COM 'NSP  Defined as multi-circuit - 345kV'
COM 'A 60506-60192  HMPTNCR3-BLUE LK3   OPENS B tower'
COM 'B 60506-60105  HMPTNCR3-PR ISLD3   OPENS A tower'
COM '-----------------------------------------------------'
CONTINGENCY 'CAPX10    '
TRIP LINE FROM BUS 60503 TO BUS 60192 CKT 1
```

TRIP LINE FROM BUS 60503 TO BUS 60105 CKT 1
END

COM 'NSP Defined as multi-circuit 345kV'
COM 'A 60506-60505 HMPTNCR3-LKMARN 3   OPENS B tower'
COM 'B 60506-63431 HMPTNCR3-NROC 345   OPENS A tower'
COM '--'
CONTINGENCY 'CAPX11   '
TRIP LINE FROM BUS 60503 TO BUS 60505 CKT C1
TRIP LINE FROM BUS 60503 TO BUS 63431 CKT 1
END

COM 'NSP Defined as multi-circuit -230/345'
COM 'A 60508-66550 HAZEL 4-GRANITF4   OPENS B C mtl'
COM 'B 60508-60149 HAZEL 4-MINVALT4   OPENS A C mtl'
COM 'C 60508-60507 HAZEL 4-HAZEL 3   OPENS A B mtl'
COM '--'
CONTINGENCY 'CAPX12   '
TRIP LINE FROM BUS 60508 TO BUS 66550 CKT C1
TRIP LINE FROM BUS 60508 TO BUS 60149 CKT C1
TRIP LINE FROM BUS 60508 TO BUS 60507 CKT C1
END

COM 'NSP Defined as multi-circuit - 345kV'
COM 'A 60507-60502 HAZEL 3-LYON CO3   OPENS B tower'
COM 'B 60503-60502 FRNKLN 3-LYON CO3   OPENS A tower'
COM '--'
CONTINGENCY 'CAPX13   '
TRIP LINE FROM BUS 60507 TO BUS 60500 CKT C1
TRIP LINE FROM BUS 60501 TO BUS 60500 CKT C1
END

COM 'NSP Defined as multi-circuit - 345/115'
COM 'A 60503-60502 FRNKLN 3-LYON CO3   OPENS B tower'
COM 'B 60502-60171 LYON CO3-LYON CO7   OPENS A tower'
COM '--'
CONTINGENCY 'CAPX14   '
TRIP LINE FROM BUS 60501 TO BUS 60500 CKT C2
TRIP LINE FROM BUS 60500 TO BUS 60171 CKT C1
END

COM 'NSP Defined as multi-circuit - 345kV'
COM 'A 66792-67010 MAPLE R3-AlexSS   OPENS B tower'
COM 'B 66792-63358 MAPLE R3-BUFFALO3   OPENS A tower'
COM '--'
CONTINGENCY 'CAPX16   '
TRIP LINE FROM BUS 66792 TO BUS 67010 CKT 1
TRIP LINE FROM BUS 66792 TO BUS 63358 CKT 1
END

COM 'NSP Defined as multi-circuit - 345kV'
COM 'A 66792-67010 MAPLE R3-AlexSS   OPENS B tower'
COM 'B 66792-63189 MAPLE R3-MAPLER1Y   OPENS A tower'
COM '--'
CONTINGENCY 'CAPX17   '
TRIP LINE FROM BUS 66792 TO BUS 67010 CKT 1
TRIP LINE FROM BUS 66792 TO BUS 63189 CKT 1
END

COM 'NSP Defined as multi-circuit - 345kV'
COM 'A 66792-63190 MAPLE R3-MAPLER2Y   OPENS B tower'
COM 'B 66792-63189 MAPLE R3-MAPLER1Y   OPENS A tower'
COM '--'
CONTINGENCY 'CAPX18   '

```
TRIP LINE FROM BUS 66792 TO BUS 63190 CKT 1
TRIP LINE FROM BUS 66792 TO BUS 63189 CKT 1
END


COM 'NSP  Defined as multi-circuit - 345kV'
COM 'A 66792-63358  MAPLE R3-BUFFALO3   OPENS B tower'
COM 'B 66792-63190  MAPLE R3-MAPLER2Y   OPENS A tower'
COM '-------------------------------------------------------'
CONTINGENCY 'CAPX19    '
TRIP LINE FROM BUS 66792 TO BUS 63358 CKT 1
TRIP LINE FROM BUS 66792 TO BUS 63190 CKT 1
END

COM 'NSP  Defined as multi-terminal'
COM 'A 67010-60366  AlexSS-N STCD     OPENS B C mtl'
COM '60366 N STCD bus replace by 60389 QUARRY3 - jrn 11-3-08'
COM 'A 67010-60389  AlexSS-QUARRY3    OPENS B C mtl'
COM 'B 67010-66792  AlexSS-MAPLE R3   OPENS A C mtl'
COM 'C 67010-67452  AlexSS-ALEXSS 7   OPENS A B mtl'
COM '-------------------------------------------------------'
CONTINGENCY 'CAPX20    '
TRIP LINE FROM BUS 67010 TO BUS 60389 CKT 1
TRIP LINE FROM BUS 67010 TO BUS 66792 CKT 1
TRIP LINE FROM BUS 67010 TO BUS 67452 CKT 1
END

COM 'NSP  Defined as multi-circuit'
COM 'A 67010-60366  ALEXSS-N STCD   OPENS B tower'
COM '60366 N STCD bus replace by 60389 QUARRY3 - jrn 11-3-08'
COM 'A 67010-60389  AlexSS-QUARRY3    OPENS B C mtl'
COM 'B 60389-60151  WSCTAP-MNTCELO3   OPENS A tower'
COM '-------------------------------------------------------'
CONTINGENCY 'CAPX24    '
TRIP LINE FROM BUS 67010 TO BUS 60389 CKT 1
TRIP LINE FROM BUS 60389 TO BUS 60151 CKT 1
END

COM 'NSP  Defined as multi-terminal'    NOT VALID IF DESIGNED AS A RING BUS
COM 'A 63431-60506  NROC 345-HMPTNCR3   OPENS B C mtl'
COM 'BVD3 is bus number 69079 - jrn 11-18-08'
COM 'was B 63431-69069  NROC 345-BVD3     OPENS A C mtl'
COM 'now B 63431-69079  NROC 345-BVD3     OPENS A C mtl'
COM 'C 63431-63432  NROC 345-NROC 161   OPENS A B mtl'
COM '-------------------------------------------------------'
CONTINGENCY 'CAPX26    '
TRIP LINE FROM BUS 63431 TO BUS 60503 CKT 1
COM TRIP LINE FROM BUS 63431 TO BUS 69069 CKT 1
TRIP LINE FROM BUS 63431 TO BUS 69079 CKT 1
TRIP LINE FROM BUS 63431 TO BUS 63432 CKT 1
END

COM 'NSP  Defined as multi-terminal'    NOT VALID IF DESIGNED AS A RING BUS
COM 'A 63432-63445  NROC 161-CHESTER    OPENS B C mtl'
COM 'B 63432-63415  NROC 161-N HILLS    OPENS A C mtl'
COM 'C 63431-63432  NROC 345-NROC 161   OPENS A B mtl'
COM '-------------------------------------------------------'
CONTINGENCY 'CAPX27    '
TRIP LINE FROM BUS 63432 TO BUS 63445 CKT 1
TRIP LINE FROM BUS 63432 TO BUS 63415 CKT 1
TRIP LINE FROM BUS 63431 TO BUS 63432 CKT 1
END

CONTINGENCY 'test'
TRIP LINE FROM BUS 99998 TO BUS 99999 CKT 15
END

END
```

COM ' MAPP Contingency file with updates from Warren Hess and Ulteig – MTO 2016 CVS
COM ' COMPLETED UPDATING June and MARCH 16, 2004, LOREN '
COM ' Pass2 Updates performed from March 26 to April 5, 2004'
COM ' '
COM '   Current MAPP Contingency File 2004 Summer'

COM ' '
COM '   DC Reductions Not Shown, commented out with XXX, to be modified'
COM '   according to model used and when needed by study group(s).'
COM ' '
COM ' ** The DC runback figures are not up to date, they'
COM '   reflect conditions modeled in the winter model'
COM ' '
COM ' Flow at 67557 to 66752 is 276.3 MW'
COM ' Flow at 67576 to 60175 is 158.3 MW'
COM ' Flow at 67564 to 60173 is 1377.1 MW'
COM ' Flow at 60198 to 60197 is 995.7 MW, Chisago N-Chisago'
COM ' Flow at 60101 to 60198 is 1012.3 MW, Chisago-Forbes 500kV'
COM ' Flow at 60197 to 61494 is 497.9 MW, Chisago xfr D27'
COM ' Flow at 60197 to 61493 is 497.9 MW, Chisago xfr D17'
COM ' '
COM ' '
COM ' '
COM ' Change load on bus 67503 dorsey from zero for DC trip'
COM ' Cannot change gen on a swing bus at kettle 67683 per PTI'
COM ' '
COM ' '
COM '   All 500 kV DC reduction responses are'
COM '   based on the flow from the Dorsey bus 67564.'
COM '   No other bus flow should be used when simulating'
COM '   a trip that OPENS any 500 kV line section(s).'
COM ' '
COM ' '
COM ' '
COM ' '
COM ' 001 Defined as multi-terminal, with DC reduction'
COM ' A 66757-60175 MORANVI4-ROSEAU 4 CKT 1   OPENS B'
COM ' B 60175-67576 ROSEAU 4-RICHER 4 CKT 1   OPENS A'
COM '---'

COM ' 007 Defined as multi-terminal, north transformer outage'
COM 'A 66753-66778 RUNNING4-RUNNINNT CKT 1   OPENS B C D E F'
COM 'B 66780-66778 RUNNINU8-RUNNINNT CKT 1   OPENS A C D E F'
COM 'C 66765-66778 RUNNINN9-RUNNINNT CKT 1   OPENS A B D E F'
COM ' south transformer trips from outage above'
COM 'D 66753-66779 RUNNING4-RUNNINST CKT 1   OPENS see above'
COM 'E 66780-66779 RUNNINU8-RUNNINST CKT 1   OPENS see above'
COM 'F 66764-66779 RUNNINS9-RUNNINST CKT 1   OPENS see above'
COM 'RUNNING4-MORANVI4 is Running-Lund (66760) -Moran - jrn 11-17-08'
COM 'G 66753-66757 RUNNING4-MORANVI4 CKT 1   VLD SGL, DC RED'
COM 'H 66753-61627 RUNNING4-SHANNON4 CKT 1   VLD SGL, DC RED'
COM '---'
CONTINGENCY '007   '
COM 'Reduce 100% measured at 67576'
COM 'TRIP LINE FROM BUS 66753 TO BUS 66757 CKT 1 DCRED'
COM TRIP LINE FROM BUS 66753 TO BUS 66757 CKT 1
TRIP LINE FROM BUS 66753 TO BUS 66760 CKT 1
TRIP LINE FROM BUS 66760 TO BUS 66757 CKT 1
TRIP LINE FROM BUS 66753 TO BUS 61627 CKT 1
CHANGE BUS 67503 SHUNT BY 158.3 MW
CHANGE BUS 60002 GENERATION BY 158.3 MW
COM 'CHANGE BUS 60001 GENERATION BY 0.0 MW'
COM 'CHANGE BUS 60002 GENERATION BY 0.0 MW'
COM 'CHANGE BUS 60008 GENERATION BY 0.0 MW'
TRIP LINE FROM BUS 66753 TO BUS 66778 CKT 1
TRIP LINE FROM BUS 66780 TO BUS 66778 CKT 1
TRIP LINE FROM BUS 66765 TO BUS 66778 CKT 1
TRIP LINE FROM BUS 66753 TO BUS 66779 CKT 1
TRIP LINE FROM BUS 66780 TO BUS 66779 CKT 1

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TRIP LINE FROM BUS 66764 TO BUS 66779 CKT 1
END

COM ' 009 Defined as multi-circuit, tower'
COM ' Both 63030-60270-60233 and 63030-60202 must trip for the Coal'
COM ' Creek to Dickinson DC line to trip.  The DC will'
COM ' carry 1000 MW if only one of these lines trip'
COM ' SET BUS 63000 AND 63001 = PGEN + PLOAD = xxx.0 and xxx.0'
COM ' SET BUS 63041 AND 63030 ALWAYS ZERO FOR DC TRIP'
COM 'A 63030-60270 DICKNSN3-MPLEGV13 CKT 1   OPENS  C tower, MTL B, A C trip DC line'
COM 'B 60270-60233 MPLEGV13-PARKERS3 CKT 1   OPENS  with A'
COM 'C 63030-60202 DICKNSN3-COON CK3 CKT 1   OPENS  A tower, A C trip DC line'
COM 'D 63030-62925 DICKNSN3-DICKNSN7 CKT 1   Transfr to better simulate DC'
COM '-------------------------------------------------------'
CONTINGENCY '009'
COM 'DC line trip, also OPENS Maple Grv. to Parkers 345kV'
COM 'TRIP LINE FROM BUS 63030 TO BUS 60270 CKT 1 DCRED'
COM 'TRIP LINE FROM BUS 60270 TO BUS 60233 CKT 1 DCRED'
TRIP LINE FROM BUS 63030 TO BUS 60270 CKT 1
TRIP LINE FROM BUS 60270 TO BUS 60233 CKT 1
TRIP LINE FROM BUS 63030 TO BUS 60202 CKT 1
TRIP BRANCH FROM BUS 63030 TO BUS 62925 TO BUS 63081 CKT 1
COM ' Dickinson Transformer 345/115kV shown to better simulate DC trip'
COM ' Dickinson Transformer is 3 winding.  Disconnecting 13.8 bus'
DISCONNECT BUS 63081
SET BUS 63030 LOAD TO 1054.2 MW
COM 'Coal Creek is outputting 620 MW in our model
COM CHANGE BUS 63000 GENERATION BY  -576.0 MW
CHANGE BUS 63000 GENERATION BY  -620.0 MW
END

COM ' 015 Defined as multi-terminal and multi-circuit'
COM ' This multi-terminal/circuit outage consists of three'
COM ' parts.  All of the multi-terminal/circuit outages listed'
COM ' in outage 63336 are valid and will trip regardless'
COM ' Is 63336 the correct bus, this is Audubon'
COM ' of any base flow.  However, if certain base flows'
COM ' are at levels as outlined below and flows are south'
COM ' the multi-terminal/circuit outage will also cause a:'
COM ' '
COM '     100% DC runback for MTL outage of the Dorsey-Roseau-Forbes'
COM '     500kV line as measured at the 67564 Dorsey bus.'
COM ' '
COM '     40% to 100% DC runback, depending on the base flow on'
COM '     the Forbes-Chisago 500kV line, for the outage of'
COM '     Forbes-Chisago 500kV line as measured at the Dorsey'
COM '     bus 67564.'
COM ' '
COM ' Also, loss of one or both series capacitors at'
COM ' Roseau can cause either a 13% or 26% DC reduction.'
COM ' respectively, regardless of base flows, as measured at'
COM ' the Dorsey bus 67564.'
COM ' '
COM ' '
COM ' On the south end of the Dorsey-Roseau-Forbes-Chisago 500 kV'
COM ' line A DC reduction may be required for the trip of'
COM ' Chisago-Forbes 500 kV line section.  If the base flow'
COM ' on Chisago-Forbes 345 kV line is 350 to 550 MW'
COM ' there is a 40% DC reduction.  If the base flow on'
COM ' Chisago-Forbes 500 kV line is greater than 550 MW'
COM ' there is a 100% DC reduction.  As measured at the'
COM ' Dorsey bus.'
COM ' '
COM ' On the South end of the Dorsey-Roseau-Forbes-Chisago 500 kV'
COM ' line Loss of BOTH  Chisago County Transfomers will in turn'
COM ' cause a multi-circuit loss of the Chisago-Forbes'
COM ' 500 kV line.  Since the south end of the 500 kV line'
COM ' is opened, a 40% DC reduction is be required if flows'
COM ' are 350 to 550 MW and a 100% reduction if flows are greater.'
COM ' than 550 MW on the Chisago-Forbes 500 kV line - as measured'
```

COM ' at the Dorsey bus. A 100% reduction required since a cross'
COM ' trip of the north end of the 500 kV line will take place'
COM ' if the flow on the south end is 550 MW or greater.'
COM ' All the text for this #15 cont. is obsolete & should be changed.
COM ' If the flow on Chisago-Forbes 500 kV line is less than'
COM ' 350 MW (419 MW), no DC reduction is required for the Chisago'
COM ' to Forbes 500 kV line trip.'
COM ' '
COM ' See Outage 905 PARTS 2 and 7 below.'
COM ' '
COM ' '
COM ' '
COM ' Part 1, North end of the 500 kV Line, Forbes north to Dorsey'
COM ' Part 1 Can trip regardless of base flows.'
COM ' '
COM ' At the north end of the 500 kV line, Forbes north to Dorsey,'
COM ' The following is a valid Transformer multi-terminal line trip'
COM ' which in turn OPENS the 500 kV line between Roseau-Forbes-Chisago.'
COM ' A DC reduction of 100%, as measured at the Dorsey bus, (Dorsey Sub)'
COM ' is required for loss of the Forbes-Roseau 500 kV line section'
COM ' in the 1998 winter transfer study, excluding reduction for'
COM ' capacitor bank(s).'
COM ' '
COM ' PART 1 simulates the trip of the Forbes 500/230 kV'
COM ' transformer 1 or 2 which open ends the Roseau-Forbes-Chisago'
COM ' Obsolete one Xfmr doesn't open end 500 kV line anymore'
COM ' 500 kV line which in turn requires a 100% DC reduction, as'
COM ' measured at the Dorsey 67564 bus, in 1998'
COM ' winter study.'
COM ' '
COM 'A 60101-61550 FORBES 2-FORB1JCT CKT 1   OPENS B C D E F G H I J K'
COM 'B 61550-61624 FORB1JCT-FORBES 4 CKT 1   OPENS A C D E F G H I J K'
COM 'C 61550-61551 FORB1JCT-FORB1TRT CKT 1   OPENS A B D E F G H I J K'
COM ' '
COM 'D 60101-61552 FORBES 2-FORB2JCT CKT 2   OPENS A B C E F G H I J K'
COM 'E 61552-61624 FORB2JCT-FORBES 4 CKT 2   OPENS A B C D F G H I J K'
COM 'F 61552-61553 FORB2JCT-FORB2TRT CKT 2   OPENS A B C D E G H I J K'
COM ' '
COM 'G 60101-60198 FORBES 2-CHIS-N 2 CKT 1'
COM 'H 60101-60174 FORBES 2-ROSEAUS2'
COM 'I 67564-60173 DORSEY 5-ROSEAUN2 CKT 1(cap banks modeled here)'
COM J 60173-60174 ROSEAUN2-ROSEAUS2 CKT 1'
COM 'K 60174-60101 ROSEAUS2-FORBES 2 CKT 1'
COM ' '
COM ' '
COM ' PART 2 - Southern End of the 500 kV line'
COM ' Part 2 Can trip regardless of base flows.'
COM ' '
COM ' The following is a valid multi-circuit trip '
COM ' with flows south and with the exception that'
COM ' IF FLOW ON FORBES-CHISAGO IS LESS THAN 350 MW, NO DC TRIP'
COM ' IF FLOW ON THE FORBES-CHISAGO IS 350 TO 550 MW, 40% DC RED'
COM ' IF FLOW ON THE FORBES-CHISAGO IS OVER 550 MW, 100% DC RED'
COM ' All the text for this cont. is obsolete & should be changed.'
COM ' If flows are 550 MW or more on the south end of the 500 kV line'
COM ' A cross trip of the north end of the 500 kV line will'
COM ' occur when the south end is tripped.'
COM ' '
COM ' Base flow on 60101-60198 = 419, 40% DC reduction '
COM ' required for the 1998 winter transfer study.'
COM '
COM ' Also,'
COM ' When the series capacitors (both cap banks) are bypassed'
COM ' at Roseau a 26% DC reduction is required as measured at'
COM ' Dorsey bus 67564. If only one cap bank is bypassed'
COM ' then there is a 13% reduction. Both banks will be'
COM ' bypassed in part 2 for the 1998 winter study'
COM ' '
COM ' There will be a minimum of 26%, 40% OR 100% DC reduction'
COM ' simulated depending on base case conditions as noted'

COM ' above in the 1998 winter study. See Part 2 outage below.'
COM ' '
COM ' C 60101-60198 FORBES 2-CHIS-N 2 CKT 1'
COM ' E 60197-60198 CHIS CO2-CHIS-N 2 CKT 1'
COM ' '
COM ' '
COM ' PART 3 North end of the 500kV Line'
COM ' PART 3 Trips regardless of base flows'
COM ' '
COM ' PART 3 Simulates the 500 kV line cross trip.'
COM ' With flows south the following outage simulates'
COM ' a multi-circuit cross trip where both Dorsey-Roseau'
COM ' 500 kV and Roseau-Forbes 500 kV lines trip together.'
COM ' With a cross trip from Dorsey to Forbes on the'
COM ' 500 kV line, a 100% DC reducion (1765.0 MW) is'
COM ' required regardless of base case flows, See Part 1.'
COM ' Also,'
COM ' When the series capacitors (both cap banks) are bypassed'
COM ' at ROSEAU a 26% DC reduction is required as measured'
COM ' at Dorsey bus 67564. If only one cap bank is bypassed'
COM ' then there is a 13% reduction. Two banks will be'
COM ' bypassed in Part 4 in 903 for the 1998 winter study.'
COM ' '
COM ' '
COM 'F 67564-60173 DORSEY 5-ROSEAUN2 CKT 1(cap banks modeled here)'
COM G 60173-60174 ROSEAUN2-ROSEAUS2 CKT 1'
COM 'H 60174-60101 ROSEAUS2-FORBES 2 CKT 1'
COM '--'
CONTINGENCY '015   1'
COM 'Multi-circuit trip of the Forbes Transformer and'
COM '500 kV line response from Roseau south to Chisago.'
COM 'A 100% DC reduction required as measred at Dorsey'
COM 'bus 67564. Same as the 500 kV line cross trip from'
COM ' Roseau south to Chisago.'
COM 'TRIP LINE FROM BUS 60101 TO BUS 61550 CKT 1 DCRED'
TRIP LINE FROM BUS 60101 TO BUS 61550 CKT 1
TRIP LINE FROM BUS 61550 TO BUS 61624 CKT 1
TRIP LINE FROM BUS 61550 TO BUS 61551 CKT 1
TRIP LINE FROM BUS 60101 TO BUS 61552 CKT 1
TRIP LINE FROM BUS 61552 TO BUS 61624 CKT 1
TRIP LINE FROM BUS 61552 TO BUS 61553 CKT 1
TRIP LINE FROM BUS 60101 TO BUS 60198 CKT 1
TRIP LINE FROM BUS 67564 TO BUS 60173 CKT 1
TRIP LINE FROM BUS 60173 TO BUS 60174 CKT 1
TRIP LINE FROM BUS 60174 TO BUS 60101 CKT 1
COM 'Also add trip of lines 60101-60100 & 60198-60197'
COM 'the load on Dorsey is 1698 MW'
CHANGE BUS 67503 SHUNT BY 1698 MW
COM 'in the MTO 2016 study the SHERCO and INV units
COM 'are fully dispatched, thus cannot be increased
COM CHANGE BUS 60001 GENERATION BY 137.7 MW
COM CHANGE BUS 60002 GENERATION BY 323.6 MW
COM CHANGE BUS 60028 GENERATION BY 915.8 MW
COM 'CHANGE BUS 60000 GENERATION BY   0.0 MW'
COM 'CHANGE BUS 61775 GENERATION BY   0.0 MW'
END
CONTINGENCY '015   2'
COM 'Trip Forbes to Chisago 500 kV line, South end'
COM 'of the 500 kV line. Reduce the DC 100% as'
COM 'measured at the Dorsey bus 67564'
COM 'TRIP LINE FROM BUS 60101 TO BUS 60198 CKT 1 DCRED'
TRIP LINE FROM BUS 60101 TO BUS 60198 CKT 1
TRIP LINE FROM BUS 60197 TO BUS 60198 CKT 1
COM 'the load on Dorsey is 1698 MW'
COM CHANGE BUS 67503 SHUNT BY 1377.1 MW
CHANGE BUS 67503 SHUNT BY 1698 MW
COM 'in the MTO 2016 study the SHERCO and INV units
COM 'are fully dispatched, thus cannot be increased
COM CHANGE BUS 60001 GENERATION BY 137.7 MW
COM CHANGE BUS 60002 GENERATION BY 323.6 MW

COM CHANGE BUS 60028 GENERATION BY 915.8 MW
COM 'CHANGE BUS 60000 GENERATION BY   0.0 MW'
COM 'CHANGE BUS 61775 GENERATION BY   0.0 MW'
END
CONTINGENCY '015   4'
COM 'Trip both Capacitor Banks at Roseau, 26% DC reduction'
COM 'at bus 67564'
COM 'flow on DC line is 1698 MW
CHANGE BUS 67503 SHUNT BY 442 MW
COM 'in the MTO 2016 study the SHERCO and INV units
COM 'are fully dispatched, thus cannot be increased
COM CHANGE BUS 60001 GENERATION BY 116.0 MW
COM CHANGE BUS 60002 GENERATION BY 242.0 MW
COM 'When caps are bypassed, chng imp on 60173-60174'
COM ' from -.0332 to +.00001'
END

COM ' 022 Defined as tower and multi-terminal combinations'
COM ' South end of the 500 kV line.'
COM ' '
COM ' Loss of both Chisago County 345 kV outlets will cause a'
COM ' 100% DC reduction, as measured at Dorsey bus 67564,'
COM ' if flows are 350 MW or higher on Forbes-Chisago'
COM ' 500 kV line.'
COM ' '
COM '**   Defined as multi-circuit, tower'
COM 'Note: Both A and B must be opened for a DC reduction'
COM 'A 60186-60199 AS KING3-CHIS CO3   OPENS B tower'
COM 'B 60199-60221 CHIS CO3-KOLMNLK3   OPENS A tower and MTL'
COM '**   Defined as multi-terminal'
COM 'B 60199-60221 CHIS CO3-KOLMNLK3   OPENS C'
COM 'C 60221-60222 KOLMNLK3-KOLMNLK7 CKT 2 VALID SINGLE'
COM '--'
CONTINGENCY '022   1'
TRIP LINE FROM BUS 60186 TO BUS 60199 CKT 1
TRIP LINE FROM BUS 60199 TO BUS 60221 CKT 1
COM 'Also trips the following because of B where'
TRIP LINE FROM BUS 60221 TO BUS 60222 CKT 10
COM 'If Chisago-Forbes 500 kV line'
COM 'flow is less than 350 MW there is no DC reduction.'
COM 'If flow on the Chisago-Forbes 500 kV line is 350 to 550 MW'
COM 'reduce the DC 40%, and reduce the DC 100% if the flow is'
COM 'above 550 MW. Base flow is 419 in the winter model.'
COM 'the flow on the DC line in the MTO 2016 model is 1698
CHANGE BUS 67503 SHUNT BY 1698 MW
COM 'in the MTO 2016 study the SHERCO and INV units
COM 'are fully dispatched, thus cannot be increased
COM CHANGE BUS 60001 GENERATION BY 137.7 MW
COM CHANGE BUS 60002 GENERATION BY 323.6 MW
COM CHANGE BUS 60028 GENERATION BY 915.8 MW
END

COM ' '
COM ' '
COM ' SINGLES AND SINGLE PRIORS THAT REQUIRE D.C. RED'
COM ' '

COM ' '
COM ' End Of Outages That Cause DC or Unit runback'
COM ' '

COM ' '
COM ' '
COM ' '
COM ' START DAKOTA AREA CONTINGENCIES'
COM ' '
COM ' '
COM ' '

CONTINGENCY 'FARGO4N BF'

TRIP LINE FROM BUS 66435 TO BUS 66444 CKT 1
TRIP LINE FROM BUS 66435 TO BUS 66446 CKT 1
END

CONTINGENCY 'FARGO4S BF'
TRIP LINE FROM BUS 66435 TO BUS 66444 CKT 2
TRIP LINE FROM BUS 66435 TO BUS 60133 CKT 1
TRIP LINE FROM BUS 66435 TO BUS 66553 CKT 1
TRIP LINE FROM BUS 66435 TO BUS 66440 CKT 1
END

CONTINGENCY 'BSMRCK4W BF'
TRIP LINE FROM BUS 66426 TO BUS 66444 CKT 1
TRIP LINE FROM BUS 66426 TO BUS 66456 CKT 1
TRIP LINE FROM BUS 66426 TO BUS 99969 CKT 1
TRIP LINE FROM BUS 66426 TO BUS 66427 CKT 1
TRIP LINE FROM BUS 66426 TO BUS 66427 CKT 2
END

CONTINGENCY 'BSMRCK4E BF'
TRIP LINE FROM BUS 66426 TO BUS 67283 CKT 1
TRIP LINE FROM BUS 66426 TO BUS 67328 CKT 1
TRIP LINE FROM BUS 66426 TO BUS 67338 CKT 1
END

CONTINGENCY 'JMSTN4N BF'
TRIP LINE FROM BUS 66444 TO BUS 66426 CKT 1
TRIP LINE FROM BUS 66444 TO BUS 66435 CKT 1
TRIP LINE FROM BUS 66444 TO BUS 66441 CKT 1
TRIP LINE FROM BUS 66444 TO BUS 66759 CKT 1
TRIP LINE FROM BUS 66444 TO BUS 66207 CKT 1
END

CONTINGENCY 'JMSTN4S BF'
TRIP LINE FROM BUS 66444 TO BUS 66435 CKT 1
TRIP LINE FROM BUS 66444 TO BUS 67328 CKT 1
TRIP LINE FROM BUS 66444 TO BUS 66199 CKT 1
END

COM 'NSP - 1 Defined as multi-circuit'
COM 'SPLIT ROCK-WHITE & SPLIT ROCK-SIOUX CITY 345'
COM 'A 60126-60130 SPLT RK3-SPLTRTA3 CKT 1   OPENS C   tower, B MTL'
COM 'B 60130-66537 SPLTRTA3-WHITE 3 CKT 1   OPENS A   MTL'
COM 'C 60126-60131 SPLT RK3-SPLTRTB3 CKT 1   OPENS A   tower, D MTL'
COM 'D 60131-66564 SPLTRTB3-SIOUXCY3 CKT 1   OPENS C   MTL'
COM '--'
CONTINGENCY 'SPK-WHT/SXC'
TRIP LINE FROM BUS 60126 TO BUS 60130 CKT 1
TRIP LINE FROM BUS 60130 TO BUS 66537 CKT 1
TRIP LINE FROM BUS 60126 TO BUS 60131 CKT 1
TRIP LINE FROM BUS 60131 TO BUS 66564 CKT 1
END

COM 'NSP - 3 DEFINED AS MULTI-CIRCUIT'
COM 'MAPLE RIVER-SHEYENE/WAHPETON'
COM 'A 66754-60133 MAPLE R4-SHEYNNE4 CKT 1   OPENS B TOWER'
COM 'B 66754-63329 MAPLE R4-WAHPETN4 CKT 1   OPENS A TOWER'
COM '--'
CONTINGENCY 'MPR-SHY/WAH'
TRIP LINE FROM BUS 66754 TO BUS 60133 CKT 1
TRIP LINE FROM BUS 66754 TO BUS 63329 CKT 1
END

COM '99 CROSS TRIP FOR TIOGA-LOGAN 230KV LINE OF THE TIOGA'
COM ' 115/230 TRANSFORMER. NOT VALID UNTIL THE B10T FLOW'
COM ' TOWARD THE SOUTH IS OVER 100MW'
COM '--'
CONTINGENCY '99   '
TRIP LINE FROM BUS 67104 TO BUS 67108 CKT 1
TRIP LINE FROM BUS 67104 TO BUS 67385 CKT 1

END

COM '105 Defined as multi-circuit, tower'
COM 'A 66426-66441 BISMARK4-GARRISN4 CKT 1   OPENS   B or C tower'
COM 'B 66426-66456 BISMARK4-WASHBRN4 CKT 1   OPENS   A tower, MTL 1 '
COM 'C 66441-67106 GARRISN4-LELANDO4 CKT 1   OPENS   A tower'
COM '**   Defined as multi-terminal'
COM 'D 66426-66456 BISMARK4-WASHBRN4 CKT 1   OPENS   E MTL'
COM 'E 66456-67106 WASHBRN4-LELANDO4 CKT 1   OPENS   D MTL'
COM '--'
CONTINGENCY '105   1'
COM 'Tower with multi-terminal'
TRIP LINE FROM BUS 66426 TO BUS 67283 CKT 1
TRIP LINE FROM BUS 66426 TO BUS 66456 CKT 1
COM 'Also trips the following because of B'
TRIP LINE FROM BUS 66456 TO BUS 67106 CKT 1
COM 67283-66441 Will also be tripped due to being multi-terminal
COM (MAG 11-21-08)
TRIP LINE FROM BUS 67283 TO BUS 66441 CKT 1
END
CONTINGENCY '105   2'
COM 'Tower only'
TRIP LINE FROM BUS 66426 TO BUS 67283 CKT 1
TRIP LINE FROM BUS 66441 TO BUS 67106 CKT 1
END
CONTINGENCY '105   3'
COM 'Multi-terminal only'
TRIP LINE FROM BUS 66426 TO BUS 66456 CKT 1
TRIP LINE FROM BUS 66456 TO BUS 67106 CKT 1
END

COM '110 Defined as multi-circuit, tower'
COM 'A 66503-66530 BLAIR 4-WATERTN4 CKT 1   OPENS B   tower'
COM 'B 66530-66550 WATERTN4-GRANITF4 CKT 1   OPENS A or C   tower'
COM 'C 66503-66550 BLAIR 4-GRANITF4 CKT 1   OPENS B   tower'
COM '--'
CONTINGENCY '110   1'
TRIP LINE FROM BUS 66503 TO BUS 66530 CKT 1
TRIP LINE FROM BUS 66530 TO BUS 66550 CKT 1
END
CONTINGENCY '110   2'
TRIP LINE FROM BUS 66530 TO BUS 66550 CKT 1
TRIP LINE FROM BUS 66503 TO BUS 66550 CKT 1
END

COM '114 WAPA Defined as multi-terminal, Interregional'
COM 'Little Missioui Tap'
COM 'BOWMAN 4-LTLMISS4 is acutally Bowman-Rhame (67915)-LtMiss -jrn 11-18-08'
COM 'Rhame has a 115 load tap bus 67913 also disconnected - jrn'
COM 'A 67310-67265 BOWMAN 4-LTLMISS4 CKT 1   OPENS B C'
COM 'B 67265-67304 LTLMISS4-BAKER 7 CKT 1   OPENS A B'
COM 'C 67265-67263 LTLMISS4-LTLMISS7 CKT 1   OPENS A C'
COM '--'
CONTINGENCY '114'
COM TRIP LINE FROM BUS 67310 TO BUS 67265 CKT 1
TRIP LINE FROM BUS 67310 TO BUS 67915 CKT 1
TRIP LINE FROM BUS 67915 TO BUS 67265 CKT 1
DISCONNECT BUS 67913
TRIP LINE FROM BUS 67265 TO BUS 67304 CKT 1
TRIP LINE FROM BUS 67265 TO BUS 67263 CKT 1
END

COM '120   Defined as multi-circuit, tower'
COM 'A 66504-66531 BROOKNG7-WATERTN7 CKT 1   OPENS B   tower'
COM 'B 66529-66537 WATERTN3-WHITE 3 CKT 1   OPENS A   tower'
COM '--'
CONTINGENCY '120   '
TRIP LINE FROM BUS 66504 TO BUS 66531 CKT 1
TRIP LINE FROM BUS 66529 TO BUS 66537 CKT 1
END

```
COM '108   Defined as multi-circuit, tower'
COM 'A 66507-66509 FTTHOMP4-FTRANDL4   OPENS  B or C  tower'
COM 'B 66507-66516 FTTHOMP4-LAKPLAT4   OPENS  A       tower'
COM 'C 66509-66516 FTRANDL4-LAKPLAT4   OPENS  A       tower'
COM '-------------------------------------------------------'
CONTINGENCY '108     1'
TRIP LINE FROM BUS 66507 TO BUS 66509 CKT 1
TRIP LINE FROM BUS 66507 TO BUS 66516 CKT 1
TRIP LINE FROM BUS 66509 TO BUS 66516 CKT 1
END

COM '130  Defined as multi-circuit, tower'
COM 'A 66507-66523  FTTHOMP4-SIOUXFL4   OPENS  BorCorD  tower'
COM 'B 66507-67122  FTTHOMP4-STORLA 4   OPENS  A        tower, MTL'
COM 'C 66513-67122  HANLON 4-STORLA 4   OPENS  A        tower, MTL'
COM 'D 66513-66523  HANLON 4-SIOUXFL4   OPENS  A        tower'
COM '**    Defined as multi-terminal, MTL'
COM 'E 66507-67122  FTTHOMP4-STORLA 4   OPENS  F G'
COM 'F 66513-67122  HANLON 4-STORLA 4   OPENS  E G'
COM 'G 67122-67123  STORLA 4-STORLA 7     VLD SGL'
COM '-------------------------------------------------------'
CONTINGENCY '130      1'
TRIP LINE FROM BUS 66507 TO BUS 66523 CKT 1
TRIP LINE FROM BUS 66507 TO BUS 67122 CKT 1
COM 'Also trips the following because of B mtl'
COM TRIP LINE FROM BUS 66507 TO BUS 67122 CKT 1
TRIP LINE FROM BUS 66513 TO BUS 67122 CKT 1
TRIP LINE FROM BUS 67122 TO BUS 67123 CKT 1
END
CONTINGENCY '130      2'
TRIP LINE FROM BUS 66507 TO BUS 66523 CKT 1
TRIP LINE FROM BUS 66513 TO BUS 66523 CKT 1
END

COM '140  Defined as multi-circuit, tower'
COM 'A 66507-66514  FTTHOMP4-HURON  4  1  OPENS  B    tower'
COM 'B 66507-66514  FTTHOMP4-HURON  4  2  OPENS  A    tower'
COM '-------------------------------------------------------'
CONTINGENCY '140    '
TRIP LINE FROM BUS 66507 TO BUS 66514 CKT 1
TRIP LINE FROM BUS 66507 TO BUS 66514 CKT 2
END

COM '150  Defined as multi-circuit, tower'
COM 'A 66507-66519  FTTHOMP4-OAHE   4  1  OPENS  B    tower'
COM 'B 66507-66519  FTTHOMP4-OAHE   4  2  OPENS  A    tower'
COM '-------------------------------------------------------'
CONTINGENCY '150    '
TRIP LINE FROM BUS 66507 TO BUS 66519 CKT 1
TRIP LINE FROM BUS 66507 TO BUS 66519 CKT 2
END

COM '151  Defined as multi-circuit'
COM 'A 66507-66519  FTTHOMP4-OAHE   4  3  OPENS  B    tower'
COM 'B 66507-66519  FTTHOMP4-OAHE   4  4  OPENS  A    tower'
COM '-------------------------------------------------------'
CONTINGENCY '151    '
TRIP LINE FROM BUS 66507 TO BUS 66519 CKT 3
TRIP LINE FROM BUS 66507 TO BUS 66519 CKT 4
END

COM '160  Defined as multi-circuit, tower'
COM 'A 66509-66565  FTRANDL4-SIOUXCY4   OPENS  BorCorD  tower'
COM 'B 66509-66526  FTRANDL4-UTICAJC4   OPENS  A        tower, MTL'
COM 'C 66526-66536  UTICAJC4-RASMUSN4   OPENS  A        tower, MTL'
COM 'D 66536-66565  RASMUSN4-SIOUXCY4   OPENS  A        tower'
COM '**    Defined as multi-terminal'
COM 'E 66509-66526  FTRANDL4-UTICAJC4   OPENS  F G'
COM 'F 66526-66398  UTICAJC4-VFODNES4   OPENS  E G'
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COM 'G 66526-66536  UTICAJC4-RASMUSN4   OPENS  E F'
COM '--------------------------------------------------'
CONTINGENCY '160       1'
TRIP LINE FROM BUS 66509 TO BUS 66565 CKT 1
TRIP LINE FROM BUS 66509 TO BUS 66526 CKT 1
COM 'Also trips the following because of B'
TRIP LINE FROM BUS 66526 TO BUS 66536 CKT 1
TRIP LINE FROM BUS 66398 TO BUS 66526 CKT 1
END
CONTINGENCY '160       2'
TRIP LINE FROM BUS 66509 TO BUS 66565 CKT 1
TRIP LINE FROM BUS 66536 TO BUS 66565 CKT 1
END
CONTINGENCY '160       3'
TRIP LINE FROM BUS 66509 TO BUS 66526 CKT 1
TRIP LINE FROM BUS 66398 TO BUS 66526 CKT 1
TRIP LINE FROM BUS 66526 TO BUS 66536 CKT 1
END


COM '170  Defined as multi-circuit, tower'
COM 'A 66514-66530  HURON  4-WATERTN4  1  OPENS  B   tower'
COM 'B 66514-66530  HURON  4-WATERTN4  2  OPENS  A   tower'
COM '---------------------------------------------------------'
CONTINGENCY '170     '
TRIP LINE FROM BUS 66514 TO BUS 66530 CKT 1
TRIP LINE FROM BUS 66514 TO BUS 66530 CKT 2
END


COM '180 GRE Defined as multi-terminal tower'
COM 'multi-terminal trips A B and C'
COM 'A 63041-63042 COAL CR4-COAL TP4 OPENS B, C'
COM 'B 63042-63049 COAL TP4-STANTON4 OPENS A, C'
COM 'C 63042-63044 COAL TP4-MCHENRY4 OPENS A, B'
COM 'A and B multi-circuit tower with portions of D and operating response'
COM 'D 63041-63049 COAL CR4-STANTON4'
COM '---------------------------------------------------------'
CONTINGENCY '180       1'
COM 'mtl outage portion'
TRIP LINE FROM BUS 63041 TO BUS 63042 CKT 1
TRIP LINE FROM BUS 63042 TO BUS 63049 CKT 1
TRIP LINE FROM BUS 63042 TO BUS 63044 CKT 1
END
COM CONTINGENCY '180       2' This contingency is no longer valid since
COM                   CoalCreek-CoalTap has been separated from
COM                   CoalCreek-Stanton (no longer double-circuited.
COM COM 'Common tower outage with mtl portion'
COM TRIP LINE FROM BUS 63041 TO BUS 63042 CKT 1
COM TRIP LINE FROM BUS 63042 TO BUS 63049 CKT 1
COM TRIP LINE FROM BUS 63042 TO BUS 63044 CKT 1
COM TRIP LINE FROM BUS 63041 TO BUS 63049 CKT 1
COM END


COM '200 Defined as multi-terminal'
COM 'A 66437-66759  GRNDFKS4-PICKERT4 CKT 1   OPENS B C D E'
COM 'B 66444-66759  JAMESTN4-PICKERT4 CKT 1   OPENS A C D E'
COM 'C 66759-63188  PICKERT4-PICKERTY CKT 1   OPENS A B D E'
COM 'D 63188-66923  PICKERTY-PICKERT8 CKT 1   OPENS A B C E'
COM 'E 63188-63167  PICKERTY-PICKERT9 CKT 1   OPENS A B C D'
COM '---------------------------------------------------------'
CONTINGENCY '200       '
TRIP LINE FROM BUS 66437 TO BUS 66759 CKT 1
TRIP LINE FROM BUS 66444 TO BUS 66759 CKT 1
TRIP LINE FROM BUS 66759 TO BUS 63188 CKT 1
TRIP LINE FROM BUS 63188 TO BUS 66923 CKT 1
TRIP LINE FROM BUS 63188 TO BUS 63167 CKT 1
END

COM '210  Defined as multi-terminal'
COM 'A 66484-66488  NUNDRWD4-PHILTAP4  CKT 1   OPENS  B C'
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COM 'B 66488-66519  PHILTAP4-OAHE   4  CKT 1   OPENS  A C'
COM 'C 66486-66488  PHILIP 4-PHILTAP4  CKT 1   OPENS  A B'
COM '----------------------------------------------------------'
CONTINGENCY '210    '
TRIP LINE FROM BUS 66484 TO BUS 66488 CKT 1
TRIP LINE FROM BUS 66488 TO BUS 66519 CKT 1
TRIP LINE FROM BUS 66486 TO BUS 66488 CKT 1
END

COM '220  Defined as multi-terminal'
COM 'A 63358-63369 BUFFALO3-JAMESTN3   OPENS B C D E F G H I J K'
COM 'B 66792-63358 MAPLE R3-BUFFALO3   OPENS A C D E F G H I J K'
COM 'C 63358-63198 BUFFALO3-BUFFALOY   OPENS A B D E F G H I J K'
COM 'D 63198-63258 BUFFALOY-BUFFALO7   OPENS A B C E F G H I J K'
COM 'E 63198-63158 BUFFALOY-BUFFALO9   OPENS A B C D F G H I J K'
COM 'F 66792-63189 MAPLE R3-MAPLER1Y   OPENS A B C D E G H I J K'
COM 'G 63189-66754 MAPLER1Y-MAPLE R4   OPENS A B C D E F H I J K'
COM 'H 63189-63359 MAPLER1Y-MAPLER19   OPENS A B C D E F G I J K'
COM 'I 66792-63190 MAPLE R3-MAPLER2Y   OPENS A B C D E F G H J K'
COM 'J 63190-66754 MAPLER2Y-MAPLE R4   OPENS A B C D E F G H I K'
COM 'K 63190-63360 MAPLER2Y-MAPLER29   OPENS A B C D E F G H I J'
COM '----------------------------------------------------------'
CONTINGENCY '220    '
TRIP LINE FROM BUS 63358 TO BUS 63369 CKT 1
TRIP LINE FROM BUS 66792 TO BUS 63358 CKT 1
TRIP LINE FROM BUS 63358 TO BUS 63198 CKT 1
TRIP LINE FROM BUS 63198 TO BUS 63258 CKT 1
TRIP LINE FROM BUS 63198 TO BUS 63158 CKT 1
TRIP LINE FROM BUS 66792 TO BUS 63189 CKT 1
TRIP LINE FROM BUS 63189 TO BUS 66754 CKT 1
TRIP LINE FROM BUS 63189 TO BUS 63359 CKT 1
TRIP LINE FROM BUS 63190 TO BUS 66754 CKT 1
TRIP LINE FROM BUS 66792 TO BUS 63190 CKT 1
TRIP LINE FROM BUS 63190 TO BUS 63360 CKT 1
END

COM '230 OTP Defined as multi-terminal'
COM 'A 63363-63327  FORMAN 4-HANKSON4   OPENS  B C D E F G H I J K L M'
COM 'B 63363-63362  FORMAN 4-OAKS   4   OPENS  A C D E F G H I J K L M'
COM 'C 67326-63362  ELLENDL4-OAKS   4   OPENS  A B D E F G H I J K L M'
COM 'D 63362-63162  OAKS   4-OAKS   9   OPENS  A B C E F G H I J K L M'
COM 'E 63363-63193  FORMAN 4-FORMAN Y   OPENS  A B C D F G H I J K L M'
COM 'F 63193-63163  FORMAN Y-FORMAN 9   OPENS  A B C D E G H I J K L M'
COM 'G 63193-63263  FORMAN Y-FORMAN 7   OPENS  A B C D E F H I J K L M'
COM '----------------------------------------------------------'
CONTINGENCY '230    '
COM 'Trip of the 230kV line sections and Forman'
TRIP LINE FROM BUS 63363 TO BUS 63327 CKT 1
TRIP LINE FROM BUS 63363 TO BUS 63362 CKT 1
TRIP LINE FROM BUS 67326 TO BUS 63362 CKT 1
TRIP LINE FROM BUS 63362 TO BUS 63162 CKT 1
TRIP LINE FROM BUS 63363 TO BUS 63193 CKT 1
TRIP LINE FROM BUS 63193 TO BUS 63163 CKT 1
TRIP LINE FROM BUS 63193 TO BUS 63263 CKT 1
END

COM '250  GRE Defined as multi-terminal line, upa/otp'
COM 'A 66755-63047 PRAIRIE4-RAMSEY 4   VLD SGL'
COM 'B 63056-63047 BALTA  4-RAMSEY 4   VLD SGL'
COM 'C 63266-63047 RAMSEY 7-RAMSEY 4   OPENS A B'
COM 'RAMSEY 7-RAMSEY 4 is 3 winding xfmr.  -jrn 11-18-08'
COM 'Opening RamseyT LV bus 63077'
COM '-------------------------------------------------------'
CONTINGENCY '250    '
COM 'Transformer fault at Ramsey, mtl'
TRIP LINE FROM BUS 66755 TO BUS 63047 CKT 1
TRIP LINE FROM BUS 63056 TO BUS 63047 CKT 1
TRIP BRANCH FROM BUS 63266 TO BUS 63047 TO BUS 63077 CKT 1
DISCONNECT BUS 63077
END
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COM '260  GRE Defined as multi-terminal line'
COM 'A 63044-63056 MCHENRY4-BALTA  4   OPENS B C'
COM 'B 63042-63044 COAL TP4-MCHENRY4   OPENS '
COM 'C 63044-60140 MCHENRY4-MCHENRY7   OPENS A B '
COM 'MCHENRY4-MCHENRY7 is a 3 winding xfmr.  -jrn11-18-08 '
COM 'Opening McHenryT LV bus 63080'
COM '----------------------------------------------------'
CONTINGENCY '260      '
TRIP LINE FROM BUS 63044 TO BUS 63056  CKT 1
TRIP LINE FROM BUS 63042 TO BUS 63044  CKT 1
TRIP BRANCH FROM BUS 63044 TO BUS 60140 TO BUS 63080 CKT 1
DISCONNECT BUS 63080
END

COM ' '
COM ' '
COM ' '
COM '  END DAKOTA AREA CONTINGENCIES'
COM ' '

COM ' '
COM ' '
COM ' '
COM ' '
COM ' '
COM ' START MINNESOTA AREA CONTINGENCIES'
COM ' '
COM ' '

COM 'NSP  Defined as multi-circuit, tower'
COM 'BLUE LK3-WILMART3 is actually BL-Helmass (60502) -Wilmart'
COM 'A 60192-60108  BLUE LK3-WILMART3  OPENS B tower'
COM 'B 60215-60261  HYLNDLK7-DEANLAK7  OPENS A tower'
COM '----------------------------------------------------'
CONTINGENCY 'BLL-WLM/HYL'
COM TRIP LINE FROM BUS 60192 TO BUS 60108 CKT 1
TRIP LINE FROM BUS 60192 TO BUS 60502 CKT 1
TRIP LINE FROM BUS 60502 TO BUS 60108 CKT 1
TRIP LINE FROM BUS 60215 TO BUS 60261 CKT 1
END


COM 'NSP  Defined as multi-circuit, tower, multi-terminal'
COM 'BLUE LK3-WILMART3 is actually BL-Helmass (60502) -Wilmart'
COM 'A 60192-60108  BLUE LK3-WILMART3  OPENS B tower'
COM 'B 60244-60261  SCOTTCO7-DEANLAK7  OPENS A tower, C mtl'
COM 'C 60244-60890  SCOTTCO7-SCOTTCO8  VLD SNG
COM '----------------------------------------------------'
CONTINGENCY 'BLL-WLM/SCO'
COM TRIP LINE FROM BUS 60192 TO BUS 60108 CKT 1
TRIP LINE FROM BUS 60192 TO BUS 60502 CKT 1
TRIP LINE FROM BUS 60502 TO BUS 60108 CKT 1
TRIP LINE FROM BUS 60244 TO BUS 60261 CKT 1
TRIP LINE FROM BUS 60244 TO BUS 60890 CKT 1
END
CONTINGENCY 'SCO-DNL/SCO'
TRIP LINE FROM BUS 60244 TO BUS 60261 CKT 1
TRIP LINE FROM BUS 60244 TO BUS 60890 CKT 1
END


COM 'NSP  Defined as multi-circuit, multi-terminal'
COM 'A 60221-60202  KOLMNLK3-COON CK3   OPENS  B TOWER, C MTL'
COM 'B 60221-60251  KOLMNLK3-TERMINL3   OPENS  A tower, DEF mtl'
COM 'C 60221-60222  KOLMNLK3-KOLMNLK7   VLD SNG'
COM 'D 61491-60251  TERMID2Y-TERMINL3   D E F VLD SNG'
COM 'E 61491-60252  TERMID2Y-TERMINL7   D E F VLD SNG'
COM 'F 61491-61188  TERMID2Y-TERTER29   D E F VLD SNG'
COM '----------------------------------------------------'
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CONTINGENCY 'KOL-CNC/TER'
TRIP LINE FROM BUS 60221 TO BUS 60202 CKT 1
TRIP LINE FROM BUS 60221 TO BUS 60251 CKT 1
TRIP LINE FROM BUS 60221 TO BUS 60222 CKT 9
TRIP LINE FROM BUS 61491 TO BUS 60251 CKT 9
TRIP LINE FROM BUS 61491 TO BUS 60252 CKT 9
TRIP LINE FROM BUS 61491 TO BUS 61188 CKT 9
END

COM 'NSP Defined as multi-circuit, multi-terminal'
COM 'A 60221-60199 KOLMNLK3-CHIS CO3   OPENS B TOWER, C MTL'
COM 'B 60221-60186 KOLMNLK3-AS KING3   OPENS A tower'
COM 'C 60221-60222 KOLMNLK3-KOLMNLK7 ckt 10   VLD SNG'
COM '--'
CONTINGENCY 'KOL-CHI/ASK'
TRIP LINE FROM BUS 60221 TO BUS 60199 CKT 1
TRIP LINE FROM BUS 60221 TO BUS 60186 CKT 1
TRIP LINE FROM BUS 60221 TO BUS 60222 CKT 10
END
CONTINGENCY 'KOL-CHI/KOL'
TRIP LINE FROM BUS 60221 TO BUS 60199 CKT 1
TRIP LINE FROM BUS 60221 TO BUS 60222 CKT 10
END

COM 'NSP Defined as multi-circuit'
COM 'A 60186-60199 AS KING3-CHIS CO3   OPENS B TOWER'
COM 'B 60186-60221 AS KING3-KOLMNLK3   OPENS A tower'
COM 'C 60186-60304 AS KING3-EAU CL 3   only for both A&B, mtl DE'
COM 'D 60304-39244 EAU CL 3-ARP 345   vld sgl'
COM 'E 60304-60305 EAU CL 3-EAU CLA5 ckt9 OPENS C D'
COM ' These lines are west of Council Creek'
COM ' They could trip for loss of E.C.-Arpin 345 kV'
COM ' 39901 [COC DPC   ] to 38342 [COC 69 69.0]'
COM ' 38333 [HLT 69 69.0] to 68821 [MAUSTON 69.0]'
COM '---'
CONTINGENCY 'ASK-ECL-69'
TRIP LINE FROM BUS 60186 TO BUS 60199 CKT 1
TRIP LINE FROM BUS 60186 TO BUS 60221 CKT 1
TRIP LINE FROM BUS 60186 TO BUS 60304 CKT 1
TRIP LINE FROM BUS 60304 TO BUS 39244 CKT 1
TRIP LINE FROM BUS 60304 TO BUS 60305 CKT 9
TRIP LINE FROM BUS 39901 TO BUS 38342 CKT 1
TRIP LINE FROM BUS 38333 TO BUS 68821 CKT 1
END
CONTINGENCY 'ASK-ECL'
TRIP LINE FROM BUS 60186 TO BUS 60199 CKT 1
TRIP LINE FROM BUS 60186 TO BUS 60221 CKT 1
TRIP LINE FROM BUS 60186 TO BUS 60304 CKT 1
TRIP LINE FROM BUS 60304 TO BUS 39244 CKT 1
TRIP LINE FROM BUS 60304 TO BUS 60305 CKT 9
END

COM 'NSP Defined as multi-circuit'
COM 'A 60186-60199 AS KING3-CHIS CO3   only for both B&C'
COM 'B 60186-60236 AS KING3-REDROCK3   OPENS C tower'
COM 'C 60186-60304 AS KING3-EAU CL 3   OPENS B tower, mtl DE'
COM 'D 60304-39244 EAU CL 3-ARP 345   vld sgl'
COM 'E 60304-60305 EAU CL 3-EAU CLA5 ckt9 OPENS C D'
COM ' These lines are west of Council Creek'
COM ' They could trip for loss of E.C.-Arpin 345 kV'
COM ' 39901 [COC DPC   ] to 38342 [COC 69 69.0]'
COM ' 38333 [HLT 69 69.0] to 68821 [MAUSTON 69.0]'
COM '---'
CONTINGENCY 'ASK-ECL/R69'
TRIP LINE FROM BUS 60186 TO BUS 60199 CKT 1
TRIP LINE FROM BUS 60186 TO BUS 60236 CKT 1
TRIP LINE FROM BUS 60186 TO BUS 60304 CKT 1

TRIP LINE FROM BUS 60304 TO BUS 39244 CKT 1
TRIP LINE FROM BUS 60304 TO BUS 60305 CKT 9
TRIP LINE FROM BUS 39901 TO BUS 38342 CKT 1
TRIP LINE FROM BUS 38333 TO BUS 68821 CKT 1
END
CONTINGENCY 'ASK-ECL/RRK'
TRIP LINE FROM BUS 60186 TO BUS 60199 CKT 1
TRIP LINE FROM BUS 60186 TO BUS 60236 CKT 1
TRIP LINE FROM BUS 60186 TO BUS 60304 CKT 1
TRIP LINE FROM BUS 60304 TO BUS 39244 CKT 1
TRIP LINE FROM BUS 60304 TO BUS 60305 CKT 9
END

COM 'NSP   Defined as multi-circuit'
COM 'A 60238-60204 REDROCK7-COTTAGE7   OPENS B tower'
COM 'B 60236-60186 REDROCK3-AS KING7   OPENS A tower'
COM '---'
CONTINGENCY 'RRK-CGR/ASK'
TRIP LINE FROM BUS 60238 TO BUS 60204 CKT 1
TRIP LINE FROM BUS 60236 TO BUS 60186 CKT 1
END

COM ' 501 Defined as multi-terminal, Drayton Transformer 1 TRIP'
COM 'A 66752-66787 DRAYTON4-DRAYTO1T CKT 1   OPENS B C'
COM 'B 66705-66787 DRAYTON7-DRAYTO1T CKT 1   OPENS A C'
COM 'C 66763-66787 DRAYTO19-DRAYTO1T CKT 1   0PENS A B'
COM '--'
CONTINGENCY '501   1'
COM 'Trip Transformer 1'
TRIP LINE FROM BUS 66752 TO BUS 66787 CKT 1
TRIP LINE FROM BUS 66705 TO BUS 66787 CKT 1
TRIP LINE FROM BUS 66763 TO BUS 66787 CKT 1
END

COM '530 Defined as multi-circuit'
COM 'A 60119-60171 LKYNKTN7-MARSHTP7 CKT 1   OPENS B C D'
COM 'B 60148-60171 MINVALY4-MARSHTP7 CKT 1   OPENS A C D'
COM 'C 60170-60171 MARSHAL7-MARSHTP7 CKT 1   OPENS A B'
COM 'D 60119-60853 LKYNKTN7-LK YANK8 CKT 2   OPENS A B C'
COM '--'
CONTINGENCY '530   '
TRIP LINE FROM BUS 60119 TO BUS 60171 CKT 1
TRIP LINE FROM BUS 60509 TO BUS 60171 CKT 1
TRIP LINE FROM BUS 60170 TO BUS 60171 CKT 1
TRIP LINE FROM BUS 60119 TO BUS 60853 CKT 2
END

COM ' 652 Defined as common tower'
COM 'A 63045-61617 BENTON 4-MUDLAKE4 CKT 1   OPENS B'
COM 'B 63045-61910 BENTON 4-MILACA 4 CKT 1   OPENS A'
COM '--'
CONTINGENCY 652'
TRIP LINE FROM BUS 63045 TO BUS 61617 CKT 1
TRIP LINE FROM BUS 63045 TO BUS 61910 CKT 1
END

COM CONTINGENCY 675 IS ALREADY IN USE IN MINN CAT B CON FILE
COM ' 675 Defined as multi-terminal'
COM 'A 63045-60142 BENTON 4-BENTON 3 CKT 1   OPENS B C '
COM 'B 63045-60142 BENTON 4-BENTON 3 CKT 2   OPENS A C '
COM 'C 60142-60160 BENTON 3-SHERCO 3 CKT 1   OPENS A B '
COM '---'
COM ' 675 Defined as multi-terminal'
COM 'BENTON 4-BENTON 3 is 2 - 3 winding xfmrs -jrn 11-18-08 '
COM 'Disconnecting both Benton1T (63075) and Benton2T (63079)'
COM 'A 63045-60142 BENTON 4-BENTON 3 CKT 1   OPENS B C '
COM 'B 63045-60142 BENTON 4-BENTON 3 CKT 2   OPENS A C '
COM 'C 60142-60160 BENTON 3-SHERCO 3 CKT 1   OPENS A B '
COM '---'

COM CONTINGENCY '675   2'
COM TRIP LINE FROM BUS 63045 TO BUS 60142 TO BUS 63075 CKT 1
COM DISCONNECT BUS 63075
COM TRIP LINE FROM BUS 63045 TO BUS 60142 TO BUS 63079 CKT 2
COM DISCONNECT BUS 63079
COM TRIP LINE FROM BUS 60142 TO BUS 60160 CKT 1
END

COM '740 Defined as multi-circuit, tower'
COM 'A 60103-63071 CANNFLS5-SPRNGCK5   OPENS B tower MTL'
COM 'B 60106-63071 PR ISLD5-SPRNGCK5   OPENS A tower'
COM 'PR ISLD5-SPRNGCK5 is actually PR ISLD5-RAVENNA5-SPRINGCK5'
COM 'RAVENNA 5 is bus 62224' (MAG 11_17_08)
COM '**   Defined as multi-terminal'
COM 'C 60103-60104 CANNFLS5-CANNFLS7   OPENS D'
COM 'D 60103-63071 CANNFLS5-SPRNGCK5   OPENS C'
COM '--'
CONTINGENCY '740   1'
TRIP LINE FROM BUS 60103 TO BUS 63071 CKT 1
TRIP LINE FROM BUS 60106 TO BUS 62224 CKT 1
TRIP LINE FROM BUS 62224 TO BUS 63071 CKT 1
COM 'Also trips the following because of A'
TRIP LINE FROM BUS 60103 TO BUS 60104 CKT 5
END
CONTINGENCY '740   2'
TRIP LINE FROM BUS 60103 TO BUS 60104 CKT 5
TRIP LINE FROM BUS 60103 TO BUS 63071 CKT 1
END

COM '760 Defined as multi-circuit, tower'
COM 'A 60105-60236 PR ISLD3-REDROCK3 1 OPENS B'
COM 'B 60105-60236 PR ISLD3-REDROCK3 2 OPENS A'
COM '--'
CONTINGENCY '760   '
TRIP LINE FROM BUS 60105 TO BUS 60236 CKT 1
TRIP LINE FROM BUS 60105 TO BUS 60236 CKT 2
END

COM '180 GRE Defined as multi-terminal tower'
COM 'multi-terminal trips A B and C'
COM 'A 63041-63042 COAL CR4-COAL TP4 OPENS B, C'
COM 'B 63042-63049 COAL TP4-STANTON4 OPENS A, C'
COM 'C 63042-63044 COAL TP4-MCHENRY4 OPENS A, B'
COM 'A and B multi-circuit tower with portions of D and operating response'
COM 'D 63041-63049 COAL CR4-STANTON4'
COM '--'
COM CONTINGENCY '180   1'
COM 'mtl outage portion'
COM TRIP LINE FROM BUS 63041 TO BUS 63042 CKT 1
COM TRIP LINE FROM BUS 63042 TO BUS 63049 CKT 1
COM TRIP LINE FROM BUS 63042 TO BUS 63044 CKT 1
COM END
CONTINGENCY '180   2'
COM 'Common tower outage with mtl portion'
TRIP LINE FROM BUS 63041 TO BUS 63042 CKT 1
TRIP LINE FROM BUS 63042 TO BUS 63049 CKT 1
TRIP LINE FROM BUS 63042 TO BUS 63044 CKT 1
TRIP LINE FROM BUS 63041 TO BUS 63049 CKT 1
END

COM '785 GRE Defined as multi-terminal'
COM 'A 60129-60128 SPLIT R7-SPLIT R5   OPENS B C D E F'
COM 'B 60128-34003 SPLIT R5-MAGNLIA5   OPENS A C D E F'
COM 'SPLITRK5-MAGNLIA5 is actually SPLTRK5-DAN JUHL-MAGNLIA5 (DAN JUHL is bus 60370)'
COM ' Bus 60067 is tapped off bus 60370 (MAG 11_17_08)'
COM 'C 34003-34004 MAGNLIA5-ELK   5   OPENS A B D E F'
COM 'D 34004-62709 ELK   -BREWSTR5   OPENS A B C E F'
COM 'E 62709-34005 BREWSTR5-HRN LK 5   OPENS A B C D F'
COM 'F 34005-34225 HRN LK 5-HERONLK8 CKT 1'
COM '--'

CONTINGENCY '785   '
TRIP LINE FROM BUS 60129 TO BUS 60128 CKT 6
TRIP LINE FROM BUS 60128 TO BUS 60370 CKT 1
TRIP LINE FROM BUS 60370 TO BUS 34003 CKT 1
TRIP LINE FROM BUS 34003 TO BUS 34004 CKT 1
TRIP LINE FROM BUS 34004 TO BUS 62709 CKT 1
TRIP LINE FROM BUS 62709 TO BUS 34005 CKT 1
TRIP LINE FROM BUS 34005 TO BUS 34225 CKT 1
DISCONNECT BUS 60067
END

COM 'Contingency 790 already defined in MN-B 2008 con file'
COM 'Ignored here. - jrn 11-18-08
COM '790 Defined as multi-terminal'
COM 'A 66550-60147 GRANITF4-MINVALY4   OPENS B'
COM 'B 60147-60148 MINVALY4-MINVALY7 5   OPENS A'
COM '---'
COM CONTINGENCY '790   '
COM TRIP LINE FROM BUS 66550 TO BUS 60147 CKT 1
COM TRIP LINE FROM BUS 60147 TO BUS 60148 CKT 5
COM END

COM Contingency '800   1' is already in use (MAG 11_18_08)
COM '800 Defined as multi-terminal'
COM Wilton 230/115 kV
COM 'A 63345-63186   WILTON 4-WILTON Y   OPENS B C D '
COM 'B 63186-63245   WILTON Y-WILTON 7   OPENS A C D'
COM 'C 63186-63343   WILTON Y-WILTON19   OPENS A B D
COM 'D 66758-63345   WINGER 4-WILTON 4   OPENS A B C
COM '---'
COM CONTINGENCY '800   1'
COM TRIP LINE FROM BUS 63345 TO BUS 63186 CKT 1
COM TRIP LINE FROM BUS 63186 TO BUS 63245 CKT 1
COM TRIP LINE FROM BUS 63186 TO BUS 63343 CKT 1
COM TRIP LINE FROM BUS 66758 TO BUS 63345 CKT 1
END

COM '810 Defined as multi-terminal'
COM The correct order of connection is
COM BLK DOG 7-BLUE LK7-BLUE LK4-MCLEOD 4
com 60190-60193-60191-62980 (MAG 11_18_08)
COM 'A 60189-62980 BLK DOG4-MCLEOD 4   OPENS B'
COM 'B 60189-60190 BLK DOG4-BLK DOG7   OPENS A'
COM '---'
CONTINGENCY '810   '
TRIP LINE FROM BUS 60191 TO BUS 62980 CKT 1
TRIP LINE FROM BUS 60191 TO BUS 60193 CKT 1
TRIP LINE FROM BUS 60190 TO BUS 60193 CKT 1
DISCONNECT BUS 60191
END

COM CONTINGENCY 'FRA-HSS-DBL'
COM TRIP LINE FROM BUS 60501 TO BUS 60502 CKT C1
COM TRIP LINE FROM BUS 60501 TO BUS 60502 CKT C2
COM END
CONTINGENCY 'PRI-RRK-DBL'
TRIP LINE FROM BUS 60105 TO BUS 60236 CKT 1
TRIP LINE FROM BUS 60105 TO BUS 60236 CKT 2
END

COM '900 Defined as multi-circuit, tower'
COM 'PR ISLD3-BLUE LK3 is actually PR ISLD3-HMPTNCR3-BLUE LK3'
COM 'HMPTNCR3=60503' (MAG 11_18_08)'
COM 'A 60105-60192 PR ISLD3-BLUE LK3   OPENS B tower'
COM 'B 60105-60236 PR ISLD3-REDROCK3   OPENS A tower'
COM '---'
CONTINGENCY '900   '
TRIP LINE FROM BUS 60105 TO BUS 60503 CKT 1
TRIP LINE FROM BUS 60503 TO BUS 60192 CKT 1
TRIP LINE FROM BUS 60105 TO BUS 60236 CKT 1

END

COM '905 Defined as multi-circuit, tower'
COM 'PR ISLD3-BYRON 3 is actually PR ISLD3-NROC 345-BYRON 3)'
COM 'NROC 345 IS BUS 61950)' (MAG 11_18_08)'
COM 'A 60105-61950 PR ISLD3-BYRON 3   OPENS B tower'
COM 'B 60105-60236 PR ISLD3-REDROCK3   OPENS A tower'
COM '--'
CONTINGENCY '905   '
TRIP LINE FROM BUS 60105 TO BUS 61950 CKT 1
TRIP LINE FROM BUS 63431 TO BUS 61950 CKT 1
TRIP LINE FROM BUS 60105 TO BUS 60236 CKT 2
END

COM '930 Defined as multi-circuit, multi-terminal'
COM 'A 60233-60114 PARKERS3-ELM CRK3   OPENS B TOWER'
COM 'B 60233-60270 PARKERS3-MPLEGV13   OPENS   A TOWER, C MTL'
COM 'C 60270-63030 MPLEGV13-DICKNSN3   OPENS B MTL'
COM 'D 61490-60233 PKLMID1Y-PARKERS3   OPENS ONLY FOR A&B, D E F MTL'
COM 'E 61490-60234 PKLMID1Y-PARKERS7   OPENS ONLY FOR A&B, D E F MTL'
COM 'F 61490-60660 PKLMID1Y-PKLTER19   OPENS ONLY FOR A&B, D E F MTL'
COM '--'
CONTINGENCY '930   1'
TRIP LINE FROM BUS 60233 TO BUS 60114 CKT 1
TRIP LINE FROM BUS 60233 TO BUS 60270 CKT 1
TRIP LINE FROM BUS 60270 TO BUS 63030 CKT 1
TRIP LINE FROM BUS 61490 TO BUS 60233 CKT 9
TRIP LINE FROM BUS 61490 TO BUS 60234 CKT 9
TRIP LINE FROM BUS 61490 TO BUS 60660 CKT 9
END
COM Contingency '930   2' is already in use (MAG 11_18_08)
CON CONTINGENCY '930   2'
CON TRIP LINE FROM BUS 60233 TO BUS 60270 CKT 1
CON TRIP LINE FROM BUS 60270 TO BUS 63030 CKT 1
CON END
COM Contingency '930   3' is already in use (MAG 11_18_08)
CON CONTINGENCY '930   3'
CON TRIP LINE FROM BUS 61490 TO BUS 60233 CKT 9
CON TRIP LINE FROM BUS 61490 TO BUS 60234 CKT 9
CON TRIP LINE FROM BUS 61490 TO BUS 60660 CKT 9
CON END

COM '935 Defined as multi-circuit, multi-terminal'
COM 'A 60114-60233 ELM CRK3-PARKERS3   OPENS B TOWER'
COM 'B 60160-60272 SHERCO 3-MPLEGV23   OPENS A TOWER, C D E F MTL'
COM 'C 60272-60202 MPLEGV23-COON CK3   OPENS B D E F MTL'
COM 'D 61488-60202 CNCMID1Y-COON CK3   OPENS D E F MTL'
COM 'E 61488-60203 CNCMID1Y-COON CK3   OPENS D E F MTL'
COM 'F 61488-60656 CNCMID1Y-CNCTER19   OPENS D E F MTL'
COM '--'
CONTINGENCY '935   1'
TRIP LINE FROM BUS 60114 TO BUS 60233 CKT 1
TRIP LINE FROM BUS 60160 TO BUS 60272 CKT 1
TRIP LINE FROM BUS 60272 TO BUS 60202 CKT 1
TRIP LINE FROM BUS 61488 TO BUS 60202 CKT 9
TRIP LINE FROM BUS 61488 TO BUS 60203 CKT 9
TRIP LINE FROM BUS 61488 TO BUS 60656 CKT 9
END
CONTINGENCY '935   2'
TRIP LINE FROM BUS 60160 TO BUS 60272 CKT 1
TRIP LINE FROM BUS 60272 TO BUS 60202 CKT 1
TRIP LINE FROM BUS 61488 TO BUS 60202 CKT 9
TRIP LINE FROM BUS 61488 TO BUS 60203 CKT 9
TRIP LINE FROM BUS 61488 TO BUS 60656 CKT 9
END
CONTINGENCY '935   3'
TRIP LINE FROM BUS 61488 TO BUS 60202 CKT 9
TRIP LINE FROM BUS 61488 TO BUS 60203 CKT 9
TRIP LINE FROM BUS 61488 TO BUS 60656 CKT 9

END

COM '940 Defined as multi-circuit, multi-terminal'
COM 'A 60114-60151 ELM CRK3-MNTCELO3   OPENS B TOWER'
COM 'B 60160-60272 SHERCO 3-MPLEGV23   OPENS A TOWER, C D E F MTL'
COM 'C 60272-60202 MPLEGV23-COON CK3   OPENS B D E F MTL'
COM 'D 61488-60202 CNCMID1Y-COON CK3   OPENS D E F MTL'
COM 'E 61488-60203 CNCMID1Y-COON CK3   OPENS D E F MTL'
COM 'F 61488-60656 CNCMID1Y-CNCTER19   OPENS D E F MTL'
COM '--'
CONTINGENCY '940   '
TRIP LINE FROM BUS 60114 TO BUS 60151 CKT 1
TRIP LINE FROM BUS 60160 TO BUS 60272 CKT 1
TRIP LINE FROM BUS 60272 TO BUS 60202 CKT 1
TRIP LINE FROM BUS 61488 TO BUS 60202 CKT 9
TRIP LINE FROM BUS 61488 TO BUS 60203 CKT 9
TRIP LINE FROM BUS 61488 TO BUS 60656 CKT 9
END

COM '945 Defined as multi-circuit, multi-terminal'
COM 'A 60160-60151 SHERCO 3-MNTCELO3   OPENS B TOWER'
COM 'B 60160-60272 SHERCO 3-MPLEGV23   OPENS A TOWER, C D E F MTL'
COM 'C 60272-60202 MPLEGV23-COON CK3   OPENS B D E F MTL'
COM 'D 61488-60202 CNCMID1Y-COON CK3   OPENS D E F MTL'
COM 'E 61488-60203 CNCMID1Y-COON CK3   OPENS D E F MTL'
COM 'F 61488-60656 CNCMID1Y-CNCTER19   OPENS D E F MTL'
COM '--'
CONTINGENCY '945   '
TRIP LINE FROM BUS 60160 TO BUS 60151 CKT 1
TRIP LINE FROM BUS 60160 TO BUS 60272 CKT 1
TRIP LINE FROM BUS 60272 TO BUS 60202 CKT 1
TRIP LINE FROM BUS 61488 TO BUS 60202 CKT 9
TRIP LINE FROM BUS 61488 TO BUS 60203 CKT 9
TRIP LINE FROM BUS 61488 TO BUS 60656 CKT 9
END

COM '950 Defined as multi-circuit, multi-terminal'
COM 'A 60202-63030 COON CK3-DICKNSN3   OPENS B TOWER'
COM 'B 60160-60272 SHERCO 3-MPLEGV23   OPENS A TOWER, C D E F MTL'
COM 'C 60272-60202 MPLEGV23-COON CK3   OPENS B D E F MTL'
COM 'D 61488-60202 CNCMID1Y-COON CK3   OPENS D E F MTL'
COM 'E 61488-60203 CNCMID1Y-COON CK3   OPENS D E F MTL'
COM 'F 61488-60656 CNCMID1Y-CNCTER19   OPENS D E F MTL'
COM '--'
CONTINGENCY '950   '
TRIP LINE FROM BUS 60202 TO BUS 63030 CKT 1
TRIP LINE FROM BUS 60160 TO BUS 60272 CKT 1
TRIP LINE FROM BUS 60272 TO BUS 60202 CKT 1
TRIP LINE FROM BUS 61488 TO BUS 60202 CKT 9
TRIP LINE FROM BUS 61488 TO BUS 60203 CKT 9
TRIP LINE FROM BUS 61488 TO BUS 60656 CKT 9
END

COM '907 Defined as multi-circuit, multi-terminal'
COM 'A 60202-60221 COON CK3-KOLMNLK3   OPENS B TOWER, C MTL'
COM 'B 60202-60251 COON CK3-TERMINL3   OPENS A TOWER, D E F MTL'
COM 'C 60221-60222 KOLMNLK3-KOLMNLK7   VLD SNG'
COM 'D 61492-60251 TERMID1Y-TERMINL3   D E F VLD SNG'
COM 'E 61492-60252 TERMID1Y-TERMINL7   D E F VLD SNG'
COM 'F 61492-61187 TERMID1Y-TERTER19   D E F VLD SNG'
COM '--'
CONTINGENCY '907   1'
TRIP LINE FROM BUS 60202 TO BUS 60221 CKT 1
TRIP LINE FROM BUS 60202 TO BUS 60251 CKT 1
TRIP LINE FROM BUS 60221 TO BUS 60222 CKT 9
TRIP LINE FROM BUS 61492 TO BUS 60251 CKT 10
TRIP LINE FROM BUS 61492 TO BUS 60252 CKT 10

TRIP LINE FROM BUS 61492 TO BUS 61187 CKT 10
END
CONTINGENCY '907   2'
TRIP LINE FROM BUS 60202 TO BUS 60221 CKT 1
TRIP LINE FROM BUS 60221 TO BUS 60222 CKT 9
END
COM Contingency '907   3' is already in use (MAG 11_18_08)
COM CONTINGENCY '907   3'
COM TRIP LINE FROM BUS 60202 TO BUS 60251 CKT 1
COM TRIP LINE FROM BUS 61492 TO BUS 60251 CKT 10
COM TRIP LINE FROM BUS 61492 TO BUS 60252 CKT 10
COM TRIP LINE FROM BUS 61492 TO BUS 61187 CKT 10
COM END
COM Contingency '907   4' is already in use (MAG 11_18_08)
COM CONTINGENCY '907   4'
COM TRIP LINE FROM BUS 61492 TO BUS 60251 CKT 10
COM TRIP LINE FROM BUS 61492 TO BUS 60252 CKT 10
COM TRIP LINE FROM BUS 61492 TO BUS 61187 CKT 10
COM END

COM '917 Defined as multi-circuit, multi-terminal'
COM 'A 60251-60221 TERMINL3-KOLMNLK3   OPENS B TOWER, F G H MTL'
COM 'B 60202-60251 COON CK3-TERMINL3   OPENS A TOWER, C D E MTL'
COM 'C 61492-60251 TERMID1Y-TERMINL3   C D E VLD SNG'
COM 'D 61492-60252 TERMID1Y-TERMINL7   C D E VLD SNG'
COM 'E 61492-61187 TERMID1Y-TERTER19   C D E VLD SNG'
COM 'F 61491-60251 TERMID2Y-TERMINL3   F G H VLD SNG'
COM 'G 61491-60252 TERMID2Y-TERMINL7   F G H VLD SNG'
COM 'H 61491-61188 TERMID2Y-TERTER29   F G H VLD SNG'
COM '---'
CONTINGENCY '917   1'
TRIP LINE FROM BUS 60251 TO BUS 60221 CKT 1
TRIP LINE FROM BUS 60202 TO BUS 60251 CKT 1
TRIP LINE FROM BUS 61492 TO BUS 60251 CKT 10
TRIP LINE FROM BUS 61492 TO BUS 60252 CKT 10
TRIP LINE FROM BUS 61492 TO BUS 61187 CKT 10
TRIP LINE FROM BUS 61491 TO BUS 60251 CKT 9
TRIP LINE FROM BUS 61491 TO BUS 60252 CKT 9
TRIP LINE FROM BUS 61491 TO BUS 61188 CKT 9
END
COM Contingency '917   2' is already in use (MAG 11_18_08)
COM CONTINGENCY '917   2'
COM TRIP LINE FROM BUS 60251 TO BUS 60221 CKT 1
COM TRIP LINE FROM BUS 61491 TO BUS 60251 CKT 9
COM TRIP LINE FROM BUS 61491 TO BUS 60252 CKT 9
COM TRIP LINE FROM BUS 61491 TO BUS 61188 CKT 9
COM END
COM Contingency '917   2' is already in use (MAG 11_18_08)
COM CONTINGENCY '917   3'
COM TRIP LINE FROM BUS 61492 TO BUS 60251 CKT 10
COM TRIP LINE FROM BUS 61492 TO BUS 60252 CKT 10
COM TRIP LINE FROM BUS 61492 TO BUS 61187 CKT 10
COM END

COM ' '
COM ' '
COM ' END MINNESOTA AREA CONTINGENCIES'
COM ' '

COM ' '
COM ' '
COM ' '
COM ' '
COM ' START WISCONSIN AREA CONTINGENCIES'
COM ' '
COM ' '

COM Contingency '050 1,2,3' are already in use (MAG 11_18_08)
COM '050 Defined as multi-circuit, Interregional'

COM 'A 60186-60304 AS KING3-EAU CL 3   OPENS B C'
COM 'B 60304-39244 EAU CL 3-ARP 345   vld sgl'
COM 'C 60304-60305 EAU CL 3-EAU CLA5 ckt9 OPENS A B'
COM ' These lines are west of Council Creek'
COM ' They could trip for loss of E.C.-Arpin 345 kV'
COM ' 39901 [COC DPC   ] to 38342 [COC 69 69.0]'
COM ' 38333 [HLT 69 69.0] to 68821 [MAUSTON 69.0]'
COM '--'
COM CONTINGENCY '050   1'
COM 'king-eau claire-arpin with 69 tripping'
COM TRIP LINE FROM BUS 60186 TO BUS 60304 CKT 1
COM TRIP LINE FROM BUS 60304 TO BUS 39244 CKT 1
COM TRIP LINE FROM BUS 60304 TO BUS 60305 CKT 9
COM TRIP LINE FROM BUS 39901 TO BUS 38342 CKT 1
COM TRIP LINE FROM BUS 38333 TO BUS 68821 CKT 1
COM END
COM CONTINGENCY '050   2'
COM 'king-eau claire-arpin w/o 69 tripping'
COM TRIP LINE FROM BUS 60186 TO BUS 60304 CKT 1
COM TRIP LINE FROM BUS 60304 TO BUS 39244 CKT 1
COM TRIP LINE FROM BUS 60304 TO BUS 60305 CKT 9
COM END
COM CONTINGENCY '050   3'
COM 'eau claire-arpin with 69 tripping'
COM TRIP LINE FROM BUS 60304 TO BUS 39244 CKT 1
COM TRIP LINE FROM BUS 39901 TO BUS 38342 CKT 1
COM TRIP LINE FROM BUS 38333 TO BUS 68821 CKT 1
COM END

COM 'NSP Defined as multi-terminal'
COM 'A 60313-60285 PINE LK7-EAGLEPT7   OPENS B tower'
COM 'B 60313-60312 PINE LK7-PINE LK5   OPENS CDEF'
COM 'C 60329-60314 CRYSTAL5-PINELKT5   OPENS BDEF'
COM 'D 69565-60314 APL RVR5-PINELKT5   OPENS BCEF'
COM 'E 60312-60314 PINE LK5-PINELKT5   OPENS BCDF'
COM 'F 69565-69007 APL RVR5-APLRVR 8   OPENS BCDE'
COM '--'
CONTINGENCY 'PNL-EAG/PNL'
TRIP LINE FROM BUS 60313 TO BUS 60285 CKT 1
TRIP LINE FROM BUS 60313 TO BUS 60312 CKT 3
TRIP LINE FROM BUS 60329 TO BUS 60314 CKT 1
TRIP LINE FROM BUS 69565 TO BUS 60314 CKT 1
TRIP LINE FROM BUS 60312 TO BUS 60314 CKT 1
TRIP LINE FROM BUS 69565 TO BUS 69007 CKT 1
END

COM '835 Defined as multi-circuit'
COM 'A 60282-60329 REDCDR 5-CRYSTAL5 CKT 1   OPENS B tower'
COM 'B 60282-60319 REDCDR 5-WHEATTP5 CKT 1   OPENS C D mtl'
COM 'C 60319-60318 WHEATTP5-WHT 56 5 CKT 1   OPENS B D mtl'
COM 'D 60319-60320 WHEATTP5-HYDROLN5 CKT 1   OPENS B C mtl'
COM '--'
CONTINGENCY '835   '
TRIP LINE FROM BUS 60282 TO BUS 60329 CKT 1
TRIP LINE FROM BUS 60282 TO BUS 60319 CKT 1
TRIP LINE FROM BUS 60319 TO BUS 60318 CKT 1
TRIP LINE FROM BUS 60319 TO BUS 60320 CKT 1
END

COM Contingency '835-1' is already in use (MAG 11_18_08)
COM CONTINGENCY '835-1   '
COM 'Fault between Wheaton Tap and Red Cedar/Hydro Lane'
COM TRIP LINE FROM BUS 60282 TO BUS 60319 CKT 1
COM TRIP LINE FROM BUS 60319 TO BUS 60318 CKT 1
COM TRIP LINE FROM BUS 60319 TO BUS 60320 CKT 1
COM END

COM Contingency '840' is already in use (MAG 11_18_08)
COM '840 Defined as multi-terminal'
COM 'A 60318-60368 WHEATON5-JEFRSRD5 CKT 1   OPENS B'

```
COM 'B 60319-60318  WHEATTP5-WHEATON5 CKT 1   OPENS  A'
COM '------------------------------------------------------'
COM CONTINGENCY '840     '
COM ' Fault on line from Wheaton looking towards Jef and
COM ' then to Eau Claire 161 kV'
COM TRIP LINE FROM BUS 60318 TO BUS 60368 CKT 1
COM TRIP LINE FROM BUS 60319 TO BUS 60318 CKT 1
COM END

COM Contingency '850' is already in use (MAG 11_18_08)
COM '850 Defined as multi-terminal'
COM 'A 60313-60312  PINE LK7-PINE LK5      OPENS B C D E'
COM 'B 60329-60314  CRYSTAL5-PINELKT5     OPENS A C D E'
COM 'C 69565-60314  APL RVR5-PINELKT5     OPENS A B D E'
COM 'D 60312-60314  PINE LK5-PINELKT5     OPENS A B C E'
COM 'E 69565-69007  APL RVR5-APLRVR 8     OPENS A B C D
COM '------------------------------------------------------'
COM CONTINGENCY '850      '
COM TRIP LINE FROM BUS 60313 TO BUS 60312 CKT 3
COM TRIP LINE FROM BUS 60329 TO BUS 60314 CKT 1
COM TRIP LINE FROM BUS 69565 TO BUS 60314 CKT 1
COM TRIP LINE FROM BUS 60312 TO BUS 60314 CKT 1
COM TRIP LINE FROM BUS 69565 TO BUS 69007 CKT 1
COM END

COM '875  Defined as multi-circuit, RW'
COM 'A 60302-60308  COULEE 5-LACROSS5 CKT 1   OPENS  B      RW'
COM 'B 69523-69535  GENOA  5-LAC TAP5 CKT 1   OPENS  A      RW'
COM '**    Defined as multi-terminal'
COM 'C 60308-69535 LACROSS5-LAC TAP5 CKT 1   OPENS D E'
COM 'D 60309-69535 MRSHLND5-LAC TAP5 CKT 1   OPENS C E'
COM 'E 69523-69535 GENOA  5-LAC TAP5 CKT 1   OPENS C D'
COM '------------------------------------------------------'
CONTINGENCY '875-1-Cat-D'
TRIP LINE FROM BUS 60302 TO BUS 60308 CKT 1
TRIP LINE FROM BUS 69523 TO BUS 69535 CKT 1
COM 'Also trips the following because of B'
TRIP LINE FROM BUS 60308 TO BUS 69535 CKT 1
TRIP LINE FROM BUS 69566 TO BUS 69535 CKT 1
END
COM Contingency '875    2' is already in use (MAG 11_18_08)
COM CONTINGENCY '875      2'
COM 'Multi-terminal portion'
COM TRIP LINE FROM BUS 60308 TO BUS 69535 CKT 1
COM TRIP LINE FROM BUS 69566 TO BUS 69535 CKT 1
COM TRIP LINE FROM BUS 69523 TO BUS 69535 CKT 1
COM END

COM '880  Defined as  tower'
COM 'A 69523-69527 GENOA  5-HARMONY5 CKT 1   OPENS  B  tower'
COM 'B 69523-34021 GENOA  5-LANSING5 CKT 1   OPENS  A  tower'
COM '------------------------------------------------------'
CONTINGENCY '880    '
TRIP LINE FROM BUS 69523 TO BUS 69527 CKT 1
TRIP LINE FROM BUS 69523 TO BUS 34021 CKT 1
END

COM ' '
COM ' '
COM ' '
COM ' '
COM ' '
COM '  END WISCONSIN AREA CONTINGENCIES'
COM ' '

COM ' '
COM ' '
COM ' '
COM ' '
COM ' START IOWA AREA CONTINGENCIES'
```

```
COM ' '
COM ' '
COM '910  Defined as multi-terminal, Interregional'
COM 'A 64350-64352  HILLS  3-TIFFIN 3   OPENS B,C'
COM 'B  64352-64353  TIFFIN 3-TIFFIN 5   OPENS VLD SGL'
COM 'C  64352-34093  TIFFIN 3-ARNOLD 3   OPENS A B'
COM 'The Hills-Tiffin 345 kV line 'A' is breakered individually'
COM 'and could be onsidered a valid single outage.  However, I '
COM 'believe we show this multi-terminal outage due to the '
COM 'reverse power relay on the Tiffin transformer that we '
COM 'discussed previously.  Therefore, I would say that this'
COM 'multi-terminal outage is valid.'
COM 'Let me know if you have questions.'
COM 'Ken'
COM ' '
COM 'Note:'
COM 'If the base case flow is from Tiffin to Hills 345 kV'
COM 'the Hills-Tiffin 345 kV outage is valid.'
COM ' '
COM 'If the base case flow if from Hills to Tiffin 345 kV''
COM 'the Hills-Tiffin 345 kV is NOT a valid outage.
COM '------------------------------------------------------'
COM '911 WAPA Defined as multi-terminal, Interregional'
COM 'A 66560-34047 CRESTON5-ANTA TP5 CKT 1   OPENS  B C'
COM 'B 66603-34047 EXIRA  5-ANTA TP5 CKT 1   OPENS  A C'
COM 'C 34048-34047 ANITA  5-ANTA TP5 CKT 1   OPENS  A B'
COM '------------------------------------------------------'
CONTINGENCY '911       '
TRIP LINE FROM BUS 66560 TO BUS 34047 CKT 1
TRIP LINE FROM BUS 66603 TO BUS 34047 CKT 1
TRIP LINE FROM BUS 34048 TO BUS 34047 CKT 1
END

COM '917  Defined as multi-terminal, Interregional'
COM 'A 34019-61930 HAZLETON-WINDSOR5 CKT 1   OPENS B'
COM 'B 61930-69531 WINDSOR5-POSTVIL5 CKT 1   OPENS A'
COM '------------------------------------------------------'
CONTINGENCY '917       '
TRIP LINE FROM BUS 34019 TO BUS 61930 CKT 1
TRIP LINE FROM BUS 61930 TO BUS 69531 CKT 1
END

COM '948  Defined as multi-circuit, RW and MTL, Interregional'
COM 'A 34038-64422  BVR CH 5-SUB 49 5   OPENS  B  RW'
COM 'B 34038-34044  BVR CH 5-ALBANY 5   OPENS  A  RW, MTL F G'
COM '**    Defined as multi-terminal'
COM 'D 34038-34044  BVR CH 5-ALBANY 5   OPENS  E F G H'
COM 'E 34044-34045  ALBANY 5-ALBANY 6   OPENS  D F G H'
COM 'F 34044-34046  ALBANY 5-YORK   5   OPENS  D E G H '
COM 'G 34043-34046  SAVANNA5-YORK   5   OPENS  D E F H'
COM 'H 34046-34351  YORK   5-YORK   9   SGL'
COM '------------------------------------------------------'
CONTINGENCY '948       1'
COM 'Combination RW and MTL'
TRIP LINE FROM BUS 34038 TO BUS 64422 CKT 1
TRIP LINE FROM BUS 34038 TO BUS 34044 CKT 1
COM 'Also trips the following because of C MTL'
TRIP LINE FROM BUS 34044 TO BUS 34045 CKT 1
TRIP LINE FROM BUS 34044 TO BUS 34046 CKT 1
TRIP LINE FROM BUS 34043 TO BUS 34046 CKT 1
TRIP LINE FROM BUS 34046 TO BUS 34351 CKT 1
END
CONTINGENCY '948       2'
COM 'multi-terminal portion only, D,E,F,G,H'
TRIP LINE FROM BUS 34038 TO BUS 34044 CKT 1
TRIP LINE FROM BUS 34044 TO BUS 34045 CKT 1
TRIP LINE FROM BUS 34044 TO BUS 34046 CKT 1
TRIP LINE FROM BUS 34043 TO BUS 34046 CKT 1
TRIP LINE FROM BUS 34046 TO BUS 34351 CKT 1
END
```

COM '960 Defined as multi-terminal, Interregional'
COM 'A 34028-34033 LORE   5-TRK RIV5 CKT 1 OPENS B C'
COM 'B 34033-69503 TRK RIV5-CASVILL5 CKT 1 OPENS A C'
COM 'C 34033-34465 TRK RIV5-TURK RV8 CKT 1 OPENS A B'
COM '--'
CONTINGENCY '960   '
TRIP LINE FROM BUS 34028 TO BUS 34033 CKT 1
TRIP LINE FROM BUS 34033 TO BUS 69503 CKT 1
TRIP LINE FROM BUS 34033 TO BUS 34465 CKT 1
END

COM '961 Defined as multi-terminal, Interregional'
COM 'A 34008-61932 FOX LK 5-RUTLAND5 CKT 1   OPENS B C'
COM 'B 61932-34009 RUTLAND5-WINBAGO5 CKT 1   OPENS A C'
COM 'C 61932-61934 RUTLAND5-RUTLAND CKT 1   OPENS A B'
COM '--'
CONTINGENCY '961   '
TRIP LINE FROM BUS 34008 TO BUS 61932 CKT P1
TRIP LINE FROM BUS 61932 TO BUS 34009 CKT P1
TRIP LINE FROM BUS 61932 TO BUS 61934 CKT 1
END

COM '962 Defined as multi-terminal, Interregional'
COM 'A 34014-69526 ADAMS 5-BVR CRK5 CKT 1   OPENS B C'
COM 'B 69526-69527 BVR CRK5-HARMONY5 CKT 1   OPENS A C'
COM 'C 61980-69526 RICE   5-BVR CRK5 CKT 1   OPENS A B'
COM '--'
CONTINGENCY '962   '
TRIP LINE FROM BUS 34572 TO BUS 69526 CKT 1
TRIP LINE FROM BUS 69526 TO BUS 69527 CKT 1
TRIP LINE FROM BUS 61980 TO BUS 69526 CKT 1
END

COM ' '
COM ' '
COM ' '
COM ' END MAPP IOWA AREA CONTINGENCIES'
COM ' '
COM ' '
COM ' '
COM   END MAPP Contingencies'
COM ' '

COM ' '
COM ' '
COM ' '
COM ' '
COM BEGIN ALTW Contingencies
COM
COM Updated 4-24-03, Dale Cathedral'
COM ' '
COM ' '
COM ' '
COM ' ******* ALTW CONTINGENCIES ONLY ********'
COM ' '
COM ' '
COM ' ALTW-1 Defined as multi-terminal, Interregional'
COM 'A 34081-30290 VIELE 5-CARBID T CKT 1   OPENS B C'
COM 'B 30290-31437 CARBID T-PALMYRA CKT 1   OPENS A C'
COM 'C 34056-30290 CARBIDE5-CARBID T CKT 1   OPENS A B'
COM '--'
CONTINGENCY 'ALTW-1'
TRIP LINE FROM BUS 34081 TO BUS 30290 CKT 1
TRIP LINE FROM BUS 30290 TO BUS 31827 CKT 1
TRIP LINE FROM BUS 34056 TO BUS 30290 CKT 1
END

COM 'ALTW-2 Defined as multi-terminal'
COM 'A 34054-34058 GR JCT 5-PERRY 5 CKT 1   OPENS B'

```
COM 'B 34058-64189  PERRY  5-NEANKNY5 CKT 1   OPENS  A'
COM 'C 34058-34166  PERRY  5-PERRY  9 CKT 1   SGL'
COM 'D 34058-34166  PERRY  5-PERRY  9 CKT 2   SGL'
COM '----------------------------------------------------------'
CONTINGENCY 'ALTW-2'
TRIP LINE FROM BUS 34054 TO BUS 34058 CKT 1
TRIP LINE FROM BUS 34058 TO BUS 64189 CKT 1
TRIP LINE FROM BUS 34058 TO BUS 34166 CKT 1
TRIP LINE FROM BUS 34058 TO BUS 34166 CKT 2
END

COM 'ALTW-5  Defined as multi-terminal'
COM 'A 34087-34089  DYSART 5-VINTON 5 CKT 1   OPENS  B'
COM 'C 34089-34091  VINTON 5-ARNOLD 5 CKT 1   OPENS  A'
COM '-----------------------------------------------------------'
CONTINGENCY 'ALTW-5'
TRIP LINE FROM BUS 34087 TO BUS 34089 CKT 1
TRIP LINE FROM BUS 34089 TO BUS 34091 CKT 1
END

COM 'ALTW-8  Defined as multi-terminal'
COM 'A 34189-34190 OTTUMWA5-BRDGPRT5 CKT 1   OPENS B'
COM 'B 34190-34558 BRDGPRT5-BRDGPR1Y CKT 1   VLD SGL'
COM 'C 34558-34205 BRDGPR1Y- BRDGPRT8 CKT 1  VLD SGL'
COM '--------------------------------------------------------'
CONTINGENCY 'ALTW-8'
TRIP LINE FROM BUS 34189 TO BUS 34190 CKT 1
TRIP LINE FROM BUS 34190 TO BUS 34205 CKT 1
END

COM 'ALTW-9  Defined as multi-circuit, RW and MTL, Interregional'
COM 'A 34038-64422 BVR CH 5-SUB 49 5 CKT 1   OPENS  B  RW'
COM '**    Defined as multi-terminal'
COM 'B 34038-34044 BVR CH 5-ALBANY 5 CKT 1   OPENS  A  RW, MTL'
COM 'C 34044-34045 ALBANY 5-ALBANY 6 CKT 1   SGL'
COM 'D 34044-34046 ALBANY 5-YORK   5 CKT 1   MTL'
COM 'E 34043-34046 SAVANNA5-YORK   5 CKT 1   MTL'
COM 'F 34046-34351 YORK   5-YORK   9 CKT 1   SGL'
COM 'G 34043-34346 SAVANNA5-SAVNA S9 CKT 1   SGL'
COM '--------------------------------------------------------'
CONTINGENCY 'ALTW-9'
COM 'Combination RW and MTL'
TRIP LINE FROM BUS 34038 TO BUS 64422 CKT 1
TRIP LINE FROM BUS 34038 TO BUS 34044 CKT 1
TRIP LINE FROM BUS 34044 TO BUS 34045 CKT 1
TRIP LINE FROM BUS 34044 TO BUS 34046 CKT 1
TRIP LINE FROM BUS 34043 TO BUS 34046 CKT 1
TRIP LINE FROM BUS 34046 TO BUS 34351 CKT 1
TRIP LINE FROM BUS 34043 TO BUS 34346 CKT 1
END

COM 'ALTW-10  Defined as multi-terminal'
COM 'A 34038-34044 BVR CH 5-ALBANY 5 CKT 1   MTL'
COM 'B 34044-34045 ALBANY 5-ALBANY 6 CKT 1   SGL'
COM 'C 34044-34046 ALBANY 5-YORK   5 CKT 1   MTL'
COM 'D 34043-34046 SAVANNA5-YORK   5 CKT 1   MTL'
COM 'E 34046-34351 YORK   5-YORK   9 CKT 1   SGL'
COM 'F 34043-34346 SAVANNA5-SAVNA S9 CKT 1   SGL'
COM '--------------------------------------------------------'
CONTINGENCY 'ALTW-10'
TRIP LINE FROM BUS 34038 TO BUS 34044 CKT 1
TRIP LINE FROM BUS 34044 TO BUS 34045 CKT 1
TRIP LINE FROM BUS 34044 TO BUS 34046 CKT 1
TRIP LINE FROM BUS 34043 TO BUS 34046 CKT 1
TRIP LINE FROM BUS 34046 TO BUS 34351 CKT 1
TRIP LINE FROM BUS 34043 TO BUS 34346 CKT 1
END

COM 'ALTW-11  Defined as multi-terminal'
COM 'A 34028-34129 LORE   5-LIBERTY5 CKT 1   OPENS B'
```

COM 'B 34129-34135 LIBERTY5-DUNDEE 5 CKT 1   OPENS A'
COM 'C 34129-34541 LIBERTY5-LIBERTYY CKT 1   SGL'
COM 'D 34541-34128 LIBERTYY-LIBERTY8 CKT 1   SGL'
COM '---'
CONTINGENCY 'ALTW-11'
TRIP LINE FROM BUS 34028 TO BUS 34129 CKT 1
TRIP LINE FROM BUS 34129 TO BUS 34135 CKT 1
TRIP LINE FROM BUS 34129 TO BUS 34128 CKT 1
END

COM ' ALTW-12 Defined as multi-terminal'
COM 'A 34052-34076 AMES   7-BNE JCT7 CKT 1
COM 'B 34076-34059 BNE JCT7-BOONE 7 CKT 1
COM 'C 34061-34076 BNE JCT5-BNE JCT7 CKT 2
COM 'D 34061-34076 BNE JCT5-BNE JCT7 CKT 3
COM '---'
CONTINGENCY 'ALTW-12'
TRIP LINE FROM BUS 34052 TO BUS 34076 CKT 1
TRIP LINE FROM BUS 34076 TO BUS 34059 CKT 1
TRIP LINE FROM BUS 34061 TO BUS 34076 CKT 2
TRIP LINE FROM BUS 34061 TO BUS 34076 CKT 3
END

COM ' ALTW-13 Defined as multi-terminal'
COM 'A 34138-34543 DUNDEE 8-DUNDEE2Y CKT 1   OPENS C D E'
COM 'B 34543-34135 DUNDEE2Y-DUNDEE 5 CKT 1   OPENS C D E'
COM 'C 34135-34020 DUNDEE 5-HAZL S 5 CKT 1   VLD SGL'
COM 'D 34135-34129 DUNDEE 5-LIBERTY5 CKT 1   SEE CONTINGENCY ALTW-11'
COM 'E 34135-34133 DUNDEE 5-DUNDEE 7 CKT 1   OPENS A B C D'
COM '---'
CONTINGENCY 'ALTW-13'
TRIP LINE FROM BUS 34138 TO BUS 34135 CKT 1
TRIP LINE FROM BUS 34135 TO BUS 34020 CKT 1
TRIP LINE FROM BUS 34135 TO BUS 34129 CKT 1
TRIP LINE FROM BUS 34135 TO BUS 34133 CKT 1
END

COM ' ALTW-15 Defined as multi-terminal'
COM 'A 34127-34141 WYOMING5-WYOMING9 CKT 1   OPENS B C'
COM 'B 34127-34053 WYOMING5-MT VERN5 CKT 1   SEE CONTINGENCY ALTW-16'
COM 'C 34127-34126 WYOMING5-MQOKETA5 CKT 1   VLD SGL'
COM '---'
CONTINGENCY 'ALTW-15'
TRIP LINE FROM BUS 34127 TO BUS 34141 CKT 1
TRIP LINE FROM BUS 34127 TO BUS 34053 CKT 1
TRIP LINE FROM BUS 34127 TO BUS 34126 CKT 1
END

COM ' ALTW-16 Defined as multi-terminal'
COM 'A 34053-34109 MT VERN5-BERTRAM5 CKT 1   OPENS B'
COM 'B 34053-34127 MT VERN5-WYOMING5 CKT 1   OPENS A'
COM '---'
CONTINGENCY 'ALTW-16 '
TRIP LINE FROM BUS 34053 TO BUS 34109 CKT 1
TRIP LINE FROM BUS 34053 TO BUS 34127 CKT 1
END

COM ' ALTW-17 Defined as multi-terminal'
COM 'A 34050-34167 GU CTR 5-GU CTR 9 CKT 1   OPENS B C D'
COM 'B 34050-34049 GU CTR 5-SCRANTN5 CKT 1   OPENS A C D'
COM 'C 34050-34048 GU CTR 5-ANITA 5 CKT 1   See Cont ALTW-18'
COM '---'
CONTINGENCY 'ALTW-17'
TRIP LINE FROM BUS 34050 TO BUS 34167 CKT 1
TRIP LINE FROM BUS 34050 TO BUS 34049 CKT 1
TRIP LINE FROM BUS 34050 TO BUS 34048 CKT 1
END

COM ' ALTW-18 Defined as multi-terminal'
COM 'A 34048-34524 ANITA 5-ANITA Y CKT 1   OPENS B C'

COM 'B 34524-34064 ANITA Y-ANITA 8 CKT 1   OPENS A C'
COM 'C 34048-34050 ANITA 5-GU CTR 5 CKT 1   OPENS A B'
COM '---'
CONTINGENCY 'ALTW-18 '
TRIP LINE FROM BUS 34048 TO BUS 34064 CKT 1
TRIP LINE FROM BUS 34048 TO BUS 34050 CKT 1
END

COM ' ALTW-19 Defined as multi-terminal'
COM 'A 34121-34539 E CALMS7-E CALMSY CKT 1   OPENS B C D'
COM 'B 34539-34122 E CALMSY-E CALMS5 CKT 1   OPENS A C D'
COM 'C 34122-34126 E CALMS5-MQOKETA5 CKT 1   VLD SGL'
COM 'D 34122-34124 E CALMS5-DEWITT 5 CKT 1   SEE ALTW-20'
COM '---'
CONTINGENCY 'ALTW-19'
TRIP LINE FROM BUS 34121 TO BUS 34122 CKT 1
TRIP LINE FROM BUS 34122 TO BUS 34126 CKT 1
TRIP LINE FROM BUS 34122 TO BUS 34918 CKT 1
END

COM ' ALTW-20 Defined as multi-terminal'
COM 'A 34122-34124 E CALMS5-DEWITT 5 CKT 1   OPENS B'
COM 'B 34124-34143 DEWITT 5-DEWITT 9 CKT 1   VLD SGL'
COM '--- '
CONTINGENCY 'ALTW-20'
TRIP LINE FROM BUS 34918 TO BUS 34124 CKT 1
TRIP LINE FROM BUS 34124 TO BUS 34143 CKT 1
END

COM ' ALTW-21 Defined as multi-terminal'
COM 'A 34122-64425 E CALMS5-DAVNPRT5 CKT 1   OPENS B C'
COM 'B 34122-34123 E CALMS5-GR MND 5 CKT 1   OPENS A C'
COM '-- '
CONTINGENCY 'ALTW-21'
TRIP LINE FROM BUS 34909 TO BUS 64425 CKT 1
TRIP LINE FROM BUS 34909 TO BUS 34123 CKT 1
END

COM 'ALTW-22 Defined as multi-circuit, RW'
COM 'A 34180-34181 DENMARK5-BRLGTN 5 CKT 1   OPENS B   RW'
COM 'B 34180-34181 DENMARK5-BRLGTN 5 CKT 2 OPENS   A   RW'
COM '-- '
CONTINGENCY 'ALTW-22'
TRIP LINE FROM BUS 34180 TO BUS 34181 CKT 1
TRIP LINE FROM BUS 34180 TO BUS 34181 CKT 2
END

COM 'ALTW-23 Defined as multi-terminal'
COM 'A 34016-34017 EMERY 5-CGORDO 5 CKT 1   OPENS B'
COM 'B 34017-34139 CGORDO 5-HANCOCK5 CKT 1   OPENS A'
COM '---'
CONTINGENCY 'ALTW-23'
TRIP LINE FROM BUS 34016 TO BUS 34017 CKT 1
TRIP LINE FROM BUS 34017 TO BUS 34139 CKT 1
END

COM 'ALTW-24 Defined as multi-terminal'
COM 'A 34028-34026 LORE   5-ASBURY 5 CKT 1   OPENS B,C,D'
COM 'B 34026-34027 ASBURY 5-CGROVE 5 CKT 1   OPENS A,C,D'
COM 'C 34027-34508 CGROVE 5-JULIAN 5 CKT 1   OPENS A,B,D'
COM 'D 34508-34030 JULIAN 5-SALEM N5 CKT 1   OPENS A,B,C'
COM '---'
CONTINGENCY 'ALTW-24'
TRIP LINE FROM BUS 34028 TO BUS 34026 CKT 1
TRIP LINE FROM BUS 34026 TO BUS 34027 CKT 1
TRIP LINE FROM BUS 34027 TO BUS 34508 CKT 1
TRIP LINE FROM BUS 34508 TO BUS 34030 CKT 1
END

COM ' ALTW-25 Defined as multi-terminal'

```
COM ' A  34030-34031  SALEM  5-SO.GVW.5 CKT 1   OPENS B'
COM ' B  34031-34032  SO.GVW.5-8TH ST.5 CKT 1   OPENS A'
COM '-------------------------------------------------------'
CONTINGENCY 'ALTW-25'
TRIP LINE FROM BUS 34034 TO BUS 34031 CKT 1
TRIP LINE FROM BUS 34031 TO BUS 34032 CKT 1
END


COM ' ALTW-26'
COM ' 01/28/03

COM ' **** Lakefield Generating Station (LGS) OPG ****'
COM ' '
COM ' LGS GUIDE REQUIRES LGS TRIP FOR LOSS OF'
COM ' LGS-WILMARTH 345KV LINE'
COM 'THE 6 GENERATORS ARE NOW CONNECTED THROUGH 3 3 WINDING TRANSFORMERS'
COM (MAG 11_18_08)
COM '-------------------------------------------------------'
CONTINGENCY 'ALTW-26'
TRIP LINE FROM BUS 60365 TO BUS 60108 CKT 1 / LGS-WILMARTH

TRIP BRANCH FROM BUS 60331 TO BUS 63011 TO BUS 63012 / LGS 1-2
TRIP BRANCH FROM BUS 60331 TO BUS 63013 TO BUS 63014 / LGS 3-4
TRIP BRANCH FROM BUS 60331 TO BUS 63015 TO BUS 63016 / LGS 5-6
COM TRIP LINE FROM BUS 60331 TO BUS 63091 CKT 1  / LGS 1-2
COM TRIP LINE FROM BUS 60331 TO BUS 63092 CKT 1  / LGS 3-4
COM TRIP LINE FROM BUS 60331 TO BUS 63093 CKT 1  / LGS 5-6
DISCONNECT BUS 63011
DISCONNECT BUS 63012
DISCONNECT BUS 63013
DISCONNECT BUS 63014
DISCONNECT BUS 63015
DISCONNECT BUS 63016
END


COM ' ALTW-27 Defined as multi-terminal'
COM ' A  64067-34529  BONDRNT5-HUXLEYT5 CKT 1   OPENS B'
COM ' C  34529-34061  HUXLEYT5-BNE JCT5 CKT 1   OPENS A'
COM '-------------------------------------------------------'
CONTINGENCY 'ALTW-27'
TRIP LINE FROM BUS 64067 TO BUS 34529 CKT 1
TRIP LINE FROM BUS 34529 TO BUS 34061 CKT 1
END


COM ' ALTW-28 Defined as multi-terminal, Interregional'
COM 'A 34179-34068 JASPER 5-M-TOWN 5 CKT 1   OPENS B C D'
COM 'B 34179-34211 JASPER 5-NEWTON 5 CKT 1   OPENS A C D'
COM 'C 34179-34549 JASPER 5-JASPER Y CKT 1   OPENS A B D'
COM 'D 34549-34204 JASPER Y-JASPER 8 CKT 1   OPENS A B C'
COM '-------------------------------------------------------'
CONTINGENCY 'ALTW-28'
TRIP LINE FROM BUS 34179 TO BUS 34068 CKT 1
TRIP LINE FROM BUS 34179 TO BUS 34211 CKT 1
TRIP LINE FROM BUS 34179 TO BUS 34204 CKT 1
END

COM ' ALTW-29 Defined as multi-terminal, Interregional'
COM 'A 34035-34037 ROCKCKW5-ROCK CK5 CKT 1   OPENS B C'
COM 'B 34035-34343 ROCKCKW5-ROCKCKW8 CKT 1   OPENS A C'
COM 'C 34035-34344 ROCKCKW5-ROCKCK 8 CKT 1   OPENS A B'
COM '-------------------------------------------------------'
CONTINGENCY 'ALTW-29'
TRIP LINE FROM BUS 34035 TO BUS 34037 CKT 1
TRIP LINE FROM BUS 34035 TO BUS 34343 CKT 1
TRIP LINE FROM BUS 34035 TO BUS 34344 CKT 1
END

COM ' ALTW-30 Defined as multi-terminal, Interregional'
COM 'A 34037-34035 ROCK CK5-ROCKCKW5 CKT 1   OPENS B C'
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COM 'B 34037-31437 ROCK CK5-ROCK CK3 CKT 1   OPENS A C'
COM 'C 34037-30290 ROCK CK5-ROCKCKE8 CKT 1   OPENS A B'
COM '---'
CONTINGENCY 'ALTW-30'
TRIP LINE FROM BUS 34037 TO BUS 34035 CKT 1
TRIP LINE FROM BUS 34037 TO BUS 34036 CKT 1
TRIP LINE FROM BUS 34037 TO BUS 34342 CKT 1
END

COM ' ALTW-31 Defined as multi-terminal'
COM 'A 34050-34049 GU CTR 5-SCRANTN5 CKT 1   OPENS B C'
COM 'B 34049-34165 SCRANTN5-SCRANTN9 CKT 1   OPENS A C'
COM 'C 34049-34054 SCRANTN5-GR JCT5 CKT 1   SGL'
COM '---'
CONTINGENCY 'ALTW-31'
TRIP LINE FROM BUS 34050 TO BUS 34049 CKT 1
TRIP LINE FROM BUS 34049 TO BUS 34165 CKT 1
TRIP LINE FROM BUS 34049 TO BUS 34054 CKT 1
END

COM ' ALTW-32 Defined as multi-terminal'
COM 'A 34180-34181 DENMARK5-BRLGTN 5 CKT 1   OPENS B'
COM 'B 34180-34181 DENMARK5-VIELE 5 CKT 1   OPENS A'
COM '---'
CONTINGENCY 'ALTW-32'
TRIP LINE FROM BUS 34180 TO BUS 34181 CKT 1
TRIP LINE FROM BUS 34180 TO BUS 34081 CKT 1
END

COM 'ALTW-33 Defined as multi-circuit'
COM 'A 34189-34172 OTTUMWA5-EIC   5 CKT 1   OPENS   B C'
COM 'B 34172-34547 EIC   5-EIC   Y CKT 1   SGL'
COM 'C 34547-34173 EIC   Y-EIC   8 CKT 1   SGL'
COM '---'
CONTINGENCY 'ALTW-33'
TRIP LINE FROM BUS 34189 TO BUS 34172 CKT 1
TRIP LINE FROM BUS 34172 TO BUS 34173 CKT 1
END

COM 'ALTW-34 Defined as multi-circuit, Interregional'
COM 'A 34190-34174 BRDGPRT5-EICTAP 5 CKT 1   OPENS B C'
COM 'B 34172-34174 EIC   5-EICTAP 5 CKT 1   OPENS A C'
COM 'C 34174-64096 EICTAP   5-BEACON 5 CKT 1   OPENS A B'
COM '---'
CONTINGENCY 'ALTW-34'
TRIP LINE FROM BUS 34190 TO BUS 34174 CKT 1
TRIP LINE FROM BUS 34172 TO BUS 34174 CKT 1
TRIP LINE FROM BUS 34174 TO BUS 64096 CKT 1
END

COM 'ALTW-35 Defined as multi-terminal, common tower'
COM 'A 64189-34179 NEANKNY 5-JASPER 5 CKT 1   OPENS B Tower'
COM 'B 34058-64189 PERRY   5-NEANKNY5 CKT 1   OPENS A Tower. Opens C'
COM 'C 34054-34058 GR JCT 5-PERRY 5 CKT 1   OPENS D,E '
COM 'D 34058-34166 PERRY   5-PERRY 9 CKT 1   SGL'
COM 'E 34058-34166 PERRY   5-PERRY 9 CKT 2   SGL'
COM '---'
CONTINGENCY 'ALTW-35'
TRIP LINE FROM BUS 64189 TO BUS 34179 CKT 1
TRIP LINE FROM BUS 34058 TO BUS 64189 CKT 1
TRIP LINE FROM BUS 34054 TO BUS 34058 CKT 1
TRIP LINE FROM BUS 34058 TO BUS 34166 CKT 1
TRIP LINE FROM BUS 34058 TO BUS 34166 CKT 2
END

COM 'ALTW-36 Defined as multi-terminal, tower'
COM 'A 34508-34030 JULIAN 5-SALEM 5 CKT 1   OPENS B C D E TOWER'
COM 'B 34030-34031 SALEM 5-SO.GVW.5 CKT 1   OPENS A F TOWER'
COM 'C 34028-34026 LORE   5-ASBURY 5 CKT 1   OPENS A,D,E'
COM 'D 34026-34027 ASBURY 5-CGROVE 5 CKT 1   OPENS A,C,E'

COM 'E 34027-34508 CGROVE 5-JULIAN 5 CKT 1   OPENS A,C,D'
COM 'F 34031-34032 SO.GVW.5-8TH ST.5 CKT 1   OPENS B'
COM '---'
CONTINGENCY 'ALTW-36'
TRIP LINE FROM BUS 34508 TO BUS 34030 CKT 1
TRIP LINE FROM BUS 34034 TO BUS 34031 CKT 1
TRIP LINE FROM BUS 34028 TO BUS 34026 CKT 1
TRIP LINE FROM BUS 34026 TO BUS 34027 CKT 1
TRIP LINE FROM BUS 34027 TO BUS 34508 CKT 1
TRIP LINE FROM BUS 34031 TO BUS 34032 CKT 1
END

COM ' NEXT CONTINGENCY NOT TAKEN, COMMENTED OUT '
COM 'ALTW-37 Defined as Common Tower'
COM 'A 34016-34015 EMERY 5-LIME CK5   OPENS B Tower'
COM 'A 34010-34015 HAYWARD5-LIME CK5   OPENS A Tower'
COM '---'
CONTINGENCY 'ALTW-37'
TRIP LINE FROM BUS 34016 TO BUS 34015 CKT 1
TRIP LINE FROM BUS 34572 TO BUS 34015 CKT 1
END

COM ' NEXT CONTINGENCY NOT TAKEN, COMMENTED OUT '
COM 'ALTW-38 Defined as multi-terminal, interregional, tower'
COM 'A 34028-34032 LORE   5-8TH ST.5 CKT 1 OPENS B Tower'
COM 'B 34028-34033 LORE   5-TRK RIV5 CKT 1 OPENS A C D Tower'
COM 'C 34033-69503 TRK RIV5-CASVILL5 CKT 1 OPENS B D'
COM 'D 34033-34465 TRK RIV5-TURK RV8 CKT 1 OPENS B C'
COM '---'
CONTINGENCY 'ALTW-38'
TRIP LINE FROM BUS 34028 TO BUS 34908 CKT 1
TRIP LINE FROM BUS 34028 TO BUS 34033 CKT 1
TRIP LINE FROM BUS 34033 TO BUS 69503 CKT 1
TRIP LINE FROM BUS 34033 TO BUS 34465 CKT 1
END

COM   END ALTW Contingencies'
COM ' '
COM ' '
COM ' '
COM ' '
COM ' '
COM ' '
COM ' '
COM ' '
COM 'ALL BRANCHES AS SINGLE OUTAGES'
COM 'AND ALL INT TIES '

CONTINGENCY 'test'
TRIP LINE FROM BUS 99998 TO BUS 99999 CKT 15
END
END

COM XFMR Contingency Description Data File for RRV – MTO 2016 CVS
COM - all contingencies under 161kV removed - jrn 10-31-08
COM

CONTINGENCY 'WILTON Y - 230'
DISCONNECT BUS 63186
END

CONTINGENCY 'WINGER Y - 230'
DISCONNECT BUS 63187
END

CONTINGENCY 'PICKERTY - 230'
DISCONNECT BUS 63188
END

```
CONTINGENCY 'MAPLER1Y - 345'
DISCONNECT BUS 63189
END

CONTINGENCY 'MAPLER2Y - 345'
DISCONNECT BUS 63190
END

CONTINGENCY 'FERGSFLY - 230'
DISCONNECT BUS 63194
END

CONTINGENCY 'BUFFALOY - 345'
DISCONNECT BUS 63198
END

CONTINGENCY 'JAMSTN1Y - 345'
DISCONNECT BUS 63199
END

CONTINGENCY 'JAMSTN2Y - 345'
DISCONNECT BUS 63200
END

CONTINGENCY 'AUDUBONY - 230'
DISCONNECT BUS 63202
END

CONTINGENCY 'JAMEST2T - 230'
DISCONNECT BUS 66199
END

CONTINGENCY 'GRNDFKST - 230'
DISCONNECT BUS 66200
END

CONTINGENCY 'JAMEST1T - 230'
DISCONNECT BUS 66207
END

CONTINGENCY 'MICTYE1T - 230'
DISCONNECT BUS 66216
END

CONTINGENCY 'MAURIN1T - 230'
DISCONNECT BUS 66246
END

CONTINGENCY 'NUNDRWDT - 230'
DISCONNECT BUS 66266
END

CONTINGENCY 'FARGOM14 - 230'
DISCONNECT BUS 66440
END

CONTINGENCY 'FARGOM24 - 230'
DISCONNECT BUS 66446
END

CONTINGENCY 'DRAYTO1T - 230'
DISCONNECT BUS 66787
END

CONTINGENCY 'DRAYTO2T - 230'
DISCONNECT BUS 66788
END

CONTINGENCY 'WILTON2T - 230'
DISCONNECT BUS 66798
```

```
END

CONTINGENCY 'LELND2TY - 345'
DISCONNECT BUS 67202
END

CONTINGENCY 'STEGALTY - 345'
DISCONNECT BUS 67207
END

CONTINGENCY 'HARVEY Y - 230'
DISCONNECT BUS 63307
END

CONTINGENCY 'GROTONTY - 345'
DISCONNECT BUS 67203
END

CONTINGENCY 'test'
TRIP LINE FROM BUS 99998 TO BUS 99999 CKT 15
END

END
```

```
COM ' Miso contingency file – MTO 2016 CVS
COM '  START "RELEVANT" GENERATION OUTAGES'
COM '  Generation outages deemed not relevant to the'
COM '  MTO study and have been removed - jrn 11-3-08'
COM '
COM '  STOP "RELEVANT" GENERATION OUTAGES'
COM '
COM '  START "RELEVANT" MINNESOTA AREA CONTINGENCIES'
COM '
CONTINGENCY PLV-ADM-HZT
OPEN LINE FROM BUS 63032 TO BUS 60102 CKT 1
OPEN LINE FROM BUS 60102 TO BUS 34018 CKT 1
END
CONTINGENCY BYN-PLV-ADM
OPEN LINE FROM BUS 61950 TO BUS 63032 CKT 1
OPEN LINE FROM BUS 63032 TO BUS 60102 CKT 1
END
CONTINGENCY PV3-AD3-AD5
OPEN LINE FROM BUS 63032 TO BUS 60102 CIRCUIT 1
OPEN LINE FROM BUS 60102 TO BUS 34014 CIRCUIT 1
OPEN LINE FROM BUS 60102 TO BUS 34018 CIRCUIT 1
END
COM 'ALTW-C108  MULTI-TERMINAL'
COM 'A 34572-69526 ADAMS_S5-BVR CRK5 CKT 1   OPENS B C'
COM 'B 69526-69527 BVR CRK5-HARMONY5 CKT 1   OPENS A C'
COM 'C 61980-69526 RICE   5-BVR CRK5 CKT 1   OPENS A B'
COM '-----------------------------------------------------'
CONTINGENCY ADM-BVC-HAR
TRIP LINE FROM BUS 34572 TO BUS 69526 CKT 1
TRIP LINE FROM BUS 69526 TO BUS 69527 CKT 1
TRIP LINE FROM BUS 61980 TO BUS 69526 CKT 1
END
CONTINGENCY 'Byron-PL Valley + PL Valley-Adams'
TRIP LINE FROM BUS 61950 TO BUS 63032 CKT 1
TRIP LINE FROM BUS 63032 TO BUS 60102 CKT 1
COM Adams 345/161 xfmr
TRIP LINE FROM BUS 60102 TO BUS 34014 CKT 1
END
COM ###'This contingency is class C -jrn 11-18-08'
COM ###CONTINGENCY 'Byron-Maple Leaf + Wabaco-Roc'
COM ###TRIP LINE FROM BUS 61948 TO BUS 61906 CKT 1
COM ###TRIP LINE FROM BUS 69549 TO BUS 69547 CKT 1
COM ###END
COM '
COM '  END "RELEVANT" MINNESOTA AREA CONTINGENCIES'
```

```
COM '
COM '
COM '  START "RELEVANT" IOWA AREA CONTINGENCIES'
COM '
COM 'ALTW-C129  MULTI-TERMINAL'
COM 'A 34016-34017  EMERY  5-CGORDO 5 CKT 1   OPENS B'
COM 'B 34017-34139  CGORDO 5-HANCOCK5 CKT 1   OPENS A'
COM '---------------------------------------------------------'
CONTINGENCY 'ALTW-C129'
TRIP LINE FROM BUS 34016 TO BUS 34017 CKT 1
TRIP LINE FROM BUS 34017 TO BUS 34139 CKT 1
END
COM 'ALTW-C203  COMMON TOWER'
COM 'A 34016-34015  EMERY  5-LIME CK5'
COM 'B 34015-34000  LIME CK5-NIW    5   OPENS C'
COM 'C 34000-34010  NIW    5-HAYWARD5   OPENS B'
COM '---------------------------------------------------------'
CONTINGENCY 'ALTW-C203'
TRIP LINE FROM BUS  34016 TO BUS  34015 CKT 1
TRIP LINE FROM BUS  34015 TO BUS  34000 CKT 1
TRIP LINE FROM BUS  34000 TO BUS  34010 CKT 1
END
COM '
COM '  END "RELEVANT" IOWA AREA CONTINGENCIES'
COM '
COM '  START "RELEVANT" WISCONSIN AREA CONTINGENCIES'
COM '
CONTINGENCY ALM-RLM
OPEN LINE FROM BUS 69543 TO BUS 69545 CKT 1
OPEN LINE FROM BUS 69545 TO BUS 68884 CKT 1
END
CONTINGENCY APP-PLK-CRY
OPEN LINE FROM BUS 69565 TO BUS 60314 CKT 1
OPEN LINE FROM BUS 69565 TO BUS 69007 CKT 1
OPEN LINE FROM BUS 60314 TO BUS 60312 CKT 1
OPEN LINE FROM BUS 60312 TO BUS 60313 CKT 3
OPEN LINE FROM BUS 60314 TO BUS 60329 CKT 1
END
CONTINGENCY ASK-ECL-ARP
OPEN LINE FROM BUS 60186 TO BUS 60304 CKT 1
OPEN LINE FROM BUS 39244 TO BUS 60304 CKT 1
END
CONTINGENCY ASK-ARP
OPEN LINE FROM BUS 60186 TO BUS 60304 CIRCUIT 1
OPEN LINE FROM BUS 60304 TO BUS 39244 CIRCUIT 1
OPEN LINE FROM BUS 39706 TO BUS 39710 CIRCUIT 1
OPEN LINE FROM BUS 68943 TO BUS 69348 CIRCUIT 1
END
CONTINGENCY ASK-ARP-W69
OPEN LINE FROM BUS 60186 TO BUS 60304 CKT 1
OPEN LINE FROM BUS 39244 TO BUS 60304 CKT 1
OPEN LINE FROM BUS 39710 TO BUS 39706 CKT 1
OPEN LINE FROM BUS 60305 TO BUS 60304 CKT 9
OPEN LINE FROM BUS 60305 TO BUS 60304 CKT 10
OPEN LINE FROM BUS 68821 TO BUS 38333 CKT 1
COM ' MAUSTON-HILLTOP IS 68821-38333 '
END
CONTINGENCY ASK-ARP-X69
OPEN LINE FROM BUS 60186 TO BUS 60304 CIRCUIT 1
OPEN LINE FROM BUS 39244 TO BUS 60304 CIRCUIT 1
OPEN LINE FROM BUS 39710 TO BUS 39706 CIRCUIT 1
OPEN LINE FROM BUS 60305 TO BUS 60304 CIRCUIT 9
OPEN LINE FROM BUS 60305 TO BUS 60304 CIRCUIT 10
END
CONTINGENCY ECL-ARP
OPEN LINE FROM BUS 60304 TO BUS 39244 CIRCUIT 1
OPEN LINE FROM BUS 39710 TO BUS 39706 CIRCUIT 1
END
CONTINGENCY ECL-ARP-W69
OPEN LINE FROM BUS 60304 TO BUS 39244 CIRCUIT 1
```

OPEN LINE FROM BUS 39710 TO BUS 39706 CIRCUIT 1
OPEN LINE FROM BUS 68821 TO BUS 38333 CIRCUIT 1
END
CONTINGENCY ECL-ARP-GRG
OPEN LINE FROM BUS 60304 TO BUS 39244 CIRCUIT 1
OPEN LINE FROM BUS 69508 TO BUS 39959 CIRCUIT 1
OPEN LINE FROM BUS 39710 TO BUS 39706 CIRCUIT 1
END
CONTINGENCY ECL-ARP-X69
OPEN LINE FROM BUS 60304 TO BUS 39244 CIRCUIT 1
OPEN LINE FROM BUS 69508 TO BUS 39959 CIRCUIT 1
OPEN LINE FROM BUS 39710 TO BUS 39706 CIRCUIT 1
OPEN LINE FROM BUS 68821 TO BUS 38333 CIRCUIT 1
END
CONTINGENCY GNO-LSG-TOW
TRIP LINE FROM BUS 69523 TO BUS 69527 CKT 1
TRIP LINE FROM BUS 69523 TO BUS 34021 CKT 1
END
CONTINGENCY GNO-LAX
OPEN LINE FROM BUS 69535 TO BUS 60308 CKT 1
OPEN LINE FROM BUS 69535 TO BUS 69523 CKT 1
END
CONTINGENCY GNO-LAX-DBL
OPEN LINE FROM BUS 69523 TO BUS 69535 CKT 1
OPEN LINE FROM BUS 69523 TO BUS 60302 CKT 1
END
CONTINGENCY GNO-LAX-RW
TRIP LINE FROM BUS 60302 TO BUS 60308 CKT 1
TRIP LINE FROM BUS 69523 TO BUS 69535 CKT 1
COM 'GNO-LAX & LAX-COU RE: COMMON R/W'
TRIP LINE FROM BUS 60308 TO BUS 69535 CKT 1
END
CONTINGENCY SNC-GNO-W69
OPEN LINE FROM BUS 69507 TO BUS 69523 CIRCUIT 1
OPEN LINE FROM BUS 68821 TO BUS 38333 CIRCUIT 1
END
CONTINGENCY SNC-GRG
OPEN LINE FROM BUS 69507 TO BUS 69508 CKT 1
OPEN LINE FROM BUS 69508 TO BUS 39959 CKT 1
END
CONTINGENCY SNC-GRG-W69
OPEN LINE FROM BUS 69507 TO BUS 69508 CKT 1
OPEN LINE FROM BUS 68821 TO BUS 38333 CKT 1
OPEN LINE FROM BUS 69508 TO BUS 39959 CKT 1
END
CONTINGENCY SNC-GRG-NED
OPEN LINE FROM BUS 69507 TO BUS 69508 CIRCUIT 1
OPEN LINE FROM BUS 69508 TO BUS 39959 CIRCUIT 1
OPEN LINE FROM BUS 69508 TO BUS 39010 CIRCUIT 1
END
CONTINGENCY SNC-BLC-XFM
OPEN LINE FROM BUS 69507 TO BUS 69511 CKT 1
OPEN LINE FROM BUS 69511 TO BUS 68775 CKT 1
END
CONTINGENCY BLC-HLB-XFM
OPEN LINE FROM BUS 68775 TO BUS 69511 CKT 2
OPEN LINE FROM BUS 69511 TO BUS 69515 CKT 1
OPEN LINE FROM BUS 69515 TO BUS 68795 CKT 1
END
CONTINGENCY BON-APP-XFM
OPEN LINE FROM BUS 69557 TO BUS 69565 CKT 1
OPEN LINE FROM BUS 69565 TO BUS 69007 CKT 1
END
CONTINGENCY STO-TRK-LOR
OPEN LINE FROM BUS 68701 TO BUS 69503 CKT 1
OPEN LINE FROM BUS 69503 TO BUS 34033 CKT 1
OPEN LINE FROM BUS 34033 TO BUS 34028 CKT 1
END
COM '
COM ' END "RELEVANT" WISCONSIN AREA CONTINGENCIES'

COM '
COM '
COM ' START GROUP I CONTINGENCIES'
COM ' THESE CONTINGENCIES ASSUME ALMA MISSISSIPPI RIVER CROSSING'
COM '
CONTINGENCY GNO-LAX-NLA
OPEN LINE FROM BUS 69535 TO BUS 60308 CKT 1
OPEN LINE FROM BUS 69535 TO BUS 69566 CKT 1
OPEN LINE FROM BUS 69535 TO BUS 69523 CKT 1
END
CONTINGENCY BVD-WBC-TOW
OPEN LINE FROM BUS 69079 TO BUS 63431 CKT 1
OPEN LINE FROM BUS 69073 TO BUS 69079 CKT 1
END
CONTINGENCY NLAX-MRS-TOW
OPEN LINE FROM BUS 69566 TO BUS 69567 CKT 1
OPEN LINE FROM BUS 60309 TO BUS 69566 CKT 1
END
CONTINGENCY NROC5-TOW
OPEN LINE FROM BUS 63432 TO BUS 63445 CIRCUIT 1
OPEN LINE FROM BUS 63432 TO BUS 63415 CIRCUIT 1
END
COM '
COM ' END GROUP I CONTINGENCIES'
COM '
COM ' START MISO CONTINGENCIES'
COM '
COM '
COM LAC_XFMR1
CONTINGENCY LAC_X1
OPEN LINE FROM BUS 60308 TO BUS 60973 CKT 1
END
COM LAC_XFMR2
CONTINGENCY LAC_X2
OPEN LINE FROM BUS 60308 TO BUS 60973 CKT 2
END
COM '
CONTINGENCY 'DPC-980'
OPEN LINE FROM BUS 69557 TO BUS 69561 CIRCUIT 1
OPEN LINE FROM BUS 69021 TO BUS 69015 CIRCUIT 1
END
CONTINGENCY 'DPC-981'
OPEN LINE FROM BUS 69557 TO BUS 69565 CIRCUIT 1
OPEN LINE FROM BUS 69021 TO BUS 69015 CIRCUIT 1
END

CONTINGENCY 'Byron-ML-Cascade'
OPEN LINE FROM BUS 61948 TO BUS 61906 CKT 1
OPEN LINE FROM BUS 61906 TO BUS 63430 CKT 1
END

COM ###'This contingency is class C -jrn 11-18-08
COM ###CONTINGENCY 'Byron-Maple Leaf + Byron_xfmr'
COM ###TRIP LINE FROM BUS 61948 TO BUS 61906 CKT 1
COM ###TRIP LINE FROM BUS 61950 TO BUS 61948 CKT 1
COM ###END

COM ###'This contingency is class C -jrn 11-18-08
COM ###CONTINGENCY 'Byron-Maple Leaf + Adams-Chester'
COM ###TRIP LINE FROM BUS 61948 TO BUS 61906 CKT 1
COM ###TRIP LINE FROM BUS 34570 TO BUS 69547 CKT 1
COM ###END

COM ###'This contingency is class C -jrn 11-18-08
COM ###CONTINGENCY 'Byron-Maple Leaf + Wabaco-Chester'
COM ###TRIP LINE FROM BUS 61948 TO BUS 61906 CKT 1
COM ###TRIP LINE FROM BUS 69549 TO BUS 69547 CKT 1
COM ###END

CONTINGENCY 'Byron-Maple Leaf + Wabaco-Alma'

```
TRIP LINE FROM BUS 61948 TO BUS 61906 CKT 1
TRIP LINE FROM BUS 69549 TO BUS 69543 CKT 1
END

COM ###'This contingency is class C -jrn 11-18-08
COM ###CONTINGENCY 'Byron-Maple Leaf + Adams_xfmr'
COM ###TRIP LINE FROM BUS 61948 TO BUS 61906 CKT 1
COM ###TRIP LINE FROM BUS 34014 TO BUS 60102 CKT 1
COM ###END

COM ###'This contingency is class C -jrn 11-18-08
COM ###CONTINGENCY 'Adams-Chester + Wabaco-Chester'
COM ###TRIP LINE FROM BUS 34570 TO BUS 69547 CKT 1
COM ###TRIP LINE FROM BUS 69549 TO BUS 69547 CKT 1
COM ###END

COM ###'This contingency is class C -jrn 11-18-08
COM ###CONTINGENCY 'Byron_xfmr + Adams-Chester'
COM ###TRIP LINE FROM BUS 61948 TO BUS 61950 CKT 1
COM ###TRIP LINE FROM BUS 34570 TO BUS 69547 CKT 1
COM ###END

COM ###'This contingency is class C -jrn 11-18-08
COM ###CONTINGENCY 'Byron_xfmr + Wabaco-Chester'
COM ###TRIP LINE FROM BUS 61948 TO BUS 61950 CKT 1
COM ###TRIP LINE FROM BUS 69549 TO BUS 69547 CKT 1
COM ###END

COM ###'This contingency is class C -jrn 11-18-08
COM ###CONTINGENCY 'Byron_xfmr + Wabaco-Alma'
COM ###TRIP LINE FROM BUS 61948 TO BUS 61950 CKT 1
COM ###TRIP LINE FROM BUS 69549 TO BUS 69543 CKT 1
COM ###END

COM ###'This contingency is class C -jrn 11-18-08
COM ###CONTINGENCY 'Byron_xfmr + Adams_xfmr'
COM ###TRIP LINE FROM BUS 61948 TO BUS 61950 CKT 1
COM ###TRIP LINE FROM BUS 34014 TO BUS 60102 CKT 1
COM ###END

COM '
COM '   END MISO CONTINGENCIES'
COM

CONTINGENCY 'test'
TRIP LINE FROM BUS 99998 TO BUS 99999 CKT 15
END

END
```

```
COM CapX tower outages for all doulbe circuit lines
COM for the MTO 2016 CVS
COM - jrn 10-30-08
COM -------------------------------------------------------------------------

COM ' CAPX-LY-FR-DB Defined as common tower outage'
COM 'A 60500-60501 LYONCO3-FRNKLN3 CKT C1   OPENS  B'
COM 'B 60500-60501 LYONCO3-FRNKLN3 CKT C2   OPENS  A'
COM '-------------------------------------------------------'
CONTINGENCY 'CAPX-LY-FR-DB'
TRIP LINE FROM BUS 60500 TO BUS 60501 CKT C1
TRIP LINE FROM BUS 60500 TO BUS 60501 CKT C2
END

COM ' CAPX-FR-HL-DB Defined as common tower outage'
COM 'A 60501-60502 FRNKLN3-HELENASS CKT C1   OPENS  B'
COM 'B 60501-60502 FRNKLN3-HELENASS CKT C2   OPENS  A'
COM '-------------------------------------------------------'
CONTINGENCY 'CAPX-FR-HL-DB'
```

```
TRIP LINE FROM BUS 60501 TO BUS 60502 CKT C1
TRIP LINE FROM BUS 60501 TO BUS 60502 CKT C2
END

COM ' CAPX-LY-BC-DB Defined as common tower outage'
COM 'A 60500-60383 LYON CO3-BRKNGCO3 CKT C1   OPENS  B'
COM 'B 60500-60383 LYON CO3-BRKNGCO3 CKT U2   OPENS  A'
COM '---------------------------------------------------------'
CONTINGENCY 'CAPX-LY-BC-DB'
TRIP LINE FROM BUS 60500 TO BUS 60383 CKT C1
TRIP LINE FROM BUS 60500 TO BUS 60383 CKT U2
END

COM ' CAPX-LY-HZ-DB Defined as common tower outage'
COM 'A 60500-60507 LYON CO3-HAZEL 3  CKT C1   OPENS  B'
COM 'B 60500-60507 LYON CO3-HAZEL 3  CKT U2   OPENS  A'
COM '---------------------------------------------------------'
CONTINGENCY 'CAPX-LY-HZ-DB'
TRIP LINE FROM BUS 60500 TO BUS 60507 CKT C1
TRIP LINE FROM BUS 60500 TO BUS 60507 CKT U2
END

COM ' CAPX-HL-LM-DB Defined as common tower outage'
COM 'A 60502-60505 HELNASS3-LKMARN 3 CKT C1   OPENS  B'
COM 'B 60502-60505 HELNASS3-LKMARN 3 CKT U2   OPENS  A'
COM '---------------------------------------------------------'
CONTINGENCY 'CAPX-HL-LM-DB'
TRIP LINE FROM BUS 60502 TO BUS 60505 CKT C1
TRIP LINE FROM BUS 60502 TO BUS 60505 CKT U2
END

COM ' CAPX-LM-HC-DB Defined as common tower outage'
COM 'A 60505-60503 LKMARN 3-HMPTNCR3 CKT C1   OPENS  B'
COM 'B 60505-60503 LKMARN 3-HMPTNCR3 CKT U2   OPENS  A'
COM '---------------------------------------------------------'
CONTINGENCY 'CAPX-LM-HC-DB'
TRIP LINE FROM BUS 60505 TO BUS 60503 CKT C1
TRIP LINE FROM BUS 60505 TO BUS 60503 CKT U2
END

COM ' CAPX-HC-NR-DB Defined as common tower outage'
COM 'A 60503-63431 HMPTNCR3-NROC 345 CKT 1   OPENS  B'
COM 'B 60503-63431 HMPTNCR3-NROC 345 CKT U2   OPENS  A'
COM '---------------------------------------------------------'
CONTINGENCY 'CAPX-HC-NR-DB'
TRIP LINE FROM BUS 60503 TO BUS 63431 CKT 1
TRIP LINE FROM BUS 60503 TO BUS 63431 CKT U2
END

COM ' CAPX-MR-AX-DB Defined as common tower outage'
COM 'A 66792-67010 MAPLE R3-ALEXSS3  CKT C1   OPENS  B'
COM 'B 66792-67010 MAPLE R3-ALEXSS3  CKT C2   OPENS  A'
COM '---------------------------------------------------------'
CONTINGENCY 'CAPX-MR-AX-DB'
TRIP LINE FROM BUS 66792 TO BUS 67010 CKT 1
TRIP LINE FROM BUS 66792 TO BUS 67010 CKT U2
END

COM ' CAPX-AX-QR-DB Defined as common tower outage'
COM 'A 67010-60389 ALEXSS3 -QUARRY3  CKT C1   OPENS  B'
COM 'B 67010-60389 ALEXSS3 -QUARRY3  CKT C2   OPENS  A'
COM '---------------------------------------------------------'
CONTINGENCY 'CAPX-AX-QR-DB'
TRIP LINE FROM BUS 67010 TO BUS 60389 CKT 1
TRIP LINE FROM BUS 67010 TO BUS 60389 CKT U2
END

COM ' CAPX-QR-MC-DB Defined as common tower outage'
COM 'A 60389-60151 QUARRY3 -MNTCELO3 CKT C1   OPENS  B'
COM 'B 60389-60101 QUARRY3 -MNTCELO3 CKT C2   OPENS  A'
```

```
COM '-------------------------------------------------------'
CONTINGENCY 'CAPX-QR-MC-DB'
TRIP LINE FROM BUS 60389 TO BUS 60151 CKT 1
TRIP LINE FROM BUS 60389 TO BUS 60151 CKT U2
END

COM ' CAPX-LK-WB-DB Defined as common tower outage'
COM 'A 34006-601018 LAKEFLD3-WINBAGO3 CKT C1   OPENS  B'
COM 'B 34006-601018 LAKEFLD3-WINBAGO3 CKT C2   OPENS  A'
COM '-------------------------------------------------------'
CONTINGENCY 'CAPX-LK-WB-DB'
TRIP LINE FROM BUS 34006 TO BUS 601018 CKT 1
TRIP LINE FROM BUS 34006 TO BUS 601018 CKT 2
END

COM ' CAPX-WB-HW-DB Defined as common tower outage'
COM 'A 601018-601019 WINBAGO3-HAYWARD  CKT C1   OPENS  B'
COM 'B 601018-601019 WINBAGO3-HAYWARD  CKT C2   OPENS  A'
COM '-------------------------------------------------------'
CONTINGENCY 'CAPX-WB-HW-DB'
TRIP LINE FROM BUS 601018 TO BUS 601019 CKT 1
TRIP LINE FROM BUS 601018 TO BUS 601019 CKT 2
END

COM ' CAPX-HW-AD-DB Defined as common tower outage'
COM 'A 601019-60102 HAYWARD -ADAMS 3   CKT C1   OPENS  B'
COM 'B 601019-60102 HAYWARD -ADAMS 3   CKT C2   OPENS  A'
COM '-------------------------------------------------------'
CONTINGENCY 'CAPX-HW-AD-DB'
TRIP LINE FROM BUS 601019 TO BUS 60102 CKT 1
TRIP LINE FROM BUS 601019 TO BUS 60102 CKT 2
END

COM ' CAPX-MR-HK-DB Defined as common tower outage'
COM 'A 66792-601063 MAPLE R3-HANKNSN3 CKT C1   OPENS  B'
COM 'B 66792-601063 MAPLE R3-HANKNSN3 CKT C2   OPENS  A'
COM '-------------------------------------------------------'
CONTINGENCY 'CAPX-MR-HK-DB'
TRIP LINE FROM BUS 66792 TO BUS 601063 CKT 1
TRIP LINE FROM BUS 66792 TO BUS 601063 CKT 2
END

COM ' CAPX-HK-BS-DB Defined as common tower outage'
COM 'A 601063-63417 HANKNSN3-BSSOUTH3 CKT C1   OPENS  B'
COM 'B 601063-63417 HANKNSN3-BSSOUTH3 CKT C2   OPENS  A'
COM '-------------------------------------------------------'
CONTINGENCY 'CAPX-HK-BS-DB'
TRIP LINE FROM BUS 601063 TO BUS 63417 CKT 1
TRIP LINE FROM BUS 601063 TO BUS 63417 CKT 2
END

COM ' CAPX-BS-BC-DB Defined as common tower outage'
COM 'A 63417-60383 BSSOUTH3-BRKNGCO3 CKT C1   OPENS  B'
COM 'B 63417-60383 BSSOUTH3-BRKNGCO3 CKT C2   OPENS  A'
COM '-------------------------------------------------------'
CONTINGENCY 'CAPX-BS-BC-DB'
TRIP LINE FROM BUS 63417 TO BUS 60383 CKT 1
TRIP LINE FROM BUS 63417 TO BUS 60383 CKT 2
END

COM ' CAPX-BC-SR-DB Defined as common tower outage'
COM 'A 60383-60126 BRKNGCO3-SPLLT RK3 CKT C1   OPENS  B'
COM 'B 60383-60126 BRKNGCO3 SPLLT RK3 CKT C2   OPENS  A'
COM '-------------------------------------------------------'
CONTINGENCY 'CAPX-BC-SR-DB'
TRIP LINE FROM BUS 60383 TO BUS 60126 CKT 1
TRIP LINE FROM BUS 60383 TO BUS 60126 CKT 2
END
```

COM ' Corridor Contingency file – MTO 2016 CVS
COM DOUBLE CIRCUIT NO EXPRESS HZL-BLL
COM REMOVED CONTINGENCIES FROM NON-EXISTANT LINES
COM --
COM Corridor Study 345 Hazel to Blue Lake
COM --
CONTINGENCY 'HZL-PTH3DBL'
TRIP LINE FROM BUS 60507 TO BUS 601058 CKT 1
TRIP LINE FROM BUS 60507 TO BUS 601058 CKT 2
END

CONTINGENCY 'PTH-MCL3DBL'
TRIP LINE FROM BUS 601057 TO BUS 601058 CKT 1
TRIP LINE FROM BUS 601057 TO BUS 601058 CKT 2
END

CONTINGENCY 'MCL-BLL3DBL'
TRIP LINE FROM BUS 60192 TO BUS 601057 CKT 1
TRIP LINE FROM BUS 60192 TO BUS 601057 CKT 2
END

COM 'This contingency is class C -jrn 11-18-08
COM 'CONTINGENCY C-BLR-BGSTN-2645STK'
COM '63314-66503 BIG STONE 230 - BLAIR 230'
COM '63314-63195 BIG STONE 230 - BIG STONE Y 230'
COM '63214-63195 BIG STONE 115 - BIG STONE Y 230'
COM '63316-63195 BIG STONE 13.2 - BIG STONE Y 230'
COM 'no NEED TO REDUCE BIG STONE GENERATION TO 250 MW NET'
COM '--'
COM CONTINGENCY '2645STK-0red'
COM TRIP LINE FROM BUS 63314 TO BUS 66503 CKT 1
COM TRIP LINE FROM BUS 63314 TO BUS 63195 CKT 1
COM TRIP LINE FROM BUS 63214 TO BUS 63195 CKT 1
COM TRIP LINE FROM BUS 63316 TO BUS 63195 CKT 1
COM END

COM 'This contingency is class C -jrn 11-18-08
COM 'CONTINGENCY C-BGSTN-BLR-482STK'
COM '63314-66503 BIG STONE 230 - BLAIR 230'
COM '66503-66224 BLAIR 230 - BLAIR 69'
COM 'NEED TO REDUCE BIG STONE GENERATION TO 250 MW NET'
COM '--'
COM CONTINGENCY '482STK-0red'
COM TRIP LINE FROM BUS 63314 TO BUS 66503 CKT 1
COM TRIP LINE FROM BUS 66503 TO BUS 66224 CKT 1
COM END

COM 'This contingency is class C -jrn 11-18-08
COM 'CONTINGENCY C-BGSTN-BLR-182STK'
COM '63314-66503 BIG STONE 230 - BLAIR 230'
COM '66503-66550 BLAIR 230 - GRANITE FALLS 230'
COM 'NEED TO REDUCE BIG STONE GENERATION TO 250 MW NET'
COM '--'
COM CONTINGENCY '182STK-0red'
COM TRIP LINE FROM BUS 63314 TO BUS 66503 CKT 1
COM TRIP LINE FROM BUS 66503 TO BUS 66550 CKT 1
COM END

COM 'This contingency is class C -jrn 11-18-08
COM 'CONTINGENCY C-HNKSN-BGSTN-2635STK'
COM '63325-63327 BROWNS VALLEY 230 - HANKINSON 230'
COM '63314-63325 BIG STONE 230 - BROWNS VALLEY 230'
COM '63325-63125 BROWNS VALLEY 230 - BROWNS VALLEY 41.6'
COM '63314-63195 BIG STONE 230 - BIG STONE Y 230'
COM '63214-63195 BIG STONE 115 - BIG STONE Y 230'
COM '63316-63195 BIG STONE 13.8 - BIG STONE Y 230'
COM 'NEED TO REDUCE BIG STONE GENERATION TO 250 MW NET'
COM '--'
COM CONTINGENCY '2635STK-0red'
COM TRIP LINE FROM BUS 63325 TO BUS 63327 CKT 1

COM TRIP LINE FROM BUS 63314 TO BUS 63325 CKT 1
COM TRIP LINE FROM BUS 63325 TO BUS 63125 CKT 1
COM TRIP LINE FROM BUS 63314 TO BUS 63195 CKT 1
COM TRIP LINE FROM BUS 63214 TO BUS 63195 CKT 1
COM TRIP LINE FROM BUS 63316 TO BUS 63195 CKT 1
COM END

COM 'This contingency is class C -jrn 11-18-08
COM 'CONTINGENCY C-BGSTN-HNKSN-2535STK'
COM '63325-63327 BROWNS VALLEY 230 - HANKINSON 230'
COM '63314-63325 BIG STONE 230 - BROWNS VALLEY 230'
COM '63325-63125 BROWNS VALLEY 230 - BROWNS VALLEY 41.6'
COM '63327-63303 HANKINSON 230 - HANKINSON 41.6'
COM 'NEED TO REDUCE BIG STONE GENERATION TO 250 MW NET'
COM '---'
COM CONTINGENCY '2535STK-0red'
COM TRIP LINE FROM BUS 63325 TO BUS 63327 CKT 1
COM TRIP LINE FROM BUS 63314 TO BUS 63325 CKT 1
COM TRIP LINE FROM BUS 63325 TO BUS 63125 CKT 1
COM TRIP LINE FROM BUS 63327 TO BUS 63303 CKT 1
COM END

Upgrade Cost vs. Transfer Graphs

(Separate PDF which contains 252 graphs)