



**Feasibility Study  
For  
Generation Interconnection  
Request  
GEN-2007-019**

SPP Tariff Studies  
(#GEN-2007-019)

January, 2008

## **Executive Summary**

<OMITTED TEXT> (Customer) has requested a Feasibility Study for the purpose of interconnecting 500 MW of wind generation within the control area of Southwestern Public Service Company (SPS) in Hamilton County, Kansas. The proposed method of interconnection is to build a new three breaker 345kV ring bus substation on the Lamar – Finney 345kV transmission line, owned by SPS. The proposed in-service date of this request is August 30, 2009

Power flow analysis has indicated that for the powerflow cases studied, it is possible to interconnect the 500 MW of generation with transmission system reinforcements within the local transmission systems. In order to maintain acceptable reactive power compensation, the Customer will need to install a combined 95 Mvar of 34.5 kV capacitor banks in the Customer's two collector substation on the 34.5 kV buses and 65 Mvar in the Customer's collector substation on the 115kV bus. Dynamic Stability studies performed as part of the impact study will provide additional guidance as to whether the required reactive compensation can be static or a portion must be dynamic (such as a SVC).

The requirement to interconnect the 500 MW of wind generation on the Lamar – Finney 345kV line consist of building a new three breaker 345kV ring bus substation on this line. The Customer did not propose a specific route for the 345 kV line extending to serve its 345/34.5 kV and 345/115 kV collection facilities. It is assumed that obtaining all necessary right-of-way for the new transmission line to serve its facilities will not be a significant expense.

The total minimum cost for building the required facilities for this 500 MW of generation is approximately \$6,200,000. These costs are shown in Table 2. This cost does not include building the 345 kV line from the Customer 345/34.5 kV and 345/115 kV collector substations into the point of interconnection. This cost does not include the Customer's 345/34.5 kV and 345/115 kV substations or the 95 Mvar of 34.5 kV and 65 Mvar of 115 kV capacitor banks.

The need for line reactors in the interconnection substation will be determined by a switching transient study. This study will be performed as part of the Impact Study. A sub synchronous resonance (SSR) study will also need to be performed for interconnection request.

Other Network Constraints in the Midwest Energy (MIDW), Missouri Public Service (MIPU), Sunflower Electric Power Corporation (SUNC), West Plains (WEPL), Westar Energy (WERE), Nebraska Public Power District (NPPD), Oklahoma Gas and Electric (OKGE) and SPS transmission systems that may be verified with a transmission service request and associated studies are listed in Table 3. These Network Constraints are in the local area of the new generation when this generation is sunk throughout the SPP footprint for the Energy Resource (ER) Interconnection request. With a defined source and sink in a Transmission Service Request (TSR), this list of Network Constraints will be refined and expanded to account for all Network Upgrade requirements.

In Table 4, a value of Available Transfer Capability (ATC) associated with each overloaded facility is included. These values may be used by the Customer for future analyses including the determination of lower generation capacity levels that may be installed. When transmission service associated with this

interconnection is evaluated, the loading of the facilities listed in this table may be greater due to higher priority reservations. If the loading of a facility is higher, the level of ATC will be lower.

There are several other proposed generation additions in the general area of the Customer's facility. It was assumed in this preliminary analysis that not all of these other projects within the Midwest Energy (MIDW), Missouri Public Service (MIPU), Sunflower Electric Power Corporation (SUNC), West Plains (WEPL), Westar Energy (WERE), Nebraska Public Power District (NPPD), Oklahoma Gas and Electric (OKGE) and SPS control areas will be in service. Those previously queued projects that have advanced to nearly complete phases were included in this Feasibility Study. In the event that another request for a generation interconnection with a higher priority withdraws, then this request may have to be re-evaluated to determine the local Network Constraints.

The required interconnection costs listed in Tables 1 and 2 and other upgrades associated with Network Constraints do not include all costs associated with the deliverability of the energy to final customers. These costs are determined by separate studies if the Customer submits a Transmission Service Request through Southwest Power Pool's OASIS.

## Contents

Introduction .....	5
Interconnection Facilities .....	5
Interconnection Estimated Costs .....	7
Powerflow Analysis .....	8
Powerflow Analysis Methodology .....	9
Powerflow Results.....	10
Conclusion .....	18
Appendix A: Point of Interconnection Area Map.....	19

## Tables

Table 1: Direct Assignment Facilities .....	7
Table 2: Required Interconnection Network Upgrade Facilities (Assuming prior queued project withdraws) .....	7
Table 3: Network Constraints.....	10
Table 4: Contingency Analysis .....	12

## Figures

Figure 1: Proposed Method of Interconnection .....	6
Figure 2: Point of Interconnection Area Map .....	19

## **Introduction**

<OMITTED TEXT> (Customer) has requested a Feasibility Study for the purpose of interconnecting 500 MW of wind generation within the control area of Southwestern Public Service Company (SPS) in Hamilton County, Kansas. The proposed point of interconnection is on the Lamar – Finney 345kV transmission line, owned by SPS. The proposed in-service date is August 30, 2009.

## **Interconnection Facilities**

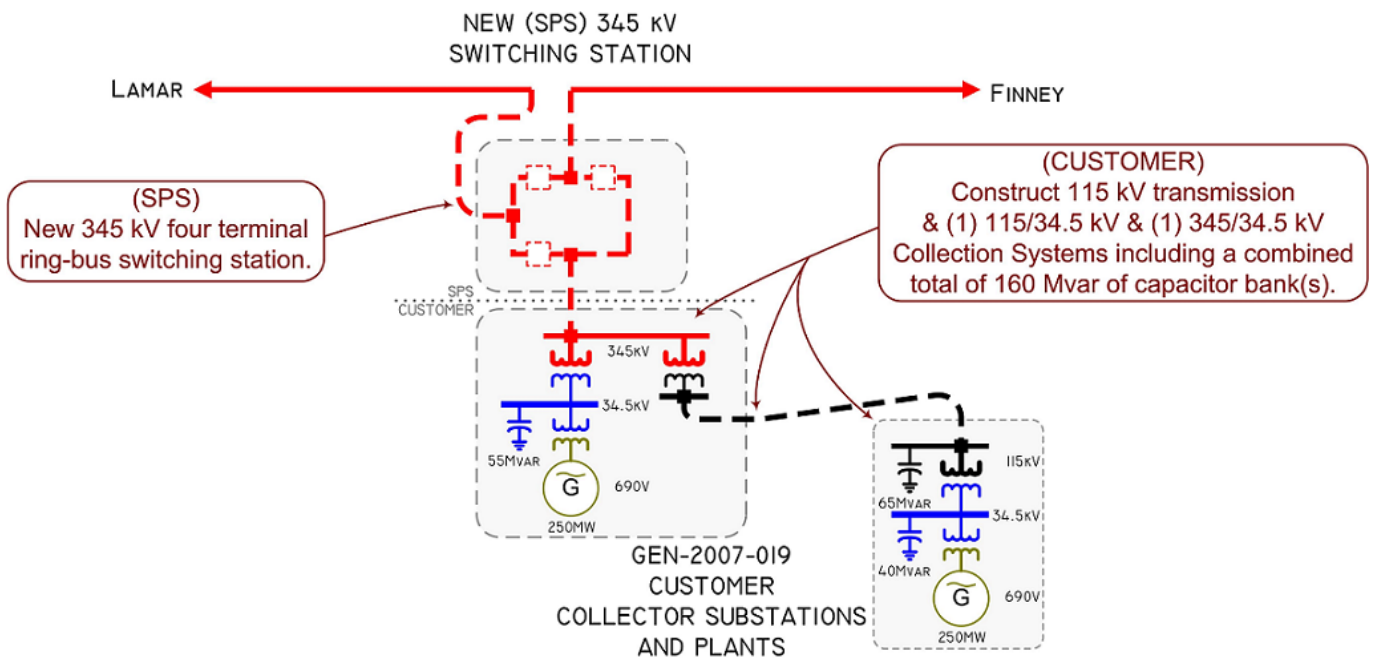
The primary objective of this study is to identify the system problems associated with connecting the plant into the area transmission system. The Feasibility and other subsequent Interconnection Studies are designed to identify attachment facilities, Network Upgrades and other direct assignment facilities needed to accept power into the grid at the interconnection receipt point.

The requirements to interconnect the 500 MW of wind generation on the Lamar – Finney 115 kV transmission line consists of constructing a new three breaker 345kV ring bus substation by SPS. The new station will be constructed and maintained by SPS. The Customer did not propose a specific route for the 345 kV line extending to serve its 345/34.5 kV and 345/115 kV collection facilities. It is assumed that obtaining all necessary right-of-way for the substation construction will not be a significant expense.

The interconnection facility may require the addition of line reactors. This will be determined through a switching transient study which will be conducted as part of the Impact Study.

Other Network Constraints in the Midwest Energy (MIDW), Missouri Public Service (MIPU), Sunflower Electric Power Corporation (SUNC), West Plains (WEPL), Westar Energy (WERE), Nebraska Public Power District (NPPD), Oklahoma Gas and Electric (OKGE) and SPS transmission systems that were identified are listed in Table 3. With a defined source and sink in a Transmission Service Request (TSR), this list of Network Constraints will be refined and expanded to account for all Network Upgrade requirements.

A preliminary one-line drawing of the interconnection and direct assigned facilities are shown in Figure 1.



**Figure 1: Proposed Method of Interconnection**

(Final design to be determined)

## Interconnection Estimated Costs

The total cost for building the required facilities for this 500 MW of generation is estimated at \$6,200,000. These estimates will be refined during the development of the impact study based on the final designs. This cost also does not include building the 345 kV line from the Customer 345/34.5 kV and 345/115 kV collector substations into the point of interconnection. This cost does not include the Customer's 345/34.5 kV and 345/115 kV substations or the 95 Mvar of 34.5 kV and 65 Mvar of 115 kV capacitor bank(s), all of which should be determined by the Customer. The Customer is responsible for these 345/34.5 kV and 345/115 kV facilities up to the point of interconnection.

The costs of interconnecting the facility to the SPS transmission system are listed in Table 1 & 2. **These costs do not include any cost that might be associated with short circuit study results or dynamic stability study results.** These costs will be determined when and if a System Impact Study is conducted.

**Table 1: Direct Assignment Facilities**

FACILITY	ESTIMATED COST (2007 DOLLARS)
Customer – 345/34.5 kV and 345/115 kV Substation facilities. Customer substation to include two (2) 345 circuit breakers for protection of each phase.	*
Customer – 345 & 115 kV transmission line facilities between Customer facilities and SPS 345 kV switching station.	*
Customer - Right-of-Way for Customer facilities.	*
Customer – 34.5 kV, 95 MVAR and 115 kV, 65 MVAR capacitor bank(s) in Customer substation.	*
<b>Total</b>	<b>*</b>

\* Estimates of cost to be determined.

**Table 2: Required Interconnection Network Upgrade Facilities**

FACILITY	ESTIMATED COST (2007 DOLLARS)
SPS – Build 345 kV three-breaker and line terminal to the new proposed switching station. Station to include switches, control relaying, high speed communications, all structures, and metering and other related equipment.	\$5,000,000
SPS – Add 345 kV line reactors per EMTP study.	\$1,200,000
<b>Total</b>	<b>\$6,200,000</b>

## Powerflow Analysis

A powerflow analysis was conducted for the facility using modified versions of the 2009 and 2012 summer and winter peak, and 2017 summer peak models. The output of the Customer's facility was offset in each model by a reduction in output of existing online SPP generation. This method allows the request to be studied as an Energy Resource (ER) Interconnection request. The proposed in-service date of the generation is August 30, 2009. The available seasonal models used were through the 2017 Summer Peak of which is the end of the current SPP planning horizon.

The analysis of the Customer's project indicates that, given the requested generation level of 500 MW and location, additional criteria violations will occur on the existing MIDW, MIPU, SUNC, WEPL, WERE, NPPD, OKGE and SPS transmission systems under steady state and contingency conditions in the peak seasons. Table 3 lists these overloaded facilities.

In Table 4, a value of Available Transfer Capability (ATC) associated with each overloaded facility is included. These values may be used by the Customer to determine lower generation capacity levels that may be installed. When transmission service associated with this interconnection is evaluated, the loading of the facilities listed in this table may be greater due to higher priority reservations. When a facility is overloaded for more than one contingency, only the highest loading on the facility for each season is included in the table.

In order to maintain a zero reactive power flow exchange at the point of interconnection, additional reactive compensation is required at the point of interconnection. The Customer will be required to install a combined 95 Mvar of capacitor banks in their substation on the 34.5 kV buses and 65 Mvar in the Customer's collector substation on the 115kV bus. These capacitors banks will need to be staged to avoid excessive switching transients. Dynamic Stability studies performed as part of the impact study will provide additional guidance as to whether the reactive compensation can be static or a portion must be dynamic (such as a SVC or STATCOM). It is possible that an SVC or STATCOM device will be required at the Customer facility because of FERC Order 661A Low Voltage Ride Through Provisions (LVRT) which went into effect January 1, 2006. FERC Order 661A orders that wind farms stay on line for 3 phase faults at the point of interconnection even if that requires the installation of a SVC or STATCOM device.

There are several other proposed generation additions in the general area of the Customer's facility. These local projects that were previously queued were assumed to be in service in this Feasibility Study. Those local projects that were previously queued and have advanced to nearly complete phases were included in this Feasibility Study.



## Powerflow Analysis Methodology

The Southwest Power Pool (SPP) criteria states that: “The transmission system of the SPP region shall be planned and constructed so that the contingencies as set forth in the Criteria will meet the applicable *NERC Planning Standards* for System Adequacy and Security – Transmission System Table I hereafter referred to as NERC Table I) and its applicable standards and measurements”.

Using the created models and the ACCC function of PSS/E, single contingencies in portions or all of the modeled control areas of Sunflower Electric Power Corporation (SUNC), Missouri Public Service (MIPU), Westar Energy (WERE), Kansas City Power & Light (KACP), West Plains (WEPL), Midwest Energy (MIDW), Oklahoma Gas and Electric (OKGE), American Electric Power West (AEPW), Grand River Dam Authority (GRDA), Southwestern Public Service Company (SPS), Western Farmers Electric Cooperative (WFEC) and other control areas were applied and the resulting scenarios analyzed. This satisfies the ‘more probable’ contingency testing criteria mandated by NERC and the SPP criteria.

## Powerflow Results

**Table 3: Network Constraints**

AREA	OVERLOADED ELEMENT
MIDW	ALEXANDER - NEKOMA 115KV CKT 1
MIDW	ALEXANDER - NESS CITY 115KV CKT 1
MIDW	BEACH STATION - REDLINE 115KC CKT 1
MIDW	COLBY - HOXIE 115KV CKT 1
MIDW	HOXIE - BEACH STATION 115KV CKT 1
MIDW	HUNTSVILLE - ST_JOHN 115KV CKT 1
MIDW	KNOLL - REDLINE 115KV CKT 1
MIDW/SUNC	COLBY - MINGO 115KV CKT 1
MIDW/SUNC	NESS CITY - NESS CITY 115KV CKT 1
MIDW/WERE	HUNTSVILLE - HUTCHINSON ENERGY CENTER 115KV CKT 1
MIPU	LAKE ROAD 161/34.5KV TRANSFORMER CKT 1
MIPU	LAKE ROAD 161/34.5KV TRANSFORMER CKT 2
NPPD	C.CREEK4 230.00 - N.PLATT4 230.00 230KV CKT 1
NPPD	CAMBRIG7 115.00 - MCCOOK 7 115.00 115KV CKT 1
NPPD	GENTLMN3 345.00 - SWEET W3 345.00 345KV CKT 1
NPPD	GR ISLD3 345.00 - SWEET W3 345.00 345KV CKT 1
NPPD	MAXWELS7 115.00 - N.PLATT7 115.00 115KV CKT 1
NPPD	MCCOOK 7 115.00 - REDWILO7 115.00 115KV CKT 1
NPPD	MCCOOK 7 115.00 - REDWILO7 115.00 115KV CKT 2
NPPD	REDWILO3 345.00 (R.WIL T1) 345/115/13.8KV TRANSFORMER CKT 1
OKGE	5 TRIBES - HANCOCK 161KV CKT 1
OKGE	MUSKOGEE - PECAN CREEK 345KV CKT 1
SPS	HARRINGTON STATION - NICHOLS STATION 230KV CKT 1
SPS	HARRNG_MID6 230.00 - NICHOLS STATION 230KV CKT 2
SPS	POTTER COUNTY INTERCHANGE (POTTR CO) 345/230/13.2KV TRANSFORMER CKT 1
SPS	TERRY COUNTY INTERCHANGE - LYNTGAR REC-BROWNFIELD 69KV CKT 1
SUNC	2001-39M 115.00 - CITIES SERVICE TAP 115KV CKT 1
SUNC	BEELER - DIGHTON TAP 115KV CKT 1
SUNC	BEELER - NESS CITY 115KV CKT 1
SUNC	CITIES SERVICE TAP - SETAB 115KV CKT 1
SUNC	DIGHTON TAP - MANNING TAP 115KV CKT 1
SUNC	DOBSON - PILE 115KV CKT 1
SUNC	HASKELL - CTU SUBLETTE 115KV CKT 1
SUNC	HASKELL - SEWARD-3 115KV CKT 1
SUNC	KANARADO - NATIONAL SUNFLOWER INDUSTRY TAP 115KV CKT 1
SUNC	KANARADO - SHARON SPRINGS 115KV CKT 1
SUNC	MANNING TAP - SCOTT CITY 115KV CKT 1
SUNC	NATIONAL SUNFLOWER INDUSTRY TAP - RULETON 115KV CKT 1
SUNC	NORTH CIMARRON - SEWARD-3 115KV CKT 1
SUNC	PALMER3 - TRIBUNE SWITCH 115KV CKT 1
SUNC	PILE - SCOTT CITY 115KV CKT 1
SUNC	PIONEER TAP - CTU SUBLETTE 115KV CKT1
SUNC	PIONEER TAP - PLYMELL 115KV CKT 1
SUNC	PLYMELL - HOLCOMB 115KV CKT 1
SUNC	SETAB (SETAB) 345/115/13.8KV TRANSFORMER CKT 1
SUNC	SHARON SPRINGS - PALMER3 115kv ckt 1
SUNC/NPPD	MINGO - REDWILO3 345.00 345KV CKT 1
WEPL	CIMARRON RIVER PLANT - NORTH LIBERAL TAP 115KV CKT 1
WEPL	CIMARRON RIVER TAP - CIMARRON RIVER PLANT 115KV CKT 1
WEPL	CIMARRON RIVER TAP - CUDAHY 115KV CKT 1
WEPL	CIMARRON RIVER TAP - EAST LIBERAL 115KV CKT 1
WEPL	CUDAHY - JUDSON LARGE 115KV CKT 1
WEPL	GREAT BEND TAP - MULLERGREN 115KV CKT 1
WEPL	GREAT BEND TAP - SEWARD 115KV CKT 1
WEPL	GREENSBURG - JUDSON LARGE 115KV CKT 1
WEPL	GREENSBURG - SUN CITY 115KV CKT 1

AREA	OVERLOADED ELEMENT
WEPL	HARPER – MEDICINE LODGE 138KC CKT 1
WEPL	HARPER – MEDICINE LODGE TAP 138KV CKT 1
WEPL	HARPER - MILAN TAP 138KV CKT 1
WEPL	MEDICINE LODGE - SUN CITY 115KV CKT 1
WEPL	MEDICINE LODGE (MED-LDG4) 138/115/2.72KV TRANSFORMER CKT 1
WEPL	MULLERGREN - SPEARVILLE 230KV CKT 1
WEPL	SEWARD - ST JOHN 115KV CKT 1
WEPL/MIDW	MULLERGREN - S HAYS6 230KV CKT 1
WEPL/MIDW	ST JOHN - ST_JOHN 115KV CKT 1
WEPL/SUNC	CIMARRON RIVER PLANT - NORTH CIMARRON 115KV CKT 1
WEPL/SUNC	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
WEPL/WERE	MULLERGREN - CIRCLE 230KV CKT 1
WERE	CIRCLE - RENO COUNTY 115KV CKT 1
WERE	DAVIS - RENO COUNTY 115KV CKT 1
WERE	EXIDE JUNCTION - NORTH AMERICAN PHILIPS 115KV CKT 1
WERE	EXIDE JUNCTION - SUMMIT 115KV CKT 1
WERE/WEPL	CLEARWATER - MILAN TAP 138KV CKT 1
SUNC	Sunflower Electric Power Corporation
MIDW	Midwest Energy
WERE	Westar Energy
MIPU	Missouri Public Service
NPPD	Nebraska Public Power District
OKGE	Oklahoma Gas and Electric
SPS	Southwestern Public Service Company
WEPL	West Plains

Table 4: Contingency Analysis

SEASON	OVERLOADED ELEMENT	RATING (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
09SP	MEDICINE LODGE - SUN CITY 115KV CKT 1	80	304	0	MULLERGREN - SPEARVILLE 230KV CKT 1
09SP	DIGHTON TAP - MANNING TAP 115KV CKT 1	98	242	0	MULLERGREN - SPEARVILLE 230KV CKT 1
09SP	BEELER - DIGHTON TAP 115KV CKT 1	98	234	0	MULLERGREN - SPEARVILLE 230KV CKT 1
09SP	MULLERGREN - SPEARVILLE 230KV CKT 1	355	232	0	MINGO - SETAB 345KV CKT 1
09SP	BEELER - NESS CITY 115KV CKT 1	98	231	0	MULLERGREN - SPEARVILLE 230KV CKT 1
09SP	COLBY - HOXIE 115KV CKT 1	101	217	0	MULLERGREN - SPEARVILLE 230KV CKT 1
09SP	CIMARRON RIVER TAP - CIMARRON RIVER PLANT 115KV CKT 1	90	211	0	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
09SP	MULLERGREN - S HAYS6 230KV CKT 1	147	210	0	CIRCLE - MULLERGREN 230KV CKT 1
09SP	GREENSBURG - JUDSON LARGE 115KV CKT 1	130	200	0	MULLERGREN - SPEARVILLE 230KV CKT 1
09SP	ALEXANDER - NESS CITY 115KV CKT 1	101	197	0	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
09SP	NESS CITY - NESS CITY 115KV CKT 1	143	195	0	MULLERGREN - SPEARVILLE 230KV CKT 1
09SP	ALEXANDER - NEKOMA 115KV CKT 1	101	191	0	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
09SP	GREENSBURG - SUN CITY 115KV CKT 1	130	191	0	MULLERGREN - SPEARVILLE 230KV CKT 1
09SP	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	188	0	GEN539670 4
09SP	CIMARRON RIVER PLANT - NORTH CIMARRON 115KV CKT 1	143	186	0	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
09SP	SEWARD - ST JOHN 115KV CKT 1	80	184	0	CIRCLE - MULLERGREN 230KV CKT 1
09SP	MEDICINE LODGE (MED-LDG4) 138/115/2.72KV TRANSFORMER CKT 1	65	178	0	MINGO - SETAB 345KV CKT 1
09SP	CITIES SERVICE TAP - SETAB 115KV CKT 1	143	169	0	MULLERGREN - SPEARVILLE 230KV CKT 1
09SP	MANNING TAP - SCOTT CITY 115KV CKT 1	143	169	0	MULLERGREN - SPEARVILLE 230KV CKT 1
09SP	PLYMELL - HOLCOMB 115KV CKT 1	143	167	0	HOLCOMB - SPEARVILLE 345KV CKT 1
09SP	PIONEER TAP - PLYMELL 115KV CKT 1	143	163	0	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
09SP	HARPER - MEDICINE LODGE 138KV CKT 1	72	161	0	MINGO - SETAB 345KV CKT 1
09SP	PALMER3 - TRIBUNE SWITCH 115KV CKT 1	98	157	0	MINGO - SETAB 345KV CKT 1
09SP	HOXIE - BEACH STATION 115KV CKT 1	101	156	0	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
09SP	SHARON SPRINGS - PALMER3 115KV CKT 1	98	154	0	MINGO - SETAB 345KV CKT 1
09SP	ST JOHN - ST JOHN 115KV CKT 1	88	153	0	CIRCLE - MULLERGREN 230KV CKT 1
09SP	POTTER COUNTY INTERCHANGE (POTTR CO) 345/230/13.2KV TRANSFORMER CKT 1	560	150	0	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
09SP	KANARADO - SHARON SPRINGS 115KV CKT 1	98	149	0	MINGO - SETAB 345KV CKT 1
09SP	KANARADO - NATIONAL SUNFLOWER INDUSTRY TAP 115KV CKT 1	98	146	0	MINGO - SETAB 345KV CKT 1
09SP	GREAT BEND TAP - SEWARD 115KV CKT 1	90	146	0	CIRCLE - MULLERGREN 230KV CKT 1
09SP	HARRINGTON STATION - NICHOLS STATION 230KV CKT 1	635	134	0	HARRNG_MID6 230.00 - NICHOLS STATION 230KV CKT 2
09SP	HARRNG_MID6 230.00 - NICHOLS STATION 230KV CKT 2	635	134	0	HARRINGTON STATION - NICHOLS STATION 230KV CKT 1
09SP	EXIDE JUNCTION - SUMMIT 115KV CKT 1	196	111	0	NORTHVIEW - SUMMIT 115KV CKT 1
09SP	PIONEER TAP - CTU SUBLETTE 115KV CKT1	143	142	1	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
09SP	NATIONAL SUNFLOWER INDUSTRY TAP - RULETON 115KV CKT 1	98	144	19	MINGO - SETAB 345KV CKT 1
09SP	CIRCLE - RENO COUNTY 115KV CKT 1	92	128	59	MINGO - REDWILO3 345KV CKT 1
09SP	HASKELL - CTU SUBLETTE 115KV CKT 1	143	136	63	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
09SP	HASKELL - SEWARD-3 115KV CKT 1	143	135	76	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
09SP	EXIDE JUNCTION - NORTH AMERICAN PHILIPS 115KV CKT 1	196	106	131	NORTHVIEW - SUMMIT 115KV CKT 1
09SP	NORTH CIMARRON - SEWARD-3 115KV CKT 1	143	129	147	HOLCOMB - SPEARVILLE 345KV CKT 1
09SP	CIMARRON RIVER TAP - CUDAHY 115KV CKT 1	130	130	155	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
09SP	CUDAHY - JUDSON LARGE 115KV CKT 1	130	125	217	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1

**TABLE 4: Contingency Analysis (continued)**

SEASON	OVERLOADED ELEMENT	RATING (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
09SP	MCCOOK 7 115.00 - REDWILO7 115.00 115KV CKT 1	105	110	230	MCCOOK 7 115.00 - REDWILO7 115.00 115KV CKT 2
09SP	MULLERGREN - CIRCLE 230KV CKT 1	319	122	263	MULLERGREN - S HAYS6 230.00 230KV CKT 1
09SP	MCCOOK 7 115.00 - REDWILO7 115.00 115KV CKT 2	105	108	286	MCCOOK 7 115.00 - REDWILO7 115.00 115KV CKT 1
09SP	GREAT BEND TAP - MULLERGREN 115KV CKT 1	120	109	308	CIRCLE - MULLERGREN 230KV CKT 1
09SP	HARPER - MILAN TAP 138KV CKT 1	96	119	313	HOLCOMB - SETAB 345KV CKT 1
09SP	BEACH STATION - REDLINE 115KV CKT 1	101	115	316	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
09SP	KNOLL - REDLINE 115KV CKT 1	101	115	328	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
09SP	C.CREEK4 230.00 - N.PLATT4 230.00 230KV CKT 1	402	103	378	AXTELL 3 345.00 - SWEET W3 345.00 345KV CKT 1
09SP	COLBY - MINGO 115KV CKT 1	143	104	400	GEN530555 1
09SP	DOBSON - PILE 115KV CKT 1	198	110	414	HOLCOMB - SETAB 345KV CKT 1
09SP	CIMARRON RIVER TAP - EAST LIBERAL 115KV CKT 1	120	104	419	CIMARRON RIVER PLANT - NORTH LIBERAL TAP 115KV CKT 1
09SP	PILE - SCOTT CITY 115KV CKT 1	198	108	429	HOLCOMB - SETAB 345KV CKT 1
09SP	HUNTSVILLE - ST_JOHN 115KV CKT 1	88	107	434	CIRCLE - MULLERGREN 230KV CKT 1
09SP	HUNTSVILLE - HUTCHINSON ENERGY CENTER 115KV CKT 1	92	101	492	CIRCLE - MULLERGREN 230KV CKT 1
09WP	MEDICINE LODGE - SUN CITY 115KV CKT 1	80	265	0	MULLERGREN - SPEARVILLE 230KV CKT 1
09WP	DIGHTON TAP - MANNING TAP 115KV CKT 1	98	210	0	MULLERGREN - SPEARVILLE 230KV CKT 1
09WP	BEELER - DIGHTON TAP 115KV CKT 1	98	204	0	MULLERGREN - SPEARVILLE 230KV CKT 1
09WP	BEELER - NESS CITY 115KV CKT 1	98	202	0	MULLERGREN - SPEARVILLE 230KV CKT 1
09WP	CIRCLE - RENO COUNTY 115KV CKT 2	92	194	0	CIRCLE - RENO COUNTY 115KV CKT 1
09WP	ALEXANDER - NESS CITY 115KV CKT 1	101	191	0	HOLCOMB - SPEARVILLE 345KV CKT 1
09WP	COLBY - HOXIE 115KV CKT 1	101	187	0	MULLERGREN - SPEARVILLE 230KV CKT 1
09WP	CIMARRON RIVER PLANT - NORTH CIMARRON 115KV CKT 1	143	186	0	HOLCOMB - SPEARVILLE 345KV CKT 1
09WP	ALEXANDER - NEKOMA 115KV CKT 1	101	186	0	HOLCOMB - SPEARVILLE 345KV CKT 1
09WP	SEWARD - ST JOHN 115KV CKT 1	80	174	0	CIRCLE - MULLERGREN 230KV CKT 1
09WP	NESS CITY - NESS CITY 115KV CKT 1	143	171	0	MULLERGREN - SPEARVILLE 230KV CKT 1
09WP	PLYMELL - HOLCOMB 115KV CKT 1	143	157	0	HOLCOMB - SPEARVILLE 345KV CKT 1
09WP	MEDICINE LODGE (MED-LDG4) 138/115/2.72KV TRANSFORMER CKT 1	65	155	0	MINGO - SETAB 345KV CKT 1
09WP	PIONEER TAP - PLYMELL 115KV CKT 1	143	154	0	HOLCOMB - SPEARVILLE 345KV CKT 1
09WP	HOXIE - BEACH STATION 115KV CKT 1	101	147	0	HOLCOMB - SPEARVILLE 345KV CKT 1
09WP	MANNING TAP - SCOTT CITY 115KV CKT 1	143	146	0	MULLERGREN - SPEARVILLE 230KV CKT 1
09WP	PIONEER TAP - CTU SUBLETTE 115KV CKT1	143	137	0	HOLCOMB - SPEARVILLE 345KV CKT 1
09WP	HASKELL - CTU SUBLETTE 115KV CKT 1	143	133	0	HOLCOMB - SPEARVILLE 345KV CKT 1
09WP	HASKELL - SEWARD-3 115KV CKT 1	143	132	0	HOLCOMB - SPEARVILLE 345KV CKT 1
09WP	POTTER COUNTY INTERCHANGE (POTTR CO) 345/230/13.2KV TRANSFORMER CKT 1	560	129	0	MINGO - SETAB 345KV CKT 1
09WP	HARRINGTON STATION - NICHOLS STATION 230KV CKT 1	706	117	0	HARRNG_MID6 230.00 - NICHOLS STATION 230KV CKT 2
09WP	HARRNG_MID6 230.00 - NICHOLS STATION 230KV CKT 2	706	117	0	HARRINGTON STATION - NICHOLS STATION 230KV CKT 1
09WP	PALMER3 - TRIBUNE SWITCH 115KV CKT 1	98	146	9	MINGO - SETAB 345KV CKT 1
09WP	SHARON SPRINGS - PALMER3 115KV CKT 1	98	144	30	MINGO - SETAB 345KV CKT 1
09WP	NORTH CIMARRON - SEWARD-3 115KV CKT 1	143	127	56	HOLCOMB - SPEARVILLE 345KV CKT 1
09WP	ST JOHN - ST_JOHN 115KV CKT 1	88	140	57	CIRCLE - MULLERGREN 230KV CKT 1
09WP	KANARADO - SHARON SPRINGS 115KV CKT 1	98	140	66	MINGO - SETAB 345KV CKT 1
09WP	KANARADO - NATIONAL SUNFLOWER INDUSTRY TAP 115KV CKT 1	98	138	82	MINGO - SETAB 345KV CKT 1
09WP	NATIONAL SUNFLOWER INDUSTRY TAP - RULETON 115KV CKT 1	98	136	99	MINGO - SETAB 345KV CKT 1

**TABLE 4: Contingency Analysis (continued)**

SEASON	OVERLOADED ELEMENT	RATING (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
09WP	CIMARRON RIVER TAP - CIMARRON RIVER PLANT 115KV CKT 1	118	133	113	HOLCOMB - SPEARVILLE 345KV CKT 1
09SP	GREENSBURG - JUDSON LARGE 115KV CKT 1	171	131	122	MULLERGREN - SPEARVILLE 230KV CKT 1
09WP	MCCOOK 7 115.00 - REDWILO7 115.00 115KV CKT 1	105	113	148	MCCOOK 7 115.00 - REDWILO7 115.00 115KV CKT 2
09WP	C.CREEK4 230.00 - N.PLATT4 230.00 230KV CKT 1	402	111	150	GENTLMN3 345.00 - SWEET W3 345.00 345KV CKT 2
09SP	HARPER - MEDICINE LODGE 138KC CKT 1	72	116	157	MULLERGREN - SPEARVILLE 230KV CKT 1
09SP	GREENSBURG - SUN CITY 115KV CKT 1	171	126	180	MULLERGREN - SPEARVILLE 230KV CKT 1
09WP	MCCOOK 7 115.00 - REDWILO7 115.00 115KV CKT 2	105	111	203	MCCOOK 7 115.00 - REDWILO7 115.00 115KV CKT 1
09WP	HARPER - MILAN TAP 138KV CKT 1	96	134	242	MINGO - SETAB 345KV CKT 1
09WP	MULLERGREN - S HAYS6 230KV CKT 1	147	114	298	GEN532653 1
09WP	MULLERGREN - SPEARVILLE 230KV CKT 1	453	113	320	BASE CASE
09WP	GENTLMN3 345.00 - SWEET W3 345.00 345KV CKT 1	1076	105	362	GENTLMN3 345.00 - SWEET W3 345.00 345KV CKT 2
09WP	BEACH STATION - REDLINE 115KC CKT 1	101	107	399	HOLCOMB - SPEARVILLE 345KV CKT 1
09WP	HUNTSVILLE - ST_JOHN 115KV CKT 1	88	107	422	CIRCLE - MULLERGREN 230KV CKT 1
09WP	KNOLL - REDLINE 115KV CKT 1	101	105	423	HOLCOMB - SPEARVILLE 345KV CKT 1
09WP	CLEARWATER - MILAN TAP 138KV CKT 1	110	106	449	MINGO - SETAB 345KV CKT 1
09WP	COLBY - MINGO 115KV CKT 1	143	101	453	MULLERGREN - SPEARVILLE 230KV CKT 1
09WP	MAXWELS7 115.00 - N.PLATT7 115.00 115KV CKT 1	201	101	457	C.CREEK4 230.00 - N.PLATT4 230.00 230KV CKT 1
09WP	GR ISLD3 345.00 - SWEET W3 345.00 345KV CKT 1	717	101	463	BASE CASE
12SP	MEDICINE LODGE - SUN CITY 115KV CKT 1	80	276	0	MULLERGREN - SPEARVILLE 230KV CKT 1
12SP	MULLERGREN - SPEARVILLE 230KV CKT 1	355	230	0	MINGO - SETAB 345KV CKT 1
12SP	DIGHTON TAP - MANNING TAP 115KV CKT 1	98	226	0	MULLERGREN - SPEARVILLE 230KV CKT 1
12SP	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	225	0	MINGO - SETAB 345KV CKT 1
12SP	BEELER - DIGHTON TAP 115KV CKT 1	98	219	0	MULLERGREN - SPEARVILLE 230KV CKT 1
12SP	BEELER - NESS CITY 115KV CKT 1	98	216	0	MULLERGREN - SPEARVILLE 230KV CKT 1
12SP	MULLERGREN - S HAYS6 230KV CKT 1	147	203	0	CIRCLE - MULLERGREN 230KV CKT 1
12SP	CIMARRON RIVER TAP - CIMARRON RIVER PLANT 115KV CKT 1	90	202	0	HOLCOMB - SPEARVILLE 115KV CKT 1
12SP	COLBY - HOXIE 115KV CKT 1	101	199	0	MULLERGREN - SPEARVILLE 230KV CKT 1
12SP	ALEXANDER - NESS CITY 115KV CKT 1	101	188	0	HOLCOMB - SPEARVILLE 115KV CKT 1
12SP	GREENSBURG - JUDSON LARGE 115KV CKT 1	130	183	0	MULLERGREN - SPEARVILLE 230KV CKT 1
12SP	CIMARRON RIVER PLANT - NORTH CIMARRON 115KV CKT 1	143	183	0	HOLCOMB - SPEARVILLE 115KV CKT 1
12SP	ALEXANDER - NEKOMA 115KV CKT 1	101	182	0	HOLCOMB - SPEARVILLE 115KV CKT 1
12SP	NESS CITY - NESS CITY 115KV CKT 1	143	180	0	MULLERGREN - SPEARVILLE 230KV CKT 1
12SP	GREENSBURG - SUN CITY 115KV CKT 1	130	174	0	MULLERGREN - SPEARVILLE 230KV CKT 1
12SP	MEDICINE LODGE (MED-LDG4) 138/115/2.72KV TRANSFORMER CKT 1	65	169	0	MINGO - SETAB 345KV CKT 1
12SP	PLYMELL - HOLCOMB 115KV CKT 1	143	167	0	HOLCOMB - SPEARVILLE 115KV CKT 1
12SP	SEWARD - ST JOHN 115KV CKT 1	80	165	0	CIRCLE - MULLERGREN 230KV CKT 1
12SP	PALMER3 - TRIBUNE SWITCH 115KV CKT 1	98	163	0	MINGO - SETAB 345KV CKT 1
12SP	PIONEER TAP - PLYMELL 115KV CKT 1	143	163	0	HOLCOMB - SPEARVILLE 115KV CKT 1
12SP	SHARON SPRINGS - PALMER3	98	160	0	MINGO - SETAB 345KV CKT 1
12SP	CITIES SERVICE TAP - SETAB 115KV CKT 1	143	158	0	MULLERGREN - SPEARVILLE 230KV CKT 1
12SP	MANNING TAP - SCOTT CITY 115KV CKT 1	143	158	0	MULLERGREN - SPEARVILLE 230KV CKT 1
12SP	KANARADO - SHARON SPRINGS 115KV CKT 1	98	154	0	MINGO - SETAB 345KV CKT 1
12SP	HARPER - MEDICINE LODGE 138KC CKT 1	72	153	0	MINGO - SETAB 345KV CKT 1
12SP	KANARADO - NATIONAL SUNFLOWER INDUSTRY TAP 115KV CKT 1	98	151	0	MINGO - SETAB 345KV CKT 1

**TABLE 4: Contingency Analysis (continued)**

SEASON	OVERLOADED ELEMENT	RATING (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
12SP	NATIONAL SUNFLOWER INDUSTRY TAP - RULETON 115KV CKT 1	98	149	0	MINGO - SETAB 345KV CKT 1
12SP	HOXIE - BEACH STATION 115KV CKT 1	101	148	0	HOLCOMB - SPEARVILLE 115KV CKT 1
12SP	POTTER COUNTY INTERCHANGE (POTTR CO) 345/230/13.2KV TRANSFORMER CKT 1	560	147	0	HOLCOMB - SPEARVILLE 115KV CKT 1
12SP	PIONEER TAP - CTU SUBLETTE 115KV CKT1	143	141	0	HOLCOMB - SPEARVILLE 115KV CKT 1
12SP	HARRINGTON STATION - NICHOLS STATION 230KV CKT 1	635	137	0	HARRNG_MID6 230.00 - NICHOLS STATION 230KV CKT 2
12SP	HARRNG_MID6 230.00 - NICHOLS STATION 230KV CKT 2	635	137	0	HARRINGTON STATION - NICHOLS STATION 230KV CKT 1
12SP	ST JOHN - ST_JOHN 115KV CKT 1	88	136	0	CIRCLE - MULLERGREN 230KV CKT 1
12SP	GREAT BEND TAP - SEWARD 115KV CKT 1	90	133	0	CIRCLE - MULLERGREN 230KV CKT 1
12SP	MCCOOK 7 115.00 - REDWILO7 115.00 115KV CKT 1	105	116	33	MCCOOK 7 115.00 - REDWILO7 115.00 115KV CKT 2
12SP	HASKELL - CTU SUBLETTE 115KV CKT 1	143	135	49	HOLCOMB - SPEARVILLE 115KV CKT 1
12SP	DAVIS - RENO COUNTY 115KV CKT 1	194	108	55	CIRCLE - HUTCHINSON ENERGY CENTER 115KV CKT 1
12SP	HASKELL - SEWARD-3 115KV CKT 1	143	134	65	HOLCOMB - SPEARVILLE 115KV CKT 1
12SP	NORTH CIMARRON - SEWARD-3 115KV CKT 1	143	127	143	HOLCOMB - SPEARVILLE 115KV CKT 1
12SP	CIMARRON RIVER TAP - CUDAHY 115KV CKT 1	130	122	237	HOLCOMB - SPEARVILLE 115KV CKT 1
12SP	C.CREEK4 230.00 - N.PLATT4 230.00 230KV CKT 1	402	107	254	GENTLMN3 345.00 - SWEET W3 345.00 345KV CKT 1
12SP	CUDAHY - JUDSON LARGE 115KV CKT 1	130	117	300	HOLCOMB - SPEARVILLE 115KV CKT 1
12SP	CIMARRON RIVER PLANT - NORTH LIBERAL TAP 115KV CKT 1	115	108	324	CIMARRON RIVER TAP - EAST LIBERAL 115KV CKT 1
12SP	MULLERGREN - CIRCLE 230KV CKT 1	319	112	359	MULLERGREN - S HAYS6 230.00 230KV CKT 1
12SP	DOBSON - PILE 115KV CKT 1	198	114	373	HOLCOMB - SETAB 345KV CKT 1
12SP	PILE - SCOTT CITY 115KV CKT 1	198	112	389	HOLCOMB - SETAB 345KV CKT 1
12SP	BEACH STATION - REDLINE 115KC CKT 1	101	106	416	HOLCOMB - SPEARVILLE 115KV CKT 1
12SP	KNOLL - REDLINE 115KV CKT 1	101	106	429	HOLCOMB - SPEARVILLE 115KV CKT 1
12SP	HARPER - MILAN TAP 138KV CKT 1	96	107	433	HOLCOMB - SETAB 345KV CKT 1
12SP	CIMARRON RIVER TAP - EAST LIBERAL 115KV CKT 1	120	102	456	CIMARRON RIVER PLANT - NORTH LIBERAL TAP 115KV CKT 1
12SP	COLBY - MINGO 115KV CKT 1	143	101	456	MULLERGREN - SPEARVILLE 230KV CKT 1
12SP	CAMBRIG7 115.00 - MCCOOK 7 115.00 115KV CKT 1	133	100	494	C.CREEK4 230.00 - N.PLATT4 230.00 230KV CKT 1
12WP	MEDICINE LODGE - SUN CITY 115KV CKT 1	80	252	0	MULLERGREN - SPEARVILLE 230KV CKT 1
12WP	DIGHTON TAP - MANNING TAP 115KV CKT 1	98	205	0	MULLERGREN - SPEARVILLE 230KV CKT 1
12WP	BEELER - DIGHTON TAP 115KV CKT 1	98	199	0	MULLERGREN - SPEARVILLE 230KV CKT 1
12WP	BEELER - NESS CITY 115KV CKT 1	98	196	0	MULLERGREN - SPEARVILLE 230KV CKT 1
12WP	MULLERGREN - S HAYS6 230KV CKT 1	147	187	0	CIRCLE - MULLERGREN 230KV CKT 1
12WP	ALEXANDER - NESS CITY 115KV CKT 1	101	184	0	HOLCOMB - SPEARVILLE 115KV CKT 1
12WP	COLBY - HOXIE 115KV CKT 1	101	182	0	MULLERGREN - SPEARVILLE 230KV CKT 1
12WP	CIMARRON RIVER PLANT - NORTH CIMARRON 115KV CKT 1	143	180	0	HOLCOMB - SPEARVILLE 115KV CKT 1
12WP	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	179	0	MINGO - SETAB 345KV CKT 1
12WP	ALEXANDER - NEKOMA 115KV CKT 1	101	179	0	HOLCOMB - SPEARVILLE 115KV CKT 1
12WP	NESS CITY - NESS CITY 115KV CKT 1	143	165	0	MULLERGREN - SPEARVILLE 230KV CKT 1
12WP	MEDICINE LODGE (MED-LDG4) 138/115/2.72KV TRANSFORMER CKT 1	65	160	0	CIRCLE - MULLERGREN 230KV CKT 1
12WP	SEWARD - ST JOHN 115KV CKT 1	80	157	0	CIRCLE - MULLERGREN 230KV CKT 1
12WP	PLYMELL - HOLCOMB 115KV CKT 1	143	154	0	HOLCOMB - SPEARVILLE 115KV CKT 1
12WP	PIONEER TAP - CTU SUBLETTE 115KV CKT1	143	151	0	HOLCOMB - SPEARVILLE 115KV CKT 1
12WP	PIONEER TAP - PLYMELL 115KV CKT 1	143	151	0	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
12WP	SHARON SPRINGS - PALMER3 115KV CKT 1	98	145	0	MINGO - SETAB 345KV CKT 1



**TABLE 4: Contingency Analysis (continued)**

SEASON	OVERLOADED ELEMENT	RATING (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
12WP	MANNING TAP - SCOTT CITY 115KV CKT 1	143	143	0	MULLERGREN - SPEARVILLE 230KV CKT 1
12WP	HOXIE - BEACH STATION 115KV CKT 1	101	141	0	HOLCOMB - SPEARVILLE 115KV CKT 1
12WP	KANARADO - SHARON SPRINGS 115KV CKT 1	98	140	0	MINGO - SETAB 345KV CKT 1
12WP	KANARADO - NATIONAL SUNFLOWER INDUSTRY TAP 115KV CKT 1	98	139	0	MINGO - SETAB 345KV CKT 1
12WP	NATIONAL SUNFLOWER INDUSTRY TAP - RULETON 115KV CKT 1	98	137	0	MINGO - SETAB 345KV CKT 1
12WP	HARRINGTON STATION - NICHOLS STATION 230KV CKT 1	706	118	0	HARRNG_MID6 230.00 - NICHOLS STATION 230KV CKT 2
12WP	MCCOOK 7 115.00 - REDWILO7 115.00 115KV CKT 1	105	118	0	MCCOOK 7 115.00 - REDWILO7 115.00 115KV CKT 2
12WP	HARRNG_MID6 230.00 - NICHOLS STATION 230KV CKT 2	706	118	0	HARRINGTON STATION - NICHOLS STATION 230KV CKT 1
12WP	HASKELL - CTU SUBLETTE 115KV CKT 1	143	129	15	HOLCOMB - SPEARVILLE 115KV CKT 1
12WP	HASKELL - SEWARD-3 115KV CKT 1	143	128	30	HOLCOMB - SPEARVILLE 115KV CKT 1
12WP	HARPER - MEDICINE LODGE 138KV CKT 1	72	172	50	MINGO - SETAB 345KV CKT 1
12WP	HARPER - MEDICINE LODGE TAP 138KV CKT 1	72	145	59	CIRCLE - MULLERGREN 230KV CKT 1
12WP	MULLERGREN - SPEARVILLE 230KV CKT 1	471	160	79	MINGO - SETAB 345KV CKT 1
12WP	NORTH CIMARRON - SEWARD-3 115KV CKT 1	143	123	105	HOLCOMB - SPEARVILLE 115KV CKT 1
12WP	POTTER COUNTY INTERCHANGE (POTTR CO) 345/230/13.2KV TRANSFORMER CKT 1	560	124	125	HOLCOMB - SPEARVILLE 115KV CKT 1
12WP	ST JOHN - ST_JOHN 115KV CKT 1	88	128	171	CIRCLE - MULLERGREN 230KV CKT 1
12WP	CIMARRON RIVER TAP - CIMARRON RIVER PLANT 115KV CKT 1	118	127	172	HOLCOMB - SPEARVILLE 115KV CKT 1
12WP	GREENSBURG - JUDSON LARGE 115KV CKT 1	171	125	177	MULLERGREN - SPEARVILLE 230KV CKT 1
12WP	GREENSBURG - SUN CITY 115KV CKT 1	171	120	241	MULLERGREN - SPEARVILLE 230KV CKT 1
12WP	HARPER - MILAN TAP 138KV CKT 1	96	119	347	MINGO - SETAB 345KV CKT 1
12WP	BEACH STATION - REDLINE 115KC CKT 1	101	101	481	HOLCOMB - SPEARVILLE 115KV CKT 1
17SP	MEDICINE LODGE - SUN CITY 115KV CKT 1	80	235	0	MULLERGREN - SPEARVILLE 230KV CKT 1
17SP	MULLERGREN - SPEARVILLE 230KV CKT 1	355	235	0	MINGO - SETAB 345KV CKT 1
17SP	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	230	0	MINGO - SETAB 345KV CKT 1
17SP	DIGHTON TAP - MANNING TAP 115KV CKT 1	98	204	0	MULLERGREN - SPEARVILLE 230KV CKT 1
17SP	CIMARRON RIVER TAP - CIMARRON RIVER PLANT 115KV CKT 1	90	198	0	HOLCOMB - SPEARVILLE 345KV CKT 1
17SP	BEELER - DIGHTON TAP 115KV CKT 1	98	197	0	MULLERGREN - SPEARVILLE 230KV CKT 1
17SP	BEELER - NESS CITY 115KV CKT 1	98	193	0	MULLERGREN - SPEARVILLE 230KV CKT 1
17SP	ALEXANDER - NESS CITY 115KV CKT 1	101	184	0	HOLCOMB - SPEARVILLE 345KV CKT 1
17SP	PALMER3 - TRIBUNE SWITCH 115KV CKT 1	98	184	0	MINGO - SETAB 345KV CKT 1
17SP	PLYMELL - HOLCOMB 115KV CKT 1	143	182	0	HOLCOMB - SPEARVILLE 345KV CKT 1
17SP	SHARON SPRINGS - PALMER3 115KV CKT 1	98	181	0	MINGO - SETAB 345KV CKT 1
17SP	ALEXANDER - NEKOMA 115KV CKT 1	101	178	0	HOLCOMB - SPEARVILLE 345KV CKT 1
17SP	CIMARRON RIVER PLANT - NORTH CIMARRON 115KV CKT 1	143	178	0	HOLCOMB - SPEARVILLE 345KV CKT 1
17SP	PIONEER TAP - PLYMELL 115KV CKT 1	143	177	0	HOLCOMB - SPEARVILLE 345KV CKT 1
17SP	MULLERGREN - S HAYS6 230KV CKT 1	147	174	0	CIRCLE - MULLERGREN 230KV CKT 1
17SP	KANARADO - SHARON SPRINGS 115KV CKT 1	98	174	0	MINGO - SETAB 345KV CKT 1
17SP	KANARADO - NATIONAL SUNFLOWER INDUSTRY TAP 115KV CKT 1	98	171	0	MINGO - SETAB 345KV CKT 1
17SP	NATIONAL SUNFLOWER INDUSTRY TAP - RULETON 115KV CKT 1	98	168	0	MINGO - SETAB 345KV CKT 1
17SP	COLBY - HOXIE 115KV CKT 1	101	167	0	MULLERGREN - SPEARVILLE 230KV CKT 1
17SP	GREENSBURG - JUDSON LARGE 115KV CKT 1	130	158	0	MULLERGREN - SPEARVILLE 230KV CKT 1
17SP	NESS CITY - NESS CITY 115KV CKT 1	143	156	0	MULLERGREN - SPEARVILLE 230KV CKT 1
17SP	2001-39M 115.00 - CITIES SERVICE TAP 115KV CKT 1	143	153	0	HOLCOMB - SETAB 345KV CKT 1



**TABLE 4: Contingency Analysis (continued)**

SEASON	OVERLOADED ELEMENT	RATING (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
17SP	GREENSBURG - SUN CITY 115KV CKT 1	130	149	0	MULLERGREN - SPEARVILLE 230KV CKT 1
17SP	CITIES SERVICE TAP - SETAB 115KV CKT 1	143	149	0	HOLCOMB - SETAB 345KV CKT 1
17SP	POTTER COUNTY INTERCHANGE (POTTR CO) 345/230/13.2KV TRANSFORMER CKT 1	560	147	0	HOLCOMB - SPEARVILLE 345KV CKT 1
17SP	MANNING TAP - SCOTT CITY 115KV CKT 1	143	143	0	MULLERGREN - SPEARVILLE 230KV CKT 1
17SP	ST JOHN - ST JOHN 115KV CKT 1	88	129	0	CIRCLE - HUTCHINSON ENERGY CENTER 115KV CKT 1
17SP	HARRINGTON STATION - NICHOLS STATION 230KV CKT 1	635	117	0	HARRNG_MID6 230.00 - NICHOLS STATION 230KV CKT 2
17SP	HARRNG_MID6 230.00 - NICHOLS STATION 230KV CKT 2	635	117	0	HARRINGTON STATION - NICHOLS STATION 230KV CKT 1
17SP	TERRY COUNTY INTERCHANGE - LYNTEGAR REC-BROWNFIELD 69KV CKT 1	54	100	0	MULLERGREN - SPEARVILLE 230KV CKT 1
17SP	PIONEER TAP - CTU SUBLETTE 115KV CKT 1	143	148	20	HOLCOMB - SPEARVILLE 345KV CKT 1
17SP	MEDICINE LODGE (MED-LDG4) 138/115/2.72KV TRANSFORMER CKT 1	65	160	46	MINGO - SETAB 345KV CKT 1
17SP	SEWARD - ST JOHN 115KV CKT 1	80	230	47	MINGO - SETAB 345KV CKT 1
17SP	HOXIE - BEACH STATION 115KV CKT 1	101	140	71	HOLCOMB - SPEARVILLE 345KV CKT 1
17SP	HASKELL - CTU SUBLETTE 115KV CKT 1	143	139	81	HOLCOMB - SPEARVILLE 345KV CKT 1
17SP	HASKELL - SEWARD-3 115KV CKT 1	143	137	97	HOLCOMB - SPEARVILLE 345KV CKT 1
17SP	MCCOOK 7 115.00 - REDWILO7 115.00 115KV CKT 1	105	112	113	MCCOOK 7 115.00 - REDWILO7 115.00 115KV CKT 2
17SP	HARPER - MEDICINE LODGE 138KC CKT 1	72	145	124	MINGO - SETAB 345KV CKT 1
17SP	GREAT BEND TAP - SEWARD 115KV CKT 1	90	116	140	GREENSBURG - JUDSON LARGE 115KV CKT 1
17SP	NORTH CIMARRON - SEWARD-3 115KV CKT 1	143	126	181	HOLCOMB - SPEARVILLE 345KV CKT 1
17SP	DOBSON - PILE 115KV CKT 1	198	131	188	HOLCOMB - SETAB 345KV CKT 1
17SP	PILE - SCOTT CITY 115KV CKT 1	198	130	207	HOLCOMB - SETAB 345KV CKT 1
17SP	MUSKOGEE - PECAN CREEK 345KV CKT 1	478	103	231	CLARKSVILLE - MUSKOGEE 345KV CKT 1
17SP	SETAB (SETAB) 345/115/13.8KV TRANSFORMER CKT 1	280	113	275	HOLCOMB - SETAB 345KV CKT 1
17SP	CIMARRON RIVER TAP - CUDAHY 115KV CKT 1	130	115	337	HOLCOMB - SPEARVILLE 345KV CKT 1
17SP	5 TRIBES - HANCOCK 161KV CKT 1	223	103	365	AGENCY - PECAN CREEK 161KV CKT 1
17SP	CUDAHY - JUDSON LARGE 115KV CKT 1	130	113	371	HOLCOMB - SPEARVILLE 345KV CKT 1
17SP	CIMARRON RIVER PLANT - NORTH LIBERAL TAP 115KV CKT 1	115	105	375	CIMARRON RIVER TAP - EAST LIBERAL 115KV CKT 1
17SP	REDWILO3 345.00 (R.WIL T1) 345/115/13.8KV TRANSFORMER CKT 1	336	106	406	GENTLMN3 345.00 - REDWILO3 345.00 345KV CKT 1
17SP	LAKE ROAD 161/34.5KV TRANSFORMER CKT 1	83	103	422	LAKE ROAD 161/34.5KV TRANSFORMER CKT 2
17SP	LAKE ROAD 161/34.5KV TRANSFORMER CKT 2	83	103	438	LAKE ROAD 161/34.5KV TRANSFORMER CKT 1
17SP	BEACH STATION - REDLINE 115KV CKT 1	101	103	470	HOLCOMB - SPEARVILLE 345KV CKT 1
17SP	KNOLL - REDLINE 115KV CKT 1	101	103	471	HOLCOMB - SPEARVILLE 345KV CKT 1
17SP	MINGO - REDWILO3 345.00 345KV CKT 1	789	101	486	HOLCOMB - SPEARVILLE 345KV CKT 1
17SP	HARPER - MILAN TAP 138KV CKT 1	96	100	497	MINGO - SETAB 345KV CKT 1

*Note: When transmission service associated with this interconnection is evaluated, the loading of the facilities listed in this Table may be greater due to higher priority reservations. If the loading of a facility is higher, the level of ATC will be lower.*

## **Conclusion**

The minimum cost of interconnecting the Customer's interconnection request is estimated at \$6,200,000 for SPS's interconnection Network Upgrade facilities listed in Table 2. At this time, the cost estimates for other Direct Assignment facilities including those in Table 1 have not been defined by the Customer. In addition to the Customer's proposed interconnection facilities, the Customer will be responsible for installing a combined 95 Mvar of 34.5 kV and 65 Mvar of 115 kV capacitors in the Customer substation for reactive support. Dynamic Stability studies performed as part of the impact study will provide additional guidance as to whether the reactive compensation can be static or a portion must be dynamic (such as a SVC or STATCOM). These costs exclude upgrades of other transmission facilities by MIDW, MIPU, SUNC, WEPL, WERE, NPPD, OKGE and SPS listed in Table 3 of which are Network Constraints. As stated earlier, the local projects that were previously queued are assumed to be in service in this Feasibility Study.

In Table 4, a value of Available Transfer Capability (ATC) associated with each overloaded facility is included. These values may be used by the Customer to determine lower generation capacity levels that may be installed. When transmission service associated with this interconnection is evaluated, the loading of the facilities listed in this table may be greater due to higher priority reservations. When a facility is overloaded for more than one contingency, only the highest loading on the facility for each season is included in the table.

These interconnection costs do not include any cost that may be associated with short circuit or transient stability analysis. These studies will be performed if the Customer signs a System Impact Study Agreement.

The required interconnection costs listed in Tables 1 and 2 and other upgrades associated with Network Constraints listed in Table 3 do not include all costs associated with the deliverability of the energy to final customers. These costs are determined by separate studies if the Customer requests transmission service through Southwest Power Pool's OASIS.

## Appendix A: Point of Interconnection Area Map

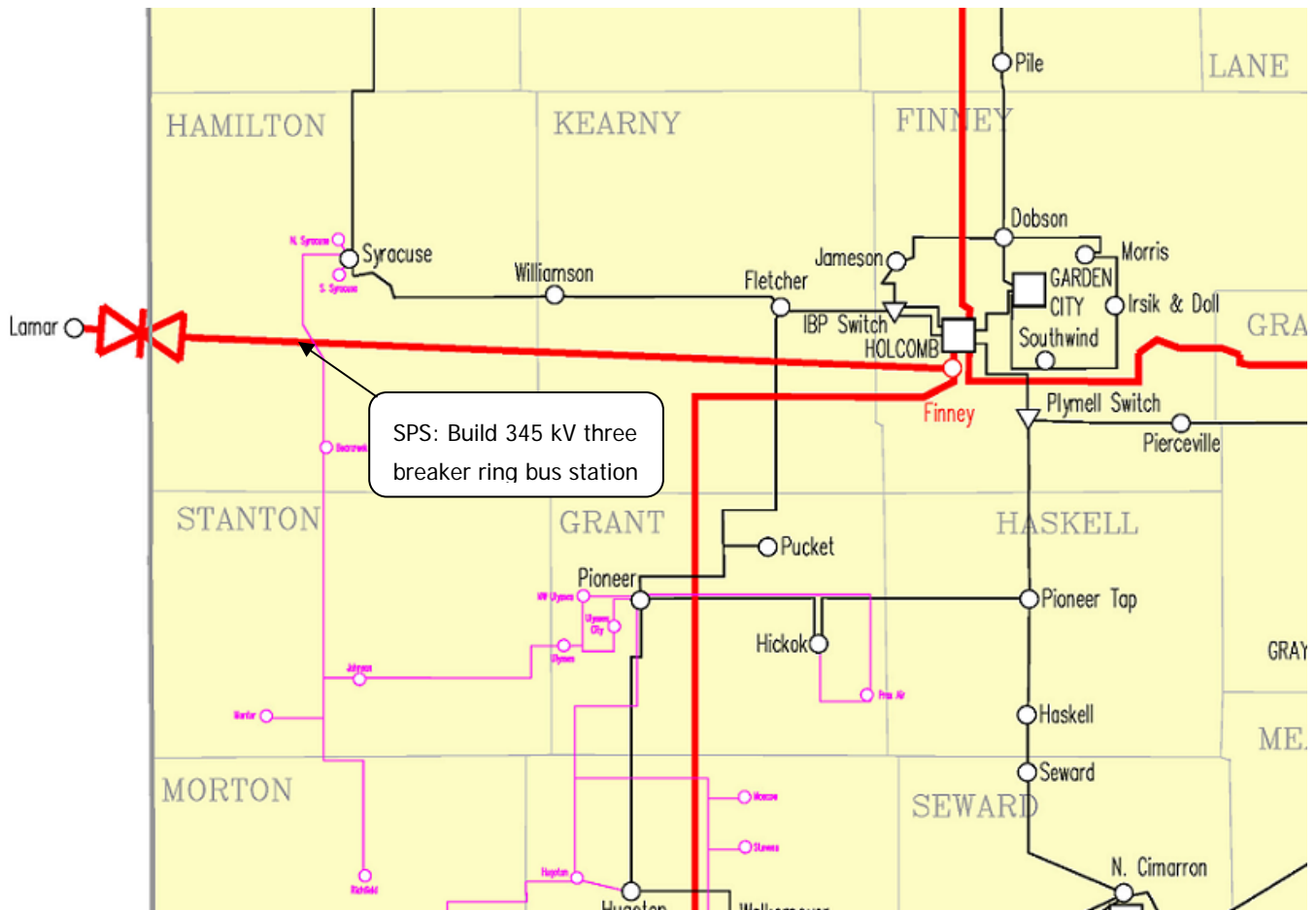


Figure 2: Point of Interconnection Area Map