



***Feasibility Study  
For  
Generation Interconnection  
Request  
GEN-2005-006***

***SPP Tariff Studies  
(#GEN-2005-006)***

**June 13, 2005**

## **Executive Summary**

<OMITTED TEXT> (Customer) has requested a Feasibility Study for the purpose of interconnecting 150MW of wind generation within the service territory of OG&E Electric Services (OKGE) in Ellis County Oklahoma. The proposed 138kV point of interconnection is at the existing Woodward 138-69kV Substation in Woodward County. This substation is owned by OKGE. The proposed in-service date is December 31, 2006.

Power flow analysis has indicated that for the powerflow cases studied, it is possible to interconnect the 150MW of generation with transmission system reinforcements within the local transmission system. Given the Point of Interconnection at an existing substation, there are additional requirements for interconnection including bus, breaker, switches, relaying, metering, etc.

The total cost for adding a new 138 terminal to the existing Woodward Substation, the required interconnection facility, is estimated at \$439,825. Other Network Constraints in the American Electric Power West (AEPW), OKGE and Western Farmers Electric Cooperative (WFEC) 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 Interconnection request. With a defined source and sink in a Transmission Service Request, this list of Network Constraints will be refined and expanded to account for all Network Resource Interconnection 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. When a facility is overloaded for more than 10 contingencies, then only the results with the 10 highest loadings may be included in this table.

There are several other proposed generation additions in the general area of the Customer's facility. It was assumed in this preliminary analysis that these other projects within the AEPW, OKGE and WFEC service territories 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.

## Introduction

<OMITTED TEXT> (Customer) has requested a Feasibility Study for the purpose of interconnecting 150MW of wind generation in Ellis County within the service territory of OKGE in Woodward County Oklahoma. The existing Woodward 138-69kV Substation is owned by OKGE, and the proposed generation interconnection is within OKGE. The proposed point of interconnection is at the existing Woodward Substation. The proposed in-service date is December 31, 2006.

## Interconnection Facilities

The primary objective of this study is to identify the system problems associated with connecting the plant to 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 for interconnection consist of adding a new 138kV terminal in the existing Woodward 138-69kV Substation. This 138kV addition shall be constructed and maintained by OKGE. The Customer did not propose a route of its 138kV line to serve its 138-34.5kV facilities. It is assumed that obtaining all necessary right-of-way for the new OKGE 138kV substation facilities will not be a significant expense.

The total cost for OKGE to add a new 138kV terminal in the Woodward substation, the interconnection facility, is estimated at \$439,825. Other Network Constraints in the AEPW, OKGE and WFEW systems that were identified are listed in Table 3. These estimates will be refined during the development of the impact study based on the final designs. This cost does not include building 138kV line from the Customer substation into the existing Woodward Substation. The Customer is responsible for this 138kV line up to the point of interconnection. This cost does not include the Customer's 138-34.5kV substation and the cost estimate should be determined by the Customer.

The costs of interconnecting the facility to the OKGE transmission system are listed in Table 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 (2005 DOLLARS)
Customer – 138-34.5 kV Substation facilities.	*
Customer – 138kV line between Customer substation and upgraded OKGE 138kV Woodward Substation.	*
Customer - Right-of-Way for Customer Substation & Line.	*
<b>Total</b>	*

Note: \*Estimates of cost to be determined by Customer.

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

Facility	ESTIMATED COST (2005 DOLLARS)
OKGE - Add a single 138kV terminal in the existing Woodward 138-69kV Substation.	\$439,825
OKGE - Right-of-Way for 138kV terminal addition	0
<b>Total</b>	<b>\$439,825</b>



**Table 4: Contingency Analysis Results**

Facility	Model & Contingency	Facility Loading (% Rate B) Or Voltage (PU)	ATC (MW)	Date Required (M/D/Y)
ALVA - KNOBHILL 69kV	15SP, 54788-55999, OKGE ENID - WFEC AEP-OP , GLASS MOUNTAIN - MOORELAND 138kV	108.4	68	6/1/2007
ALVA - KNOBHILL 69kV	15SP, 54778-54788, OKGE ENID , CLEO CORNER - GLASS MOUNTAIN 138kV	107.3	78	
ALVA - KNOBHILL 69kV	10SP, 54788-55999, OKGE ENID - WFEC AEP-OP , GLASS MOUNTAIN - MOORELAND 138kV	104.8	103	
ALVA - KNOBHILL 69kV	10SP, 54778-54788, OKGE ENID , CLEO CORNER - GLASS MOUNTAIN 138kV	103.7	114	
ALVA - KNOBHILL 69kV	07SP, 54788-55999, OKGE ENID - WFEC AEP-OP , GLASS MOUNTAIN - MOORELAND 138kV	102.0	130	
ALVA - KNOBHILL 69kV	07SP, 54778-54788, OKGE ENID , CLEO CORNER - GLASS MOUNTAIN 138kV	101.0	140	
BRANTLEY - MORWOOD 69kV	07SP, 54121-99940, AEPW WESTERN - , ELK CITY - 2002-05T 138kV	111.0	62	6/1/2007
BRANTLEY - MORWOOD 69kV	10SP, 54121-99940, AEPW WESTERN - , ELK CITY - 2002-05T 138kV	109.5	73	
BRANTLEY - MORWOOD 69kV	15SP, 54121-99940, AEPW WESTERN - , ELK CITY - 2002-05T 138kV	103.5	122	

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.

**Table 4: Contingency Analysis Results**

Facility	Model & Contingency	Facility Loading (% Rate B) Or Voltage (PU)	ATC (MW)	Date Required (M/D/Y)
CARTER JCT - ERICK 69kV	07SP, 54121-99940, AEPW WESTERN - , ELK CITY - 2002-05T 138kV	114.3	71	6/1/2007
CARTER JCT - ERICK 69kV	10SP, 54121-99940, AEPW WESTERN - , ELK CITY - 2002-05T 138kV	110.4	92	
CARTER JCT - ERICK 69kV	15SP, 54121-99940, AEPW WESTERN - , ELK CITY - 2002-05T 138kV	100.7	146	
CLEO CORNER - GLASS MOUNTAIN 138kV,	07SP, 54121-99940, AEPW WESTERN - , ELK CITY - 2002-05T 138kV	105.4	118	6/1/2007
CLEO CORNER - GLASS MOUNTAIN 138kV	10SP, 54121-99940, AEPW WESTERN - , ELK CITY - 2002-05T 138kV	104.5	123	
CLEO CORNER - GLASS MOUNTAIN 138kV	15SP, 54121-99940, AEPW WESTERN - , ELK CITY - 2002-05T 138kV	103.8	127	
DOVER SW - OKEENE 138kV	07SP, 54121-99940, AEPW WESTERN - , ELK CITY - 2002-05T 138kV	100.1	149	6/1/2007

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.

**Table 4: Contingency Analysis Results**

Facility	Model & Contingency	Facility Loading (% Rate B) Or Voltage (PU)	ATC (MW)	Date Required (M/D/Y)
ELK CITY - *2002-05T 138kV	07SP, 54787-54822, OKGE ENID - OKGE METRO , DEWEY - SOUTHARD 138kV	138.5	0	6/1/2007
ELK CITY - *2002-05T 138kV	10SP, 54787-54822, OKGE ENID - OKGE METRO , DEWEY - SOUTHARD 138kV	136.2	0	
ELK CITY - *2002-05T 138kV	07SP, 54788-55999, OKGE ENID - WFEC AEP-OP , GLASS MOUNTAIN - MOORELAND 138kV	135.1	0	
ELK CITY - *2002-05T 138kV	07SP, 54822-54823, OKGE METRO , SOUTHARD - ROMAN NOSE 138kV	135.1	0	
ELK CITY - *2002-05T 138kV	07SP, 54778-54789, OKGE ENID , CLEO CORNER - MEN TAP 138kV	134.7	0	
ELK CITY - *2002-05T 138kV	07SP, 54778-54788, OKGE ENID , CLEO CORNER - GLASS MOUNTAIN 138kV	134.6	0	
ELK CITY - *2002-05T 138kV	07SP, 54789-54790, OKGE ENID , MEN TAP - IMO TAP 138kV	133.9	0	
ELK CITY - *2002-05T 138kV	10SP, 54822-54823, OKGE METRO , SOUTHARD - ROMAN NOSE 138kV	132.6	0	
ELK CITY - *2002-05T 138kV	07SP, 54819-54823, OKGE METRO , EL RENO - ROMAN NOSE 138kV	132.4	0	
ELK CITY - *2002-05T 138kV	10SP, 54788-55999, OKGE ENID - WFEC AEP-OP , GLASS MOUNTAIN - MOORELAND 138kV	132.4	0	

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.



**Table 4: Contingency Analysis Results**

Facility	Model & Contingency	Facility Loading (% Rate B) Or Voltage (PU)	ATC (MW)	Date Required (M/D/Y)
FPL SWITCH - MOORELAND 138kV	06AP, 54785-54796, OKGE ENID , WOODWARD - IODINE 138kV	234.0	0	12/31/2006
FPL SWITCH - MOORELAND 138kV	06AP, 54787-54796, OKGE ENID , DEWEY - IODINE 138kV	232.0	0	
FPL SWITCH - MOORELAND 138kV	06AP, 54782-54785-55771, OKGE ENID , WOODWARD 138-69kV	215.2	0	
FPL SWITCH - MOORELAND 138kV	06AP, 55920-55957, WFEC AEP-OP , FT SUPPLY - IODINE 138kV	212.4	0	
FPL SWITCH - MOORELAND 138kV	06AP, 55957-55999, WFEC AEP-OP , IODINE - MOORELAND 138kV	211.7	0	
FPL SWITCH - MOORELAND 138kV	06AP, 54787-54822, OKGE ENID - OKGE METRO , DEWEY - SOUTHARD 138kV	210.0	0	
FPL SWITCH - MOORELAND 138kV	06AP, 54822-54823, OKGE METRO , SOUTHARD - ROMAN NOSE 138kV	208.2	0	
FPL SWITCH - MOORELAND 138kV	06AP, 54819-54823, OKGE METRO , EL RENO - ROMAN NOSE 138kV	207.2	0	
FPL SWITCH - MOORELAND 138kV	06WP, 55920-55957, WFEC AEP-OP , FT SUPPLY - IODINE 138kV	196.0	5	
FPL SWITCH - MOORELAND 138kV	06WP, 55957-55999, WFEC AEP-OP , IODINE - MOORELAND 138kV	195.1	6	

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.

**Table 4: Contingency Analysis Results**

Facility	Model & Contingency	Facility Loading (% Rate B) Or Voltage (PU)	ATC (MW)	Date Required (M/D/Y)
GLASS MOUNTAIN - MOORELAND 138kV	07SP, 54121-99940, AEPW WESTERN - , ELK CITY - 2002-05T 138kV	132.9	0	6/1/2007
GLASS MOUNTAIN - MOORELAND 138kV	10SP, 54121-99940, AEPW WESTERN - , ELK CITY - 2002-05T 138kV	131.9	0	
GLASS MOUNTAIN - MOORELAND 138kV	15SP, 54121-99940, AEPW WESTERN - , ELK CITY - 2002-05T 138kV	131.3	0	
GLASS MOUNTAIN - MOORELAND 138kV	15SP, 55848-55999, WFEC AEP-OP , CEDARDALE - MOORELAND 138kV	120.7	43	
GLASS MOUNTAIN - MOORELAND 138kV	15SP, 55848-56016, WFEC AEP-OP - WFEC AEP-IM , CEDARDALE - OKEENE 138kV	120.1	46	
GLASS MOUNTAIN - MOORELAND 138kV	10SP, 55848-55999, WFEC AEP-OP , CEDARDALE - MOORELAND 138kV	119.8	48	
GLASS MOUNTAIN - MOORELAND 138kV	07SP, 55848-55999, WFEC AEP-OP , CEDARDALE - MOORELAND 138kV	119.5	49	
GLASS MOUNTAIN - MOORELAND 138kV	10SP, 55848-56016, WFEC AEP-OP - WFEC AEP-IM , CEDARDALE - OKEENE 138kV	119.2	51	
GLASS MOUNTAIN - MOORELAND 138kV	07SP, 55848-56016, WFEC AEP-OP - WFEC AEP-IM , CEDARDALE - OKEENE 138kV	118.8	52	
GLASS MOUNTAIN - MOORELAND 138kV	10SP, 54787-54822, OKGE ENID - OKGE METRO , DEWEY - SOUTHARD 138kV	120.2	53	

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.

**Table 4: Contingency Analysis Results**

Facility	Model & Contingency	Facility Loading (% Rate B) Or Voltage (PU)	ATC (MW)	Date Required (M/D/Y)
HAMON BUTLER - MOREWOOD 69kV	07SP, 55999-56001, WFEC AEP-OP - WFEC AEP-CS , MOORELAND - MOREWOOD SW 138kV	105.5	133	6/1/2007

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.

**Table 4: Contingency Analysis Results**

Facility	Model & Contingency	Facility Loading (% Rate B) Or Voltage (PU)	ATC (MW)	Date Required (M/D/Y)
KNOBHILL - KNOBHIL4 138-( )kV	15SP, 54788-55999, OKGE ENID - WFEC AEP-OP , GLASS MOUNTAIN - MOORELAND 138kV	127.3	0	6/1/2007
KNOBHILL - KNOBHIL4 138-( )kV	15SP, 54778-54788, OKGE ENID , CLEO CORNER - GLASS MOUNTAIN 138kV	126.3	0	
KNOBHILL - KNOBHIL4 138-( )kV	10SP, 54788-55999, OKGE ENID - WFEC AEP-OP , GLASS MOUNTAIN - MOORELAND 138kV	125.0	0	
KNOBHILL - KNOBHIL4 138-( )kV	07SP, 54788-55999, OKGE ENID - WFEC AEP-OP , GLASS MOUNTAIN - MOORELAND 138kV	124.4	0	
KNOBHILL - KNOBHIL4 138-( )kV	10SP, 54778-54788, OKGE ENID , CLEO CORNER - GLASS MOUNTAIN 138kV	124.1	0	
KNOBHILL - KNOBHIL4 138-( )kV	07SP, 54778-54788, OKGE ENID , CLEO CORNER - GLASS MOUNTAIN 138kV	123.6	0	
KNOBHILL - KNOBHIL4 138-( )kV	15SP, 54121-99940, AEPW WESTERN - , ELK CITY - 2002-05T 138kV	116.3	28	
KNOBHILL - KNOBHIL4 138-( )kV	15SP, 55848-55999, WFEC AEP-OP , CEDARDALE - MOORELAND 138kV	114.7	33	
KNOBHILL - KNOBHIL4 138-( )kV	10SP, 54121-99940, AEPW WESTERN - , ELK CITY - 2002-05T 138kV	115.4	35	
KNOBHILL - KNOBHIL4 138-( )kV	07SP, 54121-99940, AEPW WESTERN - , ELK CITY - 2002-05T 138kV	114.2	36	

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.

**Table 4: Contingency Analysis Results**

Facility	Model & Contingency	Facility Loading (% Rate B) Or Voltage (PU)	ATC (MW)	Date Required (M/D/Y)
KNOBHILL - KNOBHIL4 69-( )kV	15SP, 54788-55999, OKGE ENID - WFEC AEP-OP , GLASS MOUNTAIN - MOORELAND 138kV	129.1	0	6/1/2007
KNOBHILL - KNOBHIL4 69-( )kV	15SP, 54778-54788, OKGE ENID , CLEO CORNER - GLASS MOUNTAIN 138kV	128.1	0	
KNOBHILL - KNOBHIL4 69-( )kV	10SP, 54788-55999, OKGE ENID - WFEC AEP-OP , GLASS MOUNTAIN - MOORELAND 138kV	126.9	0	
KNOBHILL - KNOBHIL4 69-( )kV	07SP, 54788-55999, OKGE ENID - WFEC AEP-OP , GLASS MOUNTAIN - MOORELAND 138kV	126.3	0	
KNOBHILL - KNOBHIL4 69-( )kV	10SP, 54778-54788, OKGE ENID , CLEO CORNER - GLASS MOUNTAIN 138kV	125.9	0	
KNOBHILL - KNOBHIL4 69-( )kV	07SP, 54778-54788, OKGE ENID , CLEO CORNER - GLASS MOUNTAIN 138kV	125.4	0	
KNOBHILL - KNOBHIL4 69-( )kV	15SP, 54121-99940, AEPW WESTERN - , ELK CITY - 2002-05T 138kV	117.9	23	
KNOBHILL - KNOBHIL4 69-( )kV	15SP, 55848-55999, WFEC AEP-OP , CEDARDALE - MOORELAND 138kV	115.8	28	
KNOBHILL - KNOBHIL4 69-( )kV	10SP, 54121-99940, AEPW WESTERN - , ELK CITY - 2002-05T 138kV	117.0	29	
KNOBHILL - KNOBHIL4 69-( )kV	07SP, 54121-99940, AEPW WESTERN - , ELK CITY - 2002-05T 138kV	115.3	30	

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.

**Table 4: Contingency Analysis Results**

Facility	Model & Contingency	Facility Loading (% Rate B) Or Voltage (PU)	ATC (MW)	Date Required (M/D/Y)
MOREWOOD - MOREWOOD SW 138-69kV	07SP, 54121-99940, AEPW WESTERN - , ELK CITY - 2002-05T 138kV	124.2	0	6/1/2007
MOREWOOD - MOREWOOD SW 138-69kV	10SP, 54121-99940, AEPW WESTERN - , ELK CITY - 2002-05T 138kV	123.6	0	
MOREWOOD - MOREWOOD SW 138-69kV	15SP, 54121-99940, AEPW WESTERN - , ELK CITY - 2002-05T 138kV	120.6	0	
MOREWOOD - MOREWOOD SW 138-69kV	10WP, 54121-99940, AEPW WESTERN - , ELK CITY - 2002-05T 138kV	109.6	33	
MOREWOOD - MOREWOOD SW 138-69kV	07WP, 54121-99940, AEPW WESTERN - , ELK CITY - 2002-05T 138kV	101.8	127	
WOODWARD 69kV	06AP, 55785-55999, OKGE ENID - WFEC AEP-OP , FPL SWITCH - MOORELAND 138kV	100.2	149	4/1/2007

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.

## **Powerflow Analysis**

A powerflow analysis was conducted for the facility using modified versions of models for the 2006 April, 2006 Winter Peak, Summer and Winter Peak for 2007 and 2010, and the 2015 Summer Peak seasons. This is the end of the current SPP planning horizon. The output of the Customer's facility was offset in each model by a reduction in output of existing online SPP generation. The proposed in-service date of the generator is December 31, 2006.

The analysis of the Customer's project indicates that, given the requested generation level of 150MW and location, additional criteria violations will occur on the existing AEPW, OKGE and WFEC facilities under steady state conditions in the modeled seasons.

There are several other proposed generation additions in the general area of the Customer's facility. 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 American Electric Power West, OG&E Electric Services, Western Farmers Electric Cooperative, and Southwestern Public Service Company were applied and the resulting scenarios analyzed. This satisfies the 'more probable' contingency testing criteria mandated by NERC and the SPP criteria.

## **Conclusion**

The minimum cost of interconnecting the Customer project is estimated at \$439,825 for OKGE's interconnection Network Upgrade facilities listed in Table 2 excluding upgrades of other transmission facilities by AEPW, OKGE and WFEC listed in Table 3 of which are Network Constraints. At this time, the cost estimates for other Direct Assignment facilities including those in Table 1 have not been defined by the Customer. As stated earlier, local projects that were previously queued are assumed to be in service in this Feasibility Study.

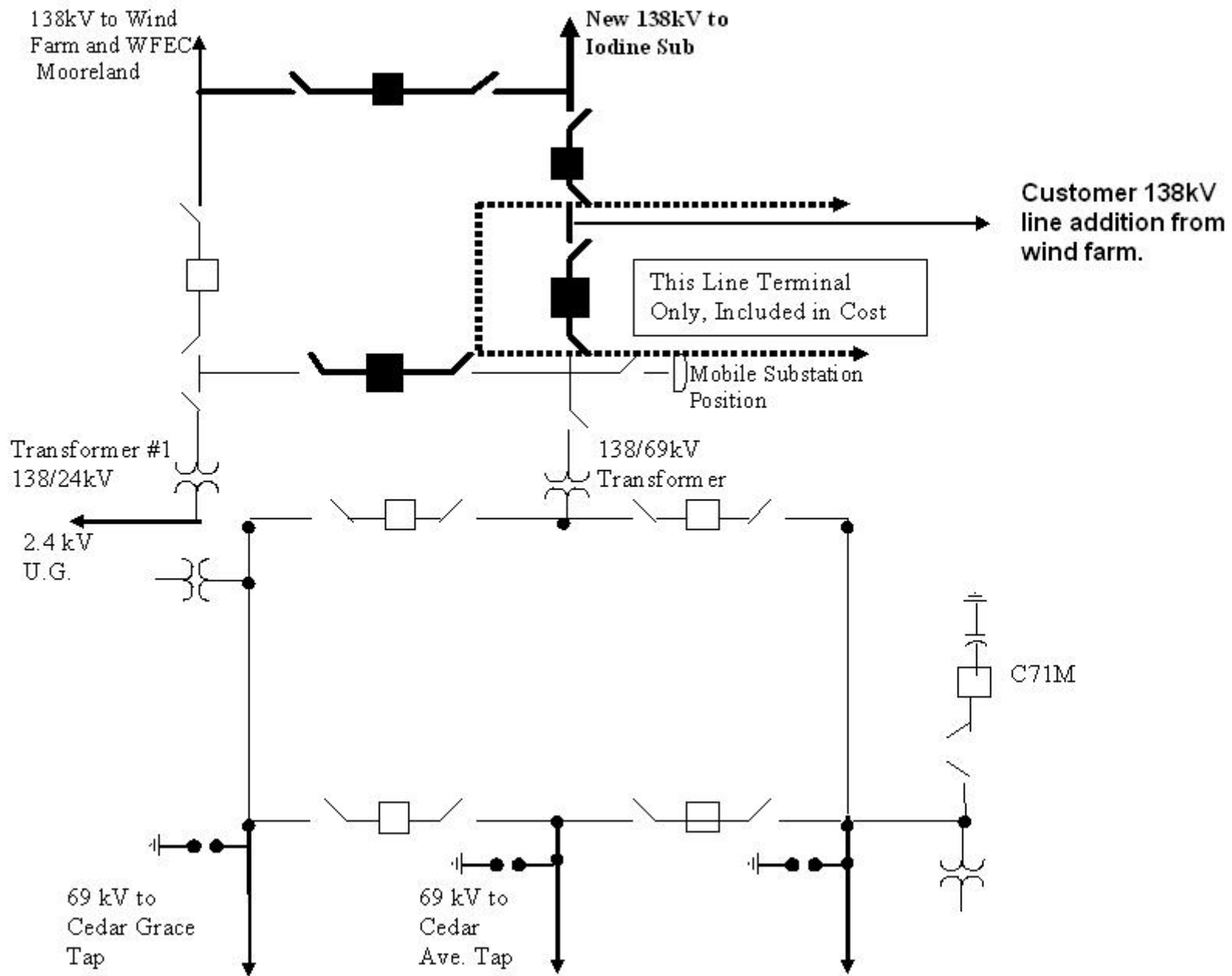
In Table 4, a value of Available Transfer Capability (ATC) associated with each overloaded facility is included. These values may be used by the Customer to determine lower generation capacity levels that may be installed. When transmission service associated with this interconnection is evaluated, the loading of the facilities

listed in this table may be greater due to higher priority reservations. When a facility is overloaded for more than 10 contingencies, then only the results with the 10 highest loadings may be included in this 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 Table 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.





**Figure 1: Proposed Interconnection (Final substation design to be determined) – Woodward District Substation**

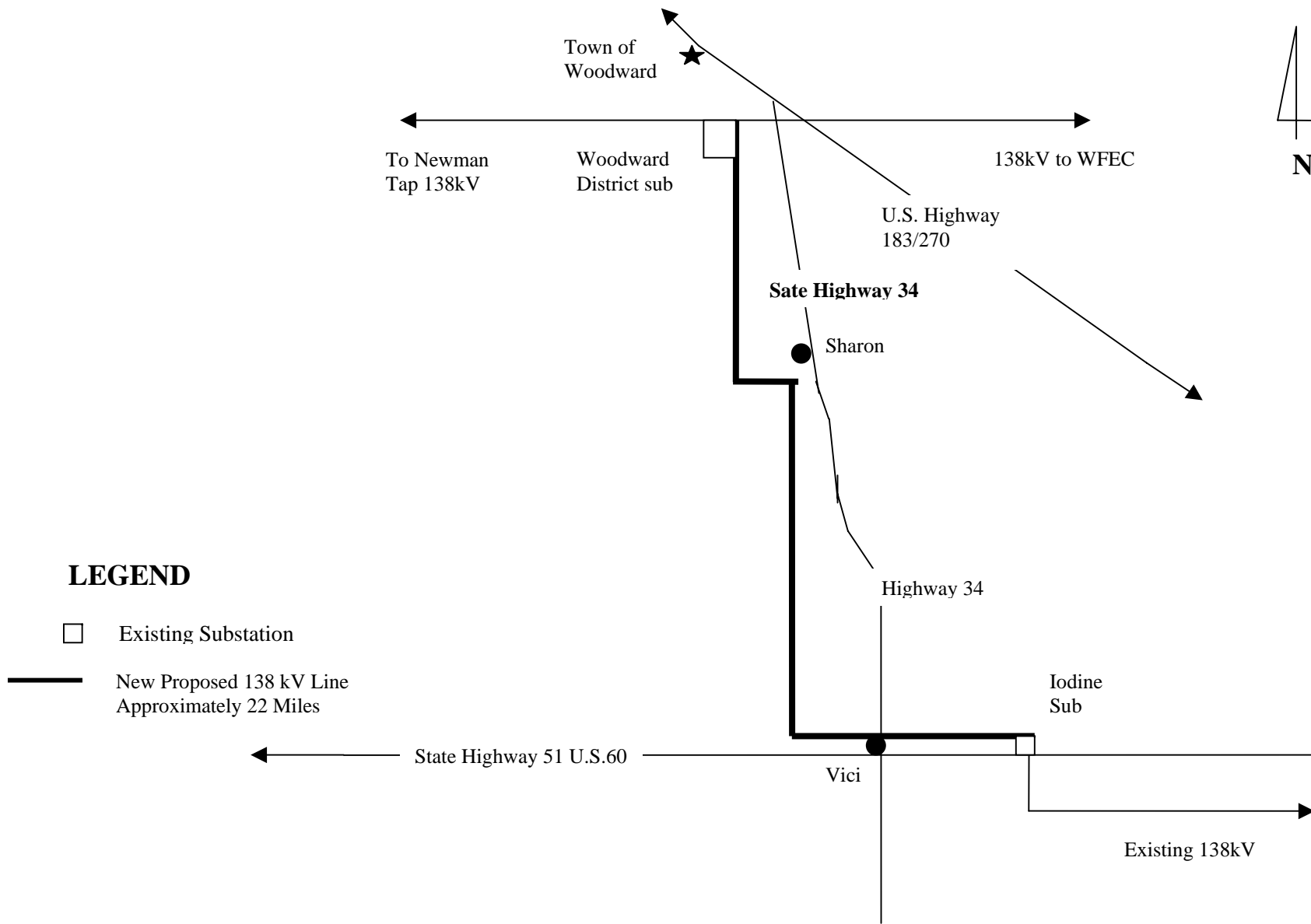


Figure 2: Map Of The Surrounding Area