



**SPP**

*Southwest  
Power Pool*

**Facility Study  
For  
Generator Interconnection  
Request  
GEN-2013-031**

*SPP Generator  
Interconnection Studies*

*(#GEN-2013-031)*

**June 2014**

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## Revision History

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Date	Author	Change Description
06/18/2014	SPP	Facility Study Report Issued

## **Summary**

Southwestern Public Service Company (SPS), an operating company subsidiary of Xcel Energy Inc., performed a detailed Facility Study at the request of Southwest Power Pool (SPP) for Generation Interconnection request GEN-2013-031 (332.0 MW Summer/370.0 MW Winter) located in Randall County, Texas. SPP has proposed the in-service date will be after the assigned Interconnection Facilities and Non-Shared Network Upgrades are completed. Full Interconnection Service will require the Network Upgrades listed in the “Other Network Upgrades” section. The request for interconnection was placed with SPP in accordance with SPP’s Open Access Transmission Tariff, which covers new generation interconnections on SPP’s transmission system.

## **Phases of Interconnection Service**

It is not expected that interconnection service will require phases however, interconnection service will not be available until all interconnection facilities and network upgrades can be placed in service.

## **Interconnection Customer Interconnection Facilities**

The Interconnection Customer will be responsible for all of the transmission facilities connecting the customer owned substation to the Point of Interconnection (POI), at SPS owned 230 kV bus at Bushland Substation. The Interconnection Customer will also be responsible for any equipment located at the Customer substation necessary to maintain a power factor of 0.95 lagging to 0.95 leading at the POI.

## **Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades**

To allow interconnection the Transmission Owner will rebuild the Bushland 230 kV substation to a breaker-and-a-half configuration to accept the Interconnection Customer’s Interconnection Facilities. A new 230 kV substation tentatively named “Tumbleweed 230 kV” will be constructed that will tap the SPS Potter County – Newhart 230 kV transmission line (Circuit K-41).

Approximately fifteen (15) miles of new 230 kV transmission line will be built to interconnect the Bushland 230 kV to the new Tumbleweed 230 kV substation. SPS has proposed a lead time of thirty (30) months for the completion of the Interconnection Facilities and all Non-Shared Network Upgrades, except the new 15 mile transmission line. The transmission line will require approximately forty-two (42) months to complete. At this time GEN-2013-031 is responsible for \$34,276,277 of Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades.

## **Shared Network Upgrades**

The Interconnection Customer was studied within the DISIS-2013-002 Impact Study. At this time, the Interconnection Customer is allocated \$0.00 for Shared Network Upgrades. If higher queued interconnection customers withdraw from the queue, suspend or terminate their GIA, restudies will have to be conducted to determine the Interconnection Customers’ allocation of Shared Network Upgrades. All studies have been conducted on the basis of higher queued interconnection requests and the upgrades associated with those higher queued interconnection requests being placed in service. At this time, the Interconnection Customer is allocated the following cost for Shared Network Upgrade:

- None at this time

### **Other Network Upgrades**

Certain Other Network Upgrades are currently not the cost responsibility of the Customer but will be required for full Interconnection Service. Currently, the following Other Network Upgrades are required:

- Newhart 230/115 kV Project
- Woodward – Border – TUCO 345 kV, Estimated In-Service Date of 9/2014
- TUCO 345/230 kV Transformer circuit #2, Estimated In-Service Date of 9/2014
- Buckner – Spearville terminal equipment replacement, Currently assigned to DISIS-2010-002 Customers
- Beaver County – Buckner 345 kV, Currently assigned to DISIS-2011-002 Customers

Depending upon the status of higher or equally queued customers, the Interconnection Customer's in-service date is at risk of being delayed or their Interconnection Service is at risk of being reduced until the in-service date of these Other Network Upgrades.

### **Conclusion**

Interconnection Service for GEN-2013-031 will be delayed until the Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades are constructed. The Interconnection Customer is responsible for \$0.00 of Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades. At this time, the Interconnection Customer is allocated \$0.00 for Shared Network Upgrades. After all Interconnection Facilities and Network Upgrades have been placed into service, Interconnection Service for 370.0 MW, as requested by GEN-2013-031, can be allowed. At this time the total allocation of costs assigned to GEN-2013-031 for Interconnection Service are estimated at \$34,276,277.



**Facilities Study For  
Southwest Power Pool (SPP)**  
370 MW Combustion Turbine Generators  
Randall County, Texas  
SPP #GEN-2013-031

June 2, 2014

Transmission Planning  
Southwestern Public Service

## Executive Summary

[Customer Name Omitted] ("Interconnection Customer") in 2013 requested the interconnection of a generation facility located in Randall County, Texas to the Southwestern Public Service Company (SPS), transmission network. SPS is a New Mexico Corporation and wholly owned subsidiary of Xcel Energy Inc. This facility has a capacity of 370 MW and will connect to the SPS Bushland Interchange also located in Randall County, Texas approximately six (6) miles west of Amarillo, Texas. The Interconnection Customer's expected commercial operation date is 6/1/2016.

The Southwest Power Pool (SPP) originally evaluated the request to interconnect the generator facility to the SPS transmission system in a Definitive Interconnection System Impact Study (DISIS)-2013-002 for GEN-2013-031, which was completed in January 2014. The interconnection request was studied using two Combustion Turbine Generators for a total output of 370 MW. The Interconnection Customer is required to maintain a Power Factor of 0.95 lagging and 0.95 leading at the Point of Interconnection (POI) on the 230 kV.

SPP requires that each generator shall implement Automatic Under Frequency Load Shedding (UFLS) according to the SPP UFLS Plan at the following link: [http://www.spp.org/publications/SPP%20UFLS%20Plan\\_Final.pdf](http://www.spp.org/publications/SPP%20UFLS%20Plan_Final.pdf). To fulfill this requirement, coordination with Xcel Energy is required during the under-frequency relay-setting phase for the generation. The Interconnection Customer is required to report their generation off-nominal frequency tripping relay settings to SPP and SPS. SPS specifies that generators shall not trip at frequencies above 58.5 Hz unless exceptions in the Transmission Provider Criteria are met. The Interconnection Customer agrees that the energy generating units installed at this interconnection will not be tripped for under-frequency conditions above 58.5 Hz in compliance with Transmission Provider criteria. This means that the generation subject to this Interconnection Agreement may not trip for under-frequency conditions on the transmission system until all under-frequency load shedding relays have operated. SPS will also require that the Interconnection Customer be in compliance with all applicable criteria, guidelines, standards, requirements, regulations, and procedures issued by the North American Electric Reliability Corporation (NERC), SPP, and the Federal Energy Regulatory Commission (FERC) or their successor organizations.

The Interconnection Customer is responsible for the cost of the Interconnection Facilities, and any Direct Assigned Interconnection Facilities; inclusive of all construction required for the 230 kV transmission line from the Interconnection Customer's substation to the SPS Bushland Interchange. The Interconnection Customer is also responsible for obtaining any permits and/or Certificate of Convenience and Necessity (CCN) for building their 230 kV transmission lines from the Public Utility Commission of Texas.

It is anticipated that the entire process of building a new 230 kV terminals at Bushland Interchange for the acceptance of the Generation facility output will require approximately 30 months to complete after an Interconnection Agreement (IA) is signed and an authorization to proceed is received. Also, to build 15 miles of 230 kV line from Bushland Interchange to Tumbleweed Interchange on Circuit K-41 will require approximately 42 months completing after an IA is signed.

The cost of these upgrades, inclusive of the Interconnection Customer's cost for the interconnection of these Combustion Turbine Generators, is shown below in Table 1, with the detailed description of the cost shown in Table 3.

**Table 1, Cost Summary, Bushland Interchange**

SPS Network Upgrades (Rebuilding Bushland Interchange):	<b>\$ 13,789,744</b>
Build 15 miles of 230 kV from Bushland to Tumbleweed Interchange:	<b>\$ 14,866,261</b>
Build new Tumbleweed Interchange on Circuit K-41:	<b>\$ 5,282,897</b>
Interconnection Facilities <sup>1</sup> :	<b>\$ 337,375</b>
Total:	<b>\$ 34,276,277</b>

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<sup>1</sup> This is a direct assigned cost to the Interconnection Customer.

## General Description of SPS Facilities<sup>2</sup>

1. **Construction of New Line Terminal:** See Appendix A, Figure A-1, for general vicinity location map
  - 1.1. **Location:** SPS will build new 230 kV terminals at Bushland Interchange. Appendix A, Figure A-2 shows the one-line diagram of the Interchange, while Appendix A, Figure 3 shows a typical elevation view of the Point of Interconnection (POI).
  - 1.2. **Bus Design:** The existing 230 kV at Bushland Interchange will be converted to a breaker and half configuration and is designed to accommodate the output from two Combustion Turbine Generators. This scheme is shown in the one-line diagram in Appendix A, Figure A-2
  - 1.3. **Line Terminals:** The 230 kV lines and static wire terminals will be designed to accommodate 18,000 pounds per phase conductor (36,000 per bundle) at maximum tension, with a maximum 15° pull-off angle from normal.
  - 1.4. **Control House:** A new control will need to be built to accommodate the new metering, protective relaying and control devices, terminal cabinets, and any fiber-optic cable terminations, etc. for the 230 kV line breaker terminals.
  - 1.5. **Security Fence:** The existing security fence has a 7-foot chain-link fence with steel posts set in concrete with 1-foot of barbed wire on the top in a “V” configuration. The enclosed area for the 230 kV yard is approximately 720’ by 730’ with a rock yard surface and will be expanded to 1340’ by 1340’.
  - 1.6. **Ground Grid:** The existing ground grid shall be extended to accommodate the additional bay required for the new line terminal per ANSI/IEEE STD 80-1986, with our standard 4/0 copper ground mesh on 40-foot centers with ground rods and 20-foot centers in corners and loop outside of fence.
  - 1.7. **Site Grading:** Company contractor, per company specifications, will perform any site grading and erosion control to accommodate the new line terminal. Soil compaction shall be not less than 95% of laboratory density as determined by ASTM-D-698.
  - 1.8. **Station Power:** The existing station power, provided from the local distribution system, will be utilized.
  - 1.9. **Relay and Protection Scheme:** The new 230 kV breaker line terminals for Bushland Interchange will have primary protection to the interconnection customer’s 230 kV transmission line with fiber will use a SEL 411L. Secondary relaying will use a SEL 311C-1 high impedance relay. No automatic re-closing scheme will be used. The SEL 411L and 311C-1 will be used for line/bus SCADA closing conditions for the 230 kV breakers. A SEL 351S will be used for breaker failure. Other relay modifications at Potter Interchange and Deaf Smith may also be required. With the addition of Tumbleweed Interchange other relay modifications at Potter County and Newhart Interchange may be required.

An SEL 421 will display the bus voltage, GCB amps, MW, MVar, and fault location. An SEL 2032 will be installed for relay communications and other functions as required.

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<sup>2</sup> All modifications to SPS facilities will be owned, maintained and operated by SPS.

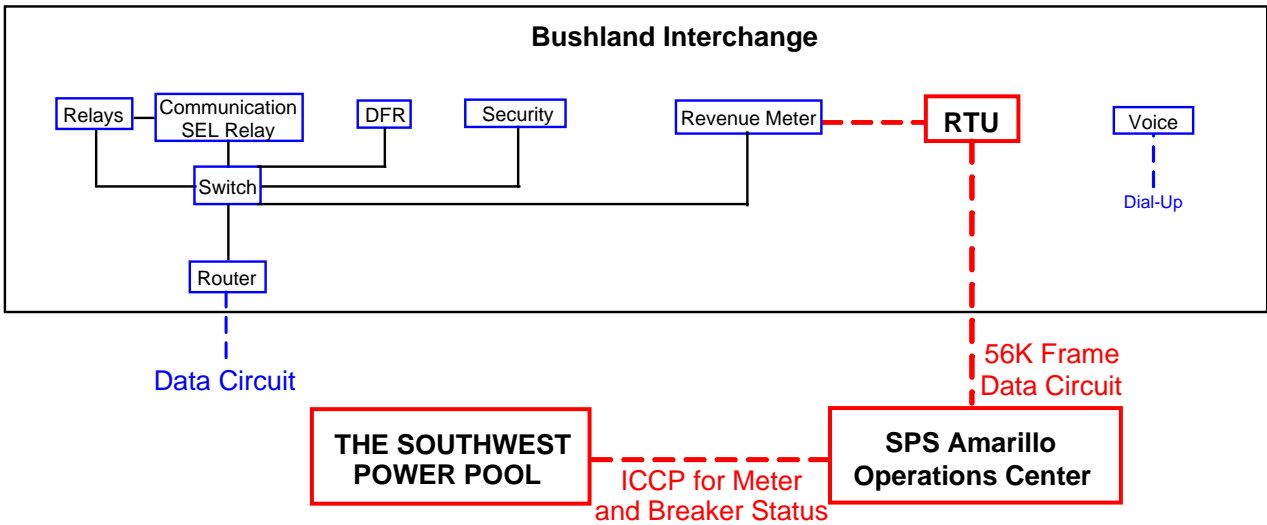


- 1.10. **Revenue Metering:** On the 230 kV line terminal to the Interconnection Customer's Substation, an individual billing meter will be installed along with a meter per ANSI C12.1 accuracy class 0.2 (3-PT's IEEE C57.13 accuracy class 0.3 and 3 CT's IEEE C57.13 accuracy class 0.15) for full 3-phase 4-wire metering. Pulses out of the billing meter will be sent via SCADA to the Transmission Owner's Control Center in Amarillo, Texas.
- 1.11. **Disturbance Monitoring Device:** A new Disturbance-Fault Recorder (DFR), capable of recording faults, swings, and long term trending, will monitor and record conditions in the substation and on the transmission lines in a new Control House. The disturbance equipment shall also be equipped with a GPS time synch clock. This equipment will have communication capability with a dedicated communication circuit. The disturbance equipment will have its own dedicated communications circuit.
- 1.12. **Remote Terminal Unit (RTU):** The existing RTU will be utilized to accommodate the new 230 kV line terminals at Bushland Interchange. SPS will provide and install if needed additional RTU cards for metering and telemetry as required by the latest Xcel Energy Interconnection Guidelines. The direct cost will be charged to the Interconnection Customer.

1.13. **Communications:** To meet its Communications obligations, the Interconnection Customer shall be responsible for making arrangements with the local phone company to provide telephone circuits as required by the Transmission Owner. Transmission Owner equipment may include, but is not limited to, the following: relay communication equipment, RTU, and disturbance monitoring equipment at Bushland Interchange. Prior to any construction, the Interconnection Customer is required to contact the Transmission Owner substation-engineering department for all communication details.

The following communications schematic diagram, which includes communication equipment information for the Interconnection Customer, Transmission Provider (Southwest Power Pool) and Transmission Owner (Southwestern Public Service), is provided to assist the Parties.

A schematic outlining the proposed communications is provided below:



The Interconnection Customer shall be responsible for providing fiber optic communication circuit installed in their overhead transmission line static wire for protective relaying from the customer substation to Bushland Interchange indicated in Section 1.9.

## 2. Transmission Work:

- 2.1. The Interconnection Customer will construct, own, operate, and maintain the 230 kV transmission line from the Interconnection Customer's Substation to the Interconnection Point at SPS Bushland Interchange as shown in Appendix A, Figure A-3. ***The SPS transmission design group prior to any construction by the Interconnection Customer or its contractor on any customer 230 kV transmission lines, or doing work in close proximity to any SPS transmission line, will require an engineering review of the customer's design. It is the Interconnection Customer's responsibility to initiate the design review in a timely manner before construction of any transmission line begins. If the review has not been made or the design at any of the aforementioned locations is deemed inadequate, the crossing(s) and or termination into the SPS Bushland Interchange will be delayed until the matters are resolved. SPS will not be held responsible for these delays.***

## 3. Right-Of-Way and Permits:

- 3.1. **Permitting:** The Texas Public Utility Commission will not require a permit for the construction of the new 230 kV line terminals to receive output from the Customer's Combustion Turbine Generator facility at Bushland Interchange. A Certificate of Convenience and Necessity will be required for the new 230 kV line to be built from Bushland to Tumbleweed Interchange. The interconnection customer will be responsible for any permitting and right of way of their substation, switching station, and the 230 kV transmission lines from their Substation to the Interconnection Point at Bushland Interchange.

4. **Construction Power and Distribution Service:** It is the sole responsibility of the Interconnection Customer to make arrangements for both construction and station power, which may be required for the Interconnection Customer's Combustion Turbine Generators facility and their substation. **Additionally, if the Interconnection Customer's substation(s) and/or construction site(s) are located outside of the SPS service area, SPS cannot provide station power (retail distribution service) and the Interconnection Customer needs to make arrangements for distribution service from the local retail provider.**

## 5. Project and Operating Concerns:

- 5.1 Close work between the Transmission group, the Interconnection Customer's personnel and local operating groups will be imperative in order to meet any in-service date that has been established.
- 5.2 The Interconnection customer will be required to maintain a Power Factor of 0.95 lagging and 0.95 leading at the Point of Interconnection (POI). This is required to maintain acceptable dynamic voltage rise as per latest revision of the Xcel Energy Interconnection Guidelines for Transmission Interconnection Producer-Owned Generation Greater than 20 MW:

6. **Fault Current Study:** The available fault current at Bushland Interchange with the 230 kV line from Bushland Interchange to Tumbleweed Interchange in service for the interconnection of GEN-2013-031, without any contribution from the Generator facility, is shown in Table 2 below.

**Table 2, - Available fault current at Point of Interconnection Location**

<b>Short Circuit Current Availability at Bushland Interchange without contribution from GEN 2013-031</b>				
<b>Fault Location</b>	<b>Fault Current (Amps)</b>		<b>Impedance (<math>\Omega</math>)</b>	
	<b>Line-to-Ground</b>	<b>3-Phase</b>	<b><math>Z^+</math></b>	<b><math>Z^0</math></b>
230 kV Bus	10,414	11,459	1.36+j11.51	2.62+j14.87

## Estimated Construction Costs

The projects required for the interconnection of this 370 MW Combustion Turbine Generators facility at Bushland Interchange consist of the projects summarized in the table below.

**Table 3, Required Interconnection Projects<sup>3</sup>**

Project	Description	Estimate
	<b>SPS Network Upgrades</b>	
1	Expand Bushland Interchange to breaker and half on the 230 kV.	\$ 11,087,954
2	Purchase additional land for Bushland Interchange expansion (30 acres).	\$ 489,374
3	Upgrade communication equipment at Bushland.	\$ 273,979
4	Re-terminate K-59, K-11 and GEN-2002-022 (wind farm 240 MW).	\$ 873,885
5	Relay Upgrades at Potter to Bushland; Deaf Smith to Bushland; and existing Wind Farm to Bushland	\$ 1,064,552
6	Build 230 kV Tumbleweed Interchange 3-ring bus configuration on K-41.	\$ 4,017,653
7	Purchase land for Tumbleweed Interchange 40 acres.	\$ 454,916
8	Install communications equipment at Tumbleweed Interchange.	\$ 160,356
9	Re-terminate K-41 in and out of Tumbleweed Interchange.	\$ 578,344
10	Relay Upgrades at Newhart to Tumbleweed	\$ 71,628
11	Build 15 miles 230 kV from Bushland to Tumbleweed Interchange.	\$ 14,866,261
12	Purchase Right-of-Way for the 10 miles of 230 kV.	\$ 2,523,722
	<b>Subtotal:</b>	<b>\$ 33,938,902</b>
	<b>Interconnection Facilities (Interconnection Customer's Expense)</b>	
13	Communications <sup>4</sup>	\$ See footnote
14	Revenue metering	\$ 280,000
15	230 kV Line arrestors	\$ 57,375
	<b>Subtotal:</b>	<b>\$ 337,375</b>
	<b>Total Cost:</b>	<b>\$ 34,276,277</b>

## Engineering and Construction:

An engineering and construction schedule for the installation of the 230 kV Breaker and one-half at Bushland Interchange is approximately 30 months. To build 15 miles of 230 kV is approximately 42 months. Other factors associated with clearances, equipment delays and work schedules could cause additional delays. The schedule is applicable after all required agreements are signed, and internal approvals are granted.

All additional cost for work not identified in this study is the sole responsibility of the Interconnection Customer unless other arrangements are made.

<sup>3</sup> The cost estimates are 2014 dollars with an accuracy level of  $\pm 20\%$  except it does not include AFUDC.

<sup>4</sup> It is the Requester's responsibility to provide both the data circuit and both dial-up telephone circuits, see Section 1.13.

## Appendix A

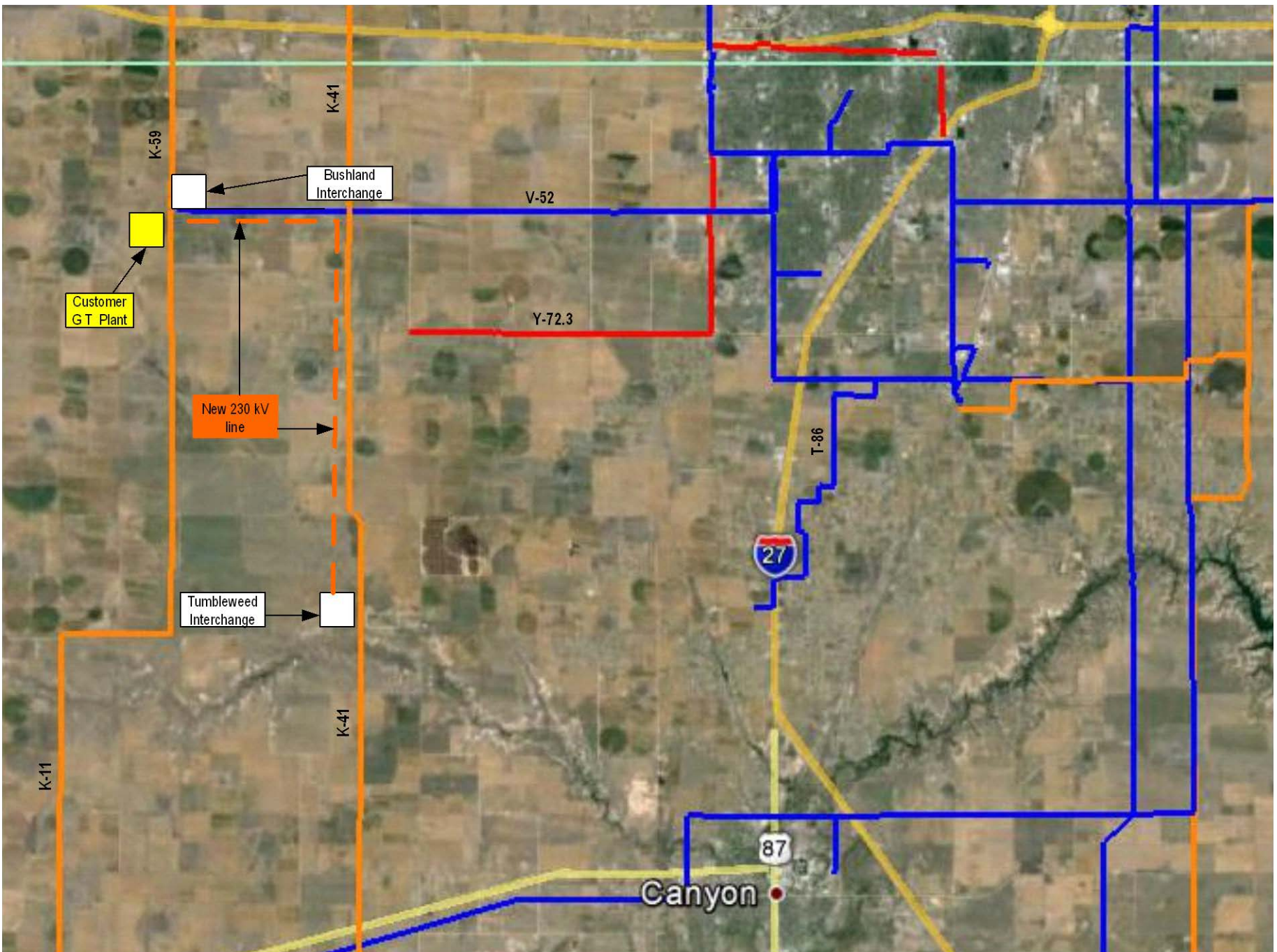
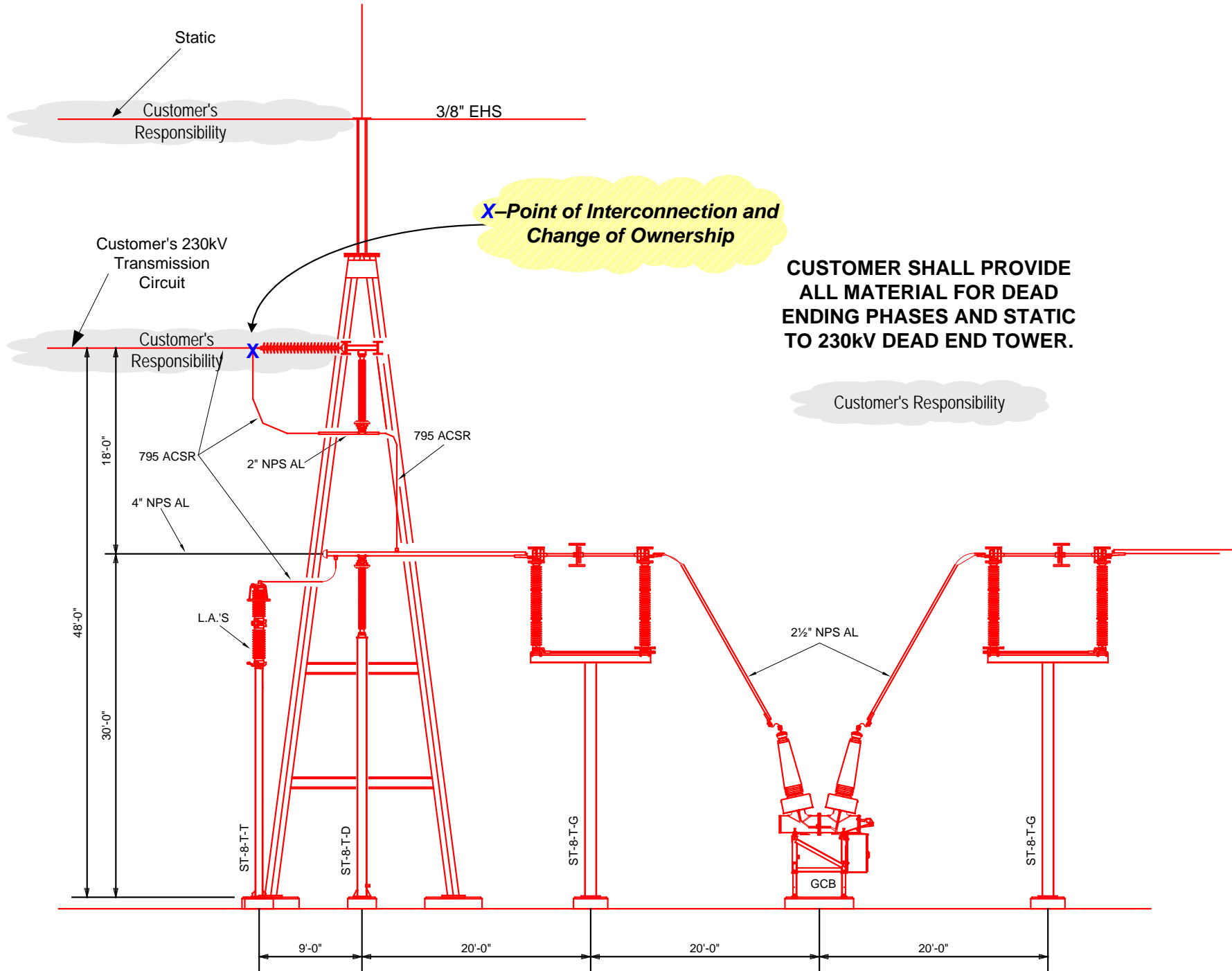


Figure A- 1 Approximate location of proposed Customer Combustion Turbine Generators







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