



Interconnection Facilities Study Report

Request # GI-2003-2

500 MW Coal-Fired Generation Facility Located in Elbert County,
Colorado

June 2005

**Xcel Energy Services, Inc.
Transmission Planning – Denver, CO**

I. Executive Summary

This Interconnection Facilities Study Report summarizes the analysis performed Public Service Company of Colorado (PSCo) to specify and estimate the cost of the engineering, siting, equipment, procurement, and construction needed to interconnect 500 MW of lignite-coal generation to the PSCo Transmission System. The generation, or “Buick Project” is proposed to be located in Elbert County, Colorado. The Customer proposed in-service date for commercial operation of the new 500 MW facility is June 1, 2008, with a back-feed date of January 1, 2008. This study indicates that the January 1, 2008 back-feed date should be achievable. However, the results of this study indicate that it is not feasible to implement the upgrades required for to accommodate full output of the plant on a firm basis by the requested date. The System Impact Study indicated that the generation could be limited to 440 MW or less for consideration as a firm network resource.

The recommended Network Upgrades for Interconnection includes constructing a new PSCo 230kV switching station (herein referred to as Corner Point) that would bisect the existing PSCo Pawnee – Daniels Park 230kV line, and provide a point of interconnection (POI) for the new generation. The Corner Point switching station would be constructed at a location approximately four miles northwest of the town of Deer Trail. This Study has further estimated the costs for PSCo to design and construct a 230kV transmission line from Corner Point the Buick station. This line is included as part of the Customer-funded Interconnection Facilities. The estimated transmission line costs are shown in Table 1.

The estimated cost¹ of the PSCo facilities required for Interconnection is approximately **\$16.49 million**, including:

- **\$ 12.45 million** for the Customer-funded Interconnection Facilities (Table 1).
- **\$ 4.04 million** for PSCo Network Upgrades for Interconnection (Table 2).

The time frame to engineer, permit, and construct the facilities described above is at least **24 months**. The Network Upgrades recommended for full delivery of the generation consists of the 64 miles of new 230kV transmission between the Corner Point Switching Station and the Daniels Park Substation. The System Impact Study Report estimated the cost of these additional upgrades associated with delivery to be **\$51.50 million**² (Table 3). The estimated time frame to implement the facilities required for delivery is at least **54 months**. Therefore, it is not feasible to implement the facilities required to accommodate delivery of the project to PSCo customers on a firm basis by the proposed in-service date.

The total estimated cost for the facilities required for Interconnection and Delivery of the project is approximately \$68 million. A simple diagram of the Network Upgrades and the regional transmission system for this request is shown in Figure 1, and a simple one-line diagram of the proposed interconnection facilities is shown in Figure 2.

¹ Appropriation estimate considered to have an accuracy of +/- 20%.

² Scoping, or planning level estimate considered having an accuracy of +/- 30%.

II. Introduction

On November 3, 2003 Xcel Energy Transmission received a request to conduct a feasibility study that would evaluate the integration of 500 MW of coal-fired generation in Elbert County, Colorado. The approximate location of the interconnection would be four miles northwest of the town of Deer Trail, Colorado. The Customer proposed in-service date for commercial operation of the facility is June 1, 2008, with a back-feed date of January 1, 2008. The Feasibility Study was completed and the report issued to the Customer and posted on the RMAO web site in February 2004. An Interconnection System Impact Study Agreement was executed on or around March 10, 2004, with the IFS report issued and posted on July 8, 2004. An Interconnection Facilities Study Agreement was executed on September 1, 2004.

Figure 1: Transmission System One-Line

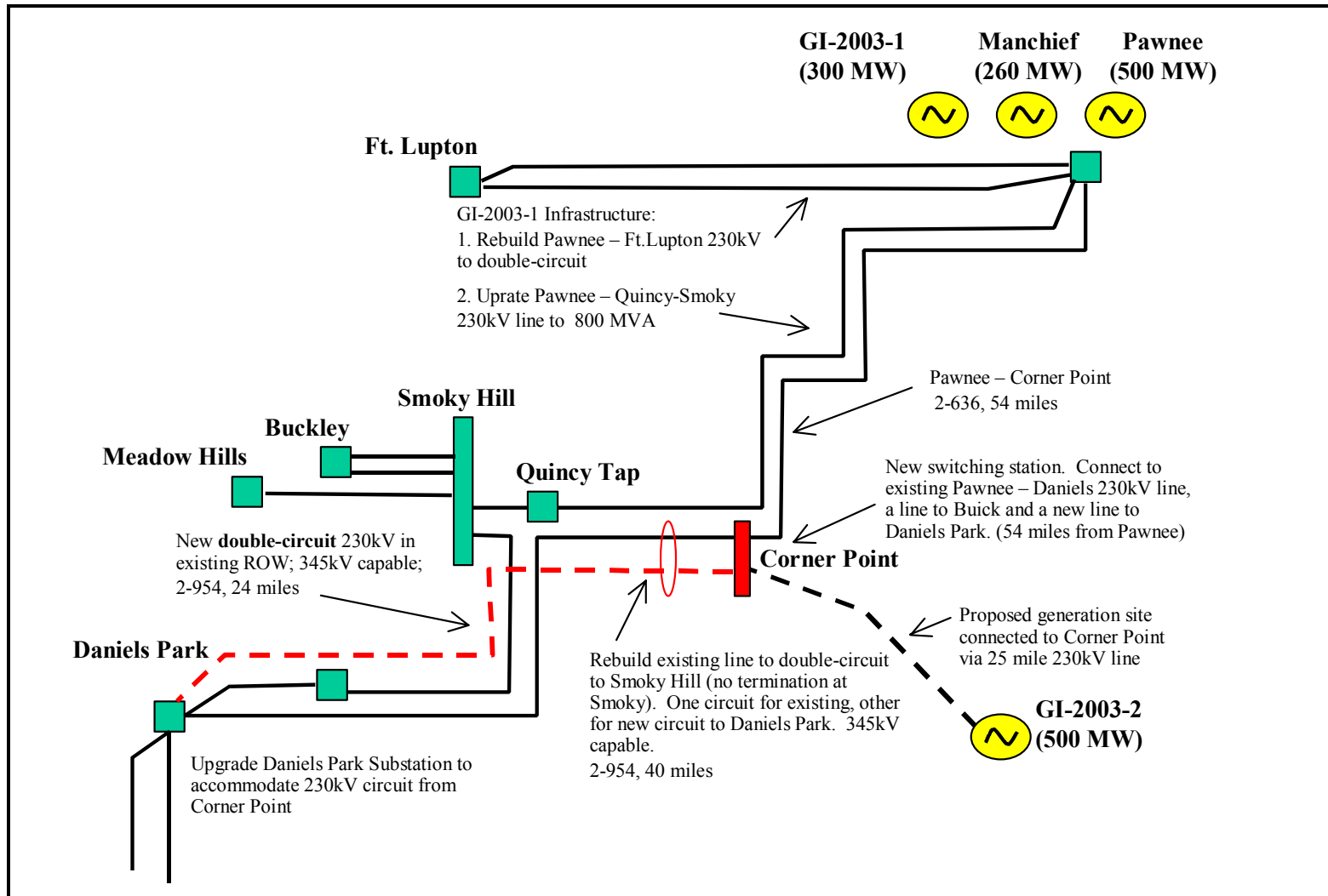
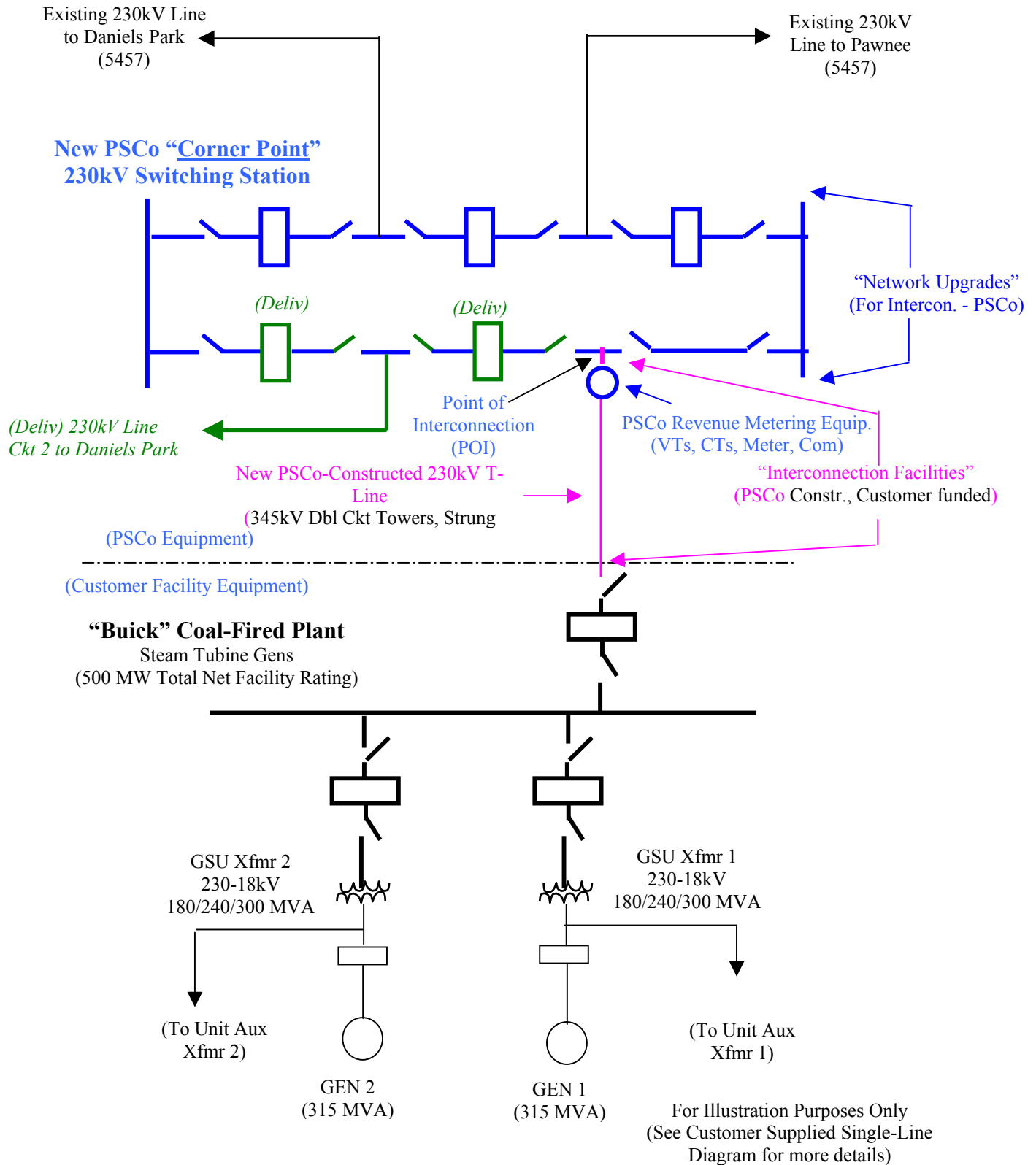


Figure 2: Interconnection One-Line Diagram



III. General Description (Project Design Guide)

A. Substation Engineering:

1. Project Purpose & Scope

The purpose of this project is to interconnect the proposed generating facility to a new 230kV Corner Point switching station. The new switching station would intersect the existing Pawnee-Daniels Park 230kV line. The exact site for the Corner Point switching station has not been determined at this time. Figure 5 shows a preliminary one-line diagram of the interconnection to Corner Point. Figure 6 shows a preliminary general arrangement (GA) layout drawing.

To accommodate full delivery of the new Customer 500 MW generation on a firm basis, an additional new 230kV transmission line would be constructed from Corner Point to the Daniels Park 230kV substation.

2. Other Considerations

The design of the new 230kV Corner Point Switching Station allows for several additional breaker-and-half bays and a future 345kV yard. The 230kV lines to the existing Daniels Park 230kV switchyard will exit to the west, and the Pawnee and Buick 230kV lines will exit to the northeast and southeast, respectively.

3. Physical Features

a) Additional Removals & Installations:

This is a new facility. There are no removals required.

b) Fault Current:

After completion of the project in 2008, the maximum symmetrical 3-phase and SLG fault currents at the Corner Point 230kV bus are:

Buick Plant Off-Line: Corner Point 3-phase = 10.5kA

Buick Plant On-Line: Corner Point 3-phase = 15.6kA

c) Electrical Installations

The Corner Point 230kV switching station will consist of two breaker-and-half bays, with a total of 5 circuit breakers. It will operate initially as a 4-position ring-bus. The additional breaker is required because both Daniels Park lines exit to the west.

d) AC Systems

A new station service transformer will be installed at Corner Point SS, and be supplied from the local cooperative's line. Backup station service will be supplied from a propane-powered generator.

- e) Control Building (Electrical Equipment Enclosure, EEE)
A new medium size EEE will be installed, complete with battery, charger, AC and DC panels, lighting, and HVAC system.
- f) Grounding
All equipment and associated structures will be connected to the ground mat.
- g) Lightning Protection
The static wires on the transmission lines will be connected to the dead-end structures within the substation to provide overhead direct stroke protection.

4. Civil Features

- a) Grading & Fencing
Moderate grading is required. The civil engineering and design details have not been determined at this time.
- b) Foundations & Structural
All foundations and structures are new.
- c) Removals & Relocations
None required.

5. Control Features

- a) Electrical Installations
New relay panels will be installed in the EEE. Line protection will consist of a SEL-321 (Pkg-P), SEL-311C (Pkg-S), and SEL-351 (BF and reclosing) using Mirror Bits over the fiber optic ground wire for pilot relay communication or via power line carrier. Transducers will also be installed on the new relay panel for SCADA telemetry. A new RTU/LCU will be installed and be utilized for SCADA. Breaker failure protection will be required for all breakers using a SEL 501 per breaker. New relay panels will be installed for this scheme.

6. Outages

The existing Pawnee-Daniels Park line will be out of service during the cut over period. This cutover period shall be minimized as much as possible.

7. Project and Operating Concerns

Substation work will be performed adjacent to two energized 230kV lines.

8. Siting and Land Rights

The exact location of the new PSCo Corner Point switching station site will be identified during the Siting study. The preferred substation site will be acquired in fee to accommodate the required substation equipment

B. Transmission Engineering:

1. Transmission Line Facilities – General Description

The proposed alignment of the new Corner Point – Buick 230kV transmission line is approximately 31 miles in length.

PSCo may build for double-circuit capacity. In that case, the transmission would consist of a double circuit design structure, constructed for 345kV, but operated at 230kV, with only one circuit strung. See Appendix A for a preliminary line route map. The proposed conductor is a two-conductor bundle of 954-cardinal ACSR, rated for approximately 2,000A (800 MVA at 230kV).

2. Design

Engineering, survey and design will take approximately 10 months to complete

3. Materials

Material procurement will require 9 months. There will be one and maybe two material yards utilized during construction.

4. Construction

Construction will take approximately 7 months to complete.

5. Siting and Land Rights

The proposed transmission line ROW is 100 feet wide. ROW acquisition is expected to occur after conducting a Siting study and obtaining the appropriate land use permits from Elbert and Arapahoe Counties. Contract agents will be utilized to obtain perpetual easements for the 100 feet wide transmission line ROW.

IV. Costs Estimates and Assumptions

A. PSCo Network Upgrades for Interconnection:

Table 1 describes the costs assumed for work to be performed by PSCo, and funded by the Customer, for the dedicated “sole-use” interconnection facilities installed between the 230kV Point of Interconnection located at Corner Point, and the Buick Generation Facility. The estimated non-binding good faith costs for the facilities to provide an interconnection for the Customer requested generation are:

- \$ 12.45 million for the Customer-funded Interconnection Facilities (Table 1).
- \$ 4.04 million for PSCo Network Upgrades for Interconnection (Table 2).

The estimated costs shown are “appropriation estimates” that are considered to be accurate within +/- 20%. The estimates are in 2008 dollars, include escalation, and are based upon typical construction costs for previously performed similar construction. These estimated costs include all applicable labor and overheads associated with the engineering, design, and construction of these new PSCo facilities. These estimates do not include any costs for any Customer-owned, supplied, and installed equipment and associated design and engineering. They do not include all of the costs required for full delivery of the generation. Those costs are included in Table 3.

Table 1 PSCo Transmission Interconnection Facilities

Element	Description of Work	Cost (\$ Millions)
Corner Point Substation	Construct transmission line exit and revenue metering for the new 230kV line to Buick. The equipment required includes: <ul style="list-style-type: none"> • 230kV voltage line metering with associated revenue metering equipment; • Conductor & misc. equipment from main 230kV bus tap to revenue metering. 	\$ 0.334
Transmission	<ul style="list-style-type: none"> • Construct a 31-mile, single-circuit 230kV line between the proposed generation project and the Corner Point switching station. 	\$ 10.996
Siting & ROW	<ul style="list-style-type: none"> • Siting and Land Rights for misc. permits; • 31-miles, 100-ft. wide ROW for Corner Point – Buick 230kV line. • CPCN activities associated with new 230kV line 	\$ 1.120
	Total Customer-funded Interconnection Facilities	\$ 12.450³
	Time Frame	24 months

³ Should PSCo pursue higher capacity transmission, it would consist of double-circuit, 345kV capable line between the proposed generation project and the Corner Point switching station. Structures would be steel pole, and have the capability to accommodate a second future circuit. Standard conductor is bundled 954 kcmil ACSR (2,000A). Incremental PSCo cost is estimated to be an additional \$3.78 million.

Table 2 describes the estimated costs for PSCo Transmission Network Upgrades associated with providing an interconnection to PSCo's Transmission system. Specifically, this includes the new 230kV Corner Point Switching Station equipment installed on the PSCo transmission side of the 230kV Point of Interconnection (POI).

Table 2 PSCo Transmission Network Upgrades Required for Interconnection

Element	Description of Work	Cost (\$ Millions)
Corner Point Substation	Construct a 4-point, 5-breaker ring-bus substation that will sectionalize the Pawnee – Daniels Park 230kV line, add a second Daniels Park line termination, and interconnect the 230kV Buick line termination, configured for ultimate breaker-and-half arrangement. The equipment required includes: <ul style="list-style-type: none"> • Site development; • Control building (EEE); • 5 circuit breakers; • 10 disconnect switches; • Dead-end structures, associated bus and connectors; • Bus voltage transformers and line synchronizing transformers; • Relaying & assoc. communication equip. for 230kV line protection (4 lines, plus 230kV buses); • SCADA RTU, LCU, station battery, etc.; • Siting and Land Rights for misc. permits. 	\$3.840
Siting & ROW	<ul style="list-style-type: none"> • Siting and Land Rights for misc. permits, site purchase (switching station) 	\$ 0.200
	Total PSCo Transmission Network Upgrades for Interconnection	\$ 4.040
	Time Frame	24 months

Table 3 describes the estimated costs for PSCo Transmission Network Upgrades associated with providing firm delivery of the new Customer 500 MW generation to PSCo native load, specifically resulting in a new Corner Point – Daniels Park 230kV line (second circuit). These estimates are a scoping level (+/- 30%) estimate, based upon basic assumptions made in the previously performed System Impact Study. More detailed appropriation level (+/- 20%) cost estimates would be determined during the later stages of the project. At the present time there is a high level of uncertainty regarding specific line routes, permitting, and other details typically necessary for the transmission line design / permit / construct & CPCN process.

Table 3 PSCo Transmission Network Upgrades Required for Delivery as a NR

Element	Description of Work	Cost (\$ Millions)
Daniels Park Substation	<p>The existing station must be modified to accommodate a single 230kV line from Corner Point. Modifications include:</p> <ul style="list-style-type: none"> • Site development • 3 circuit breakers • 12 disconnect switches • 1 dead-end structure, associated bus and connectors • Relaying and communication equipment • "Scoping level" +/-30% estimate 	\$ 3.700
Transmission	<ul style="list-style-type: none"> • Between Corner Point Switching Station and the Smoky Hill Substation, rebuild the existing 40 mile 230kV line (that originates at Pawnee and terminates at Daniels Park) to double-circuit configuration. One rebuilt circuit will replace the existing circuit. The other rebuilt circuit will be the new circuit. Neither circuit will tie in at Smoky Hill. To minimize future Siting and construction concerns, build the new transmission to 345kV capability, (initially operated at 230kV). Standard conductor is bundled 954 kcmil ACSR (2,000A). • From Smoky Hill, continue the new circuit to Daniels Park using 24-miles of new 230kV transmission within the existing corridor. To minimize future Siting and Construction concerns, construct this transmission in double-circuit configuration with 345kV capability (initially operated at 230kV). Standard conductor is bundled 954 kcmil ACSR (2,000A). 	\$ 46.000
Siting & ROW	<ul style="list-style-type: none"> • Siting and Land Rights for misc. permits, ROW (Corner Pt – Dan Park 230kV Line) . 	\$ 1.800
	Total Additional Cost for PSCo Transmission Network Upgrades for Delivery.	\$ 51.500
	Time Frame	54 months

The total costs for Interconnection, and Network Upgrades for Interconnection and Delivery are estimated to be approximately **\$68 million**.

B. Major Assumptions for Cost Estimates:

1. Any NEPA requirements imposed on transmission as a result of the generation addition will most likely have adverse effects on schedule and deliverables.
2. No screening has been estimated at any of the substations. If this is required the cost will be significant at each location.
3. These estimates do not include any cost for legal fees.
4. Detailed field investigations have not been conducted and could increase these estimates.
5. Only minimal transmission line ROW acquisition is assumed, since exist ROW will be utilized.

6. Permitting the new double circuit 345kV (230kV operated) trans line from Smoky Hill to Daniels Park will be extremely difficult and could require legal action.
7. All necessary transmission line outages can be obtained. If not, const duration times will be longer.
8. All estimates are in 2008 dollars.
9. Overall timeline to complete all required transmission and substation facilities is expected to require a minimum of 54 months. If there are problems with local and state approvals, this could require an additional year. A CPCN is assumed to be required for the new transmission line

V. Engineering Procurement and Construction Schedule

The schedule shown in Figure 3 identifies milestones for the design, construction, and commissioning / testing activities assumed to be required for this project.

Figure 3: Tentative Milestone Schedule



Figure 4: Preliminary Corner Point – Buick Transmission Line Route

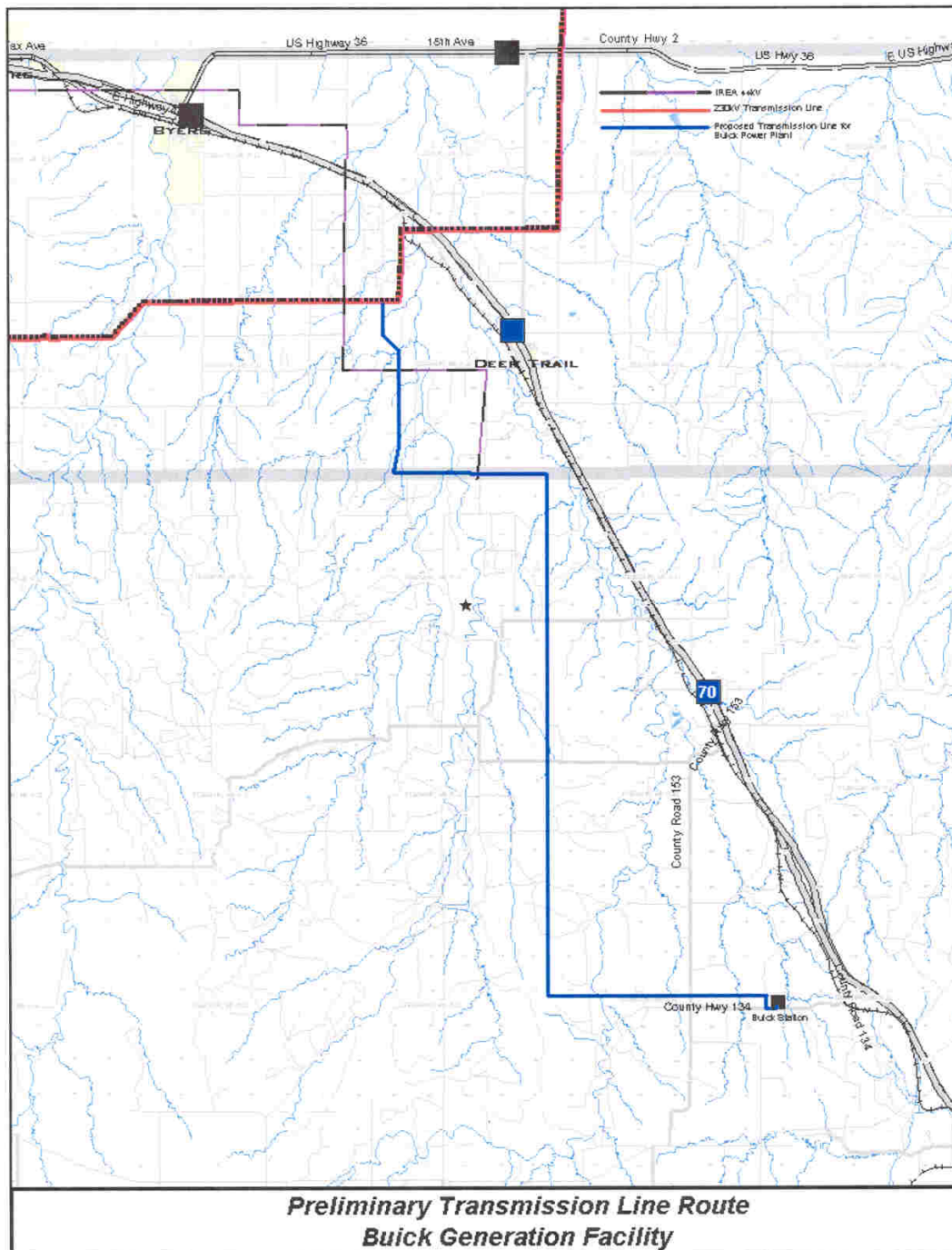


Figure 5: Proposed Corner Point Station One-Line Diagram

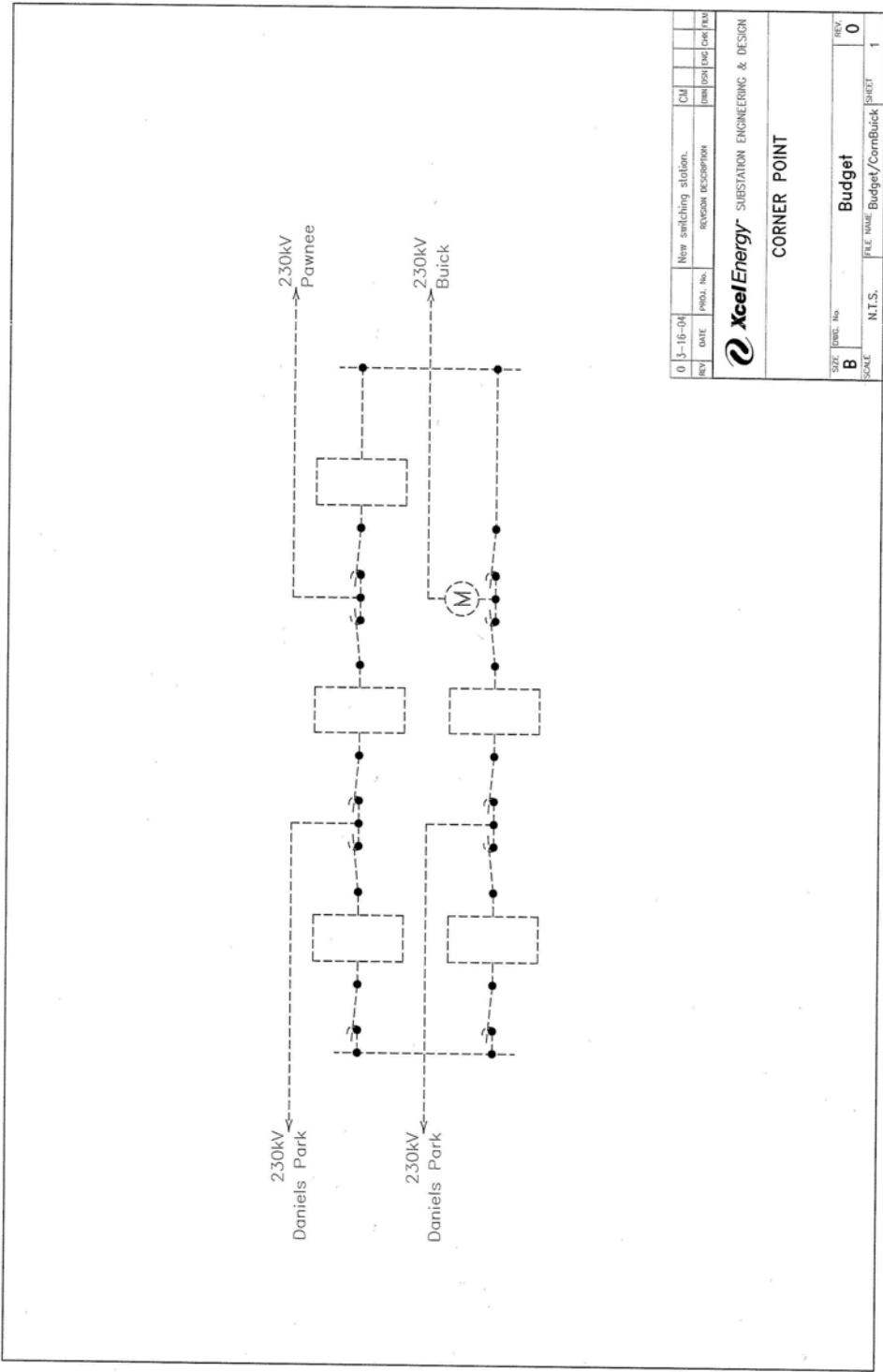


Figure 6: Proposed Corner Point Station General Arrangement Layout

