

PJM Generator Interconnection Request
Queue B3
Hosensack (Bethlehem Steel) 500kV
Facilities Study Report

February 2002

168000

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SECTION I: SCOPE

A. Description of Project

Conectiv Mid-Merit Inc. has proposed a new 1100 mw combined cycle generating plant in Bethlehem PA, consisting of two modules of 550 mw summer output. Each 550 mw module is comprised of three 120 mw gas turbines and a 190 mw steam turbine. This study covers the initial installation of 750 mw. (The remaining 350 mw at this installation has been applied for at PJM queue # D18). The plant will be electrically connected between Quarry 230kv substation and Hosensack 500kv substation. A new substation, Steel City 500/230, will be constructed at the plant site, and the Hosensack-Quarry 500/230kv line will be split and terminated in Steel City. The plant will generate into the 500kv system via the reterminated Hosensack-Steel City 500kv line. A 500/230kv transformer bank will allow retermination of the Steel City-Quarry 230kv line.

B. Changes from the Impact Study Report

The Impact Study identified several contingencies that overloaded the Martins Creek-Morris Park-Gilbert 230kv line. The proposed solution for project B3 was to string a second set of conductors on the open side of the double circuit tower line for it's entire length. The two sets of conductors would be tied together at each end, creating a six-wire circuit with approximately 3000 amp capability. Conectiv's Bethlehem Steel project B3 was the first project to necessitate this six wire circuit and was therefore responsible for the cost as a network upgrade.

Since the Impact Study was published, project A43 (Portland) has withdrawn from the queue, which has reduced the power flow on the Martins Creek to Gilbert path. The reduction in powerflow has deferred the need for a six-wire circuit for the for the B3 project. The existing Martins Creek-Morris Park-Gilbert circuit, once upgraded to 160°C temperature rating, can adequately handle the expected post-contingency powerflows. Project B3 will now only be responsible for the cost to upgrade the Martins Creek-Morris Park-Gilbert 230kv line to 160°C temperature rating.

C. Scope of PPL Electric Utilities Work

1. Direct Connection Work

- a) PPL will construct Steel City 500/230 substation to deliver the output of Conectiv's generators to the system. Electrically, Steel City will split the existing 22-mile Hosensack-Quarry 230kv line. The 2 mile portion of the line between Steel City and Quarry will remain as it exists today, except for a small portion which must be rebuilt for 230kv operation and termination in the Steel City 230kv yard. The 20 mile portion between Steel City and Hosensack is designed and built for 500kv operation. It will be re-terminated at the Hosensack 500kv yard and the Steel City 500kv yard, and the line will then operate at it's design voltage of 500kv. Conectiv's 750mw of generation will be transformed from generator voltage up to 500kv, and will be terminated in the Steel City 500kv yard.
- b) Steel City substation will be designed for ultimate 4 bay CB & ½ design in the 500kv yard, and 2 bay CB & ½ design in the 230kv yard. Space will exist for two

500/230kv transformer banks. Initially, the 500kv yard will operate as a 3 circuit breaker ring (terminations for the Hosensack line, the Conectiv generator line, and a transformer bank). The 230kv yard will initially operate as a single circuit breaker terminal for the Quarry 230kv line. One 500/230kv transformer bank will be installed, designed to be compatible with the existing PJM 500/230kv standard spare.

- c) The Hosensack 500kv substation will be reconfigured to accept the new Steel City line, and will have a new circuit breaker added. In order to accommodate the new line, the existing TMI terminal must be relocated, and the relay, protection, and control system must be modified.

Please see **Attachment A** for a diagram of this direct connection work.

2. Network Upgrades

- a) Several transmission system contingencies will overload the Martins Creek-Morris Park-Gilbert 230kv line once Conectiv's B3 plant goes online. To eliminate these contingencies, the line will be uprated from a 125°C temperature rating to a 160°C temperature rating.
- b) The construction of Steel City sub and the conversion of the Steel City-Hosensack line to 500kv will increase the phase-to-ground fault duty at Martins Creek 230 switchyard above the 50,000 amp duty rating of the buses and grounding system in the switchyard. The proposed solution involves two items. The first item is to use delta-ungrounded wye generator step-up transformers for project A12. The second item is to upgrade the Martins Creek 230kv switchyard grounding system to 63,000 amp duty rating.
- c) Due to the extremely high fault currents at Martins Creek substation several sets of current transformers on various circuit breakers at Martins Creek could saturate during a close in high magnitude fault condition. As such, five 230kv lines at Martins Creek will require relay upgrades and/or modifications to assure proper breaker clearing for high magnitude phase faults.

D. Milestone Schedule

The following major milestone dates have been communicated to Conectiv Mid Merit:

- | | |
|---|--------------|
| • Substantial completion of Steel City substation | August 2002 |
| • PJM allows Hosensack-Quarry 230kv line outage | Sep 1, 2002 |
| • 500kV service energized at Steel City | Oct 15, 2002 |

SECTION II: Description of Facilities (Substation)

Steel City 500/230kv Substation

Purpose & Necessity

Steel City 500/230kv sub will be constructed to accept Conectiv's 500kv generator leads, to terminate the Hosensack-Steel City 500kv line and the Steel City-Quarry 230kv line, and to electrically tie the system with 500/230kv transformation.

One-Line Diagram

See **Attachment A2**.

Engineering Drawings List

See **Attachment B1**.

Electrical Design Description

The substation is designed for ultimate configuration of four (4) 500 kV bays, two (2) 230 kV bays, two (2) transformer banks with nominal rating of 750 MVA each, arranged in a breaker-and-half configuration for both the 500 kV and the 230 kV yards. Initial installation will construct two (2) 500 kV line bays, one (1) 230 kV line bay, and one transformer bank. Buses are designed for 3000 amps nominal operation.

The substation layout has been specifically engineered to meet the following constraints:

- a) limited property available at the project site compressing bus and equipment spacing,
- b) anticipated contamination from cooling tower effluent requiring increased insulation creepage levels and enhanced corrosion protection for metallic structures,
- c) Fence and grading arrangements and relocations to meet criteria of different phases of the project,
- d) 500 kV and 230 kV getaway transmission corridors, both present and future,
- e) One 500 kV transmission line connection to the 1100MW power plant.

Install:

The following facilities are included with the initial installation:

- a) Three (3) A-Frame deadends for 500 connections and one (1) H-Frame deadend for transformer connection,
- b) One bank of transformation with single phase 500 – 230 kV transformers, with firewalls between phases,
- c) A closed oil containment system for the first bank of transformers to address concerns with the adjacent wetlands,
- d) Three (3) 500 kV circuit breakers arranged in an initial ring-bus configuration / ultimate breaker-and-half configuration,
- e) Eleven (11) 500 kV motor operated disconnect switches,

- f) Main 500 kV buses (designated as “North” and “South”) to be 4 inch aluminum tubular,
- g) Surge Arresters, nominal 396 kV MCOV, for all incoming 500 kV lines and transformer,
- h) Tubular structures for all 500 kV structures, rolled shapes for all 230 kV structures,
- i) One (1) 230 kV circuit breaker for initial 230 kV transmission line,
- j) Main 230 kV bus (designated as “West”) using ACSR conductor, with connection to transformer with rigid tubular bus,
- k) Four (4) 230 kV ganged switches, of which one (1) is motorized,
- l) Primary station service derived from 500 – 230 kV transformer tertiary winding, with a backup source from 12 kV distribution circuit along Applebutter Road.
- m) Stormwater Drainage of yard coordinated with Conectiv and tied into the drainage design of the plant.

Future Installation:

The following facilities are initially built as temporary facilities. Through agreement with Conectiv, these facilities will be rebuilt or relocated to their final, permanent locations after the D18 project is completed, and the costs associated with final relocations will be included in the D18 studies.:

- a) Fence in the northeast corner of the 230kV substation; relocated after the Hosensack-Quarry 230 kV line is cut, the transmission tower removed, site cut and regraded by Conectiv, and retaining wall constructed by Conectiv.
- b) Fence in the southwestern part of the 500KV yard; after the laydown area is no longer needed and the area needed for Bay 1 can be fenced-in.

Protective Relaying, Metering, Instrumentation and Control

Relay protection for the Bethlehem Power #1, Hosensack and Quarry #1 lines will each consist of two independent pilot systems. System #1 is a Line Current Differential system using a SEL-311L microprocessor based relays. System #2 is a Permissive Overreaching Transfer Trip (POTT) scheme using SEL-321 microprocessor based relays. Relay-to-relay communications for the pilot systems for Bethlehem Power #1 will be dedicated fiber optic cable. Relay-to-relay communications for the Hosensack and Quarry #1 pilot systems will be a Synchronous Optical Network (SONET) JungleMUX OC-1 system. High-speed breaker failure protection is provided by SEL-352 microprocessor based relays. Redundant 500 kV (North and South) bus protection is provided by MFAC 34 high impedance, differential relays. Transformer #1 protection is provided by SEL-387E and SEL-387 microprocessor based relays. Redundant 230 kV (West) bus protection is provided by MFAC 34 high impedance, differential relays.

All communication between Steel City substation and other PPL owned facilities is accomplished using redundant Synchronous Optical Networks (SONET). Each SONET network is configured in a diversely routed ring, providing an alternate path in the event of a fiber failure. All communication between Steel City 500-230 kV Substation and Conectiv utilizes direct fiber. Remote communication for relay

interrogation is accomplished with a SEL-2030 communication processor over one of the SONET systems. This function is not redundant.

A 500kv SCADA-controlled MOD is installed where Conectiv's GIS bus transitions to overhead air-insulated wire. Both Conectiv and PPL will have access to control this switch which will be interlocked to prevent operation when the line is energized. This SCADA unit is an independent unit from the system described below.

Redundant direct transfer trip (DTT) is accomplished via the SONET network systems or, in the case of Bethlehem Power #1 line, dedicated fiber using the Schweitzer Engineering Labs mirrored bit technology.

Control networks and relays are time synchronized through a GPS Satellite Clock receiver.

All circuit breakers (CBs) are equipped with dual trip coils for added security.

The above protection complies with standards outlined in the PJM Relaying Philosophy & Design Standards.

Steel City is designed to be controlled by primary and backup redundant computers (two controllers for the 500 kV system and two controllers for the 230 kV system) and distributed processors with individual terminal I/O modules. The main computers and the distributed processor I/O units communicate via an Ethernet network. The network minimizes processing scan times required in the main computers and provides isolation. Distributed processing I/O units are monitored for failure with alarm outputs to the Alarm Management System (AMS). Redundant computers interface with the 500 kV and 230 kV systems and provide the Human/Machine Interface (HMI). If either controller in a redundant pair fails, the remaining controller will continue to perform *all* the functions required. Both controllers in a redundant pair are continuously in parallel operation; no fail-over scheme is required.

SCADA

An independent computer provides Supervisory Control and Data Acquisition (SCADA). Circuit breaker (CB) remote control and status functions are networked through the main controllers. The Tap Changer Under Load (TCUL) is remotely controlled by the Supervisory Control and Data Acquisition (SCADA) computer, which is non-redundant since this unit is not directly involved in the protective relay tripping functions. In addition, failure of either of these computers would have a minimal impact on the operation of the substation. Multi-function meters provide analog quantities for lines and CBs, which interface with the main computers and SCADA computer by a MODBUS Plus (MB+) communication network.

DFR

Two Mehta Tech, Inc. Transscan 2000 sets provide fault recording for the 500 kV and 230 kV systems. Time synchronization is provided through a dedicated GPS Satellite Clock receiver.

Metering

PPL metering quantities are provided by Siemens 2510 meters at four points in the plant (T1A, T5A, T8A and the PPL 12 kV service feeder) and at the PPL 500 kV switchyard connection point. The quantities from the plant are summed in the plant's Net 90 system and sent to PPL's control cubicle over a dedicated fiber using a DYMEC 5842S-P-ST (RS-232-to-optical) converter.

Quantities from the Conectiv meter at the PPL 500 kV switchyard connection point to the plant are sent over (2) dedicated fibers using DYMEC 5842S-P-ST (RS-232-to-optical) converters.

Panels and Cabinets

Eighteen panels provide the mounting facilities for the relay and control equipment. Separate cabinets provide housing for equipment for each SONET system, fiber handling facilities, metering, and DFRs.

Battery System

Separate 125 VDC battery systems are utilized to provide independent power for the redundant systems. Inverters provide reliable, independent 115 VAC power for the computers and other essential equipment.

Major Equipment/Material List (Steel City):

- 3 - 500 kV circuit breakers (dead tank) w/ metering accuracy CT's
- 1 - 230 kV circuit breaker (dead tank)
- 1 - 750 MVA 500/230 kV transformer bank (comprised of 3 single phase units)
- 11 - 500 kV MOD's
- 4 - 230 kV GOD's
- 1 - control cubicle
- 1 - lot structural steel for the substation deadend structures, etc.
- 12- 500 kV CCVTs (metering accuracy)
- 3 - 500 kV CTs
- 6 - 230 kV CCVTs
- 1 - lot 500 kV and 230 kV protection panels
- 1 - lot transmission line poles or towers

Cost Estimate – Steel City Substation

Material	\$11.935 M
Labor	\$ 7.332 M
Testing	\$.348 M
<u>Engineering</u>	<u>\$ 1.945 M</u>
Total	\$21.56 million for Steel City

Project Schedule

Facilities Design	Jun 2001 – Mar 2002
Material Procurement	Mar 2001 – Feb 2002
Substation Construction	Sep 2001 – Oct 2002
Acceptance Testing	Jul 2002 – Dec 2002

HOSENSACK 500kv Substation

Purpose & Necessity:

In order to operate the newly redesignated Hosensack-Steel City line at 500kv, the line must be removed from the Hosensack 230kv yard, and reterminated in the Hosensack 500kv yard. The least-cost method to accomplish this is to relocate the TMI 500kv line terminal and the Elroy 500kv line terminal at Hosensack 500kv sub, and terminate the Steel City line in the former TMI terminal position. A 4th 500kv CB will be installed in a ring bus configuration, and a PLC-based control system will be built for the new Steel City line.

One-Line Diagram

See **Attachment A3**.

Engineering Drawings List

See **Attachment B2**.

Electrical Design Description

The scope of this project includes:

1. The addition of a 500kv circuit breaker and two sets of air switches in Bay 2T.
2. Structures and foundations for Bay 2T.
3. The re-termination of the Elroy line from South side dead-end structure to the North side dead-end structure, Bay 2.
4. Relocating the Three Mile Island line from Bay 1 South side dead-end structure to Bay 2 South side dead-end structure. **(This work will be performed by First Energy.)**
5. The installation of a North side dead-end foundation and structure in Bay 1.
6. The termination of the Steel City line on the South side dead-end structure through the North side dead-end structure, Bay 1.
7. Add relay panels, cable tray and computer work station in control house.
8. Disconnect the former Quarry terminal from the Hosensack 230kv bus, and disable/disconnect the appropriate relaying inside the Hosensack 230kv control house.

Protective Relaying, Metering, Instrumentation and Control

A. Steel City and Alburtis 500kV Lines

Relay protection for the Steel City and Alburtis 500kV lines consists of two independent pilot systems. System #1 is a Line Current Differential system using a SEL-311L microprocessor based relays. System #2 is a Permissive Overreaching Transfer Trip (POTT) scheme using SEL-321 microprocessor based relays. Relay-to-relay communications for the Steel City and Alburtis pilot systems is a Synchronous Optical Network (SONET) JungleMUX OC-1 system.

Redundant direct transfer trip (DTT) is accomplished via the SONET network systems.

B. Three Mile Island 500kV Line

Relay protection for the Three Mile Island 500kV line consists of a pilot scheme with backup zone protection. The primary pilot scheme is a Directional Comparison Blocking Scheme using an SEL-311L microprocessor relay on power line carrier. Backup zone protection is provided by a SEL-321 microprocessor relay. Direct transfer trip (DTT) is by Frequency Shift Keyed Channel (GE- CS51C) over power line carrier.

C. Elroy 500kV Line

Relay protection for the Elroy 500kV line consists of two independent pilot schemes. Pilot scheme #1 is a Power Line Carrier Directional Comparison Blocking Scheme using an SEL-311L microprocessor relay. Pilot scheme #2 is a Power Line Carrier Directional Comparison Unblocking Scheme using an SEL-321 microprocessor relay.

Direct transfer trip (DTT) is by Frequency Shift Keyed Channel (GE- CS51C) over power line carrier.

Control Philosophy

Hosensack is designed to be controlled by redundant PCs (PC A and PC B) and distributed processors with individual terminal I/O modules. The main PCs and the distributed processor I/O units communicate via an Ethernet network. The network minimizes processing scan times required in the main PCs and provides isolation. Distributed processing I/O units are monitored for failure with alarm outputs to the Alarm Management System (AMS). Redundant desktop computers interface with the 500 kV systems and provide the Human/Machine Interface (HMI). The HMI provides all local equipment controls; Permit and Tag control; and displays equipment status and metering quantities.

Note: These are *not* primary and back-up controllers, but fully redundant. If either controller in a redundant pair fails, the remaining controller will continue to perform *all* the functions required. Both controllers in a redundant pair are continuously in parallel operation; no fail-over scheme is required.

Breaker Protection/Control

All circuit breakers (CBs) are equipped with dual trip coils for added security. Both trip coils are operated from each redundant controller-TI/O system through both sets of the line relays. Breaker failure protection is provided by an ABB50 relay. Breakers 2S, 2N and 3T are live-tank breakers and have separate CT columns with ABB50 type relay protection for CT column and breaker flashover.

SCADA

An independent PC provides Supervisory Control and Data Acquisition (SCADA). Circuit breaker (CB) remote control and status functions are networked through the main controllers. Multi-function meters provide analog quantities for lines and CBs, which interface with the main PCs and SCADA PC by a MODBUS Plus (MB+) communication network. Station alarms are passed from the AMS system to SCADA.

SCADA communications are transferred to the system operator over the fiber optic network.

Alarm Management System (AMS)

A Beta Products, Inc. Betalog 512 sequence of events recorder and a personal computer provide a comprehensive Alarm Management System (AMS) to monitor all protection and control schemes, AC & DC systems, PC controllers, all major equipment and SONET systems. An expansion rack for additional 512 points was added for this project. This AMS system interfaces with the MB+ network through a bridge multiplexer.

DFR

A Mehta Tech, Inc. Transscan 2000 digital fault recorder (DFR) was added to provide fault and disturbance recording for the 500 kV systems. Time synchronization is provided through a dedicated GPS Satellite Clock receiver.

Remote Communication

A telephone circuit provides access for remote communications to the substation. A telephone-sharing switch provides a connection directly to AMS, DFR and an SEL-2030 communication processor for interrogation of each relay. Control networks and relays are time synchronized through a GPS Satellite Clock receiver.

Panels and Cabinets

Five duplex panels provide the mounting facilities for the new relay and control equipment. Existing panels and cabinets will be removed after controls are transferred to the new system. Separate cabinets provide housing for equipment for each SONET system, fiber-handling facilities, AMS and DFR systems.

Battery System

Two independent circuits from the 125 VDC battery systems are utilized to provide independent power for the redundant systems. Individual 125/24v DC power supplies are used for each control system. A set of Inverters provide reliable, independent 115 VAC power for the PCs and other essential equipment.

Major Equipment/Material List (Hosensack):

- 1 - 500 kV circuit breaker (dead tank)
- 2 - 500 kV MOD's
- 1 - lot structural steel for the substation deadend structures, etc.
- 3- 500 kV CCVT
- 1 - lot 500 kV protection panels and cabinets
- 1 - lot transmission line poles or towers

COSTS:

Material	\$1.85 M
Labor	\$1.71 M
<u>Engineering</u>	<u>\$.70 M</u>
Subtotal	\$4.26 M

Note GPU charges for the TMI tower relocation at Hosensack to be invoiced separately, and is not included in these cost totals.

Project Schedule

Facilities Design	Jun 2001 – Nov 2001
Material Procurement	Mar 2001 – Feb 2002
Substation Construction	Sep 2001 – Aug 2002
Acceptance Testing	Jul 2002 – Dec 2002

First Energy Work

While PPL Utilities will be responsible for the substation work to implement this new attachment, FirstEnergy will be required to redesign and replace the existing line-end structure of the TMI-Hosensack (5026) 500 kV line to coordinate with this new configuration.

Proposed Design

FirstEnergy proposes to replace the existing TMI-Hosensack (5026) 500 kV tower structure that is adjacent to the Hosensack 500 kV yard with a new 500 kV “H-Frame” structure. The 5026 line will then be reterminated to an adjacent bay position at the Hosensack 500 kV substation. This will allow PPL Utilities to make all necessary modifications to the Hosensack 500 kV bus-work to support the Bethlehem Steel (B3) generation project. The estimated costs for the FirstEnergy work are as follows:

500 kV, “H-Frame” Deadend Structure – Estimated Installation Costs**Direct Materials**

Steel H-Frame Structure, 500 kV	\$	40,000
Reinforced Concrete Drilled Pier Foundations	\$	80,000
Conductor & Shield Wire	\$	15,000
Insulators, Buss, Fixtures and Hardware	\$	5,000
Sub-Total:	\$	140,000

Direct Labor

Engineering - New Structure	\$	5,000
Engineering – Substation	\$	3,000
Construction Management	\$	2,500
Structure Installation	\$	53,300

Conductor & Substation Attachment Installation	\$	35,000
Payroll Overhead	\$	21,736
Sub-Total:	\$	120,536

Indirect Expenses and Adders

Administrative and General [29.46%]	\$	35,510
Other Indirects [24.35%]	\$	29,350
Contingencies [10%]	\$	12,054
Sub-Total:	\$	76,914

Return [10.87%]	\$	36,681
AFUDC [6.88%]	\$	23,216

Total Construction Estimate	\$	397,347
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In summary, the total Direct Materials Charges are \$140,000, the total Direct Labor Charges are \$120,536, the total Indirect Costs are \$76,914, the Return is \$36,681 and the AFUDC is \$23,216. Note that these estimates do not include a CIAC tax gross-up. FirstEnergy will comply with all tax rules and federal and state policies in effect at the time when the Interim Service Agreement is executed.

Schedule - Milestones

Based on an agreement with PPL Energy to expedite this project, FirstEnergy initiated work on the TMI-Hosensack (5026) 500 kV line dead-end structure during the summer of 2001. Upon authorization from the developer and concurrence by PJM Operations regarding the planned 500 kV line outages, FirstEnergy proposes to proceed to complete its work for this project during the 2nd Quarter of 2002. Below are the major project milestones that have been defined. Please note that the limiting factor in this project is the PJM Operations approval of the planned TMI-Hosensack 500 kV line outage that is scheduled during April.

- 7/1/01 – Start Project
- 7/13/01 – Spec & Order Steel Structure & other long lead materials
- 10/17/01 – Begin Construction / Begin Foundation Installation
- 11/30/01 – **Delivery of 500 kV Structure**
- 12/10/01 – Begin Preparations for Steel Structure Erection
- 03/01/02 – Execute Interim Service Agreement with Developer to proceed
- 4/22/02 – **Begin 500 kV Outage to reconfigure 5026 Line termination**
- 4/26/02 – Complete and Test new Transmission Connections
- 5/01/02 – End Project

Materials

Below is a list of the types and quantities of the materials to be installed at the interconnection site. The list is provide for informational purposes and is not meant to be final:

- 500 kV “H-Frame” Engineered Steel Structure –1 each
- 500 kV Insulator Assemblies – 12 each
- 2493 ACAR Conductor – 1000 feet
- 18/9 Alumoweld Shield Wire – 400 feet
- Miscellaneous 500 kV Hardware including Numbering – 1 Lot

QUARRY 230/69 KV SUB

SCOPE:

The existing 230 KV Hosensack line will become the Steel City- Quarry 230 KV line.

The following relay systems are to be installed to protect the new line:

- a. A SEL- 311L current differential scheme using fiber optic as pilot1.
- b. A POTT using SEL-321 relay over fiber optic as pilot 2.
- c. New Prism A and B fiber optic cabinets.
- d. Bi-directional Direct transfer trip to Steel City over fiber optic.

Cost Estimate:

Material	\$ 90,000
Labor	\$210,000
Engineering	\$ 60,000
Subtotal	\$360,000

Project Schedule

Facilities Design	Jun 2001 – Sep 2001
Material Procurement	Jun 2001 – Sep 2001
Substation Construction	Mar 2002 – Oct 2002
Acceptance Testing	Jul 2002 – Dec 2002

ALBURTIS 500 kv SUB

Scope

- a. Upgrade the existing GE-MOD II relays and install an SEL-311L current differential relay scheme over fiber optic.
- b. Remove existing Westinghouse relays and add a POTT scheme using SEL-321 relay over fiber optic
- c. Expand Prism A and B fiber optic cabinets to install additional fiber optic channels.
- d. Provide DTT to Hosensack via fiber optic channels.

Cost Estimate

Material	\$ 36,000
Labor	\$262,000
Engineering	\$159,000
PPL Contribution	-407,000
Subtotal	\$ 50,000

(Note that PPL had planned to upgrade the relaying at Alburdis prior to Conectiv announcing it's Bethlehem powerplant project. The upgrades were estimated at \$407k, and the relaying work required at Alburdis to accommodate Conectiv's plant are estimated at \$457k. The Conectiv invoices for work at Alburdis sub will be credited \$407k for work PPL had already intended to perform, resulting in a net \$50,000 estimate for work at Alburdis due to the Conectiv project.)

Project Schedule

Facilities Design
Material Procurement
Substation Construction
Acceptance Testing

Jun 2001 – Sep 2001
Jun 2001 – Sep 2001
Jun 2002 – Dec 2002
Jul 2002 – Dec 2002

Description of Facilities (Transmission)

Purpose & Necessity

In order to tie Steel City substation to the electrical system, the 22 mile Hosensack-Quarry 230kv line will be cut approximately 2 miles from Quarry. These first 2 miles will continue to operate at 230kv, and will be renamed the Steel City-Quarry #1 230kv line. The remaining 20 miles will be operated at the line's design voltage of 500kv, and will be renamed the Hosensack-Steel City 500kv line. Approximately 0.3 mile of new 500kv line will be constructed at Hosensack, to re-route the Steel City line away from the Hosensack 230kv yard and into the Hosensack 500kv yard.

DESCRIPTION OF PROPOSED ROUTE, RATINGS, AND DESIGN CRITERIA

HOSENSACK – STEEL CITY 500 kV LINE

Convert the existing Hosensack – Quarry 500/230 kV Line by reterminating approximately 1,570 feet of newly constructed 500 kV line into the 500 kV yard at Hosensack Substation. At the new Steel City 500-230 kV Substation: cut the existing Hosensack – Quarry 500/230 kV Line and terminate approximately 925 feet of new 500 kV line into Steel City Substation. 19.7 miles of the existing line will be re-energized at 500 kV operation without any further modifications.

The line is equipped with three phases (one circuit) of 2 – 2,493 kcmil, 54/37 stranding, ACAR, double bundled conductors and two 19 # 9 alumoweld overhead ground wires.

INITIAL STEEL CITY – QUARRY #1 230 kV LINE

The remaining section of the existing Hosensack – Quarry Line will be terminated into the new Steel City 230 kV Substation. Approximately 1,775 feet of the existing 500 kV line will be reconstructed with a new single circuit, 230 kV line. The reconstructed section of line will be equipped with three 1,590 kcmil, 45/7 stranding, ACSR conductors and one ½ inch extra high strength steel overhead ground wire and one 0.8228 inch diameter fiber optic ground wire. This section of line is expected to be temporary, until the final double circuit connections are made for project D18.

The remaining 2 mile portion of existing 230 kV designed line (former Hosensack – Quarry 230 kV Line) will not require any modifications except that one existing ½ inch extra high strength steel overhead ground wire will be replaced with one new 0.8228 inch diameter fiber optic ground wire. The new fiber optic ground wire is required to provide relaying protection communication from Conectiv's Generators and the new Steel City Substation back to PPL's existing relay protection system.

FIBER OPTIC COMMUNICATIONS

To provide primary and backup relay protection, PPL will design and construct two independent fiber optic loops between Steel City and Quarry Substations. The project will involve portions of installation of OPGW on transmission structures and

ADSS cable on distribution poles, as necessary. This work is required to provide communication links between Steel City, Quarry and Hosensack substations for relay protection schemes associated with the bulk power outlet for Conectiv's proposed Steel City generation plant and the new Steel City Substation. The estimated cost of this fiber optic installation project is \$739,500.

RIGHT OF WAY WIDTH

HOSENSACK – STEEL CITY 500 kV LINE

The retermination at Hosensack Substation is on PPL Electric Utilities property. No right of way is required at this location. The line termination at Steel City Substation will require acquisition of approximately 400 feet of new 200-foot wide right of way.

STEEL CITY – QUARRY #1 230 kV LINE

The 1775 foot reconstruction of this line across Bethlehem landfill property will be completed on existing right of way, and will require no additional right of way.

FUTURE 500 kV RIGHT OF WAY TO MARTINS CREEK

Because of the relocation of the Steel City Substation to accommodate this generation, right of way getaway corridor for the future 500 kV line to Martins Creek must be relocated also. This will involve acquisition of approximately 4500' of 200-foot wide right of way.

ENVIRONMENTAL CONSIDERATIONS

STEEL CITY 500 & 230 kV LINE CONNECTIONS AT STEEL CITY

Natural Features

The proposed line connections will not affect any unique geological, scenic or natural areas. Minimal tree clearing is anticipated due to the previously disturbed nature of the site. Since wetlands are adjacent to the proposed substation site PPL's "Program for Vegetation Management" and Specification for Soil Erosion and Sedimentation Control on Transmission Line Rights of Way will be employed as appropriate. All required permits will be obtained prior to the start of construction.

Threatened and Endangered Species

PPL Electric Utilities has coordinated with various state and federal agencies to obtain information regarding threatened and endangered plant and animal species that might be present within the project area. The Pennsylvania Fish and Boat Commission reported that the wetlands adjacent to the proposed substation site were potential habitat for the Bog Turtle (*Clemmys muhlenbergii* – PA-endangered; Federal-threatened). However, additional research conducted by Conectiv Mid-Merit during the permit process for their generating station, indicated that Bog Turtles did not inhabit the wetlands.

HOSENSACK – STEEL CITY 500 kV LINE CONNECTION AT HOSENSACK

Natural Features

The proposed line connections will not affect any unique geological, scenic or natural areas. Due to the existence of wetlands between the existing Hosensack

230-138/69 kV Substation and 500 kV Switchyard, a consultant has been retained to delineate all wetlands. While all construction will take place outside the wetland area PPL is communicating with appropriate federal and state agencies to ensure all required permits are obtained prior to the start of construction. In addition, PPL's "Program for Vegetation Management" and Specification for Soil Erosion and Sedimentation Control on Transmission Line Rights of Way will be employed as appropriate.

Threatened and Endangered Species

PPL Electric Utilities has coordinated with various state and federal agencies to obtain information regarding threatened and endangered plant and animal species that might be present within the project area. The Pennsylvania Fish and Boat Commission reported that the wetlands in the project area are *confirmed* habitat for the Bog Turtle (*clommys muhlenbergii* – PA-endangered; Federal-threatened). PPL has designed the line routing of the Steel City line into the Hosensack 500kv yard to completely avoid wetlands and bog turtle habitat. To this extent, both the state and federal government have granted PPL a waiver for an aerial crossing of the wetlands at Hosensack.

PERMITS/APPROVALS REQUIRED

The PA Public Utilities Commission must certify the line connections discussed above. PPL has filed a Letter of Notification with the PUC on December 18, 2001.

PUC CERTIFICATION / RIGHT OF WAY ACQUISITION & ENVIRONMENTAL PERMITTING ESTIMATE

As requested the siting estimate for ER accounting numbers 168003 and 168004 was split between location (i.e. Hosensack and Steel City). One estimate was done for the entire project and is included with this package. Assumptions used to split the cost were to place 75% of the permitting costs at Hosensack (swamp and bog turtle issues) and 100% of the right-of-way costs at Steel City (right of way not required at Hosensack).

This estimate does NOT include the cost of future 500 kV right of way across the landfill.

SPECIFIC TRANSMISSION CONSTRUCTION

The following are the major materials and costs for the 230 kV and 500 kV connections for the Steel City project, exclusive of the fiber optics.

500 kV Connections at Hosensack and Steel City to establish the new Hosensack-Steel City 500 kV Line

1. 3 - three-pole fabricated self supporting steel pole structures with concrete foundations
2. 1 - two-pole fabricated self supporting steel pole structure with concrete foundations

3. 16000 feet of 2,493 kcmil, 54/37 ACAR conductor
4. 5300 feet of 19 no. 9 Alumoweld OHGW
5. 27 type H deadend assemblies
6. 6 type F v-string assemblies
7. 9 type M jumper assemblies
8. 580 cu. yds. of concrete
9. 64,400 pounds of rebar

230 kV Temporary Connection at Steel City to establish the Steel City-Quarry 230 kv Line

1. 1 - three pole fabricated self supporting steel pole structure with concrete foundations
2. 1 - single pole fabricated self supporting steel pole structure with concrete foundation
3. 5,700 feet of 1,590 kcmil 45/7 ACSR conductor
4. 3,800 feet of 1/2 inch EHS OHGW
5. 12 type S-85 deadend assemblies
6. 8 type S-69 deadend assemblies
7. 3 type S-52 suspension assemblies
8. 2 type S-44 suspension assemblies
9. 110 cu. yds. of concrete
10. 9700 pounds of rebar

The costs for the 500 kV connections:

1. Material	\$ 899,360
2. Labor	\$1,191,340
3. Overheads	\$ 65,300
SubTotal=	\$2,156,000

The costs for the 230 kV connections:

1. material	\$ 219,160
2. Labor	\$ 267,100
3. Overheads	\$ 59,240
SubTotal=	\$ 545,500

Siting Costs

Hosensack Substation	\$120,000
Steel City Substation	\$620,000
Subtotal=	\$740,000

Fiber Optic Costs

Labor, Material, overheads	\$739,500
----------------------------	-----------

Total Costs for Transmission:

Construction	\$2,701,500
Siting	\$ 740,000
Total=	\$3,441,500

Please note that these transmission cost estimates assume no interventions in the PUC Line Certification process. Any costs beyond the normal filing, siting, and right-of-way costs will be in addition to the charges noted above.

Project Schedule

Facilities Design	Aug 2001 – Mar 2002
Material Procurement	Aug 2001 – Apr 2002
Line Construction	Feb 2002 – Oct 2002

Network Upgrades

MARTINS CREEK 230KV SUBSTATION (PPL upgrades)

Scope:

- a) Several transmission system contingencies will overload the Martins Creek-Morris Park-Gilbert 230kv line once Conectiv's B3 plant goes online. To eliminate these contingencies, the line will be uprated from a 125°C temperature rating to a 160°C temperature rating. PPL Electric Utilities is responsible for approximately 1/3 mile portion of this line, from Martins Creek substation to the Delaware River. Field surveys have shown that sufficient clearances exist and no changes are required to operate this line at 160°C. In addition, no changes will be required to the Martins Creek terminal equipment. The new rating PPL's portion of this line will be 790mva summer normal, and 941mva summer emergency.
- b) The generation additions at Steel City sub, and the conversion of the Steel City-Hosensack line to 500kv will increase the phase-to-ground fault duty at Martins Creek 230 switchyard above the 50,000 amp duty rating of the buses and grounding system in the switchyard. The proposed solution involves two items. The first item is to use delta-ungrounded wye generator step-up transformers for project A12. The 230kv ungrounded wye transformer neutral will be protected against surges by additional winding insulation and a neutral lightning arrester. The additional transformer cost adder is expected to be approximately \$250,000, which is fully attributable to the B3 developer. The second item is to upgrade the Martins Creek 230kv switchyard grounding system to 63,000 amp duty rating. The cost of this work is expected to be approximately \$140,000, which should be shared between the B3 developer and the A12 developer.
- c) Due to the extremely high fault currents at Martins Creek, the effects of DC offset and high protective relay circuit burden, several sets of Current Transformers on various circuit breakers at Martins Creek could saturate during a close in high magnitude fault condition. When CTs saturate, protective relaying connected to the CT may fail to respond for the given fault condition. The CT saturation problem is more likely to occur when fault currents exceed 50,000 amperes. As such, five 230kv lines at Martins Creek will require relay upgrades and/or modifications to assure proper breaker clearing for high magnitude phase faults. The cost exposure

for this item is on the order of \$150,000 and should be shared between the B3 developer and the A12 developer.

Cost Estimate (PPL Work):

B3 Allocation

160°C rating on MC-MP-Gilbert line	\$ 0		
Unground the A12 GSU's	\$250,000	100%	\$250,000
Upgrade MC grounding system	\$140,000	40.8%	\$ 57,120
Upgrade/modify 5 MC relays	\$150,000	40.8%	\$ 61,200
Total:	\$540,000		\$368,320

Project Schedule

Facilities Design	Dec 99 – Jan 02
Material Procurement	Feb 99 – Jun 02
Substation Construction	Mar 01 – Nov 02
Acceptance Testing	Nov 02

Martins Creek-Gilbert Line (FirstEnergy Work)

Background

The PJM Impact Study for the Bethlehem Steel (B3) 500 kV generation project identified the need for several system reinforcements in addition to the defined direct attachment facilities. This included an upgrade of the Martins Creek-Morris Park (P2016) 230 kV circuit to a 160 degrees centigrade operation to achieve an emergency conductor rating of 888 MVA. Based on the FirstEnergy review during the Impact Study, it was identified that there is sufficient ground clearance to accommodate this higher rating. However, a further analysis is needed to determine the acceptability of this rating change and its impact on the reliability of the transmission system. Should an engineering analysis find that an excessive degradation and loss-of-life of the P2016 circuit will result from implementing a higher rating, a conductor of the second side of the Martins Creek-Morris Park double circuit 230 kV tower line will be required.

Thermal Line Ratings

The FirstEnergy engineering staff has reviewed the increase in thermal rating of the Martins Creek-Gilbert (P2016) 230 kV circuit required for the initial phase of the Bethlehem Steel (B3) project. Based on an engineering analysis, it has been determined that this action will not violate any minimum ground clearance requirements and therefore is feasible. However, by increasing the Martins Creek-Morris Park 230 kV line rating from 125° C to 160° C (resulting in a 753/888 MVA normal/4-hour rating) the additional thermal loading can cause a significant annealing of the conductor and therefore decrease the effective life of the circuit.

It is estimated that the impact of increasing the Martins-Creek-Morris Park 230 kV line rating to a 160° C is to roughly result in a 10% loss of life of the circuit for each occurrence

that the circuit flow reaches the emergency rating. This is not deemed acceptable as a permanent condition. However, FirstEnergy recognizes that a second phase of the Bethlehem Steel project (D18) is being planned for service shortly after the initial (B3) phase is complete. The Impact Study for this D18 project has defined that it will require a system reinforcement to conductor and parallel the second side of the Martins Creek-Morris Park double circuit tower line with the existing circuit. This will therefore eliminate the need to upgrade the rating of the existing Morris Park-Gilbert 230 kV line and alleviate the FirstEnergy concerns.

As a compromise measure given that the second phase of the Bethlehem Steel project is proceeding through the RTEP process, FirstEnergy will allow a rerating of the Martins Creek-Gilbert 230 kV line to an 888 MVA 4-hour rating on an interim basis under two conditions. (1) If the paralleling of the Martins Creek-Morris Park 230 kV circuit does not occur within 2 years, FirstEnergy will be allowed to revisit the loading and conductor loss-of-life issues and make whatever line modifications it deems appropriate - including the addition of a second conductor on the vacant side of the Martins Creek-Morris Park double circuit tower line. (2) Any resultant modifications will be at the developer's expense. FirstEnergy bases this agreement on the expectation that there will be a minimal exposure to flows on the Martins Creek-Morris Park 230 kV line that exceed its normal rating.

SECTION III: SUMMARY

Costs

Direct Connection

Steel City costs	\$21.56 M
Hosensack costs	\$ 4.26 M
Quarry, & Alburtis costs	\$.41 M
Transmission Siting/Permitting costs	\$.74 M
Fiber Optic costs	\$.74 M
Transmission Design/Construction costs	\$ 2.70 M
Hosensack Tower Relocation (First Energy)	\$.40 M
Total direct connect for B3 project:	\$30.82 M

Network Upgrades

Martins Creek fault duty upgrades	\$368,320
MC-MP-Gilbert 230kv line upgrade	\$ 0
Total network upgrades for B3 project:	\$368,320

Please note that these substation and transmission cost estimates assume no legal interventions by third parties. If such third party interventions occur, the costs to investigate and resolve them will be in addition to the cost estimates noted above.

Cost breakdown for FERC filing (direct/indirect charges)

The estimated total costs for the direct attachment facilities are \$31,185,267. The breakdown of costs is:

• Direct Charges Labor -	\$13,329,453
• Direct Charges Material -	\$14,478,250
• Salvage Credit -	\$ 10,400
• Indirect Charges -	\$ 3,328,067
• Carrying Charges (PPL)-	\$0***
• Carrying Charges (FirstEnergy)	\$ 23,216
• Return (FirstEnergy)	\$ 36,681
	<u>\$31,185,267</u>

***Since costs associated for this project will be invoiced on a monthly basis, carrying charges are anticipated to be zero.

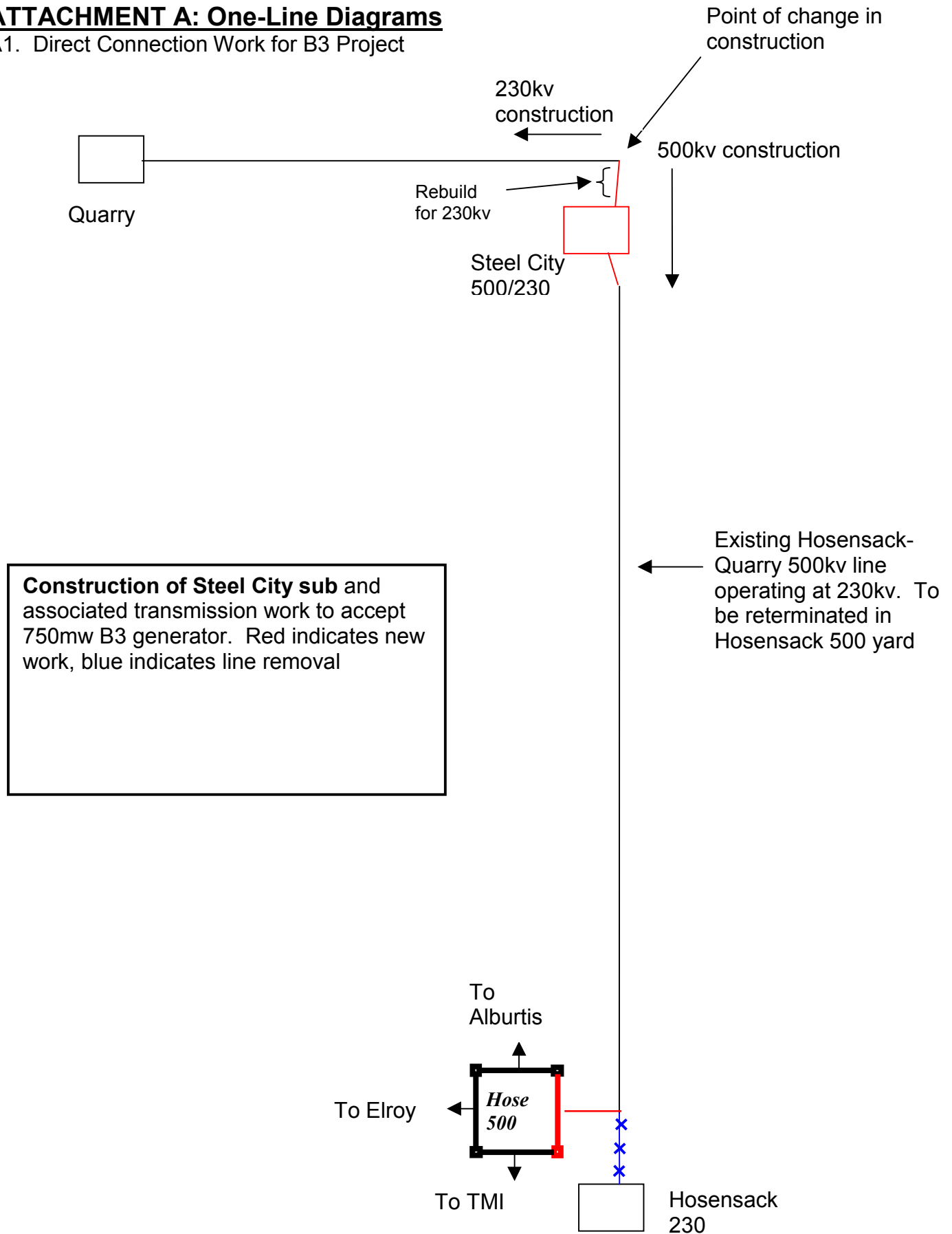
The estimates do not include cost escalation due to inflation, federal or state taxes. Where applicable, federal and state taxes will be added to the monthly invoice.

SECTION IV: ATTACHMENTS

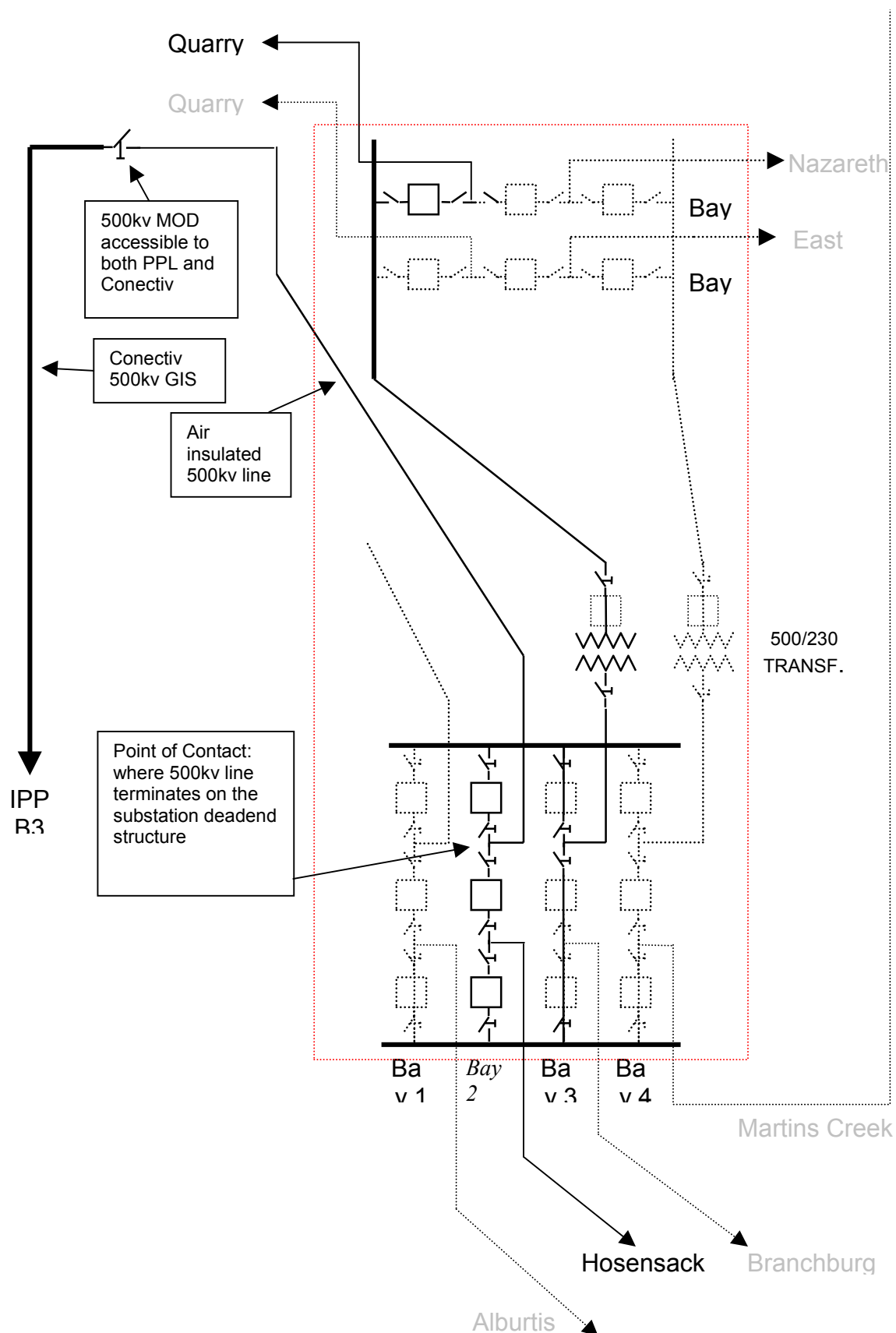
- A. One-Line Diagrams
- B. Engineering Drawings list
- C. Hosensack Tower Drawings

ATTACHMENT A: One-Line Diagrams

A1. Direct Connection Work for B3 Project



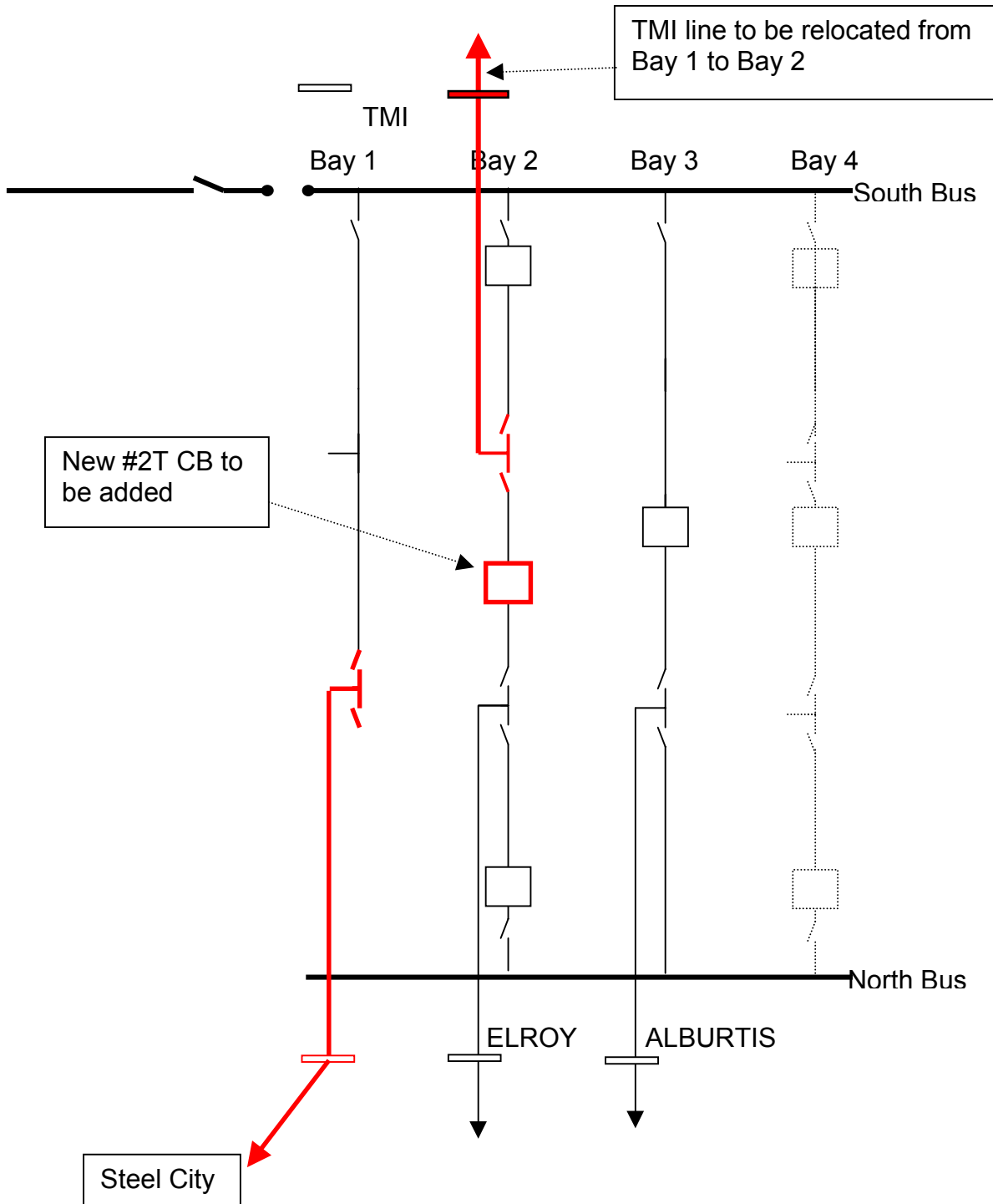
A2. Steel City Phase 1 Design: Direct Attachment Facilities



A3. Proposed changes to Hosensack 500kv sub

For connection of Steel City line

(Physical one-line diagram)



ATTACHMENT B: Engineering Drawings List

In Stock	Site	Drawing #	Sheet	Revision	Print Title
		317002 shts. 1-4	Load & Design str. 1 (500 kV)		
		317003 shts. 1-4	L&D str. 2 (500 kV)		
		317004 shts. 1-4	L&D str. 4 (500 kV)		
		317005 shts. 1-4	L&D str. 5 (500 kV)		
		317006 shts. 1-4	L&D str. 6 (230 kV)		
		317007 shts. 1-4	L&D str. 7 (230 kV)		
		317008 shts. 1-20	Steel Pole Manufacturer's Details (500 & 230)		
		317009 shts. 1-11	Construction Foundation Data (500 kv)		
		317010	Foundation Dwg (500 kV)		
		317011 shts. 1-4	Constr. Fdn. Data (230 kV)		
		317012	Fdn. Dwg. (230 kV)		
		317013	Structure Layout plan (500 kV)		
		317014	Str. Layout Plan (230 kV)		
		317015	Plan/Profile (500 kV)		
		317016	Plan/Profile (230 kV)		
		317017	Stringing Tables (500 kV)		
		317018	Stringing Tables (230 kV)		
		317019	One Line Diagram (230 & 500 kV)		
No					
Yes	Alburtis	A 077512	all		Bill of material
Yes	Alburtis	A 165553	all	0	Relay and Control Bill of Material
Yes	Alburtis	A 165937	11B	5	500KV Panel 5C Nameplate
Yes	Alburtis	A 165937	11D	1	500KV Panel 5C Nameplate
Yes	Alburtis	A 165937	12	3	500KV Panel 5R Nameplate
Yes	Alburtis	A 165937	1A	4	Nameplate Schedule- Index
Yes	Alburtis	A 165937	1A	4	Nameplate Schedule-Index
Yes	Alburtis	A 165937	49	1	Hosensack Line- Pilot 1 Nameplate
Yes	Alburtis	A 165937	49A	2	Hosensack Line- Pilot 1 Nameplate
Yes	Alburtis	A 165937	49B	0	Hosensack Line- Pilot 1 Nameplate
Yes	Alburtis	A 165937	50	1	Hosensack Line- Pilot 2 Nameplate
Yes	Alburtis	A 165937	50A	0	Hosensack Line- Pilot 1 Nameplate
Yes	Alburtis	A 165937	50B	0	Hosensack Line- Pilot 1 Nameplate
Yes	Alburtis	A 165937	55	1	Nameplate Schedule
Yes	Alburtis	A 165937	56	1	Nameplate Schedule
Yes	Alburtis	A 217408	all	11	AMS Point Assignment Sheets
Yes	Alburtis	B 077509	all		Cable and conduit list
Yes	Alburtis	B 197038	1	2	Alburtis 500KV Substation
Yes	Alburtis	B 197039	1	2	Alburtis 500KV Substation
Yes	Alburtis	B 245516	1	2	Wave trap replacement hardware
Yes	Alburtis	D 165546	1	4	Alburtis 500KV Substation
Yes	Alburtis	D 165926	1	4	Hosensack Line DTT Reciever
Yes	Alburtis	D 165927	1	4	Hosensack Line DTT Reciever
Yes	Alburtis	D 165928	1	4	500KV Hosensack Line Backup
Yes	Alburtis	D 165932	1	5	Breaker Column Failure Protection
Yes	Alburtis	D 165933	1	5	CT Column Failure Protection 3B-CE
Yes	Alburtis	D 165935	1	3	500KV Elementary Diagram Primary

Yes	Albrtis	D 165966	1	4	Alburtis 500KV Substation Motor
Yes	Albrtis	D 165967	1	2	Alburtis 500KV Substation Motor
Yes	Albrtis	D 180197	1,17		Carrier Communications Diagram
Yes	Albrtis	D 217402	1	6	Carrier and DTT Test PC 14C
Yes	Albrtis	D 217405	1	5	Loss of Potential and CCVT
Yes	Albrtis	D 241396	1	5	Prism A Fibe Optic Communication
Yes	Albrtis	D 244553	1	6	Remote Relay Communications
Yes	Albrtis	D 245662	1	4	Prism B Fiber Optic Communication
Yes	Albrtis	D 314592	1	0	Hosensack Line- Pilot 1
Yes	Albrtis	E 081508	1	17	500KV Control Panel 1C Thru
Yes	Albrtis	E 081509	1	17	500KV Relay Panels 1R Thru
Yes	Albrtis	E 165512	1	6	Three line diagram
Yes	Albrtis	E 165515	1	7	500/230KV Transformer 1 Current
Yes	Albrtis	E 165516	1	10	500/230KV Transformer 1
Yes	Albrtis	E 165517	1	8	500KV Switchyard Bay 3
Yes	Albrtis	E 165520	1	10	Synchronizing Elementary Diagram
Yes	Albrtis	E 165527	1	10	500KV CB Bat 3T Control
Yes	Albrtis	E 165529	1	7	500KV MOAB'S 3TW and 3TE
Yes	Albrtis	E 165531	1	9	CB 3T Breaker Failure, Breaker
Yes	Albrtis	E 165554	1	8	500KV Control Panel 2C Front View
Yes	Albrtis	E 165827	1	8	500KV Circuit Breaker Bay 3T
Yes	Albrtis	E 165828	1	11	500KV Control Panel 4C Front View
Yes	Albrtis	E 165829	1	7	500KV Wiring Diagram Relay Panel
Yes	Albrtis	E 165929	1	5	500KV CB BAT 3EW and 3EE
Yes	Albrtis	E 165930	1	7	500KV CB BAT 3E Control
Yes	Albrtis	E 165931	1	6	CB 3E Breaker Failure Protection
Yes	Albrtis	E 165934	1	10	500KV Elementary Diagram Primary
Yes	Albrtis	E 165936	1-6		500KV Elementary Diagram
Yes	Albrtis	E 165950	1	11	500KV Control Panel 5C Front View
Yes	Albrtis	E 165950	2	0	500KV Control Panel 5C Front View
Yes	Albrtis	E 165951	1	10	500KV Relay Panel 5R Front View
Yes	Albrtis	E 165963	1	9	Hosensack 500KV Line Pilot 1
Yes	Albrtis	E 165964	1	8	Hosensack 500KV Line Pilot 2
Yes	Albrtis	E 165965	1	7	Direct Trip Transfer Carrier
Yes	Albrtis	E 165968	1	6	500KV CB3E Control Cabinet
Yes	Albrtis	E 217541	1	9	500KV 230KV Control Panel 15C
Yes	Albrtis	E 217542	1	11	500KV 230KV Relay Panel 15R
Yes	Albrtis	E 232538	1	8	500KV 230KV Control Panel 14C
Yes	Albrtis	E 232539	1	9	500KV 230KV Relay Panel 14R
Yes	Albrtis	E 241238	1	7	Prism A Fiber Optic Communications
Yes	Albrtis	E 244960	1	4	Prism B Fiber Optic Communications
Yes	Albrtis	E 311618	1	2	Branchburg Line Carrier Cabinet
Yes	Albrtis	E 314593	1	0	Hosensack Line- Pilot 2 Line Current
Yes	Albrtis	E 314673	1	3	Digital Fault Recorder FV & WIR
Yes	Albrtis	F 077502	all		500KV switchyard electrical
Yes	Albrtis	F 077506	all		Control Cubicle Arrangement
Yes	Albrtis	F 077513	all		500KV Sections and Details
Yes	Albrtis	F 081496	3	17	500KV Equipment Wiring Diagram
Yes	Albrtis	F 081539	1	20	500KV Control Panel 16C Wiring

Yes	FibrOptx	B 317588	1-11		Relay and Control Sonet Nodes
Yes	FibrOptx	B 317589	1-13		Relay and Control Sonet Nodes
Yes	FibrOptx	D 239901	1	5	Fiber Optic Elementary Drawing
Yes	FibrOptx	E 242867	1,4		Fiber Optic Elementary Relaying
Yes	Fmnsbg	A 190974	all		concrete specs- material
Yes	Fmnsbg	A 190975	all		concrete specs- placement
No	Fmnsbg	A 203649	4-5		Material List
No	Fmnsbg	A 203649	4-5	0	bay 3L bill of material
Yes	Fmnsbg	A 204071	36-42		Material List
Yes	Fmnsbg	A 245436	1 to 11	2	SCADA point assignment sheets
Yes	Fmnsbg	A 245606	5	0	R&C Material List
Yes	Fmnsbg	A 245883	1-9		Description or R&C
Yes	Fmnsbg	A 245883	9	1	Description of Relaying and
Yes	Fmnsbg	B 204072	2-3, 14		Freemansburg 69-12KV Substation
Yes	Fmnsbg	B 204074	4-5		Freemansburg 69-12KV Substation
Yes	Fmnsbg	B 220661	all		Freemansburg 69-12KV Substation
Yes	Fmnsbg	C 245437	1	1	Freemansburg MODBUS Plus Loop
Yes	Fmnsbg	C 317587	1	0	Freemansburg 12KV CB Bay 3L
Yes	Fmnsbg	D 203639	1	2	Freemansburg foundation & fence
Yes	Fmnsbg	D 203657	1	3	Freemansburg 69-12KV Substation
Yes	Fmnsbg	D 203663	1	2	Freemansburg 69-12KV Substation
Yes	Fmnsbg	D 203664	1	4	Freemansburg 69-12KV Substation
Yes	Fmnsbg	D 203665	1	3	Freemansburg 69-12KV Substation
Yes	Fmnsbg	D 204069	1	2	Freemansburg 69-12KV Substation
Yes	Fmnsbg	D 204070	1	2	Freemansburg 63-12KV Substation
Yes	Fmnsbg	D 204073	1	3	Freemansburg 69-12KV Substation
Yes	Fmnsbg	D 204075	1-2	3	Freemansburg 69-12KV Substation
Yes	Fmnsbg	D 204084	1	2	Freemansburg 69-12KV Substation
Yes	Fmnsbg	D 204268	1	2	Freemansburg 69-12KV Substation
Yes	Fmnsbg	D 245438	all		Freemansburg SCADA Control Elem.
Yes	Fmnsbg	D 317585	1	0	Freemansburg 12KV CB Bay 3L
Yes	Fmnsbg	D 317586	1	0	Freemansburg 12KV CB Bay 3L
Yes	Fmnsbg	E 245440	1	1	Freemansburg SCADA Cabinet
Yes	Hosnsak	A 083416	1-3		Line Tuner Box for 4CLO2B1G1DL
Yes	Hosnsak	A 083417	1-3		Line Tuner Box for 4CLO2B2G2DL
Yes	Hosnsak	A 118606	all		Material List
No	Hosnsak	A 118668	10	1	list of reinforcing (SS5A & BB2A)
No	Hosnsak	A 118668	11	0	list of reinforcing (CB & fdn A & B)
No	Hosnsak	A 118668	9	0	rebar details BB1A foundation
Yes	Hosnsak	A 118668	9-11		Hosensack 500KV Substation
Yes	Hosnsak	A 118671	2	0	Hosensack 500KV Substation
No	Hosnsak	A 118671	2	0	anchor bolt details
No	Hosnsak	A 184437	5	0	B/M foundation material
Yes	Hosnsak	A 184437	5-7		Material List
No	Hosnsak	A 184437	6	0	B/M foundation material
No	Hosnsak	A 184437	7	0	B/M structures
Yes	Hosnsak	A 184714	43-58		Bill of Material
Yes	Hosnsak	A 190974	all		Concrete Materials Specification
No	Hosnsak	A 190974	all		concrete specs - material

Yes	Hosnsak	A 190975	all		Concrete Placement Specification
Yes	Hosnsak	A 235622	1	1	Carrier Checkback Panel
Yes	Hosnsak	A 235623	1	1	Panel AMS Alarm Management
Yes	Hosnsak	A 314076	all		Digital Fault Recorder Point
Yes	Hosnsak	A 316492	all		Scada Point Assignment Sheets
Yes	Hosnsak	A 316987	1-6		Panel 2P Nameplate Schedule
Yes	Hosnsak	A 316988	1-6		Panel 2B Nameplate Schedule
Yes	Hosnsak	A 316989	1-7		Panel 3P Nameplate Schedule
Yes	Hosnsak	A 316990	1-6		Panel 3B Nameplate Schedule
Yes	Hosnsak	A 317583	1	0	Panel 14P Nameplate Schedule
Yes	Hosnsak	A 317584	1-2		Panel 14B Nameplate Schedule
Yes	Hosnsak	A 317597	1-7		Panel 4P Nameplate Schedule
Yes	Hosnsak	A 317598	all		Panel 4B Nameplate Schedule
Yes	Hosnsak	A 317603	all		Panel 5P Nameplate Schedule
Yes	Hosnsak	A 317604	all		Panel 5B Nameplate Schedule
Yes	Hosnsak	A 317617	1	0	Panel AMS1 Nameplate Schedule
Yes	Hosnsak	B 118601	all		Hosensack 500KV Substation
Yes	Hosnsak	B 118700	1-8		Hosensack 500KV Substation
Yes	Hosnsak	C 118609	2-5,7		Hosensack 500KV Substation
Yes	Hosnsak	C 118610	1-2		Hosensack 500KV Substation
Yes	Hosnsak	C 184438	1	1	Hosensack 500KV Substation
Yes	Hosnsak	C 191351	1	4	Telemetry Reciever Elementary
Yes	Hosnsak	C 205447	1	2	Miscellaneous AMS Alarms
Yes	Hosnsak	C 316049	1	0	500KV CB Bay 2T Breaker
Yes	Hosnsak	D 118712	1	9	500KV Switchyard Elementary
Yes	Hosnsak	D 118722	1	3	Hosensack Substation 500KV
Yes	Hosnsak	D 118734	1	4	Hosensack Substation 500KV
Yes	Hosnsak	D 118735	1	6	Hosensack Substation 500KV
Yes	Hosnsak	D 118736	1	5	MOAB AUX SW & JCT Box
Yes	Hosnsak	D 118743	1	5	500KV Switchyard Equipment
Yes	Hosnsak	D 183148	1	1	Hosensack 500KV Substation
Yes	Hosnsak	D 184485		0	Hosensack 500KV Substation
Yes	Hosnsak	D 184658	1	2	CB 3T Breaker Trouble Alarm
Yes	Hosnsak	D 184692	1	3	MOD 3SS Equipment Wiring
Yes	Hosnsak	D 184693	1	2	MOD 3TN Equipment Wiring
Yes	Hosnsak	D 184695	1	3	Hosensack 500KV Substation
Yes	Hosnsak	D 184697	1	2	MOAB Motor Operated Air Break
Yes	Hosnsak	D 184698	1	2	MOAB Motor Operated Air Break
Yes	Hosnsak	D 184699	1	2	CB 2N Breaker Trouble Alarm
Yes	Hosnsak	D 184700	1	2	Circuit Breaker 2N Current
Yes	Hosnsak	D 184705	1	2	Circuit Breaker 2S Current
Yes	Hosnsak	D 191339	1	3	500KV Switchyard Telemetry
Yes	Hosnsak	D 205476	1	5	Carrier DTT Direct Transfer Trip
Yes	Hosnsak	D 218928	1	2	500KV Panels AMS1 and AMS2
Yes	Hosnsak	D 221713	2	1	Juniata 500-230KV Substation
Yes	Hosnsak	D 235624	1	4	AMS Alarm Management System
Yes	Hosnsak	D 239901	14	2	Hosensack 500KV Substation Fiber
Yes	Hosnsak	D 314881	1	0	Remote Relay Communication and
Yes	Hosnsak	D 315225	1	0	Prisim A Fiber Optic

Yes	Hosnsak	D 315226	1	0	Prism B Fiber Optic Communications
Yes	Hosnsak	D 315460	all		SCADA Control Elementary
Yes	Hosnsak	D 316047	1	0	500Kv CB Bay 2S CB and CT
Yes	Hosnsak	D 316048	1	0	500KV CB Bay 2N CB and CT
Yes	Hosnsak	D 316050	1	0	500KV CB Bay 3T CB and CT
Yes	Hosnsak	D 316061	1	0	Steel City Line Pott Relaying
Yes	Hosnsak	D 316117	1	0	Elroy Line Carrier Unblocking
Yes	Hosnsak	D 316428	all		500KV Panels 2P and 2B Front
Yes	Hosnsak	D 316429	all		Panels 3P and 3B Front Views
Yes	Hosnsak	D 316430	1-2		Panels 4P and 5P Front Views
Yes	Hosnsak	D 316431	1-2		Panels 5P and 5B Front Views
Yes	Hosnsak	D 316432	1-2		Panel 14P & 14B Front View
Yes	Hosnsak	D 316432	2	0	500KV Panels 14P & 14B Front
Yes	Hosnsak	D 316522	1	0	Switchyard Cable Termination
Yes	Hosnsak	D 316523	1	0	Switchyard Cable Termination
Yes	Hosnsak	D 316544	1	0	TMI 500KV Line Backup Relaying
Yes	Hosnsak	D 316580	1	0	Elroy 500KV Line Backup Relaying
Yes	Hosnsak	D 316581	1	0	Alburtis 500KV Line Pott
Yes	Hosnsak	D 316647	1	0	Bay 2T 500KV MOD 2TS Control
Yes	Hosnsak	D 316648	1	0	Bay 2T 500KV MOD 2TN Control
Yes	Hosnsak	D 316815	1	0	Hosensack 500KV Substation
Yes	Hosnsak	D 316920	1	0	500KV Carrier Checkback Panel
Yes	Hosnsak	D 317092	1-5		MOD 2TN Wiring Diagram
Yes	Hosnsak	D 317093	1-5		MOD 2TS Wiring Diagram
Yes	Hosnsak	E 118590	1	7	Hosensack 500KV Substation
Yes	Hosnsak	E 118591	1	3	Hosensack 500KV Substation
Yes	Hosnsak	E 118592	1	3	Hosensack 500KV Substation
Yes	Hosnsak	E 118593	2-3		Hosensack 500KV Substation
Yes	Hosnsak	E 118594	1	3	Hosensack 500KV Substation
Yes	Hosnsak	E 118595	1	7	Hosensack 500KV Substation
Yes	Hosnsak	E 118596	1	3	Hosensack 500KV Substation
Yes	Hosnsak	E 118598	1	10	Hosensack 500KV Substation
Yes	Hosnsak	E 118599	1-2		Hosensack 500KV Substation
Yes	Hosnsak	E 118602	1	13	Hosensack 500KV Substation
Yes	Hosnsak	E 118605	1	6	Hosensack 500KV Substation
Yes	Hosnsak	E 118620	1	3	Hosensack 500KV Substation
Yes	Hosnsak	E 118621	1	7	Hosensack 500KV Substation
Yes	Hosnsak	E 118622		3	Hosensack 500KV Substation
Yes	Hosnsak	E 118624	all		Hosensack 500-230KV Substation
No	Hosnsak	E 118625		1	original structural shop drawings
No	Hosnsak	E 118626		1	original structural shop drawings
No	Hosnsak	E 118627		1	original structural shop drawings
No	Hosnsak	E 118628		1	original structural shop drawings
No	Hosnsak	E 118629		2	original structural shop drawings
No	Hosnsak	E 118630		1	original structural shop drawings
No	Hosnsak	E 118631		1	original structural shop drawings
No	Hosnsak	E 118632		1	original structural shop drawings
No	Hosnsak	E 118633		1	original structural shop drawings
No	Hosnsak	E 118634		1	original structural shop drawings

No	Hosnsak	E 118635		1	original structural shop drawings
No	Hosnsak	E 118636		1	original structural shop drawings
No	Hosnsak	E 118637		1	original structural shop drawings
No	Hosnsak	E 118638		1	original structural shop drawings
No	Hosnsak	E 118639		2	original structural shop drawings
No	Hosnsak	E 118640		1	original structural shop drawings
No	Hosnsak	E 118641		1	original structural shop drawings
No	Hosnsak	E 118642		1	original structural shop drawings
No	Hosnsak	E 118643		1	original structural shop drawings
No	Hosnsak	E 118644		1	original structural shop drawings
No	Hosnsak	E 118645		2	original structural shop drawings
No	Hosnsak	E 118646		1	original structural shop drawings
No	Hosnsak	E 118647		1	original structural shop drawings
No	Hosnsak	E 118648		1	original structural shop drawings
No	Hosnsak	E 118649		1	original structural shop drawings
Yes	Hosnsak	E 118650		1	Hosensack 500KV Substation
Yes	Hosnsak	E 118651		2	Hosensack 500KV Substation
Yes	Hosnsak	E 118653	1	2	Hosensack 500KV Substation
Yes	Hosnsak	E 118656			Hosensack 500KV Substation
Yes	Hosnsak	E 118657		1	Hosensack 500KV Substation
Yes	Hosnsak	E 118701	1	4	Hosensack 500KV Substation
Yes	Hosnsak	E 118703	1	9	Bay 2 Potential Elementary Diagram
Yes	Hosnsak	E 118704	1	10	Three Mile Island 500KV Line South
Yes	Hosnsak	E 118705	1	12	CB 2S Control Elementary
Yes	Hosnsak	E 118732	1	11	500KV Switchyard Equipment
Yes	Hosnsak	E 118737	1	3	Hosensack 500KV Substation
Yes	Hosnsak	E 118750	1-5		Digital Fault Recorder Wiring Diag
Yes	Hosnsak	E 170335			500KV Switchyard
Yes	Hosnsak	E 184651	1	6	Bay 3 Current Elementary Diagram
Yes	Hosnsak	E 184652	1	7	Bay 3 Potential Elementary Diagram
Yes	Hosnsak	E 184659	all		CB 3T Control Elementary
Yes	Hosnsak	E 184660	1	6	MOD 3TN Control Elementary
Yes	Hosnsak	E 184664	1	5	Bay 2 Current Elementary Diagram
Yes	Hosnsak	E 184665	1	8	500KV Circuit Breaker 2N Control
Yes	Hosnsak	E 184666	1	6	Motor Operated Air Break Type
Yes	Hosnsak	E 184673	1	4	Bay 1 Current Elementary
Yes	Hosnsak	E 184690	1	6	CB-3T Cab Equipment Wiring Diag
Yes	Hosnsak	E 184691	1	2	Hosensack 500KV Substation
Yes	Hosnsak	E 184696	1	5	CB-2N Control Cab Equipment
Yes	Hosnsak	E 184704	1	5	Motor Operated Air Break 2SN and
Yes	Hosnsak	E 185677	1	5	MOD 3SS Control Elementary
Yes	Hosnsak	E 218926	1	6	Panel AMS1 Wiring Diagram
Yes	Hosnsak	E 218926	2	2	Carrier Checkback Panel Wiring
Yes	Hosnsak	E 218927	1-2		Panel AMS2 Wiring Diagram
Yes	Hosnsak	E 315218	1-2		Prism A Fiber Optic Communications
Yes	Hosnsak	E 315219	1-2		Prism B Fiber Optic
Yes	Hosnsak	E 315410	1	0	Programmable Controller Network
Yes	Hosnsak	E 315411	all		Ethernet and MODBUS Plus
Yes	Hosnsak	E 315412	1	0	Panels 2P to 14P Front Views

Yes	Hosnsak	E 315413	1	0	Panels 2B to 14B Front Views
Yes	Hosnsak	E 315422	all		PC A Control Elementary
Yes	Hosnsak	E 315423	all		PC B Control Elementary
Yes	Hosnsak	E 316005	1	0	Termination Cabinet 1 Wiring
Yes	Hosnsak	E 316006	1	0	Termination Cabinet 2 Wiring
Yes	Hosnsak	E 316060	1	0	Steel City Line
Yes	Hosnsak	E 316115	1	0	TMI Line Primary Carrier Blocking
Yes	Hosnsak	E 316116	1	0	Elroy Line Primary Carrier Blocking
Yes	Hosnsak	E 316420	1	0	CB 2T Primary and Backup Trip
Yes	Hosnsak	E 316421	all		CB 2T Close Control Elementary
Yes	Hosnsak	E 316422	1	0	CB 2T AC Control Elementary
Yes	Hosnsak	E 316423	1	0	CB 2T Equipment Legend
Yes	Hosnsak	E 316433	1-2		500KV Panel 2P Wiring Diagram
Yes	Hosnsak	E 316434	1-2		500KV Panel 2B Wiring Diagram
Yes	Hosnsak	E 316435	1-2		500KV Panel 3P Wiring Diagram
Yes	Hosnsak	E 316436	1-2		500KV Panel 3B Wiring Diagram
Yes	Hosnsak	E 316437	1-2		500KV Panel 4P Wiring Diagram
Yes	Hosnsak	E 316438	1-2		50KV Panel 4B Wiring Diagram
Yes	Hosnsak	E 316439	1-2		500KV Panel 5P Wiring Diagram
Yes	Hosnsak	E 316440	1-2		500KV Panel 5B Wiring Diagram
Yes	Hosnsak	E 316441	1-2		500Kv Panel 14P Wiring Diagram
Yes	Hosnsak	E 316442	1-2		500KV Panel 14B Wiring Diagram
Yes	Hosnsak	E 316471	1	0	Bay 2 TI/O 3E Control Elementary
Yes	Hosnsak	E 316472	1	0	Bay 2 TI/O 2F Control Elementary
Yes	Hosnsak	E 316482	1	0	Bay 3 TI/O 3E Control Elementary
Yes	Hosnsak	E 316483	1	0	Bay 3 TI/O 3F Control Elementary
Yes	Hosnsak	E 316487	1	0	Bay 1 TI/O 1C Control Elementary
Yes	Hosnsak	E 316488	1	0	Bay 1 TI/O 1D Control Elementary
Yes	Hosnsak	E 316587	1	0	TMI 500KV Line Directional
Yes	Hosnsak	E 316635	1	0	Steel City 500KV Line TI/O 1A
Yes	Hosnsak	E 316636	1	0	Steel City 500KV Line TI/O 1B
Yes	Hosnsak	E 316637	1	0	Elroy 500KV Line TI/O 2C Control
Yes	Hosnsak	E 316638	1	0	Elroy 500KV Line TI/O 2D Control
Yes	Hosnsak	E 316639	1	0	TMI 500KV Line TI/O 2A Control
Yes	Hosnsak	E 316640	1	0	TMI 500KV Line TI/O 2B Control
Yes	Hosnsak	E 316641	1	0	Alburtis 500KV Line TI/O 3C
Yes	Hosnsak	E 316642	1	0	Alburtis 500KV Line TI/O 3D
Yes	Hosnsak	E 316653	1	0	Alburtis 500KV Line Primary
Yes	Hosnsak	E 316654	1	0	Elroy 500KV Line Directional
Yes	Hosnsak	E 316921	1-2		Panel AMS1 Wiring Diagram
Yes	Hosnsak	E 317029	1	0	CB Bay 2N CCVT Switchbox
Yes	Hosnsak	E 317091	1-7		CB 2T Wiring Diagram
Yes	Quarry	A 070742	186-	0	Material List
Yes	Quarry	A 070742	188	0	bill of material
Yes	Quarry	A 207902	15-28	0	Material List - Relay Upgrade
Yes	Quarry	A 228879	all		Quarry 230-69KV Substation
Yes	Quarry	B 070741	28-		Quarry Substation
Yes	Quarry	B 077275	1	4	Quarry Substation Hosensack 1
Yes	Quarry	B 077275	1	4	Quarry Substation Hosensack 1

Yes	Quarry	B 157886	9,17	2	Quarry 230-69KV SUBstation
Yes	Quarry	C 072685	1	3	Quarry Substation
Yes	Quarry	D 070779	1	16	Quarry 230KV-69KV Substation
Yes	Quarry	D 072660	1	4	Quarry Substation
Yes	Quarry	D 165461	1	1	Hosensack 1 Line Direct Transfer
Yes	Quarry	D 165462	1	8	Quarry 230-69KV Substation
Yes	Quarry	D 165463	1	8	Quarry 23-69KV Substation
Yes	Quarry	D 165464	1	3	Quarry 230-69KV Substation
Yes	Quarry	D 165471	1	5	Quarry 230-69KV Substation
Yes	Quarry	D 165478	1	1	Quarry 230-69KV Substation
Yes	Quarry	D 165479	1	2	Wiring Diagram Hosensack 1
Yes	Quarry	D 165479	1	2	Wiring Diagram Hosensack 1
Yes	Quarry	D 165480	1	2	Logic Block Diagram Hosensack
Yes	Quarry	D 165480	1	2	Logic Block Diagram Hosensack
Yes	Quarry	D 239901	30,33	0	Fiber Optic Elementary
Yes	Quarry	D 244611	1	2	Quarry 230-69KV Substation
Yes	Quarry	D 244613	1	1	Quarry 230-69KV Substation
Yes	Quarry	D 244614	1	2	Quarry 230-69KV Substation
Yes	Quarry	D 316582	1	0	Quarry 230-69KV Substation
Yes	Quarry	D 316584	1	0	Quarry 230-69KV Substation
Yes	Quarry	D 316585	1	0	Quarry 230-69KV Substation
Yes	Quarry	D 316586	1	0	Quarry 230-69KV Substation
Yes	Quarry	D 165461	1	1	Hosensack 1 Line Direct Transfer
Yes	Quarry	E 070853	1	6	Quarry Substation
Yes	Quarry	E 070854	1	12	Quarry Substation
Yes	Quarry	E 070855	1	6	Elementary Diagram Hosensack
Yes	Quarry	E 070855	1	6	Elementary Diagram Hosensack
Yes	Quarry	E 070856	1	3	Quarry 230-69KV Substation
Yes	Quarry	E 070858	1	11	Quarry Substation
Yes	Quarry	E 070859	1	10	Quarry 230-69KV Substation
Yes	Quarry	E 120566	1	8	Quarry 230-69KV Elementary
Yes	Quarry	E 152840	1	8	Quarry 230-69KV Substation
Yes	Quarry	E 159027	1	8	Quarry 230-69KV Substation
Yes	Quarry	E 165456	1	4	Quarry 230-69KV Substation
Yes	Quarry	E 165457	1	2	Quarry 230-69KV Substation
Yes	Quarry	E 165458	1	4	Quarry 230-69KV Substation
Yes	Quarry	E 165459	1	4	Quarry 230-69KV Substation
Yes	Quarry	E 165460	1	4	Quarry 230-66KV Substation
Yes	Quarry	E 165466	1	5	Quarry 230-69KV Substation
Yes	Quarry	E 165467	1	6	Quarry 230-69KV Substation
Yes	Quarry	E 165468	1	6	Quarry 230-69KV Substation
Yes	Quarry	E 165469	1	7	Quarry 230-69KV Substation
Yes	Quarry	E 228880	1	2	Quarry 230-69KV Substation
Yes	Quarry	E 229318	1	4	Quarry 230-69KV Substation
Yes	Quarry	E 229318	2	3	Quarry 230-69KV Substation
Yes	Quarry	E 244615	all		Quarry 230-69KV Substation
Yes	Quarry	E 244616	1	2	Quarry 230-69KV Substation
Yes	Quarry	E 316583	1	0	Quarry 230-69KV Substation
Yes	Quarry	E 316660	1-2		Quarry 230-69KV Substation

Yes	Quarry	E 316661	1-2		Quarry 230-69KV Substation
Yes	Quarry	F 070739	1	11	Quarry Substation 230-69KV
Yes	Quarry	F 070745	3	12	Quarry 230-69KV Substation
Yes	Quarry	F 070746	3	11	Quarry 230-69KV Substation
Yes	Quarry	F 070749	2	11	Quarry Substation 230-66KV
Yes	Quarry	F 070770	1	12	Quarry Substation 230-66KV
Yes	Quarry	F 070773	1	15	Quarry 230KV 69KV Substtion
Yes	Quarry	F 070774	1	11	Quarry Substation 230-69KV
Yes	Quarry	F 070810	1	22	Panel 9C rear view wiring diagram
Yes	Quarry	F 070811	1	10	Rear View Wiring Diagram Panel 9R
Yes	Quarry	F 070815	1	13	Rear View Wiring Diagram Panel
Yes	Quarry	F 070822	1	18	Rear View Wiring Diagram Panel
Yes	Quarry	F 070823	1	21	Rear View Wiring Diagram Panel
Yes	Quarry	F 070870		22	Rear View Wiring Diagram Panel 9C
Yes	Quarry	F 707773	1	15	Quarry 230-69KV Substation
Yes	StlCity	A 002150			W&H - Shoring and Bracing
Yes	StlCity	A 002223			W&H - Backfilling Instructions
Yes	StlCity	A 002315			W&H - Structure Excavation
Yes	StlCity	A 002630			W&H - Storm Water Drainage Sys.
Yes	StlCity	A 003200			W&H - Concrete Reinforcement
Yes	StlCity	A 003300			W&H - Cast-In-Place Concrete
Yes	StlCity	A 013001			W&H - Spill Containment Instructions
Yes	StlCity	A 050167	all		spec for all aluminum and aluminized
Yes	StlCity	A 089229	all		Standard 230-138KV Substation
Yes	StlCity	A 095993	1-4		Standard Control Cubicle
Yes	StlCity	A 131525	1		Polymer Suspension Insulator
Yes	StlCity	A 153200	1	5	Standard 69-12KC Substation
Yes	StlCity	A 175300	all	2	Specification for Aluminum
Yes	StlCity	A 190974			Concrete Materials Specification
Yes	StlCity	A 190975	all		Concrete Placement Specification
Yes	StlCity	A 197973	1-13		Specification for Access/Yard Roads
Yes	StlCity	A 200157	All		Ground Standard
Yes	StlCity	A 203863	all		Specifications for Permanent
Yes	StlCity	A 204524	1-9		Proposal Specification for
Yes	StlCity	A 208636	1	0	Standard 230-138KV Substation
Yes	StlCity	A 315769	all		Materials List
Yes	StlCity	A 315770	1-6		Materials List
Yes	StlCity	A 315795	1	2	Steel City Substation
Yes	StlCity	A 315797	1	0	A-Frame Bus Support
Yes	StlCity	A 315798	1	0	XFMR Downcomer Assembly
Yes	StlCity	A 315799	1	0	Line D.E. Downcomer Assembly
Yes	StlCity	A 315800	1	0	Steel City 500-230KV Substation
Yes	StlCity	A 315808	1-4	2	Bill of Material- Stormwater
Yes	StlCity	A 315809	1-3		Transformer Spill Containment Bill of
Yes	StlCity	A 315810	1	0	Steel City 500-230KV Substation
Yes	StlCity	A 315813	1	0	Steel City 500-230KV Substation
Yes	StlCity	A 315814	1	0	Steel City 500 KV Substation
Yes	StlCity	A 315816	1	0	Steel City 500KV Substation
Yes	StlCity	A 315818	1	0	Steel City 500KV Substation

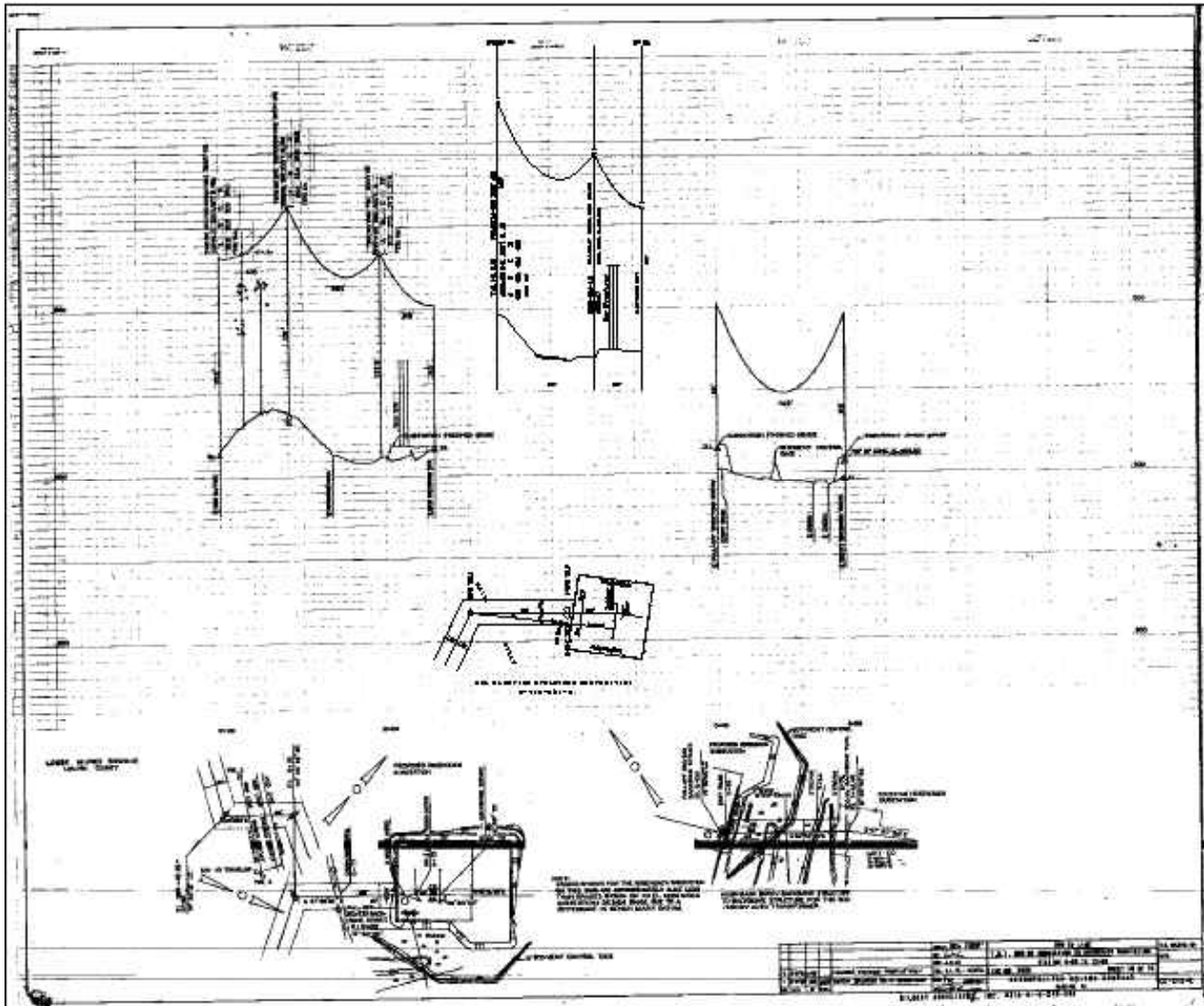
Yes	StlCity	A 315823	1	0	Transformer Firewall Re Bar
Yes	StlCity	A 315824	1	0	Transformer Firewall Re Bar
Yes	StlCity	A 315830	1	0	Re-bar list downcomer
Yes	StlCity	A 315832	1	0	Re-bar list lightning mast
Yes	StlCity	A 315833	1	0	Foundation detail lightning mast
Yes	StlCity	A 617122	1	0	Spec for Pad Mount Transformer
Yes	StlCity	B 089127	1-2		Standard 230-69KV Substation
Yes	StlCity	B 089129	1	7	230KV BUS TAP-SW STR with
Yes	StlCity	B 089136	1	6	230KV Line Dead End Structure
Yes	StlCity	B 089137	1-2		230KV Overhead Line D.E.
Yes	StlCity	B 089140	1	3	Switch Box for POT. DEV
Yes	StlCity	B 089142	1	5	230KV Potential Device-Outside
Yes	StlCity	B 089143	1	5	230KV Potential Device-Middle
Yes	StlCity	B 089152	1-2		230KV Coupling Capacitor
Yes	StlCity	B 089207	1-22		Standard 230-69KV Substation
Yes	StlCity	B 089208	1-6		Standard 230-69KV Substation
Yes	StlCity	B 089210	1-14		Standard 230-69KV Substation
Yes	StlCity	B 089215	1-9		Standard 230-69KV Substation
Yes	StlCity	B 089232	1	5	Standard 230-69KV Substation
Yes	StlCity	B 089233	1	8	Standard 230-69KV Substation
Yes	StlCity	B 089235		7	Standard 230-69 KV Substation
Yes	StlCity	B 098223		2	Standard 230 KV Substation
Yes	StlCity	B 098945	1	10	Standard 230-69KV Substation
Yes	StlCity	B 100311	1		clustered anchor bolts
Yes	StlCity	B 1030C2	1-5		PPLSteel City 500KV Sub Station
Yes	StlCity	B 136860	all		500KV Steel City Substation
Yes	StlCity	B 153202	1	4	Standard 69-12 KV Substation
Yes	StlCity	B 200311	1		Clustered Anchor Bolts
Yes	StlCity	B 213126	1-4		property fence elevs & details
Yes	StlCity	B 242345	1	1	Standard 230-69KV Substation
Yes	StlCity	B 315791	1	0	230kv insulator support struct - assy
Yes	StlCity	B 315815	1	0	Steel City 500KV Substation
Yes	StlCity	B 315817	1	0	Steel City 500KV Substation
Yes	StlCity	B 315819	1	0	Steel City 500KV Substation
Yes	StlCity	B 315829	1-4		HVAC Control Scheme
Yes	StlCity	B 315831	1	0	SC-4 Foundation detail downcomer
Yes	StlCity	B 315833	1	0	SC-5 Foundation detail lightning
Yes	StlCity	C 315767	1	0	Batt Midpoint (Protector)
Yes	StlCity	C 315825	1-5		500KV Structure Details
Yes	StlCity	C 315836	1	0	AC Wir Diag. Control Cubicle
Yes	StlCity	D 208635	1-4		Standard 230-138KV Substation
Yes	StlCity	D 237562	1-5		Steel City 230-138KV Substation
Yes	StlCity	D 315747	1-3	0	500 KV Arrg Plan
Yes	StlCity	D 315748	1	1	Electrical Argt 230KV Area
Yes	StlCity	D 315754	1-3		Below Grade Conduit Plan and
Yes	StlCity	D 315755	1	0	12 KV & Fiber Optic Duct
Yes	StlCity	D 315756	1	0	500 KV Arrg Plan
Yes	StlCity	D 315757	1	0	500 KV Arrg Plan
Yes	StlCity	D 315758	1	0	500 KV Arrg Plan

Yes	StlCity	D 315759	1	0	500 KV Arrg Plan
Yes	StlCity	D 315760	1-2		500 KV Electrical Details
Yes	StlCity	D 315762	1	1	Electrical Argt 230KV West Bus
Yes	StlCity	D 315763	1	1	Electrical Argt 230KV Bay 2
Yes	StlCity	D 315764	1-5		Control Cubicle Arrangement
Yes	StlCity	D 315771	1-6		Steel City 500-230 KV Substation
Yes	StlCity	D 315772	1-5		Steel City 500-230KV Substation
Yes	StlCity	D 315775	1	0	Steel City 500-230KV Substation
Yes	StlCity	D 315792	1	1	Steel City 500-230KV Substation
No	StlCity	D 315793	1	2	Steel City 500-230KV Substation
Yes	StlCity	D 315801	1-3		Steel City Site Plan Initial Phase
Yes	StlCity	D 315802	1-9		Steel City 500-230 KV Substation
Yes	StlCity	D 315803	1-4		Steel City 500-230 KV Substation
Yes	StlCity	D 315804	1-4		Steel City 500-230 KV Substation
Yes	StlCity	D 315805	1-8		Steel City 500-230KV Substation
Yes	StlCity	D 315806	1-8		Steel City 500-230KV Substation
Yes	StlCity	D 315807	1-3		Steel City 500-230KV Substation
Yes	StlCity	D 315811	all		Steel City 500-230KV Substation
Yes	StlCity	D 315812	1	0	Steel City 500-230KV Substation
No	StlCity	D 315812	1	0	500kV CB Fdn
Yes	StlCity	D 315827	1-4		500KV A Frame Line Deadened
Yes	StlCity	E 315801	1-3		Steel City 500-230KV Substation
Yes	StlCity	E 315821	1	0	Transformer Firewall Masonary
Yes	StlCity	E 315822	1	0	Transformer Firewall Masonary
Yes	StlCity	P 231095		8	Hinge Cornona Shield Assembly
Yes	StlCity	P 231097		6	Jaw Cornona Shield Assembly
Yes	StlCity	P 314229		5	Horn Complete for 230KV & Below
Yes	StlCity	P 314230		4	Horn complete for 230KV
Yes	StlCity	P 318746	1	4	Interlock Assembly and Instructions
Yes	StlCity	P 319039		4	Horn Assembly for 500KV "TTR-6"
Yes	StlCity	P 323703		2	Hinge-End Outrigger for use with
Yes	StlCity	P 423611		8	Kirk Interlock Assemblies for Worm
Yes	StlCity	P A00240		3	Bill of Material for Switch Shown
Yes	StlCity	P A00250		7	Bill Of Material
Yes	StlCity	P A02583		5	Bill of Material for Switch and
Yes	StlCity	P A02584		7	Bill of Material for Switch and Control
Yes	StlCity	P A04275	1-2	2	Bill of Material for Switch and
Yes	StlCity	P A04281	1-2	2	Bill of Material for Switch and
Yes	StlCity	P A04282	1-2	2	Bill of Material for Switch and
Yes	StlCity	P B00341		3	230KV (900 KV BIL) 3000 AMP
Yes	StlCity	P B04676		1	Aux. Switch Schematic
Yes	StlCity	P B04677		1	Heater Schematic
Yes	StlCity	P B05465		2	Motor Schematic
Yes	StlCity	P B06504		2	Control Schematic
Yes	StlCity	P B06505		3	Reference Location Drawing for
Yes	StlCity	P C00027		2	Jaw End Outrigger for use with
Yes	StlCity	P C01075		8	Layout for MO-10 Motor Mechanism
Yes	StlCity	P C01681		1	500KV 3000AMP 100 KA Mom
Yes	StlCity	P C01684		1	500KV 3000 AMP 100 KA Mom

Yes	StlCity	P D00124		2	230KV (900KV BIL) 3000 AMP
Yes	StlCity	P D00136		4	230kv (900kv BIL) 3000 AMP TYPE
Yes	StlCity	P D01375		4	230KV (900KV BIL) 3000 AMP
Yes	StlCity	P D01376		3	230 KV (900KV BIL) 3000 AMP
Yes	StlCity	P D01377		3	230KV (900KV BIL) 3000 AMP
Yes	StlCity	P D02831		1	500KV "AG-8" GR'D Switch
Yes	StlCity	P D02833		2	500KV 3000 AMP Type TTR-6
Yes	StlCity	P D02840		2	500KV 3000 AMP Horn Gap
Yes	StlCity	P D02841		2	500KV 3000 AMP Type TTR-6
Yes	StlCity	P D02843		2	500KV "AG-8" GR'D Switch
Yes	StlCity	S 003505	P1R2	2	Cable Trench #2012 & #3012
Yes	StlCity	S 003505	P2R2	2	Cable Trench #2012 & #3012
Yes	StlCity	S 003505	P3R2	2	Cable Trench #2012 & #3012
Yes	StlCity	T 621401	2	3	GEN.(INT) ARRGT OF MARSH.
Yes	StlCity	T 621410	1-2		Cabling & Conduit Arrangement
Yes	StlCity	T 621430	1	2	Title Sheet for Schematics
Yes	StlCity	T 621430	1	2	Circuit diagram of cooler motors
Yes	StlCity	T 621430	10	2	Diagram of driving mechanism
Yes	StlCity	T 621430	11	2	Diagram of transformer auxiliary
Yes	StlCity	T 621430	12	2	Diagram of transformer external
Yes	StlCity	T 621430	13	2	Marshalling Cubicle/Control
Yes	StlCity	T 621430	15	2	Terminals cubicle/PPL termination
Yes	StlCity	T 621430	16	2	Driving Mechanism Parts List
Yes	StlCity	T 621430	17	2	Transformer Auxiliaries Parts List
Yes	StlCity	T 621430	18	2	Terminal Layout for Marshalling
Yes	StlCity	T 621430	19	2	Terminal Layout for terminals
Yes	StlCity	T 621430	2	2	Circuit diagram of cooler controls
Yes	StlCity	T 621430	20	2	Terminal layout for driving
Yes	StlCity	T 621430	21	2	Terminal Layout for Transformer
Yes	StlCity	T 621430	22	2	Marshalling Cubicle/Control Cabinet
Yes	StlCity	T 621430	23	2	Marshalling Cubicle/Control Cabinet
Yes	StlCity	T 621430	24	2	Terml. Cubicle/PPL Termination
Yes	StlCity	T 621430	25	2	Symbols Diagram
Yes	StlCity	T 621430	3	2	Circuit diagram of tapchange control
Yes	StlCity	T 621430	4	2	Circuit diagram of tapchange ind.
Yes	StlCity	T 621430	5	2	Circuit diagram of alarms and
Yes	StlCity	T 621430	6	2	Diagrammatic arrng. Of current
Yes	StlCity	T 621430	7	2	External Wiring Schedule
Yes	StlCity	T 621430	8-9	2	Diagram of Marsh. Cubicle/Control
Yes	StlCity	T 821400	1	3	Transport Arrangement
Yes	StlCity	T 961400	1	4	Outline Arrangement
Yes	StlCity	T 965001	1	4	Rating & Diagram Plate & Valve
Yes	Wescsvl	A 175120	76-77	0	Substation Bill of Material
Yes	Wescsvl	A 186134	72-76	0	bill of material
Yes	Wescsvl	A 212533	1-29	12	Alarm mngmt system remote station
Yes	Wescsvl	B 175121	1	4	Cable and Conduit List Index and
Yes	Wescsvl	B 175121	12	3	Cable and Conduit List LP2-16 to
Yes	Wescsvl	B 317535	1	0	Wescosville 500-138KV substation
Yes	Wescsvl	B 317535	2	0	Wescosville 500-138KV Substation

Yes	Wescsvl	D 212537	1	11	Alarm management system cabinet
Yes	Wescsvl	D 212537	2	12	Alarm management system cabinet
Yes	Wescsvl	D 239901	16	4	Fiber Optic Elementary-
Yes	Wescsvl	D 239901	31	0	Fiber Optic Elementary
Yes	Wescsvl	D 241188	1	3	Fiber Optic Entry Cabinet Front
Yes	Wescsvl	D 241745	1	5	Wescosville 500KV 138KV
Yes	Wescsvl	D 245225	1	4	Prism B fiber optic communications
Yes	Wescsvl	E 085163	1	15	Wescosville 500KV 138KV and
Yes	Wescsvl	E 085164	all		Cable Duct and Grounding Plan
Yes	Wescsvl	E 175132	1	8	Cable Plan
Yes	Wescsvl	E 241237	1	7	Prism A fiber optic communications
Yes	Wescsvl	E 245247	1	4	Prism B fiber optic communications

Bethehem Steel (B3) Facilities Study
Drawing 1 - Existing 5026 Plan and Profile



Bethehem Steel (B3) Facilities Study
Drawing 2 - 500 KV "H-Frame" Steel Structure

