Facilities Study Report

For

Physical Interconnection of

PJM Generation Interconnection Request Project ID AF1-233

Flemingsburg-Spurlock 138 kV Solar Project – 188.5 MW

Revision 3: March 2025

Introduction

This Facilities Study has been prepared in accordance with the PJM Open Access Transmission Tariff. The Transmission Owner (TO) is East Kentucky Power Cooperative ("EKPC").

A. Transmission Owner Facilities Study Summary

1. PROJECT DESCRIPTION

The Project developer has proposed a solar generating facility located in Fleming County, Kentucky with a designated PJM Project ID of AF1-233. The installed facilities will have a total Maximum Facility Output (MFO) of 188.5 MW with 113.1 MW of this output being recognized by PJM as Capacity.

2. POINT OF INTERCONNECTION (POI)

The Generating Facility will interconnect with the EKPC transmission system via a newly constructed West Flemingsburg 138 kV folded breaker and a half substation, tapping the Flemingsburg-Spurlock 138 kV line, approximately 21.7 miles from Spurlock and 1.3 miles from Flemingsburg Distribution Station.

The construction of the new interconnection substation will split the existing Flemingsburg-Spurlock 138 kV line into two lines on the transmission system. These two lines will connect the new West Flemingsburg substation to the existing Flemingsburg and Spurlock substations.

The proposed generation interconnection is shown on the single-line diagram in Attachment #1

3. POINT OF CHANGE IN OWNERSHIP

The Point of Change in Ownership (PCO) will be located at the Project Developer (PD) side of a 138 kV disconnect switch to be installed by EKPC at the interface between the PD-owned substation facilities and EKPC's substation facilities at the West Flemingsburg 138 kV Substation. The switch shall be installed on a steel transmission line monopole structure located outside the substation fence. The exact location will be determined during project detailed design and EKPC will install, own, operate, and maintain the switch.

4. SCOPE OF PROJECT DEVELOPER INTERCONNECTION FACILITIES

The developer will design, build, own, operate and maintain the Project Developer Interconnection Facilities on Project Developer's side of the PCO. This includes, but is not limited to:

- Main Power Transformer (s) (MPT), Generation step-up (GSU) transformer(s) or final transformation, as applicable.
- Circuit breakers and associated equipment located between the high side of the MPT(s) or GSU(s) and the Point of Change in Ownership.
- Generator lead line from the Generating Facility to the Point of Change in Ownership.
- Relay and protective equipment, telecommunications equipment, and Supervisory Control and Data Acquisition (SCADA) to comply with EKPC's Applicable Technical Requirements and Standards.

The proposed facility must meet EKPC's published facility connection requirements. The latest version of these requirements can be accessed via the following link:

https://www.pjm.com/planning/design-engineering/to-tech-standards/ekpc.aspx

Reference section 5.9 for inverter-based generating facilities.

B. Transmission Owner Facilities Study Results

The following is a description of the planned Transmission Owner facilities for physical interconnection of the proposed AF1-233 project to the EKPC transmission system. These facilities shall be designed according to EKPC Applicable Technical Requirements and Standards. Once built, EKPC will own, operate, and maintain these Facilities.

1. TRANSMISSION OWNER INTERCONNECTION FACILITIES:

A 138 kV transmission line monopole dead-end structure and foundation outside the fence of the Interconnection Substation, to terminate the Project Developer's generator lead line will be considered Transmission Owner Interconnection Facilities (TOIF). A 138 kV 3-pole disconnect switch will also be mounted to this monopole dead-end structure serving as the PCO.

The TOIF will also include the line conductor from the dead-end structure in the switchyard of the West Flemingsburg Substation to the bus position in the switchyard of the interconnection substation.

Installation of fiber cable circuits

EKPC shall use telecommunications equipment that matches its current network and equipment requirements.

Two 48-strand fiber optic cables will be installed between the EKPC substation control house at West Flemingsburg substation and the PD facility for relaying, metering, and SCADA circuit requirements. The exact details and installation plans for this fiber will be developed during project scoping.

2. STAND ALONE NETWORK UPGRADES

West Flemingsburg 138 kV Interconnection Substation

A new 138 kV switching substation, West Flemingsburg, will be constructed along the Flemingsburg-Spurlock 138 kV transmission line to interconnect the project with the EKPC transmission system.

Scope of Work

The major equipment and material associated with the expanded station is listed below:

QTY	Unit	DESCRIPTION
1	Each	138 kV Low Profile structure
5	Each	138 kV, 2000A, Circuit Breaker
12	Each	138 kV GOAB Switches (Includes PCO Switch)
1	Lot	Electrical Material (insulators, terminals, etc.)
2	Each	Station Service Transformer, 138 kV, 1 PH
9	Each	Arresters, Lightning 138 kV Station 115 kV MCOV Polymer
3	Each	Metering CT's, 138 kV
9	Each	Line CCVT's, 138 kV
6	Each	Bus PT's, 138 kV

System Protection

The following system protection scope of work applies for this project. All system protection equipment described in this section will be owned, operated, and maintained by EKPC.

Control House: EKPC shall procure and install a drop-in style control building fully furnished and complete with the relay panels described below, along with auxiliary AC, and two 125V DC battery banks, and all required operating equipment.

Relay Panels: EKPC shall install the following protection and control panels:

North Bus Differential Panel – EKPC shall install a standard bus panel complete with P1 SEL-587Z and P2 SEL-487B relays tripping P1 & P2 bus lock-out relays.

South Bus Differential Panel – EKPC shall install a standard bus panel complete with P1 SEL-587Z and P2 SEL-487B relays tripping P1 & P2 bus lock-out relays.

Bay #1 Control Panel – EKPC shall install a bay control panel with three SEL-451 relays, one for both line breakers and the tie breaker in the bay. The SEL-451 relays will be used for breaker control breaker failure, and reclosing.

Bay #2 Control Panel – EKPC shall install a bay control panel with three SEL-451 relays, one for the PD generator line breaker, a future line breaker and tie breaker in the bay. The SEL-451 relays will be used for breaker control breaker failure, and reclosing.

Panel for protection of the PD facility connection– EKPC shall install a standard line panel with P1 & P2 SEL-411L relays. Line relays shall utilize a line current differential protection scheme.

Line Panel for the Flemingsburg 138kV Line Exit (1.3 miles)—EKPC shall install a standard line panel with P1 and P2 SEL-411L relays for each line exit. The P1 and P2 relays shall utilize comm-assisted tripping schemes over fiber.

Line Panel for Spurlock 138kV Line Exit (21.7 miles)—EKPC shall install standard line panels with P1 and P2 SEL-411L relays for each line exit. The P1 and P2 relays shall utilize comm-assisted tripping schemes over fiber.

SCADA Panel – EKPC shall install a standard SCADA panel with an Orion LX+ and dual metering for the PD. P1 Meter shall be an ION8650A, and P2 Meter shall be a SEL-735.

DFR Panel – EKPC shall install a fault recording panel with two SEL Axion 2240 I/O modules and a SEL-3555 RTAC unit.

EKPC requires the PD to utilize all Schweitzer Engineering Laboratories (SEL) relays and related protective equipment for facilities interconnecting or communicating with EKPC relaying. EKPC reserves the right to specify relays or other protective equipment utilized in the PD substation as required based on the protection schemes utilized. All protection system designs shall be reviewed by EKPC System Protection or its designer during the design phase to ensure proper clearing times, coordination, and compliance with applicable NERC regulations.

Control cables shall be pulled from new breakers and other required equipment to the control house.

Commissioning: Each relay panel shall be fully commissioned prior to being placed in service. Commissioning shall include AC current and potential circuits, DC functional, relay testing, SCADA alarms, and end-to-end testing where required.

3. NETWORK UPGRADES

Transmission Line Tie-in for new interconnection substation:

The EKPC Spurlock-Flemingsburg 138 kV line will be cut and looped into the new interconnection substation.

The new transmission line loop-in facilities will be owned, operated, and maintained by EKPC. The tap from the existing transmission line into the new switching station will consist of two 3-pole guyed 90-degree transmission structures. The circuits to the Flemingsburg and Spurlock substations will span directly into the new substation and dead-end on A-frame structures. The new transmission structures are assumed to be direct embedded structures. The tap will allow for the connection of the existing transmission line to the new substation. The loop from the Flemingsburg-Spurlock 138 kV line to the new substation is expected to extend approximately 150 feet.

Upgrade to Neighboring Substations:

Spurlock Substation

Relay settings shall be reviewed for the Spurlock-Goddard 138 kV line to accommodate the new West Flemingsburg substation, and relay files will be updated accordingly. If acceptable relay setting adjustments are not possible due to older model relays, and new modern SEL line relays are required, the cost will be higher. This is to be determined during detailed design.

Relay settings shall also be reviewed for the Spurlock-Plumville 138 kV line to ensure no zone overlap with remote-line (Plumville-Goddard) protection relay.

Goddard Substation

Relay settings shall be reviewed for the Goddard-Spurlock 138 kV line to accommodate the new West Flemingsburg substation, and relay files will be updated accordingly. If acceptable relay setting

adjustments are not possible due to older model relays, and new modern SEL line relays are required, the cost will be higher. This is to be determined during detailed design.

Relay settings shall also be reviewed for the Goddard-Rowan County and the Goddard-Plumville 138 kV lines to ensure no zone overlap with the remote-line (Goddard-Spurlock) protection relay. Ground relay settings shall be reviewed to acknowledge increased ground fault current at the remote bus (Goddard Substation).

Flemingsburg Distribution Substation

The ASPEN Oneliner model calculated a 43% increase in ground fault current at the HV side of the 138/26.4 kV distribution transformer. Therefore, a grounding grid analysis shall be performed at the substation.

Installation of fiber cable circuits

To complete the communications path to the Goddard remote end, a new OPGW will be installed on the Spurlock-Flemmingsburg-Goddard line section (32.1 miles).

For the new West Flemingsburg 138 kV switch station, the new Overhead Optical Ground Wire (OPGW) infrastructure on the Spurlock-Flemingsburg line section will be split and terminated on a splice box on the north transmission structure installed for the line loop-in facilities. This will complete the fiber communication path on the Spurlock-West Flemingsburg and from the West Flemingsburg-Flemingsburg line sections.

4. OTHER SCOPE OF WORK

No other scope has been identified for the construction of the West Flemingsburg substation

5. MILESTONE SCHEDULE FOR COMPLETION OF EKPC WORK

Facilities outlined in this report are estimated to take 36 months to construct, from the time the Generation Interconnection Agreement is fully executed. This schedule is based on the ability to obtain outages to construct and test the proposed facilities.

Description	Start Month	Finish Month
Detailed Design	1	6
Procurement	3	27
Construction	25	36

6. ASSUMPTIONS IN DEVELOPING SCOPE/COST/SCHEDULE

Cost Assumptions:

The attached excel file summarizes the total estimated costs according to FERC criteria. The estimated costs are in 2025 dollars. **This cost excludes Federal Income Tax Gross Upcharges on Contributions in Aid of Construction (CIAC)**. This tax may or may not be charged based on whether this project meets the eligibility requirements of IRS Notice 88-129. If at a future date it is determined that the Federal Income Tax Gross charge is required, the Transmission Owner shall be reimbursed by the Project Developer for such taxes.

Transmission Line Assumptions:

The following general assumptions have been included for the transmission line information.
provided:

1. Required transmission line outages can be scheduled as planned. Transmission line outages are:
    a. typically, not taken in the summer (June-August) or winter (December-February),
    b. cancelled during extreme weather conditions, and
    c. in some cases, required to be scheduled twelve (12) or more months in advance.
2. No delays due to equipment or material delivery, environmental, regulatory, permitting, real estate, extreme weather, or similar events.
3. No significant sub-surface rock is encountered during construction, and soil conditions are suitable for standard foundation installations.

The following engineering assumptions have been included for the transmission line information provided:

1. Neither foundation nor transmission pole structural analyses have been performed. The information provided assumes that no significant foundation or structural issues are present.
2. The existing transmission line structures were assumed to have adequate strength to support installation of new direct-replacement OPGW in place of the existing shield wire, and therefore structure replacement costs were not included in the associated fiber installation network upgrade. If a larger OPGW size is required, or if detailed analysis determines that structure replacements are required to support the new OPGW, then the costs will increase.
3. Construction will be scheduled to avoid winter peak load periods (December - February).
4. The preliminary schedule assumes that transmission line outages can be obtained as necessary.
5. Material and equipment costs are based on current pricing.
6. Easements, if necessary, shall be acquired by EKPC.
7. Environmental permits and reviews shall be completed by EKPC and can be completed promptly.

Substation & System Protection Assumptions:

The following general assumptions have been included for the substation information provided:

1. No delays due to equipment or material delivery, environmental, regulatory, permitting, property/easement acquisitions, extreme weather, or similar events.
2. No significant sub-surface rock encountered during construction, and soil conditions are suitable for standard ground-grid and foundation installations.
3. PD shall acquire an adequate and suitable site and grant ownership to EKPC to accommodate EKPC's interconnection substation, as mentioned above.
4. The PD will provide all necessary easements for a permanent road to provide substation access. This substation access shall be from an existing county or state road. The PD will convey these rights to EKPC if they own the property on which the substation access road will be located. Otherwise, EKPC will need to acquire the access rights from the owner of the property.

Metering Assumptions:

The following assumptions have been included for the metering information provided:

1. No delays due to equipment or material delivery, environmental, regulatory, permitting, real estate, extreme weather, or similar events.
2. Fiber-optic cable and associated equipment installation is completed as scheduled.
3. Material and equipment-related costs are based on current pricing at the time of this study.
4. Once fiber-optic cable installation is complete, the fiber will not be damaged.

Communications Assumptions:

The following assumptions have been included for the telecommunications information provided:

1. No delays due to equipment or material delivery, environmental, regulatory, permitting, real estate, extreme weather, or similar events.
2. Material and equipment-related costs are based on current pricing at the time of this study.
3. Once fiber-optic cable installation is complete, the fiber will not be damaged.

Environmental Assumptions:

The following general assumptions have been included for environmental permitting requirements:

1. For the PD's project, there are no "federal actions" (i.e., federal financial assistance or grants; or federal permit, license, or approval) present that would trigger NEPA compliance obligations for the EKPC facilities as a connected action.
2. No additional property will need to be acquired adjacent to the new West Flemingsburg substation to facilitate the project.
3. Substation location will remain in the currently identified location. Relocation of the substation site may require a re-evaluation of the permitting obligations.

7. REVENUE METERING REQUIREMENTS

All metering needed for this interconnection project must meet the metering requirements stated in Appendix 2, section 8 of the AF1-233 GIA, and in PJM Manuals M01 and M14D. The details of applicable metering requirements are given in EKPC's Facility Connection Requirements Document posted on PJM website.

The metering will be installed on the EKPC side of the Point of Change in Ownership will be owned and maintained by EKPC.

8. LAND REQUIREMENTS FOR INTERCONNECTION SUBSTATION

Land requirements for the Interconnection Substation needed for this project must meet the requirements in EKPC's Facility Connection Requirements Document posted on the PJM website.

9. ENVIRONMENTAL AND PERMITING

EKPC or its representative will perform all necessary environmental assessments and obtain all necessary permits/approvals associated with construction of all EKPC facilities required to facilitate the interconnection of the new generating facility. This includes the Storm-water Pollution Prevention Plan ("SWPPP"), obtaining KYR 10 storm-water permit, and conducting the necessary SWPPP inspections prior to all construction activities.

C. APPENDICES

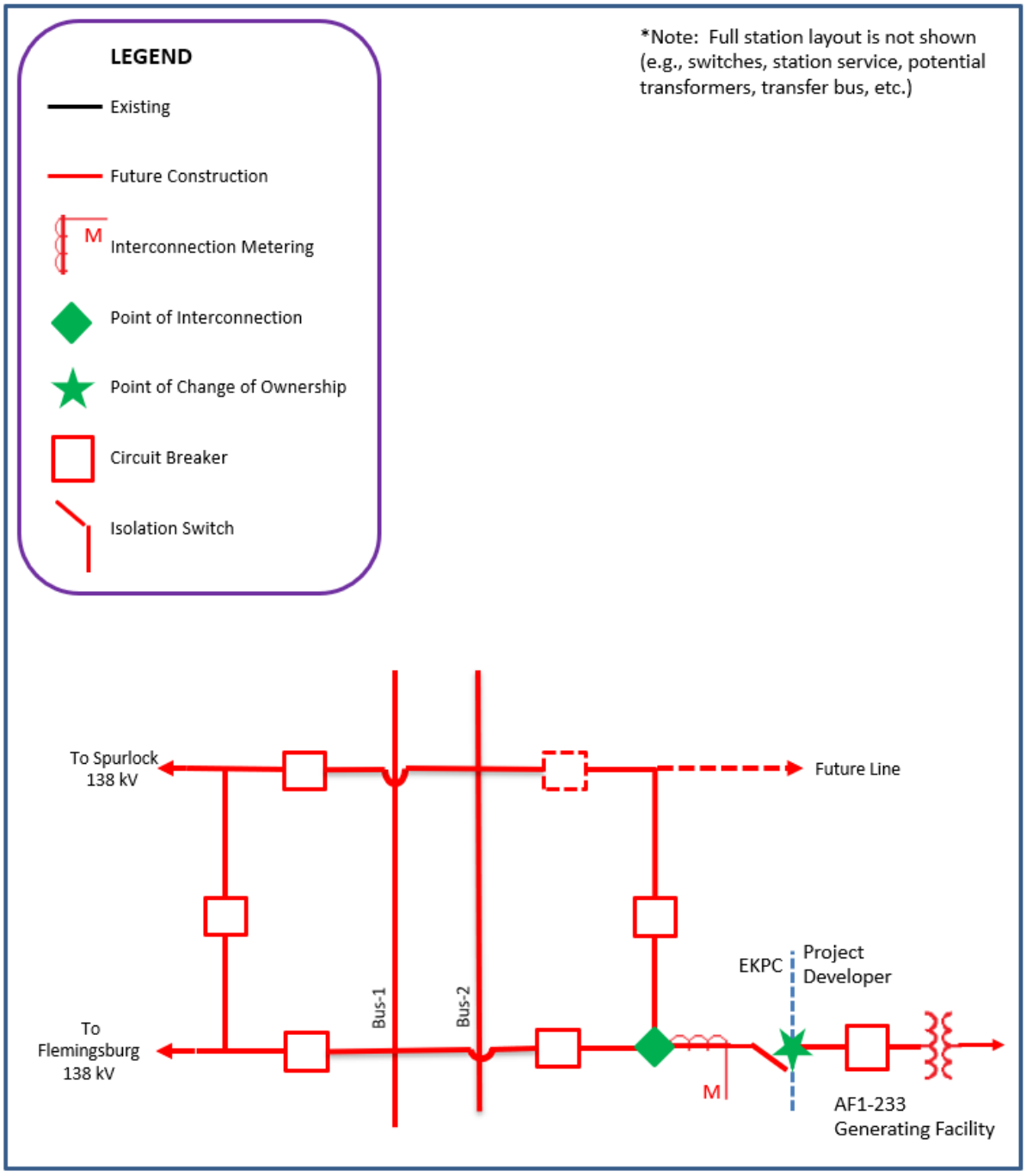
Attachment #1:	Single line Diagram for the Physical Interconnection
Attachment #2:	Substation General Arrangement
Attachment #3:	EKPC Station General Location/Layout

Attachment 1:

Single Line Diagram for the Physical Interconnection

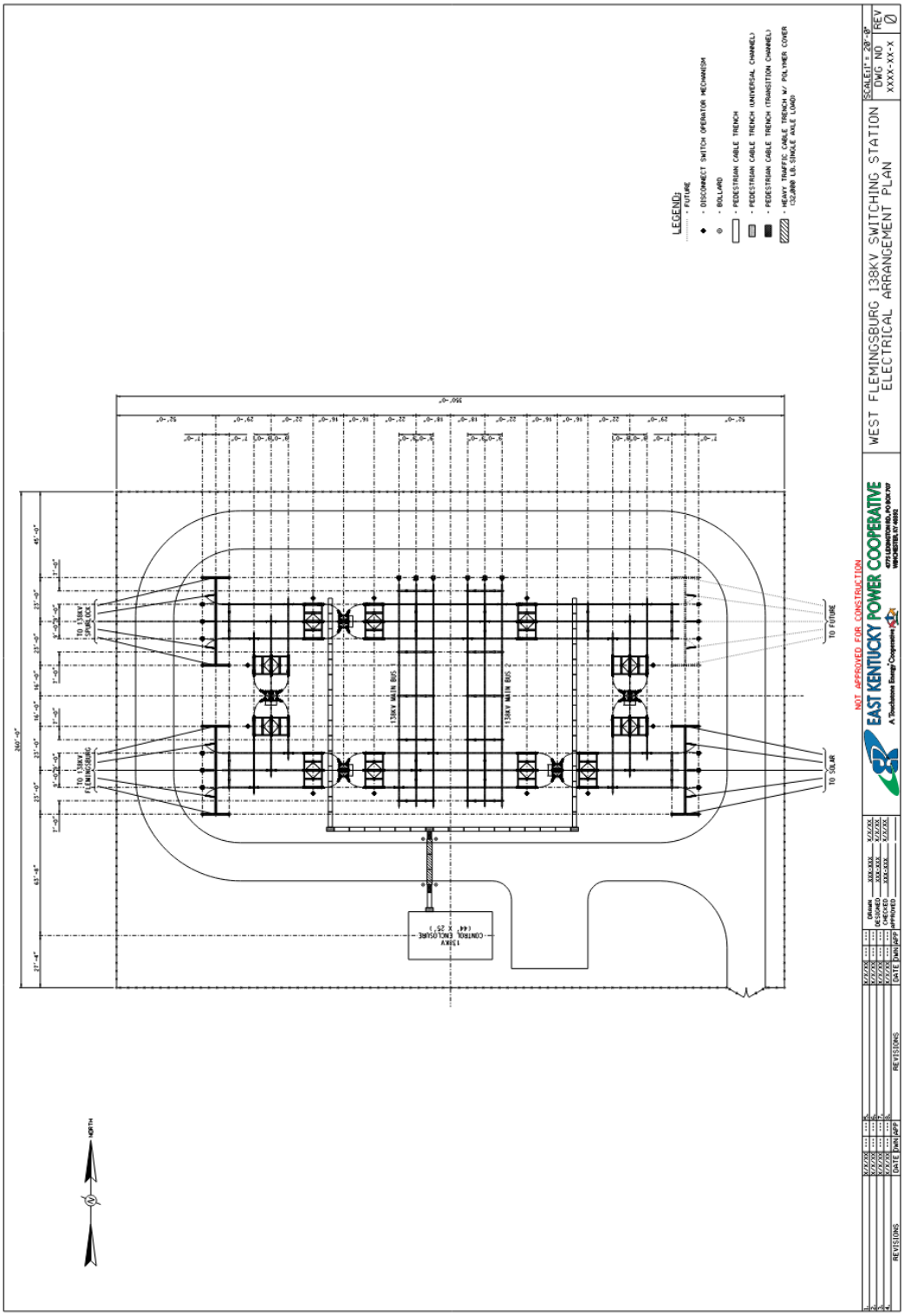
AF1-233 Conceptual One-Line Diagram of Interconnection Facilities

West Flemingsburg 138kV Substation



Attachment 2:

Substation General Arrangement



Attachment 3:

EKPC Station General Location/Layout