SECTION 3 – PROJECT DESCRIPTION

3.1 Introduction

This section describes the Project and associated facilities. Specifically, this section includes descriptions of the transmission route and facility design, including tower structures, foundations, hardware, communication facilities, other electrical and nonelectrical hardware, substation and series compensation station equipment, and access roads. Also included in this section is information regarding land requirements and construction disturbance.

3.2 Proposed Facilities

The Project will consist of an extra-high-voltage alternating current (AC) transmission line that will run between the Aeolus and Clover substations. A proposed single-circuit 500kV transmission line approximately 416 miles in length will begin at the Aeolus Substation (planned as part of Gateway West) near Medicine Bow, Wyoming; connect to two separate, series compensation substations; and terminate at the Clover Substation (constructed as part of the Gateway Central project) near Mona, Utah. The two proposed series compensation substations will be located at approximately the one-third and two-thirds points of the Project between the Aeolus and Clover substations. Modifications at the existing Mona Substation are required to re-terminate existing lines to accommodate the nearby 500kV termination at Clover Substation.

3.2.1 Transmission Segment Descriptions

A schematic diagram of the Project segments described below is provided as Figure 3-1 – Project Layout Diagram.

Segment 1 Aeolus – Series Compensation Substation No. 1

Segment 1 is composed of one single-circuit 500kV transmission line[1] between the planned Aeolus Substation near Medicine Bow, Wyoming, and the Series Compensation Substation No. 1.

Segment 2 Series Compensation Substation No. 1 – Series Compensation Substation No. 2

Segment 2 is composed of one single-circuit 500kV transmission line between the Series Compensation Substation No. 1 and the Series Compensation Substation No. 2.

Segment 3 Series Compensation Substation No. 2 – Clover Substation

Segment 3 is composed of one single-circuit 500kV transmission line between the Series Compensation Substation No. 2 and the Clover Substation.

[1] A single-circuit transmission line (whether 345kV or 500kV) is composed of three electrical phases and two lightning protection shield wires. One of the lightning-protection shield wires is a steel overhead ground wire, and the other is typically an optical ground wire (OPGW). The OPGW contains glass fibers used for communication along the fiber path for data transfer between the Company's facilities. The data transferred is required for system control and monitoring.

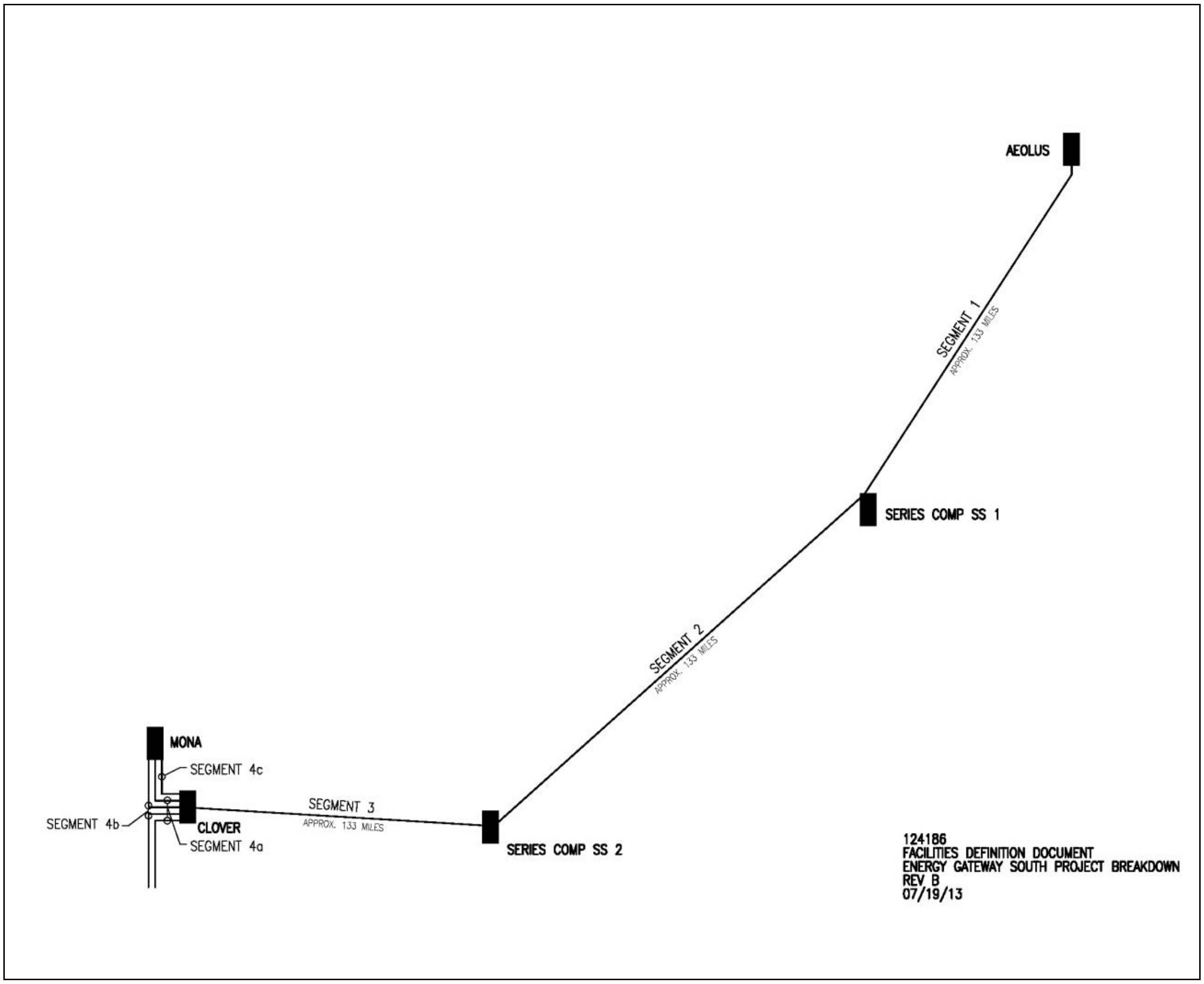

Figure 3-1 Project Layout Diagram

Segment 4a Clover Substation – Mona Substation No. 2

Segment 4a consists of rebuilding the single-circuit portion of the Clover – Mona 345kV No. 1 transmission line between the Clover Substation and the Mona Substation. The line is approximately 3 miles in length and will be rebuilt on the existing right-of-way.

Segment 4b Clover Substation – Mona Substation No. 2

Segment 4b consists of rebuilding the single-circuit portion of the Clover – Mona 345kV No. 2 transmission line between the Clover Substation and the Mona Substation. The line is approximately 3 miles in length and will be rebuilt on existing right-of-way.

Segment 4c Mona Substation – Huntington Substation

Segment 4c consists of rerouting the existing Mona – Huntington 345kV transmission line into the Clover Substation and then out of the substation headed north to the Mona Substation. This reroute will involve construction of two new single-circuit 345kV transmission-line segments extending off the existing route, approximately 1 mile in length each.

A new transmission-line right-of-way will be needed for the north-south portion of the new line between the Mona Substation and Clover Substation, north of the Clover Substation. Also, a new transmission right-of-way will be needed for a new alignment extending east-west from the existing Mona – Huntington 345kV line into the existing Clover Substation. Existing/abandoned structures will be removed when the new transmission lines are placed in service.

3.2.2 Typical Design Characteristics

This section describes the typical characteristics of the Project facilities. The typical design characteristics of the 500kV and 345kV transmission lines are summarized in Table 3-1.

TABLE 3-1
TYPICAL DESIGN CHARACTERISTICS OF THE
500-KILOVOLT AND 345-KILOVOLT TRANSMISSION LINES

Feature	Description
500-kilovolt Transmission Line	
Line length	Approximately 416 miles
Types of structures	Tangent guyed and H-Frame Tangent/angle/deadend self-supporting steel-lattice
Structure height	Guyed (140 to 200) Self-supporting steel-lattice (140 to 200 feet) H-frame (110 to 165 feet)
Span length	Guyed (1,000 to 1,800 feet) Self-supporting steel-lattice (1,000 to 1,500 feet) H-frame (1,200 to 1,300 feet)
Structures per mile	Guyed (approximately 3 to 4) Self-supporting steel-lattice (approximately 4 to 5) H-frame (approximately 4)
Right-of-way width	250 feet
Land Temporarily Disturbed	
Structure work area	250 by 250 feet per structure
Wire-pulling/tensioning	250 by 400 feet; two every 3 to 5 miles
Splicing sites	100 by 100 feet every 9,000 feet
Guard structures	150 by 75 feet; approximately 1.4 structures per 1 mile
Multi-purpose construction yards	30-acre site located approximately every 20 miles on private and/or public land (locations to be determined)[1]
Helicopter fly yards	15-acre site located approximately every 5 miles[2]
Access roads (improved existing, spur, and new)	Improved existing, spur, and new roads will be a minimum of 14-foot-wide travel surface (in steeper terrain the travel surface width could be a maximum of 22 feet for radius of curves) plus disturbance for grading and drainage features (total distance to be determined)
Land Permanently Required	
Area required for operations	0.08 acre per structure (guyed or self-supporting)[3]
Series compensation stations	Two at 160 acres each
Communication regeneration station	100 by 100 feet with 75- by 75-foot fenced areas and a 12- by 32- by 9-foot building; one station approximately every 55 miles
Access roads (improved existing, spur, and new)	Improved existing, spur, and new roads will typically have a 14-foot-wide travel surface (in steeper terrain the travel surface width could be a maximum of 22 feet for radius of curves) plus disturbance for grading and drainage features (total distance to be determined)
Electrical Properties	
Nominal voltage	500-kilovolt (kV) alternating current line-to-line
Capacity	1,500 megawatts

TABLE 3-1 TYPICAL DESIGN CHARACTERISTICS OF THE 500-KILOVOLT AND 345-KILOVOLT TRANSMISSION LINES	
Feature	**Description**
Circuit configuration	Single-circuit with three phases per structure, three subconductors per phase
Minimum ground clearance of conductor	35 feet minimum in accordance with PacifiCorp's standard practice
345-kilovolt Transmission Lines (Segments 4a, 4b, and 4c)[4]	
Line lengths	3 segments totaling approximately 6.6 miles
Types of structures	Single-circuit steel H-frame, single-circuit steel monopole, and/or double-circuit steel monopole and angle/deadend
Structure height	H-frame (80 to 140 feet) Steel monopole (85 to 130 feet) Double-circuit steel monopole (95 to 150 feet)
Span length	H-frame (800 to 1,200 feet) Single- and double-circuit monopoles (700 to 800 feet)
Structures per mile	H-frame (4 to 7 per mile)
Right-of-way width	Segments 4a and 4b in existing right-of-way Segment 4c (150 feet)
Land Temporarily Disturbed	
Structure work area	150 by 200 feet per structure
Wire-pulling/tensioning	150 by 400 feet; one site per 345kV segment
Splicing site	100 by 100 feet; one site for segments 4a and 4b
Guard structures	150 by 75 feet; approximately 1.4 structures per 1 mile
Multi-purpose construction yards	10-acre site; one site located near Clover Substation
Helicopter fly yard	15-acre site located near Clover Substation (location to be determined)[2]
Access roads (improved existing, spur, and new)	Improved existing, spur, and new roads that will be a minimum of 14 feet wide
Land Permanently Required	
Area occupied by structure (pad)	H-frame (5 by 40 feet per structure)
Access roads (improved existing, spur, and new)	Improved existing, spur, and new roads that will be a minimum of 14 feet wide and a maximum of 22 feet wide
Electrical Properties	
Nominal voltage	345kV alternating current line-to-line
Capacity	600 megawatts
Circuit configuration	Segments 4a and 4b tangent single-circuit with three phases per structure, three subconductors per phase; Segment 4c tangent single-circuit with three phases per structure, two subconductors in a double-bundle configuration
Minimum ground clearance of conductor	30 feet minimum in accordance with PacifiCorp's standard practice

SOURCE: PacifiCorp 2015b

NOTES:

[1]Multi-purpose construction yards include portable concrete batch plants, which will occur approximately every 60 miles, except in areas where the Project could be serviced by existing concrete batch plants. Helicopter landing and refueling also will be located in the multi-purpose construction yards.

[2]Helicopter fly yards, which are used to transport materials to structure work areas during construction, may include space dedicated for refueling helicopters.

[3]0.08 acre represents the area required for a transmission structure at any given location. In the case of guyed structures, the 0.08 acre will be distributed between the structure base and guy anchor; whereas, in the case of the self-supporting lattice structure, the 0.08 acre will be located around the base of the structure. Guyed structures may require less area; however, for estimating purposes, 0.08 acre was used to represent the largest potential area required for the transmission structures.

[4]Engineering details regarding the Bears Ears to Bonanza 345kV relocation and structure types will be completed upon approval of a final route in the BLM, USFS, and BIA Records of Decision; BLM right-of-way grant, USFS special-use authorization, and BIA encroachment permit and grant of easement.

3.2.3 Transmission Structures

The Project circuits typically will be supported by the following types of 500/345kV structures: 500kV self-supporting single circuit lattice steel, self-supporting single circuit steel H-frame, single circuit “guyed” lattice steel, single circuit steel mono-pole and/or 345kV double circuit steel mono-pole structures. Tangent structures are designed to support the conductors where the transmission-line angle at the structure location is typically 1 degree or less, meaning the transmission line is essentially a straight line. Very similar structures by appearance support the line at a line angle (direction changes) up to about 30 degrees. A structure with more complex insulator assembles and heavier/stronger structures will be used when line angles are greater than 30 degrees.

500-kilovolt Steel Structures

Steel-lattice structures (Figures 3-2, 3-3, 3-5, and 3-6) will be fabricated with galvanized steel members treated to produce a dulled galvanized finish. The average distance between 500kV structures, or span, typically will range between 1,000 to 1,800 feet with occasional longer spans in rough terrain. Structure heights will vary depending on terrain and the requirement to maintain minimum conductor clearances from ground. The 500kV single-circuit structures will vary in height from 110 to 200 feet.

H-frame steel structures, Figure 3-4, will be fabricated using tubular self-weathering steel. Oxidation products form to create a protective coating and produce a rust-like finish. The average distance between 500kV structures will range from 1,200 to 1,300 feet. Structure heights will vary depending on terrain and the requirement to maintain minimum conductor clearances from ground. The 500kV single-circuit H-frame structures will vary in height from 100 to 165 feet.

345-Kilovolt Steel Structures

The two existing and one proposed 345kV single-circuit transmission lines between the Clover and Mona substations (Segments 4a, 4b, and 4c) will use steel H-frame, steel mono-pole single circuit, and/or steel mono-pole double circuit 345kV structures (Figures 3-7, 3-8, and 3-9).

The 345kV structures will be steel H-frame, steel mono-pole single-circuit or steel mono-pole double-circuit structures depending on final design requirements. The steel H-frame structures will use self-weathering steel or a dulled galvanized steel finish. Weathering steel is manufactured from a group of steel alloys that were developed to eliminate the need for maintenance painting. This type of steel alloy forms a stable dark red-brown rust-like appearance after exposed to the weather for a few years. The average distance between H-frame structures will be approximately 800 to 1,200 feet. Typically, the 345kV single-circuit H-frame structures will have pole lengths ranging between 80 and 140 feet. Embedment depths are typically 10 percent of the pole length plus 5 feet, which in the case of this Project is expected to range between 13 and 19 feet.

The average span between single-circuit monopole structures will be approximately 700 to 800 feet. Structures will be set on a drilled-pier foundation. The structure heights aboveground will vary from 85 to 130 feet.

The average distance between double-circuit monopole structures will be approximately 700 to 800 feet. Structures will be set on a drilled-pier foundation. The structure heights aboveground will vary from 95 to 150 feet.

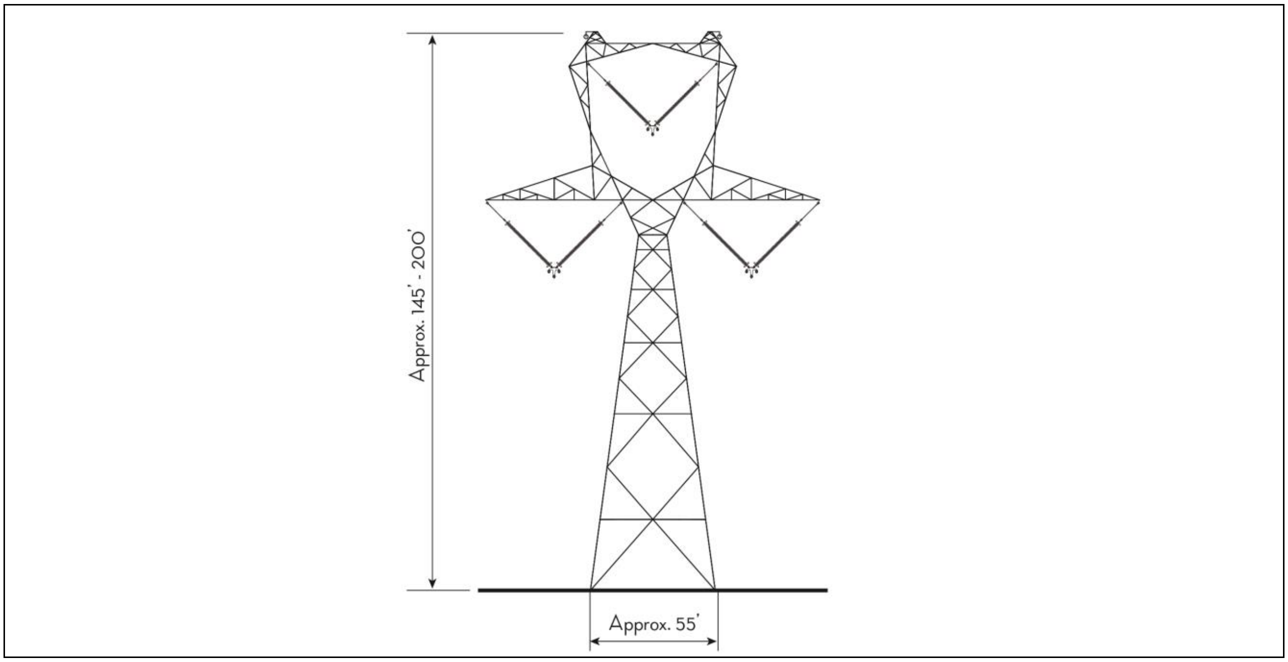

Figure 3-2 Proposed Tangent Single-circuit 500-kilovolt Lattice Steel Structure (Delta Configuration)

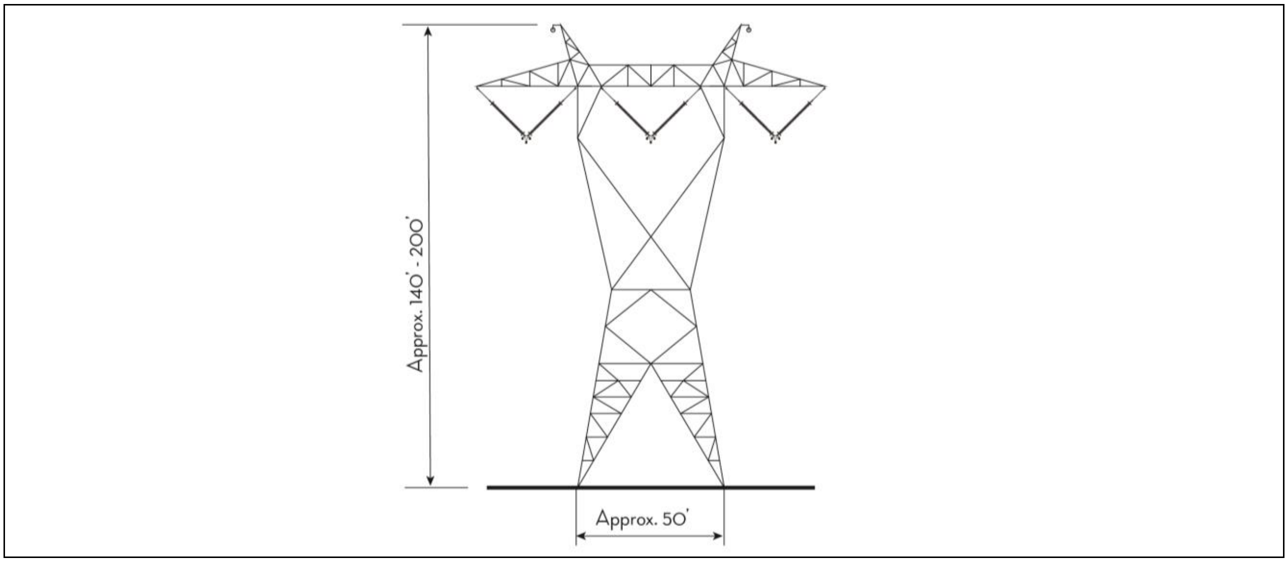

Figure 3-3 Alternative Proposed Single-circuit 500-kilovolt Lattice Steel Structure (Horizontal Configuration)

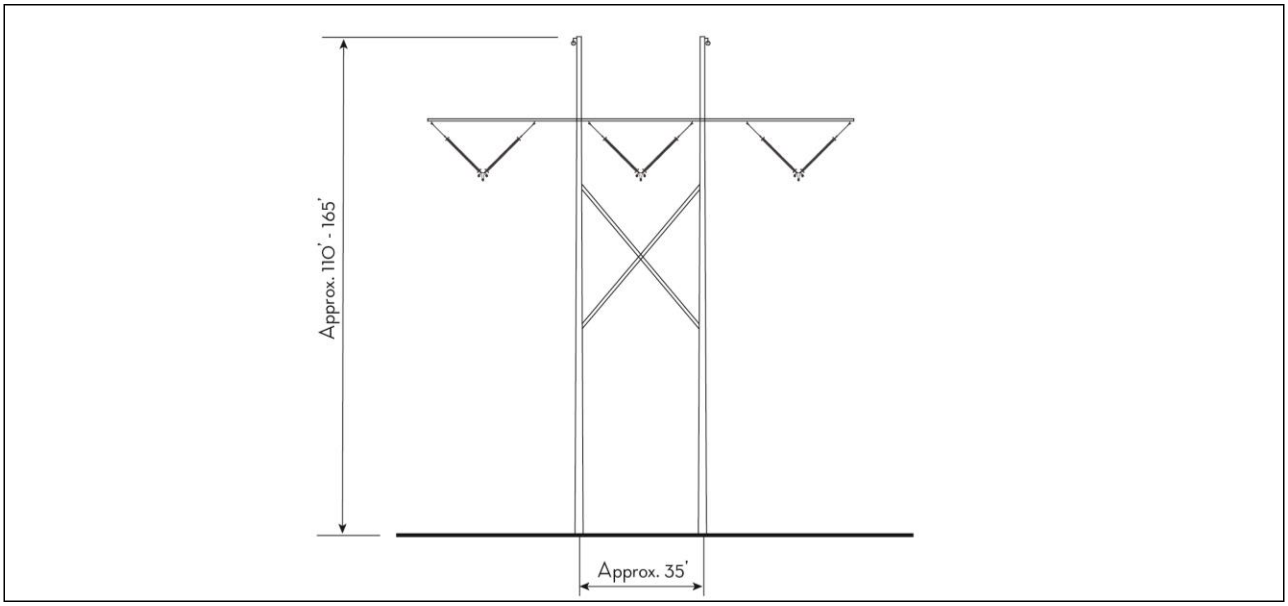

Figure 3-4 Proposed Tangent Single-circuit 500-kilovolt H-frame Structure

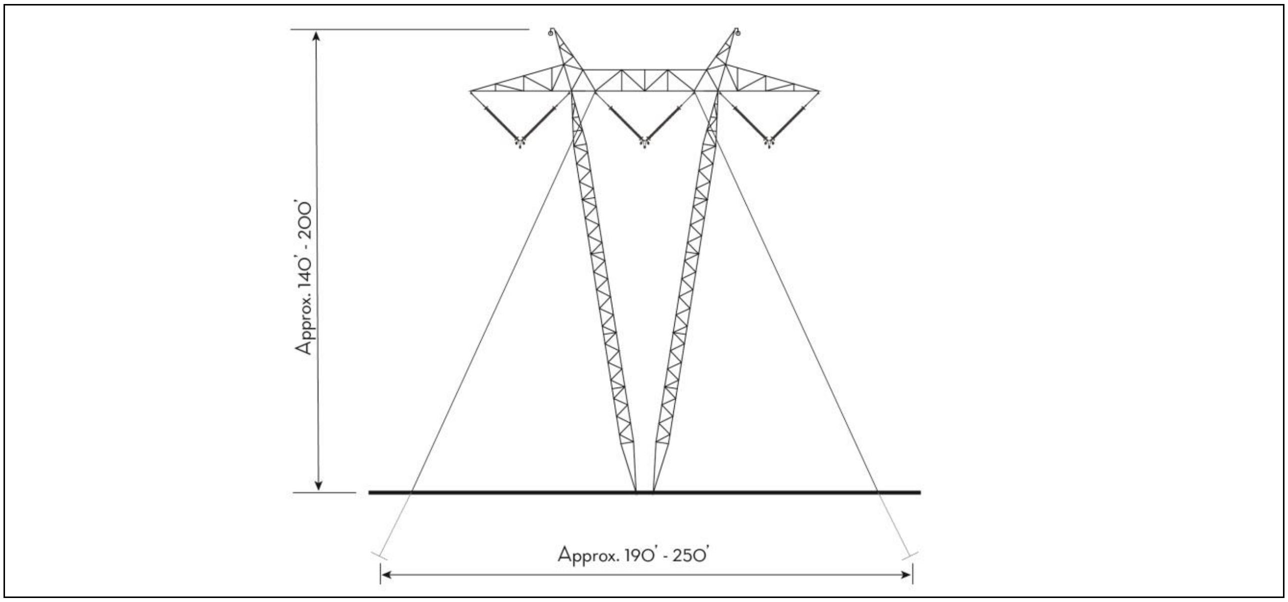

Figure 3-5 Proposed Tangent Single-circuit 500-kilovolt Guyed V

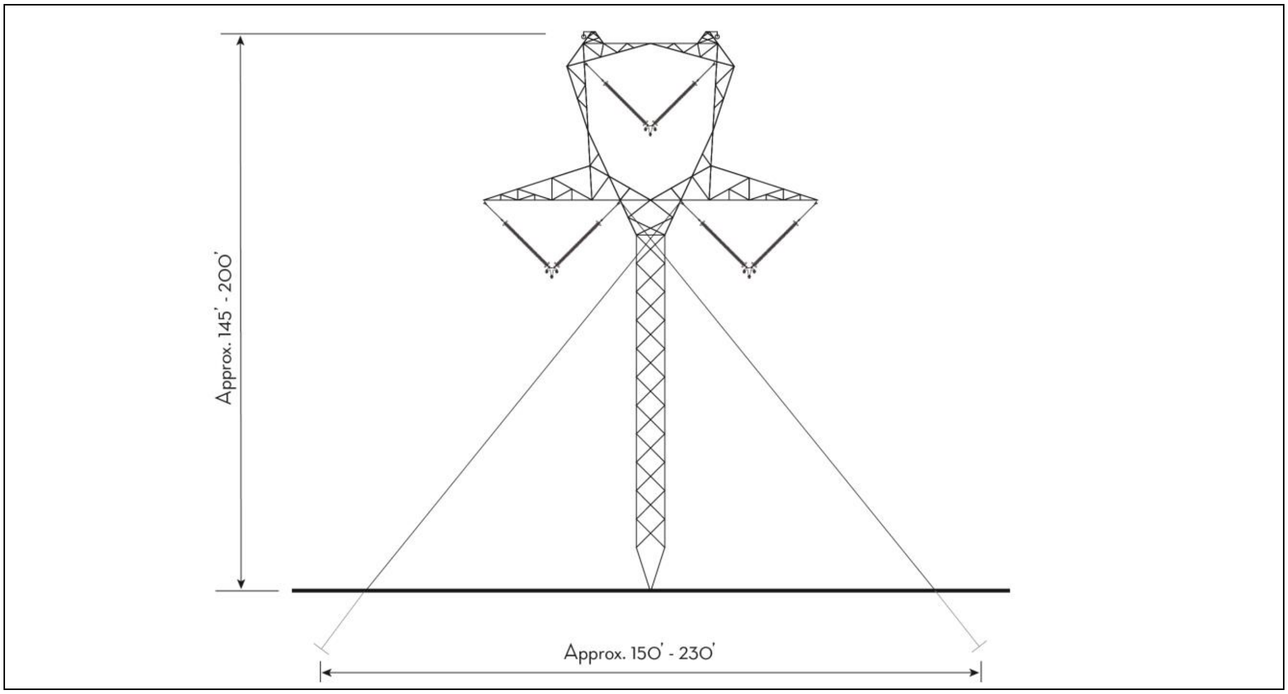

Figure 3-6 Proposed Tangent Single-circuit 500-kilovolt Guyed Delta

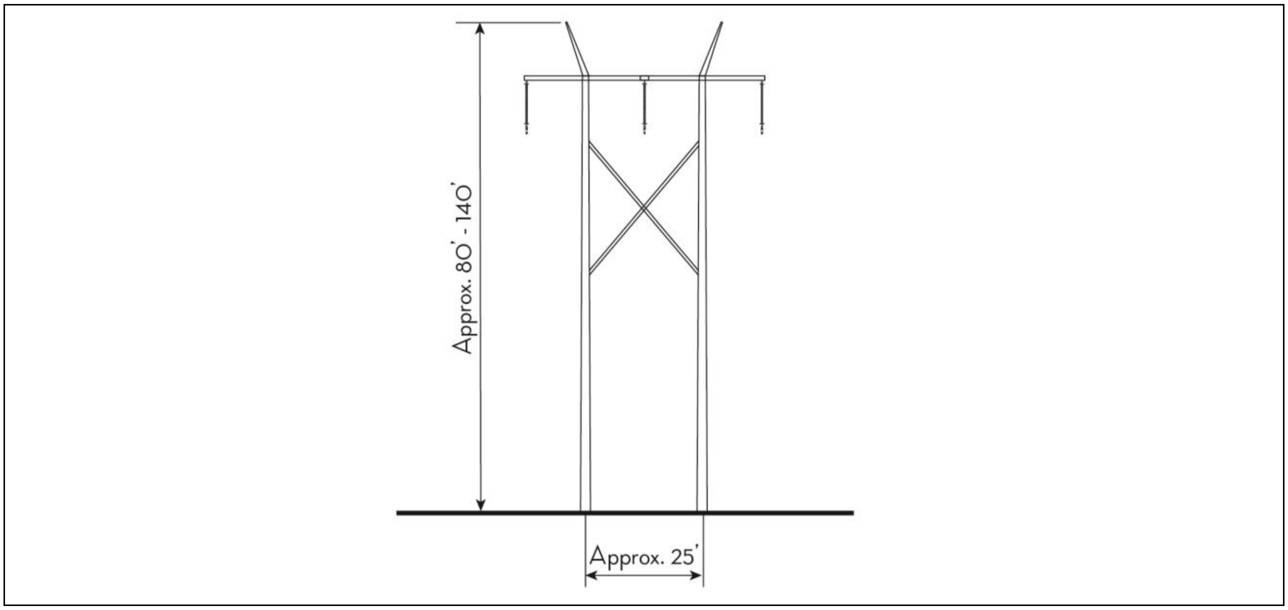

Figure 3-7 Proposed Tangent Single-circuit 345-kilovolt H-frame Structure

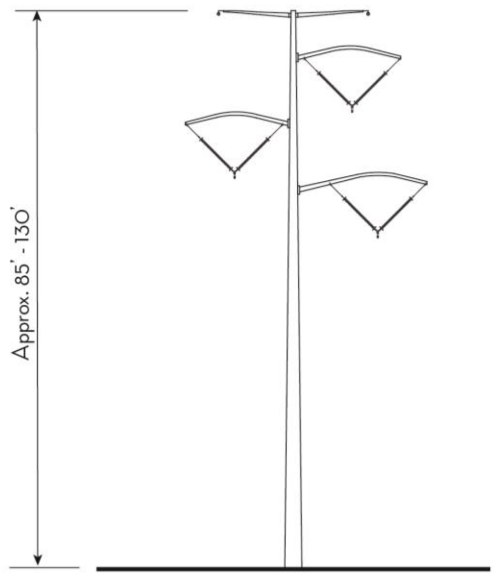

Figure 3-8 Proposed Single-circuit 345-kilovolt Mono-pole Tangent Structure (for angles 0° to 5°)

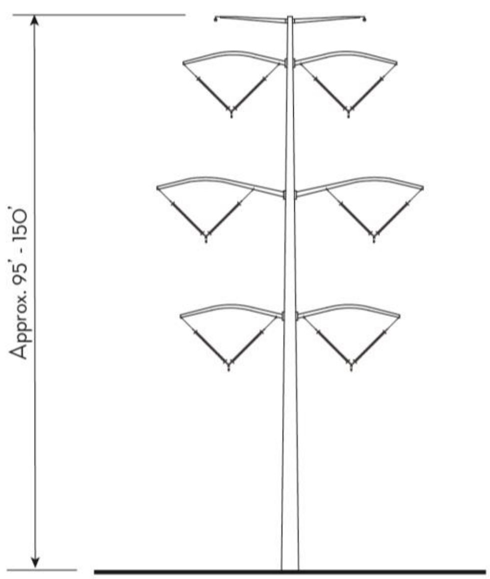

Figure 3-9 Proposed Double-circuit 345-kilovolt Mono-pole Tangent Structure (for angles 0° to 5°)

3.2.4 Structure Foundations

The 500kV single-circuit lattice-steel self-supported structures each require four foundations with one on each of the four corners of the lattice structures. The 500kV H-frame requires two foundations, one foundation for each tubular steel leg. The foundation diameter and depth for both steel-lattice and H-frame structures will be determined during final design and are dependent on the type of soil or rock present at each site; typical diameters and depths of foundation are shown in Table 3-2. Typically, the foundations for the self-supported single-circuit tangent lattice and H-frame structures will be composed of steel-reinforced concrete drilled piers. Alternative foundation types may be used where appropriate. These include grillage, precast pad and pedestal, as well as screw or micro piles. Geologic or loading conditions, as well as environmental disturbance constraints, among other concerns, may necessitate the use of one or more of these alternatives. Guys will be anchored using rock anchors, screw piles or micro piles.

Guyed V and Delta type structures require a single foundation located where the structure body meets the ground surface. Guyed V and Delta structures each require four guy anchors.

TABLE 3-2
TYPICAL 500-KILOVOLT STRUCTURE TYPE FOUNDATION

Structure Type	Number of Foundations/ Anchors	Foundation Diameter (feet)	Foundation Depth (feet)	Area of All Foundations (square feet)
Tangent lattice (delta configuration)	4	4.0	21.0	52.0
Tangent lattice (horizontal configuration)	4	4.0	21.0	52.0
Small angle lattice	4	4.0	27.0	52.0
Medium angle lattice	4	4.0	30.0	52.0
Medium deadend lattice	4	5.0	36.0	80.0
Heavy deadend lattice	4	5.0	41.0	80.0
Tangent H-frame tubular steel	2	6.0	25.0	57.0
Angle H-frame tubular steel	2	7.0	30.0	77.0
Deadend 3-pole tubular steel	3	7.0	35.0	116.0
Guyed V	1/4	~5.0	~15.0	20.0
Guyed Delta	1/4	~5.0	~15.0	20.0

Depending on soil and tubular-steel structure type, the 345kV foundations will be either drilled-pier foundations or directly embedded. Typically, the tangent (no line angle change) 345kV single-circuit H-frame structures are directly embedded into the ground and do not require concrete foundations. The embedment depth is typically 10 percent of the pole length plus 5 feet. The diameter of the hole excavated for embedment is typically the pole diameter plus 18 inches. When a pole is placed in a hole, native or select backfill will be used to fill the voids around the perimeter of the hole.

Monopole 345kV single- and double-circuit structures will use a drilled-pier foundation. The foundation diameter and depth will be determined during final design and are dependent on the type of soil or rock present at each specific site. Typical foundation diameters and depths for the single-circuit and double-circuit mono-pole structure families are shown in Table 3-3.

TABLE 3-3
TYPICAL 345-KILOVOLT STRUCTURE TYPE FOUNDATIONS

Structure Type	Number of Foundations	Foundation Diameter (feet)	Foundation Depth (feet)	Area of All Foundations (square feet)
Single Circuit				
Tangent H-frame	2	4.0	18.0	26.0
Tangent monopole	1	7.0	24.0	39.0
Small angle monopole	1	7.5	26.0	45.0
Medium deadend 3-pole tubular steel	3	7.0	30.0	116.0
Medium deadend monopole tubular steel	1	10.0	35.0	79.0
Heavy deadend 3-pole tubular steel	3	7.0	30.0	116.0

TABLE 3-3 TYPICAL 345-KILOVOLT STRUCTURE TYPE FOUNDATIONS				
Structure Type	**Number of Foundations**	**Foundation Diameter (feet)**	**Foundation Depth (feet)**	**Area of All Foundations (square feet)**
Heave deadend monopole tubular steel	1	10.0	35.0	79.0
Double Circuit				
Tangent monopole	1	8.5	32.0	57.0
Small angle monopole	1	9.0	34.0	64.0
Medium deadend monopole	1	10.5	40.0	87.0
Heavy deadend monopole	1	12.0	45.0	114.0

3.2.5 Transmission Line Hardware

Conductors for Segments 1, 2, and 3

The conductor for the self-supported 500kV lines, as well as the guyed steel 500kV lines, is 1,272 kcmil (thousand circular mil) aluminum-conductor steel-reinforced triple bundled "Bittern." For all 500kV lines, each phase of the three-phase circuit[2] will be composed of three subconductors in a triple-bundle configuration. The triple-bundle configuration provides adequate current carrying capacity and provides for a reduction in audible noise and radio interference as compared to a single large-diameter conductor. Each 500kV subconductor will have a 45/7 aluminum/steel stranding, with an overall conductor diameter of 1.345 inches and a weight of 1.432 pounds per foot and a nonspecular finish[3].

Conductors for Segments 4a and 4b

The conductor for the 345kV lines (Segments 4a and 4b) is 1,272 kcmil 45/7 ACSR "Bittern." Each phase of the 345kV three-phase circuit will be composed of three subconductors. The individual 1,272 kcmil conductors will be bundled in a triangle configuration with spacing of 18 inches. The triple-bundle configuration provides adequate current carrying capacity and provides for a reduction in audible noise and radio interference when compared to a single large-diameter conductor. Each 345kV conductor will have 45/7 aluminum/steel stranding, with an overall conductor diameter of 1.345 inches and a weight of 1.432 pounds per foot and a nonspecular finish.

Conductors for Segment 4c

The conductor for the relocated Mona – Huntington 345kV transmission line loop into Clover Substation (Segment 4c) is 954 kcmil 54/7 ACSR "Cardinal." Each phase of the 345kV three-phase circuit will be composed of two subconductors in a double-bundle configuration. The individual 954 kcmil conductors will be bundled in a vertical configuration with spacing of 18 inches. The double-bundle configuration provides adequate current carrying capacity and provides for a reduction in audible noise and radio interference when compared to a single large-diameter conductor. Each 345kV conductor will have 54/7 aluminum/steel stranding, with an overall conductor diameter of 1.196 inches and a weight of 1.229 pounds per foot and a nonspecular finish.

Insulators and Associated Hardware

As shown in Figures 3-2 through 3-9, insulator assemblies for both the 345kV and 500kV tangent structures will consist of two strings of insulators in the form of a "V" or a single string of insulators in

[2]For transmission lines, a circuit consists of three phases. A phase may consist of one conductor or multiple conductors (i.e., subconductors) bundled together.
[3]Nonspecular finish refers to a dull finish rather than a shiny or reflective finish.

the form of an "I." The V-shaped configuration of the insulators restrains the conductor bundle from excessive swing into the structure in high winds, allowing a more compact phase separation. The I-shaped configuration is hung vertically from the cross arm, arm, or bridge in the form of an "I" and is subject to higher swing angles in high winds than the "V." Deadend insulator assemblies for both 345kV and 500kV lines will use an I-shaped configuration in the horizontal position on both the ahead and back span sides of the structure, which consists of insulators suspended from either a structure deadend cross arm or bridge in the form of a horizontal "I." The conductor from the ahead and back span sides of the structure is connected from either of the horizontal I-shaped configuration, through an I-shaped configuration insulator or "jumper" in the vertical position, to the horizontal I-shaped configuration on the opposite side of the structure. Tangent structures use 3 insulator assemblies where deadend structures consist of 9 total I-shaped insulator strings—6 in the horizontal position and 3 in the vertical position. Insulators will be composed of porcelain, toughened glass, or polymer.

Grounding Systems

A grounding system will be installed at the base of each transmission structure (except potentially the direct-embedded 345kV structures) that will consist of copper ground rods embedded into the ground in immediate proximity to the structure foundation and connected to the structure by a buried copper lead. When the resistance to ground for each transmission structure is shown to be greater than 15 ohms with the use of ground rods, counterpoise will be installed to lower the resistance to 15 ohms or less. Counterpoise consists of a bare copper-clad or galvanized-steel cable buried a minimum of 12 inches deep, extending from structures (from one or more legs of the structure) for approximately 200 feet within the right-of-way. During final design of the Project, appropriate electrical studies will be conducted to identify the issues associated with paralleling other facilities and the types of equipment that will need to be installed (if any) to mitigate the effects of the induced currents. In extremely rare situations where the soil conditions are highly resistant, the buried copper lead may need to be extended outside of the right-of-way. Coordination with the agencies will occur in these instances.

Minor Additional Hardware

In addition to the conductors, insulators, and overhead shield wires, other associated hardware will be installed on the structure as part of the insulator assembly to support the conductors and shield wires. This hardware will include clamps, shackles, links, plates, and various other pieces composed of galvanized steel and aluminum.

Other hardware that is not associated with the transmission of electricity may be installed as part of the Project. This hardware may include aerial marker spheres or aircraft warning lighting as required for the conductors or structures per Federal Aviation Administration (FAA) regulations[4]. Structure proximity to airports and structure height are the determinants of whether FAA regulations will apply based on an assessment of wire/structure strike risk.

3.2.6 Communications Systems

Optical Ground Wire

Reliable and secure communications for system control and monitoring of the Project is very important to maintain the operational integrity of the Project and of the overall interconnected system. Primary communications for relaying and control will be provided via the OPGW, for use by and for the Company's operation of the transmission system, which will be installed on the transmission lines. For

[4] U.S. Department of Transportation, Federal Aviation Administration, Advisory Circular AC 70/7460-1K Obstruction Marking and Lighting, August 1, 2000; and Advisory Circular AC 70/7460-2K Proposed Construction or Alteration of Objects that May Affect the Navigable Airspace, March 1, 2000.

the 500kV transmission lines, a secondary communications path will be provided by the Company's existing microwave system, which is currently installed from the central Wyoming area to existing substations in central Utah. A secondary communications path also may be developed using a power line carrier for the Company's operation of the transmission system. No new microwave sites are anticipated for the Project. Updated microwave equipment may be installed at existing sites and at the substations.

Each structure will have two lightning-protection shield wires installed on the peaks of each of the 500kV single-circuit steel-lattice and H-frame structures. On the 345kV H-frame structures, these lightning-protection shield wires will be installed at the top of each pole. On both the 500kV and 345kV transmission lines where communication is required, one of the shield wires will be composed of extra-high-strength-steel wire with a diameter of 0.5 inch and a weight of 0.517 pound per foot. The second shield wire will be an OPGW constructed of aluminum and steel, which carries 48 glass fibers in its core. The OPGW will have a diameter of 0.64 inch and a weight of 0.375 pound per foot. The glass fibers inside the OPGW shield wire will provide optical data transfer capability among the Company's facilities along the fiber path for the Company's operation of the Project. The data transferred are required for system control and monitoring. On lines where communication is not required, both of the shield wires will be composed of the extra-high-strength steel wires. All 500kV line segments of the Project will be designed to carry an OPGW. For the 345kV lines, Segment 4a will be designed to carry an OPGW.

Regeneration Stations

As the data signal is passed through the OPGW, the signal degrades with distance. Consequently, signal regeneration stations are required to amplify the signals if the distance between substations or regeneration stations exceeds 55 miles. The exact locations cannot be determined at this time.

A regeneration station may be housed within a substation control house in those cases where a substation is located along or near the Project at an appropriate milepost. Otherwise, land must be obtained. Where a new site is required, the typical site will be 100 feet by 100 feet, with a fenced area of 75 feet by 75 feet. A 12-foot- by 32-foot- by 9-foot-tall building or equipment shelter (metal or concrete) will be placed on the site, and access roads to the site and power from the local electric distribution circuits will be required. An emergency generator with a liquid-petroleum-gas-fuel tank will be installed, in compliance with current regulations, at the site inside the fenced area. Two diverse communication cable routes (aerial and/or buried) from the Project right-of-way to the equipment shelter will be required. Figure 3-10 illustrates the plan arrangement of a typical regeneration station.

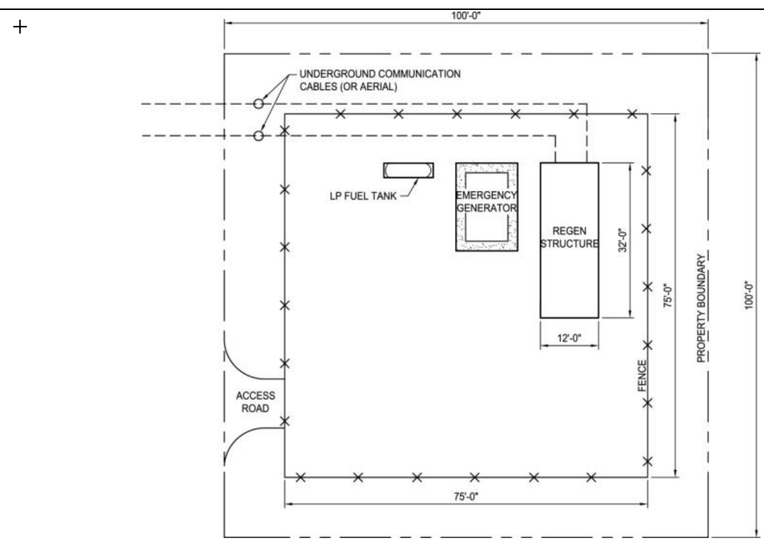

Figure 3-10 Typical Regeneration Site Layout

3.2.7 Substations and Series Compensation Stations

3.2.7.1 Substation and Series Compensation Stations Overview

Aeolus Substation

This substation will be built as part of the Gateway West Project and a single 500kV deadend structure will be constructed inside that substation for this Project. Major facility/equipment additions to be installed at Aeolus Substation for Gateway South include, substation steel deadend structures, circuit breakers and related switching equipment and bus work. It is anticipated that all work involved with terminating the Gateway South 500kV line will be performed within the substation fence as proposed by Gateway West.

Series Compensation Substation No. 1

Construction of Series Compensation Substation No. 1 will consist of installation of circuit breakers and related switching equipment, bus supports, and other equipment to be installed for the 500kV transmission-line structures. Additional equipment, including 500kV series capacitors, shunt-reactor banks, and emergency generators with liquid-petroleum-gas-fuel tank containment protection, along with all associated site preparation, fencing, foundations, protection, control, communications equipment, and metering, will be installed. Refer to additional information regarding series compensation station components below. Siting areas to screen locations for the series compensation stations have been identified so that this site would be located approximately one-third the distance from the Aeolus Substation to the Clover Substation.

Series Compensation Substation No. 2

Construction of Series Compensation Substation No. 2 will consist of installation of circuit breakers and related switching equipment, bus supports, and other equipment to be installed for the 500kV transmission-line structures. Additional equipment, including 500kV series capacitors, shunt-reactor banks, and emergency generators with liquid-petroleum-gas-fuel tank containment protection, along with all associated site preparation, fencing, foundations, protection, control, communications equipment, and metering, will be installed. Refer to additional information regarding series compensation station components below. Siting areas to screen locations for the series compensation stations have been identified so that the site would be located approximately two-thirds the distance from the planned Aeolus Substation to the planned Clover Substation.

Clover Substation

The Clover Substation is an existing facility of Gateway Central and has been permitted and assessed under previous NEPA documentation. Expansion of the existing facility, in the area previously permitted and assessed, is necessary to accommodate the equipment required to terminate the new 500kV and 345kV transmission lines into the substation. Major facility/equipment additions to Clover Substation include 500kV- and 345kV-related equipment.

Mona Substation

Changes to the existing Mona Substation occurring within the existing fence line include installation of new circuit breakers, protective relaying metering, substation structural members, and bus work to upgrade the Mona to Clover No. 1 and No. 2 transmission line bays. For this Project, it is anticipated the current footprint of the Mona Substation will remain the same with no expansion of the substation required.

3.2.7.2 Series Compensation Station Components

Two series compensation substations are required to improve the transport capacity and efficiency of the Project. Locations for the series compensation stations have not been identified, as of the date of this POD; however, they will be located approximately one-third (Series Compensation Station No. 1) and two-thirds (Series Compensation Station No. 2) of the distance from the Aeolus Substation to the Clover Substation.

The following sections describe key components of the series compensation substations.

Bay

A series compensation substation "bay" is the physical location in a series compensation substation fenced area where the high-voltage circuit breakers and associated steel transmission line termination structures, high-voltage switches, series compensation equipment, bus supports, controls, and other equipment are installed. For the 500kV transmission line, circuit breakers, high-voltage switches, bus supports, and transmission line termination structures typically will be installed. The tallest structures in the series compensation substations will be the 500kV deadend structures, which vary in height from approximately 70 to 135 feet, and/or a microwave antenna tower, which will be 100 feet or more depending on the height needed to maintain line of sight to the nearest microwave relay site. Additional equipment, including 500kV transformers and 500kV shunt reactors (which resemble a transformer in appearance), and 500kV shunt-capacitor banks, will be installed.

Figure 3-11 is a perspective sketch illustrating the appearance of a typical 500kV series compensation substation with multiple line connections.

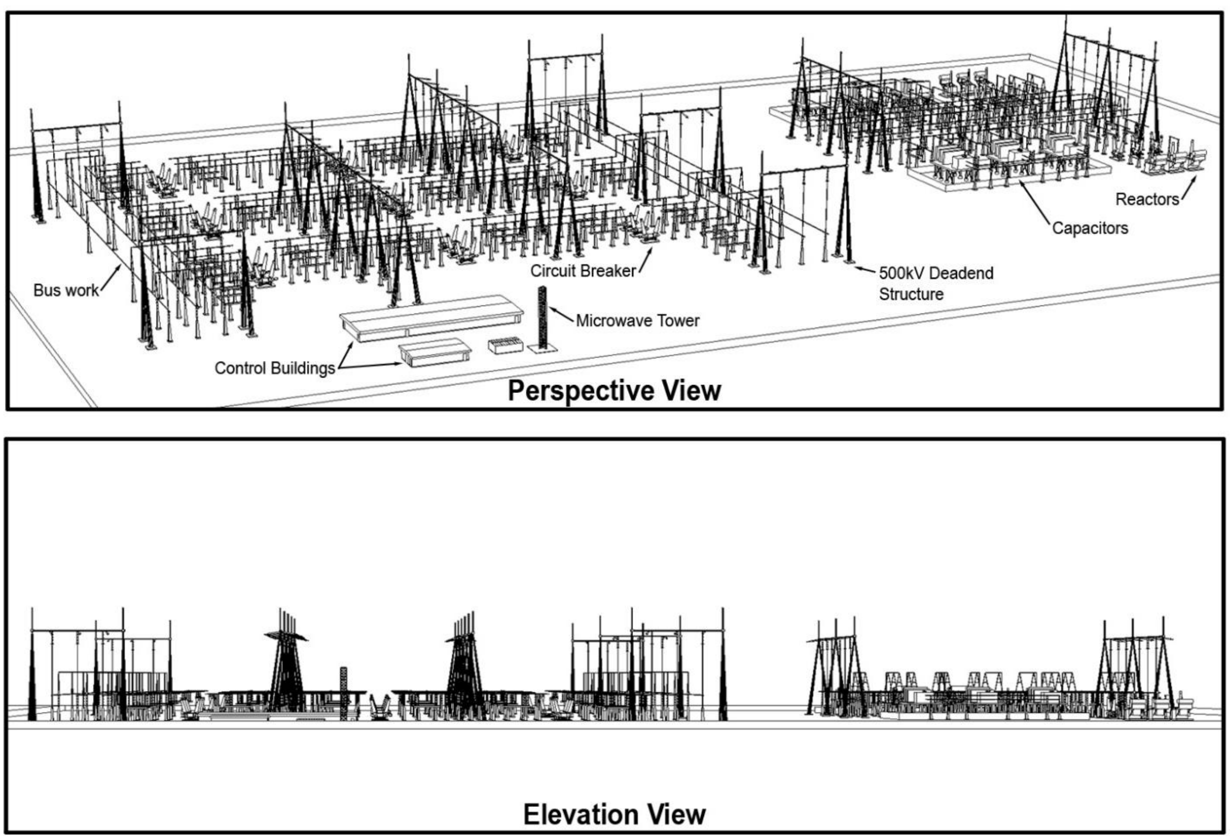

Figure 3-11 Typical 500-kilovolt Substation

Access Road

Permanent all-weather access roads are required at the series compensation substation sites to provide access for personnel, material deliveries, vehicles, trucks, heavy equipment, low-boy tractor trailer rigs (used for moving large transformers), and ongoing maintenance activities at each site. Substation access roads normally are well-compacted, graded gravel roads approximately 20 feet wide with a minimum 110-foot turning radius to accommodate the delivery of large transformers to the site. New access roads will be developed from public roads to the two series compensation substations.

Control Building

One or more control buildings are required at each substation to house protective relays, control devices, battery banks for primary control power, and remote monitoring equipment. The size and construction of the building depends on individual substation requirements. Typically, the control building will be constructed of concrete block, pre-engineered metal sheathed, or composite surfaced materials. Special control buildings may be developed in the series compensation substation developments to house other control and protection equipment.

Fencing

Security fencing will be installed around the entire perimeter of each series compensation substation to protect sensitive equipment and prevent accidental contact with energized conductors by third parties. This 7-foot-high fence will be constructed of chain link with steel posts, with 1 foot of barbed wire above the chain link and with locked gates.

Distribution Supply Lines

Station-service power will be required at each series compensation substation or regeneration station. Typically, station-service power is provided from a local electric distribution line, located in proximity to the series compensation substation or regeneration station. The voltage of the distribution supply line is typically 34.5kV or lower and carried on wood poles. For all new series compensation substations sites, it will be necessary to extend the electric distribution line from a suitable take-off point on the existing distribution line to the new Gateway South substation site or regeneration station. The location and routing of the existing distribution lines to the new substation sites will be determined during the final design process. Modifications to the existing distribution facilities may be necessary to provide increased capacity to support the expansions at the existing substation sites.

3.2.8 Preliminary Access Road Information

Access to the right-of-way is an essential part of the construction and operation of the Project. Large foundation auger equipment, heavily loaded trucks, cranes, and specialized transmission-line construction equipment will be required for construction, maintenance, and emergency restoration activities. Annual ground-based inspections require vehicular access using four-wheel-drive trucks or four-wheel-drive all-terrain vehicles (ATVs) and bucket trucks to each structure site.

During construction, vehicular access will be required to each structure. New access will be constructed and existing pathways widened as needed. Access not required after construction will be restored to the original condition or left as is, depending on landowner or land-management agency requirements (refer to Appendix A2 – Traffic and Transportation Management Plan).

Access construction employs heavy equipment, including bulldozers, front-end loaders, dump trucks, water trucks, backhoes, excavators (both tracked and rubber-tired), and graders. Other specialized equipment, including boom trucks to install culverts in some areas, will be used where needed. Access will be built to provide a stable, permanent (where allowed) minimum 14-foot-wide travel surface. Depending on the side slope, disturbance width will be greater than 14 feet and can include cuts and fills, crowning and ditching, at-grade water bars, and various kinds of water-body crossings.

The largest of the heavy equipment needed, which dictates the minimum-needed road dimensions, is a truck-mounted aerial-lift crane 100,000 pounds gross-vehicle-weight eight-wheel-drive, 210-foot telescoped boom. Vehicle width is 8 feet 6 inches (102 inches) or less and wheelbase is approximately 40 feet. To accommodate this equipment, the road specifications require a minimum 14-foot-wide road top (travel way) with a minimum of 16- to 22-foot-wide road width in turns. The required access disturbance area and travel way in areas of rolling to hilly terrain will require a wider disturbance to account for cuts and fills, or where vehicles are required to pass one another while traveling in opposite directions.

During routine operations, vehicular access by four-wheel-drive trucks and ATVs will be needed to each structure for periodic inspections and maintenance and to areas of forest or tall shrubs to control vegetation in the right-of-way for safe operation. In an emergency, full emergency access, including access for cranes and other heavy equipment, will be needed. Based on historical reliability of lattice structures and conductors, it is anticipated that only a small fraction of the structure sites will require emergency access over the life of the Project.

Following are access types anticipated to be used and or developed for the Project.

- **Type 1: Existing Roads – No Improvement**. This access road type includes paved or all-weather surfaced roads, including well traversed and established dirt roads that meet the Company's construction road standards. The Company's construction-road standards include the use of a minimum travel surface width of 14 feet and require a travel-surface width up to 22 feet depending on the radius of curves.

  The term "No-Improvement" is intended to signify that no new disturbance will be created outside of an established disturbed area. As such, the Existing Roads – No Improvement access-road type could include regular maintenance to make the road passable for construction. Regular maintenance could include minor blading activities, repair of washed out areas, wash-boarded areas, depressions requiring graveling, approach installation, and other minor improvements.

- **Type 2: Existing Roads – Improvements Required**. This access-road type includes existing roads that require improvements to meet the Company's construction-road standards. The Existing Roads – Improvements Required access-road type includes existing roads that may require widening to a minimum 14-foot-wide travel surface to meet the Company's construction road standards. In areas of steep terrain, the road travel-surface width could be a maximum of 22 feet to meet the Company's construction-road standards, depending on the radius of curves and the slope of the terrain. As a result, total disturbance has the potential to exceed 22 feet, depending on the slope of the terrain. Disturbed areas, as a result of cut-and-fill slopes, will exceed the travel-surface width in areas of steep terrain. The area for tree clearing is not included in the maximum disturbance width.

  Improvements to this access-road type could include blading to create a road to meet the Company's construction-road standards, cut-and-fill activities, re-establishing drainage features, tree removal, boulder and rock removal, bridge and culvert construction, installation of wash crossings, and other improvements to provide an adequate surface to support construction and maintenance vehicles.

  Improvements to this access-road type may require reclamation to preconstruction conditions as determined by the land-management agency requirements or landowner requirements.

- **Type 3: New Roads – Bladed.** This access-road type includes the construction of new permanent access roads where existing roads do not exist with the purpose of allowing for access to the Project right-of-way. New bladed access roads will be constructed to meet the Company's construction-road standards. The Company's road-construction standards include constructing a minimum travel-surface width of 14 feet. In areas of steep terrain, the road travel-surface width could be a maximum of 22 feet to meet the Company's construction-road standards, depending on radius of curves and the slope of the terrain. As a result, total disturbance has the potential to exceed 22 feet, depending on the slope of terrain. Disturbed areas, as a result of cut-and-full slopes, will exceed the travel-surface width in areas of steep terrain. The area for tree clearing is not included in the maximum disturbance width. Stabilized construction entrances will be used to transition from paved surfaces to other access types.

- **Type 4: New Roads – Overland Travel**. This access-road type includes new permanent access routes that will use overland travel with the purpose of allowing access to the Project right-of-way. It is intended that overland travel access is used in areas where access can be attained without construction of roads according to the Company's access road standards. As such overland travel will be used in areas of relatively flat topography. The result will be an access route that will eventually become a two-track trail or naturally revegetate completely, but still allow the Company's access without grading after construction.

  Overland travel comprises the following two different methods:

  - **Type 4a: Drive and Crush**. This type is vehicular travel to access a site without significantly modifying the terrain. This access type will have a minimum 14-foot travel surface and disturbance width. Vegetation is crushed, but not cropped, and soil is compacted, but no surface soil is removed. Even though vegetation may be damaged or destroyed, this creates vertical mulch on the surface soil and leaves the seed bank in place. Crushed vegetation will likely resprout after temporary use is stopped. A dozer, grader, or other type of equipment may be used to move boulders or other obstructions that prevent overland travel. Additionally, minor areas where the planned access crosses a side slope that exceeds the allowable slope for access by construction or maintenance vehicles may be graded to provide safe passage. The disturbed area will be blended, to the extent practicable, into the existing grades and revegetated according to the prescribed mitigations.

  - **Type 4b: Clear and Cut**. This type is considered as above-grade removal of vegetation to improve or provide suitable access for equipment. This access type will have a minimum 14-foot travel surface and disturbance width. All vegetation is removed using above-grade cutting methods that leave the root crown intact. The vegetation root ball will be left in place wherever practical to facilitate re-establishment. Soils are compacted, but no surface soil is removed. A dozer, grader, or other type of equipment may be used to move boulders or other obstructions that prevent overland travel. Additionally, minor areas where the planned access crosses a slide slope that exceeds the allowable slope for access by construction or maintenance vehicles may be graded to provide safe passage. The disturbed area will be blended, to the extent practicable, into the existing grades and revegetated according to the prescribed mitigations. The area for tree clearing outside of the travel surface is not included in the maximum disturbance width.

- **Type 5: Temporary Roads**. This access-road type can include the temporary construction of new access roads, the use of existing trails/two-track roads, or overland travel access to support the construction of the Project and access the Project right-of-way. This access-road type does not require construction to meet the Company's road-construction standards. However, this access-road type will be constructed to provide a safe travel way and, as such, temporary disturbance could result. Temporary disturbance will be dictated by the underlying ground conditions, but disturbance could range from significant, such as blading/cut-and-fill activities, to minor, such as overland travel. Unless otherwise noted by the land-management agency or landowner, this access-road type requires reclamation, to the extent practicable, to preconstruction conditions. Reclamation activities will be consistent with the requirements identified in Appendix C1 – Reclamation, Revegetation, and Monitoring Plan Framework.

3.3 Land Requirements and Construction Disturbance

The Company proposes to acquire a permanent 250-foot-wide right-of-way for the 500kV single-circuit sections of the Project, and a 150-foot-wide right-of-way for the 345kV single-circuit Segment 4c of the Project. Segments 4a and 4b will be in existing rights-of-way. Figure 3-12 shows a typical 250-foot-wide right-of-way for the 500kV portion of the Project. The determination of these widths is based on two criteria:

- Sufficient clearance in the span between support structures to obstacles outside the right-of-way must be maintained during a high-wind event when the conductors are blown toward the right-of-way edge.
- Sufficient room must be provided in the right-of-way at the support structures to perform Project maintenance.

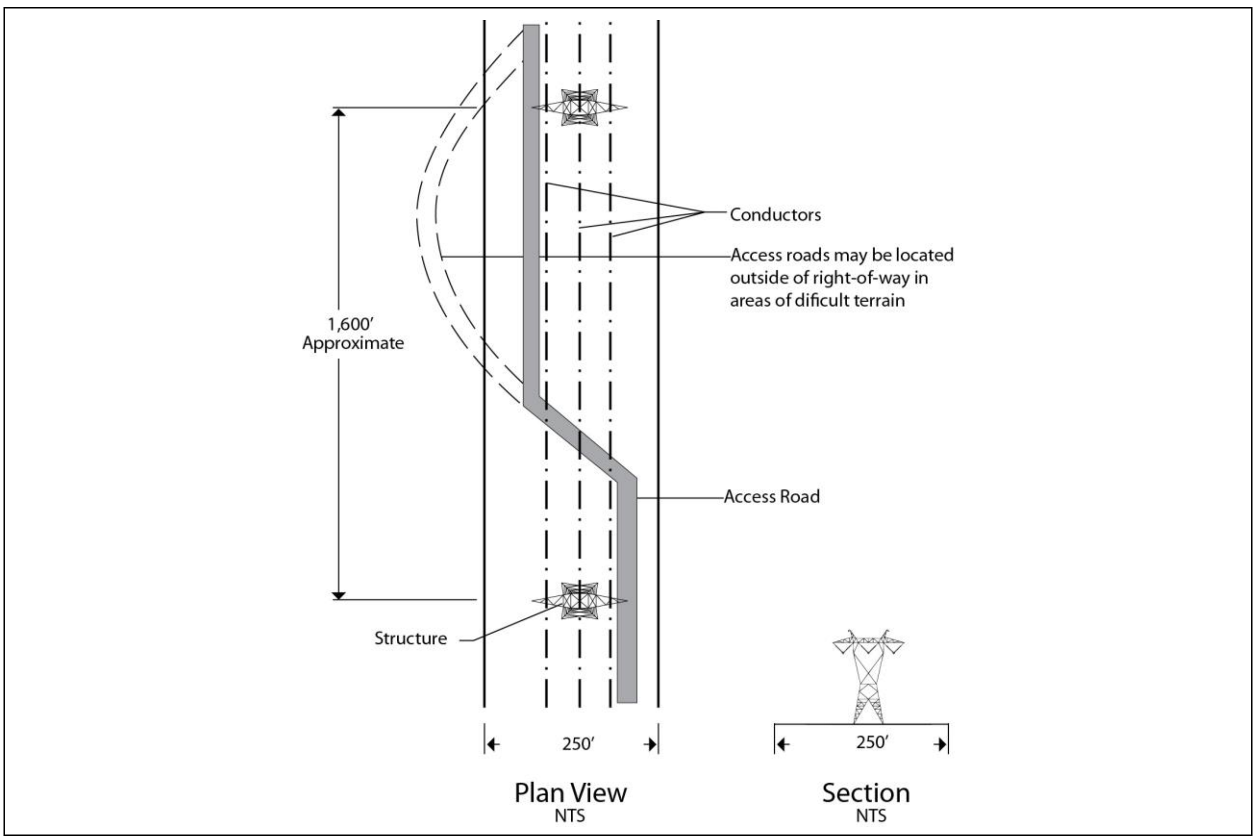

Figure 3-12 Typical Right-of-Way

During construction, temporary permission and/or right-of-way will be required from landowners and land-management agencies during construction of temporary components of the Project, such as multi-purpose construction yards and helicopter fly yards. During operation, Project land requirements will be restricted to the right-of-way, access roads, series compensation substations, and communication facilities. Access to the right-of-way will be in accordance with the land rights obtained as part of the grant or easement acquisition process. As further details of the final Project design are engineered, the amount of land required may change.

Table 3-4 – Right-of-way Disturbance Acreages Across Administrative Jurisdictions for the Project provides a general breakdown of right-of-way requirements during construction and operation by landowner type. As further details of the final Project design are engineered, the amount of land required or disturbed may change. Final land requirements for federal lands will be provided as needed for any easement transaction with state or private entities.

TABLE 3-4
RIGHT-OF-WAY DISTURBANCE ACREAGES ACROSS ADMINISTRATIVE JURISDICTIONS FOR THE PROJECT

Jurisdiction	Right-of-way Acres for Temporary Use	Right-of-way Acres for Permanent Use	Total Right-of-Way Disturbance Acres
BLM	2,478	1,369	3,847
USFS	91	50	141
Indian Reservation	18	10	28
State	528	291	819
Private	1,502	830	2,332
Total	**4,617**	**2,550**	**7,167**

3.3.1 Right-of-Way Acquisition

New permanent (long-term) and temporary land use is required for the transmission line facilities, such as the transmission line corridor, access roads, and structure work areas. The Project must obtain new rights-of-way through a combination of right-of-way grants (BLM), special-use authorizations (USFS), encroachment permit and grant of easement (BIA), and easements between the Company; various federal, state, and local governments; other companies/utilities; and private landowners.

Additional rights-of-way may be required in areas where the transmission line will turn at a sharp angle. Access roads may be located outside of the transmission line right-of-way in areas of difficult terrain. Also, areas used temporarily on federally administered lands may require a short-term right-of-way.

Rights-of-way for transmission line facilities on private lands will be obtained as perpetual easements. Land for series compensation substations or regeneration stations will be obtained in fee simple where located on private land. Every effort will be made to purchase the land and/or obtain easements on private lands through reasonable negotiations with the landowners. All negotiations with landowners will be conducted in good faith, and the Project’s effect on the parcel or any other concerns the landowner may have will be addressed.

To achieve the capacity needed to serve present and future loads in the Company’s service areas, the North American Electricity Reliability Corporation (NERC) and Western Electricity Coordinating Council (WECC) reliability standards require minimum separation from existing transmission lines that serve substantially the same load as the Project. In these cases, it is the Company’s minimum separation guideline that the Project be located at least 250 feet from the nearest existing 230kV or higher-voltage transmission lines or at least 300 feet from planned high-voltage transmission lines. Land between rights-of-way that are separated to meet reliability criteria will not be encumbered with an easement but could be limited in some land uses due to the proximity of two or more large transmission lines.

3.3.2 Temporary and Permanent (Long-term) Construction Disturbance

Areas of temporary and permanent (long-term) disturbance for the construction areas will be calculated using geographic information systems (GIS) per specifications presented in Table A3-3 – Summary of Estimated Ground Disturbance and Vegetation Clearing for the Project.

A temporary disturbance area of 250 by 250 feet typically is assumed for each structure work area. The actual dimensions of the temporary area of disturbance may vary depending on factors, such as terrain and vegetation. Variations in the area of disturbance will be monitored by the CIC during Project construction (refer to Appendix A5 – Environmental Compliance Management Plan).

Temporary work areas will be delineated by the Company and the Construction Contractor(s) in coordination with the CIC prior to construction, and the CIC will track the actual Project disturbance acreage. If the amount of temporary disturbance exceeds the acreage presented in Table A3-3 – Summary of Estimated Ground Disturbance and Vegetation Clearing for the Project, consultation with the BLM and other agencies will be required (refer to Section A5.4 – Procedures of Appendix A 5 – Environmental Compliance Management Plan). If work areas at the base of some structures are needed for maintenance activities, consultation with the BLM and other agencies also will be required (refer to Section A5.4 – Procedures of Appendix A5 – Environmental Compliance Management Plan).

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