Appendix D

Final EIS Plan of Development

TransWest Express Transmission Project

Preliminary Plan of Development, Amended from July 2010

Submitted by

TRANSWEST EXPRESS LLC

Submitted to

NATIONAL SYSTEM OF PUBLIC LANDS

Wyoming State Office

Western Area Power Administration

November 2014

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ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
°F	degrees Fahrenheit
±	plus or minus
AC	alternating current
AC/DC	alternating current/direct current
ACC	Arizona Corporation Commission
ACSR	aluminum conductor steel reinforced
ACSR/TW	Aluminum Conductor Steel Reinforced/Trapezoidal Wire
AEG	Anschutz Entertainment Group
Anschutz	Anschutz Company
ANSI	American National Standards Institute
APLIC	Avian Power Line Interaction Committee
Applicant	TransWest Express LLC, also TransWest
ATV	all terrain vehicles
BA	Biological Assessment
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BMP	Best Management Practices
BO	Biological Opinion
CCR	Code of Colorado Regulations
CDOT	Colorado Department of Transportation
CEQ	Council on Environmental Quality
CFR Part	Code of Federal Regulations, and use Part before the number (e.g., 20 CFR Part 4)
CIC	Compliance Inspection Contractor
COM	Construction, Operation, and Maintenance
CRS	Colorado Revised Statutes
CWA	Clean Water Act
DC	direct current
DEIS	Draft Environmental Impact Statement
DEQ	Department of Environmental Quality
DOE	U.S. Department of Energy
DOT	Department of Transportation
E.O.	Executive Order
ECMP	Environmental Compliance and Monitoring Plan
EHV	extra high voltage
EIS	Environmental Impact Statement
EMF	electromagnetic field
EMM	Environmental Mitigation Measure
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FEIS	Final Environmental Impact Statement
FERC	Federal Energy Regulatory Commission
FLPMA	Federal Land Policy and Management Act of 1976
GHG	Greenhouse Gas
GIS	Geographic Information System
GWh/yr	gigawatt-hours per year
HVDC	high voltage direct current

IEEE	Institute of Electrical and Electronics Engineers
IPP	Intermountain Power Plant
IRA	Inventoried Roadless Areas
IVM	integrative vegetation management
kV	kilovolt
LADWP	Los Angeles Department of Water and Power
LWCF	Land and Water Conservation Fund Act
MW	megawatt
NAC	Nevada Administrative Code
NAGPRA	Native American Graves Protection and Repatriation Act of 1990
NDEP	Nevada Division of Environmental Protection
NEPA	National Environmental Policy Act of 1969
NERC	North American Electric Reliability Corporation
NESC	National Electrical Safety Code
NHPA	National Historic Preservation Act of 1966
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPS	National Park System
NREL	National Renewable Energy Lab
NRS	Nevada Revised Statutes
NTP	Notice to Proceed
OPGW	optical ground wire
OSHA	Occupational Safety and Health Administration
OSLI	Office of State Lands and Investments
PA	Programmatic Agreement
PI	Points of Intersection/Inflection
PL	Public Land
POD	Plan of Development
Project	TransWest Express Transmission Project, also TWE Project
PSC	Public Service Commission
PUC	Public Utility Commission
REC	renewable energy credit
Reclamation	U.S. Bureau of Reclamation
RES	Renewable Energy Standard
ROD	Record of Decision
ROW	right-of-way
RPS	Renewable Portfolio Standards
SB	Senate Bill
SCADA	Supervisory Control and Data Acquisition
SHPO	State Historic Preservation Office
SPCC	Spill Prevention, Containment and Countermeasure
STS	Southern Transmission System
SUA	Special Use Authorization
SWPPP	Stormwater Pollution Prevention Plan
TAC	The Anschutz Corporation
TIP	Transmission Infrastructure Program
TransWest	TransWest Express LLC, also Applicant
TWE Project	TransWest Express Transmission Project, also Project
U.S.C. §	U.S. Code and section number symbol
UCA	Utah Code Annotated
UDOT	Utah Department of Transportation

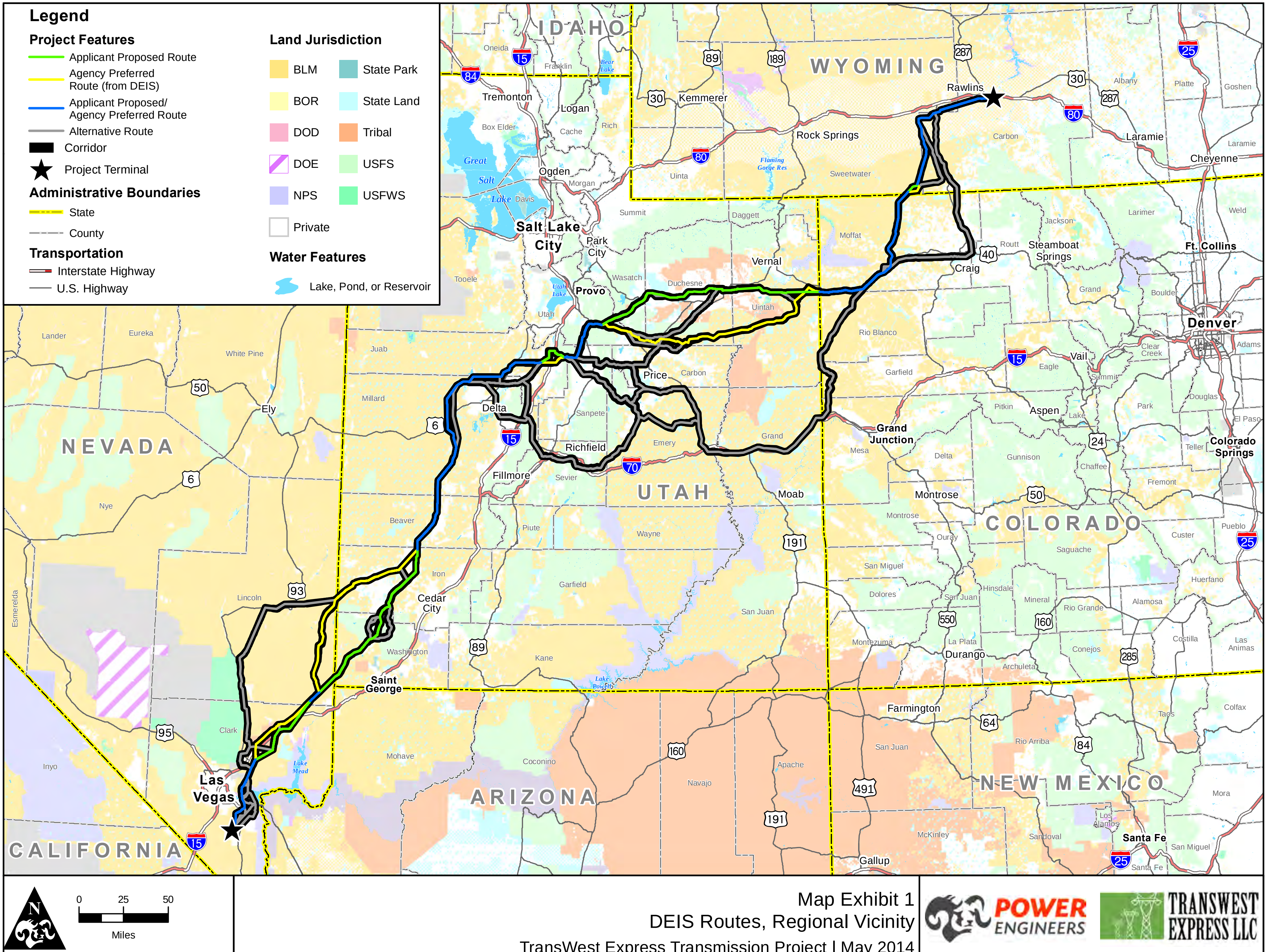
UHF	ultra-high frequency
USACE	U.S. Army Corps of Engineers
USDA	US Department of Agriculture
USDI	U.S. Department of Interior
USDOT	U.S. Department of Transportation
USFS	United States Forest Service
USFWS	U.S. Fish and Wildlife Service
VHF	very high frequency
WECC	Western Electricity Coordinating Council
Western	Western Area Power Administration
WGA	Western Governors Association
WGFD	Wyoming Game and Fish Department
WSO	work stoppage order
WWEC	West-wide Energy Corridor

1.0 INTRODUCTION

1.1 Project Background

TransWest Express LLC (TransWest or Applicant) proposes to construct, operate and maintain the TransWest Express Transmission Project (TWE Project or Project). The TWE Project is an extra-high voltage (EHV) direct current (DC) transmission system extending from south-central Wyoming to southern Nevada. The TWE Project begins at a northern terminal near Sinclair, Wyoming and terminates at a southern terminal at the Marketplace Hub in the Eldorado Valley near Boulder City, Nevada (Map Exhibit 1). At each of the terminals, there will be an alternating current/direct current (AC/DC) converter station designed to convert the DC current carried by the TWE Project to AC current to be carried on the western United States AC electrical grid (the northern and southern terminals). The TWE Project is planned to interconnect into the 230 kV AC system in Wyoming and the Eldorado Substation, the McCullough Switching Station, the Marketplace Substation and the Mead Substation in Nevada. Western Area Power Administration (Western), a federal power marketing administration within the United Stated Department of Energy (DOE), has partnered with TransWest in the development of the TWE Project.

Because it is necessary for the TWE Project to cross federal lands, a right-of-way (ROW) application was filed with the Department of the Interior's (USDI) Bureau of Land Management (BLM) in 2007. The application was amended by TransWest in 2008 and again in 2009, 2010, and 2014. To comply with the National Environmental Policy Act of 1969 (NEPA), the BLM and Western are preparing an Environmental Impact Statement (EIS). Public scoping was conducted in 2011. In July 2013, the BLM and Western published the Draft Environmental Impact Statement (DEIS) for the TWE Project. The DEIS analyzed approximately 2,600 miles of Alternatives.



Map Exhibit 1

DEIS Routes, Regional Vicinity

TransWest Express Transmission Project | May 2014

POWER ENGINEERS

TRANSWEST EXPRESS LLC

1.2 Project Overview

The TWE Project will entail the construction, operation and maintenance of a ±600 kilovolt (kV) DC transmission line and two AC/DC converter stations - a Northern AC/DC Converter Station (Northern Terminal) to be located near Sinclair, Wyoming and a Southern AC/DC Converter Station (Southern Terminal) to be located at the Marketplace Hub in the Eldorado Valley, approximately 15 miles south of Boulder City, Clark County, Nevada. The ±600 kV DC transmission line will provide for a potential interconnection with the Intermountain Power Plant (IPP) transmission system in Millard County, Utah as well. The preliminary cost estimate for the construction of the TWE Project is $3.0 billion in 2014 dollars. This estimate is based on the Applicant Proposed Alternative and will need to be updated to reflect the Alternative ultimately selected through the NEPA compliance process and upon completion of final engineering design studies. Preliminary cost estimates for operation and maintenance of the TWE Project are on the order of $25 million per year. The life of the TWE Project is anticipated to be 50 years. Project facilities will be maintained to ensure the safe, reliable operation of the system.

The proposed TWE Project consists of the following components:

- A ±600 kV DC transmission line between south-central Wyoming and southern Nevada. A 250-foot-wide ROW will generally be required for the ±600 kV DC transmission line.

- Two terminals for the AC/DC converter stations and related substations, to be located at either end of the ±600 kV DC transmission line. The proposed TWE Project includes the Northern Terminal near Sinclair, Wyoming, and the Southern Terminal south of Boulder City, Nevada near the Marketplace Hub in the Eldorado Valley, with interconnections to the existing and planned regional alternating current (AC) transmission grid.

- Two independent communications systems, including a dedicated fiber optic network, for command and control of the transmission system. The fiber optic network will require regeneration sites at periodic distances along the ±600 kV DC transmission line. In most cases, the regeneration sites will be located within the transmission line ROW. The second communication system will use existing private networks. Microwave antennas may be located at the terminals to connect into these private systems.

- Two ground electrode systems, to be located within approximately 100 miles of the terminals. A low voltage overhead line will be needed to connect the ground electrode systems and AC/DC converter stations.

- Access roads to the TWE Project facilities. The TWE Project's proposed Access Road Plan entails making improvements to existing roads, constructing new roads, and using overland access methods for the construction, operation, and maintenance of the TWE Project. Existing roads will be used to the extent feasible

- Temporary work areas will be required during construction of the TWE Project including terminals; ground electrode systems; structures; staging areas; material storage areas; fly yards; pulling, tensioning, and splicing sites; communication and regeneration sites; and batch plants.

1.3 Purpose of the Plan of Development (POD)

A Plan of Development (POD) documents a federal ROW applicant's construction, operation, rehabilitation, and environmental protection plan. See 43 Code of Federal Regulations (CFR) Part 2804.25. The POD is a dynamic document updated as a project progresses through the NEPA review and analysis process. The purpose of this version of the POD is to support the analysis and publication of the BLM's Final Environmental Impact Statement (FEIS). An updated POD will be issued with the federal agencies Record of Decision (ROD) for the Project to include additional data such as biological assessments and evaluations and to support additional engineering, micro-siting, contracting and permitting of the Agency Preferred Alternative included in the ROD. Appendix AB provides an example of the mapping to be provided in the ROD POD which will show the initial layout of access roads, temporary work areas, and constraints (e.g., special status species habitat) based on the selected Agency Preferred Alternative. .An updated and final POD will be issued with the Project Notice to Proceed (NTP). The NTP POD will include the final project description; final engineered alignment; access road layouts; construction plans; construction practices and procedures; processes and procedures for complying with the ROD and Environmental Compliance and Monitoring Plan (Appendix G); and will be based on field verified segment-specific construction plans including results of surveys. The TWE Project POD development approach is described in detail in the Project Design and Implementation Plan of Development Refinement Process provided in Appendix Y.

The POD for the TWE Project serves many purposes. For the Project, the POD will:

- Provide the Project description and technical information necessary for the federal agencies to conduct required environmental reviews of the Project, including compliance with the NEPA.
- Identify TransWest's construction plans and specifications, including federal agency stipulations, conditions of approval, environmental requirements and best management practices (BMPs).
- Support the federal agencies ROD for the Project.
- Meet all federal land management agency requirements for issuance of ROW grants or special use authorizations.
- Provide the basis for the federal land management agencies to issue NTPs for construction, operation, and maintenance of the Project. Multiple NTPs are anticipated, each to be issued on a construction segment basis.
- Balance Project design development with the extent of available siting opportunities and constraints data throughout the federal approval process.

The POD and its appendices will serve as the TWE Project's reference for new or amended permits, approvals, clearances and plans that may be issued during construction.

The USDI defines mitigation to encompass the full suite of activities to avoid, minimize, and compensate for adverse impacts to particular resources or values (Clement et al. 2014). Twenty-four plans that detail TransWest's commitment to mitigate adverse impacts resulting from construction, operation, and maintenance of the TWE Project comprise Appendices A through X of the POD. Table 1 indicates the status of these environmental protection plans for the current and subsequent phases of the POD.

TABLE 1 STATUS OF ENVIRONMENTAL PROTECTION PLANS IN THE POD

PLAN	APPENDIX DESIGNATION	POD STATUS		
		FEIS	ROD	NTP
Access Road Siting and Management Plan	A	Framework plan	Update based on Agency Preferred Alternative: provide mapping of initial access road	Complete with final layout of access roads and temporary work

PLAN	APPENDIX DESIGNATION	POD STATUS		
		FEIS	ROD	NTP
			layout and initial layout of temporary work areas.	areas defined in Section 5.2.2.
Avian Protection Plan	B	Framework plan	Update based on the selected Agency Preferred Alternative and relevant mitigation measures to ensure regulatory compliance.	Complete based on final design.
Blasting Plan	C	Framework plan	Update based on the selected Agency Preferred Alternative; proposed methods to achieve the desired excavations using individual shot plants (where the explosives are planted).	Complete with updated information to include mapping of explosive storage locations and areas where blasting will occur, including identification of blasting within 0.25 mile of a known sensitive resource; as well as blasting in the vicinity of pipelines, and wells and springs that may be impacted.
Cultural Resources Protection and Management Plan	D	Framework plan	Update with information contained within the executed Programmatic Agreement (PA).	Complete with updated information based on completion of cultural inventory studies, mitigation plans, and monitoring plans.
Dust Control and Air Quality Plan	E	Framework plan	Update relevant mitigation measures to ensure regulation compliance.	Complete
Emergency Preparedness and Response Plan	F	Framework plan	Update with current available information.	Complete with updated contact information
Environmental Compliance and Monitoring Plan	G	Framework plan	Include more specifically defined roles, responsibilities and procedures.	Complete with fully defined roles, responsibilities and procedures.
Fire Protection Plan	H	Framework plan	Update restricted operations section, complete notifications section, update relevant mitigation measures to ensure regulation compliance and safety.	Complete
Flagging, Fencing and Signage Plan	I	Framework plan	Update flagging, fencing and signage scheme (table) based on selected Agency Preferred Alternative.	Complete with final flagging, fencing and signage scheme.
Geotechnical Plan	J	Framework plan	Update based on selected Agency Preferred Alternative.	Complete
Greater-Sage Grouse Habitat	K	Framework plan	Updated based on selected	Complete

PLAN	APPENDIX DESIGNATION	POD STATUS		
		FEIS	ROD	NTP
Equivalency Analysis, Mitigation and Monitoring Plan		based on FEIS Agency Preferred Alternative	Agency Preferred Alternative.	
Hazardous Materials Management Plan	L	Framework plan	Include relevant mitigation measures to ensure regulation compliance and safety.	Complete
Health and Safety Plan	M	Framework plan	Include relevant mitigation measures to ensure regulation compliance and safety.	Complete
Noxious Weed Management Plan	N	Framework plan	Update plan based on selected Agency Preferred Alternative including access roads and temporary work areas; and complete agency contact information and weed GIS data.	Complete based on the final design and results of noxious weed preconstruction survey.
Operations and Maintenance Plan	O	Framework plan	Update environmental mitigation measures based on selected Agency Preferred Alternative. Complete seasonal wildlife restrictions table.	Complete
Paleontological Resources Management and Mitigation Plan	P	Framework plan	Update plan based on selected Agency Preferred Alternative. Include relevant mitigation measures to ensure resource protection.	Complete
Reclamation Plan	Q	Framework plan	Update plan based on selected Agency Preferred Alternative.	Complete based on final design.
ROW Preparation and Vegetation Management Plan	R	Framework plan	Update plan based on selected Agency Preferred Alternative including access roads and temporary work areas; and complete agency contact information and seed mix requirements for each relevant BLM and Forest Service field office.	Complete based on final design.
Spill Prevention and Response Plan	S	Framework plan	Include relevant mitigation measures to ensure regulation compliance and safety.	Complete with appropriate emergency contacts.
Stormwater Pollution Prevention Plan	T	Framework plan	Include relevant mitigation measures to ensure compliance and for incorporation into Stormwater Pollution Prevention Plans (SWPPPs).	Complete Plan will be the same, but individual SWPPPs will be completed for each state.
Traffic and Transportation	U	Framework plan	Update plan based on	Complete

PLAN	APPENDIX DESIGNATION	POD STATUS		
		FEIS	ROD	NTP
Management Plan			selected Agency Preferred Alternative: use of public roads and highways.	
Visual Resources Management Plan	V	Framework plan	Update plan based on selected Agency Preferred Alternative: more specific visual resource mitigation.	Complete
Water Resources Protection Plan	W	Framework plan	Update plan based on selected Agency Preferred Alternative: complete 303(d) list of impaired waters and preliminary estimate of impacts to waters of the U.S.	Complete with identified impacts and a mitigation plan (if necessary) based on field surveys.
Wildlife and Plant Conservation Measures Plan	X	Framework plan	Update plan based on selected Agency Preferred Alternative: define specific species lists, habitats, draft mitigation, and preconstruction requirements.	Complete with identified impacts and a mitigation plan (if necessary) based on field surveys.

1.4 Organization of the FEIS POD

The FEIS POD describes the TWE Project according to the following topics:

Section 2 describes the TWE Project purpose and need including project objectives and needs, North American Electric Reliability Corporation (NERC) standards and Western Electricity Coordinating Council (WECC) criteria, and renewable energy and transmission.

Section 3 describes roles and responsibilities of each major Project entity including TransWest, Western, BLM, the United States Forest Service (USFS), and other Federal agencies, compliance inspection contractor, and construction contractor(s).

Section 4 provides a description of TWE Project components which includes a description of all proposed facilities and temporary and permanent land disturbance estimates.

Section 5 describes the construction practices that would be performed for the TWE Project, including standard construction activities, schedules and equipment/manpower requirements, and special construction practices which will be used in selective or sensitive environments.

Section 6 discusses operation and maintenance practices for the TWE Project, including routine maintenance and vegetation management of the transmission line ROWs, emergency response, fire protection, and ROW safety requirements.

Section 7 discusses the design options for the TWE Project, including a description of Design Options 2 and 3 and the conditions under which each design option would meet the Project purpose and need.

Section 8 summarizes the TWE Project general environmental mitigation measures, which are part of the proposed TWE Project Description, and would be common to all the FEIS alternatives.

Section 9 contains a list of references for this document.

1.5 Relationship with Other Environmental Documents

This FEIS POD has been prepared to support the TWE Project FEIS. The FEIS is being prepared by the BLM and Western, in compliance with the requirements and guidelines of the NEPA and the Federal Land Policy and Management Act of 1976 (FLPMA). This POD provides a description of the TWE Project for the lead agencies' use in preparing the FEIS. The POD contains detailed design, construction, operation and maintenance information for the agencies' use in the analyses of environmental impacts and mitigation measures adopted by the Applicant for the TWE Project and all alternatives analyzed in the FEIS. This FEIS POD is preliminary in that it addresses the range of alternatives being analyzed in the FEIS and incorporates design features, Applicant committed mitigation measures, best management practices, and BLM proposed mitigation measures from the DEIS updated to reflect revisions incorporated in the FEIS. TransWest anticipates preparing one additional preliminary POD at the time of issuance of the ROD (the ROD POD). The POD(s) prepared in connection with TransWest's request for a NTP will be the final POD (the NTP POD). TransWest may file multiple NTP PODs for the Project, each covering a separate construction spread or work management area, but for convenience all such PODs are referred to herein as the NTP POD.

1.6 Background on TransWest Express LLC

TransWest Express LLC is a limited liability company that was formed in July, 2008. TransWest is a wholly owned subsidiary of The Anschutz Corporation (TAC). In turn, TAC is a 100% owned subsidiary of Anschutz Company (Anschutz), a privately held multi-billion dollar diversified company based in Denver, Colorado. The principal offices of TransWest are located at 555 Seventeenth Street, Suite 2400, Denver, Colorado. TransWest was formed to hold and develop certain electric transmission assets for Anschutz.

TAC was formed in 1965 by Philip F. Anschutz, initially as an oil and gas drilling and exploration company. Today, Anschutz has worldwide investments in natural resources (oil and gas development and pipelines, ranching and agriculture), real estate, telecommunications, transportation, sports and entertainment, film production, movie theaters, and newspaper and internet publishing. TAC has successfully developed large and complex energy infrastructure projects. In the 1990s, TAC constructed a 130-mile intrastate common carrier crude oil pipeline to transport heavy crude from California's San Joaquin Valley to refineries and terminal facilities in the Los Angeles Basin.

In 1987, TAC built AREPI Pipeline to transport crude oil from its oil field on the Utah Wyoming border to refineries in Salt Lake City. At its peak, TAC's pipeline company operated over 3,100 miles of pipeline and 14 million barrels of crude oil storage capacity.

In the mid-1990s, TAC founded Qwest Communications which constructed the country's first transcontinental high-speed fiber-optic link between Los Angeles and Boston. The mammoth construction project originated on Southern Pacific/Union Pacific rights-of-way controlled by TAC and expanded onto rights-of-way acquired from federal, state, and local governments and private landowners. In all, Qwest developed a 25,500-mile North American fiber network connecting 250 cities and consisting of approximately 3.4 million fiber miles.

Through its wholly-owned subsidiary Anschutz Entertainment Group (AEG), Anschutz has successfully developed and constructed a number of sports, entertainment and real estate assets, investing several billion dollars. AEG played an integral role in the revitalization of downtown Los Angeles when it constructed the Staples Center, a 20,000 seat mixed use arena that is home to the LA Lakers, LA Clippers, LA Kings, and other professional sports teams. The arena hosts 250 events and nearly 4 million customers per year. AEG has also constructed a 4.4 million square foot mixed use entertainment district around the Staples Center that is anchored by a 7,100 seat theater and includes hotels, luxury condos, and restaurants. AEG also successfully constructed a number of other development projects including the Home Depot Center in Carson, California, the Sprint Center in Kansas City, the O2 Arena in London, and a 17,000 seat multi-purpose arena in Berlin.

TransWest is an extension of TAC's long and successful tradition of resource development and investment in the western United States. The TWE Project responds to the nation's demand for clean renewable energy while representing TAC's commitment to responsible development and delivery of natural resources. TAC's resources and commitment to developing the TWE Project are demonstrated by the substantial investment of capital and time already made by TAC. Since 2008, TAC has funded all of TransWest's extensive development activities – a period of over five years. This includes undertaking the highest level of environmental review in the United States. To date, TransWest has expended approximately $34 million dollars in developing the TWE Project – a significant capital investment by TransWest and TAC. To date, Western has reimbursed TransWest approximately $8 million dollars of this investment pursuant to the Development Agreement.

1.7 Federal, State, and Local Permits

The Applicant will be responsible for the acquisition of all applicable federal, state, and local permits, licenses and agreements. A list of applicable permit requirements was provided through the NEPA process and incorporated into this POD for the TWE Project. The TWE Project will necessitate crossings of existing electrical transmission lines, U.S. and State Highways, and railroads. The proposed line crossings will be coordinated with the appropriate entity and TransWest will obtain all required licenses, permits, or agreements.

Table 2 is a list of the authorizations, permits, and reviews that may be needed in order for the Project to be constructed and are based on the Agency Preferred Alternative and the Applicant's Proposed Action in the FEIS.

TABLE 2 SUMMARY OF POTENTIAL FEDERAL, STATE, AND LOCAL PERMITS AND ENVIRONMENTAL REVIEW REQUIREMENTS

ISSUE	ACTION REQUIRING PERMIT, APPROVAL, OR REVIEW	AGENCY	PERMIT, LICENSE, COMPLIANCE, OR REVIEW	RELEVANT LAWS AND REGULATIONS
FEDERAL				
National Environmental Policy Act of 1969 (NEPA) Compliance	Federal action: to grant right-of- way (ROW) across land under federal jurisdiction	Lead agencies (Bureau of Land Management [BLM] and Western Area Power Administration [Western]); Affected land-managing agencies; Cooperating agencies	Environmental Impact Statement (EIS) and Record of Decision (ROD)	NEPA (42 United States Code [U.S.C.] § 4321); Council on Environmental Quality (CEQ) (40 Code of Federal Regulations [CFR] Parts 1500-1508); Department of Energy (DOE) NEPA implementing Regulations (10 CFR Part 1021)
ROW Across Land Under Federal Management	Preconstruction surveys including geotechnical surveys; construction, operation, maintenance, and abandonment	BLM	ROW grant and temporary use permit	Federal Land Policy and Management Act (FLPMA) of 1976 (PL 94-579); 43 U.S.C. §§1761-1771; 43 CFR Part 2800
		BLM	Short-Term ROW Grant	FLPMA (PL 94-579); 43 U.S.C. §§1761-1771; 43 CFR Part 2800
		BLM	Resource Management Plans	BLM requirements
		BLM	Plan of Development	BLM requirements
		BLM	Notice to Proceed	48 CFR
		BLM	Pesticide Use Proposal	Final Vegetation Treatments Using Herbicides Programmatic EIS (BLM 2007)
		U.S. Bureau of Reclamation (Reclamation)	License Agreement	Technology Transfer Act of 1986 (Public Law 99-502), Section 11
		Reclamation	Right of Use Authorization	Act of Congress of June 17, 1902 (32 Stat. 388), Act of Congress of August 4, 1939 (53 Stat. 1187), Section 10, and 43 CFR 429
		U.S. Department of Agriculture (USDA)	Coordination with the USDA's Farm Service Agency for crossing Conservation Reserve Program lands, if applicable	Title II, Subtitle B of the Food, Conservation, and Energy Act of 2008
		USDA	Coordination with the Natural Resources Conservation Service for crossing Wetland Reserve Program lands, if applicable	Title II, Subtitle C of the Food, Conservation, and Energy Act of 2008
		U.S. Forest Service (USFS)	Special use authorization permit or easement	36 CFR Part 251
		USFS	Operation and Maintenance Plan	USFS requirements
		USFS	Notice to Proceed	48 CFR

ISSUE	ACTION REQUIRING PERMIT, APPROVAL, OR REVIEW	AGENCY	PERMIT, LICENSE, COMPLIANCE, OR REVIEW	RELEVANT LAWS AND REGULATIONS
		USFS	Road Use Permit	16 U.S.C. §§ 535 and 537, National Forest Roads and Trails Act Sections 4 and 6
		USFS	Pesticide Use Proposal	FS Manual 2150
		Bureau of Indian Affairs (BIA), tribe	ROW grant across American Indian lands	25 CFR Part 169
		National Park Service (NPS)	Authorization to cross NPS lands	16 U.S.C. § 79
		U.S. Fish and Wildlife Service (USFWS)	Special use permit for crossing a national wildlife refuge	50 CFR Part 25
		Utah Reclamation Mitigation and Conservation Commission	License Agreement to cross Federal Lands	Central Utah Completion Act, 43 CFR Part 1000
	"Conversion of use" for a use other than recreation on lands reserved with Land and Water Conservation Fund Act (LWCF) monies	NPS	Review of transmission line corridor to identify conflicts with recreational area	Land and Water Conservation Fund Act, Public Law (PL) 88-578, Section 6(f)(3)
	Construction, operation, maintenance, and abandonment of transmission line across or within highway ROWs	Federal Highway Administration	Permits to cross Federal Aid Highway; 4 (f) compliance	U.S. Department of Transportation (USDOT) Act, 23 CFR Part 1.23 and 1.27; 23 U.S.C. §§ 109 and 315; 23 CFR Part 645; 23 CFR Part 771
Biological Resources	Grant ROW by Federal land-managing agency	USFWS	Endangered Species Act (ESA) compliance by Federal land- managing agency and lead agency	ESA of 1973 as amended (16 U.S.C. § 1531 et seq.)
	BLM issuance of a ROW grant covering USFWS fee lands within National Wildlife Refuges	USFWS	Compatibility Determination	National Wildlife Refuge System Administration Act of 1966 as amended by the National Wildlife Refuge System Improvement Act of 1997, 16 U.S.C. 668dd-668ee
	Protection of migratory birds	USFWS	Compliance	Migratory Bird Treaty Act of 1918, 16 U.S.C. § 703-712; 50 CFR
	Protection of bald and golden eagles	USFWS	Compliance	Bald and Golden Eagle Protection Act of 1972 (16 U.S.C. §668)
Ground Disturbance and Water Quality Degradation	Construction activities that disturb one or more acres of land	U.S. Environmental Protection Agency (EPA)	Section 402 National Pollutant Discharge Elimination System (NPDES) General Permit and accompanying Notice of Intent (NOI) and Storm Water Pollution Prevention Plan (SWPPP) for Storm Water Discharges from Construction Activities	Clean Water Act (33 U.S.C. §1342)
	Construction across water	U.S. Army Corps of	General easement	10 U.S.C. §§ 2668 to 2669

ISSUE	ACTION REQUIRING PERMIT, APPROVAL, OR REVIEW	AGENCY	PERMIT, LICENSE, COMPLIANCE, OR REVIEW	RELEVANT LAWS AND REGULATIONS
	resources	Engineers (USACE)		
	Construction in or modification of floodplains	Federal lead agency	Compliance	42 U.S.C. § 4321 Ex. Ord. No. 11988 Floodplains
	Construction in or modification of wetlands	Federal lead agency	Compliance	42 U.S.C. § 4321 Ex. Ord. No. 11990 Wetlands
	Potential discharge into waters of the state (including wetlands and washes)	USACE (and states); EPA on tribal lands	Section 401 Water Quality Certification	Clean Water Act (33 U.S.C. §1344)
	Discharge of dredged or fill material into waters of the United States, including wetlands	USACE; EPA on tribal lands	Section 404 Permit, Individual or Nationwide Permit	Clean Water Act (33 U.S.C. §1344)
	Placement of structures and construction work in or across navigable waters of the U.S.	USACE	Section 10 permit	Rivers and Harbors Act of 1899 (33 U.S.C. § 403)
	Protection of all rivers included in the National Wild and Scenic Rivers Systems	Affected land-managing agencies	Review by permitting agencies	Wild and Scenic Rivers Act (PL 90-542) (16 U.S.C. §§ 1271-1287)
	Potential pollutant discharge during construction, operation, and maintenance	EPA	Spill Prevention, Control, and Countermeasure (SPCC) Plan for oil-filled equipment	Oil Pollution Act of 1990 (40 CFR Part 112)
Cultural Resources	Disturbance of historic properties	Federal lead agency, State Historic Preservation Officers (SHPO), Advisory Council on Historic Preservation	Section 106 consultation and signed PA prior to Record of Decision	National Historic Preservation Act of 1966, (16 U.S.C. § 470) (36 CFR Part 800)
	Potential conflicts with freedom to practice traditional American Indian religions	Federal lead agency, Federal land-managing agency	Consultation with affected American Indians	American Indian Religious Freedom Act (42 U.S.C. § 1996)
	Disturbance of graves, associated funerary objects, sacred objects, and items of cultural patrimony	Federal land-managing agency	Consultation with affected Native American group regarding treatment of remains and objects	Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) (25 U.S.C. §§ 3001-3002)
	Investigation of cultural and paleontological resources	Affected land-managing agencies	Permit for study of historical, archaeological, and paleontological resources	Antiquities Act of 1906 (16 U.S.C. §§ 432-433)
	Investigation of cultural resources; Excavation of archaeological resources	Affected land-managing agencies	Permits to excavate and remove archaeological resources on Federal lands; American Indian tribes with interests in resources must be consulted prior to issuance of permits	Archaeological Resources Protection Act of 1979 (16 U.S.C. §§ 470aa to 470ee) (43 CFR Part 7)
	Protection of segments, sites, and features related to national trails	Affected land-managing agencies	National Trails System Act compliance	National Trails System Act (PL 90-543) (16 U.S.C. §§ 1241 to 1249)
Paleontological Resources	Ground disturbance on Federal land or Federal aid project	BLM	Compliance with BLM mitigation and planning standards for Paleontological	FLPMA of 1976 (43 U.S.C. §§ 1701-1771); Antiquities Act of 1906 (16 U.S.C. §§ 431-

ISSUE	ACTION REQUIRING PERMIT, APPROVAL, OR REVIEW	AGENCY	PERMIT, LICENSE, COMPLIANCE, OR REVIEW	RELEVANT LAWS AND REGULATIONS
			resources of public lands	433); Paleontological Resources Preservation Act (PRPA) of 2009.
Air Traffic	Location of towers in regards to airport facilities and airspace	Federal Aviation Administration (FAA)	A "Determination of No Hazard to Air Navigation" for structure heights and locations in proximity to public airports	Federal Aviation Act of 1958 (PL 85-726) (14 CFR Part 77)
			Section 1101 Air Space Permit for air space construction clearance	Federal Aviation Act of 1958 (PL 85-726) (14 CFR Part 77)
Rate Regulation	Sales for resale and transmission services	Federal Energy Regulatory Commission (FERC)	Federal Power Act compliance by power seller	Federal Power Act (16 U.S.C. §792)
TRIBAL				
UTE				
ROW Encroachment	Encroachment onto Uintah and Ouray Reservation Land	Ute Indian Tribe-BIA Department of Energy and Minerals	ROW easement	25 CFR Part 169
WYOMING				
STATE				
Wildlife Resources	Permitting within sage-grouse core areas	All State Agencies	Compliance with Executive Order (EO) 2011-5	Sections 1 and 2 of Article V of the Michigan Constitution of 1963; Executive Order 2011-5
	Permitting within state wildlife habitat management areas	All State Agencies	Special Use Permit to cross Wildlife Habitat Management Areas	WS 23-1-302 (a)(iii)
Utility Siting	Primary permitting authority for transmission line siting, county level necessary	Public Service Commission (PSC)	Certificate of Public Convenience and Necessity	WS 37-2-101; PSC-R 202, 204, 205
	Construction of an industrial facility	Department of Environmental Quality (DEQ), Industrial Siting Division	Industrial Development Information and Siting Act Permit	WS 35-12
ROW Encroachment	Non-roadway easement across State Lands	State Board of Land Commissioners	ROW Easement	WS 36-2-107 and 36-9-118
	Encroachment into state roadway ROW	Wyoming Department of Transportation	ROW encroachment permit and accompanying traffic control plan	WS 1-26-813
Ground Disturbance and Water Quality Degradation	Construction sites with greater than one acre of land disturbed	DEQ	Wyoming Pollutant Discharge Elimination System Permit Section 401 Water Quality Certification NOI and SWPPP	WS 35-11-3 Clean Water Act, Section 401
Fish and Wildlife	Project impacts to fish and wildlife species and associated habitat	Wyoming Game and Fish Department (WGFD)	Compliance	WGFD requirements
Air Quality	Fugitive dust emissions generated during construction	DEQ, Air Quality Division	Construction Permit	40 CFR Part 63
Cultural Resources	Surveying and limited testing on state lands	State Historic Preservation Office (SHPO); Office of State	Permit	Wyoming Antiquities Act of 1935; WS 36-1-114-116

ISSUE	ACTION REQUIRING PERMIT, APPROVAL, OR REVIEW	AGENCY	PERMIT, LICENSE, COMPLIANCE, OR REVIEW	RELEVANT LAWS AND REGULATIONS
		Lands and Investments (OSLI)		
	Archaeological data recovery or extensive testing on state lands	SHPO and OSLI	Permit	Same regulation as above
	Disturbance of cultural resources	SHPO	Potential permit	Wyoming Protocol Agreement
	Disturbance of cultural resources	BLM and SHPO	Section 106 Consultation	National Historic Preservation Act of 1966 (NHPA), (16 U.S.C. §470) (36 CFR Part 800)
Explosives	Storage and use of explosives	Varies	Explosives Permit	18 U.S.C. § 40
LOCAL				
Land Use	Construction and operation of Transmission Lines greater than 69 kV	Carbon County	Conditional Use Permit, if applicable	2011 Carbon County Zoning Resolution, Chapter IV, Sections 4.2(b)(5) and 4.8(b)(3)
			Building Permit	2011 Carbon County Zoning Resolution, Chapter VI, Section 6.2(a)(2)
Water Resources	Development in a special flood hazard area	Carbon County	Floodplain Development Permit, if applicable	2011 Carbon County Zoning Resolution, Chapter V, Section 5.1(f)
Land Use	Construction and operation of transmission lines	Sweetwater County	Conditional Use Permit, if applicable	2012 Sweetwater County Zoning Resolution, Section 5(A)(13)(d)(8)
Transportation / Access	Accessing work sites via county roads	Sweetwater County	County Road Crossings and Access Permits, County Road Maintenance Agreements	February 2012 Sweetwater County License Permit Application per Engineering Department
Water Resources	Discharging waste water	Sweetwater County	Small waste water permits	Water quality standards per Sweetwater County District Board of Health
Hazardous Materials	Storing hazardous materials	Sweetwater County	Recordation of Hazardous Material Storage	Sweetwater County Hazardous Chemical Inventory per Local Emergency Planning Committee
Hazardous Materials	Spraying herbicides	Sweetwater County	Noxious Weed Control	Weed control standards per Sweetwater County Weed and Pest Board
COLORADO				
STATE				
Utility Siting	Primary permitting authority for transmission line siting, county level necessary	Public Utility Commission (PUC)	Certificate of Public Convenience and Necessity	Colorado Revised Statutes (CRS) 40-5-101-106; 4 CCR 723-3
Air Quality	Land development	Department of Public Health and Environment, Air Pollution Control Division	Land Development Air Pollutant Emission Notice and Application for Construction Permit	5 CCR 1001-5
Pesticides	Applying pesticides	Department of Public Health and Environment, Water Quality Control Division	Pesticides General Permit	CRS 25-8-101
Hazardous Materials	Transporting hazardous materials on state roads	PUC	Hazardous Materials Transportation Permit	8 Code of Colorado Regulations (CCR) 1507-25

ISSUE	ACTION REQUIRING PERMIT, APPROVAL, OR REVIEW	AGENCY	PERMIT, LICENSE, COMPLIANCE, OR REVIEW	RELEVANT LAWS AND REGULATIONS
	Using explosives for excavation	Division of Public Safety	Type II Explosives Permit	Division of Public Safety regulations
Transportation / Access	Transporting oversized and overweight loads on state roads	Colorado Department of Transportation (CDOT)	Transport Permit for Movement of Extra-Legal Vehicles or Loads	2 CCR 601-4
	Accessing state roads	CDOT	Access Permit	State Highway Access Code
ROW Encroachment	ROW across State Lands	State Lands Trust	ROW Easement	State Land Board policies
	Encroachment into state road ROW	CDOT	Utility/Special use permit	CRS 9-1.5-103
Ground Disturbance and Water Quality Degradation	Construction sites with greater than one acre of land disturbed	Department of Public Health and Environment, Water Quality Control Division	General permit and accompanying SWPPP	5 CCR 1002-61 and CRS 25-8-101
			General permit for construction dewatering	
Cultural and Archaeological Resources	Disturbance of cultural or archeological resources	Office of the State Archaeologist, Office of Archaeology and Historic Preservation	Potential permit	CRS 24-80-401-410
	Treatment of unmarked human graves	Office of the State Archaeologist, Office of Archaeology and Historic Preservation, County Coroner	Review	CRS 20-80-1301-1305
Biological Resources	Habitat modification in wetland or riparian areas	Division of Wildlife	Wildlife certification	CRS 33-5-101-105
LOCAL				
Land Use	Construction and operation of transmission lines	Moffat County	Conditional Use Permit, if applicable	Moffat County Zoning Resolution, Article IV
Transportation / Access	Maintaining county roads	Moffat County	Road Maintenance Permit for Private Entities	Moffat County Road Department Policies and Procedures
	Accessing work sites via county roads	Moffat County	ROW Access Permit	
	Transporting oversized and overweight loads on county roads	Moffat County	Transport Permit	Moffat County Resolution No. 2010-102
Utilities	Installing utilities in county road ROW	Moffat County	Utilities Installation Permit	Moffat County Road Department Policies and Procedures
Land Use	Construction and operation of transmission lines	Rio Blanco County	Conditional Use Permit, if applicable	2002 Rio Blanco County Land Use Resolution, Article IX
Transportation / Access	Accessing work sites via county roads	Rio Blanco County	Driveway ROW Access Permit	Rio Blanco County Road and Bridge Department requirements
	Transporting oversized and overweight loads on county roads	Rio Blanco County	Transport Permit	
	Maintaining county roads for which county funds have not been allocated	Rio Blanco County	Private Construction of County Roads Permit	
UTAH				
STATE				

ISSUE	ACTION REQUIRING PERMIT, APPROVAL, OR REVIEW	AGENCY	PERMIT, LICENSE, COMPLIANCE, OR REVIEW	RELEVANT LAWS AND REGULATIONS
Permitting Process	Proposed transmission line facility	Resource Development Coordinating Committee	Expedites Review of Permitting Process for all State Agencies	Utah Code Annotated (UCA) 63-38d-501, UCA 63-38d-504
ROW Encroachment	Encroachment on, through or over state lands	Division of Forestry, Fire, and State Lands	Application approval	UCA Title 65A
	Encroachment into state roadway ROW	Utah Department of Transportation (UDOT)	ROW Encroachment Permit, Grant of Access Permit, and Traffic Impact Study	UCA 63-46b-3
Ground Surface Disturbance	Project construction	Public Service Commission	Certificate of Public Convenience and Necessity; Approve construction contracts	UCA 54-4-25, R 746-401
	Crossing state lands	Division of Forestry, Fire, and State Lands	Easement onto state lands. Bond may be required.	UCA 65A-7-8, R 652-40
Cultural, Paleontological, and Biological Resources	Crossing state lands	Division of Forestry, Fire, and State Lands	Provide a cultural and/or paleontological and/or biological survey and submit procedures for reasonable mitigation actions	R 652-40-500
Historical and Cultural Review	Impact on historical sites	Division of State History	Notification of Planning Stage and before Construction	UCA 9-8-306
Archaeological Resources	Survey or excavation of archaeological resources on lands owned or controlled by the state	Governor's Public Lands Policy Coordinating Office	Permit to survey or excavate	UCA 9-8-305, R 694-1
Cultural Resources	Discovery of Native American grave on state or non-federal land	Antiquities Section, Division of State History	Notification	UCA R456-1-1-17
Encroachment on State Park Lands	Utility easement on state park lands	Division of Parks and Recreation	Agreement for Granting and Maintenance of Easements or Rights-of-Way across Park Lands	UCA 63-11-10.3
Air Quality	Construction and operation	Air Quality Board	Approval Order for construction activity and accompanying NOI	UCA 19-2-108
			Fugitive Dust Plan Permit	
Water Resources	Construction and operation	Water Quality Board	Utah Pollutant Discharge Elimination System General Permit for Construction Activities, NOI and SWPPP	UCA 19-5-107
	Alteration of bed or banks of a natural stream	Utah Department of Natural Resources, Division of Water Rights	Stream alteration permit	UCA 73-3-29, Administrative Rule R655-13
Wildlife	Modification of habitat	Division of Wildlife Resources	Easement for Use of State Wildlife Resource lands	UCA Title 23
LOCAL				
Land Use	Construction and operation of transmission lines	Uintah County	Conditional Use Permit, if applicable	2006 Uintah County Land Use Ordinance
			Building Permit	Uintah County Building Code, Chapter 14.16
Transportation /	Encroaching onto county road ROW	Uintah County	ROW Encroachment Permit	Uintah County Road Department

ISSUE	ACTION REQUIRING PERMIT, APPROVAL, OR REVIEW	AGENCY	PERMIT, LICENSE, COMPLIANCE, OR REVIEW	RELEVANT LAWS AND REGULATIONS
Access				requirements
Land Use	Construction and operation of transmission lines	Duchesne County	Conditional Use Permit, if applicable	2013 Duchesne County Code, Title 8
			Building Permit	
Transportation / Access	Constructing approaches to county roads	Duchesne County	Permit	2013 Duchesne County Code, Title 6
Utilities	Installing utilities in county road ROW	Duchesne County	Utility Easement	
Land Use	Construction and operation of transmission lines	Wasatch County	Conditional Use Permit, if applicable	2013 Wasatch County Land Use and Development Code, Chapter 16
			Building and Grading permits	
Transportation / Access	Encroaching onto county road ROW	Wasatch County	Driveway Encroachment Permit	2013 Wasatch County Land Use and Development Code, Chapter 14
Ground Disturbance and Water Quality Degradation	Ground-disturbing activities	Wasatch County	SWPPP and Erosion Control Permit	2013 Wasatch County Land Use and Development Code, Chapter 16
Water Resources	Development in a special flood hazard area	Wasatch County	Floodplain Development Permit	
Land Use	Construction and operation of transmission lines	Utah County	Conditional Use Approval, if applicable	2014 Utah County Land Use Ordinance
			Building Permit	
			Zoning Compliance Permit	
Transportation / Access	Accessing work sites via county roads	Utah County	Road Access Permit	Utah County Code, Chapter 17
	Installing utilities in county road ROW	Utah County	ROW Grant	
Utilities	Installing utilities	Utah County	Utility Installation Permit	2014 Utah County Land Use Ordinance
Land Use	Construction and operation of transmission lines	Juab County	Conditional Use Permit, if applicable	2007 Juab County Land Use Code, Section 12-1-15
			Building Permit	Buildings & Grounds Department requirements
Land Use	Construction and operation of transmission lines	Sanpete County	Conditional Use Permit, if applicable	2013 Sanpete County Land Use Ordinance, Chapter 14.68
			Building Permit	Sanpete County Building, Planning, and Zoning Department requirements
Transportation / Access	Accessing work sites via county roads	Sanpete County	Road Access (Approach) Disclosure Form	
Land Use	Construction and operation of transmission lines	Millard County	Conditional Use Permit, if applicable , General Plan Amendment, if applicable	2012 Millard County Code, Titles 7 and 10
			Building Permit	
			Development Permit for flood control	
Transportation / Access	Accessing work sites via county roads	Millard County	Access Permit	
	Construction activities in county road ROW	Millard County	Encroachment Permit	

ISSUE	ACTION REQUIRING PERMIT, APPROVAL, OR REVIEW	AGENCY	PERMIT, LICENSE, COMPLIANCE, OR REVIEW	RELEVANT LAWS AND REGULATIONS
Land Use	Construction and operation of transmission lines	Beaver County	Conditional Use Permit, if applicable	2010 Beaver County Zoning Ordinance, various chapters
		Beaver County	Building Permit	Beaver County Building Department requirements
Transportation / Access	Encroaching onto county road ROW	Beaver County	ROW Encroachment Permit	
Water Resources	Construction in a flood-related erosion-prone area	Beaver County	Flood Control Development Permit	2010 Beaver County Zoning Ordinance, Chapter 10.26
Land Use	Construction and operation of transmission lines	Iron County	Conditional Use Permit, if applicable	1994 Iron County Code, as amended, Titles 12, 15, and 17
			Building Permit	
Transportation / Access	Encroaching onto county road ROW	Iron County	ROW Encroachment Permit and accompanying ROW Encroachment Plan	
Land Use	Construction and operation of transmission lines	Washington County	Conditional Use Permit, if applicable	Washington County Planning Department requirements
			Building Permit	Washington County Building Department requirements
NEVADA				
STATE				
ROW Encroachment	ROW across State Lands	Division of State Lands	Easement	Nevada Revised Statutes (NRS) 322.050
	Encroachment into state roadway ROW	Nevada Department of Transportation	Occupancy Permit for utilities in state ROW	NRS 408.423, 408.210
			ROW Encroachment Permit and accompanying Traffic Control Plan	
Ground Surface Disturbance	Project construction	Nevada Division of Environmental Protection (NDEP)	Registration certificate	Nevada Administrative Code (NAC) 445.704
		Division of Forestry	Timberland Conversion Certificate and accompanying Conversion Plan	NRS 528
			Logging Permit and accompanying Logging Plan	
	Construction of electric transmission line	Public Service Commission	Authority to construct and Certificate of Public Convenience and Necessity	NRS 704.330, NRS 704.820, NRS 704.701
Ground Disturbance and Water Quality Degradation	Construction in or near 100-year floodplains, streams and rivers, or waters of the state	NDEP	Floodplain use permits, Clean Water Act Section 401, 402, and 404 permits	Nevada State Statutes - State Water Quality Certification rules
	Pollutant discharge	NDEP	NPDES Construction Stormwater General Permit, NOI, SWPPP, and SPCC Plan	
Cultural and	Crossing state lands	Division of State Lands	Easement onto state lands	NRS 321.001

ISSUE	ACTION REQUIRING PERMIT, APPROVAL, OR REVIEW	AGENCY	PERMIT, LICENSE, COMPLIANCE, OR REVIEW	RELEVANT LAWS AND REGULATIONS
Paleontological Resources	Investigation of Paleontological, archaeological, and historic sites	Nevada State Museum	Permit to investigate antiquities	Nevada Antiquities Law (NRS 381.195 to 381.227)
	Disturbance of American Indian burial sites on state and private lands	Nevada SHPO	Notification of discoveries, consultation with affiliated groups	Nevada Protection of Indian Burial Sites (NRS 383.150) (NRS 383.190)
Air Quality	Construction and operation	NDEP	Authority to construct, permit to operate	NRS 445
			Surface Area Disturbance Permit for non-agricultural activities of more than 5 acres	
Biological Resources	Modification of sensitive plant species habitat	Division of Forestry	Compliance to survey for identification of plant species	NRS 527.270, NRS 527.050
	Controlling pests	Department of Agriculture	License to engage in pest control	NRS 555.280
	Disturbance of special status plant species	Division of Forestry	Permit for lawful take of protected plant	NRS 527.250
	Construction and operation in areas of rare and endangered animal species	Division of Wildlife	Compliance	NRS 501, NAC 503
	Modification of habitat of threatened and endangered species	Division of Wildlife	Special permit	NAC 5-4.510 through 4.550
LOCAL				
Land Use	Construction and operation of transmission lines	Lincoln County	Special Use Permit, if applicable	Lincoln County Code, Title 13, Chapters 6 and 8
			Airport Zoning Permit	Lincoln County Code, Title 9, Chapter 2
			Building Permit	Lincoln County Code, Title 11, Chapter 2
Air Quality	Construction activities	Clark County Department of Air Quality	Dust Control Permit	Clark County Department of Air Quality requirements
Biological Resources	Construction activities	Clark County	Desert Tortoise Assist	Clark County Desert Conservation Program requirements
Land Use	Construction and operation of transmission lines	Clark County	Conditional Use and Special Use Permits	Clark County Code, Title 30, Chapter 44
			Building and Grading Permits	Clark County Code, Title 30, Chapter 32
			Drainage Compliance Report	Clark County Department of Building
			Geotechnical Report	
Transportation / Access	Encroaching onto county road ROW	Clark County	Encroachment Permit	Clark County Code, Title 30, Chapter 32
	Accessing work sites via county roads	Clark County	Traffic Control Plan	Clark County Department of Public Works requirements
Ground Disturbance and Water Quality Degradation	Construction activities	Clark County	Stormwater Pollution Prevention documentation	Clark County Department of Building requirements

2.0 PURPOSE AND NEED

2.1 TWE Project Objectives and Needs

TransWest's primary goal is to provide the transmission infrastructure and capacity necessary to reliably and cost-effectively transmit up to 3,000 megawatts (MW) of electric power from Wyoming to the Desert Southwest. TransWest's objectives for the Project are to:

- Allow consumers access to renewable energy sources and contribute to meeting national, regional, and state energy and environmental policies, including state-mandated renewable energy portfolio and greenhouse gas reduction targets;
- Meet increasing customer demand with improved electrical system reliability;
- Allow consumers access to domestic energy sources and contribute to complying with national energy policy;
- Provide system flexibility and increased access to the grid for third-party transmission users;
- Expand regional economic development through increased employment and enlargement of the property tax base; and
- Maintain the standard of living associated with highly reliable electricity service.

While meeting these broad objectives, TransWest would work within the following Project-specific objectives:

- Provide for the efficient, cost-effective, and economically feasible transmission of approximately 20,000 gigawatt hours per year (GWh/yr) of clean and sustainable electric energy from Wyoming to markets in the Desert Southwest region. This estimate is based on 8,760 hours per year of 3,000-MW transmission capacity.
- Meet NERC Reliability Standards and WECC planning criteria and line separation requirements.
- Maximize the use of designated federal utility corridors and existing access roads to the extent practicable to minimize adverse effects of the Project.
- Maximize co-location of the Project with existing linear infrastructure generally and, in particular, existing transmission infrastructure to the extent practicable to minimize adverse effects of the Project.
- Provide these benefits in a timely manner to the Desert Southwest region and the broader Western U.S. to meet the region's pressing environmental and energy needs. TransWest has identified a need for the Project by the expected in-service date of 2015 or as soon as the regulatory reviews can be completed.
- Provide for flexibility and maximize the use of infrastructure to increase future transmission capacity by configuring the Project to allow for future interconnection with the IPP transmission system near Delta, Utah.

2.2 NERC Standards and WECC Criteria

The Reliability Standards used within the electric utility industry for the bulk power electrical grid are developed by the NERC. The WECC develops Regional Criteria that supplement the NERC Standards. The West-Wide Energy Corridor (WWEC) Final Programmatic Environmental Impact Statement includes a comprehensive overview of this subject in Chapter 2, Section 2.6.3, *What Steps Are Being Taken To Ensure The Reliability of Bulk Electricity Transmission* (DOE et al. 2008). The overview includes a description of how NERC and WECC regulate the industry through a wide series of standards that address all facets of the bulk electricity transmission grid, including design, planning, operations, infrastructure and cyber security, communication, coordination and operational safety.

These reliability standards affect the technical aspects of the TWE Project in several ways. Reliability standards limit the operational capacity of any single transmission system element based on a complex contingency analysis that considers the impact to grid operations following various events (e.g., equipment failures, line outages).

Reliability standards affect the TWE Project ROW requirements and separation requirements from other high voltage lines. As a single transmission system element, the TWE Project is effectively limited in capacity to approximately 3,000 MW.

The contingency analysis required for new transmission projects such as the TWE Project involves examining several types of events including the loss of “Adjacent Transmission Circuits” and the loss of multiple transmission lines within a corridor.

WECC’s Regional Criteria addresses separation distances based upon the location of a project from Adjacent Transmission Circuits. WECC requires a minimum separation distance between high voltage transmission lines. The WECC Regional Criteria specifies that to avoid being rated as Adjacent Transmission Circuits, or common transmission system elements, circuits must be separated by “at least 250 feet between the transmission circuits” (WECC 2012). The applicability of this portion of the Regional Criteria is for circuits greater than or equal to 300 kV. The loss of multiple lines within a corridor involves analyzing impacts after a line outage of the TWE Project transmission line and any other transmission line(s) within the corridor. The most likely event would be the loss of the TWE Project and an adjacent transmission line.

The likelihood of having a line outage of two transmission lines is even higher at places where transmission lines cross one another. The mechanical failure of the top line would typically cause the line below to also fail. The practicality of needing transmission lines to cross is recognized in the standards; however, the number of crossings needs to be minimized to reduce the likelihood of such an event.

Reliability analysis examining the scenario where multiple lines are lost including the TWE Project has shown this loss will have a significant impact on transmission grid performance, including local and widespread transmission grid blackouts. This reliability analysis has found that the higher the capacity of the line lost along with the TWE Project, the more severe the transmission grid performance consequences. The reliability analysis also demonstrated that it is not feasible for the TWE Project and another transmission project to use common structures for any portion of the route.

TransWest has developed minimum line separation requirements based on the “tower height” dimensions adopted by WECC in 2012. This tower height dimension takes into consideration both the height and width of typical transmission line structures and is meant to prevent a tower failure of one line from impacting the adjacent line. Application of the NERC and WECC reliability standards and preliminary transmission system contingency analyses indicate that the proposed Project transmission line centerline should be optimally no closer than 250 feet from parallel transmission line centerlines rated 230 kV and above. The 250 foot separation criteria will allow for safe and reliable operation of the Project, as well as more efficient use of designated and existing utility corridors and will reduce the extent of the disturbance associated with access roads and other potential impacts caused by construction in a new transmission corridor.

2.3 Renewable Energy and Transmission

The TWE Project will provide the transmission infrastructure and capacity necessary to reliably and cost-effectively deliver approximately 20,000 GWh/yr of clean and sustainable electric power generated primarily from renewable wind energy resources in Wyoming to the Desert Southwest. Another major benefit of the TWE Project is to facilitate the states of the Desert Southwest in their ability to meet their renewable energy needs and Renewable Portfolio Standards.

Wind and solar have been cited in numerous studies as the most economic large scale resources that can be used to meet the Nation's demand for renewable and clean energy. However, developable solar and wind resources are typically found in remote areas located far from urban centers where the demand is the greatest. Thus, transmission infrastructure is required to enable renewable energy development that will meet both the demand for energy and environmental policy objectives.

In its July 2008 report entitled "20% Wind Energy by 2030, Increasing Wind Energy's Contribution to U.S. Electricity Supply" (DOE 2008), the DOE recognized the challenge of bringing wind energy to market. According to the DOE report:

> "If the considerable wind resources of the United States are to be utilized, a significant amount of new transmission will be required. Transmission must be recognized as a critical infrastructure element needed to enable regional delivery and trade of energy resources, much like the interstate highway system supports the nation's transportation needs…Significant expansion of the transmission grid will be required under any future electric industry scenario. Expanded transmission will increase reliability, reduce costly congestion and line losses, and supply access to low-cost remote resources, including renewables."

In discussing required improvements to the nation's transmission infrastructure necessary to achieve 20% wind energy by 2030, the DOE report concludes:

> "The 20% Wind Scenario would require widespread recognition that there is national interest in ensuring adequate transmission. Expanding the country's transmission infrastructure would support the reliability of the power system; enable open, fair, and competitive wholesale power markets; and grant owners and operators access to low-cost resources. Although built to enable access to wind energy, the new transmission infrastructure would also increase energy security, reduce GHG emissions, and enhance price stability through fuel diversity."

The electrical demand for the Desert Southwest region is also expected to increase over the next ten to twenty years. According to the U.S. Census Bureau, the western United States has experienced a population growth of approximately 10 percent from 2000 to 2006. The Bureau expects the growth in population to increase by 33 percent between 2006 and 2030. The Bureau's latest projection of population growth between 2000 and 2030 for the combined area of Arizona, California, and Nevada is nearly 50 percent (U.S. Census Bureau 2005). Arizona and Nevada were identified as the fastest growing states during this period (U.S. Census Bureau 2005a).

Population increase is a key driver in the projected increase in electrical demand, although it is not the only factor. The amount of electricity used per person is also expected to increase as the scope and expectation for the uses of electricity increases. The per capita increase is due to the continued electrification of day to day life, including the expanded deployment of air conditioning, computers, high-definition televisions, and potentially, electric powered automobiles. While this upward tendency on per capita electricity usage is countered by conservation efforts in the form of energy efficiency standards, utility programs, and individual responsibility, overall per capita electricity usage is still expected to increase (Global Environment Fund 2008). Therefore, even accounting for conservation programs, the electricity demand is expected to increase on the order of two percent per year in the Desert Southwest region (ICF International 2009).

The increase in overall forecasted electric demand in the Desert Southwest region will require the addition of 55,000 GWh/yr of renewable energy by 2020 to satisfy projected Renewable Portfolio Standards (RPS) requirements. Even with significant gains in energy efficiency and/or slower than expected growth, the need to access new renewable resources remains. For instance, if overall demand for electricity is 15 percent below the forecasted levels for 2020, the estimated requirements for additional renewable energy would only change from 55,000 GWh/yr to 45,000 GWh/yr (ICF International 2009).

2.3.1 Relevant State Laws and Regulations – Renewable Energy Resources and Standards

Arizona, California, Nevada, and Utah have adopted renewable energy standards, commonly referred to as RPS. These states have enacted legislation that requires utilities to meet a portion of the overall customer energy supply with renewable energy resources by specific dates. Each state has adopted programs that vary in the portion of overall renewable energy required, the deadlines, and the type of resources that can be utilized. Beyond the legislated RPS, California, which has a 20 percent renewable energy requirement by 2010, has recently adopted a policy to increase the requirement to 33 percent by 2020. A brief summary of each state's RPS requirements follows.

California. California's RPS was initially established by the State of California legislature in 2002. In 2011, the State of California legislature enacted [Senate Bill 2] that codified a 33% Renewable Portfolio Standard by 2020 that would apply to all utilities, including publicly-owned municipal utilities.

Arizona. In November 2006, the Arizona Corporation Commission (ACC) adopted final rules to expand the state's Renewable Energy Standard (RES) to 15% by 2025. In June 2007, the state attorney general certified the rule as constitutional, allowing the new rules to go forward and they took effect 60 days later. Investor-owned utilities serving retail customers in Arizona are subject to the standard.

Utilities subject to the RES must obtain renewable energy credits (RECs) from eligible renewable resources to meet 15% of their retail electric load by 2025 and thereafter. Of this percentage, 30% (i.e., 4.5% of total retail sales in 2025) must come from distributed renewable resources by 2012 and thereafter.

Nevada. Nevada established a RPS as part of its 1997 restructuring legislation. Under the standard, NV Energy (parent company of Nevada Power, Sierra Pacific Power, and Sierra Pacific Resources) must use eligible renewable energy resources to supply a minimum percentage of the total electricity it sells. In 2001, the state increased the minimum requirement by two percent every two years, culminating in a 15% requirement by 2013. The portfolio requirement has been subsequently revised, most recently by Senate Bill (SB) 358 of 2009, which increased the requirement to 25% by 2025. In addition to solar, qualifying renewable energy resources include biomass, geothermal energy, wind, certain hydropower, and waste tires (using microwave reduction).

2.3.2 Greenhouse Gas Reduction Goals

In addition to RPS mandates, states and the federal government are also considering various Greenhouse Gas (GHG) reduction policies. Several western governors, including the governors of California, Arizona, and Utah, formed the Western Climate Action Initiative in 2007 to jointly reduce regional GHG levels. A regional goal has been established by the members of the Initiative and details of the economy-wide (e.g., electricity, transportation, industry) program is being developed. GHG reduction policies are also being considered at the federal level. This need for additional renewable energy could be greater depending on how GHG reduction is implemented by utilities (DOE 2008; ICF International 2009).

2.3.3 Wyoming's Abundant and Cost Effective Resources

According to the National Renewable Energy Lab (NREL), Wyoming has one of the densest concentrations of high class wind energy potential in the country (NREL 2006, 2008). NREL data shows that over 50 percent of the best quality (Class 6 and 7) wind capacity in the continental United States is located in Wyoming. This Class 6 and 7 wind resource has an energy potential of 235,000 GWh/yr. Wyoming's Class 4 and above wind resource has a potential of 944,000 GWh/yr. Wind and other energy developers have been very active in Wyoming.

The existing transmission capacity available to export electric energy from Wyoming is fully committed. These constraints led to the recommendations for transmission expansion along similar routes as the TWE Project from the Western Governors Association (WGA), the Rocky Mountain Area Transmission Study (2004), and the Clean and Diversified Energy Advisory Committee (WGA 2006). In addition to wind resources, Wyoming has a number of other natural energy resources that could also be developed for production of electricity and transmitted on the infrastructure to be constructed pursuant to the TWE Project to the growing markets in the Desert Southwest region. The WGA and DOE have identified over 14,000 MW of high quality developable wind resources within Wyoming (WGA and DOE 2009).

Two recent studies, one by the Western Electricity Industry Leaders, have looked specifically at regional renewable energy alternatives, including remote resources supplied through new transmission infrastructure, to meet the needs of the Desert Southwest region. Wyoming wind resources were identified as one of the most economic alternatives to meet a portion of the overall needs (NREL 2006, 2008). The TWE Project will cost effectively provide up to 20,000 GWh/yr of the estimated 55,000 GWh/yr need for renewable energy need in the Desert Southwest region.

3.0 ROLES AND RESPONSIBILITIES

The following section describes the roles and responsibilities of each major Project entity. If other parties become engaged in the Project as additional participants, they would be responsible to function and abide by the roles and responsibilities outlined in this section and their reporting relationships would be case-specific according to their jurisdiction, expertise, and/or nature of their input.

3.1 TransWest

TransWest as the Applicant will be responsible for the administration of the ROW and coordination with the Construction Contractor(s). TransWest and its Construction Contractor(s) will be responsible for all activities associated with the construction, operation, and maintenance of the transmission line and ancillary facilities in a manner that complies with the conditions outlined in the ROW grants, special use authorizations, and other permits listed in Table 2 in Section 1 of this POD. TransWest will be the ultimate authority for its contractors; however, for execution purposes of this document, it will refer specifically to the Construction Contractor(s) when needed to define their activities. To help ensure construction activities are conducted in a manner that complies with all federal, state, and local regulations, the Construction Contractor(s) will contract with or employ a multi-disciplinary team of environmental specialists and inspectors to work jointly and cooperatively with the third party Compliance Inspection Contractor (CIC). TransWest will also maintain regular and consistent communication with the Construction Contractor(s) to track the success of environmental protection, mitigation, and compliance efforts before, during, and after construction.

3.2 Western

Under the Hoover Act, as amended by Section 402 of the Recovery Act, Western was granted authority to borrow funds from the U.S. Treasury to (among other things) construct, finance, facilitate, plan, operate, maintain, and/or study construction of new or upgraded transmission facilities that facilitate the delivery of renewable energy. Prior to committing funds, Western must certify that a project is in the public interest; a project will not adversely impact system reliability, system operations, or other statutory obligations; and it is reasonable to expect the proceeds from the project will be adequate to make repayment of the loan.

Western created the Transmission Infrastructure Program (TIP) to administer the use of borrowing authority and on March 4, 2009 solicited interest in proposed transmission projects that promote the delivery of clean, renewable power. This resulted in the submission of Statements of Interest, including one for this Project. Western is considering whether to participate in the Project as a joint owner with TransWest as part of Western’s TIP and in order for Western to participate, the Project must satisfy Western’s TIP requirements. As with the BLM’s decision, Western’s decision is informed by the required NEPA analysis and disclosure in the EIS.

Should Western decide to participate in the Project as a joint owner with TransWest, the decision would be managed through agreements that would include defining the respective rights and obligations associated with the ownership of the Project which include financing, ownership structure, operations, maintenance, marketing and acquisition of ROWs for the Project on private lands. As a federal agency, Western would need to comply with all applicable laws and policies for the joint ownership of transmission projects, and comply with the stipulations included within the Record(s) of Decision and other similar authorizations made by the respective federal land management agencies.

3.3 BLM, USFS, and Other Federal Land Management Agencies

The role of the BLM, USFS, and other federal agencies is to ensure that all stipulations and requirements of the ROW grants, special use authorizations, and the POD are implemented and complied with during the construction, operation, and maintenance of the Project on the lands they administer. Oversight will be provided by both federal Authorized Officers and by federal Project Managers for each involved federal agency. Authorized Officers will have ultimate authority and be the decision makers for issues pertaining to ROW grants and authorizations. The Authorized Officers will supervise the federal Project Managers to verify that environmental compliance is meeting the requirements of all applicable laws, permits, regulations, and agreements. The Authorized Officers, in coordination with others, will determine if noncompliance events for which TransWest is accountable qualify as violations to the terms and conditions of any ROW grant or authorization. Only the Authorized Officers, in accordance with 43 CFR Part 2807 and 36 CFR Part 251.60, will have the authority to suspend or terminate a ROW grant or authorization if TransWest and/or its Construction Contractor(s) do not comply with the stipulations, conditions, or with other applicable laws and regulations. The Authorized Officers will be the primary federal agent to issue decisions unless otherwise delegated to a federal Project Manager.

Federal Project Managers will be primarily responsible for ensuring stipulations and mitigation measures in the POD are adhered to during Project construction, operation, and maintenance. They will ensure that compliance during construction is done in a manner which facilitates timely and efficient construction while protecting the public interest and the environment. They will also be responsible for ensuring that environmental impacts do not exceed those analyzed in the Final EIS and will manage the CIC. Federal Project Managers will coordinate with agency resource specialists for their technical expertise and input when needed. Federal Project Managers will be responsible for notifying TransWest of any grant or authorization violations due to noncompliance, issue Notices to Proceed, issue work stoppage order (WSO) if needed, issue resume work orders and resolving any conflicts that arise relating to the Project on lands they administer.

As described in the Environmental Compliance and Monitoring Plan (ECMP) (Appendix G), Level 2 variance requests will require approval by the appropriate federal Project Manager and Level 3 variance requests will require approval by the appropriate federal Project Manager and Authorized Officer.

3.4 Compliance Inspection Contractor (CIC)

TransWest and the federal agencies have agreed to use a third-party CIC to act on the BLM and other federal land management agencies' behalf to ensure adequate oversight during the construction and reclamation phases of the Project. The CIC will be hired by TransWest prior to issuance of any NTP to allow adequate time for the CIC to review documents and develop on-the-ground familiarity with the Project. The CIC will report directly to each federal Project Manager and will be authorized to enforce the POD, stipulations of the ROW grant and authorizations. It is not the role of the CIC to direct the work of either TransWest or its Construction Contractor(s). Rather the CIC's primary role is to observe work activities and bring noncompliant situations to the attention of the appropriate party and offer recommendations on how to prevent noncompliance. Additional responsibilities of the CIC are discussed in the ECMP (Appendix G).

The CIC will deploy an adequate number of field personnel to sufficiently monitor all constructions activities and fulfill the responsibilities listed above. It is important to note that it is not the role of the CIC to direct work of either TransWest or the Construction Contractor(s) and the CIC will take no direction from them with respect to times, places, or manner of conducting compliance monitoring. The CIC is to have complete access to inspect all parts of the Project.

3.5 Construction Contractor(s)

The Construction Contractor(s) will be contractually bound to comply with all laws, regulations, and permit requirements, including the implementation of mitigation measures, environmental mitigation measures (EMMs), and other specific stipulations and methods set forth in the ROW grants, special use authorizations, permits, POD, FEIS, ROD, and NTPs throughout all construction phases of the Project. All construction personnel and employees entering the ROW will be required to participate in environmental training before entering the ROW. Construction crews will also be required to cooperate and support the work of the environmental inspectors, monitors, and CIC to build the Project safely and in compliance with all Project terms and conditions; federal, state, and local laws and regulations; and all landowner agreements. If a noncompliance event occurs during construction, it will be the responsibility of the Construction Contractor(s) to notify TransWest and the CIC and to cooperate fully in developing and implementing a solution as soon as possible to resolve the noncompliance. The Construction Contractor(s) will also be responsible for the removal of noncompliant personnel, as necessary. The Construction Contractor will be expected to involve the CIC in key project management meetings and the project safety program.

3.6 Communication Procedures

Effective communication and the sharing of information between all parties will be critical to achieving and maintaining environmental compliance throughout the construction of the Project. It is especially important for construction crews to communicate daily with environmental monitors concerning work schedules and locations. The Construction Contractors(s) will be responsible for assuring that field crews have the ability to communicate effectively and will implement solutions if communication problems arise.

Given the scope and complexity of the Project, it is critical that all communications involving key decisions, safety, approvals, noncompliance, or variances be documented in writing. Oral communication will not substitute for written approvals. Additional information concerning communication procedures can be found in the ECMP (Appendix G) and in the Traffic and Transportation Management Plan (Appendix U).

4.0 PROJECT COMPONENTS

Sections 4.1 through 4.4 describe the typical design characteristics for the proposed TWE Project facilities and associated permanent and temporary land disturbance estimates:

- Section 4.1 – the TWE Project transmission line, including structure designs and foundations, conductors, insulators and associated hardware, overhead shield (ground) wires, grounding rods, minor hardware, system interconnection lines and access roads.

- Section 4.2 – the TWE Project Northern and Southern Terminals, including the AC/DC converter stations, substation equipment.

- Section 4.3 – the TWE Project ground electrode systems, including the ground electrode facilities and low voltage electrode connector line(s).

- Section 4.4 – the TWE communication system for command control of the transmission system.

Appendix AA provides the revised indicative disturbance data tables for the project components by FEIS alternative route segments and an updated description of the methodology used to determine the indicative disturbance levels for access roads for analysis in the FEIS.

4.1 Transmission Line Design Characteristics

The TWE Project proposed ±600 kV DC transmission line will be approximately 750 miles long, located in a ROW 250 feet wide. The design characteristics of the ±600 kV DC transmission line are summarized in Table 3 and are described in this section.[1]

TransWest has determined that a ROW width of 250 feet is sufficient for the long-term maintenance and operation of the transmission line and will accommodate any of the transmission structure designs under consideration. Increased ROW width may be required in a small number of site specific locations to accommodate unusually long spans. These exceptions will be identified and addressed on a case-by-case basis during final design and engineering of the transmission line. ROW width for the TWE Project is based upon engineering studies that considered:

- Structure configuration (horizontal vs. vertical configurations), pole spacing, and insulator configuration (I-string vs. V-string insulator configurations);

- Operating voltage, elevation and clearance criteria (National Electrical Safety Code [NESC] and project-specific);

- Conductor size, weight, number and configuration of conductors in the bundle, tensions, and sag;

- Span length between structures and conductor blowout (conductor movement envelope under pre-defined wind conditions);

[1] Short segments of 500 kV AC and 230 kV AC transmission lines will be required near the Northern and Southern Terminals to connect to the existing and planned regional transmission grid. The design characteristics of these transmission structures are described in Section 4.1.1.

- Structure footprint (guyed vs. self-supported), terrain and maintenance access (space requirements for maintenance equipment at each structure site);
- Audible noise levels at the edge of the ROW; and
- Potential co-location with buried underground high pressure natural gas and other petroleum pipelines within the same corridor. The DC transmission line can be located in its ROW adjacent to the ROW for such pipelines.

TABLE 3 TYPICAL ±600 KV DC TRANSMISSION LINE DESIGN CHARACTERISTICS

FEATURE	DESCRIPTION
	Physical Properties
Line Length	Miles per route segment depending on selected alternative.
Structure Type	Proposed Structure Type: guyed steel lattice; Alternative Structure Types: self-supporting steel lattice, tubular steel poles
Structure Height	Guyed steel lattice -120 to 180 feet; self-supporting steel lattice -120 to 180 feet; tubular steel poles - 100 to 150 feet (special crossing structures may be in excess of 200 ft.)
Span Length	Guyed lattice - 900 to 1,500 feet; self-supporting steel lattice - 900 to 1,500 feet; tubular steel poles - 700 to 1,200 feet
Number of Structures per Mile	Four to eight - depending on structure type, terrain, and other factors to be identified through detailed design studies
ROW Width	250 feet; Increased ROW may be required in a small number of site specific locations to accommodate unusually long spans
	Land Temporarily Disturbed
Structure Work Area	ROW width (250 ft) x 200 feet per structure
Wire-Pulling and Tensioning Sites	ROW width (250 ft) x 500 feet for dead-end structure (two sites at all dead-end structures); ROW width (250 ft) x 500 feet for mid-span conductor and shield wire (approximately every 9,000 feet); 100 x 500 feet for fiber optic cable set-up sites (approximately every 18,000 feet)
Material Storage Yards	Located approximately every 30 miles of transmission line Typical material storage yard area: approximately 20 acres
Staging Areas / Fly Yards	Located approximately every 5 miles of transmission line Typical fly yards/staging areas: approximately 7 acres
Batch Plant Sites	Located approximately every 15 miles of transmission line Stand-alone temporary batch plants, estimated size: approximately 5 acres
Guard Structures	100 x 100 feet at road and existing overhead electrical line crossings
	Land Permanently Disturbed
Structure Base[1]	Guyed lattice (tangent) - 500 square feet (100 square feet mast foundation + 4 x 100 square feet for anchors) Self-Supporting Lattice (tangent) - 900 square feet (30 x 30 feet tower base) Self-Supporting Lattice (angle) - 1,225 square feet (35 x 35 feet tower base) Self-Supporting Lattice (dead-end) - 1,600 square feet (40 x 40 feet tower base) Tubular Steel Pole (tangent) - 40 square feet (7-foot diameter foundation) Tubular Steel Pole (dead-end/angle) - 100 square feet (two poles x eight-foot diameter foundations)
Regeneration Sites	Located approximately every 50 miles of transmission line, most located on the transmission line ROW and each approximately 10,000 square feet (100 x 100 feet).
	Access Roads
Existing Paved Roads[2]	Existing paved roads are typically highways and state routes that will be used for

FEATURE	DESCRIPTION
	travel to existing and new dirt roads to access the ROW.
Existing Dirt and Gravel Roads (no improvement)[2]	Existing dirt and gravel roads with wide (at least 14 feet), well graded or graveled surfaces that do not require improvement beyond regular maintenance, which could include, but not be limited to, blading of the road surface, placing gravel in low spots and repair of drainage structures within the previously disturbed area of road .
Existing Dirt Road (with improvements)	Existing dirt roads that may require improvement. The bladed road surface may need to be widened to 14 - 24 feet depending on terrain. Total disturbance, including that for drainage, cut and fill, may extend beyond the bladed road surface especially in steep terrain where the maximum total disturbance width will typically not exceed 52 feet, but will be determined in consultation with the land management agency or landowner on a case-by-case basis. Surface disturbance outside of the bladed road surface will be limited to the smallest area necessary while still providing a safe work area.
New Dirt Access Road (bladed)	Typically constructed with a 14 foot wide bladed surface with two or three foot berms or ditches on either side, but can be wider in steep and mountainous terrain because of cut and fill requirements according to ground slope. Based on the terrain and grade of the road, new bladed access roads to be constructed with an inslope or outslope design with water dips, water breaks and wings in the berm as necessary to manage water flow and mitigate erosion. Total disturbance, including that for drainage, cut and fill, may extend beyond the bladed road surface especially in steep terrain where the maximum total disturbance width will typically not exceed 52 feet, but will be determined in consultation with the land management agency or landowner on a case-by-case basis. Surface disturbance outside of the bladed road surface will be limited to the smallest area necessary while still providing a safe work area.
Overland Access	Overland access (“drive and crush”) where terrain and soil conditions are suitable. No blading or grading required. Some areas may require taller vegetation to be removed while still leaving the root systems intact, as well as, rocks to be removed and placed outside the travel surface in order to utilize overland access. Access surface will typically not exceed 14 feet in width but will be determined in consultation with the land management agency or landowner on a case-by-case basis.
Electrical Properties	
Nominal Voltage	±600 kV DC
Nominal Capacity	3,000 MW (as measured at the Southern Terminal)
Circuit Configuration	DC Bi-Pole Bundled
Conductor Size	Approximately 1.5 inch diameter aluminum conductor steel reinforced (ACSR) conductor bundled with three or four sub-conductors per pole.
Ground Clearance of Conductor	37 feet minimum at a conductor temperature of 176 degrees Fahrenheit (°F)

Notes: [1] Structure types to be used in site-specific settings will be determined during engineering and design of the Agency Preferred Alternative. Tangent self-supporting lattice structures were used to calculate permanent disturbance since this structure type would result in greater disturbances per structure than the proposed guyed lattice structure.
[2] Existing paved, gravel, and dirt public and private roads that can be used to access the FEIS corridor are part of the Backbone Access Road Network described in Appendix Z Revised Access Road Methodology for FEIS Memorandum (February 2014).

4.1.1 Structure Types

The TWE Project transmission line will be constructed primarily with guyed lattice structures (Figure 1). Self-supporting steel lattice and single shaft tubular steel poles (Figures 2 and 3) would be used in selective locations where engineering or other site-specific considerations determine that the guyed lattice steel structure is not appropriate. Table 4 indicates the general suitability of the transmission structure designs by characteristic settings. Figure 4 shows each structure design within a typical 250 foot-wide ROW.

The guyed lattice structure shown on Figure 1 is the proposed tangent design for most locations due to its smaller disturbance area, constructability and overall cost considerations. In addition to tangent structure configurations, specialized structures will be engineered wherever the line must change direction. Specialized structures require the use of either self-supporting lattice or single shaft tubular steel poles. Each angle structure will be individually designed, taking into consideration both the degree of the angle and site-specific geologic conditions, to withstand the increased lateral stress of conductors pulling in two different directions. Angle structures are stronger and have deeper foundations than tangent structures. The term ‘dead-end’ or ‘strain’ structure typically refers to a structure where the conductors are separated and connected together (electrically) by a jumper. These dead-end structures are typically placed at locations where the transmission line significantly changes direction.

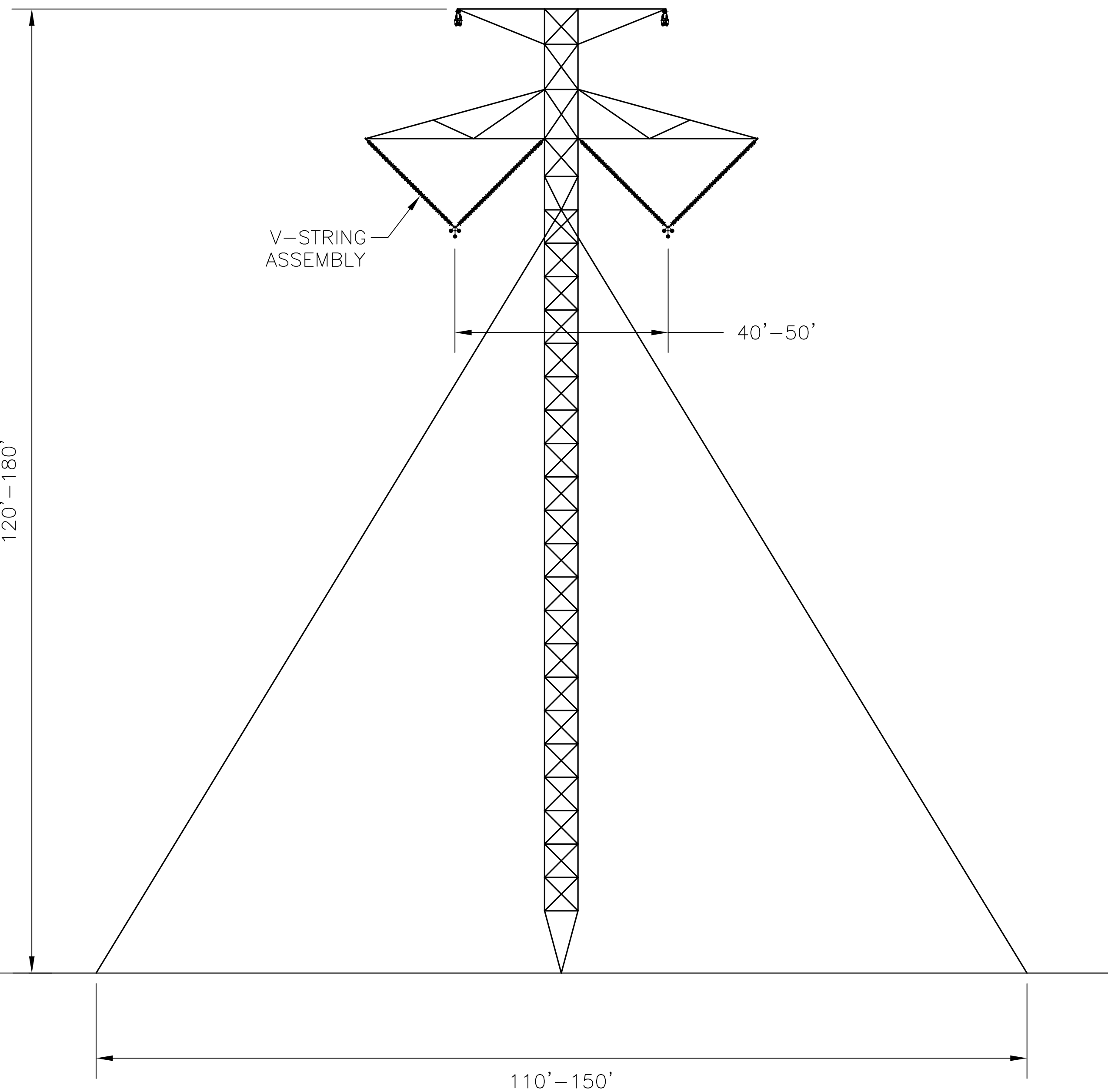
The TWE Project will be designed in accordance with guidelines established by the Avian Power Line Interaction Committee (APLIC 1994, 2006, 2012). Appendix B provides the framework level Avian Protection Plan for the FEIS.

During detailed engineering and design of the selected Alternative, a series of structure types will be designed to meet the project-specific design criteria. These project-specific design criteria address industry standards and guides, legislated requirements, anticipated environmental conditions, terrain, applications (settings) and land use. In addition to the common or standard structure types designed and to be used across the project, a small number of unique and special structures will be designed to address site-specific conditions such as long spans due to terrain or sub-regional conditions such as weak sandy soils, landslide areas or highly corrosive soils.

TABLE 4 ±600 KV DC TRANSMISSION LINE DESIGN ALTERNATIVES POTENTIALLY USED IN CHARACTERISTIC SETTINGS

CHARACTERISTIC SETTING	GUYED STEEL LATTICE	SELF SUPPORTING STEEL LATTICE	TUBULAR STEEL POLE
Flat to Rolling Terrain	X		
Steep to Mountainous Terrain and Steep Side Slopes	*	X	X
Open Lands	X		
Agricultural Fields, Urban Areas		X	X
Highly constrained ROW			X
Line Angle 0-2°	X		
Heavier Line Angles and Dead-end Strain Structures		X	X

* Should helicopter erection of structures be preferred or required, guyed lattice steel structures may be utilized in steep to mountainous terrain as long as specific structure locations do not have excessively steep side slopes.



NOTES

1. DIMENSIONS SHOWN ARE FOR ILLUSTRATION PURPOSES ONLY.

2. TOWER OUTLINE AND BRACINGS ARE INDICATIVE ONLY.

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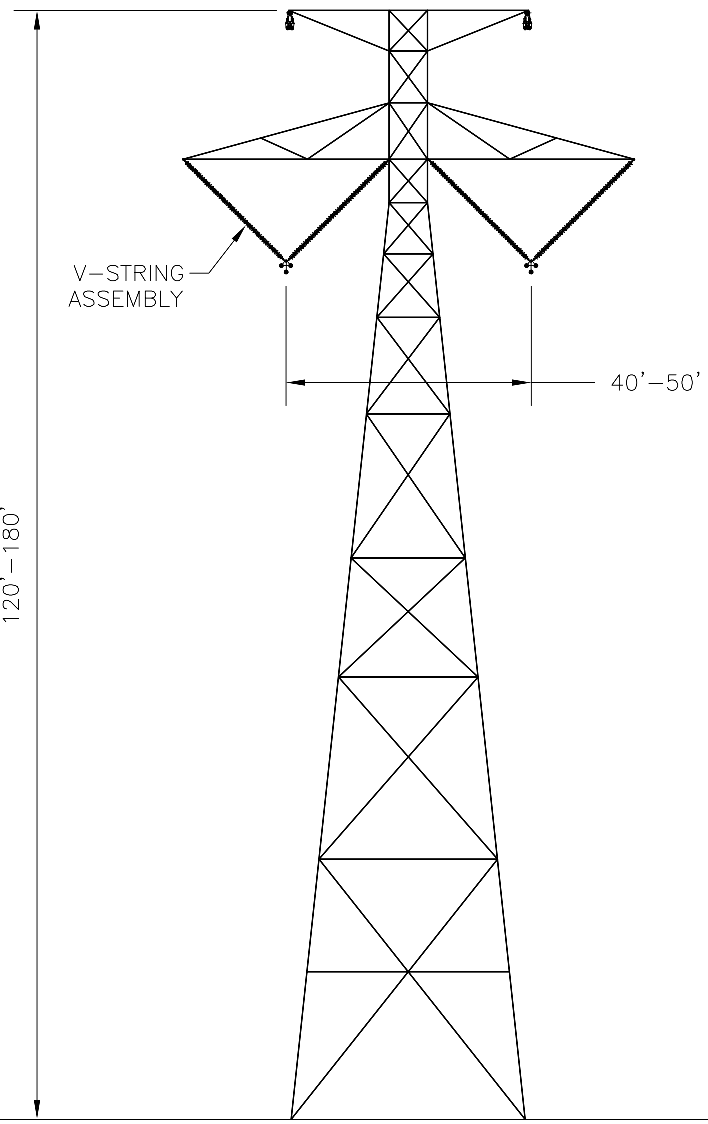
TRANSWEST EXPRESS TRANSMISSION PROJECT

FIGURE 1

TYPICAL ±600kV DC
GUYED V-STRING
LATTICE STRUCTURE



<u>NOTES</u>

1. DIMENSIONS SHOWN ARE FOR ILLUSTRATION PURPOSES ONLY.
2. TOWER OUTLINE AND BRACINGS ARE INDICATIVE ONLY.

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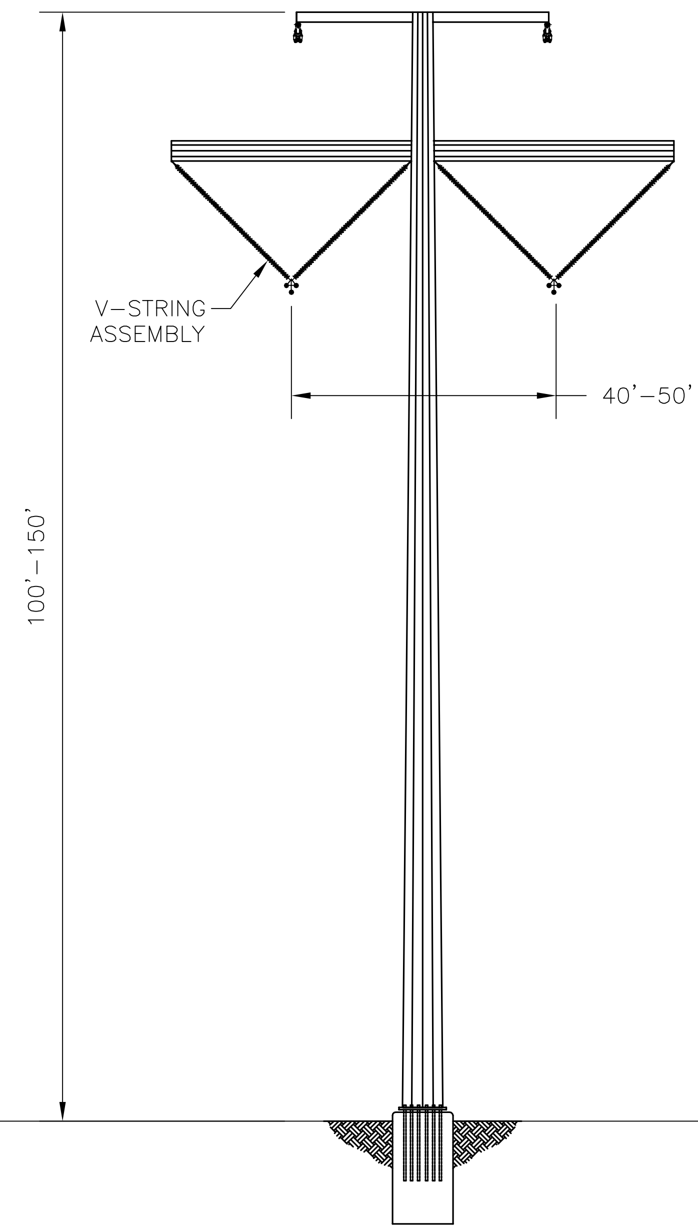
FIGURE 2

TYPICAL ±600kV DC
SELF SUPPORTING LATTICE
V–STRING STRUCTURE



NOTES

1. DIMENSIONS SHOWN ARE FOR ILLUSTRATION PURPOSES ONLY.

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FIGURE 3

TYPICAL ±600kV DC
TUBULAR STEEL POLE
V-STRING STRUCTURE

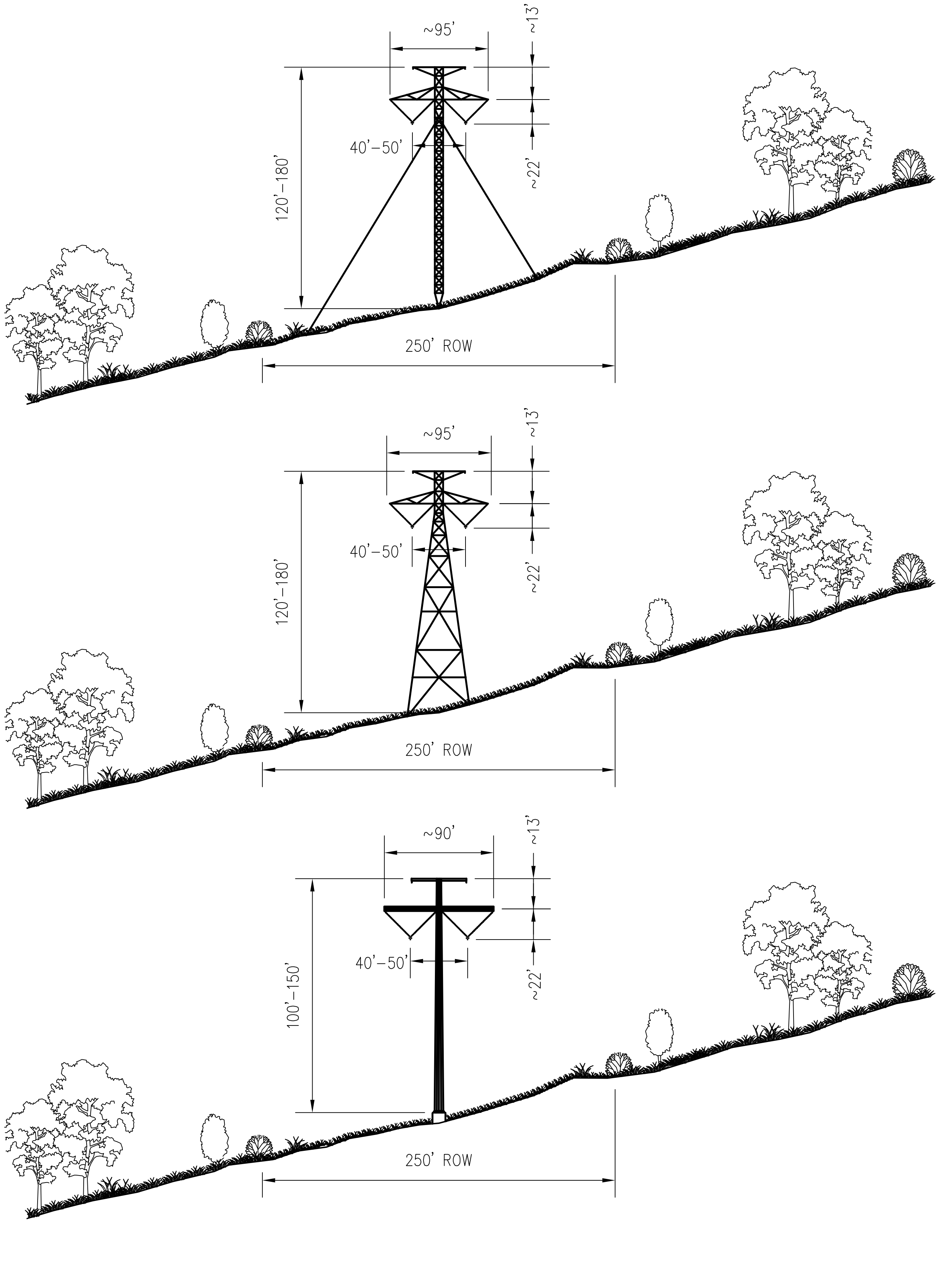

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FIGURE 4

TYPICAL ROW CROSS SECTIONS
BY STRUCTURE TYPE

4.1.2 Structure Foundations

The guyed steel lattice towers will generally require one precast concrete support pedestal for the tower base and four anchors for guy cables. The typical precast concrete support pedestal will be three to six feet in diameter and four to six feet in depth. Due to site-specific characteristics, some foundations may require a cast-in-place reinforced concrete support pedestal. The anchors for attachment of the guy cables will be anchors designed for soil/rock conditions at each site.

Self-supporting lattice towers will require four foundations with one foundation on each of the four corners (legs) of the lattice towers. 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. Typically, the foundation for each leg of the structure will be a reinforced cast-in-place concrete drilled pier, with a typical diameter of three to four feet and a depth of approximately 12 to 25 feet. Foundations for dead-end and angles structures will be larger, typically ranging from five to eight feet in diameter and 20 to 50 feet in depth.

Tubular steel pole towers will require one cast-in-place concrete foundation per steel pole. These tubular steel towers will be installed on a single reinforced concrete pier with anchor-bolts connecting the tubular pole base plate to the 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. Foundations for these structures will typically be six to ten feet in diameter and 20 to 60 feet in depth.

In a limited number of locations, specialized foundations may be required to address shallow rock, landslide prone areas, unstable soils, corrosive soils, weak sandy soils, shallow water table, etc. These site specific or sub-region specific foundation designs may include micro-pile, helical pile, grouted, epoxy, grillage, driven pile, vibratory pile and/or steel caisson type designs. All specialized foundations will be determined during final design.

4.1.3 Conductors

Design Characteristics

The proposed conductor for the TWE Project transmission line is an ACSR/TW (Aluminum Conductor Steel Reinforced/Trapezoidal Wire) conductor approximately 1.5 inches in diameter. Each pole of the ±600 kV bipole[2] line will be composed of three or four subconductors in a triple-bundle or quad-bundle configuration. The individual conductors will be bundled in either a triangular configuration (triple-bundle) or a diamond configuration (quad-bundle) with spacing of approximately 18 inches between subconductors. The bundled configuration is proposed to provide adequate current carrying capacity and to provide a reduction in audible noise and radio interference as compared to a single large-diameter conductor. Each ±600 kV subconductor will have a non-specular finish[3].

Ground Clearance Requirements and Guidelines

Conductor phase-to-phase and phase-to-ground clearance parameters are determined in accordance with the NESC, ANSI C2, produced by the American National Standards Institute (ANSI). The NESC provides for minimum distances between the conductors and ground, crossing points of other lines and the transmission support structure and other conductors, and minimum working clearances

[2] A bipole HVDC transmission line consists of two poles – positive and negative. A pole may consist of one conductor or multiple conductors (i.e., sub-conductors) bundled together.
[3] Non-specular finish refers to a "dull" finish rather than a "shiny" finish.

for personnel during energized operation and maintenance activities. The clearance requirements for conductor heights above ground are based on the current and potential use of the land being crossed.

The minimum ground clearance for the TWE Project ±600 kV DC conductor is 37 feet at a conductor temperature of 176°F. For a ±600 kV DC transmission line, the minimum conductor heights will typically range from 37 feet for range lands to 50 feet or more above railroad tracks. Clearances above highways would typically be 40 to 50 feet. Lands with center pivot irrigation or lands that are aerially sprayed would typically use a minimum ground clearance of 37 feet. The exact clearance criteria for each type of land use and each type of facility being crossed will be determined during detailed design.

The clearance requirements for vertical separation at crossings over existing transmission lines are also governed by NESC 2012 Rule 233. In addition to the minimum NESC requirements, additional clearances or buffers are added to account for additional safety, construction tolerances, wire movements, differential wire temperatures, and utility specific requirements. The vertical separation typically ranges from approximately 25 feet for distribution and lower voltage lines to approximately 50 feet or more for 500 kV EHV or high voltage direct current (HVDC) lines. The exact clearance criteria for each voltage class being crossed will be determined during detailed design.

Standard industry practice suggests that the higher voltage line would cross over the lower voltage line. This standard would be followed at the line crossing locations in coordination with each facility owner or manager. To optimize the crossing structure heights, the line crossing locations are typically at mid-spans of the lines being crossed and at right angles to each other. Depending on the terrain and heights of the facility being crossed, taller structures for the TWE Project transmission line may be required at the line crossing locations. Guard structures will be installed, if required, to protect underlying wires and structures during wire stringing operations. These guard structures intercept the wire should it drop below a conventional stringing height, preventing damage to underlying wires and structures. In addition to guard structures, during construction, the Contractor for the TWE Project will be required to coordinate with the owner or operator of the line being crossed to comply with outage and other utility-specific requirements.

Due to the static nature of DC electrical and magnetic fields, the proposed transmission line will not induce any current in oil and gas well heads. The transmission line will be sited such that oil or gas wellheads, and associated above ground facilities at the wellhead, will not be located on the transmission ROW. Additionally, a 250-foot buffer from oil and gas wellheads will be used as a siting criteria for locating the final centerline of the ±600 kV DC transmission line. Section 6.2.2 of this POD provides additional details concerning siting a DC or AC transmission line in proximity to pipelines.

4.1.4 Insulators and Associated Hardware

As shown in Figures 1, 2, and 3, insulator assemblies for ±600 kV DC tangent structures will consist of two strings of insulators normally in the form of a “V.” These insulator strings are used to suspend each conductor bundle (pole) from the structure, maintaining the appropriate electrical clearance between the conductors, the ground, and the structure. The V-shaped configuration of the ±600 kV DC insulators also restrains the conductor so that it will not swing into contact with the structure in high winds. Dead-end insulator assemblies for ±600 kV DC transmission lines will use an I-shaped configuration, which consists of insulators connected horizontally from either a tower dead-end arm or a dead-end pole in the form of an “I.” Individual insulators for both suspension and dead-end applications will be composed of a single unit polymer (non-ceramic insulators).

4.1.5 Overhead Shield (Ground) Wires

Design Characteristics

To protect the ±600 kV DC transmission line from direct lightning strikes, two lightning protection shield wires, also referred to as ground wires, will be installed on the peaks or top arms of each structure. Electrical current from lightning strikes will be transferred through the shield wires and structures into the ground.

Standard Configuration

In the standard configuration (all of the transmission line with the exception of short sections near the terminals where the overhead electrode line connecting the AC/DC converter station to the ground electrode facility is carried in the shield wire position), the shield wires will be composed of two wire types. Neither of these two wire types will have a non-specular finish.

One of the shield wires will be composed of extra high strength steel wire approximately 0.5 inch in diameter. The second shield wire will be an optical ground wire (OPGW) constructed of aluminum and steel, which will carry 36 to 48 glass fibers within its core. The OPGW wire will have a diameter of approximately 0.65 inch. The glass fibers inside the OPGW will facilitate data transfer between the two AC/DC converter stations at the Northern and Southern Terminals. The data will be used for system control and monitoring.

Electrode Line Configuration

In short sections of the transmission line, near the terminals, both shield wires will also serve as the overhead electrode line connecting the AC/DC converter station to the ground electrode facility. The proposed conductor for the overhead electrode line in the shield wire position is a high temperature, low sag conductor approximately 1.0 inches in diameter. The OPGW, described above, will be carried on the structures at a lower elevation between the shield wires and the conductors

4.1.6 Ground Rods

A grounding system, which is distinct from the ground electrode system, will be installed at the base of each transmission tower and will consist of copper ground rods embedded in the ground in immediate proximity to the tower foundation, and connected to the tower by a buried copper lead. After the ground rods have been installed, the grounding will be tested to determine the resistance to ground. If the resistance to ground for a transmission tower is excessive, then counterpoise will be installed to lower the resistance. Counterpoise consists of a bare copper-clad or galvanized-steel cable buried a minimum of 12 inches deep, extending from one or more legs of a tower for approximately 100 feet within the ROW.

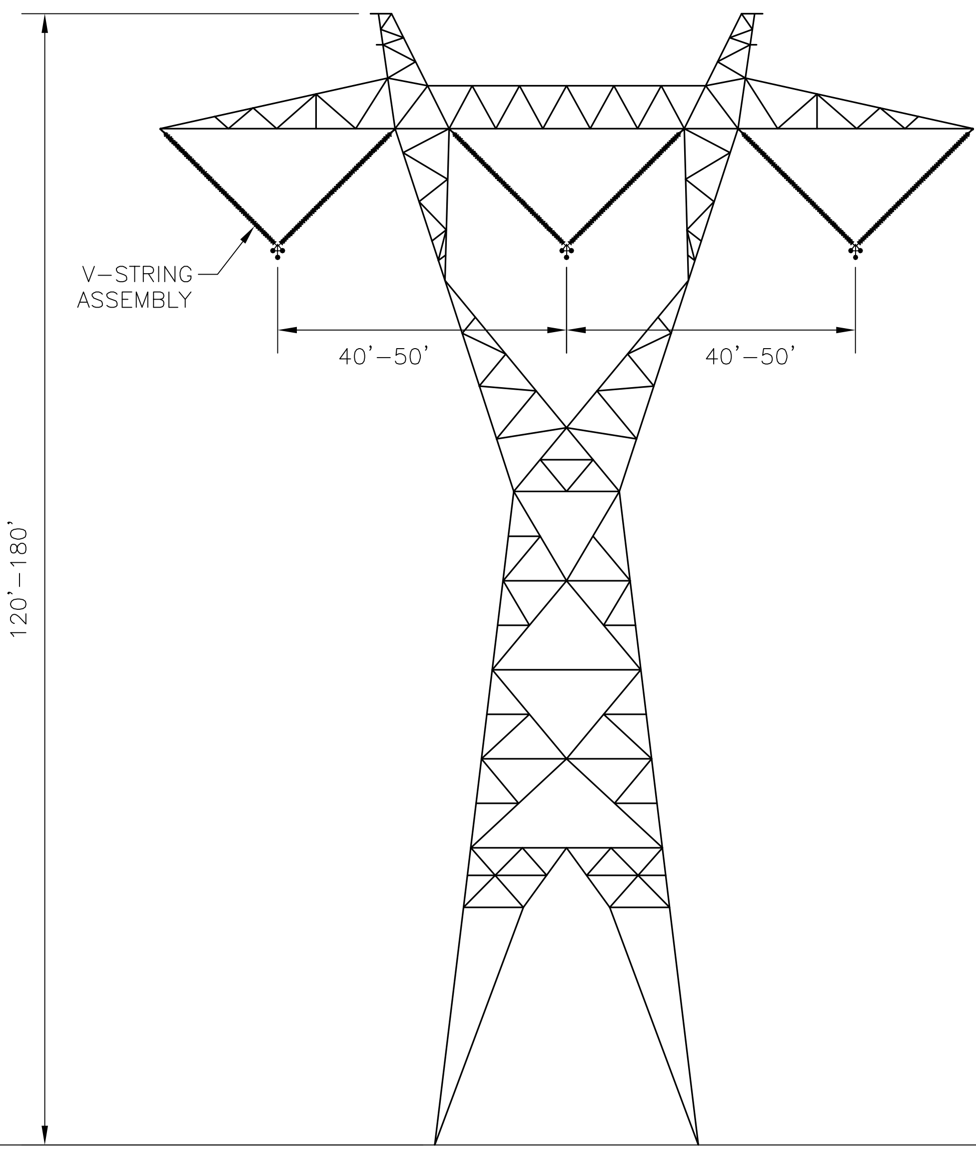
4.1.7 Minor Additional Hardware

In addition to the conductors, insulators, and overhead shield wires, other associated hardware will be installed on the structures 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 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 FAA regulations (FAA 2000, 2007). Tower proximity to airports and tower height are the determinants of whether FAA regulations would apply based on an assessment of wire/tower strike risk. The Applicant does not anticipate that tower lighting will be required because proposed towers will be less than 200 feet tall and will be located to the greatest extent to avoid airport impacts. However, if special circumstances (e.g., a tall crossing) require structures taller than 200 feet, FAA regulations regarding lighting and marking will be followed.

4.1.8 Grid Interconnections

The TWE Project will need to connect to planned or existing 500 kV and 230 kV transmission grids in Wyoming and to existing 500 kV transmission grids in Nevada, near each terminal. Specific structure types are not known at this time and will be determined during final engineering and design. A typical self-supporting lattice structure, used for a single circuit 500 kV AC line connection, is shown on Figure 5. Typical single circuit and double circuit 230 kV AC single pole structures are shown on Figure 6. The components for the 500 kV and 230 kV structures including foundations, conductors, insulators, and associated hardware, overhead shield (ground) wires, and grounding rods, are similar to those described for the ±600 kV DC transmission line.



NOTES

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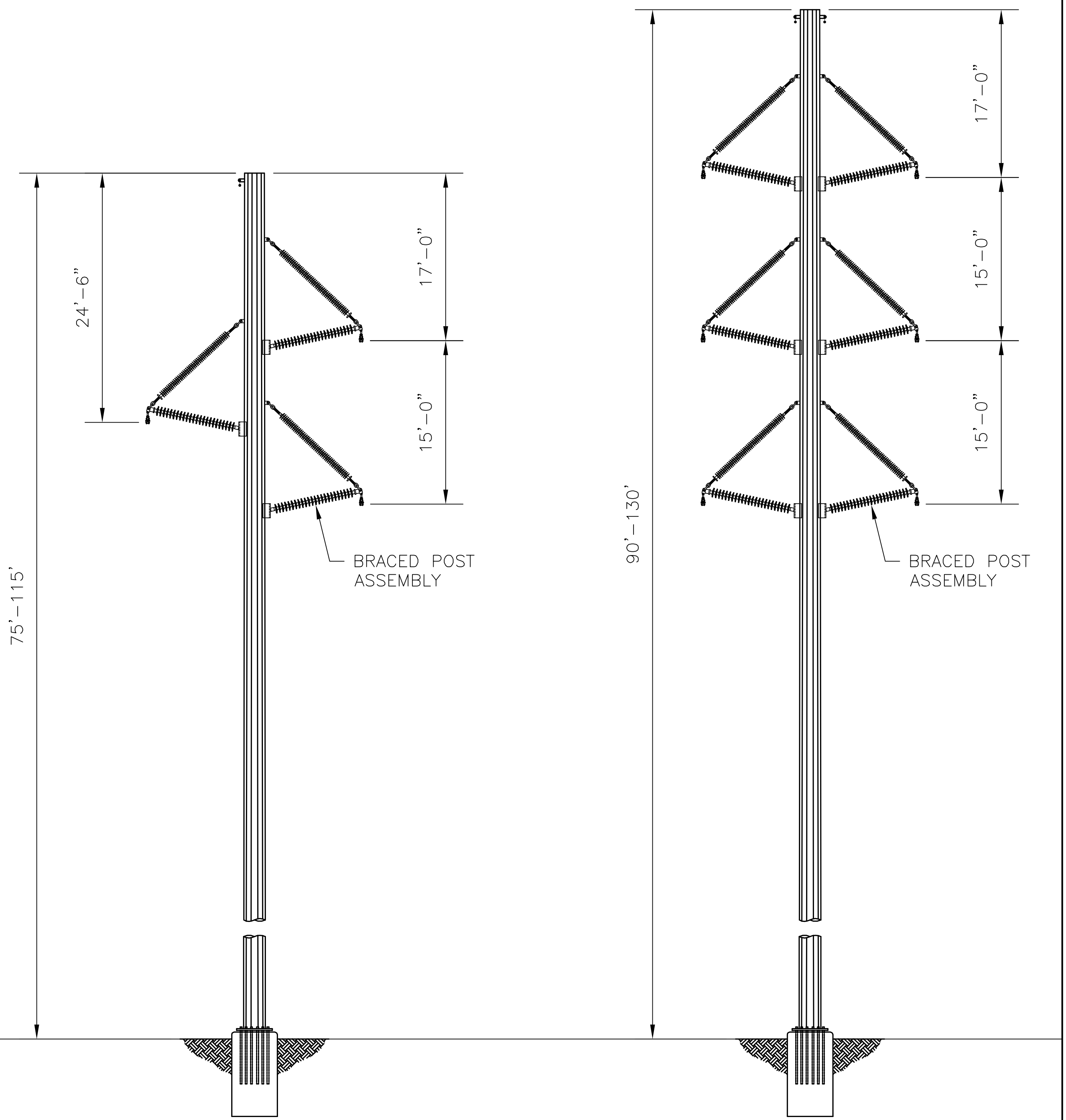
FIGURE 5

TYPICAL 500kV AC SINGLE CIRCUIT
SELF SUPPORTING
LATTICE STRUCTURE



NOTES

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FIGURE 6

TYPICAL 230kV AC SINGLE & DOUBLE CIRCUIT POLE STRUCTURE

4.2 Northern and Southern Terminals

The terminal stations will be designed to include the AC/DC converter station and an adjacent AC substation. The AC/DC converter station will include a ±600 kV DC switchyard, AC/DC conversion equipment, transformers, and multiple equipment, control, maintenance and administrative buildings. There will be two buildings to house the AC/DC conversion equipment, each approximately 200 feet long by 80 feet wide by 60 to 80 feet high. Additionally, there will be smaller buildings to house the control room, control and protection equipment, auxiliary equipment, and cooling equipment. The AC substations will be either a 500/230 kV substation (Northern Terminal) or a 500 kV substation (Southern Terminal). The AC substations will include a switchyard, transformers, control equipment, and control buildings. Figure 7 is a photograph of a representative AC/DC terminal (converter station and adjacent AC substation).

FIGURE 7 TYPICAL AC/DC CONVERTER STATION

Table 5 summarizes the general design characteristics of the terminals.

TABLE 5 DESIGN CHARACTERISTICS OF TERMINALS

DESCRIPTION OF TERMINALS	
Northern Terminal	Six 500 kV AC line positions, two 500/230 kV transformer banks, twelve 230 kV line positions, two AC filter bank line positions, two reactive support device positions, two DC line positions with transformers, converter building(s), and AC and DC filter yards. The reactive support equipment will require other structures and building development within the proposed complex. Maintenance and storage facilities will be developed as required and as appropriate for this remote location. Certain assigned shift operators, maintenance staff, and site security staff may be on-site at all times, although no permanent residence(s) will be established. On-site fire protection and emergency/security staff will support operations and maintenance staff at the facility in accordance with state, county, and federal requirements.
Southern Terminal	Six 500 kV AC line positions, two 500 kV AC filter line positions, two DC line positions with transformers, converter building(s), and AC and DC filter yards. Maintenance and storage facilities will be developed as required and as appropriate for this remote location. Certain assigned shift operators, maintenance staff, and site security staff may be on site at all times, although no permanent residence(s) will be established. On site fire protection and emergency/security staff will support operations and maintenance staff at the facility in accordance with state, county, and federal requirements.
Physical Properties of Interconnection Lines	
Line Length	Miles per interconnection line
Structure Type	Self supporting lattice for 500 kV line Single pole tubular steel for 230 kV line
Number of Structures per Mile	Approximately six (230 kV structure) and four (500 kV structure)
ROW Width	125 feet for 230 kV line 250 feet for 500 kV line
Land Temporarily Disturbed	
Storage and Concrete Batch Plant	7.5 acres
Structure Work Areas for Interconnection Lines	200 x 200 feet per 230 kV structure; approximately 6 per mile of line (Northern Terminal only) 250 x 200 feet per 500 kV structure; approximately 4 per mile of line
Wire-Pulling, Tensioning and Splicing Sites for Interconnection Lines	ROW width x 500 feet – mid-span conductor and shield wire sites every 9,000 feet and fiber optic set-up sites every 18,000 feet
Land Permanently Disturbed	
Converter Station and Substations	205 acres (N. Terminal), 140 acres (S. Terminal)
Structure Base 500 kV Interconnection Line	Self supporting lattice (tangent) – 1,225 sq. feet (35 x 35 feet tower base) Self supporting lattice (angle) – 1,600 sq. feet (40 x 40 feet tower base) Self supporting lattice (dead-end) – 2,025 sq. feet (45 x 45 feet tower base)
Structure Base 230 kV Interconnection Line	Single pole tubular (tangent) – 40 sq. feet Single pole tubular (angle) – 45 sq. feet Single pole tubular (dead-end) – 50 sq. feet
New Access Roads	See Section 5.2.1: Access Road Construction and Appendix Z Revised Access Road Methodology for FEIS Memorandum (February 2014)

4.2.1 Northern Terminal

The Northern Terminal will consist of an AC/DC converter station (a ±600 kV DC switchyard and a converter building containing power electronics and control equipment), a 500/230 kV AC substation, and a 230 kV AC substation. The facilities will be located on private lands in Carbon County, Wyoming, approximately 2.5 miles southwest of the town of Sinclair, Wyoming. The Northern Terminal will connect to the existing Platte – Point of Rocks 230 kV line located within a mile of the terminal. The Northern Terminal will also connect to the planned Energy Gateway West and Gateway South 500 kV transmission lines being developed by PacifiCorp.

The Northern Terminal will require the following components:

- An AC/DC converter station approximately 30 acres in size.
- A 500/230 kV AC substation approximately 135 acres in size.
- A 230 kV AC substation approximately 40 acres in size.
- An electrical connection from the AC/DC converter station to the ±600 kV DC transmission line connecting to the Southern Terminal. All facilities for this connection are incorporated into the ±600 kV DC transmission line.
- Two electrical connections from the proposed single circuit Energy Gateway West 500 kV transmission line to the 500/230 kV substation. These connections will connect the Northern Terminal to both the Aeolus and Anticline substations via the Energy Gateway West 500 kV transmission line. These two connections may require 500 kV transmission facilities, assumed to be four miles total or less in length, to connect the 500/230 kV substation to the route of the Energy Gateway West 500 kV transmission line. Figure 5 shows a typical structure design for the 500 kV transmission line connections.
- Two electrical connections from the proposed single circuit Energy Gateway South 500 kV transmission line to the 500/230 kV Substation. These connections will connect the Northern AC/DC converter station to both the Aeolus and Mona Substations via the Energy Gateway South 500 kV transmission line. These two connections may require 500 kV transmission facilities, assumed to be four miles total or less in length, to connect the 500/230 kV substation to the route of the Energy Gateway West 500 kV transmission line. Figure 5 shows a typical structure design for the 500 kV transmission line connections.
- Two electrical interconnections to the existing Platte – Point of Rocks 230 kV line, which will be rerouted into and out of the 230 kV substation. This 230 kV connection is assumed to require four miles or less of double circuit 230 kV transmission line. Figure 6 shows a typical structure design for the 230 kV transmission line connections.
- Up to six electrical interconnections from proposed and planned generation facilities by 230 kV transmission lines. Figure 6 shows a typical structure design for the 230 kV transmission line connections.

Construction of the Northern Terminal is estimated to require approximately 520 acres. Approximately 250 acres of this area or less will be permanently dedicated for the AC/DC converter station and substations, terminal access road, transmission line structures, and interconnection line access roads. Approximately 205 acres will be fenced for the Northern Terminal. Approximately 275 acres are estimated to be temporarily disturbed for construction work areas, including land for storage and a concrete batch plant, transmission line structure work areas, and pulling, tensioning and splicing sites.

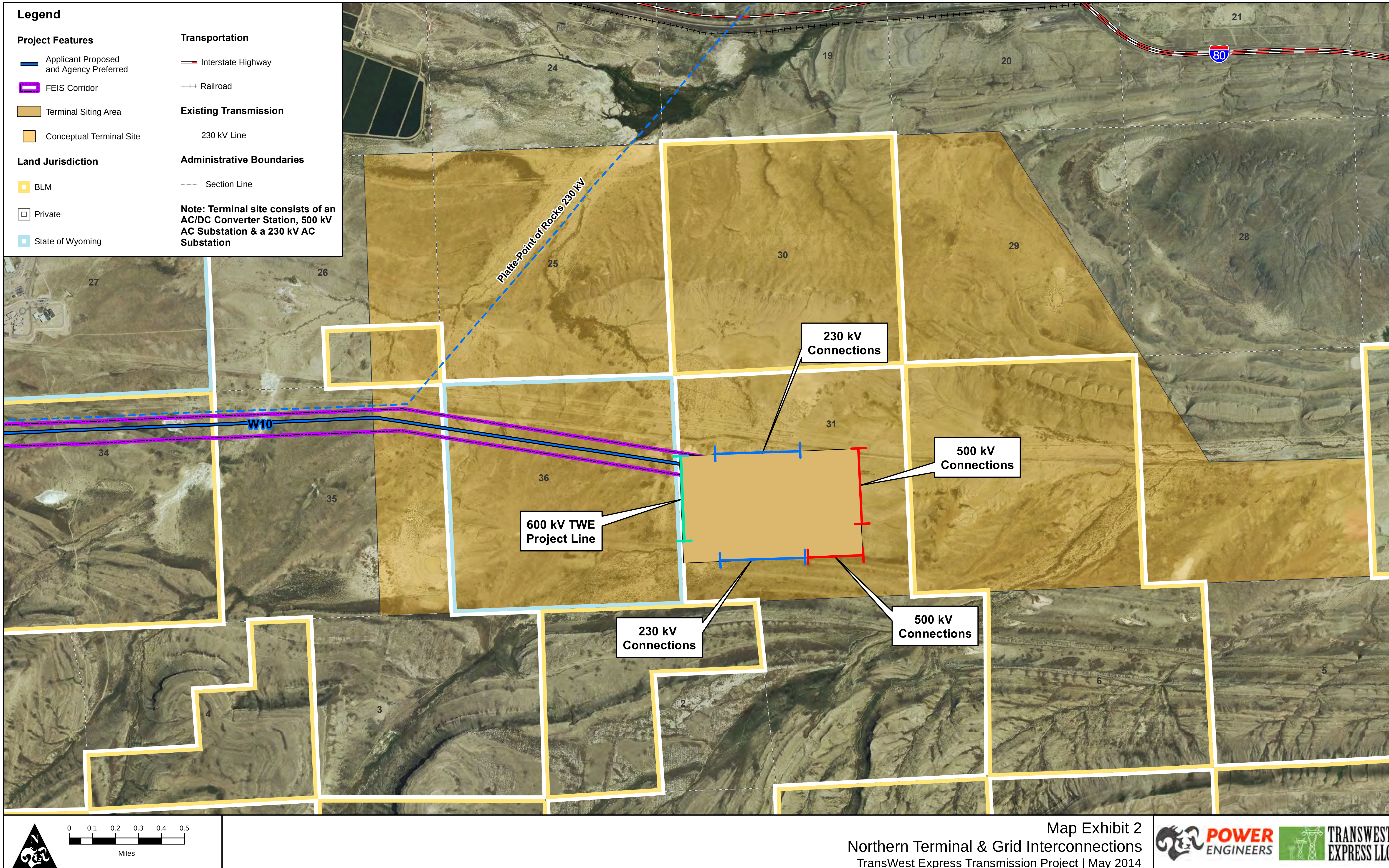
The general planned locations for the Northern Terminal and grid interconnections are shown on Map Exhibit 2. The location for the Northern Terminal site is proposed to be within the siting area shown. The final site location will be determined during final engineering and design. The criteria used in selecting the siting area and the final site location are:

- Land Ownership - use of private lands over public lands is preferable.
- Land Use - other current and planned land uses in the area, in particular other infrastructure that is being planned and permitted.
- Environmental Constraints - avoidance of sensitive resources, including sensitive wildlife habitats, cultural resource sites, wetlands, and major drainages.
- Topography - use of level dry land over more rugged terrain is preferable.
- Access to the TWE Project transmission line corridors coordinated with other existing and planned infrastructure and which minimize line crossings.
- Interconnections with existing, planned, and potential transmission lines such that line crossings are minimized, and conflicts with other existing and planned infrastructure are avoided.

Map Exhibit 2 illustrates a conceptual layout of the Northern Terminal and associated 230 kV and 500 kV connections to existing and planned facilities. The location of the Northern Terminal and the alignments of the 230 kV and 500 kV transmission line connections will be located within the proposed terminal siting area and will be determined during final design.[4]

Based on final ownership/operating agreements and interconnection contracts, it is possible that the 500/230 kV AC substation and/or the 230 kV AC substation could each be broken into two separate facilities. The total required acreage of the separate 500/230 kV AC substation(s) and the 230 kV AC substation(s) would not be greater than the 175 acres (135 plus 40) described above. The total fenced acreage for the Northern Terminal would be 205 acres in either one contiguous facility or 70 acres in one location and an additional 135 acres in a remote location. Land outside of this area would be used for access roads. Terminal access will require an estimated 10 acres of permanent disturbance. With the exception of the associated interconnection lines, no other permanent development outside of the fenced area for this facility is anticipated.

[4] The three major components of the Northern Terminal (AC/DC converter station, 500/230 kV AC substation, and 230 kV AC substation) are planned to be co-located and contiguous. Although each of these three components are stand-alone facilities and could be located on separate parcels connected together by short “transmission” lines, it is common practice and preferable for the AC/DC converter station and 500/230 kV AC substation(s) to be located adjacent to each other. Although it is also preferable to locate the 230 kV AC substation next to the 500 kV AC substation, depending on the availability of space and other constraints in this area, these stand-alone facilities could be separated by a distance of up to two miles.



Map Exhibit 2

Northern Terminal & Grid Interconnections

TransWest Express Transmission Project | May 2014

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4.2.2 Southern Terminal

The Southern Terminal will consist of an AC/DC converter station (a ±600 kV DC switchyard and a converter building containing power electronics and control equipment) and a 500 kV AC substation. The facilities will be located in the Eldorado Valley on private or BLM administered land, approximately 15 miles south of Boulder City, in Clark County, Nevada. The Southern Terminal will connect to all four of the existing 500 kV substations located at the Marketplace Hub. These four substations are the Mead, Eldorado, Marketplace, and McCullough substations.

The Southern Terminal will require the following components:

- An AC/DC converter station approximately 30 acres in size.
- A 500 kV AC substation approximately 110 acres in size.
- An electrical connection from the AC/DC converter station to the ±600 kV DC transmission line connecting to the Southern Terminal. All facilities for this connection are incorporated into the ±600 kV DC transmission line.
- Two electrical connections from the existing Mead – Marketplace 500 kV transmission line to the new 500 kV AC substation. These connections will connect the Southern Terminal to both the Mead and Marketplace substations via the existing Mead – Marketplace 500 kV transmission line. These two connections may require 500 kV transmission facilities, assumed to be five miles total or less in length, to connect the new 500 kV AC substation to the existing Mead – Marketplace 500 kV transmission line. Figure 5 shows a typical structure design for the 500 kV transmission line connections.
- Construction of a 500 kV transmission line from the new 500 kV AC substation to the Eldorado Substation. This single circuit 500 kV transmission line is estimated to be five miles in length or less. Figure 5 shows a typical structure design for the 500 kV transmission line connections.
- Construction of a 500 kV transmission line from the new 500 kV AC substation to the McCullough Substation. This single circuit 500 kV transmission line is estimated to be five miles in length or less. Figure 5 shows a typical structure design for the 500 kV transmission line connections.
- Although not anticipated at this time, one or more of the existing 138/230 kV lines within the Proposed Terminal Siting Area may need to be re-routed/re-configured to accommodate the Southern Terminal due to congestion within the area. If necessary, this reroute or reconfiguration of 138/230 kV transmission line facilities is not anticipated to impact more than a total of five miles of line. Figure 6 shows a typical structure design for the 230 kV transmission line connections.

Construction of the Southern Terminal on private land is estimated to require approximately 555 acres whereas the terminal construction on BLM land is estimated to require approximately 750 acres (differences in construction acreages due to lengths of access roads and lengths of 500 kV transmission lines). Approximately 230 to 260 acres of this area will be permanently dedicated for the AC/DC converter station and switchyards, terminal access road, transmission line structures, and interconnection line access roads. Approximately 140 acres will be fenced for the Southern Terminal. Approximately 335 acres on the private land site and 500 acres of the BLM land site are estimated to be temporarily disturbed for construction work areas, including land for storage and a concrete batch plant, transmission line structure work areas, and pulling, tensioning and splicing sites.

The general planned location for the Southern Terminal and grid interconnections are shown on Map Exhibit 3, which illustrates a conceptual layout of the Southern Terminal and associated 500 kV connections to existing substations. The location of the Southern Terminal and the alignments of the 500 kV transmission line connections will be located within the terminal siting area and will be determined during engineering and design.[5]

Terminal access on the private land site and BLM land site will require an estimated 15 and 20 acres of permanent disturbance, respectively. With the exception of the associated interconnection lines, no other permanent development outside of the fenced area for this facility is anticipated.

4.3 Ground Electrode Facilities

Two ground electrode facilities are proposed, one connecting to the Northern Terminal and one connecting to the Southern Terminal. Table 6 provides the design characteristics of the ground electrode facilities. The proposed site for the northern ground electrode facility is termed ‘Bolten Ranch’ and shown on Map Exhibit 4. This proposed site is suitable for use with all route alternatives. The three alternative sites shown on Map Exhibit 4 would also connect to the Northern Terminal: Separation Flat, Eight Mile Basin, and Separation Creek.

The proposed site for the southern ground electrode facility is termed ‘Mormon Mesa-Carp Elgin Road’ and shown on Map Exhibit 5.[6] This proposed site is suitable for use with all route alternatives. The two alternative sites shown on Map Exhibit 5 would also connect to the Southern Terminal: Halfway Wash E. and Halfway Wash-Virgin River.

The proposed and alternative ground electrode sites were selected based on feasibility studies that considered surface and deep earth geology, proximity to the alternative routes, proximity to underground infrastructure (oil, gas and water wells, pipelines, etc.), environmental constraints, and topography. Major factors in selecting the alternative sites were:

1. Geology and ground resistivity of the area. The primary need is for deep sedimentary basins with large volumes of sediment having a low resistivity. Locations with potentially high resistance geologic formations that could potentially interfere with the current path are generally avoided.

2. Distance from grounded metallic infrastructure that might be negatively impacted by DC ground currents. In general, this consideration results in the electrode site being a few miles or more from power plants, electrical substations, underground pipelines, and active oil or gas wells. The ground electrodes cannot be located within two miles of major pipelines due to the risk of having a corrosive impact on nearby metallic structures. Ground electrodes located

[5] The two major components of the Southern Terminal (AC/DC converter station and the 500 kV AC substation) are planned to be co-located and contiguous. Although these two components are stand-alone facilities and could be located on separate parcels connected together by short “transmission” lines, it is common practice and preferable for the AC/DC converter station and 500 kV AC substation to be located adjacent to each other.

[6] Map Exhibits 4 and 5 show both the proposed and alternative ground electrode sites and siting areas

within 2 to 10 miles of major pipelines may require additional or modified corrosion protection systems.

3. Environmental constraints such as special federal and state management areas, sensitive resources (e.g., wetlands), and special status species (e.g., sage-grouse). Secondary consideration was given to topography as it would be impractical to drill the ground wells in mountainous topography.

More detailed information will be required during final engineering and design to make a final determination of the location of the proposed ground electrode sites including: a) availability of public lands or private lands; b) detailed measurements of ground resistivity; c) chemical and thermal characteristics of the soil at the site; and d) a detailed analysis of grounded metallic infrastructures in the area.

TABLE 6 GROUND ELECTRODE FACILITIES DESIGN CHARACTERISTICS

FEATURE	DESCRIPTION
Physical Properties of Overhead Electrode Lines	
Line Length	Miles per electrode line
Structure Type	Wood / wood pole equivalent for low voltage electrode line (similar to 34.5 kV line)
Number of Structures per Mile	18
ROW Width	50 feet
Land Temporarily Disturbed	
Ground Electrode Site	65 acres
Material Storage Yards	10 acres per electrode site
Structure Work Areas for 34.5 kV Line	ROW (50 ft) x 100 feet
Wire-Pulling, Tensioning and Splicing Sites for Interconnection Lines	75 x 150 feet – two at every dead-end 75 x 100 feet – mid-span conductor site every 9,000 feet
Land Permanently Disturbed	
Ground Electrode Site	0.5 acres
Well Access	5 acres
Structure Base Electrode Line (similar to 34.5 kV line)	Wood / wood pole equivalent (tangent) – 16 sq. feet Wood / wood pole equivalent (angle) – 25 sq. feet plus 25 sq. feet per anchor (2 per structure location) Wood / wood pole equivalent (dead-end) – 36 sq. feet plus 25 sq. feet per anchor (4 per structure location)
New Access Roads	See Section 5.2.1: Access Road Construction and Appendix Z Revised Access Road Methodology for FEIS Memorandum (February 2014)

Once construction is completed, approximately 0.5 of an acre, or less, near the center of the electrode containing the control house will be fenced. Agricultural land uses outside the fenced area such as grazing and cultivated crops would be permissible.

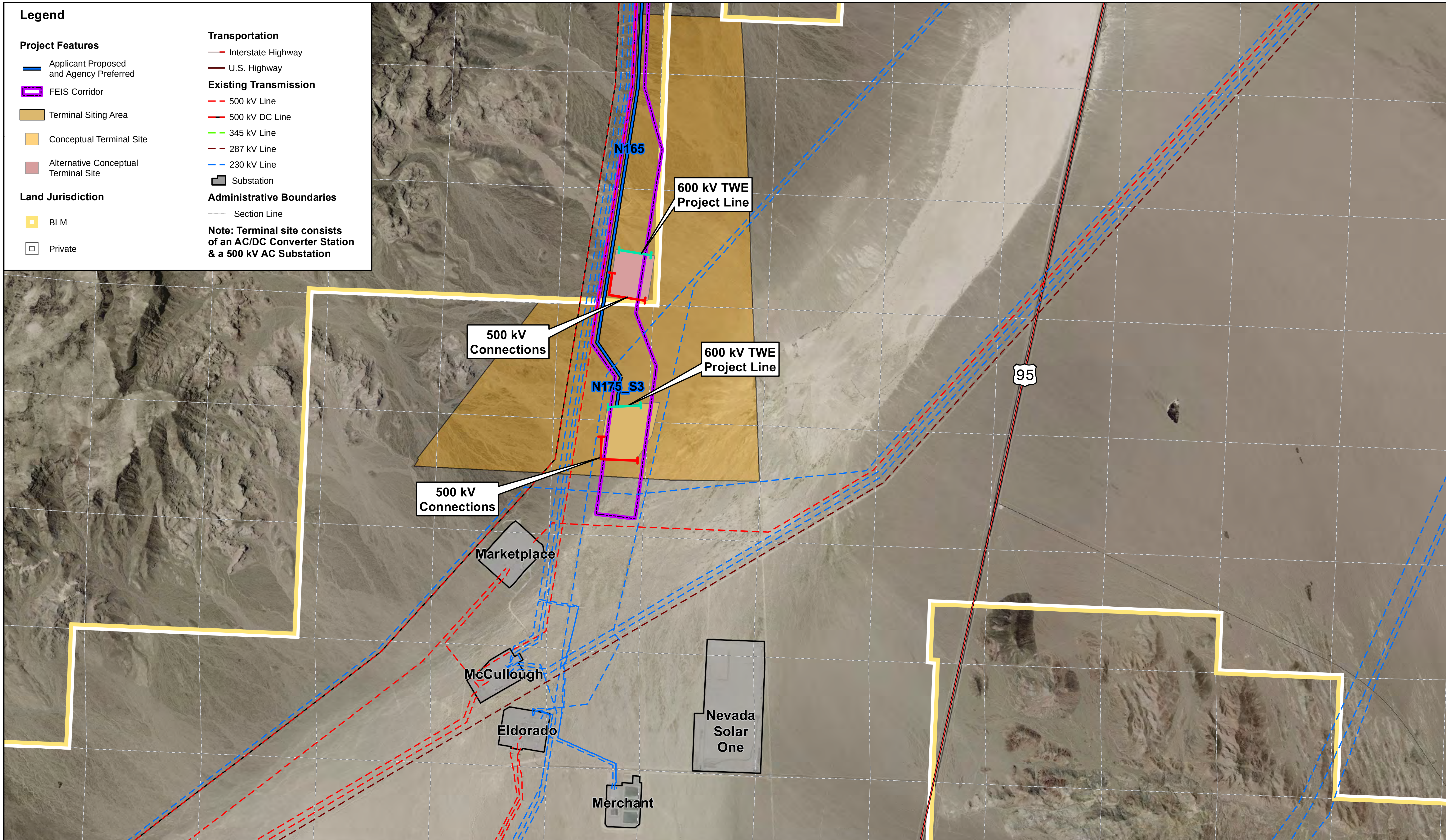
These two ground electrode facilities will be built, each within approximately 100 miles or less of the Northern and Southern Terminals, to establish and maintain electrical current continuity during normal operations and immediately following an unexpected outage of one of the two poles (or circuits) of the ±600 kV DC terminal or converter station equipment.

Each ground electrode facility will consist of a network of approximately 60 deep-earth electrode wells arranged along the perimeter of a circle expected to be about 3,000 feet in diameter. All wells at a site will be electrically interconnected and wired to a small control building via low voltage underground cables. A typical site plan for a ground electrode system is shown in Figure 8 and a photograph of a typical above ground facility is provided in Figure 9.

A low voltage electrode line will be required to connect the ground electrode facilities to the AC/DC converter stations (at the Northern and Southern Terminals). To the extent practical, the overhead electrode line will be co-located on the ±600 kV DC structures in the overhead shield wire position. The overhead electrode line (connecting the terminal to the ground electrode facility) will occupy both shield wire positions from the Southern Terminal to the location where the electrode lines leaves the ±600 kV DC transmission line. Figure 10 shows a typical structure with the electrode line in the shield wire position with the fiber optic line (OPGW) located between the shield wires and the DC conductors. Where the electrode line diverges from the ±600 kV DC transmission line, it will be located on single pole structures, similar to those used for a modified 34.5 kV subtransmission line, built within a separate 50-foot-wide ROW. The electrode line will consist of two, high temperature, high capacity conductors. Figure 11 shows a typical single pole structure design that would be used for the overhead electrode line.

During a DC transmission disturbance where one pole (or “circuit”) becomes inoperable, the ground electrodes will carry a short-term large current that was previously flowing in the inoperable pole. The electrodes will be sized and designed to disperse this current into the ground at levels which are safe for people and animals in the vicinity. Such contingency conditions that result in high ground electrode currents are most often the result of an unexpected outage on the transmission line or equipment in the AC/DC converter station. The high current operation of the ground electrode facilities and the use of the earth as a return path is limited to unexpected emergency conditions and typically only operated for 10 minutes to less than an hour following the loss of a pole. For planning and preliminary engineering purposes, 12 to 16 unexpected disturbances resulting in the loss of a pole are anticipated on a yearly basis. Although the ground electrode facilities will be designed to operate at high current levels for up to 200 hours per year, typical yearly use at high currents is expected to be less than 30 hours per year.

The use of these ground electrode facilities allows system operators to maintain a portion of the TWE Project’s power transmission capacity to support power network reliability. This feature will allow critical time for network operators to determine the extent of the electrical disturbance and reconfigure the transmission and generation systems into a more stable configuration that minimizes disruption of customer loads.



Map Exhibit 3
Southern Terminal & Grid Interconnections
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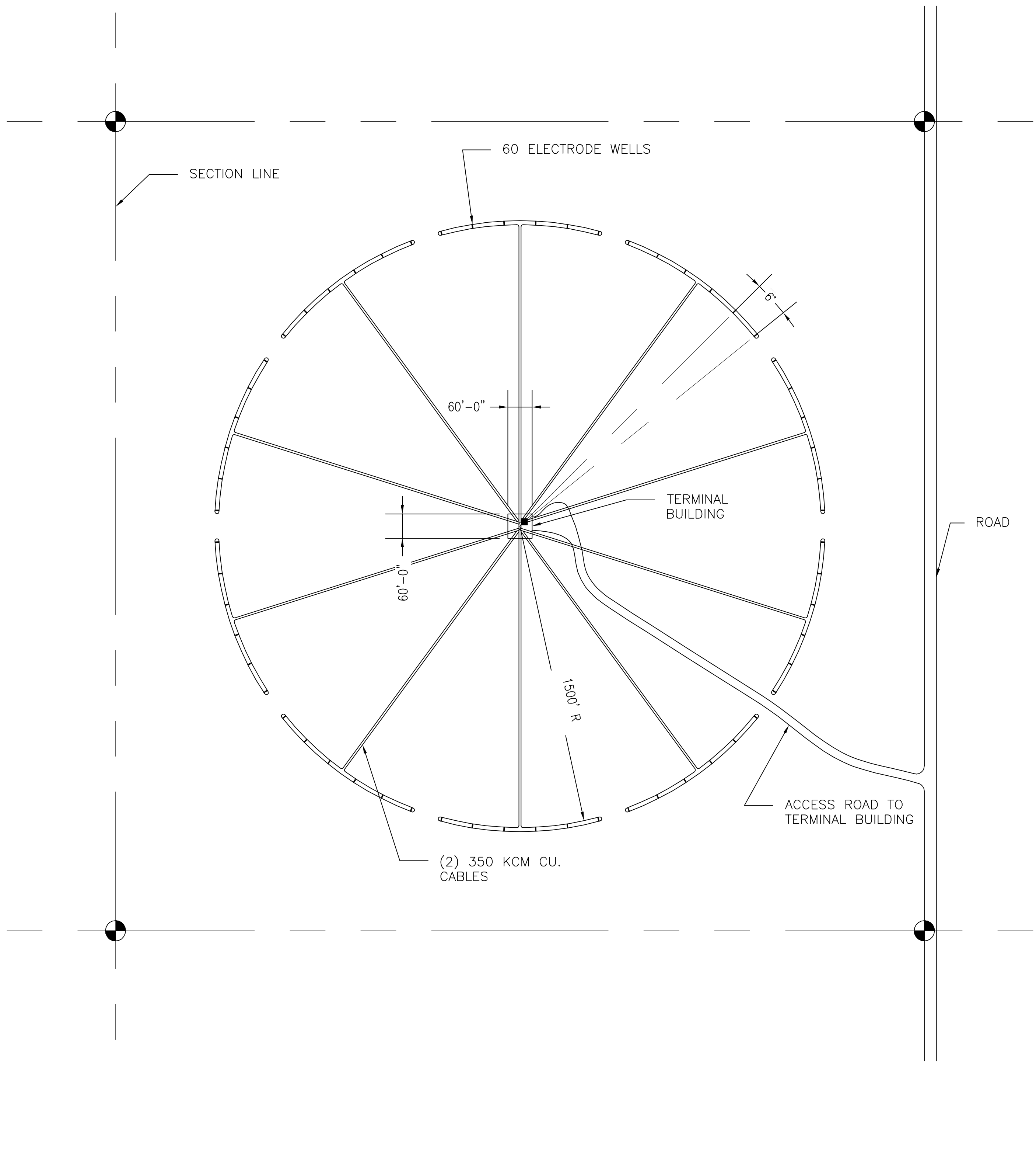

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FIGURE 8

TYPICAL SITE PLAN FOR
GROUND ELECTRODE SYSTEM

FIGURE 9 TYPICAL ABOVE GROUND CONSTRUCTION AT THE GROUND ELECTRODE FACILITY

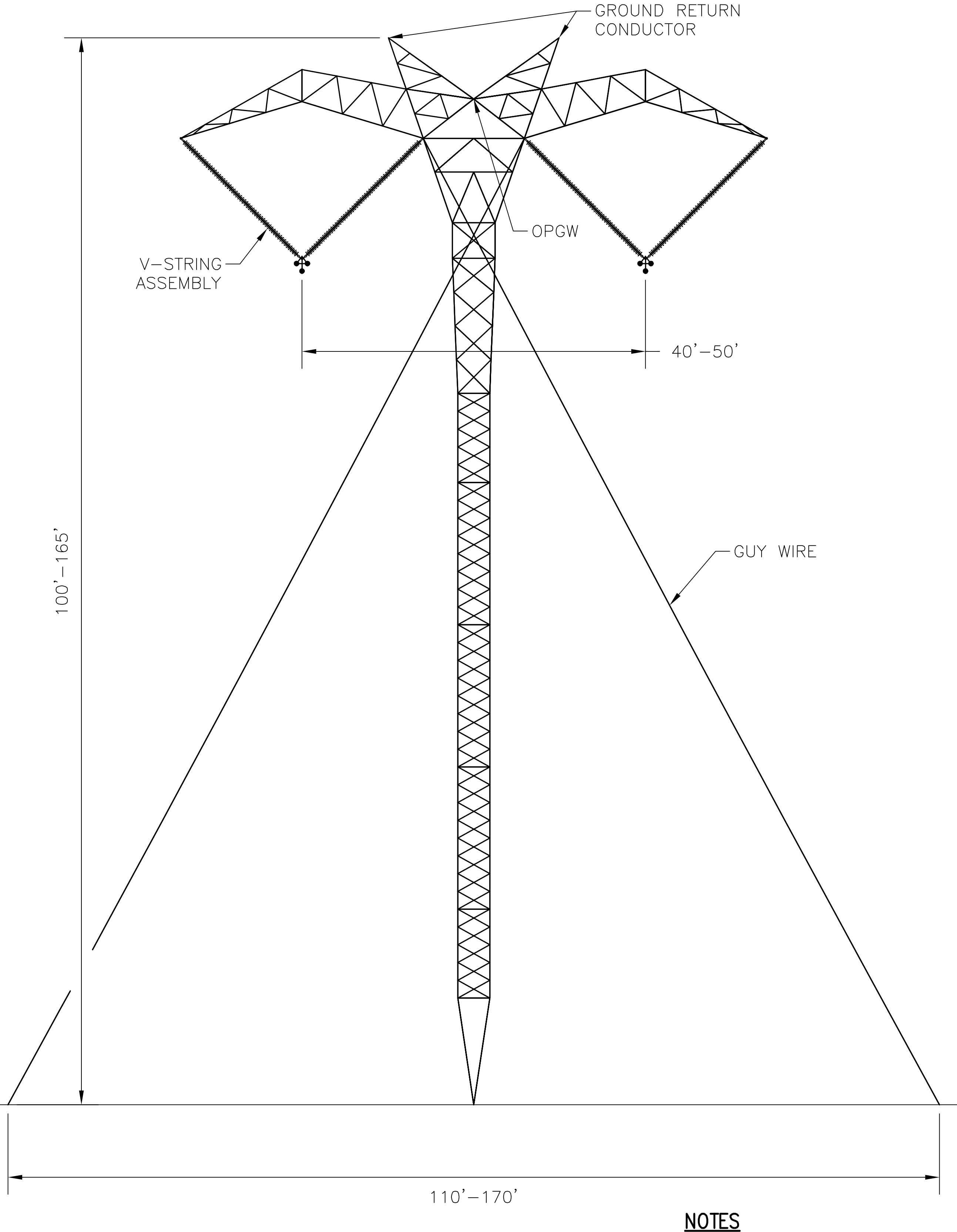

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FIGURE 10

CO–LOCATED GROUND ELECTRODE LINE
ON GUYED LATTICE STRUCTURE

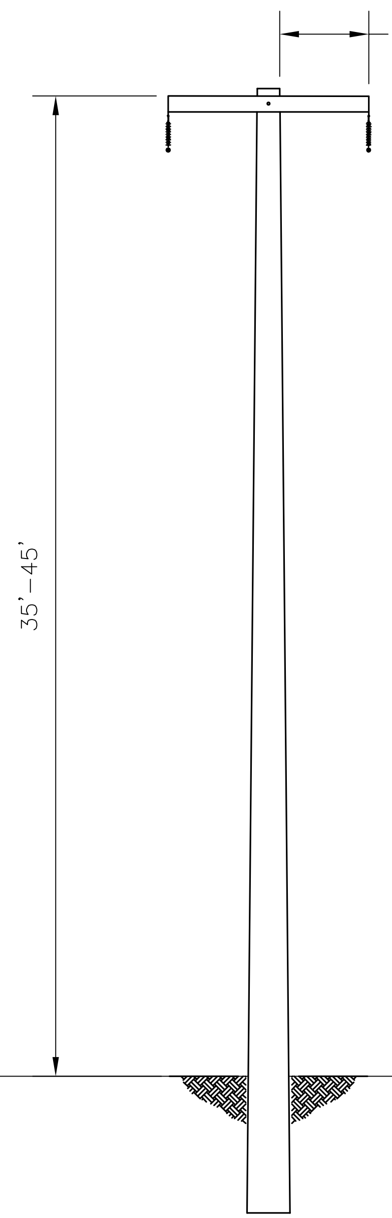

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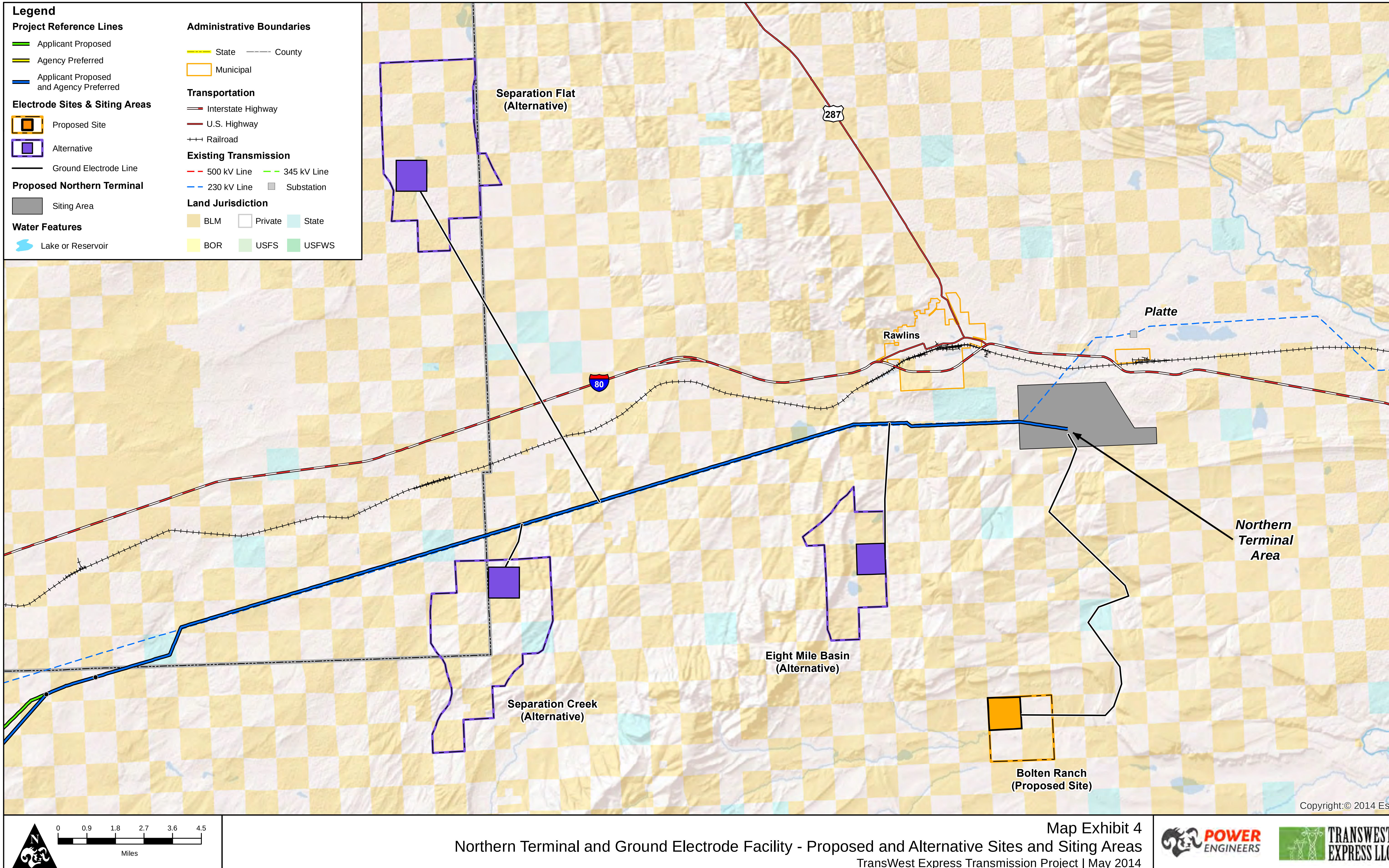
FIGURE 11

TYPICAL POLE STRUCTURE FOR OVERHEAD ELECTRODE LINE



Map Exhibit 4

Northern Terminal and Ground Electrode Facility - Proposed and Alternative Sites and Siting Areas

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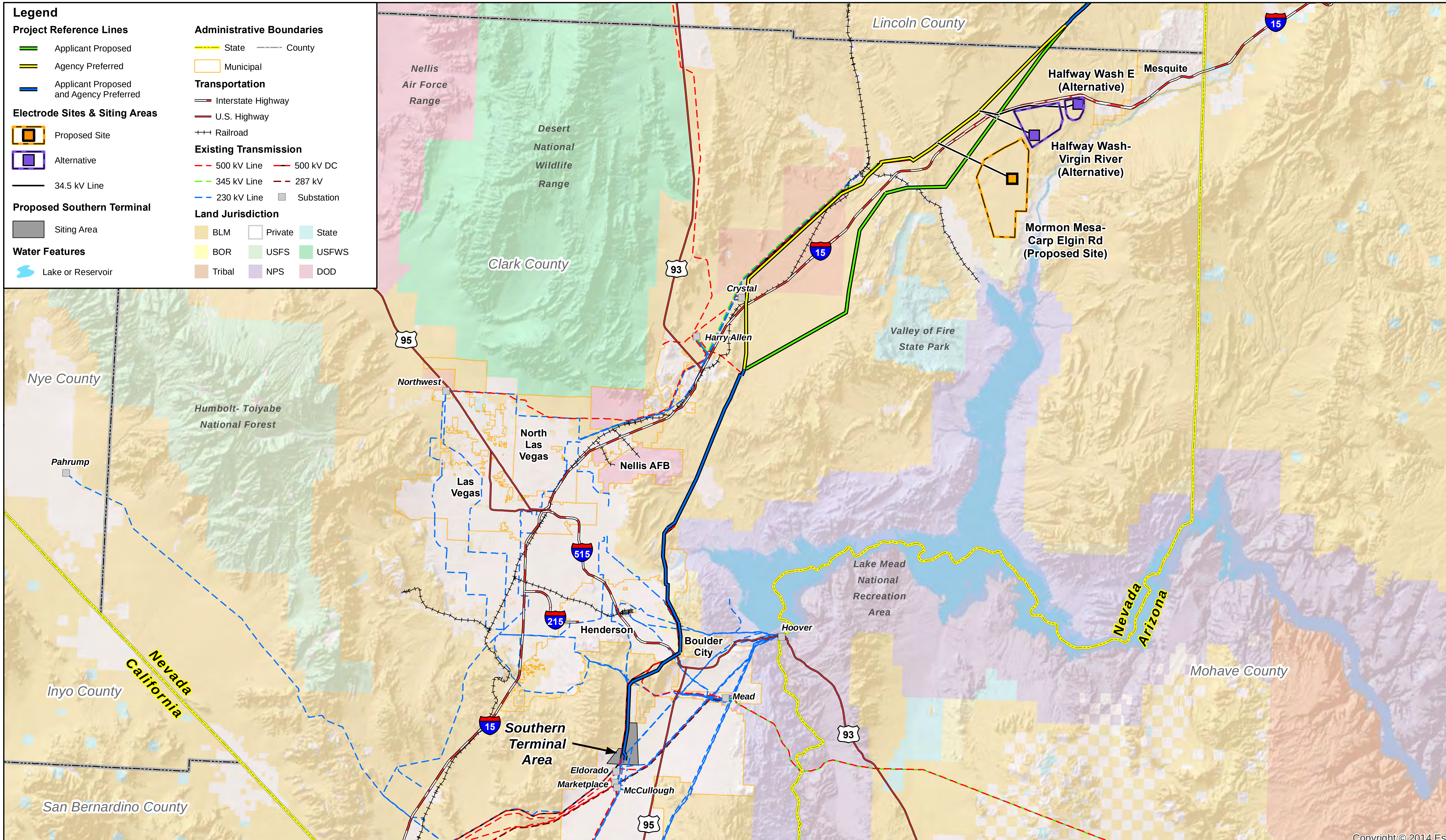

Map Exhibit 5

Southern Terminal and Ground Electrode Facility- Proposed and Alternative Sites and Siting Areas

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4.4 Communications Systems

The TWE Project will require a number of critical telecommunications support subsystems. These systems will be configured and designed to support the overall availability and reliability requirements for the operation of the HVDC terminal facilities and supporting substations. To provide secure and reliable communications for the control system real-time requirements, protection and day-to-day operations and maintenance needs, a mix of telecommunications systems will be used. The primary communications for protection and control will be provided via the one OPGW installed in the shield wire position on the transmission line. For redundancy purposes, a secondary communications path will be provided via existing or expanded/upgraded microwave systems or existing alternate buried fiber paths in the TWE Project region.

In addition to protection and control, the communications system will be used for Supervisory Control and Data Acquisition (SCADA). The SCADA system is a computer system for gathering and analyzing real time data which is used to monitor and control the substation (e.g., transformers and transmission lines), and auxiliary (e.g., pumps and cooling systems) equipment. A SCADA system gathers information, such as the status of a transmission line, transfers the information back to a central site, alerting the central site that the line has opened, carrying out necessary analysis and control, such as determining if outage of the line is critical, and displaying the information in a logical and organized fashion.

The primary communications will be an all-digital fiber system with repeater/regeneration facilities utilizing the OPGW located on the transmission line structures. The optical data signal degrades with distance as it travels through the optical fiber cable. Consequently, signal regeneration sites are required to amplify the signals if the distance between stations or regeneration sites exceeds approximately 50 miles. In total, approximately 15 to 20 regeneration sites will be required for the proposed TWE Project. In most cases, the regeneration communication sites will be located within the transmission line ROW and will typically be 100 feet by 100 feet or less in size. Figure 12 shows a typical communications regeneration site.

The secondary communications path for the TWE Project will be provided either by a private Project microwave system or purchasing/leasing capacity on existing utility dedicated communication networks within the TWE Project region.

If required, a private microwave system will be structured to utilize existing developed communications sites, access roads and utility held sites to the maximum extent possible. A small number of new microwave sites may be required for the TWE Project. As a microwave system requires line-of-site communications, the number and location of microwave sites, if needed, will be determined during final design and engineering. A typical microwave communication site is less than 100 feet by 100 feet, and consists of a fenced enclosure that contains a small building for the communications equipment and a tower for mounting the microwave antenna(s). The microwave tower may be 50 feet to 150 feet high to meet the line-of-site communications requirement. In addition, multiple antennas may be mounted on the microwave tower depending upon the communications needs. In some cases, such as very remote locations with limited access to a reliable power supply, a small back-up generator may be required.

To facilitate mobile communications along the transmission line route for transmission line patrol, inspection, routine maintenance and emergency operations, a mobile ultra-high frequency (UHF)/very high frequency (VHF) radio communications system will be implemented. For planning purposes, UHF/VHF radio equipment, towers, antennae and repeaters are assumed to be installed at each regeneration station.

FIGURE 12 COMMUNICATIONS REGENERATION SITE

5.0 CONSTRUCTION

This section describes the construction practices that will be used for the TWE Project, including the ± 600 kV DC transmission line; terminals; ground electrode facilities; and communication systems. Construction activities are described in the following sections:

- Section 5.1 – Pre-construction activities to be completed prior to construction commencing.
- Section 5.2 – Construction activities for the + 600 kV DC transmission line and associated access roads.
- Section 5.3 – Construction activities for the northern and southern terminals.
- Section 5.4 – Construction activities for the ground electrodes.
- Section 5.5 – Construction activities for the communications system.
- Section 5.6 – Post-construction clean up and restoration.
- Section 5.7 – Special construction methods to be used in specific sensitive locations, including blasting and helicopter construction techniques; roadless construction methods in IRAs; construction techniques applicable to sensitive water resource areas; and water use during construction.
- Section 5.8 – TWE Project construction schedules, manpower, and equipment requirements.

Construction of the TWE Project will require surface access to all structures and work areas during construction and operation of the Project to allow construction vehicles and equipment to access the location of each transmission structure or Project facility. In most cases, existing public roads (identified as the backbone access network) would be used to transport construction labor, equipment and materials to the approved work areas.

Although the number of construction vehicles needed for the Project is not expected to substantially increase traffic volumes, the delivery of large pieces of equipment or material as part of the construction process may slow or interrupt traffic on state or county roads on a short-term basis. The duration of these types of traffic disruption are typically very short, a few minutes or less while the delivery truck passes down a roadway or turns a corner. The limited number of large pieces of equipment or material that are delivered to any one portion of the Project tends to make traffic disruptions infrequent and generally unnoticed by the motoring public. Additionally, short-term traffic diversions and brief road closures (if needed) may be required to complete wire stringing activities. All traffic impacts resulting from any construction activities including short-term traffic diversions, traffic congestion, traffic warning systems and brief road closures (if needed) will comply with the Traffic and Transportation Management Plan (Appendix U).

5.1 Pre-Construction Activities

Prior to construction, the Applicant will obtain all applicable federal, state, and local permits; acquire easements and ROW grants for the TWE Project facilities; conduct geotechnical surveys and testing; and conduct pre-construction engineering and environmental surveys.

5.1.1 Permitting

The Applicant will acquire all federal, state, and local permits, licenses and agreements. A list of potential applicable permit requirements has been provided through the NEPA process and incorporated into this POD (see Section 1). The TWE Project will necessitate crossings of existing electrical transmission lines, U.S. and State Highways, and railroads. The proposed line crossings will be coordinated with the appropriate entity and TransWest will obtain all required licenses, permits, or agreements.

5.1.2 ROW and Property Rights Acquisition

The acquisition of ROW or properties necessary to construct, operate, and maintain the TWE Project will be completed by Western or the Applicant conditioned on Western's continued involvement in the TWE Project. New ROW will be acquired for the transmission line(s) through a combination of ROW grants and easements with various federal, state, and local governments; other companies (e.g., utilities and railroads); and private landowners.

Property owners affected by the TWE Project would initially be contacted by a realty agent who would explain the steps involved in site selection, property rights acquisition, and construction. A realty agent would request permission (for workers or Contractors) to enter the property to conduct engineering and environmental surveys and studies. Landowners will be contacted early in the process to obtain right-of-entry for surveys. Each landowner along the final centerline route will be contacted to explain the Project and to secure right-of-entry and access to the ROW.

Studies will be conducted to select structure sites, based on engineering design criteria, terrain, geologic investigations, and property owner input regarding land use and how to minimize potential impacts to properties. Geotechnical drilling will be required at some sites. Property owners will be compensated for damages to crops, fences, and other property caused by surveys and studies.

Property rights, in the form of perpetual easements or ROW, will be needed to construct, operate, and maintain the transmission line. Land for the terminals, substations, series compensation (as may be required for Design Options 2 and 3; see Section 7.0), and communication regeneration stations will be obtained in fee simple where located on private land. Easements and fee simple properties will be purchased through negotiations with landowners based on independent appraisals. Independent appraisals are used to determine the fair market value of the easement or property. Every effort will be made to acquire easements and properties through landowner negotiations to obtain an agreement, which is fair and reasonable to both parties. For transmission line easements, the landowner will retain title to the land and may continue to use the property in ways that are compatible with the transmission line.

To the extent that Western acquires land for the TWE Project, Western will do so in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

Federal and state laws enable public agencies, and in some cases private parties, to acquire property rights for facilities to be built in the public interest. If a negotiated agreement cannot be reached, easements can be acquired through eminent domain (condemnation) proceedings. Through the eminent domain process, a court determines the compensation to be paid to the property owner(s).

5.1.3 Geotechnical Surveys and Testing

Prior to construction of the TWE Project, ground-based land surveys will be required at soil boring locations required for geotechnical investigations. These ground-based land surveys will include staking of the boring location and layout and staking (as needed) of access roads to the boring locations.

A desktop study will initially be conducted to identify geologic hazards. Specifically, the desktop study will research available published data related to soils, expansive soils, mapped bedrock, surficial geology, corrosivity, faulting and folding, seismicity and earthquakes, surface and groundwater, flood areas and hazards, landslides, rock fall hazards, subsidence, liquefiable soils and wells. The desktop study will be used for preliminary engineering designs.

Field geological and geotechnical studies will reference the desktop study to prepare the appropriate exploration programs given the planned structure locations, foundation loading, access, and geologic setting. The proposed studies will be performed to evaluate potential geologic and geotechnical hazards and to determine specific requirements (soil/rock types, depth to rock, depth to groundwater, soil strength properties, etc.) for foundation design and construction. These studies will be used for final engineering designs necessary for construction.

Geological evaluation will occur at generally the same time as geotechnical investigations, and will be a part of the final Geotechnical Plan. The framework Geotechnical Plan is provided in Appendix J. For this activity, an engineering geologist will evaluate fault lines, landslide prone areas, steep slopes, and unstable soils to identify potential hazards, primarily at structure sites. Geologic review and evaluation will also be performed in the immediate vicinity of structure sites, and for access roads crossing steep slopes and unstable soils. The primary purpose of the geologic evaluation is to identify potential hazards with sufficient lead time to evaluate options for avoiding or mitigating potential hazards. The Project geotechnical engineer and geologist will prepare a report including recommendations for any necessary relocation of structure sites or access roads in potentially hazardous areas. In the event that a structure site cannot be relocated, the Geotechnical Plan will also specify construction methods designed to stabilize the site as well as any adjacent areas that might pose a hazard to the main site. Initial recommendations will be incorporated into the ROD POD and final recommendations incorporated into the NTP POD, including construction details for grading, drainage, and specialized slope treatments. The Contractor will implement the plans. All geologic/geotechnical field studies required will be coordinated with the appropriate land management agencies or private landowner and the appropriate permits will be obtained by the Applicant.

To determine foundation design requirements, geotechnical investigations will be performed in the field to evaluate site conditions and determine the soil/rock type, strength and design properties. This study will entail a geotechnical drilling program at select structure locations along the selected Alternative. At sampling sites, borings will be performed from which soil and/or bedrock material samples will be taken for laboratory testing and analysis. Soil borings are typically six to eight inches in diameter and as much as 70 feet deep and they will be advanced with continuous flight hollow-stem auger, mud rotary, or ODEX drilling techniques. Where bedrock is encountered, standard rock coring techniques will be used. Soil borings are commonly taken at structure site locations at intervals of approximately one mile and at PIs (Points of Intersection/Inflection).

Soil borings will be performed with rubber tired, track or low impact drill rigs using approved access routes and methods in accordance with the appropriate land management agency or private landowner requirements with applicable mitigation measures applied. Equipment typically used for geotechnical evaluations includes a drill rig, water truck, and 4-wheel drive support vehicles. The average estimated drilling time at each site is approximately one-half day. Work areas are typically 40 feet by 40 feet in size (1,600 square feet/0.37 acre) with the disturbed area contained approximately within a 5 feet diameter circle.

Small surface disturbances may occur at the structure site drill locations caused by parking, use of equipment, and associated field crew activities in the work area. Water may be used during the drilling process and a very small amount of water may exit the drill holes. Following the completion of drilling and before leaving each site, the soil boring will be backfilled with the cuttings removed from it during drilling per the appropriate federal agency requirements. Excess spoils not backfilled into the bore hole will be removed from the site and disposed of in accordance with the appropriate land management agency or private landowner requirements with applicable mitigation measures applied. No open holes will be left unattended, and all holes will be fully backfilled before moving to the next boring.

Ground disturbance from geotechnical investigations would occur within the structure work areas and would not cause additional disturbance. Access roads used for geotechnical investigations would be the same as those used to access structures for construction. Although none is anticipated, any additional ground disturbance from geotechnical investigations on federal lands prior to the issuance of the TWE Project ROW grants may require additional authorizations. The Applicant will apply for and obtain all necessary federal, state, and local authorizations.

5.1.4 Pre-Construction Surveys

Pre-construction engineering surveys will be conducted to identify the transmission line ROW centerline and width, structure sites, vegetation clearance boundaries, property boundaries, ground profiles, access routes, temporary work areas, and stream crossings. Access for engineering surveys will be with 4-wheel drive and all terrain vehicle (ATV) type vehicles using existing roads. All off-road access will be by low-impact rubber-tired ATV or on foot depending upon terrain and vegetation and in accordance with the appropriate land management agency or private landowner requirements with applicable mitigation measures applied.

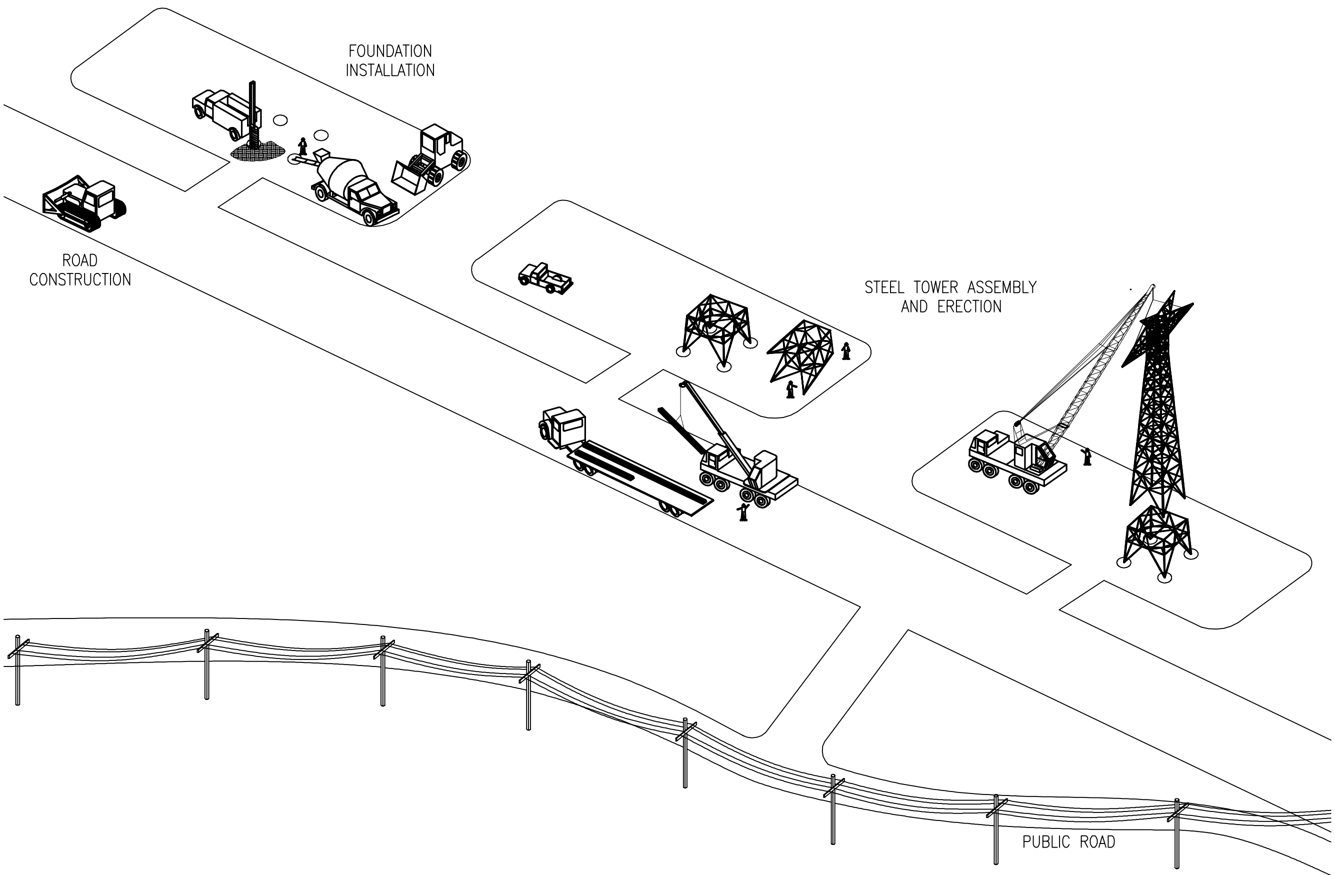
Pre-construction environmental surveys will be conducted, as required by permitting agencies, for the identification, flagging, and avoidance of sensitive resources. The timing of pre-construction surveys will vary depending upon the resource being surveyed. Requirements for environmental pre-construction surveys will be documented in the FEIS and the regulatory agencies' decision documents and stipulations. Documents currently under development which may identify additional biological and cultural pre-construction surveys include the Biological Assessment/Biological Opinion (BA/BO) and the PA, respectively. Pre-construction environmental surveys may include, but are not limited to: (1) migratory bird and raptor nest surveys; (2) special status wildlife and botanical species, including those protected by USFWS, BLM, USFS, and respective state resource management agencies; (3) noxious weed identification; (4) cultural resource surveys; (5) paleontological resource survey, and (6) wetlands delineations in accordance with requirements of the Clean Water Act (CWA) Section 404 permit.

The following appendices in this POD provide details of required pre-construction surveys:

- Avian Protection Plan (Appendix B);
- Cultural Resources Protection and Management Measures Plan (Appendix D);
- Noxious Weed Management Plan (Appendix N);
- Paleontological Resources Management and Mitigation Plan (Appendix P);
- Water Resources Protection Plan (Appendix W); and
- Wildlife and Plant Conservation Measures Plan (Appendix X).

5.2 Transmission Line Construction

The following sections detail the transmission line construction activities associated with the proposed ±600 kV DC transmission line and access roads. The general sequence of transmission line construction includes: construction of access roads; clearing of ROW and temporary work areas; installation of foundations; assembly and erection of structures; installing ground rods/counterpoise; installing shield wires and conductors; and site cleanup and reclamation. Typical transmission line construction activities and sequencing are depicted in Figures 13 and 14. Various construction activities will occur during the construction process, with several construction crews operating simultaneously at different locations. Section 5.8.3 summarizes the types and quantities of equipment to be used for the transmission line construction.



TYPICAL TRANSMISSION LINE CONSTRUCTION ACTIVITIES

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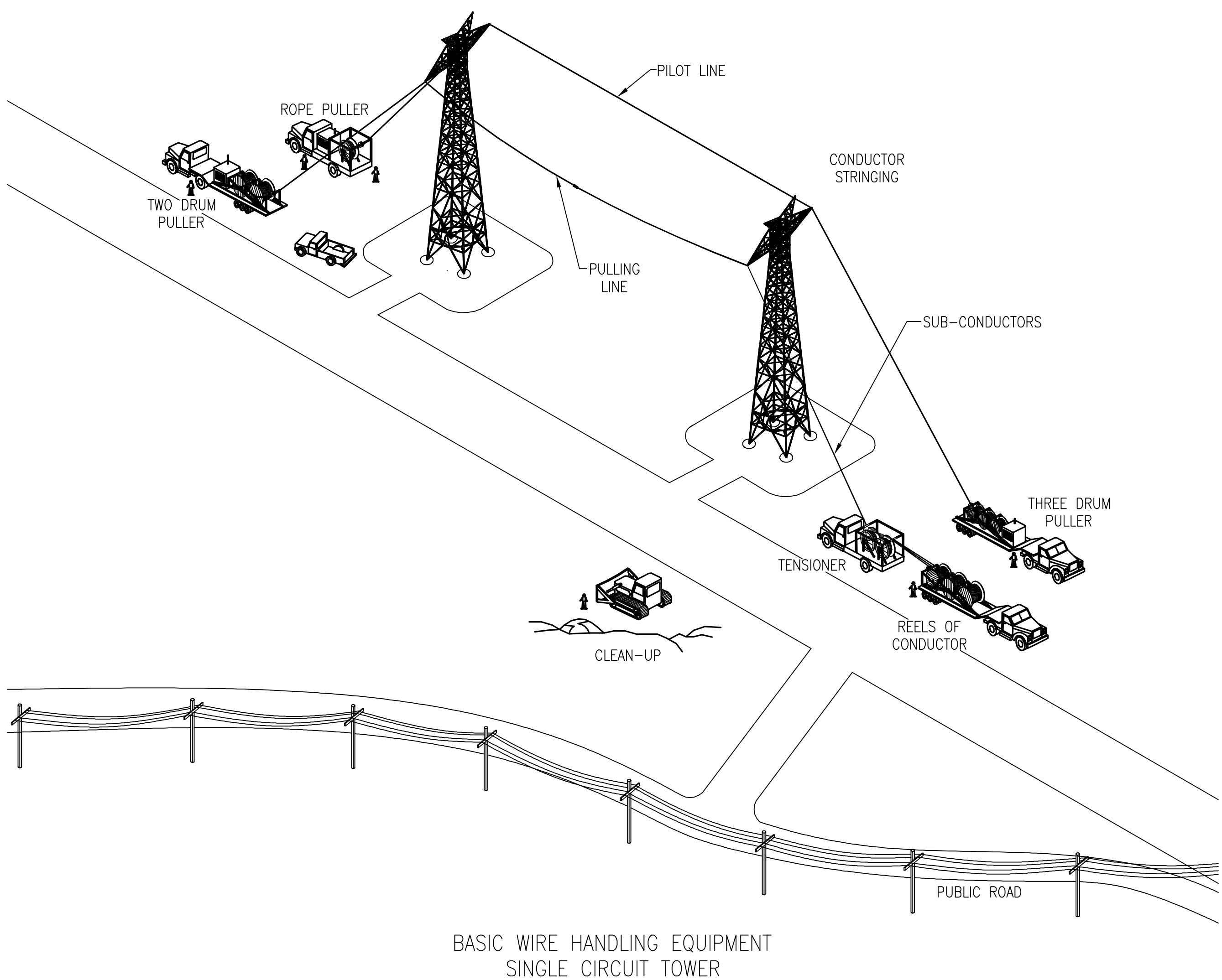
FIGURE 13

STRUCTURE FOUNDATION INSTALLATION,
TOWER ASSEMBLY, &
ERECTION ACTIVITIES



BASIC WIRE HANDLING EQUIPMENT
SINGLE CIRCUIT TOWER

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FIGURE 14
CONDUCTOR STRINGING ACTIVITIES

5.2.1 Access Road Construction

Access roads are an essential part of the construction and operation of the TWE Project. As such, the TWE Project will require surface access to all structures and work areas during construction and operation to allow construction vehicles and equipment to access the location of each transmission structure and Project facility. Access roads constructed as part of the Project but not required for operations will be restored to their original condition or left as-is per the appropriate land management agency or private landowner requirements. Access in Inventoried Roadless Areas (IRAs) is discussed in Section 5.7.3 Roadless Construction. The TWE Project has been designed to utilize existing access roads wherever practicable in order to minimize environmental impacts associated with new road construction.

Table 7 summarizes typical road requirements for construction and routine and non-routine operations.

TABLE 7 TYPICAL ROAD REQUIREMENTS FOR TRANSMISSION LINE SYSTEM

ROAD TYPE	ACCESS ROADS FOR CONSTRUCTION	ACCESS ROADS FOR ROUTINE OPERATIONS	ACCESS ROADS FOR NON-ROUTINE OPERATIONS USE
Existing Improved Roads	No change	No change	No change
Existing Roads Needing Improvement	Unsurfaced - use as-is with improvements as needed throughout construction	For routine activities, an 8-foot portion of the road will be used and vehicles will drive over the vegetation (“two-track”).	For non-routine maintenance requiring access by larger vehicles, the full width of the access road may be used. Roads will be repaired, as necessary, but will not be routinely graded. In order to preserve the ability to enter rapidly, the road structure (cuts and fills) will be left in place.
New roads	Unsurfaced – “drive and crush”, “clear and cut” or bladed roads as required by terrain, use, local conditions, regulatory requirements, etc.	For routine activities, an 8-foot portion of the road will be used and vehicles will drive over the vegetation (“two-track”).	
Temporary Roads (roads constructed to access temporary work areas)	Unsurfaced – similar treatment to new roads	None—contours will be restored, and the road will be ripped and seeded.	None

Existing roads will be used to access work areas whenever practicable. Two types of existing roads are “Existing Improved Roads” and “Existing Roads Needing Improvement”. “Existing Improved Roads” are roads that appear to either be hard-surfaced roads or have well maintained surfaces. No improvement or maintenance of “Existing Improved Roads” is anticipated as a result of TWE Project construction. “Existing Roads Needing Improvement” will have varied conditions across the Project and include trails, two-track roads, and non-maintained dirt roads. It is anticipated that the Contractor may need to perform some level of improvement to provide the safe travel way required for construction. Based on the Contractor’s construction plan and the construction techniques employed, it is anticipated that sections of the access roads classified as “Existing Roads Needing Improvement” will receive one of the following treatments.

- The existing road will be sufficient and provide a safe travel way throughout the duration of Project construction.

- The existing road will be sufficient and provide a safe travel way during a portion of the line construction period. Weather events, progressive damage due to heavy use and larger heavier equipment needed are examples of reasons that an existing road would need some level of construction at one or more intermediate points during line construction.

- The existing road at project initiation needs more extensive construction, including blading, prior to the start of line construction.

- Portions of these roads will involve "clear and cut", or "drive and crush".

The construction of new access roads will be required only as necessary to access structure sites lacking direct access from existing roads, or where topographic conditions (e.g., steep terrain, rocky outcrops, and drainages) prohibit safe overland access to the site. A new access road refers to implementing all activities required to establish a travel-way that allows vehicular access from an existing road to the required work location and does not imply construction of a new road with a ditch and raised shoulder. Where terrain and soil conditions are suitable, non-graded overland access ("drive and crush") will be utilized. New access roads will be located within the ROW whenever practical and will be sited to minimize potential environmental impacts. The number of new access roads will be held to a minimum, consistent with their intended use (e.g., access to structure work areas or wire-pulling and tensioning sites).

Where new roads are required or where improvements to existing roads are required, access roads will be designed in accordance with standards and guidelines for Non-constructed Roads and Routes as described in "The Gold Book – Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development" (AASHTO 2006). Portions of the access road network requiring design and construction to a more stringent standard will be identified in the Access Road Siting and Management Plan submitted with the NTP POD.

An Access Road Siting and Management Plan will be developed for the selected Alternative during final engineering and design, which will define site-specific access to each structure and work area. A framework Access Road Siting and Management Plan is provided in Appendix A.

Prior to finalizing access road locations during final engineering and design, a methodology was developed to estimate the miles of access roads and to ultimately approximate the area of potential ground disturbance associated with access roads to be used in the EIS analysis. This methodology is described in detail in the Revised Access Road Methodology for the FEIS Memorandum (February 2014) provided in Appendix Z. Table 8 summarizes the access road categories used to estimate access road requirements by greenfield vs. co-located route segments for different terrain types and for roads inside and outside of the proposed right-of-way. Figure 15 illustrates typical access road cross-sections in the various terrain conditions.

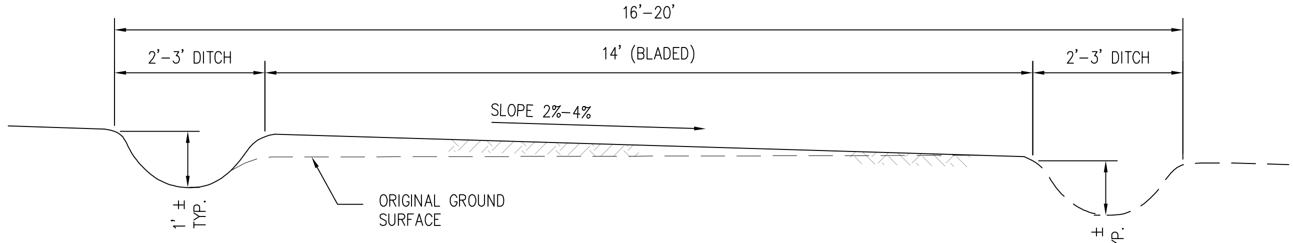
TABLE 8 ACCESS ROAD CATEGORIES AND DISTURBANCE ASSUMPTIONS FOR FEIS ANALYSIS

ACCESS ROAD CATEGORY	TERRAIN TYPES	ASSUMPTIONS FOR ESTIMATING DISTURBANCE
	Backbone Access Road Network Outside FEIS Corridors	
Category 1 – Existing Improved Roads	All terrain types	Geographic Information System (GIS) data provided. No ground disturbances would occur.
Category 2 (A) – Existing Roads Outside FEIS Corridor Requiring	All terrain types	GIS data provided. Access roads widths estimated 16 to 24 feet wide depending on terrain.

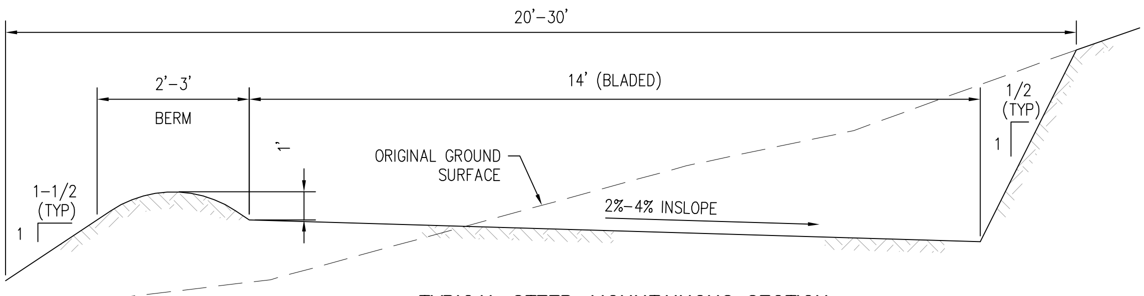
ACCESS ROAD CATEGORY	TERRAIN TYPES	ASSUMPTIONS FOR ESTIMATING DISTURBANCE
Improvements		
Access Roads Inside FEIS Corridors for Greenfield Alternatives		
Category 1 – Existing Improved Roads	All terrain types	GIS data provided. No ground disturbances would occur.
Category 2 (B) – Existing Roads Inside FEIS Corridor Requiring Improvements	All terrain types	For the FEIS analysis, a percentage of the length of Category 2B roads is considered new roads, under Road Categories 3-6.
Category 3 – New Access Roads in Flat Terrain	Flat – 0-8% slopes	Ratio of access road miles to one mile of transmission line – 1.2 miles Access Road Width – 16 feet
Category 4 – New Access Roads in Rolling Terrain	Rolling – 8-15% slopes	Ratio of access road miles to one mile of transmission line – 1.3 miles Access Road Width – 18 feet
Category 5 – New Access Roads in Steep Terrain	Steep – 15-25% slopes	Ratio of access road miles to one mile of transmission line – 1.8 miles Access Road Width – 22 feet
Category 6 – New Access Roads in Mountainous Terrain	Mountainous – greater than 25% slopes	Ratio of access road miles to one mile of transmission line – 2.7 miles Access Road Width – 24 feet
Access Roads Inside FEIS Corridors for Co-Located Alternatives		
Category 1 – Existing Improved Roads	All terrain types	GIS data provided. No ground disturbances would occur.
Category 2 (B) – Existing Roads Inside FEIS Corridor Requiring Improvements	All terrain types	For the FEIS analysis, a percentage of the length of Category 2B roads is considered new roads, under Road Categories 3-6.
Category 3 – New Access Roads in Flat Terrain	Flat – 0-8% slopes	Ratio of access road miles to one mile of transmission line – 0.8 miles Access Road Width – 16 feet
Category 4 – New Access Roads in Rolling Terrain	Rolling – 8-15% slopes	Ratio of access road miles to one mile of transmission line – 1.1 miles Access Road Width – 18 feet
Category 5 – New Access Roads in Steep Terrain	Steep – 15-25% slopes	Ratio of access road miles to one mile of transmission line – 1.6 miles Access Road Width – 22 feet
Category 6 – New Access Roads in Mountainous Terrain	Mountainous – greater than 25% slopes	Ratio of access road miles to one mile of transmission line – 2.4 miles Access Road Width – 24 feet

Construction of new access roads will begin with vegetation removal to the extent required for new road development. Vegetation management is described in Appendix R, ROW Preparation and Vegetation Management Plan. For bladed roads and where appropriate, topsoil will be removed and salvaged from the road construction area as required by the appropriate land management agency or private landowner. Topsoil will be stored adjacent to the road or in a nearby workspace. Based on terrain and grade of the road, new bladed access roads will be constructed with an inslope or outslope design with water dips, water bars, water breaks and wings in the berm as necessary to manage water flow on the road and mitigate erosion. Figure 16 illustrates typical water bar cross-sections to be used to manage water flow on access roads in areas of steep terrain. Appropriate erosion control devices will be installed to prevent erosion or loss of the topsoil, including measures to prevent wind erosion and fugitive dust, and silt fencing to prevent sediment runoff. As needed, the structure site construction pads and access roads will be bladed/graded to allow for safe access and construction. The blading/grading may include cut and fill as needed to achieve a safe, workable surface.

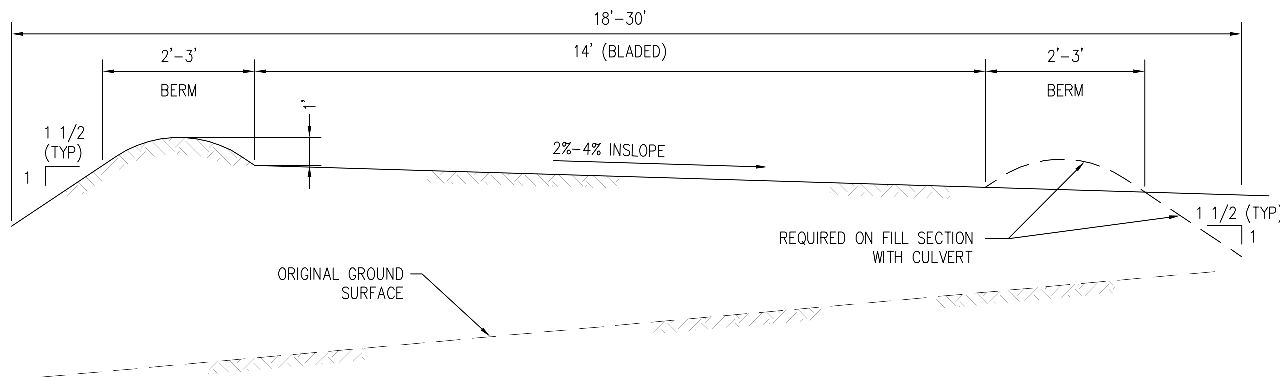
Access road construction may employ heavy equipment including bulldozers, front-end loaders, dump trucks, backhoes, excavators - both tracked and rubber-tired, and graders. Other specialized equipment including boom trucks to install culverts in some areas will be used where needed.



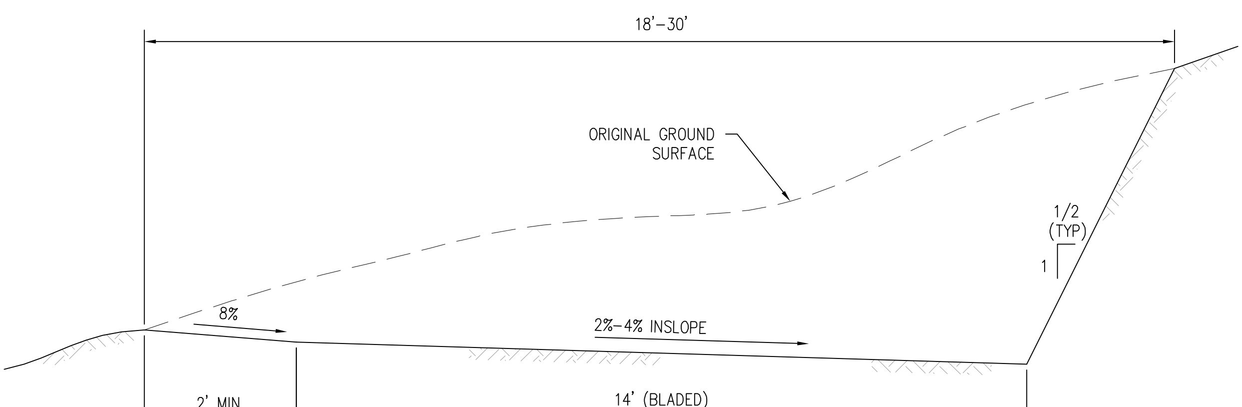
TYPICAL FLAT–ROLLING SECTION



TYPICAL STEEP–MOUNTAINOUS SECTION



TYPICAL FULL FILL SECTION



TYPICAL FULL CUT SECTION

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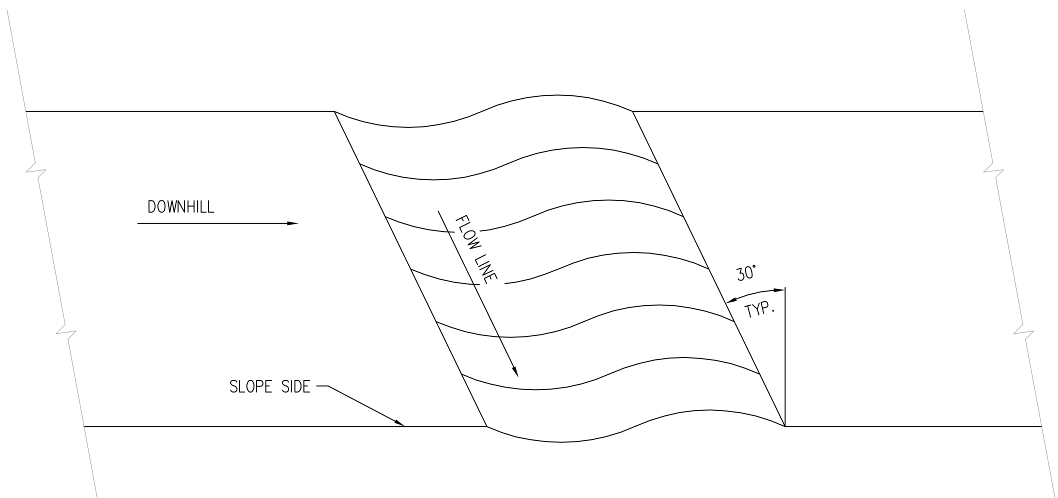
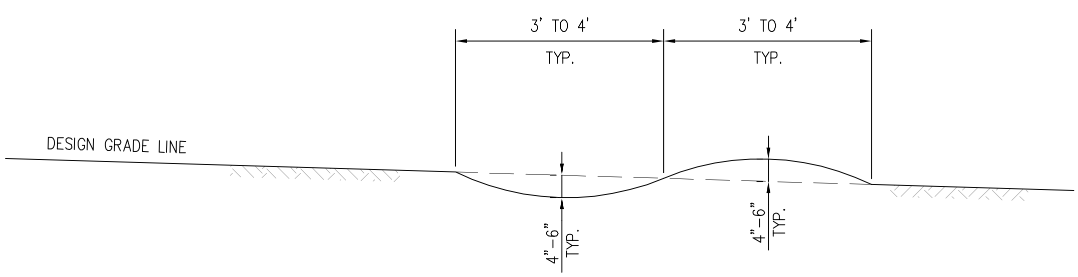
FIGURE 15
TYPICAL ACCESS ROAD CROSS–SECTIONS BY TERRAIN TYPE

WATER BARS





TYPICAL PROFILE

DISTANCE BETWEEN WATER BARS

ROAD GRADE PERCENT	SPACING FEET
2	250
5	135
10	80
15	60
20	45

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FIGURE 16
TYPICAL ROADS – WATER BARS

5.2.2 Clearing of Transmission ROW and Temporary Work Areas

Vegetation within the ROW will be cleared in accordance with the ROW Preparation and Vegetation Management Plan in Appendix R. Figure 17 provides a plan view of typical transmission ROW and temporary work areas.

Temporary work areas will be cleared of vegetation or flagged, as needed, prior to construction. Temporary work areas will include staging areas; material storage yards; fly yards; pulling, tensioning and spicing sites; work areas at each structure site; batch plant sites; and guard structures. Table 9 summarizes the temporary land disturbance that would be required for Project construction including the typical size and spacing required for the TWE Project facilities and activities.

TABLE 9 SUMMARY OF TEMPORARY LAND DISTURBANCE FOR WORK AREAS

TEMPORARY WORK AREA	DIMENSIONS/ SIZE	LOCATION AND NUMBER OF FREQUENCY NEEDED
TWE Project Transmission Line		
Staging Areas / Fly Yards	Average size: 7 acres	Approximately every 5 miles
Material Storage Yards	Average size: 20 acres	Approximately every 30 miles
Wire Pulling, Tensioning and Splicing Sites	ROW width x 500 feet for dead-end structure	Two sites at every dead-end structure
	ROW width x 500 feet for mid-span conductor and shield wire	Approximately every 9,000 feet
	100 x 500 feet for fiber optic cable set-up sites	Approximately every 18,000 feet
Structure Work Areas	ROW width x 200 feet per structure	All structure sites, average 4 per mile
Batch Plants	Average size: 5 acres	Approximately every 15 miles
TWE Project Northern and Southern Terminals		
Storage and Concrete Batch Plant	7.5 acres	On-site
Interconnection Line Structure Work Areas	200 feet x 200 feet (230 kV structures)* ROW width x 200 feet (500 kV structures)	All structure sites Approximately 6 per mile for 230 kV* Approximately 4 per mile for 500 kV
Interconnection Line Wire Pulling, Tensioning, Splicing Sites	ROW width x 500 feet	Mid-span conductor and shield wire sites – every 9,000 feet
	(230 kV ROW width – 100 feet)*	Fiber optic cable set-up sites – every 18,000 feet
	(500 kV ROW width – 250 feet)	Splicing sites typically at the same locations as the pulling/tensioning sites per common construction practices
TWE Project Northern and Southern Ground Electrode Systems		
Ground Electrode Site	65 acres	On-site
Overhead Electrode Line, Structure Work Areas	ROW width x 100 feet (34.5 kV ROW width – 50 feet)	All structure sites, average 18 per mile
Overhead Electrode Line, Pulling, Tensioning, and Splicing Sites	75 feet x 100 feet	Mid-span conductor sites – every 9,000 feet
	75 feet x 150 feet	All dead-end structure sites – two sites each
Material Storage Yards	10 acres	One at each ground electrode site (total of two)

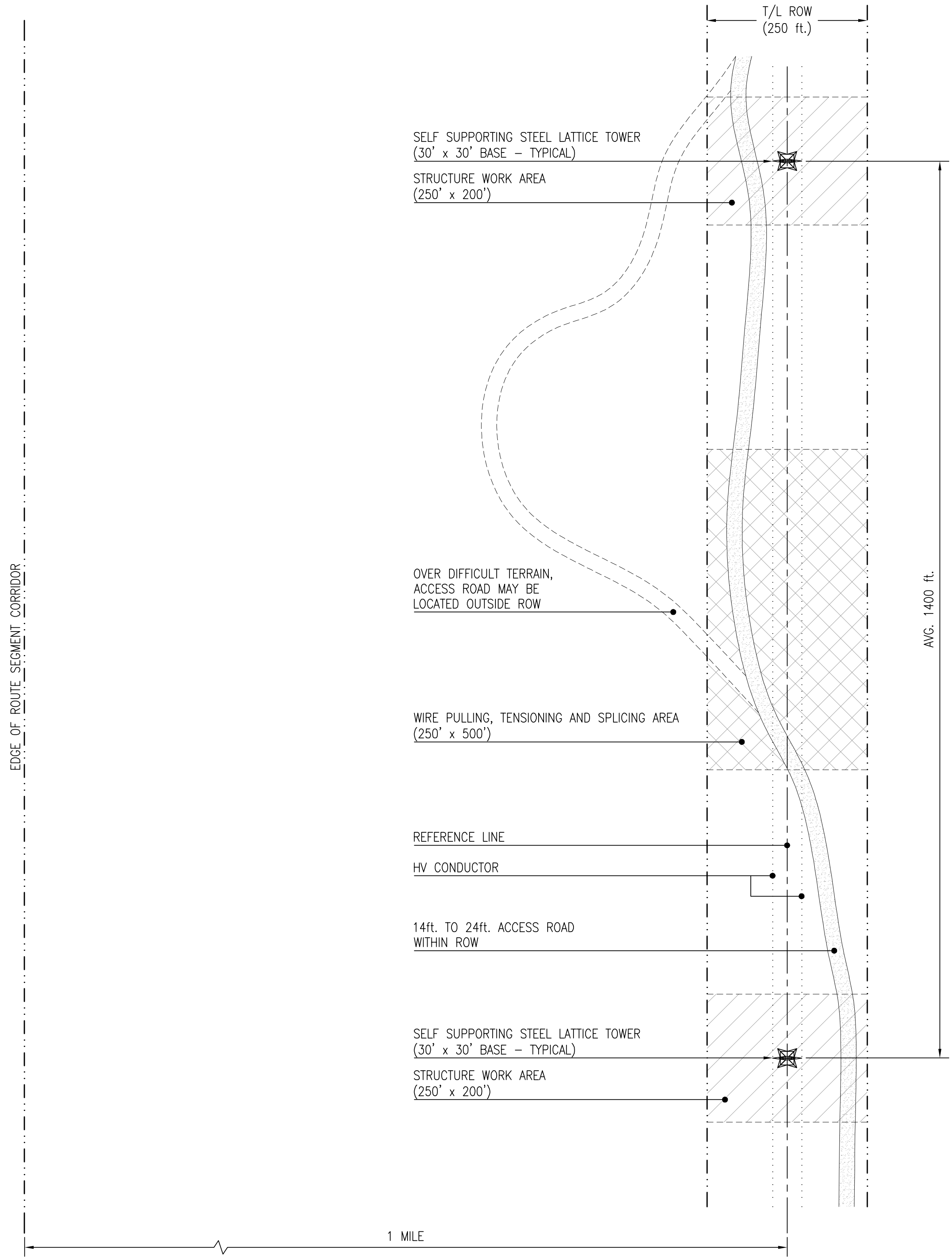
Notes: *Only applies to Northern Terminal

The following is a summary of the purpose and use of structure work areas; wire-pulling, tensioning and splicing sites; construction staging areas/fly yards; concrete batch plants; and equipment staging and refueling sites.

Structure Work Areas

Individual structure sites will be cleared to install the transmission line structures and facilitate access for future transmission line and structure maintenance. At each structure location (±600 kV DC and 500 kV), an area up to approximately 250 by 200 feet, will be needed for construction laydown, structure assembly, and erection at each structure site. This temporary disturbance will occur within the ROW. To the extent necessary, the work area will be cleared of vegetation and bladed to create a safe working area for placing equipment, vehicles, and materials. After line construction, all areas not needed for normal transmission line maintenance, including fire and personnel safety clearance areas, will be graded to blend as near as possible with the natural contours, then revegetated as required.

Additional equipment may be required if solid rock is encountered at a structure location. Rock-hauling, hammering, or blasting may be required to remove the rock. Excess rock that is too large in size or volume to be spread at the individual structure sites will be hauled away and disposed of at approved landfills or at a location specified by the appropriate agency or landowner. See *Excavating and Installing Foundations* below for additional information on blasting activities.



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TRANSWEST EXPRESS TRANSMISSION PROJECT
FIGURE 17

PLAN VIEW OF TYPICAL TRANSMISSION ROW
& CONSTRUCTION WORK AREAS

Wire Pulling, Tensioning, and Splicing Sites

Wire pulling, tensioning and splicing sites will be cleared and bladed as necessary to perform safe wire installation construction activities. During planning for wire installation activities wire pulling, tensioning, and splicing sites will be selected to minimize clearing and blading to the extent practical such that actual disturbance areas will not exceed those described in Table 8. After line construction, all areas disturbed for wire pulling, tensioning and splicing sites will be restored as described in Appendix Q, ROW Preparation and Vegetation Management Plan.

Construction Staging Areas/Fly Yards

The staging areas will be located in previously disturbed sites or in areas of minimal vegetative cover where possible. The staging areas will serve as field offices; reporting locations for workers; parking space for vehicles and equipment; and sites for material storage, fabrication assembly, concrete batch plants, and stations for equipment maintenance. Staging area dimensions and disturbance areas are summarized in Table 9. Additionally, fly yards for helicopter operations will be located approximately every five miles along the route where helicopter construction is planned, and will occupy approximately seven acres.

Depending upon location, use, type of material or equipment stored, adjacent land use or agency or landowner requirements, the Contractor may be required to provide necessary security arrangements at staging areas such as fencing and/or security guards. Staging area locations will be finalized following discussion with the land management agency or negotiations with landowners. In some areas, the staging area may need to be scraped by a bulldozer and a temporary layer of rock laid to provide an all-weather surface. Unless otherwise directed by the landowner, the rock will be removed from the staging area upon completion of construction and the area will be restored.

Concrete Batch Plant Sites

Concrete for use in the structure foundations will be dispensed from portable concrete batch plants located at approximately 15-mile intervals along the ROW, most located at staging areas adjacent to or near hard surface roadways. Initial site selection will be identified in the ROD POD with final sites identified in the NTP POD. Equipment typically required at a batch plant site includes generators, concrete trucks, front-end loaders, Bobcat loaders, dump trucks, transport trucks and trailers, water tanks, concrete storage tanks, scales, and job site trailers. Rubber-tired trucks and flatbed trailers will be used to assist in relocating the portable plant along the ROW. Commercial ready-mix concrete may be used when access to structure construction sites is economically feasible.

Equipment Staging and Refueling Sites

Staging of equipment will be located at staging areas, pulling and tensioning sites, or other temporary work areas previously described. These areas will be used to temporarily lay out equipment to be used for work on specific TWE Project activities at nearby locations.

During construction, the Contractor will implement standard refueling procedures for heavy equipment that is left on the ROW for long periods of time such as cranes, blades, dozers, drill rigs, etc. This equipment will be refueled in place. As a rule, no personal or light-duty vehicles will be allowed to refuel on the ROW. Procedures and precautions similar to those used for helicopter refueling (discussed below) will be utilized.

Staging areas and helicopter fly yards where helicopters are parked or refueled may be fenced with security guards stationed as needed.

5.2.3 Excavation and Installation of Foundations and Anchors

Foundations for guyed steel lattice towers will typically be small precast or cast-in-place concrete pedestals. The precast pedestals will be hauled to the tower site on a flatbed truck and set in a small excavation dug by a backhoe or digger. Although not anticipated, site-specific foundation design other than the concrete pedestals could be warranted depending on subsurface conditions. The single shaft tubular steel poles and self supporting steel lattice towers will typically be supported by cast-in-place drilled concrete pier foundations. For these structure types, vertical excavations for foundations will be made with power drilling equipment. Where soils permit, truck-or track-mounted augers of various sizes, depending on the diameter and depth requirements of the hole to be drilled, will be used.

In rocky areas, the foundation holes may be excavated by drilling or blasting methods, or installing special rock anchor or micro-pile type foundations. The rock anchoring or micro-pile system will be used in areas where site access is limited, or adjacent structures could be damaged as a result of blasting or rock hauling activities. If hard rock is encountered within the planned drilling depth of tower foundations, blasting may be required to loosen or fracture rock. Potential areas requiring blasting will be identified based on geological setting of the proposed alignment. A Blasting Plan (Appendix C) is being prepared as part of the POD. It details the general concepts proposed to achieve the desired excavations, proposed methods for blasting warning, use of non-electrical blasting systems, provisions for controlling fly rock, vibrations, and air blast damage. Blasting is described in detail in Section 5.7.1.

In environmentally sensitive areas with very soft soils, a HydroVac, which uses water pressure and a vacuum, may be used to excavate material into a storage tank. Alternatively, a temporary casing may be used during drilling to hold the excavation open, and then the casing is withdrawn as the concrete is placed in the hole. In areas where it is not possible to operate large drilling equipment due to access or environmental constraints, hand-digging may be required.

In areas where single shaft tubular steel pole structures are used, increased volumes of excavated subsoil spoils, based on foundation size and depth are anticipated. These excess subsoil spoils will be disposed of in locations and methods as previously agreed upon by the Applicant and the appropriate land management agency or private landowner.

Methods and locations of disposal of material excavated from any type of foundation will consider hauling offsite to an approved disposal area, spreading within the general disturbance area to maintain grades and runoff, and to facilitate restoration (in these instances, topsoil will be salvaged and set aside to be placed over the subsoil material during restoration) and using spoil material as backfill for fill areas or to maintain graded access roads. Each of these disposal options will be mitigated on a case-by-case basis as agreed upon by the Applicant and the appropriate land management agency or private landowner.

Foundation or anchor holes left open or unguarded will be covered to protect the public and wildlife. If practical, fencing may be used. All safeguards associated with using explosives (e.g., blasting mats) will be employed. Blasting activities will be coordinated with the appropriate agencies, particularly for purposes of safety and protection of sensitive areas and biological resources (see Appendix C Blasting Plan). In extremely sandy areas, water or an appropriate land management agencies' approved gelling agent may be used to stabilize the soil before and during excavation.

Reinforced-steel anchor bolt cages will be installed after excavation and prior to structure installation. These cages are designed to increase the structural integrity of the foundations, will be assembled at the nearest laydown yard or staging area, and delivered to the tower site via flatbed truck. These cages will be inserted in the holes prior to pouring concrete. The excavated holes containing the reinforcing anchor bolt cages will be filled with concrete.

Typically, and because of the remote location of much of the transmission line route, concrete will be provided from portable batch plant areas as described above. Concrete will be delivered directly to the site in concrete trucks with a capacity of up to ten cubic yards. In the more developed areas along the route, the Contractor may use local concrete providers to deliver concrete to the site when available and economically feasible. Concrete trucks will be washed in designated areas within the ROW more than 100 feet from streams and wetlands. The hardened waste concrete will be removed from the site and properly recycled or disposed of.

Guyed lattice structures require the installation of anchors and guy wires to support the structure. Depending upon the soil type and engineering strength requirements, anchors will be either excavated plate anchors, drilled and epoxy, or grouted anchors.

Drilled anchors will require a small truck or track mounted drilling equipment that will drill a hole four to eight inches in diameter, 20 to 40 feet or more in depth. The anchor rod is inserted into the open bore and secured to the soil or rock either with epoxy or grout.

Plate anchors are installed in a three to four foot diameter excavation, 10 to 20 feet in depth, drilled by a small truck or track mounted drilling rig. The anchor rod is attached to the plate anchor, placed in the hole and the excavation is backfilled and compacted.

5.2.4 Erection of Transmission Structures

Bundles of steel members and associated hardware (insulators, hardware, and stringing sheaves) will be transported to each structure site by truck. Wood blocking will be hauled to each location and laid out; the tower steel bundles will be opened and laid out for assembly by sections and assembled into subsections of convenient size and weight. Typically, the leg extensions for the towers will be assembled and erected by separate crews with smaller cranes to make ready for setting of the main tower assembly. The assembled subsections will then be hoisted into place by means of a large crane and fastened together to form a complete tower. A follow-up crew will then tighten all the bolts in the required joints. Refer to Figure 13 for a general illustration of this procedure. The use of helicopters for structure erection is described in Section 5.7.2 Helicopter Construction.

5.2.5 Stringing of Conductors, Shield Wire, and Fiber Optic Ground Wire

Insulators, hardware, and stringing sheaves will be delivered to each tower site. The towers will be rigged with insulator strings and stringing sheaves at each shield (ground) wire and conductor position.

Interruption of road traffic on all types of roads (county, state, federal, interstate) is not anticipated during conductor stringing and tensioning activities unless required under the terms and conditions of a specific road or highway crossing permit. As described below, pilot lines will be pulled from tower to tower by either a helicopter (most commonly) or land operated equipment. The use of a helicopter to pull the pilot lines is commonly used so that impacts to road traffic are minimized or avoided. For safety and efficiency reasons, wire stringing and tensioning activities are typically performed during daylight hours and are scheduled to coincide to the extent practical with periods of least road traffic in order to minimize traffic disruptions.

Railroad crossing operations and procedures are controlled by and permitted through the railroad company operating the affected rail line (see the Union Pacific Railroad website for Overhead Wire Crossings as an example). Terms and conditions to be followed are specified in the crossing permit. Typically, stoppage of railroad traffic is not required during construction or conductor stringing and tensioning activities. Crossing activities are similar to those for road crossings and typically involve the use of guard structures as discussed below. Stringing and tensioning activities will be performed in coordination with the appropriate railroad authorities. For safety and efficiency, stringing and tensioning activities are performed during daylight periods and scheduled to coincide with times of least railroad traffic. The railroad will typically provide a switchman who is present at all times when work is being performed near or over any railroad line.

For protection of the public during stringing activities, temporary guard structures will be erected at road crossing locations where necessary. Guard structures will typically consist of H-frame wood poles placed on either side of the road to prevent ground wires, conductors, or equipment from falling on underlying facilities and disrupting road traffic. Typically, guard structures are installed just outside of the road ROW. Although the preference is for access to each of these guard structures to be located outside the road ROW, it may be necessary for access to be within the road ROW depending on topography and access restrictions imposed by the regulatory agency (i.e., USDOT, county road and bridge department). Access use within the road ROW will be performed in compliance with the stipulations of the crossing permit and regulatory agency requirements.

Site specific road crossing locations with excessive widths (generally greater than 200 to 300 feet) such as may occur on interstate highways would require installation of temporary guard structures in medians between opposite traffic flow lanes. Although the Applicant does not currently anticipate needing guard structures in medians, as final engineering design progresses, locations requiring center median guard structures may be identified. The erection and dismantling of these temporary guard structures may require short-term traffic diversions.

All traffic impacts resulting from wire stringing including short-term traffic diversions, traffic congestion and brief road closures (if needed) will comply with the Traffic and Transportation Management Plan (Appendix U). Short-term traffic diversions, which may last from a few hours to a day, are most commonly a short duration closure of the shoulder of the road or in more congested locations might consist of the closure of one lane of traffic. Complete closure of one direction of traffic is not anticipated. Temporary traffic diversion signs, signals, markers, barriers and traffic control personnel, if required by the State Department of Transportation (DOT), will be employed. These activities would be coordinated with the appropriate State DOTs. Traffic disruptions will be kept to a minimum and the Applicant will comply with crossing permit requirements which typically limit durations of traffic interruptions.

In urban locations or for extremely high volume roadways (such as interstate highways), the State DOTs may require the installation of protective steel netting above the roadway for the duration of wire stringing and tensioning operations (generally ranging from a few days to two to three weeks). The installation of protective steel netting requires a brief closure of the roadway while the netting is pulled across the roadway and hoisted onto the temporary support structures. This process is repeated when the netting is removed. Because of the heavy traffic volume and the impact of stopping traffic, netting is typically installed during the lowest traffic period (normally 3 a.m. to 5 a.m. on a Sunday morning) per the requirements of the State DOT. Although not anticipated, any road stoppage will employ all appropriate State DOT traffic safety requirements (signage, flagmen, lighting, signals, temporary barriers, law enforcement, etc.).

Equipment for erecting guard structures will include augers, backhoes, line trucks, boom trucks, pole trailers, and cranes. Guard structures may not be required for small roads. In such cases, other safety measures such as barriers, flagmen, or other traffic controls will be used. Following stringing and tensioning of all ground wires and conductors, the guard structures will be removed and the area restored.

Pilot lines will be pulled (strung) from tower to tower by either a helicopter or land operated equipment, and threaded through the stringing sheaves at each tower. Following pilot lines, a stronger, larger diameter line will be attached to conductors to pull them onto towers. This process will be repeated until the shield wire, optical ground wire, and conductor is pulled through all sheaves.

Shield wires, fiber optic cable, and conductors will be strung using powered pulling equipment at one end and powered braking or tensioning equipment at the other end of a conductor segment. Site dimensions for pulling and tensioning equipment are provided in Table 9. These sites may differ in size and dimensions, however, depending on the structure's purpose (e.g., mid-span or dead-end), site-specific topography, and whether anchoring of the shield wire or conductor will be located at these sites. The tensioner, in concert with the puller, will maintain tension on the ground wires or conductor while they are fastened to the towers. Once each type of wire has been pulled in, the tension and sag will be adjusted, stringing sheaves will be removed, and the conductors will be permanently attached to the insulators.

Caution will be exercised during construction to avoid scratching or nicking the conductor surface, which may provide points for corona to occur. Refer to Figure 13 for a general illustration of this procedure.

At tangent and small-angle towers, the conductors will be attached to the insulators using clamps while at the larger angle dead-end structures the conductors are cut and attached to the insulator assemblies by "dead-ending" the conductors, either with a compression fitting or an implosive type fitting. Both are industry-recognized methods. When utilizing the implosive type fitting, pertinent land management agencies, private landowners, and public safety organizations will be notified before proceeding with this method.

Part of standard construction practices prior to conductor installation will involve measuring the resistance of the ground to electrical current near the towers. If the measurements indicate a high resistance, counterpoise will be installed, which will consist of trenching in-ground wire to a depth of 12 inches in non-cultivated land and 18 inches in cultivated land, with a ground rod driven at the end. The counterpoise will be contained within the limits of the ROW and may be altered or doubled back and forth to meet the requirements of the TWE Project. Typical equipment used for installing ground rods includes line trucks, backhoes, and trenchers.

5.3 Terminal and Substation Construction

Terminal construction activities will occur at the Northern and Southern Terminals. Section 5.8.3 summarizes the types of construction equipment to be used at each terminal, substation or series compensation station.[1]

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[1] Terminal construction for the proposed Project includes the adjacent substations. Separate substations and/or series compensation stations are required for Design Options 2 and 3. Descriptions of the construction for the

Construction of the AC/DC converter stations, substations or series compensation stations will initially consist of survey work, geotechnical sample drillings approximately 20 to 50 feet deep, and soil resistivity measurements that will be used in the final design phases of the station. Once the final design of the station has been completed, a Contractor will mobilize to perform site development work, including grubbing and then reshaping the general grade to form a relatively (one percent slope) flat working surface. This effort also will include the construction of permanent all-weather access roads. An eight-foot-tall chain link fence will be erected around the perimeter of the terminal, substation or series compensation station to prevent unauthorized personnel from accessing the construction and staging areas. The perimeter fence will be a permanent feature to protect the public from accessing the facility. The excavated and fill areas will be compacted to the required densities to allow structural foundation installations. Oil containment structures required to prevent oil from transformers, reactors, circuit breakers, etc., from getting into the ground or water bodies in the event of rupture or leak, will be installed.

Following the foundation installation, underground electrical raceways and copper ground grid installation will take place, followed by steel structure erection and area lighting. The steel structure erection will overlap with the installation of the insulators and bus bar, as well as the installation of the various high-voltage apparatus typical of an electrical substation. The converter valve hall and ancillary buildings will be erected. The installation of the high-voltage transformers will require special high-capacity cranes and crews (as recommended by the manufacturer) to be mobilized for the unloading, setting into place, and final assembly of the transformers. While the above mentioned activities are taking place, the enclosures that contain the control and protection equipment for the terminal, substation and series compensation station will be constructed, equipped, and wired. A final crushed rock surface will be placed on the subgrade to make for a stable driving and access platform for the maintenance of the equipment. After the equipment has been installed, testing of the various systems will take place, followed by electrical energization of the facility. The energization of the facility generally is timed to take place with the completion of the transmission line work and other required facilities.

Soil Borings

Typically, soil borings will be made on 600-foot grid spacing within the terminal, substation or series compensation station, particularly at the approximate location of large structures and equipment such as substation dead-ends and transformers, to determine the engineering properties of the soil for foundation design. Borings will be made with truck- or track-mounted equipment. The borings will be approximately four inches in diameter, range from 20 to 50 feet deep, and be backfilled with the excavated material upon completion of soil sampling.

Clearing and Grading

The Contractor will mobilize to perform site development work including grubbing, grading and construction of an all-weather access road (gravel). Clearing of all vegetation will be required for the entire terminal, substation or series compensation station area, including a distance of approximately eight to ten feet outside the fence.

Once the vegetation is cleared, the entire site will be graded essentially flat, with enough slope to provide for runoff of precipitation. The site will be graded to use existing drainage patterns to the extent possible. Depending upon the size of the site a more complex drainage design may be required

substations and series compensation station for Design Options 2 and 3 are included within this section for convenience and completeness.

to handle larger volumes of runoff. Drainage design for large sites may require drainage zones, retention basins, and drainage structures such as ditches or culverts. Discharge of stormwater during construction will require State specific Stormwater Pollution Prevention Plans. A framework Stormwater Pollution Prevention Plan is provided in Appendix T. After grading, the entire site will be treated with a soil sterilizer to prevent vegetation growth to minimize future maintenance. Clearing and grading material will be disposed of in compliance with local ordinances. Material from off-site will be obtained at existing borrow or commercial sites and will be trucked to the site using existing roads and the site access road.

Once installation of foundations, underground electrical raceways and copper ground grid are completed, a four to six inch layer of crushed rock will be applied to the finished surface of the station to provide a solid all-weather working surface and to protect personnel from high currents and voltages during electrical fault conditions.

Storage and Staging Yards

Construction material storage yards may be located outside the terminal, substation or series compensation station-fenced area near the facility being constructed. These storage yards may be part of the terminal, substation series compensation station property or leased by the Contractor. After construction is completed, all debris and unused materials will be removed and the staging/storage yards returned to pre-construction conditions by the Contractor.

Grounding

A grounding system will be required in each terminal, substation and series compensation station for detection of faults and for personnel safety. The grounding system typically consists of buried copper conductor arranged in a grid and driven ground rods, typically eight to ten feet long. The ground rods and any equipment and structures are connected to the grounding conductor. The amount of conductor and length and number of ground rods required will be calculated based on fault current and soil characteristics.

Fencing and Lighting

Security fencing will be installed around the entire perimeter of each terminal, substation and series compensation station to protect sensitive equipment and prevent accidental contact with energized conductors by third parties. This seven-foot-high fence would be constructed of chain link with steel posts. One foot of barbed wire or similar material will be installed on top of the chain link yielding a total fence height of eight feet. Locked gates will be installed at appropriate locations for authorized vehicle and personnel access.

Safety and security lighting at the terminals, substations and series compensation stations will be provided inside the fence for safety and security, and for uncommon emergency night repair work. Dusk to dawn safety and security lighting will be used at the terminals and 500 kV AC substations.

Foundation Installation

Foundations for supporting structures and large buildings are of two types: spread footings or drilled piers. Spread footings are placed by excavating the foundation area, placing forms and reinforced-steel and anchor bolts, and pouring concrete into the forms. After the foundation has been poured, the forms would be removed, and the surface of the foundation finished. Drilled pier foundations are placed in a hole generally made by a track or truck-mounted auger. Reinforced-steel and anchor bolts are placed into the hole using a track or truck-mounted crane. The portion of the foundation above ground would be formed. The portion below ground uses the undisturbed earth of the augured hole as the form. After the foundation has been poured, the forms would be removed, the excavation would be backfilled, and the surface of the foundation finished.

Equipment foundations for circuit breakers, transformers, and small prefabricated buildings will be slab-on-grade type. These foundations are placed by excavating the foundation area; placing forms, reinforced steel, and anchor bolts (if required); and placing concrete into the forms. After the foundations have been poured, the forms are removed, and the surface of the foundation finished. Where necessary, provisions will be made in the design of the foundations to mitigate potential problems due to frost. Reinforced steel and anchor bolts will be transported to each site by truck, either as a prefabricated cage or loose pieces, which will then be fabricated into cages on the site. Concrete will be hauled to the site in concrete trucks. Excavated material will be spread at the site or disposed of in accordance with agency requirements or local ordinances. Structures and equipment will be attached to the foundations by means of threaded anchor bolts embedded in the concrete. Some equipment, such as transformers and reactors, may not require anchor bolts.

Oil Containment

Some types of electrical equipment, such as transformers, and some types of reactors and circuit breakers, are filled with an insulating liquid. Containment structures are required to prevent equipment insulating liquids from getting into the ground or waterbodies in the event of a rupture or leak. These structures take many forms depending on site requirements, environmental conditions, and regulatory restrictions. The simplest type of containment is a pit, of a calculated capacity, under the equipment that has an impervious liner. The pit is filled with rock to grade level. In case of a leak or rupture, the liquid captured in the containment pit is pumped into tanks or barrels and transported to a disposal facility. If required, more elaborate containment systems can be installed. This may take the form of an on-site or off-site storage tank and/or insulating liquid-water separator equipment depending on site requirements.

Structure and Equipment Installation

Supporting steel structures are erected on concrete foundations. These are set with a track or truck-mounted crane and attached to the foundation anchor bolts by means of a steel base plate. These structures will be used to support the energized conductors and certain types of equipment. This equipment will be lifted onto the structure by means of a truck-mounted crane and bolted to the structures; electrical connections are then made. Some equipment, such as transformers, reactors, and circuit breakers, will be mounted directly to the foundations without supporting structures. These will be set in place by means of a truck-mounted crane. Some of this equipment requires assembly and testing on the pad. Electrical connections to the equipment will then be made.

Equipment Housing, Control, Storage and Ancillary Building Construction

The Project will require several buildings at each terminal, substation or series compensation site. Depending upon size and function, these buildings will be either prefabricated or constructed on-site as concrete block or metal clad steel frame buildings.

The following provides a brief description and approximate dimension of the building types generally required for the terminals:

> The **HVDC Converter Valve Hall** is a large building that contains the high-voltage electronics involved in the conversion process (referred to as valves), the valve cooling circulation system (pipes required to circulate the cooling medium), clean air exchange, and other supporting environmental conditions required for operation of the converter system.

The valves are typically suspended from the ceiling of the building which requires large clearance distances to the ground and surrounding structures due to the high voltages that are generated within the building during the conversion process. The building will be approximately 60 to 80 feet in height and the footprint will be approximately 200 by 80 feet. There will be two buildings of this size; one housing the valve equipment for the positive DC pole and the other housing the equipment for the negative DC pole.

An **HVDC Auxiliary Support Building** is typically placed between the two valve halls or very near the valve halls. This building contains the pumps and heat exchange system for cooling of the valves. The building is typically 100 feet wide, 100 feet long and approximately 20 feet high.

A **Main Operations Building** housing operations, general office and support functions is approximately 150 by 150 feet square and is typically a two-story building with a complete basement. The HVDC control room and supporting control systems are housed in a main operations building. The telecommunications equipment, the HVDC controls equipment, and the operational control room is typically located in separated secure spaces to assure safety and to restrict access to all levels of automation and telecommunication. Operations, administrative staff, and maintenance dispatch supporting facilities are also located within this building. Control spaces will be equipped with full ranges of uninterrupted power supply power protection, fire safety operations, and dispatcher coordination centers. This facility will also include the SCADA control and monitoring systems for the Project's entire AC substation, and transmission systems as necessary up to the points of interconnection with the regional grid.

The **Security Control Office Building** will be an approximately 30 by 30 foot single story building with a full basement, to facilitate life safety and other equipment including domicile facilities for security personnel on extended shift work.

The **Diesel Generator Building** will be an approximately 100 by 30 foot single story building. This building contains diesel generators and support equipment necessary to operate the facility on loss of the primary power source.

The **DC Switchyard Building** is typically a single story building of approximately 30 feet by 60 feet. One or more control buildings may be required at each terminal to house control devices, battery banks for primary control power, and remote monitoring equipment. The size and construction of the building will depend on DC switchyard requirements. Typically, the control building will be constructed of concrete block, pre-engineered metal sheathed, or composite surfaced materials. Once the control house is erected, protection and control equipment will be mounted and wired inside.

A **Hazardous Chemical and Dry Storage Building** will be developed to place the various chemical bulk storage and other items outside and apart from the other buildings in the terminal complex. This building will be approximately 30 feet by 30 feet. This building will be supplied with the code required containment, life, and fire safety systems.

A **Dry Indoor Storage Building** will be developed based on the requirements of the HVDC Contractor and is estimated to be approximately 100 feet by 150 feet, single story, high bay building.

The following provides a brief description and approximate dimension of the buildings types generally required for the terminals, substations and series compensation stations:

> The **AC Switchyard Control House** is typically a single story structure of approximately 30 feet by 60 feet. One or more control buildings may be required at each switchyard, substation or series compensation station to house protective relays, control devices, battery banks for primary control power, and remote monitoring equipment. The size and construction of the building will depend on individual substation requirements. Typically, the control building will be constructed of concrete block, pre-engineered metal sheathed, or composite surfaced materials. Once the control house is erected, protection and control equipment will be mounted and wired inside.

Conductor Installation

The two main types of high-voltage conductors used in terminals and substations are tubular aluminum for rigid bus sections and/or stranded aluminum conductor for strain bus and connections to equipment. Rigid bus will be a minimum of four inches in diameter and will be supported on porcelain or polymer insulators on steel supports. The bus sections will be welded together and attached to special fittings for connection to equipment. Stranded aluminum conductors will be used as flexible connectors between the rigid bus and the station equipment.

Conduit and Control Cable Installation

Most terminal and substation equipment requires low-voltage connections to protect relaying and control circuits. These circuits allow metering, protective functions, and control (both remote and local) of the power system. Connections will be made from the control building to the equipment through multi-conductor control cables installed in conduits and/or a pre-cast concrete cable trench system.

5.4 Ground Electrode Construction

Construction of the two ground electrode facilities will be initiated with a survey and staking to layout the location of the access road, deep earth electrode wells, control building and low voltage underground electrical, control and monitoring cables connecting the wells to the control building. The Contractor will mobilize to perform site development work including grubbing and grading and construction of an all-weather access road (gravel). Grubbing, grading, and contouring of the entire site is not required. Removal of vegetation will be required for the access road, control building site, well sites, alignments of the underground electrical, control and monitoring cables and on-site material storage yard/staging area.

Once the vegetation is cleared, the control building site will be graded essentially flat, with enough slope to provide for runoff of precipitation. After grading, the control building site will be treated with a soil sterilizer to prevent vegetation growth to minimize future maintenance. Next, a thin layer of gravel or crushed rock will be applied to the finished surface of the control building site. With the exception of the permanent and temporary access roads, no additional grading will be required. Clearing and grading material will be disposed of in compliance with local ordinances. Material from off-site will be obtained at existing borrow or commercial sites, and will be trucked to the ground electrode site using existing roads and the ground electrode site access road.

Security fencing will be installed around the perimeter of the control building site. This seven-foot-high fence would be constructed of chain link with steel posts. One foot of barbed wire or similar material will be installed on top of the chain link yielding a total fence height of eight feet. A locked gate will be installed for authorized vehicle and personnel access.

Foundations for the prefabricated building will be slab-on-grade type. These foundations are placed by excavating the foundation area; placing forms, reinforced steel, and anchor bolts; and placing concrete into the forms. After the foundations have been poured, the forms are removed, and the surface of the foundation finished. Where necessary, provisions will be made in the design of the foundations to mitigate potential problems due to frost.

Reinforced steel and anchor bolts will be transported to each site by truck which will then be fabricated into cages on the site. Concrete will be hauled to the site in concrete trucks. Excavated material will be spread at the site or disposed of in accordance with agency requirements or local ordinances. The pre-fabricated building will be transported to the site by truck and attached to the foundations by means of threaded anchor bolts embedded in the concrete.

Each ground electrode site will require drilling approximately 60 deep earth wells. Each electrode well will be a 12 to 18 inch diameter bore drilled to a depth of 200 to 700 feet (depth based upon engineering and design). The well drilling will require small amounts of water which will be procured from commercial or municipal sources. Ground water will not be removed although small amounts of water, mud and spoil will be brought to the surface as part of the drilling process. All excess water, mud, drilling fluids, and spoils will be contained adjacent to the drill rig and when completed will be disposed of per landowner and agency requirements.

Once drilling is completed, a wire will be grouted into the well, the well capped, and a small area excavated around the well head for the installation of the utility access vault. A precast concrete utility access vault is installed. This utility access vault provides access to the well in addition to preventing public access to the well connections or electrode components.

Several underground cables are installed in trenches connecting each well to the control building. These cables provide a low voltage electrical connection from the control building to each well, and perform control and monitoring functions. Cables will be direct buried with the trench backfilled and compacted with spoil. Once backfilling is complete, the trenched area will be contoured back to match existing slopes and grades.

A communication system used for monitoring and control of the ground electrode facility will be installed. This communication link will require installation of either a buried or overhead fiber optic cable, and equipment or fixed radio communication equipment and antenna.

Connection to a local electric distribution circuit will be required to provide power to the site. Additionally, an emergency generator with a liquid propane gas fuel tank will be installed adjacent to the control building inside the fenced area.

5.5 Communications System Construction

The fiber optic network will require regeneration sites at periodic distances along the transmission line, as determined in the detailed engineering studies. In general, these regeneration sites are planned to be within the transmission line ROW. The communications system facilities will be constructed concurrently with the transmission line.

Construction will be initiated with a survey and staking to layout the location, and extent of the regeneration site. The Contractor will mobilize to perform site development work including grubbing, grading, and construction of an all-weather access road (gravel).

Clearing of all vegetation will be required for the entire regeneration site, including a distance of approximately eight to ten feet outside the fence. Once the vegetation is cleared, the entire regeneration site will be graded essentially flat, with enough slope to provide for runoff of precipitation. After grading, the entire site will be treated with a soil sterilizer to prevent vegetation growth to minimize future maintenance. Next, a thin layer of gravel or crushed rock will be applied to the finished surface of the regeneration site. Clearing and grading material will be disposed of in compliance with local ordinances. Material from off-site will be obtained at existing borrow or commercial sites, and will be trucked to the regeneration site using existing roads and the regeneration site access road.

Security fencing will be installed around the entire perimeter of each regeneration station. This seven-foot-high fence would be constructed of chain link with steel posts. One foot of barbed wire or similar material will be installed on top of the chain link yielding a total fence height of eight feet. A locked gate will be installed for authorized vehicle and personnel access.

Foundations for the prefabricated building(s) will be slab-on-grade type. These foundations are placed by excavating the foundation area; placing forms, reinforced steel, and anchor bolts; and placing concrete into the forms. After the foundations have been poured, the forms are removed, and the surface of the foundation finished. Where necessary, provision will be made in the design of the foundations to mitigate potential problems due to frost.

Reinforced steel and anchor bolts will be transported to each site by truck which will then be fabricated into cages on the site. Concrete will be hauled to the site in concrete trucks. Excavated material will be spread at the site or disposed of in accordance with agency requirements or local ordinances. Pre-fabricated building(s) will be transported to the site by truck and attached to the foundations by means of threaded anchor bolts embedded in the concrete.

The fiber optic cable will be connected from the splice box located near the bottom of the nearest transmission structure to the control building at the regeneration site via two diverse paths, either overhead or underground. The overhead path may require one, two or three short distribution type poles all located on the transmission ROW. An underground path will require trenching and burial of an underground fiber optic cable. All trenching is to occur on the transmission ROW.

Connection to a local electric distribution circuit will be required to provide power to the site. Additionally, an emergency generator with a liquid propane gas fuel tank will be installed at the site inside the fenced area.

A short tower (generally less than 30 feet) with a UHF/VHF radio antenna will be installed to provide communication support for transmission line patrol and maintenance operations and allow emergency operations independent of commercial common carrier (i.e., cellular telephone).

5.6 Post-Construction Clean-Up and Restoration

Terminal, ground electrode, series compensation station and transmission line construction will generate a variety of solid wastes including concrete, hardware, and wood debris. The solid wastes generated during construction will be recycled or hauled away for disposal. Excavation along the

ROW and at terminals and substations will generate excavated subsoil spoil that could potentially be used as fill; however, some of the excavated material will be removed for disposal.

The majority of waste associated with terminal and substation construction results from spoils created during site grading. Very little of the soil excavated during foundation installation is waste product. Above-grade waste will be packing material such as crates, pallets, and paper wrapping to protect equipment during shipping. It is assumed a 12-yard dumpster will be filled once a week with waste material for the duration of each terminal or substation project.

Clean-up and restoration will consist of:

- Removing packing crate reels, shipping material and debris, and disposing of them at approved landfill sites;
- Backfilling holes and ruts in access roads, installing water bars, and doing final grading;
- Dressing work sites and structure sites to remove ruts;
- Mitigating soil compaction and leveling, disking, and preparing areas for seeding, as required;
- Maintaining permanent access roads as needed for future maintenance work;
- Leaving access roads in place, but not regularly maintaining them. Access roads will be graded, have water bars installed, and reseeded to encourage vegetation cover according to appropriate land management agency or private landowner requirements;
- Repairing fences and gates to their original condition or better;
- Grounding fences;
- Seeding and revegetating, as specified in the Appendix Q Reclamation Plan and in accordance with appropriate land management agency or private landowner requirements; and
- Contacting property owners and processing claims for settlement.

5.7 Special Construction Practices

5.7.1 Blasting

As described earlier in this section, foundations for tubular steel poles and self supporting steel lattice towers will normally be installed using drilled shafts or piers. Foundations for guyed steel lattice towers will typically be small precast or cast-in-place concrete pedestals. If hard rock is encountered within the planned drilling depth, blasting may be required to loosen or fracture the rock to reach the required depth to install the tower foundations. Areas where blasting will likely occur will be identified during final design based on the geologic conditions of the selected Alternative alignment as determined by the geotechnical investigation. The Contractor will be required to prepare a Blasting Plan for the Project, subject to the approval of the Applicant. The Blasting Plan will detail the Contractor's proposals for compliance with the Applicant's blasting specifications and Blasting Plan framework (Appendix C), and will detail the general concepts proposed to achieve the desired excavations. In addition, the Blasting Plan will address proposed methods for controlling fly rock, for blasting warnings, and for use of non-electrical blasting systems. The Contractor will be required to provide data to support the adequacy of the proposed efforts regarding the safety of structures and slopes and to ensure that an adequate foundation is obtained. When utilized, blasting will take place between sunrise and sunset.

The Blasting Plan will contain shot plans which will detail the drilling and blasting procedures; the number, location, diameter, and inclination of drill holes; the amount, type, and distribution of explosive per hole and delay; and pounds of explosive per square foot for pre-splitting and smooth blasting. The Contractor will be required to maintain explosives logs.

Blasting near buildings, structures, and other facilities susceptible to vibration or air blast damage will be carefully planned by the Contractor and the Applicant, and controlled to eliminate the possibility of damage to such facilities and structures. The Blasting Plan will include provisions for control to eliminate vibration, fly rock, and air blast damage.

Blasting will be very brief in duration (milliseconds), and the noise will dissipate with distance. Blasting produces less noise and vibration than comparable non-blasting methods to remove hard rock. Non-blasting methods include track rig drills, rock breakers, jack hammers, rotary percussion drills, core barrels, and rotary rock drills with rock bits, which all require much longer time duration to excavate the same amount of rock as blasting.

5.7.2 Helicopter Construction

Helicopter construction techniques may be used for the erection of structures, stringing of conductor and shield wire, and other Project construction activities. The use of helicopters for structure erection is evaluated based on site- and region-specific considerations including access to structure locations, sensitive resources, permitting restrictions, construction schedule, weight of structural components, time of year, elevation, availability of heavy lift helicopters, and/or construction economics.

Helicopter erection of structures is a viable option for all locations without restrictions prohibiting or restricting helicopter use. As such "fly yards" have been incorporated into Project planning. In areas without restrictions on helicopter usage, the decision to employ helicopter construction techniques will be determined by the Contractor. However it is not anticipated that helicopter erection will be used except potentially in areas with extremely difficult access, in areas with some form of access restriction or in areas required by mitigation measures.

The use of helicopters for pulling shield wire and conductor lead lines is the normal and expected construction technique for wire stringing, as such, helicopters will be used for this purpose on the Project.

Other Project construction activities potentially facilitated by helicopters may include delivery of construction laborers, equipment, and materials to structure sites; structure placement and hardware installation. Helicopters may also be used to support the administration and management of the Project by the Applicant. Except in areas with restrictions on constructing or maintaining access roads, the use of helicopter construction methods would not change the length of the access road system required for operating the Project, because vehicle access will be required to each structure site regardless of the construction method employed.

When helicopter construction methods are employed, the structure assembly activities will be based at a fly yard. The fly yards will be approximately seven acres and will be sited typically at about five mile intervals within the section of the line employing helicopter erection. Optimum helicopter methods of erection will be used. Bundles of steel members and associated hardware for up to 15 to 20 towers (generally to include insulators, hardware, blocking, stringing sheaves, etc.) are transported to the appropriate fly yard by truck and stored. The steel bundles are opened and laid out by component section and then assembled into assemblies of convenient size and weight according to the helicopter's lifting capabilities. The leg extensions are typically transported to the tower location, assembled, and erected in place (with smaller equipment) in preparation for flying the completed tower sections to each location. After a planned quantity of towers is completely assembled, the helicopter and support force are mobilized and, within a few days, will set all the planned towers within a given section. A follow-up crew will then tighten all the bolts in the joints.

Prior to installation, each tower would be assembled in multiple sections at the fly yard. Tower sections or components would be assembled by weight, based on the lifting capacity of the helicopter in use. The lift capacity of helicopters is dependent on the elevation of the fly yard, the tower site, and the intervening terrain. The heavy lift helicopters that could be used to erect the complete towers or sections of a tower would be able to lift a maximum of 15,000 to 20,000 pounds per flight, depending on elevation.

After assembly at the fly yard, the complete tower or tower section would be attached by cables from the helicopter to the top of the tower section and airlifted to the tower location. Upon arrival at the tower location, the section would be placed directly onto the foundation or atop the previous tower section. Guide brackets attached on top of each section would assist in aligning the stacked sections. Once aligned correctly, line crews would climb the towers to bolt the sections together permanently.

It should be noted that the fly yard locations provided are considered approximate and subject to change, additions, or deletions upon acquisition of a Contractor prior to the beginning of construction. Upon completion of field review, a final determination would be made on the necessity of certain fly yards and the respective locations that provide the most efficient, economic, safest, and least impactful use of the fly yards that are needed.

A helicopter may be used to move personnel and equipment (e.g., pulling lines and assembling towers). Helicopters will set down in areas previously identified to receive temporary disturbance such as fly yards and staging areas. Travelers may be dropped at pulling and tensioning sites or other work areas previously described. Spill protection measures will be in place and all FAA regulations will be followed. Notification will be made to coordinate the air space with other possible helicopters or aircraft in the area (i.e., seeding operations, fire support, and Military Operation Areas).

If needed, additional temporary work areas within close proximity to or on the ROW will be identified by the Contractor and approved by the appropriate land management agency or private landowner for landing and refueling the helicopter. Each fuel truck will be equipped with automatic shutoff valves and will carry spill kits. In addition to the required preventive spill measures, a water truck may be required to spray the site to reduce dust. The Contractor will be required to clean up any materials released on the ROW. Any accidental spills will be handled according to the guidelines presented in the Hazardous Materials Management Plan (Appendix L).

5.7.3 Roadless Construction Methods

The standard construction methods described in this POD are the preferred methods for the TWE Project. Under specific conditions where access road construction is restricted or prohibited such as in IRAs, roadless construction methods will be used to eliminate the need for access roads and allow all construction activities to take place with specialized techniques, vehicles, and equipment. The roadless construction methods described in this section will be used to construct the Project in IRAs and other restricted areas.

The Applicant is not proposing to build or maintain any new temporary or permanent roads across IRAs. There will be no addition of Forest classified or temporary road miles for either construction or maintenance of the TWE Project. Where existing National Forest System roads are available and open to motor vehicle use, they will be used to access structure work areas in the TWE Project transmission line ROW. These system roads in or outside IRAs may need to be improved or widened depending on the condition of the road. However, existing roads will not be widened or otherwise upgraded for construction, as determined by the land management agency, where soils and vegetation are particularly sensitive to disturbance, except in areas where repairs are necessary to make existing roads passable and safe. Roadless construction methods include the use of helicopter construction techniques supported by minimal impact overland travel. A detailed description of helicopter construction techniques is provided in Section 5.7.2. Helicopters would transport personnel, drilling equipment, towers and other construction materials to and from the ROW and would be used for wire stringing. Access to the ROW for transport of personnel, equipment and material also could be accomplished by overland travel using low-impact vehicles. These low-impact vehicles would only be used in suitable terrain to the extent that no visible road or pathway is created. No blade work would be performed to assist overland travel within the IRAs.

Within a restricted area, the structure foundations could be constructed by several methods depending on soil conditions, terrain conditions, and final engineering design. Examples of construction options for installing tower foundations include using precast concrete support pedestals for the guyed steel lattice structures and micro-piles for the self supporting lattice tower foundations transported into the restricted area by helicopter or by overland travel using low-impact vehicles. Tower structure sections would be preassembled at approved construction fly yards located outside of the restricted areas and airlifted to the tower site locations by helicopter for erection.

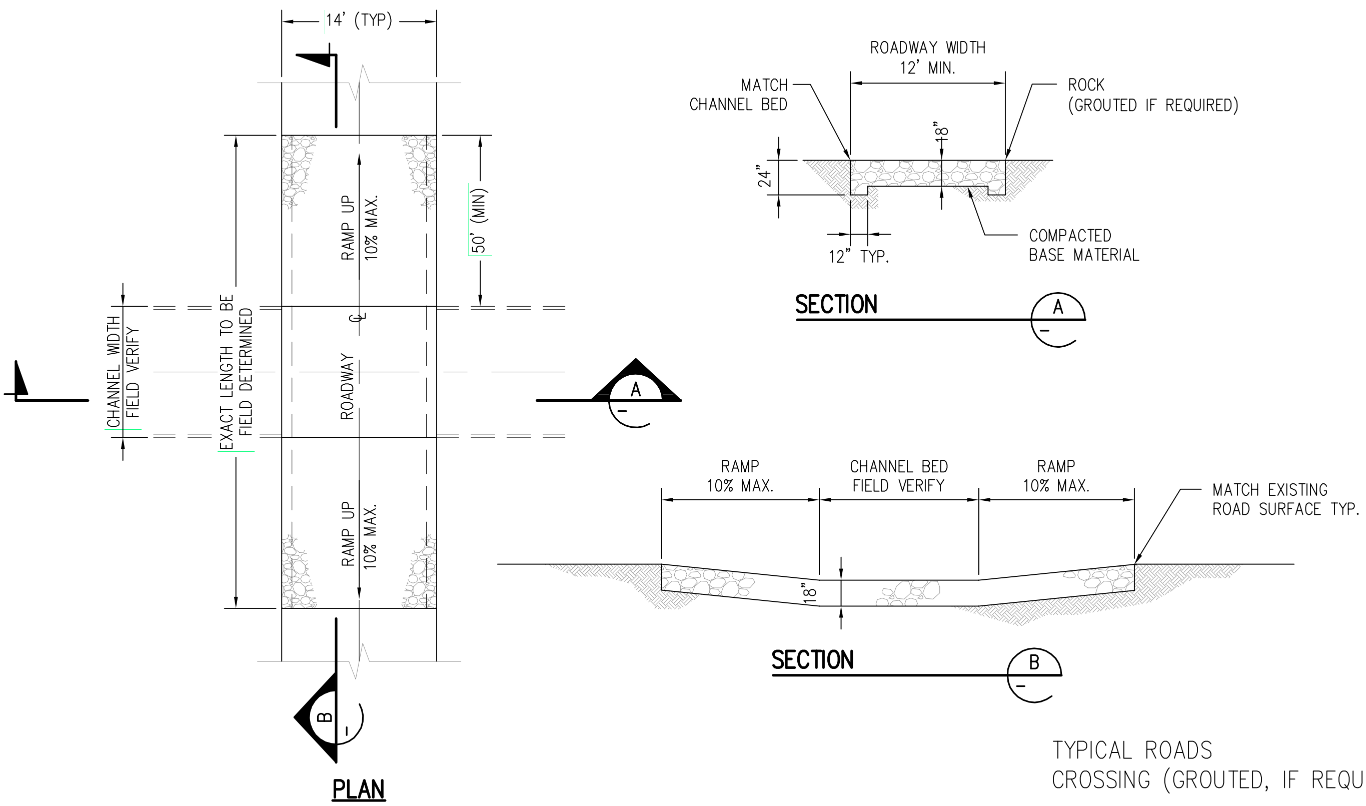
Following the completion of construction activities, any temporary disturbance, including any associated with overland travel to access the ROW would be reclaimed. The use of low-impact vehicles and equipment for overland access and ground-based site work will result in minimal disturbance in the temporary work areas. Any disturbance that does occur will be re-contoured, topsoil replaced, and revegetated with vegetation consistent with USFS requirements and the Reclamation Plan (Appendix Q). Revegetation treatments would be monitored in accordance with USFS requirements and the Reclamation Plan. Once the roadless construction area is reclaimed, routine maintenance would be via aircraft or low-impact vehicles such as vehicles with rubber treading, low pressure tires, or specialized mechanical movement to accommodate the terrain and landscape, and ATVs, or by non-motorized methods (e.g., foot, horseback, or other non-motorized methods). Unless otherwise approved, the transmission line ROW would only be accessed with motorized equipment for emergency repairs, or to maintain NESC electrical line clearances. Long-term disturbances would include maintenance of a limited ROW width, in which active vegetation management would occur. Authorization for continued vegetation management and emergency repairs would be the responsibility of the USFS and conducted in accordance with the POD and USFS stipulations.

The Applicant will work with the USFS to control the use of the ROW and prevent unauthorized travel along the ROW by off-road vehicles. Measures would be determined in consultation with the USFS and may include the following: a) installing gates or other man-made physical barriers; b) creating natural barriers (e.g., large boulders or debris); and c) stockpiling trees cut for ROW clearing at barrier locations.

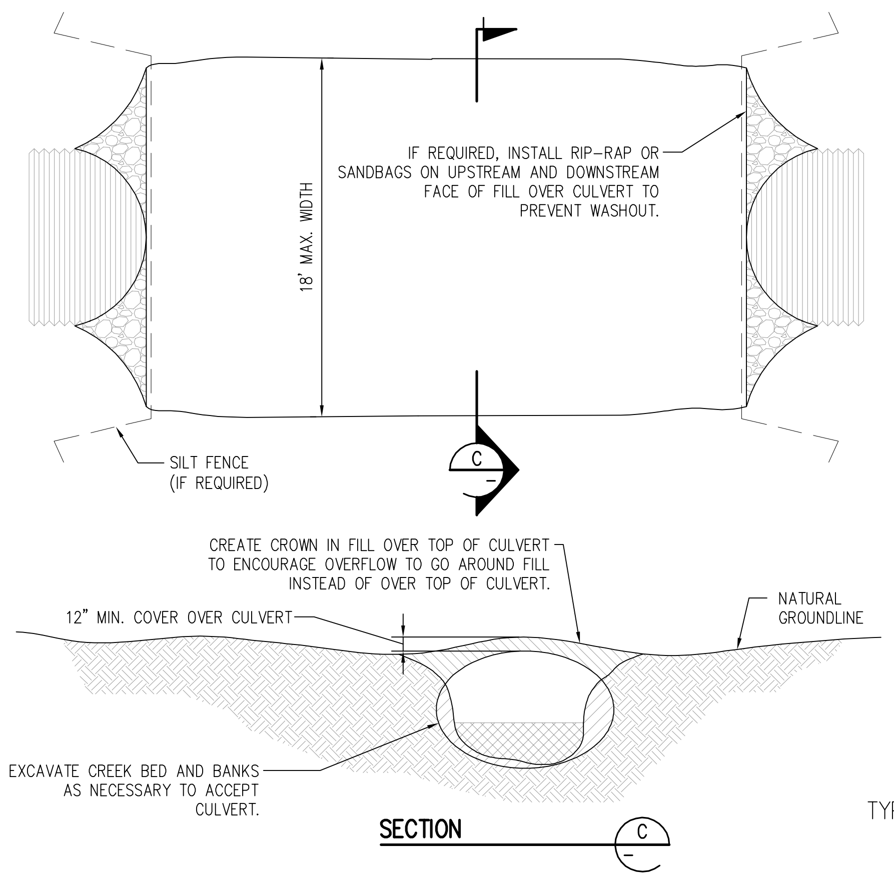
5.7.4 Water Crossings

Access roads will be designed and constructed to minimize disruption of natural drainage patterns and waterbodies including rivers, streams, ephemeral streams, ponds, lakes, reservoirs, and playas. Structure sites, new access roads, and other disturbed areas will be located away from waterbodies, wherever practicable. Each waterbody crossing will be designed in a distinct segment of the associated access roads as advanced engineering is completed. On all federally-managed lands, the Applicant will consult with the managing agency regarding relevant standards and guidelines pertaining to waterbody road-crossing methods.

Consultation will include site assessment, design, installation, maintenance, and decommissioning of the crossings. Wherever needed, culverts, low-water crossings, and other devices of adequate accepted design will be used to accommodate estimated peak flows of waterways, including crossings of all affected perennial, intermittent, and ephemeral streams. Construction disturbances of banks and beds of waterbodies will be minimized. Performance of low water stream crossings (i.e., drive thru and ford) will be monitored for the life of the access road, and maintained as necessary to preserve water quality. Figure 18 shows typical road designs for low-water crossings and culvert stream crossings.



TYPICAL ROADS
CROSSING (GROUTED, IF REQUIRED)



TYPICAL ROADS – CULVERT

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FIGURE 18
TYPICAL ROAD DESIGNS FOR
LOW WATER & CULVERT CROSSINGS

Potential types of water crossings that would be implemented include:

- **Drive Thru (Arizona Crossing):** Crossing of a channel with minimal vegetation removal where no cut or fill is needed. This is typical for low-precipitation sagebrush country characterized by rolling topography and streams that rarely flow with water.

- **Ford:** Crossing of a channel that includes grading and stabilization. Stream banks and approaches will be graded and stabilized with rock or other erosion control devices to allow vehicle passage. With approval of the land management agency, streambeds in select areas will be reinforced with coarse rock material to support vehicle loads, prevent erosion, and minimize sedimentation of the waterways. Coarse rock will be installed in the streambed in a manner such that it will not raise the level of the streambed, thus allowing continued movement of water, fish, and debris. A typical ford crossing results in a disturbance footprint 25 feet wide (along the waterbody) and 50 feet long (along the roadway) for 1,250 square feet or 0.03 acre of disturbed area at each crossing. The 0.03 acre is based on an estimated disturbance based on the requirement to operate equipment within the riparian area to construct a 14-foot-wide travel way and install armoring to protect it from erosion.

- **Culvert:** Crossing of a waterbody that includes installation of a culvert and construction of a stable road surface for vehicle passage over the culvert. Culverts will be designed and installed under the direction of a qualified engineer who, in collaboration with a hydrologist and an aquatic biologist where required by the land management agency, will specify placement locations; culvert gradient, height, and sizing; and proper construction methods. Culvert design will consider roadbed loading and debris size and volume. The disturbance footprint for a typical culvert installation is estimated to be 50 feet wide (along the waterbody) and 150 feet long (along the road) for 7,500 square feet or 0.17 acre of disturbed area at each crossing. This disturbed area includes approaches to the crossing and side slopes. The amount of area disturbed by excavation and fill material at each crossing will typically be much less and will be determined during final design and engineering. Ground-disturbing activities will comply with agency approved BMPs. Construction will occur during periods of low water or normal flow. The operation of construction equipment in riparian areas will be minimized. All culverts will be designed and installed to meet specified riparian conditions, as identified in applicable unit management plans. Culvert slope will not exceed stream gradient.

  Culverts will typically be partially buried in the streambed to maintain streambed material in the culvert. Sandbags or other non-erosive material will be placed around culverts to prevent scour or water flow outside the culvert. Adjacent sediment control structures such as silt fences, check dams, rock armoring, or riprap may be necessary to prevent erosion or sedimentation. Stream banks and approaches may be stabilized with rock or other erosion control devices. Culverts will be inspected annually for proper operation and maintained to preserve water quality for the life of the Project (estimated at 50 years or longer).

Wetlands will be avoided to the maximum extent practicable in siting transmission line structures, terminals, ground electrode facilities, temporary work areas, and access roads. Wetlands can typically be spanned by transmission lines to avoid impacts. Timber or other types of matting can be used to support construction equipment in wetlands to avoid the need to fill a wetland either temporarily or permanently for access during construction. Impacts to wetlands and waters of the U.S. will require a CWA Section 404 permit from USACE, NPDES Construction Stormwater Permit (Section 402), and Section 401 water quality certification.

5.7.5 Water Use

Construction of the transmission line and substation/converter stations will require water. Major water uses are required for transmission line structure and substation foundations, and dust control during ROW and substation grading and site work. A minor use of water during construction would include the establishment of substation landscaping where required.

Water usage for transmission line construction is for two primary purposes: foundation construction and dust control. In the construction of foundations, water is transported to the batch plant site where it will be used to produce concrete. From the batch plant, the wet concrete will be transported to the structure site in concrete trucks for use in foundation installation.

Construction of the transmission lines and related facilities will generate a temporary increase in fugitive dust. If the level of fugitive dust is too high in specific project areas, as determined in cooperation with the landowner or agency, water would be applied to disturbed areas to minimize dust.

Water usage for substation/converter station construction is primarily for dust control during site preparation work. During this period, construction equipment would be cutting, moving, and compacting the subgrade surface. As a result, water trucks patrolling the site to control dust would make as many as one pass per hour over the site. Once site preparation work is complete, concrete for the placement of foundations becomes the largest user of water and dust control becomes minimal.

Once site grading is complete, the balance of the substation construction work would be performed on bare subgrade soil or subgrade with a thin layer of rock. Fire risk would be minimal due to the bare ground or rock surface and would be contained within the confines of station-fenced area.

The estimated water required per mile of transmission line construction is approximately 3,400 gallons for foundation concrete and 240,000 gallons for dust control. Water required for construction of the Northern Terminal is estimated to be 600,000 gallons including dust control. Water required for construction of the Southern Terminal is estimated to be 400,000 gallons including dust control due to less disturbance and fewer foundations. Estimated water required for each ground electrode site is 150,000 gallons including dust control. The required water will be procured from municipal sources, from commercial sources, or under a temporary water use agreement with landowners holding existing water rights. No new water rights will be required.

5.8 Construction Schedule, Workforce, and Equipment

The proposed construction schedule for the TWE Project will be developed for the selected Alternative during final engineering and design and will be presented in the NTP POD. The construction schedule for the TWE Project will incorporate timing restrictions for special status plant and animal species, as determined by the land management and regulatory agencies in their respective decision documents. For purposes of the FEIS analysis, conceptual schedules have been developed, which provide general estimates on the duration of activities for each of the proposed TWE Project facilities. Conceptual construction schedules are described in Section 5.8.1. Estimated workforce and equipment needs are described in Sections 5.8.2 and 5.8.3, respectively.

5.8.1 Construction Schedule

It is anticipated that total construction timeframe for the transmission line will be approximately three years, concurrent with terminals and ground electrode system construction.

Conceptual schedules for the proposed TWE Project are shown in Figures 19, 20, 21 and 22. Figure 19 provides a bar chart construction schedule for a typical 20-mile stretch of the ±600 kV DC transmission line. Figure 20 shows the entire conceptual schedule for constructing the 750 mile long ±600 kV DC transmission line, including access roads and communication facilities. Figure 21 is a schedule for the proposed Northern and Southern Terminals, and Figure 22 is a construction schedule for the ground electrode systems.

For planning purposes, the overall schedule for the transmission line has been separated into three construction spreads or operations by line segment. The transmission line schedules show a staggered start to allow time for setups, material and equipment logistics and coordination between spreads. The total elapsed time of the combined transmission line schedule is approximately 137 weeks. These construction schedules include consideration for the anticipated conditions; however, severe winter weather, delays in equipment manufacturing and/or delivery, seasonal restrictions required for permitting and/or unexpected mitigation could interrupt the schedule inserting delays of weeks to several months or more.

Construction spreads for the transmission line are anticipated at three different locations. The approximate geographic locations are: (1) Northern Terminal to North-East Utah; (2) North-East Utah to West-Central Utah; and (3) West-Central Utah to the Southern Terminal. The line construction will progress simultaneously at these locations. The construction spreads for the transmission line have been designed such that one or more Contractors may be employed to construct the complete line.

The duration of transmission line construction activities on any given parcel of land may extend up to a year, although the total amount of time of actual construction activity would be much shorter, in the range of a few months. Over any particular section of the route, transmission line construction would be characterized by short periods (ranging from a day to one to two weeks) of relatively intense activity interspersed with periods with no activity. Figure 19 illustrates the typical durations for the construction of a 20-mile section of the transmission line.

The construction of the Northern and Southern Terminals is planned to start approximately three to six months after the start of the construction of the transmission line and run concurrently. The total elapsed time is scheduled for approximately two years. These construction schedules include consideration for the anticipated conditions; however, severe winter weather at the Northern Terminal could interrupt the schedule inserting delays of weeks to several months or more. The ground electrode facilities will take approximately one year to construct and is planned to start 18 months after the start of construction of the transmission line.

TASK	DURATION (WEEKS)
SURVEY / STAKE ACCESS ROADS & STRUCTURE PADS	2.5
CONSTRUCT ACCESS ROADS AND / OR STRUCTURE PADS	2.5
GEOLOGICAL INVESTIGATIONS	3
SURVEY / STAKE STRUCTURE LOCATIONS	3
EXCAVATE HOLES FOR SELF SUPPORTING LATTICE STRUCTURE	1
INSTALL FOUNDATIONS FOR SELF SUPPORTING LATTICE STRUCTURE	1
HAUL MATERIALS FOR SELF SUPPORTING LATTICE STRUCTURE	3
ASSEMBLE SELF SUPPORTING LATTICE STRUCTURE	3
ERECT SELF SUPPORTING LATTICE STRUCTURE	4
WIRE INSTALLATION	3
FINAL CLEAN UP / RECLAMATION / RESTORATION	4

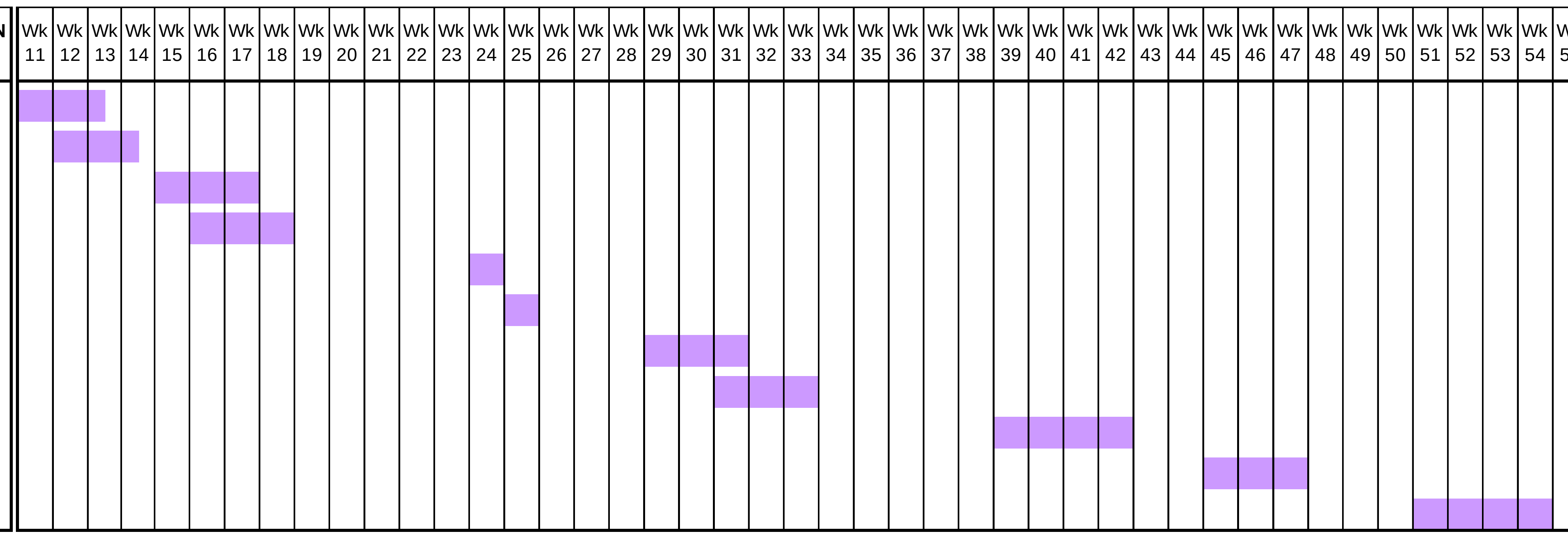

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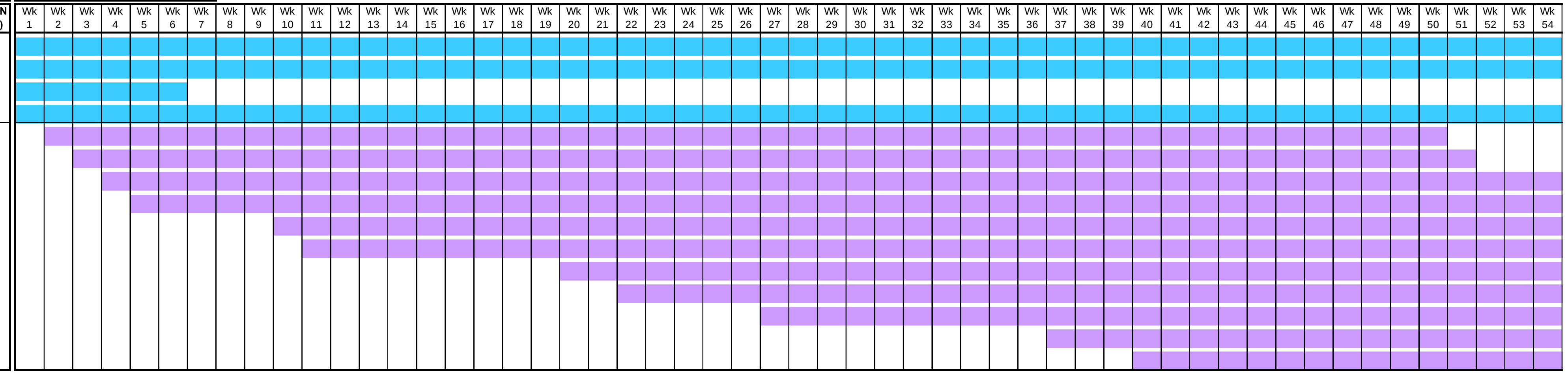
FIGURE 19
CONSTRUCTION SCHEDULE FOR 20 MILE SECTION OF ±600kV DC TRANSMISSION LINE

SECTION 1 - NORTHERN TERMINAL - NORTHEASTERN UTAH

TOTAL DURATION: 111 weeks

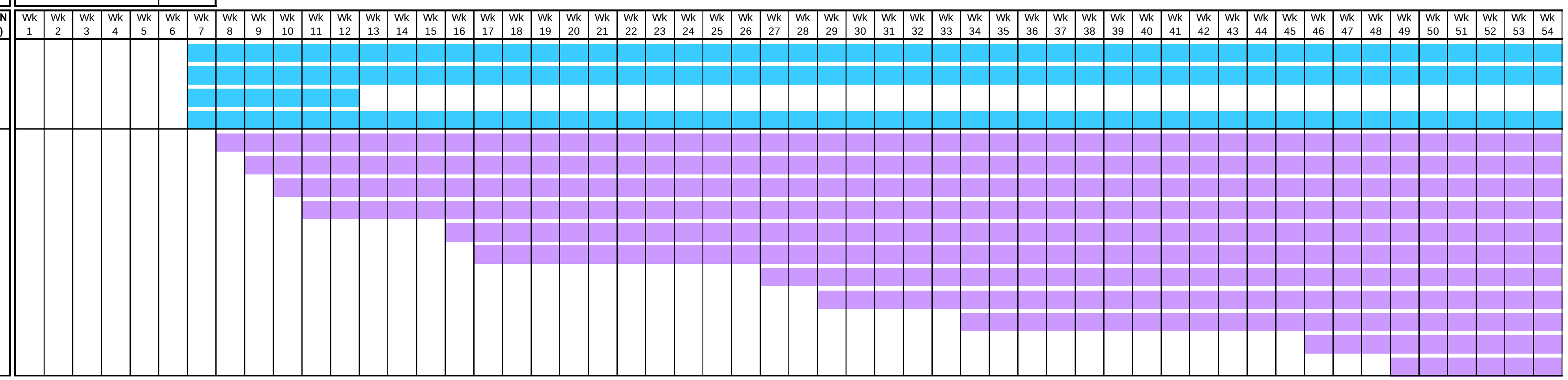
TASK	DURATION (WEEKS)
CONSTRUCTION MANAGEMENT / ENGINEERING SUPPORT / ADMINISTRATION	111
INSPECTION	109
MOBILIZE CONTRACTOR	6
RECEIVE / HANDLE MATERIALS	109
SURVEY / STAKE ACCESS ROADS & STRUCTURE PADS	49
CONSTRUCT ACCESS ROADS AND / OR STRUCTURE PADS	49
GEOLOGICAL INVESTIGATIONS	56
SURVEY / STAKE STRUCTURE LOCATIONS	56
EXCAVATE HOLES FOR SELF SUPPORTING LATTICE STRUCTURE	67
INSTALL FOUNDATIONS FOR SELF SUPPORTING LATTICE STRUCTURE	67
HAUL MATERIALS FOR SELF SUPPORTING LATTICE STRUCTURE	60
ASSEMBLE SELF SUPPORTING LATTICE STRUCTURE	60
ERECT SELF SUPPORTING LATTICE STRUCTURE	70
WIRE INSTALLATION	61
FINAL CLEAN UP / RECLAMATION / RESTORATION	70



SECTION 2 - NORTHEASTERN UTAH - WEST CENTRAL UTAH

TOTAL DURATION: 131 weeks

TASK	DURATION (WEEKS)
CONSTRUCTION MANAGEMENT / ENGINEERING SUPPORT / ADMINISTRATION	131
INSPECTION	129
MOBILIZE CONTRACTOR	6
RECEIVE / HANDLE MATERIALS	129
SURVEY / STAKE ACCESS ROADS & STRUCTURE PADS	60
CONSTRUCT ACCESS ROADS AND / OR STRUCTURE PADS	60
GEOLOGICAL INVESTIGATIONS	69
SURVEY / STAKE STRUCTURE LOCATIONS	69
EXCAVATE HOLES FOR SELF SUPPORTING LATTICE STRUCTURE	83
INSTALL FOUNDATIONS FOR SELF SUPPORTING LATTICE STRUCTURE	83
HAUL MATERIALS FOR SELF SUPPORTING LATTICE STRUCTURE	75
ASSEMBLE SELF SUPPORTING LATTICE STRUCTURE	75
ERECT SELF SUPPORTING LATTICE STRUCTURE	87
WIRE INSTALLATION	76
FINAL CLEAN UP / RECLAMATION / RESTORATION	87



SECTION 3 - WEST CENTRAL UTAH - SOUTHERN TERMINAL

TOTAL DURATION: 120 weeks

TASK	DURATION (WEEKS)
CONSTRUCTION MANAGEMENT / ENGINEERING SUPPORT / ADMINISTRATION	120
INSPECTION	118
MOBILIZE CONTRACTOR	6
RECEIVE / HANDLE MATERIALS	118
SURVEY / STAKE ACCESS ROADS & STRUCTURE PADS	56
CONSTRUCT ACCESS ROADS AND / OR STRUCTURE PADS	56
GEOLOGICAL INVESTIGATIONS	64
SURVEY / STAKE STRUCTURE LOCATIONS	64
EXCAVATE HOLES FOR SELF SUPPORTING LATTICE STRUCTURE	75
INSTALL FOUNDATIONS FOR SELF SUPPORTING LATTICE STRUCTURE	75
HAUL MATERIALS FOR SELF SUPPORTING LATTICE STRUCTURE	70
ASSEMBLE SELF SUPPORTING LATTICE STRUCTURE	70
ERECT SELF SUPPORTING LATTICE STRUCTURE	80
WIRE INSTALLATION	70
FINAL CLEAN UP / RECLAMATION / RESTORATION	80

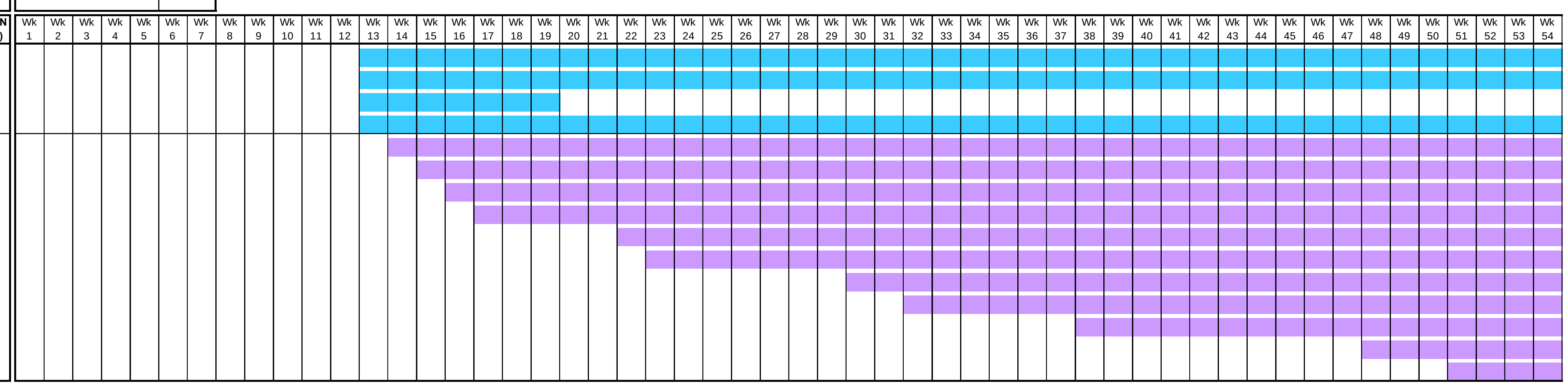


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FIGURE 20

CONSTRUCTION SCHEDULE FOR ±600kV DC TRANSMISSION LINE BY SEGMENT

SHEET 1

SECTION 1 - NORTHERN TERMINAL - NORTHEASTERN UTAH

TOTAL DURATION: 111 weeks

TASK	DURATION (WEEKS)
CONSTRUCTION MANAGEMENT / ENGINEERING SUPPORT / ADMINISTRATION	111
INSPECTION	109
MOBILIZE CONTRACTOR	6
RECEIVE / HANDLE MATERIALS	109
SURVEY / STAKE ACCESS ROADS & STRUCTURE PADS	49
CONSTRUCT ACCESS ROADS AND / OR STRUCTURE PADS	49
GEOLOGICAL INVESTIGATIONS	56
SURVEY / STAKE STRUCTURE LOCATIONS	56
EXCAVATE HOLES FOR SELF SUPPORTING LATTICE STRUCTURE	67
INSTALL FOUNDATIONS FOR SELF SUPPORTING LATTICE STRUCTURE	67
HAUL MATERIALS FOR SELF SUPPORTING LATTICE STRUCTURE	60
ASSEMBLE SELF SUPPORTING LATTICE STRUCTURE	60
ERECT SELF SUPPORTING LATTICE STRUCTURE	70
WIRE INSTALLATION	61
FINAL CLEAN UP / RECLAMATION / RESTORATION	70

SECTION 2 - NORTHEASTERN UTAH - WEST CENTRAL UTAH

TOTAL DURATION: 131 weeks

TASK	DURATION (WEEKS)
CONSTRUCTION MANAGEMENT / ENGINEERING SUPPORT / ADMINISTRATION	131
INSPECTION	129
MOBILIZE CONTRACTOR	6
RECEIVE / HANDLE MATERIALS	129
SURVEY / STAKE ACCESS ROADS & STRUCTURE PADS	60
CONSTRUCT ACCESS ROADS AND / OR STRUCTURE PADS	60
GEOLOGICAL INVESTIGATIONS	69
SURVEY / STAKE STRUCTURE LOCATIONS	69
EXCAVATE HOLES FOR SELF SUPPORTING LATTICE STRUCTURE	83
INSTALL FOUNDATIONS FOR SELF SUPPORTING LATTICE STRUCTURE	83
HAUL MATERIALS FOR SELF SUPPORTING LATTICE STRUCTURE	75
ASSEMBLE SELF SUPPORTING LATTICE STRUCTURE	75
ERECT SELF SUPPORTING LATTICE STRUCTURE	87
WIRE INSTALLATION	76
FINAL CLEAN UP / RECLAMATION / RESTORATION	87

SECTION 3 - WEST CENTRAL UTAH - SOUTHERN TERMINAL

TOTAL DURATION: 120 weeks

TASK	DURATION (WEEKS)
CONSTRUCTION MANAGEMENT / ENGINEERING SUPPORT / ADMINISTRATION	120
INSPECTION	118
MOBILIZE CONTRACTOR	6
RECEIVE / HANDLE MATERIALS	118
SURVEY / STAKE ACCESS ROADS & STRUCTURE PADS	56
CONSTRUCT ACCESS ROADS AND / OR STRUCTURE PADS	56
GEOLOGICAL INVESTIGATIONS	64
SURVEY / STAKE STRUCTURE LOCATIONS	64
EXCAVATE HOLES FOR SELF SUPPORTING LATTICE STRUCTURE	75
INSTALL FOUNDATIONS FOR SELF SUPPORTING LATTICE STRUCTURE	75
HAUL MATERIALS FOR SELF SUPPORTING LATTICE STRUCTURE	70
ASSEMBLE SELF SUPPORTING LATTICE STRUCTURE	70
ERECT SELF SUPPORTING LATTICE STRUCTURE	80
WIRE INSTALLATION	70
FINAL CLEAN UP / RECLAMATION / RESTORATION	80

SECTION 1 - NORTHERN TERMINAL - NORTHEASTERN UTAH

TOTAL DURATION 111 weeks

TASK	DURATION (WEEKS)	Wk 109	Wk 110	Wk 111	Wk 112	Wk 113	Wk 114	Wk 115	Wk 116	Wk 117	Wk 118	Wk 119	Wk 120	Wk 121	Wk 122	Wk 123	Wk 124	Wk 125	Wk 126	Wk 127	Wk 128	Wk 129	Wk 130	Wk 131	Wk 132	Wk 133	Wk 134	Wk 135	Wk 136	Wk 137	Wk 138	Wk 139	Wk 140
CONSTRUCTION MANAGEMENT / ENGINEERING SUPPORT / ADMINISTRATION	111																																
INSPECTION	109																																
MOBILIZE CONTRACTOR	6																																
RECEIVE / HANDLE MATERIALS	109																																
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SURVEY / STAKE STRUCTURE LOCATIONS	56																																
EXCAVATE HOLES FOR SELF SUPPORTING LATTICE STRUCTURE	67																																
INSTALL FOUNDATIONS FOR SELF SUPPORTING LATTICE STRUCTURE	67																																
HAUL MATERIALS FOR SELF SUPPORTING LATTICE STRUCTURE	60																																
ASSEMBLE SELF SUPPORTING LATTICE STRUCTURE	60																																
ERECT SELF SUPPORTING LATTICE STRUCTURE	70																																
WIRE INSTALLATION	61																																
FINAL CLEAN UP / RECLAMATION / RESTORATION	70																																

SECTION 2 - NORTHEASTERN UTAH - WEST CENTRAL UTAH

TOTAL DURATION 131 weeks

TASK	DURATION (WEEKS)	Wk 109	Wk 110	Wk 111	Wk 112	Wk 113	Wk 114	Wk 115	Wk 116	Wk 117	Wk 118	Wk 119	Wk 120	Wk 121	Wk 122	Wk 123	Wk 124	Wk 125	Wk 126	Wk 127	Wk 128	Wk 129	Wk 130	Wk 131	Wk 132	Wk 133	Wk 134	Wk 135	Wk 136	Wk 137	Wk 138	Wk 139	Wk 140
CONSTRUCTION MANAGEMENT / ENGINEERING SUPPORT / ADMINISTRATION	131																																
INSPECTION	129																																
MOBILIZE CONTRACTOR	6																																
RECEIVE / HANDLE MATERIALS	129																																
SURVEY / STAKE ACCESS ROADS & STRUCTURE PADS	60																																
CONSTRUCT ACCESS ROADS AND / OR STRUCTURE PADS	60																																
GEOLOGICAL INVESTIGATIONS	69																																
SURVEY / STAKE STRUCTURE LOCATIONS	69																																
EXCAVATE HOLES FOR SELF SUPPORTING LATTICE STRUCTURE	83																																
INSTALL FOUNDATIONS FOR SELF SUPPORTING LATTICE STRUCTURE	83																																
HAUL MATERIALS FOR SELF SUPPORTING LATTICE STRUCTURE	75																																
ASSEMBLE SELF SUPPORTING LATTICE STRUCTURE	75																																
ERECT SELF SUPPORTING LATTICE STRUCTURE	87																																
WIRE INSTALLATION	76																																
FINAL CLEAN UP / RECLAMATION / RESTORATION	87																																

SECTION 3 - WEST CENTRAL UTAH - SOUTHERN TERMINAL

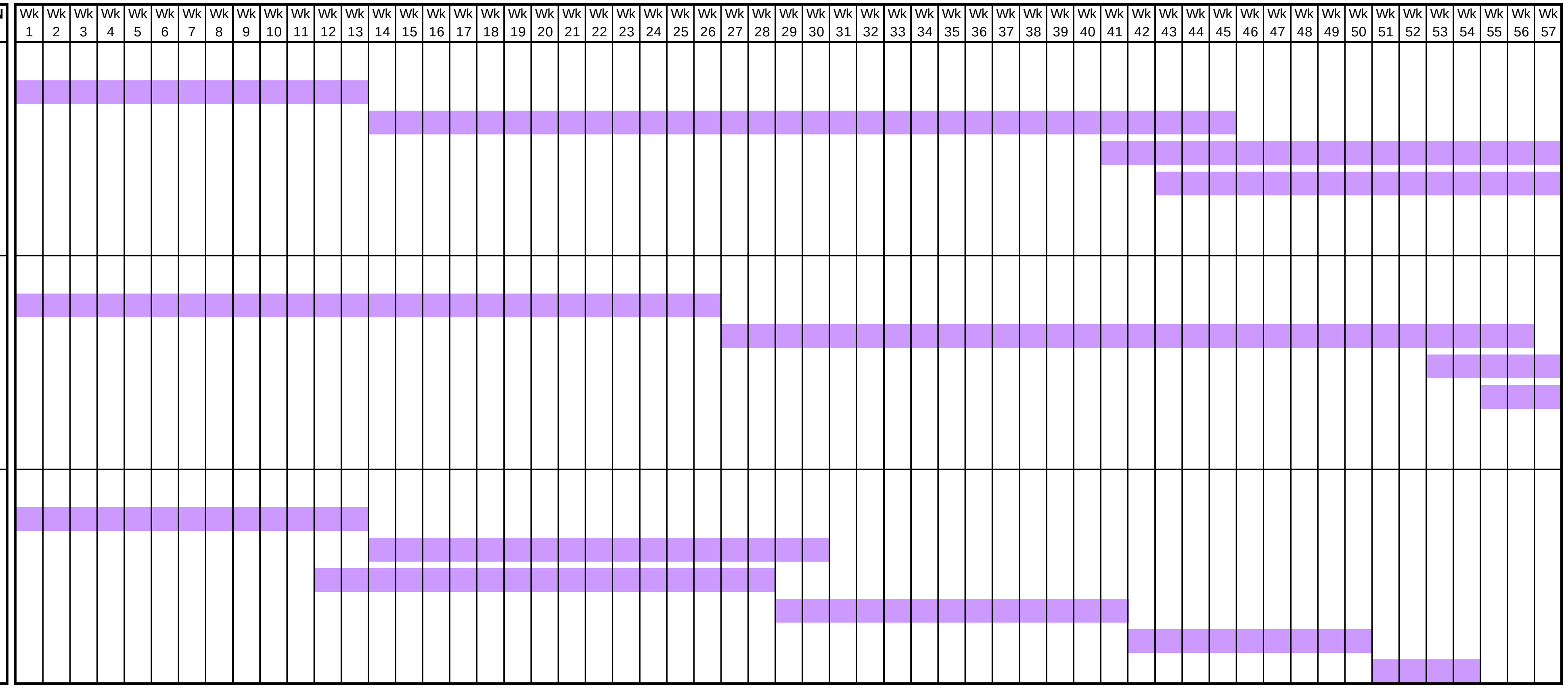
TOTAL DURATION 120 weeks

TASK	DURATION (WEEKS)	Wk 109	Wk 110	Wk 111	Wk 112	Wk 113	Wk 114	Wk 115	Wk 116	Wk 117	Wk 118	Wk 119	Wk 120	Wk 121	Wk 122	Wk 123	Wk 124	Wk 125	Wk 126	Wk 127	Wk 128	Wk 129	Wk 130	Wk 131	Wk 132	Wk 133	Wk 134	Wk 135	Wk 136	Wk 137	Wk 138	Wk 139	Wk 140
CONSTRUCTION MANAGEMENT / ENGINEERING SUPPORT / ADMINISTRATION	120																																
INSPECTION	118																																
MOBILIZE CONTRACTOR	6																																
RECEIVE / HANDLE MATERIALS	118																																
SURVEY / STAKE ACCESS ROADS & STRUCTURE PADS	56																																
CONSTRUCT ACCESS ROADS AND / OR STRUCTURE PADS	56																																
GEOLOGICAL INVESTIGATIONS	64																																
SURVEY / STAKE STRUCTURE LOCATIONS	64																																
EXCAVATE HOLES FOR SELF SUPPORTING LATTICE STRUCTURE	75																																
INSTALL FOUNDATIONS FOR SELF SUPPORTING LATTICE STRUCTURE	75																																
HAUL MATERIALS FOR SELF SUPPORTING LATTICE STRUCTURE	70																																
ASSEMBLE SELF SUPPORTING LATTICE STRUCTURE	70																																
ERECT SELF SUPPORTING LATTICE STRUCTURE	80																																
WIRE INSTALLATION	70																																
FINAL CLEAN UP / RECLAMATION / RESTORATION	80																																

NORTHERN TERMINAL

TOTAL DURATION	111 week

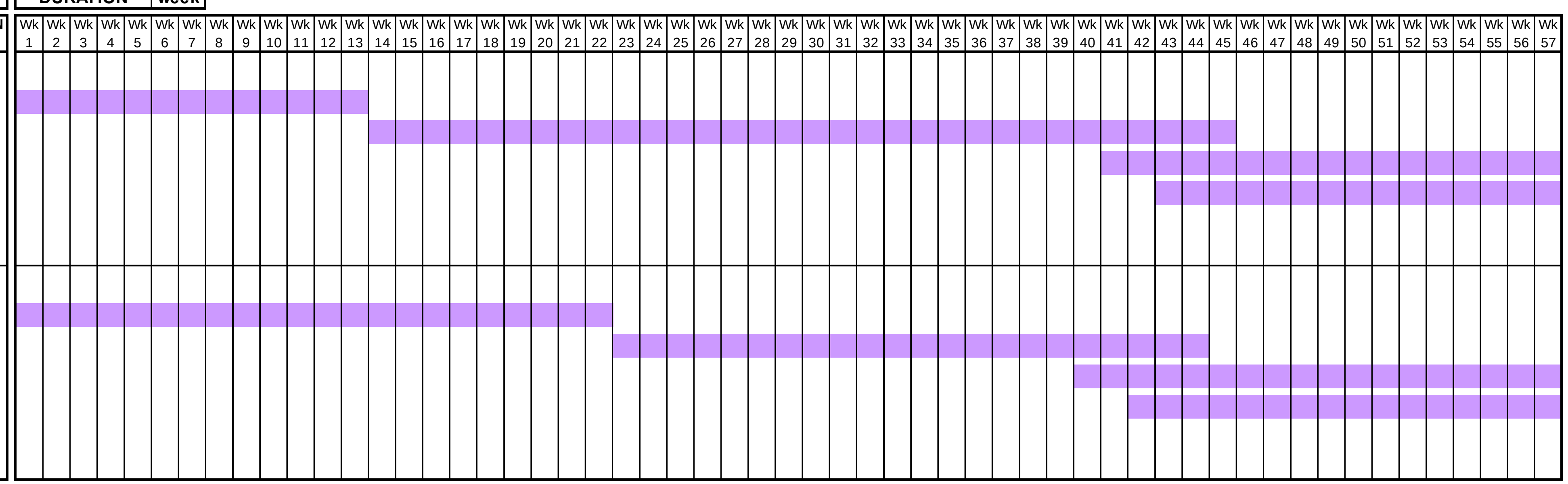
TASK	DURATION (WEEKS)
AC/DC CONVERTER STATION	
SITE GRADING	13
BELOW-GRADE WORK (FOUNDATIONS, CONDUIT, GROUNDING)	32
BUILDING CONSTRUCTION	35
EQUIPMENT INSTALLATION	39
EQUIPMENT TESTING	21
OPERATIONAL	9
500 kV AC SUBSTATION	
SITE GRADING	26
BELOW-GRADE WORK (FOUNDATIONS, CONDUIT, GROUNDING)	30
BUILDING CONSTRUCTION	34
EQUIPMENT INSTALLATION	30
EQUIPMENT TESTING	17
OPERATIONAL	7
230 kV AC SUBSTATION	
SITE GRADING	13
BELOW-GRADE WORK (FOUNDATIONS, CONDUIT, GROUNDING)	17
BUILDING CONSTRUCTION	17
EQUIPMENT INSTALLATION	13
EQUIPMENT TESTING	9
OPERATIONAL	4



SOUTHERN TERMINAL

TOTAL DURATION	111 week

TASK	DURATION (WEEKS)
AC/DC CONVERTER STATION	
SITE GRADING	13
BELOW-GRADE WORK (FOUNDATIONS, CONDUIT, GROUNDING)	32
BUILDING CONSTRUCTION	35
EQUIPMENT INSTALLATION	39
EQUIPMENT TESTING	21
OPERATIONAL	9
500 kV AC SUBSTATION	
SITE GRADING	22
BELOW-GRADE WORK (FOUNDATIONS, CONDUIT, GROUNDING)	22
BUILDING CONSTRUCTION	26
EQUIPMENT INSTALLATION	22
EQUIPMENT TESTING	13
OPERATIONAL	6



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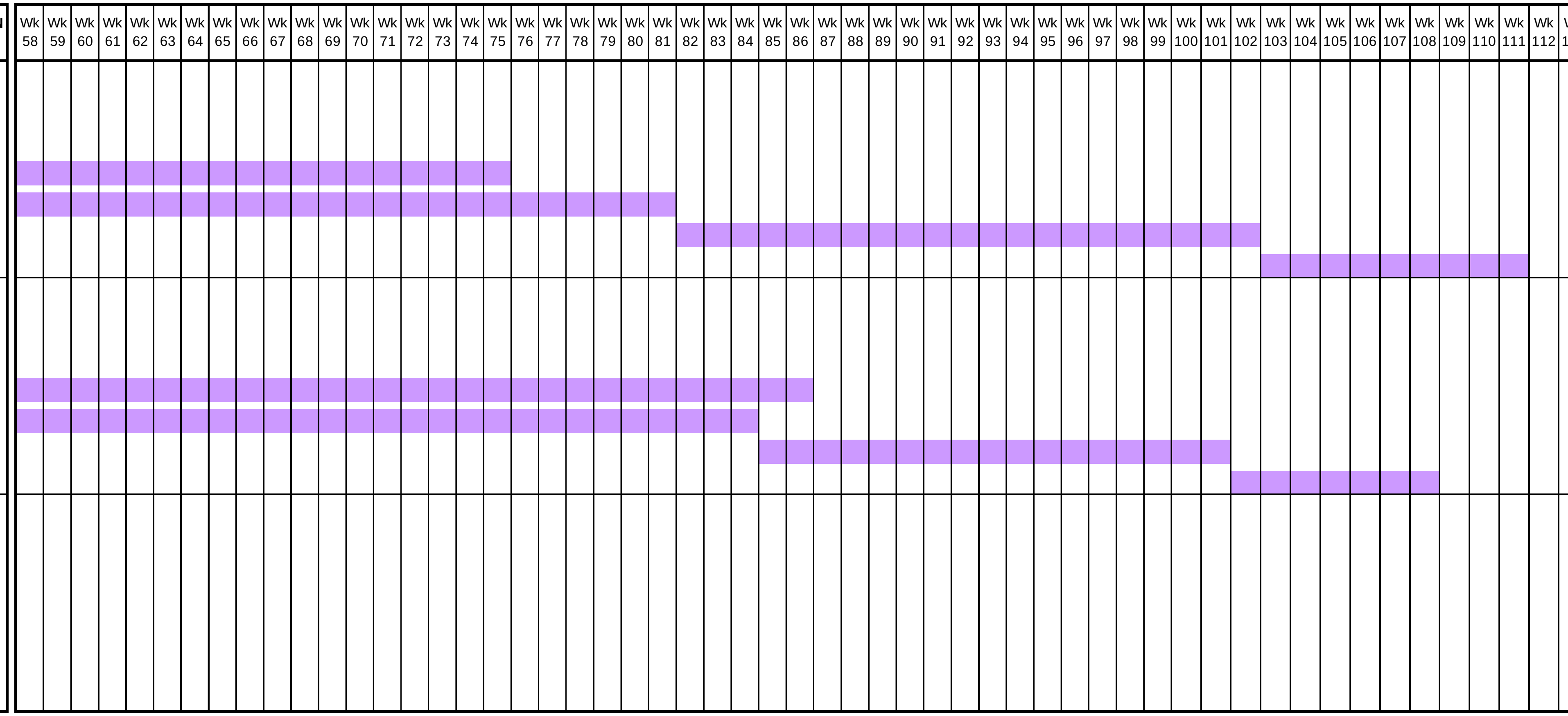
TRANSWEST EXPRESS TRANSMISSION PROJECT
FIGURE 21
CONSTRUCTION SCHEDULE FOR
NORTHERN & SOUTHERN TERMINALS
SHEET 1

NORTHERN TERMINAL

TOTAL DURATION: 111 week

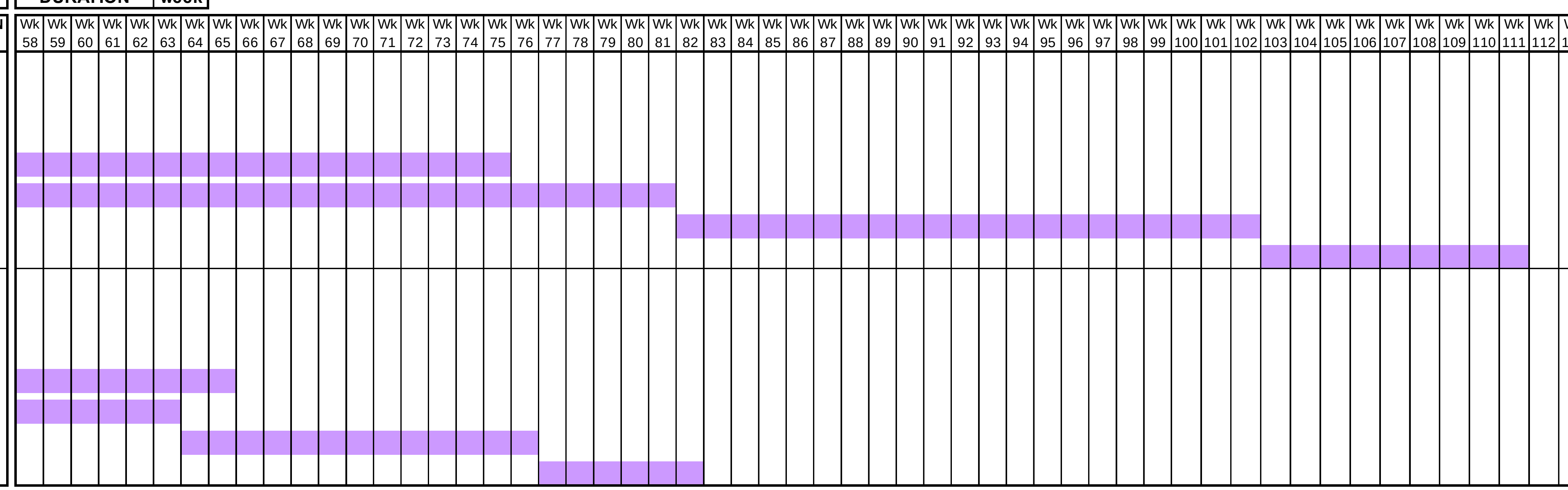
TASK	DURATION (WEEKS)
AC/DC CONVERTER STATION	
SITE GRADING	13
BELOW-GRADE WORK (FOUNDATIONS, CONDUIT, GROUNDING)	32
BUILDING CONSTRUCTION	35
EQUIPMENT INSTALLATION	39
EQUIPMENT TESTING	21
OPERATIONAL	9
500 kV AC SUBSTATION	
SITE GRADING	26
BELOW-GRADE WORK (FOUNDATIONS, CONDUIT, GROUNDING)	30
BUILDING CONSTRUCTION	34
EQUIPMENT INSTALLATION	30
EQUIPMENT TESTING	17
OPERATIONAL	7
230 kV AC SUBSTATION	
SITE GRADING	13
BELOW-GRADE WORK (FOUNDATIONS, CONDUIT, GROUNDING)	17
BUILDING CONSTRUCTION	17
EQUIPMENT INSTALLATION	13
EQUIPMENT TESTING	9
OPERATIONAL	4



SOUTHERN TERMINAL

TOTAL DURATION: 111 week

TASK	DURATION (WEEKS)
AC/DC CONVERTER STATION	
SITE GRADING	13
BELOW-GRADE WORK (FOUNDATIONS, CONDUIT, GROUNDING)	32
BUILDING CONSTRUCTION	35
EQUIPMENT INSTALLATION	39
EQUIPMENT TESTING	21
OPERATIONAL	9
500 kV AC SUBSTATION	
SITE GRADING	22
BELOW-GRADE WORK (FOUNDATIONS, CONDUIT, GROUNDING)	22
BUILDING CONSTRUCTION	26
EQUIPMENT INSTALLATION	22
EQUIPMENT TESTING	13
OPERATIONAL	6



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TRANSWEST EXPRESS TRANSMISSION PROJECT
FIGURE 21
CONSTRUCTION SCHEDULE FOR NORTHERN & SOUTHERN TERMINALS
SHEET 2

CONSTRUCTION SCHEDULE FOR ONE GROUND ELECTRODE LOCATION

TASK	DURATION (WEEKS)
SITE GRADING	3
DRILLING 60 WELLS	8
EXCAVATE CABLE TRENCHES	6
BUILD CONCRETE CABLE TRENCHES	10
INSTALL ELECTRODE ELEMENTS	8
INSTALL LV CABLES, SWITCHES	4
INSTALL TEMPERATURE & CURRENT TRANSDUCERS, WIRING	2
BUILD CONTROL / COMMUNICATION BUILDING & FENCED AREA	8
INSTALL SITE COMMUNICATIONS EQUIPMENT, SCADA	4
ELECTRODE COMMISSIONING*	8

*PERFORMED AFTER CONVERTER STATIONS ARE FUNCTIONAL

CONSTRUCTION SCHEDULE FOR LOW VOLTAGE TRANSMISSION LINE (10 MILES ASSUMED)

TASK	DURATION (WEEKS)
SURVEY / STAKE ACCESS ROADS & STRUCTURE PADS	3
CONSTRUCT ACCESS ROADS AND / OR STRUCTURE PADS	4
FOUNDATION EXCAVATION	3
HAUL STRUCTURES	3
INSTALL STRUCTURES	4
INSTALL WIRES	2
FINAL CLEAN UP / RECLAMATION / RESTORATION	4

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TRANSWEST EXPRESS TRANSMISSION PROJECT
FIGURE 22
CONSTRUCTION SCHEDULE FOR GROUND ELECTRODE FACILITIES

5.8.2 Construction Workforce

The proposed TWE Project will be constructed by contract personnel, with the Applicant responsible for Project management, Project administration, and inspection. The construction workforce will consist of laborers, craftsmen, supervisory personnel, support personnel, and construction management personnel who will perform the construction tasks. Estimated construction workforce requirements by major activity are summarized in Tables 10 and 11.

Table 10 identifies the estimated personnel and equipment that is required for each of the three transmission line spreads. The total estimated number of construction personnel for construction of the entire transmission line is 630 people. Table 11 identifies the estimated personnel and equipment that is required for each of the two terminals and each of the two ground electrodes. The total estimated number of construction personnel for construction of both terminals and both ground electrodes is 360 people. The total estimated workforce for the complete proposed Project is approximately 1,000 people.

Construction will generally occur between 7 a.m. and 7 p.m., Monday through Saturday. Additional hours may be necessary to make up schedule deficiencies or to complete critical construction activities.

Temporary work camps are not expected to be necessary for the construction of the TWE Project. Variables considered in determining if work camps would be required are:

- The total distance between living facilities for construction workers and designated work areas. A general one-way travel time of two hours may be considered as a limit in determining if temporary work camps are necessary.
- Workers' Union wage agreement regarding the driving time one-way (to worksite) or round trip (to/from worksite). If the agreement allows for driving time then the camp consideration may not be required.
- The ability of existing communities to provide housing for workers or to make improvements to meet the workers' accommodation demands.
- Socioeconomic impacts on communities along the route with or without the work camps.
- Economic feasibility of permitting a work camp.
- Service life of the work camps and the restoration requirements after tear down.

The TWE Project does not appear to have areas that are more than 50 miles (on paved roads) from the ROW to existing communities or towns. The average travel distance for the Project is approximately 15 miles. The populations of these towns indicate their capability to handle the housing and/or accommodation demands of the construction workers. It should be noted during typical transmission line construction, the entire work force and support personnel generally do not all work in one area at any given time. Generally one or more activities are completed and the associated crews move to a new location prior to all the other activities becoming fully operational in that area.

5.8.3 Construction Equipment

Equipment required for construction of the TWE Project transmission lines, terminals and ground electrode facilities will include, but is not limited to, that listed in Tables 10 and 11.

TABLE 10 ESTIMATED PERSONNEL AND EQUIPMENT FOR TRANSMISSION LINE CONSTRUCTION FOR EACH SPREAD

ACTIVITY	PEOPLE	QUANTITY	TYPE OF EQUIPMENT	TRACK OR RUBBER TIRES
Survey Crew	6	2	Pickup trucks	Rubber
		2	ATV	Rubber
Geologic/ Geotechnical Investigations	6	2	Pickup trucks, 4-wheel drive	Rubber
		1	ATV	Rubber
		2	Rubber tire drill trucks (2-ton)	Either (should change description)
Road Construction Crew	6	2	Dozer (D-8 Cat or equivalent)	Track
		1	Motor grader	Rubber
		1	Pickup truck	Rubber
		2	Carry alls	Rubber
		1	Water truck (for construction and maintenance)	Rubber
		1	Dump truck	Rubber
		1	Front end loader	Either
		1	Diesel tractor w/lowboy	Rubber
Foundation Installation Crew	26	4	Hole diggers	Either
		2	Dozers	Either
		2	Trucks (2-ton)	Rubber
		2	Trucks, flatbed, w/boom (5-ton)	Rubber
		4	Concrete trucks	Rubber
		2	Dump trucks	Rubber
		2	Diesel tractors (equipment hauling)	Rubber
		3	Pickup trucks	Rubber
		1	Mechanics truck	Rubber
		1	Water truck	Rubber
		1	Carry all	Rubber
		2	Cranes, all terrain (35-ton)	Either
		1	Front end loader	Either
		1	Backhoe, w/bucket	Rubber
		1	Wagon drill	Either
		3	Equipment-tool trailers	Rubber
Anchor Installation	20	2	Pickup trucks	Rubber
		4	Carry alls	Rubber

ACTIVITY	PEOPLE	QUANTITY	TYPE OF EQUIPMENT	TRACK OR RUBBER TIRES
		1	Truck, flatbed (2-ton)	Rubber
		2	Trucks, flatbed, w/boom (5-ton)	Rubber
		1	Dump truck	Rubber
		1	Water truck	Rubber
		2	Concrete trucks	Rubber
		1	Mechanics truck	Rubber
		2	Diesel tractors, w/lowboy	Rubber
		2	Dozers	Track
		1	Loader, front end	Either
		3	Backhoes, w/bucket	Either
		3	Wagon drills	Either
		3	Cranes, all terrain (35-ton)	Either
Structure Steel Haul Crew	8	1	Equipment-tool trailer	Rubber
		2	Diesel tractors (steel hauling)	Rubber
		1	Pickup truck	Rubber
		1	Truck, flatbed (2-ton)	Rubber
		1	Carry all	Rubber
		5	Cranes, all terrain (35-ton)	Either
		3	Fork lifts	Rubber
Structure Assembly Crews 8-9 Crews	72	2	Pickup trucks	Rubber
		10	Carry alls	Rubber
		5	Cranes, all terrain (35-ton)	Either
		1	Water truck	Rubber
		5	Air compressors	Rubber
		2	Trucks (2-ton)	Rubber
		1	Mechanics truck	Rubber
		2	Tool-equipment trailers	Rubber
Structure Erection Crews 1-2 Crews	20	2	Cranes (120 – 300-ton)	Either
		2	Trucks (2-ton)	Rubber
		2	Pickup trucks	Rubber
		5	Carry alls	Rubber
		1	Mechanics truck	Rubber
		2	Air compressors	Rubber

ACTIVITY	PEOPLE	QUANTITY	TYPE OF EQUIPMENT	TRACK OR RUBBER TIRES
		1	Tool-equipment trailer	Rubber
Wire Installation Crew	36	6	Wire reel trailers	Rubber
		4	Haul trailers	Rubber
		4	Diesel tractors	Rubber
		4	Cranes (2) 20-ton, (2) 30-ton	Either
		5	Trucks, flatbed, w/bucket (5 -ton)	Rubber
		4	Pickup trucks	Rubber
		2	Splicing trucks	Rubber
		2	3-drum pullers (one medium, one heavy)	Rubber
		2	Single drum pullers (large)	Rubber
		1	Backhoe, w/bucket	Rubber
		1	Water truck	Rubber
		2	Trucks, flatbed (2-ton)	Rubber
		4	Double bull-wheel tensioner (two light and two heavy)	Rubber
		2	Sagging equipment (D-8 Cat)	Track
		6	Carry alls	Rubber
		2	Static wire reel trailers	Rubber
		3	Tool-equipment trailers	Rubber
		2	Mechanics trucks	Rubber
Clean-up Crew	4	1	Truck, flatbed, w/bucket (5-ton)	Rubber
		1	Pickup truck	Rubber
		1	Carry all	Rubber
Road Rehabilitation Crew (ROW Restoration)	6	1	Dozer (D-8 Cat or equivalent)	Track
		1	Front end loader w/bucket	Either
		1	Backhoe, w/bucket	Either
		1	Diesel tractor, w/lowboy	Rubber
		1	Seeding/harrowing equipment, w/tractor	Either
		1	Motor grader	Rubber
		1	Pickup truck	Rubber
		1	Dump truck	Rubber
		1	Carry all	Rubber

Estimated maximum personnel required for all transmission line tasks including maintenance, management, and quality control personnel = 210 for each of the three spreads.

TABLE 11 ESTIMATED PERSONNEL AND EQUIPMENT FOR EACH TERMINAL AND GROUND ELECTRODE FACILITIES

ACTIVITY	PEOPLE	QUANTITY	TYPE OF EQUIPMENT	TRACK OR RUBBER TIRE
Survey Crew	4	2	Pickup trucks	Rubber
Site Management Crew	10-12	4	Office trailers	Rubber
		4	Pickups	Rubber
		4	Generators	Rubber
Site Development – Civil Work Crew	30-35	4	Scrapers	Rubber
		2	Dozers (ripper)	Track
		2	Motor graders	Rubber
		2	Roller compactors	Rubber
		2	Excavators	Either
		4	Dump trucks	Rubber
		3	Water trucks	Rubber
		1	Mechanics truck	Rubber
		1	Fuel truck	Rubber
		2	Pickup trucks	Rubber
		6	Carry alls	Rubber
Fence Installation Crew	10-20	1	Pickup truck	Rubber
		1	Boom truck	Rubber
		2	Carry alls	Rubber
		1	Backhoe	Either
		1	Concrete truck	Rubber
		1	Reel stand truck	Rubber
		2	Bobcats	Either
Equipment Footings Installation Crew	24-30	2	Hole diggers	Either
		2	Boom trucks	Rubber
		1	Excavator	Either
		3	Concrete trucks	Rubber
		1	Dump truck	Rubber
		1	Roller compactor	Rubber
		2	Plate compactors	----------
		1	Backhoe	Either
		2	Bobcats	Either
		1	Mechanics truck	Rubber

ACTIVITY	PEOPLE	QUANTITY	TYPE OF EQUIPMENT	TRACK OR RUBBER TIRE
		1	Fuel truck	Rubber
		1	Water truck	Rubber
		2	Pickup trucks	Rubber
		4	Carry alls	Rubber
Cable Trench, Conduits, and Station Grounding Crew	12-16	2	Trenchers	Either
		2	Dozers (ripper)	Track
		2	Roller compactors	Rubber
		2	Plate compactors	----------
		2	Excavators	Either
		1	Boom truck	Rubber
		3	Pickup trucks	Rubber
		2	Flatbed trucks	Rubber
		4	Carry alls	Rubber
		1	Air compressor	Rubber
		1	Backhoe	Either
		1	Mechanics truck	Rubber
		1	Fuel truck	Rubber
		1	Dump truck	Rubber
		1	Reel stand truck	Rubber
Steel Structure and Bus Installation Crew, Converter Valve Hall, Ancillary Buildings Construction Crew, Equipment Assembly and Erection Crew	16-24	2	Cranes, RT	Either
		2	High capacity cranes	Either
		4	Boom trucks	Either
		6	Manlifts	Either
		4	Welder trucks	Rubber
		2	Carry alls	Rubber
		3	Pickup trucks	Rubber
		2	Flatbed trucks	Rubber
		1	Mechanics truck	Rubber
		4	Vans	Rubber
		2	Flatbed trucks	Rubber
Control Building and Wiring Crew	20-24	2	Boom trucks	Rubber
		4	Manlifts	Either
		3	Wire pullers-small	Rubber
		2	Reel stand trucks/trailers	Rubber

ACTIVITY	PEOPLE	QUANTITY	TYPE OF EQUIPMENT	TRACK OR RUBBER TIRE
		4	Vans	Rubber
		4	Pickup trucks	Rubber
		2	Carry alls	Rubber
		1	Splicing van	Rubber
		2	Concrete trucks	Rubber
		1	Bobcat	Either
		1	Trencher	Either
		2	Plate compactors	----------
Ground Electrode Construction Crew	12-18	2	Pickup trucks	Rubber
		1	Fuel truck	Rubber
		1	Water truck	Rubber
		2	Trenchers	Either
		2	Drill rigs	Either
		1	Boom truck	Rubber
		2	Flatbed trucks	Rubber
		1	Bobcat	Either
		1	Backhoe	Rubber
		1	Mechanics truck	Rubber
		1	Concrete trucks	Rubber
		1	Air compressor	Rubber

The above table reflects estimated personnel requirements, which may reach as high as 180 for each terminal, substation, and ground electrode construction, including maintenance, management, and quality control personnel.

6.0 OPERATION AND MAINTENANCE

The TWE Project ±600 kV DC, 500 kV AC and 230 kV AC transmission lines, terminals, substations, ground electrode facilities, communications system, and other ancillary facilities will comprise critical infrastructure of the Desert Southwest transmission systems and of the western U.S. electrical grid. Limiting the duration of unplanned outages, and planning for the use of live-line maintenance techniques to minimize the requirement for and duration of outages is an important part of the design, construction, and operation/maintenance requirements for this Project.

Regular inspection of transmission lines, terminals, substations, ground electrodes, and support systems is critical for safe, efficient, and economical operation of the Project. Regular ground and aerial inspections will be performed in accordance with the Applicant's established policies and procedures for transmission line inspection and maintenance (Western 2007). The TWE Project ±600 kV DC, 500 kV AC and 230 kV AC transmission lines, terminals, substations, ground electrode facilities, communications system, and other ancillary facilities will be inspected regularly for corrosion, equipment misalignment, loose fittings, vandalism, and other mechanical problems. The need for vegetation management on transmission line ROWs will also be determined during inspection patrols. A detailed Operations and Maintenance Plan is included in Appendix O.

This section includes a discussion of compatible uses, ROW safety requirements, inspection, maintenance and repair, emergency response and decommissioning practices.

6.1 Compatible Uses

Transmission lines are designed and constructed to meet or exceed the requirements of the National Electrical Safety Code. These standards provide for the safety and protection of landowners and their property, the public, and utility employees. After construction, compatible uses in the ROW will be considered and approved by TransWest, BLM or other land management agency depending on the land ownership.

For private lands, compatible uses are determined in accordance with the terms and conditions of the easement for the TWE Project with the property owner. Ranching and farming activities, gardening, recreational activities, and other uses are generally permitted in the easement as long as care is taken to prevent damage and maintain access to transmission line structures. No buildings or structures may be erected in the easement because they could impede the safe operation of the line or interfere with maintenance access. For safety reasons, pumps, wells, swimming pools, and flammables must not be placed in the easement area. Properly grounded and permitted irrigation systems are acceptable.

For public lands, BLM retains the right to require common use of a ROW, including subsurface and air space, and authorize use of the ROW for compatible uses (43 CFR §2805.15(b)). If BLM receives an application for a grant of land subject to TransWest's ROW Grant or near or adjacent to it, the BLM will notify TransWest in writing when it receives a grant application. BLM will consider TransWest's written recommendations as to how the proposed use affects the integrity of, or TransWest's ability to operate, its facilities. The notice will contain a time period within which TransWest must respond. The notice may also notify TransWest of additional opportunities to comment (43 CFR §2807.14).

Other federal and state agencies have their own rules and regulations concerning compatible uses of ROW. These rules and regulations as applicable will be incorporated into the terms and conditions of any special use permits, licenses or ROW issued for the TWE Project.

6.2 Right-of-Way Safety Requirements

The design, operation, and maintenance of the TWE Project will meet or exceed applicable criteria and requirements outlined by the FERC, WECC, NESC, and U.S. Department of Labor, Occupational Safety and Health Standards (OSHA) for the safety and protection of landowners, their property, and the general public. The transmission line will be protected with power circuit breakers and line relay protection equipment. If a conductor or component failure occurs, power will be automatically removed from the line. Lightning protection will be provided by overhead shield wires on the top of the line. Where vegetation presents a potential hazard, trees will be trimmed or cut to prevent accidental grounding contact with conductors.

The ±600 kV DC transmission line presents no risk of inducing line currents due to the static nature of the DC electrical and magnetic fields. In comparison, AC transmission systems can induce currents. As described below in Section 6.2.2, mitigation measures for AC inductive currents would be implemented for the AC transmission lines associated with the TWE Project or for Design Options 2 and 3.

6.2.1 Building and Fence Grounding

As part of the proposed TWE Project, short distances (five miles or less) of AC transmission lines will be constructed between the TWE Project substations and the existing and planned regional AC transmission system. In order to mitigate possible electric shock caused by electrostatic and electromagnetic AC induction, all buildings, fences, and other structures with metal surfaces located within 300 feet of the centerline of the ROW will be grounded to the mutual satisfaction of the parties involved. Typically, residential buildings located 300 feet or further from the centerline will not require grounding. Other buildings or structures outside of the ROW will be reviewed in accordance with the NESC to determine grounding requirements. All metal irrigation systems and fences that parallel the transmission line for distances of 500 feet or more, within 300 feet of the centerline will be grounded. All fences that cross under the transmission line also will be grounded. This procedure will be included in the construction specifications, and if grounding is required outside the ROW, agency and landowner consent will be obtained as necessary.

6.2.2 Induced Currents on Adjacent Facilities from AC Transmission Lines

Railroads

When a high voltage transmission line is located adjacent to a railroad, the tracks and signals may be subjected to electrical interference from electric and magnetic induction, conductive interference, and capacitive effects. Capacitive coupling results from the electric field from the transmission lines' conductors coupling with above ground conductive objects that are insulated from the earth, such as railroad tracks that are typically installed on high impedance ballast (the rock bed used to support the tracks). Electric and magnetic induction results from the magnetic field produced by the AC flowing in the conductors of the transmission line coupling with above ground and below ground metallic objects, such as railroad tracks and buried communications cables. If a transmission line is located in proximity and parallel to a railroad for long distances, these interference mechanisms can cause high currents and voltages to develop on the tracks and communication cables. If the AC interference is above certain thresholds, it can result in personal safety hazards, damage to signal and communication equipment, and false signaling of equipment.

These AC interference effects can be predicted with computer modeling. With proper planning and mitigation management, railroads and high voltage AC transmission lines can be safely co-located. The American Railway Engineering and Maintenance-of-Way Association has specifications for steady state rail-to-ground and equipment-to-ground voltage levels to ensure safety of railway operating personnel and the public. During fault conditions the safety criteria established by the ANSI/IEEE (Institute of Electrical and Electronics Engineers) Standard 80 (Guide for Safety in AC Substation Grounding) is used. In addition, railroad signal and equipment manufacturers provide AC interference voltage tolerances for proper signal operation so that nearby transmission facilities can be designed to ensure that AC interference levels do not exceed the acceptable safety criteria or equipment voltage tolerance.

Depending on AC interference levels, several mitigation methods may be used. These include increasing the distance between the transmission line and the railroad tracks, reducing the distance between insulated joints in track sections, grounding the railroad's tracks, and burying gradient control wires or matting.

For locations where the final alignment of an AC section of transmission line is in close proximity to a railroad for long distances, the Applicant, during detailed design, would perform computer modeling of potential AC interference effects to design and implement required mitigation to be installed prior to energizing the transmission line.

Pipelines

When a high voltage transmission line is located adjacent to a pipeline ROW, the pipeline may be subjected to electrical interference from electric and magnetic induction, conductive interference, and capacitive effects. Electric and magnetic induction is the primary effect of the high voltage AC transmission line on a buried pipeline during normal (steady-state) operation. This form of interference is due to the magnetic field produced by the AC current flowing in the conductors of the transmission line coupling with the metallic pipeline, inducing a voltage and associated current on the pipeline.

Conductive interference is a concern when a transmission line fault occurs in proximity to the pipeline, because it can cause AC currents to enter the pipeline at coating holidays (flaws in the coating) and produce a voltage gradient across the pipeline coating. Electric and magnetic effects are also a concern during a fault because the phase current in at least one phase (conductor) of the high voltage AC transmission line is elevated.

If these electrical interference effects are great enough during normal operation, then a potential shock hazard exists for anyone that touches an above ground part of the pipeline, such as a valve or cathodic protection test station. In addition, during normal operation, if the induced AC current density at a flaw in the pipeline coating is great enough, AC pipeline corrosion may occur. Lastly, damage to the pipeline coating can occur if the voltage between the pipeline and surrounding soil becomes excessive during a fault condition.

With proper planning and mitigation, pipelines and high voltage AC transmission lines can be safely co-located. The AC interference effects can be easily predicted with computer modeling. The National Association of Corrosion Engineers has standards that ensure that pipeline integrity would not be degraded nor personnel safety compromised because of AC interference from a transmission line constructed and operated adjacent to a pipeline.

Mitigation techniques for AC interference on pipelines include reducing the impedance of the transmission structure grounds, grounding the pipeline in conjunction with de-couplers, burying gradient control wires along the pipeline or burying ground mats under aboveground facilities (such as valves) and using dead fronts at test stations.

The TWE Project configured as an overhead AC transmission line can be located in its 250 foot ROW adjacent to the ROW for buried underground high pressure natural gas and other petroleum pipelines as long as proper grounding and cathodic protection systems are utilized for the pipeline. The TWE Project however, may not be sited in the same ROW as an underground pipeline regardless of whether the TWE Project is a DC or AC line. For locations where the final alignment of an AC section of transmission line is in close proximity to a pipeline, the Applicant, during detailed design, would ensure that computer modeling of AC interference effects is completed and that any required mitigation is designed and installed prior to energizing the transmission line.

6.3 Transmission Line Maintenance

Inspection of the entire transmission line system will be conducted semi-annually. Aerial inspection will be conducted by helicopter semi-annually and will require two or three crew members, including the pilot. Detailed ground inspections will take place on an annual basis. Ground inspection would use 4x4 trucks or 4x4 ATVs for all structures with access roads. For structures in areas without permanent access roads, ground inspection will be on foot or by other approved means. The inspector would assess the condition of the transmission line and hardware to determine if any components need to be repaired or replaced, or if other conditions exist that require maintenance or modification activities. The inspector would also note any unauthorized encroachments and trash dumping on the ROW that could constitute a safety hazard. The inspector would access each of the structure locations along each line and use binoculars and spotting scopes to perform this inspection.

If during transmission line maintenance and monitoring, it is determined that new or reconstruction activities should be implemented, the Applicant will notify the appropriate land management agency or private landowner.

Dust control during maintenance of the transmission line will be managed the same as during construction.

6.3.1 Routine Maintenance and Repairs

Routine maintenance activities are ordinary maintenance tasks that have historically been performed and are regularly carried out on a routine basis. The work performed is typically repair or replacement of individual components (no new ground disturbance), performed by relatively small crews using a minimum of equipment, and usually is conducted within a period from a few hours up to a few days. Work requires access to the damaged portion of the line to allow for a safe and efficient repair of the facility. Equipment required for this work may include four-wheel-drive trucks, material (flatbed) trucks, bucket trucks (low reach), boom trucks (high reach), or man lifts. This work is typically required due to issues found during inspections. For maintenance work near energized parts (insulators, hardware, conductors) and to the extent practicable, this work is scheduled for times when the transmission line can be taken out of service and de-energized. Typical items that may require periodic replacement on structures include insulators, hardware, or structural members. It is expected that these replacements would be required infrequently.

The Applicant plans to conduct maintenance on the ±600 kV DC, 500 kV AC and 230 kV AC transmission lines whenever practical in a de-energized condition. However, provisions for the use of live line maintenance techniques have been planned into the Project. Maintenance on the transmission lines can be completed safely using live line techniques thereby avoiding an outage to the critical transmission line infrastructure. High reach bucket trucks along with other equipment are used to conduct both de-energized and live-line maintenance activities. For the ±600 kV DC, 500 kV AC and 230 kV AC structures, this requires that adequate space be available at each structure site so that the high reach bucket truck can be positioned to one side or the other of the structure and reach up to or over the poles/phases to access the poles/phases or upper sets of wires (shield wires or OPGW) to perform the live-line maintenance procedures. To allow room at each structure for these activities in low slope areas a crane pad is required with the structure in the center of 250 feet (ROW width) by 100 feet for the ±600 kV DC and 500 kV structures and 125 feet by 50 feet for the 230 kV structures. The size and location of these required crane pads near the structures may vary depending on the side slope and access road at each site. The pads are cleared to the extent needed to safely complete the work. The Applicant will work with the BLM Field Offices and USFS on a case-by-case basis to determine what size pad would be left in place and revegetated following initial construction for operations and maintenance.

For all structures in locations without permanent ground access, maintenance activities will be performed using low impact ground-based equipment and/or by helicopter/aerial methods. Maintenance activities for structures in these locations (without permanent ground access) will be performed using the same or similar equipment and methods as was used for initial construction.

6.3.2 ROW Maintenance and Repairs

The Applicant will maintain work areas adjacent to structures and along the ROW for vehicle and equipment access necessary for operations, maintenance, and repair. Where long-term access is required for maintenance of the line, the Applicant will maintain the approved access roads in a safe, useable condition, as directed by an authorized officer from the appropriate land management agency or private landowner.

When needed, ROW repairs may include grading or repair of existing maintenance access roads and work areas, and spot repair of sites subject to erosion, flooding or scouring. Access road maintenance entails activities to ensure that approved access roads are in appropriate condition for access to transmission lines by maintenance and inspection crews. These activities include re-grading, re-surfacing, and re-constructing water diversions such as culverts, ditches and water bars. Required equipment may include a grader, backhoe, four-wheel-drive pickup truck, and a cat-loader or bulldozer. The cat-loader has steel tracks whereas the grader, backhoe, and truck typically have rubber tires. Repairs to the ROW would be scheduled as a result of line inspections, or would occur in response to an emergency situation.

Snow removal, if necessary for terminal, substation, ground electrode and regeneration station access roads, will be performed with blades equipped with shoes to keep the blade off the road surface in order to avoid damage.

Vegetation within the ROWs will be managed in accordance with the TWE Project Vegetation Management Program described below in Section 6.3.4.

6.3.3 Access Road Maintenance

Authorized access roads will only be used for maintenance purposes upon completion of construction. Where long-term access is required for maintenance of the line, the Applicant shall maintain the approved access roads in a safe, useable condition, as directed by an authorized officer from the appropriate land management agency. A regular maintenance program may include, but is not limited to blading, ditching, culvert installation, and surfacing.

If snow removal is necessary, equipment used shall be equipped with shoes to keep the blade two inches off the road surface in order to avoid damage to it. Where the ground is uneven at drainage crossings, special precautions will be taken in order to ensure equipment blades do not destroy vegetation.

6.3.4 Vegetation Management

A framework ROW Preparation and Vegetation Management Plan is provided in Appendix R. This plan will be further developed for the selected Alternative in the ROD POD. The Plan will be designed to meet NERC reliability requirements in a cost-effective manner, and provide measures for minimizing potential conflicts with critical environmental resources or management issues. Vegetation management in the TWE Project transmission line ROWs will be based on meeting reliability requirements of NERC through integrative vegetation management (IVM) practices (NERC 2009; ANSI 2006). The TWE Project will comply with NERC reliability standards.

NERC has established reliability standard FAC-003-2 to prevent vegetation related outages from occurring on bulk transmission systems, which could lead to cascading outages. The standard was developed in response to serious outages and operational problems, which have resulted from interference between overgrown vegetation and transmission lines over the past 10 to 20 years. Compliance with this standard is mandatory. FAC-003-2 requires having and implementing a documented transmission vegetation management program, designed to control vegetation on transmission ROWs (NERC 2009).

IVM is a best management practice conveyed in the American National Standard for Tree Care Operations, Part 7 (ANSI 2006) and the International Society of Arboriculture's *Best Management Practices: Integrated Vegetation Management* (Miller 2007). IVM is consistent with the requirements of FAC-003-2 and is recognized as containing the most appropriate techniques for transmission ROWs to meet and exceed the NERC requirements (NERC 2009). IVM is a system of managing plant communities by setting objectives for desired conditions and identifying and managing ROWs for compatible and incompatible vegetation. Implementation of TWE Project's ROW Preparation Vegetation Management Plan (Appendix R) will comply with NERC standards through IVM practices. IVM principles will serve as guidance in establishing and maintaining a desired condition for TWE Project ROWs and associated facilities.

6.4 Terminals, Substation, Ground Electrode and Communication Systems Maintenance

Maintenance activities include equipment testing, equipment monitoring and repair, and emergency and routine procedures for service continuity and preventive maintenance. Terminal, substation, ground electrode, and regeneration station monitoring and control functions are performed wholly or in part remotely from the Applicant's central operations facilities. Unauthorized entry into the terminal, substations or regeneration stations is prevented with the provision of fencing and locked gates. Warning signs would be posted and entry to the operating facilities would be restricted to authorized personnel.

Several forms of security are planned for each of the locations, although the security arrangements at each of the terminals, substations, ground electrode facilities, or regeneration stations may differ somewhat. Security measures may include fire detection in the control building via a monitoring system; alarming for forced entry; and a perimeter security system coupled with remote sensing infrared camera equipment in the fenced area of the station to provide visual observation/confirmation to the system operator of disturbances at the fence line.

Safety and security lighting at the terminals, substations and series compensation stations would be provided inside the fence for safety and security and for uncommon emergency night repair work. Dusk to dawn safety and security lighting will be used at the terminals and 500 kV AC substations.

Each of the terminals may have a control room staffed 24 hours per day, 365 days per year by two to three system operators and supervisory personnel. Remote operation, typically from control rooms housed in nearby utility facilities, may be utilized. In addition to control room staffing, 8 to 20 technicians, engineers, maintenance, security, and supervisory personnel may be staffed at each terminal. Total staffing at each terminal is expected to be 20 to 30 people.

Routine maintenance for the terminal and adjacent substations would be performed by the on-site staff. Major inspection or maintenance activities would require additional personnel and equipment estimated to be 15 to 20 craft, technician, engineering, manufacturer, consultant and supervisory personnel for a period of two to four weeks on an estimated once per year basis.

For AC substations and series compensation stations located remote from the terminals it is anticipated that maintenance at each of these remote facilities would require approximately six trips per year by a two to four person crew. Routine operations would require two workers in a light utility truck to visit the remote substation or series compensation station monthly. Typically, once per year a major inspection or maintenance effort may be required which would require up to 15 personnel for one to three weeks. If substation landscaping is required by the permitting agency, drought-tolerant plant materials would be used to minimize watering requirements after plant establishment.

Ground electrode facilities would be visited every two to three months by two individuals in a light truck to inspect the facilities. Annual maintenance would be performed by a two man crew in a light truck over a two to five day period. The ground electrode connector line would be inspected by aerial and ground based inspection identical to the maintenance program described for the transmission lines.

Communication regeneration stations would be visited every two to three months by two individuals in a light truck to inspect the facilities. Annual maintenance would be performed by a two-man crew in a light truck over a two to five day period.

Water Use

Operation and maintenance of the Northern and Southern Terminals is expected to require water use by personnel in the Operations and Maintenance office building and by the HVDC evaporative cooling and misting systems during summer months. Monthly and annual estimated water use is provided in Table 12.

TABLE 12 NORTHERN AND SOUTHERN TERMINAL ANNUAL ESTIMATED WATER USE (ALL VALUES IN ACRE-FEET)

MONTH	OFFICE USE	COOLING & MISTING SYSTEMS FOR N. TERMINAL	COOLING & MISTING SYSTEMS FOR S. TERMINAL	TOTAL USE N. TERMINAL	TOTAL USE S. TERMINAL
January	0.07	0	0	0.07	0.07
February	0.06	0	0	0.06	0.06
March	0.07	0	0	0.07	0.07
April	0.07	0	0	0.07	0.07
May	0.07	0	0.03	0.07	0.10
June	0.07	0.07	0.07	0.13	0.13
July	0.07	0.14	0.14	0.21	0.21
August	0.07	0.07	0.14	0.14	0.20
September	0.07	0	0.07	0.07	0.13
October	0.07	0	0	0.07	0.07
November	0.07	0	0	0.07	0.07

MONTH	OFFICE USE	COOLING & MISTING SYSTEMS FOR N. TERMINAL	COOLING & MISTING SYSTEMS FOR S. TERMINAL	TOTAL USE N. TERMINAL	TOTAL USE S. TERMINAL
December	0.07	0	0	0.07	0.07
Annual	0.81	0.27	0.44	1.08	1.25

Source: BBA 2012

Annual office use of water for each terminal is estimated at 0.809 acre-feet. The office building will consist of approximately 7,200 square feet of actively used space including offices, kitchen, and bathrooms with a shower. The annual office water use was conservatively estimated based upon this actively used square footage and a water use estimate of 0.75 acre-feet per year per 6,695 square feet of office space (Douglas County 1999).

Evaporative cooling will not likely be needed for ambient air temperatures up to 104° Fahrenheit (40° Celsius). If ambient air temperatures exceed 113° Fahrenheit (45° Celsius), then misting and evaporative cooling will be required for these short time periods.

Annual water use for HVDC evaporative cooling and misting systems at the Northern Terminal is estimated at 0.272 acre-feet. Use includes 400 gallons per year for maintenance and flushing of the cooling system and an estimated 88,000 gallons per year for the misting system. The misting system use was estimated to at 275 gallons per hour, running eight hours per day for 10 days in June, 20 days in July, and 10 days in August for a total of 40 days. Evaporative cooling of the filters is not anticipated.

Annual water use for HVDC evaporative cooling and misting systems at the Southern Terminal is estimated at 0.440 acre-feet. Use includes 400 gallons per year for maintenance and flushing of the cooling system and an estimated 143,000 gallons per year for the misting system. The misting system use was estimated to at 275 gallons per hour, running eight hours per day for 5 days in May, 10 days in June, 20 days in July, 20 days in August and 10 days in September for a total of 65 days. Evaporative cooling of the filters is not anticipated.

The water use for each of the terminals may vary from these estimates based on the cooling system technology employed for the terminals. Non-evaporative cooling technologies are available and will be considered during the detailed engineering for the terminal equipment.

6.5 Emergency Response

The operation of the system is managed and monitored from control rooms at or near each of the terminals and at the Applicant’s operation center. Electrical outages or variations from normal operating protocols would be sensed and reported at these operation centers. The remote substations and series compensation stations are equipped with remote monitoring, proximity alarms, and in some cases, video surveillance with monitoring and control functions performed at the control rooms at the terminals and/or at the Applicant’s operation center.

The implementation of routine operation and maintenance activities on power lines minimize the need for most emergency repairs. Emergency maintenance activities are often those activities necessary to repair natural hazard, fire, or human-caused damages to a line. Such work is required to eliminate a safety hazard, prevent imminent damage to the power line, or restore service if there is an outage. In an emergency, the Applicant must respond as quickly as possible to restore power.

In most cases, the equipment necessary to carry out emergency repairs is similar to that necessary to conduct routine maintenance. More extensive emergency repair may also require the same types of equipment used during construction, including hole drilling equipment, backhoes for excavation, and/or concrete trucks and cranes for structure erection. Other required equipment may include power tensioners, pullers, wire trailers, crawler tractors, and trucks and pickups for hauling materials, tools, and workers. Under certain conditions, a helicopter may be used to haul in material and erect towers or string conductor in those areas where access and/or terrain conditions preclude the use of conventional methods. Site and access road disturbances, such as ruts created during emergency operations, will be restored to satisfactory condition using restoration and rehabilitation procedures.

In the event of an emergency, crews will be dispatched quickly to repair or replace any damaged equipment. Every attempt will be made to contact the agency or landowners along the ROW. In the event notification cannot be made, repair operations will proceed only in the case of an emergency situation. Repair of the line will have priority under emergency conditions, and reasonable efforts will be made to protect plants, wildlife, and other resources. Restoration and rehabilitation procedures following completion of repair work will be similar to those prescribed during construction.

Emergency response procedures will be implemented for the following potential events:

- Downed transmission lines, structures, or equipment failure
- Fires
- Sudden loss of power
- Natural disasters
- Serious personal injury

A detailed Emergency Preparedness and Response Plan is provided in Appendix F.

6.5.1 Fire Protection

All federal, state, and county laws, ordinances, restrictions, rules, and regulations pertaining to fire prevention and suppression would be strictly adhered to. All personnel would be advised of their responsibilities under the applicable fire laws and regulations. A framework Fire Protection Plan is provided in Appendix H.

When working on public or National Forest System lands, the Applicant's employees and Contractors would be equipped with approved suppression tools and equipment. The Applicant or its Contractor would notify local fire authorities and the BLM or USFS (as appropriate) if a Project-related fire occurs within or adjacent to a construction area.

If the Applicant becomes aware of an emergency situation that is caused by a fire on or threatening BLM-managed or USFS lands and that could damage the transmission lines or their operation, it would notify the appropriate agency contact. Specific construction-related activities and safety measures would be implemented during construction of the transmission line to prevent fires and to ensure quick response and suppression if a fire occurs. Typical practices to prevent fires during construction and maintenance/repair activities include brush-clearing prior to work, stationing a water truck at the job site to keep the ground and vegetation moist in extreme fire conditions, enforcing red flag warnings, providing "fire behavior" training to all pertinent personnel, keeping vehicles on or within designated roads or work areas, and providing fire suppression equipment and emergency notification numbers at each construction site. A detailed Fire Protection Plan is included as Appendix H.

6.6 Decommissioning Practices

The proposed transmission line would have a projected operational life of at least 50 years or longer. At the end of the useful life of the Project and if the facility were no longer required, the transmission line would be removed from service. At such time, structures, conductors, insulators, and hardware would be dismantled and removed from the ROW. The transmission foundations would be removed to below-ground surface.

Following abandonment and removal of the transmission line structures and equipment from the ROW, any areas disturbed during line dismantling would be restored and rehabilitated. In the same way, if a terminal, substation, or regeneration station is no longer required, the buildings, structures and equipment would be dismantled and removed from the site. The station structures would be disassembled and either re-used at another station or sold for scrap. Major equipment such as breakers, transformers, and reactors would be removed, refurbished, and stored for use at another facility. Foundations would be cut off below ground surface.

For access roads constructed by the Applicant and used for operations and maintenance of the transmission line, the Applicant will reclaim all access roads unless the landowner, land management agency, or county requests the road to remain open and the landowner, land management agency or county agrees in writing to assume all maintenance and reclamation responsibility for the road.

7.0 DESIGN OPTIONS

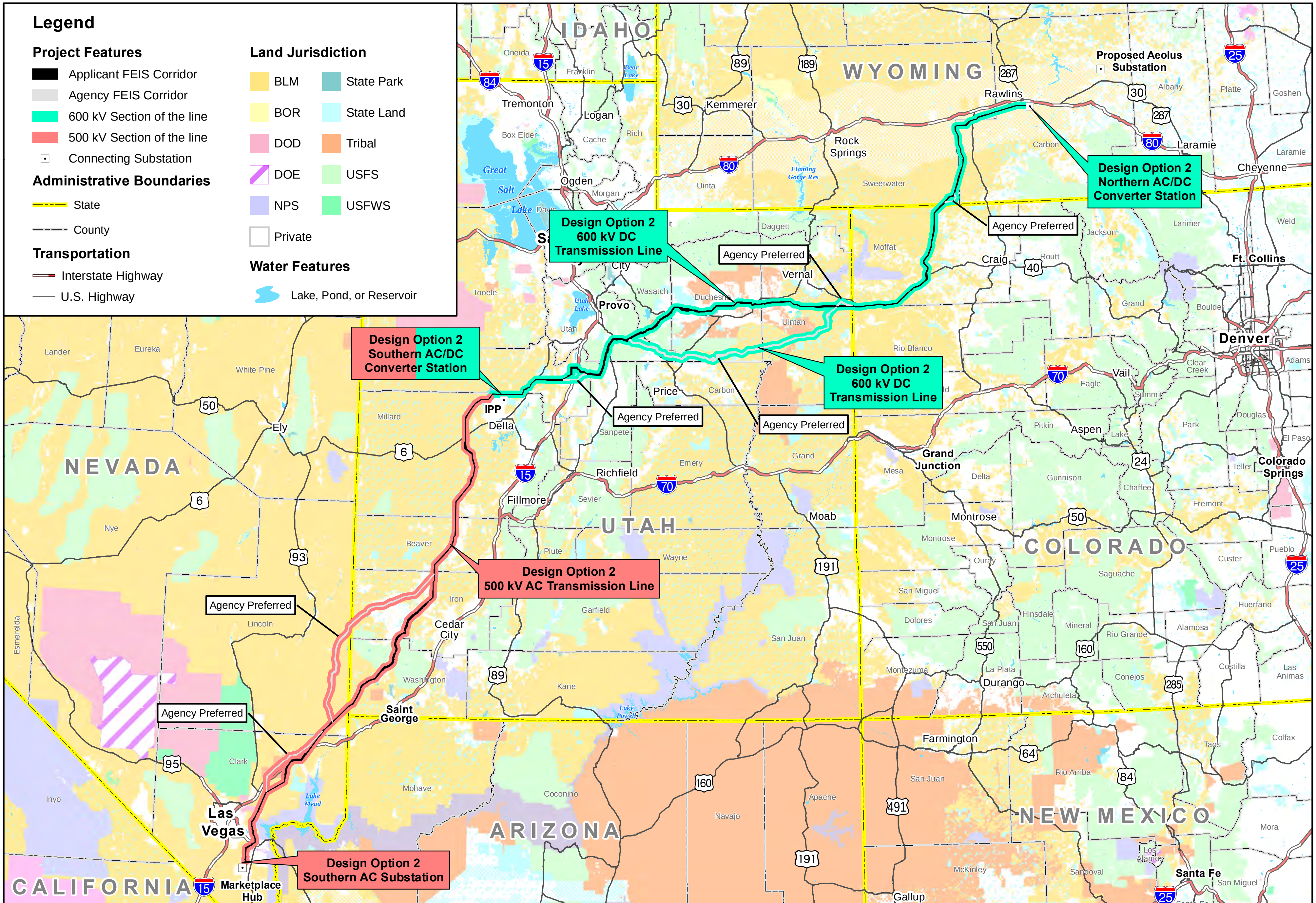
Section 7.0 describes the Design Options, formerly referred to as System Alternatives, considered for the TWE Project. System Alternatives 1, 2 and 3, were initially suggested by TransWest in the *TransWest Express Transmission Project ROW Application SF 299 (Amended from December 2008) January 2010* (TWE 2010b). TransWest amended the Preliminary ROW Application SF 299 to eliminate System Alternative 1 from further consideration in August 2012. System Alternatives 2 and 3 are recommended by TransWest for inclusion in the FEIS and from here on are referred to as Design Options 2 and 3.

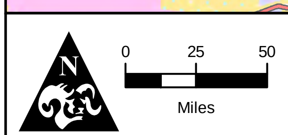
- Section 7.1 provides an overview of Design Options 2 and 3.
- Section 7.2 describes the design options according to the conditions under which each design option would meet the TWE Project purpose and need and the options' specific components and design characteristics.
- Section 7.3 discusses how the design options would differ from the proposed TWE Project with respect to construction, operation, and maintenance practices.
- Section 7.4 provides a comparison of the design options to the proposed TWE Project.

7.1 Overview of Design Options

Design Option 2 – Design Option 2 would be an alternative system configuration, which would replace the proposed TWE Project (Map Exhibit 6). This alternative would entail TransWest constructing and operating a 3,000 MW, ±600 kV DC transmission line approximately 375 miles in length, from the Northern Terminal to a new AC/DC converter station near the existing IPP Substation near Delta, Utah. From the new AC/DC converter station in Utah, a single circuit 1,500 MW, 500 kV AC transmission line, approximately 350 miles in length, would be constructed to one of the existing substations in the Eldorado Valley, south of Boulder City, Nevada (Marketplace Hub). Near the halfway point of the southern segment (AC segment), a 500 kV Series Compensation Station would also be constructed.

Design Option 3 – Design Option 3 would be a phased approach to building and operating the proposed TWE Project (Map Exhibit 7). This phased approach would entail construction of a 3,000 MW, ±600 kV DC transmission line approximately 375 miles in length between the location of the proposed Northern Terminal to the IPP substation near Delta, Utah and operated initially as a 1,500 MW, 500 kV AC transmission system. For AC operation, the initial phase of this design option would require 500/345 kV substation connections near the IPP line in Millard County, Utah and construction of a 500 kV series compensation station near the halfway point of the northern segment. Full development of the TWE Project using this phased build out approach would involve constructing the remaining portion of the 3,000 MW, ±600 kV DC line from IPP to the Southern Terminal, south of Boulder City, Nevada and converting operations to a DC system.





Map Exhibit 6

Design Option 2: DC from Wyoming to IPP, AC from IPP to Marketplace Hub

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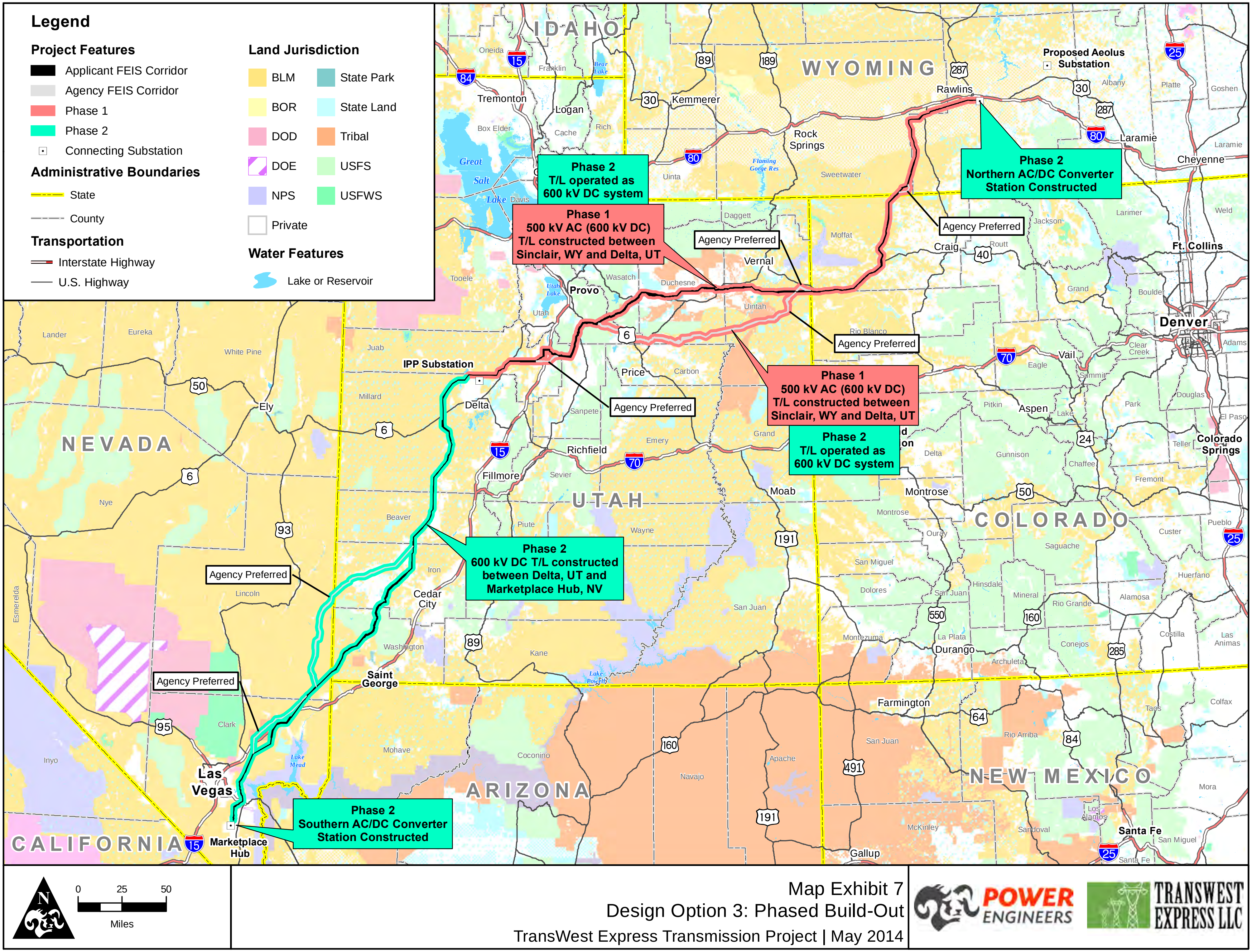

Map Exhibit 7
Design Option 3: Phased Build-Out
TransWest Express Transmission Project | May 2014

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7.2 Design Options' Purpose and Need and Design Characteristics

7.2.1 Design Option 2 – DC from Wyoming to IPP, AC from IPP to Marketplace Hub

Design Option 2 would meet the TWE Project's stated objectives only if transmission capacity becomes available and can be utilized to transmit energy delivered by the TWE Project from Delta, Utah to Southern California. Under this design option, the delivery of energy to markets in the Desert Southwest region would be through both the new 1,500 MW, 500 kV transmission line and through the existing 2,400 MW, 500 kV DC transmission system, IPP's 'Southern Transmission System' (STS), between Delta, Utah and Adelanto, California. Because capacity is not currently available on the STS, Design Option 2 does not currently meet the TWE Project's purpose and need. Should capacity become available in the future, TransWest would only consider implementing this design option under the conditions that sufficient capacity, approximately 1,500 MW, was commercially available to transmit energy delivered by the TWE Project to California; and that TransWest is able to establish commercial interconnection agreements with the utility owning and operating the IPP transmission line (currently Los Angeles Department of Water and Power [LADWP]). TransWest will provide the lead agencies with notice if a decision is made to implement Design Option 2.

Design Option 2 would replace the proposed TWE Project. This alternative would entail a 3,000 MW, ±600 kV DC transmission line approximately 375 miles in length, from the Northern Terminal to a new AC/DC converter station near the existing IPP substation near Delta, Utah. From the new AC/DC converter station in Utah, a single circuit 1,500 MW, 500 kV AC transmission line, approximately 350 miles in length, would be constructed to one of the existing substations in the Eldorado Valley, south of Boulder City, Nevada (Marketplace Hub). See Map Exhibit 6.

Design Option 2 would entail the following specific facilities and actions:

1. Construction of the Northern Terminal and ground electrode system (identical facilities to the proposed TWE Project);

2. Construction of a new AC/DC converter station and an adjacent 500/345 kV AC substation near the IPP in Millard County, Utah;

3. Construction of a ground electrode system within 50 miles of Delta, Utah;

4. Construction of a double circuit 345 kV AC line between the new 500/345 kV AC Substation near IPP to the existing IPP 345 kV AC substation adjacent to the existing IPP AC/DC converter station. The length of the double circuit 345 kV AC connection is estimated to be less than five miles;

5. Construction of a ±600 kV DC transmission line, approximately 375 miles long, from the Northern Terminal to the new AC/DC converter station and associated 500/345 kV substation near IPP (northern segment, similar to proposed TWE Project);

6. Construction of a single circuit, 1,500 MW, 500 kV AC line from the new 500/345 kV AC substation near IPP to one of the existing Marketplace Hub substations in the Eldorado Valley (southern segment); and

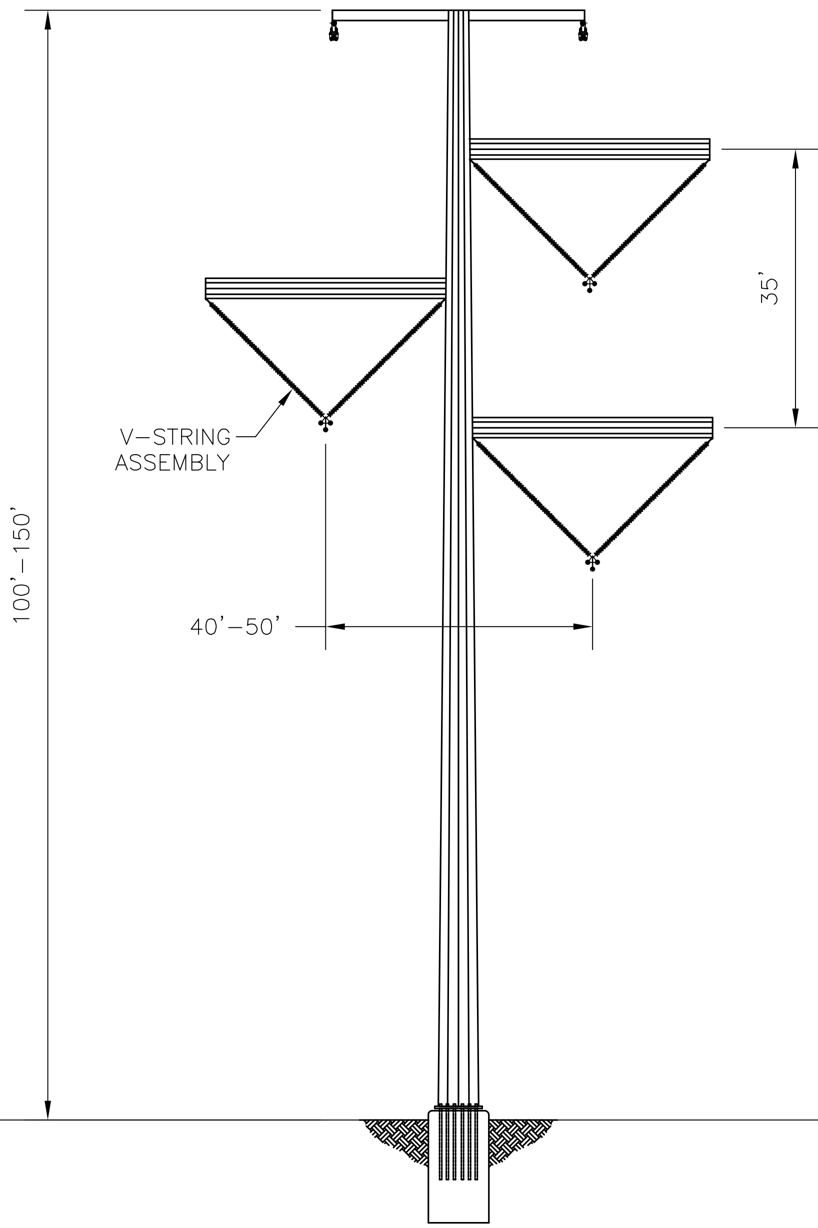
7. Construction of a series compensation station (similar to a small 500 kV substation) adjacent to the 500 kV AC transmission line, near the halfway point in the 500 kV AC line southern segment.

Compared to the proposed TWE Project, Design Option 2 would: 1) replace the ±600 kV DC transmission line with a single circuit 500 kV AC line, from near IPP in Millard County, Utah to one of the existing Marketplace Hub substations in Clark County, Nevada; 2) eliminate the Southern Terminal and ground electrode system in Clark County, Nevada and replace these facilities with similar facilities near IPP in Millard County, Utah; 3) construct additional new facilities, including a 500/345 kV AC substation, a double circuit 345 kV transmission line, less than five miles in length, and a 500 kV series compensation station, near the halfway point in the 500 kV AC line.

Design Option 2 would require both a 500 kV single circuit AC configuration and a 345 kV double circuit AC configuration. Design Option 2 would require a single circuit 500 kV configuration and structures, similar to the structure design shown in Figures 21 and 22. The 500 kV single circuit configuration would require three sets of conductor bundles, one steel shield wire, and one OPGW. The components for the 500 kV structures including foundations, guys, anchors, conductors, insulators, and associated hardware, overhead shield (ground) wires, and grounding rods, would be similar to those described for the ±600 kV DC transmission line.

One double circuit 345 kV transmission line would be required for Design Options 2 and 3. The 345 kV double circuit structures would be either self-supporting steel lattice towers or single shaft tubular steel poles. Figure 22 shows a typical steel pole design. The 345 kV double circuit configuration would require six sets of conductor bundles, one steel shield wire, and one OPGW. The components for the 345 kV structures including foundations, conductors, insulators, and associated hardware, overhead shield (ground) wires, and grounding rods, would be similar to those described for the ±600 kV DC transmission line.

Map Exhibit 8 depicts the siting areas for the Design Option 2 AC/DC converter station, 500/345 kV AC substation, ground electrode system, double circuit 345 kV connector line and the 500 kV series compensation station. The substation would be located on one of the two parcels shown on the map.



NOTES

1. DIMENSIONS SHOWN ARE FOR ILLUSTRATION PURPOSES ONLY.

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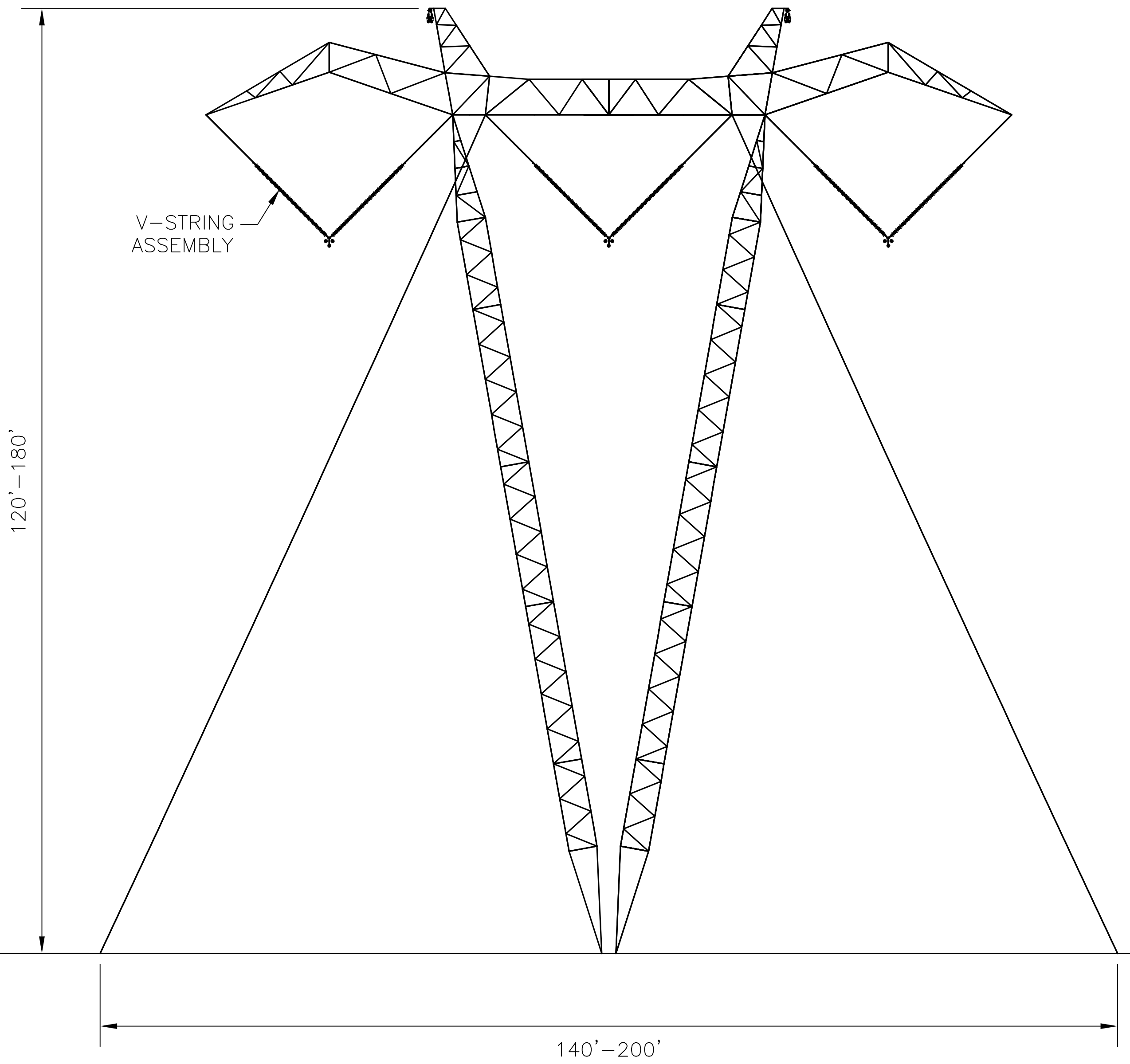
FIGURE 23

TYPICAL 500kV AC SINGLE CIRCUIT TUBULAR POLE STRUCTURE



NOTES

1. DIMENSIONS SHOWN ARE FOR ILLUSTRATION PURPOSES ONLY.
2. TOWER OUTLINE AND BRACINGS ARE INDICATIVE ONLY.

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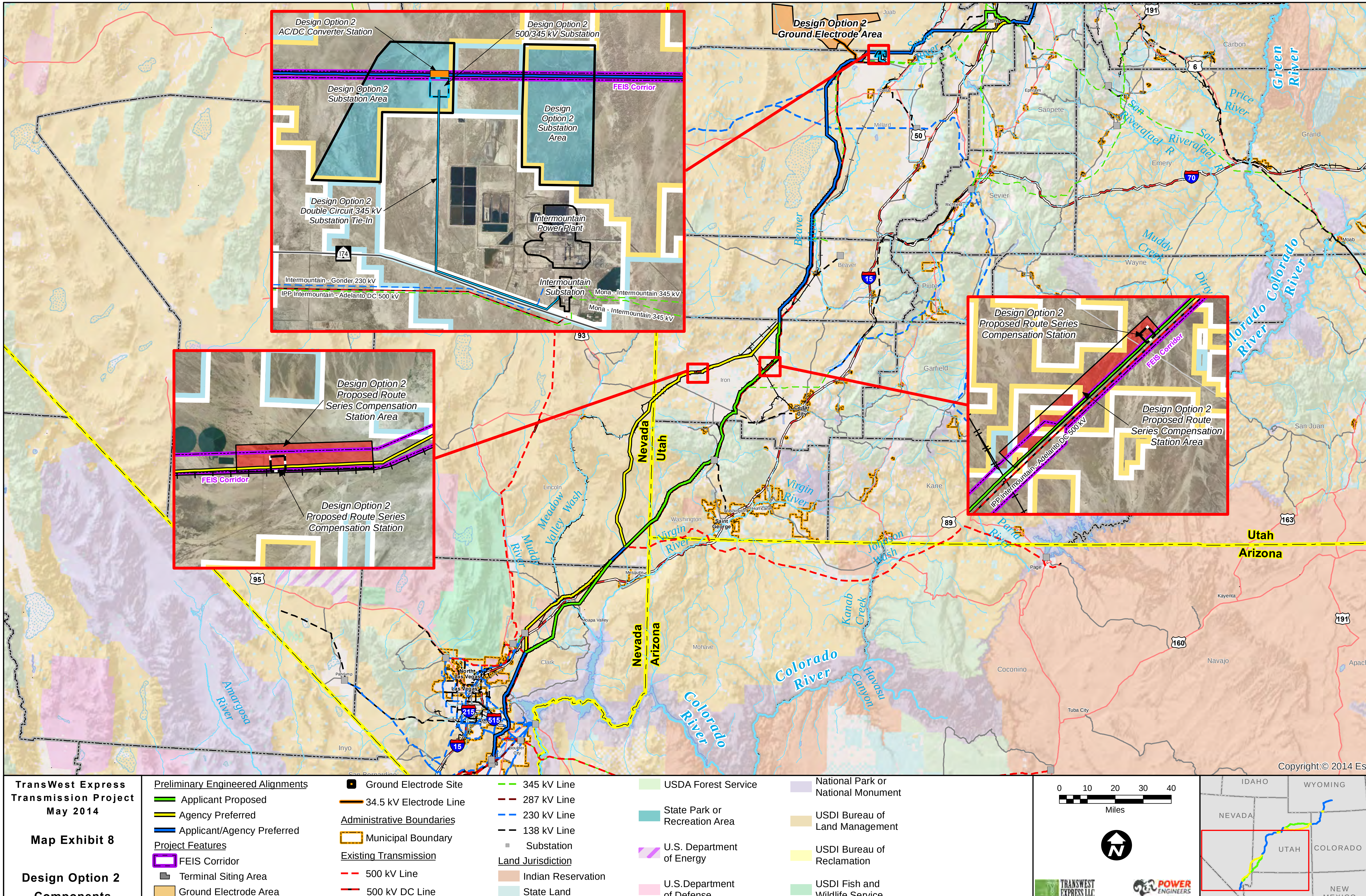
TRANSWEST EXPRESS TRANSMISSION PROJECT
FIGURE 24

TYPICAL 500kV AC
SINGLE CIRCUIT GUYED
LATTICE STRUCTURE


Design Option 2
AC/DC Converter Station
Design Option 2
500/345 kV Substation
Design Option 2
Substation Area
Design Option 2 Substation Area
FEIS Corrior
Design Option 2
Double Circuit 345 kV
Substation Tie-In
Intermountain Power Plant
Intermountain Substation
Intermountain - Gonder 230 kV
IPP Intermountain - Adelanto DC 500 kV
Mona - Intermountain 345 kV
Mona - Intermountain 345 kV
Design Option 2
Ground Electrode Area
Design Option 2
Proposed Route
Series Compensation
Station Area
FEIS Corridor
Design Option 2
Proposed Route Series
Compensation Station
Design Option 2
Proposed Route Series
Compensation Station
FEIS Corridor
IPP Intermountain - Adelanto DC 500 KV
Design Option 2
Proposed Route
Series Compensation
Station Area
Nevada
Utah
Nevada
Arizona
Utah
Arizona
Green River
Price River
San Rafael R
San Rafael R
Muddy Creek
Dirty Devil
Colorado River
Beaver River
Sevier River
Virgin River
Virgin River
Meadow Valley Wash
Muddy River
Johnson Wash
Paria River
Kanab Creek
Colorado River
Colorado River
Havasu Canyon
Amargosa River
Juab
Carbon
Sanpete
Emery
Grand
Millard
Sevier
Wayne
Beaver
Piute
Garfield
Iron
Kane
San Juan
Washington
Lincoln
Clark
Mohave
Coconino
Navajo
Apache
Inyo
Cedar City
Saint George
Page
Kayenta
Tuba City
Moapa Valley
North Las Vegas
Las Vegas
Boulder City
Moab
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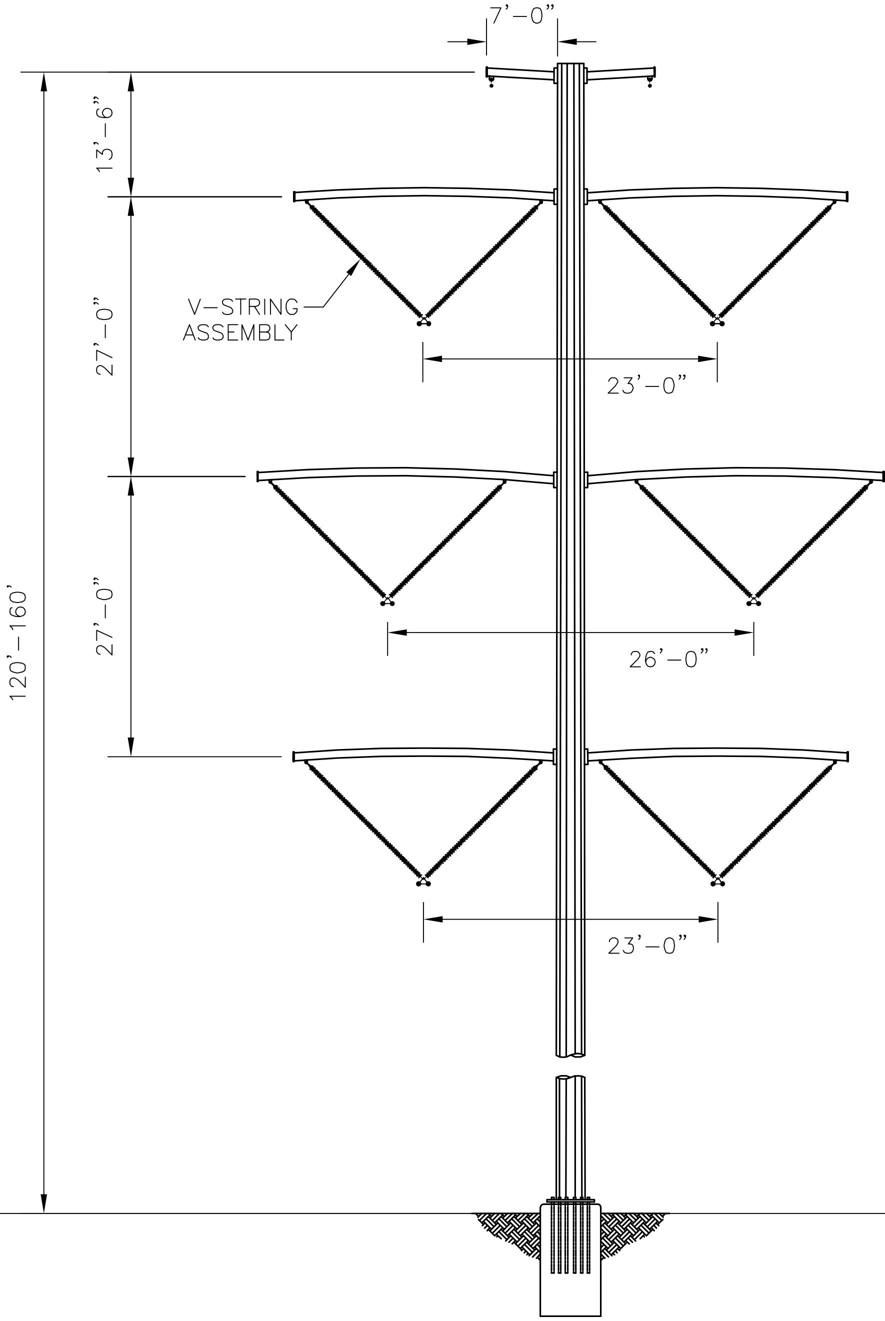
TransWest Express Transmission Project
May 2014
Map Exhibit 8
Design Option 2 Components
Preliminary Engineered Alignments
Applicant Proposed
Agency Preferred
Applicant/Agency Preferred
Project Features
FEIS Corridor
Terminal Siting Area
Ground Electrode Area
Ground Electrode Site
34.5 kV Electrode Line
Administrative Boundaries
Municipal Boundary
Existing Transmission
500 kV Line
500 kV DC Line
345 kV Line
287 kV Line
230 kV Line
138 kV Line
Substation
Land Jurisdiction
Indian Reservation
State Land
USDA Forest Service
State Park or Recreation Area
U.S. Department of Energy
U.S.Department of Defense
National Park or National Monument
USDI Bureau of Land Management
USDI Bureau of Reclamation
USDI Fish and Wildlife Service
0 10 20 30 40
Miles
N
TRANSWEST EXPRESS LLC
POWER ENGINEERS
IDAHO
WYOMING
NEVADA
UTAH
COLORADO
NEW MEXICO
ARIZONA



NOTES

1. DIMENSIONS SHOWN ARE FOR ILLUSTRATION PURPOSES ONLY.

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TRANSWEST EXPRESS TRANSMISSION PROJECT

FIGURE 25

TYPICAL 345kV AC DOUBLE CIRCUIT SELF SUPPORTING STEEL POLE STRUCTURE

7.2.2 Design Option 3 – Phased Build Out

Similar to Design Option 2, this Design Option would meet the TWE Project's stated objectives only if transmission capacity becomes available and can be utilized to transmit energy delivered by the TWE Project from Delta, Utah to Southern California. This initial delivery of energy to markets in the Desert Southwest region would be through the existing 2,400 MW, 500 kV DC transmission system, and IPP's STS. This design option would meet the TWE Project's objectives and is considered feasible, however, it is more costly than building out the full system as a single non-phased project and would only be required if the demand for Wyoming resources in the Desert Southwest proves to be slower in development than expected. Construction of the line between Utah and Nevada, the Southern Terminal and completion of the Northern Terminal would be phased, however, to occur at some point in the future when market demands warrant converting the line's operation from 1,500 MW to 3,000 MW.

Should capacity become available, TransWest would only consider implementing this design option under the condition that sufficient capacity, approximately 1,500 MW, was commercially available to transmit energy delivered by the TWE Project to California; and that TransWest is able to establish commercial interconnection agreements with the utility owning and operating the IPP transmission line (currently LADWP). A market analysis would also need to be completed with results showing a phased approach to be commercially beneficial. TransWest will provide the lead agencies with notice if a decision is made to implement Design Option 3.

Design Option 3 is similar to the proposed TWE Project, except the project would be built and operated in phases. This phased approach would entail construction of a 3,000 MW, ±600 kV DC transmission line approximately 375 miles in length between the location of the proposed Northern Terminal to the IPP substation near Delta, Utah and operated initially as a 1,500 MW, 500 kV AC transmission system. For AC operation, the initial phase of this design option would require 500/345 kV substation connections near the IPP in Millard County, Utah and construction of a 500 kV Series Compensation Station near the halfway point of the northern segment. Full development of the TWE Project using this phased build out approach would involve constructing the remaining portion of the 3,000 MW, ±600 kV DC line from IPP to the Southern Terminal, south of Boulder City, Nevada and converting operations to a DC system (see Map Exhibit 7).

The TWE Project would be energized in phases. Phase 1 would entail the following:

1. Construction of the 500 kV substation portion of the Northern Terminal. The adjacent AC/DC converter station in Wyoming would be built in Phase 2;

2. Construction of a 500/345 kV AC substation in the vicinity of the existing IPP 345 kV substation near Delta, Utah;

3. Construction of a single circuit 500 kV AC line from the Northern Terminal near Sinclair, Wyoming to the new 500/345 kV AC substation near IPP (northern line segment). The single circuit 500 kV AC line would be designed to operate at both 500 kV AC and ±600 kV DC for easy conversion to ±600 kV DC operation;

4. Construction of a 500 kV series compensation station near the halfway point of the 500 kV AC northern line segment;

5. Construction of a double circuit 345 kV transmission line connecting the new 500/345 kV AC substation to the existing IPP 345 kV substation. The length of the double circuit 345 kV AC connection is estimated to be less than five miles; and

6. Energization of Phase 1 of Design Option 3 as a 1,500 MW, 500 kV AC system.

Phase 2 would entail the following:

1. Construction of the AC/DC converter station portion of the Northern Terminal in Wyoming and construction of the entire Southern Terminal in Nevada;

2. Construction of the ground electrodes for both the Northern and Southern Terminals (see Map Exhibits 4 and 5);

3. Construction of the ±600 kV DC transmission line between IPP and the Southern Terminal (southern line segment);

4. Removal of the connection to the IPP substation at Delta, Utah and connecting the Phase 1 500 kV AC line (constructed during Phase 1, designed for conversion to ±600 kV DC and operated at 500 kV AC during Phase 1) to the Phase 2 ±600 kV DC line between Delta, Utah and the Southern Terminal;

5. Convert the operation of the TWE Project to a 3,000 MW, ±600 kV DC system;

6. Decommission the 500/345 kV AC substation at IPP;

7. Decommission the double circuit 345 kV transmission line at IPP; and

8. Decommission the series compensation station on the 500 kV AC northern line segment.

Design Option 3 would utilize the same transmission corridor as the proposed TWE Project. Construction of the Northern Terminal in Wyoming would occur in phases. Phase 1 would require the construction of the AC substation portion of the Northern Terminal complex. In Phase 2, the AC/DC converter station portion of the Northern Terminal complex would be constructed adjacent to the 500 kV AC substation constructed in Phase 1, completing the Northern Terminal. The AC operation of the northern line segment would require the construction of a 500/345 kV substation near IPP. Upon conversion of the line to DC operations, this 500/345 kV substation would be decommissioned along with the double circuit 345 kV line. The 500 kV AC line constructed in Phase 1 from Wyoming to Utah (northern line segment) would be designed and constructed as a DC line to a criteria that would enable it to be initially operated at 500 kV AC and then converted from 500 kV AC operation to ±600 kV DC operation. No further changes to the transmission line would be required to convert the line from AC to DC operation. AC operation of the northern line segment would require the construction of a 500 kV series compensation station near the halfway point of this segment. Upon conversion of the line to DC operations, this 500 kV series compensation station would be decommissioned.

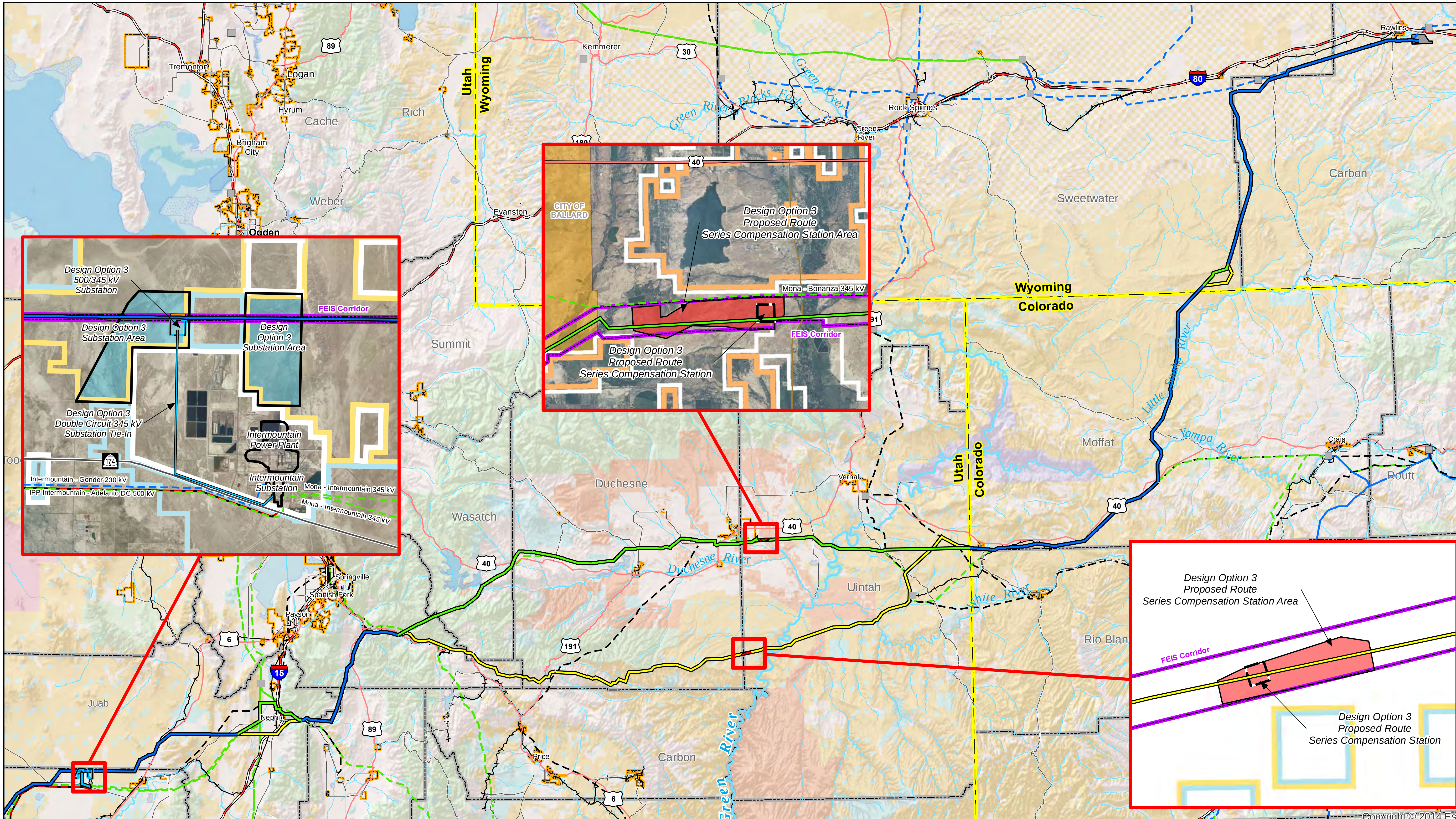
Phase 1 of Design Option 3 would require a single circuit 500 kV AC configuration designed and constructed to meet the ±600 kV DC criteria. The typical Phase 1 single circuit 500 kV AC structures would be similar in appearance to those shown in Figures 21 and 22. The single circuit 500 kV AC configuration would require three sets of conductor bundles, one steel shield wire, and one OPGW. The conversion from 500 kV AC to ±600 kV DC would not require physical changes to the structure or wire system constructed in Phase 1 as one of the three conductor bundle sets would be de-energized and left in place.

Phase 1 of Design Option 3 would also require one 345 kV double circuit transmission line. The 345 kV double circuit structures would be either self-supporting steel lattice towers or single shaft tubular steel poles. Figure 22 shows a typical steel pole design. The 345 kV double circuit configurations would require six sets of conductor bundles, one steel shield wire, and one OPGW. The components for the 345 kV structures including foundations, conductors, insulators, and associated hardware, overhead shield (ground) wires, and grounding rods, would be similar to those described for the ±600 kV DC transmission line.

Map Exhibit 9 depicts the siting areas for the Design Option 3 components, including the 500/345 kV AC substation, double circuit 345 kV connector lines and the 500 kV series compensation station.

7.3 Construction, Operation and Maintenance Activities of Design Options

The construction, operation, and maintenance activities described for the proposed TWE Project would be very similar for most aspects of the design options. Applicant-committed environmental mitigation measures would also apply to these alternatives. This section discusses key differences between the design options and the proposed TWE Project.



TransWest Express Transmission Project
May 2014

Map Exhibit 9

Design Option 3 Components

Preliminary Engineered Alignments
- Applicant Proposed
- Agency Preferred
- Applicant/Agency Preferred

Project Features
- FEIS Corridor
- Terminal Siting Area

Administrative Boundaries
- Municipal Boundary

Existing Transmission
- 500 kV Line
- 500 kV DC Line
- 345 kV Line
- 287 kV Line
- 230 kV Line
- 138 kV Line
- Substation

Land Jurisdiction
- Indian Reservation
- State Land
- USDA Forest Service
- State Park or Recreation Area
- U.S. Department of Energy
- U.S.Department of Defense
- National Park or National Monument
- USDI Bureau of Land Management
- USDI Bureau of Reclamation
- USDI Fish and Wildlife Service

7.3.1 Design Option Construction Activities, Workforce and Equipment Requirements

The construction activities, workforce and equipment requirements for the transmission line and terminals would be very similar or the same for the design options as described for the proposed TWE Project in Section 5.8. Construction of each substation or series compensation station would require approximately 135 personnel. The construction activities, workforce and equipment requirements for the substations and series compensation stations for Design Options 2 and 3 would be approximately as shown in Table 13. Special construction methods and Applicant-committed environmental mitigation measures would apply to these alternatives, as presented in Section 5.7.

TABLE 13 ESTIMATED PERSONNEL AND EQUIPMENT FOR DESIGN OPTION SUBSTATIONS

ACTIVITY	PEOPLE	QUANTITY AND TYPE OF EQUIPMENT		TRACK OR RUBBER TIRE
Survey Crew	4	2	Pickup trucks	Rubber
Site Management Crew	8-10	2	Office trailers	Rubber
		3	Pickups	Rubber
		4	Generators	Rubber
Site Development – Civil Work Crew	20-25	4	Scrapers	Rubber
		2	Dozers (ripper)	Track
		2	Motor graders	Rubber
		2	Roller compactors	Rubber
		2	Excavators	Either
		4	Dump trucks	Rubber
		3	Water trucks	Rubber
		1	Mechanics truck	Rubber
		1	Fuel truck	Rubber
		2	Pickup trucks	Rubber
		6	Carry alls	Rubber
Fence Installation Crew	10-15	1	Pickup truck	Rubber
		1	Boom truck	Rubber
		2	Carry alls	Rubber
		1	Backhoe	Either
		1	Concrete truck	Rubber
		1	Reel stand truck	Rubber
		2	Bobcats	Either
Equipment Footings Installation Crew	20-25	2	Hole diggers	Either
		2	Boom trucks	Rubber
		1	Excavator	Either

ACTIVITY	PEOPLE	QUANTITY AND TYPE OF EQUIPMENT		TRACK OR RUBBER TIRE
		3	Concrete trucks	Rubber
		1	Dump truck	Rubber
		1	Roller compactor	Rubber
		2	Plate compactors	---------
		1	Backhoe	Either
		2	Bobcats	Either
		1	Mechanics truck	Rubber
		1	Fuel truck	Rubber
		1	Water truck	Rubber
		2	Pickup trucks	Rubber
		4	Carry alls	Rubber
Cable Trench, Conduits, and Station Grounding Crew	10-12	2	Trenchers	Either
		2	Dozers (ripper)	Track
		2	Roller compactors	Rubber
		2	Plate compactors	---------
		2	Excavators	Either
		1	Boom truck	Rubber
		3	Pickup trucks	Rubber
		2	Flatbed trucks	Rubber
		4	Carry alls	Rubber
		1	Air compressor	Rubber
		1	Backhoe	Either
		1	Mechanics truck	Rubber
		1	Fuel truck	Rubber
		1	Dump truck	Rubber
		1	Reel stand truck	Rubber
Steel Structure and Bus Installation Crew, Control Buildings Construction Crew, Equipment Assembly and Erection Crew	16-24	2	Cranes, RT	Either
		2	High capacity cranes	Either
		4	Boom trucks	Either
		6	Manlifts	Either
		4	Welder trucks	Rubber
		2	Carry alls	Rubber
		3	Pickup trucks	Rubber
		2	Flatbed trucks	Rubber

ACTIVITY	PEOPLE	QUANTITY AND TYPE OF EQUIPMENT		TRACK OR RUBBER TIRE
		1	Mechanics truck	Rubber
		4	Vans	Rubber
		2	Flatbed trucks	Rubber
Control Building and Wiring Crew	16-20	2	Boom trucks	Rubber
		4	Manlifts	Either
		3	Wire pullers-small	Rubber
		2	Reel stand trucks/trailers	Rubber
		4	Vans	Rubber
		4	Pickup trucks	Rubber
		2	Carry alls	Rubber
		1	Splicing van	Rubber
		2	Concrete trucks	Rubber
		1	Bobcat	Either
		1	Trencher	Either
		2	Plate compactors	---------

The above table reflects estimated personnel requirements, which may reach as high as 135 for each substation or series compensation station construction, including maintenance, management, and quality control personnel.

7.3.2 Design Option Construction Schedules

The conceptual construction schedule for the transmission line for Design Option 2 would employ a three spread approach very similar to the schedule presented for the proposed TWE Project in Section 5.8.1 and shown on Figure 18. For Design Option 2, the conceptual construction schedules shown in Figure 18 would need to be increased by approximately ten weeks to accommodate the additional work required for installing an AC transmission line in place of a DC transmission line.

The conceptual construction schedule for the transmission lines for Design Option 3 follows a phased approach and is shown on Figure 25. The conceptual construction schedule shown on Figure 25 would be used for both Phase 1 and Phase 2 of Design Option 3.

The construction schedules for the terminal, ground electrodes, substations and series compensation stations for Design Options 2 and 3 would differ from the proposed TWE Project, as illustrated on Figures 23 and 24.

7.3.3 Induced Currents on Adjacent Facilities

Unlike the proposed TWE Project ±600 kV DC transmission line, which presents no risk of inducing currents line due to the static nature of the DC electrical and magnetic fields, AC transmission systems can induce currents. Mitigation measures for AC inductive currents would be implemented as necessary for the AC portions of Design Options 2 and 3.[1] Mitigation measures would be incorporated into the siting of the AC transmission line ROWs, as well as through transmission line design and operation measures. Measures to mitigate induced current impacts on pipelines, railroads and other land uses are described in Section 6.2.2. .

[1] The proposed TWE Project includes short sections of AC transmission lines to connect between the terminals and existing and planned AC transmission systems. Potential impacts from AC induced currents on these system interconnection lines would be mitigated, if necessary.

DESIGN OPTION - 2

TOTAL DURATION	111 week

TASK	DURATION (WEEKS)
AC/DC CONVERTER STATION (NEAR IPP)	
SITE GRADING	13
BELOW-GRADE WORK (FOUNDATIONS, CONDUIT, GROUNDING)	32
BUILDING CONSTRUCTION	35
EQUIPMENT INSTALLATION	39
EQUIPMENT TESTING	21
OPERATIONAL	9
500/345 kV AC SUBSTATION (NEAR IPP)	
SITE GRADING	22
BELOW-GRADE WORK (FOUNDATIONS, CONDUIT, GROUNDING)	22
EQUIPMENT INSTALLATION	26
CONTROL BUILDING INSTALLATION	22
EQUIPMENT TESTING	13
OPERATIONAL	7
IPP 345 kV AC SUBSTATION MODIFICATION	
SITE GRADING	13
BELOW-GRADE WORK (FOUNDATIONS, CONDUIT, GROUNDING)	15
EQUIPMENT INSTALLATION	17
CONTROL BUILDING MODIFICATION	13
EQUIPMENT TESTING	7
OPERATIONAL	3
SERIES COMPENSATION STATION	
SITE GRADING	10
BELOW-GRADE WORK (FOUNDATIONS, CONDUIT, GROUNDING)	15
CONTROL HOUSE CONSTRUCTION	17
EQUIPMENT INSTALLATION	16
EQUIPMENT TESTING	10
OPERATIONAL	3

Week columns: Wk 1 – Wk 57

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FIGURE 26

CONSTRUCTION SCHEDULE FOR DESIGN OPTION 2 TERMINALS, SUBSTATIONS AND SERIES COMPENSATION STATION – SHEET 1

DESIGN OPTION - 2

TOTAL DURATION 111 week

TASK	DURATION (WEEKS)	Wk 58	Wk 59	Wk 60	Wk 61	Wk 62	Wk 63	Wk 64	Wk 65	Wk 66	Wk 67	Wk 68	Wk 69	Wk 70	Wk 71	Wk 72	Wk 73	Wk 74	Wk 75	Wk 76	Wk 77	Wk 78	Wk 79	Wk 80	Wk 81	Wk 82	Wk 83	Wk 84	Wk 85	Wk 86	Wk 87	Wk 88	Wk 89	Wk 90	Wk 91	Wk 92	Wk 93	Wk 94	Wk 95	Wk 96	Wk 97	Wk 98	Wk 99	Wk 100	Wk 101	Wk 102	Wk 103	Wk 104	Wk 105	Wk 106	Wk 107	Wk 108	Wk 109	Wk 110	Wk 111	Wk 112	Wk 113
AC/DC CONVERTER STATION (NEAR IPP)																																																									
SITE GRADING	13																																																								
BELOW-GRADE WORK (FOUNDATIONS, CONDUIT, GROUNDING)	32																																																								
BUILDING CONSTRUCTION	35																																																								
EQUIPMENT INSTALLATION	39																																																								
EQUIPMENT TESTING	21																																																								
OPERATIONAL	9																																																								
500/345 kV AC SUBSTATION (NEAR IPP)																																																								
SITE GRADING	22																																																								
BELOW-GRADE WORK (FOUNDATIONS, CONDUIT, GROUNDING)	22																																																								
EQUIPMENT INSTALLATION	26																																																								
CONTROL BUILDING INSTALLATION	22																																																								
EQUIPMENT TESTING	13																																																								
OPERATIONAL	7																																																								
IPP 345 kV AC SUBSTATION MODIFICATION																																																								
SITE GRADING	13																																																								
BELOW-GRADE WORK (FOUNDATIONS, CONDUIT, GROUNDING)	15																																																								
EQUIPMENT INSTALLATION	17																																																								
CONTROL BUILDING MODIFICATION	13																																																								
EQUIPMENT TESTING	7																																																								
OPERATIONAL	3																																																								
SERIES COMPENSATION STATION																																																									
SITE GRADING	10																																																								
BELOW-GRADE WORK (FOUNDATIONS, CONDUIT, GROUNDING)	15																																																								
CONTROL HOUSE CONSTRUCTION	17																																																								
EQUIPMENT INSTALLATION	16																																																								
EQUIPMENT TESTING	10																																																								
OPERATIONAL	3																																																								

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FIGURE 26

CONSTRUCTION SCHEDULE FOR DESIGN OPTION 2 TERMINALS, SUBSTATIONS AND SERIES COMPENSATION STATION – SHEET 2

DESIGN OPTION - 3

TOTAL DURATION: 82 week

TASK	DURATION (WEEKS)
500/345 kV AC SUBSTATION (NEAR IPP)	
SITE GRADING	22
BELOW-GRADE WORK (FOUNDATIONS, CONDUIT, GROUNDING)	22
EQUIPMENT INSTALLATION	26
CONTROL BUILDING INSTALLATION	22
EQUIPMENT TESTING	13
OPERATIONAL	7
IPP 345 kV AC SUBSTATION MODIFICATION	
SITE GRADING	13
BELOW-GRADE WORK (FOUNDATIONS, CONDUIT, GROUNDING)	15
EQUIPMENT INSTALLATION	17
CONTROL BUILDING MODIFICATION	13
EQUIPMENT TESTING	7
OPERATIONAL	3
SERIES COMPENSATION STATION	
SITE GRADING	10
BELOW-GRADE WORK (FOUNDATIONS, CONDUIT, GROUNDING)	15
CONTROL HOUSE CONSTRUCTION	17
EQUIPMENT INSTALLATION	16
EQUIPMENT TESTING	10
OPERATIONAL	3

Wk 1 · Wk 2 · Wk 3 · Wk 4 · Wk 5 · Wk 6 · Wk 7 · Wk 8 · Wk 9 · Wk 10 · Wk 11 · Wk 12 · Wk 13 · Wk 14 · Wk 15 · Wk 16 · Wk 17 · Wk 18 · Wk 19 · Wk 20 · Wk 21 · Wk 22 · Wk 23 · Wk 24 · Wk 25 · Wk 26 · Wk 27 · Wk 28 · Wk 29 · Wk 30 · Wk 31 · Wk 32 · Wk 33 · Wk 34 · Wk 35 · Wk 36 · Wk 37 · Wk 38 · Wk 39 · Wk 40 · Wk 41 · Wk 42 · Wk 43 · Wk 44 · Wk 45 · Wk 46 · Wk 47 · Wk 48 · Wk 49 · Wk 50 · Wk 51 · Wk 52 · Wk 53 · Wk 54 · Wk 55 · Wk 56 · Wk 57

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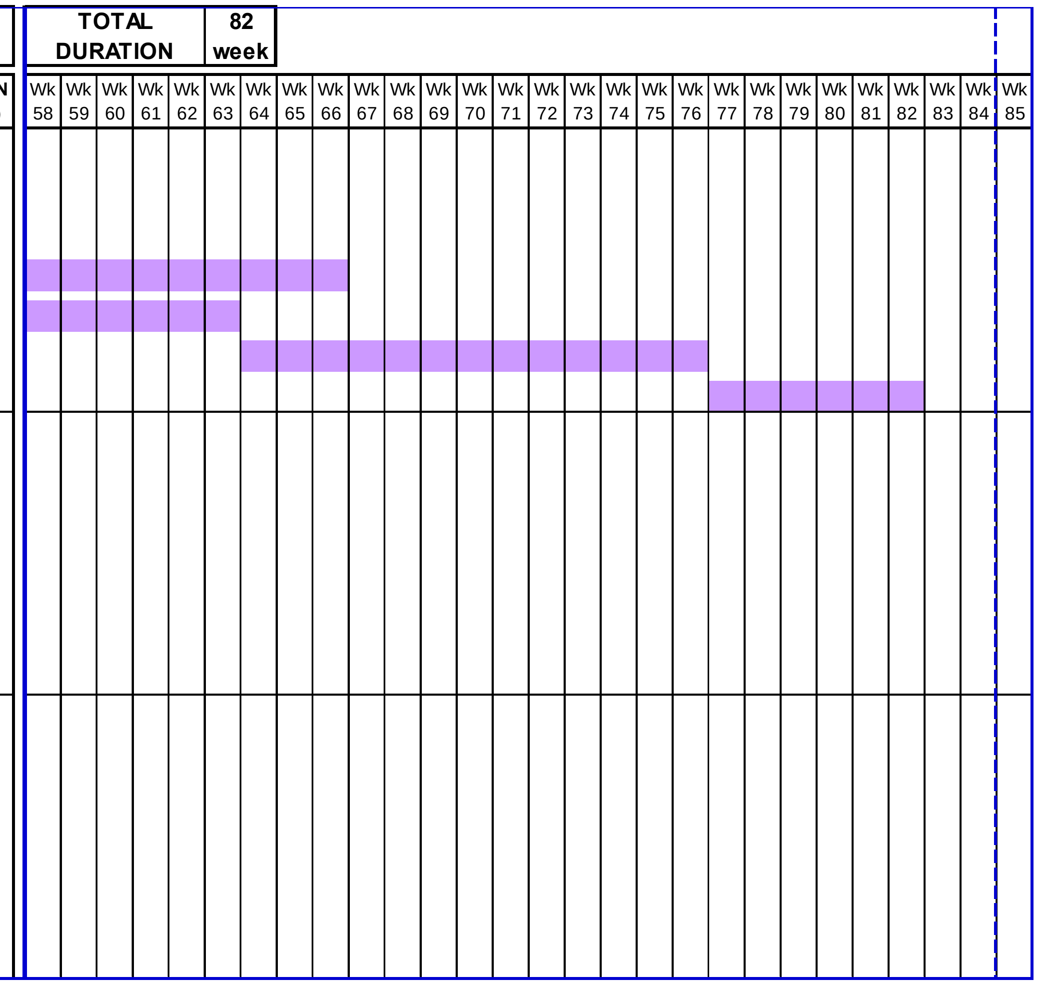
FIGURE 27
CONSTRUCTION SCHEDULE FOR DESIGN OPTION 3 SUBSTATION AND SERIES COMPENSATION STATION – SHEET 1

DESIGN OPTION - 3

TASK	DURATION (WEEKS)
500/345 kV AC SUBSTATION (NEAR IPP)	
SITE GRADING	22
BELOW-GRADE WORK (FOUNDATIONS, CONDUIT, GROUNDING)	22
EQUIPMENT INSTALLATION	26
CONTROL BUILDING INSTALLATION	22
EQUIPMENT TESTING	13
OPERATIONAL	7
IPP 345 kV AC SUBSTATION MODIFICATION	
SITE GRADING	13
BELOW-GRADE WORK (FOUNDATIONS, CONDUIT, GROUNDING)	15
EQUIPMENT INSTALLATION	17
CONTROL BUILDING MODIFICATION	13
EQUIPMENT TESTING	7
OPERATIONAL	3
SERIES COMPENSATION STATION	
SITE GRADING	10
BELOW-GRADE WORK (FOUNDATIONS, CONDUIT, GROUNDING)	15
CONTROL HOUSE CONSTRUCTION	17
EQUIPMENT INSTALLATION	16
EQUIPMENT TESTING	10
OPERATIONAL	3



SECTION 1
NORTHERN TERMINAL - NORTHEASTERN UTAH

TOTAL DURATION 122 weeks

TASK	DURATION (WEEKS)
CONSTRUCTION MANAGEMENT / ENGINEERING SUPPORT / ADMINISTRATION	122
INSPECTION	120
MOBILIZE CONTRACTOR	6
RECEIVE / HANDLE MATERIALS	120
SURVEY / STAKE ACCESS ROADS & STRUCTURE PADS	49
CONSTRUCT ACCESS ROADS AND / OR STRUCTURE PADS	49
GEOLOGICAL INVESTIGATIONS	56
SURVEY / STAKE STRUCTURE LOCATIONS	67
EXCAVATE HOLES FOR SELF SUPPORTING LATTICE STRUCTURE	70
INSTALL FOUNDATIONS FOR SELF SUPPORTING LATTICE STRUCTURE	70
HAUL MATERIALS FOR SELF SUPPORTING LATTICE STRUCTURE	60
ASSEMBLE SELF SUPPORTING LATTICE STRUCTURE	66
ERECT SELF SUPPORTING LATTICE STRUCTURE	72
WIRE INSTALLATION	85
FINAL CLEAN UP / RECLAMATION / RESTORATION	70

SECTION 2
NORTHEASTERN UTAH - WEST CENTRAL UTAH

TOTAL DURATION 124 weeks

TASK	DURATION (WEEKS)
CONSTRUCTION MANAGEMENT / ENGINEERING SUPPORT / ADMINISTRATION	124
INSPECTION	122
MOBILIZE CONTRACTOR	6
RECEIVE / HANDLE MATERIALS	122
SURVEY / STAKE ACCESS ROADS & STRUCTURE PADS	50
CONSTRUCT ACCESS ROADS AND / OR STRUCTURE PADS	50
GEOLOGICAL INVESTIGATIONS	58
SURVEY / STAKE STRUCTURE LOCATIONS	69
EXCAVATE HOLES FOR SELF SUPPORTING LATTICE STRUCTURE	72
INSTALL FOUNDATIONS FOR SELF SUPPORTING LATTICE STRUCTURE	72
HAUL MATERIALS FOR SELF SUPPORTING LATTICE STRUCTURE	63
ASSEMBLE SELF SUPPORTING LATTICE STRUCTURE	68
ERECT SELF SUPPORTING LATTICE STRUCTURE	74
WIRE INSTALLATION	88
FINAL CLEAN UP / RECLAMATION / RESTORATION	72

SECTION 3
WEST CENTRAL UTAH - SOUTHERN TERMINAL

TOTAL DURATION 140 weeks

TASK	DURATION (WEEKS)
CONSTRUCTION MANAGEMENT / ENGINEERING SUPPORT / ADMINISTRATION	140
INSPECTION	138
MOBILIZE CONTRACTOR	6
RECEIVE / HANDLE MATERIALS	138
SURVEY / STAKE ACCESS ROADS & STRUCTURE PADS	66
CONSTRUCT ACCESS ROADS AND / OR STRUCTURE PADS	66
GEOLOGICAL INVESTIGATIONS	76
SURVEY / STAKE STRUCTURE LOCATIONS	76
EXCAVATE HOLES FOR SELF SUPPORTING LATTICE STRUCTURE	90
INSTALL FOUNDATIONS FOR SELF SUPPORTING LATTICE STRUCTURE	90
HAUL MATERIALS FOR SELF SUPPORTING LATTICE STRUCTURE	83
ASSEMBLE SELF SUPPORTING LATTICE STRUCTURE	83
ERECT SELF SUPPORTING LATTICE STRUCTURE	96
WIRE INSTALLATION	84
FINAL CLEAN UP / RECLAMATION / RESTORATION	96

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TRANSWEST EXPRESS TRANSMISSION PROJECT
FIGURE 28
CONSTRUCTION SCHEDULE FOR
DESIGN OPTION 3 TRANSMISSION LINE
SHEET 1

SECTION 1
NORTHERN TERMINAL - NORTHEASTERN UTAH

TOTAL DURATION	111 weeks

TASK	DURATION (WEEKS)
CONSTRUCTION MANAGEMENT / ENGINEERING SUPPORT / ADMINISTRATION	122
INSPECTION	120
MOBILIZE CONTRACTOR	6
RECEIVE / HANDLE MATERIALS	120
SURVEY / STAKE ACCESS ROADS & STRUCTURE PADS	49
CONSTRUCT ACCESS ROADS AND / OR STRUCTURE PADS	49
GEOLOGICAL INVESTIGATIONS	56
SURVEY / STAKE STRUCTURE LOCATIONS	67
EXCAVATE HOLES FOR SELF SUPPORTING LATTICE STRUCTURE	70
INSTALL FOUNDATIONS FOR SELF SUPPORTING LATTICE STRUCTURE	70
HAUL MATERIALS FOR SELF SUPPORTING LATTICE STRUCTURE	60
ASSEMBLE SELF SUPPORTING LATTICE STRUCTURE	66
ERECT SELF SUPPORTING LATTICE STRUCTURE	72
WIRE INSTALLATION	85
FINAL CLEAN UP / RECLAMATION / RESTORATION	70

SECTION 2
NORTHEASTERN UTAH - WEST CENTRAL UTAH

TOTAL DURATION	124 weeks

TASK	DURATION (WEEKS)
CONSTRUCTION MANAGEMENT / ENGINEERING SUPPORT / ADMINISTRATION	124
INSPECTION	122
MOBILIZE CONTRACTOR	6
RECEIVE / HANDLE MATERIALS	122
SURVEY / STAKE ACCESS ROADS & STRUCTURE PADS	50
CONSTRUCT ACCESS ROADS AND / OR STRUCTURE PADS	50
GEOLOGICAL INVESTIGATIONS	58
SURVEY / STAKE STRUCTURE LOCATIONS	69
EXCAVATE HOLES FOR SELF SUPPORTING LATTICE STRUCTURE	72
INSTALL FOUNDATIONS FOR SELF SUPPORTING LATTICE STRUCTURE	72
HAUL MATERIALS FOR SELF SUPPORTING LATTICE STRUCTURE	63
ASSEMBLE SELF SUPPORTING LATTICE STRUCTURE	68
ERECT SELF SUPPORTING LATTICE STRUCTURE	74
WIRE INSTALLATION	88
FINAL CLEAN UP / RECLAMATION / RESTORATION	72

SECTION 3
WEST CENTRAL UTAH - SOUTHERN TERMINAL

TOTAL DURATION	140 weeks

TASK	DURATION (WEEKS)
CONSTRUCTION MANAGEMENT / ENGINEERING SUPPORT / ADMINISTRATION	140
INSPECTION	138
MOBILIZE CONTRACTOR	6
RECEIVE / HANDLE MATERIALS	138
SURVEY / STAKE ACCESS ROADS & STRUCTURE PADS	66
CONSTRUCT ACCESS ROADS AND / OR STRUCTURE PADS	66
GEOLOGICAL INVESTIGATIONS	76
SURVEY / STAKE STRUCTURE LOCATIONS	76
EXCAVATE HOLES FOR SELF SUPPORTING LATTICE STRUCTURE	90
INSTALL FOUNDATIONS FOR SELF SUPPORTING LATTICE STRUCTURE	90
HAUL MATERIALS FOR SELF SUPPORTING LATTICE STRUCTURE	83
ASSEMBLE SELF SUPPORTING LATTICE STRUCTURE	83
ERECT SELF SUPPORTING LATTICE STRUCTURE	96
WIRE INSTALLATION	84
FINAL CLEAN UP / RECLAMATION / RESTORATION	96

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TRANSWEST EXPRESS TRANSMISSION PROJECT
FIGURE 28
CONSTRUCTION SCHEDULE FOR
DESIGN OPTION 3 TRANSMISSION LINE
SHEET 2

SECTION 1
NORTHERN TERMINAL - NORTHEASTERN UTAH

TOTAL DURATION **122 weeks**

TASK	DURATION (WEEKS)	Wk 109	Wk 110	Wk 111	Wk 112	Wk 113	Wk 114	Wk 115	Wk 116	Wk 117	Wk 118	Wk 119	Wk 120	Wk 121	Wk 122	Wk 123	Wk 124	Wk 125	Wk 126	Wk 127	Wk 128	Wk 129	Wk 130	Wk 131	Wk 132	Wk 133	Wk 134	Wk 135	Wk 136	Wk 137	Wk 138	Wk 139	Wk 140	Wk 141	Wk 142	Wk 143	Wk 144	Wk 145	Wk 146	Wk 147	Wk 148	Wk 149	Wk 150	Wk 151	Wk 152	Wk 153	Wk 154	Wk 155	Wk 156	Wk 157	Wk 158	Wk 159	Wk 160	Wk 161	Wk 162	Wk 163
CONSTRUCTION MANAGEMENT / ENGINEERING SUPPORT / ADMINISTRATION	122																																																							
INSPECTION	120																																																							
MOBILIZE CONTRACTOR	6																																																							
RECEIVE / HANDLE MATERIALS	120																																																							
SURVEY / STAKE ACCESS ROADS & STRUCTURE PADS	49																																																							
CONSTRUCT ACCESS ROADS AND / OR STRUCTURE PADS	49																																																							
GEOLOGICAL INVESTIGATIONS	56																																																							
SURVEY / STAKE STRUCTURE LOCATIONS	67																																																							
EXCAVATE HOLES FOR SELF SUPPORTING LATTICE STRUCTURE	70																																																							
INSTALL FOUNDATIONS FOR SELF SUPPORTING LATTICE STRUCTURE	70																																																							
HAUL MATERIALS FOR SELF SUPPORTING LATTICE STRUCTURE	60																																																							
ASSEMBLE SELF SUPPORTING LATTICE STRUCTURE	66																																																							
ERECT SELF SUPPORTING LATTICE STRUCTURE	72																																																							
WIRE INSTALLATION	85																																																							
FINAL CLEAN UP / RECLAMATION / RESTORATION	70																																																							

SECTION 2
NORTHEASTERN UTAH - WEST CENTRAL UTAH

TOTAL DURATION **124 weeks**

TASK	DURATION (WEEKS)	Wk 109	Wk 110	Wk 111	Wk 112	Wk 113	Wk 114	Wk 115	Wk 116	Wk 117	Wk 118	Wk 119	Wk 120	Wk 121	Wk 122	Wk 123	Wk 124	Wk 125	Wk 126	Wk 127	Wk 128	Wk 129	Wk 130	Wk 131	Wk 132	Wk 133	Wk 134	Wk 135	Wk 136	Wk 137	Wk 138	Wk 139	Wk 140	Wk 141	Wk 142	Wk 143	Wk 144	Wk 145	Wk 146	Wk 147	Wk 148	Wk 149	Wk 150	Wk 151	Wk 152	Wk 153	Wk 154	Wk 155	Wk 156	Wk 157	Wk 158	Wk 159	Wk 160	Wk 161	Wk 162	Wk 163
CONSTRUCTION MANAGEMENT / ENGINEERING SUPPORT / ADMINISTRATION	124																																																							
INSPECTION	122																																																							
MOBILIZE CONTRACTOR	6																																																							
RECEIVE / HANDLE MATERIALS	122																																																							
SURVEY / STAKE ACCESS ROADS & STRUCTURE PADS	50																																																							
CONSTRUCT ACCESS ROADS AND / OR STRUCTURE PADS	50																																																							
GEOLOGICAL INVESTIGATIONS	58																																																							
SURVEY / STAKE STRUCTURE LOCATIONS	69																																																							
EXCAVATE HOLES FOR SELF SUPPORTING LATTICE STRUCTURE	72																																																							
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ERECT SELF SUPPORTING LATTICE STRUCTURE	74																																																							
WIRE INSTALLATION	88																																																							
FINAL CLEAN UP / RECLAMATION / RESTORATION	72																																																							

SECTION 3
WEST CENTRAL UTAH - SOUTHERN TERMINAL

TOTAL DURATION **140 weeks**

TASK	DURATION (WEEKS)	Wk 109	Wk 110	Wk 111	Wk 112	Wk 113	Wk 114	Wk 115	Wk 116	Wk 117	Wk 118	Wk 119	Wk 120	Wk 121	Wk 122	Wk 123	Wk 124	Wk 125	Wk 126	Wk 127	Wk 128	Wk 129	Wk 130	Wk 131	Wk 132	Wk 133	Wk 134	Wk 135	Wk 136	Wk 137	Wk 138	Wk 139	Wk 140	Wk 141	Wk 142	Wk 143	Wk 144	Wk 145	Wk 146	Wk 147	Wk 148	Wk 149	Wk 150	Wk 151	Wk 152	Wk 153	Wk 154	Wk 155	Wk 156	Wk 157	Wk 158	Wk 159	Wk 160	Wk 161	Wk 162	Wk 163
CONSTRUCTION MANAGEMENT / ENGINEERING SUPPORT / ADMINISTRATION	140																																																							
INSPECTION	138																																																							
MOBILIZE CONTRACTOR	6																																																							
RECEIVE / HANDLE MATERIALS	138																																																							
SURVEY / STAKE ACCESS ROADS & STRUCTURE PADS	66																																																							
CONSTRUCT ACCESS ROADS AND / OR STRUCTURE PADS	66																																																							
GEOLOGICAL INVESTIGATIONS	76																																																							
SURVEY / STAKE STRUCTURE LOCATIONS	76																																																							
EXCAVATE HOLES FOR SELF SUPPORTING LATTICE STRUCTURE	90																																																							
INSTALL FOUNDATIONS FOR SELF SUPPORTING LATTICE STRUCTURE	90																																																							
HAUL MATERIALS FOR SELF SUPPORTING LATTICE STRUCTURE	83																																																							
ASSEMBLE SELF SUPPORTING LATTICE STRUCTURE	83																																																							
ERECT SELF SUPPORTING LATTICE STRUCTURE	96																																																							
WIRE INSTALLATION	84																																																							
FINAL CLEAN UP / RECLAMATION / RESTORATION	96																																																							

7.4 Comparison of Proposed TWE Project to Design Options

Table 14 provides a comparison summary of Design Options 2 and 3 to the proposed TWE Project.

TABLE 14 COMPARISON OF PROPOSED TWE PROJECT TO DESIGN OPTIONS

COMPARISON FACTORS	PROPOSED TWE PROJECT	DESIGN OPTION 2	DESIGN OPTION 3
TWE Project Configuration	Two-terminal ±600 kV DC transmission line between WY and NV with potential interconnection to IPP system near Delta, UT.	Two terminal ±600 kV DC transmission line between WY and IPP system near Delta, UT. Two terminal single circuit 500 kV AC transmission line between Delta, UT and NV.	Phased Approach Phase 1 – Two terminal 500 kV AC (±600 kV DC) line between WY and IPP near Delta, UT. Phase 2 – proposed TWE Project. Involves building DC line from IPP to Marketplace and two AC/DC converter stations.
Contingencies for Design Options	N/A	Capacity available in the future on IPP STS to serve Desert Southwest.	Capacity available in the future on IPP STS to serve Desert Southwest. The need for transmission capacity requires a phased implementation.
Current Status of System Contingencies and Design Options	N/A	Future available capacity on the IPP STS is uncertain. Therefore, the status of Design Option 2 is uncertain.	Future available capacity on the IPP STS is uncertain. Currently, all of the TWE Project's 3,000 MW of capacity is needed by the projected in-service date. It is unlikely Design Option 3 will be pursued.
Routing Alternatives	As part of the EIS preparation, the BLM and Western have established four regions for the TWE Project route. Each region has a distinct set of Route Alternatives.	The TWE Project route region and all Route Alternatives for each region all apply to Design Option 2.	The TWE Project route region and all Route Alternatives for each region all apply to Design Option 3.
System Capacity	3,000 MW between WY and NV	3,000 MW between WY and UT 1,500 MW between UT and NV	Phase 1 - 1,500 MW between WY and UT Phase 2 - 3,000 MW between WY and NV
Typical Transmission Line Towers Used	Guyed or self-supporting lattice towers holding up <u>two conductor bundles</u> for entire Project.	Guyed or self-supporting lattice towers holding up <u>two conductor bundles</u> between WY and Delta, UT. Guyed or self-supporting lattice towers holding up <u>three conductor bundles</u> between Delta, UT and NV.	Guyed or self-supporting lattice towers holding up <u>three conductor bundles</u> between WY and Delta, UT. Guyed or self-supporting lattice towers holding up <u>two conductor bundles</u> between Delta, UT and NV.

COMPARISON FACTORS	PROPOSED TWE PROJECT	DESIGN OPTION 2	DESIGN OPTION 3
Terminals - AC/DC Converter Stations	Northern Terminal near Sinclair, WY. Southern Terminal at Marketplace Hub near Boulder City, NV.	Northern Terminal same as proposed TWE Project. Southern Terminal near the IPP near Delta, UT.	Phase 1 – no AC/DC Converter Stations Phase 2 - Same as proposed TWE Project.
TWE Project Interconnections	Northern Terminal will interconnect with existing 230 kV line and one (two total) 500 kV circuit of the Energy Gateway West and Energy Gateway South projects. Southern Terminal will interconnect with the existing 500 kV AC substations (up to 4 total) at the Marketplace Hub near Boulder City, NV. Potential interconnection with IPP system near Delta, UT.	Same as proposed TWE Project for Northern Terminal. Southern Terminal would be located near Delta, UT and would be interconnected to the IPP transmission system, and the TWE Project 500 kV AC line. The TWE Project 500 kV AC line would interconnect with one of the existing 500 kV AC substations at the Marketplace Hub near Boulder City, NV.	Phase 1 – The TWE Project 500 kV AC line would interconnect with the existing 230 kV line and the 500 kV Energy Gateway West and Energy Gateway South lines in WY and with the IPP Substation near Delta, UT. Phase 2 – same as the proposed TWE Project.
Related Structures and Facilities	Fiber optic network communications system. Two ground electrode facilities near terminals.	Same as the proposed TWE Project, however, ground electrode facility would be within 50 miles of the Southern Terminal near IPP Substation, Delta, UT.	Phase 1 – Fiber optic network communications system between WY and NV. No ground electrode. Phase 2 - Same as proposed TWE Project.

8.0 ENVIRONMENTAL MITIGATION MEASURES

8.1 Introduction

This section of the FEIS POD describes the framework for the environmental compliance program to be implemented for the TWE Project.

Prior to construction, TransWest will prepare the NTP POD, which will incorporate environmental measures and terms and conditions stipulated in the RODs, ROW grants and special use authorizations issued by each federal agency. The NTP POD will provide detailed information on the TWE Project's construction plans and specifications, and construction practices and procedures for the selected alternative. It will also describe the processes and procedures TransWest will employ to comply with the requirements of the RODs, ROW grants, and special use authorizations and include the final Environmental Compliance and Monitoring Plan. A framework Environmental Compliance and Monitoring Plan is provided in Appendix G.

Below is a list of specific framework plans which are part of this FEIS POD. The process leading to a set of final plans is iterative. Initial (framework) plans are based upon preliminary engineering and design of all alternatives analyzed in the FEIS, potential impacts disclosed in the DEIS, and proposed BMPs and mitigation measures. Final plans will be based upon final engineering and design of the selected alternative and requirements and terms and conditions of the RODs, ROW grants, special use authorizations and any other required permits. Framework plans describe the process to be followed and matters to be considered in preparing the final plans for the selected alternative. These framework plans are an intermediate step and establish the structure of each plan.

- Appendix A: Access Road Siting and Management Plan
- Appendix B: Avian Protection Plan
- Appendix C: Blasting Plan
- Appendix D: Cultural Resources Protection and Management Plan
- Appendix E: Dust Control and Air Quality Plan
- Appendix F: Emergency Preparedness and Response Plan
- Appendix G: Environmental Compliance and Monitoring Plan
- Appendix H: Fire Protection Plan
- Appendix I: Flagging, Fencing, and Signage Plan
- Appendix J: Geotechnical Plan
- Appendix K: Greater Sage-Grouse Mitigation Plan
- Appendix L: Hazardous Materials Management Plan
- Appendix M: Health and Safety Plan

- Appendix N: Noxious Weed Management Plan
- Appendix O: Operations and Maintenance Plan
- Appendix P: Paleontological Resources Management and Mitigation Plan
- Appendix Q: Reclamation Plan
- Appendix R: ROW Preparation and Vegetation Management Plan
- Appendix S: Spill Prevention and Response Plan
- Appendix T: Stormwater Pollution Prevention Plan
- Appendix U: Traffic and Transportation Management Plan
- Appendix V: Visual Resources Management Plan
- Appendix W: Water Resources Protection Plan
- Appendix X: Wildlife and Plant Conservation Measures Plan

8.2 POD Implementation on Public/Private Lands

The NTP POD will outline the stipulations, terms and conditions, and mitigation measures set forth in the RODs, ROW grants, special use authorizations and other required permits that must be followed during construction, operation, and maintenance of the Project. The POD is intended to be used Project-wide as (1) a summary of Project environmental requirements and protection measures, and (2) a description of the processes and procedures that will be used to ensure compliance (including the requirements of the U.S. Fish and Wildlife Service, BLM, USFS, and other federal, state, and/or local agencies) as appropriate.

The POD will be an enforceable stipulation of the ROD and the BLM ROW grant. The USFS may choose to make the POD or a similar document enforceable as part of the ROD, or special use authorization (SUA). The POD applies not only to construction of the Project, but also to the operation and maintenance phase of the Project. The BLM and USFS have jurisdiction over all lands under the administrative control of each of respective agency.

8.3 Overview of Mitigation Measures

Table 15 outlines the Applicant committed environmental mitigation measures proposed by TransWest that are being taken into account to reduce impacts to environmental resources. Mitigation measures are organized by major resource topics. These measures are part of the proposed TWE Project, and would be common to all the FEIS alternatives. Table 15 identifies the phase(s) during which each measure would be implemented:

- P – planning and engineering design
- C – construction
- O – operation and maintenance
- D – decommissioning

Mitigation measures include general mitigation measures, which would apply to the TWE Project as a whole; and selective mitigation measures, which would be implemented on a case-by-case basis to address specific environmental impacts or localized conditions. The mitigation measures will be updated through the NEPA process to incorporate appropriate selective mitigation measures. Note that the Construction, Operation and Maintenance Plan will be a part of the NTP POD.

TABLE 15 APPLICANT COMMITTED ENVIRONMENTAL MITIGATION MEASURES

DEIS NO.	PHASE(S)[1]	TOPIC	DESCRIPTION OF MITIGATION MEASURE
General Measures			
TWE-1	P	General, compliance with agency stipulations and RODs	The TWE Project will be planned, constructed, operated, and decommissioned in accordance with the agencies' Records of Decision (RODs) the U.S. Bureau of Land Management's (BLM) ROW Grant stipulations, U.S. Forest Service (USFS) Special Use Permit stipulations, and requirements of other permitting agencies.
TWE-2	P	General, compliance with laws and regulations	The Applicant will comply with all applicable environmental laws and regulations. Applicable laws and regulations may include, but are not limited to, the Clean Water Act (CWA) Section 303(d) and Section 404; the Wild and Scenic Rivers Act, Section 3(a) or 2(s)ii; the Endangered Species act (ESA), Section 7; the National Historic Preservation Act (NHP), Section 106; and the Native American Graves Protection and Repatriation Act (NAGPRA). Compliance with all applicable laws and regulations will be documents in the Final Plan of Development (POD)/Construction, Operation and Maintenance (COM) Plan.
TWE-3	P	General, mitigation monitoring plan	The POD will include a mitigation monitoring plan that will address how each mitigation measure required by permitting agencies in their respective decision documents and permits will be monitored for compliance.
TWE-4	P	General, environmental training	Prior to construction, all personnel will be instructed on the protection of cultural, paleontological, ecological resources, and other natural resources in accordance with the POD provisions. To assist in this effort, the construction contract would address (a) federal, state , and tribal laws regarding cultural resources, fossils, plants, and wildlife, including collection and removal; and (b) the importance of these resources and the purpose and necessity of protecting them.
Project Design, Access, and Construction			
TWE-5	P	General, compliance with laws and regulations	The POD will display the location of Project infrastructure (e.g., towers, access roads, substations) and identify short-term and long-term land and resource impacts and the mitigation measures that will be implemented for the site-specific and resource-specific environmental impacts.
TWE-6	P	General, Access Road Plan	The POD will include an Access Road Siting and Management Plan that incorporates relevant agency standards regarding road design, construction, maintenance, and decommissioning. The Access Road Siting and Management Plan will incorporate best management practices, stipulated by the agencies in their respective decision documents and permits.
TWE-7	P	Access, visual	The alignment of any new access roads will follow the designated area's landform contours where practical, providing that such alignment does not additionally impact resource values. This will minimize ground disturbance and reduce scarring (visual contrast).
TWE-8	P,C	Access, tower placements, surface water, vegetation management, drainage, dust control	Crossings of streams and waterways will be done in compliance with federal, state, and local regulations. Roads will be built as near as possible at right angles to the streams and washes (Arizona crossing). Culverts will be installed where necessary. All construction and maintenance activities will be conducted in a manner that will minimize disturbance to vegetation, drainage channels, and intermittent or perennial stream banks. In addition, fugitive dust will be controlled during road construction as required by state and local permits. All existing roads will be left in a condition equal to, or better than, their condition prior to the construction of the transmission line. Structures will be sited with a minimum distance of 200 feet from streams, wherever possible.
TWE-9	C,O	Access	All construction vehicle movement outside the ROW will be restricted to pre-designated access or public roads.

DEIS NO.	PHASE(S)[1]	TOPIC	DESCRIPTION OF MITIGATION MEASURE
TWE-10	P,C	General ROW, visual	The area limits of construction activities will be predetermined, with activity restricted to and confined within those limits. No paint or permanent discoloring agents will be applied to rocks or vegetation to indicate survey or construction activity limits.
TWE-11	P,C	Access, visual	In construction areas where pre-contouring is not required, vegetation will be left in place, wherever possible, and original contour will be maintained to avoid excessive root damage and to allow for re-sprouting.
TWE-12	P,C,O	Access, soils, vegetation, water, cultural visual resources	Except for repairs necessary to make roads passable, no widening or upgrading of existing access roads will be undertaken in the area of construction and operation, where soils or vegetation are sensitive to disturbance. In designated areas, structures will be placed to avoid sensitive features such as, but not limited to, riparian areas, water courses and cultural sites, or to allow conductors to clearly span the features within limits of standard structure design. This will minimize the amount of disturbance to the sensitive features or reduce visual contrast.
TWE-13	C	Vegetation management, restoration, erosion control	In construction areas (e.g., marshalling yards, structure sites, spur roads from existing access roads) where ground disturbance is significant or where re-contouring is required, surface restoration will occur as required by the landowner or land management agency. The method of restoration will normally consist of returning disturbed areas back to their natural contour, reseeding (if required), installing cross drains for erosion control, placing water bars in the road, and filling ditches.
TWE-14	P,C	General, soils, erosion control, visual	The POD will show the location of borrow sites, from which material will be obtained. Borrow pits will be stripped of topsoil to a depth of approximately six inches. Stripped topsoil will be stockpiled and, upon completion of borrow excavation, spread to a uniform depth of six inches over areas of borrow pits from which removed. Before replacing topsoil, excavated surfaces will be reasonably smooth and uniformly sloped. The sides of borrow pits will be brought to stable slopes with slope intersection shaped to carry the natural contour of adjacent undisturbed terrain into the pit to give a natural appearance. When necessary, borrow pits will be drained by open ditches to prevent accumulation of standing water.
TWE-15	C	Flagging, Fencing and Signage	The POD will include a Flagging, Fencing, and a Signage Plan. Except for permanent survey markers and material that locate proposed facilities, stakes, pins, rebar, spikes, and other material will be removed from the surface and within the top 15 inches of the topsoil as part of final clean-up. The Applicant will adhere to BLM fencing standards where required. Fences on ROW will be removed where necessary and replaced to the original condition or better when the work is finished. Where existing fences are removed to facilitate the work, temporary fence protection for lands adjacent to the ROW will be provided at all times during the continuation of the Contract. Such temporary fence protection will be adequate to prevent public access to restricted areas. Temporary fencing constructed on the ROW will be removed by the Contractor as part of the clean-up operations prior to final acceptance of the completed work.
TWE-16	C	Site restoration and clean-up, water resources, land use	Watering facilities (tanks, natural springs and/or developed springs, water lines, wells, etc.) will be repaired or replaced, if damaged or destroyed by construction activities, to their pre-disturbed condition as required by the landowner or land management agency.
TWE-17	C	Site restoration and clean-up	Existing vegetation such as landscape plants, gardens, and field crops, which are damaged by the application of the soil-applied herbicide, will be replaced by the Contractor at its expense.

DEIS NO.	PHASE(S)[1]	TOPIC	DESCRIPTION OF MITIGATION MEASURE
TWE-18	C	Site clean-up	The Applicant will pay fair market value to the land management agency for any merchantable forest products that will be cut during ROW clearing. Merchantable forest products will either be removed or stacked at locations determined by the land management agency.
Geology and Soils			
TWE-19	C	Drainage, soil erosion control	The POD will include an Erosion Control Plan as part of the Stormwater Pollution Prevention Plan (SWPPP). Grading will be performed to provide adequate drainage around structure sites and sufficient clearance under conductors. Excavated material will be spread around the site where it was excavated. Topsoil will be piled separately and replaced after work completion.
Groundwater, Surface Water and Wetlands			
TWE-20	P	Water quality	As part of the Clean Water Act (CWA) 404 Permit for the TWE Project, the POD will include a Water Resources Protection Plan, which will incorporate measures to avoid and minimize impacts to wetlands and waters of the U.S. to the extent practical. The POD will include a SWPPP. The Applicant will identify all streams in the vicinity of the proposed project sites that are listed as impaired under Section 303(d) of the CWA and develop a management plan to avoid, reduce, and/or minimize adverse impacts to those streams.
TWE-21	P	Water quality	The Applicant will obtain a National Pollutant Discharge Elimination System (NPDES) permit from the Environmental Protection Agency (EPA) prior to construction.
TWE-22	C	Water quality	Runoff from excavated areas, construction materials or wastes (including truck washing and concrete washes), and chemical products such as oil, grease, solvents, fuels, and pesticides will be controlled. Excavated material or other construction material will not be stockpiled or deposited near or on stream banks, lake shorelines, ditches, irrigation canals, or other areas where runoff could impact the environment.
TWE-23	C	Water quality	Washing of concrete trucks or disposal of excess concrete in any ditch, canal, stream, or other surface water will not be permitted. Concrete wastes will be disposed of in accordance with all federal, state and local regulations.
TWE-24	C,O	Surface water, wetlands	Vehicle refueling and servicing activities will be performed in designated construction zones located more than 100 feet from wetlands and intermittent streams and more than 500 feet from perennial streams. Spill prevention and containment measures or practices will be incorporated as needed.
TWE-25	P	Dewatering	A dewatering permit will be obtained from the appropriate agencies if required for construction dewatering activities.
Vegetation and Soils Management			
TWE-26	P,C	Vegetation management and noxious weeds	The POD will include a Reclamation Plan and a Noxious Weed Management Plan. The Reclamation Plan will address plant removal and selective clearing. The Noxious Weed Management Plan will be developed in accordance with appropriate land management agencies' standards, consistent with applicable regulations and agency permitting stipulations for the control of noxious weeds and invasive species (Executive Order [E.O.] 13112). Included in the Noxious Weed Management Plan will be stipulations regarding construction, restoration, and operation (use of weed-free materials, washing of equipment, etc.).
TWE-27	C	Vegetation management	In construction areas where re-contouring is not required, vegetation will be left in place wherever possible and original contour will be maintained to avoid excessive root damage and allow for re-sprouting.

DEIS NO.	PHASE(S)[1]	TOPIC	DESCRIPTION OF MITIGATION MEASURE
TWE-28	C	Vegetation management, visual	Clearing will be performed in a manner that minimizes the marring and scarring of the countryside and preserves the natural beauty to the maximum extent possible. Except for danger trees, no clearing will be performed outside the limits of the ROW.
Ecological Resources			
TWE-29	P,C	Ecological, special status species	The POD will include a Wildlife and Plant Conservation Measures Plan, which will identify important, sensitive, or unique habitats and BLM sensitive, USFS sensitive, and state-listed species in the vicinity of the TWE Project. The POD will identify measures to be taken to avoid, minimize, or mitigate impacts to these habitats and species.
TWE-30	P	Ecological, raptors	In applicable areas, the TWE Project will be designed to meet or exceed the raptor safe design standards described in the Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006 (Avian Power Line Interaction Committee [APLIC] 2006).
TWE-31	P,C,O	Ecological, special status species	Mitigation measures that will be developed during the consultation period with the BLM and the U. S. Fish and Wildlife Service under Section 7 of the ESA will be adhered to, along with mitigation developed in conjunction with state authorities.
TWE-32	P,C, D	Ecological, special status species	Seasonal restrictions may be implemented in certain areas to mitigate impacts on wildlife. With the exception of emergency repair situations, the activities of ROW construction, restoration, maintenance, and decommissioning will be modified or discontinued in designated areas during sensitive periods (e.g., nesting and breeding periods) for candidate, proposed of listed threatened or endangered, or other sensitive animal species, as required by permitting agencies. Potential seasonal restrictions and avoidance buffers for nesting raptors will be identified in the DEIS. The Wildlife and Plant Conservation Measures Plan will incorporate the seasonal restrictions and stipulations contained in the federal agency RODs.
TWE-33	P,C	Ecological, special status species and habitats	Prior to the start of construction, the Applicant will provide training to all Contractor and Subcontractor personnel and others involved in construction activities where/if there is a known occurrence of protected species or habitat in the construction area. Sensitive areas will be considered avoidance areas. Prior to any construction activity, avoidance areas will be marked on the ground and maintained through the duration of the Contract. The Applicant will remove markings during or following final inspection of the Project.
TWE-34	C	Ecological, special status species and habitats	If evidence of a protected species not previously identified or known is found in the Project area, the Contractor will immediately notify the appropriate land management agencies and provide the location and nature of the findings.
Cultural Resources – Historic Archaeological, and Tribal Traditional			
TWE-35	P,C	Cultural resources	In consultation with the appropriate land management agencies and state historic preservation officers (SHPOs), and in accordance with the Programmatic Agreement (PA), a Cultural Resources Protection and Management Measures will be prepared as part of the POD to address the specific mitigation measures for cultural resources that will be developed and implemented to mitigate any identified adverse effects. These may include Project modifications to avoid adverse impacts, monitoring of construction activities, and data recovery studies.
TWE-36	P,C	Native American cultural resources	The Applicant will comply with all laws, policies, and regulations pertaining to consultations with federally recognized Tribes.

DEIS NO.	PHASE(S)[1]	TOPIC	DESCRIPTION OF MITIGATION MEASURE
TWE-37	P	General, cultural	Prior to construction and upon the introduction of new construction personnel, all construction personnel will be instructed on the protection of cultural resources, including the provisions of federal, state, and tribal laws regarding the prohibition of collecting and removing cultural resources, and the importance of these resources and the purpose and necessity of protecting them.
Paleontological Resources			
TWE-38	P,C,O	Paleontology	If paleontological resources are known to be present in the Project area, or if areas with a high potential to contain paleontological material has been identified through the NEPA process and DEIS, the Applicant will prepare a Paleontological Resources Management and Mitigation Plan as part of the POD.
TWE-39	P	Paleontology	Paleontological mitigation may be required in areas of greatest disturbance and areas likely to have significant fossils. Preconstruction surveys of such areas may be conducted as agreed upon by the land-managing and lead federal agency.
Land Use and Visual Resources			
TWE-40	P,C,O	Land Use, agriculture	On agricultural land, the ROW will be aligned, in so far as practical, to reduce the impacts to farm operations and agricultural production.
TWE-41	C	Land Use, agriculture	In cultivated agricultural areas, soils that have been compacted by construction activities will be disked to uncompact soils.
TWE-42	C	Land Use, ranching	In grazing areas, excessive amounts of pine needles left by clearing of trees, will be removed from the ROW and disposed of in a location to prevent harm to grazing domestic animals.
TWE-43	C	Access, land use, gates	The POD will include a Flagging, Fencing, and Signage Plan. The Applicant will adhere to BLM fencing standards where required. Fences and gates will be repaired or replaced to their original pre-disturbed condition as required by the landowner or the management agency if they are damaged or destroyed by construction activities. Temporary gates will be installed only with the permission of the landowner or the land management agency, and will be restored to their original pre-disturbed condition following construction. Cattle guards will be installed where new permanent access roads cut through fences, at the request of the land management agency.
TWE-44	P,C,O	Visual	Non-specular conductors will be used to reduce potential visual impacts.
TWE-45	P,C,O	Structure design and public safety	Structures and/or shield/ground wire will be marked with high-visibility devices where required by governmental agencies (Federal Aviation Administration [FAA]). Structure heights will be less than 200 feet, where feasible, to minimize the need for aircraft obstruction lighting.
TWE-46	P,C,O	Visual resources	The Applicant will comply with federal permitting agency stipulations regarding visual resources through development of a Visual Resources Management Plan.
Air Quality			
TWE-47	P,C	Air quality, dust control	The POD will include a Dust Control and Air Quality Plan. Requirements of those entities having jurisdiction over air quality matters will be adhered to and dust control measures will be developed. Open burning of construction trash will not be allowed unless permitted by local authorities.
TWE-48	P,C	Air quality, emissions	The Contractor and Subcontractor(s) will be required to have and use air emissions control devices on construction machinery, as required by federal, state or local regulations or ordinances.

DEIS NO.	PHASE(S)[1]	TOPIC	DESCRIPTION OF MITIGATION MEASURE
Corona Effects			
TWE-49	P,C,O	Corona	Transmission line materials will be designed to minimize corona. The proposed hardware and conductor will limit the audible noise, radio interference, and TV interference due to corona. Tension will be maintained on all insulator assemblies to assure positive contact between insulators, thereby avoiding sparking. Caution will be exercised during construction to avoid scratching or nicking the conductor surface that may provide points for corona to occur.
TWE-50	O	TV, radio interference	The Applicant will respond to complaints of line-generated radio or television interference by investigating the complaints and implementing appropriate mitigation measures. The transmission line will be patrolled on a regular basis so that damaged insulators or other line materials that could cause interference are repaired or replaced.
Public Health and Safety			
TWE-51	P,C,O	Safety standards	The TWE project will be designed, constructed and operated to meet or exceed the requirements of the National Electrical Safety Code (NESC), U.S. Department of Labor, Occupational Safety and Health Administration standards, and the Applicant's requirements for safety and protection of landowners and their property.
TWE-52	O	Induced currents	The Applicant will apply necessary mitigation to eliminate problems of induced currents and voltages onto conductive objects sharing ROW, to the mutual satisfaction of the parties involved.
TWE-53	P,C	Blasting	The POD will include a Blasting Plan, which will identify methods and mitigation measures to minimize the effects of blasting, where applicable. The Blasting Plan will document the proposed methods to achieve the desired excavations, proposed methods for blasting warning, use of non-electrical blasting systems, and provisions for controlling fly rock, vibrations, and air blast damage.
TWE-54	P,C,O	Noise, electrostatic, and EMF	Research studies performed to determine the effects of audible noise and electrostatic and electromagnetic fields (EMF) will be regularly monitored by the Applicant to ascertain whether these effects are significant.
TWE-55	P,C,O	FAA regulations	The TWE Project will be designed to comply with FAA regulations, including lighting regulations, to avoid potential safety issues associated with proximity to airports, military bases or training areas, or landing strips.
TWE-56	P	Worker health and safety	As part of the POD, the Applicant will provide a Health and Safety Plan, which will outline measures to protect workers and the general public during construction, operation, and decommissioning of the TWE Project. The Heath and Safety Plan will identify applicable federal and state occupational safety standards, establish safe work practices, and define safety performance standards.
Hazardous Materials, Waste, and Wastewater Management			
TWE-57	P	Hazardous materials	As part of the POD, the Applicant will provide a Spill Prevention and Response Plan. The Plan will address compliance with all applicable federal, state and local regulations, and will include: spill prevention measures, notification procedures in the event of a spill, employee awareness training, and commitment of manpower, equipment, and materials to respond to spills, if they occur.
TWE-58	P	Hazardous materials	As part of the POD, the Applicant will provide a Pesticide Use Plan as a component of the Noxious Weed Management Plan. The Plan will address compliance with all applicable federal, state, and local regulations.

DEIS NO.	PHASE(S)[1]	TOPIC	DESCRIPTION OF MITIGATION MEASURE
TWE-59	P	Hazardous materials	As part of the POD, the Applicant will provide a Hazardous Materials Management Plan that has been approved by applicable federal, state or local environmental regulatory agencies. The plan will address on-site excavation of contaminated soils and debris and will include identification of contaminants, methods of excavation, personnel training, safety and health procedures, sampling requirements, management of excavated soils and debris, and disposal methods.
TWE-60	C	Waste management	No non-biodegradable debris will be deposited in the ROW. Slash and other biodegradable debris will be left in place or disposed of in accordance with agency requirements.
TWE-61	C,O	Hazardous materials, waste management	As part of the POD, the Applicant will provide a Hazardous Materials Management Plan. Hazardous materials will not be drained onto the ground or drainage areas. Totally enclosed containments will be provided for all trash. All construction waste including trash and litter, garbage, other solid waste, petroleum products, and other potentially hazardous materials will be removed to a disposal facility authorized to accept such materials.
TWE-62	C,O	Hazardous materials	If a reportable release of hazardous substance occurs at the work site, the Contractor will immediately notify the Applicant and all environmental agencies, as required by law. The Contractor will be responsible for the clean-up.
Fire Protection			
TWE-64	P,C	Fire, safety	The POD will include a Fire Protection Plan. The Applicant or its Contractor(s) will notify the BLM of any fires and comply with all rules and regulations administered by the BLM and USFS concerning the use, prevention, and suppression of fires on federal lands, including any fire prevention orders that may be in effect at the time of the permitted activity. The Applicant or its Contractor(s) may be held liable for the cost of fire suppression, stabilization, and rehabilitation. In the event of a fire, personal safety will be the first priority of the Applicant or its Contractor(s). The Applicant or its Contractor(s) will: • Operate all internal and external combustion engines on federally-managed lands per 36 CFR Part 261.52(j), which requires all such engines to be equipped with a qualified spark arrester that is maintained and not modified; • Carry shovels, water, and fire extinguishers that are rated at a minimum as ABC-10 pound on all equipment and vehicles. If a fire spreads beyond the suppression capability of workers with these tools, all workers will cease fire suppression action and leave the area immediately via pre-identified escape routes; • Initiate fire suppression actions in the work area to prevent fire spread to or on federally-administered lands. If fire ignitions cannot be prevented or contained immediately, or it may be foreseeable that a fire would exceed the immediate capability of workers, the operation must be modified or discontinued. No risk or ignition or re-ignition will exist upon leaving the operation area; • Notify the appropriate fire center immediately of the location and status of any escaped fire; • Review weather forecasts and the potential fire danger prior to any operation involving potential sources of fire ignition from vehicles, equipment, or other means. Prevention measures to be taken each workday will be included in the specific job briefing. Consideration will be given to additional mitigation measures or temporary discontinuance of the operation during periods of extreme wind and dryness; • Operate all vehicles on designated roads. Vehicle parking to be restricted to areas free of vegetation on roads or within the permitted ROW and designated work areas.;

DEIS NO.	PHASE(S)[1]	TOPIC	DESCRIPTION OF MITIGATION MEASURE
			• Operate welding, grinding, or cutting activities in areas cleared of vegetation within range of the sparks for that particular action. A spotter will be required to watch for ignitions; and • Use only diesel-powered vehicles in areas where excessive heat from vehicle exhaust systems could start brush or grass fires.

Notes: [1] P = Planning and Engineering, C = Construction, O = Operation, D = Decommissioning

8.4 Selective Mitigation by Milepost

To be determined.

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APPENDIX A
FRAMEWORK ACCESS ROAD SITING AND MANAGEMENT PLAN

TABLE OF CONTENTS

ACRONYMS

Applicant	TransWest Express LLC, also TransWest
AUMs	a unit of measure equal to the amount of forage needed to sustain one animal unit (or its equivalent) for one month
BLM	Bureau of Land Management
BMP	Best Management Practice
CDOT	Colorado Department of Transportation
COM Plan	Construction, Operation, and Maintenance Plan
DEIS	Draft Environmental Impact Statement
EMM	Environmental Mitigation Measure
FEIS	Final Environmental Impact Statement
FSH	Forest Service Handbook
FSM	Forest Service Manual
IRAs	Inventories Roadless Areas
NDOT	Nevada Department of Transportation
NFS	National Forest System
NTP	Notice to Proceed
Plan	Access Road Siting and Management Plan
POD	Plan of Development
Project	TransWest Express Transmission Project, also TWE Project
ROD	Record of Decision
ROW	right-of-way
SWPPP	Stormwater Pollution Prevention Plan
TransWest	TransWest Express LLC, also Applicant
TWE Project	TransWest Express Transmission Project, also Project
UDOT	Utah Department of Transportation
USACE	United States Army Corps of Engineers
USFS	United States Forest Service
WDOT	Wyoming Department of Transportation

A1.0 INTRODUCTION

This framework Access Road Siting and Management Plan (Plan) addresses regulatory compliance, access road management practices, design features and Best Management Practices (BMPs) to reduce environmental impacts related to construction of new access roads during construction of the TransWest Express Transmission Project (TWE Project or Project) by TransWest Express LLC (TransWest or Applicant) and its Construction Contractor(s).

A2.0 PLAN PURPOSE

The purpose of this plan is to provide the Bureau of Land Management (BLM), U.S. Forest Service (USFS) and other agencies with a description of the types and location of access roads associated with the construction, operation, and maintenance of the Project. The goal of this Plan is to establish management practices and mitigation measures that, when implemented, will avoid and minimize impacts from construction of the transmission line and any associated access roads. These practices and measures are intended to mitigate the effects of construction access on environmental resources.

A3.0 PLAN UPDATES

The initial layout of all access roads to each structure location for the selected Agency Preferred Alternative will be provided in the Record of Decision (ROD) Plan of Development (POD). The Plan will include detailed mapping of the backbone access network, existing access, existing access with improvements, overland access and proposed new access. The Notice to Proceed (NTP) POD will include final field verified access road layouts specific to each construction segment. TransWest will be responsible for developing the final Access Road Siting and Management Plan. Local BLM Field Offices may require field verification to approve the final Access Road Siting and Management Plan.

A4.0 REGULATORY

A number of agencies have jurisdiction over the transportation-related components of the Project. These include the BLM, the USFS, Wyoming Department of Transportation (WDOT), Colorado Department of Transportation Department (CDOT), Utah Department of Transportation (UDOT), Nevada Department of Transportation (NDOT), Federal Highway Administration, local law enforcement and road departments, and local highway districts in the counties crossed by the Project. The Construction Contractor must file encroachment and oversized vehicle permit applications with appropriate road agencies prior to construction for those areas where the transmission line crosses public roads or where oversized vehicles will be used on public roads.

Other permits and approvals not directly related to transportation could affect the construction, use, and/or maintenance of roads in certain areas. Persons responsible for Project transportation activities must be familiar with all relevant sections of the Project's POD, of which this Plan is a part.

Where new roads are required or where improvements to existing roads are required, access roads will be designed in accordance with standards and guidelines for Non-constructed Roads and Routes as described in "The Gold Book – Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development" (AASHTO 2006). Portions of the access road network requiring design and construction to a more stringent standard will be identified in this Access Road Siting and Management Plan to be submitted with the NTP POD.

On BLM-managed lands, new road construction and existing roads improved for Project use in some locations may be required to meet or exceed the minimum standards of width, alignment, grade, surface, and other requirements presented in the BLM Travel Management Program and BLM

Manual Section 9113 (BLM 1985). On USFS lands, road construction and existing roads improved for Project use in some locations may be required to comply with the Forest Service Manual (FSM) (USFS 1999a) and Forest Service Handbook (FSH) (USFS 1999b). Some example sections relative to the Project are FSH 7709.56 – *Road Preconstruction Handbook (Forest Service 2010)*, FSH 7709.57 – *Road Construction Handbook (Forest Service 1992)*, and 7709.58 – *Transportation System Maintenance Handbook (Forest Service 2009b).*

Existing travel and transportation networks identified in BLM and USFS land use plans or travel management plans will be used as guidance for the identification and siting of access roads for the Project. These federal plans are designed to provide decision-makers with information to manage road systems that are safe and responsive to public needs and desires, are economically and efficiently managed, and have minimal negative ecological impacts on the land. The plans include designated areas for motorized use, prohibition of some uses to protect resources, or limitations on road use at certain times of the year for resource protection.

No new or improved access roads may be sited within USFS Inventoried Roadless Areas (IRA). IRAs are identified as areas of National Forest Service (NFS) land currently inventoried for planning purposes as roadless. The 2001 Roadless Area Conservation Rule does not prohibit special use developments, but generally does prohibit the construction or reconstruction of any roads associated with these uses within the boundaries of an IRA. Construction of any portions of the TWE Project which fall within IRA or other areas where access road construction is prohibited or restricted will follow the Roadless Construction Methods described in Section 5.7.3 of the Final Environmental Impact Statement (FEIS) POD.

A5.0 ACCESS ROAD MANAGEMENT PRACTICES

With the exception of IRAs and other sensitive areas identified by land management agencies, the TWE Project will require surface access to all structures and work areas during construction to allow vehicles and equipment to access the location of each transmission structure. Existing public roads will be used as the backbone access road network to access the selected Agency Preferred Alternative. Construction of new access roads will be required only as necessary to access structure sites lacking direct access from existing roads, or where topographic conditions (e.g., steep terrain, rocky outcrops, and drainages) prohibit safe overland access to the site. New access road layouts will require the appropriate approvals from jurisdictional agencies.

A route-specific plan will be developed for the selected Alternative and will be described within the Access Road Siting and Management Plan to be submitted with the NTP POD. The types of access including backbone access, existing access with improvements, overland access and proposed new access will be identified. A detailed map book will be provided showing the location of the 250-foot-wide transmission line right-of-way (ROW), proposed structure locations, backbone access network, and existing access that do not require improvements, existing access that require improvements, and new access to be constructed. The surface type (gravel, paved or other) and terrain type (flat, rolling, steep and mountainous) will also be defined. The detailed Plan for the selected Agency Preferred Alternative will be used to define location-specific mitigation measures, as needed.

Prior to construction, authorized access roads and associated limits of disturbance will be clearly delineated and marked in the field. The Construction Contractor(s) will review the location of approved access and will be responsible for ensuring construction travel is limited to those approved access roads and limits of disturbance.

All field personnel will attend an environmental training program. As part of this program, field personnel will be instructed to use only approved access roads, drive within the limits of disturbance, obey posted and jurisdictional speed limits, and become familiar with the Flagging, Fencing and Signage Plan (Appendix I).

A6.0 DESIGN FEATURES AND BEST MANAGEMENT PRACTICES

In addition to applicable design and operational standards, regulations, laws and permit requirements, the following design features and BMPs are intended to help reduce impacts related to construction of new access roads. Note that the Construction, Operation and Maintenance Plan will be incorporated into the NTP POD.

> **TWE-5**: The Construction, Operation and Maintenance (COM) Plan will display the location of Project infrastructure (i.e. towers, access roads, substations) and identify short-term and long-term land and resource impacts and the mitigation measures that will be implemented for site-specific and resource-specific environmental impacts.
>
> **TWE-6:** The Construction, Operation and Maintenance (COM) Plan will include an Access Road Plan that incorporates relevant agency standards regarding road design, construction, maintenance, and decommissioning. The Access Road Plan will incorporate BMPs, stipulated by the agencies in their respective decision documents and permits.
>
> **TWE-8:** Crossings of streams and waterways will be done in compliance with federal, state, and local regulations. Roads will be built as near as possible at right angles to the streams and washes (Arizona crossing). Culverts will be installed where necessary. All construction and maintenance activities will be conducted in a manner that will minimize disturbance to vegetation, drainage channels, and intermittent or perennial stream banks. In addition, fugitive dust will be controlled during road construction as required by state and local permits. . All existing roads will be left in a condition equal to, or better than, their condition prior to the construction of the transmission line. Structures will be sited with a minimum distance of 200 feet from streams, wherever possible.
>
> **TWE-9:** All construction vehicle movement outside the ROW normally will be restricted to pre-designated access or public roads.
>
> **TWE-12:** Except for repairs necessary to make roads passable, no widening or upgrading of existing access roads will be undertaken in the area of construction and operation, where soils or vegetation are sensitive to disturbance. In designated areas, structures will be placed to avoid sensitive features such as, but not limited to, riparian areas, water courses and cultural sites, or to allow conductors to clearly span the features within limits of standard structure design. This will minimize the amount of disturbance to the sensitive feature or reduce visual contrast.

Additional BMPs and Environmental Mitigation Measures (EMMs) identified in the Draft Environmental Impact Statement (DEIS) are listed below. These measures have not been finalized at this time and may be updated, changed, or eliminated in future revisions of this Plan.

> **TRAN-1:** The Applicant shall prepare an access road siting and management plan that incorporates relevant agency standards regarding road design, construction, maintenance, and

decommissioning. Corridors would be closed to public access unless determined by the appropriate federal land manager to be managed as part of an existing travel and transportation network in a land use plan or subsequent travel management plan(s).

TRAN-2: The Applicant shall prepare a comprehensive transportation plan for the transport of transmission tower or pipeline components, main assembly cranes, and other large equipment. The plan should address specific sizes, weights, origin, destination, and unique equipment handling requirements. The plan should evaluate alternative transportation routes and should comply with state regulations and all necessary permitting requirements. The plan should address site access roads and eliminate hazards from truck traffic or impacts to normal traffic flow. The plan should include measures such as informational signage and traffic controls that may be necessary during construction or maintenance of facilities.

TRAN-3: Applicants shall consult with local planning authorities regarding increased traffic during the construction phase, including an assessment of the number of vehicles per day, their size, and type. Specific issues of concern (e.g., location of school bus routes and stops) should be identified and addressed in the traffic management plan.

TRAN-4: Additional access roads needed for decommissioning shall follow the paths of access roads established during construction to the greatest extent possible; all access roads not required for the continued operation and maintenance of other energy systems present in the corridor shall be removed and their footprints reclaimed and restored.

PHS-5: The health and safety program shall establish a safety zone or setback from roads and other public access areas that is sufficient to prevent accidents resulting from various hazards. It should identify requirements for temporary fencing around staging areas, storage yards, and excavations during construction or decommissioning activities. It should also identify measures to be taken during the operations phase to limit public access to those components of energy facilities that present health or safety risks.

AGRI-3: Minimize locating access roads within the two-mile transmission line corridor in areas with croplands. For croplands that cannot be avoided by access roads, establish procedures for determining temporary and permanent access road locations with landowners and operators, and establish protection methods for roads over croplands that cannot be avoided by construction activities. Restore locations of temporary access roads to pre-construction conditions and leave permanent access roads intact through mutual agreement with the landowner and operator.

LU-1: The proponent will develop an approved Plan of Development (POD) and shall coordinate with land managers on final structure placement, including all aboveground components, access roads, and permanent disturbance areas, to ensure optimal compatible land use.

RANGE-1: Prior to construction of each segment, access road, or ancillary facility crossing a BLM or USFS grazing allotment, TransWest shall coordinate with the associated BLM Field Office and USFS national forest concerning planned development and operations that will occur and identify potential livestock management issues. TransWest will provide a schedule and locations of construction activities on affected grazing allotments to the BLM Field Office and USFS national forest to be provided to the affected grazing permittees. The construction activities schedule and construction activity locations shall be provided on a date early enough to allow grazing permittees sufficient time to make decisions and allocate their resources during the construction time period.

RANGE-2: Prior to construction of transmission line segments, access road, or ancillary facilities, active range improvement locations shall be inventoried. Based on the results of these inventories, no roads, or ancillary facilities would be placed within 200 meters of range improvements, including livestock and wildlife water sources/systems. If avoidance is not feasible, features would be relocated to an alternate location per BLM, USFS, or state wildlife agency guidance.

RANGE-6: Prior to construction and placement of permanent facilities and access roads, TransWest shall coordinate with the associated BLM Field Office and USFS forest to identify areas where the placement of tower structures, facilities, and access roads would prevent access to either a portion or all of a livestock grazing allotment resulting in the livestock grazing allotment becoming unusable or decreasing the AUMs (a unit of measure equal to the amount of forage needed to sustain one animal unit (or its equivalent) for one month) available to a point that requires the grazing permit to be modified. In these areas, corrective actions would then be identified including rearranging of grazing allotment fences, additional access roads to the grazing allotment, re-arrangement of project facilities and access roads as feasible, etc.

GEN-5: Corridors are to be efficiently used. The Applicant, assisted by the appropriate agency, shall consolidate the proposed infrastructure, such as access roads, wherever possible and utilize existing roads to the maximum extent feasible, minimizing the number, lengths, and widths of roads, construction support areas, and borrow areas.

WAT-7: A Stormwater Pollution Prevention Plan (SWPPP) permit will be obtained and its provisions implemented for all affected areas before any ground disturbance activities commence.

WAT-10: The Applicant shall minimize stream crossings by access roads to the extent practicable. All structures crossing intermittent and perennial streams should be located and constructed so that they do not decrease channel stability, increase water velocity, or impede fish passage.

WET-3: Access roads will be routed around riparian areas, wetlands, intermittent or perennial drainages, and ephemeral channels to the extent practical. If jurisdictional wetlands or waters of the U.S. cannot be avoided, U.S. Army Corps of Engineers (USACE) approved construction techniques for construction in wetlands and waters of the U.S. will be applied. BLM and USFS construction techniques for non-jurisdictional wetlands, riparian areas, intermittent drainages, and ephemeral channels would be applied on BLM and USFS lands, as appropriate. These include the use of timber mats, erosion controls, and the placement of equipment outside of the wetland, riparian areas, intermittent drainages, and ephemeral channels boundaries.

A7.0 REFERENCES

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APPENDIX B
AVIAN PROTECTION PLAN

Avian Protection Plan

Prepared by

TRANSWEST EXPRESS LLC

November 2014

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ATTACHMENTS:

1.0 INTRODUCTION

TransWest Express LLC (TransWest) is an independent transmission developer committed to responsible practices across all aspects of transmission line siting, operations and design. Based in Denver, Colorado, the company guides its operations under environmental programs and principles led by a dedicated environmental team with over 50 years of experience in the energy development, generation and transmission industries. TransWest also retained independent consultants, ecologists and biologists to help the firm develop a comprehensive wildlife conservation strategy. Designed to avoid and minimize potential impacts on wildlife in general and avian species in particular, the strategy is based on science and best practices from the electric transmission industry and other appropriate sources.

TransWest is developing the TransWest Express Transmission Project (the TWE Project or Project), an extra high-voltage, direct current regional electric transmission system. The TWE Project will reliably deliver cost-effective renewable energy produced in Wyoming to the Desert Southwest region (California, Nevada, Arizona), ultimately helping contribute to a cleaner world, strengthen the electric grid, and provide much-needed electricity to millions of homes and businesses every year. The TWE Project will deliver enough clean, sustainable energy to power nearly 2 million homes and reduce greenhouse-gas emissions equivalent to taking 1.5 million cars from the road.

Major components of the TWE Project include a ±600 kilovolt (kV) DC transmission line and two alternating current (AC)/ direct current (DC) converter stations - a Northern AC/DC Converter Station (Northern Terminal) to be located near Sinclair, Wyoming and a Southern AC/DC Converter Station (Southern Terminal) to be located at the Marketplace Hub in the Eldorado Valley, approximately 15 miles south of Boulder City, Clark County, Nevada. The TWE Project will also include, among other facilities, two ground electrode systems and a low voltage overhead line to connect the ground electrode system to each AC/DC converter. The low voltage overhead line will be similar to a 34.5 kV subtransmission line.

2.0 BACKGROUND

TransWest is committed to protecting avian species that occur within the vicinity of its facilities. This Avian Protection Plan (APP) has been developed to protect resident and migrant birds that may interact with the TransWest Express Transmission Project (TWE Project or Project). TransWest is committed to maintaining the reliability of the TWE Project in a cost effective manner while meeting the regulatory requirements to conserve avian species.. The responsibility of effectively improving avian safety and minimizing avian risk at its facilities lies with both TransWest management and its employees.

To this end, TransWest will:

- Implement this APP;
- Ensure that its actions comply with the most recent applicable laws, regulations, and permits, and incorporate as applicable Avian Power Line Interaction Committee (APLIC) guidelines;
- Document bird mortalities; problem structures or locations; and problem nests;
- Provide information, resources, and training to improve its employees' knowledge and awareness of avian protection and the implementation of the TransWest avian protection program;
- Identify key TransWest personnel responsible for ensuring accountability and compliance with this APP;

- Identify key U.S. Fish and Wildlife Service (USFWS) personnel responsible for reporting and permitting; and
- Maintain the integrity of the transmission line and repair or retrofit structures as necessary if impacts to avian species are detected.

The purpose of this APP is to establish a program to manage avian safety on the TWE Project. This APP has been developed consistent with APLIC's principles of avian protection (APLIC 2005) to support TransWest's commitment to reduce impacts to avian resources. This APP supports compliance with the Migratory Bird Treaty Act (MBTA) of 1918 (16 United States Code [U.S.C.] §§703 – 712), the Bald and Golden Eagle Protection Act (BGEPA) of 1940 (16 U.S.C. §§668 – 668d), and the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. §§1531 – 1544), and appropriate state requirements. Plans, methods, and direction are outlined to ensure that birds are protected on TransWest facilities associated with the TWE Project, providing a framework for documenting the success of TransWest's good-faith efforts to protect avian species and to comply with the laws and regulations discussed in Section C2.1.

This APP has been written with consideration to and guidance from the data and suggestions presented in APLIC's Mitigating Bird Collisions with Power Lines: The State of the Art in 2012 (APLIC 2012), Avian Protection Plan Guidelines (APLIC 2005) and Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006 (APLIC 2006). In addition, existing information on bird use in the Project area will be combined with pre-construction Project-specific survey information to effectively address avian safety specific to the long-term operation of the TWE Project. The protective measures and methods described in this document provide a mechanism for implementing and tracking mitigation measures to operate the TWE Project in the most avian safe manner possible.

The key TransWest staff member responsible for ensuring accountability and compliance with this APP is the APP Program Coordinator. The APP Program Coordinator may be contacted at 303-298-1000.

The key USFWS personnel shall be the Region 6 Migratory Bird Program Office. The office may be contacted at 303-236-7905.

2.1 Scope and Limitations

This APP presents the framework for developing a program of specific actions implemented comprehensively to support avian safety on the TWE Project. It is not to be considered a delineation of legal requirements. Instead, it provides guidance for achieving and maintaining legal compliance under the regulations related to avian protection, minimizing avian-related interruptions in service, and documenting efforts to improve avian safety.

TransWest has set the overall goal of advancing progress toward an avian safe transmission system. Through a policy of avian protection, TransWest will improve its service to customers, ensure regulatory compliance, reduce costs, and document good-faith efforts to diminish risks to avian species. As such, this plan is considered a "living document" and is intended to be revised and updated as goals are achieved, innovative solutions are developed to mitigate impacts, agency guidance is adjusted, and conditions of the TWE Project warrant.

3.0 AVIAN PROTECTION PLAN PURPOSE AND NEED

Under certain conditions, power lines may present risk to avian species (APLIC 2006). However, empirical data is highly limited and usually site-specific, which allows for broad estimates of risk based on a series of assumptions. While the exact risk or level of impacts may be difficult to quantify, the most obvious risks from power lines are associated with birds directly contacting facilities and being killed either by electrocution or impact. In addition, birds nesting on utility structures may face increased risk of mortality by regularly maintaining close contact with transmission structures. Such risks also become costly to the utility company because of the risk of outages due to fault-triggering electrocutions, contact of nesting material with energized elements, prey falling on live equipment, and flashover caused by bird waste (streamers). Regulatory agencies and utilities recognize that avian interactions can be ecologically significant events and have worked collaboratively (through organizations such as APLIC) for several decades to reduce both system and avian impacts.

One mechanism for utilities to cooperatively engage agencies on operational avian safety issues is the APP. This APP exclusively addresses TransWest's avian protection program for construction as well as operations and maintenance (O&M), and initiates an avian safety framework for the life of the TWE Project.

The TWE Project is a ±600 kilovolt (kV) extra-high voltage (EHV) direct current (DC) transmission system extending from south-central Wyoming to southern Nevada. The TWE Project begins at a northern terminal near Sinclair, Wyoming and terminates at a southern terminal at the Marketplace Hub in the Eldorado Valley near Boulder City, Nevada. At each of the terminals, there will be an alternating current/direct current (AC/DC) converter station designed to convert the DC current carried by the TWE Project to AC current to be carried on the western United States AC electrical grid (the northern and southern terminals). The TWE Project is planned to interconnect into the Eldorado Substation, the McCullough Switching Station, the Marketplace Substation and the Mead Substation.

The TWE Project area spans approximately 750 miles of four western states. It passes through landscapes considered ecologically diverse because of their species' richness and endemicity. The extreme northeastern portion of the Project crosses the Central Flyway, a north south migration flyway along the eastern slope of the Rocky Mountains. The remainder of the Project occurs within the Pacific Flyway (USFWS 2012). Southern Utah and Nevada, with their mild climate, is a wintering destination for many migrant birds.

As a responsible corporation, TransWest strives to protect ecosystems and safeguard wildlife. Stewardship of the West's natural resources is the impetus for this avian protection program. There are four factors underlying the development of the program which are briefly presented in this section:

- Federal and State laws and regulations
- Conditions of approval and requirements identified in the right-of-way grants and special use authorizations for the Project
- Reliability
- Customer relations

3.1 Applicable Laws and Regulations

Most birds are protected under one or more state or federal regulations. Below is a brief summary of laws and other regulations governing avian protection applicable to the TWE Project.

3.1.1 Federal

Migratory Bird Treaty Act (MBTA)

The Migratory Bird Treaty Act (MBTA) is the cornerstone of migratory bird conservation and protection in the United States. The MBTA implements four treaties that provide for international protection of migratory birds. It has been described as a strict liability statute, meaning that proof of intent, knowledge, or negligence is not an element of an MBTA violation. The statute's language is clear that actions resulting in a "taking" or possession (permanent or temporary) of a protected species, in the absence of an USFWS permit or regulatory authorization, are a violation of the MBTA.

The MBTA states, "Unless and except as permitted by regulations . . . it shall be unlawful at any time, by any means, or in any manner to pursue, hunt, take, capture, kill . . . possess, offer for sale, sell . . . purchase . . . ship, export, import . . . transport or cause to be transported . . . any migratory bird, any part, nest, or eggs of any such bird . . . . [The Act] prohibits the taking, killing, possession, transportation, import and export of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior." *16 U.S.C. § 703.* The word "take" is defined by regulation as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect." *50 C.F.R. § 10.12.*

USFWS maintains a list of all species protected by the MBTA at 50 C.F.R. § 10.13. This list includes over one thousand species of migratory birds, including eagles and other raptors, waterfowl, shorebirds, seabirds, wading birds, and passerines. The MBTA does not protect introduced species such as the house (English) sparrow, European starling, rock dove (pigeon), Eurasian collared-dove, and non-migratory upland game birds. The USFWS maintains a list of introduced species not protected by the Act. *See* 70 Fed. Reg. 12,710 (2005).

The MBTA provides criminal penalties for persons who commit any of the acts prohibited by the statute in Section 703 on any of the species protected by the statute. *See 16 U.S.C. § 707.*

Endangered Species Act

In addition to the MBTA, some at risk bird species in the United States receive further protection under the Endangered Species Act of 1973 (16 U.S.C. §§1531-1544, as amended) (ESA). The ESA protects federally listed threatened or endangered species and their habitats from unlawful take, where "take" is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." It also prohibits the illegal import, export, carrying, transport, or shipment of any listed species without authorization from the Secretary of the Interior. With a submitted conservation plan, the Secretary may permit exceptions for scientific purposes, the propagation or survival of the affected species, or for instances where "taking is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity." Violations of the ESA can result in civil penalties or, criminal violations.

Bald and Golden Eagle Protection Act

Under the authority of the Bald and Golden Eagle Protection Act (BGEPA), 16 U.S.C. §§ 668–668d, bald eagles and golden eagles are afforded additional legal protection. BGEPA prohibits the "take, sale, purchase, barter, offer of sale, purchase, or barter, transport, export or import, at any time or in any manner of any bald or golden eagle, alive or dead, or any part, nest, or egg thereof." *See 16 U.S.C. § 668.* BGEPA also defines take to include "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb," 16 U.S.C. § 668c, and includes criminal and civil penalties for violating the statute. *See 16 U.S.C. § 668.* USFWS has further defined the term "disturb" as agitating or bothering an eagle to a degree that causes, or is likely to cause, injury, or either a decrease in productivity or nest abandonment by substantially interfering with normal breeding, feeding, or sheltering behavior. *See 50 C.F.R. § 22.3.* BGEPA authorizes the USFWS to permit the take of eagles for certain purposes and under certain circumstances, including scientific or exhibition purposes, religious purposes of Indian tribes, and the protection of wildlife, agricultural, or other interests, so long as that take is compatible with the preservation of eagles. *See generally, 16 U.S.C. § 668a.*

3.1.2 State

State-specific regulations regarding species addressed in this APP have not been identified at this time.

3.2 Conditions of Approval and Requirements

TransWest has filed an application for Transportation and Utility Systems and Facilities on Federal Land (SF 299) for the TWE Project with the Bureau of Land Management (BLM) for the right-of-way grants necessary to construct, operate and decommission the TWE Project on federal land. The BLM determined that responding to TransWest's right-of-way application required the preparation of an Environmental Impact Statement (EIS) under the National Environmental Policy Act of 1969, as amended (NEPA). Western Area Power Administration, a Federal power marketing administration within the United States Department of Energy (Western), is acting as a joint lead agency with the BLM in the preparation of the EIS. Western is TransWest's development partner under its Transmission Infrastructure Program. The EIS contains a description of the environment in which the TransWest Project will be built and discloses potential impacts to resources that may be affected by the construction, operation and development of the TWE Project, including avian species. The EIS presents general practices for wildlife protection as well as conservation measures specifically addressing issues of avian protection. BLM's and Western's Records of Decision for the TWE Project may impose additional avoidance, minimization and mitigation measures for avian species beyond those set forth in this APP. If so, this APP will be updated as appropriate.

3.3 Reliability

Avian interactions with transmission systems have the potential to cause outages, result in equipment failures, shorten the lifespan of equipment, increase maintenance costs, and create safety issues. An avian-safe system increases reliability, results in fewer outages, reduces the exposure to risks for company personnel that respond to outages, and leads to less replacement of expensive equipment.

3.4 Customer Relations

The public places a high value on reliable electric service. TransWest, through implementation of this APP, seeks to minimize potential service disruptions and outages caused by avian interactions with TWE Project facilities. Communicating a program of avian protection administered in a cost conscious manner improves customer relations and makes good business sense.

4.0 PRINCIPLES OF AVIAN PROTECTION

The roots of APLIC avian protection planning lie in the development of system-wide avian safety programs to direct new-builds, implement remedial actions and track success, expenditures and incidents. Under this framework, twelve elements of avian safety were identified (APLIC 2005):

- Corporate policy
- Training
- Permit compliance
- Construction design standards
- Nest management
- Avian reporting system
- Risk assessment methodology

- Mortality reduction measures
- Avian enhancement options
- Quality control
- Public awareness
- Key resources

As originally conceived by APLIC, these principles served as an outline for an effective plan. However, not all APPs need to contain information about all twelve principles, as each document should be specific to an individual utility's operations, site-specific avian issues, and agency collaboration history. The TWE Project is a new project constructed to current APLIC construction recommendations, sited and designed to ameliorate potential avian risk within the constraints of feasibility and the Project purpose and need. There are no elements of the Project involving rebuilding or retrofitting activities. In addition, there is neither history of avian safety issues nor mortality data from which to conduct a risk assessment. In the following sections, background information is provided where appropriate on how each component is relevant to the Project and how it will be implemented. As a "living document," as circumstances change, sections will be added to future revisions of this Plan.

5.0 AVIAN INTERACTIONS AND POTENTIAL ISSUES

Though power lines and associated facilities may provide some benefit to avian species through increased perching, roosting and nesting opportunities, the addition of power line structures with electrical elements also presents the potential risk of direct mortality through electrocutions and collisions. Risk of direct mortality to individual birds and local populations varies with project characteristics as well as a number of natural factors. These include bird size, flight characteristics, behavior, habitat, weather conditions, time of day, and topography. The TWE Project traverses a diverse landscape ranging from flat desert scrub, rolling chaparral, steep mountains, ridgelines, cliffs, large water bodies, streams, wetlands, and forests. In the resulting mosaic of habitats, a rich avian fauna is present with an assortment of resident and seasonally transient species. The potential exists for system elements, avian behavior, and environmental factors to interact in complex ways resulting in varying levels of risk to birds throughout the Project area. As a new project, TransWest considered risks to avian species and sought to enhance their safety through routing, siting, and design decisions. Through this APP, TransWest and agencies can continue to work collaboratively to actively minimize risk and adaptively manage the TWE Project to proactively respond to specific issues that may arise.

5.1 Avian Electrocutions

Avian electrocution may occur because of a combination of biological and electrical design factors (Janss and Ferrer 2001). Biological factors such as habitat, prey, and species, are those that influence avian use of structures. Raptors often use structures for perch-hunting, an energy-saving foraging behavior utilized by many species (APLIC 2006). Raptors and other species will use poles and towers for nesting, especially in open areas or areas where there are few natural nesting locations (Bevanger 1994; APLIC 2006).

Power lines electrocute birds when they simultaneously contact two conductors, or an energized conductor and a ground wire or grounded hardware (Bevanger 1998). Wet feathers raise the risk of electrocution for a bird by increasing conductivity. Wet feathers can conduct dangerous amperages beginning at around 5 kV, whereas dry feathers require currents greater than 70 kV before they will begin conducting current (APLIC 2006).

Body size (wingspan and perching height) and behavior, such as perching and roosting on poles or wires, are the keys to understanding why and how birds become electrocuted. Generally speaking, some species are more prone to mortality from electrocution than from collision, primarily birds of prey and ravens (Bevanger 1998). Because of the greater vertical and horizontal spacing required on higher voltage lines, the majority of raptor electrocutions occur on lines that are energized at voltage levels of 69 kV and below. The risk of electrocution from lines energized above 69 kV is highly unlikely on properly designed and maintained facilities (APLIC 2006). An APLIC avian-safe line has horizontal spacing that has considered the "wrist-to-wrist" wingspan distance for the largest bird species likely to be at risk in the area (APLIC 2006). The TWE Project transmission line is a high voltage transmission line and therefore presents a low avian electrocution risk. Even for the largest avian species present in the Project area (California condor), the proposed vertical and horizontal separation distances between energized components and between energized components and grounded elements exceed APLIC recommendations of the "wrist-to-wrist" measurements.

The overhead ground electrode line will be designed to APLIC recommendations by ensuring that vertical and horizontal separation distances between energized components and between energized components and grounded elements meet or exceed APLIC recommendations of the "wrist-to-wrist" measurements of the largest bird that may occur within the local vicinity of the Project (golden eagles in the north and California condors in the south). The terminals for the TWE Project will also be designed to be avian safe.

Based on the above discussion, avian electrocutions on the TWE Project do not present a significant risk and will not be addressed further in this APP.

5.2 Avian Collisions

Avian collisions with transmission lines may be a major cause of avian mortality. Factors that influence collision risk can be divided into three categories: those related to the biology of the avian species, those related to the environmental conditions, and those related to the configuration and location of transmission lines (APLIC 2012, 2006; Savereno et al. 1996).

5.3 Biological Factors Related to Bird Collisions

Biological factors include body size, flight behavior, age, sex, habitat use, and flocking behavior. These relate to the bird's ability to detect and avoid a power line. Birds that spend an abundance of time in the air may face a greater risk of collision than those that are predominantly ground-based (Bevanger 1994). For example, swallows swarming after insects may be more likely to collide with a power line than grouse (Sporer et al. 2013). A bird's flight manner has been shown to be one of the most important factors determining the chances of collision with a transmission line, perhaps more important than the sheer frequency of birds flying near the lines (Janss 2000). Juvenile birds, which are not as familiar with their surroundings and are less experienced in both flight and landing can be expected to have a greater likelihood of colliding with transmission lines (Bevanger 1994, 1998; Dorin and Spiegel 2005). In general, birds are quick-moving, visual-orienting animals that are very adept at identifying and avoiding obstacles in their flight paths; however, large-bodied birds with low maneuverability and birds that are distracted by specific behaviors (e.g., foraging, flocking, territorial displays, competition, courtship, soaring) tend to be more likely to collide with power lines. In addition, birds that are unfamiliar with an area and its power lines (such as migrants) may be at elevated risk.

5.3.1 Environmental Factors Related to Bird Collisions

Environmental factors influencing collision risk include the effects of weather and time of day; transmission line visibility; surrounding land use practices that may attract birds; and human activities that may flush birds toward transmission lines. Overcast weather and thick fog tends to cause birds to lower their flying altitudes. Likewise, headwinds generally cause birds to fly lower, whereas tailwinds may cause birds to fly higher (Bevanger 1994; Perdeck and Speek 1984). High winds may cause some species, especially waterfowl, to fly at lower elevations (Hunting 2002). If winds are blowing perpendicular to conductors, this can also increase collision possibility (Hunting 2002). Weather conditions may also make transmission lines more difficult to see, thus increasing the likelihood of a collision (Mathiasson 1992). Visibility can also be affected by the time of day. Additionally, lines become increasingly difficult to see at times with poor lighting, such as night, dawn, or dusk. Hunting (2002) observed increased transmission line strikes occurring at night or during poor weather. Further studies by Stout and Cornwell (1976) also emphasize the risk of power line collision that poor visibility poses to waterfowl.

Wetlands, lakes, and streams all have potential for avian risk if they are located near power lines. Because water is often used by birds for foraging, nesting and roosting activities, adjacent power lines can pose collision risks to birds that utilize these areas (APLIC 2012). Stout and Cornwell (1976) found that in a review of reported non-hunting mortality of wild waterfowl from 1930 to 1964, 65% of collision mortalities were due to telephone and power lines.

Disturbance of birds perched near power lines can pose a risk. If birds are startled into leaving a water body or feeding area adjacent to power lines, the likelihood of a bird flying into the lines increases. Wetlands tend to have a high concentration of birds nesting, feeding, roosting, and shuttling back and forth among use areas, thus adding to the collision risk with nearby transmission lines (Bevanger 1994).

Anthropogenic land use may attract birds into areas that contain transmission lines. For instance, a section of highway may be an attractant to vultures or similar scavenging species because of the presence of road-killed animals. Agriculture activities may attract birds and raptors to certain areas for foraging opportunities. Birds avoiding urban area may be funneled into transmission corridors and be exposed to the risk of collision.

5.3.2 Power Line Factors Related to Bird Collisions

Power line factors that may relate to avian collisions include the type of structures supporting the transmission line and their placement in the landscape. Equipment placed on the structure and the manner that conductors are arranged also influences risk. While it is believed that flat-line configurations are less of an avian risk than vertical configurations (Bevanger 1994), power line structure design has not been sufficiently analyzed to determine a specific correlation with bird collisions (Janss 2000). However, there seems to be a positive correlation between the presence of a static wire and the number of bird collisions (Bevanger 1994; Savereno et al. 1996; APLIC 2012). It is thought that when a bird sees the larger conductor wires, it increases its altitude to avoid them, and subsequently collides with the thinner, less-visible static wire. This has been supported by studies that have demonstrated an average mortality decline of 50 to 60% when markers are placed on static wires in relation to wires left unmarked (Savereno et al. 1996).

Transmission line location may also influence the risk of collision for birds. Generally, there is more of a risk in placing a transmission line corridor in an open area than against an existing obstruction; however, the visual contrast of the conductors against the background is a consideration (Bevanger 1994). The risks to birds flying across a single corridor in an open space become dependent not only on the line's visibility, but on the altitude of the bird and its ability to first see the transmission line wires, and then change its flight pattern to avoid them. On the other hand, lines are grouped with existing lines or against a landscape reference such as tall trees are theoretically easier to avoid. Multiple lines in one corridor allow birds to avoid several sets of lines at once (Bevanger 1994). The perpendicular placement of transmission line corridors relative to avian flyways can increase the risk posed by the lines. There is also a greater risk of collision when lines are in between areas used by birds, such as between foraging and roosting areas (APLIC 2012). The problem is compounded when the areas are close enough that only a short, low level flight is required (Bevanger 1994).

Lines placed near a ridgeline also can create a hazard. When horizontal winds get deflected upward by ridgelines, the resulting updrafts attract raptors that seek to gain elevation for gliding and soaring purposes (Pope et al. 2006). Passes or valleys may act as funnels for migrating birds crossing mountain ranges. River courses are also followed by migrants. Power lines spanning passes, valleys and rivers create a risk of collision.

It is difficult to predict the frequency of collision-caused bird mortality without long term information on bird species activity and both daily and seasonal movements in the Project area. These data are not available for the TWE Project; however, it is generally expected that collision mortality would be greatest where the movements of susceptible species are the greatest (e.g., near open bodies of water, wetlands, nesting habitats, ridgelines). It is possible that birds will strike the new transmission lines, but it is not expected to result in a substantial increase from current conditions. TransWest has also utilized existing transmission corridors to a large extent, including the West-Wide Energy Corridor (WWEC) and corridors identified in various BLM Resource Management Plans. By placing the Project in existing transmission corridors, collision-related impacts will be reduced.

6.0 CONSTRUCTION DESIGN STANDARDS

All aspects of the Project were designed to meet APLIC construction recommendations both in the State of the Art, 2006 and Reducing Avian Collisions, 2012 documents. No further action is directed in this APP. Attachment D, Design Standards includes the design specifications for the Project.

For areas TransWest identifies as posing a high-risk for avian collisions (e.g., near open bodies of water, wetlands, nesting habitats, ridgelines) or in areas of high collision mortality identified through post-construction reporting, TransWest may install flight diverters or line markers as appropriate. Preferred flight diverters and markers are shown in the attached Exhibit D, Design Standards.

7.0 TRAINING / MONITORING, DEVELOP TRAINING MATERIALS

TransWest supervisors, construction crews, linemen, environmental contractors, and any other transmission-related field personnel will undergo avian protection awareness training prior to beginning work on the TWE Project. Ensuring that Project personnel are knowledgeable and aware of the protocols and methods outlined in this APP will decrease the likelihood of avian interactions with the transmission line and increase the likelihood of quick and efficient responses to incidents. Personnel will undergo a Worker Environmental Awareness Program (WEAP) that places emphasis on TransWest's avian protection policy. Also addressed are any ongoing Project permits that may be issued for avian protection; special-status avian species that could occur and where they would be most likely to occur. Workers will be instructed in how to identify these species; their natural histories where relevant to areas of probable occurrence; and what steps to take should an avian injury or mortality occur. Training will also include a discussion of the law and the consequences for non-compliance with this APP and/or with applicable permits or regulations. All new transmission-related personnel will be required to undergo WEAP training prior to conducting any construction or O&M work on any TWE Project components. As part of the WEAP training all workers will be instructed on the proper protocol for contacting the APP Program Coordinator for any assistance in circumstances of uncertainty. For a more explicit discussion of how newly discovered nests or avian incidents will be reported, see Section 9.0 Nest Management, and Section 10.0 Adaptive Management.

Summary

- All TransWest supervisors, construction crews, linemen, environmental contractors, and any other transmission-related field personnel will undergo an avian protection awareness training prior to beginning work on the Project.
- All TransWest on-site personnel will undergo WEAP training with emphasis on avian protection prior to the start of construction.
- All new contractors will undergo WEAP training before they begin work.

8.0 AREAS OF RESPONSIBILITY AND PERMIT COMPLIANCE

The APP will be administered by designated TransWest staff members under the direction of the APP Program Coordinator. A list of additional responsible persons, chain of responsibility, and contact information will be established prior to project construction and appended to this APP.

TransWest management tasks all line crews, field engineers, operators, foremen, and design personnel with understanding this plan and complying with its direction.

Currently, TransWest does not possess federal or state permits pertaining to migratory birds, eagles or federal ESA listed avian species. It is not authorized to capture injured birds, remove inactive eagle or colonial bird nests, disturb active nests of any bird species, or remove or store carcasses. Any such activity will be conducted by the USFWS or under their direct supervision. This APP will be modified if TransWest obtains a permit in the future.

Should it be warranted in the future, TransWest may apply for federal or state permits. The following permits are described to inform the APP Program Coordinator in making decisions regarding future permits. It does not imply that TransWest possesses these permits or may conduct any covered action described below.

- **Incidental Take Permits** – Incidental take permits are issued to allow the unintentional take of specified individuals per the conditions within each permit.
  - **Section 7 Incidental Take Statement** – None of the federally listed avian species known to be in the Project area are at an elevated risk for collision or mortality. Because of the voltage of TransWest transmission lines and the large separation distance that will be required, electrocution is highly unlikely.
  - **Bald and Golden Eagle Act Permit** – Based on known occurrences and activities in the vicinity of the Project area, both species could occur in various locations along the Project route. Should any eagle electrocution or collision incidents occur during construction or should an eagle nest be discovered that will be impacted by construction, TransWest construction crews will carry out measures described in Section 9.0, Nest Management, and Section 10.0, Adaptive Management, and immediately notify the APP Program Coordinator.
- **Collection/Salvage Permits** – These permits are required to collect, salvage, or handle birds.
  - **State Scientific Collecting Permit** – These permits are issued by state resource agencies and allow the collection, salvage, or capture and release of special-status species as allowed by the individual permit conditions. TransWest will seek this permit from the appropriate state agencies if any of these actions is required during Project construction.

  - **Federal Migratory Bird Permit** – These permits are issued by the USFWS under the MBTA and may be required if it is necessary to salvage and/or rehabilitate birds protected by the MBTA during construction. Fish and Game Code 3513 also prohibits the take or possession of any migratory nongame bird protected by the MBTA, except where allowed by the Secretary of the Interior.
- **Nest Removal and Relocation Permits** – Bird nests are protected by the MBTA and by the Fish and Game Code. Under the MBTA, it is illegal to possess, sell, purchase, barter, transport, import, export, or take—defined as collecting, for nests—or attempt any of those actions on a migratory bird nest (USFWS 2003). Under Fish and Game Code Sections 3503 and 3503.5, it is illegal to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise provided by the Fish and Game Code or pursuant regulations. However, it is lawful to remove inactive nests or nests during the non-breeding season for most birds, excepting those of eagles. When it is necessary to remove a protected nest as dictated by the MBTA and Fish and Game Code, TransWest will seek permits from the USFWS prior to taking any further actions other than those described under Section 9.0, Nest Management.

9.0 NEST MANAGEMENT

Nest management addresses both nests that may be constructed on facilities and nests near facilities that may be affected by construction or O&M activities. Under the MBTA, it is illegal to possess, sell, purchase, barter, transport, import, export, or take—defined as collecting, for nests—or attempt any of those actions on a migratory bird nest (USFWS 2003). In order to comply with these regulations, the various best management practices (BMPs) and protocols that will be utilized by TWE Project staff to avoid and minimize impacts to nesting avian species on structures or in the Project ROW are discussed below. Additionally, all BLM and U.S. Forest Service (USFS) spatial and timing stipulations regarding nesting birds will be followed as set forth in the right-of-way grants and special use authorizations for the TWE Project. TransWest recognizes that it may be difficult at times to determine whether a nest is active or inactive, and that even checking on the status of a nest may result in disturbance. If in doubt, O&M personnel will contact the APP Program Coordinator who will have the nest checked by a qualified biologist as appropriate.

9.1 Definition of an Active Nest

Nests of native bird species are protected by the MBTA. The USFWS has clarified that the federal regulations only pertain to active nests except in the cases of listed species and eagle nests, which are protected under the Endangered Species Act and the Bald and Golden Eagle Protection Act, respectively, whether they are active or inactive. Regarding all other bird species however, the MBTA does not clearly define what an active nest is. This being the case, it is left to qualified biologists to determine what constitutes an active nest. For the TWE Project, a nest will be considered active when construction of a new nest or use of an existing nest commences, and its formal status will remain active as long as adults, viable eggs, and/or living young are present at the nest. A nest may be abandoned, fail, or fledge young and become inactive during the breeding season. Prior to removal of the buffer around an inactive nest, a qualified biologist will confirm that the nest is inactive using appropriate survey methods.

A number of species will utilize existing nests built in prior years. These include owls (Strigiformes) and diurnal raptors such as falcons, hawks, vultures, and eagles (Falconiformes). Because known nesting sites are likely to be utilized in the current year, each existing nest suitable for use by owls and diurnal raptors should be considered active when the designated seasonal avoidance period begins. Its formal status should remain active until such time as a qualified biologist determines the nest is inactive.

9.2 Inactive Nests

Inactive nests may be removed and/or destroyed in compliance with the MBTA, unless they are nests of listed species or eagles as discussed above. In most cases, a previously active nest becomes inactive when it no longer contains viable eggs or young and is not being used by a bird as part of the reproductive cycle. According to the Migratory Bird Permit Memorandum regarding nest destruction, "the MBTA does not contain any prohibition that applies to the destruction of a bird nest alone (without birds or eggs), provided that no possession occurs during the destruction" (USFWS 2003).

Nests known to be used by ESA-listed species or bald or golden eagles will not be removed unless coordination with state or federal agencies has deemed it appropriate to remove them. Active nests will be protected through establishment of buffers determined by BLM and USFS and set forth in the right-of-way grants and special use authorizations for the TWE Project.

9.3 Operations and Maintenance Procedures

In order to properly assess and document any potential nesting issues, O&M activities occurring during the avian breeding season, generally from mid-February through late-July, will be subdivided into activities that strictly involve work on overhead structures and activities on the ground that involve ROW vegetation management. For activities strictly occurring on towers and other overhead structures, linemen and O&M personnel will conduct visual surveys of the maintenance area prior to beginning work to determine whether any bird nest are present in the work area. For activities involving ROW vegetation management, a qualified biologist would conduct a nesting bird survey not more than 14 days prior to the O&M activities to determine if active nests of any bird species are present within the work area. All active bird nests that are encountered are to be documented using the nest reporting form (Attachment B). All construction and O&M work that might disturb an active nest is to be halted immediately and the APP Program Coordinator contacted. The APP Program Coordinator will develop a treatment plan that will protect the active nest or contact the USFWS for guidance.

TransWest will comply with all federal and state laws regarding nest management or removal. Removal of an inactive, non-eagle nest outside the breeding season may be conducted for safety or maintenance issues without a take permit. When in doubt about the status of a nest (or type) field engineers will consult with the managing engineer who may seek a professional opinion from the APP Program Coordinator or an agency. Active problem nests will be addressed on a case-by-case basis and in coordination with the USFWS and appropriate state agencies.

While inactive bird nests—those without birds or eggs—are not protected from destruction by the MBTA, some inactive nests are protected by other regulations, including those of ESA-listed species or of bald and golden eagles. Nests of eagles cannot be altered, moved, or destroyed without specific authorization from the applicable agency (APLIC 2006). Recent legislation changes in 2009 allow take of eagle nests when there is a safety concern to people or eagles, when it is a public health and safety concern, when the nest prevents use of a human-engineered structure, or when the activity or its mitigation will have a net benefit to eagles; only inactive nests can be taken except in safety emergencies (50 Code of Federal Regulations [CFR] Part 22.27). However, permits are still required for nest removal and ground crews must notify the APP Program Coordinator if a problem nest is discovered. Therefore, determining the active or inactive status of a nest in the vicinity of planned work is paramount to protecting the birds that may be occupying it and protecting the Project by ensuring smooth and avian-safe construction.

If there is question as to whether an observed nest is active or inactive, the APP Program Coordinator and the appropriate land management agency are to be consulted for assistance. Under no circumstances is an active nest to be disturbed until the APP Program Coordinator has been notified and applicable permits and/or resource agencies have been consulted for further action. The nest reporting form must be completed for all active nests. Construction may only proceed within an established distance of an active nest after the nest has been determined to be inactive or after approval has been given by the APP Program Coordinator or the applicable regulatory agency.

Should a nesting bald eagle be encountered prior to work, the USFWS has issued recommendations for avoiding or minimizing disturbance to the nest and its inhabitants (USFWS 2007). If the construction will be visible from the nest, the USFWS recommends a buffer of 660 feet if there is no similar activity occurring within one mile of the nest; if a similar activity is occurring within one mile of the nest, the USFWS recommends a construction buffer of 660 feet or as close as the other activity is allowed. Landscape buffers are recommended as available. If construction is not visible from the nest, the USFWS recommends a buffer of 330 feet from the nest if there is no similar activity within one mile of the nest; if a similar activity is occurring within mile of the nest, the USFWS recommends a construction buffer of 330 feet or as close as the other activity is allowed. All clearing, external construction, and landscaping between 330 and 660 feet of the nest should be conducted outside of the breeding season. In the DEIS and relevant Resource Management Plans, BLM has broadly identified the spatial buffers surrounding bald eagle nests at one mile on BLM managed lands. The USFWS recommends that the temporary use of loud machinery be restricted to outside of the breeding season. While the breeding season for bald eagles can range from January through August, the most critical time periods when bald eagles are most sensitive to disturbance—courtship, nest building, egg-laying, and incubation—are generally from January through May (USFWS 2007).

For active golden eagle nests, the USFWS recommends a spatial buffer in non-urban areas of 0.5 miles (USFWS 2008). In the DEIS and relevant Resource Management Plans, BLM has broadly identified the spatial buffers surrounding golden eagle nests at one mile on BLM managed lands. Similar to the measures for bald eagle, it is recommended that use of loud machinery as well as all clearing, external construction, and landscaping within the spatial buffers for golden eagle nests should be conducted outside of the golden eagle breeding season.

9.4 Problem Nests

Many birds build nests on power poles. Nests that do not pose safety, reliability, outage, or bird electrocution risks will be left undisturbed. Nests that may present safety, reliability, outage, or bird electrocution risks are referred to as “problem nests”. Managing problem nests involves several components:

- Discouraging birds from nesting in problem areas
- Providing an alternative nest site
- Ensuring that surrounding utility facilities are avian-safe

Problem nests may be removed or relocated if inactive unless it is an ESA-listed species or a bald or golden eagle nest. If active, an ESA-listed species, or a bald or golden eagle nest then the APP Program Coordinator must be contacted before any further action is taken. If a problem with a specific nest is anticipated in the future, permit requirements may be minimized by taking appropriate action during the non-breeding season before the nest is active.

Summary

- If O&M efforts such as repairs, equipment replacement or routine vegetation removal are to occur during the avian breeding season, generally from mid-February through late-July, line maintenance crews will conduct a nesting bird survey prior to construction on above ground structures to determine if active nests of any bird species are present within the work area. If any ROW vegetation management will occur, a qualified biologist will conduct a nest survey no more than 14 days prior to work. All active bird nests that are encountered are to be documented using the nest reporting form (Attachment B).

- If an active nest is present, then all construction and O&M work that might disturb the nest is to be halted immediately and the APP Program Coordinator contacted. The APP Program Coordinator will develop a treatment plan that will protect the active nest or contact the USFWS for guidance. Any active bald eagle nest will be given a 660-foot buffer if maintenance activity is visible from the nest or a 330-foot buffer if it is not, active golden eagle nests will be given a 0.5 mile buffer, and both eagle species will be given a one mile buffer on BLM managed lands (or less as directed or approved by BLM staff).
- All active nests will be documented with the attached Avian Nest Reporting Form (Attachment B).
- Active nests of any species protected under the MBTA, active or inactive eagle nests, or active nests of ESA listed species are not to be moved without approval from the APP Program Coordinator, who will first consult with the USFWS. When in doubt about the status of a nest (or type) field engineers will consult with the managing engineer who may seek professional opinion from the APP Program Coordinator or an agency. Active problem nests will be addressed on a case-by-case basis and in coordination with the USFWS and appropriate state agencies.
- Inactive nests of common species (i.e. non-eagles and non-ESA listed species) can be removed where they are in the path of the work.

10.0 ADAPTIVE MANAGEMENT

As stated previously, this APP will be a living document that will be revised and updated as goals are achieved, innovative solutions are developed to mitigate impacts, agency guidance is adjusted, and conditions of the TWE Project warrant. As such, TransWest will utilize an adaptive management approach to address issues with the Project as they arise. Through this process, TransWest will better be able to identify potential risk and avoid and minimize impacts to avian species. Set out below are examples of some areas where adaptive management will serve to benefit avian species as well as the TWE Project.

10.1 Retrofit/ Remedial Protective Measures

The TWE Project is a new build transmission line that will be built to APLIC construction recommendations, which eliminates the need for retrofit devices and remedial protection. However, if an area is identified where avian species are being impacted by the transmission line, the issue will be investigated, identified and corrected through the use of retrofit devices or other accepted protective measures which will again reduce the potential risk to avian species. General types of equipment that may be used for these situations include covers for hardware and conductors; perching dissuaders; flight path diverters; line marking devices; and other similar types of equipment. TransWest has preemptively considered and approved the use of a few market available products; specifications for these products are located in Attachment D, Design Standards. Records will be kept of the nature of any problems requiring avian protection equipment, bird species involved, site conditions, materials, performance characteristics of equipment and lifespan. The records will be reviewed on a semiannual basis by the APP Program Coordinator to ascertain patterns or developing conditions.

The APP will be reviewed annually and updated as needed based on field data on retrofitted equipment and monitoring of any system changes to improve avian safety. The overarching goal of the APP is to be a living document that will strive to protect avian species by reducing the potential risk created by the Project.

10.2 Incident Tracking

Avian incidents and mortalities will be documented during all phases of the TWE Project by supervisors, construction crews, linemen, environmental contractors, O&M personnel, and any other transmission-related field personnel. Personnel will undergo avian protection awareness training prior to beginning work on the TWE Project that will include recognition and effective documentation of observed avian issues and mortalities. All avian injuries or mortalities that are a result of collision or electrocution with the transmission lines or other Project components are to be documented and reported to the APP Program Coordinator. Following initial notification, the employee or contractor is to fill out the avian reports included as Attachment C. Avian incidents will also be recorded into a Geographic Information Systems (GIS) database for tracking purposes and to determine particular repeat problem areas.

If the affected bird is a special-status species or if it is discovered that a particular area or stretch of transmission line is a "hot spot" for avian safety issues, TransWest will investigate remedial measures to alleviate the issue, as discussed in Section 9.1.

TransWest will maintain an annual list of avian mortalities, including dates, locations, and the species involved, as well as a list of remedial measures implemented (e.g., retrofitting, avian safety devices installed), a shape file or map of the annual avian incident data, and an itemized breakdown of the annual cost of implementing this APP. This information will be internally maintained for use in any future permitting action or enforcement action.

TransWest management and the APP Program Coordinator will review the annual list of avian mortalities and the annual report for compliance with this APP and to insure that adequate measures are being taken to avoid and minimize risks to birds. Where areas of substantial concern are identified through the internal reporting described above, mortality surveys may be conducted to identify the location and scope of the problem, which will then inform the adaptive management process and result in the correction of aspects of the TWE Project that may be causing impacts to avian species. The adaptive management process will utilize the best available information, methods, and analysis techniques implemented by the utility industry. Currently the APLIC *Reducing Avian Collisions*, 2012 document provides up-to-date survey and data collection methods, as well as analysis information.

11.0 EXPENDITURE TRACKING

To determine the amount of investment being expending on measures set out in Section C9.0, TransWest will track its expenses in order to inform the agencies (e.g., USFWS) of these costs. Cost capture is a mechanism agencies use to track efforts utilities expend to improve and sustain avian safety of their systems. As a new project, no data exist to meaningfully prepare a scope and budget for mortality reduction measures. Within one year of commencement of Project operations, TransWest will establish an annual budget and cost tracking mechanism for remedial actions (purchase and installation of avian protection equipment), training, and other activities such as attendance of avian protection workshops.

Examples of potential work that will be tracked in the APP reporting system include the following:

1) Modification of poles associated with a raptor mortality

2) Installation of bird flight diverters/markers to prevent bird collisions

3) Proactive installation of bird guards to prevent squirrel/bird outages

4) Proactive modification of existing poles considered to have a high risk of electrocution.

12.0 QUALITY CONTROL

TransWest will implement quality control measures to ensure that this APP is accurate, up-to-date, and used effectively during the long-term operation of the Project. These measures will include the following:

- TransWest line crews, field engineers, operators, foremen, design personnel, and all contractors associated with the Project, are tasked with understanding and complying with this Plan.
- Quality control will be overseen by the APP Program Coordinator who will provide quarterly reports to TransWest's General Management.
- The APP Program Coordinator will review submitted nest reporting forms and avian incident reporting forms and ensure that they are properly and adequately completed. Any missing information will be obtained from the worker who completed the form. The APP Program Coordinator will ensure that a local (TransWest) incident database is kept up-to-date. Any problems with the reporting system will be reported to management for review and remedial action will be taken.
- Any transmission towers or sections of conductor that are retrofitted with avian safety measures as described under Section 10.0 Adaptive Management, will be monitored for effectiveness by checking for injured birds, carcasses, or signs of potentially risky nest-building weekly for the first month after the retrofitting. Any observed incidents of additional nesting, injury, or mortality will be investigated for further remedial actions, which will then be determined and implemented.
- TransWest will keep an internal database which tracks detected avian injuries or mortalities, a list of retrofitting operations over the last year, a shape file or map of the last year's avian incident data, and an itemized list of the operating costs associated with implementing the protective measures in this APP. TransWest management and the APP Program Coordinator will discuss and implement any necessary changes to this APP or avian protection methods based on this annual report.

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ATTACHMENT A
SPECIAL STATUS AVIAN SPECIES

TABLE A1 POTENTIAL SPECIAL STATUS AVIAN SPECIES IN TWE PROJECT AREA

COMMON NAME	SCIENTIFIC NAME	STATUS[1]	RANGE AND HABITAT REQUIREMENTS	NESTING STRUCTURE	POTENTIAL FOR OCCURRENCE2
American white pelican	*Pelecanus erythrorhynchos*	BLM; UT-SS Tier II	Range: The American white pelican breeds in widely distributed island colonies from Canada to northeastern California, Utah, Nevada, Wyoming, and Colorado. Habitat: The species breeds on islands in large bodies of water. It forages in marshes, lakes, and rivers. It constructs a scrape nest on flat, open ground, near water. It is a colonial nester.	Wetlands: ground nester	Regions I and II: High. The species has been documented within the 2-mile transmission line corridor in Millard County, Utah. It has also been documented within 5 miles of the reference line in Iron, Juab, Millard, Sevier, Uintah, and Washington counties, Utah. No suitable habitat for the American white pelican is crossed by the project alternatives in Region III. A breeding colony has been documented within 5 miles of the reference line in Carbon County, Wyoming.
Least bittern	*Ixobrychus exilis*	BLM; NV-P	Range: The least bittern nests throughout the eastern United States and in select areas of Oregon, California, Colorado, Arizona, New Mexico, Texas, Utah, Nebraska, Nevada, Mexico, and South America. Habitat: The species breeds and forages in freshwater marshes. It nests on a platform of marsh vegetation with a canopy.	Wetlands: ground nester	Regions I, III, and IV: Moderate. The species has been documented within 5 miles of the reference line in Clark County, Nevada. Probable breeding records exist for the Pahranagat National Wildlife Refuge in Lincoln County, Nevada.
White-faced ibis	*Plegadis chihi*	BLM	Range: The white-faced ibis nests from central Mexico to coastal Texas and Louisiana and through the Great Basin. Isolated colonies exist in Alberta, New Mexico, California, Montana, North Dakota, Iowa, Kansas, and South America. Habitat: The species breeds in tall emergent vegetation growing as "islands", surrounded by water (at least 18 inches deep). It forages in wet hay meadows and flooded agricultural croplands, marshes, shallow ponds, lakes, and reservoirs. It constructs a nest of emergent vegetation in bulrushes, cattails, or reeds; on floating mats; or in low trees.	Wetlands: ground nester	Regions I, II, III, and IV: High. The species has been documented within the 2-mile transmission line corridor in Carbon County, Wyoming. It has also been documented within 5 miles of the reference line in Sweetwater County, Wyoming. Possible breeding colonies exist in northwestern Colorado and in Clark County, Nevada.

COMMON NAME	SCIENTIFIC NAME	STATUS[1]	RANGE AND HABITAT REQUIREMENTS	NESTING STRUCTURE	POTENTIAL FOR OCCURRENCE2
Barrow's goldeneye	*Bucephala islandica*	BLM	Range: The Barrow's goldeneye breeds in the western mountains of North America, from Alaska to central California. Habitat: The species breeds near densely vegetated water bodies with abundant aquatic vegetation. It forages in water bodies. It nests in cavities, usually in dead trees close to cold-water lakes, pools, or rivers. The species exhibits high nest fidelity.	Wetlands: cavities	Region I: Low. The species is a confirmed breeder in Sweetwater and Carbon counties, Wyoming.
Trumpeter swan	*Cygnus buccinator*	BLM	Range: The trumpeter swan was once distributed across most of North America and currently occurs locally from Alaska south to Oregon and east to Michigan. Habitat: The species breeds in areas with stable, quiet, and shallow waters where small islands, muskrat houses, or dense emergent vegetation provide nesting and loafing habitat. It forages in shallow marshes, ponds, lakes, and river oxbows with nutrient-rich waters, and dense aquatic plants and invertebrates. It constructs a nest of aquatic and emergent vegetation, often on a muskrat house surrounded by water.	Wetlands: ground nester	Region I: High. The species has been documented within the 2-mile transmission line corridor in Sweetwater County, Wyoming.
Bald eagle	*Haliaeetus leucocephalus*	BLM; USFS; CO-ST; UT-SS Tier I; NV-P	Range: The bald eagle occurs throughout the United States and Canada, south into central Mexico. Habitat: The species breeds near large lakes and rivers, in forested habitat where adequate prey and large, old cottonwood or conifer trees are available for nesting. It constructs a large stick nest, and exhibits high nest fidelity.	Raptor: trees	Regions I, II, III, and IV: High. This species has been documented throughout Wyoming, Colorado, Utah, and Nevada. Bald eagles nest and winter along major waterbodies in mature riparian woodlands.

COMMON NAME	SCIENTIFIC NAME	STATUS[1]	RANGE AND HABITAT REQUIREMENTS	NESTING STRUCTURE	POTENTIAL FOR OCCURRENCE2
Ferruginous hawk	*Buteo regalis*	BLM; UT-SS Tier II; NV-P	Range: The ferruginous hawk occurs in Canada, eighteen western and central states, and Mexico. Habitat: The species breeds in semiarid open country, primarily grasslands, basin prairie shrublands, and badlands, typically near prairie dog colonies. It requires large tracts of relatively undisturbed rangeland for foraging habitat. It constructs a large stick nest on rock outcrops, knolls, cutbanks, cliff ledges, or trees, and exhibits high nest fidelity.	Raptor: cliffs/trees	Regions I, II, III, and IV: High. The species has been documented within the 2-mile transmission line corridor in Carbon and Sweetwater counties, Wyoming; in Beaver, Duchesne, Emery, Grand, Iron, Juab, Millard, Uintah, and Washington counties, Utah; and in Lincoln County, Nevada. Suitable habitat also occurs within the study area in Clark County, Nevada.
Golden eagle	*Aquila chrysaetos*	BLM	Range: The golden eagle occurs throughout North America, from Alaska to central Mexico. Habitat: The species breeds and forages in a variety of habitats, including large expanses of grasslands, sagebrush, agricultural lands, and tundra. It constructs a large stick nest on cliffs and in large trees, and exhibits high nest fidelity.	Raptor: cliffs/trees	Regions I, II, III, and IV: High. The species has been documented within the 2-mile transmission line corridor in Carbon and Sweetwater counties, Wyoming, and in White Pine and Lincoln counties, Nevada. Suitable habitat also occurs within the 2-mile transmission line corridor in Colorado, Utah, and Nevada.
Northern goshawk	*Accipiter gentilis*	BLM; USFS; UT-SS Tier I; NV-P	Range: The northern goshawk occurs in Alaska, Canada, and south through the southern Rocky Mountains and Mexico. Habitat: The species breeds and forages in mixed coniferous forest and mature aspen stands with tall trees, intermediate canopy coverage for nesting, and small open areas for foraging. It constructs a stick and twig nest on a large horizontal limb, usually against or near the truck.	Raptor: trees	Regions I and II: High. The species is known to occur within the 2-mile transmission line corridor in Sweetwater County, Wyoming and in Emery and Millard counties, Utah. It has also been documented within 5 miles of the reference line in Carbon County, Wyoming; Garfield and Rio Blanco counties, Colorado; in Daggett, Duchesne, Emery, Millard, Sanpete, Sevier, Uintah, Utah, and Wasatch counties, Utah; and in Lincoln County, Nevada. No suitable habitat for the northern goshawk is crossed by the project alternatives in Region III.
Peregrine falcon	*Falco peregrinus*	BLM; USFS; NV-P	Range: The peregrine falcon occurs throughout most of North America. Habitat: The species breeds and forages in a	Raptor: cliffs	Regions I, II, III, and IV: High. The species has been documented within the 2-mile transmission line corridor in Sweetwater County, Wyoming, Uintah

COMMON NAME	SCIENTIFIC NAME	STATUS[1]	RANGE AND HABITAT REQUIREMENTS	NESTING STRUCTURE	POTENTIAL FOR OCCURRENCE2
			variety of open habitats, including woodlands, forests, shrub-steppe, grasslands, marshes, and riparian habitats. It nests on cliffs and rarely on tall buildings near habitats with abundant prey. It constructs a well-rounded scrape nest of accumulated debris on a ledge.		County, Utah, and Clark County, Nevada. It has also been documented within 5 miles of the reference line in Carbon County, Wyoming, and in Utah (Daggett, Duchesne, Emery, Sevier, and Washington counties).
Prairie falcon	*Falco mexicanus*	BLM	Range: The prairie falcon occurs throughout western North America from Canada to Mexico. Habitat: The species breeds and forages in open terrain, including sagebrush, grasslands, and other arid habitats. It nests on cliff ledges facing open habitat.	Raptor: cliffs	Regions I, II, III, and IV: High. Potential habitat for this species occurs in the 2-mile transmission line corridor. It has been documented within 5 miles of the 2-mile transmission line corridor in Lincoln County, Nevada, and in Colorado.
Swainson's hawk	*Buteo swainsoni*	BLM	Range: The Swainson's hawk breeds in western North America, from Alaska south into northern Mexico, and east to Oklahoma and Iowa. The species range includes Wyoming, Colorado, Utah, and Nevada. Habitat: The species breeds and forages in arid grasslands, desert, and agricultural areas with scattered trees and shrubs. It constructs a modest nest in trees and exhibits moderate nest fidelity.	Raptor: trees	Regions I, II, III, and IV: High. The species has been documented within the 2-mile transmission line corridor in Utah. Suitable habitat is present along the 2-mile transmission line corridor in Wyoming, Colorado, Utah, and Nevada.
Columbian sharp-tailed grouse	*Tympanuchus phasianellus columbianus*	BLM; USFS; UT-SS Tier II	Range: The Columbian sharp-tailed grouse occurs locally from Canada, south to Nevada and east to Colorado. It has been extirpated from Oregon, California, and Nevada. Habitat: The subspecies inhabits mountain-foothill shrub communities, sagebrush, grassland, and riparian habitats. Leks are located in flat areas with low, sparse vegetation. Nests occur within 0.6 mile of the lek area.	Shrublands: ground nester	Regions I and II: Low. The subspecies occurs in suitable habitat in isolated locations in south-central Wyoming, and northwestern Colorado.

COMMON NAME	SCIENTIFIC NAME	STATUS[1]	RANGE AND HABITAT REQUIREMENTS	NESTING STRUCTURE	POTENTIAL FOR OCCURRENCE2
Greater sage-grouse	*Centrocercus urophasianus*	FC; BLM; USFS; UT-SS Tier II;	Range: The greater sage-grouse is found throughout the western United States. Habitat: The species breeds and forages in sagebrush grasslands. Leks are located in open areas (e.g., ridges, knolls, dry lake beds, burned areas) in close proximity to taller sagebrush which is used as escape cover. Most nests are located under sagebrush plants, typically within 4 miles of the lek. Brooding habitat consists of grassy areas near sagebrush. Winter habitat consists of south and east facing slopes with minimal snow cover.	Shrublands: ground nester	Regions I, II, and III: High. Active leks occur within the 2-mile transmission line corridor in Wyoming, Colorado, and Utah. Suitable nesting, brooding, and wintering habitat also occurs within the 2-mile transmission line corridor in these states. The 2-mile transmission line corridor includes greater sage-grouse core habitat areas in Wyoming.
Black tern	*Chlidonias niger*	BLM	Range: The black tern occurs locally in Canada and the northern two-thirds of the United States. Habitat: The species breeds in large marshes, usually greater than 50 acres and forages in marshes and aquatic areas. It nests in small, loose colonies, in still water. It constructs a floating nest of dead rushes in marshes, or on grass tufts in wetlands	Wetlands: ground nester	Regions I and II: High. Breeding colonies of this species have been documented within the 2-mile transmission line corridor in Carbon County, Wyoming and within 5 miles of the 2-mile transmission line corridor in Sweetwater County, Wyoming. The species has been documented within 5 miles of the reference line in Uintah County, Utah. Suitable habitat occurs at Pelican Lake, and on sandbars in the Green River, Utah.
Long-billed curlew	*Numenius americanus*	BLM; UT-SS Tier II	Range: The long-billed curlew occurs from southern Canada into most of the western United States. Habitat: The species breeds and forages in a variety of grassland habitats, including moist meadow grasslands, agricultural areas, and dry prairie uplands, usually near water. It nests in grass less than 12 inches tall, with bare ground, shade, abundant invertebrate prey.	Grasslands: ground nester	Regions I, II, and III: High. This species has been documented within the 2-mile transmission line corridor in Carbon County, Wyoming and Juab, Millard, and Uintah counties, Utah. It has also been documented within 5 miles of the reference line in Beaver, Grand, and Iron counties, Utah.

COMMON NAME	SCIENTIFIC NAME	STATUS[1]	RANGE AND HABITAT REQUIREMENTS	NESTING STRUCTURE	POTENTIAL FOR OCCURRENCE2
Mountain plover	*Chardrius montanus*	BLM; USFS; UT-SS;	Range: The mountain plover occurs in dry short-grass prairies from south-central Canada to Texas. Habitat: The species breeds and forages in flat, short-grass prairie habitat and fallow agricultural fields with sparse vegetation. It constructs a ground nest of cow manure chips, grass, and roots.	Grasslands: ground nester	Regions I and II: High. The species has been documented within the 2-mile transmission line corridor in Carbon and Sweetwater counties, Wyoming. It has been documented within 5 miles of the reference line in Grand County, Utah. Historic records also exist for mountain plovers in Duchesne and Uintah counties, Utah.
Yellow-billed cuckoo (western)	*Coccyzus americanus*	FC; BLM;UT-SS Tier I; NV-P	Range: The western yellow-billed cuckoo occurs west of the continental divide in North America. Habitat: The species breeds and forages in dense woodlands along riparian corridors in otherwise arid areas. It requires a multi-storied canopy, and dense, shrubby vegetation, adequate invertebrate prey, cover, and water. It constructs twig nests, in shrubs.	Wetlands: trees	Regions I, II, III, and IV: High. The species has been documented within the 2-mile transmission line corridor in Utah county, Utah. It has also been documented within 5 miles of the reference line in Emery, Grand, Uintah, and Washington counties, Utah. The species is documented in Meadow Valley Wash in Lincoln County, Nevada. It is also a confirmed breeder along the Muddy River in Nevada.
Boreal owl	*Aegolius funereus*	USFS	Range: The boreal owl occurs from Alaska, south through the Rocky Mountains to northern New Mexico. Habitat: The species breeds and forages in mature, high elevation (above 9,000 feet amsl) coniferous forests, interspersed with mature aspen stands for nesting cavities. It requires large areas of forested habitat. It nests in large woodpecker holes or natural cavities in trees.	Raptor: cavities	Regions I and II: Moderate. The species is documented within 5 miles of the reference line in Carbon County, Wyoming.

COMMON NAME	SCIENTIFIC NAME	STATUS[1]	RANGE AND HABITAT REQUIREMENTS	NESTING STRUCTURE	POTENTIAL FOR OCCURRENCE2
Burrowing owl	*Athene cunicularia*	BLM; CO-ST; UT-SS Tier II	Range: The burrowing owl occurs from Canada, south through most of the western United States to central Mexico. Habitat: The species breeds and forages in a wide variety of arid and semiarid environments, including grassland, desert, and shrub-steppe habitats, and agricultural areas. It generally nests in burrows excavated by small mammals, particularly prairie dogs and ground squirrels.	Raptor: burrow nester	Regions I, II, III, and IV: High. The species is documented within the 2-mile transmission line corridor in Carbon and Sweetwater counties, Wyoming, Moffat County, Colorado, throughout Utah, and in Clark and Lincoln counties, Nevada.
Flammulated owl	*Otus flammeoulus*	BLM; USFS	Range: The flammulated owl breeds from Canada, south through Washington, Oregon, California, Nevada, Utah, Wyoming, Colorado, Arizona, New Mexico, western Texas, and Mexico. Habitat: The species breeds and forages in montane forests, especially ponderosa pine where it feeds on moths. It nests in cavities, especially abandoned woodpecker holes.	Raptor: cavities	Regions I and II: Moderate. The species is known to occur in Colorado, Utah, and Nevada. Suitable habitat occurs in Rio Blanco County, Colorado, Daggett, Sevier, and Uintah counties, Utah, and Carbon County, Wyoming. It has been documented within 1 mile of the reference line. No suitable habitat for the flammulated owl is crossed by the project alternatives in Region III.
Long-eared owl	*Asio otus*	BLM	Range: The long-eared owl occurs from southern Canada through most of the United States, except in the southeast. Habitat: The species breeds and forages in dense, woody vegetation for roosting, and open country for hunting. It nests in abandoned corvid nests in trees or brush.	Raptor: trees	Regions I, II, III, and IV: Low. The species is known to occur in Wyoming, Colorado, Utah, and Nevada. Suitable habitat occurs along the 2-mile transmission line corridor.

COMMON NAME	SCIENTIFIC NAME	STATUS[1]	RANGE AND HABITAT REQUIREMENTS	NESTING STRUCTURE	POTENTIAL FOR OCCURRENCE2
Short-eared owl	*Asio flammeus*	BLM; UT-SS Tier II	Range: The short-eared owl occurs from Alaska and Canada, south to central California and east to Maryland. Habitat: The species breeds and forages in broad expanses of open habitat, with dense, low vegetation, including grasslands, meadows, marshes, and open sagebrush shrublands. It is strongly associated with ungrazed and undisturbed native grasslands and wetlands that support dense small mammal populations. It constructs a grass nest in low vegetation.	Raptor: ground nester	Regions I, II, and III: High. The species is documented within the 2-mile transmission line corridor in Millard County, Utah and Carbon and Sweetwater counties, Wyoming. It has also been documented within 5 miles of the reference line in Beaver, Juab, and Uintah counties, Utah.
Black swift	*Cypseloides niger*	BLM; UT-SS Tier II	Range: The black swift occurs in scattered colonies throughout western North America, from southeast Alaska to central Mexico. Habitat: The species breeds and forages in a variety of habitats, foraging far from nesting areas. It nests on vertical rock faces, near waterfalls, or in dripping caves. Nests are constructed of ferns and algae in small colonies.	Cliffs	Regions I and II: High. Nesting colonies are known to occur in Utah County, Utah. The species has been documented within the 2-mile transmission line corridor in Duchesne County, Utah. It has also been documented within 5 miles of the reference line in Uintah County, Utah.
Lewis's woodpecker	*Melanerpes lewis*	BLM; UT-SS Tier II	Range: The Lewis's woodpecker occurs from southern Canada, to south-central California and New Mexico. Habitat: The species breeds and forages in open country with scattered trees, usually below 9,000 feet amsl. Habitat includes open ponderosa pine forests, burned-out coniferous stands, riparian and oak woodlands, and deciduous forests. It excavates cavities for nests in trees.	Forests: cavities	Regions I, II and III: High. The species has been documented within the 2-mile transmission line corridor area in Juab and Utah counties, Utah. It has also been documented within the 2-mile transmission line corridor in Millard and Uintah counties, Utah.

COMMON NAME	SCIENTIFIC NAME	STATUS[1]	RANGE AND HABITAT REQUIREMENTS	NESTING STRUCTURE	POTENTIAL FOR OCCURRENCE2
Red-naped sapsucker	*Sphyrapicus nuchalis*	BLM	Range: The red-naped sapsucker occurs from the Rocky Mountains, west to eastern California and Oregon, and from southern Canada to Arizona and New Mexico. Habitat: The species breeds and forages in aspen, cottonwood riparian stands, and mixed aspen/coniferous forests from 5,000 to 9,000 feet amsl. It nests in tree cavities and exhibits some nest fidelity.	Forests: cavities	Regions I, II, III, and IV: Low. The species is known to occur in Wyoming, Colorado, Utah, and Nevada.
American three-toed woodpecker	*Picoides dorsalis*	BLM; USFS; UT-SS Tier II	Range: The American three-toed woodpecker occurs from Canada and Alaska, south through the Rocky Mountains to New Mexico. Habitat: The species is a high elevation spruce-fir forest obligate. It breeds and forages in coniferous forests, particularly in burned and beetle killed areas where it scales off bark in search of prey. It nests in tree cavities.	Forests: cavities	Regions I and II: Moderate. The species has been documented within 5 miles of the reference line in Emery and Sevier counties, Utah. Suitable habitat is present within the 2-mile transmission line corridor in Wyoming, Colorado, and Utah. No suitable habitat for the American three-toed woodpecker is crossed by the project alternatives in Region III.
Bobolink	*Dolichonyx oryzivorus*	BLM; UT-SS Tier II	Range: The bobolink occurs from Canada, south to eastern Oregon, central Colorado, central Illinois, and western North Carolina. Habitat: The species breeds and forages in large grassland expanses. It constructs a grass nest in a depression in wet meadows, flooded pastures, and fields.	Grasslands: ground nester	Regions I, II, and III: Moderate. The species has been documented within 5 miles of the reference line in Carbon County, Wyoming; Uintah County, Utah; and Moffat County, Colorado. Suitable habitat occurs within the 2-mile transmission line corridor in Wyoming, Colorado, and Utah.
Baird's sparrow	*Ammodramus bairdii*	BLM	Range: Baird's sparrow occurs from Canada south through the northern Great Plains. Habitat: The species breeds and forages in shortgrass prairie. It constructs a ground nest in a depression.	Grasslands: ground nester	Region I: Low. This species may be found in grasslands and weedy fields in the Rawlins Field Office, but likely outside of the Special Status Bird Analysis Area.

COMMON NAME	SCIENTIFIC NAME	STATUS[1]	RANGE AND HABITAT REQUIREMENTS	NESTING STRUCTURE	POTENTIAL FOR OCCURRENCE2
Brewer's sparrow	*Spizella breweri*	BLM	Range: The Brewer's sparrow occurs from southeastern Alaska south to southern California and southwestern Kansas. Habitat: The species is a sagebrush obligate. It breeds and forages in sagebrush shrublands with abundant, scattered shrubs and short grasses. It constructs a nest of grass, forbs, and roots in a shrub or low tree.	Shrublands: shrubs/trees	Regions I, II, and III: High. The species has been documented within the 2-mile transmission line corridor in Lincoln County, Nevada. It has been documented within 5 miles of the reference line in Carbon and Sweetwater counties, Wyoming. Suitable habitat occurs throughout the 2-mile transmission line corridor in Wyoming, Colorado, Utah, and Nevada. No suitable habitat for the Brewer's sparrow is crossed by the project alternatives in Region IV.
Grasshopper sparrow	*Ammodramus savannarum*	BLM; UT-SS Tier II	Range: The grasshopper sparrow occurs from Canada east to southern Maine, and south to southern California and central Georgia. The main population occurs in the Great Plains. Habitat: The species breeds and forages in mid- and long-grass prairie, mixed grasslands, meadows, and open sagebrush-grasslands. It constructs a grass nest in a depression.	Grasslands: ground nester	Region I: High. The species has been documented within the 2-mile transmission line corridor in Carbon and Sweetwater counties, Wyoming.
Gray vireo	*Vireo vicinior*	BLM	Range: The gray vireo occurs in Arizona, New Mexico, Colorado, Utah, Nevada, and southern California. Habitat: The species breeds and forages in hot, arid mountains, in desert scrub, pinyon-juniper, pine-oak scrub, and high plains scrubland. It constructs a deep, rounded grass nest, suspended in a forked twig in a shrub.	Shrublands: shrubs	Regions I, II, III, and IV: High. This species has been documented within the 2-mile transmission line corridor in Lincoln County, Nevada. It has been documented within 5 miles of the reference line in Moffat, and Rio Blanco counties, Colorado. Suitable habitat occurs throughout the 2-mile transmission line corridor in Utah and Nevada.

COMMON NAME	SCIENTIFIC NAME	STATUS[1]	RANGE AND HABITAT REQUIREMENTS	NESTING STRUCTURE	POTENTIAL FOR OCCURRENCE2
Juniper titmouse	*Baeolophus griseus*	BLM	Range: The juniper titmouse occurs in western North America, from southern Oregon west to Wyoming, and south to Arizona, western Texas, and Mexico. Habitat: The species breeds and forages in juniper woodlands interspersed with sagebrush and other shrubs. It nests in a natural cavity or in an abandoned woodpecker hole.	Woodlands: cavities	Region I and II: High. The species has been documented within the 2-mile transmission line corridor in Carbon and Sweetwater counties, Wyoming, and Lincoln County, Nevada. Suitable habitat occurs throughout the 2-mile transmission line corridor in Colorado, Utah, and Nevada. No suitable habitat for the juniper titmouse is crossed by the project alternatives in Regions III and IV.
Loggerhead shrike	*Lanius ludovicianus*	BLM	Range: The loggerhead shrike occurs from south-central Canada, throughout the United States, and Mexico. Habitat: In the western U.S., the species breeds and forages in arid, open country with scattered small trees and shrubs or hedgerows. It constructs a twig nest in a thorny tree or shrub.	Shrublands: shrubs/trees	Regions I, II, III, and IV: High. The species has been documented within the 2-mile transmission line corridor in Carbon and Sweetwater counties, Wyoming, and Lincoln County, Nevada. Suitable habitat occurs throughout the 2-mile transmission line corridor in Wyoming, Colorado, Utah, and Nevada.
Pinyon jay	*Gymnorhinus cyanocephalus*	BLM	Range: The pinyon jay occurs from central Oregon, Montana, and South Dakota, south to Baja California, Arizona, and New Mexico. Habitat: The species breeds and forages in ponderosa pine savannah, pinyon-juniper, and montane shrublands. It constructs a bulky twig nest in a juniper or pine tree.	Woodlands: trees	Regions I, II, and III: High. The species has been documented within the 2-mile transmission line corridor in Lincoln County, Nevada. It is known to occur in Wyoming, Colorado, Utah, and Nevada. No suitable habitat for the pinyon jay is crossed by the project alternatives in Region IV.
Sage sparrow	*Amphispiza belii*	BLM	Range: The sage sparrow occurs from central Washington, east to northwestern Colorado and south to Baja California and northwestern New Mexico. Habitat: The species is a sagebrush obligate. It breeds and forages in habitat with tall shrubs (3 to 6 feet tall) and low grass cover, and requires large blocks of unfragmented habitat. It constructs a twig nest in sagebrush.	Shrublands: shrubs	Regions I, II, and III: High. The species has been documented within the 2-mile transmission line corridor in Carbon and Sweetwater counties, Wyoming, Moffat County, Colorado, and Lincoln County, Nevada. It has also been recorded within 5 miles of the reference line in Rio Blanco County, Colorado. Suitable habitat occurs throughout the 2-mile transmission line corridor in Wyoming, Colorado, Utah, and in Lincoln County, Nevada.

COMMON NAME	SCIENTIFIC NAME	STATUS[1]	RANGE AND HABITAT REQUIREMENTS	NESTING STRUCTURE	POTENTIAL FOR OCCURRENCE2
Sage thrasher	*Oreoscoptes montanus*	BLM	Range: The sage thrasher occurs from Canada, south through the Great Basin, to Arizona and New Mexico. Habitat: The species is a sagebrush obligate. It breeds and forages in habitat with tall shrubs (3 to 6 feet tall) and low grass cover. It constructs a bulky, twig nest in sagebrush.	Shrublands: shrubs	Regions I, II, and III: High. The species has been documented within the 2-mile transmission line corridor in Carbon and Sweetwater counties, Wyoming, and Lincoln County, Nevada. Suitable habitat occurs in Wyoming, Colorado, Utah, and in Lincoln County, Nevada.
Vesper sparrow	*Pooecetes gramineus*	BLM	Range: The vesper sparrow occurs from southern Canada to the Appalachian Mountains, along the Ohio River, and in much of the western United States. Habitat: The species breeds and forages in a variety of open, grass habitats, including sagebrush steppe, meadows, pastures, and roadsides. It constructs a grass nest in a depression.	Grasslands: ground nester	Regions I, II, and III: Low. The species is known to occur in Wyoming, Colorado, Utah, and in Lincoln County, Nevada.
Yellow-breasted chat	*Icteria virens*	BLM	Range: The yellow-breasted chat occurs throughout the United States and northern Mexico. Habitat: The species breeds and forages in riparian shrub and marshes below 7,000 feet amsl. It constructs a large leaf and weed nest in a deciduous shrub.	Woodlands: trees	Regions I, II, III, and IV: High. The species has been documented within the 2-mile transmission line corridor in Lincoln County, Nevada. It is known to occur in Wyoming, Colorado, Utah, and Nevada.

[1]Status:

FE = Federally Endangered; FT = Federally Threatened; FC = Federal Candidate; FP = Federal Proposed; EXP/NE = Experimental Non-essential population; BLM = BLM Sensitive; USFS = USFS Sensitive; CO-E = Colorado State Endangered; CO-T = Colorado State Threatened; NV-P = Nevada State Protected; UT-SS = Utah Sensitive Species (Tier I and Tier II species are defined in Utah's Comprehensive Wildlife Strategy)

[2]Potential for Occurrence

High = The species is known to occur within suitable habitat within the 2-mile transmission line corridor.
Moderate = The species is known to occur within 5 miles of the study area and suitable habitat for the species occurs within the 2-mile transmission line corridor.
Low = The known geographic range of the species is within the 2-mile transmission line corridor.
None = The geographic range of the species is outside the 2-mile transmission line corridor.

ATTACHMENT B
AVIAN NEST AND INCIDENT REPORTING FORM

Avian Nest Reporting Form

Discoverer's Name

Discoverer's Phone Number

Date of Nest Discovery

Nest Location (circle one) Tower/Pole Tree Shrub Ground

Line Name, Voltage, and Closest Tower/Pole ID

Other Specific Location Information

Surrounding Habitat (circle all that apply)

Agricultural	Chaparral/Shrubs	Desert Scrub
Disturbed/Developed	Grassland	Riparian

Nest Condition (circle one) Active Inactive, Intact Inactive, Partial Deterioration Inactive, Heavy Deterioration

Describe any Bird Signs Around the Nest (feathers, scat, prey remains)

Are Birds Present? (circle one) Yes No

Number of Birds Visible

Age of Bird(s) (circle all that apply) Adult Juvenile Nestling Eggs Unknown

Bird Species (if known)

Type of Bird (circle one if species unknown)

Raptor (hawk, falcon, eagle) Owl Crow/Raven

Passerine (small bird) Unknown

Risk to Birds/Construction (circle one)

No Risk Potential Risk – Imminent Potential Risk – Not Imminent

Additional Comments

ATTACHMENT C
AVIAN INCIDENT REPORTING FORM

Avian Incident Reporting Form

Discoverer's Name

Discoverer's Phone Number

Date of Nest Discovery

Date of Incident/Discovery

Time of Incident/Discovery

Line Name, Voltage, and Tower/Pole ID

GPS Coordinates of Incident (if available)

Species (if known)

Type of Bird (circle one if species unknown)

Raptor (hawk, falcon, eagle)	Owl	Crow/Raven
Passerine (small bird)	Waterfowl	Unknown

Number of Birds

Age of Bird(s) (circle all that apply) Adult Juvenile Nestling Eggs Unknown

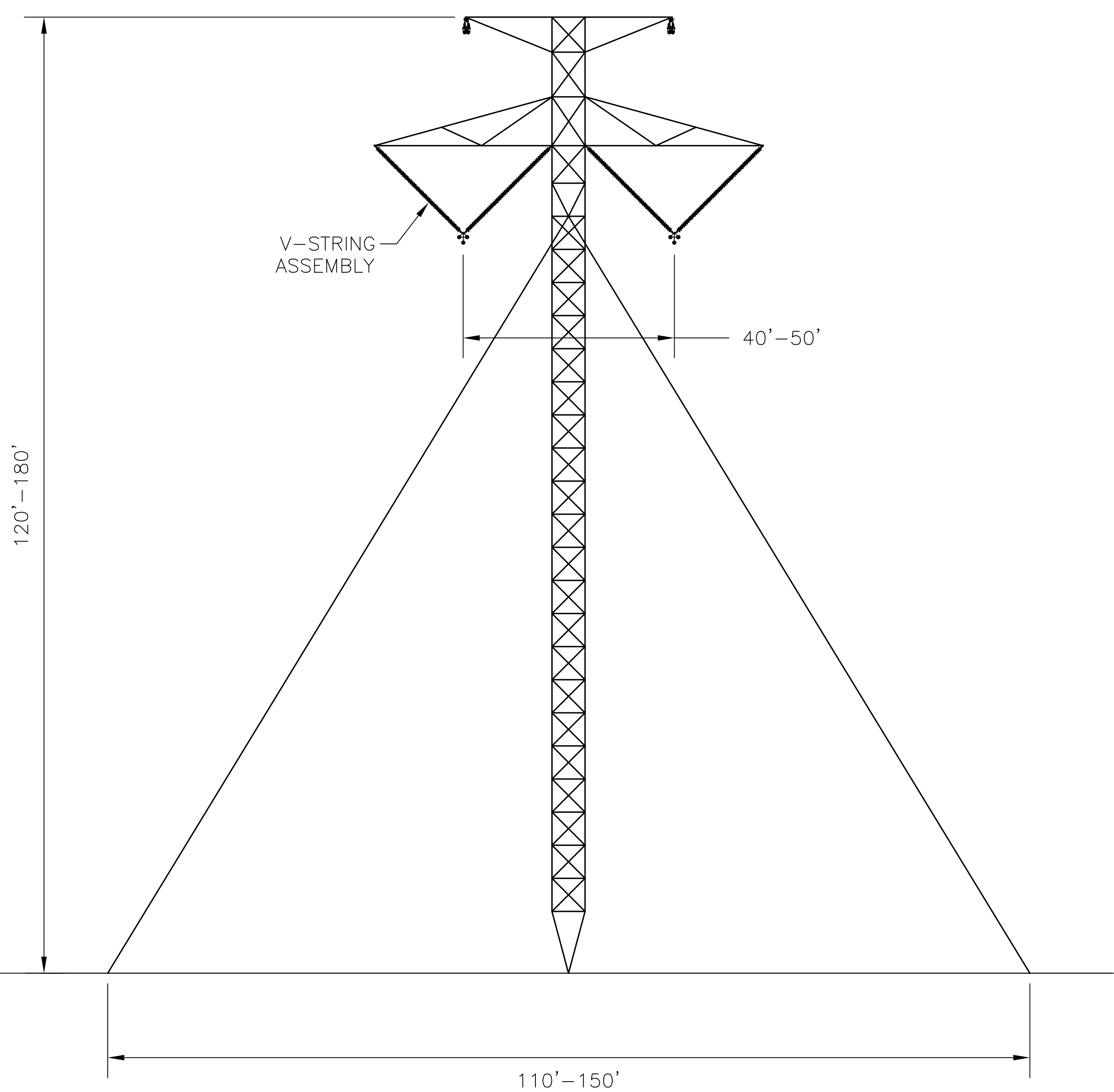
Surrounding Habitat (circle all that apply)

Agricultural	Chaparral/Shrubs	Desert Scrub
Disturbed/Developed	Grassland	Riparian

Type of Incident (circle one) Injury Mortality

Description of Incident. Include condition of bird, circumstances of incident and cause of injury or mortality, and any damage or impacts to construction.

ATTACHMENT D
DESIGN STANDARDS



NOTES

1. DIMENSIONS SHOWN ARE FOR ILLUSTRATION PURPOSES ONLY.
2. TOWER OUTLINE AND BRACINGS ARE INDICATIVE ONLY.

POWER ENGINEERS
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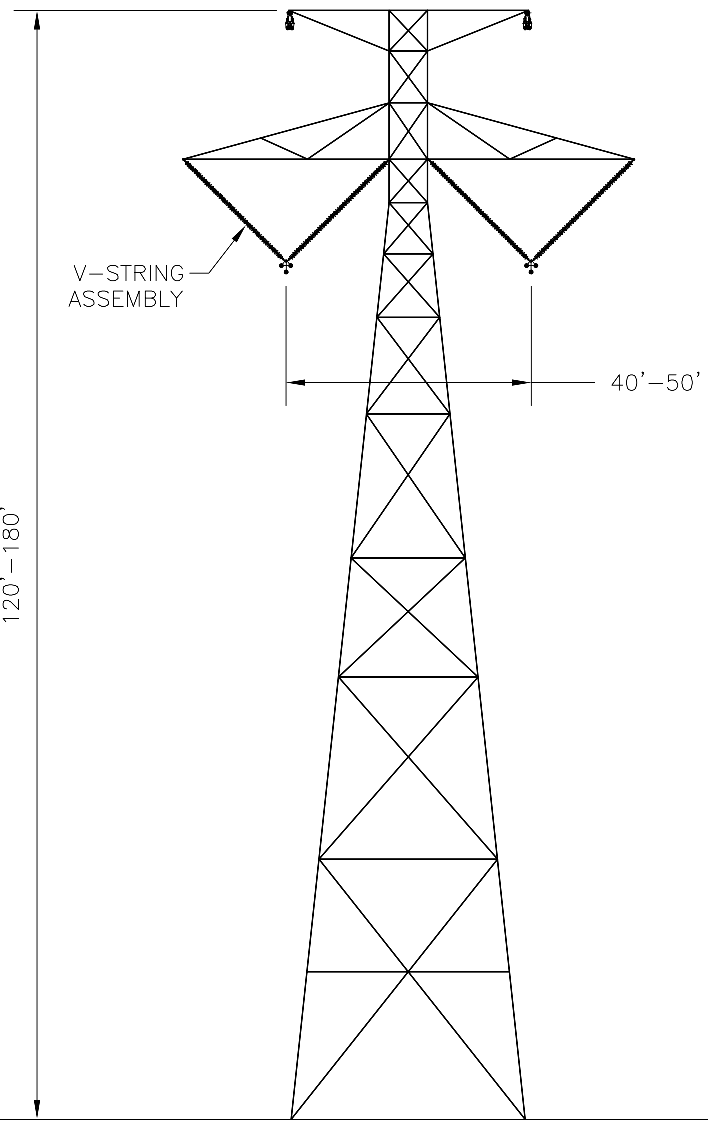
TRANSWEST EXPRESS TRANSMISSION PROJECT

FIGURE 1

TYPICAL ±600kV DC
GUYED V-STRING
LATTICE STRUCTURE



<u>NOTES</u>

1. DIMENSIONS SHOWN ARE FOR ILLUSTRATION PURPOSES ONLY.
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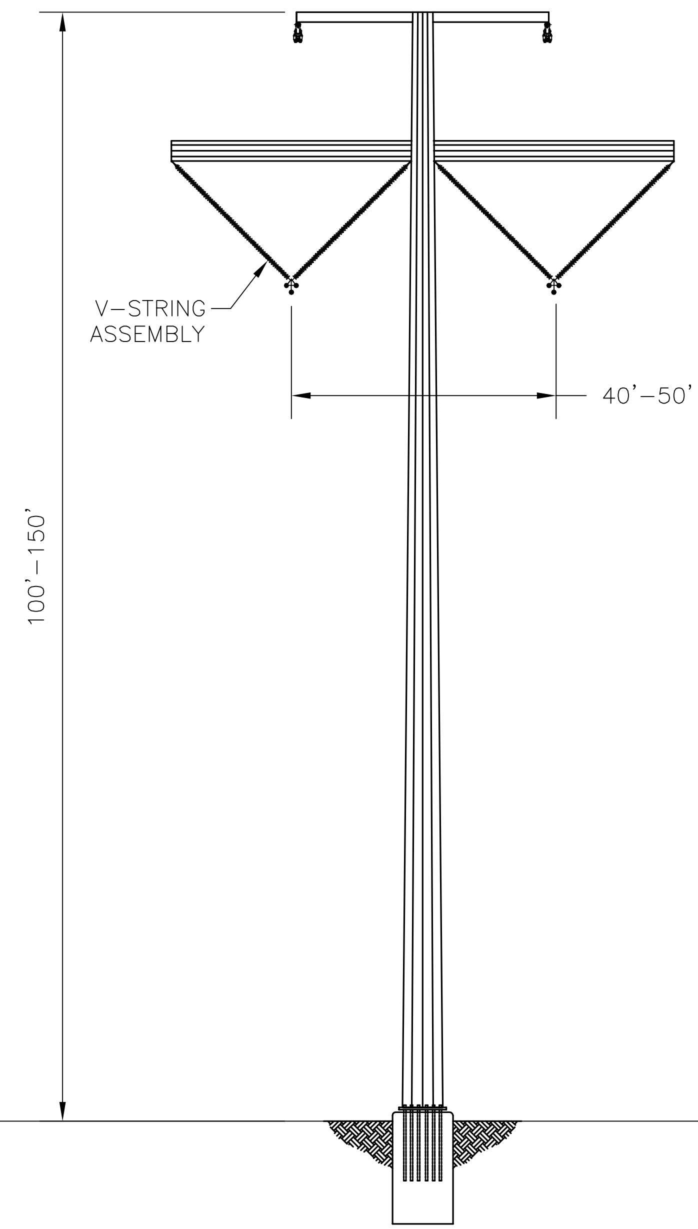
TRANSWEST EXPRESS TRANSMISSION PROJECT
FIGURE 2

TYPICAL ±600kV DC
SELF SUPPORTING LATTICE
V-STRING STRUCTURE



NOTES

1. DIMENSIONS SHOWN ARE FOR ILLUSTRATION PURPOSES ONLY.

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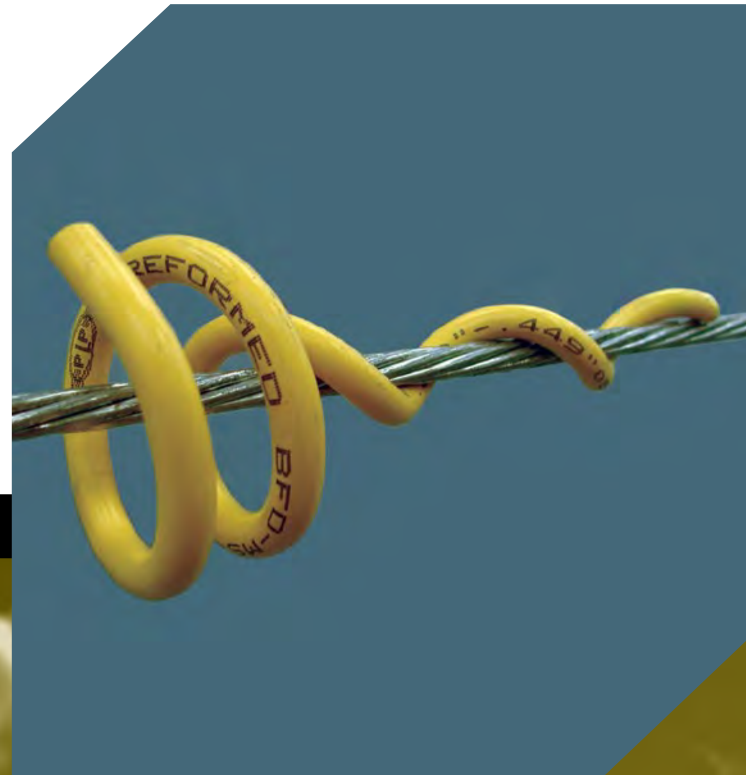
TRANSWEST EXPRESS TRANSMISSION PROJECT

FIGURE 3

TYPICAL ±600kV DC
TUBULAR STEEL POLE
V-STRING STRUCTURE

PREFORMED LINE PRODUCTS
The connection you can count on.

BIRD-FLIGHT™ DIVERTER



COMMUNICATIONS ENERGY SPECIAL INDUSTRIES SOLAR

PLP® Special Industries Products

BIRD-FLIGHT™ Diverter

General Information

The BIRD-FLIGHT Diverter is designed to make overhead lines and guyed structures visible to birds and provides an economical means of reducing the hazard to both lines and birds.

The BIRD-FLIGHT Diverter is lightweight, offers little wind resistance and is easily and quickly applied by hand. The positive grip of the fitting on the cable ensures that it remains in the applied position and cannot move along the span under aeolian vibration or other conditions.

Visibility

The diverter section increases the visible profile of the cable and is designed to ensure safety, but avoid an undesirably bulky outline.

Material

Manufactured from rigid high impact polyvinyl chloride (PVC), the BIRD-FLIGHT Diverter possesses excellent chemical and strength properties and will retain good physical characteristics within a range of extreme temperatures. The performance of the BIRD-FLIGHT Diverter is not deteriorated in severe weather conditions. Industrial fumes and salt water cannot seriously degrade the properties of rigid PVC.

Product Characteristics

BIRD-FLIGHT Diverters are designed to offer the following advantages:

- Increased conductor/strand profile to provide enhanced visibility where bird flight paths are present
- Economical and easily applied
- Lightweight
- Long service life without deterioration of material properties
- Minimal wind resistance
- Manufactured from gray or yellow high impact PVC with UV protection (Contact PLP for other color/voltage options).

Application Notes

Ensure the correct size BIRD-FLIGHT Diverter is used. For a detailed installation description, refer to the application procedure SP2805.

Spacing

For optimum results the recommended spacing distances are 15 foot intervals depending upon local conditions. Since wind resistance is limited, more BIRD-FLIGHT Diverters can be used to ensure adequate visibility without creating stresses on the line.

Product Data

Catalog Number (Yellow)	Catalog Number (Gray)	Conductor Ranger (in)		Overall Length	Internal Diameter of Diverter Coil	Diameter of PVC Rod	Approx. Weight (lbs)	Color Code
		Min	Max					
BFD-MS-3331	BFD-MS-3346	.175	.249	8.00	1.50	.375	.090	Black
BFD-MS-3155	BFD-MS-2921	.250	.349	8.50	1.75	.375	.100	Blue
BFD-MS-3164	BFD-MS-3355	.350	.449	9.50	2.00	.375	.110	Brown
BFD-MS-11135	BFD-MS-11060	.350	.449	12.37	4.50	.500	.240	Brown
BFD-MS-3341	BFD-MS-3366	.450	.599	11.00	2.25	.375	.140	Green
BFD-MS-3344	BFD-MS-3371	.600	.770	13.00	2.75	.500	.300	Purple
BFD-MS-3345	BFD-MS-3376	.771	.858	15.00	3.25	.500	.330	Red
BFD-MS-3405	BFD-MS-11699	.859	.942	16.50	3.75	.500	.360	Orange
BFD-MS-11111	BFD-MS-12290	.971	1.121	15.50	4.25	.438	.420	Pink
BFD-MS-11430		1.122	1.306	16.25	4.38	.438	.450	Gray
BFD-MS-11110		1.307	1.530	17.00	4.70	.438	.450	Black
BFD-MS-12351		1.531	1.786	20.00	4.88	.438	.520	White
BFD-MS-11566		1.787	2.100	23.00	5.25	.438	.600	Purple
BFD-MS-12603		2.101	2.500	26.00	5.25	.438	.650	Orange

PREFORMED LINE PRODUCTS

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660 Beta Drive
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Cleveland, Ohio 44101

Telephone: 440.461.5200
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E-mail: inquiries@preformed.com

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NU-SS-1035-1
02.14.5C

Avian Flight Diverters

The Patented shape is designed to provide excellent visibility at any angle of approach...day or night. This profile is based on research that found contrast in low light conditions is the most important aspect to alert birds of the oncoming power lines, guy and static wires.

Specifications

- UV resistant RPVC
- Florescent reflective yellow prism tap
- 24 hour glow tape for improved dawn, dusk, and night visibility
- Withstands > 100 mph winds for sustained periods
- Patented "V" shape design for maximum constrast at all angles
- Hotstick or Extended Stick capable
- Recommend Spacing: 30 feet apart in normal areas and 15 feet apart in high priority zones
- Size: .08" thick by 6.0" by 4" tall
- Weight: 4.7 oz.
- Patent No. 8,438,998

Flight Diverter and Line Marker Sizes

Product Number	Description	Wire Size	Box Qty
BFD-050	Line Marker for .20" - .56" total diameter wire	#6, #4, #2, #1, 1/0, 2/0, static, OPGW	50
BFD-075	Line Marker for .57" - 1.10" total diameter wire	3/0, 4/0, 266 mcm - 666 mcm	50
BFD-XX	Larger sizes available - Call for quotation		
BFD-AT	Hotstick and Extending stick attachment tool	All Sizes	1

Raptor Guard Part Number Chart

Example: BFD-050

BFD - Bird Flight Diverter

050- fits #6 through 2/0, static and OPGW
050G - fits up to .58" guy wire
075 - fits 3/0, 4/0, 266 - 666 mcm
XX - Call for larger custom sizes
AT - Hotstick attachment tool

Fresh Links

- Avian Power Line Interaction Committee - APLIC
- Rural Utility Services - RUS
- Raptor Research Foundation - RRF

Contact

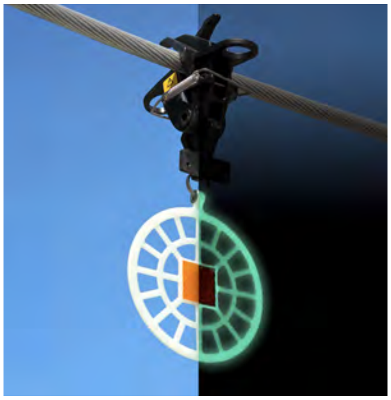
Power Lne Sentry, LLC
432 WCR 66, Fort Collins, CO 80524
Phone: 970-599-1050
Email: info@powerlinesentry.com

P&R TECH

making life visibly safer

P&R Technologies, Inc. Phone 503-292-8682 Toll Free 800-722-8078 Fax 503-292-8697 www.pr-tech.com

BirdMark BM-AG Bird Diverter



Helping Birds See Hazards Day or Night

Birds large and small—including swans, eagles, hawks, ducks, geese, and many others—often cannot see power lines near the horizon, and they lack the maneuverability to avoid them when they get close enough to see them. Over one million birds are killed annually in North America! BirdMark BM-AG (After Glow) diverters are designed to prevent collisions between birds and hard-to-see power lines day or night.

Easy to See

The BirdMark BM-AG offers a low cost, permanent solution for helping endangered species avoid power lines in traditional flight paths. BirdMarks stand out like a beacon against background features, letting birds see where the power lines are. When swaying in the wind, BirdMarks also make a noise that birds can hear. Highly reflective orange and yellow tape is positioned in the center of each BirdMark to further assist in warning birds.

Night Glow Capability

Other types of bird diverters are usually designed to help birds avoid obstructions during daylight, but recent studies indicate that most bird collisions happen during low light situations such as fog, rain, and the hours before and after dusk. The BirdMark BM-AG glows up to 10 hours after the sun has set, providing extended protection for at risk birds.

Easy to Install

The BirdMark BM-AG can be installed and removed from the ground without interrupting power. Our patented SnapFast mounting clamp securely prevents line slippage on single or bundled cables 0.375″–2.75″ in diameter. (Clamp for smaller lines available by special order.) Once in position, the grip is such that the BirdMark BM-AG stays in position, even in a Force 8 gale.

Features

- Highly visible day and night
- Sways and reflects in the wind to alert birds of obstructions
- Glows up to 10 hours after dusk and in other low light conditions
- Fully tested and developed by biologists
- Rugged spring-loaded clamp prevents line slippage
- Quick installation by hot stick
- Easily moved for seasonal flight path variations
- Also hazes birds from buildings and structures

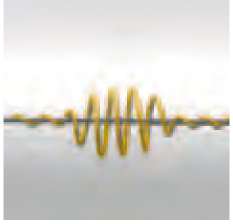
Dimensions

- 11½" total length
- 5⅜" diameter white disk
- Use 15ft spacing for best results

PREFORMED LINE PRODUCTS
The connection you can count on.

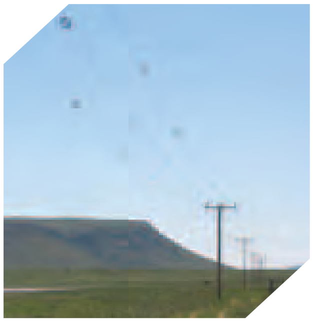
SWAN-FLIGHT™ DIVERTER

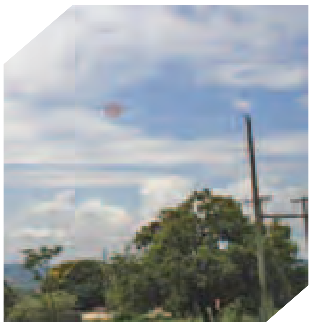
COMMUNICATIONS ENERGY SPECIAL INDUSTRIES SOLAR

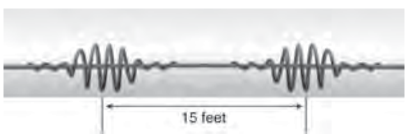


PLP® Distribution Products

SWAN-FLIGHT™ DIVERTER







Description

The Preformed Line Products SWAN-FLIGHT Diverter is designed for use on overhead conductors to create greater visibility for avian flight paths on overhead lines and tower down guys. Offering little wind resistance, it reduces hazards to both lines and birds. For low and medium voltage construction, apply the SWAN-FLIGHT Diverter to phase conductors (bare or jacketed). For high voltages, it is typically used on shield wire.

The SWAN-FLIGHT Diverter is lightweight, offers little wind resistance and is easily and quickly applied by hand or hot stick. The positive grip on the conductor is designed to ensure that the SWAN-FLIGHT Diverter remains in the applied location and does not move along the span under Aeolian vibration or other conditions.

Materials

Manufactured from rigid high impact polyvinyl chloride (PVC), the SWAN-FLIGHT Diverter possesses excellent chemical resistance, strength properties and will retain good physical characteristics within a range of extreme temperatures. Industrial fumes and salt water cannot seriously degrade the properties of rigid PVC.

Spacing

For optimal results, spacing distances are generally recommended at 15' intervals, depending upon local conditions. Since wind resistance is very limited, sufficient SWAN-FLIGHT Diverters can be used to ensure adequate visibility without creating stresses on the line. When marking adjacent spans, overall visibility is improved by staggering the placement between the spans.

Features

SWAN-FLIGHT Diverters are designed to offer the following advantages:

- Increased conductor profile to provide increased visibility where large, slow moving bird flight paths are present
- Economical and easily applied
- Lightweight
- Long service life without deterioration of material properties
- Minimal wind resistance
- Manufactured from gray or yellow high impact PVC with UV protection

Visibility

The diverter section increases the visible profile of the cable or conductor to ensure safety, but avoids an undesirable bulky outline.

Application

Ensure the correct size SWAN-FLIGHT Diverter is used. For detailed installation description, refer to the application procedure. Hot stick application is fast and simple with standard equipment.

SWAN-FLIGHT Diverter - Product Data							
PLP Catalog Number	Conductor Range (Inches)		Overall Length (Inches)	Diameter of Diverter Coil (Inches)	Diameter of PVC Rod (Inches)	Approx. Weight (lbs)	Color Code
	Min	Max					
SFD-0445	0.175	0.249	20	7.0	0.375	0.40	Black
SFD-0635	0.250	0.349	23	7.0	0.375	0.46	Blue
SFD-0890	0.350	0.449	25	7.5	0.375	0.50	Brown
SFD-1140	0.450	0.599	35	8.0	0.375	0.70	Green
SFD-1520	0.600	0.770	38	8.0	0.500	1.40	Purple
SFD-1960	0.771	0.858	38	8.0	0.500	1.40	Red
SFD-2220	0.859	0.942	40	8.0	0.500	1.50	Orange
SFD-2460	0.943	1.121	40	8.0	0.500	1.50	Pink
SFD-2700	1.122	1.306	40	8.0	0.500	2.00	Gray*
SFD-3035	1.307	1.530	46	8.0	0.500	2.00	Black

*Gray is the standard color. For yellow add "-Y" after the catalog number.
For voltage over 230kv, add "-B" for black semi-conductive material.

PREFORMED
LINE PRODUCTS

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APPENDIX C
FRAMEWORK BLASTING PLAN

TABLE OF CONTENTS

ACRONYMS

Applicant	TransWest Express LLC, also TransWest
ATF	Bureau of Alcohol, Tobacco, Firearms, and Explosives
BLM	Bureau of Land Management
BMP	Best Management Practice
CFR	Code of Federal Regulations
CIC	Compliance Inspection Contractor
COM Plan	Construction, Operation, and Maintenance Plan
DEIS	Draft Environmental Impact Statement
NESC	National Electrical Safety Code
NTP	Notice to Proceed
OSHA	Occupational Safety and Health Administration
Plan	Blasting Plan
POD	Plan of Development
PPE	Personal Protective Equipment
Project	TransWest Express Transmission Project, also TWE Project
TransWest	TransWest Express LLC, also Applicant
TWE Project	TransWest Express Transmission Project, also Project
USDOT	United States Department of Transportation
USFS	United States Forest Service

C1.0 INTRODUCTION

This framework Blasting Plan (Plan) outlines the contents, procedures, safety measures, and environmental protection measures that will go into a final Blasting Plan for the TransWest Express Transmission Project (TWE Project or Project) where blasting activities are required during construction. The final Blasting Plan will be prepared by the Construction Contractor(s) prior to construction of the Project. The TWE Project is being developed by TransWest Express LLC (TransWest or Applicant).

C2.0 PLAN PURPOSE

The purpose of the Blasting Plan is to provide safe procedural practices, environmental protection measures, and other specific stipulations and methods to minimize the environmental impact of blasting during Project construction. The final Blasting Plan will provide construction crews, environmental monitors, and the Compliance Inspection Contractor (CIC) with Project-specific information concerning blasting procedures. The primary objective of this Plan is to prevent adverse impacts to human health and safety, property, and the environment that could potentially occur as a result of construction of the TWE Project. This Plan incorporates Best Management Practices (BMPs) and Mitigation Measures identified in the Draft Environmental Impact Statement (DEIS) for the TWE Project.

C3.0 REGULATORY

The Construction Contractor(s) will be responsible for preparing and implementing the Blasting Plan in compliance with all local, state, and federal regulations pertaining to blasting. No blasting operations will be undertaken until approval and appropriate permits have been obtained from the applicable agencies. The Construction Contractor(s) will use qualified, experienced, and licensed professionals that will perform blasting using current and professionally accepted methods, products, and procedures to maximize safety during blasting operations.

C4.0 BLASTING PLAN GUIDANCE

Prior to blasting, the Construction Contractor(s) will prepare a final Blasting Plan for review by the Bureau of Land Management (BLM), CIC, and any other relevant jurisdictional organization as applicable. The final Blasting Plan will address blasting operations and safety and include full details of the drilling and blasting patterns, as well as the procedures the Construction Contractor(s) proposes to use for both production and controlled blasting. If at any time changes are proposed to the final Blasting Plan, the Construction Contractor(s) will submit them to BLM and CIC for review. The following items should be addressed in a Blasting Plan:

1. Identify proposed methods to achieve the desired excavations using individual shot plants (where the explosives are planted).

2. Address the proposed methods for controlling fly rock, blasting warnings, and use of non-electrical blasting systems.

3. Map explosive storage locations and areas where blasting will occur, including identification of blasting within 0.25 mile of a known sensitive resource; as well as blasting in the vicinity of pipelines, and wells and springs that may be impacted.

4. Identify blasting procedures including safety, use, storage, and transportation of explosives that will be employed where blasting is needed, and will specify the locations of needed blasting.

5. All blasting will be performed by current registered licensed blasters who will be required to secure all necessary permits and comply with regulatory requirements in connection with the transportation, storage, and use of explosives, and blast vibration limits for nearby structures, utilities, and wildlife.

6. Appropriate flags, barricades, and warning signals will be used to ensure safety during blasting operations. Blast mats will be used when needed to prevent damage and injury from fly rock.

7. Blasting near buildings, structures, and other facilities susceptible to vibration or air blast damage will be carefully planned by the contractor and controlled to eliminate the possibility of damage to such facilities and structures. The Blasting Plan will include provisions for control to eliminate vibration, fly rock, and air blast damage.

8. Blasting in the vicinity of pipelines will be coordinated with the pipeline operator, and will follow operator-specific procedures, as necessary.

9. Damages that result from blasting will be repaired or the owner fairly compensated.

C5.0 BLASTING PLAN CONTENTS

The Blasting Plan will include at a minimum the following information:

1. Blast officer
   a. Other personnel who will be present
2. Site and location of planned blasting
   a. Date of planned blasting
3. Environmental protection Measures
4. Safety Considerations
5. Explosives
   a. Type
   b. Quantity
   c. Detonator device
6. Means of transporting explosives
   a. Provisions for storing and securing explosives on site
7. Minimum acceptable weather conditions
   a. If electrical initiation to be used – considerations for stray radio frequency energy and electrical currents
8. Procedures
   a. Handling explosive charges
   b. Setting explosive charges

    c. Wiring explosive charges
    d. Firing explosive charges
9. Required Personal Protective Equipment (PPE)
10. Minimum standoff distances
    a. Procedures for clearing and controlling access to blast danger
11. Procedures for handling misfires or other unusual occurrences
12. Emergency action plan
    a. Phone numbers
        i. Ambulance
        ii. Fire department
        iii. Police
    b. Location and phone number of nearest medical services facility
    c. Actions to be taken when a person is injured
13. Attach a copy of material safety data sheet for each explosive or other hazardous material expected to be used

C6.0 SAFETY MEASURES

C6.1 Transportation

Transportation of explosives will comply with all applicable federal, state, and local laws, including Title 49 of the Code of Federal Regulations (CFR), Chapter III. These regulations are administered by the U.S. Department of Transportation (USDOT) and govern the packaging, labeling, materials compatibility, driver qualifications, and safety of transported explosives. In general, these regulations require vehicles carrying explosive materials must be well-maintained, properly marked with placards, and have a non-sparking floor. Materials in contact with the explosives will be non-sparking, and the load will be covered with a fire- and water-resistant tarpaulin. Vehicles also must be equipped with fire extinguishers and a current copy of the USDOT and Transport Canada's 2012 *Emergency Response Guidebook*. Every effort will be made to minimize the transportation of explosives through congested or heavily populated areas.

Prior to loading an appropriate vehicle for carrying explosives, the vehicle shall be fully fueled and inspected to ensure its safe operation. Refueling of vehicles carrying explosives shall be avoided. Smoking shall be prohibited during the loading, transporting, or unloading of explosives. In addition, the following specific restrictions apply to transport of other items in vehicles carrying explosives:

- Tools may be carried in the vehicle, but not in the cargo compartment.
- Detonation devices can, in some cases, be carried in the same vehicle as the explosives, but they must be stored in a specially constructed compartment(s).
- Batteries and firearms shall never be carried in a vehicle with explosives.
- Vehicle drivers must comply with the specific laws related to the materials being transported.

- Vehicles carrying explosives shall not be parked or left unattended except in designated parking areas with approval of the State Fire Marshall. When traveling, vehicles carrying explosives will avoid congested areas to the maximum extent possible.

C6.2 Storage

Explosives must be stored in an approved structure (magazine) and kept cool, dry, and well-ventilated. The Construction Contractor will provide the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) Cheyenne Wyoming, Denver Colorado, Salt Lake City Utah, and Las Vegas Nevada Field Offices with a list of dates and locations for the explosives and blasting agent storage facilities to be used on the Project at least 14 days before the establishment of such storage facilities.

At a minimum, the following storage requirements will be implemented:

- Explosives must be stored in an approved structure (magazine), and storage facilities will be bullet-resistant, weather-resistant, theft-resistant, and fire-resistant.
- Magazine sites will be located in remote (out-of-sight) areas with restricted access; kept cool, dry, and well ventilated; and will be properly labeled and signed.
- Detonators will be stored separately from other explosive materials.
- The most stringent spacing between individual magazines will be determined according to the guidelines contained in the ATF publication or state or local explosive storage regulations.
- Both the quantity and duration of temporary on-site explosives storage will be minimized.
- The Construction Contractor will handle and dispose of dynamite storage boxes in accordance with relevant federal, state, and local laws.

C6.3 Fire Safety

The presence of explosive materials on the Project site could potentially increase the risk of fire during construction. Special precautions will be taken to minimize this risk in conjunction with Appendix H - Fire Protection Plan, including but not limited to:

- Prohibiting ignition devices within 50 feet of explosives storage areas;
- Properly maintaining magazine sites so they are clear of fuels and combustible materials, well ventilated, and fire-resistant;
- Protecting magazines from wildfires that could occur in the immediate area;
- Posting fire suppression personnel at the blast site during high fire danger periods; and
- Prohibiting blasting during extreme fire danger periods.

C7.0 DESIGN FEATURES AND BEST MANAGEMENT PRACTICES

In addition to applicable design and operational standards, regulations, laws and permit requirements, the following design features and BMPs have been developed to avoid or minimize potential blasting related impacts. Note that the Construction, Operation and Maintenance (COM) Plan will be a part of the Notice to Proceed (NTP) Plan of Development (POD).

TWE-51: The TWE Project will be designed, constructed, and operated to meet or exceed the requirements of the National Electrical Safety Code (NESC), U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) standards, and the Applicant's requirements for safety and protection of landowners and their property.

TWE-53: The Construction, Operation and Maintenance (COM) Plan will include a Blasting Plan, which will identify methods and mitigation measures to minimize the effects of blasting, where applicable. The Blasting Plan will document the proposed methods to achieve the desired excavations, proposed methods for blasting warning, use of non-electrical blasting systems, and provisions for controlling fly rock, vibrations, and air blast damage.

TWE-56: As part of the COM Plan, the Applicant will provide a Health and Safety Plan, which will outline measures to protect workers and the general public during construction, operation, and decommissioning of the TWE Project. The Plan will identify applicable federal and state occupational safety standards, establish safe work practices, and define safety performance standards.

TWE-64: The COM Plan will include a Fire Protection Plan. The Applicant or its Contractor(s) will notify the BLM of any fires and comply with all rules and regulations administered by the BLM and U.S. Forest Service (USFS) concerning the use, prevention, and suppression of fires on federal lands, including any fire prevention orders that may be in effect at the time of the permitted activity. The Applicant or its Contractor(s) may be held liable for the cost of fire suppression, stabilization, and rehabilitation. In the event of a fire, personal safety will be the first priority of the Applicant or its Contractor(s). The Applicant or its Contractor(s) will:

- Operate all internal and external combustion engines on federally-managed lands per 36 CFR Part 261.52(j), which requires all such engines to be equipped with a qualified spark arrester that is maintained and not modified;

- Carry shovels, water, and fire extinguishers that are rated at a minimum as ABC-10 pound on all equipment and vehicles. If a fire spreads beyond the suppression capability of workers with these tools, all workers will cease fire suppression action and leave the area immediately via pre-identified escape routes;

- Initiate fire suppression actions in the work area to prevent fire spread to or on federally-administered lands. If fire ignitions cannot be prevented or contained immediately, or it may be foreseeable that a fire would exceed the immediate capability of workers, the operation must be modified or discontinued. No risk of ignition or re-ignition will exist upon leaving the operation area;

- Notify the appropriate fire center immediately of the location and status of any escaped fire;

- Review weather forecasts and the potential fire danger prior to any operation involving potential sources of fire ignition from vehicles, equipment, or other means. Prevention measures to be taken each work day will be included in the specific job briefing. Consideration will be given to additional mitigation measures or temporary discontinuance of the operation during periods of extreme winds or dryness;

- Operate all vehicles on designated roads vehicle parking to be restricted to areas free of vegetation on roads or within the permitted ROW and designated work areas.;
- Operate welding, grinding, or cutting activities in areas cleared of vegetation within range of the sparks for that particular action. A spotter will be required to watch for ignitions; and
- Use only diesel-powered vehicles in areas where excessive heat from vehicle exhaust systems could start brush or grass fires.

Additional BMPs and Mitigation Measures identified in the Draft EIS are listed below. The identified BMPs and Mitigation Measures have not been finalized at this time and may be updated, changed, or eliminated in future revisions of this Plan.

PHS-1: The applicant shall prepare an explosives use plan that specifies the times and meteorological conditions when explosives will be used and specifies minimum distances from sensitive vegetation and wildlife or streams and lakes.

PHS-2: If blasting or other noisy activities are required during the construction period, the applicant must notify nearby residents in advance.

PHS-4: A health and safety program shall be developed by the applicant to protect both workers and the general public during construction, operation, and decommissioning of an energy transport project. The program should identify all applicable federal and state occupational safety standards, establish safe work practices for each task (e.g., requirements for personal protective equipment and safety harnesses, OSHA standard practices for safe use of explosives and blasting agents, measures for reducing occupational electromagnetic field exposures), and define safety performance standards (e.g., electrical system standards). The program should include a training program to identify hazard training requirements for workers for each task and establish procedures for providing required training to all workers. Documentation of training and a mechanism for reporting serious accidents to appropriate agencies should be established.

AIR-2: To minimize fugitive dust generation, the applicant shall water land before and during surface clearing or excavation activities. Areas where blasting will occur should be covered with mats.

WAT-1: Blasting activities will be avoided or minimized in the vicinity of sole source aquifer areas to reduce the risk of releasing sediments or particles into the groundwater and inadvertently plugging water supply wells.

NOISE-1: The applicant shall limit noisy construction activities (including blasting) to the least noise-sensitive times of day (i.e., daytime only between 7 a.m. and 10 p.m.) and weekdays.

APPENDIX D
FRAMEWORK CULTURAL RESOURCES PROTECTION AND MANAGEMENT PLAN

TABLE OF CONTENTS

ACRONYMS

ACHP	Advisory Council on Historic Preservation
AHPA	Archaeological Historic Preservation Act of 1974
AIRFA	American Indian Religious Freedom Act of 1978
Applicant	TransWest Express LLC, also TransWest
ARPA	Archaeological Resources Protection Act of 1979
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
CFR	Code of Federal Regulations
CRS	Colorado Revised Statutes
NAGPRA	Native American Grave Protection and Repatriation Act of 1990
NHPA	National Historic Preservation Act
NPS	National Park Service
NRS	Nevada Revised Statutes
NTP	Notice to Proceed
PA	Programmatic Agreement
Plan	Cultural Resources Protection and Mitigation Measures Plan
POD	Plan of Development
Project	TransWest Express Transmission Project, also TWE Project
Reclamation	Bureau of Reclamation
ROD	Record of Decision
ROW	right-of-way
TransWest	TransWest Express LLC, also Applicant
TWE Project	TransWest Express Transmission Project, also Project
U.S.C.	United States Code
UCA	Utah Code Annotated
USFS	United States Forest Service
USFWS	United State Fish and Wildlife Service
Western	Western Area Power Administration
WS	Wyoming Statutes

D1.0 INTRODUCTION

This framework Cultural Resources Protection and Management Plan (Plan) outlines the contents, procedures, and environmental protection measures that will be taken by TransWest Express LLC (TransWest or Applicant) and its Construction Contractor(s) for the TransWest Express Transmission Project (TWE Project or Project). This Plan is largely related to the development of a Programmatic Agreement (PA) between TransWest and various agencies and consulting parties.

D2.0 PLAN PURPOSE

The Bureau of Land Management (BLM) has determined that issuance of the right-of-way (ROW) grant for the TWE Project and related authorizations is an undertaking as defined at 36 Code of Federal Regulations (CFR) 800.16(y) that triggers the requirements of Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA Section 106) on affected federal and non-federal lands during the planning, construction, operation, maintenance and decommissioning of the Undertaking. For purposes of the Undertaking, the BLM Wyoming State Office is lead federal agency for compliance with NHPA Section 106 on behalf of the involved federal agencies. Because the effects on historic properties are multi-state in scope and cannot be fully determined prior to approval of the Undertaking, the BLM, in consultation with the Consulting Parties has determined to use a phased process to identify historic properties (36 CFR 800.4(b)(2)) and assess the effects on those properties (36 CFR 800.5(a)(3)); such that completion of the identification and evaluation of historic properties, determinations of effect on historic properties, and consultation concerning measures to avoid, minimize, or mitigate any adverse effects will be carried out in phases as part of planning for and prior to any Notice to Proceed (NTP) and Undertaking implementation. Therefore, the BLM has determined that a PA documenting the terms and conditions for compliance with Section 106 will be entered into among Consulting Parties according to 36 CFR 800.14(b)(1)(ii).

Signatories to the PA include the BLM, Western Area Power Administration (Western), the United States Forest Service (USFS), the National Park Service (NPS), the Bureau of Reclamation (Reclamation), the Bureau of Indian Affairs (BIA), the U.S. Fish and Wildlife Service USFWS), the U.S. Army Corps of Engineers (USACE) - Sacramento District, the Advisory Council On Historic Preservation (ACHP), the Wyoming State Historic Preservation Officer, the Colorado State Historic Preservation Officer, the Utah State Historic Preservation Officer, and the Nevada State Historic Preservation Officer. TransWest is an Invited Signatory to the PA. Tribes and other interested parties may be Concurring Parties to the PA.

Execution and implementation of the PA satisfies the federal agencies' Section 106 responsibilities for the Project. As an Invited Signatory, TransWest has certain responsibilities under the PA and will comply with the terms and conditions of the PA.

D3.0 PLAN UPDATES

This Plan will be updated for the NTP Plan of Development (POD) once the PA is signed and the selected Agency Preferred Alternative is identified. Other plans that may be developed related to the protection and management of cultural resources, such as a Historic Properties Treatment Plan, Monitoring Plan, or Unanticipated Discovery Plan, will be incorporated into the PA as they become available.

D4.0 REGULATORY REQUIREMENTS

The TWE Project will require the issuance of ROW grants and special use authorizations; and therefore, qualifies as a federal Undertaking and must comply with Section 106 of the NHPA. Other federal and state laws concerning the protection of cultural resources that must be complied with include:

- American Indian Religious Freedom Act of 1978 (AIRFA) (42 United States Code [U.S.C.] §1996)
- Antiquities Act of 1906 (16 U.S.C. §431-433)
- Archaeological Resources Protection Act of 1979 (ARPA) (16 U.S.C. §470 aa-mm)
- Archeological and Historic Preservation Act of 1974 (AHPA) (16 U.S.C. §469)
- Federal Cave Resource Protection Act of 1988 (16 U.S.C. §4301)
- National Trails System Act of 1968, as amended (16 U.S.C. §§1241-1249)
- Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) (25 U.S.C. §3001)
- Executive Order 11593, Protection and Enhancement of the Cultural Environment
- Executive Order 13007, Indian Sacred Sites
- Executive Order 13175, Consultation and Coordination with Indian Tribal Governments
- Executive Order 13287, Preserve America
- Wyoming Antiquities Act of 1935 (Wyoming Statutes [WS] 35-1-114 to 116)
- Wyoming State Archaeologist Statute, 1967 (WS 36-4-106)
- Colorado Historical, Prehistorical, and Archaeological Resources Act of 1973 (Colorado Revised Statutes [CRS] 24-80-401 to 410)
- Colorado Unmarked Human Graves (CRS 24-80-1301 to 1305)
- Utah State Antiquities Act (Utah Code Annotated [UCA] 9-8-301 to 308)
- Utah Native American Grave Protection and Repatriation Act (UCA R456-1-1 to 17)
- Utah Heritage and Arts, History (UCA Title R455)
- Utah Protection of Human Remains (UCA 76-9-704)
- Utah Ancient human remains on nonfederal lands that area not state lands (UCA 9-8-309)
- Utah Archaeological Vandalism Statutes 76-6-901, 76-6-902, 76-6-903
- Nevada Preservation of Prehistoric and Historic Sites (Nevada Revised Statutes [NRS] 381.195 to 381.227)
- Nevada Protection of Indian Burial Sites (NRS 383.150, NRS 383.190)
- Nevada Protection of Historic and Prehistoric Sites (NRS 383,400-440)

APPENDIX E
FRAMEWORK DUST CONTROL AND AIR QUALITY PLAN

TABLE OF CONTENTS

ACRONYMS

Applicant	TransWest Express LLC, also TransWest
BLM	Bureau of Land Management
BMP	Best Management Practice
CFR	Code of Federal Regulations
COM Plan	Construction, Operation, and Maintenance Plan
CWA	Clean Water Act
DEIS	Draft Environmental Impact Statement
EPA	United States Environmental Protection Agency
FLPMA	Federal Land Policy and Management Act of 1976
mph	miles per hour
NDEP	Nevada Division of Environmental Protection
NPDES	National Pollutant Discharge Elimination System
NTP	Notice to Proceed
Plan	Dust Control and Air Quality Plan
POD	Plan of Development
Project	TransWest Express Transmission Project, also TWE Project
ROD	Record of Decision
ROW	right-of-way
SWPPP	Stormwater Pollution Prevention Plan
TransWest	TransWest Express LLC, also Applicant
TWE Project	TransWest Express Transmission Project, also Project
U.S.C.	United States Code
USACE	United States Army Corps of Engineers
WDEQ	Wyoming Department of Environmental Quality

E1.0 INTRODUCTION

This framework Dust Control and Air Quality Plan (Plan) to be implemented by TransWest Express LLC (TransWest or Applicant) and its Construction Contractor(s) addresses regulatory compliance, environmental concerns, mitigation recommendations, and monitoring. This Plan will be utilized for the construction of the TransWest Express Transmission Project (TWE Project or Project) to ensure impacts associated with construction activities are minimized as they relate to soil conservation and air quality.

E2.0 PLAN PURPOSE

This Plan provides measures to be utilized by TransWest and its Construction Contractor(s) to ensure protection of the soils and air quality that will be affected by the Project. This Plan is to be implemented during the construction, operation, and maintenance phases of the Project. These measures are intended to: 1) address soil erosion and sedimentation; and 2) minimize dust and air emissions from construction-related activities. This document provides direction for the detailed final Dust Control and Air Quality Plan to be developed by the Construction Contractor(s).

E3.0 PLAN UPDATES

This Plan will be updated for the Record of Decision (ROD) Plan of Development (POD) based on the selected Agency Preferred Alternative and preliminary engineering and design. Mitigation measures will also be updated if required. The Plan for the Notice to Proceed (NTP) POD will include updates as required based on final design and engineering. The Construction Contractor(s) will be responsible for preparing and implementing the final Plan in compliance with all local, state, and federal regulations pertaining to air quality.

E4.0 REGULATORY

Construction, operation, and maintenance activities for the Project are subject to various regulations designed to protect environmental resources and the public from erosion, dust, and other possible effects to air quality. The following federal, state and local permits and documents are required for preventing accelerated erosion and minimizing dust and air emissions. These documents should be referred to along with this Plan, when assessing which mitigation measures are appropriate for a specific area. At a minimum, TransWest and the Construction Contractor(s) will need to adhere to or obtain the following permits, as applicable:

E4.1 Federal Permits

- BLM – Right-of-way (ROW) grant and temporary use permit: Federal Land Policy and Management Act of 1976 (FLPMA) (Public Law 94-579); 43 United States Code (U.S.C.) §§1761-1771; 43 Code of Federal Regulations (CFR) Part 2800
- U.S. Forest Service (USFS) special use authorization or easement: 36 CFR Part 251
- U.S. Army Corps of Engineers (USACE) – Clean Water Act (CWA), Section 401: CWA (33 U.S.C. §1344)
- U.S. Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) Construction General Permit

E4.2 State Permits

- Wyoming Department of Environmental Quality (WDEQ) – Air Quality Division Construction Permit to control fugitive dust emissions during construction.
- WDEQ – Sections 401, 402, and 404, CWA, Water Quality Certification (State implementation of the USACE permits for water quality and stormwater discharges).
- Colorado Department of Public Health and Environment, Water Quality Control Division-Stormwater Permit.
- Utah Department of Environmental Quality, Air Quality Board- Notice of Construction.
- Nevada Division of Environmental Protection (NDEP) - Stormwater Pollution Prevention Plan (SWPPP), Water Quality Certification.
- NDEP Bureau of Air Pollution Control - Authority to construct, permit to operate.

E4.3 Local Permits

- Clark County, Department of Air Quality and Environmental Management - Dust Control Permit, Stationary Source Permit.
- County conditional use permits, temporary use permits for staging areas, road crossing permits and/or encroachment permits. May have erosion or air quality considerations. Requirements vary by county.

E5.0 AIR QUALITY AND DUST CONTROL

Soil conservation for the Project includes minimizing impacts that will affect soils from the construction and operation of the Project, such as minimizing wind and water erosion, surface disturbance, and construction activities in highly erodible soils. Erosion potential is the result of several factors including slope, vegetation cover, climate, and the physical and chemical characteristics of the soil. Increased soil erosion may occur when vegetation is removed during construction, or in areas where the surface is disturbed by heavy equipment. Wind is also an erosion factor throughout portions of the Project area.

Where disturbance is anticipated in areas of steep terrain with high potential for erosion, vegetation clearing and grading will be conducted in a manner to minimize these effects. Soil stabilization and reclamation practices will also be implemented to reduce erosion. In areas of soil disturbance or compaction (e.g., temporary work areas) soil treatment and reclamation will be implemented as directed in Appendix Q –Framework Reclamation Plan.

Construction of the Project may temporarily increase fugitive dust particularly in areas with high winds and fragile soils. Ambient levels of nitrogen oxides, hydrocarbons, and carbon monoxide near the construction zone may also be temporarily increased due to emissions from heavy construction equipment. Related facilities may cause a minimal increase in fugitive dust.

Air quality control measures are intended to minimize fugitive dust and air emissions, and to maintain conditions as free from air pollution where practical. All requirements of those entities having jurisdiction over air quality matters will be adhered to, and any permits needed for construction activities will be obtained. The Construction Contractor(s) will not proceed with any construction activities without taking reasonable precautions to prevent excessive particulate matter from becoming airborne and creating nuisance conditions.

Excessive exhaust emissions from vehicles and heavy equipment will be prevented by proper maintenance, and no open burning of construction trash or other open fires will be allowed.

Where necessary, water may be used as Bureau of Land Management (BLM) approved dust control methods during construction, including the grading of roads or the clearing of vegetation in the ROW, and will be applied on unpaved roads, material stockpiles, and other surfaces, which can create airborne dust. Where application of water is not possible, material stockpiles will be enclosed or covered. In addition, open bodied trucks transporting materials likely to become airborne will be covered. Soil tracks or other materials that may become airborne will promptly be removed from paved roads. Techniques to minimize and control dust during rock blasting operations can be found in Appendix C – Blasting Plan Framework.

E6.0 DESIGN FEATURES AND BEST MANAGEMENT PRACTICES

In addition to applicable design and operational standards, regulations, laws and permit requirements, the following design features and Best Management Practices (BMPs) have been identified to avoid or minimize potential air quality related impacts. Note that the Construction, Operation and Maintenance Plan will be a part of the NTP POD.

TWE-21: The Applicant will obtain an NPDES from the USEPA prior to construction.

TWE-47: The Construction, Operation and Maintenance (COM) Plan will include a Dust Control and Air Quality Plan. Requirements of those entities having jurisdiction over air quality matters include ensuring the regulations are adhered to and dust control measures will be developed. Open burning of construction trash will not be allowed unless permitted by appropriate authorities.

TWE-48: The contractor and subcontractors will be required to have and use air emission control devices on construction machinery, as required by federal, state and local regulations or ordinances.

TWE-53: The COM Plan will include a Blasting Plan, which will identify methods and mitigation measures to minimize the effects of blasting, where applicable. The Blasting Plan will document the proposed methods to achieve the desired excavations; proposed methods for blasting warning; use of non-electrical blasting systems; and provisions for controlling fly rock, vibrations, and air blast damage.

Additional BMPs and Mitigation Measures identified in the Draft Environmental Impact Statement (DEIS) are listed below. The identified BMPs and Mitigation Measures have not been finalized at this time and may be updated, changed, or eliminated in future revisions of this Plan.

SS-7: The Dust Control and Air Quality Plan will include dust abatement measures to minimize impacts to special status plant species. This includes slower speed limits on unpaved roads, using gravel for roads in occupied habitat and avoidance areas, and the application of water for dust abatement.

SSS-1: (Water Use): No new surface water or groundwater withdrawals that are hydrologically connected to streams containing Colorado River cutthroat trout and Bonneville cutthroat trout would be allowed. Any water necessary for construction, operation, or maintenance (including dust abatement) would not be acquired from existing water sources.

AIR-1: The Applicant shall cover construction materials and stockpiled soils if these are sources of fugitive dust.

AIR-2: To minimize fugitive dust generation, the Applicant shall water land before and during surface clearing or excavation activities. Areas where blasting would occur should be covered with mats.

AIR-3: Dust abatement techniques (e.g., water spraying) shall be used by the Applicant on unpaved, unvegetated surfaces to minimize airborne dust. Water for dust abatement should be obtained and used by the Applicant under the appropriate state water use permitting system. Used oil will not be used for dust abatement.

AQ-1: In Region II, the Alternative B transmission line route passes within about 10 miles of Arches National Park. No concrete batch plants would be located within 30 miles of Arches National Park; therefore, concrete required for structure foundations should be acquired from local sources in the vicinity of Moab.

AQ-2: In Region III, the Proposed Action (Alternative A) passes within about 20 miles of Zion National Park. No concrete batch plants would be located within 30 miles of Zion National Park; therefore, concrete required for structure foundations should be acquired from local sources in the vicinity of Cedar City or St. George, Utah.

AQ-3: The Clark County nonattainment area is located in both Region III and Region IV. No new concrete batch plants are to be located within the nonattainment area; concrete required for structure foundations and other construction are to be acquired from existing local vendors.

PHS-1: The Applicant shall prepare an explosives use plan that specifies the times and meteorological conditions when explosives will be used and specifies minimum distances from sensitive vegetation and wildlife or streams and lakes.

The following dust and air control measures were identified in the main body of the DEIS.

- Predict future impacts from externally initiated actions prior to approval of those actions. Comply with all applicable local, state, and federal regulations to limit air quality degradation;
- Reduce vehicle speeds on native surfaced roads (e.g., 15 miles per hour [mph])
- Restrict surface disturbing activities to periods when wind speeds are less than 25 mph.
- To minimize fugitive dust, the Applicant shall cover, at all times when in motion, open bodied trucks, transporting materials likely to give rise to airborne dust; and

APPENDIX F
FRAMEWORK EMERGENCY PREPAREDNESS AND RESPONSE PLAN

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TABLES:

ACRONYMS

ACGIH	American Conference of Industrial Hygienists
AMA	American Medical Association
ANSI	American National Standards Institute
Applicant	TransWest Express LLC, also TransWest
BLM	Bureau of Land Management
CIC	Compliance Inspection Contractor
CSA	Council on Scientific Affairs
NESC	National Electrical Safety Code
NTP	Notice to Proceed
OSHA	Occupational Safety and Health Administration
Plan	Emergency Preparedness and Response Plan
POD	Plan of Development
Project	TransWest Express Transmission Project, also TWE Project
ROD	Record of Decision
TransWest	TransWest Express LLC, also Applicant
TWE Project	TransWest Express Transmission Project, also Project

F1.0 INTRODUCTION

This framework Emergency Preparedness and Response Plan (Plan) provides an overview of methods to be implemented by TransWest Express LLC (TransWest or Applicant) and it Construction Contractor(s) if the need for emergency management is necessary during the construction and operation and maintenance of the TransWest Express Transmission Project (TWE Project or Project). This document discusses the existing support structure, chain of command, and emergency communication protocols to be used as a guide for a Plan to be completed by TransWest, and its Construction Contractor(s) and approved by the Bureau of Land Management (BLM). More specific emergency procedures for blasting, fire, and hazardous materials are included in Appendices C – Blasting Plan Framework, H– Fire Protection Plan, and L – Hazardous Materials Management Plan.

Emergency response procedures will be implemented for the following potential or similar events:

- Downed transmission lines, structures, or equipment failure
- Fires
- Sudden loss of power
- Natural disasters
- Serious personal injury

F2.0 PLAN PURPOSE

The purpose of the Emergency Preparedness and Response Plan is to provide clear procedures and information to enable TransWest, the Construction Contractor(s), the Compliance Inspection Contractor (CIC), and BLM Project Manager(s) to prepare for and effectively respond to emergency situations. The primary objective of this Plan is to prevent adverse impacts to human health and safety, property, and the environment that could potentially occur as a result of the construction, operation and maintenance of the TWE Project.

F3.0 PLAN UPDATES

This Plan will be updated for the Record of Decision (ROD) Plan of Development (POD) and will include appropriate mitigation measures to ensure safety and regulation compliance. The updated Plan for the Notice to Proceed (NTP) POD will include a complete emergency contact list. The Construction Contractor(s) will be responsible for preparing and implementing this Plan in compliance with all local, state, and federal regulations pertaining to emergency response.

F4.0 REGULATORY COMPLIANCE

Health and safety guidelines related to high-voltage transmission lines are provided by a number of sources, including the National Electric Safety Code (NESC), American National Standards Institute (ANSI), American Conference of Governmental Industrial Hygienists (ACGIH), American Medical Association (AMA), Council on Scientific Affairs (CSA), various state regulation and other organizations. In addition, the Occupational Safety and Health Administration (OSHA) provides regulations for construction activities.

F5.0 RESPONSIBILITIES

TransWest and the Construction Contractor(s) are responsible for the effective response to any emergency situation or event related to the construction, operation and maintenance of the TWE Project. To ensure a coordinated and effective response, a chain of command will be developed as part of this Plan and followed in the event of an emergency.

In the establishment of a chain of command, considerations such as the level of activation and the participation necessary to respond to specific situations are to be taken into account. The following are factors for the establishment of a chain of command:

- Type of event (natural, environmental, electrical supply/outage, external forces)
- Severity and geographic area (multiple or combination of events)
- Anticipated duration
- Multi-division/discipline response required
- External agency coordination

F6.0 RESPONSE COORDINATION

The amount of resources and coordination required for response to a specific hazard or emergency is determined by type, severity, location and duration of the event. Most events require managing at the field operations level and will require increasing resource requirements to match the severity and duration of the event. This emergency management organization will be included as part of this Plan and will provide increasing levels of resources and the coordination necessary to support immediate or escalating emergency events.

In the event of an emergency, crews will be dispatched quickly to repair or replace any damaged equipment. Public health and safety and the health and safety of workers will have priority under emergency conditions. Repair of the transmission line and restoration of electric service is a public health and safety concern and will proceed as rapidly as possible under the circumstances. All reasonable efforts will be made to protect plants, wildlife and other resources. Reclamation procedures following completion of repair work will be similar to those prescribed during construction.

F7.0 EMERGENCY COMMUNICATIONS

Effective communication and exchange of information is essential in every emergency response. Misdirected, incorrect, or untimely information can be detrimental and can increase the threat to life or property. As an emergency event escalates, the rapid increase of information creates chaos and confusion. Simple communication diagrams can help alleviate this situation and will be developed as part of the final Plan.

F7.1 Emergency Contact

IN CASE OF EMERGENCY, ON-SITE PERSONNEL WILL CALL 911 FIRST. Additional potential emergency contacts are listed in Table F1 and should be called as appropriate, depending on the situation (e.g., fire, personal injury). The emergency contacts in Table F1 will be populated for the NTP POD when the selected Agency Preferred Alternative is identified. Further guidance on emergency response, notification and reporting protocols are included in Appendices C – Blasting Plan, H – Fire Protection Plan, and L – Hazardous Materials Management Plan.

This emergency contact list shall be verified at the beginning of construction and updated throughout the Project by the Construction Contractor(s) to ensure accurate contact information.

TABLE F1 EMERGENCY CONTACT LIST

IN CASE OF EMERGENCY, CALL 911		
	Fire – Call 911 first	
Counties: Primary Contact: TBD Secondary Contact: TBD	BLM Field Offices: TBD USFS Ranger Districts: TBD	State Interagency Fire Centers: TBD
	Law Enforcement	
County Sheriffs: TBD	State Highway Patrol: TBD	
	Poison Control	
National/State Poison Control Centers: TBD		
	Hospitals and Clinics	
County and Municipal as Applicable: TBD		
	Hazardous Spill Response and Notification – Call 911 After 911 notification, the following mandatory notifications will be made by the Compliance Inspection Contractor. Select and notify the appropriate government agencies based on geographic location of the spill site. Also see Appendix L – Hazardous Materials Management Plan	
Counties: TBD	State Divisions of Emergency Services and Homeland Security: TBD	National Response Center: TBD
State Departments of Environmental Quality: TBD		
	Other Numbers	
County Fire Dispatch: TBD	BLM Authorized Officer or Representative: TBD	Construction Contractor Manager: TBD

F7.2 Hazard Identifications and Key Response Criteria

Construction activities for the Project can pose potential hazards or threats. The most effective response to any situation is awareness of the hazard, its potential effects and consequences, and an understanding of the resources and actions necessary to respond. Listing all the potential hazards and a detailed each response is not appropriated for this Plan. Reponses to different events may vary as the event evolves, but reasonable response methods and responsibilities will be determined in future updates to this Plan. Scenarios that may be considered are electrocution, fatality, massive equipment failure, structure failure, weather, environmental, etc.

APPENDIX G
FRAMEWORK ENVIRONMENTAL COMPLIANCE AND MONITORING PLAN

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ATTACHMENTS

ACRONYMS

Applicant	TransWest Express LLC, also TransWest
BLM	Bureau of Land Management
CFR	Code of Federal Regulations
CIC	Compliance Inspection Contractor
ECMP	Environmental Compliance and Monitoring Plan, also Plan
EMM	Environmental Mitigation Measure
FEIS	Final Environmental Impact Statement
NTP	Notice to Proceed
Plan	Environmental Compliance and Monitoring Plan, also ECMP
POD	Plan of Development
Project	TransWest Express Transmission Project, also TWE Project
Reclamation	Bureau of Reclamation
ROD	Record of Decision
ROW	right-of-way
TransWest	TransWest Express LLC, also Applicant
TWE Project	TransWest Express Transmission Project, also Project
USFS	United States Forest Service
Western	Western Area Power Administration
WSO	Work Stoppage Order

G1.0 INTRODUCTION

This framework Environmental Compliance and Monitoring Plan (ECMP or Plan) provides an overview of how TransWest Express LLC (TransWest or Applicant) will manage compliance with all laws, regulations and agreements related to the TransWest Express Transmission Project (TWE Project or Project). This Plan may be updated, revised and changed as roles and responsibilities are further refined during the Project development process. More specifically, this Plan may be revised and changed following the issuance of the Records of Decision (RODs) for the Project by the Bureau of Land Management (BLM) and Western Area Power Administration (Western).

The BLM, the U.S. Forest Service (USFS), the Bureau of Reclamation (Reclamation) and other federal agencies issuing right-of-way (ROW) grants or special use authorizations on federal lands will be responsible for enforcement of the terms and conditions of those grants and authorizations. As the lead federal land management agency during construction of the Project, the BLM will engage a third-party Compliance Inspection Contractor (CIC) to act on behalf of the federal land management agencies to provide construction oversight and monitor compliance with the terms and conditions of the federal grants and authorizations.

G2.0 PLAN PURPOSE

The ECMP is the primary guide for documentation and management of compliance with the federal grants and authorizations for the Project. This ECMP contains information on the following items:

- Roles and responsibilities of the Compliance Team
- Procedures for assessing Project compliance and process for implementing corrective actions
- Procedures for submitting, evaluating, and approving/denying variance requests
- Communications
- Training
- Reporting and documentation
- Project closeout

Because there is the potential for the Project to affect sensitive environmental resources, environmental mitigation measures (EMMs) have been developed to minimize potential impacts on these resources. The ECMP is intended to be a guidance document to facilitate compliance and the effective implementation of EMMs. As needed, the ECMP will be updated and revised.

As mentioned above, a third party CIC will be engaged by the BLM to enforce terms and conditions of the federal grants and authorizations. The CIC will be responsible for assuring that the Notice to Proceed (NTP) Plan of Development (POD) and all associated permitting documents have been distributed to the Compliance Team for their review prior to construction being initiated. The CIC will also review all environmental requirements with key construction managers and environmental monitors at the initial construction kickoff meeting. At that time a document control system, which may be used to manage the submittal and distribution of Project compliance information and documentation, may be presented and demonstrated. Environmental inspectors and monitors will also be retained by TransWest and/or by the Construction Contractor(s) to implement EMMs, provide specific resource monitoring, and to prepare daily reports on those construction activities monitored.

G3.0 PLAN UPDATES

This ECMP will be updated for the ROD POD to include more specifically defined roles, responsibilities and procedures. The NTP POD will be completed by TransWest and will include fully defined roles, responsibilities and procedures as agreed to by TransWest and the federal agencies.

G4.0 ROLES AND RESPONSIBILITIES

The following section describes the roles and responsibilities of the Compliance Team in executing the ECMP and describes their reporting relationships (Figure 3-1 to be developed for ROD POD). The Compliance Team includes the BLM and other federal agencies, CIC, TransWest, Construction Contractor(s), and Environmental inspectors and monitors. Subject to the requirements of the site health and safety plan, the Compliance Monitoring Team shall have access to all Project work areas to inspect construction and reclamation activities in accordance with the terms and conditions of the federal grants and authorizations. Access to work areas will not be unreasonably withheld provided that the members of the Compliance Monitoring Team have received all required safety training necessary to enter the work area.

G4.1 Bureau of Land Management and Other Federal Agencies

The role of the BLM and other federal agencies is to ensure that all stipulations and requirements of the federal grants and authorizations are implemented and complied with during the construction, operation, and maintenance of the Project. Oversight will be provided by both federal Authorized Officers and by Project Managers for each federal agency. Authorized Officers will have ultimate authority and be the decision makers for issues pertaining to ROW grants and authorizations. The Authorized Officers will supervise the federal Project Managers to verify that environmental compliance is meeting the requirements of all applicable laws, permits, regulations, and agreements. The Authorized Officers, in coordination with others, will determine if noncompliance events for which TransWest is accountable qualify as violations to the terms and conditions of any ROW grant or authorization. Only the Authorized Officers, in accordance with 43 Code of Federal Regulations (CFR) Part 2807 and 36 CFR Part 251.60, will have the authority to suspend or terminate a ROW grant or authorization if TransWest and/or its Construction Contractor(s) do not comply with their stipulations, conditions, or with other applicable laws and regulations. The Authorized Officers will be the primary federal agent to issue decisions unless otherwise delegated to a federal Project Manager.

Federal Project Managers will be primarily responsible for enforcing TransWest's day-to-day compliance with environmental laws and regulations, the POD, and all stipulations and conditions of the federal grants and authorizations. They will ensure that compliance during construction is done in a manner which facilitates timely and efficient construction while protecting the public interest and the environment. They will also be responsible for ensuring that environmental impacts do not exceed those analyzed in the Final EIS and will manage the third-party CIC. Federal Project Managers will coordinate with agency resource specialists for their technical expertise and input when needed. Federal Project Managers will be responsible for notifying TransWest of any grant or authorization violations due to noncompliance, issuing work stoppage orders (WSOs) if needed, issuing work continuation notices (or lifting work stoppage orders) and enforcing corrective actions as needed. Non-compliance will be reported to the appropriate Authorized Officer(s). Each federal Project Manager will be responsible for maintaining an accurate and complete administrative record for their respective agency.

All Level 2 or Level 3 variance requests described in Section G5.3 below, will require approval by either the appropriate federal Project Manager or Authorized Officer.

G4.2 Compliance Inspection Contractor

TransWest and the federal agencies will agree to use of a third-party CIC to act on the BLM and other federal agencies' behalf to ensure adequate oversight during the construction and reclamation phases of the Project. The CIC will report directly to each federal Project Manager and will be authorized to enforce the stipulations of the federal grants and authorizations. It is not the role of the CIC to direct the work of either TransWest or its Construction Contractor(s). Rather the CIC's primary role is to observe work activities and bring non-compliant situations to the attention of the appropriate party and offer recommendations on how to prevent or rectify non-compliance. Additional responsibilities of the CIC include:

- Track all Project construction disturbance by type and jurisdiction during inspections, for inclusion in an End of Construction Project Report.
- Report if construction disturbance exceeds levels analyzed in the Final Environmental Impact Statement (FEIS).
- Prepare and maintain a project compliance contact list containing the names, titles, phone numbers and email addresses of all federal Authorized Officers and federal Project Managers, TransWest Project Managers, Construction Contractor(s) field supervisors and construction managers, environmental inspectors, monitors and any other individuals or agencies who will be involved with environmental compliance for the Project.
- Participate in pre-construction meetings, safety meetings, safety training, environmental training and other meetings attended by the BLM, TransWest, and Construction Contractor(s) as appropriate that involve environmental compliance aspects of the Project.
- Prepare and distribute weekly summary report.
- Review all applicable environmental documents and requirements, including the FEIS, ROD, PODs, ROW grants, and special use authorizations.
- Maintain a complete copy of the NTP POD and associated environmental documents while in the field.
- Verify that construction occurs as outlined in the NTP POD, FEIS, ROD, ROW grants, special use authorizations, and NTPs.
- Perform compliance monitoring in areas of active construction or reclamation.
- Maintain records that assure all required environmental training of construction personnel has been conducted.
- Respond to inquiries by TransWest or its Construction Contractor(s) concerning environmental compliance.
- Discuss any potential compliance issues with Construction Contractor(s), environmental inspectors, and environmental monitors.
- Provide recommendations to federal Project Managers on ways to resolve or prevent non-compliance.
- At a minimum, meet weekly with the federal Project Managers (or designees), in person or by telephone, to review status of construction and compliance.

- Meet with TransWest and Construction Contractor(s) project managers, construction managers, environmental inspectors, or environmental monitors as needed.
- Support and coordinate the preparation, submittal, and review of all variance requests.
- Approve or deny Level 1 variance requests described below.
- Participate in and support Project safety.
- Work with TransWest and Construction Contractor(s) to support the Project's safe, timely, and effective construction.
- If warranted, issue an immediate temporary suspension or WSOs for any construction activity determined to be in non-compliance.
- As warranted, rescind any temporary suspension or WSOs in a timely fashion following determination that non-compliance issue has been adequately addressed.
- Conduct field reviews and inspections with agency personnel as needed.
- Conduct a final route review and prepare End of Construction Project Report documenting the status of the ROW and the final amount of construction disturbance.
- Document completion of all reclamation activities (excluding reclamation monitoring).
- Document instances of non-compliance through mapping and photography and complete non-compliance report.
- Review environmental inspector and environmental monitor daily logs.
- Prepare meeting notes that highlight any decisions made during key project meetings.

The CIC will deploy an adequate number of field personnel to sufficiently monitor construction activities and fulfill the responsibilities listed above. It is important to note that it is not the role of the CIC to direct work of either TransWest or the Construction Contractor(s).

G4.3 TransWest

TransWest will be the holder of all ROW grants, authorizations, and easements, both public and private. As such, TransWest is ultimately accountable for adherence to the environmental permit requirements and is responsible for ensuring that environmental impacts do not exceed those analyzed in the FEIS and approved in the ROD. To facilitate this goal, TransWest will employ environmental inspectors and monitors who will work with the Construction Contractor(s) and will support the efforts of the CIC. TransWest will also maintain regular and consistent communication with the Construction Contractor(s) to track the success of environmental protection, mitigation, and compliance efforts before, during, and after construction. TransWest is responsible for assuring that all instances of non-compliance are corrected.

G4.4 Construction Contractor(s)

As part of TransWest's commitment to environmental compliance, the Construction Contractor(s) will be contractually bound to comply with all relevant laws, regulations, and permits, including the ECMP, POD, EMMs, and other specific stipulations set forth in the federal grants and authorizations. All construction personnel and employees entering work areas will be required to participate in environmental training before starting work. Construction crews will also be required to cooperate and support the work of the Compliance Team to build the Project safely and in compliance with all terms and conditions; federal, state, and local laws and regulations; and all landowner agreements. If a non-compliance event occurs, it will be the responsibility of the Construction Contractor(s) to notify TransWest and the CIC and to cooperate fully in developing and implementing a solution as soon as possible to resolve the non-compliance. The Construction Contractor(s) will be expected to involve the CIC in key Project management meetings and the Project safety program.

G4.5 Environmental Inspectors and Monitors

TransWest and its Construction Contractor(s) will employ a team of environmental inspectors and monitors to monitor compliance with the federal grants and authorizations. The duties and responsibilities of the environmental inspectors and monitors will include:

- Daily inspections and monitoring of construction activities as required.
- Coordinate and communicate with the CIC.
- Support and participate in field inspections by federal agency personnel as needed.
- Deliver environmental training and provide CIC with a current list of all personnel who have received training.
- Confirm on the ground the location of sensitive resources and areas of concern prior to construction activities commencing.
- Verify that construction work areas, access roads, and sensitive resources or areas of concern have been properly marked and flagged prior to work commencing in those areas.
- Communicate and coordinate with construction crews and act as a resource to explain environmental regulations and requirements.
- Attend safety meetings.
- Prepare daily logs/reports to be provided to the CIC.
- Support the preparation of variance requests and review by the federal agencies and CIC.
- Inform Construction Contractor(s) and CIC of all potential and existing compliance issues and support implementation of corrective actions.
- Stop-work authority when construction activities violate the environmental conditions of the federal grants and authorizations or when sensitive resources are threatened.
- Participate in and support the implementation of corrective actions for non-compliance violations.
- Monitor, inspect, and document reclamation and revegetation activities as needed.

G5.0 PROCEDURES

This section describes the procedures that will be followed to assess compliance levels, responses to non-compliance, and for the submittal, review, and tracking of variance requests.

G5.1 Compliance Levels

Each separate activity that is inspected and documented in a daily report will be assigned one of the following compliance levels:

- Acceptable

- Problem area
- Non-compliance

Environmental inspectors, monitors, and the CIC will assess potential non-compliant activities based on the extent and nature of actual impacts on a resource, the potential for additional impacts on a resource, the intent behind the action, and the history of the occurrence. Failure by TransWest or the Construction Contractor(s) to disclose in a timely manner or accurately characterize an impact will result in an automatic non-compliance and temporary suspension of work in the area where the impact has occurred. Each compliance level is described below.

G5.1.1 Acceptable

All activities that are in compliance with the Project's federal grants and authorizations will be documented as acceptable.

G5.1.2 Problem Area

A problem area is a location or activity that does not meet the definition of acceptable but no impacts to sensitive resources have occurred. Examples include:

- An incident that is accidental or unforeseeable, where no sensitive resources were damaged, is reported in a timely manner, and is repaired quickly.
- A location where the CIC, environmental inspector, or monitor has determined that damage to a sensitive resource could occur if corrective actions are not taken.
- Implementation of mitigation measures is occurring too slowly to be fully effective.

The Construction Contractor(s) will be notified of the problem area and it will be documented in the daily report, as well as the corrective actions that will be applied. If a problem area is corrected in a timely manner it will not be considered non-compliance. If a problem area is found to be a repeat situation, or has happened in multiple locations, or is not corrected within an agreed upon timeframe, the CIC, environmental inspector, or monitor may document the situation as non-compliance.

G5.1.3 Non-Compliance

Non-compliance occurs when one or more of the following take place:

- Requirements or stipulations contained within the Project's federal grants or authorizations are not followed or implemented properly.
- Damage to sensitive resources has occurred.
- Problem areas consistently reoccur and threaten sensitive resources.
- Corrective actions for problem areas are not implemented.
- Construction Contractor(s) display direct disregard for Project requirements.

G5.2 Responses to Non-Compliance

Depending on the circumstances of the non-compliance and if sensitive resources are threatened, the CIC may orally issue a temporary suspension of construction activities within a localized area. All non-compliance will be documented in a non-compliance report (see Attachment A). The non-compliance report will be prepared by the CIC based on personal observations or information provided by the environmental inspectors, monitors or other parties. In all cases when non-compliance occur the CIC will be informed immediately.

Once prepared, the CIC will provide a copy of the non-compliance report to TransWest, the Construction Contractor(s), and the applicable federal Project Manager(s). Upon review, the appropriate federal Project Manager(s), in consultation with the Authorized Officer as needed, will direct the CIC to take one or more of the following actions:

- Work with the Construction Contractor(s) and TransWest to develop a written plan to address the cause of the non-compliance and actions to avoid its reoccurrence.
- Work with the Construction Contractor and TransWest to develop a written plan to repair any impacts to resources.
- Issue a temporary suspension to halt specific activities or all activities within in a localized work area.
- Issuance of a WSO to temporarily suspend all activities within a given construction area of the Project (requires written authorization by either the federal Project Manager or the Authorized Officer).
- ROW grant or authorization suspension (requires written authorization by the Authorized Officer).
- ROW grant or authorization termination (requires written authorization by the Authorized Officer).

In cases where construction activities have been halted, TransWest, the Construction Contractor(s), appropriate federal Project Manager (s), and the CIC will meet to discuss the corrective actions that must be implemented before work will be allowed to resume. Prior to any ROW grant or authorization suspension or termination, TransWest will be notified in writing and allowed a reasonable opportunity to correct any non-compliance pursuant to 43 CFR Part 2807.18(a), and if applicable, provided a hearing pursuant to 43 CFR Part 2807.18(b) and 36 CFR Part 251.

G5.3 Variances

It is expected that during the construction of the TWE Project circumstances will arise requiring a change, or variance, in how the Project will be constructed, or how mitigation measures or stipulations will be implemented. Under such circumstances TransWest will follow the procedures for variances, exceptions and modifications set forth in the applicable BLM Resource Management Plan. Where such procedures are not described in detail, TransWest will follow the procedures described in this ECMP.

The first step in the variance process is the preparation of a variance request form (see Attachment B). It is important that the form is complete, accurate, and contains sufficient information for the CIC and agency to adequately assess the request and reach a decision on its approval or denial. The Construction Contractor(s) will be responsible for preparing the request with the prior approval of TransWest.

A completed variance request form, with any required attachments, will be submitted to the CIC in electronic format. The CIC will conduct an initial assessment of the request for completeness and will determine a variance level based on the following definitions:

- Level 1: minor field adjustment within an approved/granted area that was previously analyzed in the Project's environmental documents, does not result in greater impacts to resources, and does not result in an increase in the estimated acres of disturbance contained in the FEIS or NTP POD.
- Level 2: changes in procedures or adjustments located outside of an approved/granted work area but still within an area analyzed in the Project's environmental documents, do not result in greater impacts to resources, and does not result in an increase in the estimated acres of disturbance contained in the FEIS or NTP POD.
- Level 3: changes in procedures or adjustment located outside of an approved/granted work area and outside area analyzed in the Project's environmental documents, results in greater impacts to resources, and/or results in an increase in the estimated acres of disturbance contained in the FEIS or NTP POD.

Incomplete or inadequate submittals will be returned within 24 hours with an explanation. Level 1 variance requests will be approved, approved with conditions, or denied by the CIC within 48 hours. Level 2 variance requests will be forwarded on to the appropriate federal Project Manager and will be approved, approved with conditions, or denied within a specified time to be determined. If denied, the federal Project Manager will provide a written explanation for the denial. Level 3 variances will be forwarded to the appropriate federal Project Manager and Authorized Officer. The timeframe for approval or denial of a Level 3 variance will depend on the scope of any additional studies and consultations that may be required and will take place within a specified time to be determined. If denied the Authorized Officer or federal Project Manager will provide a written explanation for the denial.

The CIC will be responsible for tracking all variance requests and will provide a summary of these in the End of Construction Project Report.

G6.0 COMMUNICATIONS

Effective communication and the sharing of information between the Compliance Team will be critical to achieving and maintaining environmental compliance throughout the construction of the Project. It is especially important for construction crews to communicate daily with environmental monitors concerning work schedules and locations. The Construction Contractor(s), CIC, environmental inspectors and monitors will maintain a communications network that consists of two-way radios and/or cellular phones. The Construction Contractors(s) will be responsible for assuring that field crews have the ability to communicate effectively and will implement solutions if communication problems arise.

Given the scope and complexity of the Project, it is critical that all communications involving key decisions, safety, approvals, non-compliance, or variances be documented in writing. Oral communication will not substitute for written approvals.

The CIC will be responsible for developing and maintaining a Project compliance contact list containing the names, titles, phone numbers and email addresses of all agency Authorized Officers, federal Project Managers, TransWest project managers, Construction Contractor(s) field supervisors and construction managers, environmental inspectors, monitors and any other individuals or agency personnel who will be involved with environmental compliance for the Project. The CIC will also be responsible for developing appropriate distribution lists for weekly compliance reports, non-compliance notifications, and variance requests.

The Construction Contractor(s) will hold daily morning meetings that will include the CIC or the CIC's compliance monitors, environmental inspectors and monitors to review the day's construction activities, discuss safety, and if needed discuss any compliance problem areas. The Construction Contractor(s) will also schedule periodic meetings with the CIC, lead environmental staff, and construction managers to discuss such topics as safety, communication, compliance, schedule, staffing, or other issues related to keeping the Project safe, on schedule, and in compliance.

G7.0 TRAINING

All personnel, including agency personnel, entering work areas are required to receive environmental and safety training prior to entering. Safety training will be provided by the Construction Contractor(s) following the requirements found in the Health and Safety Plan (Appendix M).

Environmental training will be provided by environmental inspectors and/or monitors. Training will emphasize compliance with all Project-wide environmental requirements including stipulations in the ROW grant, special use authorizations, NTP POD, and NTP(s). Requirements pertaining to a particular construction spread, such as requirements for the protection of threatened and endangered species or cultural resources, will be addressed as necessary. Roles and responsibilities will be reviewed and the authority of the CIC, environmental inspectors, and monitors will be emphasized.

The CIC will be provided with a list of all personnel who successfully completed the environmental training. Each trainee will receive proof of certification that must be carried at all times. At the discretion of the CIC, they may ask any personnel on the ROW to produce their training certification card. Any personnel present in work area that is found to have not gone through the training will result in non-compliance. The individual will be required to leave the work area immediately and will not be allowed back onto the Project until training has been completed.

G8.0 REPORTING AND DOCUMENTATION

Effective management of the Project will require the completion of multiple forms and reports to be submitted on a regular basis during the course of construction. These will include:

- Daily inspection reports
- Weekly compliance reports
- End of Construction Project Report
- Non-compliance report
- Variance request forms
- Environmental training list

The CIC will be responsible for compiling and distributing these reports to the appropriate federal Project Managers. The federal Project Managers will be responsible for assuring that documents are incorporated into the official administrative record for the Project.

G9.0 PROJECT CLOSEOUT

Once all construction has been completed, the Project energized, and reclamation activities completed, the CIC will coordinate final on-the-ground inspections with the federal Project Managers. The purpose of these final inspections will be to document compliance with the requirements contained within the ROW Preparation and Vegetation Management Plan (Appendix R) and the Reclamation Plan (Appendix Q). After the inspections are completed, the federal Project Managers will determine if any further work is required. If no further work is required, the CIC will prepare the End of Construction Project Report.

The End of Construction Project Report will contain the following information:

- Record of final reports and documentation.
- Number of days of construction.
- Number of CIC monitors employed.
- Number of environmental inspectors and monitors employed.
- Number of personnel who received environmental training.
- Number of safety incidents that occurred during construction.
- Final acres of permanent and temporary disturbance compared to amounts contained in the FEIS and POD.
- Number of non-compliance reports issued.
- A summary of causes for non-compliance.
- A summary of corrective actions taken for non-compliance.
- Number and duration of temporary suspensions of construction activities.
- Number and duration of WSOs.
- Number of variances submitted, approved, and denied.
- A summary of special status animals or plants taken (including number of captures, displacements, mortalities, injuries, or harassment).
- Overall assessment of Construction Contractor(s) support of and compliance with requirements.
- A summary of lessons learned that could be applied to future projects.

Once the report is drafted, the CIC will coordinate a construction closeout meeting with the Compliance Team. At this meeting the End of Construction Project Report will be reviewed to ensure that all requirements have been met and any issues have been satisfactorily resolved. If no further actions are needed the work of the CIC will be deemed complete and the post-construction reclamation monitoring period will begin, as described in the Reclamation Plan (Appendix Q).

ATTACHMENT A
NON-COMPLIANCE REPORT

To be determined.

ATTACHMENT B
VARIANCE REQUEST FORM

To be determined.

APPENDIX H
FRAMEWORK FIRE PROTECTION PLAN

TABLE OF CONTENTS

ACRONYMS

Applicant	TransWest Express LLC, also TransWest
BLM	Bureau of Land Management
BMP	Best Management Practice
CFR	Code of Federal Regulations
CIC	Compliance Inspection Contractor
COM Plan	Construction, Operation, and Maintenance Plan
DEIS	Draft Environmental Impact Statement
EMF	Electromagnetic Field
NESC	National Electrical Stately Code
NIFC	National Interagency Fire Center
NTP	Notice to Proceed
OSHA	Occupational Safety and Health Administration
Plan	Fire Protection Plan
POD	Plan of Development
Project	TransWest Express Transmission Project, also TWE Project
ROW	right-of-way
TransWest	TransWest Express LLC, also Applicant
TWE Project	TransWest Express Transmission Project, also Project
USFS	United Stated Forest Service
WSFD	Wyoming State Forestry Division

H1.0 INTRODUCTION

This framework Fire Protection Plan (Plan) describes the measures to be taken by TransWest Express LLC's (TransWest or Applicant) and its Construction Contractor(s) to ensure fire prevention and suppression measures are carried out in accordance with federal, state, and local regulations for the TransWest Express Transmission Project (TWE Project or Project). Measures identified in this Plan apply to work within the Project area defined as the right-of-way (ROW); access roads; temporary work and storage areas; and other areas used during construction and operation of the TWE Project. This document provides direction for the detailed final Plan to be developed by the Construction Contractor(s).

H2.0 PLAN PURPOSE

The purpose of the Fire Protection Plan is to provide safe procedural practices, environmental protection measures, and other specific stipulations and methods to prevent and respond to fires during construction and operation of the Project. The final Plan will provide construction crews, environmental monitors, and the Compliance Inspection Contractor (CIC) with Project-specific information concerning fire protection procedures. The detailed final Plan will define fire prevention practices, establish fire protection requirements, control of combustible materials and flammable liquids and establish communication for agency responses in the event of a fire.

H3.0 PLAN UPDATES

This framework Plan will be updated for the Notice to Proceed (NTP) Plan of Development (POD) and will include a restricted operations section, complete notifications section, and updated relevant mitigation measures to ensure regulation compliance and safety. The Plan will include updates as needed based on final design and engineering and per agency requirements. The Construction Contractor(s) will be responsible for preparing and implementing the final Plan in compliance with all local, state, and federal regulations pertaining to fires.

H4.0 REGULATORY

H4.1 Wyoming's Wildfire Protection System

The prevention and suppression of wildfires in southern Wyoming is carried out by the Bureau of Land Management (BLM), U.S. Forest Service (USFS), and local fire districts and agencies. The agencies' activities are closely coordinated, primarily through the National Interagency Fire Center (NIFC) in Boise, Idaho, and Regional Interagency Dispatch Centers in Casper and Rawlins, Wyoming. Individual fire crews from BLM Field Offices and Forest Service Ranger Districts coordinate fire suppression activities on federal land within their jurisdictions. The Wyoming State Forestry Division (WSFD) is responsible for fire suppression on Wyoming state lands. Local fire districts and agencies provide fire prevention and suppression activities on private land, and may assist with fires on state or federal lands as requested by those agencies.

H4.2 Colorado's Wildfire Protection System

The prevention and suppression of wildfires in northwest Colorado is carried out by the BLM, USFS, Colorado Division of Fire Prevention and Control, and local fire districts and agencies. The agencies' activities are closely coordinated, primarily through NIFC in Boise, Idaho, and Regional Interagency Dispatch Center in Craig, Colorado. Individual fire crews from BLM Field Offices and Forest Service Ranger Districts coordinate fire suppression activities on federal land within their jurisdictions. Local fire districts and agencies provide fire prevention and suppression activities on private land, and may assist with fires on state or federal lands as requested by those agencies. County Sherriff offices coordinate fire suppression activities in the counties as well as un-incorporated portions of counties.

H4.3 Utah's Wildfire Protection System

The prevention and suppression of wildfires in Utah is carried out by the BLM, USFS, Utah Division of Forestry, Fire and State Lands, and local fire districts and agencies. The agencies' activities are closely coordinated, primarily through NIFC in Boise, Idaho, and the Eastern Great Basin Geographic Area Coordination Center in Salt Lake City, Utah. Individual fire crews from BLM Field Offices and Forest Service Ranger Districts coordinate fire suppression activities on federal land within their jurisdictions. The Utah Division of Forestry, Fire and State Lands provide fire suppression activities on state and private lands. Local fire districts and agencies provide fire prevention and suppression activities on private land, and may assist with fires on state or federal lands as requested by those agencies.

H4.4 Nevada's Wildfire Protection System

The prevention and suppression of wildfires in southern Nevada is carried out by the BLM, USFS, Nevada Division of Forestry, and local fire districts and agencies. The agencies' activities are closely coordinated, primarily through NIFC in Boise, Idaho, and Western Great Basin Geographic Area Coordination Center in Reno, Nevada. Individual fire crews from BLM Field Offices and Forest Service Ranger Districts coordinate fire suppression activities on federal land within their jurisdictions. The Nevada Division of Forestry provides fire suppression activities on state and private lands and may assist with fires on state or federal lands as requested by those agencies. Local fire districts and agencies provide fire prevention and suppression activities on private land, and may assist with fires on state or federal lands as requested by those agencies.

H5.0 FIRE PROTECTION PLAN CONTENTS

The Fire Protection Plan will include information on the following topics:

1. Worker Training
2. Smoking Restrictions
3. Spark Arresters
4. Parking, Vehicle operation, and Storage Areas
5. Equipment
6. Road Closures
7. Refueling
8. Burning
9. Flammable Liquids and Explosives
10. Communications
11. Welding
12. Fire Suppression
13. Restricted operations
14. Monitoring

H6.0 FIRE PREVENTION PLAN GUIDANCE

Components of this Plan will include, but are not limited to: requiring work vehicles to carry shovels, water, and fire extinguishers; operating all vehicles on designated roads; parking in designated areas or areas free of vegetation; and operating welding, grinding, or cutting activities in areas cleared of vegetation. To minimize the occurrence of fire from the power line, safety measures would be taken that include brush-clearing within the corridor prior to work, enforcing red flag warnings, providing appropriate training to all pertinent personnel, and keeping vehicles on or within designated roads or work areas.

The presence of explosive materials on the Project site could potentially increase the risk of fire during construction. Special precautions will be taken to minimize this risk in conjunction with the Appendix C - Blasting Plan Framework, including but not limited to:

- Prohibiting ignition devices within 50 feet of explosives storage areas;
- Properly maintaining magazine sites so they are clear of fuels and combustible materials, well ventilated, and fire-resistant;
- Protecting magazines from wildfires that could occur in the immediate area;
- Posting fire suppression personnel at the blast site during high fire danger periods; and
- Prohibiting blasting during extreme fire danger periods.

H7.0 DESIGN FEATURES AND BEST MANAGEMENT PRACTICES

In addition to applicable design and operational standards, regulations, laws and permit requirements, the following design features and best management practices (BMPs) have been developed to avoid or minimize potential fire related impacts. Note that the Construction, Operation and Maintenance Plan will be a part of the NTP POD.

TWE-51: The TWE Project will be designed, constructed, and operated to meet or exceed the requirements of the National Electrical Safety Code (NESC), U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) standards, and the Applicant’s requirements for safety and protection of landowners and their property.

TWE-53: The Construction, Operation and Maintenance (COM) Plan will include a Blasting Plan, which will identify methods and mitigation measures to minimize the effects of blasting, where applicable. The Blasting Plan will document the proposed methods to achieve the desired excavations, proposed methods for blasting warning, use of non-electrical blasting systems, and provisions for controlling fly rock, vibrations, and air blast damage.

TWE-56: As part of the COM Plan, the Applicant will provide a Health and Safety Plan, which will outline measures to protect workers and the general public during construction, operation, and decommissioning of the TWE Project. The Health and Safety Plan will identify applicable federal and state occupational safety standards, establish safe work practices, and define safety performance standards.

TWE-64: The COM Plan will include a Fire Protection Plan. The Applicant or its Contractor(s) will notify the BLM of any fires and comply with all rules and regulations administered by the BLM and USFS concerning the use, prevention, and suppression of fires on federal lands, including any fire prevention orders that may be in effect at the time of the permitted activity. The Applicant or its Contractor(s) may be held liable for the cost of fire suppression, stabilization, and rehabilitation. In the event of a fire, personal safety will be the first priority of the Applicant or its Contractor(s). The Applicant or its Contractor(s) will:

- Operate all internal and external combustion engines on federally-managed lands per 36 Code of Federal Regulations (CFR) Part 261.52(j), which requires all such engines to be equipped with a qualified spark arrester that is maintained and not modified;
- Carry shovels, water, and fire extinguishers that are rated at a minimum as ABC-10 pound on all equipment and vehicles. If a fire spreads beyond the suppression capability of workers with these tools, all workers will cease fire suppression action and leave the area immediately via pre-identified escape routes;
- Initiate fire suppression actions in the work area to prevent fire spread to or on federally-administered lands. If fire ignitions cannot be prevented or contained immediately, or it may be foreseeable that a fire would exceed the immediate capability of workers, the operation must be modified or discontinued. If the operation area is evacuated there will be no risk of ignition or re-ignition upon leaving.
- Notify the appropriate fire center immediately of the location and status of any escaped fire;
- Review weather forecasts and the potential fire danger prior to any operation involving potential sources of fire ignition from vehicles, equipment, or other means. Prevention measures to be taken each work day will be included in the specific job briefing. Consideration will be given to additional mitigation measures or temporary discontinuance of the operation during periods of extreme winds or dryness;
- Operate all vehicles on designated roads and park in designated areas or areas free of vegetation;
- Operate welding, grinding, or cutting activities in areas cleared of vegetation within range of the sparks for that particular action. A spotter will be required to watch for ignitions; and
- Use only diesel-powered vehicles in areas where excessive heat from vehicle exhaust systems could start brush or grass fires.

Additional BMPs and Mitigation Measures identified in the Draft Environmental Impact Statement (DEIS) are listed below. The identified BMPs and Mitigation Measures have not been finalized at this time and may be updated, changed, or eliminated in future revisions of this Plan.

PHS-1: The Applicant shall prepare an explosives use plan that specifies the times and meteorological conditions when explosives will be used and specifies minimum distances from sensitive vegetation and wildlife or streams and lakes.

PHS-4: A health and safety program shall be developed by the Applicant to protect both workers and the general public during construction, operation, and decommissioning of an energy transport project. The program should identify all applicable federal and state occupational safety standards, establish safe work practices for each task (e.g., requirements for personal protective equipment and safety harnesses, OSHA standard practices for safe use of explosives and blasting agents, measures for reducing occupational electromagnetic field [EMF] exposures), and define safety performance standards (e.g., electrical system standards). The program should include a training program to identify hazard training requirements for workers for each task and establish procedures for providing required training to all workers. Documentation of training and a mechanism for reporting serious accidents to appropriate agencies should be established.

FIRE-1: The Applicant shall develop a fire management strategy to implement measures to minimize the potential for a human-caused fire during Project construction, operation, and decommissioning. The strategy should consider the need to reduce hazardous fuels (e.g., native and non-native annual grasses and shrubs) and to prevent the spread of fires started outside or inside a corridor, and clarify who has responsibility for fire suppression and hazardous fuels reduction for the corridor.

FIRE-2: The Applicant must work with the local land management agency to identify Project areas that may incur heavy fuel buildups, and develop a long-term strategy on vegetation management of these areas. The strategy may include land treatment during Project construction, which may extend outside the planned ROW clearing limits.

FIRE-3: The Applicant must ensure that all construction equipment used is adequately muffled and maintained and that spark arrestors are used with construction equipment in areas with, and during periods of, high fire danger.

FIRE-4: Flammable materials (including fuels) will be stored in appropriate containers.

APPENDIX I
FRAMEWORK FLAGGING, FENCING, AND SIGNAGE PLAN

TABLE OF CONTENTS

TABLES:

ACRONYMS

Applicant	TransWest Express LLC, also TransWest
BLM	Bureau of Land Management
BMP	Best Management Practice
CIC	Compliance Inspection Contractor
DEIS	Draft Environmental Impact Statement
NTP	Notice to Proceed
Plan	Flagging, Fencing, and Signage Plan
POD	Plan of Development
Project	TransWest Express Transmission Project, also TWE Project
ROD	Record of Decision
ROW	right-of-way
TransWest	TransWest Express LLC, also Applicant
TWE Project	TransWest Express Transmission Project, also Project
USFS	United States Forest Service

I1.0 INTRODUCTION

This framework Flagging, Fencing, and Signage Plan (Plan) describes the methods that will be used in the field by TransWest Express LLC (TransWest or Applicant) and its Construction Contractor(s) to delineate the TransWest Express Transmission Project (TWE Project or Project) limits of disturbance and protect sensitive environmental and cultural resources during Project construction. These methods are intended to ensure TransWest personnel, Construction Contractor(s), Bureau of Land Management (BLM), U.S. Forest Service (USFS), Compliance Inspection Contractor (CIC), and environmental investigators and monitors on the Project construction sites stay on approved access routes and within approved work areas. The measures described in this Plan are an integral part of the environmental compliance program for avoiding and minimizing impacts on sensitive resources.

I2.0 PLAN PURPOSE

The purpose of this Plan is to describe the methods that will be used in the field to delineate the Project limits of disturbance and protect sensitive environmental and cultural resources during Project construction. The objective of this Plan is to provide information on the field markings (i.e., flagging, fencing, and signage) that will be used to identify approved Project travel and work areas, as well as environmentally sensitive areas where construction or travel is to be excluded.

I3.0 PLAN UPDATES

This Plan will be updated for the Record of Decision (ROD) Plan of Development (POD) and will include updated signage standards (Table I1) based on the selected Agency Preferred Alternative. The Plan for the Notice to Proceed (NTP) POD will be updated as needed based on final design and engineering. The Construction Contractor(s) will be responsible for preparing and implementing the final Plan.

I4.0 REGULATORY REQUIREMENTS

No federal, state or local laws, rules or regulations specifically address flagging, fencing, and signage protocols for construction projects. However, some of the mitigation measures identified in the Draft Environmental Impact Statement (DEIS) for the Project are dependent on adequate field marking of work areas and/or of sensitive resource areas to avoid and minimize impacts to environmental resources. These mitigation measures include flagging or fencing requirements to help protect vegetative cover, water quality, cultural resources, and special status species and minimize the spread of noxious weeds.

I5.0 METHODS

I5.1 Demarcating Project Facilities

Standard survey flags and stakes will be installed before the start of Project construction. Structure sites (e.g., transmission structure locations, anchor points and reference points) will be marked by the Construction Contractor(s). Designated Project access roads, parking areas and pullout areas will be marked to facilitate travel to and from the right-of-way (ROW). Temporary work areas at structure sites, wire pulling/tensioning/splicing sites, material storage yards, fly yards/staging areas, and batch plants will be demarcated as necessary to indicate the limits of approved work areas. The Construction Contractor(s) will stake the boundaries of the maximum area needed for work areas and will provide the dimensions to the CIC. If the delineated work areas exceed the approved dimensions for the Project facilities, the Construction Contractor(s) will coordinate with the CIC for approval and a variance may be required.

I5.2 Environmental Exclusion Areas

Signs, flags and/or fencing will be used to establish exclusion areas to protect sensitive environmental resources (e.g., biological, cultural, wetland, and paleontological resources) in the vicinity of construction activities. A system of standardized and simplified exclusion markings will be used to reduce potential confusion during construction and minimize the risk of highlighting types of sensitive resources that could be targeted by vandals (e.g., if exclusion areas protecting archaeological sites were marked differently than those protecting sensitive natural resource areas, the sties would be at a higher risk of unauthorized artifact collecting or other disturbances). In extremely sensitive areas identified by the BLM Authorized Officer, the work area limits may be flagged or fenced for protection of the resource from destruction, harassment or pillaging.

I5.2.1 Signage

Signs will be used to help identify TWE Project facilities such as approved access roads and temporary work areas. Signs will be a minimum of 8.5 inches by 11 inches on laminated color paper. Signs will be installed on metal posts and wooden stakes or attached to exclusion fencing/roping as appropriate. Background colors will vary to enhance sign recognition from a distance.

Table I1 provides standards for marking Project features that will be needed during construction. The attachments at the end of this Plan framework show the size and configuration of typical sign layouts. Signs for sensitive resource areas will be oriented for visibility from both directions of likely travel. Table I1 may be updated, changed, or revised in future revisions of this Plan.

TABLE I1 SIGNAGE STANDARDS

FEATURE	FLAGGING OR SIGN COLOR	SIGN TEXT	WHAT TO DO
Project access roads	To be determined by Construction Contractor(s)	Project Access Road – Road No. (e.g., Road 3) – TransWest Express Transmission Project	To be located at points of intersection, additional intermittent flagging may be required. Construction Contractor(s) to verify that right-of-entry has been obtained before marking these areas.
Temporary work areas (structure sites, material yards, etc.)	To be determined by Construction Contractor(s)	Not applicable	Construction Contractor(s) to verify that right-of-entry has been obtained before marking these areas.
Protected animals/plants or sensitive environmental areas.	Yellow	Sensitive Resource Area Keep Out	Avoid these items/areas – do not drive vehicles or equipment near flagging or within flagged areas.
Reclamation project areas	Brown	Restoration in Progress – No Vehicle Traffic Allowed	Avoid these items/areas – do not drive vehicles or equipment near flagging or within flagged areas.
Noxious weed cleaning stations	Blue	Weed Cleaning Station	Signs will be posted at entry points into weed cleaning stations.
Proposed structure locations	To be determined by Construction Contractor(s)	Not applicable	Do not disturb survey stakes.
Structure offsets	To be determined by Construction Contractor(s)	Not applicable	Do not disturb survey stakes.
Outside edge of permitted ROW or centerline	To be determined by Construction Contractor(s)	Not applicable	Do not drive vehicles or equipment outside of designated corridor.

FEATURE	FLAGGING OR SIGN COLOR	SIGN TEXT	WHAT TO DO
Cadastral survey monument	To be determined by Construction Contractor(s)	Not applicable	Protect in place.
Non-authorized access roads	To be determined by Construction Contractor(s)	Do Not Enter Not An Authorized Access Road	Do not drive vehicles or equipment on unauthorized roads.
Existing and Temporary Gates	To be determined by Construction Contractor(s)	Close Gate	Post at appropriate locations along the ROW in coordination with the appropriate land management agency or landowner.

NOTES:

- Staking, flagging and signage will be conducted by the Construction Contractor(s) and verified by the CIC, including sensitive resource areas and exclusion areas.
- Construction Contractor(s) shall stake all proposed tower center hub and footer locations, structure locations and associated reference points and mark the centerline with inter-visible stakes not to exceed 500 feet and at all road crossings.
- Construction Contractor(s) shall use staking intervals appropriate to the conditions observed in the field. For example, areas of rough terrain or dense vegetation may require staking intervals less than 500 feet. In all cases, field staking intervals shall be done at a frequency such that each adjacent stake can be easily discernable.
- Maintain, refurbish and replace staking as necessary over time as conditions require.

I5.2.2 Flagging

Survey flagging (i.e., surveyor's ribbon tied to wooden stakes, metal posts or appropriate vegetation) will be used to delineate the disturbance limits of temporary work areas, access roads, etc., unless existing fencing or other features clearly indicate the limits of the area. Survey flagging may be used to demarcate sensitive resource locations situated a safe distance from planned construction activities but generally will not be used to define resource exclusion areas close to planned construction activities due to concerns about the visibility and stability of flagging during construction.

The BLM and USFS Authorized Officers or CIC, as needed, will determine whether flagging or fencing is the appropriate marking and protection device for a given location. Flagging color will conform to the requirements of Table I1.

I5.2.3 Fencing

To delineate the limits of construction near sensitive resources requiring a high level of protection from Project disturbance, a combination of one or more of the following fencing materials will be installed by the Construction Contractor(s):

- Rope (0.25 inch in diameter colored yellow or orange),
- Plastic or fabric tape; and/or
- Safety fencing (plastic orange or red mesh at least 24 inches wide and at least 18 inches off the ground to facilitate travel by small animals).

Rope with periodic marking by exclusionary signs or lengths of tape is a highly visible and effective exclusion device. Rope, tape, and safety fence will be installed using metal posts for increased durability and in areas with compact or rocky soils. If construction within a wetland is necessary, the boundaries of the approved disturbance areas will be demarcated so impacts are limited to the area authorized. In most cases, it is anticipated the exclusion device will be installed at the boundaries of the sensitive resource (including any required buffers), rather than at the edge of the work area. If a buffer zone encroaches into the work area, only the portions that overlap with the work area will be delineated and signed as an exclusion zone.

I6.0 INSTALLATION, MONITORING, AND MAINTENANCE

The objectives of this Plan are dependent on the proper installation, monitoring, and maintenance of protective devices. The Construction Contractor(s) will be responsible for the installation and maintenance of the field marking of Project features as described above. These markings will be installed in advance of construction activities in the area, maintained during the course of construction (as necessary), and removed after Project cleanup and reclamation activities. Environmental exclusion signs, flags and fencing will be installed by the Construction Contractor(s) in coordination with the CIC and with the assistance of appropriate environmental inspectors and monitors (e.g., botanists, biologists, archaeologists). These environmental exclusions will be installed prior to the start of construction within a Project work area. The CIC will be consulted if there is uncertainty as to the type or location of needed exclusion devices for botanical, wildlife, wetlands, streams or archaeological sites.

Routine Project monitoring by the CIC and Construction Contractor's environmental inspectors and monitors will include an on-going assessment of the need for replacement or repair of exclusionary signs, flagging or fencing. Maintenance needs related to exclusionary devices will either be corrected at the time of observation by the CIC or will be documented as a future maintenance need. If maintenance of an exclusionary device is needed within an active construction area, corrective action will be taken within one workday. Maintenance of signs, flagging and fencing within inactive work areas will be implemented as necessary.

I7.0 DESIGN FEATURES AND BEST MANAGEMENT PRACTICES

In addition to applicable design and operational standards and designation of sensitive ecological areas, the following design features and Best Management Practices (BMPs) have been identified. Note that the Construction, Operation and Maintenance Plan will be a part of the NTP POD.

TWE-10: The area of limits of construction activities will normally be predetermined, with activity restricted to and confined within those limits. No paint or permanent discoloring agents will be applied to rocks or vegetation to indicate survey or construction activity limits.

TWE-15: The NTP POD Plan will include a Clean-up Work Management Plan and a Flagging, Fencing, and Signage Plan. Except for permanent survey markers and material that locate proposed facilities, stakes, pins, rebar, spikes, and other material will be removed from the surface and within the top 15 inches of topsoil as a part of final clean-up. The Applicant will adhere to BLM fencing standards where required. Fences on ROW will be removed where necessary and replaced to the original condition or better when the work is finished. Where existing fences are removed to facilitate the work, temporary fence protection for lands adjacent to the ROW will be provided at all times during the continuation of the Contract. Such temporary fence protection will be adequate to prevent public access to restricted areas. Temporary fencing constructed on the ROW will be removed by the Contractor as part of the clean-up operations prior to final acceptance of the completed work.

TWE-33: Prior to the start of construction, the Applicant will provide training to all Contractor and Subcontractor personnel and others involved in construction activities where/if there is a known occurrence of protected species or habitat in the construction area. Sensitive areas will be considered avoidance areas. Prior to any construction activity, avoidance areas will be marked on the ground and maintained through the duration of the Contract. The Applicant will remove markings during or following final inspection of the Project.

TWE-43: The NTP POD Plan will include a Flagging, Fencing, and Signage Plan. The Applicant will adhere to BLM fencing standards where required. Fences and gates will be repaired or replaced to their original pre-disturbed condition as required by the landowner or the land management agency if they are damaged or destroyed by construction activities. Temporary gates will be installed only with the permission of the landowner or the land management agency, and will be restored to their original pre-disturbed condition following construction. Cattle guards will be installed where new permanent access roads cut through fences, at the request of the land management agency.

Project Access Road Road No.

Sensitive Resource Area

Keep Out

Restoration In Progress – No Vehicle Traffic Allowed

No Refueling Within 100 Feet of Wetlands and Streambanks

Do Not Enter
Not an
Authorized
Access Road

Weed Cleaning Station No.

APPENDIX J
FRAMEWORK GEOTECHNICAL PLAN

TABLE OF CONTENTS

ACRONYMS

4WD	four-wheel drive
Applicant	TransWest Express LLC, also TransWest
BLM	Bureau of Land Management
DEIS	Draft Environmental Impact Statement
gvm	gross vehicle mass
Plan	Geotechnical Plan
POD	Plan of Development
Project	TransWest Express Transmission Project, also TWE Project
psi	pounds per square inch
ROD	Record of Decision
ROW	right-of-way
TransWest	TransWest Express LLC, also Applicant
TWE Project	TransWest Express Transmission Project, also Project
USCS	Unified Soil Classification System

J1.0 INTRODUCTION

This framework Geotechnical Plan (Plan) generally describes the procedures required by TransWest Express LLC (TransWest or Applicant) and its Construction and Geotechnical Contractors to gather geotechnical information to allow for design and construction of the TransWest Express Transmission Project (TWE Project or Project).

J2.0 PLAN PURPOSE

This Plan provides a sequence of events to be utilized by TransWest and its Construction and Geotechnical Contractors to accomplish the necessary geotechnical exploration and sampling to facilitate design of the Project. This Plan is to be implemented after the receipt of the Record of Decision (ROD) and during the final engineering phase of the Project. These measures are intended to provide the required engineering parameters for design while staying within the disturbance limits as defined by the ROD Plan of Development (POD).

The mitigation measure which relates to this Plan is identified in the Draft Environmental Impact Statement (DEIS) as mitigation measure GE-1 which states: in areas with geologic hazards and active mining; placement of Project structures and other Project related disturbance would be avoided to the extent practical. Where avoidance is not possible a site specific geotechnical investigation and engineering design would be implemented during construction and operation of the Project. Depending on the type of potential geologic hazard, the designs may vary and should address specific needs for enhanced structural supports. Site specific assessment of geologic hazards shall include review of available information concerning areas of hazards, and consultation with appropriate government agency personnel who are knowledgeable about the hazards. Assessment also shall include, if necessary, field surveys and gathering of geotechnical information to determine what engineering design methods would mitigate or lessen potential risks. If active mines cannot be avoided, Applicant will conduct similar due diligence in regard to hazards from underground and historic mining to ensure that Project facilities will not hinder access to mineral resources or create dangers to mining activities. The Geotechnical Plan will address this measure as it is further developed.

J3.0 PLAN UPDATES

This Plan will be updated for the ROD POD based on preliminary engineering and design for the selected Agency Preferred Alternative and will include results from the geotechnical desktop study to be completed during the summer of 2014. All geotechnical field activities will be performed following the ROD and all ground disturbing activities associated with geotechnical studies will be contained within the disturbance limits as described in the ROD POD. The final Geotechnical Plan will be prepared by TransWest and its Geotechnical Contractor(s) and approved by the Bureau of Land Management (BLM) or the land management agency as appropriate prior to initiation of any surface disturbing activities. Field surveys for sensitive plant species, Class III cultural resource inventories, and other required resource surveys will be conducted as necessary for the final Geotechnical Plan.

J4.0 TYPICAL PROCEDURES

A geotechnical exploration program may be prepared for the Project. This program will describe specific boring locations, access, landowner/agency notifications, schedule, in-field testing and boring depth requirements. The program may consider borings at every point of interest and at 3 mile maximum spacing along tangents. Points of interest are defined as structures with a line angle greater than 5 degrees, exceptionally long spans, line crossings, potential landslide areas or other areas of geologic instability, or a change in geologic setting. All boring locations will be located within the Project right-of-way (ROW) and will avoid sensitive resources to the maximum extent practicable. The Applicant will consider other investigative techniques for determining the engineering properties of the soil needed for foundation design as is appropriate and practical for the soil conditions and types. Access to each of the drill sites will be considered in selecting geotechnical exploration locations. Locations that can be accessed with existing roads will be chosen when available to avoid even elementary road construction. Some locations will require overland travel (i.e. "drive and crush") from existing access roads.

The drilling equipment needed to perform the drilling and sampling activities will include truck mounted, track mounted or all-terrain drill rigs, water truck, four-wheel drive (4WD) support vehicle including an air compressor, and a 4WD vehicle for the field engineer. The type of rig used will depend on accessibility of boring locations, and practicality of using continuous flight hollow-stem auger, mud rotary, or ODEX drilling techniques to advance the borings. Possible types of drilling equipment are listed below:

- Conventional two-ton or larger truck with a drill rig mounted on the chassis.
- A 30,000 gross vehicle mass (gvm) 6-wheeled truck, about 30 feet long, with or without 4WD capabilities.
- All-terrain vehicle consisting of a similar drilling rig mounted on a lighter framed, shorter vehicle equipped with oversized low-pressure tires. Track mounted drilling rigs use a wide variety of drilling machinery on tracked vehicles with low (about 10 pounds per square inch [psi]) ground pressure.

Soil samples will be collected by driving a sampling device into the undisturbed soils just below the augers. Where necessary, rock core samples will also be taken using a rock coring barrel. Laboratory testing will be conducted on soil/rock samples to define the Unified Soil Classification System (USCS) soil type, strength parameters and corrosion characteristics. Upon completion and before leaving each site, soil borings will be backfilled, securely covered and all cuttings will be removed from the site. No open holes will be left unattended, and all holes will be backfilled to near the ground surface before moving to the next boring.

Boring depth requirements will vary based on structure type and foundation loading. However, an average soil boring depth is anticipated to be 40 feet unless bedrock is encountered, in which case, up to 15 feet of rock core will be accomplished.

APPENDIX K
GREATER SAGE-GROUSE MITIGATION PLAN

DRAFT REPORT:
TransWest Express Transmission Line Project: Greater Sage-grouse Mitigation Plan

All numbers in this draft report are provisional and may be subject to change pending agency review and additional quality checks.

Prepared by:

TRANSWEST EXPRESS LLC

May 2014

Contents

Attachments

Draft Report: Greater Sage-grouse Habitat Equivalency Analysis for the TransWest Express Project, dated May 2014

1. Introduction

This document presents the results of TransWest Express LLC's (TransWest) Habitat Equivalency Analysis (HEA) modeling and a framework for compensatory mitigation for greater sage-grouse (*Centrocercus urophasianus*) potentially impacted by the TransWest Express Transmission Project (TWE Project or Project). Changes to greater sage-grouse policies and guidance, analyses of effects and final TWE Project alignments continue to be developed and refined as the TWE Project is reviewed by the Bureau of Land Management (BLM) and Western Area Power Administration (Western) pursuant to requirements of the National Environmental Policy Act (NEPA). TransWest will consider new information as it becomes available and revise this Mitigation Plan as appropriate.

1.1. TransWest Express Project Overview

The TWE Project is a proposed extra high voltage, direct current (DC) transmission system extending from south-central Wyoming to southern Nevada. The proposed transmission line would cross four states (Wyoming, Colorado, Utah, and Nevada) on lands owned or administered by the BLM, United States Forest Service (USFS), National Park Service (NPS), Bureau of Reclamation (BOR), Utah Reclamation Mitigation and Conservation Commission (URMCC), various state agencies, Native American tribes, municipalities, and private parties. The TWE Project would provide the transmission infrastructure and capacity necessary to deliver cost-effective renewable energy produced in Wyoming to the Desert Southwest region (California, Nevada, Arizona), ultimately helping contribute to a cleaner world, strengthen the electric grid, and provide much-needed electricity to millions of homes and businesses every year. The TWE Project will deliver enough clean, sustainable energy to power nearly 2 million homes and reduce greenhouse-gas emissions equivalent to taking 1.5 million cars from the road.

The ±600 kilovolt (kV) DC transmission line would be approximately 725 to 750 miles in length (depending upon the alternative selected), located within a 250-foot wide right-of-way (ROW). The TWE Project includes ground-disturbing activities associated with the construction of above-ground transmission lines and includes transmission tower locations, access roads, a ground electrode line, a ground electrode site, fly yards, material yards, two AC/DC converter stations (a northern terminal and a southern terminal), pulling/tensioning areas, and work areas. The TWE Project has been sited to avoid and minimize greater sage-grouse (*Centrocercus urophasianus*) lek buffers and occupied habitat. However, complete avoidance is unachievable and portions of the TWE Project cross designated habitat for greater sage-grouse (BLM's Preliminary General Habitat [PGH]) in Wyoming, Colorado, and Utah. As a result, TransWest has coordinated with the BLM, Western Area Power Administration (Western), U.S. Fish and Wildlife Service (USFWS), Wyoming Game and Fish Department (WGFD), and Colorado Parks and Wildlife (CPW), and Utah Division of Wildlife Resources (UDWR) to develop a mitigation strategy to compensate for the unavoidable loss of greater sage-grouse habitat that would potentially occur as a result of the TWE Project construction, operation and maintenance in areas of greater sage-grouse habitat.

1.2. Greater Sage-grouse Habitat

As described in the draft EIS (BLM 2013), greater sage-grouse use a variety of habitats throughout their life cycle. Breeding occurs on strutting grounds, or leks, that are located in flat, sparsely vegetated areas within large tracts of sagebrush (Connelly et al. 2004). Nesting habitat is typically located near active leks in medium to tall sagebrush with a perennial grass understory (Connelly et al. 2000). Studies have shown that taller sagebrush with larger canopies and more understory cover can lead to higher nesting success (Connelly et al. 2004, 2000). Hens and their broods are found in more lush habitats consisting of a high diversity of grasses and forbs that attract insects, such as wet meadows, riparian areas, and irrigated farmland within or near sagebrush. In winter, greater sage-grouse move to south- and west-facing slopes that maintain exposed sagebrush at least 10 to 12 inches above the snow. The quality and quantity of habitat and location within the landscape is key to the long-term survival and success of the greater sage-grouse.

1.3. Greater Sage-grouse Conservation Strategies

In March 2010, the USFWS completed a status review for greater sage-grouse. After reviewing the five listing factors (habitat destruction, overutilization, disease and predation, inadequate regulatory mechanisms, and other natural or manmade factors) under section 4(a)(1) of the Endangered Species Act (ESA), the USFWS concluded that the greater sage-grouse warrants protection under the ESA. However, the USFWS determined that proposing the species for protection was precluded by the need to take action on other species facing more immediate and severe extinction threats. As a result, the greater sage-grouse was added to the list of species that are candidates for ESA protection.

In an effort to prevent federal listing of the greater sage-grouse, Wyoming, Colorado, Utah, and Nevada have developed greater sage-grouse management/conservation plans that outline goals and objectives for managing the species. In addition, the BLM and the State of Wyoming have issued several policies regarding management of the greater sage-grouse in Wyoming. BLM Instruction Memoranda IM) 2010-012, 2012-043, 2012-044, 2012-019, and State of Wyoming Executive Order 2011-5 include specific protection measures guiding development in greater sage-grouse habitat. The BLM is also currently completing resource management plan amendments in Wyoming, Colorado, Utah and Nevada specifically to address management of greater sage-grouse and their habitats on public lands.

1.3.1. BLM Sensitive Species

The principal greater sage-grouse regulatory mechanism for the BLM is conservation measures in Resource Management Plans (RMPs). In 2011, the BLM established the National Greater Sage-Grouse Planning Strategy to evaluate the adequacy of the RMPs and address revisions and amendments throughout the range of the greater sage-grouse. IM 2012-044 provides direction to the BLM for considering conservation measures identified in the Sage-Grouse National Technical Team's *A Report on National Greater Sage-Grouse Conservation Measures* during the RMP revisions that are now underway in accordance with the 2011 National Greater Sage-Grouse Planning Strategy.

1.3.2. Wyoming Greater Sage-grouse Strategy

Wyoming Executive Order 2011-5 (preceded by Executive Orders 2008-8 and 2010-4) designated certain portions of Wyoming where viable greater sage-grouse populations are to be maintained at current levels, as core greater sage-grouse areas. The WGFD has developed a map of greater sage-grouse core population areas in Wyoming. The core areas contain important seasonal habitats and more than 80% of the state's greater sage-grouse population. Executive Order 2011-5 also identified corridors through several of Wyoming's core areas where large energy transmission projects were directed to be sited to minimize impacts to greater sage-grouse. Generally, these transmission corridors were identified adjacent to previous disturbed corridors (highways, railroads, pipelines, transmission lines, etc.). The TWE Project is located in one such corridor that follows Interstate Highway 80.

The Wyoming Greater Sage-grouse Conservation Plan (Wyoming Sage-Grouse Working Group 2003) established the framework for local working groups to guide management efforts directed at halting long-term population declines and maintaining and improving greater sage-grouse habitats in Wyoming. The TWE Project falls within the South Central Wyoming Sage-grouse Conservation Plan (SC Working Group 2007) and Southwest Wyoming Local Sage-grouse Working Group.

1.3.3. Colorado Greater Sage-grouse Strategy

CPW developed a comprehensive Colorado Greater Sage-Grouse Conservation Plan (2008) with a conservation strategy that identifies key issues facing greater sage-grouse conservation. For each issue, objectives were developed to help mitigate the issue; for each of these objectives, a number of specific strategies are described. The plan provides a statewide perspective to help ensure the long-term survival of greater sage-grouse and supplements local working groups. The TWE Project crosses land within the Northwest Colorado Greater Sage-grouse Conservation Plan (NWCGSGWG 2008).

1.3.4. Utah Greater Sage-grouse Strategy

The Conservation Plan for Greater Sage-grouse in Utah (UDWR 2013) is designed to eliminate the threats facing greater sage-grouse while balancing the economic and social needs of the residents of Utah through coordination with local, state, and federal agencies, and local area working groups. The Plan states that transmission lines should be sited in existing corridors, or at a minimum, in concert with existing linear features in greater sage-grouse habitat and the direct effects of construction should be mitigated.

1.3.5. Nevada Greater Sage-grouse Strategy

The TWE Project does not cross any greater sage-grouse habitat in Nevada.

1.4. Mitigation Purpose

The Draft Environmental Impact Statement for the TWE Project prepared by the BLM and Western (DEIS) (BLM 2013) analyzed potential impacts to greater sage-grouse from construction, operation and maintenance of the TWE Project. Known impacts would include direct mortality, permanent and temporary habitat loss, habitat fragmentation, and temporary displacement due to noise and human activity. The purpose of the TransWest mitigation strategy is to compensate for known and quantifiable direct and indirect impacts to greater sage-grouse habitat that may occur as a result of the TWE Project construction, operation and maintenance.

Mitigation includes (a) avoiding the impact altogether; (b) minimizing impacts by limiting the degree or magnitude of the action; (c) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (d) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and (e) compensating for the impact by replacing or providing substitute resources or environments. This definition is consistent with National Environmental Policy Act (NEPA) regulations (40 CFR Part 1508.20(a-e)), USFWS Mitigation Policy (January 23, 1981 Federal Register, pp 7644-7663), and Wyoming Game and Fish Commission Mitigation Policy No. VII H.

In response to Secretarial Order Number 3330 entitled "Improving Mitigation Policies and Practices of the Department of the Interior," issued by the Secretary of the Interior Sally Jewel in October 2013, *"A Strategy for Improving Mitigation Policies and Practices of The Department of the Interior"* was released in April 2014 (Strategy). The Strategy highlights the challenges and opportunities associated with developing and implementing an effective mitigation policy, and describes the key principles and actions necessary to successfully shift from project-by-project management to consistent, landscape-scale, science-based management of the land and resources for which the Department is responsible. The Strategy concludes that taking a landscape-scale approach to mitigation can meet the Department's needs of accommodating both infrastructure development and conservation while improving permitting efficiencies, reducing conflicts, and better achieving development and conservation goals.

TransWest's greater sage-grouse mitigation plan is consistent with the Strategy by utilizing a landscape-scale, science-based approach to avoid, minimize and compensate for potential impacts to greater sage-grouse that may result from development of the TWE Project.

2. Mitigation Strategy

The mitigation strategy will generally adhere to the following principles:

- BLM-identified spatial and temporal mitigation measures will be used to lessen the impacts to extent practicable.
- Greater sage-grouse habitat quality and quantity varies across the landscape. To ensure that habitat variability is fully captured, a quantitative habitat metric (i.e., the HEA) will be used to measure the potential loss of habitat that would result from construction, operation and maintenance of the TWE Project within currently occupied greater sage-grouse habitat.
- When possible, greater sage-grouse habitat that is directly lost or impacted during construction would be compensated for by replacing or enhancing habitats of similar quality and size. Mitigation siting would occur in the nearest suitable location in an effort to provide the greatest benefit to the local greater sage-grouse population being impacted by TWE Project construction, operation and maintenance.
- When possible, multiple mitigation measures will be coupled to maximize the benefit to greater sage-grouse populations.

- A maintenance and monitoring approach will be identified for each mitigation measure type.

2.1. Mitigation Guidance

2.1.1. BLM Mitigation Policy

The mitigation approach TransWest will implement for the TWE Project will follow the guidance provided by BLM IMs IM 2013-142, 2012-043, and 2012-044 and Department of Interior Secretarial Order 3330 (Order 3330). Collectively, these provide guidance for greater sage-grouse habitat management and mitigation for pending transmission rights-of-way in Preliminary Priority Habitat (PPH) and Preliminary General Habitat (PGH). These policies state that transmission rights-of-ways having disturbances greater than 1 linear mile or 2 acres require cooperation between the BLM, project proponents, and other appropriate agencies to develop and consider implementation of appropriate regional mitigation to avoid or minimize habitat and population-level effects to greater sage-grouse.

Under these policies, offsite and onsite mitigation can include in-kind or out-of-kind mitigation. In-kind is defined as the replacement or substitution of resources that are of the same type and kind of those being impacted. Out-of-kind is defined as replacement or substitutions of resources that while related are of equal or greater overall value to public lands. IM 2013-142 also identifies that the BLM may accept monetary contributions, how they may be used, and that mitigation may be conducted on non-Federal lands.

2.1.2. Framework for Sage-grouse Impacts Analysis for Interstate Transmission Lines

The BLM, working in concert with the USFWS, has developed a *Framework for Sage-grouse Impacts Analysis for the TransWest Express Transmission Project* (Framework). The Framework addresses TWE Project-related impacts to greater sage-grouse habitat that bear directly on listing factors considered by the USFWS when evaluating the need to provide full listing protection under the ESA. The Framework specifies the use of HEA to scale mitigation and compensate for the loss of habitat services over the life of the TWE Project. HEA is a science-based, peer-reviewed method of scaling compensatory mitigation requirements to potential TWE Project-related effects, measured as a loss of habitat services from pre-disturbance conditions (Allen et al. 2005; Dunford et al. 2004; King 1997; Kohler and Dodge 2006; National Oceanic and Atmospheric Administration 2006, 2009). Habitat services include those ecosystem features (i.e., physical site-specific characteristics of an ecosystem) and ecosystem functions (i.e., biophysical processes that occur within an ecosystem) that support wildlife and human populations (King 1997).

In compliance with IM 2012-43, IM 2013-142, Order 3330, and the Framework, TransWest has completed an HEA to determine the amount of compensatory mitigation necessary to offset potential impacts to greater sage-grouse resulting from the construction, operation, and maintenance of the TWE Project. The HEA produced an estimate of the permanent and interim potential loss of greater sage-grouse habitat services as a result of vegetation loss, noise, and human presence anticipated with TWE Project construction and operation. The HEA also modeled mitigation measures that may be implemented to offset the potential lost habitat services.

2.1.3. U.S. Fish and Wildlife Service Mitigation Recommendations

The USFWS Wyoming Ecological Services Office has provided recommendations regarding the development and implementation of a mitigation plan to address TWE Project impacts on greater sage-grouse and its habitat. Per these recommendations, TransWest will:

- Using results of the HEA, TransWest will allocate how much will be spent on mitigation in terms of specific actions or mitigation projects proposed for implementation. The selected mitigation project mix will be described providing a general breakdown regarding the amount of money going toward conservation easements, habitat enhancement projects, fence marking, etc.
- Focus the majority of mitigation on conservation of habitat, specifically on mitigation projects that protect habitat, enhance or maintain quality of habitat, and reduce fragmentation. Components of habitat conservation include preservation through easements, enhancements (such as juniper removal), and reclamation/restoration. These habitat conservation projects may then be supplemented by a smaller portion of mitigation projects such as fence-marking, focused research in designated areas following specific guidelines, improvement of mesic habitats important for brood-rearing and summer use, or others.
- Implement mitigation in a collaborative manner by working with members of an "Oversight Committee" composed of biologists working for BLM, Western, USFWS, WGFD, CPW, and UDWR. The role of this team is to provide guidance and biological advice concerning the accomplishment of successful mitigation on the ground.

Additionally, the USFWS provided specific recommendations to ensure successful completion of mitigation projects that contribute to greater sage-grouse habitat conservation. Within these recommendations, the USFWS emphasizes the need to consider each mitigation site individually and provide a clear justification regarding the value of the mitigation measure at that site.

2.2. Mitigation Siting Prioritization

Mitigation projects will be sited in the same state where the impact occurred and in a manner consistent with the priorities identified in the BLM's IM 2013-142 and Order 3330. As a baseline, mitigation project location will be prioritized according to following hierarchy to the extent practicable:

1. Mitigation will be located in Core Areas/Preliminary Priority Habitats that are intersected by the TWE Project or areas where habitat connectivity may be restored (i.e., local offsite mitigation),
2. Mitigation will be located within 18 kilometer (km) (11.2 mile [mi]) of the transmission line (i.e., onsite as defined in the DEIS) to benefit the impacted greater sage-grouse populations and their habitat.
3. Mitigation will be located within the region (e.g., Western Association of Fish and Wildlife Agencies' management zones) to benefit greater sage-grouse (i.e., regional offsite mitigation), particularly when onsite or nearby offsite mitigation is deemed to offer less benefit to impacted greater sage-grouse populations or their habitat than regional mitigation.

TransWest shall consider the above hierarchy and emphasize mitigation that benefits the populations that are impacted within each state; however, mitigation projects may be located elsewhere if the

Oversight Committee (see Section 2.4) identifies specific opportunities that will provide a greater benefit to greater sage-grouse than those in the impacted area.

2.3. Mitigation Schedule

Mitigation for the TWE Project is tied to the issuance of the BLM right-of-way grant or a specific notice-to-proceed. Mitigation funds would not be available for implementation until the right-of-way grant is issued or a specific notice-to-proceed for construction is issued although planning activities may take place earlier.

2.4. Oversight Committee

As described in the USFWS recommendations, an Oversight Committee consisting of agency biologists and other stakeholders/advisors, would be created to provide guidance on the mitigation approach for the TWE Project. As necessary, both local and landscape level perspectives would be represented on the Oversight Committee by involving local greater sage-grouse working groups, or other experts in the fields of mitigation, greater sage-grouse ecology, or other needed discipline. Committee member should have familiarity with the TWE Project area so that they can provide guidance on selection of mitigation locations. Committee participation may also be dependent upon the state in which the impact and mitigation occurs.

Primary objectives of the Oversight Committee would include recommendations for selection of mitigation projects, validation of the success of mitigation projects and their effectiveness at the local or landscape level, oversight of mitigation implementation, identification of alternate mitigation projects and strategies, and review of mitigation monitoring results. A selected committee member/entity would be responsible for facilitating communications among Oversight Committee members and would schedule necessary review meetings to discuss mitigation projects and monitoring results. The roles and responsibilities of Oversight Committee members will vary by mitigation project type and location. Once final mitigation projects are identified, participants, roles and responsibilities within the Oversight Committee will be determined and assigned.

2.5. Changes to the Plan

Changes to greater sage-grouse policies and guidance may be issued during the TWE Project ROW application review process. TransWest will consider new information as it becomes available and revise the Mitigation Plan as appropriate.

3. Types of Impacts to Greater Sage-grouse

TransWest's mitigation strategy is to compensate for known impacts to greater sage-grouse habitat that may occur as a result of TWE Project construction, operation and maintenance. Known and quantifiable impacts were modeled with a HEA.

3.1. HEA Modeled Impacts

The HEA for the TWE Project was completed using best-available scientific information regarding the primary indicators of quality greater sage-grouse habitat and the known anthropogenic impacts to that habitat. The Draft Report for the HEA completed for the TWE Project is attached to this mitigation plan. Regulatory and resource agency staff, Non-Governmental Organizations (NGOs), and researchers generally agree on the potential direct impacts to greater sage-grouse and its habitat, and how to quantify these known impacts for the TWE Project. Direct loss of habitat resulting from ground-disturbing activities, construction related traffic and noise, and habitat loss associated with the footprint of the physical structures are the known potential impacts that can be accounted for in the HEA model. Compensatory mitigation, which may include mitigation projects undertaken by TransWest or in-lieu fees, will be applied to these potential direct impacts to ensure that there is no net loss of modeled habitat services as a result of TWE Project construction, operation and maintenance.

The total habitat service losses anticipated with the TWE Project construction, operation, and maintenance are provided in Table 1. Discounted service-acre-years (DSAYs) is the currency used by HEAs. The anticipated habitat service gains to be created with mitigation projects are also measured in DSAYs. Within the, the modeled impacts of the TWE project are considered to be fully offset when the DSAYs produced by the proposed mitigation project mix equal or exceed 3,733,029 DSAYs (the Total Habitat Services Lost from Table 1).

Table 1. Habitat Services Lost in the Analysis Area Over the Lifetime of the TWE Project (Modeled Years 1–104*).

State	Permanent Disturbances Modeled	Habitat Services in the Assessment Area at Baseline Condition (DSAYs over lifetime of the TWE Project assuming no development)	Habitat Services Lost in the Assessment Area (DSAYs lost over lifetime of the TWE Project)
Wyoming	AC/DC converter station and transmission tower pads	102,603,325	1,101,889
Colorado	transmission tower pads	71,739,071	1,374,208
Utah	transmission tower pads	73,696,032	1,256,932
Total	AC/DC converter station and transmission tower pads	248,038,428	3,733,029

* For the purposes of this analysis, the TWE Project lifetime is defined as the period between the TWE Project initiation and full recovery of vegetation. There are three years of construction and a year of reclamation, which is followed by a period of vegetation recovery. To be conservative, it was assumed that sagebrush will take 100 years to recover its full habitat service level after reclamation.

3.2. Other Potential Impacts

The HEA captures direct disturbances from the TWE Project construction, operation, and maintenance, and the indirect disturbance from noise and human presence during the years of construction. The effects of operating transmission lines on greater sage-grouse have not been established, are poorly understood, and require more research (Utah Wildlife in Need Cooperative [UWIN] 2010a, 2010b).

Literature, agency personnel, and the USFWS have identified the following potential impacts of transmission lines:

- Introduction and spread of invasive plant species in habitat;
- Collision and electrocution hazards;
- Decreased lek attendance near transmission corridors;
- Habitat fragmentation and habitat loss caused by behavioral avoidance of transmission corridors;
- Increased public access and associated impacts (e.g., noise, trash); and
- Increased predation by raptors and corvids due to the presence of transmission structures.

The HEA does not model indirect disturbance caused by the transmission line after construction is complete because insufficient information is available to characterize and quantify these effects. No "peer-reviewed" manuscripts have reported results from experimental studies that document greater sage-grouse avoidance of tall structures, increased predation related to avian predators using tall structures as perches, increased mortality attributed to collisions, or habitat degradation and/or fragmentation attributed to tall structures (UWIN 2010). Steenhof et al. 1993 and Lammers and Collopy 2007 provide substantial evidence on the use of transmission lines for nesting raptors and the effectiveness (or lack thereof) of perch deterrents, respectively; however, they provide very little insight on effects of transmission lines on greater sage-grouse. Lammers and Collopy (2007) discuss that perch deterrents did not have an effect on the observed number of greater sage-grouse predators and sagebrush conservation may better serve greater sage-grouse populations. Furthermore, ongoing research performed by Dr. James Sedinger of the University of Nevada – Reno and his colleagues, studying the Falcon to Gondor transmission line in eastern Nevada, has resulted in over ten years of data indicating that impacts to greater sage-grouse are more attributed to natural predation, wildfire impacts-habitat impacts from cheatgrass invasion, habitat fragmentation, and fitness of females (Nonne et al. 2013). The presence of the power line itself does not directly or indirectly result in increased mortality or a reduction in overall breeding success (Nonne et al 2013).

TransWest has addressed these potential impacts through adherence to the BLM spatial and timing stipulations identified in the DEIS as well as the development of effective reclamation and maintenance procedures, efficient and timely construction, environmental protection measures, traffic and access management, and avoidance of leks as discussed in Section 4.3.

4. Mitigation Measures

4.1. Avoidance and Minimization

TransWest has avoided and minimized both direct and indirect potential impacts to greater sage-grouse to the maximum extent practicable through the routing and siting process, adhering to buffers, and utilizing existing corridors and establishing environmental protection measures (EPMs) for construction, operation and maintenance activities. During the routing and siting process, TransWest has identified and will adhere to the appropriate spatial and timing stipulations surrounding leks and other greater sage-grouse habitat to the extent practicable. TransWest has also worked with state and federal agencies, local governments, and local working groups and NGOs to avoid and minimize impacts to greater sage-grouse habitats.

To minimize potential direct and indirect impacts, the transmission line and ancillary facilities were located following existing linear corridors (e.g., other transmission lines, pipelines, roads, designated west-wide energy corridor) where possible. For instance, in Colorado TransWest's proposed action is to co-locate with the existing Craig-Bonanza 345 kV transmission line. In Utah, TransWest's proposed action is to co-locate with the existing Mona-Bonanza 345 kV transmission line. Co-location with existing transmission lines would minimize potential incremental impacts.

4.1.1. Environmental protection measures

The TWE Project includes EPMs to maintain environmental quality during construction, operation, and maintenance activities. Implementation of the EPMs will help TransWest to avoid and/or minimize impacts to greater sage-grouse and its habitat. The EPMs are listed the following appendices to the Preliminary Plan of Development (May 2014):

Avian Protection Plan, addresses measures to minimize risk to avian species, including greater sage-grouse, during construction and operation of the TWE Project. The Avian Protection Plan follows the guidance of the Avian Power Line Interaction Committee (APLIC).

Traffic and Transportation Plan, includes measures that limit roads to the minimum distance and width necessary for construction and operation of the transmission line, limit non-approved use and introduction of weeds by unauthorized vehicles, and control dust from roads and other surface disturbances. These measures minimize the potential for direct mortality of greater sage-grouse by vehicles, substantially reduce the potential for degradation of greater sage-grouse habitat from weeds and dust.

Fire Prevention Plan, addresses fire preventative measures to minimize fire risk during construction of the TWE Project.

Reclamation Plan, includes measures to reduce the impact of construction on greater sage-grouse habitat by re-establishing vegetation and reducing habitat degradation, including the use of seed mixes compatible with greater sage-grouse habitat and monitoring to ensure successful reclamation.

Noxious Weed Plan, includes measures to prevent the introduction or transport of noxious or invasive weeds and control thereof, thus reducing potential habitat degradation.

Stormwater Pollution Prevention Plan, includes measures to reduce erosion and sedimentation, thus reducing potential habitat degradation both on and off-site.

Spill Prevention, Containment, and Countermeasures Plan, includes measures that reduce the chance of contamination from spills affecting habitat adjacent to the construction area.

Dust Control and Air Quality Plan, includes measures to minimize fugitive dust and air quality impacts that could affect greater sage-grouse habitat.

Operation and Maintenance Plan, includes measures to avoid and minimize potential impacts during operation and maintenance.

4.2. HEA Modeled Mitigation

The avoidance and minimization measures discussed above substantially avoid known impacts to greater sage-grouse and minimize impact to their habitat. However, even with these measures in place, there are unavoidable potential impacts to habitat from the construction and operation of the TWE Project.

The HEA quantified the long-term and interim loss of habitat services (measured in DSAYs) resulting from unavoidable potential impacts (Table 1). The HEA used the same habitat services metric to quantify the habitat services to be gained by implementing habitat improvement measures selected by the interagency HEA Technical Advisory Team (See Table 2 in the Draft HEA Report, Attached). These measures include fence marking and removal, sagebrush restoration and enhancement, juniper removal, and purchase of conservation easements. The estimated DSAYs returned per one acre or one mile of each mitigation measure is provided in Table 2. The analysis also produced a cost per DSAY gained for each habitat improvement measure based on the average cost of mitigation project implementation (See Tables 6 and 8 in the Draft HEA Report, Attached).

Table 2. Mean Discounted Service-Acre-Years Gained for Each Mitigation Measure Modeled in the HEA.

Conservation Measure	General Method	Mean Habitat Services Gained (present value service-acre-years per unit)
Fence removal and marking with flight diverters*	Fence marking within 3 km of leks and in other high risk areas (e.g., winter concentration areas, movement corridors)	3,597 per mile of fence marked
	Fence removal within 3 km of leks and in other high risk areas	3,597 per mile of fence removed
Sagebrush restoration and improvement projects	Seeding sagebrush and bunchgrass understory	1,751 per acre of disturbance treated
	Transplanting containerized sagebrush stems and seeding bunchgrass understory	4,556 per acre of disturbance treated
	Planting seedlings and seeding bunchgrass understory	1,935 per acre of disturbance treated
Juniper/conifer removal	Lop and scatter Phase I† juniper	480 per acre treated
	Cut-pile-cover or mastication of Phase II[2] juniper	328 per acre treated
	Mastication of Phase III† juniper and seeding bunchgrass understory	197 per acre treated
Conservation easements	Land purchase (baseline value service credit) applying the annual maintenance and monitoring fee to every 5,000 acres of easement.	650 per acre purchased§

* Although fence removal is more effective at removing the threat of sage-grouse collision than fence marking, both measures were modeled as having the same benefit due to a limitation in the model.

† Phases of juniper describe the dominance of this vegetation on the landscape. Phase I is a sagebrush-dominated landscape with scattered juniper, Phase II is a landscape comprising a 50:50 mixture of sagebrush and juniper, and Phase III is a landscape dominated by juniper.

§Estimated using the average habitat services value per acre in the Assessment Area, because no specific easements have been proposed.

A mitigation package will be developed that describes a mitigation project mix that will produce a net balance of habitat services over the lifetime of the TWE Project. The mitigation package will consist of conservation easements (at 100% baseline habitat service level credit), sagebrush restoration and enhancement (including juniper removal), fence marking and removal, and other mitigation projects not modeled in the HEA where justified (e.g., understory seeding and enhancement of mesic habitats).

4.2.1. Mitigation Project Types

Descriptions of the mitigation project types modeled in the HEA are provided below. These mitigation projects are consistent with recommendations provided by the USFWS. TransWest is not limited to these mitigation project types for mitigation credit.

Fence Marking and Removal

Based on Christiansen (2009) it has been demonstrated that each mile of fence within 2 miles of leks kills up to 53 greater sage-grouse per year. This threat can be eliminated by removing fences or significantly reduced by increasing the visibility of fences. Christiansen (2009) estimated a 70% reduction in mortalities could be expected along marked sections of fence. Stevens (2011) similarly predicted that marking fences with vinyl reflectors (flight diverters) reduced collision rates by up to 74%.

To eliminate the threat of collisions, fences would be removed or marked with flight diverters similar to those used in the Christiansen (2009), Wolfe (2007), and Stevens (2011) studies to increase fence visibility to greater sage-grouse. Fences will be removed where possible. Where removal is not possible, two flight diverters would be installed between each fence span (4 m post-to-post). Priority areas for fence removal and marking would be:

- Sections of fence known to cause greater sage-grouse collisions,
- Fences within 2 km (1.2 mi) of leks (Braun 2006; Stevens 2011) or other high risk area,
- Fences in areas with low slope and terrain ruggedness (Stevens 2011), and
- Fence segments bounded by steel t-posts with spans greater than 4 m (Stevens 2011).

Once fences have been removed or marked, local annual mortality due to fence collisions will be substantially reduced. This mitigation project type will be used on a limited site-specific basis per recommendations from the USFWS. As described in Section 2.2, all mitigation projects will be sited in the same state where the impact occurred and in a manner consistent with the priorities identified in the BLM's IM 2013-142 and Order 3330.

The HEA calculated that 3,597 service-acre-years would be created for every mile of fence marked (with annual maintenance) or fence removed over the lifetime of the TWE Project.

Sagebrush Restoration and Enhancement

Sagebrush restoration and enhancement creates new habitat for greater sage-grouse and can be used to create corridors between existing sagebrush patches to produce contiguous habitat. Habitat for greater sage-grouse consists of a mosaic of plant communities dominated by sagebrush and a diverse grass and forb understory. This conservation measure increases the quality and quantity of habitat within the landscape, contributing to the long-term survival and success of the greater sage-grouse.

New habitat for greater sage-grouse will be created by establishing sagebrush and understory grasses and forbs in disturbed areas (e.g., roads, unreclaimed pipeline corridors, well pads, burned areas). These mitigation areas are in pre-existing areas of surface disturbance, not areas disturbed by the TWE Project. Vegetation disturbance from the TWE Project will be restored as described in the Plan of Development. All mitigation projects will be sited in the same state where the impact occurred and in a manner consistent with the priorities identified in the BLM's IM 2013-142 and Order 3330. Where possible, mitigation projects will be placed strategically to decrease habitat fragmentation by connecting existing habitats. All treatments will have monitoring plans and funding to conduct monitoring until the treatment is determined to be successful.

Sagebrush can be seeded, planted as seedlings, or transplanted (i.e., containerized stems). Because seeded sagebrush can take several decades to grow to a size that provides habitat for greater sage-grouse, the HEA determined that planting containerized stems can be the most economical and successful option in many cases. Sagebrush restoration and enhancement projects will include understory (grass and forb) treatments.

The value of sagebrush restoration depends on the method used; methods that result in faster plant establishment have higher value. For every acre of disturbance planted with sagebrush seedlings and seeded with bunchgrass, 1,935 service-acre-years would be created. For every acre of disturbance planted with containerized sagebrush stems and seeded with bunchgrass, 4,556 service-acre-years would be created.

Juniper Removal

Fire suppression and other post-settlement conditions have allowed western juniper to spread into areas previously dominated by grasses, forbs, and shrubs. Many areas have experienced an estimated 10-fold increase in juniper over the last 130 years (Miller et al. 2005). The expansion of juniper and other conifer species reduces habitat for greater sage-grouse and other sagebrush obligate species that depend on large patches of sagebrush-dominated vegetation. Sagebrush cover decreases with juniper encroachment as the vegetation transitions into woodland.

Most juniper communities are still in a state of transition. Miller et al. (2005) characterized three stages of woodland succession:

- Phase I (early) – trees are present but shrubs and herbs are the dominant vegetation that influence ecological processes (hydrologic, nutrient, and energy cycles) on the site;
- Phase II (mid) – trees are codominant with shrubs and herbs and all three vegetation layers influence ecological processes on the site;
- Phase III (late) – trees are the dominant vegetation and the primary plant layer influencing ecological processes on the site.

Sites in Phase I or II successional stages often retain a significant understory of grasses and forbs, so removal of Phase I or II can produce immediate habitat benefits for greater sage-grouse (NRCS 2010; USFWS recommendations). Therefore juniper/conifer removal projects used for mitigation will focus primarily on areas in the early to mid stages of succession (i.e., Phase I or Phase II) with no cheatgrass component. Removal of juniper/conifer will be done by mechanical means without the use of fire or chemicals. Phase I juniper/conifer will be treated by having a field crew walk from tree-to-tree, cutting them into pieces and scattering them on-site (lop and scatter). Phase II juniper/conifer will be treated by using a masticator, a large mechanical device that goes from tree-to-tree and demolishes the tree with whirling blades; debris is then left on site (mastication).

All juniper/conifer removal projects will include understory treatment, where needed, and vegetation monitoring until the understory vegetation is established. Locations of removal projects will be selected with guidance from the Oversight Committee so that each treatment site provides value to the local greater sage-grouse population. Mitigation projects will be located in the same state where the impact occurred and in a manner consistent with the priorities identified in the BLM's IM 2013-142 and Order 3330 (Section 2.2).

The value of juniper/conifer removal in the HEA depended on the density of juniper removed (i.e., Phase I, Phase II, or Phase III juniper). The HEA calculated that 480 service-acre-years are created for every acre of Phase I juniper removed, 328 service-acre-years for every acre of Phase II juniper removed, and 197 service-acre-years for every acre of Phase III juniper removed with understory seeding over the lifetime of the TWE Project.

Bunchgrass and Forb Seeding

Bunchgrasses, as opposed to rhizomatous grasses, are recognized as an important component of greater sage-grouse nesting and brood-rearing habitats (Connelly et al. 2000; Crawford et al. 2004). The structure and abundance of bunchgrasses influence the quality of a site for nesting greater sage-grouse. Tall, dense, residual grass in nesting habitat improves hatching success by providing cover for incubating females (Cagney et al. 2010). Herbaceous cover may provide scent, visual, and physical barriers to potential predators (DeLong et al. 1995, as cited in Connelly et al. 2000). In addition to providing cover from predators, forbs are an important food source for greater sage-grouse broods.

Greater sage-grouse nesting and brood-rearing habitat will be improved by seeding native bunchgrasses and forbs into existing sagebrush stands or into adjacent disturbance. Understory seeding project sites will be selected in coordination with the Oversight Committee to maximize the benefit of these mitigation projects for greater sage-grouse. Objectives for these mitigation projects and criteria for success will be developed in coordination with the Oversight Committee.

While not captured in the TransWest HEA because of lack of available data, using results from other similar HEA models that contained bunchgrass variables, including the model for the Energy Gateway West transmission project, overseeding bunchgrass in 1-acre of sagebrush habitat is approximately 5% of the services returned by removing 1-acre of Phase I juniper. As a result, it is estimated 24 service-acre-years would be returned for each acre of overseeding. A greater number of service-acre-years are created when areas of disturbance (i.e., no vegetation) are seeded with bunchgrass. Using results from other similar HEA models indicates that overseeding bunchgrass in 1-acre of disturbed habitat is equivalent to approximately 25% of the services returned by removing 1-acre of Phase I juniper. As a result, it is estimated 120 service-acre-years would be returned for each acre of seeding in disturbed areas over the life of the TWE Project.

Conservation Easements

Conservation easements may be purchased and managed to remove or reduce threats to greater sage-grouse. The purchase of easements can prevent future greater sage-grouse habitat destruction or degradation near urban areas or other industrial developments.

Conservation easements purchased for mitigation would focus on areas or locations that demonstrate the highest need for protection and potential for reducing habitat fragmentation. Conservation easements would be purchased and managed in coordination with the Oversight Committee. Specific locations of conservation easements would depend on availability of easements for purchase, but would generally follow the priorities identified in the BLM’s IM 2013-142 and Order 3330.

The HEA calculated that, on average, 650 service-acre-years would be created per acre of conservation easement purchased, assuming the easement is maintained over the life of the TWE Project. Greater credit could be possible if the easement was maintained in perpetuity. This total does not include the value of any subsequent habitat improvements to the property and assumes the proponent receives 100% credit for the baseline habitat-service level of the property.

4.2.2. Specific Mitigation Projects

In the final mitigation plan, TransWest will include viable mitigation projects/opportunities which meet mitigation goals and strategy. Specific mitigation projects will be selected in coordination with the Oversight Committee following the recommendations and guidelines provided by the states, BLM, Western, and USFWS. Mitigation projects may be located on either public or private land. Although only five mitigation measures are modeled, TransWest is not bound to only those project types. If other project types are recognized by the Oversight Committee as providing greater sage-grouse population or habitat benefits similar to those modeled in the HEA, then these mitigation projects may be included in future updates of this Plan.

Potential mitigation sites would be evaluated to determine their current state, the type of mitigation that would be most beneficial, and the potential for that mitigation project to meet the success criteria defined by the Oversight Committee. Mitigation projects that confer the greatest potential benefit to greater sage-grouse and have a high probability of success will be given priority.

4.2.3. In-lieu fees

For all or a portion of the compensatory mitigation, TransWest may employ an in-lieu fee approach that considers the cost of purchasing or implementing a mitigation project and monitoring and managing that project over the life of the TWE Project. TransWest may pay mitigation fees into accounts that will fund mitigation projects that benefit greater sage-grouse and their habitats. Refer to Section 2.2 for general/minimum criteria for selection of mitigation projects that would utilize in-lieu fees. TransWest will work with the Oversight Committee to identify the appropriate organizations to receive and manage in-lieu fees in each state, as well as to set standards for the mitigation projects funded by those fees.

Mitigation may include programs that are currently being pursued by other entities where there is opportunity for TransWest to provide financial support. Support of such identified mitigation projects would be in the form of direct funding or in-lieu fees to assist the entity proposing the mitigation project with implementation. The balance of the mitigation dollars owed (the total dollar cost estimated by the HEA minus the costs of the specific mitigation projects) may be provided through in-lieu fees.

In Wyoming, the Wyoming Wildlife and Natural Resource Trust (WWNRT) has been identified as a potential organization that could receive and manage in-lieu fees for the TWE Project. The WWNRT is an independent state agency governed by a nine-member citizen board appointed by the Governor and works closely with the WGFD and Wyoming state government.

4.2.4. Monitoring and maintenance

Monitoring the success of mitigation measures and maintaining each measure to ensure continued success are important elements the mitigation strategy. TransWest and the Oversight Committee will identify a monitoring and maintenance approach for each mitigation project or project type in the mitigation package. Each mitigation project will require a monitoring and mitigation facilitator role that could be filled by agencies, private landowners, NGOs, environmental or reclamation contractors, or TransWest.

The final monitoring and maintenance approach for each mitigation project will be formalized in a monitoring and maintenance strategy that will be reviewed by the Oversight Committee annually, or as necessary. The duration of monitoring may vary for each mitigation project type. The strategy will also include success criteria for each mitigation project, such as:

- Measurable increase in desired vegetation structure and composition in a restoration area when compared to a suitable control area
- Adherence to conservation easement contract terms
- Removal of stated acreage of encroaching juniper stands

5. Conclusion

Reliable, cost-effective electricity is a basic necessity for Americans' quality of life and for the health and prosperity of American industry. The TWE Project not only will ensure delivery of a vital renewable wind-energy resource for a growing America but also will create jobs, support environmental protection, enhance tax revenues, and further strengthen the nation's energy foundation for the future. TransWest is committed to developing the TWE Project in an environmentally responsible manner using best available science and best management practices from the electric transmission industry. TransWest's greater sage-grouse mitigation plan is consistent with Order 3330 and *"A Strategy for Improving Mitigation Policies and Practices of The Department of the Interior"* by utilizing a landscape-scale, science-based approach to avoid, minimize and compensate for potential impacts to greater sage-grouse that may result from development of the TWE Project.

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ATTACHMENT

DRAFT REPORT: Greater Sage-grouse Habitat Equivalency Analysis for the TransWest Express Project

All numbers in this draft report are provisional and may be subject to change pending agency review and additional quality checks.

Prepared by:

TRANSWEST EXPRESS LLC

May 2014

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TransWest Express LLC's (TransWest) **TransWest Express Project** (TWE Project) is a proposed extra high voltage, direct current (DC) transmission system extending from south-central Wyoming to southern Nevada. The proposed transmission line would cross four states (Wyoming, Colorado, Utah, and Nevada) on lands owned or administered by the BLM, United States Forest Service (USFS), National Park Service (NPS), Bureau of Reclamation (BOR), Utah Reclamation Mitigation and Conservation Commission (URMCC), various state agencies, Native American tribes, municipalities, and private parties. The TWE Project would provide the transmission infrastructure and capacity necessary to deliver cost-effective renewable energy produced in Wyoming to the Desert Southwest region (California, Nevada, Arizona), ultimately helping contribute to a cleaner world, strengthen the electric grid, and provide much-needed electricity to millions of homes and businesses every year. The TWE Project will deliver enough clean, sustainable energy to power nearly 2 million homes and reduce greenhouse-gas emissions equivalent to taking 1.5 million cars from the road.

The ±600 kilovolt (kV) DC transmission line would be approximately 725 to 750 miles in length (depending upon the alternative selected), located within a 250-foot wide right-of-way (ROW). The TWE Project includes ground-disturbing activities associated with the construction of above-ground transmission lines and includes transmission tower locations, access roads, a ground electrode line, a ground electrode site, fly yards, material yards, two AC/DC converter stations (a northern terminal and a southern terminal), pulling/tensioning areas, and work areas. The TWE Project has been sited to avoid and minimize greater sage-grouse (*Centrocercus urophasianus*) lek buffers and occupied habitat. However, complete avoidance is unachievable and portions of the TWE Project cross designated habitat for greater sage-grouse (BLM's Preliminary General Habitat [PGH]) in Wyoming, Colorado, and Utah. As a result, TransWest has coordinated with the BLM, Western Area Power Administration (Western), U.S. Fish and Wildlife Service (USFWS), Wyoming Game and Fish Department (WGFD), and Colorado Parks and Wildlife (CPW), and Utah Division of Wildlife Resources (UDWR) to develop a mitigation strategy to compensate for the unavoidable loss of greater sage-grouse habitat that would potentially occur as a result of the TWE Project construction, operation and maintenance in areas of greater sage-grouse habitat.

The mitigation approach TransWest will implement for the TWE Project will follow the guidance provided by BLM IMs IM 2013-142, 2012-043, and 2012-044 and Department of Interior Secretarial Order 3330 (Order 3330). Collectively, these provide guidance for greater sage-grouse habitat management and mitigation for pending transmission rights-of-way in Preliminary Priority Habitat (PPH) and Preliminary General Habitat (PGH). These policies state that transmission rights-of-ways having disturbances greater than 1 linear mile or 2 acres require cooperation between the BLM, project proponents, and other appropriate agencies to develop and consider implementation of appropriate regional mitigation to avoid or minimize habitat and population-level effects to greater sage-grouse.

Under these policies, offsite and onsite mitigation can include in-kind or out-of-kind mitigation. In-kind is defined as the replacement or substitution of resources that are of the same type and kind of those being impacted. Out-of-kind is defined as replacement or substitutions of resources that while related are of equal or greater overall value to public lands. IM 2013-142 also identifies that the BLM may accept monetary contributions, how they may be used, and that mitigation may be conducted on non-Federal lands.

The BLM, working in concert with the USFWS, has developed a *Framework for Sage-grouse Impacts Analysis for the TransWest Express Transmission Project* (Framework). The Framework addresses TWE Project-related impacts to greater sage-grouse habitat that bear directly on listing factors considered by the USFWS when evaluating the need to provide full listing protection under the ESA. The Framework specifies the use of HEA to scale mitigation and compensate for the loss of habitat services over the life of the TWE Project. HEA is a science-based, peer-reviewed method of scaling compensatory mitigation requirements to potential TWE Project-related effects, measured as a loss of habitat services from pre-disturbance conditions (Allen et al. 2005; Dunford et al. 2004; King 1997; Kohler and Dodge 2006; National Oceanic and Atmospheric Administration 2006, 2009). Habitat services include those ecosystem features (i.e., physical site-specific characteristics of an ecosystem) and ecosystem functions (i.e., biophysical processes that occur within an ecosystem) that support wildlife and human populations (King 1997).

In compliance with IM 2012-43, IM 2013-142, Order 3330, and the Framework, TransWest has completed an HEA to determine the amount of compensatory mitigation necessary to offset potential impacts to greater sage-grouse resulting from the construction, operation, and maintenance of the TWE Project. The HEA produced an estimate of the permanent and interim potential loss of greater sage-grouse habitat services as a result of vegetation loss, noise, and human presence anticipated with TWE Project construction and operation. The HEA also modeled mitigation measures that may be implemented to offset the potential lost habitat services.

The following sections provide overviews of HEA, the HEA process for the TWE Project, the methods used for the HEA, the results of the HEA, and potential types of mitigation measures that could be used to compensate for habitat loss. Detailed methods excerpt from the TWE Project's HEA Plan are provided in the appendices to this report.

Overview of Habitat Equivalency Analysis

HEA is a science-based, peer-reviewed method of quantifying interim and permanent habitat injuries, measured as a loss of habitat services from pre-disturbance conditions, and scaling compensatory habitat requirements to those injuries (King 1997; Dunford et al. 2004; Allen et al. 2005; Kohler and Dodge 2006; National Oceanic and Atmospheric Administration [NOAA] 2006, 2009). Habitat services include those ecosystem features (i.e., physical site-specific characteristics of an ecosystem) and ecosystem functions (i.e., biophysical processes that occur within an ecosystem) that support wildlife and human populations (King 1997).

Habitat services are generally quantified using a metric that represents the functionality or quality of habitat (i.e., the ability of that habitat to provide wildlife "services" such as nest sites, forage, cover from predators, etc.). When wildlife habitat is the primary service of interest, areas with the highest habitat service levels are those areas with highest habitat quality. Interim (or short-term) habitat injuries are those services that are absent during certain phases of the project that would have been available if that disturbance had not occurred (e.g., temporary vegetation losses, temporary soil partitioning, temporary displacement of wildlife populations). Permanent habitat injuries are those habitat injuries remaining after project completion and interim reclamation and recovery are complete (e.g., permanent vegetation loss, permanent loss of wildlife or fisheries populations, irrecoverable impacts to soils or water as a result of contamination).

HEA uses a service-to-service approach to scaling. HEA does not assume a one-to-one trade-off in resources (e.g., number of acres). Rather, HEA balances the number of services lost with those that are gained as a result of conservation activities (NOAA 2006). For example, one acre of land with a diverse vegetative structure and abundant tree canopy can support higher numbers of nesting songbirds (the habitat service of interest) than one acre of land with few trees and little vegetative diversity. The two land parcels, although equal in size, provide unequal habitat services.

What Does Habitat Equivalency Analysis Do?

HEA is an economics model that:

- Quantifies current habitat services provided in a project area or landscape (commonly referred to as the baseline habitat service level)
- Quantifies the interim and permanent injuries to the baseline habitat service level
- Determines appropriately scaled restoration and conservation activities to offset habitat services lost as a result of project impacts

Benefits of Habitat Equivalency Analysis

The benefits of HEA include:

- High credibility – the approach has been evaluated and documented in scientific peer-reviewed literature and has held up in numerous court cases
- Quantitative rather than qualitative in nature
- Equations are straightforward, but have enough input variables to allow flexibility in project design

- Provides a replicable method for negotiation of mitigation ratios, acceptable compensatory restoration, and/or fines
- Valuable planning tool; can be used to evaluate the cost of multiple compensatory mitigation measures
- Applicable to any ecosystem type where an appropriate habitat services metric can be defined
- Currently the most commonly used method by natural resource trustees to assess damages to ecosystems
- Used by federal regulatory agencies, such as the U.S. Fish and Wildlife Service, NOAA, BLM, Environmental Protection Agency, Department of Interior, U.S. Army Corps of Engineers

When Habitat Equivalency Analysis Should Be Used (Chapman 2004)

HEA is an appropriate tool for scaling mitigation:

- When habitat services can be defined or modeled
- When quantification of project impacts is possible
- When replacement of services lost is feasible
- When conservation methods are sufficiently known

Compensation Components

Compensation for impacts includes two components: (1) recovery of the injured area (primary restoration; Figure 1), and (2) compensation for the interim loss of habitat services occurring prior to full recovery (compensatory restoration; Figure 2).

HEA quantifies the habitat services lost during the lifetime of a project compared to baseline (Area X in Figure 1) and scales the compensatory project (mitigation project) so that it provides services that are equal to that loss (Area Y in Figure 2). Baseline refers to the condition of the resources and quantity of habitat services that would have existed had the disturbance not occurred. The quantity of services lost (Area X) depends on the extent of the injury and the time required for restoration; actions taken to accelerate the rate of primary restoration would decrease the interim loss of habitat services, requiring less compensatory restoration. In some cases, full restoration of the lost services may not be feasible, in which case the area required for compensation (Area Y) would be larger. Compensatory restoration may occur off-site (e.g., the purchase of additional habitat), or on-site through habitat improvements that increase habitat services above baseline (e.g., non-native vegetation removal, shrub thinning, or understory planting).

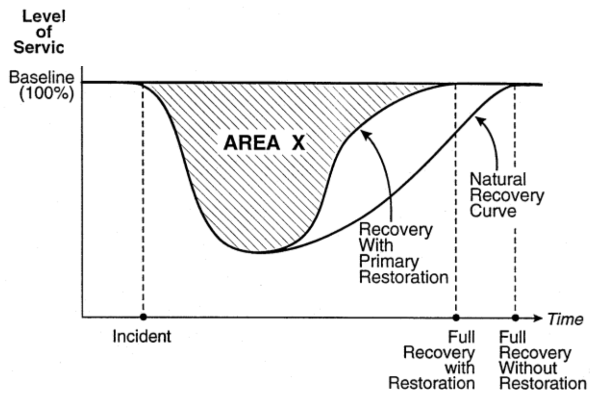

Figure 1. Changes in habitat service level compared to the baseline service level during construction and restoration (copied from King 1997). Area X represents the services lost at an injury site with Primary Restoration expressed as percent of baseline.

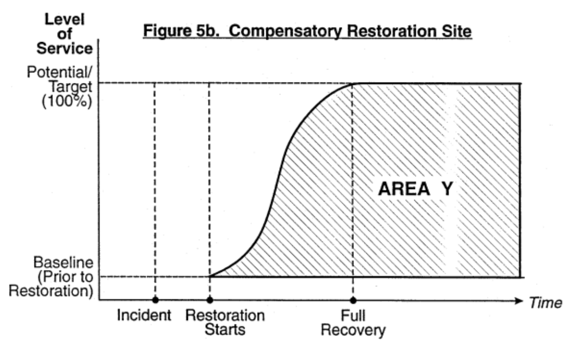

Figure 2. Changes in habitat service level with compensatory restoration (copied from King 1997). Area Y represents the services gained at the compensatory restoration site expressed as percent of potential/target level less baseline (pre-restoration) percent.

Measuring Habitat Services (Ecological Economics)

Quantifying the services provided by an ecosystem is a complex task. This complexity can be reduced through the use of an attribute, or metric, that provides a measure of the services of interest. The metric must be able to capture the relative differences in the quality and quantity of services being provided before and after restoration and between primary and compensatory sites (NOAA 2009).

Measurements of habitat services over the lifetime and area of a project are used in the HEA. These measurements have three components: land area, service level, and time. The relative service level can be quantified using a metric that measures or scores one or more key habitat elements for a species or wildlife community of interest (e.g., vegetation stem density, vegetation type, nest density, percentage of canopy cover, proximity to critical habitat, etc.). Habitat services are commonly expressed in service-acres (one year) or service-acre-years (multiple years).

Overview of the Habitat Equivalency Analysis Process for the TWE Project

Completion of the HEA process for the TWE Project Agency Preferred Alternative required close coordination with the BLM, Western, and other appropriate agencies and stakeholders (the HEA Technical Advisory Team, hereafter). Such coordination ensures that the best available scientific data were used, the habitat service metric was appropriate for resources in the TWE Project area, the results of the HEA are understood, and the compensation offsets the interim and permanent loss of habitat services modeled. The following steps will be completed as part of the development of the HEA for the TWE Project:

1. **Establishing baseline habitat services prior to disturbance.**

   TransWest has worked closely with the HEA Technical Advisory Team to finalize a habitat services metric that will quantified the baseline greater sage-grouse habitat services available prior to TWE Project construction. Appendix A provides information related to the development of the habitat services metric that served as the basis for quantifying baseline habitat services and determining TWE Project impacts and appropriate mitigation. Appendix B presents information related to how this metric was applied to establish baselines habitat services for the TWE Project area. Development of the baseline habitat service metric presented in Appendix A considered the best available scientific information regarding greater sage-grouse habitat and response to disturbance.

2. **Quantifying the permanent and interim losses to the baseline service level that result from the TWE Project disturbance.**

   Permanent and interim losses of habitat services caused by the construction and operation of the TWE Project were subtracted from the baseline habitat services. Direct and indirect losses that remain following reclamation efforts and vegetation recovery in the ROW over the life of the TWE Project will provide the basis for assessing the adequacy of mitigation proffered by TransWest. Appendix C describes the approach that was used to assess the direct and indirect losses that will occur as a result of TWE Project construction and operations.

3. **Identifying appropriate mitigation measures that may be used to compensate for lost services.**

TransWest worked the HEA Technical Advisory Team to identify mitigation measures that may be used to compensate for the permanent and interim losses of habitat services. All mitigation measures would be subject to appropriate land management agency or landowner approval, permits, and planning. Appendix D describes the methods that were used to quantify habitat service gains resulting from mitigation measures.

In the HEA process, the benefits of mitigation measures must be quantifiable using the habitat services metric. Additional mitigation measures with benefits that cannot be quantified in the HEA (e.g., brood rearing habitat improvement and understory improvement measures) will be considered separately in TransWest's Mitigation Plan and their compensatory value determined in coordination with the lead agencies and other stakeholders.

4. **Quantifying the amount of mitigation necessary to compensate for the losses to baseline services that remain after the TWE Project implementation.**

   Once final mitigation measures have been identified and approved by TransWest, the lead agencies and involved stakeholders, the average habitat service gain and cost per service returned were quantified for each mitigation measure. The resulting values will be balanced with the services lost to determine the compensatory mitigation appropriate to offset the permanent and interim loss of greater sage-grouse habitat services resulting from development of the TWE Project. This balancing will occur in TransWest's Mitigation Plan with a proposed mitigation project mix. TransWest's Mitigation Plan that documents the scaled compensatory mitigation will be provided to BLM and Western as a voluntary applicant-committed mitigation measure for greater sage-grouse.

Overview of the Habitat Equivalency Analysis Methods Used

The following sections provide an overview of methods used to develop the HEA models that were applied to assess the loss of greater sage-grouse habitat services associated with the TWE Project development and the benefits of various conservation project types that may be proposed for mitigation.

Development of Habitat Service Metric

To quantify the habitat services (e.g., greater sage-grouse habitat functionality) provided by an ecosystem, a habitat service metric is developed that scores key habitat elements for the species. Scoring habitat services is a critical step in the HEA process because it provides a way to quantitatively measure the quality of specific habitat functions in a specific area. The habitat metrics used in the HEA must be able to capture the relative differences in the quantity of services provided before and after construction and conservation-focused activities. Habitat services often have three components—land area, service level, and time—and are commonly expressed in service-acres (one year) or service-acre-years (service-acres summed over multiple years).

The greater sage-grouse habitat services metric for the TWE Project was developed collaboratively by the HEA Technical Advisory Team. The focus of the metric was to capture changes in greater sage-grouse habitat services over time with vegetation removal and recovery. Using this approach, lost habitat services (decreases in habitat quality) must be replaced with like services. The HEA does not assume a one-to-one trade-off in resources (e.g., number of acres of greater sage-grouse habitat affected), but instead determines compensation based on the habitat services those acres provide (e.g., development in high-quality greater sage-grouse habitat would have higher compensation levels than development in lower-quality habitat that provides fewer services).

The habitat service metric developed for the TWE Project included variables identified by the peer-reviewed literature as having influence on the quality of greater sage-grouse habitat, including dominant vegetative components and anthropogenic influences (Table 1). The variables included were limited to those for which reliable and consistent data were available across the TWE Project area. For each of the variables, a habitat service score ranging from 0 to 3 (zero to high services) was assigned for categories like those defined in the Sage-Grouse Habitat Assessment Framework Multi-scale Habitat Assessment Tool (Stiver et al. 2010). Categorical variables were more appropriate than continuous variables due to the resolution of the remotely sensed vegetation data available for the length of the TWE Project. The breaks between scores were primarily based on information contained in the literature regarding greater sage-grouse habitat use and selection. When literature did not allow for direct quantification of the HEA scores, professional judgments of the HEA Technical Advisory Team informed by the available peer-reviewed literature were used. When a particular variable matched literature-based optimal conditions, that variable was given a service score of 3.

The metric for greater sage-grouse habitat services used in this HEA is an additive model (Table 1) with a score adjustment for the presence of fences posing a high collision risk to greater sage-grouse during the lekking season. Each cell in the analysis area is scored separately by summing the scores of Variables 01 through 08. The summed score is then multiplied by a factor that reduces the score where high risk fences are present. Each of the variables and the fence collision score adjustment is described in detail in Appendix A.

The metric is only applied to areas that contain occupied greater sage-grouse habitat. The assessment area was first clipped to the BLM's Priority General Habitat (PGH). Then, land cover types typically avoided by greater sage-grouse are assigned a metric score of 0 (provides no habitat services) before the metric was applied to the remaining areas. Disturbances of these lands require no mitigation in the HEA. These avoided land cover types include all forest types, urban areas, open water, some introduced vegetation types, roadways, well pads, mine footprints, areas <100 meters (m) from roadways with >6,000 annual average daily traffic (AADT), and <25 m of paved roads with <6,000 AADT and heavily traveled gravel roads (multiple sources per U.S. Fish and Wildlife listing decision in Federal Register; Johnson et al. 2011). The specific GAP vegetation classifications that were included in these avoided land cover types are listed in Appendix E.

All variables were weighted evenly. Weights were not applied because there was not adequate information in the literature to support the use of one specific weight over another. The importance of sagebrush was already intrinsically weighted higher than other vegetation types due to the number of variables that measured an aspect of sagebrush vegetation (for which non-sagebrush vegetation types would score low). Comparisons of the final baseline maps to maps of known greater sage-grouse use indicated that the metric performed well to distinguish between high-quality and low-quality greater sage-grouse habitat across the length of the TWE Project without adjusting the variable weights.

Greater sage-grouse habitat suitability publications vary in their baseline environmental conditions affecting a particular study site. Even studies within a single state may describe different suitable habitat conditions depending on elevation, precipitation zone, and other geographic or climatic factors affecting each study site. The habitat metric relied on generalizations presented in BLM et al. (2000), Cagney et al. (2009), Connelly et al. (2011), Connelly et al. (2000), Stiver et al. (2010), and other summary publications. Specific citations are given to support these generalizations when applicable. The same metric of habitat services was applied to the entire TWE Project area.

The HEA metric was used to score habitat service level for all areas on and within 2 kilometers (km) of the TWE Project footprint, including access roads and other infrastructure (Assessment Area). None of the habitat service losses modeled (vegetation loss, noise, and human presence) extended outside the Assessment Area. The Assessment Area was clipped to the greater sage-grouse PGH and partitioned by state (Wyoming, Colorado, and Utah). The final Assessment Area centerline length varied by state.

Table 1. Anthropogenic and Habitat Variables Used as a Metric of Greater Sage-grouse Habitat Services.

Variable Number	Variables	3	2	1	0	Primary Citations
VAR01	Distance to high-traffic (>6,000 AADT) road, such as an interstate, federal, or state highway (meters)	>1,000	650–1,000	100–650	N/A*	Craighead Beringia South (2008); Johnson et al. (2011); Pruett et al. (2009)
VAR02	Distance to low-traffic (<6,000 AADT) paved roads, heavily travelled gravel roads, well pads, mine footprints, transmission substations (meters)	>200	50–200	25–50	N/A*	Connelly et al. (2004); Craighead Beringia South (2008); Johnson et al. (2011); Pruett et al. (2009)
VAR03	Percent slope	<10	10–30	30–40	>40	Beck (1977); Lincoln County Sage Grouse Technical Review Team (2004)
VAR04	Distance to occupied lek[†] (kilometers)	0–6.4	6.4–8.5	>8.5	N/A	Cagney et al. (2009); Connelly et al. (2000); Connelly et al. (2011); Holloran and Anderson (2005)
VAR05	Sagebrush abundance index (% of vegetation that is sagebrush within a 1 km^2 moving window)	50–95	30–50 or >95	10–30	0–10	Carpenter et al. (2010); Walker et al. (2007); Aldridge and Boyce (2007); Aldridge et al. 2008; Wisdom et al. (2011)
VAR06	Percent sagebrush canopy cover	15–35	5–15 or >35	1–5	<1	Cagney et al. (2009); Connelly et al. (2000); Stiver et al. (2010)
VAR07	Sagebrush canopy height (centimeters)	30–80	20 to <30 or >80	5–20	<5	Crawford et al. (2004); Connelly et al. (2000); Stiver et al. (2010)
VAR08	Distance of habitat to sage or shrub dominant (meters)	<90	90–275	275–1,000	>1,000	BLM et al. (2000); Connelly et al. (2000); Lincoln County Sage Grouse Technical Review Team (2004)

* Lands less than 100 m from a high traffic road and less than 25 m from a low traffic paved road or high traffic gravel road were given a total metric score of 0 (provides no habitat services), not just a score of 0 for these individual variables.
[†] Leks were classified as active if their 10-year attendance average was greater than 0.

Quantification of Habitat Service Losses

The following sections describe the losses of habitat services that would likely occur as a result of the TWE Project construction and operation. These changes in the habitat service level were simulated in a GIS platform to produce data inputs for the HEA.

The HEA model calculates the present value of future changes to the baseline habitat service level with time caused by losses of habitat services with TWE Project development and gains of habitat services with mitigation projects. Economists call this process *discounting* and it is a standard part of the HEA model. Discounting converts services being provided in different time periods into current time period equivalents (Allen et al. 2005). Discounting results in a gradual increase in the service-acres provided by injured habitats over time, and the same rate of decrease in service-acres gained by habitat conservation over time. Consequently, credit for mitigation in the form of habitat conservation (increase in discounted service-acre-years) is greater when implemented early in the lifetime of the TWE Project than when implemented late in the lifetime of the TWE Project. This encourages early mitigation to offset habitat service losses, to ensure that long-term adverse effects to the resource are minimal. Likewise, the injury (i.e., loss of discounted service-acre-years) due to construction and operation of the TWE Project is greater when it occurs early in the project lifetime than when it occurs later in the project lifetime.

Ideally, the baseline habitat service level would account for all habitat service losses associated with existing environmental disturbances. This was done to the extent possible with the existing data for the Assessment Area. In some cases, existing habitat disturbances were not mapped in the baseline service level because they were not detected by the chosen habitat services metric, or because the data were unavailable for use in the baseline analysis. Omission of these disturbances is a conservative approach to the analysis of the TWE Project-related habitat service losses. When baseline disturbances are omitted, the analysis assumes that the habitats affected by the TWE Project are of higher-quality than they actually are, and thus require a greater amount of mitigation to offset the TWE Project-related habitat service losses.

Description of Changing Habitat Service Level by Project Milestone

The habitat services provided by the Assessment Area were calculated at TWE Project milestones that reflected varying levels of disturbance. The TWE Project milestones modeled with GIS data for the HEA are listed below.

1. **Baseline**—the baseline milestone quantifies habitat services available to greater sage-grouse before disturbance. The calculation of Baseline is described above and in Appendix B.
2. **Construction—**the construction milestone quantifies habitat services available to greater sage-grouse during the construction or operation of the AC/DC converter station proposed as part of the TWE Project and the construction of the transmission line and electrode grid. Magnitude of the loss of habitat services during construction is dependent on proximity to the TWE Project and the amount of new surface disturbance.
3. **Restoration**—the restoration milestone quantifies habitat services available to greater sage-grouse after substation and transmission line construction is complete and some services return with the reduction in noise and human presence.
4. **Recovery**—the recovery milestone quantifies habitat services available to greater sage-grouse after a vegetation type has recovered to the greatest extent expected after the TWE Project restoration is complete. Habitat services return to baseline conditions in restored areas with the time to recovery being dependent on the vegetation type.

Quantifying Habitat Service Losses during Construction

Snapshots of the changing habitat services over time are modeled using GIS-based tools for each of the milestones identified above for incorporation into the HEA. The HEA calculates the total interim and permanent habitat injuries associated with the TWE Project. Specifics of the GIS and HEA methods are provided in Appendix C.

Timing

A conceptual substation, transmission structure, and infrastructure layout was provided by TransWest from which all habitat service losses were calculated (Table 2). The transmission line is planned to be constructed over a period of 3 years in each state, which is concurrent for all states.

Direct Disturbance

The footprint of the TWE Project was provided electronically by TransWest. The footprint files specified the anticipated locations of and direct disturbance associated with access roads, the ground electrode grid and line, transmission towers, pulling/tensioning areas, an AC/DC converter station (the northern terminal), mid spans, material yards, and fly yards.

During the three Construction years, direct disturbance was defined as the loss of all habitat services within the entire construction footprint for the segment modeled (Table 3). Access roads were assumed to have a width of 10 m. The model did not capture temporal restrictions on the TWE Project construction required by the BLM, which may have resulted in high estimates of service losses in the three Construction years. In the Restoration year following construction, direct disturbance was still defined as the loss of all habitat services in the construction footprint, because the vegetation had not regrown sufficiently to provide habitat. In the Recovery years, direct disturbance was defined as the loss of all habitat services in the footprint of permanent facilities (i.e., the AC/DC converter station and transmission structure pads). The direct disturbance in restored areas was returned at different rates depending on baseline vegetation type. There were four vegetation-based recovery endpoints: 1) agriculture and wetland (1 year after Restoration); 2) grassland and riparian (5 years after Restoration), 3) shrubs other than sagebrush (20 years after restoration); and 4) sagebrush (100 years after Restoration). The assignment of the GAP vegetation types to these four recovery endpoints is described in Appendix E.

Table 2. TWE Project Milestone Years

Project Year	Project Milestone
0	Baseline
1	Construction
2	Construction
3	Construction
4	Restoration
5	Recovery 1
6	--
7	--
8	--
9	Recovery 2
10	--
11	--
12	--
13–23	--
24	Recovery 3
25	--
26	--
27	--
28–103	--
104	Recovery 4; End of Analysis

Table 3. Direct Disturbance Levels Modeled by TWE Project Year and Disturbance Type

Project Milestones	Project Year Applied	Percent Baseline Services Present at each Milestone by Direct Disturbance Type: AC/DC Converter Station	Transmission Towers*	Access Roads, Transmission Lines, Ground Electrode Line, Ground Electrode Grid, and Temporary Infrastructure
Baseline	0	100%	100%	100%
Construction	1, 2, 3	0%	0%	0%
Restoration	4	0%	0%	0%
Progressive Vegetation Recovery	5 (Recovery 1)	0%	• 0% in tower pad† (500 ft^2) Elsewhere‡: • 100% of agricultural and wetland baseline services • 20% of grassland and riparian baseline services • 5% shrub baseline services • 1% of sagebrush baseline services	• 100% of agricultural and wetland baseline services • 20% of grassland and riparian baseline services • 5% shrub baseline services • 1% of sagebrush baseline services
	9 (Recovery 2)	0%	• 0% in tower pad (0.06 acre) Elsewhere: • 100% of agricultural, wetland, grassland, and riparian baseline services • 25% shrub baseline services • 5% of sagebrush baseline services	• 100% of agricultural, wetland, grassland, and riparian baseline services • 25% shrub baseline services • 5% of sagebrush baseline services
	24 (Recovery 3)	0%	• 0% in tower pad (0.06 acre) Elsewhere: • 100% of agricultural, wetland, grassland, riparian, and shrub baseline services • 20% of sagebrush baseline services	• 100% of agricultural, wetland, grassland, riparian, and shrub baseline services • 20% of sagebrush baseline services
	104 (Recovery 4)	0%	• 0% in tower pad (0.06 acre) Elsewhere: • 100% of agricultural, wetland, grassland, riparian, shrub, and sagebrush baseline services	• 100% of agricultural, wetland, grassland, riparian, shrub, and sagebrush baseline services

* The guide lattice tower type is assumed for this analysis.
† Tower pad in this table refers to the permanent tower footprint.
‡ Elsewhere refers to construction roads that were reduced to two-track roads, or any areas where vegetation was cleared for Project construction that were subsequently revegetated during Restoration (e.g., staging areas).

Indirect Disturbance

In addition to the actual surface disturbance, indirect disturbance buffers were applied to reduce habitat services around the Project Footprint during active construction (Table 4). Within these buffers (>200 meters [m], 50–200 m, 25–50 m, or <25 m), the habitat services were scored by the metric as if they were in the same proximity to a secondary road (a paved road with <6,000 AADT or heavily travelled gravel road) to account for the disturbance associated with noise and human presence (see Appendix C, Quantifying Loss of Habitat Services Due to Indirect Disturbances During Construction for additional detail).

After construction, the indirect disturbance buffers were dropped from everything except the AC/DC converter station. The noise associated with the operation of this station was characterized as a permanent indirect disturbance in the model. Little information has been published on greater sage-grouse habitat use near transmission lines. TransWest decided not to model disturbance due to transmission lines after construction is complete, because insufficient information was available to characterize and quantify these effects. Potential indirect impacts associated with transmission lines are discussed in detail in the TWE Project's DEIS.

Table 4. Indirect Disturbance Levels Modeled by TWE Project Year and Disturbance Type

Project Milestones	Project Year Applied	Indirect Disturbance Buffers* Applied by Disturbance Type		
		AC/DC Converter Station	Transmission Towers	Access Roads, Transmission Lines, Ground Electrode Line, Ground Electrode Grid, and Temporary Infrastructure
Baseline	0	None	None	None
Construction	1, 2, 3	Secondary Road	Secondary Road	Secondary Road[†]
Restoration	4	Secondary Road	None	None
Progressive Vegetation Recovery	5	Secondary Road	None	None
	9	Secondary Road	None	None
	24	Secondary Road	None	None
	104	Secondary Road	None	None

* "Secondary Road" indicates that the footprint of the disturbance was classified as having the same indirect disturbance as a secondary road in the GIS model and the scores of the surrounding vegetation decreased as defined by the habitat services metric.

[†] Construction of the ground electrode grid will be completed in the first year. No indirect disturbances were modeled for the ground electrode grid after Construction Year 1.

Quantification of conservation Benefit to Habitat Services

Habitat conservation measures (Table 5) were selected by the HEA Technical Advisory Team to be modeled in the HEA. These measures have been identified to improve greater sage-grouse habitat services and produced a benefit that could be measured by the habitat service metric used in this HEA. These conservation measures serve as a "toolbox" from which mitigation options may be selected by

TransWest for inclusion in a mitigation package.[1] The benefit (in service-acres) for each habitat conservation measure was calculated with GIS technology, using the same habitat service metric as was used to calculate habitat service losses.

The same conservative vegetation growth rates that were used to model vegetation recovery in the TWE Project footprint were applied to the habitat conservation measures proposed for mitigation. Conservative growth rates offset the potential for mitigation project failure in the model.

Three to five hypothetical mitigation project areas were selected to model each conservation measure. The variable scores were manipulated using GIS technology to approximate the change expected with implementation of the measure. The benefit of the measure was the difference in the service score before and after implementation. The mean benefit among the hypothetical mitigation project areas was entered into the HEA, where estimated time until full benefit and discount rate was applied to estimate the discounted service-acre-years gained per mitigation project area. The HEA assumed that the mitigation projects would be funded in the first year of the TWE Project construction.

The cost of the modeled habitat conservation measures was estimated by averaging the known cost of similar conservation projects previously implemented in Idaho and Wyoming—cost estimates from the Gateway West HEA (BLM 2013) were adjusted using a 3% annual inflation rate (equal to the discount rate used in this HEA) to bring the costs up to 2014 dollars. These cost estimates were used to calculate the price per service-acre-year. An HEA scales the mitigation package (i.e., funding to create habitat services) to offset the loss of habitat services over the lifetime of the TWE Project. Appendix D describes the calculation used to quantify the benefit of the mitigation projects compared to baseline.

[1] Proposed mitigation may not be limited to the modeled conservation measures. The benefit of some measures could not be measured using the habitat service metric (e.g., improvement of brood rearing habitat, improvement of understory vegetation).

Table 5. Potential Mitigation Projects Modeled in the HEA

Mitigation Project Type	Brief Project Description	Anticipated Benefits	Average Cost of Implementation*,§
Fence removal and marking with flight diverters	Fences would be removed or marked in: 1) Sections of fence known to cause greater sage-grouse collisions, 2) Within 3 km (1.2 mi) of leks (Stevens et al. 2013) or other high risk areas, 3) In areas with low slope and terrain ruggedness (Stevens 2011), and 4) Where segments are bounded by steel t-posts with spans greater than 4 m (Stevens 2011).	• Reduce mortality due to greater sage-grouse collisions • Increase visibility of fences, where diverters are used • Increase contiguous patches of shrub-steppe habitat • Remove localized grazing pressure where fences are removed, thereby increasing local habitat quality (e.g., bunchgrass cover)	• $1,485 per mile ($920 per km) for fence removal or initial installation of flight diverters, and $320 per mile per year ($200 per km per year) for maintenance on flight diverters†
Sagebrush restoration and improvement projects	Seeding, planting seedlings, or transplanting containerized sagebrush plants (one plant per 5 m^2) and seeding a bunchgrass understory	• Create contiguous patches of shrub-steppe habitat with optimal sagebrush cover and height and a bunchgrass understory • Increase availability of high-quality nesting, brood rearing, and winter habitats	• $3,975 to $7,320 per acre ($9,820 to $18,090 per hectare), depending on method used
Juniper/conifer removal	Mechanical removal (lop and scatter, cut-pile-cover, or mastication) of juniper/confer adjacent to areas with optimal sagebrush cover and height	• Reverse juniper/conifer encroachment on shrub-steppe habitat to increase contiguous patches of greater sage-grouse habitat • Increase light penetration to support a forb and grass understory	• $180 to $2,120 per acre ($445 to $5,240 per hectare), depending on density of vegetation removed. ‡
Conservation easements	Removes threat of specific land uses to sensitive wildlife populations	• Prevent greater sage-grouse habitat destruction or degradation near urban areas and oil and gas development • Reduce future fragmentation of shrub-steppe habitat	• $615 per acre ($1,515 per hectare) average purchase price • $2650 per year for each easement for maintenance and monitoring

* Cost of implementation includes a 50% markup for indirect costs, which include contract writing, supervision, clearances, monitoring, inspections, and vehicle costs.
† The cost of maintenance for the lifetime of the project is included in the HEA model and the resulting estimated cost per service-acre-year in Table 7.
‡ The cost of this treatment varies widely depending on the baseline vegetation. The lower end cost includes lop and scatter of Phase I juniper with no understory treatment. The upper end cost includes mastication of Phase III juniper and seeding a bunchgrass understory.
§ Costs were estimated for the Gateway West Transmission Line HEA (BLM 2013) and then adjusted using a 3% inflation rate to bring them up to 2012 to 2014 dollars. Mitigation funds provided in years after 2014 should be further adjusted for inflation.

HABITAT EQUIVALENCY ANALYSIS RESULTS

The following sections describe the results of the HEA for habitat service losses over the lifetime of the TWE Project and the results of the HEA for conservation measure benefits. These results are expressed as the discounted service-acre-years (DSAYs) lost or gained, which is the sum of the permanent and interim losses gains over the lifetime of the TWE Project with the economic discount rate applied. These results may be used to scale mitigation.

HEA Habitat Service loss Results

A separate HEA was run for each state where the TWE Project intersected greater sage-grouse habitat (Wyoming, Colorado, and Utah). The modeled habitat service level at each of the TWE Project milestones was entered into the HEA to calculate the present value of the habitat services lost over the lifetime of the TWE Project. A linear change in service level was assumed between modeled milestones. A summary of the estimated habitat service losses due to the TWE Project's construction, operation, and maintenance are provided in Table 6 for the full Analysis Area (i.e., 2-km buffer around Project footprint). These are the habitat service totals that need to be offset with mitigation. Service losses varied among states with differences in the buffered TWE Project centerline that intersected greater sage-grouse PGH, differences in baseline habitat quality, and the type of development.

Table 6. Habitat Services Lost in the Analysis Area Over the Lifetime of the TWE Project (Modeled Years 1–104).

State	Permanent Disturbances Modeled	Habitat Services in the Assessment Area at Baseline Condition (DSAYs over lifetime of the TWE Project assuming no development)	Habitat Services Lost in the Assessment Area (DSAYs lost over lifetime of the TWE Project)
Wyoming	AC/DC converter station and transmission tower pads	102,603,325	1,101,889
Colorado	transmission tower pads	71,739,071	1,374,208
Utah	transmission tower pads	73,696,032	1,256,932
Total	AC/DC converter station and transmission tower pads	248,038,428	3,733,029

HEA Conservation Benefit Results

A separate HEA was run for each habitat conservation measure. The habitat service increases modeled using GIS-based tools were entered into the HEA, along with estimates of time between receipt of funding and implementation of the measure, and time between implementation of the measure and full service benefit from the measure. The habitat service gains per unit area treated summed over the lifetime of the TWE Project are provided for each conservation measure in Table 7.

New habitat services (measured in DSAYs) and cost per services gained varied among conservation measures (Table 7). Conservation easements preserve existing habitat services in areas of potential development and can create new habitat services if existing land practices that are damaging to greater sage-grouse habitat are restricted.

Application of Results to a Mitigation Package

TransWest, BLM, and agencies will evaluate the services returned per habitat conservation measure, compare those services gained to the services lost as a result of the TWE Project, and develop an appropriate mitigation plan to compensate for services lost. This analysis is a decision-making support tool for the development of the mitigation plan.

To accomplish a 1:1 trade-off in habitat service-acre-years over the lifetime of the TWE Project per a traditional HEA, habitat conservation measures from Table 7 should be selected to offset 100% of the habitat service losses quantified for each segment in Table 6. The recommended approach to this process is outlined in the steps below.

1. Select the habitat conservation measures most appropriate for each segment from Table 5 and define the proportion of each measure to be used as mitigation (e.g., mitigation in Segment A will be composed of w% fence modification, x% sagebrush restoration, y% juniper removal, and z% conservation easements).
2. Calculate the habitat services to be replaced using each habitat conservation measure. The total of the habitat services replaced using each measure should equal the total services lost in Table 6.
3. Calculate the cost to implement each habitat conservation measure in each segment. Multiply the habitat services to be replaced using a measure by the cost per habitat services gained for that measure from Table 7.
4. Sum the costs of the habitat conservation projects separately for each segment. The total would be the mitigation for the modeled habitat service losses in that segment.

Table 7. Mean Present Value Habitat-Service-Acre Gained and Average Cost for Each Habitat Conservation Measure

Conservation Measure	General Method	Mean Habitat Services Gained (DSAYs per unit)	Cost per Services Gained (U.S. dollars per DSAY) ‡
Fence removal and marking with flight diverters*	Fence marking within 3 km of leks and in other high risk areas (e.g., winter concentration areas, movement corridors)	3,597 per mile of fence marked	$9.57
	Fence removal within 2 km of leks and in other high risk areas	3,597 per mile of fence removed	$0.41
Sagebrush restoration and improvement projects	Seeding sagebrush and bunchgrass understory	1,751 per acre of disturbance treated	$2.27
	Transplanting containerized sagebrush stems and seeding bunchgrass understory	4,556 per acre of disturbance treated	$1.61
	Planting seedlings and seeding bunchgrass understory	1,935 per acre of disturbance treated	$2.30
Juniper/conifer removal	Lop and scatter Phase I† juniper	480 per acre treated	$0.38
	Cut-pile-cover or mastication of Phase II† juniper	328 per acre treated	$2.11
	Mastication of Phase III† juniper and seeding bunchgrass understory	197 per acre treated	$10.76
Conservation easements	Land purchase (baseline value service credit) applying the annual maintenance and monitoring fee to every 5,000 acres of easement.	650 per acre purchased§	$1.03

* Although fence removal is more effective at removing the threat of greater sage-grouse collision than fence marking, both measures were modeled as having the same benefit due to a limitation in the model. The cost of fence removal is much lower than marking because no ongoing maintenance is required.

† Phases of juniper describe the dominance of this vegetation on the landscape. Phase I is a sagebrush-dominated landscape with scattered juniper, Phase II is a landscape comprising a 50:50 mixture of sagebrush and juniper, and Phase III is a landscape dominated by juniper.

‡ Cost estimates include permitting and maintenance as described in Table 5.

§ Estimated using the average habitat services value per acre in the Assessment Area excluding scores of 0, because no specific easements have been proposed.

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APPENDIX A

Greater Sage-Grouse Habitat Service Metric for the TransWest Express Project

Text is excerpt from the TWE Project HEA Plan.

DEVELOPMENT OF HABITAT SERVICE METRIC FOR HABITAT EQUIVALENCY ANALYSIS

A habitat service metric was developed for the greater sage-grouse (*Centrocercus urophasianus*) using variables identified in the peer-reviewed literature as representative of greater sage-grouse habitat. Habitat service levels are intended to reflect both the quality of the habitat and the ability of the birds to use the habitat. For each of the metric variables, a habitat service score ranging from 0 to 3 (no services [contributing no value to habitat] to high services [optimal habitat]) was assigned, similar to the greater sage-grouse habitat assessment framework developed by Stiver et al. (2010) and the greater sage-grouse habitat suitability index developed by LaGory et al. (2012). Scoring habitat services is a critical step in the HEA process, because it provides a way to measure the relative quality of specific habitat functions in a specific area.

The scores for this HEA are primarily based on information contained in the literature regarding greater sage-grouse habitat use and selection. When literature did not allow for direct assignment of value ranges for HEA scores, professional judgments, which were based on peer-reviewed literature, were used. Professional judgments are associated with specific literature references when possible and/or confirmed with academic and agency biologists.

When a basic life requisite of greater sage-grouse is absent (vegetation is absent, the area is forested, or high levels of disturbance are present), the cell being scored is assigned a total service value of 0. When a measurements for particular variable within the metric (e.g., % sagebrush cover) matches literature-based descriptions of sub-optimal conditions, that variable is given a service score of 0 (contributing no value to habitat), 1 (poor habitat), or 2 (moderate habitat). For example, sagebrush cover <1% would score a 0, cover of 1%–5% would score a 1, and cover of 5%–15% or >35% would score a 2 for that variable. When measurements for a particular variable match literature-based recommended conditions, that variable is given a service score of 3 (optimal habitat). For example, sagebrush cover of 15%–35% would score a 3 for that variable.

Scoring of the variables is categorical and each variable is given the same weight in the model. This approach is based on the best available data and is consistent with the general approach of LaGory et al. (2012). LaGory et al. (2012) describe their approach as follows:

> In general, there was insufficient information in existing studies to determine relationships among variables and habitat suitability or relative contributions between variables/components. Therefore, for simplicity, we developed piecewise linear functions of suitability based on the assumption that all variables are of equal weight and applied these functions to geospatial layers to generate indices ranging from 0 (poor) to 100 (optimal). This approach is similar to that used for many of the U.S. Fish and Wildlife Service (USFWS) Habitat Suitability Index models in their Habitat Evaluation Procedure, (available at http://www.fws.gov/policy/ESMindex.html).

While the individual variables are not weighted, the number of variables relating to a habitat attribute (e.g., six for vegetation vs. one for slope) and the size of the buffers (e.g., 1,000 m for high traffic roads vs. 200 m for low traffic roads) give some attribute categories more influence than others. In the metric, there are three variables that score sagebrush characteristics (sagebrush abundance index, sagebrush % cover, and sagebrush canopy height), so areas that are not dominated by sagebrush will score low for these three variables, resulting in a lower overall score.

Greater sage-grouse habitat suitability publications vary in their baseline environmental conditions affecting a particular study site. Even studies within the same state may describe different suitable habitat conditions depending on elevation, precipitation zone, and other geographic or climatic factors affecting each study site.

No specific habitat studies have been conducted on the TWE Project's transmission line corridor alternatives, therefore the habitat metrics described below mostly rely on information presented in BLM et al. (2000), Cagney et al. (2009), Connelly et al. (2000), Connelly et al. (2011), and other summary publications. Specific citations are given to support the habitat model framework when applicable.

A single habitat service metric is applied to the entire TWE Project corridor in order to standardize results. This approach assumes that optimal habitat or poor habitat for greater sage-grouse looks the same (that is, measures the same for the variables in the metric) regardless of its location, despite regional differences in habitat features and availability.

As a result, the best available habitat at the edge of the species' range may not score as high as the best available habitat in the center of the species' range, unless they have the same measurements for the variables in the metric. The following sections describe the development of the habitat service model variables.

METRIC OF GREATER SAGE-GROUSE HABITAT SERVICES

The metric is only applied to areas that contain greater sage-grouse habitat. The assessment area was first clipped to the BLM's Priority General Habitat (PGH). Then, land cover types typically avoided by greater sage-grouse are assigned a metric score of 0 before the metric is applied to the remaining areas. Disturbances of these lands require no mitigation in the HEA. These land cover types include all forest types, urban areas, open water, some introduced vegetation types, roadways, well pads, mine footprints, areas <100 meters (m) from roadways with >6,000 annual average daily traffic (AADT), and <25 m of paved roads with <6,000 AADT and heavily traveled gravel roads (multiple sources per U.S. Fish and Wildlife listing decision in Federal Register; Johnson et al. 2011).

The metric for greater sage-grouse habitat services used in this HEA is an additive model (Table A1) with a score adjustment for the presence of fences posing a high collision risk to greater sage-grouse during the lekking season. Each cell in the analysis area is scored separately by summing the scores of Variables 01 through 08. The summed score is then multiplied by a factor that reduces the score where high risk fences are present. Each of the variables and the fence score adjustment is described in detail below.

Descriptions of Additive Metric Variables

After areas of non-habitat (i.e., areas not suitable for greater sage-grouse or areas located outside the BLM's PGH boundaries) are assigned a metric score of 0, the remaining habitats are scored by adding the individual scores for the eight following variables.

VAR01 and VAR02 Distance to Roads and Highways

Research into the effects of roads on greater sage-grouse is varied. For instance in Colorado, Rogers (1964) mapped 120 leks with regard to distance from roads and found that 42% of leks were over 1.6 km (1 mile) from the nearest improved road, but that 26% of leks were within about 90 m (about 100 yards) of a county or state highway, and two leks were on a road. Connelly et al. (2004) also note the use of roads for lek sites. In contrast, Craighead Beringia South (2008) reported results from a 2007 to 2009 study of greater sage-grouse seasonal habitat use in Jackson Hole, Wyoming. Results indicate that greater sage-grouse avoid areas within approximately 100 m of paved roads. Similarly, Pruett et al. (2009) found that lesser prairie-chickens avoided one of the two highways in the study by 100 m; however, some prairie-chickens crossed roads and had home ranges that overlapped the highways, thus roads did not completely exclude them from neighboring habitat. Johnson et al. (2011) examined the correlation between trends in lek attendance and the environmental and anthropogenic features within 5- and 18-km buffers around leks. They found that lek attendance declined over time with length of interstate highway within 5 km, although the authors note that this trend was based on relatively few data points and no pre-highway data were available for comparison. Interstate highways >5 km away and smaller state and federal highways had little or no effect on trends in lek attendance. Thresholds less than 5 km were not examined.

In the habitat services metric, those habitats located within 100 m of a high-traffic (>6,000 AADT) paved road (an interstate highway or high-traffic federal or state highway, for example), or within 25 m of a low-traffic (<6,000 AADT) paved road (a low-traffic federal or state highway, for example) were considered to provide no services to greater sage-grouse due to traffic and associated noise/human disturbance and were given a full metric score of 0 (no services). Unpaved roads with high traffic loads (for example, oil and gas service roads, mine service roads, etc.) provide similar disturbance levels as paved roads with similar traffic loads (e.g., low-traffic state highway). To characterize this disturbance in the model, mine footprints and well pad footprints were classified and scored as if they were low-traffic roads, so that there are no habitat services within 25 m of these disturbances. The AC/DC converter station will also classified and scored as if it is a low-traffic road in the model to account for the noise and human presence associated with this facility.

Those habitats located farther than 200 m and 1,000 m, respectively, of a low-traffic road or high-traffic road were considered the most serviceable to greater sage-grouse (that is, exhibited no decrease in lek attendance) and given a score of 3. A logarithmic curve was fit between the highest and lowest categories so that score increased with distance from the road to estimate the distance breaks associated with scores 1 and 2. A logarithmic rate of change simulates sound attenuation rates better than a linear rate of change (Crocker 2007). Conflicting research results regarding greater sage-grouse use near and on unpaved resource/collector roads (e.g., two-track roads) did not allow for quantification of the disturbance caused by these roads in the model.

While the application of distances to all scores (0–3) is not perfectly supported in the peer-reviewed literature, our approach places a penalty upon habitats that are bisected by all types of large roadways. Penalties are higher for roads that typically have higher traffic levels and risk to greater sage-grouse (e.g., mortality from collision, noise disturbance) than less-utilized secondary roads that generally have less traffic and implied risk.

VAR03 Slope

Slope was used to refine greater sage-grouse habitat potential. Greater sage-grouse generally use flat or gently sloping terrain (Connelly et al. 2011; Eng and Schladweiler 1972; Nisbet et al. 1983; Rogers 1964). Beck (1977) plotted the distribution of 199 greater sage-grouse flocks in Colorado and found that 66% of flocks were on slopes less than 5% and only 13% of flocks were on slopes greater than 10%. Areas with slopes greater than 40% are unsuitable for nesting habitat (Lincoln County Sage Grouse Technical Review Team 2004), but still have some value to greater sage-grouse and should be retained in the model (professional judgment of the agency biologists). Therefore, areas with less than 5% slope were assigned a habitat service score of 3, and those exceeding 10% subjectively received incrementally lower habitat service scores. Slopes >40% did not add value to the habitat and received a score of 0 for this variable, but these areas may provide habitat services depending on the scores for the other variables.

A terrain roughness index (TRI) was evaluated for use in place of the slope variable, as some studies have shown that it is a better indicator of greater sage-grouse use (Carpenter et al. 2010; Doherty et al. 2008; Doherty et al. 2010; Dzialak et al. 2011). However, there was substantial variation in the methods used to calculate TRI (e.g., measure of roughness used and analysis window size) and region evaluated (e.g., Alberta, Canada, vs. Powder River Basin, Wyoming) by these studies. Given this variation, it was not possible to identify literature-supported cutoffs between scores for use in the model.

Table A1. Additive Variables in the Metric of Greater Sage-grouse Habitat Services

Variable Number	Variables	3	2	1	0	Primary Citations
VAR01	Distance to high-traffic (>6,000 AADT) road, such as an interstate, federal, or state highway (meters)	>1,000	650–1,000	100–650	N/A*	Craighead Beringia South (2008); Johnson et al. (2011); Pruett et al. (2009)
VAR02	Distance to low-traffic (<6,000 AADT) paved roads, heavily travelled gravel roads, well pads, mine footprints, transmission substations (meters)	>200	50–200	25–50	N/A*	Connelly et al. (2004); Craighead Beringia South (2008); Johnson et al. (2011); Pruett et al. (2009)
VAR03	Percent slope	<10	10–30	30–40	>40	Beck (1977); Lincoln County Sage Grouse Technical Review Team (2004)
VAR04	Distance to occupied lek† (kilometers)	0–6.4	6.4–8.5	>8.5	N/A	Cagney et al. (2009); Connelly et al. (2000); Connelly et al. (2011); Holloran and Anderson (2005)
VAR05	Sagebrush abundance index (% of vegetation that is sagebrush within a 1 km^2 moving window)	50–95	30–50 or >95	10–30	0–10	Carpenter et al. (2010); Walker et al. (2007); Aldridge and Boyce (2007); Aldridge et al. 2008; Wisdom et al. (2011)
VAR06	Percent sagebrush canopy cover	15–35	5–15 or >35	1–5	<1	Cagney et al. (2009); Connelly et al. (2000); Stiver et al. (2010)
VAR07	Sagebrush canopy height (centimeters)	30–80	20 to <30 or >80	5–20	<5	Crawford et al. (2004); Connelly et al. (2000); Stiver et al. (2010)
VAR08	Distance of habitat to sage or shrub dominant (meters)	<90	90–275	275–1,000	>1,000	BLM et al. (2000); Connelly et al. (2000); Lincoln County Sage Grouse Technical Review Team (2004)

* Lands less than 100 m from a high traffic road and less than 25 m from a low traffic paved road or high traffic gravel road were given a total metric score of 0 (provides no habitat services), not just a score of 0 for these individual variables.
† Leks were classified as active if their 10-year attendance average was greater than 0.

VAR04 Distance to Lek (10-year Average Count >0 Males)

Current greater sage-grouse habitat management guidance uses occupied leks as focal points for nesting habitat management (Connelly et al. 2000; Connelly et al. 2011); therefore, distance to lek was used as a variable in the habitat services metric. These guidelines recommend protecting sagebrush communities within 3.2 km of a lek in uniformly distributed habitats and 5.0 km in non-uniformly distributed habitats. Holloran and Anderson (2005) studied nesting greater sage-grouse at 30 leks in central and western Wyoming and determined that 45% and 64% of female greater sage-grouse nested within 3.2 km and 5.0 km, respectively, of the lek where the hen was radio-collared. Moreover, statistical analyses suggested that the area of interest for nesting greater sage-grouse should be truncated at 8.5 km from a lek. Similar frequencies are reported in Cagney et al. (2009)—66% within 5.0 km and 75% within 6.4 km of a lek where the female bred.

Female greater sage-grouse do nest at distances greater than 8.5 km (farthest distance reported in Holloran and Anderson [2005] was 27.4 km), so all distances >8.5 km from occupied leks were given a service score of 1 to reflect some potential use by nesting greater sage-grouse. Areas within 6.4 km of a lek provide the highest service level, because they provide female grouse with forage, roost sites, and cover from predators or inclement weather during the lekking season, in addition to containing lekking habitat and nesting habitat (Cagney et al. 2009). Therefore, areas within 6.4 km of an occupied lek were assigned a service score of 3 for this variable. Between these distances (6.4–8.5 km), areas were assigned a score of 2 for this variable.

VAR05 Sagebrush Abundance Index

Walker et al. (2007) found that the proportion of habitat that was sagebrush within a 6.4-km moving window was a strong predictor of lek persistence in the Powder River Basin of Wyoming. The moving window is an analysis area that is larger than and centered on the cell being scored; in this case, the window is a 6.4-km buffer that moves as the cell being scored is changed. Areas with less than 30% of sagebrush within 6.4 km of the lek center had a lower probability of lek persistence. Aldridge and Boyce (2007) also used a moving window (1 km^2) to measure sagebrush cover and abundance. Their resource selection function found that greater sage-grouse selected nesting habitat that contained large patches (1 km2) of sagebrush with moderate canopy cover and moderate sagebrush abundance (i.e., heterogeneous distribution of sagebrush). Carpenter et al. (2010) found similar results in Alberta, Canada. Their top resource selection functions included a quadratic function for sagebrush abundance, which indicates that areas of moderate sagebrush abundance were selected more frequently than areas of homogenous sagebrush.

Aldridge et al. (2008) [per Wisdom et al. (2011)] found that at least 25% of the landscape in a 30.77-km analysis area needed to be dominated by sagebrush for greater sage-grouse persistence, with 65% being preferred. Wisdom et al. (2011) found that landscapes with less than 27% sagebrush were not different from landscapes from which greater sage-grouse have been extirpated. Similar to Aldridge et al. (2008), Wisdom et al. (2011) found that 50% sagebrush across a landscape was a good indicator of greater sage-grouse persistence.

The agency biologists indicated that greater sage-grouse prefer higher sagebrush abundance in the southern part of their range than is indicated by these studies. For example, the Colorado Parks and Wildlife Avian Research Center has generally found a positive linear relationship between sagebrush abundance and measures of habitat selection (Brian Holmes, Colorado Parks and Wildlife, personal communication with Jon Kehmeier, SWCA, on February 13, 2013). Colorado Parks and Wildlife has not observed an upper inflection point in the proportion of the landscape covered in sagebrush where use or selection begins to drop, and suggest that the difference may be due to the structure and composition of the sagebrush community (that is, silver sagebrush mixed grassland rangelands of Alberta [Aldridge and Boyce 2007; Carpenter et al. 2010] vs. big sagebrush steppe [TWE Project Area]).

Sagebrush covering 50% to 95% of the landscape scored a 3 for this variable (Aldridge et al. 2008; Wisdom et al. 2011; professional judgment of the agency biologists). Sagebrush covering 30% to 50% or >95% scored a 2 for this variable (Aldridge et al. 2008). Sagebrush covering 10% to 30% scored a 1 (Walker et al. 2007; Wisdom et al. 2011) and sagebrush covering less than 10% scored a 0 for this variable.

VAR06 Sagebrush Canopy Cover

Recommended sagebrush canopy cover for greater sage-grouse habitat varies seasonally. Seasonal habitats were not modeled, but seasonal differences in the selection for sagebrush cover was considered when developing habitat services metrics. The seasonal habitat needs of greater sage-grouse are described below, followed by scoring of percent sagebrush cover in the habitat services metric.

Seasonal Habitat Use

Nesting

Connelly et al. (2000) cite 13 references to sagebrush coverage that range from 15% to 38% mean canopy cover surrounding the nest. Citations contained within Crawford et al. (2004) reported 12% to 20% cover and 41% cover in nesting habitat. In their species assessment, Connelly et al. (2000) conclude that 15% to 25% canopy cover is the recommended range for productive greater sage-grouse nesting habitat. This is also the range identified in the greater sage-grouse habitat assessment framework (Stiver et al. 2010) as providing the highest service level for greater sage-grouse based on a review of the available literature. Wallestad and Pyrah (1974) reported that successful nests were in stands where sagebrush cover approximated 27%. This cover range is used as a goal in some greater sage-grouse management guidelines (Bohne et al. 2007; BLM et al. 2000). Cagney et al. (2009) guidelines for grazing in grouse habitat, which use information synthesized from over 300 sources, state that hens tend to select an average 23% live sagebrush canopy cover when selecting nesting sites.

Greater sage-grouse in Utah use habitats with higher sagebrush canopy cover than is observed in the northern and eastern portions of the species range, possibly due to the relative scarcity of understory grasses in Utah (Renee Chi, BLM, personal communication with Ann Widmer, SWCA, on March 22, 2013). Nest sites in Wildcat Knoll (part of the Emery-Sanpete population of Utah) were located in areas with an average of 33% shrub canopy cover for successful nests and 22% for unsuccessful nests (Perkins 2010). Nests (n = 50) in Parker Mountain were located at sites with an average canopy cover of 35.5% for big sagebrush and 32% for big sagebrush mixed with black sagebrush (Chi 2004; Renee Chi, BLM, personal communication with Ann Widmer, SWCA, on March 22, 2013). In the Sheeprock greater sage-grouse population, nest site shrub canopy cover measured an average of 62% in 2005 and 83.5% in 2006 (Robinson 2007).

Brood Rearing

Connelly et al. (2000) found that productive brood-rearing habitat should include 10% to 25% cover of sagebrush. This is the range used as a goal in greater sage-grouse management guidelines (Bohne et al. 2007; BLM et al. 2000). While sagebrush is a vital component of greater sage-grouse habitat, very thick shrub cover may inhibit understory vegetation growth and reduce the birds' ability to detect predators (Wiebe and Martin 1998).

Again, greater sage-grouse in Utah may use areas with higher canopy cover than is typical throughout the northern and eastern parts of their range. Grouse in the Sheeprock population were documented using areas with an average shrub canopy cover of 73% during brood rearing in 2005 and 2006 (Robinson 2007).

Winter

Connelly et al. (2000) cite 10 references to sagebrush coverage in winter-use areas that range from 15% to 43% mean canopy cover (Crawford et al. [2004] also cite two of these references in their assessment); however, they considered a canopy of 10% to 30% cover (above the snow) as a characteristic of sagebrush needed for productive greater sage-grouse winter habitat. This is the cover range used as a goal in greater sage-grouse management guidelines (Bohne et al. 2007; BLM et al. 2000). Greater sage-grouse in Utah may prefer higher cover in winter. In Emma Park, areas of high sagebrush cover were used disproportionally to their availability on the landscape, with an average of 38.3% sagebrush canopy cover in winter-use areas (Crompton and Mitchell 2005).

Scoring in Habitat Services Metric

In general, the recommended sagebrush cover for nesting habitats was intermediate to, and overlapped that of, brood-rearing and winter habitats. Thus, favorable conditions for nesting were given the highest scores for percent sagebrush cover in the greater sage-grouse habitat services metric.

This variable used the scores assigned by Stiver et al. (2010) for sagebrush cover categories in greater sage-grouse nesting habitat, with a slight adjustment to account for use of higher canopy cover in Utah. This adjustment is also consistent with the Colorado Greater Sage-Grouse Conservation Plan (Colorado Division of Wildlife et al. 2008). Sagebrush percent canopy cover of 15% to 35% was assumed to provide the highest level of services (score of 3) to nesting greater sage-grouse. This includes canopy covers that are 10% higher than the average ranges provided in Connelly et al. (2000) and Cagney et al. (2009). Areas with slightly less or more cover than this (55–15 or >35) were given a habitat services score of 2. Habitats with <5% cover received a score of 1.

VAR07 Sagebrush Canopy Height

Sagebrush canopy height is an important aspect of all greater sage-grouse seasonal habitats. As described above, seasonal habitat models will not be developed for the TWE Project. However, seasonal habitat requirements were considered when developing habitat metric values. The seasonal habitat needs of greater sage-grouse are described below, followed by scoring of percent sagebrush cover in the habitat services metric.

Seasonal Habitat Use

Nesting

Gregg et al. (1994, cited in Crawford et al. 2004) found that the area surrounding successful nests in Oregon consisted of medium-height (40 to 80 centimeters [cm]) sagebrush. Connelly et al. (2000) cite 11 references to sagebrush height that range from 29 to 79 cm mean height. In their assessment, Connelly et al. (2000) conclude that sagebrush with a height of 30 to 80 cm is needed for productive greater sage-grouse nesting habitat in arid sites and 40 to 80 cm in mesic sites. These ranges are supported by Stiver et al. (2010), who recommend a range of 30 to 80 cm, and BLM et al. (2000), which state that optimum greater sage-grouse nesting habitat consists of sagebrush stands containing plants 40 to 80 cm tall.

Winter

Important structural components in winter habitat include medium to tall (25–80 cm) sagebrush stands (Crawford et al. 2004). Connelly et al. (2000) cite 10 references to sagebrush height in winter habitat that range from 20 to 46 cm above the snow. Two studies measured the entire plant height and provided a range from 41 to 56 cm. In their assessment, Connelly et al. (2000) conclude that characteristics of productive winter habitat include sagebrush that is 25 to 35 cm in height above the snow. This is the height range used as a goal in greater sage-grouse management guidelines (Bohne et al. 2007; BLM et al. 2000).

Scoring in Habitat Services Metric

Sagebrush canopy heights that provided high-quality nesting habitat generally also provided high-quality winter habitat for greater sage-grouse. Thus, favorable conditions for nesting were given the highest scores for sagebrush canopy height in the greater sage-grouse habitat services metric.

The sagebrush cover scores assigned for nesting habitat in the greater sage-grouse habitat assessment framework by Stiver et al. (2010) to different sagebrush cover categories were assigned to this variable. Areas of sagebrush with a height of 30 to 80 cm were assigned a habitat services score of 3. As sagebrush canopy height decreases, the value of a sagebrush plant to provide cover for nesting females and their nests is diminished. Additionally, low-lying sagebrush is less available to greater sage-grouse during the winter due to snow cover. Areas with canopy heights greater than 80 cm provided intermediate levels of services because they may provide relatively poor cover for nesting greater sage-grouse and have foliage that is difficult for greater sage-grouse to access during mild and moderate winters. Sites with lower and higher sagebrush canopy heights were scored lower (sagebrush 12 to <30 cm or >80 cm in height received a score of 2). Areas with minimal sagebrush canopy heights were considered to have the lowest habitat service value (sagebrush <20 cm received a score of 1).

VAR08 Distance to Vegetation Dominated by Sagebrush or Shrub

Greater sage-grouse use shrubby habitats including sagebrush during the brood-rearing season (Connelly et al. 2000) and for grouse movement and dispersal (Stiver et al. 2010). Close proximity to shrubby vegetation increases the service value of all vegetation types modeled because shrubby vegetation provides cover from predators, facilitates grouse movement, and supports population connectivity.

The Lincoln County Sage Grouse Technical Review Team (2004) identified proximity to sagebrush cover as an important component in habitat suitability of non-sagebrush, brood-rearing habitats (e.g., mesic lowland habitats, hay meadows). The Team considered brood-rearing areas within <100 yards, 100 to 300 yards, and >300 yards of sagebrush cover as suitable, marginal, and unsuitable habitat, respectively. Similarly, Stiver et al. (2010) considered mesic habitats <90 m, 90 to 275 m, and >275 m of sagebrush to be suitable, marginal, and unsuitable late brood-rearing/summer habitat, respectively. These categorizations support the concept of increasing service level with proximity to shrubs, particularly sagebrush.

The distance to vegetation dominated by sagebrush or shrub variable (VAR09) measured the distance of the cell being scored (regardless of its vegetation type) to the next nearest cell that was dominated by sagebrush or a shrub species, including willows. For this variable, cells <90 m, 20 to 275 m, and >275 m to a cell dominated by a shrub species were assigned scores of 3, 2, and 1, respectively. The scoring was applied to all vegetation types, because this variable is relevant to bird movement and dispersal from all habitat types.

Score Adjustment for Fences that Pose a High Risk for Collision

Habitat within and surrounding the TWE Project transmission line corridor is currently influenced by fences used for livestock management. These fences are typically constructed from barbed wire and are used to control livestock movements and vegetation use within grazing allotments and pastures, to delineate or protect private property and agricultural croplands, and to restrict livestock from improved and unimproved roadways.

Fence collisions have been reported as a cause of significant injury and mortality to grouse species (greater sage-grouse [Braun 2006; Call and Maser 1985; Connelly et al. 2004; Christiansen 2009; Danvir 2002; Stevens et al. 2012]; lesser prairie-chicken [Wolfe et al. 2007]; ptarmigan [Bevanger and Broseth 2000]; and red grouse, black grouse, and capercaillie [Baines and Summers 1997; Catt et al. 1994; Petty 1995]). In addition to direct mortality, fences provide corridors for mammalian predators increasing the opportunity for predation of hens and broods (Braun 1998). Unlike the additive variables in the metric, which are primarily meant to characterize use and avoidance of habitat by greater sage-grouse, the distance to high risk fences was added to account for the potential direct loss of greater sage-grouse (not greater sage-grouse avoidance of fences).

In Wyoming, Christiansen (2009) reported preliminary results of a multiple-year study (2005–ongoing) near Farson on greater sage-grouse fence strikes and mortalities and the utility of fence markers on reducing collisions. After installation of fence markers on portions of high-risk fences, grouse mortality decreased by 70%. Although the study did not compare the number of strikes with regard to distance to lek, the author recommends that fences should not be located within 0.25 mile (0.4 km) of leks.

In Idaho, Stevens (2011) and Stevens et al. (2012a; 2012b) evaluated the environmental features associated with greater sage-grouse fence collision risk, and tested the efficacy of reflective vinyl fence markers to reduce collision rates at eight study sites. Modeling of these data predicted marking reduced collision rates by 74% to 83% at the mean lek size and fence distance from the lek during the breeding season. Collision probability varied by region, topography, fence type, fence density, and lek proximity. Areas with high slope or terrain ruggedness generally showed lower collision risk than flat areas. Collisions were more common on fence segments bound by steel t-posts with spans between posts exceeding 4 m. Collision probability increased with fence length per km^2 and proximity to nearest active lek.

For this variable, fences segments having a high risk for collision were identified using the model by Stevens et al. (2013), which is determines the fence-collision risk from proximity to lek and a terrain roughness index (Equation 1).

Equation 1: $\hat{y} = 78 * \exp(\beta_0 + \beta_1 * TRI + \beta_2 * distance)$

Where:

$\hat{y}$ is an estimate of the total number of greater sage-grouse collisions over a 78-day lekking season for each 30-m pixel if a fence is present;

β_0 = -3.325 (per Bryan Stevens, personal communication with Ann Widmer, SWCA, on February 14, 2014);

β_1= -0.25;

β_2 = -0.0006;

TRI is a terrain roughness index calculated using ArcInfo; and

$distance$ is the distance from each 30-m pixel to the nearest greater sage-grouse lek in GIS using the Euclidean distance function (up to 3 km).

The additive metric score (the sum of VAR01 through VAR08) for a cell was multiplied by an adjustment factor that reduced the score if the cell was located within 3 km of a greater sage-grouse lek (i.e., it was scored by the Stevens et al. 2013 model) and there was a fence present in that cell. The adjustment factor for each probability of collision is provided in Table A2. Allotment boundaries were used as a surrogate for fence lines. Following the convention established by Stevens et al. 2013, the arbitrary threshold of 1 grouse collision per lekking season was used as the breaking point between our score adjustment categories. The other category break was established based on a natural break in the data distribution.

Table A2. Cell score adjustment for the presence of fences posing a high collision risk.

$\hat{y}$ **(prediction of the total number of greater sage-grouse collisions per lekking season)**	**Score adjustment factor**
0.00-0.40	0.75
0.40-1.00	0.50
≥1.00	0

Here are three examples of the application of the fence score adjustment factor. In the first, there is a cell with an additive score of 10 (the sum of VAR01-VAR08) that is located within 3 km of a lek and has a fence running through it. The Stevens et al. 2013 model predicts 0.2 collisions per lekking season for a fence in that cell, so the additive score of 10 is multiplied by 0.75 for a final metric score of 7.5 for that cell. In the second example, there is another cell with an additive score of 10 that is located within 3 km of a lek and has a fence running through it. The Stevens et al. 2013 model predicts 1.4 collisions per year a fence in this cell, so the additive score of 10 is multiplied by 0 to produce a final metric score of 0 (no habitat services). In the third example, there is a cell with an additive score of 10 that has a fence running through it, but the cell is located >3 km from a lek. Stevens et al. 2013 model does not produce an estimated number of collisions for this cell, because it is located more than 3 km from a lek. This fence is considered to have a relatively low collision risk during the lekking season, so the cell retains its full value (no adjustment).

Collisions with fences may occur outside of the lekking season. Marking of fences located more than 3 km of a fence may be considered for mitigation. If so, they will be treated as if they have the lowest fence risk collision (0.00-0.39 collisions/year) for the purposes of modeling.

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APPENDIX B

Quantification of Baseline Habitat Service Level

Text is excerpt from the TWE Project HEA Plan.

QUANTIFICATION OF BASELINE HABITAT SERVICE LEVEL

The pre-construction baseline of the habitat services will be based on existing datasets to the extent possible. It is not anticipated that additional data collection will be necessary to complete the HEA. The baseline service level will be determined by applying the habitat service metrics described in Appendix A to the Assessment Area that is identified for the TWE Project. The Assessment Area will include the footprint of the project and a buffer around the footprint, because greater sage-grouse (*Centrocercus urophasianus*) habitat service losses are expected to extend beyond the area of direct disturbance. For the TWE Project, this buffer will be clipped to the Bureau of Land Management's (BLM) Priority General Habitat (PGH) boundaries.

ESRI ArcGIS ArcInfo 10.X, Spatial Analyst, and ModelBuilder software and tools will be used to conduct analyses. To facilitate calculations across the entire assessment area, it is anticipated that all data will be converted to a raster/grid format. Raster or grid algebra processing is significantly faster for an analysis of this size.

PREPARATION OF GIS MODEL INPUT LAYERS

Habitats within and surrounding the corridor for the preferred alternative will be summarized in a series of representative raster layers for the eight additive metric variables (see Appendix A). These eight variables consist of data representations within the TWE Project Area for human disturbance, landscape characteristics, proximity to greater sage-grouse lek locations, and vegetation characteristics that may influence the use of habitat by greater sage-grouse. A spatial resolution of 30-meters is anticipated to be sufficient to capture a 'landscape level' perspective of habitat across the Assessment Area.

Representative raster data will be created for each additive variable in the HEA metric (Appendix A). Scores for each cell in each raster will be assigned per the variable scores listed in Table A1 of Appendix A. In addition, a raster layer will be developed that locates fences and their relative collision risk during the lekking season. The following sections describe the datasets anticipated to be necessary to describe each of these variables:

Lands Assigned No Habitat Value

As described in Appendix A, land cover types and terrain features that do not provide suitable habitat for greater sage-grouse will be removed from the HEA model. All vegetation types and landforms that potentially provide habitat for greater sage-grouse will remain in the model.

Distance to Roads (VAR01 and VAR02)

Road layers used in developing the baseline HEA model are available from the BLM, Forest Service, state agencies, or from readily available standard road and infrastructure layers (e.g., TIGER data from the U.S. Census Bureau). Road layers will be compared between states to ensure consistency in classification prior to using them in the HEA model development. HEA model scores will be applied to 30-meter raster cells according to the process described in Table A1, Appendix A. For example, all cells that are more than 1,000 meters from interstate highways or high traffic volume state and federal highways (>6,000 AADT) will be given a score of 3, those between 650 and 1,000 meters will be given a score of 2, those between 100 and 650 meters will be given a score of 1, and those cells within 100 meters will be assigned a value of 0 habitat services (no habitat value) in the model per the description provided Appendix A (Metric of Greater Sage-grouse Habitat Services).

Percent Slope (VAR03)

Slope will be calculated using 30-meter digital elevation models and scored according to the process described in Appendix A.

Distance to Lek (10-year Average Count >0 Males) (VAR04)

Lek data will be obtained from the wildlife management agencies in each state. Lek status will be determined for all leks. Leks that have been active in the past 10 years or that have an unknown status will be included in the HEA model. Those that are labeled as unoccupied or inactive will not be included. Cells surrounding leks will be scored according to the methods described in Appendix A with cells closest to leks receiving the highest scores.

Sagebrush Abundance Index (VAR05)

A sagebrush abundance index will be determined from available vegetation layers by calculating the proportion of sagebrush in a 1-km^2 area surrounding each 30-meter cell in the assessment area. Scores will be applied using the methods described in Appendix A. Areas with a high proportion of sagebrush in the landscape and some habitat heterogeneity will be score higher than areas with little habitat heterogeneity or areas with little or no sagebrush.

Sagebrush Cover, Sagebrush Canopy Height (VAR06 and VAR07)

When possible, percent cover and height will be determined directly from the vegetation attribute data included in the GAP and Landfire vegetation datasets. Where data are not available, attributes for percent cover and height will be determined using other data sources. Sampling data from GAP/Landfire datasets as well as datasets obtained from BLM and the state agencies will be used to attribute vegetation percent cover and height for segments of the landscape with the most similar characteristics. Once vegetation values have been applied to the 30-meter grid, HEA scores will be applied using the methods described in Appendix A.

Distance to Vegetation Dominated by Sagebrush or Shrub (VAR08)

The distance from each cell to the nearest sagebrush or shrub dominated cell will be calculated. Cells within or closest to sagebrush or shrub landscapes will be scored higher than those that are distant from shrub-dominated cells.

Fences that Pose a High Risk for Collision (Adjustment Factor)

A raster file will be produced by running the Stevens et al. 2013 model as described in Appendix A to estimate the greater sage-grouse collision risk during the lekking season within 3 km of leks. The Stevens et al. 2013 model does not consider actual fence locations, so a separate fence location dataset will be intersected with the results of the model to identify actual locations of high collision risk.

Fence locations will be used if the data are available for the entire assessment area. In the event that fence data are not available, grazing allotment boundaries will be used as surrogates for fence layers in the HEA baseline model development.

After the model results and fence layer are intersected, cells in the resulting raster file will be assigned to different score adjustment factors as described in Appendix A. Every cell with a fence running through it that is located within 3 km of a lek will have an estimated number of collisions per lekking seasons. If the estimate is between 0 and 0.39, the adjustment factor will be 0.75. If the estimate is between 0.40 and 0.99, the adjustment factor will be 0.50. If the estimate is 1.0 or above, the adjustment factor will be 0 (i.e., cells containing the highest risk fences have no habitat value).

SUMMATION OF BASELINE SERVICES IN THE HEA MODEL

Spatial grids representing the above HEA variables will be combined through additive and multiplicative raster calculations to create a final raster layer. A simple additive overlay process will be used to calculate the HEA metric value for each cell. The value of each cell will be the sum of VAR01 through VAR08. The resulting value will be multiplied by 0 or 1 to remove all vegetation types that do not provide habitat for greater sage-grouse (e.g., urban areas, roadways, forests) and to retain those habitats that do provide value for greater sage-grouse. This value will be multiplied by the Fence Collision Adjustment Factor if it is located within 3 km of a lek. The final numeric value for each cell is the habitat services provided to greater sage-grouse by that cell.

The resulting habitat service values and the number of acres associated with each of the habitat service values will be multiplied together and summed across the assessment area to calculate the total habitat services (expressed in service acres) (Equation 1). The total habitat services provided by the Assessment Area will be calculated and will serve as the pre-construction baseline for the TWE Project.

Equation 1. $$VJ = \sum_{1}^{i} (V_i * J_{V_i})$$

where:

VJ is the habitat services (service-acres) provided by the Assessment Area,

V is the habitat service score (i.e., the sum of the variable scores in the habitat service metric),

i is the number of possible unique values for *V*, and

J_{V_i} is the number of acres for each value of V_i, where $\sum_1^i J_{V_i}$ would equal the total acreage of the Assessment Area (*J*).

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APPENDIX C

Quantification of Habitat Service Losses

Text is excerpt from the TWE Project HEA Plan.

QUANTIFICATION OF HABITAT SERVICE LOSSES

Habitat service losses caused by the TWE Project will be modeled using geographic information system (GIS) technology for important TWE Project milestones by decreasing the variable scores for the habitat services metric below the Baseline level in the footprint of the TWE Project (direct disturbances) and in buffers around the footprint (indirect disturbances). The habitat service scores for each milestone will be summed across the Assessment Area to calculate the estimated interim and permanent habitat service losses associated with the TWE Project.

DESCRIPTION OF DISTURBANCES BY TWE PROJECT MILESTONE

The habitat services provided by the Assessment Area will be measured at several different TWE Project milestones that reflected varying levels of disturbance.

The TWE Project milestones modeled for the HEA will be:

1. **Baseline**—the baseline milestone quantifies habitat services available to greater sage-grouse before disturbance. The calculation of the habitat services available to greater sage-grouse at Baseline is described in Appendix B.
2. **Construction—**the transmission line construction milestone quantifies habitat services available to greater sage-grouse during the construction of the TWE Project.
3. **Restoration**—the restoration milestone quantifies habitat services available to greater sage-grouse after TWE Project construction is complete and some services return with the reduction in noise and human presence.
4. **Recovery**—the recovery milestone quantifies habitat services available to greater sage-grouse after a vegetation type has recovered to the greatest extent expected after TWE Project restoration is complete. Habitat services return to baseline conditions in restored areas with the time to recovery being dependent on the vegetation type. It is anticipated that there will be multiple vegetation-based recovery endpoints. Vegetation recovery endpoints will be determined upon identification of the vegetation communities impacted by the TWE Project.

QUANTIFYING LOSS OF HABITAT SERVICES DUE TO SURFACE DISTURBANCE DURING CONSTRUCTION

For the Construction milestone, direct disturbances will be defined as the loss of habitat services associated with vegetation removal and ground disturbing activities within the construction footprint (Table C1). The habitat service scores for all 30-m^2 raster cells in the TWE Project footprint where vegetation removal or ground disturbance occur will be changed from the Baseline service scores to 0 in the GIS model for this milestone. Recovery from the disturbed state will be applied per the vegetation-specific recovery curves for the TWE Project.

Table C1. Direct Disturbance Levels Modeled by TWE Project Milestone and Disturbance Type

Project Milestones	Percent Baseline Services Present by Direct Disturbance Type		
	AC/DC Converter Station	**Transmission Towers**	**Access Roads, Transmission Lines, and Temporary Infrastructure**
Baseline	100%	100%	100%
Construction	0%	0%	0%
Restoration	0%	0%	0%
Progressive Vegetation Recovery	0%	0% within permanent tower footprint (500 ft^2 for a guide lattice tower, which is 5.2% of a 30-m cell) Elsewhere baseline services will be retuned per the vegetation-specific recovery curves developed for the Project.	Baseline services will be retuned per the vegetation-specific recovery curves developed for the Project.

QUANTIFYING LOSS OF HABITAT SERVICES DUE TO INDIRECT DISTURBANCES DURING CONSTRUCTION

Indirect disturbances will be simulated by applying buffers to the construction footprint and decreasing the habitat service scores below the Baseline habitat service scores within the buffers. Because of uncertainties in the indirect impacts of transmission on greater sage-grouse, at this time, noise and human presence will be the only indirect disturbance modeled in the HEA.

Use of construction equipment such as backhoes, cranes, front-end loaders, bulldozers, graders, excavators, compressors, generators, and various trucks would be needed for mobilizing crew, transportation and use of materials, line work, site clearing, and preparation during the construction phase of the TWE Project. Construction of and improvements to access roads would require use of earthmoving equipment such as bulldozers and graders. Table C2 provides the typical noise levels for the construction equipment that could potentially be used during the construction phase of the TWE Project (ranging 80 to 90 A-weighted decibels [dBA] at 50 feet [15 meters (m)] from any work site).[2]

Table C2. Typical Noise Levels from Construction Equipment

Equipment Type	Noise Level at 50 feet (dBA)
Crane	88
Backhoe	85
Pan loader	87
Bulldozer	89

[2] Construction noise values taken from Energy Gateway West HEA report.

Fuel truck	88
Water truck	88
Grader	85
Roller	80
Mechanic truck	88
Flatbed truck	88
Dump truck	88
Tractor	80
Concrete truck	86
Concrete pump	82
Front end loader	83
Scraper	87
Air compressor	82
Average construction site	85

Noise during the construction phase of the TWE Project would be similar in magnitude to noise produced by vehicles using secondary roads (county highways, state highways, and heavily travelled gravel roads [e.g., access roads for oil and gas development, mining, etc.]). Passenger vehicles, medium trucks, and heavy trucks going 55 miles per hour (mph) produce typical noise levels of 72 to 74 dBA, 80 to 82 dBA, and 84 to 86 dBA, respectively, from a distance of 50 feet. Therefore, the noise disturbance associated with construction will be modeled as if the construction area was a secondary road (Table C3).

In the model, buffers will be placed around active construction areas in a manner that is identical to the methods used for secondary roads. The cells that fall within these buffers will be scored in a manner identical to a secondary road (i.e., the score for VAR02 decreased).

Table C3. Indirect Disturbance Levels Modeled by TWE Project Year and Disturbance Type

Project Milestones	Indirect Disturbance Buffers Applied by Disturbance Type		
	AC/DC Converter Station	**Transmission Towers**	**Access Roads, Transmission Lines, and Temporary Infrastructure**
Baseline	None	None	None
Construction	Secondary Road	Secondary Road	Secondary Road
Restoration	Secondary Road	None	None
Progressive Vegetation Recovery	Secondary Road	None	None
	Secondary Road	None	None
	Secondary Road	None	None
	Secondary Road	None	None

QUANTIFYING HABITAT SERVICES LOSSES DURING RESTORATION AND RECOVERY

TWE Project-related habitat service losses are anticipated to decrease once construction is complete. Although still below baseline levels, the habitat service scores rise during restoration and recovery with vegetation regrowth (direct disturbances) and decreased levels of noise and human presence (indirect disturbances).

Restoration Milestone

For the Restoration milestone, direct disturbances will be defined as the loss of all habitat services in the construction footprint where vegetation clearing and ground disturbance occurs because the vegetation has not regrown sufficiently to provide habitat (see Table C1).

The indirect disturbance buffers that are applied to the power conversion terminal during construction will remain during the restoration milestone and for the life of the TWE Project because of the noise human activity associated with operation of the facility. No indirect disturbances will be modeled for the rest of the TWE Project because little vehicle traffic or human presence is anticipated in these areas after construction of the line is complete.

Progressive Recovery Milestone

For the Recovery milestone, direct disturbances will be defined as the loss of all habitat services in the footprint of the transmission structure pads and the partial loss of services in areas of vegetation regrowth (see Table C1). Indirect disturbances will be applied in a manner identical to the Construction milestone (see Table C3).

Habitat services in areas where the vegetation is reclaimed (i.e., outside the footprint of permanent facilities) will gradually return to baseline conditions at a rate dependent on the vegetation type. Services will return more rapidly for vegetation having rapid recovery rates (e.g., agriculture, wetland, grassland, or riparian) than for those with slower recovery times (e.g., shrub-dominated including sagebrush). Vegetation recovery curves will be developed for the vegetation communities that are impacted by TWE Project activities.

To calculate the progressive return of services, the percentage of the baseline service value for a cell will be calculated based on the appropriate vegetation recovery curve. For example, in those vegetation types with rapid restoration potential (agricultural areas, some grasslands, etc.), habitat services could be returned to 100% of Baseline in the first year following construction. Those with longer recovery times may only achieve partial service returns per year until achieving their maximum value. For example, a vegetation community with a 50 year recovery period might achieve 10% value in year 5 after restoration, 20% in year 10, 30% in year 15, etc. until all services are returned in year 50.

HEA TO QUANTIFY INTERIM AND PERMANENT HABITAT INJURIES

The approach described above will produce a measure of habitat services (in service-acres) for each of the TWE Project milestones for each of the modeled project segments. The HEA is a stepwise model which quantifies the habitat injury separately in each year (Figure C1) and each of the milestones will be assigned to a calendar year per the schedule provided by TransWest after the preferred alternative is identified. It is likely that a linear change in habitat services will be used to estimate annual service-acre increases between restoration and recovery and between the vegetation-specific recovery times. The total number of service-acres lost per year will be summed across the analysis period and expressed as service-acre-years. This value is the estimated sum of the interim and permanent losses to greater sage-grouse habitat that would occur as a result of the TWE project construction, operation, and maintenance.

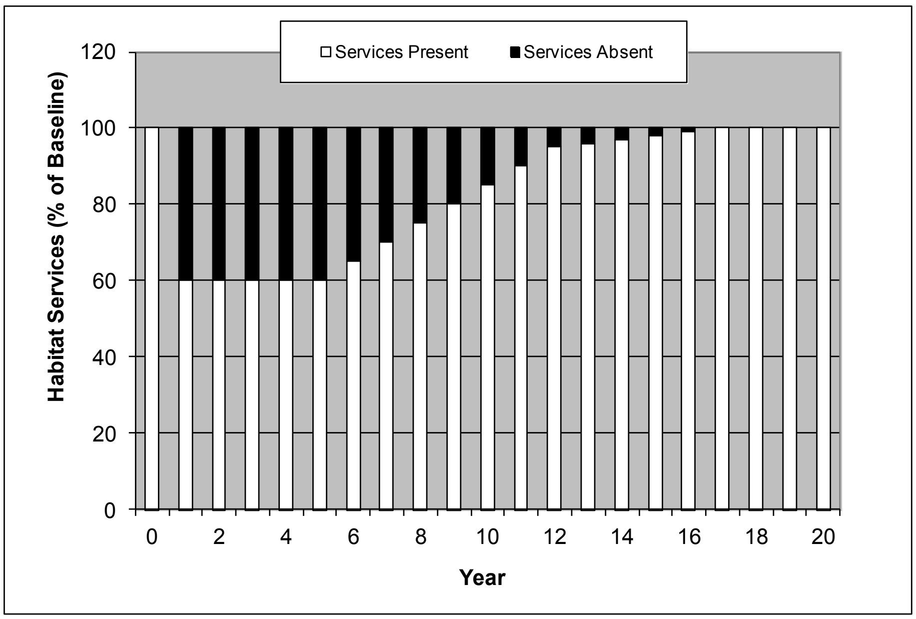

Figure C1. Hypothetical example of how the HEA model considers habitat services absent and habitat services present in each year to calculate the total services lost over the Project period (i.e., sum of the black bars).

The HEA model balances the cumulative injury (*I*, service-acre-years) over the lifetime of the TWE Project with the cumulative benefit of habitat restoration and mitigation (*R*, service-acre-years), so that the services returned by habitat restoration and mitigation are greater than or equal to the cumulative injury ($R \geq I$). The habitat injury (*I*, service-acre-years) will be quantified for the life of the TWE Project using Equation 2. Equation 2 was adapted from Equation 8.1 in Allen et al. (2005). The discount rate (*r*) is anticipated to be set to 3%, which is standard for this type of analysis. The discount rate converts services being provided in different time periods into current time period equivalents (Allen et al. 2005). The discount rate effectively weighs the habitat service losses so that losses occurring early in the TWE Project result in a greater overall injury than losses occurring later in the project. Likewise, habitat restoration and mitigation occurring early in the TWE Project would result in a greater benefit than habitat restoration and mitigation occurring late in the project.

Equation 2. $$I = \sum_{t=0}^{y} JV^{j} * \rho_{t} * \left[(b^{j} - x_{t}^{j}) / b^{j}\right]$$

where:

I is the present value of the service-acre-years lost over *y* due to interim and permanent injury,

$t = 0$ is the year the TWE Project begins,

y is the analysis period, in years (e.g., 107),

JV^j is the value of the habitat services provided by the injured habitat (service-acres) before injury (i.e., at the Baseline milestone),

b^j is the mean service score provided by the Assessment Area (JV^j/J, where J is the injury Assessment Area in acres) at the Baseline milestone (time [*t*] = 0),

ρ_t is the discount factor, where $\rho_t = 1/(1+r)^{t-C}$, where *r* is the discount rate for the time period and *C* is the time the claim is presented (*C* = Project Year 1), and

x_t^j is the mean service score provided by the Assessment Area at the end of year *t* if TWE Project disturbances are applied.

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APPENDIX D

Quantification of Habitat Service Gains Produced by Habitat Restoration and Mitigation Measures

Text is excerpt from the TWE Project HEA Plan.

MODELING MITIGATION PROJECT HABITAT SERVICE GAINS

Habitat restoration and conservation measures are intended to create new, or protect existing, greater greater sage-grouse habitat services (Table D1). These measures serve as a “toolbox” from which mitigation projects may be selected by TransWest for inclusion in a mitigation package once the BLM has identified the preferred alternative and final HEA results are available for that alternative. The purpose of the mitigation projects is to offset the cumulative greater sage-grouse habitat service losses in the Assessment Area over the TWE Project lifetime (i.e., *I* in Equation 2 from Appendix C). The HEA will used to evaluate the benefit of a sample of conservation measures in the Assessment Area.

Table D1. Potential Habitat Restoration and Conservation Measures for Inclusion in the HEA.

Measure	Brief Conservation Measure Description	Anticipated Benefits
Fence removal and marking with flight diverters	Fences would be removed or marked in: 1) Sections of fence known to cause greater sage-grouse collisions, 2) Fences within 2 km (1.2 mi) of leks (Braun 2006; Stevens 2011) or other high risk area, 3) Fences in areas with low slope and terrain ruggedness (Stevens 2011), and 4) Fence segments bounded by steel t-posts with spans greater than 4 m (Stevens 2011).	• Reduce mortality due to greater sage-grouse collisions • Increase visibility of fences • Increase contiguous patches of shrub-steppe habitat • Remove localized grazing pressure and increase habitat
Sagebrush restoration and improvement projects	Seeding, planting seedlings, or transplanting containerized sagebrush plants (one plant per 5 m^2) and seeding a bunchgrass understory.	• Create contiguous patches of shrub-steppe habitat with optimal sagebrush cover and height and a bunchgrass understory • Increase availability of high quality nesting, brood rearing, and winter habitats
Juniper/conifer removal	Mechanical removal (lop and scatter, cut-pile-cover, or mastication) of juniper/confer adjacent to areas with optimal sagebrush cover and height	• Reverse juniper/conifer encroachment on shrub-steppe habitat to increase contiguous patches of greater sage-grouse habitat • Increase light penetration to support a forb and grass understory
Conservation easements	Removes threat of specific land uses to sensitive wildlife populations	• Prevent greater sage-grouse habitat destruction or degradation near urban areas and oil and gas development • Reduce future fragmentation of shrub-steppe habitat

GIS MODELING OF CONSERVATION BENEFITS

The analysis of habitat service benefits produced by each habitat restoration or mitigation measure in Table D1 will be completed using an approach similar to that described or quantifying habitat losses. It is necessary that both analyses (i.e., quantification of habitat service losses and habitat service gains) use the same habitat services metric (see Appendix A), the same unit of measure (service-acres and service-acre-years), the same analysis period, and the same discount rate. Figure D1 illustrates a hypothetical example of how mitigation would be added to the baseline service metric over time to derive an estimate of the service-acre-years provided by the mitigation measures that will be modeled for the TWE Project.

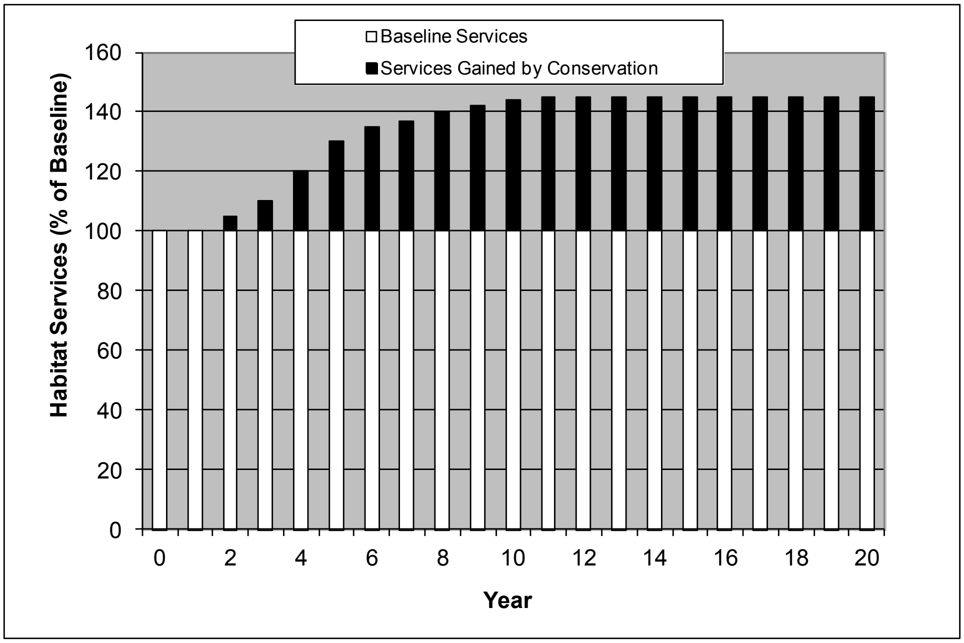

Figure D1. Hypothetical example of how the HEA model considers habitat services gained by habitat restoration and mitigation to calculate the total services gained over the project period (i.e., sum of the black bars).

Modeling Habitat Restoration and Mitigation Measures

Ideally, locations of possible habitat restoration and mitigation projects will be identified prior to finalization of the HEA process. In the event that these locations are not known, hypothetical habitat restoration and mitigation project areas will be used to estimate average habitat service gain.

Once actual or hypothetical habitat restoration and mitigation project locations are identified, variable scores in the HEA model will be changed to approximate the change in habitat services expected with implementation of the measure. The new habitat service score will be calculated for each cell in the Assessment Area using the same habitat services metric used to quantify baseline and impacts (see Appendix A). The habitat service benefit of a modeled mitigation project will be calculated by determining the difference in the habitat services provided at baseline and after implementation of the habitat restoration or mitigation measure.

For each habitat restoration/mitigation project, the time to full benefit and project initiation timing will be determined and accounted for in the HEA model to estimate of the present value habitat service gain that would be created. The present value habitat service gain (*R*, service-acre-years) will be quantified for the life of the TWE Project using Equation 3 (adapted from Equation 8.1 in Allen et al. 2005).

Equation 3. $$R = \sum_{t=0}^{y} PV^{p} * \rho_{t} * \left[(x_t^p - b^p) / b^p \right]$$

where:

R is the present value of the service-acre-years gained by the habitat restoration or mitigation measure,

t = 0 is the year the transmission line TWE Project begins,

y is the analysis period, in years (i.e., 107),

PV^p is the value of the habitat services provided by the improved habitat (service-acres) before habitat restoration or mitigation measure (i.e., at the Baseline milestone),

b^p is the mean service score provided by the Assessment Area (PV^p/P, where P is the injury Assessment Area in acres) at the Baseline milestone (time [t] = 0),

ρ_t is the discount factor, where $\rho_t = 1/(1+r)^{t-C}$, where r is the discount rate for the time period and C is the time the claim is presented (C = Project Year 1), and

x_t^p is the mean service score provided by the Assessment Area at the end of year t if habitat restoration or mitigation measure benefits are applied.

The present value habitat service gain (R) will be standardized among mitigation project types by dividing by size of mitigation project (units in acres or linear mile depending on the conservation measure modeled) and averaged among hypothetical projects applying the same conservation measure to produce the service-years gained per unit of treatment ($\overline{R}^m$). This value will be used in mitigation calculations.

ESTIMATING COST TO IMPLEMENT MODELED HABITAT RESTORATION AND MITIGATION MEASURES

The cost of the modeled habitat conservation measures will be estimated by averaging the known cost of similar mitigation projects previously implemented (in current year U.S. dollars). The cost per unit treated will be divided by the average service-acre-years per unit area treated (calculated in the previous section), to estimate the price per service-acre-year gained for each of the habitat restoration and mitigation measures. This is the currency that will be used to offset the permanent and interim habitat service losses associated with the TWE Project's construction, operation, and maintenance for the lifetime of the TWE Project.

APPROACH TO OFFSET HABITAT SERVICE LOSSES WITH HABITAT SERVICE GAINS

An HEA scales the mitigation package (i.e., funding to create habitat services) to offset the loss of habitat services over the lifetime of the TWE Project. The injury is offset by planned habitat restoration and mitigation projects in Equation 4, where the mitigation project size (P^m) can be solved for each habitat restoration or mitigation measure type (m).

Equation 4
$$I = \sum_{m1}^{i} P^m * \overline{R}^m$$

where:

I is the present value of the service-acre-years lost over y due to interim and permanent injury,

i is the number of habitat restoration and mitigation measures modeled,

Pm is the size of the habitat restoration or mitigation project of type m (in units of acres or miles), and

$\overline{R}^{m}$ is mean service-years gained per unit (acres or miles) of treatment.

Once the P^m is defined for each habitat improvement and mitigation measure, the costs per unit can be applied. Mitigation due is the sum of the costs to implement each of the habitat improvement and mitigation projects needed to offset the TWE Project

APPENDIX E

Assignment of National Gap Analysis Program (GAP) Vegetation Classifications to Categories for HEA Modeling

VEGETATION CATEGORIZATION FOR HEA MODELING

Vegetation and other landcover types in the USGS GAP Land Cover Dataset were classified as providing habitat for greater sage-grouse or not providing habitat for greater sage-grouse. Vegetation types providing no habitat services to greater sage-grouse (Non-Habitat in Table E1) were assumed to require no mitigation in the HEA. Those vegetation types that are used by greater sage-grouse (Habitat in Table E1) were assigned to one of four modeled vegetation categories. Each of the modeled vegetation categories had a different vegetation recovery time in the HEA model.

Table E1. Vegetation categorization based on GAP landcover types

Vegetation Categories	**GAP Vegetation: ECOLSYS_LU**
Non-Habitat: Anthropogenic Disturbance and Open Water	Developed, High Intensity
	Developed, Low Intensity
	Developed, Medium Intensity
	Developed, Open Space
	Disturbed/Successional - Recently Chained Pinyon-Juniper
	Open Water (Fresh)
	Quarries, Mines, Gravel Pits and Oil Wells
Non-Habitat: Natural Vegetation	Colorado Plateau Mixed Bedrock Canyon and Tableland
	Colorado Plateau Pinyon-Juniper Shrubland
	Colorado Plateau Pinyon-Juniper Woodland
	Great Basin Pinyon-Juniper Woodland
	Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland
	Inter-Mountain Basins Cliff and Canyon
	Inter-Mountain Basins Juniper Savanna
	Inter-Mountain Basins Shale Badland
	Introduced Riparian and Wetland Vegetation
	Introduced Upland Vegetation - Annual Grassland
	Introduced Upland Vegetation - Perennial Grassland and Forbland
	Introduced Upland Vegetation - Treed
	North American Warm Desert Bedrock Cliff and Outcrop
	North American Warm Desert Lower Montane Riparian Woodland and Shrubland
	Recently Burned
	Rocky Mountain Alpine Bedrock and Scree
	Rocky Mountain Aspen Forest and Woodland
	Rocky Mountain Bigtooth Maple Ravine Woodland
	Rocky Mountain Cliff, Canyon and Massive Bedrock
	Rocky Mountain Foothill Limber Pine-Juniper Woodland
	Rocky Mountain Gambel Oak-Mixed Montane Shrubland

	Rocky Mountain Lodgepole Pine Forest
	Rocky Mountain Lower Montane Riparian Woodland and Shrubland
	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland
	Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland
	Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland
	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland
	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland
	Western Great Plains Cliff and Outcrop
Habitat: Agriculture and Wetland (HEA assumed 1 year recovery time)	Cultivated Cropland
	Inter-Mountain Basins Playa
	North American Arid West Emergent Marsh
	North American Warm Desert Playa
	Pasture/Hay
	Rocky Mountain Alpine-Montane Wet Meadow
	Rocky Mountain Subalpine-Montane Mesic Meadow
	Western Great Plains Closed Depression Wetland
	Western Great Plains Open Freshwater Depression Wetland
	Western Great Plains Saline Depression Wetland
Habitat: Grassland and Riparian (HEA assumed 5 years recovery time)	Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland
	Inter-Mountain Basins Semi-Desert Grassland
	North American Warm Desert Riparian Mesquite Bosque
	North American Warm Desert Wash
	Northwestern Great Plains Mixedgrass Prairie
	Rocky Mountain Subalpine-Montane Riparian Shrubland
	Southern Rocky Mountain Montane-Subalpine Grassland
	Western Great Plains Riparian Woodland and Shrubland
Habitat: Sagebrush (HEA assumed 20 years recovery time)	Colorado Plateau Mixed Low Sagebrush Shrubland
	Great Basin Xeric Mixed Sagebrush Shrubland
	Inter-Mountain Basins Big Sagebrush Shrubland
	Inter-Mountain Basins Big Sagebrush Steppe
	Inter-Mountain Basins Montane Sagebrush Steppe
Habitat: Shrub Steppe (HEA assumed 100 years recovery time)	Great Basin Semi-Desert Chaparral
	Inter-Mountain Basins Active and Stabilized Dune
	Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland
	Inter-Mountain Basins Greasewood Flat

	Inter-Mountain Basins Mat Saltbush Shrubland
	Inter-Mountain Basins Mixed Salt Desert Scrub
	Inter-Mountain Basins Semi-Desert Shrub Steppe
	Mogollon Chaparral
	Mojave Mid-Elevation Mixed Desert Scrub
	Rocky Mountain Lower Montane-Foothill Shrubland
	Sonora-Mojave Creosotebush-White Bursage Desert Scrub
	Sonora-Mojave Mixed Salt Desert Scrub
	Wyoming Basins Dwarf Sagebrush Shrubland and Steppe